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The adequate use of opioids and the position of the Latin American Federation of Associations for the Study of Pain

Uso adequado de opioide e a posição da Federação Latino Americana de Associações para o Estudo da Dor

The adequate consumption of opioids in developing countries is still a significant challenge as it can bring about the reflection on the issues involving the correct treatment of acute and chronic pain. The literature is classic in reporting that physicians find it difficult to prescribe opioids, and the patient to accept therapy, for fear of adverse effects or addiction. On the other hand, opioids, a gold standard in the treatment of cancer pain and other types of moderate or severe pain, have insufficient availability and access to the patient, either because of the cost or the health surveillance public policy. The poor education on the subject of pain in undergraduate and postgraduate courses in medical schools, the restrictive government policies for the purchase and distribution of opioids, the need for registration to acquire specific prescriptions, fear of addiction, and the use of opioids for illicit purposes, as well as cultural attitudes towards pain contribute to what the scientific community calls *opiophobia*¹-⁵. This refers to the opioid crisis that developed countries face⁶. Paradoxically, this crisis deals precisely with the consequences of prolonged and indiscriminate use of opioids in developed countries, since there has been an increase in the number of reports of death and addiction related to these drugs. In Latin America, however, the incidence of abuse is around 1%⁷. In fact, in our region, cocaine and marijuana are the substances that lead to problems of abuse. In this way, we are facing a new paradigm, where the look and the critical reading of the *opiophobia* must be differentiated and related to the global geographic and economic context. It suffices to say that the daily average dose of opioids consumption for statistical purposes is 150 (S-DDD). This dose is below the recommended by the literature, reflecting how much we have to improve to achieve optimal pain treatment⁸. Also, the global consumption of opioids is higher in developed countries, and 75% of the world population in underdeveloped or developing countries do not receive any painkillers proportionally to the intensity of pain⁹. Therefore, the Latin American Federation of Associations for the Study of Pain (FEDELAT), in its current management, gathered in São Paulo opinion leaders and representatives from several Latin American countries to publish a position on the measures necessary to reverse this situation and the impact of opio研判 in developing countries. This paper¹⁰ to be published in the Pain Reports (already accepted for publication and in press) addresses the necessary measures to correct this problem, which include: 1) *continuous education* - promoting the training of professionals on the safe use of opioids, based on protocols and scientific evidence. The training can be with meetings with experts and educational materials on the institutional web platforms; 2) *public policies* - creating awareness among the leaders about the need to develop specific programs for the treatment of pain and national scientific recommendations for the use of opioids, facilitating the access and the prescription of these drugs correctly; 3) *creation of an electronic prescription* – allowing the registration of the opioid prescription, the patient’s disease, the dose, the duration of the prescription, the pharmacy that provided the medicine and the monitoring of risks; 4) *statistics* - promoting the registration of hospital and outpatient use and distribution of opioids; 5) *multidisciplinary care* - encouraging the creation of clinics involving other health professionals who ensure the assessment, diagnosis, treatment and the appropriate follow-up of cancer or non-cancer patients; 6) *jointly work of organizations* - involving national and international institutions to promote joint actions that include continuous education, publication of recommendations and incentives to clinical and experimental research around the theme of opioids; 7) *conflict of interest* – avoiding the undue influence of entities that have profit in the engagement and bid of opioids to establish the most ethic relationship possible with the prescribers. Therefore, we can conclude that we must contribute unconditionally for the legitimation of the proper treatment of pain in Brazil and the correct prescription of opioids, monitoring and treating the adverse effects, stratifying the risks and fighting the *opiophobia*, offering, with sympathy, the relief of pain to the suffering patient.

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REFERENCES


Comparison of the pain pressure threshold on the pelvic floor in women with and without primary dysmenorrhea

Comparação do limiar pressórico de dor no assoalho pélvico em mulheres com e sem dismenorreia primária

Victória dos Santos Guarda Lima¹, Guilherme Tavares de Arruda¹, Cyntia Scher Strelow¹, Michele Adriane Froelich¹, Michele Forgiarini Saccol¹, Melissa Medeiros Braz¹

ABSTRACT

BACKGROUND AND OBJECTIVES: Primary dysmenorrhea is characterized as menstruation with painful conditions in women with no associated pathologies, whose pain sites are classically investigated in the abdomen. However, it is known that the pelvic floor can also be compromised by primary dysmenorrhea and can be a source of hyperactivity of this musculature. The objective of this study was to compare the pain pressure threshold in the pelvic floor of women with and without primary dysmenorrhea.

METHODS: An observational, quantitative and cross-sectional study was conducted with young women. The sample consisted of 20 women divided into two groups: with primary dysmenorrhea (n=10) and without primary dysmenorrhea (n=10). The Adapted Assessment Questionnaire was applied for the data collection on the characteristics of the menstrual cycle followed by an evaluation of the pressure threshold of the pelvic floor of the participants using the Microfet 2 HHD manual dynamometer.

RESULTS: There was no significant difference in pressure pain threshold between the groups on the left side (p=0.198) and right side (p=0.198) of the pelvic floor.

CONCLUSION: In this women sample, the occurrence or non-occurrence of primary dysmenorrhea was not associated with an increase in the pain pressure threshold of the pelvic floor.

Keywords: Dysmenorrhea, Pelvic floor, Women.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A dismenorreia primária é caracterizada como uma menstruação com quadros álgicos em mulheres sem doenças associadas, cujos pontos de dor são investigados classicamente no abdômen. Entretanto, sabe-se que o assoalho pélvico também pode ser comprometido pela dismenorreia primária e pode ser fonte de hiperatividade dessa musculatura. O objetivo deste estudo foi comparar o limiar pressórico de dor no assoalho pélvico de mulheres com e sem dismenorreia primária.

MÉTODOS: Foi realizado um estudo observacional, com abordagem quantitativa e de caráter transversal com mulheres jovens. A amostra constituiu de 20 mulheres divididas em dois grupos: com dismenorreia primária (n=10) e sem dismenorreia primária (n=10). O Questionário Adaptado de Avaliação foi aplicado para a coleta dos dados sobre as características do ciclo menstrual, seguido de uma avaliação do limiar pressórico do assoalho pélvico das participantes com o dinamômetro manual Microfet 2 HHD.

RESULTADOS: Não houve diferença significativa no limiar de dor à pressão entre os grupos no lado esquerdo (p=0,198) e lado direito (p=0,198) do assoalho pélvico.

CONCLUSÃO: Nesta amostra de mulheres, a ocorrência ou não de dismenorreia primária não foi associada ao aumento do limiar pressórico de dor do assoalho pélvico.

Descritores: Diafragma pélvico, Dismenorreia, Mulheres.

INTRODUCTION

Primary dysmenorrhea (PD) is characterized by menstruation with painful periods in women with no lesions in the pelvic organs. It is also considered as a gynecological dysfunction that manifests with pain in the lower abdomen, which may radiate to the paravertebral region and thighs. It usually begins in adolescence and is accompanied by nausea, vomiting, and diarrhea, varying in intensity according to the commitment in daily activities.¹² The most accepted theories to explain the pain in women with PD are the production and excess release of prostaglandins during menstruation through the endometrium, which would cause uterine hypercontractility, hypoxia, and ischemia.¹³ More frequently, the abdominal region is investigated in women with PD. However, current research considers the hypothesis that, during the menstrual cycle, the hormonal variations of these women may be related to the pain sensitization mecha-
nisms of the central nervous system (CNS), making the pelvic floor (PF) more sensitized during the entire menstrual cycle\textsuperscript{5,6}. A recent study\textsuperscript{6} demonstrated hyperalgesia during the menstrual cycle of women with PD, especially in the deep tissues, as evidence of the presence of central sensitization. The pain thresholds for pressure, heat and electricity are reduced in the abdominal, paravertebral and limb regions in the menstrual phase in patients with PD\textsuperscript{5}. However, research is still incipient in relation to painful PF sites in women with PD.

Central sensitization may be associated with pain in the PF of women with PD, by the passage of nociceptive stimuli through the facilitation of the CNS, which generates tension and hyperactivity in the pelvic floor muscles (PFM). These pelvic structures, when affected, can result in cognitive, sexual, behavioral and emotional dysfunctions. In addition, this impairment may be associated with urinary incontinence\textsuperscript{7} in the future.

It is of fundamental importance to have a better knowledge of the painful places to be able to intervene on them. Physiotherapy has resources for pain relief and many other ways of minimizing the effects of pain in PF have been studied.

The objective of this study was to compare the pain pressure threshold in the pelvic floor of women with and without PD.

METHODS

An observational cross-sectional study with a quantitative approach was carried out with university students from a Higher Education Institution of the south of Brazil, from March to June 2018.

The sample consisted of young women divided into two groups: with PD (G1) and without PD (G2). The study included women between the ages of 18 and 35, with and without complaints of PD, nulliparous and users of oral contraceptives (OC) in a non-continuous way. Women with a diagnosis of secondary dysmenorrhea or who presented, at the time of data collection, some diagnosed gynecological pathology were excluded.

The sample calculation was performed using G-Power software 3.1.9.2, based on the results of a pilot study with 10 women divided into two groups. It was estimated a sample of 8 individuals in each group to achieve a level of significance (alpha) of 5% (p<0.05) and power (beta) of 80%.

The data collection occurred during the menstrual cycle at a painless time between the second and third week of OC use. The instruments used to collect the data were the Adapted Questionnaire according to the criteria of Lefebvre et al.\textsuperscript{8}, which includes information such as personal characteristics, gynecological history and characteristics of PD; and an algometer, Microfet 2 HHD (Hoggan Health, United States) manual dynamometer, for evaluation of the pressure threshold of pain, the point where the pain starts. All measurements of the dynamometer were expressed in kg/cm\textsuperscript{2}. The protocol for evaluation of pain points was based on the Molins-Cubero et al.\textsuperscript{9}. For the PFM evaluation (levator ani and coccygeal), the patient was asked to stay in the lithotomy position, with the support of the lower members and relaxed PFM, locating the points located bilaterally in the pelvis (Figure 1).

The participant was shown how algometry would be performed on the adductor muscle of the thumb, after which she was asked to speak the word “pain” when she felt a painful stimulus in the PF for three repetitions. For the PF evaluation, the algometer was positioned perpendicularly at each of the demarcated points, increasing the pressure at a constant rate (1kg/s), without abrupt variations. Measurements were made three times consecutively at each point, on the right side, and the left side, with a 30-second interval between each repetition, considering the average between these measurements. Participants were examined by a single researcher to maintain data collection consistency.

The research began after approval of the Institutional Research Ethics Committee under Opinion number 2.384.714 in 2017.

Statistical analyses

All variables were analyzed for normality using the Kolmogorov-Smirnov test so that the variables that presented Gaussian distribution were submitted to parametric tests, and those that did not were analyzed through non-parametric tests. Parametric data were presented in mean±SD and non-parametric variables in median and interquartile range. Statistical differences between
groups were analyzed using Student’s t-test or the Mann-Whitney test. Values of p<0.05 were considered statistically significant, using a 95% confidence interval. All statistical analysis was performed using GraphPad Prism® software, version 6.0 for Windows (GraphPad Software, San Diego, CA).

RESULTS

Twenty-four young women were evaluated. Under the eligibility criteria, the sample consisted of 20 women divided into two groups: G1 (n=10) and G2 (n=10). The flowchart with the inclusion and exclusion criteria is shown in figure 2.

Table 1 presents data on the groups’ characterization of body mass index (BMI), age at menarche, bleeding time and blood flow.

Table 1. Characterization of young women

<table>
<thead>
<tr>
<th></th>
<th>G1</th>
<th>G2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>21.0 ± 0.3</td>
<td>22.5 ± 0.4</td>
<td>0.015*</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>23.1 ± 0.9</td>
<td>22.1 ± 0.8</td>
<td>0.449</td>
</tr>
<tr>
<td>Menarca (years)</td>
<td>12.7 ± 0.5</td>
<td>12.8 ± 0.4</td>
<td>0.878</td>
</tr>
<tr>
<td>Bleeding time (days)</td>
<td>3.0 (2.0-3.0)</td>
<td>2.5 (2.0-3.0)</td>
<td>0.449</td>
</tr>
<tr>
<td>Menstrual flow (grade)</td>
<td>2 (2.0-3.0)</td>
<td>2 (1.75-2.0)</td>
<td>0.232</td>
</tr>
<tr>
<td>Light</td>
<td>1 (10%)</td>
<td>2 (20%)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>6 (60%)</td>
<td>8 (80%)</td>
<td></td>
</tr>
<tr>
<td>Intense</td>
<td>2 (30%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Family history of PD</td>
<td>7 (70%)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

G1 = with primary dysmenorrhea; G2 = without primary dysmenorrhea; PD = primary dysmenorrhea. Data expressed as mean±SD, median, interquartile range and percentage. *p<0.05.

Table 2 presents the results of the pain pressure threshold in the groups during the period outside the menstrual bleeding. There was no statistically significant difference between groups.

Table 2. Pressure pain threshold of young women

<table>
<thead>
<tr>
<th>Pressure threshold</th>
<th>G1</th>
<th>G2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right side</td>
<td>2.4 ± 0.2</td>
<td>2.8 ± 0.2</td>
<td>0.156</td>
</tr>
<tr>
<td>Left side</td>
<td>2.5 ± 0.2</td>
<td>2.9 ± 0.3</td>
<td>0.198</td>
</tr>
</tbody>
</table>

G1 = with primary dysmenorrhea; G2 = without primary dysmenorrhea; Data expressed as mean±SD. *p<0.05.

DISCUSSION

In this study, we sought to compare the pain pressure threshold in the PF of women with and without PD. The participants of the G1 were younger than those of G2, and no difference was observed between the PF pain pressure threshold between the groups. Thus, despite the occurrence of pain during the menstrual period, the PF of the G1 did not present pain sensitization at the central level, and it is possible to influence the use of OC in response to noxious stimuli.

Vincent et al.11, when comparing pain tolerance among women with and without PD who were not users of OC, found that the former showed higher responses to noxious stimulation, not only at the moment of pain but throughout the cycle. This suggests that women have central sensitization to pain related to the chronicity of pain. In the present study, the time of complaint of PD was not investigated and, considering that the patients did not present chronic pain, this may have contributed to the non-occurrence of central sensitization, in addition to the results that were similar between the two groups.

The evaluation of the pressure pain threshold in the lower limb muscles and trunk of young women with PD and non-users of OC has already been demonstrated. Alfieri et al.12 observed a reduction in the pain tolerance values at the follicular phase of the menstrual cycle, suggesting that pain tolerance is negatively influenced by the follicular phase of the cycle. Although the mechanisms remain unclear, female hormones interact with the nociceptive processes at multiple CNS and peripheral levels, and hormonal variations are associated with variations in the pain experience. However, in another study, no difference in pain sensitivity was observed during the menstrual cycle phases, suggesting that there was no consensus in the studies regarding pressure tolerance to pressure in PD patients5.

For women who do not use OC, there is a fluctuation in pressure tolerance, which is lower in the menstrual phase. However, for women using OC, the threshold seems to remain the same at different stages of the cycle13. It has already been shown that women who used OC presented a lower variation in the

Figure 2. Flowchart of inclusion and exclusion criteria
pressure pain threshold compared to those who did not use this medication. Similarly, another study examined the influence of the menstrual cycle in women with symptoms of temporomandibular joint dysfunction and found that women who have used OC, with or without PD, showed higher tolerance to pain when subjected to algometry. Comparing OC and non-OC users, the difference in pain tolerance was observed throughout the cycle only in women who did not use OC, which could indicate that the hormonal variation along the cycle may influence the perception of pain. Women who use OC showed no significant variations in the perception of pain during the menstrual cycle, since hormonal variation is small, which lessens the effects of the same cycle, suggesting that the OC can modulate pain.

It should be emphasized that no studies were found that evaluated the PF pressure threshold in women with and without PD. In the present study, in relation to the values found in the non-menstrual phase, it was observed that the PF pain threshold values were lower than those of the studies evaluating the abdomen and anteroposterior iliac spines. In addition, no reference values were found for women in this age group for comparison. Sherman et al. observed a variation in pain intensity at different stages of the menstrual cycle, but not at the blood pressure threshold. However, another study concluded that both the PD and the phase of the cycle might influence the pain threshold. Thus, it is assumed that the differences between the studies may relate to the different tissues evaluated and the type of stimulus that was given, so that there was little difference in the effect of the menstrual cycle on the response to pain by specific stimuli, except for electrical stimulation.

In the literature, PD charts are related to family history. Lopes analyzed 48 women with PD and found that 70% had a family history of menstrual cramps. Likewise, the present study, in which 70% of the women with PD reported having relatives with menstrual cramps, corroborates the findings of another study, in which women who had mothers with PD had a better chance of developing PD.

This study was the first to evaluate the pressure pain threshold in the PF algometry. Moreover, it stands out for evaluating women users of OC that, as previously described, can influence the sensation of pain throughout the cycle.

CONCLUSION

Apparently, the presence of primary dysmenorrhea does not influence the pressure pain threshold in the pelvic floor of young women using oral contraceptives.

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Prevalence and factors associated with chronic neuropathic pain in workers of a Brazilian public university

Prevalência e fatores associados à dor neuropática crônica em trabalhadores de uma universidade pública brasileira

Igor Garcia Barreto¹, Katia Nunes Sá²

ABSTRACT

BACKGROUND AND OBJECTIVES: Although it is a public health problem, the prevalence of chronic pain, especially in workers, is underestimated. The present study aims to estimate the prevalence of chronic pain and chronic neuropathic pain in workers of a federal public institution and to identify the associated factors.

METHODS: A cross-sectional study conducted in a stratified random sample of civil servants of a federal higher education institution, between October 2017 and March 2018. Standardized questionnaires involving sociodemographic characteristics and life habits were applied. For those with chronic pain (duration equal to or greater than three months), a questionnaire with pain characteristics was also applied, including a body map, the visual analog scale, and the neuropathic pain questionnaire Doleur Neuropathic 4. The prevalence of chronic pain was estimated, and the Poisson model was used to test the associations between variables (5% of alpha).

RESULTS: In a sample of 108 active civil servants, chronic pain was found in 50% of the sample (95% CI=40.6-59.4) and chronic neuropathic pain in 12% (CI 95%=6.9-19.2). No associations were found between chronic pain and sociodemographic characteristics or life habits. An independent association was confirmed between the frequency of pain and neuropathic pain, where continuous pain in relation to the occasional pain showed a prevalence ratio of 5.17 (CI95% CI=1.69-15.79; p=0.004).

CONCLUSION: Chronic pain had a high prevalence in the institution, being continuous in workers with neuropathic pain. The severity of this type of pain requires urgent actions for its control.

Keywords: Chronic pain, Pain measurement, Risk factors.

RESUMO

JUSTIFICATIVA E OBJETIVOS: Embora seja um problema de saúde pública, a prevalência de dor crônica, especialmente em trabalhadores, é subestimada. O presente estudo teve o objetivo de estimar a prevalência de dor crônica e de dor neuropática crônica em trabalhadores de uma instituição pública federal e identificar os fatores associados.

MÉTODOS: Estudo de corte transversal conduzido em amostra aleatória estratificada de servidores de uma instituição de ensino superior federal, entre outubro de 2017 e março de 2018. Foram aplicados questionários padronizados envolvendo características sociodemográficas e hábitos de vida. Para os que tinham dor crônica (duração igual ou maior que três meses), foram também aplicados um questionário de características dolorosas, envolvendo um mapa corporal, a escala visual analógica e o questionário de dor neuropática Doleur Neuropathic 4. A prevalência de dor crônica foi estimada e o modelo de Poisson utilizado para testar as associações entre as variáveis (alfa de 5%).

RESULTADOS: Em uma amostra de 108 servidores ativos, a dor crônica foi encontrada em 50% da amostra (IC95%=40.6-59.4), sendo 12% (IC95%=6.9-19.2) com características neuropáticas. Não foram encontradas associações entre dor crônica e características sociodemográficas ou hábitos de vida. Foi confirmada a associação independente entre a frequência de dor e dor neuropática, onde a dor continua em relação à ocasionais apresentou razão de prevalência de 5.17 (IC95%=1.69-15.79; p=0.004).

CONCLUSÃO: A dor crônica apresentou elevada prevalência na instituição, sendo contínua em trabalhadores com dor neuropática. A gravidade desse tipo de dor exige ações urgentes para seu controle.

Descritores: Dor crônica, Fatores de risco, Mensuração da dor.

INTRODUCTION

According to the International Association for the Study of Pain (IASP), chronic pain (CP) is the one that lasts longer than the expected period for tissue healing. The threshold of three months has been recognized as the most convenient for non-malignant pain¹. CP causes great damage for the individual, such as reduction of quality of life (QoL) and psychiatric disorders, including anxiety², insomnia³, and depression⁴. It also creates an enormous burden on society, since it causes considerable damage to the health care systems and is associated with significant losses of productivity⁵,⁶. In the United States alone, CP affects around 100 million adults, which is higher than the total of heart disease, cancer, and diabe-
tes combined. In addition to its high frequency, it also presents a low annual recovery rate, since 79% of the affected individuals still have the symptoms even after four years. On a global scale, CP has reached epidemic proportions due to the increasing prevalence over the years. In developed countries, its prevalence is estimated between 26.4 and 51.3%7-10, while in Brazil, between 28.1 and 42%.11-13. Due to its subjective nature, CP varies according to psychosocial, cultural and sociodemographic factors, which is why tracking and identification of associated factors become relevant.

CP can be classified as nociceptive or neuropathic. Neuropathic pain arises from injury or nervous system dysfunction14, and it is associated with more intense pain, in addition to being more difficult to treat.15,16. Chronic neuropathic pain (CNP) causes more significant QoL impairment, mood disorders and difficulties in daily life activities17. Its treatment is very different from the effective treatment for nociceptive pain, being of utmost importance its differentiation. The careful evaluation of CP, especially the CNP, is vital to address more effective measures for its control.

Despite the high social cost and magnitude of the problem, with the involvement of a significant portion of the population on productive age, few studies have been conducted in Brazil to check the prevalence of CP in work environments. In this context, back pain is a recurrent complaint18,19. When it comes to workers of the public sector, the damage caused by CP affects the whole society directly, since they pay the costs.

The present study aimed to estimate the prevalence of CP and CNP, as well as to check the factors associated with this disease in a population of workers of a higher education federal institution.

METHODS

A cross-sectional study conducted at the Federal University of Recôncavo da Bahia (UFRB), at its campuses located in the cities of Cruz das Almas, Santo Antônio de Jesus, Amargosa, Cachoeira, Santo Amaro and Feira de Santana (Bahia-Brazil) between October 2017 and March 2018.

The active workers of UFRB were eligible for the study. According to data from March 2017, there were 1,496 active workers, of these 781 teachers and 715 administrative technicians. The exclusion criteria were pregnancy, workers at gestation leave, workers away for personal reasons, for health reasons, provided that the cause was not the CP and training, with a scheduled date for the end of the respective leaves after 30 days after the expected date to conclude the data collection. Employees working out of their main workplace and with difficulties to answer the questionnaires were also excluded. Workers who were away from their activities for less than the study period, such as in the case of leave, short leave or holidays, were interviewed after 30 days of returning to work.

The stratified random sample was performed with the Microsoft Excel® software using the following procedure: a) the list of all workers was divided by position (teachers or administrative technicians), b) the command “= random ( )” was used to generate a random number assigned to each worker, c) the lists were sorted in ascending order based on the random number, d) the list was then followed strictly until the sample calculation was reached within each category. The stratification was performed due to significant wage and socio-cultural differences between these categories. With an estimated prevalence of CP of 41.4%, as found in a study conducted in Salvador12, a sample was calculated by WinPepi, version 11.65, with a 95% confidence interval (CI) and an acceptable difference of 9%, of 56 teachers and 52 administrative technicians.

The participants selected were invited to the study via institutional email or telephone contact. For those who indicated an intention to participate, individual face-to-face interviews were scheduled with a single investigator, a labor physician who performed the collection in a standardized manner.

First, a questionnaire was applied involving sociodemographic information and lifestyle. In the end, individuals were asked about the presence of pain and, if so, how long they have had the problem. The minimum duration of three months was used as the classification criteria for CP. Participants with CP then answered a questionnaire about pain characteristics, with a body map to identify the sites with the worst pain, a visual analog scale, ranging from “zero”, without pain, to “10”, the worst pain possible, in addition to questions about the frequency of pain and if they have had any treatment for it.

The Doleur Neuropathic 4 (DN-4) questionnaire was used to differentiate the type of pain between neuropathic or nociceptive, which was validated for Brazilian Portuguese, showing good validity and reliability. The participants answered two questions, involving seven pain symptoms. Each item had “yes” or “no” answers. Each “no” answer received a “zero” score, and each “yes” received a “1”. Participants with a score greater than or equal to 3 were classified as neuropathic pain. When using this strategy, the instrument has a sensitivity of 81.6% and specificity of 85.7% in the detection of neuropathic pain.

The Human Research Ethics Committees of the Escola Baiana de Medicina e Saúde Pública (Medicine and Public Health Care School of Bahia), and Universidade Federal do Recôncavo da Bahia (Federal University of the Recôncavo of Bahia), approved the present study under numbers 69348117.8.0000.5544 and 69348117.8.3001.0056, respectively. All the workers had the signatures collected in the Free and Informed Consent Form (FICT).

Statistical analysis

All data were tabulated and analyzed by Stata for Windows version 13.0 (StataCorp LP, College Station, TX, USA). The variables were presented descriptively in absolute numbers and proportions, and their prevalence were estimated by the number of affected individuals divided by the number of individuals exposed. Two analyses were performed after the descriptive statistic. The first one had as independent variables: age, gender, marital status, skin color, position, physical activities, smoking, alcoholism, education level and distance between the cities of residence and work, being the dependent variable the presence or not of CP. The second analysis used as independent variables, the time since the beginning of the pain symptoms, their intensity,
location, frequency and if the patient was receiving any treatment for control. The type of pain (nociceptive or neuropathic) was the dependent variable.

The variable marital status was categorized as single, married, domestic partnership, divorced or widowed. The color of the skin was classified according to the criteria of the Brazilian Institute of Geography and Statistics (IBGE) as white, black, brown, yellow and indigenous, the latter category being excluded due to lack of representatives. For physical activity, the guidelines of the American College of Sports Medicine (ACSM) were used, defining as active individuals those who performed 30 minutes or more of physical activity (PA) with moderate intensity at least 5 days per week or 20 minutes of vigorous PA at least 3 days per week. The others were classified as sedentary.

The educational level was categorized into 5 levels (high school or below, higher education, postgraduate, masters, doctorate or higher). The alcohol consumption was determined as moderate or excessive if the consumption was higher than weekly or in the presence of drunkenness. Less frequent use classified respondents as non-consumers. For smoking, the workers were divided into nonsmokers, former smokers, and current smokers. The location of the pain was categorized according to the segments of the body in the head and neck, lumbar spine, lower limbs, and upper limbs. The numerical variables were analyzed in their original form.

A high prevalence of the study outcome was expected due to previous population-based studies of CP. For this reason, the estimate of the prevalence ratio (PR) obtained by the Odds Ratio (OR) in logistic regression models became inadequate. Due to this problem, the Poisson regression with the sandwich estimator of the variance was used in the present study, since this model presents estimates of the PR and its CI95% similar to those obtained by the Mantel-Haenszel procedure, even with the use of more than one confounding variable and continuous covariates.

An initial univariate analysis was performed in the two statistical analyzes cited. The variables that had a p<0.2 were selected to enter the multivariate model. Through the “Backward” elimination process, the least significant variables were successively excluded until a p<0.1 in the remnants was reached, which was used as the threshold for inclusion of the variables in the final multivariate model. Analysis with p<0.05 was considered statistically significant.

RESULTS

Figure 1 shows the flowchart of the data collection. As noted, 108 participants completed the questionnaires and were included in the study. The sociodemographic characteristics and lifestyle of the interviewed workers are shown in table 1.

The workers in the sample had a mean age of 42.4±10.7 years. The majority of them were male (62%), married or in a domestic relationship (60.2%). Regarding skin color, brown was the predominant (48.6%), while white was 31.4%, black 17.1% and yellow 2.9% of the sample. Teachers accounted for 51.9% of the participants, followed by lower level technicians, 32.4% and higher level, 15.7%. In terms of educational level, the majority of the workers had a Ph.D. (39.8%), followed by postgraduate or specialization (20.4%), master’s degree (18.5%), higher education (13.9%) and high school or lower (7.4%).

Regarding life habits, the sample was predominantly composed of sedentary individuals (52.3%), non-smokers (81.6%) and non-consumers of alcoholic beverage (75.5%). The distance between the city of residence and work had a median of zero and an interquartile range (IQR) of zero in the quartile of 25% and of 117.5 in the quartile of 75%, indicating that most people live in the same city where they work.

![Figure 1. Data collection flowchart](image)
Of the 108 participants, 54 were positively tracked for CP, resulting in a prevalence of 50% (CI95%=40.6-59.4). The pain time had a median of 28.5 months (IQI: 16.5-61.0), and the pain intensity had a mean of 5.55±1.76. Low back pain was the major cause of CP in the sample, affecting 22 individuals (41.5%), followed by pain in the upper limbs present in 13 (24.5%), lower limbs in 11 (20.8%) and head and neck pain in 7 (13.2%). The pain was occasional in 31 people (57.4%), and the majority of the workers (66.7%) were not receiving any treatment for it. Regarding the type of pain, 41 individuals (75.9%) had nociceptive pain characteristics, while only 13 had neuropathic pain. This data allows the calculation of the prevalence of CP with neuropathic characteristics of 12% (95% CI = 6.9-19.2) (Table 2).

An analysis was performed involving possible factors associated with the presence of CP in the worker's sample, using the Poisson model with a robust estimator of the variance. In the univariate analysis, no statistically significant associations were found among the variables. Of the possible factors associated with CP in the sample, only the gender reached the pre-specified threshold of p <0.2 for multivariate analysis, justifying its non-performance (Table 3).

A second analysis was performed to test possible associations between the pain characteristics and the probability of having CP with neuropathic characteristics. In the univariate analysis, it was observed that the time, intensity and frequency of pain variables reached the thresholds of p <0.2 and entered the initial multivariate model (Table 4).

After the Backward elimination procedure, only the variable pain frequency remained significant enough to enter the final model, where a p=0.004 was observed. When analyzing the factors, it was noted that this association was due to a PR of 5.17 (95% CI = 1.69-15.79) for ongoing pain in relation to the occasional pain (Table 5).

### Table 1. Sociodemographic profile and lifestyle of the UFRB workers sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total (n = 108)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>42.4±10.7</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male (n and %)</td>
<td>67 (62)</td>
</tr>
<tr>
<td>Female (n and %)</td>
<td>41 (38)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Single (n and %)</td>
<td>36 (33.3)</td>
</tr>
<tr>
<td>Married or domestic part (n and %)</td>
<td>65 (60.2)</td>
</tr>
<tr>
<td>Divorced or widowed (n and %)</td>
<td>7 (6.5)</td>
</tr>
<tr>
<td>Skin color a</td>
<td></td>
</tr>
<tr>
<td>White (n and %)</td>
<td>33 (31.4)</td>
</tr>
<tr>
<td>Black (n and %)</td>
<td>18 (17.1)</td>
</tr>
<tr>
<td>Brown (n and %)</td>
<td>51 (48.6)</td>
</tr>
<tr>
<td>Yellow (n and %)</td>
<td>3 (2.9)</td>
</tr>
<tr>
<td>Position</td>
<td></td>
</tr>
<tr>
<td>Teacher (n and %)</td>
<td>56 (51.9)</td>
</tr>
<tr>
<td>Higher education technician (n and %)</td>
<td>17 (15.7)</td>
</tr>
<tr>
<td>high school or less educational technician (n and %)</td>
<td>35 (32.4)</td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
</tr>
<tr>
<td>Active (n and %)</td>
<td>51 (47.7)</td>
</tr>
<tr>
<td>Sedentary (n and %)</td>
<td>56 (52.3)</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
</tr>
<tr>
<td>Yes (n and %)</td>
<td>6 (5.8)</td>
</tr>
<tr>
<td>No (n and %)</td>
<td>84 (81.6)</td>
</tr>
<tr>
<td>Ex-smoker (n and %)</td>
<td>13 (12.6)</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td></td>
</tr>
<tr>
<td>No (n and %)</td>
<td>80 (75.5)</td>
</tr>
<tr>
<td>Moderate or excessive (n and %)</td>
<td>26 (24.5)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>High school or lower (n and %)</td>
<td>8 (7.4)</td>
</tr>
<tr>
<td>Higher education (n and %)</td>
<td>15 (13.9)</td>
</tr>
<tr>
<td>Postgraduate or specialization (n and %)</td>
<td>22 (20.4)</td>
</tr>
<tr>
<td>Master’s degree (n and %)</td>
<td>20 (18.5)</td>
</tr>
<tr>
<td>Ph.D. (n and %)</td>
<td>43 (39.8)</td>
</tr>
<tr>
<td>Distance between the city of residence and work in km</td>
<td>Median (IQR)</td>
</tr>
</tbody>
</table>

SD = standard deviation; IQI = interquartile interval; a the “indigenous” category was excluded due to lack of representatives.

### Table 2. Characterization of pain among chronic pain patients in the UFRB workers sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total (n=54)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of pain (in months)</td>
<td>28.5 (16.5-61.0)</td>
</tr>
<tr>
<td>Pain intensity</td>
<td>5.55±1.76</td>
</tr>
<tr>
<td>Location of pain (n and %) a</td>
<td></td>
</tr>
<tr>
<td>Head and neck</td>
<td>7 (13.2)</td>
</tr>
<tr>
<td>Lumbar spine</td>
<td>22 (41.5)</td>
</tr>
<tr>
<td>Upper limbs</td>
<td>13 (24.5)</td>
</tr>
<tr>
<td>Lower limbs</td>
<td>11 (20.8)</td>
</tr>
<tr>
<td>Pain frequency (n and %)</td>
<td></td>
</tr>
<tr>
<td>Occasional</td>
<td>31 (57.4)</td>
</tr>
<tr>
<td>Daily</td>
<td>17 (31.5)</td>
</tr>
<tr>
<td>Continuous</td>
<td>6 (11.1)</td>
</tr>
<tr>
<td>Treatment for pain (n and %)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>18 (33.3)</td>
</tr>
<tr>
<td>No</td>
<td>36 (66.7)</td>
</tr>
<tr>
<td>Type of pain (n and %)</td>
<td></td>
</tr>
<tr>
<td>Nociceptive</td>
<td>41 (75.9)</td>
</tr>
<tr>
<td>Neuropathic</td>
<td>13 (24.1)</td>
</tr>
</tbody>
</table>

SD = standard deviation; IQI = interquartile interval; a there were no participants with thoracic spine pain.
### Table 3. Univariate analysis of the factors associated with chronic pain among UFRB workers (n=108)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Chronic pain</th>
<th>Gross PR (CI95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td>0.74</td>
</tr>
<tr>
<td>Mean±SD 42±11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>0.16</td>
</tr>
<tr>
<td>Male (%) 30 (27.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female (%) 24 (22.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td>0.87</td>
</tr>
<tr>
<td>Single (%) 17 (15.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married or domestic part (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Divorced or widowed (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin color</td>
<td></td>
<td>0.39</td>
</tr>
<tr>
<td>White (%) 18 (17.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black (%) 10 (9.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown (%) 24 (22.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow (%) 1 (0.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td></td>
<td>0.23</td>
</tr>
<tr>
<td>Teacher (%) 25 (23.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher education technician (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school educational technician or lower (%) 20 (18.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td>0.78</td>
</tr>
<tr>
<td>Active (%) 26 (24.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary 27 (25.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td>0.44</td>
</tr>
<tr>
<td>Yes (%) 3 (2.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (%) 42 (40.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex-smoker 8 (7.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td></td>
<td>0.66</td>
</tr>
<tr>
<td>No (%) 41 (38.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate or excessive (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td>0.22</td>
</tr>
<tr>
<td>High school or lower (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher education (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postgraduate or specialization (%) 14 (13.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master’s degree (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ph.D. (%) 18 (16.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance between the city of residence and work in km</td>
<td>0.98</td>
<td></td>
</tr>
<tr>
<td>Median (IQR) 61.6 (106.6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**p-value**

- **SD** = standard deviation, **IQI** = interquartile interval; **PR** = prevalence ratio; *the category “indigenous” was excluded due to lack of representatives; **PR calculated by Poisson regression with robust estimator; ^ these values represent the PR of the increment of one unit in the independent variable; † multivariate analysis was not performed because only the variable “gender” had reached the pre-defined threshold of p<0.2.

### Table 4. Analysis of factors associated with neuropathic pain among patients with chronic pain in the sample (n=54)

<table>
<thead>
<tr>
<th>Variables *</th>
<th>Neuropathic n (%)</th>
<th>Nociceptive n (%)</th>
<th>Univariate - p a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of pain (in months)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (IQR) 24 (14.5-56)</td>
<td>30 (17.5-75)</td>
<td>0.99 (0.98-1.00)</td>
<td></td>
</tr>
<tr>
<td>Location of pain b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head and neck 3 (25.0)</td>
<td>4 (9.8)</td>
<td>2.36 (0.47-11.75)</td>
<td></td>
</tr>
<tr>
<td>Lumbar spine 1 (8.3)</td>
<td>21 (51.2)</td>
<td>0.25 (0.23-2.65)</td>
<td></td>
</tr>
<tr>
<td>Upper limbs 6 (50.0)</td>
<td>7 (17.1)</td>
<td>2.54 (0.59-10.82)</td>
<td></td>
</tr>
<tr>
<td>Lower limbs 2 (16.7)</td>
<td>9 (22.0)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**p-value**

- *the category “indigenous” was excluded due to lack of representatives; **PR calculated by Poisson regression with robust estimator; ^ these values represent the PR of the increment of one unit in the independent variable; † multivariate analysis was not performed because only the variable “gender” had reached the pre-defined threshold of p<0.2.
DISCUSSION

CP has reached alarming proportions, becoming a priority concern for the health care systems. By reaching a significant portion of the working-age population, it has negative impacts on employers. Despite this, there is a scariness of studies that track the prevalence of CP, especially in labor environments in Brazil. The present sample showed a high prevalence was found, placing the institution and the federation in a situation of economic vulnerability and workers in social risks related to the loss of health. A 50% prevalence of CP was found among active public workers of the institution. This result exceeds most of the previous studies. Three population-based studies conducted in Brazil found prevalence of 28.1% in São Paulo, 41.4% in Salvador and 42% in São Luís. Considering a work environment, a study conducted by Kreling, da Cruz e Pimenta found an even higher prevalence of 61.4% among employees of a state university in Paraná. However, that study did not screen for CNP. It is noteworthy that the prevalence of CP is so high in educational institutions. In a study conducted among tobacco farmers, whose mechanical risk is high, they found a prevalence of 8.4% of pain in the lumbar spine, a result much lower than the one found in the present study, which estimated 20.4% prevalence of pain in this body area. In other countries, prevalences were always lower and ranged from 19.6% to 43.5% in Libya, Morocco, France, and the United Kingdom. These differences can be justified by the cut-off point for the stratification of CP, varying between three and six months, and by the different economic, social and cultural conditions involved.

CNP had a prevalence of 12% in the sample. This value is worrisome, mainly because this type of pain is related to a worse prognosis and has greater interference in the life of the individuals affected compared to those who only have nociceptive pain. A similar result was found in a population-based study in São Luís that found a prevalence of CNP of 10% . However, that study included the elderly and retirees, indicating that the prevalence of CNP in the current study is even more serious because it affects explicitly active workers. At the global level, the prevalence of neuropathic pain is 3.9% in Libya, 6.9% in France, 8.1% in Canada, from 8.2 to 8.9% in the United Kingdom and 10.6% in Morocco. The variation in the outcome found in these studies can be explained by the use of different scales to diagnose the type of pain. In Brazil, the high incidence of CNP is alarming, which requires urgent measures.

In the present study, no differences were found between the sociodemographic factors or lifestyle and the presence of CP. In the literature, there are differences among the predictors for CP, but most of the studies state that its prevalence is higher in females and increases with age. The size of the sample may have been insufficient to find significance in these associations since the study was not designed to evaluate these outcomes specifically.

The individuals with CNP had a higher prevalence of continuous pain compared to occasional pain. Previous studies have shown that pain characteristics vary significantly among people with nociceptive and neuropathic pain. Similarly, it was found in these studies a more intense pain and a longer time since the onset of the symptoms and the location in the limbs among those with CNP. These were also the findings of the study conducted by De Moraes Vieira et al., with the additional finding of a higher daily and continuous pain frequency among patients with CNP. The higher frequency of pain among those with CNP suggests a more significant impairment of daily activities, which further affects the ability to work, leads to early retirement and increases the direct and indirect costs for the whole society.

The present study sought a rigorous methodology to get an accurate estimate of the prevalence of CP and CNP among workers of a federal institution, using a stratified random sampling and appropriate robust statistical models. It also applied the
instrument that presented the best results for the tracking of neuropathic pain. However, the study faced difficulties in getting answers from teachers. Even reaching the calculation of the sample and applying adequate techniques for randomization, the high refusal in this group of workers may have led, to some degree, to a selection bias. The fact that the present study was conducted with a particular population of workers, and the finding of the prevalence of CP and CNP was higher than most of the previous studies, suggests an association with being a public worker. This association was not tested since a comparison group of non-public workers was not used. However, it can serve as the basis for future studies on this subject. The cross-sectional design did not allow to establish causal or trend inferences. However, as an exploratory study, it provides relevant data for longitudinal studies, socio-educational interventions in occupational health and public health policies.

CONCLUSION

In conclusion, the 50% prevalence of CP and 12% of CNP was found among the employees of a higher education institution located in the countryside of the state of Bahia, Brazil. No associations were found between sociodemographic characteristics or lifestyle and the presence of CP. Continuous pain was more prevalent among people with CNP. The study broadens the knowledge about the epidemiology of pain in the workplace, showing the higher prevalence of CNP found so far, both in national and international studies.

ACKNOWLEDGMENTS

To the participants for the time and collaboration in the study, as well as to the entire team of the Pro-Rectory of People Management of the Federal University of the Recôncavo da Bahia for the support and provision of the necessary data for this study.

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Pain assessment in critical patients using the Behavioral Pain Scale

Avaliação da dor em pacientes críticos por meio da Escala Comportamental de Dor

Laudice Santos Oliveira1, Maiara Pimentel Macedo1, Stefany Ariadley Martins da Silva1, Ana Paula de Freitas Oliveira1, Victor Santana Santos2

ABSTRACT

BACKGROUND AND OBJECTIVES: The sensation of pain is essential for life, and its assessment in critical non-contacting patients can be performed using validated scales. The Behavioral Pain Scale is a highly accurate tool that has been widely used in this group of patients. This study aimed to describe and characterize pain and the use of analgesia in the emergency or intensive care service.

METHODS: This was a cross-sectional study with a quantitative approach with 67 critically ill patients unable to verbalize their pain perception, who were hospitalized in the emergency service or Intensive Care Units of a public hospital in Vitória da Conquista, Bahia from April to July 2017. Clinical and epidemiological data were collected using the medical record and then applied to the Behavioral Pain Scale for pain assessment.

RESULTS: There was a predominance of male patients (47/70.1%). Three groups were identified based on the use of sedatives and analgesics: patients taking sedatives and analgesics combined, only analgesia, and those without any sedation or analgesia. We observed ascending Behavioral Pain Scale scores in all groups during tracheal suction, but the same did not occur with the physiological parameters.

CONCLUSION: The study proposes the adoption of pain assessment scales in critical patients, such as the Behavioral Pain Scale, as well as the use of protocols for analgesia management, and consequently improve the quality of care and patient’s recovery.

Keywords: Emergency medical services, Intensive Care Units, Pain, Pain management, Pain measurement.

INTRODUCTION

The sensation of pain is essential for life. Its perception is the result of multidimensional and personal experiences in the face of the various stimuli that result or not in tissue injury1. Therefore, the protocols of care recommend the evaluation of pain by health professionals during the assistance. In individuals who verbalized and have preserved cognition, pain measurement can be more easily reported because the individual is able to describe the pain he/she feels2. However, in critically ill patients who are under adverse conditions that prevent them from verbalizing the presence or absence of pain1,4 either by changes in the level of consciousness, the effects of sedative agents and/or the use of mechanical ventilation3, the measurement of pain can only be indirect.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A sensação de dor é essencial para a vida. Sua avaliação em pacientes críticos não contatantes pode ser realizada por meio de escalas validadas. A Behavioral Pain Scale é um instrumento de aplicação, com elevada acurácia, e que tem sido amplamente utilizada neste grupo de pacientes. Este estudo objetivou descrever e caracterizar a dor e o uso de analgesia no serviço de urgência e cuidados intensivos.

MÉTODOS: Trata-se de um estudo transversal com abordagem quantitativa, realizado com 67 pacientes críticos impossibilitados de verbalizar a percepção de dor, os quais estavam hospitalizados na área vermelha do pronto-socorro ou nas Unidades de Terapia Intensiva de um hospital público de referência em Vitória da Conquista, Bahia no período de abril a julho de 2017. Dados clínicos e epidemiológicos foram coletados utilizando-se o prontuário e em seguida foi aplicada a Behavioral Pain Scale para avaliação da dor.

RESULTADOS: Houve predomínio de pacientes do sexo masculino (47/70,1%). Foram identificados três grupos com base no uso de sedativos e analgésicos: pacientes em uso de sedoanalgesia, uso apenas de analgesia, e os que estavam sem sedação ou analgesia. Visualizou-se ascensão dos escores da Behavioral Pain Scale em todos os grupos durante a aspiração traqueal, porém o mesmo não aconteceu com os parâmetros fisiológicos.

CONCLUSÃO: O estudo apresentou como proposta a adoção de escalas de avaliação da dor no paciente crítico, como a Behavioral Pain Scale, bem como uso de protocolos de analgesia e manuseio, melhorando assim a qualidade da assistência prestada e a recuperação do paciente.

Descritores: Dor, Manuseio da dor, Mensuração da dor, Pronto-Socorro, Unidade de Terapia Intensiva.
Some studies report that the observation of changes in physiological parameters may be a quick and simple method to infer pain. However, the use of physiological data alone is debatable, since several factors such as fear, anxiety and psychological stressors can influence this measurement. Also, the absence of changes in the vital signs does not necessarily indicate the absence of pain.

As the inability to report pain does not deny its existence and does not discard the right to adequate treatment, when it is impossible to obtain the patient’s self-report about the pain it is recommended to use observational scales that are based on the individual’s physiological parameters and body expressions. Among the available scales to measure the pain in non-responsive patients, the most used by the health services is the Behavioral Pain Scale (BPS) because it is highly accurate and easy to apply to patients with severe pain.

Knowing the level of pain of patients, whether critical or not, is essential to optimize comfort and minimize suffering. In addition, effective and adequate pain control is associated with a reduction in mechanical ventilation time, shorter patient length of stay, and lower morbidity and mortality rates in intensive care units (ICU). However, despite these benefits, pain assessment has been performed inadequately (or not performed) in some health services that provide care to critical patients, making it difficult to manage pain in these patients adequately.

Given the above, the present study aimed to evaluate the pain and the use of analgesia in critically ill patients admitted to the emergency and intensive care services of a public reference institution in southwest Bahia.

**METHODS**

This is a cross-sectional and descriptive study with a quantitative approach, referring to critically ill patients admitted to the red area of the emergency room or to one of the two ICUs of a public reference hospital in Vitória da Conquista, Bahia, Brazil, between April and July 2017.

This hospital is located 519 km from the capital, Salvador, and it is a reference for 73 smaller cities with a population of approximately 1.7 million inhabitants. The sampling was non-probabilistic due to adequacy, with an estimated sample size of about 60 – 65 patients. The calculation was based on an accuracy of 0.95±0.05 of the Cronbach’s alpha coefficient for a scale with three subscales. All critical patients admitted during the study period, older than 18 years of age, of both genders, using mechanical ventilation, sedated and unarticulated, who were unable to report pain, and with a maximum stay time of 48h were included. Patients in neurological protection, quadriplegic, who had received a neuromuscular blocker, who had peripheral neuropathy or suspicion of brain death, were excluded. These exclusion criteria were used not to include patients whose diseases or drugs could compromise the expression of pain behaviors.

After the written consent was signed by a responsible family member, duly trained research assistants, using the previously prepared data collection instrument, obtained the clinical and demographic data from the patient’s medical records. The demographic information included age and gender. The clinical data included prior comorbidities, diagnosis, pharmacological prescription (use of analgesics and continuous infusion sedatives, given at regular intervals or if necessary). In addition, the information on the neurological assessment of each patient was obtained using the Glasgow Coma Scale, FOUR (Full Outline of Unresponsiveness), and the Richmond Agitation Sedation Scale (RASS), which are routinely used by professionals who work in the field of study.

The research assistants also collected information on the vital signs of each patient using a multimodal monitor during three moments of the study: at rest, during eye cleansing (EC) with gauze moistened in saline (considered a non-painful procedure) performed by the nursing technician and during the tracheal suction (TS) (considered a painful procedure) performed by the assistant physiotherapist. These procedures are already part of the patient care routine, so no additional procedure is required.

Simultaneously, the researchers applied the BPS validated in Brazil by Morete et al. (Table 1). The BPS has a total of 12 descriptors, distributed in 3 items (1. Facial expression, 2. Upper limbs, 3. Adaptation to mechanical ventilation) with results varying from 3 (absence of pain) to 12 (unbearable pain). A score ≥3 indicates the presence of pain and ≥5 indicates significant pain.

<table>
<thead>
<tr>
<th>Table 1. The Brazilian version of the Behavioral Pain Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Facial expression</td>
</tr>
<tr>
<td>Partially contracted (e.g., lowering eyelid)</td>
</tr>
<tr>
<td>Completely contracted (eyes closed)</td>
</tr>
<tr>
<td>Facial contortion</td>
</tr>
<tr>
<td>Movement of the upper limbs</td>
</tr>
<tr>
<td>Partial motion</td>
</tr>
<tr>
<td>Full motion with finger flexion</td>
</tr>
<tr>
<td>Permanently contracted</td>
</tr>
<tr>
<td>Comfort with the mechanical ventilation</td>
</tr>
<tr>
<td>Cough, but tolerant of mechanical ventilation most of the time</td>
</tr>
<tr>
<td>Fighting with the fan</td>
</tr>
<tr>
<td>No ventilation control</td>
</tr>
</tbody>
</table>

The present study complies with the provisions of Resolution 466/12 and was approved by the Human Research Ethics Committee of the Multidisciplinary Health Institute, Anísio Teixeira Campus of the Federal University of Bahia under CAAE 65835917.6.0000.5556.

**Statistical analysis**

All information obtained was coded and inserted into a database. Then, we performed an exploratory analysis of the data through the calculation of absolute and percentage simple frequencies for the categorical variables. The normal distribution of the data set was checked using the Kolmogorov-Smirnov test. The ANOVA test was used to check the fluctuation of the
parameters within the same group between the three moments of measurement of the values. The level of significance of the analysis was 5% (p<0.05). The data were analyzed using the SPSS software version 20.0.

**RESULTS**

Sixty-seven patients were included in the study. Each of them was evaluated in three moments: a) at rest, b) eye cleansing (EC) and c) tracheal suction (TS); totaling 201 observations (67 patients versus three observations each). Patients were predominately male (47/70.1%), with a median age of 56 years (IQR: 36-74), urban residents (51/76.1%), with reports of pre-existing comorbidity (41/61.2%). Most patients had a clinical diagnosis (49/73.1%), followed by trauma (18/26.9%) (Table 2).

After collection, three groups of patients were identified based on the use of sedatives and analgesics: G1, patients undergoing sedation and analgesia; G2, only using analgesia; and G3, without sedation or analgesia.

The majority of the patients were using analgesia associated with sedation (31/46.3%), and midazolam and fentanyl were the most commonly used drugs. Patients undergoing sedation and analgesia were evaluated by RASS and had an average score of -4.5±1.29. Eighteen (26.9%) were using analgesia alone, with fentanyl and dipyrone being the most prescribed analgesics. For these individuals, the neurological evaluation was performed using the FOUR scale in 28 patients with a mean of 6.2±3.63; and Glasgow coma scale in six patients with a mean of 4.3±2.16.

Sixteen patients (23.9%) were without analgesia or sedation. Of the 201 observations, in 70 (34.8%) patients had a score of ≥5 on BPS (Table 2).

Table 3 shows the variation of the physiological parameters in the three evaluation moments for the three groups identified. Variation was observed in the three evaluation groups in all the physiological parameters with the interventions, except in temperature.

Table 4 shows the variation of the BPS scores. In all three groups of patients, a significant fluctuation was observed in all scores on the scale, except between at rest and tracheal suction.

---

**Table 2.** Demographic and clinical data of the patients included in the study. Vitória da Conquista, April to July/2017

<table>
<thead>
<tr>
<th>Categorical variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, male</td>
<td>47 (70.1)</td>
</tr>
<tr>
<td>Area, urban</td>
<td>51 (76.1)</td>
</tr>
<tr>
<td>Diagnostic classification</td>
<td></td>
</tr>
<tr>
<td>Clinical</td>
<td>49 (73.1)</td>
</tr>
<tr>
<td>Trauma</td>
<td>18 (26.9)</td>
</tr>
<tr>
<td>Comorbidity</td>
<td>41 (61.2)</td>
</tr>
<tr>
<td>Pharmacological scheme</td>
<td></td>
</tr>
<tr>
<td>Prescribed sedation and analgesia</td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>31 (46.3)</td>
</tr>
<tr>
<td>Group 2</td>
<td>18 (26.9)</td>
</tr>
<tr>
<td>Group 3</td>
<td>16 (23.9)</td>
</tr>
<tr>
<td>Pain assessment</td>
<td></td>
</tr>
<tr>
<td>BPS ≥5†</td>
<td>70 (34.8)</td>
</tr>
<tr>
<td>BPS ≥5 (During TS) **</td>
<td>61 (91)</td>
</tr>
<tr>
<td>Numerical variables</td>
<td></td>
</tr>
<tr>
<td>Age, median (IQR)</td>
<td>56 (36-74)</td>
</tr>
<tr>
<td>FOUR</td>
<td>6.2±3.63</td>
</tr>
<tr>
<td>Coma Glasgow scale</td>
<td>4.3±2.16</td>
</tr>
<tr>
<td>RASS</td>
<td>-4.5±1.29</td>
</tr>
</tbody>
</table>

BPS = Behavioral Pain Scale; TS = tracheal suction; FOUR = Full Outline of Unresponsiveness; RASS = Richmond Agitation Sedation Scale; IQR = interquartile interval; Group 1 = sedation and analgesia; Group 2 = analgesia; Group 3 = no sedation or analgesia. Categorical data presented quantitatively and percentage, numerical data on average and standard deviation. † 201 observations, ** 67 observations.

**Table 3.** Variation of the physiological parameters in the three moments of evaluation with the Behavioral Pain Scale in patients hospitalized in a regional hospital of Vitória da Conquista, Bahia, Brazil, 2017

<table>
<thead>
<tr>
<th>Groups</th>
<th>Parameters</th>
<th>At rest</th>
<th>Mean±SD</th>
<th>Eye cleansing</th>
<th>Tracheal suction</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1</strong></td>
<td>HR (bpm)</td>
<td>88.7 (26.6)</td>
<td>89.9 (26.4)</td>
<td>104 (29.1)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RR (irpm)</td>
<td>15.7 (3.8)</td>
<td>15.6 (3.9)</td>
<td>20.4 (7.4)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SpO₂ in%</td>
<td>97.3 (4.0)</td>
<td>97.3 (3.8)</td>
<td>95.0 (4.9)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SBP (mmHg)</td>
<td>122.3 (29.4)</td>
<td>122.3 (28.9)</td>
<td>139.8 (38.5)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DBP (mmHg)</td>
<td>67.3 (15.4)</td>
<td>67.7 (14.8)</td>
<td>80.1 (18.7)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAP (mmHg)</td>
<td>83.2 (20.8)</td>
<td>86.4 (16.9)</td>
<td>101.3 (24.2)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature °C</td>
<td>35.9 (1.2)</td>
<td>35.9 (1.2)</td>
<td>35.9 (1.2)</td>
<td>0.846</td>
<td></td>
</tr>
<tr>
<td><strong>Group 2</strong></td>
<td>HR (bpm)</td>
<td>90.9 (21.7)</td>
<td>91.2 (22.3)</td>
<td>104.4 (20.1)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RR (irpm)</td>
<td>16.1 (4.5)</td>
<td>16.4 (4.7)</td>
<td>25.2 (9.2)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SpO₂ in%</td>
<td>97.7 (2.5)</td>
<td>97.8 (2.6)</td>
<td>95.3 (3.6)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SBP (mmHg)</td>
<td>121.2 (27.8)</td>
<td>123.8 (25.5)</td>
<td>141.8 (30.8)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DBP (mmHg)</td>
<td>63.6 (12.5)</td>
<td>64.8 (11.6)</td>
<td>77.9 (11.8)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAP (mmHg)</td>
<td>82.5 (17.2)</td>
<td>84.6 (15.4)</td>
<td>101.7 (17.9)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature °C</td>
<td>35.7 (1.1)</td>
<td>35.7 (1.1)</td>
<td>35.7 (1.1)</td>
<td>0.717</td>
<td></td>
</tr>
</tbody>
</table>

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Continue...
DISCUSSION

Pain control, even in critically unarticulated patients, is vital. However, despite the technological advances in the care of critical patients in emergency or intensive care units, pain assessment and its proper management have been poorly addressed. This study found that even for patients undergoing analgesia and sedation, there was variation in the physiological parameters and BPS scores when they underwent painful procedures, especially TS, a routine technique in hospital units. This implies flaws in the process of pain assessment and the adequacy of analgesia in patients in intensive care.

This ineffective control of pain is the result of a series of factors indicated in literature such as choosing an inadequate method of pain measurement, insufficient professional training or improper management of the pain without scientific evidence. In addition, the resistance to change the routine of many professionals is also an important cause of inadequacies in the control of the pain in critical patients.

Some studies have also pointed out the lack of knowledge of the professionals about scales with considerable accuracy to assess pain in unarticulated patients. However, since it is not possible to obtain the patient's verbal report about his/her pain, several observational scales have been recommended. Among them, the BPS stands out for its high accuracy, easy application and for being adapted to the Brazilian reality.

Like other studies conducted in Brazil, this study showed that the BPS was adequate to evaluate pain in unarticulated patients. The comparison of the scale scores at rest and during eye cleansing, considered as a non-painful procedure, showed no variation. In this study, eye cleansing simulates other situations or procedures that are performed by the professional, such as dressing changes and measure temperature, but which do not necessarily correspond to painful stimuli. However, the results showed a significant variation in the scale scores during TS – considered a painful process for the patient – and the highest scores of the instrument were observed, regardless of the form of analgesia (or absence).
Although the change in physiological parameters is not necessarily an indication to assess the pain in unarticulated patients, a significant variation in heart rate, respiratory rate, oxygen saturation, and systemic blood pressure was observed in the present study. These results are similar to those reported in other studies that analysed whether changes in BPS were accompanied by physiological changes in patients.27,28 However, it is worth mentioning that the physiological parameters can be sensitive to several factors besides the presence of pain, such as fear, anxiety and psychological stressors17 and other clinical conditions. Thus, the monitoring of physiological parameters alone as a way to assess pain has not been recommended29,30,27,31, making necessary the use of properly validated scales/instruments and with proved accuracy, such as the BPS.32

The lowest BPS scores were found in group 1. However, even these patients showed significant variations in the scores of the pain scale, which implies that even in them the pain was being underestimated. Also, it was not possible to establish whether those in group 1 were experiencing less pain or if they were unable to present it,3 as it would be unethical to conduct research involving the manipulation of sedation or analgesia levels since the patients would be exposed to a higher possibility of feeling pain.17 Indeed, from the results of this study, it can be inferred that adjustments in pain control should be performed even in individuals with sedation and analgesia, which can be obtained with an accurate assessment of the pain in these patients. Other studies show that behavioral indicators are more sensitive and present more adequate data than the hemodynamic parameters in the assessment of pain in critically ill patients.33,34 However, the use of observational scales should not be considered as the most reliable or the only evaluation necessary since they do not reflect the intensity or the location of the pain, and they can be masked by deep sedation or the use of blocking agents. Likewise, these instruments should not replace the self-report of pain, when possible.32,33

CONCLUSION

Considering the observed aspects, we noticed an intense pain during TS, visualized by the elevation of the BPS scores in all the groups observed, confirming their responsiveness. Despite the alteration of the physiological parameters during the observation of groups 1 and 2, the same did not happen in group 3, indicating that the hemodynamic alterations should not be used as valid precursors to measure the pain.

REFERENCES

Low back pain, anthropometric indexes and range of motion of rural workers

Dor lombar, índices antropométricos e flexibilidade em trabalhadores rurais

Patrik Nepomuceno¹, Luiza Müller Schmidt¹, Marcelo Henrique Glänzel³, Miriam Beatris Reckziegel², Hildegard Hedwig Pohl²,3, Eboni Marília Reuter¹

ABSTRACT

BACKGROUND AND OBJECTIVES: This study is necessary considering the expressive number of rural workers that are not assisted by a health professional despite the presence of musculoskeletal changes such as low back pain. Thus, the objective was to check if there is a relationship among low back pain levels, anthropometric measures and range of motion of rural workers.

METHODS: A cross-sectional study with rural workers that used the visual analog scale to measure low back pain. The data on body mass index, fat percentage, waist circumference, waist-hip ratio and visceral fat area were obtained, as well as the assessment of posterior chain range of motion.

RESULTS: Fifty-five rural workers were evaluated, with a predominance of women and married. Of the subjects evaluated, 37 (67.3%) reported low back pain, with an average pain of 3.4±2.7. More than half of the sample presented values of body mass index, fat percentage, waist circumference and waist-hip ratio considered undesirable. Those with pain had higher values of body mass index and visceral fat area.

CONCLUSION: Rural workers with low back pain presented higher values of body mass index and visceral fat area, as well as those with an inadequate range of motion in the same region who had higher values of visceral fat area and pain. It is also possible to infer that there is an association between the values of body mass index and visceral fat area with the level of pain, just as the waist-hip ratio is associated with the levels of range of motion.

Keywords: Anthropometry, Farmers, Low back pain, Range of motion.

RESUMO

JUSTIFICATIVA E OBJETIVOS: O estudo justifica-se pelo expressivo contingente de trabalhadores rurais que não são acompanhados quanto à saúde, ao mesmo tempo que apresentam alterações musculoesqueléticas como dor lombar. Dessa forma, o objetivo foi verificar se há relação entre a dor lombar, medidas antropométricas e níveis de flexibilidade de trabalhadores rurais.

MÉTODOS: Trata-se de um estudo transversal com trabalhadores rurais que utilizou a escala analógica visual para mensurar a dor lombar. Foram obtidas as medidas de índice de massa corporal, percentual de gordura, circunferência da cintura, relação cintura-quadril e área de gordura visceral, além da aferição da flexibilidade de cadeia posterior.

RESULTADOS: Foram avaliados 55 trabalhadores rurais, com predomínio do sexo feminino e casados. Dos sujeitos avaliados 37 (67,3%) referiram queixas de dor lombar, sendo a pontuação média de dor de 3,4±2,7. Mais da metade da amostra apresentava valores de índice de massa corporal, percentual de gordura, circunferência da cintura e relação cintura-quadril classificados em categorias indesejáveis. Aqueles com dor apresentaram valores de índice de massa corporal e área de gordura visceral superiores.

CONCLUSÃO: Os trabalhadores rurais com dor lombar apresentaram valores de índice de massa corporal e área de gordura visceral maiores, assim como aqueles com flexibilidade inadequada na mesma região apresentam maiores valores de área de gordura visceral e dor. Também é possível inferir que há associação entre os valores de índice de massa corporal e área de gordura visceral com o nível de dor, bem como a relação cintura-quadril se associa aos níveis de flexibilidade.

Descritores: Agricultores, Amplitude de movimento, Antropometria, Dor lombar.

INTRODUCTION

Worker’s health has been highlighted in research in the area of collective health, a fact that is related to the incidence of health problems arising from work activity. However, in some populations, these issues need to be addressed in-depth, as is the case of rural workers¹. These workers present more health problems and diseases when compared to workers in the urban area, not to mention their difficulty in accessing health services². Farmers often perform activities that require intense physical effort leading to frequent musculoskeletal disorders. As a consequence, they refer to pain and discomfort that interfere with their daily activities. Among the main discomforts identified in these workers is low back pain (LBP). LBP can occur due to...
several factors, such as the reduction of the flexibility of the posterior muscle chain related to workload and lack of actions to prevent injuries, and it may also be connected to obesity. Estimates indicate that from 60 to 80% of the general population will have low back pain at some point in life. Such disorders in the spine, which are expressed in pain, lead to the impairment of work activities and postural changes. These workers may have high-intensity pain, which associated with musculoskeletal disorders cause changes in postural stability. In addition, overweight is frequent in this population, which can aggravate their condition. The physical overload during the work activity may favor the onset of LBP and decrease the flexibility of this population. Thus, it is essential to detect these changes to develop actions to prevent related disorders.

Considering that Brazil has a significant number of workers in this sector whose health needs are not monitored, it is evident the importance of knowing their illness profile.

In this context, the present study is justified since it addresses the painful symptoms, referred to as common in rural workers, trying to identify the contributing elements associated with physical fitness. It is known that due to the characteristics of the rural work, high prevalence of LBP is common, reaching 98%, but there is still a gap to be filled by research on this subject in the population. Also, the exponential increase in non-communicable chronic diseases in rural areas, especially obesity, has been described. Therefore, the objective was to check if there is a relationship between LBP, anthropometric measures and levels of flexibility of rural workers.

METHODS

It is a cross-sectional retrospective study conducted with rural workers from Santa Cruz do Sul and municipalities of the Regional Development Council of the Rio Pardo Valley (COREDE-VRP). It was considered a (two-sided) 0.05 and 80% power to estimate the statistical power. Thus, with 55 workers it was possible to reach the effect magnitude of 0.45. The sample power to estimate the statistical power. Thus, with 55 workers it was possible to reach the effect magnitude of 0.45. The sample power to estimate the statistical power. Thus, with 55 workers it was possible to reach the effect magnitude of 0.45. The sample power to estimate the statistical power. Thus, with 55 workers it was possible to reach the effect magnitude of 0.45. The sample power to estimate the statistical power. Thus, with 55 workers it was possible to reach the effect magnitude of 0.45.

The flexibility was measured in cm with the sit and reach test using a Wells Bench, with three maneuvers performed and considered the best result. It was classified according to Wells and Dillon as “adequate” and “increased risk” and “high risk” as “inadequate”. The WHR was calculated by the ratio between the WC and the hip ratio, obtaining the hip circumference of the major trochanter of the femur, was classified according to Heyward in “low risk” as “adequate” and “moderate risk”, “high risk” and “very high risk” considered “inadequate”. The AVF was obtained by bioimpedance analysis (InBody 720®) and expressed in cm³ and classified according to Pitanga et al. as “normal” and “high”.

The flexibility was measured in cm with the sit and reach test using a Wells Bench, with three maneuvers performed and considered the best result. It was classified according to Wells and Dillon as “weak”, “regular”, “medium” classified as “inadequate” and “good” and “very good” as “suitable”.

The WC was obtained with an anthropometric tape at the midpoint between the last rib and the iliac crest. It was classified according to Lean, Han and Morrison as “normal” considered to be “adequate” and “increased risk” and “high risk” as “inadequate”. The WHR was calculated by the ratio between the WC and the hip ratio, obtaining the hip circumference of the major trochanter of the femur, was classified according to Heyward in “low risk” as “adequate” and “moderate risk”, “high risk” and “very high risk” considered “inadequate”. The AVF was obtained by bioimpedance analysis (InBody 720®) and expressed in cm³ and classified according to Pitanga et al. as “normal” and “high”.

A self-reported questionnaire on sociodemographic and lifestyle data was applied to characterize the sample. The workers answered questions about gender (female/male), age (in years), socioeconomic class (Brazilian Business Association criteria), marital status (married/other), domestic journey (less than 2h and more than 2h) time of activity in the area (in years), hours of work per day, number of children, predominant posture at work (standing, sitting, alternating) and physical activity practice (yes/no).

LBP was measured by the visual analog scale (VAS). Individuals were informed that zero meant no pain and 10 would be the maximum pain. They referred the corresponding value looking at the scale. The results were classified as “no pain” (zero), “mild to moderate pain” (1 to 5), and “moderate to severe pain” (6 to 10).

The data considered for the anthropometric evaluation was the total obesity indexes such as body mass index (BMI) and percentage of fat (%G), and fat location such as waist circumference (WC), waist-hip ratio (WHR) and area of visceral fat (AVF).

The weight and height were obtained in an analog scale with a stadiometer to calculate the BMI (kg/m²), being classified according to the categories of the World Health Organization and later dichotomized in “recommended range” and “overweight.”

The WC and the hip ratio, obtaining the hip circumference of the major trochanter of the femur, was classified according to Heyward in “low risk” as “adequate” and “moderate risk”, “high risk” and “very high risk” considered “inadequate”. The AVF was obtained by bioimpedance analysis (InBody 720®) and expressed in cm³ and classified according to Pitanga et al. as “normal” and “high”.

A self-reported questionnaire on sociodemographic and lifestyle data was applied to characterize the sample. The workers answered questions about gender (female/male), age (in years), socioeconomic class (Brazilian Business Association criteria), marital status (married/other), domestic journey (less than 2h and more than 2h) time of activity in the area (in years), hours of work per day, number of children, predominant posture at work (standing, sitting, alternating) and physical activity practice (yes/no).

LBP was measured by the visual analog scale (VAS). Individuals were informed that zero meant no pain and 10 would be the maximum pain. They referred the corresponding value looking at the scale. The results were classified as “no pain” (zero), “mild to moderate pain” (1 to 5), and “moderate to severe pain” (6 to 10).

The data considered for the anthropometric evaluation was the total obesity indexes such as body mass index (BMI) and percentage of fat (%G), and fat location such as waist circumference (WC), waist-hip ratio (WHR) and area of visceral fat (AVF). The weight and height were obtained in an analog scale with a stadiometer to calculate the BMI (kg/m²), being classified according to the categories of the World Health Organization and later dichotomized in “recommended range” and “overweight.”

The %G of seven skinfolds, obtained with the Lange caliper, and the measurements taken in the right hemisphere, and calculated by the Jackson and Pollock equation, followed by the Siri equation, was classified using the proposal by Pollock and Wilmore. The results “excellent”, “good” and “above average” were considered “adequate”, and “average”, “below average”, “bad” and “very bad”, as “inadequate”.

The WC was obtained with an anthropometric tape at the midpoint between the last rib and the iliac crest. It was classified according to Lean, Han and Morrison as “normal” considered to be “adequate” and “increased risk” and “high risk” as “inadequate”. The WHR was calculated by the ratio between the WC and the hip ratio, obtaining the hip circumference of the major trochanter of the femur, was classified according to Heyward in “low risk” as “adequate” and “moderate risk”, “high risk” and “very high risk” considered “inadequate”. The AVF was obtained by bioimpedance analysis (InBody 720®) and expressed in cm³ and classified according to Pitanga et al. as “normal” and “high”.

The flexibility was measured in cm with the sit and reach test using a Wells Bench, with three maneuvers performed and considered the best result. It was classified according to Wells and Dillon as “weak”, “regular”, “medium” classified as “inadequate” and “good” and “very good” as “suitable”.

This study was approved by the Ethics Committee of the institution under opinion number 2.349.234/2017.

Statistical analysis

The results were presented in tables and expressed by the mean and standard deviation for numerical data, and frequency and percentage for categorical data, and analyzed by the SPSS Statistics’ software. The Shapiro-Wilk test was used to check data normality. Pearson’s (parametric variables) and Spearman’s tests (non-parametric variables) were used for the correlation analysis. The comparison of means between the groups was checked by the Student’s t-test for independent samples, and ANOVA with Hochberg’s post-hoc GT2 (parametric variables) and Mann-Whitney and Kruskal-Wallis U (non-parametric variables). For the categorical variables, the Chi-square test was used considering p<0.05.
RESULTS

Fifty-five individuals with mean age of 48.4±12.2 years were evaluated, of which 30 (54.5%) were female, mostly married (76.4%) with children (85.5%) and C1 and C2 socioeconomic status (56.4%). The average years working in agriculture was 26.64±15.88 years. Regarding household chores, the majority of the sample reported less than 2h daily (72.2%), with no relation between household chores and pain. Also, no differences were observed between gender and household chores time (p=0.269), although only women have reported dedicating from 4 to 6 hours for such activities (n=5).

In the comparison of sociodemographic and lifestyle variables in the groups with pain, no differences were found for gender, age, marital status, domestic journey, activity time, hours of work per day, number of children and practice of physical activity. However, it is possible to observe that individuals of the B socioeconomic class had more pain than those belonging to class C. In addition, individuals with higher pain intensity perform their work activities alternating between standing and sitting (Table 1).

When asked about LBP, 37 (67.3%) complained of pain in this region with a mean pain score in the VAS of 3.4±2.7. Regarding the variables evaluated, more than half of the sample had BMI values. %G, WC and WHR were classified as undesirable categories (Table 2).

When comparing the averages of the anthropometric variables and the flexibility of the individuals without LBP with mild to moderate and moderate to severe pain, it was identified that

Table 1. Characterization of the sample regarding sociodemographic data and lifestyle

<table>
<thead>
<tr>
<th>Variables</th>
<th>Without pain (n=18)</th>
<th>Low back pain</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mild to moderate (n=24)</td>
<td>Moderate to intense (n=13)</td>
</tr>
<tr>
<td>Gender*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>8 (32.0)</td>
<td>12 (48.0)</td>
<td>5 (20.0)</td>
</tr>
<tr>
<td>Male</td>
<td>10 (33.3)</td>
<td>12 (40.0)</td>
<td>8 (26.7)</td>
</tr>
<tr>
<td>Age**</td>
<td>49.89 (11.62)</td>
<td>46.96 (13.04)</td>
<td>48.92 (12.20)</td>
</tr>
<tr>
<td>Socioeconomic class*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>2 (9.5)</td>
<td>14 (66.7)</td>
<td>5 (23.8)</td>
</tr>
<tr>
<td>C</td>
<td>15 (48.4)</td>
<td>8 (25.8)</td>
<td>8 (25.8)</td>
</tr>
<tr>
<td>Marital status*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>13 (31.0)</td>
<td>18 (42.9)</td>
<td>11 (26.2)</td>
</tr>
<tr>
<td>Others</td>
<td>5 (38.5)</td>
<td>6 (46.2)</td>
<td>2 (15.4)</td>
</tr>
<tr>
<td>Domestic journey*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 2 hours</td>
<td>13 (32.5)</td>
<td>19 (47.5)</td>
<td>8 (20.0)</td>
</tr>
<tr>
<td>More than 2 hours</td>
<td>5 (33.3)</td>
<td>5 (33.3)</td>
<td>5 (33.3)</td>
</tr>
<tr>
<td>Time of activity**</td>
<td>21.17 (13.80)</td>
<td>29.75 (16.48)</td>
<td>28.46 (16.65)</td>
</tr>
<tr>
<td>Working hours/day**</td>
<td>8.67 (2.50)</td>
<td>9.33 (2.26)</td>
<td>10.46 (1.85)</td>
</tr>
<tr>
<td>Children*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15 (31.9)</td>
<td>21 (44.7)</td>
<td>11 (23.4)</td>
</tr>
<tr>
<td>No</td>
<td>3 (37.5)</td>
<td>3 (37.5)</td>
<td>2 (25.0)</td>
</tr>
<tr>
<td>Number of children**</td>
<td>2.07 (0.88)</td>
<td>1.81 (0.93)</td>
<td>2.36 (0.81)</td>
</tr>
<tr>
<td>Predominant posture*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing</td>
<td>15 (40.5)</td>
<td>17 (45.9)</td>
<td>5 (13.5)</td>
</tr>
<tr>
<td>Alternating standing/sitting</td>
<td>3 (16.7)</td>
<td>7 (38.9)</td>
<td>8 (44.4)</td>
</tr>
<tr>
<td>Physical activity*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3 (37.5)</td>
<td>5 (62.5)</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>15 (31.9)</td>
<td>19 (40.4)</td>
<td>13 (27.7)</td>
</tr>
</tbody>
</table>

* absolute frequency (relative frequency); ** mean±Standard deviation; * Chi-square test; ** ANOVA with Hochberg post hoc GT2; c Kruskal-Wallis test.

Table 2. Characterization of subjects regarding the anthropometric and flexibility variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Adequate n (%)</th>
<th>Inadequate n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>19(34.5)</td>
<td>36(65.5)</td>
</tr>
<tr>
<td>%G</td>
<td>24 (43.6)</td>
<td>31 (56.4)</td>
</tr>
<tr>
<td>WC</td>
<td>25 (45.5)</td>
<td>30 (54.5)</td>
</tr>
<tr>
<td>WHR</td>
<td>10 (18.2)</td>
<td>45 (81.8)</td>
</tr>
<tr>
<td>AVF</td>
<td>29 (52.7)</td>
<td>26 (47.3)</td>
</tr>
<tr>
<td>SRT</td>
<td>32 (58.2)</td>
<td>23 (41.8)</td>
</tr>
</tbody>
</table>

BMI = body mass index; %G = percentage of fat; WC = waist circumference; WHR = waist-to-hip ratio; AVF = area of visceral fat; SRT = sit and reach test.
those with pain had higher BMI and AVF values, and the values of these variables increased with the referred pain intensity. In multiple comparisons, it was identified an AVF and BMI difference between the groups without pain and moderate to severe pain (p=0.031; p=0.046, respectively) (Table 3).

When comparing the anthropometric and VAS values considering the categories of flexibility, the individuals with inadequate levels of flexibility had higher AVF values (p=0.035) and LBP (p=0.014) (Table 4).

Moreover, it was observed an association between the VAS for the lumbar region and the BMI variables (r=0.304; p=0.024) and AVF (r=0.314; p=0.020). Thus, one can infer that the higher the BMI and AVF, the higher the referred pain score. We also identified a weak and inverse association between the WHR and the flexibility that involves the lumbar region, the higher the WHR, the lower the SRT values (r=-0.276; p=0.042).

When comparing the variables for age, it was observed that there was no difference in BMI values, AVF, SRT, and VAS, indicating that age does not influence pain and flexibility. However, values of central adiposity, evaluated by WC and WHR increase progressively with age, as well as total obesity by %G. In multiple comparisons, differences between 18 and 39 years and 40 and 59 years were observed for %G (p=0.025); between 40-59 and 60-65 years for WHR (p=0.015) and between 18-39 and 60-65 years for WC (p=0.026) and WHR (0.004) (Table 5).

### Table 3. Comparison of means between groups of pain

<table>
<thead>
<tr>
<th>Variables</th>
<th>Without pain (n=18)</th>
<th>Low back pain</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>25.94 (2.78)</td>
<td>27.18 (5.92)</td>
<td>30.97 (6.02)</td>
</tr>
<tr>
<td>%G</td>
<td>25.26 (5.84)</td>
<td>25.48 (7.85)</td>
<td>29.26 (5.83)</td>
</tr>
<tr>
<td>WC</td>
<td>86.86 (9.24)</td>
<td>87.85 (10.08)</td>
<td>93.72 (13.43)</td>
</tr>
<tr>
<td>WHR</td>
<td>0.87 (0.08)</td>
<td>0.86 (0.08)</td>
<td>0.86 (0.10)</td>
</tr>
<tr>
<td>AVF</td>
<td>86.91 (29.15)</td>
<td>98.01 (43.00)</td>
<td>124.24 (41.46)</td>
</tr>
<tr>
<td>SRT</td>
<td>28.09 (7.83)</td>
<td>26.72 (9.70)</td>
<td>23.53 (7.26)</td>
</tr>
</tbody>
</table>

BMI = body mass index; %G = percentage of fat; WC = waist circumference; WHR = waist-to-hip ratio; AVF = area of visceral fat; SRT = sit and reach test; VAS = visual analog scale; <sup>a</sup> Kruskal-Wallis test; <sup>c</sup> ANOVA with Hochberg post-hoc GT2.

### Table 4. Comparison of means between groups of flexibility

<table>
<thead>
<tr>
<th>Variables</th>
<th>Adequate (n=32)</th>
<th>Inadequate (n=23)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>45.39 (11.16)</td>
<td>50.53 (12.69)</td>
<td>0.125&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>BMI</td>
<td>26.40 (3.42)</td>
<td>29.44 (7.03)</td>
<td>0.162&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>%G</td>
<td>25.60 (6.82)</td>
<td>27.28 (7.00)</td>
<td>0.378&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>WC</td>
<td>86.90 (8.17)</td>
<td>91.72 (13.44)</td>
<td>0.136&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>WHR</td>
<td>0.87 (0.09)</td>
<td>0.86 (0.08)</td>
<td>0.945&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>AVF</td>
<td>90.89 (33.54)</td>
<td>114.06 (45.90)</td>
<td>0.035&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>VAS</td>
<td>2.63 (2.47)</td>
<td>4.35 (2.64)</td>
<td>0.014&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

BMI = body mass index; %G = percentage of fat; WC = waist circumference; WHR = waist-to-hip ratio; AVF = area of visceral fat; VAS = visual analog scale; <sup>a</sup> Mann-Whitney U test; <sup>b</sup> Student’s t-test.

### DISCUSSION

Agriculture is characterized by heavy manual labor. Farmers need to handle a considerable amount of weight to transport their materials and products. During this activity, they adopt inappropriate postures that can damage the tissues, especially muscles and joints which favor the onset of LBP<sup>12</sup>. LBP may be associated with radiated pain or pain in the lower limbs, especially in rural workers who spend long hours standing to do their job<sup>13</sup>. In the present study, it was observed that individuals with high pain values performed their activities alternating between standing and sitting, which may be related to an attempt to adapt to the work routine due to the pain.

Although agricultural activity is considered as a risk factor for the development of LBP, its influence on the health of the worker is poorly explored, especially in the painful situations<sup>14</sup>. The present results show that both BMI and AVF are related to pain and its intensity in rural workers. It is also possible to observe that pain, AVF and WHR are associated with flexibility, which can be explained by a possible overload in the lumbar spine and changes in the center of gravity.

A study by Briggs et al.<sup>15</sup> observed that subjects with increased WC had significantly higher pain values (OR=2.39; CI: 1.09-5.21), a different result from the present study. However, it was also observed that subjects classified by BMI with overweight or obesity showed a higher frequency of LBP and systemic inflammation that may contribute to the aggravation of pain.

In a large-scale study by Hashimoto et al.<sup>16</sup> conducted with Japanese men found that the chance of LBP is greater in overweight individuals when compared to those who have desirable BMI results, highlighting the need for BMI control, both to prevent and treat LBP. A national survey in the United States<sup>17</sup> observed that individuals with overweight or obesity, evaluated by BMI, had great chances of having LBP (OR=1.21; CI: 1.11-1.32 and OR=1.55; CI: 1.44-1.67, respectively). This survey found that white men and women were at increased risk of developing LBP. Considering the characteristics of our region, this could be a justification for the high prevalence of pain observed in this study. The findings described corroborate those found in the present study.
study. Thus, one can infer that overweight is related to the increased chance of developing LBP.

Iizuka et al.\textsuperscript{18} analyzed the prevalence of chronic non-specific LBP and related factors in middle-aged and elderly individuals and did not identify a relationship between BMI and the presence of pain (p=0.422). This result is the opposite of that observed in the present study and may be due to the low prevalence of LBP (24.8\%) in the sample. However, it has pointed out that smoking and the quality of life is related to LBP (p=0.021; p=0.016, respectively). The authors did not have a justification for such results.

Su et al.\textsuperscript{19} studied the association between BMI and prevalence, severity and frequency of LBP. When comparing the frequency of LBP with the BMI classification, it was observed that the frequency is higher (p<0.05) in overweight and obesity, as well as in severe and morbid obesity (p<0.01) when compared to the group with normal weight or low weight. Therefore, these data corroborate those of this study considering that the higher the BMI and AVF, the greater the pain intensity. The authors did not identify a relationship between BMI and the severity or frequency of low back pain episodes.

Rahmani et al.\textsuperscript{20} used ultrasonography to check the dimensions of the multifidus muscle in adolescents with and without LBP and found an association between muscle size and BMI, and this is a possible explanation for the high prevalence of LBP in overweight individuals observed in the present study. Besides, it was observed that all muscle measures correlate inversely with pain intensity and functional disability, suggesting that the smaller the muscle, the greater the pain and the disability.

In a study with rural workers from a region of Santa Catarina\textsuperscript{1} the prevalence of 98.3\% of LBP was found with an average pain on the VAS of 5.89±2.49, being more intense in women (mean: 6.14±2.45). There was a relationship between pain and SRT (r=0.42; p<0.01). These data are in agreement with the present results considering that individuals with inadequate flexibility had higher pain values.

Silva et al.\textsuperscript{21} found similar results with rural workers in the Vale do Rio Pardo. The individuals with high intensity of pain had lower levels of flexibility and considerable postural changes. LBP is common in Thai rubber farmers. Udom, Janwantanakul and Kanlayanaphotporn\textsuperscript{22} found a high prevalence of LBP (55.7\%) with high intensity, identifying a relationship between BMI and pain (p=0.048) and corroborating the present study. So, it is possible to infer that BMI is an important predictor of LBP in different populations. Several studies have observed that there is an association between anthropometric markers, such as weight, BMI, WC, and LBP confirming that the increase in fat is a risk factor for the development of LBP\textsuperscript{23,24}.

Workers from several sectors are exposed to the reduction of elements of physical fitness according to the work performed. Nepomuceno et al.\textsuperscript{25} analyzed the profile of industrial workers and detected prevalence of pain, reduced flexibility and anthropometric changes, reinforcing the results found in the present study. They also observed a tendency in the association between flexibility and the presence of pain. Therefore, flexibility may influence pain.

Paz et al.\textsuperscript{26} identified that the anthropometric variables were not related to lumbar functional disability. Even so, the study sample was considered relatively healthy, which may have contributed to this result. It was highlighted that lumbar flexibility, assessed by the SRT, presented greater association with disability. Obesity can play a role not only on pain and flexibility but also in muscular endurance. Ummunah, Ibkunle and Ezekunne\textsuperscript{27} identified an inverse relationship between BMI and hip circumference with the maximum sustaining time of isometric contraction. That means that the higher the fat, the shorter the maintenance time of muscle contraction, and these results may be important in explaining LBP in overweight individuals.

It was considered that the sample size might have been a limiting factor of the study, in part due to the difficulty of access of this population historically unassisted. However, this study brings important considerations about the health of the rural population and also for the planning of actions that promote health and the prevention of diseases related to LBP. Moreover, it was found that individuals with a higher socioeconomic class had more pain. Nonetheless, the mechanisms that associate this variable with pain remain unknown.

**CONCLUSION**

The present study showed that rural workers with LBP had higher BMI and AVF values, as well as those with inadequate flexibility in the same region had higher values of AVF and pain. It is also possible to infer that there is an association between the values of BMI and AVF with the level of pain, and WHR is associated with levels of flexibility.

**ACKNOWLEDGMENTS**

To Professor Tania Cristina Malezan Fleig from the Physiotherapy course of the University of Santa Cruz do Sul for the valuable contribution in the elaboration of this research project and manuscript.

**REFERENCES**

Sleep alterations in patients with the human immunodeficiency virus and chronic pain

Alterações do sono em pacientes vivendo com o vírus da imunodeficiência humana e dor crônica

Glória Pinto Soares de Aguiar¹, Jairo Alberto Dussán-Sarria², Andressa de Souza³

ABSTRACT

BACKGROUND AND OBJECTIVES: In patients with chronic pain, insomnia is reported between 50 and 88% of them. It is essential to recognize sleep disorders to estimate its repercussions on the quality of life and to seek knowledge that supports the necessary interventions. This study aims to identify the possible factors that influence sleep quality, as well as its prevalence in these patients.

METHODS: Sample consisting of 68 patients (58 women, 10 men), the mean age of 45.3±10.3 years, with a positive diagnosis of human immunodeficiency virus undergoing antiretroviral and chronic pain treatment in Porto Alegre, RS. The Pittsburgh Sleep Quality Index was used to assess the components of the scale as well as their overall score. For the classification of the type of chronic pain, the Leeds Assessment of Neuropathic Symptoms and Signs scale was used, which differentiates nociceptive and neuropathic pain.

RESULTS: Patients classified with no pain, nociceptive pain and neuropathic pain. Overall score divided into good sleep, bad sleep and sleep disorder, where patients without pain accounted for 8.8%, 16.2 and 2.9% respectively. With nociceptive pain 4.4, 11.8 and 5.9%, respectively. With neuropathic pain 4.4, 23.5 and 22.1% respectively. Patients with neuropathic pain had the highest rates of poor sleep and sleep disorder, accounting for 50.0% and using more sleeping pills compared to the control group (p<0.05).

CONCLUSION: There is a high prevalence of sleep disorders or poor sleep in patients with the human immunodeficiency virus with neuropathic pain. The importance of assessing the sleep as an essential part of the clinical assessment should be recognized and incorporated without delay by health professionals.

Keywords: Chronic pain, Human immunodeficiency virus, Nursing, Sleep.

RESUMO

JUSTIFICATIVA E OBJETIVOS: Em pacientes com dor crônica, a insônia é relatada entre 50 e 88% deles. É fundamental reconhecer as alterações do sono para estimar suas repercussões na qualidade de vida e buscar conhecimentos que respaldem as necessárias intervenções. Este estudo buscou identificar os possíveis fatores que influenciam a qualidade do sono, bem como suas prevalências nesses pacientes.

MÉTODOS: Amostra constituída por 68 pacientes (58 mulheres e 10 homens) com idade média de 45,3±10,3 anos, diagnóstico positivo para o vírus da imunodeficiência humana em tratamento antirretroviral e dor crônica, de uma instituição em Porto Alegre, RS. O Questionário do Índice de Qualidade de Sono de Pittsburgh foi usado para a avaliação dos componentes da escala de sono, bem como sua pontuação total. Para a classificação do tipo de dor crônica foi utilizada a escala Leeds Assessment of Neuropathic Symptoms and Signs, que diferencia dor nociceptiva e neuropática.

RESULTADOS: Os pacientes foram classificados em sem dor, dor nociceptiva e dor neuropática. A pontuação global foi dividida em sono bom, sono ruim e distúrbio do sono, onde os pacientes sem dor representaram 8,8, 16,2 e 2,9% respectivamente. Com dor nociceptiva 4,4, 11,8 e 5,9% respectivamente. Com dor neuropática 4,4, 23,5 e 22,1% respectivamente. Os pacientes com dor neuropática apresentaram os maiores índices de sono ruim e distúrbio do sono, representando 50,0% e utilizavam mais fármacos para dormir em comparação com o grupo controle (p<0,05).

CONCLUSÃO: Existe elevada prevalência de distúrbios do sono ou sono ruim em pacientes portadores do vírus com dor neuropática. A importância da avaliação do sono como parte essencial da avaliação clínica deve ser reconhecida e incorporada sem demora pelos profissionais de saúde.

Descritores: Dor crônica, Enfermagem, Sono, Vírus da imunodeficiência humana.

INTRODUCTION

The human immunodeficiency virus (HIV) attacks the immune system destroying the defense cells, CD4+ T lymphocytes, causing an immunosuppression picture. Immunode-
ficiency is characterized by continuous viral replication and depletion of CD4+ T-lymphocytes, affecting the capacity of the immune system to defend the body from foreign or anomalous cells that invade or attack it, such as bacteria, viruses, fungi, and cancer cells. As the lymphatic system and immune responses slowly collapse, an HIV-infected person becomes more susceptible to opportunistic infections, getting sicker more often. This condition of susceptibility due to the lymphatic system and defective immune responses is diagnosed as Acquired Immunodeficiency Syndrome (AIDS), characterized not by a symptom, but by a set of signs and symptoms arising from a decrease in the CD4+ T-cell lymphocyte count. AIDS is diagnosed when the T-cell count falls below 200 per microliter of blood. The CD4+ T-lymphocyte count, and the viral load are important prognostic markers to monitor the infection and to follow-up the disease progression in these patients. According to the Joint United Nations Program on HIV/AIDS, the number of people living with HIV/AIDS in the world is approximately 36.7 million. The report shows that antiretroviral therapy is providing a longer life to people with HIV. In 2015, people over the age of 50 accounted for about 17% of the adult population (15 years or older) living with HIV. In high-income countries, 31% of people living with HIV were over 50 years old.

In Brazil, from 1980 to 2016, 548,850 (65.1%) cases of AIDS in men and 293,685 (34.9%) in women were registered. Over the last 10 years, AIDS detection rates in men have shown a growth trend. In 2006 the rate was 24.1 cases per 100 thousand inhabitants, reaching 27.9 in 2015, an increase of 15.9%. According to the HIV/AIDS Epidemiological Bulletin of the Department of Surveillance of the Ministry of Health, published annually, in 2015 there were 39,113 new cases of HIV infection in Brazil. The city of Porto Alegre presented a rate of 74 cases for 100 thousand inhabitants, corresponding to 2.9 times the rate of the State of Rio Grande do Sul and almost four times the rate of Brazil. The AIDS detection rate in Brazil has stabilized in the last 10 years, with an mean of 20.7 cases per 100,000 inhabitants. The recommendation for the treatment of people with HIV, regardless of CD4 count, is in place since December 2013. In June 2016, around 18.2 million people worldwide had access to the antiretroviral treatment, including 910,000 children, twice the number registered five years earlier.

As people with HIV become older, they are also more susceptible to the long-term adverse effects of the antiretroviral treatment, developing resistance to drugs, and requiring the treatment of comorbidities, such as tuberculosis and hepatitis C, among other factors, that may also interact with the antiretroviral therapy. Ongoing research and investments are needed to discover simpler and more tolerable treatments for HIV and comorbidities, as well as to discover a vaccine and the cure for the virus.

The use of combined antiretroviral therapy, available at the Brazilian public services since 1997, has determined a new course for the disease. Controlling the virus replication and the consequent improvement of patients’ immunity, AIDS has taken the characteristics of chronic disease, increasing the life expectancy of patients. Unfortunately, even providing patients with a longer life expectancy, the mechanism of action of the drugs brings chronic complications not directly related to the HIV infection, such as cardiovascular diseases, liver, renal and bone alterations, as well as neoplasms and loss of neurocognitive functions and neuropathologies.

Neurological manifestations are frequent in people with HIV, being the first manifestation of the disease in 10% of cases, and between 30 and 50% of patients will report neurological symptoms at some point in life. Peripheral neuropathies are commonly associated with HIV infections, and distal peripheral neuropathy is the most frequent symptomatic form in 35% of the patients.

The neuropathic pain in HIV patients is a result of changes in the immune system, due to immunosuppression. Immunosuppression makes the individual more susceptible to infections and malignancies, which are aggravated by the huge negative interaction of drugs used for analgesia and the antiretrovirals, making it difficult to treat painful symptoms in these patients, reducing their quality of life (QoL).

Statistics show that 30% of the world’s population suffers from chronic pain. In Brazil, this number reaches almost 60 million people, with 50% reporting serious impact to their routine. Larue, Fontaine and Colleau found that in the HIV/AIDS population, 30% of outpatients and 62% of hospitalized patients due to HIV reported HIV-related pain and that their severity was significantly underestimated by the physicians who cared seropositive patients. In adults with HIV, neuropathic pain is more common in men with low CD4 levels or increased viral load. In this population, 80% of patients report experiencing intense pain, which interferes with the mood, QoL and work capacity.

It is known that QoL is directly related to sleep quality, among other factors. Sleep, characterized by the temporary suspension of the sensory and perceptive voluntary motor activity, is part of the basic needs of the human being, as well as eating and drinking, having a restorative function for the organism and the brain. Studies have related sleep to the immune function, indicating that its deprivation may compromise this function. Experimentally sleep-deprived subjects have decreased the NK (Natural Killer) cells activity, which is part of the innate immunity, accounting for about 10 to 20% of the circulating lymphocytes.

According to the World Health Organization, about 40% of the world population does not sleep as desired and has some of the more than 80 sleep disorders and syndromes listed by the International Classification of Sleep Disorders (ICSD). In addition, it is known that sleep disorders are a significant impact factor in a person’s life, causing short- or long-term impairment in daily activities, social, somatic, psychological or cognitive adversities and according to the Brazilian Sleep Association, sleep disorders can have important repercussions on performance and social costs. Estimates of the rate of accidents and deaths caused by drowsiness or fatigue vary from...
2 to 41%, with a high cost in financial and life terms involving economic and health issues, such as increased hospitalizations, absenteeism, traffic accidents and the development of mental disorders. Patients with AIDS have many complaints, especially regarding chronic pain and adverse reactions of the antiretroviral treatment, and it is also expected to find complaints related to sleep quality.

The diagnosis of sleep disorders is not so easy because most people are unaware that this is a clinical condition that can be treated. Because of this lack of knowledge, patients fail to report sleep problems, and due to the lack of knowledge of most health professionals in identifying such disorders, there is no input to a diagnosis and treatment, thus increasing the worsening of symptoms.

Since sleep is a basic human need, its preservation and maintenance are fundamental for the individual to have a healthy life. It is important to recognize and relate these difficulties in order to seek knowledge that supports the necessary nurse interventions to improve the QoL.

Nurses, as health professionals, play a fundamental role in the promotion, prevention, and care of health problems. It is believed that such an understanding is essential for the planning of decisive actions in this context.

The objective of this study was to identify the possible factors that impact sleep quality as well as the prevalence in patients with HIV.

METHODS

A cross-sectional cohort study, with a quantitative approach, conducted at a Non-Governmental Organization (NGO) in Porto Alegre/RS, where participants were included in the study according to the following inclusion criteria: confirmed diagnosis of HIV/AIDS in treatment with antiretroviral therapy; aged between 18 and 65 years, of both genders; and Free and Informed Consent Term (FICT) understood and signed. The exclusion criteria were active acute contagious infection (meningitis, active pulmonary tuberculosis); history of chronic diseases associated with neuropathy (diabetes, lupus, rheumatoid arthritis); HTLV infection (Human T-cell Lymphotrophic Virus); chronic renal failure; peripheral vascular disease; use of systemic corticosteroids; cancer; severe disease that would limit the understanding of the FICT or the questionnaires.

Data collection was from August to December 2015. The data were collected when the subjects had an appointment at the NGO. The interviews were in a private room, before or after the care visit. Semi-structured data collection forms were used for data collection, which included questions related to the patient’s identification, socioeconomic profile, health history, and treatment.

The Pittsburgh Sleep Quality Index (PSQI-BR) questionnaire was used, an American questionnaire validated for the Portuguese language, which characteristic is the evaluation of sleep quality in the last month. This questionnaire has 19 questions that configure seven components of sleep evaluation: quality, latency, duration, efficiency, nocturnal disorders, use of sleeping pills and daytime sleepiness. Each component receives a score ranging from zero to three so that the instrument’s final score can range from zero to 21. The higher the score, the worse the sleep quality, and values higher than five indicate poor quality sleep.

For the classification of the chronic pain, the Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) was used. This scale is validated in Brazil and used to differentiate nociceptive pain from neuropathic pain.

All the 68 patients who made up this sample has completed 100% of the data related to the PSQI-BR questionnaire and were evaluated in accordance with the mentioned tests. Considering that the description of the quality of sleep in patients with HIV/AIDS, evaluated for the Pittsburgh scale would be one of the most significant contributions of the present study to the scientific literature, the size of the sample was calculated on this outcome. Ferreira and Ceolim described that patients with HIV have a high prevalence of poor sleep quality. The effect size was 1.35 (Cohen's D). Sample size calculation was performed with a two-tailed alpha error of 0.05, 95% power and equal sample size. The calculation of the sample size was performed by the Gpower software.

According to the ethical recommendations of the Ministry of Health, the development of the study is in accordance with Resolution 466/12 - National Health Council (CNS), which deals with human research ethics. The patients were informed about the purpose of the study and agreed to participate signed the FICT. They were also told that they could withdraw at any time, without any discontinuation of their care. At the end of the study, the institution where the study was conducted had all data available, as well as all those who might be interested. This study is part of a larger project entitled "Neuropsychology of Nociception and Central Sensitization in Patients with HIV Neuropathy", coordinated by Prof. Dr. Andressa de Souza and collaborators, of the Graduate Program in Health and Human Development, line of Pathological Processes Research, funded by the National Council for Scientific and Technological Development - CNPq (Universal 442479 / 2014-0), with Certificate of Presentation for Ethical Appraisal (CAAE) number 30388114.3.0000.5307 and with the opinion of approval number 647.372. University La Salle.

Statistical analysis

The data were summarized using conventional descriptive statistics. Continuous variables were described using mean, median and standard deviation. Categorical variables were described using absolute numbers and percentages. The comparison between the groups for the continuous variables was performed using the Kruskal-Wallis test. The comparisons between the categorical variables were performed using the Chi-square test or Fisher’s Exact test, accordingly. For all analysis, the level of statistical significance for the established alpha error was a two-tailed p<0.05. Analyses were processed using SPSS version 20.0 (SPSS, Chicago, IL).
RESULTS

The sample consisted of 68 patients with a mean age of 45.3±10.3 years, all with a confirmed diagnosis of HIV/AIDS in treatment with antiretroviral therapy. Of the 68 patients, 15 live alone, 49 (72.0%) live with the family, that could be spouse, parents or children, and 04 (6.0%) do not fit the previous ones. As for the time of schooling, the mean is 5.9 years.

Table 1. Characterization of the sample regarding sociodemographic data and lifestyle

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>14.7</td>
</tr>
<tr>
<td>Female</td>
<td>58</td>
<td>85.3</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 35 and 55</td>
<td>46</td>
<td>67.7</td>
</tr>
<tr>
<td>More than 55</td>
<td>13</td>
<td>19.1</td>
</tr>
<tr>
<td>Less than 35</td>
<td>9</td>
<td>13.2</td>
</tr>
<tr>
<td>Housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living alone</td>
<td>15</td>
<td>22.0</td>
</tr>
<tr>
<td>Living with family</td>
<td>49</td>
<td>72.0</td>
</tr>
<tr>
<td>Other types of housing</td>
<td>4</td>
<td>6.0</td>
</tr>
<tr>
<td>Schooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean years of study</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>Median years of study</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Professional work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active</td>
<td>14</td>
<td>21.0</td>
</tr>
<tr>
<td>Unemployed</td>
<td>27</td>
<td>40.0</td>
</tr>
<tr>
<td>Social allowance</td>
<td>25</td>
<td>37.0</td>
</tr>
<tr>
<td>Viral load</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undetectable</td>
<td>31</td>
<td>45.6</td>
</tr>
<tr>
<td>Not informed</td>
<td>3</td>
<td>4.4</td>
</tr>
<tr>
<td>Detectable</td>
<td>34</td>
<td>50.0</td>
</tr>
<tr>
<td>Use of Efavirenz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using</td>
<td>17</td>
<td>25.0</td>
</tr>
<tr>
<td>Not using</td>
<td>51</td>
<td>75.0</td>
</tr>
</tbody>
</table>

Regarding the professional occupation, 27 (40.0%) are unemployed. The viral load is detectable in 34 (50.0%) patients. In this sample, all patients are being treated with antiretroviral therapy, and only 17 (25.0%) patients used the reverse transcriptase inhibitor Efavirenz. Table 1 shows the data obtained.

Regarding the perceived pain, only 31% reported no pain and the remaining 69% reported pain in the head (46%), upper limbs (41%), chest (43%) and lower limbs (43%).

In this study, the patients were classified according to the LANSS scale24, which differentiates nociceptive from neuropathic pain. Thus, patients were subdivided into a control group (no pain, n=19), nociceptive pain (n=15), and neuropathic pain (n=34). The results are shown in Table 2.

Regarding the usual sleep characteristics, the patients were also divided between control (no pain), nociceptive pain and neuropathic pain groups. The results are shown in table 3. Of the total sample, 35 (51.5%) had habitual sleep efficiency above 85%, 13 (19.1%) between 75 and 84%, 10 (14.7%) between 65 and 74% and 10 (14.7%) had sleep efficiency lower than 65%.

In the sleep quality analysis, obtained with the PSQI-BR, the indexes of subjective quality, latency, duration, efficiency, disturbances, use of sleeping pills and daytime sleepiness are correlated. The values of these indices are shown in table 4.

According to the PSQI-BR, the following factors that cause considerable difficulties to sleep were evaluated in the sample: cough or loud snoring, taking more than 30 minutes to get to sleep, getting up to go to the bathroom, waking up in the middle of the night or too early, have difficulty breathing, feel very cold, feel very hot, have bad dreams or nightmares, feel pain and other reasons, as shown in table 5. Of these factors, the following stand out especially in the neuropathic pain group; get up to go the bathroom, 20 (29.4%) patients; take more

Table 2. Sociodemographic and clinical characteristics with a significant association with the classification of the with pain and without pain groups in patients with HIV/AIDS

<table>
<thead>
<tr>
<th>Variables</th>
<th>Characteristics</th>
<th>Control (No pain)</th>
<th>Nociceptive pain</th>
<th>Neuropathic pain</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>13 (19.1%)</td>
<td>13 (19.1%)</td>
<td>32 (47.1%)</td>
<td>58 (85.3%)</td>
<td>0.033*</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>6 (8.8%)</td>
<td>2 (2.9%)</td>
<td>2 (2.9%)</td>
<td>10 (14.7%)</td>
<td></td>
</tr>
<tr>
<td>Age (years) #</td>
<td>-</td>
<td>44.93±11.23</td>
<td>44.50±10.48</td>
<td>-</td>
<td>-</td>
<td>0.838*</td>
</tr>
<tr>
<td>Education (years) #</td>
<td>-</td>
<td>4.93±2.67</td>
<td>5.78±2.90</td>
<td>-</td>
<td>-</td>
<td>0.122*</td>
</tr>
<tr>
<td>Smoking</td>
<td>Yes</td>
<td>4 (6.1%)</td>
<td>11 (16.7%)</td>
<td>19 (28.8%)</td>
<td>34 (50%)</td>
<td>0.938*</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>12 (18.2%)</td>
<td>22 (33.3%)</td>
<td>44 (66.7%)</td>
<td>78 (114%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not informed</td>
<td>1 (1.5%)</td>
<td>1 (1.5%)</td>
<td>3 (4.5%)</td>
<td>5 (7.6%)</td>
<td></td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>Yes</td>
<td>7 (10.6%)</td>
<td>12 (18.2%)</td>
<td>24 (36.4%)</td>
<td>43 (63%)</td>
<td>0.096*</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>8 (12.1%)</td>
<td>22 (33.3%)</td>
<td>37 (56.1%)</td>
<td>67 (98%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not informed</td>
<td>2 (3%)</td>
<td>0 (0%)</td>
<td>5 (7.6%)</td>
<td>7 (10%)</td>
<td></td>
</tr>
<tr>
<td>Viral load</td>
<td>Detectable</td>
<td>8 (11.8%)</td>
<td>16 (23.5%)</td>
<td>34 (50%)</td>
<td>58 (85.3%)</td>
<td>0.138*</td>
</tr>
<tr>
<td></td>
<td>Undetectable</td>
<td>9 (13.2%)</td>
<td>18 (26.5%)</td>
<td>31 (45.6%)</td>
<td>68 (100%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No information</td>
<td>2 (2.9%)</td>
<td>0 (0%)</td>
<td>3 (4.4%)</td>
<td>5 (7.6%)</td>
<td></td>
</tr>
<tr>
<td>Use of Efavirenz</td>
<td>Yes</td>
<td>7 (10.3%)</td>
<td>7 (10.3%)</td>
<td>17 (25%)</td>
<td>31 (46%)</td>
<td>0.409*</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>12 (17.6%)</td>
<td>27 (39.7%)</td>
<td>51 (75%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Variables expressed in absolute numbers (percentage). # variable shown as mean±SD of the mean. * Exact Fisher and Kruskal-Wallis tests. p<0.05 was considered a significant difference.
Table 3. Regarding the usual sleep characteristics, the patients were also divided into control (no pain), nociceptive pain and neuropathic pain groups

<table>
<thead>
<tr>
<th>Usual sleep characteristics</th>
<th>Control (no pain)</th>
<th>Nociceptive pain</th>
<th>Neuropathic pain</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to go to bed</td>
<td>23.000 1.452</td>
<td>23.000 22.666</td>
<td>22.000 23.029</td>
<td>0.701*</td>
</tr>
<tr>
<td>Latency (minutes)</td>
<td>43.421 65.448</td>
<td>15.000 57.400</td>
<td>30.000 51.323</td>
<td>0.218*</td>
</tr>
<tr>
<td>Wake-up time</td>
<td>7.105 1.696</td>
<td>7.000 6.933</td>
<td>7.000 7.088</td>
<td>0.820*</td>
</tr>
<tr>
<td>Sleep duration (hours)</td>
<td>7.111 1.449</td>
<td>7.000 7.400</td>
<td>8.000 6.650</td>
<td>0.225*</td>
</tr>
</tbody>
</table>

Usual sleep efficiency

| >85%                         | 12 (17.6%)        | 8 (11.8%)       | 15 (22.1%)       | 0.336#  |
| 75 to 84%                    | 3 (4.4%)          | 3 (4.4%)        | 7 (10.3%)        |         |
| 65 to 74%                    | 2 (2.9%)          | 0 (0.0%)        | 8 (11.8%)        |         |
| <65%                         | 2 (2.9%)          | 4 (5.9%)        | 4 (5.9%)         |         |
| Total                        | 19 (27.9%)        | 15 (22.1%)      | 34 (50.0%)       |         |

For sleep efficiency, the variables are expressed in absolute numbers (percentage). SD of the mean; * Kruskal Wallis test. # Fisher’s Exact test; p<0.05 was considered a significant difference.

Table 4. Comparison of overall PSQI-BR score and components among patients without pain, nociceptive pain or neuropathic pain

<table>
<thead>
<tr>
<th>PSQI-BR components</th>
<th>Control (no pain)</th>
<th>Nociceptive pain</th>
<th>Neuropathic pain</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective sleep quality</td>
<td>1.500 0.730</td>
<td>1.500 0.650</td>
<td>1.727 0.801</td>
<td>0.529*</td>
</tr>
<tr>
<td>Sleep latency</td>
<td>1.263 1.284</td>
<td>1.666 1.234</td>
<td>1.970 1.086</td>
<td>0.148*</td>
</tr>
<tr>
<td>Sleep duration</td>
<td>0.736 0.933</td>
<td>0.866 1.125</td>
<td>1.294 1.268</td>
<td>0.276*</td>
</tr>
<tr>
<td>Sleep efficiency</td>
<td>0.684 1.056</td>
<td>1.000 1.309</td>
<td>1.029 1.086</td>
<td>0.477*</td>
</tr>
<tr>
<td>Sleep disorders</td>
<td>1.578 0.507</td>
<td>2.000 0.755</td>
<td>1.911 0.621</td>
<td>0.119*</td>
</tr>
<tr>
<td>Sleeping pills</td>
<td>0.157 0.688</td>
<td>1.000 1.463</td>
<td>1.058 1.412</td>
<td>0.038*</td>
</tr>
<tr>
<td>Daytime sleepiness</td>
<td>0.894 0.936</td>
<td>0.866 0.743</td>
<td>1.323 1.000</td>
<td>0.192*</td>
</tr>
</tbody>
</table>

Overall score (%)

| Good sleep                  | 6 (8.8%)          | 3 (4.4%)         | 3 (4.4%)         | 0.059#  |
| Poor sleep                  | 11 (16.2%)        | 8 (11.8%)        | 16 (23.5%)       |         |
| Sleep disorder              | 2 (2.9%)          | 4 (5.9%)         | 15 (22.1%)       |         |
| Total                       | 19 (27.9%)        | 15 (22.1%)       | 34 (50.0%)       | 0.059   |

Overall sleep score, data expressed in absolute numbers (percentage). # Fisher’s Exact test; *Kruskal-Wallis test; p<0.05 was considered a significant difference.

Table 5. Factors that have caused, more frequently, difficulty to fall asleep among patients without pain, nociceptive pain or neuropathic pain

<table>
<thead>
<tr>
<th>Variables</th>
<th>Occurrence</th>
<th>Control (no pain)</th>
<th>Nociceptive pain</th>
<th>Neuropathic pain</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough or snore very loud</td>
<td>Never</td>
<td>13 (19.1%)</td>
<td>9 (13.2%)</td>
<td>15 (22.1%)</td>
<td>0.592*</td>
</tr>
<tr>
<td></td>
<td>Less than once a week</td>
<td>1 (1.5%)</td>
<td>1 (1.5%)</td>
<td>1 (1.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Once-twice a week</td>
<td>2 (2.9%)</td>
<td>2 (2.9%)</td>
<td>6 (8.8%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or more</td>
<td>3 (4.4%)</td>
<td>4 (4.4%)</td>
<td>12 (17.6%)</td>
<td></td>
</tr>
<tr>
<td>Take more than 30 minutes to fall asleep</td>
<td>Never</td>
<td>7 (10.3%)</td>
<td>4 (5.9%)</td>
<td>8 (11.8%)</td>
<td>0.647*</td>
</tr>
<tr>
<td></td>
<td>Less than once a week</td>
<td>2 (2.9%)</td>
<td>2 (2.9%)</td>
<td>1 (1.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Once-twice a week</td>
<td>3 (4.4%)</td>
<td>3 (4.4%)</td>
<td>6 (8.8%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or more</td>
<td>7 (10.3%)</td>
<td>6 (8.8%)</td>
<td>19 (27.9%)</td>
<td></td>
</tr>
<tr>
<td>Get up to go to the bathroom</td>
<td>Never</td>
<td>2 (2.9%)</td>
<td>3 (4.4%)</td>
<td>4 (5.9%)</td>
<td>0.694*</td>
</tr>
<tr>
<td></td>
<td>Less than once a week</td>
<td>1 (1.5%)</td>
<td>0 (0.0%)</td>
<td>1 (1.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Once-twice a week</td>
<td>4 (5.9%)</td>
<td>1 (1.5%)</td>
<td>9 (13.2%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or more</td>
<td>12 (17.6%)</td>
<td>11 (16.2%)</td>
<td>20 (29.4%)</td>
<td></td>
</tr>
</tbody>
</table>

Continue...
than 30 minutes to fall asleep and wake up in the middle of the night or too early, 19 (27.9%) patients with both factors in the last month. In the nociceptive pain group, the factors that caused the most difficulty to fall asleep were wake up in the middle of the night or too early in the morning, 12 (17.6%) patients; get up to go to the bathroom, 11 (16.2%); and take more than 30 minutes to fall asleep, 6 (8.8%) patients. All factors repeated three times or more per week. Feeling the pain and having bad dreams or nightmares were also preponderant factors, with a significant difference in the study among patients with neuropathic pain.

**DISCUSSION**

Some studies suggest that 90% of individuals with HIV have pain. Specifically, pain occurs for three main reasons: (1) HIV symptom; (2) another opportunistic disease or infection; (3) or adverse effect of the antiretroviral therapy (ART). The problem is even worse in cases of chronic pain associated with AIDS since there is a big negative interaction among the drugs used for analgesia and the antiretrovirals, making it difficult to treat the pain symptoms in these patients. In addition, there is a higher incidence of adverse drug effects; greater under-treatment of pain in AIDS (85%) than in cancer (49%), and there is a worse scale of emotional well-being when compared with any chronic disease, regardless of the disease stage, except primary depression.

According to the International Association for the Study of Pain (IASP), pain is an unpleasant sensory and emotional experience associated with an existing or potential injury, or described in terms of such injury. When named as “chronic pain,” it is characterized as continuous or recurrent pain, lasting at least for three months, often with uncertain etiology, and does not disappear with the use of conventional therapeutic procedures, becoming the cause of prolonged incapacity and disability. This study confirms the data presented in the literature since almost 70% of the sample reported pain with chronicity. The interaction between antiretrovirals and

**Table 5. Factors that have caused, more frequently, difficulty to fall asleep among patients without pain, nociceptive pain or neuropathic pain – continuation**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Occurrence</th>
<th>Control (no pain)</th>
<th>Nociceptive pain</th>
<th>Neuropathic pain</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waking up in the middle of the night</td>
<td>Never</td>
<td>5 (7.4%)</td>
<td>1 (1.5%)</td>
<td>2 (2.9%)</td>
<td>0.114*</td>
</tr>
<tr>
<td>or early morning</td>
<td>Less than once a</td>
<td>1 (1.5%)</td>
<td>0 (0.0%)</td>
<td>6 (8.8%)</td>
<td></td>
</tr>
<tr>
<td>week</td>
<td>Once-twice a week</td>
<td>5 (7.4%)</td>
<td>2 (2.9%)</td>
<td>7 (10.3%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or</td>
<td>8 (11.8%)</td>
<td>12 (17.6%)</td>
<td>19 (27.9%)</td>
<td></td>
</tr>
<tr>
<td>more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult breathing</td>
<td>Never</td>
<td>14 (20.6%)</td>
<td>9 (13.2%)</td>
<td>23 (33.9%)</td>
<td>0.928*</td>
</tr>
<tr>
<td></td>
<td>Less than once a</td>
<td>1 (1.5%)</td>
<td>2 (2.9%)</td>
<td>1 (1.5%)</td>
<td></td>
</tr>
<tr>
<td>week</td>
<td>Once-twice a week</td>
<td>2 (2.9%)</td>
<td>2 (2.9%)</td>
<td>6 (8.8%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or</td>
<td>2 (2.9%)</td>
<td>2 (2.9%)</td>
<td>4 (5.9%)</td>
<td></td>
</tr>
<tr>
<td>more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feel very cold</td>
<td>Never</td>
<td>12 (17.6%)</td>
<td>4 (5.9%)</td>
<td>15 (22.1%)</td>
<td>0.504*</td>
</tr>
<tr>
<td></td>
<td>Less than once a</td>
<td>1 (1.5%)</td>
<td>2 (2.9%)</td>
<td>2 (2.9%)</td>
<td></td>
</tr>
<tr>
<td>week</td>
<td>Once-twice a week</td>
<td>3 (4.4%)</td>
<td>4 (5.9%)</td>
<td>7 (10.3%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or</td>
<td>3 (4.4%)</td>
<td>5 (7.4%)</td>
<td>10 (14.7%)</td>
<td></td>
</tr>
<tr>
<td>more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To feel very hot</td>
<td>Never</td>
<td>11 (16.2%)</td>
<td>3 (4.4%)</td>
<td>15 (22.1%)</td>
<td>0.088*</td>
</tr>
<tr>
<td></td>
<td>Less than once a</td>
<td>2 (2.9%)</td>
<td>5 (7.4%)</td>
<td>2 (2.9%)</td>
<td></td>
</tr>
<tr>
<td>week</td>
<td>Once-twice a week</td>
<td>4 (5.9%)</td>
<td>3 (4.4%)</td>
<td>6 (8.8%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or</td>
<td>2 (2.9%)</td>
<td>4 (5.9%)</td>
<td>11 (16.2%)</td>
<td></td>
</tr>
<tr>
<td>more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have bad dreams or nightmares</td>
<td>Never</td>
<td>15 (22.1%)</td>
<td>7 (10.3%)</td>
<td>13 (19.1%)</td>
<td>0.051*</td>
</tr>
<tr>
<td></td>
<td>Less than once a</td>
<td>1 (1.5%)</td>
<td>4 (5.9%)</td>
<td>4 (5.9%)</td>
<td></td>
</tr>
<tr>
<td>week</td>
<td>Once-twice a week</td>
<td>2 (2.9%)</td>
<td>3 (4.4%)</td>
<td>7 (10.3%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or</td>
<td>1 (1.5%)</td>
<td>1 (1.5%)</td>
<td>10 (14.7%)</td>
<td></td>
</tr>
<tr>
<td>more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To feel pain</td>
<td>Never</td>
<td>15 (22.1%)</td>
<td>8 (11.8%)</td>
<td>12 (17.6%)</td>
<td>0.007*</td>
</tr>
<tr>
<td></td>
<td>Less than once a</td>
<td>0 (0.0%)</td>
<td>1 (1.5%)</td>
<td>2 (2.9%)</td>
<td></td>
</tr>
<tr>
<td>week</td>
<td>Once-twice a week</td>
<td>4 (5.9%)</td>
<td>2 (2.9%)</td>
<td>6 (8.8%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or</td>
<td>0 (0.0%)</td>
<td>4 (5.9%)</td>
<td>14 (20%)</td>
<td></td>
</tr>
<tr>
<td>more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other reasons</td>
<td>Never</td>
<td>14 (20.5%)</td>
<td>9 (13.2%)</td>
<td>21 (30.8%)</td>
<td>0.668*</td>
</tr>
<tr>
<td></td>
<td>Less than once a</td>
<td>1 (1.5%)</td>
<td>1 (1.5%)</td>
<td>0 (0.0%)</td>
<td></td>
</tr>
<tr>
<td>week</td>
<td>Once-twice a week</td>
<td>2 (2.9%)</td>
<td>1 (1.5%)</td>
<td>5 (7.4%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 times/week or</td>
<td>2 (2.9%)</td>
<td>4 (5.9%)</td>
<td>8 (11.8%)</td>
<td></td>
</tr>
</tbody>
</table>

Data expressed in absolute numbers (percentage). # Fisher’s Exact test; *Kruskal-Wallis test; p<0.05 was considered a significant difference.
Sleep alterations in patients with the human immunodeficiency virus and chronic pain

Drugs, such as cigarette and alcohol, is a risky behavior that can lead to toxicity and ineffective therapy; increased morbidity and mortality; increased exposure to high-risk sexual activity; acceleration of the disease progression; low adherence to ART; decline in CD4+ T-cell lymphocytes and increase in viral load. In this study, it was observed that 28.8% were smokers and 36.4% consumed alcohol, in these, neuropathic pain prevails.

Some studies have related the frequency of neuropathic pain with increased viral load and low CD4 levels, which did not present significance (p=0.138) in this sample. The use of the antiretroviral Efavirenz showed no significant association between the groups (p=0.409).

According to the data in table 2, there was no significant association between sociodemographic and clinical characteristics with the control and pain groups. A significant difference was observed between the gender ratio in the neuropathic pain group, women 32 and men 21, in comparison to the others, which is explained by the number of requests for care at the NGO where the study was performed.

Sleep is important to maintain the body homeostasis, and if it does not happen, the person will be subject to daytime sleepiness, fatigue, altered mood, and periods of disorientation. It may also reduce pain resistance because the fatigue of the sympathetic central nervous system is increased, which in turn causes an increase in the use of drugs to control pain, which contributes to sleep deprivation. Therefore, sleep is a basic human need that deserves all the attention and interventions from health professionals, especially the nurse.

According to Souza and Guimarães, the human being needs to sleep, as he needs to breathe and feed. Sleeping is not a passive act, but rather a restful and active act, so its time should be respected and the less unregulated as possible. The number of sleeping hours varies among people according to gender, age, and biological constitution. Women sleep 40 to 50 minutes longer than men and have greater amount of deep sleep. In relation to age, sleep decreases during life. While a newborn sleeps up to 18 hours a day, a young person needs about seven to eight hours, and an old person may be satisfied with five hours. Impaired sleep and inadequate wakefulness are invaluable sources of human suffering.

The evidence indicates that deep sleep outweighs chronic painful processes so that patients with more hours of sleep probably experience the symptoms with less intensity. For Vasilceac, a night’s sleep of poor quality may increase pain sensitivity on the following day. This is evident in this sample because, on mean, the pain groups had fewer hours of sleep than the control group (no pain).

The response to pain is one of the behaviors that can be altered due to changes in the sleep pattern. Patients with chronic pain have sleep fragmentation, a condition that may increase pain. A study by Edwards et al. investigated the relationship between sleep duration and the presence of pain complaints in the population. They found that subjects who slept less than six hours or for nine hours or more reported pain more frequently on the following day, and those who slept for three hours or less had an 81% increase in pain frequency over the sleep period from 6 to 9 hours, and sleeping for more than 11 hours was associated with a 137% increase in pain frequency. Several authors stress the importance of a good night’s sleep and its benefits. Moreover, there is an association between poor sleep and reduction in survival. Sleep disorders are typical signs of depression, as well as of pharmacological interactions, and it is necessary to investigate to solve this problem.

Symptomatic or asymptomatic AIDS can lead to excessive daytime sleepiness (EDS) and insomnia. Studies with asymptomatic HIV patients have shown increased slow-wave sleep, especially during the second part of the night, as well as reduced sleep efficiency. As HIV progresses, sleep becomes more fragmented, with frequent arousal, the slow-wave sleep decreases and rhythmic REM/non-REM cycles are suppressed. Insomnia and fatigue are the most common complaints, but more than 100 other disorders have been identified. Among its main categories are the problems to keep a regular resting routine and unusual behaviors during sleep.

According to Cruess et al., the presence of sleep disorders is of particular importance in HIV due to the already known adverse effects exerted by sleep deprivation on the immunity of healthy subjects and in HIV patients.

When comparing the overall score between the PSQI-BR components and the control, nociceptive and neuropathic pain groups, a significant association was found among patients with neuropathic pain who used sleeping pills (p<0.05). In this study, it was observed that more than 80% of the patients had poor sleep or sleep disorders. When compared to WHO data, that shows that 40% of the world population have difficulties in relation to the overall quality of sleep, the sample recorded the double of that loss of quality.

The Brazilian Society for the Study of Pain (SBED) describes that approximately 50% of patients with chronic pain report some sleep problems, such as difficulty in sleeping and awakening, closely associated with pain intensity. Many researchers and clinical practice professionals are becoming aware of the importance of the relationship between changes in time or quality of sleep and the presence of chronic pain. Although the mechanisms involved in this bidirectional relationship are still unclear, a good night’s sleep can be an important tool to reduce pain complaints and improve patients’ QoL.

Studies related to sleep in patients with HIV/AIDS describe that these patients face a lot of stress during the course of the disease, including dependence, disability, fear of pain and painful death, which can lead to bad dreams and nightmares, such as presented in the sample. They also point out that pain, whether acute or chronic, associated with sleep disorders is an important public health problem, causing numerous damages, including human, occupational and labor injuries.

It is known that pain interferes with sleep, but lack of sleep can increase the perception of pain. Although there is a clear, strong relationship between pain and sleep, the reasons to explain it are unclear. The relationship between sleep and pain is bidirectional and more studies are still required. Also, both chronic pain and sleep disorders share a range of physical and
mental health problems, such as obesity, type II diabetes, and depression. Having an interdisciplinary view is fundamental to understand the diagnosis better. In 2017, SBED recommended that the teams who treat patients with these symptoms should be staffed by professionals from several areas. Extended periods of rest deprivation may increase the risk of heart problems, as well as mental disorders or pain-related complaints. The studies on the relationship between sleep and pain manifestations have intensified and confirmed their association. Individuals with chronic pain, for example, are also susceptible to severe sleep problems. The circadian marker and the sleep homeostasis play central roles in the functions of daily life. Studies suggest that improved sleep enhances the immune function, both in cancer patients and in HIV-positive patients. Despite the benefits of antiretroviral therapy, AIDS has a physical, psychic and social impact. The nursing team seeks to improve its knowledge to provide individualized assistance in the different spaces where health care is provided. There is an increasing and continuous development towards comprehensive and personalized care, which allows nurses to plan their daily activities, enabling the development of nursing activity and valuing their knowledge.

The nursing care directed to these patients should be performed with systematized actions in order to produce positive results in the care of these patients. To obtain a satisfactory result with the treatment of pain, it is necessary to pay attention to the complaints related to sleep, characterizing and identifying these alterations to propose the required interventions to improve the QoL of these patients.

CONCLUSION

There is a high prevalence of sleep disorders or poor sleep in HIV patients with neuropathic pain. There was also a higher number of patients with normal sleep efficiency in the neuropathic pain group, which may be related to the greater use of sleeping pills, practically the double of the other groups.

REFERENCES


Comparative analysis between three forms of application of transcutaneous electrical nerve stimulation and its effect in college students with non-specific low back pain

Análise comparativa de três formas de aplicação de estimulação elétrica nervosa transcutânea e seu efeito na redução da dor em universitários com lombalgia inespecífica

Carla Maria Verruch\textsuperscript{1}, Andersom Ricardo Fréz\textsuperscript{2}, Gladson Ricardo Flor Bertolini\textsuperscript{1}

ABSTRACT

BACKGROUND AND OBJECTIVES: There are a variety of ways to apply the transcutaneous electrical nerve stimulation (TENS) without an established way that provides better results in the treatment of nonspecific low back pain. The objective of this study was to evaluate which application of TENS has a better effect on the immediate reduction of the intensity of spontaneous and provoked pain in college students with nonspecific low back pain.

METHODS: Quantitative, randomized and cross-sectional study. Twenty young individuals were divided into four groups and received a different intervention per week, totaling four weeks. The groups were Conventional TENS with the frequency of 100Hz, a pulse duration of 200μs; TENS with frequency and intensity variation with frequency variation and automatic pulse duration, TENS Burst with frequency modulated at 2Hz, pulse duration of 250μs; and placebo in which the subjects underwent a pacing protocol with no tingling sensation or muscle contraction. All sessions had a total application time of 20 minutes. They were evaluated for spontaneous pain through the application of the visual analog scale (VAS), and pain provoked by the algometer and cold pain through the application of solid ice directly to the skin, and VAS for the intensity of cold pain, all performed before and after each application of the electrotherapy.

RESULTS: Only the visual analog scale of spontaneous pain showed significant results (p<0.05) when compared intragroups, in the three applied currents.

CONCLUSION: The three forms used in the present study were able to reduce spontaneous pain after the intervention by electrostimulation.

INTRODUCTION

Low back pain is defined as pain or discomfort, located in the dorsal area between the last ribs and the gluteal folds, and may or may not present referred pain in the lower limbs. It represents a substantial economic burden for people in general, requiring
Comparative analysis between three forms of application of transcutaneous electrical nerve stimulation and its effect in college students with non-specific low back pain

BrJP. São Paulo, 2019 apr-jun;2(2):132-6

National and international measures aimed at prevention and reduction of treatment costs. Diagnostic screening, depending on the degree of specificity, can be classified in two ways: specific and non-specific low back pain (LBP). Non-specific LBP is characterized as a pain that is not attributed to a previous disease/injury, such as infections, tumors, fractures, structural deformities, root syndrome, among others. Although not having a primary cause, non-specific LBP has many risk factors related to childhood and adolescence, such as excessive heavy backpacks, improper posture, and ergonomics of school desks. Although the first cases are linked to puberty, the occurrence of low back pain in students and healthcare professionals is possibly related to the amount of academic and professional tasks, coupled with inadequate furniture and physical requirements.

The first choice to treat LBP is always conservative, as it is effective in reducing pain. The use of pharmacological therapy, application of local heat and electrostimulation, besides being less invasive, costs less than the surgical treatment. Transcutaneous electrical nerve stimulation (TENS) is considered a good treatment option for LBP because it is a non-invasive, non-pharmacological technique and responsible for activating afferent inhibitory neurons using electrodes on the skin surface. This therapy can be performed in different clinical settings. When applied with a high frequency, such as conventional TENS therapy, it has an Aβ fiber depolarization effect, capable of activating interneurons that are responsible for inhibiting the conduction of pain by the Aδ and C fibers. When applied at low frequencies, such as the TENS burst therapy characterized by strong stimuli, it depolarizes the fast pain (Aδ) and slow pain (C) fibers, which through the activation of pain modulating mechanisms located in the region of pons and bulb can produce descending analgesia. Both applications are effective in reducing pain through the release of endogenous opioids. Another form of TENS application is the one in which there is an automatic variable intensity frequency (VIF), as well as changes in the pulse length, presenting combined effects of the therapies with high and low frequencies, aiming mainly to hinder the accommodation phenomenon.

To evaluate the effectiveness of different types of electrostimulation, different pain stimuli can be measured, such as cold, analyzing intensity and pain threshold, as well as the pressure pain threshold. Such stimuli are responsible for pain reactions and can occur by depolarization of C and Aδ fibers. There are many ways of applying TENS, without having a definite way to obtain better treatment results for non-specific LBP. Thus, the objective of the present study was to evaluate which kind of application of TENS has a better effect on the immediate reduction of the intensity of spontaneous and provoked pain, in college students with non-specific LBP.

METHODS

The present study is characterized as quantitative, randomized and crossed-sectional. Data collection was performed at the Physical Rehabilitation Center (CRF) - UNIOESTE and all participants signed the Free and Informed Consent Form (FICT). Eight male and 12 female volunteers participated in the study, aged from 18 to 27 years old (mean of 20.78±2.65 years), weight 70.25±14.97kg, height 1.68±0.07m, and body mass index (BMI) of 24.53±4.58, who presented non-specific LBP for at least three months, and were included only those who were not performing any type of treatment. The exclusion criteria were contraindications for the use of electrostimulation of any kind, the use of a pacemaker or a metal implant.

Data collection lasted for four weeks, and all 20 subjects were submitted, crossed-sectional, to the four sessions, once a week, in groups previously selected by lot, and the individual had to go through the four intervention groups, not being allowed to repeat the type of current application.

The groups were: conventional TENS (CTG), burst TENS (BTG), VIF TENS (VTG) and placebo (PG).

It was used the visual analog scale (VAS) to quantify the intensity of spontaneous pain, which presents values from zero to 10, where zero refers to no discomfort and 10 refers to the maximum bearable discomfort, being measured before the other evaluations. A pain stimulus under pressure and cold was applied to evaluate the provoked pain threshold. First, the Kratos algometer was used, capable of producing a pressure of up to 50Kgf. All procedures were explained to the volunteers, and the pressure was applied in the low back area, always bilaterally, 2cm lateral to the spine process of the vertebrae referred to as being more sensitive to palpation. The moment the pressure pain threshold was reached, the algometer was removed, and the value of the highest pressure exerted was written down. To evaluate the pain for cold, ice was applied directly to the skin in the low back area, at the same place of the pressure evaluation, writing down the time in seconds that the volunteer took to feel the pain stimulus, that is, the threshold of pain for cold. Besides, the VAS was also used to quantify the intensity of pain for cold after contact with the ice. All evaluations were performed before the application of the therapy and repeated at the end of the session, including in the PG.

After the pain evaluation, the electrostimulation therapy was applied using the lBramed Neurodyn II device, drawn for the participant in each intervention day. In all groups, the individual was positioned in the prone position, with the electrodes arranged longitudinally on the low back area (L1-L5). The gel was applied to create the interface for current transmission, and the electrodes were fixed with adhesive tape. Finally, the device was switched on following the parameters of each protocol. In the three types of current application, whenever there was accommodation, the intensity was increased, according to the patient’s report. The total duration of therapy was 20 minutes in all groups.

In the CTG, the subjects were submitted to the application of the current with a frequency of 100Hz, a pulse duration of 200μs (microseconds), with comfortable amplitude, depending on the participant’s threshold, without occurring motor stimulation. In the VTG, the current application used as parameter the frequency of 2 to 247Hz, a pulse duration of 50 to 500μs and high amplitude, yet comfortable. And in BTG, the current was...
applied with frequency modulated at 2Hz, a pulse duration of 250µs, with sufficient amplitude to generate a rhythmic muscle contraction sensation, associated with tingling, yet comfortable. At the PG, the volunteers did not receive electrical stimulation, but at the beginning of the intervention, the evaluator explained that they were being submitted to a protocol below the sensory threshold, in which they would not have any sensation of tingling or muscular contraction. The electrodes were placed, and the device switched on, however, there was no electric current transmission.

All procedures followed the ethical criteria required for work in humans, with prior approval by the Research Ethics Committee of the State University of the Oeste do Paraná (UNIOESTE), under number: 2.588.536 of 2018.

**Statistical analysis**

For this size of the sample used, with a difference to be detected and a standard deviation of 2.5, and a significance level of 5%, the calculated test power was 80% for ANOVA evaluation using the software Bioestat 5.0. The results were analyzed by descriptive and inferential statistics, and there was normality for the daily VAS (Shapiro-Wilk). Thus, one-way ANOVA was used with an evaluation of the size of the Cohen effect. For the other variables, the Friedman test was used for non-parametric data. The accepted level of significance was 5% ($p <0.05$).

**RESULTS**

Table 1 shows the assessment of the spontaneous pain intensity by VAS, before and after the treatment with a $p<0.0001$, and when compared between the groups there was no significant difference. When compared with PG, the effect sizes were considered small for the initial evaluation (conventional - 0.13, VIF 0.13, and burst 0.05), as well as for the final evaluation (conventional 0.32; VIF -0.22 and burst -0.32).

In the evaluation of pain by pressure stimulus with the algometer, there was no significant difference between initial and final evaluations intra-group or between the different ways of the current application (Fr: 7.1 and $p=0.4185$), as shown in table 2.

For the evaluation of the threshold of pain for cold pain, there were no significant results in the intra-group analysis in both tests (Fr: 10.4 and $p=0.1666$) and (Fr: 32.4 and $p<0.0001$), respectively. Yet, the VAS presented a significant $p$-value, which occurred when the different evaluations of the different treatment groups were compared, not happening between the evaluations in the same group or at similar moments in the four groups. Table 3 shows the other data.

### Table 1. Data on mean and standard deviation for the groups when evaluated by the visual analog scale, before and after treatment and value of difference and $p$ between evaluations

<table>
<thead>
<tr>
<th>Groups</th>
<th>Initial evaluation</th>
<th>Final evaluation</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTG</td>
<td>5.15 ± 2.64</td>
<td>2.4 ± 1.95 *</td>
<td>-1.21</td>
</tr>
<tr>
<td>VTG</td>
<td>5.15 ± 2.45</td>
<td>2.65 ± 1.69 *</td>
<td>-1.20</td>
</tr>
<tr>
<td>BTG</td>
<td>4.95±2.66</td>
<td>2.4 ± 1.95*</td>
<td>-1.08</td>
</tr>
<tr>
<td>PG</td>
<td>4.8 ± 2.76</td>
<td>3.15±2.66</td>
<td>0.60</td>
</tr>
</tbody>
</table>

CTG = conventional TENS group; VTG = VIF TENS group; BTG = burst TENS group; PG = placebo group; * significant value of $p$ (5%) when compared to the initial evaluation.

### Table 2. Presentation of the data in the median, first and third quartile, and the sum of ranks for the groups when the threshold of pressure pain algometer (gf) was evaluated before and after treatment

<table>
<thead>
<tr>
<th>Groups</th>
<th>Median 1st and 3rd Q</th>
<th>Sum of Ranks</th>
<th>Median 1st and 3rd Q</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTG</td>
<td>5497.5</td>
<td>80</td>
<td>6222.5</td>
<td>103</td>
</tr>
<tr>
<td></td>
<td>4159.8-6720</td>
<td></td>
<td>4282.6-7150</td>
<td></td>
</tr>
<tr>
<td>VTG</td>
<td>5055</td>
<td>78</td>
<td>4700</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>4138.7-6436.2</td>
<td></td>
<td>4331.2-6810</td>
<td></td>
</tr>
<tr>
<td>BTG</td>
<td>5290</td>
<td>85</td>
<td>5570</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>4700-7047.5</td>
<td></td>
<td>4952.5-7905</td>
<td></td>
</tr>
<tr>
<td>PG</td>
<td>5700.5</td>
<td>87</td>
<td>5050</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>4370-7089.6</td>
<td></td>
<td>4113.3-8277.5</td>
<td></td>
</tr>
</tbody>
</table>

CTG = conventional TENS group; VTG = VIF TENS group; BTG = burst TENS group; PG = placebo group.

### Table 3. Presentation of the data in the median, first and third quartile, and the sum of ranks for the groups when assessing the pain threshold of cold pain (seconds) and the visual analog scale for cold pain, before and after treatment

<table>
<thead>
<tr>
<th>Groups</th>
<th>Median 1st and 3rd Q</th>
<th>Sum of Ranks</th>
<th>Median 1st and 3rd Q</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTG</td>
<td>28.2</td>
<td>79.5</td>
<td>48.5</td>
<td>103.5</td>
</tr>
<tr>
<td></td>
<td>17.8 - 64.5</td>
<td></td>
<td>18.2 - 160.8</td>
<td></td>
</tr>
<tr>
<td>VTG</td>
<td>24.2</td>
<td>75</td>
<td>33</td>
<td>104.5</td>
</tr>
<tr>
<td></td>
<td>14.3 - 70.5</td>
<td></td>
<td>17.7 - 152</td>
<td></td>
</tr>
<tr>
<td>BTG</td>
<td>34.5</td>
<td>87</td>
<td>41.5</td>
<td>108.5</td>
</tr>
<tr>
<td></td>
<td>15.7 - 65.3</td>
<td></td>
<td>19.7-104.3</td>
<td></td>
</tr>
<tr>
<td>PG</td>
<td>33</td>
<td>79</td>
<td>32.5</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>15.6 - 81.3</td>
<td></td>
<td>14.8 - 90.3</td>
<td></td>
</tr>
</tbody>
</table>

Continue...
DISCUSSION

Three types of application of TENS therapy (conventional, burst and VIF) were tested for the analysis of the reduction of spontaneous and induced pain by pressure and thermal stimuli. Since all three were effective in reducing spontaneous pain, no significant results were found to indicate the best for the treatment of low back pain.

Several studies have shown that the use of TENS to treat LBP is a viable option, with significant evidence of its effectiveness, both for acute and chronic pain and with few contraindications for the patient.\(^{16,17}\) The reduction of spontaneous pain evaluated by the VAS had a significant result for the three ways of TENS application, which reproduces the results found in a study\(^ {18}\) that used a model of low frequency (20Hz, 220µs) TENS and interferential current in the low back area. It also reproduced another study\(^ {19}\) which evaluated the effectiveness of TENS in high and low frequencies. However, one study has shown that for the reduction of post-caesarean pain intensity, the high frequency would be better.\(^ {20}\)

In a systematic review of 29 studies on the efficacy of conventional TENS, 16 had positive results in pain reduction. When evaluated specifically for pressure pain, 8 studies have proved their efficacy, while 4 have not shown significant results. As for the pain caused by cold, there is moderate evidence regarding its effectiveness. There are three low-quality studies with positive results, and one low-quality study with negative results for this type of stimulus.\(^ {21}\)

A study comparing the application of TENS in low and high frequencies, as well as the combined approach, emphasized that the use of TENS with variable frequency and intensity, such as VIF, reduces the occurrence of the development of current tolerance and can produce a greater analgesic effect. However, this fact was not reproduced in the present study, due to the single application of each TENS intervention.\(^ {22}\)

The samples were composed of subjects of both genders, most women, which may be a limitation of this study. A previous study pointed out that there are differences in the pain threshold between men and women, mainly regarding pressure pain, which is the most sensitive to the differences of gender.\(^ {23}\) This corroborates the results of previous studies using TENS in the conventional mode (100Hz, 250µs) and the high voltage polarized current (100Hz, 50µs) and TENS therapy in different frequency configurations, both in the elbow area that did not obtain significant values in the evaluation of pressure pain after the treatment with analgesic currents.\(^ {12,24}\)

However, a comparative study between TENS therapy (100Hz, 40µs) and its association with cryotherapy (20 minutes) was effective in increasing the pressure pain threshold in the forearm area in healthy individuals. However, the method used to apply the pressure algometer differed from the other studies, since it asked the participant to report when they felt pain proportional to level 3 of the VAS, which may be the cause of the uneven results.\(^ {25}\)

Regarding its efficacy in the reduction of cold-induced pain, there are differences in the results of a study,\(^ {26}\) which using TENS at the frequency of 10Hz applied in acupuncture points was able to reduce the intensity of cold pain in the hand area. Another study,\(^ {27}\) which used the acupuncture mode (10Hz and 250µs) to assess cold pain by the hand immersion method in cold water, did not obtain significant results. This data is in line with this study that used different parameters of TENS current application with the same purpose and did not find significance in the pain threshold supported in seconds, and pain intensity, quantified by the VAS.

CONCLUSION

The three ways of TENS application, conventional, VIF, and burst, were effective in the treatment of spontaneous pain since there was a significant numerical reduction in the VAS after the intervention. However, as none of the three ways of application has been excelled in the efficacy of pain reduction, further studies are needed to see if a similar result will be found when performed with a more extended protocol or with same-gender volunteers.

REFERENCES


ABSTRACT

BACKGROUND AND OBJECTIVES: Children with cerebral palsy are affected by postoperative painful processes. These children’s pain may be underestimated due to difficult communication especially when a specific tool is not used. The objective of this study was to evaluate the pain in children with cerebral palsy in postoperative orthopedic surgery and the pain perception of parents and health professionals.

METHODS: It is a cross-sectional, observational study performed at Associação de Apoio à Criança Deficiente in São Paulo. Fifty-one children with cerebral palsy were recruited, aged between 6-15 years, 51 parents/caregivers and 51 health professionals. Pain assessment was measured by an observer during the routine procedures in which the child was manipulated. After the procedure, the observer asked health professionals and parents about the child’s pain.

RESULTS: Eighty-two percent of patients had postoperative pain, and of these, 50% had moderate and intense pain. In unarticulated patients, parents and caregivers had discordant perceptions from the observer in 65% of the cases (p=0.05) and health professionals had discordant responses in 75% (p<0.001). In communicative patients, parents had discordant responses from the observer in 58% of the cases (p=0.20) and health professionals had discordant responses in 55% of the cases (p=0.44).

CONCLUSION: Children with cerebral palsy present moderate and intense pain in the postoperative period of orthopedic surgeries. In the hospital, it is more challenging to detect pain in unarticulated patients without the use of a specific scale, even by experienced parents or professionals.

Keywords: Cerebral palsy, Pain measurement, Postoperative pain.

INTRODUCTION

The International Association for the Study of Pain (IASP) defines pain as an unpleasant experience associated with actual or potential tissue injury involving the sensory, emotional and cognitive aspects. The recognition of the stimulus by the nociceptors is called noiception, and pain is a conscientious experience that
The sample was of convenience, chosen due to the limited collection time and availability of the researchers. Regarding the sample calculation, due to the few numbers of research on this matter, the calculation was based on a pilot sample, and the calculated n, unfortunately, was approximately 216 subjects for the group of patients (articulated and unarticulated).

The sample consisted of 51 patients and 102 evaluators. The group of 51 patients was divided into 2 groups: Group 1 UA = unarticulated children with cerebral palsy (n=20); Group 2 A = articulated children with cerebral palsy (n=31); of both genders, aged between 6 and 16 years, diagnosis of CP, hospitalized and submitted to corrective orthopedic surgery in any segment of the lower limbs. Regarding the Group of Evaluators (evaluators of the subjective perception of the pain of the child with CP) (n=102), it was also subdivided into two groups: Group 1 P/C = composed by the respective parents/caregivers (responsible) of the patients (n=51); Group 2 HP=health professionals, composed by physiotherapists and nursing technicians (n=51).

In the preoperative period, the observer completed a form with the patients’ clinical and personal data taken from their medical records. Then the following vital signs of the patient at rest were collected: heart rate (HR), respiratory rate (RR) and peripheral oxygen saturation (SpO₂). The period between the 1st and 2nd postoperative day was chosen as the moment of pain evaluation during the hospital routines in which it was necessary to manipulate the patient and the operated segment in bed, in activities such as bathing, change of decubitus position, and physiotherapy. The manipulations were performed by different health professionals, physiotherapists or nursing technicians; and all the professionals participating in the study were randomly selected when they were providing care to the selected patient.

To assess the impressions of the caregiver and the health professional regarding the presence or absence of pain in the patient, both were verbally asked by the observer if the patient has had pain or not during the routine procedure. To serve as a comparison parameter, at the same time, the observer also evaluated the patient’s pain, and used specific instruments for pain assessment: In group 1 (UA), the FLACC-R scale was used, with a score between zero and 10. In the patients in group 2 (A) the verbal numerical rating scale (vNRS) was used, which also varies from zero to 10. Both scales evaluate the intensity of pain through the values obtained between zero and 10, being zero absence of pain; 1-3 mild pain; 4-6 moderate pain; 7-10 severe pain.

The research was approved by the Research Ethics Committee of the Associação de Assistência à Criança Deficiente (AACD), with opinion number 835.133 and 32717214.6.0000.0085.

**Statistical analysis**
The data was tabulated in the Microsoft Excel spreadsheet and then analyzed using the SPSS 17.0 software. For the descriptive analysis, the position and dispersion measures (mean and standard deviation) were calculated. The test for the equality of two proportions was used to calculate the agreement between the answers given by the caregivers and the health professionals, and the responses obtained by the observer regarding the presence or absence of pain in the patients. Regarding the hypothesis that the
vital signs were altered in the presence of pain, the paired Student *t*-test was used. Two scales were used to evaluate the pain, FLACC and vNRS, and to check whether both scales matched, the Pearson correlation test was performed. In this study, the null hypothesis was rejected when the alpha error was less than 5% (p<0.05).

**RESULTS**

Fifty-one patients were evaluated, 22 female (44.2%) and 29 male (56.8%) articulated and unarticulated. Fifty-one health professionals were interviewed, 24 nursing technicians (47.05%) and 27 physiotherapists (52.9%), as well as 51 parents/caregivers (Table 1).

Taking the observer’s assessment as a reference of the presence of postoperative pain during the manipulation of the patient, 82% of the patients had pain, regardless of the group (p<0.001) (Table 2), with 50% of the patients with moderate to severe pain intensity.

The answers given by the caregivers and the health professionals were compared with the ones obtained by the observer, who used the FLACC-R (unarticulated) and vNRS (articulated) scales for the presence or absence of pain in both groups of patients. The answers obtained by the observer (FLACC-R scale) were compared with the reports of caregivers and health professionals regarding the presence or absence of pain in the unarticulated patient’s group. In both groups of evaluators, a statistically significant difference in the answers was observed in relation to the observer’s evaluation. Parents and caregivers had discordant perceptions from the observer in 65% of cases (p=0.05), and health professionals had discordant responses in 75% (p<0.001) (Figure 1).

The dark gray bar represents the percentage of disagreement, and the light gray indicates the percentage of agreement in the answers obtained from health professionals and parents/caregivers. The observer responses (vNRS scale) were compared with the reports of caregivers and health professionals regarding the presence or absence of pain in the group of articulated patients, and a significant disagreement was observed in the responses of both groups of evaluators. The caregivers had discordant responses when compared to the observer’s in 58% (p=0.20), and the health professionals had discordant responses when compared to the observers in 54% (p=0.44) (Figure 2).

The dark gray bar represents the percentage of disagreement, and the light gray indicates the percentage of agreement in the answers obtained from health professionals and parents/caregivers.

**Face, Legs, Activity, Cry, Consolability scale versus verbal numerical rating scale**

The agreement between the FLACC and vNRS scales was analyzed in the group of articulated patients, to evaluate whether the responses and intensities were the same. There was a moderate correlation with statistically significant agreement between them, regarding the presence and intensity of the pain (Table 3).

**Table 1. General characteristics of the groups**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Subgroups</th>
<th>n</th>
<th>Time of engagement</th>
<th>Age</th>
<th>Gender</th>
<th>Hospitalizations (previous/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean±SD</td>
<td>Mean±SD</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>Group 1</td>
<td>A</td>
<td>31</td>
<td>-</td>
<td>10.97±2.5</td>
<td>48.3</td>
<td>51.6</td>
</tr>
<tr>
<td>Group 2</td>
<td>UA</td>
<td>20</td>
<td>-</td>
<td>10.10±2.8</td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td>Evaluators</td>
<td>HP</td>
<td>51</td>
<td>4.15±4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>P/C</td>
<td>51</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>General</td>
<td></td>
<td>153</td>
<td>-</td>
<td>10.62±2.6</td>
<td>43.1</td>
<td>56.8</td>
</tr>
</tbody>
</table>

A = articulated; UA = unarticulated; n = number; SD = standard deviation; HP = health professional; P/C = parents/caregivers; F = Female; M = Male.
In order to evaluate the relationship between changes in the vital signs and the presence of pain in the patients, the vital signs were compared in the preoperative and post-manipulation periods, dividing the patients into those who had pain, versus those who did not to the vital signs of HR, MAP and RR (Table 4). For patients who had pain during manipulation, the change in the vital signs was statistically significant in relation to their preoperative baseline values, HR (p<0.001), MAP (p=0.009) and RR (p<0.003). However, there was an increase in the RR variable in relation to the baseline values also in patients who did not have pain (p<0.006).

**DISCUSSION**

Orthopedic surgeries are among the most frequent in patients with CP, and these patients often present intense postoperative muscle spasms, causing pain and stress to the child, parents, and physicians. In this study, the prevalence of pain in the lower limbs between the 1st and 2nd postoperative days was 82.4%, and in 50% the pain was moderate to severe. This result is slightly more than double the percentage found by Goodman and McGrath in a study that observed pain on the 1st postoperative day in 40% of children with a mean age of 8 years. The control of acute postoperative pain is the responsibility of the anesthesiologist, the surgeon, and the nursing team. On the other hand, all those involved in the assistance process; patients, parents, and health professionals are responsible for the detection and assessment of the pain to be treated. Pain relief is a patient’s right and must be ensured regardless of its level of consciousness, and the use of valid and reliable instruments for the pain assessment is paramount for its proper handling.

The present study evaluated the perception of “pain” by parents and health professionals in articulated and unarticulated children with CP during potential pain procedures such as the manipulation performed by physiotherapists and nursing technicians. The fact that children could communicate seems to have been a decisive factor for better perception and detection of pain or no pain by parents/caregivers and health professionals, without the use of a specific scale. On the other hand, in the group of unarticulated patients, it was observed in the present study that the perception of the state of “pain” or “no pain” by parents/caregivers and health professionals was more difficult, showing high values of disagreement when compared to the observer’s responses. Although parents and caregivers may be able to assess the sensation of pain in daily activities in patients with cognitive impairment and/or difficulty in communicating, the fact of being in a stressful situation in a hospital environment seems to influence their ability to perceive pain in their children, either because they are out of their daily family and professional routines, or because of the possibility of catastrophizing pain. Concerning the perception of pain by health professionals, the reactions of fear, such as crying and increased tone presented by the children during the various care procedures and interventions could have made it difficult for the health professional to tell pain from fear since some reactions are similar. These results are similar to the ones found in a review study where the professionals also had difficulty in detecting pain without the use of specific scales for the assessment.

In both groups of this study, however, a high percentage of disagreement in the patient’s pain perception was observed, which corroborates the findings by Bacellar, in which the family members identified pain only in 41.2% of the cases, the nursing team in 33.7%, and physicians in 29.6%.

It was observed that the intensity of pain obtained with both the vNRS and FLACC scales had a strong correlation in the articulated patients, but it is important to emphasize that in this study the perception of pain intensity by parents/caregivers and health professionals was not addressed. However, literature provides consistent data regarding the importance of using instruments to assess pain intensity.

The scales for pain assessment are subjective, and their purpose is to facilitate the detection and measurement of the intensity, and when talking about pain scales for unarticulated patients, these are, most of all, scarce. A “gold standard” would be welcome for the detection of pain and its measurement in children unable to self-report, but such a standard pattern does not yet exist. An alternative would be a mixed method, where the pain behavior evaluation would be complemented by a physiological evaluation, that is, by the recording of the vital signs. It was observed in this study that the pain interferes precisely in the values of HR, MAP, and RR. However, the change in RR seems to have no single relation with the presence of pain since we have also observed a significant increase in RR in the group that did not have pain during manipulation. It is possible that fear is also a determinant for this change.

Another aspect to be highlighted is that although this was not the objective of this study, the presence of previous hospitalizations...
as a characteristic of the patients was observed in 100% of the sample. This fact has raised an important issue to be considered in the management of pain in patients with CP. In a systematic review by Petovello29 he reported that children who go through several hospitalizations develop greater fear and anguish due to the memory of stored pain and that in such cases, the painful memory anticipates their reactions to painful procedures that in turn may cause the cycle increase in tone and pain.

Finally, detecting and treating the patient’s pain correctly, regardless of their capacity to self-report is paramount for any health service. The National Council of the Rights of the Child and Adolescent, in its Resolution 41 on the Rights of Hospitalized Children and Adolescents, article 7 provides that the patient has “the right not to feel pain when there are ways to avoid it”28. In this sense, the recognition of the painful episode and the application of instruments to assess the pain according to each patient allows health professionals to handle the pain appropriately27.

The limitations of this study are related to the limited time for data collection and, consequently, the small sample size. Considering the importance of the topic, it is necessary to conduct more studies with a larger sample and perhaps to include samples with other characteristics such as different surgical interventions or institutions with established pain protocols.

CONCLUSION

Children with CP have pain during manipulations in the initial lower limbs postoperative period. Even with parents present in the daily routine of the unarticulated patient and professionals of a referral institution in the care of this population, the pain can still not be properly detected without the use of a specific tool. Therefore, in the hospital setting, pain can be detected effectively with the use of specific scales for each population.

REFERENCES

Non-pharmacological measures for pain relief in venipuncture in newborns: description of behavioral and physiological responses

ABSTRACT

BACKGROUND AND OBJECTIVES: Venipuncture is considered a painful procedure, often performed in the neonatal intensive care unit. The objective of this study is to describe the behavioral and physiological responses of newborns undergoing venipuncture, with and without the use of non-pharmacological measures for the relief of pain.

METHODS: A total of 84 newborns participated in this research. It was observed if the nurse prepared the newborn for the puncture. Newborns that did not receive the non-pharmacological approach were allocated in group 1, and those who received were to group 2. The behavioral and physiological parameters were assessed two minutes before and two minutes after the procedure in all newborns. The data analysis was descriptive.

RESULTS: Before the procedure, 45.5% of the newborns in group 1 had a contracted face; however, after the procedure, this number increased to 69.7%. After the procedure in group 2, 29.4% grumbled, 3.9% had a vigorous cry, 66.7% did not cry. Arms and legs movement had similar responses in both groups. After the procedure, 72.7% of newborns in group 1 had a heart rate higher than 160bpm. After the procedure in group 1, 15.2% had an oxygen saturation between 96 and 100% and this value increased to 58.8% in group 2.

CONCLUSION: The behavioral and physiological responses presented by the newborns are altered when babies undergo venipuncture without the use of measures for the relief of pain, the most common being: contracted face; grumbling; arms and legs flexed/extended; tachycardia; and hypoxia.

Keywords: Neonatal intensive care units, Newborn, Pain, Peripheral catheterization.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A punção venosa é considerada um procedimento doloroso, realizado com frequência na unidade de terapia intensiva neonatal. O objetivo deste estudo foi descrever as respostas comportamentais e fisiológicas de recém-nascidos submetidos à punção venosa, com e sem a utilização de medidas não farmacológicas para alívio da dor.

MÉTODOS: Participaram da pesquisa 84 recém-nascidos. Foi observado se o profissional de enfermagem realizava o preparo do recém-nascido para a punção. Os recém-nascidos que não receberam medida não farmacológica foram alocados no grupo 1 e os que receberam foram para o grupo 2. Foram avaliados os parâmetros comportamentais e fisiológicos dois minutos antes e dois minutos após o procedimento em todos os recém-nascidos. A análise dos dados ocorreu de forma descritiva.

RESULTADOS: Antes do procedimento, 45,5% dos recém-nascidos no grupo 1 apresentavam a face contraída, entretanto, após o procedimento, esse número aumentou para 69,7%. Depois do procedimento no grupo 2, 29,4% resmungaram, 3,9% tiveram choro vigoroso e em 66,7% o choro ficou ausente. Os movimentos de braços e pernas apresentaram respostas semelhantes nos dois grupos. Após o procedimento, 72,7% do grupo 1 apresentaram frequência cardíaca maior que 160bpm. Após o procedimento no grupo 1, 15,2% apresentaram saturação de oxigênio entre 96 e 100%, já no grupo 2, esse valor aumentou para 58,8%.

CONCLUSÃO: As respostas comportamentais e fisiológicas apresentadas pelos recém-nascidos sofreem maiores alterações quando os bebês são submetidos à punção venosa sem o uso de medidas para alívio da dor, sendo as mais presentes: face contraída; resmungos; braços e pernas flétidos/estendidos; taquicardia e hipossaturação.

Descritores: Cateterismo periférico, Dor, Recém-nascido, Unidades de terapia intensiva neonatal.
INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with a real or potential tissue injury. Newborns (NB) admitted to a neonatal intensive care unit (NICU) are usually submitted to painful procedures, such as surgeries, venous punctures, and aspirations. However, other seemingly simple care, such as changing diapers, weighing and removing tape can also result in noxious stimuli.

Pain is becoming increasingly important in the health area because it causes a high level of discomfort and instability that can influence the alteration of vital signs and, consequently, the hemodynamics of patients. It is essential to recognize pain as a vital data that deserves to be valued and included in the planning of the care of the individuals.

Healthcare professionals have the responsibility to provide a systematic approach in pain management, including assessment, prevention and treatment of pain in NB. In a study conducted with nurses of a NICU of a university hospital, professionals reported that the non-verbalization of the newborns was the greatest difficulty found to recognize and assess pain.

Thus, the implementation of guidelines for pain control in clinical practice is not an easy task since it involves several organizational and individual factors. Caregiving practices should be based on evidence and not on tradition, routine, or individual’s experiences.

Both pharmacological and non-pharmacological measures are necessary to control pain. The pharmacological strategies are indicated for severe pain, usually caused by invasive, prolonged, more complex procedures, and include the use of opioids and local anesthetics, among others.

Non-pharmacological interventions are most commonly used for acute pain, caused by minor procedures, such as venipuncture and blood collection that cause agitation and stress. The Department of Health recommends the use of non-pharmacological measures, such as sweetened solutions (glucose or sucrose), breastfeeding, non-nutritive sucking, skin-to-skin contact, and to reduce tactile stimuli.

The use of non-pharmacological measures, before painful procedures, is becoming a strategy of care that must be performed in newborns in hospital units. This is because the pain suffered by the NB causes organic repercussions that may compromise its development, and the pharmacological therapy presents several adverse effects due to the immaturity of the baby’s organic systems.

Oral glucose administration has been the most widely used measure in NB interventions. However, new strategies are being pointed out, such as the use of scents to promote pain relief and winding.

A flowchart to help to handle the pain in NICUs, created by nurses, states that breastfeeding and oral breast milk supplementation need to be prioritized because it favors the mother’s participation in the care of the newborn. In addition to these strategies, the flowchart also recommends the use of environmental measures such as reducing the noise, stimuli, abrupt changes in brightness and temperature.

However, for the implementation of non-pharmacological measures to take place effectively, it is necessary to make health professionals aware of the right of the newborns to have the pain avoided and treated. They also need to know how these measures must be applied.

To use the pain relief measures properly, it is necessary to evaluate, identify and initiate pain treatment, as these actions contribute to a faster recovery and better quality of care.

Venipuncture is considered a painful procedure and is frequently performed in the NICU. Therefore, it is necessary to evaluate the behavioral and physiological responses of the newborns who undergo such procedure, since a reliable description of the pain experience is fundamental to identify the best treatment for each NB.

The objective of this study was to describe the behavioral and physiological responses of newborns undergoing venipuncture, with and without the use of non-pharmacological measures for pain relief.

METHODS

This is a cross-sectional study conducted in a NICU of a tertiary referral hospital in the city of Fortaleza, CE, Brazil. The institution is a teaching hospital, accredited by the Unified Health System, which assists the mothers and children at risk.

The study evaluated the behavioral and physiological parameters of newborns subject to venipuncture. To estimate the study sample, we considered n=640 (NB admitted in 2014), confidence level=90%, P=50% (pain prevalence during puncture), Q=50% (complementary percentage of P), sampling error=10%. The calculation of the sample size resulted in 61 NB. However, the data was collected in 84 NB, considering the possibility of losses during the study, which did not occur. The study included those NB hospitalized in the unit during data collection, regardless of gestational age. NB under pharmacological measures for pain relief and those with congenital malformation were excluded from the study.

Data collection was from September 2015 to June 2016. The data collection instrument used was a form containing the NB identification data. The assessment of pain before and after the venipuncture used the Neonatal Infant Pain Scale (NIPS), the heart rate and oxygen saturation, and the description of the non-pharmacological measure if any.

The NIPS is a scale used to assess pain signs in the newborn. It has six pain indicators, one physiological and five behavioral, including facial expression, crying, movement of arms and legs, sleep/alertness state and respiratory pattern. The scale scores vary between zero, one and two points, depending on the characteristic presented. The minimum score is zero, and the maximum score is seven. The pain is characterized by the sum of points greater than or equal to four.

It is noteworthy that in this unit, the multiprofessional team was trained to use non-pharmacological measures before painful procedures. Some strategies recommended are the use of oral glucose at 25%, facilitated containment, lap, and touch.

Initially, the researchers were trained to collect data, after the approval of the research project. The data was collected in the morning and afternoon shifts. The researcher recorded whether
RESULTS

Table 1 shows the clinical variables of the newborns participating in the study.

As observed in Table 1, most of the NBs were male (67.9%), low weight (73.8%), c-section delivery (73.8%) and premature (79.8%). The mean weight was 2.067±789g. The mean gestational age was 34.6±3 weeks. The leading causes of hospitalization were respiratory distress (41.7%), prematurity (27.4%), hypoglycemia (8.3%), among others. The non-pharmacological measures used by the nursing team for the NB subjected to venipuncture, with and without non-pharmacological measures for pain relief, while group 2 (G2) was formed by the NB who received some non-pharmacological measure before the puncture.

To better understand the data, the newborns were divided into two groups. Group 1 (G1) was comprised the NB with no non-pharmacological measures for pain relief, while group 2 (G2) was formed by the NB who received some non-pharmacological measure before the puncture.

The research complied with the standards of the Resolution 466/12. The NB was included in the study after the signing of the Free and Informed Consent Term (FICT) by the person responsible for the NB. The study is part of an umbrella project and was approved by the Ethics Committee of the Institution under number 011201/2011.

Table 2 describes the behavioral responses of the newborns before and after the procedure. The parameters were recorded two minutes before and two minutes after the puncture.

Regarding the behavioral responses, it is observed that before the procedure, in group 1, 45.5% had a contracted face. However, after the procedure this number increased to 69.7%. On the other hand, in group 2, only 27.5% had a contracted face before the procedure, evolving to 33.3% afterward.

After the procedure in group 1, 81.8% of the NB grunted, and 6.1% had vigorous crying. In group 2, after the procedure, 29.4% grunted, 3.9% had vigorous crying, and crying was absent in 66.7%.

### Table 1. Description of variables of the newborns in the study, Fortaleza, CE

<table>
<thead>
<tr>
<th>Variables</th>
<th>n</th>
<th>%</th>
<th>Means±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>57</td>
<td>(67.9)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>27</td>
<td>(32.1)</td>
<td></td>
</tr>
<tr>
<td>Weight (gr)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2500</td>
<td>62</td>
<td>(73.8)</td>
<td>2.067±789</td>
</tr>
<tr>
<td>≥2500</td>
<td>22</td>
<td>(26.2)</td>
<td></td>
</tr>
<tr>
<td>Delivery type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-section</td>
<td>62</td>
<td>(73.8)</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>22</td>
<td>(26.2)</td>
<td></td>
</tr>
<tr>
<td>Gestational age (weeks)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;37</td>
<td>67</td>
<td>(79.8)</td>
<td>34.6±3</td>
</tr>
<tr>
<td>≥37</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory distress</td>
<td>35</td>
<td>(41.7)</td>
<td></td>
</tr>
<tr>
<td>Premature</td>
<td>23</td>
<td>(27.4)</td>
<td></td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>7</td>
<td>(8.3)</td>
<td></td>
</tr>
<tr>
<td>Sepsis</td>
<td>5</td>
<td>(5.9)</td>
<td></td>
</tr>
<tr>
<td>Jaundice</td>
<td>4</td>
<td>(4.8)</td>
<td></td>
</tr>
<tr>
<td>Neonatal infection</td>
<td>3</td>
<td>(3.6)</td>
<td></td>
</tr>
<tr>
<td>Congenital syphilis</td>
<td>2</td>
<td>(2.4)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>(5.9)</td>
<td></td>
</tr>
<tr>
<td>Non-pharmacological measures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose at 25%</td>
<td>37</td>
<td>(72.5)</td>
<td></td>
</tr>
<tr>
<td>Facilitated contention</td>
<td>11</td>
<td>(21.6)</td>
<td></td>
</tr>
<tr>
<td>Lap</td>
<td>3</td>
<td>(5.9)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors.

### Table 2. Description of the behavioral responses of the newborns subjected to venipuncture, with and without non-pharmacological measures, Fortaleza, CE

<table>
<thead>
<tr>
<th>Behavioral parameters at venipuncture</th>
<th>G1 (n=33)</th>
<th>G2 (n=51)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before n %</td>
<td>After n %</td>
</tr>
<tr>
<td>Facial Expression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relaxed</td>
<td>18 (54.5)</td>
<td>10 (30.3)</td>
</tr>
<tr>
<td>Contracted</td>
<td>15 (45.5)</td>
<td>23 (69.7)</td>
</tr>
<tr>
<td>Crying</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>19 (57.6)</td>
<td>4 (12.1)</td>
</tr>
<tr>
<td>Grumble</td>
<td>13 (39.4)</td>
<td>27 (81.8)</td>
</tr>
<tr>
<td>Vigorous</td>
<td>1 (3)</td>
<td>2 (6.1)</td>
</tr>
<tr>
<td>Breathing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relaxed</td>
<td>17 (51.5)</td>
<td>13 (39.4)</td>
</tr>
<tr>
<td>Altered</td>
<td>16 (48.5)</td>
<td>20 (60.6)</td>
</tr>
<tr>
<td>Arms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relaxed</td>
<td>12 (36.4)</td>
<td>9 (27.3)</td>
</tr>
<tr>
<td>Flexed / extended</td>
<td>21 (63.6)</td>
<td>24 (72.7)</td>
</tr>
<tr>
<td>Legs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relaxed</td>
<td>12 (36.4)</td>
<td>10 (30.3)</td>
</tr>
<tr>
<td>Flexed / extended</td>
<td>21 (63.6)</td>
<td>23 (69.7)</td>
</tr>
<tr>
<td>Conscious state</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleeping / quiet</td>
<td>18 (54.5)</td>
<td>13 (39.4)</td>
</tr>
<tr>
<td>Uncomfortable</td>
<td>15 (45.5)</td>
<td>20 (60.6)</td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors.
Regarding the movement of the limbs, the arms and legs showed similar responses when the newborns were subjected to the venipuncture. After the procedure in group 1, 72.7% of the NB had their arms flexed/extended. However, after the procedure in group 2, it was observed that the arms were flexed/extended in 35.3% of the NB. Regarding the legs, 69.7% of the newborns in group 1 remained with the lower limbs flexed/extended after the procedure, and in group 2, the same was observed in 37.3% of the newborns.

The NB showed an uncomfortable state of consciousness in 60.6% of the cases, after the puncture in group 1. On the other hand, discomfort was observed in only 19.6% of the NB in group 2.

Breathing is a physiological manifestation; however, because it is part of NIPS, it was checked at that time. Thus, it is possible to state that 39.4% of the NB in group 1 had relaxed breathing after the procedure, and 78.4% had the same after the procedure in group 2.

Table 3 shows the heart rate and oxygen saturation of NB subjected to venipuncture. Thus, one can notice that 72.7% of the NB in group 1 had a heart rate higher than 160bpm (tachycardia), after the procedure. On the other hand, 35.3% of the NB in group 2 had tachycardia.

After the procedure in group 1, only 15.2% of the NB had oxygen saturation between 96 and 100%; in group 2, this value increased to 58.8%.

Table 3. Description of the physiological responses of the newborns subjected to venipuncture, with and without non-pharmacological measures, Fortaleza, CE

<table>
<thead>
<tr>
<th>Physiological parameters at venipuncture</th>
<th>G1 (n=33)</th>
<th>G2 (n=51)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before n %</td>
<td>After n %</td>
</tr>
<tr>
<td>Heart rate (bpm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100-119</td>
<td>- (1)</td>
<td>- (3)</td>
</tr>
<tr>
<td>120-139</td>
<td>8 (24.2)</td>
<td>3 (9.1)</td>
</tr>
<tr>
<td>140-159</td>
<td>23 (68.7)</td>
<td>5 (15.2)</td>
</tr>
<tr>
<td>≥160</td>
<td>2 (6.1)</td>
<td>24 (72.7)</td>
</tr>
<tr>
<td>Oxygen saturation (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81-85</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>86-90</td>
<td>1 (3)</td>
<td>18 (54.5)</td>
</tr>
<tr>
<td>91-95</td>
<td>10 (30.3)</td>
<td>10 (30.3)</td>
</tr>
<tr>
<td>96-100</td>
<td>22 (66.7)</td>
<td>5 (15.2)</td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors.

DISCUSSION

Among the invasive procedures performed in NICUs, venipuncture is one of those with the highest percentage of moderate and severe pain13. Therefore, it is essential that health professionals use measures that help to control or reduce pain in the NB subjected to venipuncture. The results of the study showed that more than half of the NB had venipuncture and were prepared for the procedure with non-pharmacological measures for pain relief. This finding is the opposite of what was found in a study to assess the pain in NB during peripheral and capillary puncture, in which nurses used non-pharmacological measures in NB who had already presented pain14. The absence of pain relief measures in the other punctures performed may be because there is no systematization of the procedures performed at the institution since the use of pharmacological, behavioral and environmental analgesic strategies is still inconsistent in Brazil14. Thus, it is necessary to implement guidelines and protocols in health institutions for the appropriate management of pain in NB in NICUs, considering that this population is constantly subjected to stressful and painful procedures15.

The organization, preparation of the material, the agility of the nursing professional at the moment of the puncture and the concern with the number of puncture attempts on the NB are measures that contribute to optimize the procedure and, therefore, reduce the pain. However, it is important to avoid the negative effects of the procedure using strategies to control the pain, such as non-pharmacological measures12. In the present study, the non-pharmacological measure mostly used for pain relief was glucose at 25%, followed by facilitated containment and lap. In a study performed with 110 NB submitted to venous and capillary puncture, the result was similar because glucose at 25% became the most used measure, also being mentioned coziness, therapeutic touch, and massage13.

Studies have been conducted to evaluate the efficacy of non-pharmacological measures for pain relief. It is important to emphasize an investigation conducted in Turkey about the effect of breastfeeding and sucrose in newborns submitted to venipuncture. In such an approach, it was shown that the mean NIPS score in the control group was significantly higher than in the breastfeeding and sucrose groups16. Another study conducted in João Pessoa-PB found that the use of non-pharmacological measures (contention and non-nutritive suction) were able to reduce pain in the observed NB17. The use of NIPS to assess pain in newborns is recommended because the specific scales for newborns usually provide better knowledge about the subject, minimizing the insecurity of the professional and helping the team in the identification, evaluation, and application of measures for the relief and treatment of pain17.

Regarding the responses presented, according to the NIPS, the study showed that after the procedure, the NB who did not receive any preparation had a higher percentual of the contracted face when compared to those who received. This result is similar to a study in which 32 NB undergoing venipuncture showed suggestive signs of pain, and 100% had a contracted face13. In another study conducted with 29 NB, among those who showed suggestive signs of pain, the contracted face was described in 77.8%18. As for crying, most of the NB who did not receive the measures presented grunts and vigorous crying. This data is in line with the results of a study that showed grunts (44.4%) and vigorous crying (44.4%) as suggestive signs of pain after puncture18. Another study reports that the mean crying
time was higher in the control group than in the groups that received the non-pharmacological measures for pain relief. However, although very present, the crying observed in the form of grunts, both in the NB who received the preparation measures and in those who did not, should not be considered an isolated factor to identify the presence of pain, since it can be triggered by other stimuli, like sleep and hunger.

The movement of the arms and legs was similar, with a higher percentage of NB with relaxed limbs after the procedure when non-pharmacological measures were used, in comparison to the ones that did not have preparation. This finding corroborates the results of a study also conducted in Fortaleza, where the movements of the arms were practically the same as those observed in the movements of the legs.

A study recommends that to make the assessment of pain more reliable, it is important to evaluate the motor activity with other indicators, which reinforces the use of scales for pain analysis.

As for the state of consciousness, the NB who received the non-pharmacological measures were considerably calmer after the procedure than those who did not receive. A study developed with 26 nursing professionals found a similar result in which the interviewed professionals reported that after the use of non-pharmacological measures, newborns were much calmer and in better conditions for the procedure, reducing the period of exposure to painful stimulus.

Regarding breathing, the NB who went through the preparation measures had relaxed breathing, for the most part. A survey showed that among the NB who felt pain, the breathing in 88.9% was different from the baseline. The alteration of the respiratory rate was one of the characteristics mentioned by health professionals to identify pain, even when they haven't heard about the validated scales for this purpose.

In the present study, it was observed a variation in the heart rate, especially for higher values, in the NB who did not receive preparation with the non-pharmacological measures. This result differs from what was found in research about the use of sucrose and breastfeeding for pain relief in NB subjected to venipuncture, where there was no difference in the mean heart rate before, during and after the procedure, even with the use of non-pharmacological measures for the relief of pain.

Finally, it was observed a decrease in oxygen saturation after the procedure, both in the NB who received non-pharmacological measures and those who did not. However, the NB who did not receive preparation had a higher percentage of decrease in oxygen saturation. This is in line with the results of another study, in which the mean level of oxygen saturation after the procedure was significantly higher in the NB who received the preparation than in those who did not.

As a limitation of the results of the study is the fact that the cross-sectional design does not allow to establish the relationship between cause and effect.

CONCLUSION

The behavioral and physiological responses presented by the NB were significantly altered when they were submitted to venipuncture without the use of measures for pain relief. The most frequent responses were contracted face, grunts, arms and legs flexed/extended, tachycardia and hyposaturation.

REFERENCES

Use of non-invasive neuromodulation in the treatment of pain in temporomandibular dysfunction: preliminary study

Uso da neuromodulação não invasiva no tratamento da dor em disfunção temporomandibular: um estudo preliminar

Tatyanne dos Santos Falcão Silva, Melyssa Kellyane Cavalcanti Galdino, Suellen Mary Marinho dos Santos Andrade, Luciana Barbosa Sousa de Lucena, Renata Emanuela Lyra de Brito Aranha, Evelyn Thais de Almeida Rodrigues

ABSTRACT

BACKGROUND AND OBJECTIVES: In temporomandibular disorder, the pain is a very present and striking symptom, with a tendency to chronicity, through mechanisms of maladaptive neuroplasticity. In the face of this, transcranial direct current stimulation appears as a possible strategy for the treatment of chronic pain in the temporomandibular disorder. This study aimed to evaluate the efficacy of anodal transcranial direct current stimulation in the pain symptoms and anxiety levels in individuals with chronic myofascial temporomandibular disorder.

METHODS: The participants received three different types of intervention in a randomized order: anodic in the primary motor cortex, in the dorsolateral prefrontal cortex and sham stimulation.

RESULTS: There were significant improvements in clinical pain in all stimulation protocols, with a relief of approximately 40% (p=0.001). There was no significant difference in the effect of the transcranial direct current stimulation between the different types of stimulation (p=0.14). There was a positive impact on anxiety symptoms, leading to a significant decrease in state anxiety levels (p=0.035) and trait (p=0.009).

CONCLUSION: The use of the transcranial direct current stimulation improved the health status of patients with chronic myofascial temporomandibular disorder, promoting pain relief, decreased level of anxiety, and quality of life.

Keywords: Orofacial pain, Rehabilitation, Transcranial stimulation by continuous current.

RESUMO

JUSTIFICATIVA E OBJETIVOS: Na disfunção temporomandibular, a dor aparece de forma frequente e marcante, com tendência à cronicidade, através de mecanismos de neuroplasticidade mal adaptativa. Diante disso, a estimulação transcraniana por corrente contínua surge como uma possível estratégia de tratamento da dor crônica em disfunção temporomandibular. O presente estudo objetivou avaliar a eficácia da estimulação transcraniana por corrente contínua anódica nos sintomas dolorosos e, por conseguinte, nos níveis de ansiedade em indivíduos com disfunção temporomandibular muscular crônica.

MÉTODOS: Os participantes receberam três tipos diferentes de intervenção cuja ordem foi randomizada: anódico no córtex motor primário, na região cortical dorsolateral pré-frontal e estimulação simulada.

RESULTADOS: Houve melhorias significativas para a dor clínica em todos os protocolos de estimulação, com um alívio de aproximadamente 40% (p=0.001). Não houve diferença significativa no efeito da estimulação transcraniana por corrente contínua entre os diferentes tipos de estimulação (p=0.14). Ocorreu impacto positivo sobre os sintomas de ansiedade, com diminuição significativa nos níveis de ansiedade estado (p=0.035) e traço (p=0.009).

CONCLUSÃO: O uso da estimulação transcraniana por corrente contínua melhorou a condição de saúde dos portadores de disfunção temporomandibular muscular crônica, promovendo um alívio do quadro álgico, diminuição do nível de ansiedade, além de gerar qualidade de vida.

Descritores: Dor orofacial, Estimulação transcraniana por corrente contínua, Reabilitação.

INTRODUCTION

Temporomandibular dysfunction (TMD) is a disease of high prevalence that affects the masticatory muscles and/or the temporomandibular joint. Among the symptoms, pain appears frequently and markedly, with a tendency to chronicity1,2. Chronic pain represents a significant public health problem that impacts the performance of daily activities, physical and psychosocial functioning, as well as the patients’ quality of life (QoL), generating a high cost for society and the health system3,4,5. Studies indicate that chronic pain results from a constant stimulus in the central nervous system (CNS), which in turn leads to central...
sensitization where there are changes in the excitability of the neuronal membrane due to physiological and structural changes. This mechanism is characterized by maladaptive neuroplasticity but can be reversed with treatment. Chronic TMD pain is a complex and multidimensional phenomenon that is often associated with an altered emotional state, requiring a multidisciplinary treatment that involves different therapies. Some aim to treat the muscles, others act on dental occlusion or joint structures, and there are those whose main focus is the psychoemotional factor. It is believed that this neuronal modification, coupled with the emotional imbalance present in many patients with this disorder, leads to an unsatisfactory response to traditional therapies such as patient education in relation to self-care, pharmacotherapy, acupuncture, stabilizing occlusal splint, biofeedback, ultrasound, transcutaneous electrical nerve stimulation (TENS), cognitive-behavioral therapy, among others.

Given this context, it is evident the need for a therapy that acts directly on the CNS. This can be accomplished with drugs. However, many patients are refractory or have adverse effects, as the dependence and/or tolerance. It is important to have new treatments involving the neuromodulation and neuroplasticity mechanisms, as the transcranial direct-current stimulation (tDCS), that can be a therapeutical alternative and also to complement the different types of treatment already in use. Moreover, the tDCS corroborates the need to give to preference the reversible and non-invasive procedures. tDCS emerges as a possible TMD treatment modality, to modify the pattern of the cortical activity and restore the normal activation of pain processing centers, and consequently, promoting pain relief. It is a simple, low-cost, non-invasive, painless, safe and well-tolerated technique.

Some studies show that the use of tDCS protocols is promising, with good results in reducing pain symptoms in patients with chronic pain. The analgesic effect has been reported with anodic stimulation, mainly in the primary motor cortex (M1). However, there is another protocol option of anodic stimulation that corresponds to the dorsolateral region of the prefrontal cortex (DLPF), which demonstrates the involvement in the processing of the emotional component of pain. However, these results are still scarce and inconclusive, which indicates the need for further investigation, especially when it comes to TMD.

In this context, it is pertinent to investigate alternative methods in the treatment of chronic musculoskeletal TMD in order to increase the range of possibilities and, therefore, to promote pain relief, functional recovery and, consequently, better QoL for a greater number of patients. Considering the lack of studies comparing the effect tDCS in patients with chronic musculoskeletal TMD, the objective of the present study was to evaluate and compare the efficacy of anodic tDCS applied in different cortical regions (M1 and DLPF) to treat the painful symptoms and, therefore, the levels of anxiety in patients with TMD with chronic pain.

**METHODS**

A preliminary double-blind, cross-sectional, controlled study was conducted with three intervention arms, which sequence was determined at random.

Initially, the sample consisted of patients with chronic muscular TMD who sought treatment at the Orofacial Pain Control Service of the University Hospital Lauro Wanderley (HULW) of the Federal University of Paraíba (UFPB). Due to the difficulty in finding participants for the study, we used printed and electronic ads, direct contact or health professional referrals from the recruitment of volunteers. After the volunteers contact, screening appointments were scheduled for the evaluation of the selection criteria.

Participants were evaluated by a trained researcher, using the Diagnostic Criteria for Research in Temporomandibular Dysfunction (RDC/TMD) to confirm the TMD diagnosis. Those who met the eligibility criteria were invited to participate in the study. Those who agreed signed the Free and Informed Consent Term (FICT), in two copies, after a thorough reading and explanation of all the research procedures.

To be included in the study, the individual should: (1) have previously signed the FICT; (2) be in the age range of 18-60 years, regardless of gender; (3) have a diagnosis of muscular TMD corresponding to group I of RDC/TMD Axis I; (4) have a pain score equivalent to 4 or higher on the visual analog scale (VAS), present regularly for 6 months or more; (5) have no history of moderate depressive symptoms assessed by Axis II of the SCL-90 scale (RDC/TMD); (6) not be pregnant; (7) have no metal or electronic devices implanted in the head; (8) have no history of alcohol or drug abuse in the past 6 months; (9) not taking carbamazepine in the last 6 months (use of modulating CNS activity drugs); (10) have no history of epilepsy, stroke, moderate to severe traumatic brain injury, or migraine; (11) not perform neurosurgery; (12) not suffering from psychiatric disorder, such as schizophrenia or bipolar disorder; (13) have no other source of pain similar to muscular TMD, such as fibromyalgia.

The present study had the following exclusion criteria: (1) two absences during the treatment sessions; (2) miss any inclusion criteria during the study, as becoming pregnant in the case of women.

To characterize the sample, a sociodemographic questionnaire was used to collect information on age, gender, religion, marital status, schooling, family income, history of illness, use of drugs, treatments performed or in progress.

In order to evaluate the levels of anxiety, pain and overall perception of change, the following instruments were used: The State-Trait Anxiety Inventory (STAI), VAS, and the Perception of Change Global Scale (PCGS).

- The STAI objectively assesses both aspects of anxiety: trait and condition. It is an instrument with 40 descriptive statements about the person’s feelings, distributed in two parts (trait and state of anxiety), where each part is formed by 20 statements and the answers are given in a Likert-type scale of four points (1 - absolutely not to 4 - very much). The score of each questionnaire...
ranges from 20 to 80, with an anxiety level rating of low (20 to 33), average (33 to 49) and high (49 to 80)\textsuperscript{43}.

- PCGS is an understandable instrument capable of measuring the perception of change in health status and satisfaction with the treatment of patients with chronic musculoskeletal pain. It is a one-dimensional measure in which individuals classify their improvement associated with intervention on a 7-item scale ranging from 1 (no change) to 7 (much better)\textsuperscript{44}.

- The VAS allows the subjective experience of pain to be converted into numerical data. Subjects were asked to mark their score on the horizontal rating scale from zero to 10 representing the pain intensity, in which zero means the absence of pain, (1-3) mild pain, (4-7) moderate pain, and (8-10) intense pain. It is a widely used instrument with valid and reproducible results for pain measurement\textsuperscript{45}.

Participants were allocated in a single group and received three different types of intervention, and the order was randomized for each participant. The treatment protocols were: 1. Anodic tDCS on the left M1 cortex (C3) and cathodic in the right supraorbital region (Fp2), 2. anode on the left DLPF (F3) and cathode on the right supraorbital region (Fp2), and 3. simulated tDCS (placebo) with the same electrode arrangement as the first protocol (C3 and Fp2), but the current was stopped after 30 seconds, following the protocol of previous studies\textsuperscript{21,22,39,42}.

The neurostimulator used was the TCT (Research Version) developed by Trans Cranial Research Limited (Hong Kong, China), with a kit containing the neurostimulator pads, sponges, rubber, electrodes, and connecting cables. The positioning of the electrodes followed the 10/20 international electroencephalogram system. They were wrapped by 5x7 cm of sponge moistened with saline solution at 0.9%.

The procedure took place in three steps, each step with five sessions. Each session lasted 20 minutes and was held daily (from Monday to Friday). A 2 mA current with a current density equivalent to 0.05 A/m\textsuperscript{2} was applied. The stimulation protocol used (regarding intensity, frequency of sessions, electrode/position size, and duration of treatment) was based on previous studies\textsuperscript{21-23,39,42}.

The painful symptoms and level of anxiety were quantified prior to initiation of treatment. Then, the order of the three types of intervention that each participant received was randomized, and the interventions started. At the end of the five sessions of each type of intervention, reevaluations were made regarding the levels of pain and anxiety, as well as the application of scales regarding the global perception of change and level of confidence. Based on previous studies, there was a four-week wash-out period between the different types of stimulation to avoid undesirable residual effects (carry-over)\textsuperscript{21,46-48}. Thus, participants were re-evaluated for pain and anxiety levels before and after each step of the five stimulation sessions, with a four-week wash-out interval between the different treatment protocols. During the study, no participant received any other type of treatment for the disease in question, avoiding any effect besides the neuromodulation (except for the sporadic use of analgesic in the wash-out period).

The randomization was done by online computer software (www.random.org). The team involved in the study was properly trained and blinded. For this purpose, each researcher was responsible for one step, without access to the other information. Regarding the role of each researcher (P), we had diagnosis (P1), randomization and hidden allocation (P2), treatment (P3), data collection (P1) and data analysis (P1).

In order to blind the allocation, we used opaque and sealed envelopes, sequentially numbered. The participants were identified by codes and were not aware of the type of intervention they received in the study.

The clinical trial was registered at clinicaltrials.gov (registration number NCT03285685) after the approval of the HULW Ethics Committee in Research of the University (CAAE Opinion number 64862817.0.0000.5183).

**Statistical analysis**

The numerical data were presented in mean and standard deviation, and their distribution was evaluated by the Kolmogorov-Smirnov normality test. The alpha value was set at 5% (p<0.05). The analysis was performed with the SPSS statistical package version 21.0.

The data were analyzed by repeated-measures ANOVA, followed by the Bonferroni’s post-hoc test. The primary dependent variable was pain intensity, and the factors were the different stimulation sites (M1, DLPF, and placebo) and time (at baseline, after five stimulation sessions and four weeks later). The secondary dependent variable, the trait-state of anxiety level, was analyzed similarly, with the scores presented in terms of mean and standard deviation.

The adverse effects were investigated after each stimulation session, and the data analysis was also performed by repeated measures ANOVA. The results of the Global Perception of Change and Confidence Level scales were presented by mean and standard deviation, which were analyzed by one-way ANOVA. The presence of correlations between the studied variables was investigated using the Pearson correlation coefficient.

**RESULTS**

The present study went from March 2017 to December 2017. A total of 151 patients were screened, 13 met the eligibility criteria, but only nine accepted to participate in the study. After signing the FICT, the sequence of the different types of stimulation was randomized. During the study, four individuals were excluded from the research.

With regard to the loss of follow-up, one participant received only the first tDCS step and was excluded since he no longer had pain. Others three participants gave up the last step due to lack of time. Therefore, only five participants concluded the study (Figure 1).

Table 1 shows the main variables that characterized the sample, such as gender, age, duration of pain, VAS and STAI T and E data. The sample comprised only women, possibly because the studies show that female has two to three times more the risk of developing TMD\textsuperscript{48,50,51}.

---

**Table 1**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
</tr>
<tr>
<td>Age</td>
<td>35-45</td>
</tr>
<tr>
<td>Duration of Pain</td>
<td>2-5</td>
</tr>
<tr>
<td>VAS</td>
<td>3-5</td>
</tr>
<tr>
<td>STAI T and E</td>
<td>30-50</td>
</tr>
</tbody>
</table>
Eligibility

Figure 1. CONSORT flowchart with the sequence of the study development
DLPF = dorsolateral region of the prefrontal cortex.

Table 1. Characterization of the sample with clinical and demographic data

<table>
<thead>
<tr>
<th>Characterization of the sample (n=5)</th>
<th>Mean (SD)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>31 (10)</td>
<td>22</td>
<td>48</td>
</tr>
<tr>
<td>Duration of pain (months)</td>
<td>16 (12)</td>
<td>08</td>
<td>36</td>
</tr>
<tr>
<td>VAS</td>
<td>6.8 (0.8)</td>
<td>36</td>
<td>50</td>
</tr>
<tr>
<td>STAI-E</td>
<td>44.8 (6)</td>
<td>33</td>
<td>55</td>
</tr>
<tr>
<td>STAI-T</td>
<td>47.2 (9.7)</td>
<td>04</td>
<td>15</td>
</tr>
</tbody>
</table>

SD = standard deviation; n = number of participants; BDI = Beck’s depression inventory; VAS = visual analog scale; STAI= State-Trait Anxiety Inventory.

All participants had used some type of analgesic and/or muscle relaxant drug before the study. Sporadically, the use of analgesics (paracetamol or dipyrone) was reported in the wash-out period not to influence the results of the study. None were taking central-acting drugs during study participation or had any comorbidities.

According to the VAS scores pre and post-treatment, both the active stimulation and placebo generated significant improvement (p=0.001 and CI:0.93-3.47) with a decrease equivalent to 37% in the intensity of pain. In the tDCS in M1, it was observed an average difference pre and post-treatment of 2.8 (40%) (p=0.012 and CI:0.6-5) in the pain score. It was smaller in the DLPF region, only one score of improvement (p=0.69 and CI:-1.2-3.2). However, there was no significant difference in the tDCS effect between the types of intervention (p=0.14) (Table 2).

Table 2 shows a substantial improvement in pain, especially in M1 and placebo stimulation (p=0.012 and CI:0.6-5). However, after four weeks of placebo stimulation, there was a large decrease in analgesia, including worsening in three of the five participants (p=0.003 e CI: -6.29-- -1.3).

Table 2. tDCS effect on pain intensity pre, post-intervention and after 4 weeks

<table>
<thead>
<tr>
<th>tDCS type</th>
<th>VAS pre, mean (SD)</th>
<th>VAS post, mean (SD)</th>
<th>p-value</th>
<th>VAS post-4w, mean (SD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>7 (1)</td>
<td>4.2 (2.6)</td>
<td>0.14</td>
<td>4.4 (1.6)</td>
<td>0.28</td>
</tr>
<tr>
<td>DLPF</td>
<td>4.4 (2.6)</td>
<td>3.4 (1.8)</td>
<td>2.6</td>
<td>5.8 (2.7)</td>
<td>0.28</td>
</tr>
<tr>
<td>Placebo</td>
<td>4.8 (1.7)</td>
<td>2 (1)</td>
<td>5.8</td>
<td>2.6 (1.6)</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Total 5.4 (2) 3.2 (2) 0.001* 4.2 (2.3) 0.15

p = value represents the significance by the repeated measures ANOVA test; tDCS = transcranial direct-current stimulation; DLPF = dorsolateral region of the prefrontal cortex; VAS = visual analog scale; *p<0.05.
Figure 2 shows that after four weeks the pain relief remained in the active stimulation protocols (M1 and DLPF), with an improvement in pain in the DLPF region, equivalent to 41%. However, according to the repeated measures ANOVA test, there was no difference between the different stimulation protocols (p=0.28).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (SD)</th>
<th>CI95%</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAI-E</td>
<td>4.8 (7.3)</td>
<td>0.39 – 9.2</td>
<td>0.035</td>
</tr>
<tr>
<td>STAI-T</td>
<td>4.1 (5.2)</td>
<td>1.2 – 7</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Table 3. Mean effect of tDCS on the level of state and trait anxiety after the intervention

Participants showed a high level of confidence in the treatment received, on a scale ranging from 1 to 5. It is noteworthy that when participants received the placebo stimulation, they reported a slightly higher confidence (Mean [SD]: 4.4 [0.8] and CI: 3.5-5.5) compared to M1 regions (Mean [SD]: 4 [0.7] and CI: 3-4.8) and DLPF (Mean [SD]: 4.2 [0.8] and CI: 3-5.2), with no significant difference (p=0.74). There was a negative correlation between the confidence level and intensity of pain after the treatment (r=–0.61 and p=0.015), as well as a positive correlation between confidence and global perception of change (r=0.612 and p=0.015). Through the PCGS, the participants demonstrated a moderate and significant change in their health state, performance of daily activities, emotions and QoL due to the improvement in the pain situation, with an average score of approximately 5 (SD=1.3 and CI: 4.1-5.7), in a scale from zero to 7. This change has a slightly higher value in the tDCS in the cortical M1 area (Mean [SD]: 5.4 [1.1] and CI: 4-6.8), but there was no difference between the different stimulation protocols (p=0.67).

Concerning the adverse effects during tDCS sessions, all three types of stimulation were well tolerated. When present, they had low intensity with no difference between the different stimulation protocols (p=0.05). After each stimulation session, the participants answered a questionnaire that listed some adverse effects, rating them on a 1 to 4 scale in absent, mild, moderate, or severe. No skin lesions were observed under or near the areas where the electrodes were positioned. No participant reported severe discomfort or worsening of the clinical picture during the intervention. Thus, it was confirmed that tDCS is safe and well tolerated, with tingling, itching and burning among the most prevalent adverse symptoms.

Since it was a blind study, when questioned after treatment, all subjects who participated in the study believed that they had received the active current.

**DISCUSSION**

The present study observed as primary endpoint a significant improvement in all stimulation protocols. Especially with the M1 and placebo stimulation, soon after the stimulation, when compared to the DLPF region. After four weeks, the analgesic effect persisted mainly in the active stimulation protocols. However, there was no significant difference related to the perception of pain between the different stimulation protocols. It is worth mentioning that according to the standard recommendations of the Initiative on Methods, Measurement, and Clinical Trial Pain Evaluation (IMMPACT), the decrease in pain intensity by 50% is considered to be of substantial importance, and a 30% reduction is considered a moderately satisfactory clinical improvement.

Similarly, three controlled and parallel trials investigated the use of tDCS in subjects with TMD, but the stimulation was only in the M1 cortex. Oliveira et al. did not find a significant difference between the groups, but they observed a great improvement in the pain intensity after the treatment, mainly in the group of active stimulation added to physiotherapy. Sakrajai et al. and Donnell et al. observed a significant difference in the pain picture in the group that received active tDCS, noting that the latter used a high definition tDCS device on M1, which allows a more focal emission of the current.

The most frequent protocol is the anodal stimulation on M1 for 20 minutes on five consecutive days, in which the pain relief lasts from two to six weeks. The analgesic effect of the neurostimulation measured by VAS after four weeks of inter-
vention showed a large decrease in analgesia due to the placebo stimulation, unlike the active tDCS in M1 and DLPF, in which the effect size tended to remain, with an improvement of 37 and 41%, respectively.

As for the regions chosen in non-invasive neuromodulation for the treatment of pain, it is known that the M1, somatosensory (S1) and dorsolateral prefrontal cortices integrate what is called the "pain matrix", which can be directly reached by the tDCS, and thereby influence the dysfunctional pathway of how the pain is being processed, indirectly reaching the subcortical components. Studies have shown that the M1 stimulation, especially on the left side, produces significant clinical improvements in patients with chronic pain, which has made this cortical region the main target of several neuromodulatory techniques, including tDCS, dedicated to the improvement of chronic pain in clinical trials. The intricate neurophysiological mechanisms that explain the clinical efficacy of the M1 stimulation for pain relief are not fully understood. However, it is believed that its analgesic mechanisms involve the activation of top-down controls related to the excitation of the horizontal intracortical fibers and facilitating the descending control of pain inhibition. Neuroimaging studies revealed the presence of chemical pain mediation through opioidergic, glutamatergic, GABAergic and serotonergic neurotransmissions.

Pain due to muscular TMD is believed to be strongly related to emotional distress. The DLPF cortex is the fulcrum of several brain networks involved in the cognitive, affective and sensory processing, which stimulation probably mediates the analgesic effects through the modulation of affective-emotional networks related to pain.

The left DLPF cortical region plays a role in the active control of pain perception through the bilateral modulation of the cortico-subcortical and cortico-cortical pathways. In addition, some studies have compared the effect of tDCS on M1 and DLPF cortices in individuals with chronic pain, in whom the stimulation in the DLPF region generated pain relief as good as the M1 group, and sometimes greater.

Considering previous studies and the relationship between the left DLPF area with the emotional aspects of pain, the present study hypothesized that the anodic neuromodulation on the left side would promote a more intense analgesic effect in the stimulation protocol in the DLPF region of the cortex compared to the stimulation in the M1 cortex, since that area is shown to be responsible for the processing of the emotional component of pain, often underlining the refractoriness of treatment. Although the participants reported improvement in pain when they received the anodic current in the DLPF cortex, shortly after the treatment, the analgesic effect was higher with the tDCS in M1. However, the size of the analgesic effect on both stimulation sites was similar after four weeks.

A study involving patients with fibromyalgia compared the protocol of 10 sessions, once a day, with the intensity of 2mA and duration of 20 minutes. tDCS was applied to the left side of the M1 or DLPF cortex, and it was observed that both regions induced significant improvements in pain and QoL. However, the M1 group was more effective in maintaining the observed decrease in pain scores for up to 60 days. This same group of scholars has previously used a five-session protocol in which only the stimulation in the M1 cortex generated a significant improvement in the pain picture. Following this reasoning, it is possible that an increase in the number of tDCS sessions, from five to ten, will provide a more pronounced analgesic effect after the stimulation in the DLPF region.

The psychosocial factor appears to be associated with TMD, with patients with high levels of anxiety and/or depression being more prone to this dysfunction. And the longer the pain lasts, the higher the risks of behavioral, psychosocial, and cognitive problems, which worsens the prognosis.

As a secondary endpoint, the levels of anxiety state-trait after the stimulation sessions were evaluated according to the STAI-E and T. Some studies support the association between pain and anxiety, especially when the pain is muscular. In this study, there was a significant decrease in the anxiety state-trait levels after the therapy. However, there was no difference between the different types of intervention nor a positive correlation between pain and anxiety, possibly due to the small size of the sample. Donnell et al. did not find any significant difference in the anxiety state after treatment. However, Oliveira et al. found improvements in the depressive symptoms.

The participants reported a moderate and significant change in their health status, but there was no difference between the types of intervention. This data corroborates previous studies that showed a relationship of negative influence between the pain and the performance of the daily activities, physical and psychosocial functioning, as well as the patients' QoL.

The placebo effect corresponds to benefits attributable to brain-mind responses to the context in which a treatment is administered. This effect, coupled with the fact that patients report a high level of confidence in the treatment received, justifies the high improvement of the participants who received the tDCS placebo. Similar improvement in the control group occurred in the studies by Donnell et al., Oliveira et al., and Sakrajai et al. In the latter, about one-third, half the patients experienced some kind of pain relief. This phenomenon is well observed in studies involving neuromodulation in the treatment of pain. Some studies have also observed a reduction of anxiety in volunteers allocated to placebo group, an effect also observed in the present study.

On the other hand, in the placebo stimulation, the pain picture worsened markedly after four weeks when compared to active tDCS. This may be justified by the optimized effect at the molecular and clinical levels of the actual tDCS over placebo, besides the fact that the clinical effects of the tDCS are cumulative and develop slowly, possibly due to neuroplastic changes. Based on the findings of brain imaging analysis, placebo-based analgesia is considered to be a real phenomenon, i.e., biologically measurable. They are mediated by a variety of processes including learning, expectations, and social cognition, and can influence several health-related clinical and physiological outcomes. The evidence of neuroscience believes that multiple brain systems and neurochemical mediators are involved, including opioids and dopamine.
Limitations of the study and future outlooks

A limitation of the present study is due to the small size of the sample since it is a preliminary study. Perhaps the sample was insufficient to detect statistically significant effects in the variables of the studied protocols. Also, there was no follow-up of brain activity before and after treatment so that no results can be given about possible neurophysiological mechanisms related to tDCS. The persistence of the tDCS analgesic effect, especially in the active stimulations after four weeks, shows that the wash-out period adopted between the study steps possibly was not enough to avoid the residual effects of the stimulation performed in the previous step, although the washout period has been defined based on previous studies.21,46-48

Another important point regarding the difficulty of the participant’s compliance with the study is that his/her presence is required during 15 sessions. Also, between every five sessions, there was a four-week interval, causing the study to last approximately four months for each participant. Moreover, the lack of comparison between the efficacy of tDCS and other conventional techniques, such as the occusal splint, is another limitation, suggesting the need for further studies about these aspects.

The results of this study should not be extrapolated to the clinical application of tDCS in the treatment of chronic TMD pain. It is suggested the development of new studies with significant sample size, aiming to quantify the effect size and differences between the types of intervention, to facilitate the decision making regarding the best choice of treatment. Given that this is a study with preliminary data, the results need to be interpreted with caution.

CONCLUSION

The present study suggests that the use of tDCS improved the health condition of patients with chronic muscular TMD, promoting relief of pain, decreased the level of anxiety, and a positive contribution to QoL. The M1 cortex was the stimulated area that showed the best result, taking into account the effect of the treatment shortly after the five sessions of neurostimulation. It is worth mentioning that the tDCS has proved to be a safe and well-tolerated instrument.

REFERENCES


Self-reported musculoskeletal disorders by the nursing team in a university hospital

Distúrbios musculoesqueléticos autorreferidos na equipe de enfermagem em um hospital universitário

Edilson Gonçalves Maciel Júnior¹, Francis Trombini-Souza², Paula Adreatta Maduro³, Fabrício Olinda Souza Mesquita³, Tarcísio Fulgêncio Alves da Silva²

ABSTRACT

BACKGROUND AND OBJECTIVES: The hospital environment is considered to be unhealthy, and, moreover, the work performed by nursing professionals presents several risk factors for the development of pain. In this sense, the present study aims to analyze the musculoskeletal disorders in the nursing team and to correlate with the level of physical activity, anthropometric characteristics and the professional profile at the University Hospital in Petrolina, Pernambuco.

METHODS: This was a cross-sectional study with 143 nursing professionals, of which 122 were female (37±7 years) and 21 were male (33±6 years). The individuals answered the International Physical Activity Questionnaire and the Nordic Musculoskeletal Questionnaire.

RESULTS: Pain was reported in 77 volunteers, which corresponds to 53.8% of the sample. In 35 (24.4%) volunteers there was the presence of musculoskeletal disorders in more than one body segment. Regarding pain distribution by body segment, the higher prevalences were observed in the lumbar region and the knees, both with 17.4%. In addition, there were associations between being male and pain in the elbows (PR=5,5, 95% CI: 1,1; 25,5, p=0,028) and ankles (PR=5,1, 95% CI: 1,3; 19,2, p=0,016), and pain and physical inactivity for the elbow segments (PR=3,4, 95% CI: 1,1; 10,3, p=0,027) and knees (PR=2,4, 95% CI: 1,1; 5,0, p=0,021).

CONCLUSION: It can be noticed that the prevalence of pain in the team of professionals analyzed was high and that the risk factors, such as physical inactivity and being male were associated with a greater onset of musculoskeletal disorders.

Keywords: Cumulative trauma disorders, Occupational health, Pain.
Currently, the literature adopts the term musculoskeletal disorders (MSD) in place of the WRMD expression. MSD is becoming a relevant problem for public health, especially in industrialized countries, affecting workers in different sectors because they determine a variety of signs and symptoms, such as pain, discomfort, the feeling of weight, fatigue, paresthesia, movement limitation, among others, that may be concurrent or not. Generally, they start insidiously and evolve rapidly if there are no changes in the working conditions.

In this sense, it is possible to say that the workspace presents several risk factors for the onset of MSD, mainly due to the association between inadequate work environment and the poor physical conditions of the workers. The hospital environment can generate emotional stress and physical injuries due to its unhealthy nature with continuous exposure to one or more factors that can lead to diseases or illness resulting from the very nature of the work and its organization.

Among health professionals, the nursing staff has a high incidence and prevalence of MSD, due to the demanding hospital environment. Generally, the activities performed by these workers are directly related to the patient and may require inappropriate postures; work overload; weightlifting; repetitive movements and tension in addition to factors such as poor work organization; inadequate equipment and excessive demand for productivity.

The objective of this study was to analyze MSD in the nursing team and to correlate with the level of physical activity (PA), anthropometric characteristics and the professional profile at the University Hospital (UH) of Petrolina, Pernambuco.

METHODS

This is a cross-sectional study. The analyzed population comprises professional nurses and nursing technicians’ employees of the Federal University Vale do São Francisco (UNIVASF), in the city of Petrolina, Pernambuco. All were invited to participate, and the research was carried out with a convenience sample of 143 nursing professionals. The inclusion criteria were a minimum age of 18 years; the presence of employment relationship with at least one month in the UH. The exclusion criteria were all subjects who did not meet the requirements described or who did not agree to participate in the research. Demographic and anthropometric data were collected, such as gender, age, mass, and height. In addition, two evaluation tools were applied, the Nordic Musculoskeletal Questionnaire (NMQ), and the International Physical Activity Questionnaire (IPAQ).

The NMQ was used in its general form that comprises all the anatomical area for the evaluation of the major symptoms of MSD. This instrument was validated in Brazil in 2002 and consists of multiple or binary choices regarding the occurrence of symptoms in several anatomical regions in which they are more common, according to figure 1. The pain referred to in the last seven days was considered for analysis in this study.

Another important factor in evaluating workers is the Physical Activity Index by IPAQ since the more physically inactive the individual, the higher the chances to develop certain limitations and comorbidities, including pain. This instrument is the result of studies conducted by normative health agencies, such as the World Health Organization (WHO) and the desire to unify a questionnaire that could be useful in all world’s populations to facilitate research.

The IPAQ short version was used for the interviews. The reference used to evaluate PA was the previous week. Thus, a set of questions was asked related to the frequency and duration of moderate, vigorous PA, and walking. The adopted evaluation system categorized the participants as very active; a) active; insufficiently active; b) insufficiently active, and sedentary.

For the data analysis, the volunteers who answered the IPAQ were classified into two categories: active - representing the participants who obtained results as “very active” or “active”; and insufficiently active - the population that obtained results as “insufficiently active a” and “insufficiently active b” at the PA level. The individuals classified as sedentary were excluded from the study because they represented a tiny sample in relation to the others.

The research was approved by the Ethics and Research Committee of UNIVASF (Opinion 1386029). All participants were aware of the research objectives and signed the Free and Informed Consent Term (FICT).

Statistical analysis

The data was processed in the Microsoft Excel software and analyzed using the Statistical Package for the Social Sciences (SPSS)
program, version 22.0. The descriptive results were explored by the mean, standard deviation; absolute and relative frequencies. The Student’s t-test was used for the comparison between the two groups. The prevalence ratios were used in the adjusted analysis, as a measure of association, estimated by the Poisson regression, with adjustment for a robust variance. Those that had a p<0.05 were associated with the outcome studied.

RESULTS

The study population consisted of 374 nursing professionals. Of these, 143 professionals participated in the present study, being 26 nurses (18.2%) and 117 nursing technicians (81.8%). Of the total number of volunteers, 122 (85.3%) were female, and 21 (14.7%) were male. Table 1 shows the characteristics of the professionals evaluated.

Regarding the level of PA referred to in the IPAQ, according to the categorization adopted in the present study, 74 individuals (51.8%) were classified as “active” and 69 (48.2%) as “insufficiently active”.

The pain was reported in 77 volunteers, equivalent to 53.8% of the sample. Of these, 15 are nurses (57.6%), and 62 are nursing technicians (52.9%). Overall, 35 (24.4%) volunteers reported pain in more than one body segment. Table 2 shows the prevalence of pain by body segments. The MSD complaints were distributed as follows: lumbar region and knees (17.4%) each; neck and shoulders (13.2%) each; chest region (11.1%); wrist and hand (9.7%); ankle and foot (8.3%); thigh (7.6%) and elbow (2%).

Table 3 shows the association between the pain outcome and the independent variables studied, with the adjusted values of the prevalence ratios obtained with the Poisson regression. The variables that remained in the final model were gender; function; PA level; mass; body mass index (BMI) and age. However, only the regressions that obtained statistically significant results (p≤0.05) are presented.

DISCUSSION

Low back pain was the most prevalent in this study, corroborating some findings in the literature [3-15]. Other body segments significantly affected were shoulders and cervical. This can be explained by the very nature of the work of the nursing team, responsible for most of the direct patient care. It is known that activities related directly to patients are often accompanied by static postures; anterior torso tilt and asymmetric lifting of loads; elements recognized in the literature as risk factors for the development of MSD in these regions [13]. Also, in a recent study with nurses in Pakistan, the identified factors that most contributed to the development of MSD were working in the same position for prolonged periods (93.1%); working in tight spaces (78.6%) and handling loads apart from the body (64.1%) [16].

In the present study, it was not possible to observe significant differences in pain regarding the professional profile. Nursing technicians had more physical and biomechanical risk factors that lead to MSD since they have more direct contact with patient demands, such as transfers, personal hygiene, among others [16]. On the other hand, nurses would be more exposed to psychosocial risk factors and cognitive demand, since they are the ones who perform most of the administrative functions of the sector [17]. Males had higher prevalence ratios for elbow pain (PR=5.5, CI95%:1.1, 25.5) and ankle (PR=5.1, CI95%:1.3, 19.2) in

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Table 1. Anthropometric characteristics of the nursing professionals and nursing technicians of the study

<table>
<thead>
<tr>
<th>Variables</th>
<th>Female</th>
<th>Gender</th>
<th>p-value</th>
<th>Male</th>
<th>Nurse</th>
<th>Function</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>37±7</td>
<td>33±6</td>
<td>0.028</td>
<td>34±7</td>
<td>37±7</td>
<td>0.031</td>
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</tr>
<tr>
<td>Mass (kg)</td>
<td>65.5±12.5</td>
<td>80±15.6</td>
<td>≤0.001</td>
<td>66.5±14.9</td>
<td>67.9±13.8</td>
<td>0.631</td>
<td></td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.59±0.06</td>
<td>1.71±0.07</td>
<td>≤0.001</td>
<td>1.62±0.07</td>
<td>1.6±0.08</td>
<td>0.311</td>
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<tr>
<td>Body mass index</td>
<td>25.8±4.7</td>
<td>27.1±4.3</td>
<td>0.253</td>
<td>25±4.1</td>
<td>26.2±4.8</td>
<td>0.211</td>
<td></td>
</tr>
</tbody>
</table>

p: Student’s t-test.

Table 2. Prevalence of pain per body segment in the nursing professionals of the study

<table>
<thead>
<tr>
<th>Body segment</th>
<th>Absolute frequency</th>
<th>Prevalence of pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower back</td>
<td>25</td>
<td>17.4</td>
</tr>
<tr>
<td>Knees</td>
<td>25</td>
<td>17.4</td>
</tr>
<tr>
<td>Neck</td>
<td>19</td>
<td>13.2</td>
</tr>
<tr>
<td>Shoulders</td>
<td>19</td>
<td>13.2</td>
</tr>
<tr>
<td>Chest</td>
<td>16</td>
<td>11.1</td>
</tr>
<tr>
<td>Wrist and hand</td>
<td>14</td>
<td>9.7</td>
</tr>
<tr>
<td>Ankle and foot</td>
<td>12</td>
<td>8.3</td>
</tr>
<tr>
<td>Thigh</td>
<td>11</td>
<td>7.6</td>
</tr>
<tr>
<td>Elbow</td>
<td>3</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table 3. Poisson regression analysis with estimates of prevalence ratios and 95% confidence interval of the association between the presence of pain in each segment and the independent variables

<table>
<thead>
<tr>
<th>Body segment</th>
<th>Independent variable</th>
<th>Adjusted analysis - PR CI 95% p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elbow</td>
<td>Gender</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Knee</td>
<td>PA level</td>
<td>Active</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficiently active</td>
</tr>
<tr>
<td>Ankle</td>
<td>Gender</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
</tbody>
</table>
relation to the females. In a survey with Australian nursing stu-
dents, males had a higher prevalence of MSD than females. In 
this population, men were more involved in the manual han-
dling of patients34, possibly exposing them to greater overloads 
in the elbow region. This may explain the higher occurrence 
of pain in this gender, and it is linked to anthropometric and 
cultural factors. As for ankle pain, it is possible to say that both individual factors such as the type of footstep and the BMI, as well as work-re-
lated factors such as working hours and aspect of each sector, 
are relevant for complications35. Many of these factors were not 
analyzed in the present study. However, BMI did not show a 
significant difference between the genders. 
Other relevant results in the present study were higher prevale-
ance rates of elbow pain (PR:3.4 CI95%:1.1-10.3) and knee 
(PR:2.4 CI95%:1.1-5.0) in individuals who are insufficiently 
active in relation to the active ones. 
A recent study26 found an association between decreased muscle 
strength and self-reported pain. Others have shown the benefi-
cial effects of physical exercises to prevent or even reduce pain31-
25. In a clinical trial with industrial technicians in Denmark, 
upper limb muscles endurance was positively associated with 
the prevention and improvement of forearm pain. Physiological 
adaptations due to the forces exerted during the exercises, 
such as the increase in the synthesis of type I collagen in the eccentric 
phase of the movement may be associated with better work per-
ficiency and lower association with MSD23. 
Regarding the knee segment, a three-week aerobic exercise pro-
gram showed a considerable increase in the percentage of CD4+ 
CD28+ cell activation compared to the pre-intervention peri-
od24, thereby reducing the pain and inflammatory conditions 
triggered during work and daily activities23. However, other factors 
such as a history of injuries in other joints of the lower limbs 
and a varus alignment are of great importance in predicting the 
tors such as a history of injuries in other joints of the lower limbs 
are relevant for complications19. Many of these factors were not 
analyzed in the present study. However, BMI did not show a 
significant difference between the genders. 

CONCLUSION 
It can be noticed that in the sample of the evaluated profession-
als, the prevalence of musculoskeletal symptoms was high, sug-
gesting a relationship between these symptoms and the activities 
performed by the nursing professionals. Moreover, some risk 

factors such as physical inactivity and being male were associated with increased pain. 

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inflamatória em idosos com osteoartrite de joelho-resultados preliminares. Rev T er Man. 
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prediction model for knee pain in the Nottingham community: a Bayesian modelling 
Analysis of pain and free cortisol of newborns in intensive therapy with therapeutic procedures

Análise da dor e do cortisol livre em recém-nascidos em terapia intensiva com procedimentos terapêuticos

Cibele Thomé da Cruz Rebelato¹, Eniva Miladi Fernandes Stumm²

ABSTRACT

BACKGROUND AND OBJECTIVES: Newborns at high risk in the intensive care unit are exposed to painful, repetitive and prolonged procedures that may be related to changes in brain development and behavioral abnormalities. The objective of this study was to relate pain and free cortisol of premature newborns undergoing therapeutic procedures in intensive care units.

METHODS: A quantitative, descriptive, cross-sectional study conducted with 32 premature newborns submitted to venipuncture, who were evaluated for pain and stress related to assisted ventilation; sedatives, prenatal corticoid, type of venipuncture, site, and the number of attempts.

RESULTS: Preterm newborns undergoing invasive ventilation had a predominance of moderate pain in 12 (37.5%) and cortisol increase in 14 (43.8%) of them. Venipuncture triggered moderate and intense pain, 10 (31.3%), and in 17 (53.1) the cortisol levels increased. More than half was due to peripherally inserted central catheter placement, so that 10 (43.8) had moderate pain. The results of the research suggest that the exposure of newborns to invasive procedures is stressful, especially when repeated several times.

CONCLUSION: Repeated venous puncture associated with therapeutic procedures intensified pain and altered cortisol, causing stress in premature newborns.

Keywords: Intensive care unit, Nursing, Pain measurement, Physiological stress, Premature newborn.

RESUMO

JUSTIFICATIVA E OBJETIVOS: Os recém-nascidos de alto risco em unidade de terapia intensiva, são expostos a procedimentos dolorosos, repetitivos e prolongados que podem estar relacionados a alterações no desenvolvimento do cérebro e anormalias comportamentais. O objetivo deste estudo foi relacionar a dor e o cortisol livre de recém-nascidos prematuros, com procedimentos terapêuticos instituídos em terapia intensiva.

MÉTODOS: Pesquisa quantitativa, descritiva, transversal, realizada com 32 recém-nascidos prematuros submetidos à punção venosa, que foram avaliados quanto à dor e estresse relacionado à ventilação assistida; sedativos, corticoide no pré-natal, tipo de punção venosa, local e número de tentativas.

RESULTADOS: Recém-nascidos prematuros submetidos à ventilação invasiva apresentaram predomínio de dor moderada em 12 (37,5%) e aumento de cortisol em 14 (43,8%) deles. A punção venosa desencadeou dor moderada e intensa, 10 (31,3%) e em 17 (53,1) ocorreu aumento do nível de cortisol. Mais da metade ocorreu para passagem de cateter central de inserção periférica, de modo que 10 (43,8) tiveram dor moderada. Os resultados da investigação, sugerem que a exposição dos recém-nascidos a procedimentos invasivos é estressante, especialmente quando repetido várias vezes.

CONCLUSÃO: A punção venosa repetida associada a procedimentos terapêuticos intensificou a dor e alterou o cortisol, o que implica em estresse ao recém-nascido prematuro.

Descritores: Enfermagem, Estresse fisiológico, Mensuração da dor, Recém-nascido prematuro, Unidades de terapia intensiva.

INTRODUCTION

The high-risk newborn (NB) in the neonatal intensive care unit (NICU) is exposed to painful procedures, repeated, prolonged events, related to a deficiency of brain development and behavioral abnormalities¹.

Neonatal pain may trigger stress. In addition, the stress caused by the NICU environment may result in higher plasma cortisol levels than surgery. Increased concentrations of stress-related hormones in sick and preterm NB is associated with an increased risk of mortality². Therefore, it is incumbent on nurses to use pharmacological and non-pharmacological measures in order to prevent and reduce pain and neonatal stress.

In a research study in California with 237 neonatal nurses, 81% of them reported the use of pain assessment instruments, 83%
felt confident with pharmacological measures, and 79% with nonpharmacological. The authors pointed out that pain management was correlated with adequate training and pain assessment instruments from care protocols. Cortisol is a glucocorticoid that exerts physiological effects on the metabolism of carbohydrates, proteins, and fatty acids and plays an important role in the physiological response to stress. Cortisol also has negative feedback effects on the hypothalamus to reduce the formation of corticotrophin-releasing hormone, and on the anterior pituitary, decreasing the formation of the adrenocorticotropic hormone.

On the other hand, stress has a physiological effect on the secretion of adrenocorticotropic hormone, triggering, in minutes, an increase of up to 20 times in the secretion of cortisol.

In this sense, a research quantified the severity of common stressors for premature infants. Seventeen physicians and 130 nurses working in NICU participated in the research, and classified the severity of the perceived stress of 44 acute events (peripheral venous access, peripheral arterial access, central venous access, ventilation, nutrition, medical procedures, surgery, radiology and others) and 24 life conditions, characterized as chronic (receiving intranasal oxygen due to repeated bronchopulmonary dysplasia and infection), in preterm infants with gestational age of 28, 28 to 32 and after 32 weeks. Physicians and nurses have realized that almost all events are stressful for NB to some degree and become equally stressful over the ages.

Thus, this article aimed to correlate pain and cortisol free of preterm NB with therapeutic procedures instituted in NICUs, in order to assess the occurrence of stress in these NB.

**METHODS**

A quantitative, descriptive, cross-sectional study conducted at a NICU of a philanthropic hospital institution, size IV, in the northwest of the State of Rio Grande do Sul. This unit provides eight neonatal beds of the Unified Health System (SUS), with a multiprofessional team, composed of pediatricians, nurses, nursing technicians, physiotherapists, and speech therapists.

The calculation of the sample was for convenience. 32 preterm NB hospitalized at the NICU between March and October 2016 participated in the study and met the included inclusion criteria: being premature, not having undergone another painful procedure one hour before venipuncture and signing the Free Informed Consent Term (FICT).

Data collection was performed through a research protocol composed of a form with identification data, sociodemographic, and clinical data of the NB obtained directly from their medical records. The particular form contemplates the variables: assisted ventilation; sedatives, prenatal corticoid, type of venipuncture, site, and the number of attempts. Pain assessment was performed with the Neonatal Infant Pain Scale (NIPS), and cortisol, with diuresis samples from the NB.

The diuresis samples of the NB participating in the research were obtained by collector device, or directly from the bladder catheter after being submitted to venipuncture for peripheral access, or a peripherally inserted central catheter (PICC) insertion. The first diuresis sample was obtained after exposure of the NB to this procedure. The urine samples were kept without a preservative in a refrigerator at 2 to 8°C and then sent to the Laboratory of Clinical Analysis and for analysis by electrochemiluminescence. 11 NB, in whom the diuresis samples collected were insufficient for cortisol analysis, were excluded from the research.

All the ethical precepts governing human research (Resolution 466/12 of the Ministry of Health) were respected. The study was approved by the Ethics and Research Committee, in December 2015, CAAE nº 50914015.8.0000.5350, opinion number 1.354.128.

**Statistical analysis**

Data analysis was performed with descriptive statistics, involving position measurements (lower limit, upper limit, quartile 1, median, quartile 3 and mean) and of dispersion (standard deviation and range), and Student’s t-test, with the use of SPSS 17.0 software.

**RESULTS**

Table 1 shows that invasive ventilation, which routinely preterm NB undergo, triggers a predominance of moderate pain in 37.5%. In the NBs with continuous positive airway pressure (CPAP), moderate or severe pain occurred in 9.4% of the sample and severe pain occurred in 56% of the cases in the NB in the hood. Regarding the puncture site, in the upper limbs, 68.8% of the NB received the largest number of punctures and presented moderate and severe pain at the same frequency, which was 31.3%. Regarding the purpose of the puncture, more than half occurred for the passage of PICC, so that 10 NB (43.8%) had moderate pain. Still concerning venipuncture, in terms of the number of attempts, infants submitted to a single venipuncture presented moderate pain in 12.5% and severe pain in 9.4% of the sample. Regarding invasive ventilation, table 2 shows an increase of cortisol in 43.8% of the NB. 12.5% of the newborns in CPAP and 9.4% of those in the hood had alterations in cortisol levels. The highest number of punctures was in UL in 68.8% of NB, and 53.1% presented increased cortisol level. Regarding the purpose of the puncture, more than half occurred for the passage of PICC, so that in 43.8% there was an increase in free cortisol levels. Also, regarding venipuncture in terms of number of attempts, 25% of NB submitted to a single venipuncture showed alterations in the cortisol level.

Table 3 presents the descriptive measures of cortisol according to some variables, where it is observed in each of them that the lower limbs (LL) and the lower limbs (UL) have a large range. Also, a broader standard deviation is observed in relation to the mean. It is observed that there is a significant difference only between the means of cortisol levels with variable “type of puncture.” Figure 1 shows the position measurements (LL, UL, quartile 1, median, and quartile 3), where four cases of outliers are identified, in which the values of cortisol levels were very high. These preterm newborns (PTNB) are considered to be the most stressed.
Table 1. Pain analysis, according to variables of newborns in the neonatal intensive care unit. March-October 2016

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>No pain n (%)</th>
<th>Mild pain n (%)</th>
<th>Moderate pain n (%)</th>
<th>Severe pain n (%)</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation</td>
<td>Invasive ventilation</td>
<td>1(3.1)</td>
<td>1(3.1)</td>
<td>12(37.5)</td>
<td>4(12.5)</td>
<td>18(56.3)</td>
</tr>
<tr>
<td></td>
<td>Nasal CPAP</td>
<td>-</td>
<td>-</td>
<td>3(9.4)</td>
<td>3(9.4)</td>
<td>6(18.8)</td>
</tr>
<tr>
<td></td>
<td>Hood</td>
<td>-</td>
<td>-</td>
<td>1(3.1)</td>
<td>5(15.6)</td>
<td>6(18.8)</td>
</tr>
<tr>
<td></td>
<td>Ambient air</td>
<td>-</td>
<td>-</td>
<td>1(3.1)</td>
<td>1(3.1)</td>
<td>2(6.3)</td>
</tr>
<tr>
<td>Puncture site</td>
<td>Cephalic region</td>
<td>-</td>
<td>-</td>
<td>1(3.1)</td>
<td>-</td>
<td>1(3.1)</td>
</tr>
<tr>
<td></td>
<td>UL</td>
<td>1(3.1)</td>
<td>1(3.1)</td>
<td>10(31.3)</td>
<td>10(31.3)</td>
<td>22(68.8)</td>
</tr>
<tr>
<td></td>
<td>LL</td>
<td>-</td>
<td>-</td>
<td>4(12.5)</td>
<td>1(3.1)</td>
<td>5(15.6)</td>
</tr>
<tr>
<td></td>
<td>Cephalic region, UL and LL</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2(6.3)</td>
<td>2(6.3)</td>
</tr>
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<td></td>
<td>UL and LL</td>
<td>-</td>
<td>-</td>
<td>2(6.3)</td>
<td>-</td>
<td>2(6.3)</td>
</tr>
<tr>
<td>Type of puncture</td>
<td>Passage of PICC</td>
<td>1(3.1)</td>
<td>-</td>
<td>10(31.3)</td>
<td>7(21.9)</td>
<td>18(56.3)</td>
</tr>
<tr>
<td></td>
<td>Peripheral venous access</td>
<td>-</td>
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<td>7(21.9)</td>
<td>6(18.8)</td>
<td>14(43.8)</td>
</tr>
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<td>Number of attempts</td>
<td>One</td>
<td>1(3.1)</td>
<td>1(3.1)</td>
<td>4(12.5)</td>
<td>3(9.4)</td>
<td>9(28.1)</td>
</tr>
<tr>
<td></td>
<td>Two</td>
<td>-</td>
<td>-</td>
<td>4(12.5)</td>
<td>3(9.4)</td>
<td>7(21.9)</td>
</tr>
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<td></td>
<td>Three</td>
<td>-</td>
<td>-</td>
<td>3(9.4)</td>
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<td>5(15.6)</td>
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<td></td>
<td>Four</td>
<td>-</td>
<td>-</td>
<td>3(9.4)</td>
<td>2(6.3)</td>
<td>5(15.6)</td>
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<td>Six</td>
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<td>-</td>
<td>3(9.4)</td>
<td>1(3.1)</td>
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</tr>
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<td>Eight</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1(3.1)</td>
<td>1(3.1)</td>
</tr>
<tr>
<td></td>
<td>Nine</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1(3.1)</td>
<td>1(3.1)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1(3.1)</td>
<td>1(3.1)</td>
<td>17(53.1)</td>
<td>13(40.6)</td>
<td>32(100)</td>
</tr>
</tbody>
</table>

CPAP = continuous positive airway pressure; UL = upper limbs, LL = lower limbs; PICC = peripherally inserted central catheter.

Table 2. Cortisol analysis, according to the variables of newborns in the neonatal intensive care unit. March-October 2016

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Cortisol 2 to 27 n (%)</th>
<th>Greater than 27 n (%)</th>
<th>Total</th>
</tr>
</thead>
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<tr>
<td>Ventilation</td>
<td>Invasive ventilation</td>
<td>4(12.5)</td>
<td>14(43.8)</td>
<td>18(56.3)</td>
</tr>
<tr>
<td></td>
<td>Nasal CPAP</td>
<td>2(6.3)</td>
<td>4(12.5)</td>
<td>6(18.8)</td>
</tr>
<tr>
<td></td>
<td>hood</td>
<td>3(9.4)</td>
<td>3(9.4)</td>
<td>6(18.8)</td>
</tr>
<tr>
<td></td>
<td>Ambient air</td>
<td>-</td>
<td>2(6.3)</td>
<td>2(6.3)</td>
</tr>
<tr>
<td>Puncture site</td>
<td>Cephalic region</td>
<td>-</td>
<td>1(3.1)</td>
<td>1(3.1)</td>
</tr>
<tr>
<td></td>
<td>UL</td>
<td>5(15.6)</td>
<td>17(53.1)</td>
<td>22(68.8)</td>
</tr>
<tr>
<td></td>
<td>LL</td>
<td>2(6.3)</td>
<td>3(9.4)</td>
<td>5(15.6)</td>
</tr>
<tr>
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<td>Cephalic region, UL and LL</td>
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<td>UL and LL</td>
<td>2(6.3)</td>
<td>-</td>
<td>2(6.3)</td>
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<tr>
<td>Type of puncture</td>
<td>Passage of PICC</td>
<td>4(12.5)</td>
<td>14(43.8)</td>
<td>18(56.3)</td>
</tr>
<tr>
<td></td>
<td>Peripheral venous access</td>
<td>5(15.6)</td>
<td>9(28.1)</td>
<td>14(43.8)</td>
</tr>
<tr>
<td>Number of attempts</td>
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<td>1(3.1)</td>
<td>8(25.0)</td>
<td>9(28.1)</td>
</tr>
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<td></td>
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<td>4(12.5)</td>
<td>3(9.4)</td>
<td>7(21.9)</td>
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<tr>
<td></td>
<td>Three</td>
<td>2(6.3)</td>
<td>3(9.4)</td>
<td>5(15.6)</td>
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<tr>
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<td>Four</td>
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<td>4(12.5)</td>
<td>5(15.6)</td>
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<td>Six</td>
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<td>Eight</td>
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</tr>
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<td>Nine</td>
<td>-</td>
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<td>1(3.1)</td>
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<tr>
<td>Total</td>
<td></td>
<td>9(28.1)</td>
<td>23</td>
<td>32(100)</td>
</tr>
</tbody>
</table>

CPAP = continuous positive airway pressure; UL = upper limbs, LL = lower limbs; PICC = peripherally inserted central catheter.
Table 3. Descriptive statistics and Student t test of cortisol according to the variables of the newborns. March-October/2016

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>n</th>
<th>LL</th>
<th>UL</th>
<th>Range</th>
<th>Median</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>15</td>
<td>3.04</td>
<td>557.1</td>
<td>554.06</td>
<td>52.60</td>
<td>124.93</td>
<td>157.24</td>
<td>0.380</td>
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<tr>
<td></td>
<td>Male</td>
<td>17</td>
<td>16.94</td>
<td>598.0</td>
<td>581.06</td>
<td>45.20</td>
<td>78.77</td>
<td>135.92</td>
<td></td>
</tr>
<tr>
<td>Sedation</td>
<td>Yes</td>
<td>16</td>
<td>3.04</td>
<td>598.0</td>
<td>594.96</td>
<td>52.50</td>
<td>121.43</td>
<td>182.17</td>
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</tr>
<tr>
<td></td>
<td>No</td>
<td>16</td>
<td>6.51</td>
<td>373.0</td>
<td>366.49</td>
<td>37.80</td>
<td>79.39</td>
<td>98.91</td>
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<tr>
<td>Ventilation</td>
<td>Invasive</td>
<td>18</td>
<td>3.04</td>
<td>598.0</td>
<td>594.96</td>
<td>49.25</td>
<td>110.89</td>
<td>173.85</td>
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<tr>
<td></td>
<td>Non-invasive</td>
<td>14</td>
<td>6.51</td>
<td>373.0</td>
<td>366.49</td>
<td>45.60</td>
<td>86.92</td>
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<td>Corticoid</td>
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<td>14</td>
<td>3.04</td>
<td>598.0</td>
<td>594.96</td>
<td>32.60</td>
<td>110.86</td>
<td>198.86</td>
<td>0.727</td>
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<tr>
<td></td>
<td>No</td>
<td>18</td>
<td>6.51</td>
<td>373.0</td>
<td>366.49</td>
<td>52.90</td>
<td>92.28</td>
<td>91.36</td>
<td></td>
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<tr>
<td>Type of puncture</td>
<td>Passage of PICC</td>
<td>18</td>
<td>3.04</td>
<td>598.0</td>
<td>594.96</td>
<td>52.90</td>
<td>142.11</td>
<td>182.33 *</td>
<td>0.044*</td>
</tr>
<tr>
<td></td>
<td>Peripheral venous access</td>
<td>14</td>
<td>3.76</td>
<td>169.5</td>
<td>165.74</td>
<td>41.65</td>
<td>46.79</td>
<td>41.14</td>
<td></td>
</tr>
<tr>
<td>Number of attempts</td>
<td>One</td>
<td>9</td>
<td>25.30</td>
<td>169.5</td>
<td>144.20</td>
<td>41.20</td>
<td>54.07</td>
<td>44.16</td>
<td>0.267</td>
</tr>
<tr>
<td></td>
<td>More than one</td>
<td>23</td>
<td>3.04</td>
<td>598.0</td>
<td>594.96</td>
<td>53.20</td>
<td>118.54</td>
<td>167.36</td>
<td></td>
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</tbody>
</table>

* There was a significant difference for p<0.05; LL = lower limbs; UL = upper limbs; PICC = peripherally inserted central catheter.

Figure 1. Cortisol position measurements according to gender, sedation, ventilation, corticosteroid, type of puncture, and number of attempts. March-October/2016
However, to better understand the relationships, we opted to exclude these four extreme values of cortisol, which are: 598; 557.1; 373 and 224.1. The results are shown in table 4, showing that there is a significant difference in the value of cortisol in the corticosteroid variable.

**DISCUSSION**

The long-term effects of untreated neonatal pain include adverse neurological outcomes, increased pain response, increased somatization, and other neuropsychological changes. In this sense, pharmacological therapies should be used in conjunction with non-pharmacological interventions.

One research analyzed the association of pain assessment scores obtained through re-assessment, according to the Joint Commission (JC), with painful events and analgesia use in 196 premature infants on mechanical ventilation. In general, 2% of the pain scores suggested the presence of pain, 0.1% of the pain scores were associated with analgesia. Ventilated NB who were exposed to multiple procedures on a single day did not demonstrate high pain scores, despite frequent preventive or continuous analgesics.

The authors concluded that pain assessment scores obtained through reassessments were poorly correlated with procedures or conditions associated with pain. Low pain scores through reassessment may not correlate with low pain exposure. Although...
JC supervision occurs, the results of this study suggest that documentation of pain reassessment may not directly facilitate the effective management of pain in NICUs. Additional research is needed to explore scales, to reassess pain in the NICU to identify best practices, and to facilitate the management of the accumulated pain experience in premature infants. A Swiss study with 120 ventilated NB and assessed for the presence of pain in procedures during 14 days showed that the NB were submitted to 38,626 procedures, an average of 22.9 procedures per patient, and 75.6% were painful. The most frequent was the manipulation of CPAP nasal cannulas. The pain assessment occurred four to seven times a day, 99.2% of the patients received non-pharmacological and pharmacological measures of pain, and 70.8% received glucose as preventive analgesia for pain.

Regarding the use of corticosteroids in prenatal care, the same is indicated for pregnant women in labor, from 23 to 34 weeks of gestational age. One study assessed 463 pregnant women and their 514 NB. With regard to NB, they presented better Apгар scores at 1 and 5 minutes, less need for intervention in the delivery room and lower SNAPPE II (Score for Neonatal Acute Physiology with Perinatal Extension-II) for mortality and morbidity prediction in NICUs, were born in better clinical conditions, greater weight and gestational age. They also used less exogenous surfactant, and the NB remained shorter on mechanical ventilation and oxygen therapy.

However, it was associated with an increase in neonatal sepsis because the NB whose mothers received antenatal corticosteroids had a higher incidence of positive blood cultures and greater use of antibiotics and necrotizing enterocolitis. Investigations about antenatal treatment and the risk of infection are conflicting.

Venipuncture is a painful procedure often performed in a NICU. Some authors have analyzed the efficacy of snoring PTNB for venipuncture. It was a study composed of 42 NB, 21 in the control group, and 21 in the treatment. When submitted to venipuncture, the pain was assessed with the Premature Infant Pain Profile Scale. In the treatment group, the NB were snored before the puncture, and the pain was significantly lower (p<0.05). A study of 38 PTNB of very low weight at Hermann Children’s Hospital in Texas submitted to radial venous puncture for blood collection and/or calcaneal puncture were assessed for cardiac variability in response to pain stimuli. They found a change in heart rate variability during procedures, coupled with evidence that a low-frequency response improved with advancing gestational age.

Regarding cortisol, a hormone that assesses stress, a review of the integrative literature that analyzed 16 articles showed that the examination of retinopathy and the heel puncture provoked an increase in salivary cortisol level. However, measures with music, prone position, and the use of the same crib between the twins reduced the level of salivary cortisol. The difficulties reported refer to the low rate of saliva sampling, and because they did not use control groups.

The assessment of salivary cortisol concentration is a precise method to indicate neonatal stress. The use of glucocorticoids in prenatal care, such as betamethasone, interferes with the response to stress due to suppression of the adrenal gland. NB with a weight between 1,500 and 2,500g showed a more intense reaction to stress, with mean salivary cortisol of 6,650.0±2,660.0ng/dL. The authors state that the intense reaction of the NB to stress is detrimental to several physiological, functional, and structural systems in the short and long period.

PTNB, especially those of 24-32 weeks, undergo repeated painful procedures during a period of rapid brain development and stress system programming. They have nociceptive circuits to perceive pain; however, their sensory systems are immature so that an imbalance of excitatory versus inhibitory processes can lead to increased nociceptive signaling in the central nervous system. Also, specific cells in the central nervous system of PTNB are particularly vulnerable to excitotoxicity, oxidative stress, and inflammation. Thus, increased exposure to stress related to neonatal pain has been associated with altered brain microstructure, levels of stress hormone, and changes in cognitive, motor, and behavioral development.

One study longitudinally examined gestational age and developmental differences in the self-regulating abilities of preterm infants in response to a painful stressor, as well as the associations between behavioral and cardiovascular responses. Heel puncture blood samples from children 28 to 31 and from 32 to 34 weeks of gestational age at birth were assessed. Both groups presented behavioral and cardiovascular indications of stress in response to the blood draw. However, the NB at gestational ages more extreme (28-31 weeks) were more physiologically reactive. In this sense, the greater vulnerability to the stress of premature infants of 28-31 weeks compared to those of 32-34 weeks of gestation and the implications of this subsequent development are discussed.

Early life stress may alter the function of the hypothalamic axis (HPA) and the adrenal gland. Differences in cortisol levels were found in PTNB exposed to procedural stress during neonatal intensive care compared with full-term NB, but only a few studies investigated whether the HPA axis alteration persists with child growth. In addition, there is a lack of knowledge about what can contribute to these alterations in cortisol. In this context, a prospective cohort study examined salivary cortisol profiles in response to the stress of cognitive assessment as well as the diurnal rhythm of cortisol in children (n=129) born at different levels of prematurity (24-32 weeks gestation), term (38-41 weeks of gestation), and at 7 years of age.

The authors demonstrated that cortisol profiles were similar in preterm and term NB, although preterms presented higher cortisol at bedtime compared to full-term infants. Importantly, in the preterm group, greater stress related to procedural neonatal pain was associated with higher levels of cortisol on the day of study (p=0.044) and lower daytime cortisol at home (p=0.023), with effects observed mainly in boys. Also, attention deficit, negativity, and neuropsychological problems were associated with the cortisol response in the cognitive assessment in preterm NB.
Thus, pain and stress may contribute to the alteration of HPA axis function to school age in preterm infants, and gender may be an important factor. Early postnatal exposure to invasive procedures is stressful, especially when repeated several times a day during a period of immaturity.

CONCLUSION

The repeated venipuncture procedure intensified pain and altered cortisol. Upper limbs were more sensitive to pain reactions than lower limbs.

REFERENCES

ConheceDOR: the development of a board game for modern pain education for patients with musculoskeletal pain

ConheceDOR: desenvolvimento de um jogo de tabuleiro para educação moderna em dor para pessoas com dor musculoesquelética

Juliana Carvalho de Paiva Valentim1, Ney Armando Meziat-Filho2, Leandro Calazans Nogueira3, Felipe J. Jandre Reis3

ABSTRACT

BACKGROUND AND OBJECTIVES: Chronic pain is one of the main challenges for health systems. Pain education and self-motivated strategies have great potential in the treatment of people with chronic pain, especially by modifying beliefs and behavior. The development of board games for educational purposes can contribute to the learning of pain concepts and behavioral strategies. The objective of this study was to develop a board game (ConheceDor) to be used as an intervention tool for pain education.

CONTENTS: The systematic review for the development of the game ConheceDor, considered the following search strategy: “chronic pain”, “musculoskeletal pain”, “health education”, “patient education”, “neuroscience education”, “pain education”, “therapeutic neuroscience education”. The primary outcomes considered were pain intensity and disability. Fifteen studies were included, with a total of 1,486 participants. Six studies reported reduction on pain of at least 10%, and two studies reported an improvement of at least 30% on disability. For the development of the game, we elaborated the layout of the board, the rules and other components (dice, cards, and pins). The cards of the game included the contents commonly used in the randomized controlled trials: negative thoughts, pain neurophysiology, stress management, and relaxation, coping and exercises.

CONCLUSION: The development of the present board game was based on the critical appraisal of the content of educational strategies present in the literature. The board game can be a potent resource to be applied in clinical practice in people with musculoskeletal pain.

Keywords: Chronic pain, Experimental games, Health education, Neuroscience-based education.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A dor crônica é um dos principais desafios para os sistemas de saúde. As estratégias comportamentais e a educação em dor apresentam grande potencial no tratamento de pessoas com dor crônica, especialmente pela modificação de crenças e do comportamento. Os jogos de tabuleiro podem ser uma estratégia educativa que contribui para a aprendizagem dos conceitos sobre dor e estratégias comportamentais. O objetivo deste estudo foi desenvolver um jogo de tabuleiro (ConheceDor) como ferramenta de intervenção para educação em dor.

CONTEÚDO: A revisão sistemática para o desenvolvimento do jogo ConheceDor, considerou a estratégia de busca com os descritores “chronic pain”, “musculoskeletal pain”, “health education”, “patient education”, “neuroscience education”, “pain education”, “therapeutic neuroscience education”. Os desfechos primários considerados foram a intensidade da dor e a incapacidade. Foram incluídos 15 estudos com um total de 1,486 participantes. Seis estudos apresentaram redução da dor de pelo menos 10% e dois estudos atingiram uma melhora de pelo menos 30% na incapacidade. Para o desenvolvimento do jogo foram elaborados o layout do tabuleiro, as regras e os demais componentes (dados, cartas, pinos). As cartas do ConheceDor incluíram os temas mais utilizados nos estudos identificados que foram: pensamentos negativos, neurofisiologia da dor, manuseio do estresse e relaxamento, enfrentamento e exercícios físicos.

CONCLUSÃO: A criação de um jogo de tabuleiro considerou uma análise crítica da literatura dos conteúdos das estratégias educativas presentes nos ensaios clínicos. O desenvolvimento dessa intervenção pode ser um recurso para ser aplicado na prática clínica em pessoas com dor musculoesquelética.

Descritores: Dor crônica, Educação com base em neurociência, Educação em saúde, Jogos experimentais.

INTRODUCTION

The health conditions that are characterized by the presence of pain can lead to disability and high costs to the individual and
such as catastrophic thoughts, anxiety, fear, kinesiophobia, maladaptive behaviors, and depression. The literature highlights pain education (PE) and behavioral interventions to intervene in this components. Recently, a systematic review evaluated the efficacy of pain neuroscience education in patients with chronic musculoskeletal pain and identified that the intervention contributed to the reduction of pain, disability, and catastrophization. Behavioral and cognitive interventions help in the deconstruction of negative thinking patterns, beliefs, emotional states, and maladaptive behaviors, with the main objectives of reducing symptom-related distress, improving functionality, assisting in changing adaptive patterns, and teaching techniques for the self-management of pain.

Educational games can contribute to the learning process since they favor the interaction of the participants and the assimilation of concepts in a playful way. Considering that the development of individuals is related to the learning process acquired through the socio-cultural interaction, the use of games as a teaching-learning proposal allows the content to be presented and the concepts constructed during the course of the game. Educational games can be relevant tools used in the PE process to teach and learn the contents as well as for the modification of behaviors through the construction of knowledge.

The objective of this study was to develop a board game (ConheceDor) to serve as a tool to promote the knowledge about the pain concepts and the motivational strategies for people with chronic musculoskeletal pain.

**CONTENTS**

A systematic review of the literature of intervention studies using PE or behavioral strategies was carried out to develop the board game. The protocol defined for this study followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The question of the review was: “what are the contents of education and pain relief interventions used in randomized clinical trials that have promoted benefits for pain and disability outcomes in people with chronic musculoskeletal pain?” These contents, identified exclusively in clinical trials, were used to elaborate the domains of the board game ConheceDor.

**Inclusion and exclusion criteria**

The studies considered were randomized controlled trials that investigated the effects of PE based on neuroscience or behavioral, self-management or motivational strategies on pain and disability. The studies should include participants over 18 years of age and with musculoskeletal pain lasting longer than 12 weeks. Interventions could be done in person or at distance (online, telehealth, among others), individually or in a group. In case there has been an intervention with contact with the health professional and the other group having received the intervention at a distance, the in-person intervention was used. The studies should be available for access, and there was no restriction on the language of publication provided that the translation was available. We excluded studies that used as main intervention education based on only biomedical concepts, as well as those that provided an orientation of posture or only orientations based on purely biomechanical concepts. The exclusion of this type of study was because these concepts contribute to the increase of catastrophization, anxiety, and fear related to pain. The control groups could be from usual treatment, waiting list or other educational strategies. Also, PE or behavioral strategies could be associated with other interventions such as exercises, for example. The primary outcomes considered for the study were pain intensity and disability. The secondary outcomes included changes in catastrophizing, kinesiophobia, anxiety, depression, improvement perception, patient satisfaction, and return to work. In addition to these criteria, a minimum score of six on the PEDro scale was adopted for methodological quality.

**Search strategy for the identification of the studies**

A search was performed on the Pubmed, PEDro, Scopus, and Web of Science databases in February 2018. The search strategy utilized the following descriptors: “chronic pain” OR “musculoskeletal pain” AND “health education” OR “patient education” OR “neuroscience education” OR “pain education” OR “therapeutic neuroscience education” (Annex 1). The search terms were adapted for use with other bibliographic databases in combination with specific database filters for controlled trials, when available.

**Selection of studies and data extraction**

After the search, the results were imported to the EndNote Web. Considering the eligibility criteria, two researchers independently selected the potentially eligible articles based on the title, abstract and full text. There was no blinding for the journal or authors. The data extraction was performed, and the divergences were resolved by consensus. In the absence of consensus, a third evaluator could be convened. The data extracted included the author (year), clinical condition, population, intervention group, the control group, follow-up, outcomes and content of interventions.

**Data analysis**

In order to identify the contents used in the educational interventions of the clinical trials included in the present study, the data analysis was performed descriptively. The intragroup difference between baseline and post-intervention measures was considered to attest the modification of the interventions on pain and disability outcomes. The follow-up time was grouped in short (up to 3 months), medium (3 to 6 months) and long (over 6 months), and the largest follow-ups were considered for grouping. The change in outcomes was presented as a percentage. The
reduction of at least 10% in pain intensity and an improvement of at least 30% in disability was considered a significant change. After identifying the studies that reached these values of change, the contents of the interventions were grouped by similarity and presented by their absolute frequencies. The overall quality of the evidence was evaluated using the PEDro scale which has 11 items and a total score of 10 according to the following criteria: eligibility criteria; random allocation; secret allocation; comparability at the baseline; participants; blind therapist surveyors; suitable follow-up; intention-to-treat analysis; comparison between groups; accuracy and variability. The highest score on the PEDro scale indicated better methodological quality.

Board game development
After the identification of the studies, the development of the ConheceDor board game began. For this stage, two researchers identified the contents of the interventions used in the studies included in the systematic review and then developed the main elements to visually compose the board that included the layout, the number, and content of the houses and cards, the rules and other components (dice and pins). For the development of the charts of the board domains, the content addressed in at least 50% of the studies was selected.

Description of the studies
The initial search identified a total of 2,907 studies. Of these, 1,945 duplicate studies were excluded. The screening of titles and abstracts identified 44 potential articles and, after a detailed analysis of the full text of the studies, the final sample for analysis was composed of 15 studies (Figure 1). The main reasons for the exclusion of the articles were: not being a clinical trial, not describing how the educational proposal was performed and presenting a score lower than six on the PEDro scale. The studies that did not meet the inclusion criteria were excluded, that is, access not available (n=3); educational content not described (n=2) or education combined with other intervention (n=1); no evaluation of the outcomes considered for the inclusion (n=1); addressing patients with acute pain or cancer-related pain (n=2); using posture-orientation based content (n=2) and with a PEDro score <6 (n=18).

Characteristics of the articles included
Fifteen studies were included, totaling 1,486 people with chronic musculoskeletal pain. Five studies with people with chronic low back pain\textsuperscript{15-19}, four studies with musculoskeletal pain of different origins\textsuperscript{20-23}, two studies with participants with chronic neck pain\textsuperscript{24,25}, one study with patients with chronic fatigue syndrome\textsuperscript{26}, one study with fibromyalgia\textsuperscript{27}, one study with participants with spinal pain or upper back pain\textsuperscript{28}, one study with patients with chronic knee pain\textsuperscript{29}. Among the interventions, seven studies (46.7%) used neuroscience-based PE\textsuperscript{15,17,18,22,25,26,29}, five studies (33.4%) used PE and behavioral strategies\textsuperscript{20,21,23,24,27}, one study (6.7%) used only behavioral strategies\textsuperscript{19}, one study (6.7%) used general health guidelines\textsuperscript{28} and one study (6.7%) associated neuroscience-based PE with hypnosis\textsuperscript{16}. Table 1 presents the characteristics of the studies included in the systematic review.

![Figure 1](image-url)
Table 1. Summary of the studies included (n=15)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Clinical condition</th>
<th>Population</th>
<th>Intervention group</th>
<th>Control group</th>
<th>Follow-up</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andersen et al. 28</td>
<td>Pain in the spine or upper back</td>
<td>n=141 F=78; Age=45.2±0.5 years</td>
<td>Personalized physical activity group = 1.5h of general health guidelines + aerobic and strength exercises for 50min (n=47). Group of self-management=1.5h of general health guidelines + weekly workshop of 2.5h for 6 weeks in groups of 12 to 18 people (n=47).</td>
<td>Reference treatment group = 1.5h of general health guidelines (n=47).</td>
<td>3 months</td>
<td>Intensity of pain with VAS (zero to 100mm); Ability to work (VAS zero to 100mm); TSK.</td>
</tr>
<tr>
<td>Bennell et al. 29</td>
<td>Chronic knee pain</td>
<td>n=148 F=83; Age=61.1±7.5 years</td>
<td>Three internet interventions: educational material on the exercises + educational material on coping + 7 consultations via Skype with a physiotherapist for exercise prescription (n=74).</td>
<td>Two interventions via the internet: educational material on the exercises + educational material on coping (n=74).</td>
<td>3 and 9 months</td>
<td>Mean pain during gait in the previous week (zero to 10); WOMAC and PSC.</td>
</tr>
<tr>
<td>Brage et al. 24</td>
<td>Chronic neck pain</td>
<td>n=20 F=20; Age=41.4±12.2 years</td>
<td>4 sessions of 1.5h on education + 8 sessions of 30min with specific exercises (shoulder girdle and shoulder, balance and aerobic training) (n=10).</td>
<td>4 sessions of 1.5h, covering topics on mechanisms, acceptance, coping strategies and definition of pain goals based on the concepts of pain management and cognitive-behavioral therapy (n=10).</td>
<td>4 and 12 months</td>
<td>Pain (NRS from zero to 10); Neck-related disability (NDI); Perceived Global Effect (GPE).</td>
</tr>
<tr>
<td>Carmody et al. 23</td>
<td>Chronic musculoskeletal pain (low back and neck pain, with and without radiculopathy, arthritis)</td>
<td>n=101 F=3; Age=67.5±9.5 years</td>
<td>Cognitive behavioral therapy by telephone (12 weeks) (n=50)</td>
<td>Telephone education (12 weeks) (n=51)</td>
<td>2, 5, 8 and 12 months</td>
<td>Health-related quality of life (SF-12v2); BDI; PBCL; CSQR; Intensity of pain (pain journal for two weeks); PSC.</td>
</tr>
<tr>
<td>Chiauzzi et al. 15</td>
<td>Chronic low back pain</td>
<td>n=199 F=134; Age=46.1±11.9 years</td>
<td>Online education for low back pain (painACTION-Back Pain) (painACTION-Back Pain) (n=104)</td>
<td>Low back pain guide that should be read in 4 weeks (n=105)</td>
<td>1, 3 and 6 months</td>
<td>BPI, ODQ, DASS, PGIC, CPCI, PSC, PSEQ FABQ.</td>
</tr>
<tr>
<td>Gallagher, McAuley and Moseley 22</td>
<td>Chronic musculoskeletal pain</td>
<td>n=79 F=48; Age=43.5±11 years</td>
<td>Booklet on pain education through metaphors (n=40).</td>
<td>Information booklet on pain (n=39).</td>
<td>3 months</td>
<td>PBQ, PSC, NRS 0-10, PSFS.</td>
</tr>
<tr>
<td>Lefort et al. 20</td>
<td>Chronic musculoskeletal pain</td>
<td>n=110 F=82; Age=39.5 years</td>
<td>Psychoeducation program (2 hours per week for 6 weeks) (n=57)</td>
<td>Waiting list (n=53)</td>
<td>6 weeks</td>
<td>SF-36, PRI, SF-M-PQ, SF-BDI; SOPA-D; VAS=100mm.</td>
</tr>
<tr>
<td>Meeus et al. 26</td>
<td>Chronic fatigue syndrome</td>
<td>n=48 F=40; Age=40.3±10.4 years</td>
<td>Neuroscience-based pain education (n=24)</td>
<td>Information on self-management seeking the balance between activity and rest to avoid exacerbations and establish realistic goals to increase activity (n=24).</td>
<td>Post-treatment</td>
<td>NPT, PCS, TSK, PCI.</td>
</tr>
</tbody>
</table>
### Table 1. Summary of the studies included (n=15)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Clinical condition</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Moseley, Nicholas and Hodges18</td>
<td>Chronic low back pain</td>
<td>n=58 F=33 Age=43.58 years</td>
<td>Neuroscience-based pain education (n=31)</td>
<td>Education on the anatomy of the spine (n=27)</td>
<td>Post-treatment</td>
<td>RMDQ, SOPA-R, PSC.</td>
</tr>
<tr>
<td>Nicholas et al.19</td>
<td>Chronic pain</td>
<td>n=141 F=96 Age=73.9±6.5 years</td>
<td>Self-management of pain (8 sessions of 2h for 4 weeks) + encouragement to practice exercises at home (n=49) Self-management of pain (8 sessions of 2h for 4 weeks) (n=53)</td>
<td>Waiting list (n=39)</td>
<td>1, 6 and 12 months</td>
<td>NRS, mRMDQ; DASS-21, PSEQ, PRSS.</td>
</tr>
<tr>
<td>Ris et al.25</td>
<td>Chronic neck pain</td>
<td>n=200 F=149 Age=45.1 years</td>
<td>Pain education with a focus on the understanding/acceptance of pain and goals setting (4 sessions (1.5h each, once a month) + 8 sessions of exercises (neck muscles, balance, oculomotor training, shoulder girdle (n = 101))</td>
<td>Pain Education with a focus in the understanding/acceptance of pain and goals setting (4 sessions (1.5h each, once a month)(n=99)</td>
<td>4 months</td>
<td>SF-36, NDI, BDI-II, TSK.</td>
</tr>
<tr>
<td>Rizzo et al.16</td>
<td>Chronic low back pain</td>
<td>n=100 F=80 Age=50±13.5 years</td>
<td>Neuroscience-based pain education (4 sessions; 2 times/week) + hypnosis (2h of self-hypnosis in 2 weeks + book with hypnosis suggestions) (n=50)</td>
<td>Neuroscience-based pain education (4 sessions; 2 times/week)(n=49)</td>
<td>3 months</td>
<td>NRS, RMDQ, PSC, GPE, PSFS.</td>
</tr>
<tr>
<td>Ryan et al.17</td>
<td>Chronic low back pain</td>
<td>n=38 F=25 Age=45.3±10.7 years</td>
<td>Neuroscience-based pain education + 6 sessions of exercises for 8 weeks (10min warm-up, 20-30min aerobic phase, and 10-15min slowdown) (n=20).</td>
<td>Neuroscience-based pain education (2.5 h reformulation of beliefs and attitudes regarding pain)(n=18)</td>
<td>3 months</td>
<td>NRS, TSK-13, PSEQ.</td>
</tr>
<tr>
<td>Thorn et al.21</td>
<td>Chronic musculoskeletal pain</td>
<td>n=73 F=65 Age=52.8±13.1 years</td>
<td>Cognitive-Behavioral Therapy + homework (1.5h, once/week, 10 weeks)(n=49)</td>
<td>Education on pain neurophysiology (1.5h, once/week, 10 weeks)(n=34)</td>
<td>6 months</td>
<td>BPI, RMDS, PSC, CES-D, QOLS.</td>
</tr>
<tr>
<td>Van Oosterwijck et al.27</td>
<td>Fibromyalgia</td>
<td>n=30 F=26 Age=45.8±10.5 years</td>
<td>Neuroscience-based pain education (2 sessions; 30 minutes) (n=18)</td>
<td>Self-management (self-management techniques and handling of daily activities in relation to their symptoms), (2 sessions, 30 minutes) (n=15)</td>
<td>3 months</td>
<td>FIQ, SF-36, PCI, PCS, TSK, PVAQ.</td>
</tr>
</tbody>
</table>

VAS = visual analog scale; PSC = Pain Catastrophizing Scale; WOMAC = Arthritis Self-Efficacy Scale; NDI = Neck Disability Index; GPE = Global Perceived Effect; SF-12v2 = Short Form 12v2 Health Survey; BDI - Beck Depression Inventory; PBCL = Pain Behavior Checklist; CSQR = Coping Strategies Questionnaire Revised; BPI = Brief Pain Inventory; ODI = Oswestry Disability Questionnaire; DASS = Depression Anxiety Stress Scale; PGIC = Patient Global Impression of Change; CPCI = Chronic Pain Coping Inventory; PSEQ = Pain Self-Efficacy Questionnaire; FABQ = Fear-Avoidance Beliefs Questionnaire; PBQ = Pain Biology Questionnaire; NRS = Numerical Rating Scale; PSFS = Patient-Specific Functional Scale; SF-36 = Medical Outcomes Study Short Form-36; PRI = Pain Rating Index; SF-MPQ = Short Form-McGill Pain Questionnaire; SF-BDI = Short Version - Beck Depression Inventory; SOPA-D = Survey of Pain Attitudes); NPT = Neurophysiology of Pain Test; PCI = Pain Coping Inventory; RMDQ = Roland Morris Disability Questionnaire; SOPA-R = Survey of Pain Attitudes-Modified; mRMDQ = Roland Morris Disability Questionnaire-Modified; DASS-21 = Depression Anxiety Stress Scales; PRSS = Pain Response Self-Statements Scale; BDI-II = Beck Depression Inventory-II; RMDS = Roland-Morris Disability Scale; CES-D = Center for Epidemiological Studies Depression Scale; QOLS = Quality of Life Scale -QOLS; FIQ = Fibromyalgia Impact Questionnaire; SF-36 = Medical Outcomes Short Form 36 Health Status Survey; PVAQ = Pain Vigilance and Awareness Questionnaire.
Methodological quality of the studies included
The risk of bias of the articles included in the present systematic review was independently assessed by two reviewers who used the PEDro scale to analyze the methodological quality (Table 2).

Change in pain and disability
Regarding the primary outcomes (pain intensity and disability), six studies reported pain reduction of at least 10% and two studies achieved at least 30% improvement in disability compared to baseline. The percentages of modification for pain and disability, considering the follow-up time are presented in table 3.

The content of interventions and domains found in the studies
Considering the contents covered in the studies of the systematic review it was possible to observe that the most frequent contents included negative thoughts and behavior (n=5)15,19,21,23,29, stress management and relaxation techniques (n=5)15,19,21,23,29, pain neurophysiology (n=4)16,17,19,23, exercises and return to activity (n=4)15,16,19,29 and coping strategies (n=3)15,23,29. Figure 2 shows

Table 2. Methodological quality of the studies included considering the PEDro scale criteria

<table>
<thead>
<tr>
<th>Studies</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andersen et al.28</td>
<td>X</td>
<td>V</td>
<td>X</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>7</td>
</tr>
<tr>
<td>Bennell et al.29</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>7</td>
</tr>
<tr>
<td>Brage et. al.24</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>7</td>
</tr>
<tr>
<td>Carmody et. al.23</td>
<td>V</td>
<td>V</td>
<td>X</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>V</td>
<td>X</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>6</td>
</tr>
<tr>
<td>Chiauzzi et al.15</td>
<td>V</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>6</td>
</tr>
<tr>
<td>Gallagher, McAuley and Moseley22</td>
<td>X</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>V</td>
<td>X</td>
<td>V</td>
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<td>6</td>
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<tr>
<td>Lefort et al.20</td>
<td>V</td>
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<td>V</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>V</td>
<td>V</td>
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<td>V</td>
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<td>8</td>
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<tr>
<td>Meeus et al.26</td>
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<td>V</td>
<td>V</td>
<td>X</td>
<td>X</td>
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<td>7</td>
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<tr>
<td>Moseley, Nicholas and Hodges18</td>
<td>V</td>
<td>V</td>
<td>X</td>
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<td>V</td>
<td>X</td>
<td>V</td>
<td>V</td>
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<tr>
<td>Nicholas et al.19</td>
<td>V</td>
<td>V</td>
<td>X</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>V</td>
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<tr>
<td>Ris et al.25</td>
<td>X</td>
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<td>V</td>
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<td>6</td>
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<tr>
<td>Rizzo et al.16</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>V</td>
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<td>V</td>
<td>V</td>
<td>8</td>
</tr>
<tr>
<td>Ryan et al.17</td>
<td>X</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>V</td>
<td>V</td>
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<td>V</td>
<td>V</td>
<td>7</td>
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<tr>
<td>Thorn et al.21</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>V</td>
<td>V</td>
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<td>6</td>
</tr>
<tr>
<td>Van Oosterwijck et al.27</td>
<td>V</td>
<td>V</td>
<td>X</td>
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<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>8</td>
</tr>
</tbody>
</table>

1 = Eligibility Criteria; 2 = Random allocation; 3 = Secret allocation; 4 = Comparability at baseline; 5 = Blinding of participants; 6 = Blinding of therapists; 7 = Blinding of evaluators; 8 = Suitable follow-up; 9 = Analysis by intention-to-treat; 10 = Comparison between groups; 11 = Measurement of accuracy and variability. X = absence; V = presence.

Table 3. Percentage of change from baseline on pain and disability outcomes considering the follow-up periods of the studies included

<table>
<thead>
<tr>
<th>Authors</th>
<th>Short (&lt;3 months)</th>
<th>Medium (3-6 months)</th>
<th>Long (&gt;6 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pain</td>
<td>Disability</td>
<td>Pain</td>
</tr>
<tr>
<td>Andersen et al.28</td>
<td>-6.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bennell et al.29</td>
<td>-17.4</td>
<td>15.0</td>
<td>-</td>
</tr>
<tr>
<td>Brage et. al.24</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Carmody et. al.23</td>
<td>-11.6</td>
<td>-</td>
<td>-13.9</td>
</tr>
<tr>
<td>Chiauzzi et al.15</td>
<td>-7.8</td>
<td>6.7</td>
<td>-9.5</td>
</tr>
<tr>
<td>Lefort et al.20</td>
<td>-16.1</td>
<td>8.7</td>
<td>-</td>
</tr>
<tr>
<td>Moseley, Nicholas, Hodges18</td>
<td>-</td>
<td>6.6</td>
<td>-</td>
</tr>
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<td>Nicholas et al.19</td>
<td>-12.3</td>
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<td>Ris et al.25</td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>Rizzo et al.16</td>
<td>-29.1</td>
<td>43.2</td>
<td>-</td>
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<td>Ryan et al.17</td>
<td>-51.3</td>
<td>60.1</td>
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<td>Thorn et al.21</td>
<td>-</td>
<td>-</td>
<td>-20.6</td>
</tr>
</tbody>
</table>

The figures in bold meet the inclusion criteria of at least 10% pain reduction and 30% improvement in function.
the frequency of the intervention themes. For the development of the cards of the board domains, the content addressed in at least 50% of the studies were selected.

**Development of the ConheceDor game**

For the development of the game ConheceDor, we considered some examples of board games on the market that have a diversity of models, colors, shapes, and objectives. The game consists of a board, 110 cards, one die and the number of markers (pawns) according to the number of participants. The board layout was rectangular measuring 250mm by 500mm, with 50 houses, consisting of a path signaled by the words “Start” and “End,” shortcuts, symbols and drawings (Figure 3).

The visual identity of the game ConheceDor is mainly composed of the colors green, yellow and red to attract the eyes to the board. The character present in the identity represents a young man with pain positioned on the spot that the game begins. Along the way, there are several aspects related to pain such as sleep, negative thoughts, drug use, and exercises until the end of the course where the character is illustrating his recovery. The presence of these graphic elements suggests that the theme of the game exemplifies a person with pain until the recovery.

The number of game houses available on the market that were evaluated during the ConheceDor game development goes from 40 to 60. Therefore, the 50 houses for the ConheceDor game were divided into colors (blue, orange, green, red and black), houses “choose your way” and “X” houses. The colors of the houses that represent the game domains were defined by consensus among the developers: negative thoughts (kinesiophobia and catastrophization) (orange), pain neurophysiology (green), stress management (black), relaxation/coping (blue) and physical exercises/activities (red). The game cards were divided into domain cards according to the colors of the board houses and “X” cards. For the house “choose your way,” the player can choose any of the cards of the five domains to respond. The game cards assess the pain knowledge based on “true or false” answers where the player will judge whether a particular statement is beneficial or harmful to a person with pain. The statements used in the game cards were developed based on the scales and questionnaires used to assess patients with pain such as the Tampa Scale of kinesiophobia (TSK), Pain Catastrophizing Scale, Self-efficacy Scale, the Neurophysiological Pain Questionnaire and Attitudes to Pain. When the scales used questions, they have been converted into statements. In house X the player is punished that can be to stay one round without playing or to return some houses according to the result obtained when throwing the dice. All cards are rectangular with a dimension of 90mm x 60mm, printed on millboard, totaling 110 cards being 20 cards per domain and 10 X cards (Figure 3).

In the beginning, players (maximum of 4) are invited to set the order of the match by throwing the dice. The participant who obtains the highest number will be the first to start the match, followed by the participant with the second highest result, and so on. When moving his marker, the player must follow the command according to the house of the board that can be one of the domain cards, “choose your way” and house “X.” The other player will read the card and indicate the correct answer after the first player has answered. If the player’s answer is correct, he will have the right to throw the dice once more. If the answer is wrong, he will switch to the other player. It is only allowed to throw the

![Figure 2](image-url)  
*Figure 2. Absolute frequency of the themes in the interventions considering the studies included in the systematic review*
dice twice, even if the player’s answer is correct. In the “choose your way” house, the player can choose the card he wants to answer, and if the answer is correct, he will have the right to follow the “shortcut,” shortening his path. The winner will be the one who arrives first at the “FIM” (End) house.

**DISCUSSION**

The systematic review of the clinical trials conducted in the present study identified the contents used in PE interventions based on neuroscience and behavioral strategies that contributed to the improvement of pain and disability in people with musculoskeletal pain. In the analysis of the 15 studies that met the inclusion criteria, it was observed that the main contents included the handling of negative thoughts and behavior, pain neurophysiology, stress management and relaxation techniques, coping strategies, exercises and return to activities. A study carried out in Salvador developed a PE booklet addressing the following topics: pain definition, pain classification (acute and chronic), living with pain, myths about pain, strategies for dealing with pain.

The reduction of pain and disability was assessed in the short term (up to three months) by most studies, three studies evaluated in the medium term (three to six months) and five studies in the long term (longer than six months). The reduction in pain intensity ranged from 6.7 to 51.3% and the improvement in disability from 2.2 to 60%. It is possible that this difference among the studies was due to the characteristics of the population (for example, the health condition addressed), the content of the intervention and the form of administration. The present study did not seek to investigate the effectiveness of the neuroscience-based PE since other studies have already presented these results. In the meta-analysis conducted by Geneen et al., which included different types of educational interventions, the authors did not identify the effect of education on pain intensity relative to the comparison group immediately after and within three months of follow-up. However, for disability, when using neuroscience-based PE, there was evidence of significant improvement immediately after. This effect was not observed in the other types of education investigated in the studies. Other findings in the review by Geneen et al. included significant improvement in catastrophizing and pain...
awareness only in the studies that used neuroscience-based PE. The systematic review by Louw et al.\textsuperscript{11} showed that neuroscience-based PE improved the knowledge about pain, disability, catastrophizing, pain-related fear, attitudes and behaviors related to pain, return to activities, and decreased the use of Health Services. However, the heterogeneity of the studies was not considered, and the meta-analysis was not performed. Recently, in a systematic review with meta-analysis, it was identified the evidence of moderate quality that the addition of PE to physiotherapy promoted short-term improvement in pain and also moderate evidence for the improvement of disability when PE was conducted isolated or combined with physiotherapy. For the kinesiophobia and catastrophizing outcomes, the authors found no statistical or clinical difference\textsuperscript{31}.

The objective of the elaboration of the board game was to develop an educational tool with an interactive interface, facilitating the understanding of theoretical contents about pain and behavioral strategies. Games are considered an active and useful tool in the teaching-learning process of patients. This is only possible because the playfulness allows the acquisition of the concepts attractively and pleasantly. Another characteristic of games is the horizontal relationship between the educator and the learner since games stimulate the interaction among participants, as well as motivating and supporting learning\textsuperscript{33}. However, it should be noted that it is still necessary to validate the game with the target audience. During the validation process, it is essential to introduce the game to the target audience so they can evaluate the layout of the game that includes the shape of the board, the colors of the houses, the cards (both their format and the clarity of the information) and the playability that relates to how enjoyable the game is, the time it takes to play and the clarity of the rules. In this way, it is possible that the game needs some modifications after being submitted to this validation process.

Although the development and use of board games in the health area are not very frequent, the few that exist have shown positive results about the learning and education of patients\textsuperscript{35}. There are some examples of games in the literature, such as a board game aimed at promoting active and healthy aging. This game acted like a playful pedagogical resource in nursing care, contributing to the construction of knowledge in the elderly health area\textsuperscript{34}. Fernandes et al.\textsuperscript{35} described the development of a board game called "Family Nursing Game" aimed at nurses. The participants emphasized the preference for the game, due to the source of interaction and reflection it allows among the participants and for having motivated family care. Pires and Guilhem\textsuperscript{36}, developed a board game titled "(IN) DICA-SUS" and realized that the learning sought by the paths of the game for health professionals contemplates the plural aspects of human formation, such as group interaction, active participation, the capacity for self-reflection, the motivation for the study and the willingness to achievement.

It is possible that the intervention strategies using board games have the potential to improve the knowledge about the theoretical content and to facilitate the acquisition or modification of behaviors. During the game, the relationship established between the game and the knowledge is comprehensive due to the numerous cognitive and social phenomena that the game allows the player to experience such as problem-solving, language learning, role-playing, among others\textsuperscript{37}.

Although some PE interventions have already been developed for Brazil\textsuperscript{38,39}, it is believed that this is the first board game based on a systematic review and critical analysis of the studies on the subject. Also, the characterization of these interventions allowed the development of a board game with previously used content that has demonstrated its effects, especially for pain and disability in people with musculoskeletal pain, based on studies with good methodological quality (PEDro≥6). Thus, this study can contribute by filling a gap in the literature that is the development of educational strategies easy to apply to people with pain. However, this study is not free of limitations either. The biggest was not having conducted the content validation process by a panel of experts and a sample of the target audience. This is a step that should occur after the development of the game, and then the effectiveness of the intervention should be compared to other forms of educational strategies. Therefore, new studies are necessary to evaluate the acceptability, usability, and applicability of the board game by patients and health professionals. These subsequent studies can significantly contribute to fix any issues and to enhance to the board game.

**CONCLUSION**

The systematic review followed by the evaluation of the content of the educational interventions allowed to identify the main themes used in clinical trials. This process contributed to the development of a board game for PE that may be a tool to be applied in the clinical practice to treat people with musculoskeletal pain.

**Annex 1. Search strategy**

| #1 MeSH descriptor: [Chronic Pain] explode all trees |
| #2 MeSH descriptor: [Pain] explode all trees |
| #3 Widespread Chronic Pain |
| #4 MeSH descriptor: [Patient Education as Topic] explode all trees |
| #5 Patient Education or Education of Patients |
| #6 Education or neuroscience or neurobiology or neurophysiology or pain education or pain science or modern pain education or therapeutic neuroscience education |
| #7 MeSH descriptor: [Behavior Therapy] explode all trees |
| #8 Randomised controlled trial or clinical trial as a topic or randomised or placebo or randomly or trial |
| #9 #1 or #2 or #3 |
| #10 #4 or #5 or #6 or #7 |
| #11 #8 and #9 and #10 |

**REFERENCES**

3. Bushnell MC, Ciko M, Low LA. Cognitive and emotional control of pain and its
Pregnancy-related lumbosacral pain

Dor lombossacral relacionada à gestação

Fábio Farias de Aragão

ABSTRACT

BACKGROUND AND OBJECTIVES: Pregnancy causes physiological and anatomical changes in the woman's body, affecting several systems such as the musculoskeletal. During pregnancy or in the postpartum period, these changes may cause low back pain or low pelvic pain, preventing the normal movement of these structures and causing suffering. The objective of this study was to discuss the diagnosis and treatment of pregnancy-related lumbosacral pain, focusing on terminology, epidemiology, risk factors, pathophysiology, prognosis, diagnosis, and treatment.

CONTENTS: We searched the literature in Pubmed, Cochrane Library, Ovid and Google using the terms “low back pain”, “pelvic girdle pain”, “lumbopelvic pain”, “posterior pelvic pain”, “pregnancy-related low back pain”, “pregnancy-related pelvic girdle pain” and “pregnancy-related lumbopelvic pain”, for articles in English, Portuguese and Spanish in the last 20 years or older, where relevant.

CONCLUSION: Pregnancy is one of the main causes of lumbosacral pain, and one of the most frequent diseases during gestation. The correct management of this pathology reduces negative impacts on the life of pregnant women.

Keywords: Low back pain, Pelvic pain, Pregnancy.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A gestação causa alterações fisiológicas e anatômicas no corpo da mulher, podendo afetar diversos sistemas como o musculoesquelético. Durante a gestação ou no período pós-parto, essas alterações podem causar dor lombar ou dor pélvica, impedindo a movimentação normal dessas estruturas e causando sofrimento. O objetivo deste estudo foi discutir o diagnóstico e o tratamento da dor lombossacral relacionada à gestação, com foco na terminologia, epidemiologia, fatores de risco, fisiopatologia, prognóstico, diagnóstico e tratamento.

INTRODUCTION

Pregnancy causes physiological and anatomical changes in the woman’s body and can affect several systems (such as cardiovascular, respiratory, endocrine, renal, among others), as well as the musculoskeletal system. These changes are necessary to meet the increased metabolic demand of the mother during pregnancy, the fetal needs and allow the pregnant woman and the fetus to prepare for the birth. On the other hand, in many women, during pregnancy or in the postpartum period, changes in the musculoskeletal system will cause lower back or pelvic pain, preventing the normal movement of these structures and causing suffering. Pregnancy is one of the main causes of lumbosacral pain, being one of the most frequent diseases during pregnancy and it has gained importance in recent years due to the impact it has on the pregnant woman’s life and the costs involved.

Absenteism is directly related to the intensity of pain and the degree of disability. Absenteism doubles in pregnant women with pelvic pain (PP) or low back pain (LBP) when compared with other women. Pregnant women with LBP and PP face difficulties in daily activities, such as getting up, sitting for prolonged periods, walking longer distances, dressing, carrying weights and even sexual difficulties. In more severe cases, crutches or wheelchairs may be required.

The objective of this study was to discuss the diagnosis and treatment of pregnancy-related lumbosacral pain (PRLSP), focusing on terminology, epidemiology, risk factors, pathophysiology, prognosis, diagnosis, and treatment.

CONTENTS

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nancy-related lumbopelvic pain”, for articles in English, Portuguese and Spanish in the last 20 years or more, when relevant. The most relevant articles on the topic were selected and included in the study.

**PATHOPHYSIOLOGY**

The PRLSP etiology is not well-defined. Weight gain during pregnancy, associated with changes in posture required to accommodate the increased abdominal and breast volume lead to a change in the load pattern on the joints and other musculoskeletal structures, leading to pain. From the biomechanical point of view, the increase of the uterine volume leads to stretching and weakening of the abdominal muscles, generating an increase of tension on the lumbar muscles. Also, the increased volume of the breast and the abdomen shifts the center of gravity forwards, causing changes in the posture with pelvic anteversion and increased lumbar lordosis, leading to increased load on the lumbar spine and sacroiliac ligaments. The increased axial load compresses the intervertebral discs, expelling the fluids from the disc and decreasing their height, which may contribute to LBP. From the endocrine point of view, there is a ligament laxity related to the increased levels of progesterone, estrogen, and relaxin, making the hip and spine joints less stable. From the vascular point of view, the compression of the large abdominal vessels by the gravid uterus causes venous stasis and hypoxemia, compromising the metabolic activity of the nerve structures, causing pain.

**TERMINOLOGY**

Many papers use different terminologies, making it uncertain that the terms refer to the same condition. Madeira et al. used the terms pelvic pain, posterior low back pain, and combined pain. Wu et al. introduced the term “pregnancy-related”, taking into account that the symptoms may begin after birth and proposed the use of the terms “pregnancy-related pelvic girdle pain”, “pregnancy-related low back pain” and “pregnancy-related lumbopelvic pain”. This study adopted the terms proposed by Wu et al.

**EPIDEMIOLOGY**

The incidence of PRLSP varies greatly, affecting between 24 and 90% of pregnant women. There is a large variation in the incidence due to the lack of a universally accepted classification system. In some studies, this prevalence may reach 95.23% of pregnant women. According to Cochrane review, more than two-thirds of the pregnant women have LBP, and approximately one-fifth have PP. It usually starts around the 18th gestational week, with a peak between the 24th and 36th weeks. Between the 12th and the 18th gestational weeks, the prevalence of PRLSP is around 62%, and 33% of the pregnant women had PP; 11% had LBP, and 18% had both. At the end of gestation, around the 35th week, the incidence of LBP may reach 71.3% and PP 64.7%.

**RISK FACTORS**

Among the predictive factors of lumbosacral pain, we can mention strenuous work during pregnancy and history of PRLSP. The incidence of LBP is higher in pregnant women with advanced maternal age, history of LBP in previous pregnancies, elevated body mass index (BMI), joint hypermobility, pain worsening when lying down for prolonged periods and higher levels of anxiety. The history of LBP in previous pregnancies is a strong predictor for recurrence in subsequent pregnancies, with a probability around 85%. In relation to PP, strenuous work, history of low back pain, or trauma on the pelvic bones, advanced pregnancy stages, higher BMI and higher depression scores are important predictors.

There is a relationship between pain intensity, catastrophizing levels of pain, depression, and anxiety. Anxiety during pregnancy is related to complications including abortion, pre-eclampsia, prematurity, and low birth weight. Depression and anxiety are important predictors of postpartum depression. Pregnant women with PRLSP have a three times greater chance of presenting symptoms of postpartum depression than pregnant women without pain.

**CLINICAL PRESENTATIONS**

PRLSP may manifest as PP, LBP, or with the association of the two. Both are more intense with the advance of pregnancy and, in some cases, pain may radiate to the gluteal region, thigh, leg, and foot. It is essential to differentiate between LBP and PP since they have different etiologies and require specific treatment strategies.

Pregnancy-related pelvic pain (PRPP) is located between the posterior iliac crest and the gluteal fold, particularly close to the sacroiliac joints, and can radiate to the posterior aspect of the thigh. Pain in the pubic symphysis may occur in association or alone, with possible irradiation to the anterior aspect of the thigh. The pain is intermittent and may be precipitated by prolonged postures, usually occurring during daily tasks such as walking, sitting or standing. The first manifestation of pain occurs during pregnancy, with painful palpation of the gluteal musculature and the topography of the sacroiliac joints, and positive PP provocation tests.

The posterior PP is defined as low without the component of the pubic symphysis. It is characterized by a stinging pain in the gluteal region, distal and lateral to the L5 to S1 area, and may or may not radiate to the posterior aspect of the thigh and knee. It is intermittent, usually associated with weight lifting, the range of movement of the spine and hips within the normal range, in addition to positive posterior PP provocation test.

The pregnancy-related low back pain (PRLBP) occurs between the upper region of the spinal process of the last thoracic vertebra, inferiorly by the sacrum and laterally by the lateral borders of the erector muscle of the spine and can irradiate to the leg. The pain is usually exacerbated by anterior flexion, causes movement restriction in the lumbar region, and is exacerbated by the palpation of the erector spinae muscles. The first manifestation...
may occur before pregnancy. The lumbar range of motion decreases, usually there is no relation to ambulation or to perform daily tasks such as sitting or standing, and the PP provocation tests are negative. While PRPP is more intense and disabling during pregnancy, PRLBP appears to be more intense and more common after birth.

**DIAGNOSIS**

In pregnant women with PRLSP, a good patient’s history and physical examination are necessary to exclude other causes of pain, to differentiate between LBP and low PP, the level of disability and propose an individualized treatment. The warning signs may be a history of traumas, weight loss, cancer, use of steroids and other states of immunosupression, neurological symptoms, fever, among others. These red flags may indicate the presence of hidden causes such as inflammatory, infectious, traumatic, neoplastic, degenerative or metabolic causes.

The diagnosis of PRLSP is based on the symptoms, as there are few available tests. However, it is important to differentiate between PRLBP and PRPP, since the management and prognosis of the two conditions are different. The location of the pain, its characteristics, and intensity, triggering factors and provocation tests are useful.

In relation to PRPP, in addition to the clinical presentation described, the European Guidelines recommend performing a functional test (straight leg elevation), four tests for the sacroiliac (posterior provocation of PP; Patrick-Fabere, Gaenslen and palpation of the long dorsal sacroiliac ligament) and two tests for pubic symphysis (palpation of the pubic symphysis and modified Trendelenburg pelvic girdle test). The diagnosis of PRPP is considered positive with a positive functional test plus one of the tests for sacroiliac, or one of the positive pubic symphysis tests. PRPP can be categorized into five subgroups: 1) Pelvic girdle syndrome, when the pain is present in the three pelvic joints; 2) bilateral sacroiliac syndrome, when the pain is referred in both sacroiliac joints; 3) Unilateral sacroiliac syndrome, with pain present in one sacroiliac joint; 4) Simphysiolyis, when only the pubic symphysis presents pain; and 5) Miscellaneous group, when there is pain in one or more pelvic joints, but with inconsistent conclusions. This classification is important because the number of joints involved seems to interfere in both pain intensity and function.

Several questionnaires have been applied in pregnant women with PRLSP in order to evaluate the functionality and direct the most appropriate treatment for each case. The resulting disability from the pain is generally measured using the Quebec Back Pain Disability Scale. Although this scale has been developed to assess the degree of disability in patients with not-pregnancy related low back pain, it has been adapted for this use. Other evaluation methods are also used to evaluate the degree of disability and functionality of pregnant women (Roland-Morris, Oswestry, Disability Rating Index (DRI) and others), without being developed for this purpose. For example, the DRI used by Olsson and Nilsson-Wikmar, which evaluates, in one of its 12 items, the ability of the pregnant woman to run, may not reflect the reality of most pregnant women, especially in the third quarter.

The Pregnancy Mobility Index (PMI) was developed specifically for pregnant women with PRLSP, accessing their ability to perform daily activities. It is possible to evaluate the mobility and quality of life of the pregnant woman.

The Pelvic Girdle Questionnaire (PGQ) is a specific instrument to measure the PP during pregnancy and postpartum. The Brazilian version of the questionnaire was validated in 2014 and helps to evaluate and monitor the impact that PRPP can have on the functionality of pregnant women, considering all the social and cultural context in which they are inserted, as well as helping to find more appropriate ways to plan a specific treatment for this condition. Thus, the development of specific questionnaires for PRLSP and its subtypes may facilitate the diagnosis and help with the appropriate treatment.

Although the diagnosis of PRLSP is basically clinical, the use of imaging exams may be necessary, especially when warning signs are present. Preferably, one should opt for those with non-ionizing radiation, such as ultrasonography and magnetic resonance imaging (MRI). Despite the fear that MRI could induce teratogenicity, acoustic lesion and heating effects in the fetus, no changes were observed when 1.5T devices were used. The safety of the 3T devices is not established yet. In 2013, the American College of Radiology recommended MRI to be used in pregnant women, independently of the gestational age when the benefits are greater than the risk.

Regarding the exams that use ionizing radiation, doses lower than 50mGy, when administered in gestations above two weeks, they seem to be very low to be clinically detected. Doses between 50 and 100mGy, when administered between 2 and 25 weeks, can be teratogenic but do not show a teratogenic effect in pregnancies above 25 weeks. Doses above 100mGy have the potential for fetus injury, especially in pregnant women who may undergo further exams, leading some authors to discuss the indication to abort.

**PROGNOSIS**

Inadequate follow-up and management of pregnant women with PRLBP and PRPP may lead to chronic pain. Persistent PRLSP, both recurrent and continuous, is directly related to the symptoms during pregnancy. While most of the pregnant women show improvement in the first six months after delivery, some women will experience the symptoms for a prolonged time. After delivery, there is a higher demand for activities that increase the intensity of LBP, such as lifting and carrying weight. It is difficult to avoid these activities due to the necessary care required by the newborn.

A study that evaluated 464 pregnant women with PRLSP during pregnancy showed that 43.1% had pain six months after delivery, 36.2% had recurrent pain, while 6.9% had continuous pain. Pregnant women with more pronounced symptoms (continuous pain) are more likely to be away from work and to use health services than women with less pronounced symptoms (recurrent pain). Pregnant women with more pronounced symptoms may fall in a specific subgroup of pregnant women with persistent PRPP where the prognosis is less favorable.
Pregnant women with PRPP can have serious consequences several years after pregnancy. One in 10 can have pain up to 11 years postpartum, especially those with a history of PRLSP in previous pregnancies, higher number of positive tests for pain provocation and pressure tests on the pubic symphysis, positive Trendelenburg or Faber. The pregnant woman should be evaluated during pregnancy and in the postpartum period and treated appropriately to avoid suffering, costs increase and to reduce the chance of a transition to chronicity.

Subgroups of pregnant women with PRLSP should be identified and directed to specific treatments. Pregnant women classified as having combined pain (LBP and PP), especially at the beginning of pregnancy, should receive special attention since they have a higher intensity of symptoms and a greater chance of chronification.

**TREATMENT**

The treatment of PRLSP is a difficult task because of the myth that it is a normal condition in pregnancy and the fear that the treatment will cause changes in the pregnant woman and the fetus. One of the treatment strategies is based on prevention. When seeking effective pain management, conservative measures are more often used for obvious reasons, although these treatments typically do not show high success rates. Treatment options include physiotherapy, transcutaneous electrical nerve stimulation, pharmacological treatment, acupuncture, the use of pelvic belts, among others.

**EXERCISES**

Exercise-based treatment is the most common component in PRLSP management. Stabilization exercises are the most commonly used techniques, followed by pelvic floor exercises, strengthening exercises and repeated directional exercises. In a Cochrane review of 2015 that evaluated the effects of any intervention to prevent or treat LBP, PP or the association of both in women at any stage of pregnancy, soil exercises in their various formats reduced the pain scores and the functional impairment in pregnant women with LBP, with an additional improvement when information on pain management is provided to the pregnant woman. Hydrotherapy seems to reduce the pain scores and the functional impairment in pregnant women with LBP. Regarding PP, physical activity does not seem to improve the prognosis when compared to usual prenatal care. Moreover, acupuncture appears to be superior to stabilization exercises to reduce PP. Although LBP and PP are distinct diseases and cannot be directly compared, the exercises, when compared to usual prenatal care, do not seem to improve the prognosis of PP. These observations suggest that the stabilization of the anatomical source of the symptoms is paramount for the proper management of the pain.

**PHYSICAL MEASURES**

The use of simple devices, such as a nest-shaped pillow, may be helpful to reduce pain and insomnia in later stages of pregnancy. The pillow supports the abdomen when the pregnant woman adopts the lateral decubitus position, and it seems to lessen the symptoms.

Another device is the pelvic belt, which acts by pressing the joint surfaces promoting stability and reducing the mobility of the sacroiliac joint, with a reduction in pain. The use of non-rigid pelvic belts significantly reduces the pain scores and functional impairment compared to stabilization exercises. They should be used only for a short time.

**ACUPUNCTURE**

The use of acupuncture for the treatment of PRLSP is increasing over the years, and several studies have shown its analgesic potential in pregnant women with PRLSP when compared to control. Acupuncture seems to relieve LBP and pelvic girdle pain during pregnancy. In addition, it increases the ability to perform some physical activities and helps decrease the need for drugs, which is a good advantage in that period. Acupuncture seems to stimulate the endogenous opioids system. When used as an adjuvant, acupuncture provides greater pain reduction than the standard treatment alone, improving daily activities in pregnant women with PRLSP. Although it is considered a safe technique, acupuncture should be performed by experienced people, since some points that supply the uterus and cervix should be avoided, as they may induce labor.

**PHARMACOLOGICAL TREATMENT**

Paracetamol is the first-line analgesic in the treatment of pain during the pregnancy. It is a non-opioid analgesic and, although the mechanism of action is not yet completely known, it can inhibit the synthesis of central prostanadlin and modulate the serotonergic descending inhibitory pathways. At the recommended doses, the use of paracetamol during pregnancy is safe. Nonsteroidal anti-inflammatory drugs (NSAIDs) are usually second-line analgesics. Due to the risk of early fetal loss, oligohydramnios, fetus renal injury, and premature closing of the arterial duct, NSAIDs during pregnancy must be used with caution. Antidepressants, anticonvulsants, local anesthetics and clonidine can be a good alternative during pregnancy. Amitriptyline, due to the time of use and a large number of published studies, seems to be a good option for the treatment of neuropathic pain during pregnancy since it was not associated with an increased incidence of malformations. Venlafaxine also appears to be unrelated to increased malformations. However, the use of high doses of antidepressants during pregnancy, or their use near the term, can lead to neonatal withdrawal syndrome. Sodium valproate has a possible teratogenic effect, alteration of the neurological development. Some countries have already banned its use in pregnant women and women of childbearing potential with bipolar disorders. There are only a few reports of pregnant women using gabapentin, and there is no evidence of an increase in the incidence of malformations. It may be related to an increased risk of fetal loss, restricted intrauterine
growth, and preterm birth. It has a C classification by the Food and Drug Administration (FDA) and B3 by the Australian Drug Evaluation Committee (ADEC).

Regarding pregabalin, it does not appear to be associated with a significant increase in malformations when used in the first quarter, mainly as a monotherapy. Cyclobenzaprine is considered safe during pregnancy and is one of the most commonly used analgesics for the treatment of PRLSP. Despite a report of early closure of the arterial duct, it is widely used in pregnant women. It has a B classification from the FDA. During lactation, about 50% of the drug passes to the breast milk. Most opioids are considered class B or C during pregnancy by the FDA, being considered D mainly in the third quarter due to the risk of neonatal withdrawal syndrome. However, it is prudent to evaluate each drug individually. Codeine is not related to the increased incidence of malformations and fetal survival rate, and it is classified as A by ADEC. Tramadol seems to be related to an increase in the incidence of malformations (clubfoot and cardiovascular defects) when used near conception, not causing significant effects when used in later stages of pregnancy. It is considered Class C by the FDA and ADEC. There are no reports of malformations related to morphine when used in the first quarter, but it should be used with caution. Newborns exposed to opioids with shorter half-lives, such as morphine, are more likely to have neonatal withdrawal syndrome. It is Class B by the FDA and C by ADEC. Transdermal fentanyl seems to be a good option for the treatment of chronic pain during pregnancy and lactation. Although it may cause neonatal withdrawal syndrome when used at high doses or close to term, it does not appear to pass to the breast milk. Most opioid treatments during pregnancy are of short duration, but women who use opioids chronically before pregnancy keep on their use, often until the term. While long-term treatment with opioids in pregnancy is not recommended, it may be necessary in the case of chronic pain or treatment of dependence. Methadone and buprenorphine may be used to prevent withdrawal syndrome.

NON-SURGICAL TREATMENTS

The use of steroids in the epidural space during pregnancy is controversial, although one dose is of low risk for the fetus. Its use is indicated in pregnant women with new symptoms, consistent with compression of the lumbar nerves (for example, unilateral loss of deep reflex, motor and sensitive alterations in the distribution of one dermatome). There are case reports describing the peridural administration of steroids in pregnant women with sciatica and signs of radicular pain with the improvement of the feeling of pain, but some evolved for the surgical treatment due to recurrence or progression of the neurological symptoms. In patients with PRLSP, the peridural analgesia seems to have a good result, given either as a single dose or for a short time interval in the periods of increased pain. However, whatever is the case, it should be considered as a temporary method of pain relief until birth. The administration of steroids and local anesthetics on the pubic symphysis and sacroiliac joints has also been reported with good analgesic response.

SURGICAL TREATMENT

The role of surgery for the treatment of PRLSP during pregnancy is limited. When indicated, it is required good coordination between the surgeon and the obstetrician. The prone position may be used in the first quarter, but in the second, the lateral decubitus for either side may be used. In the third quarter, the left lateral decubitus should be used due to the compression of the vena cava by the gravid uterus, but as of the 34th week, the pregnancy interruption should be discussed. As of the 23rd week, the fetal heart rate should be monitored.

There are reports in the literature of surgical interventions during pregnancy for the treatment of disc herniations causing neurological deficits (sensory, motor, bladder and/or intestinal alterations), including discectomy, microdiscectomy, laminectomy, and endoscopic surgery. Surgery, when well indicated, has a good success rate and a return of the function, with no increase in morbidity or mortality.

CONCLUSION

PRLSP is a common pathological condition that can occur in most pregnant women. Despite this, there are still questions about the diagnosis and proper management of this condition. On the other hand, the localization of the pain is common to other conditions, being important the search for warning signs as pain irradiating to the leg, neurological deficits (paresthesia and/ or weakness), alterations in intestinal and bladder functions, fever, amongst others. Although the clinical diagnosis is more common and adequate, in some cases, it is necessary to perform imaging tests, preferably the techniques that do not use non-ionizing radiation (ultrasound and MRI). The treatment of PRLSP is a difficult task because it is considered a normal condition during pregnancy and there is the fear that the treatment may cause changes in the pregnant woman and the fetus. One of the treatment strategies is based on prevention. When seeking effective pain management, conservative measures are more often used for obvious reasons, although these treatments typically do not show high success rates. The most commonly used drugs are paracetamol and NSAIDs. For more intense pain, opioids can be used, but they should not be administered for prolonged periods or close to the term. The use of epidural or joint blockades is being reported with good results. The surgical treatment is restricted to more severe cases but, when well indicated, it has a good success rate and the return of function, with no increase in morbidity or mortality. Thus, it is very important that health professionals know that there are safe strategies for the management of PRLSP that reduces the suffering and brings comfort to the pregnant woman.

REFERENCES

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Effects of the hyaluronic acid infiltration in the treatment of internal temporomandibular joint disorders

Efeitos da infiltração de ácido hialurônico no tratamento das desordens internas da articulação temporomandibular

Liliane Emilia Alexandre de Oliveira¹, Jandenilson Alves Brigido², Aline Dantas Diógenes Saldanha²

ABSTRACT

BACKGROUND AND OBJECTIVES: The primary protocol for the control of temporomandibular disorders prioritizes reversible and less invasive measures. However, conservative treatment is sometimes ineffective. Therefore, the use of hyaluronic acid has been suggested as a therapeutic alternative to verify the effectiveness of the hyaluronic acid in patients who are not responsive to the most conservative treatments, helping them in the control of pain. This article aims to perform a literature review on the efficacy of this substance in the treatment of internal changes of the temporomandibular joint.

CONTENT: The search strategy used the Pubmed portal and the Web of Science database for the last 10 years. We included articles in English that evaluated the efficacy of the hyaluronic acid in the intra-articular disorders of temporomandibular joint, and excluded articles from literature review, clinical case reports, theses, and dissertations. Fifteen studies, classified as randomized clinical trials, prospective and retrospective studies, case-control, pilot study, and systematic reviews were selected. The hyaluronic acid is of fundamental importance in the function and lubrication of joint tissues due to its high molecular weight. When degenerative and inflammatory changes are present, their concentration and molecular weight are diminished, and the injection of this acid raises these levels, which can generate pain relief.

CONCLUSION: Intra-articular therapy with hyaluronic acid is effective in the reduction of symptomatologic levels and the functional restoration of the temporomandibular joint.

Keywords: Hyaluronic acid, Intra-articular injections, Viscos-supplementation, Temporomandibular joint disorder.

RESUMO

JUSTIFICATIVA E OBJETIVOS: O protocolo primário de controle das disfunções temporomandibulares prioriza as medidas reversíveis e menos invasivas. Entretanto, o tratamento conservador mostra-se, algumas vezes, ineficaz, e como alternativa terapêutica, tem sido sugerido o uso de ácido hialurônico para com isso, verificar a sua efetividade em pacientes que não responsivos aos tratamentos mais conservadores e poder auxiliá-los no controle da dor. O objetivo deste estudo foi rever na literatura a eficácia dessa substância no tratamento das alterações internas da articulação temporomandibular.

CONTEÚDO: A estratégia de busca utilizou o portal eletrônico Pubmed e a base de dados Web of Science, nos últimos 10 anos. Foram incluídos artigos em inglês que avaliaram a eficácia do ácido hialurônico nas desordens intra-articulares da articulação temporomandibular, e excluídos artigos de revisão de literatura, relatos de casos clínicos, teses e dissertações. Foram selecionados 15 estudos, classificados como ensaios clínicos randomizados, estudos prospectivos e retrospectivos, caso-controle, estudo piloto e revisões sistemáticas. O ácido hialurônico tem importância fundamental na função e lubrificação dos tecidos articulares, devido ao seu alto peso molecular. Quando alterações degenerativas e inflamatórias estão presentes, sua concentração e peso molecular estão diminuídos, e a injeção desse ácido eleva esses níveis, o que pode gerar alívio da dor.

CONCLUSÃO: A terapia intra-articular com ácido hialurônico é efetiva na diminuição dos níveis sintomatológicos e no restabelecimento funcional da articulação temporomandibular.


INTRODUCTION

The temporomandibular joint (TMJ) consists of a ginglymoarthroial joint that allows hinging movements on one axle and sliding movements on another axle¹. The synovial fluid nourishes and lubricates the joint tissues, and its quality and quantity are directly related to the joint normal function and health.¹²³ Temporomandibular dysfunction (TMD) is a collective term that encompasses clinical disorders in the TMJ, chewing muscles and associated structures. Among the signs and symptoms, the individuals may have pain, limitation of the mandibular movements and clicking.¹³ The possible etiological factors are trauma in the facial structures; occlusal factors; increased emotional
stress; source of deep pain; muscle hyperactivity; parafunctional activities and orthopedic instability. TMDs of articular origin include dislocation of the disc with and without reduction, arthralgia, osteoarthritis, and TMJ osteoarthrosis.

The disc displacement of the TMJ is described as an abnormal relationship of the mandibular condyle with the joint disc, fossa and articular eminence, which can occur with and without disc reduction. TMJ arthralgia is a localized pain (of moderate to severe intensity) located in the TMJ and adjacent tissues. In osteoarthritis, there is a chronic and non-inflammatory degeneration that affects the cartilaginous tissue of the synovial joints and is associated with the remodeling processes of the subchondral bone and the involvement of the synovial tissue. TMJ osteoarthritis occurs when there is a compromise of the dynamic balance between the collapse and repair of the joint tissues.

One of the minimally invasive therapies for the control of the TMJ internal disorders is known as viscosupplementation (infiltration of hyaluronic acid in the TMJ). The hyaluronic acid (HA) is an acidic mucopolysaccharide that is present in the primary substance of animal tissues, being the major component of the synovial fluid and has vital importance in the lubrication of the articular tissues. In the degenerative and inflammatory disorders, its concentration and weight are reduced, and the HA injection elevates these levels, which may be related to pain relief since it contains anti-inflammatory effects, such as inhibition of phagocytosis, chemotaxis, prostaglandin synthesis, metalloproteinases activity, and removal of oxygen radicals from the synovial tissue.

The primary protocol to control TMD prioritizes simple, reversible and less invasive approaches. However, the conservative treatment is sometimes ineffective, and as a therapeutic alternative, the use of HA has been suggested. Thus, checking the effectiveness of the HA in patients who are not responsive to more conservative treatments can help to control their pain. Therefore, the objective of the present study was to review the literature on the efficacy of this substance in the treatment of internal changes of the TMJ.

### CONTENTS

A literature review was conducted using the Pubmed electronic portal and the Web of Science database, using the MeSH keywords: “Temporomandibular Joint Disorder”, “Hyaluronic Acid”, “Viscosupplementation” and “Injections”, “Intra-articular”. The articles were selected according to the pre-established eligibility criteria. The inclusion criteria were studies related to the effects of the HA on intra-articular changes of the TMJ; studies that reported the applicability of the HA; articles in English published in the last ten years. The exclusion criteria were literature reviews; clinical case reports; theses and dissertations; articles not available in full.

After searching the database and the electronic portal, the duplicates were removed, and the titles and abstracts were read to identify potentially eligible articles that met the inclusion criteria. The articles that met the exclusion criteria were removed from the study. It is worth mentioning that the full text of each selected article was carefully evaluated. The initial selection generated a total of 415 articles, of which 107 duplicates were removed. After being adapted to the inclusion criteria, 288 articles remained, and 15 articles were selected in full after an exploratory reading and critical analysis of titles and abstracts. The detailed selection method of the articles, according to the search mechanisms, is summarized in table 1.

The articles selected were randomized clinical trials, prospective and retrospective studies, case-control, pilot study, and systematic reviews that evaluated, primarily, the efficacy of the HA infiltration for the treatment of internal temporomandibular joint disorders. Of the 15 articles selected, 4 are systematic reviews, 2 of these were published in 2017, 2 in 2016 and 2010, respectively. The publication period ranged from 2009 to 2017. Study samples varied from 25 to 141 patients. The age of the groups of patients ranged from 17 to 65 years. In most the analyzed cases, the follow-up of the results was of short and medium term, between three and six months. Table 2 shows the selection of the studies included with their main characteristics.

### Table 1. Article selection flowchart

<table>
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<th>Search strategy</th>
<th>Articles</th>
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<tbody>
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<td>Pubmed</td>
<td>104</td>
</tr>
<tr>
<td>Temporomandibular joint disorder and viscosupplementation</td>
<td></td>
</tr>
<tr>
<td>Injections, intra-articular and temporomandibular joint disorder</td>
<td>216</td>
</tr>
<tr>
<td>Web of Science</td>
<td>54</td>
</tr>
<tr>
<td>Temporomandibular joint disorder and viscosupplementation</td>
<td></td>
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<tr>
<td>Injections, intra-articular and temporomandibular joint disorder</td>
<td>29</td>
</tr>
<tr>
<td>Articles removed</td>
<td>Duplicates: 107</td>
</tr>
<tr>
<td>15 selected articles</td>
<td>Inclusion and exclusion criteria: 33 articles excluded</td>
</tr>
<tr>
<td>Reading of titles and abstracts: 260 articles excluded</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2. Description of the studies included in the review

<table>
<thead>
<tr>
<th>Authors</th>
<th>Type of study</th>
<th>Objective</th>
<th>n</th>
<th>Diagnosis</th>
<th>Main findings</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long et al.</td>
<td>Randomized clinical trial</td>
<td>To compare HA infiltration in the lower and upper joint space</td>
<td>120</td>
<td>DDSR</td>
<td>Pain improvement in both groups</td>
<td>The intra-articular infiltration of HA in the upper and lower joint space was effective</td>
</tr>
<tr>
<td>Korkmaz et al.</td>
<td>Prospective clinical study</td>
<td>Compare the HA therapy and the treatment with the occlusal splint</td>
<td></td>
<td>DDCR</td>
<td>Better results with the HA therapy</td>
<td>The injection of HA and the occlusal splint therapy were effective in relieving the signs and symptoms of DDCR</td>
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</table>

Continue...
Table 2. Description of the studies included in the review – continuation

<table>
<thead>
<tr>
<th>Authors</th>
<th>Type of study</th>
<th>Objective</th>
<th>n</th>
<th>Diagnosis</th>
<th>Main findings</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guarda-Nardini et al.</td>
<td>Retrospective clinical trial</td>
<td>To compare the efficacy of the HA infiltration therapy in different age groups</td>
<td>76</td>
<td>Osteoarthritis of the TMJ</td>
<td>The HA was effective in most of the evaluated symptoms</td>
<td>The treatment protocol was more effective in people over 45 years of age</td>
</tr>
<tr>
<td>Li et al.</td>
<td>Randomized clinical trial</td>
<td>To compare the effects of HA infiltration in the lower and upper joint space</td>
<td>141</td>
<td>Osteoarthritis of the TMJ and DDDR</td>
<td>Improvement of TMJ function in both groups</td>
<td>The HA infiltration is an effective method for the treatment of DDDR associated with osteoarthritis</td>
</tr>
<tr>
<td>Bonotto et al.</td>
<td>Retrospective clinical study</td>
<td>Discuss the viscosupplementation in the treatment of the TMJ</td>
<td>55</td>
<td>DDDR and osteoarthritis of the TMJ</td>
<td>There was an increase in mouth opening in patients with DDDR and osteoarthritis</td>
<td>The viscosupplementation with HA is considered a good alternative to improve the function of the TMJ in the short term</td>
</tr>
<tr>
<td>Goiato et al.</td>
<td>Systematic review</td>
<td>Compare the HA injections and other drugs used in the arthrocentesis of the TMJ</td>
<td></td>
<td>Internal TMJ disorders</td>
<td>Intra-articular injections of HA are beneficial to improve the functional symptoms of TMJ</td>
<td>Positive results were observed with the HA therapy, but other therapies may be used</td>
</tr>
<tr>
<td>Iturriaga et al.</td>
<td>Systematic review</td>
<td>Analyze the efficacy of the HA</td>
<td></td>
<td>Osteoarthritis of the TMJ</td>
<td>The application of HA had positive results</td>
<td>Further research is needed.</td>
</tr>
<tr>
<td>Guarda-Nardini, Manfredini and Ferronato</td>
<td>Pilot study</td>
<td>Provide data about the effect of a cycle of five arthrocentesis plus HA infiltration</td>
<td>31</td>
<td>DDDR and arthralgia</td>
<td>Improvement regarding all variables of the study</td>
<td>Five infiltrations of HA after arthrocentesis were effective to ameliorate the DDDR symptoms</td>
</tr>
<tr>
<td>Aktas, Yalcin and Sencer</td>
<td>Retrospective clinical study</td>
<td>Analyze the prognosis of arthrocentesis with and without HA</td>
<td>25</td>
<td>DDDR</td>
<td>It is sufficient to use only arthrocentesis in patients without degenerative alterations</td>
<td>Having a standardized study group for future studies is necessary</td>
</tr>
<tr>
<td>Guarda-Nardini et al.</td>
<td>Case-control study</td>
<td>Determine the effectiveness of viscosupplementation with the HA</td>
<td>25</td>
<td>Osteoarthritis of the TMJ</td>
<td>Improvement in all outcome parameters</td>
<td>Effective therapy for pain improvement and the TMJ function</td>
</tr>
<tr>
<td>Guarda-Nardini et al.</td>
<td>Retrospective clinical study</td>
<td>Evaluate the effect of viscosupplementation with HA</td>
<td>49</td>
<td>Osteoarthritis</td>
<td>Significant reduction of pain over time</td>
<td>Further studies are required</td>
</tr>
<tr>
<td>Guarda-Nardini et al.</td>
<td>Retrospective clinical study</td>
<td>Evaluate the efficacy of the HA in elderly patients</td>
<td>50</td>
<td>Osteoarthritis of the TMJ</td>
<td>Significant improvement of signs and symptoms</td>
<td>There was no significant difference between the groups</td>
</tr>
<tr>
<td>Guarda-Nardini et al.</td>
<td>Randomized clinical trial</td>
<td>Compare the efficacy of a single session protocol with a five-session protocol of HA infiltration in the TMJ</td>
<td>30</td>
<td>Osteoarthritis of the TMJ</td>
<td>There was greater reduction of pain in the group treated with the 5-session protocol of HA infiltration</td>
<td>The five-session protocol showed better results in 6 months</td>
</tr>
<tr>
<td>Manfredini, Piccotti and Guarda-Nardini</td>
<td>Systematic review</td>
<td>Evaluate the clinical studies on HA infiltration in the TMJ</td>
<td></td>
<td>TMJ disorders</td>
<td>All studies reported a decrease in pain levels</td>
<td>The results are similar to those obtained with corticosteroid injection and the use of occlusal splints</td>
</tr>
<tr>
<td>Manfredini et al.</td>
<td>Prospective randomized clinical trial</td>
<td>Evaluate the efficacy of 100 platelet-rich plasma with growth factors injection versus HA</td>
<td>Internal TMJ disorder and osteoarthritis</td>
<td>The group treated with platelet-rich plasma with growth factors injection had better results</td>
<td>The injection of platelet-rich plasma with growth factors after arthroscopy has shown to be more effective than the HA injection in patients with internal TMJ disorders</td>
<td></td>
</tr>
</tbody>
</table>

n = number of patients; TMJ = temporomandibular joint; HA = hyaluronic acid; DDDR = anterior disc displacement without reduction; DDDR = anterior disc displacement with reduction.
DISCUSSION

In its first reports, the HA was used to treat racehorses diagnosed with traumatic arthritis. It was later used in humans to treat osteoarthritis involving larger joints such as knees, hips, and shoulder\(^1\). In 1979, it was first used in intracapsular changes of the TMJ\(^16,19,22\), and since then some studies have tried to evaluate the efficacy of the technique as well as to establish a protocol for its use\(^20\). Its metabolic activity contributes to cell renewal and facilitates the nutrition of the avascular areas of the disc and the articular cartilage due to its combination with the glycosaminoglycans originated by proteoglycans\(^3,19\).

Viscosupplementation consists of intra-articular infiltration of HA in the TMJ\(^17\) to eliminate or reduce the symptomatic levels and restoring the masticatory function by qualitative and quantitative enhancement of the synovial fluid\(^16,17\), mainly because of the metabolic and mechanical properties of the HA\(^3\). Viscosupplementation alone or in combination with other modalities such as arthrocentesis is being considered a treatment option for inflammatory or biomechanical changes of the TMJ\(^18,20\).

It is believed that the decrease of painful symptoms with viscosupplementation may occur by the blockade of endogenous receptors and pain substances in the synovial tissues\(^16,18\). The infiltration of HA can improve or normalize the functionality of the TMJ by disrupting the adhesions or adherences between the mandibular fossa and the articular disc\(^16,17,22\). Moreover, it may decrease the secondary wear allowing better perfusion of nutrients and metabolites of the synovial fluid to the vascular tissues\(^17\). Although the HA is kept in the joint only for a few days, results last for months\(^18,21\). The low molecular weight of the HA molecules showed the best in vivo results and are more likely to induce the synthesis of the endogenous HA\(^19,20\). However, products that have a high molecular weight are less able to pass into the intracellular environment\(^17,20,21\) and ends up precluding their action on the synoviocytes and chondrocytes, which is necessary for the reduction of the synovial inflammation and the restoration of the properties of the synovial fluid\(^19\).

A systematic review conducted by Iturriaga et al.\(^14\) evaluated the regulation of inflammatory mediators when applying HA in patients with TMJ osteoarthritis (OA). The results showed that the application of HA had a positive effect on the regulation of the inflammatory mediators. The mediators studied were plasminogen, activating system, and nitric oxide levels. The evidence available suggested that the application of HA regulates several inflammatory mediators in osteoarthritic processes in the TMJ. However, the authors stated that further evidence is needed in this regard, through the study of specific TMJ diseases, complementing the evaluation of clinical parameters with quality experimental studies with larger sample sizes.

In this context, the efficacy of the HA treatment was also evaluated by Guarda-Nardini, Ferronato and Manfredini\(^5\), but in patients with different age groups diagnosed with OA. From this study, it was suggested that the protocol of treatment applied until then was more effective in older patients. In the study conducted by Long et al.\(^3\), 120 patients diagnosed with disc displacement without reduction (DDSR) received an HA infiltration. One group of patients received injections in the upper joint space, and the other group was treated with injections in the lower joint space. The clinical symptoms were evaluated at the follow-up visits of 3 and 6 months. The parameters evaluated were maximum mouth opening (MMO), pain intensity on a visual analog scale (VAS) and the Helkimo’s clinical dysfunction index. The MMO, VAS, and Helkimo index of the two groups improved significantly, with no difference between the groups.

In agreement with the study by Long et al.\(^3\), Bonotto et al.\(^12\) discussed the viscosupplementation technique in the treatment of internal TMJ alterations in 55 patients with disc displacement with reduction (DDCR) and DDSR. The results showed a significant increase in mouth opening in all groups. These results remained constant over four months of follow-up, and the authors stated that the viscosupplementation with HA could be a good alternative, in the short-term, to the functional restoration of the TMJ in patients with internal TMJ alteration that did not respond to conservative treatments.

With the study by Li et al.,\(^11\) it was possible to compare the effect of the HA injections in the upper and lower joint space in patients diagnosed with DDSR in association with OA by cone beam computed tomography. It showed that the HA injections in the upper and lower joint space are effective methods to treat DDSR in association with OA, corroborating previous studies using the HA in the treatment of degenerative alterations and DDSR and DDCR of the TMJ\(^12\).

Korkmaz et al.\(^7\) compared the effectiveness of single and double infiltrations of HA and the therapy with an occlusal splint to treat DDCR. The patients were divided into four groups: control (group 1), single HA injection (group 2), double HA injection (group 3) and therapy with an occlusal splint (group 4). The results showed functional improvement and a decrease in the pain symptoms in all groups, but the patients who underwent the HA therapy had better results. Thus, they concluded that the HA is more effective in improving the clinical signs and symptoms of DDCR than the occlusal splint therapy.

Accordingly, Guarda-Nardini, Manfredini and Ferronato\(^15\) evaluated the short-term effect of a weekly cycle of five arthrocentesis associated with HA injections to control the signs and symptoms of 31 patients with DDCR. At the end of the treatment, there was a significant improvement over baseline in all variables analyzed and maintained for three months of follow-up. Thus, they concluded that a cycle of five weekly injections of HA performed immediately after arthrocentesis, is effective in improving the signs and symptoms of DDCR.

Goiato et al.\(^13\) conducted a systematic review to investigate whether intra-articular injections of HA are more effective than other drugs used in TMJ arthrocentesis and showed that intra-articular injections of HA are beneficial in the control of pain and the functional symptoms of TMD. However, corticosteroids and nonsteroidal anti-inflammatory drugs can be used with satisfactory results.

Manfredini et al.\(^22\) evaluated the efficacy of platelet-rich plasma in growth factor (PRGF) versus HA injection after arthroscopic surgery in patients with OA. Group A (n=50) received a PRGF injection, and Group B (n=50) an HA injection. The mean age
was 35.5 years (ranging from 18 to 77 years), and 88% of the patients were women. The pain intensity (VAS) and maximum mouth opening before and after the procedure were analyzed statistically. The best results were observed in the PRGF treated group, with a significant reduction in pain at 18 months compared to patients treated with HA. Regarding mouth opening, there was an increase in both groups, with no significant difference, besides an improvement in the functional capacity of the group treated with PRGF.

Some early studies supported the efficacy of HA injections to treat internal TMJ disorders. However, recent evidence suggests that it may also be effective in inflammatory and degenerative disorders, especially if it is associated with arthrocentesis. These considerations allowed widening the indications for HA injections to a broader range of TMDs.

CONCLUSION

Most of the studies analyzed showed that the intra-articular infiltration of HA is an effective treatment, both in short and medium terms, for the internal alterations of the TMJ provided that a correct diagnosis is made, and the patient has not responded successfully to the more conservative therapies. HA infiltration can eliminate or diminish the levels of the symptoms and restore the function through the qualitative and quantitative improvement of the synovial fluid.

REFERENCES

Hydrotherapy and crenotherapy in the treatment of pain: integrative review

ABSTRACT

BACKGROUND AND OBJECTIVES: The Integrative and Complementary Practices were implemented in the Unified Health System as adjunctive modalities in the treatment of pain. This article focuses on crenotherapy and hydrotherapy, whose agents are the natural mineral waters and common for the rehabilitation of functional alterations. The scarcity of these practices for the treatment of pain in the literature justifies this review. This study aimed to check the scientific productions about the efficacy of balneology/balneotherapy/crenoterapy and hydrotherapy in the treatment of pain.

CONTENTS: It is an integrative review, carried out in May 2018, searching in the electronically available scientific articles, in full, in the LILACS, Pubmed, BVS and CINAHL database in periodicals published in the last 10 years focusing on crenotherapy and hydrotherapy for pain relief, in the Portuguese, English and Spanish language. The descriptors used were: “Pain”, “Balneology”, “Crenotherapy”, “Hydrotherapy” “Efficacy”; “Effectiveness” in the three languages, combined with the Boolean expressions AND/ Y/E and OR/O/U/OU, finding 2306 articles, of which 111 were identified, and only 27 met the inclusion criteria, analyzed and incorporated the evidence that emerged in pain relief.

CONCLUSION: This study showed that most of the evidence emerged from the studies analyzed regarding the efficacy of hydrotherapy and balneology in pain pictures focused on levels 1 to 3. Of the 27 studies, 18 showed the efficacy of hydrotherapy and eight of balneology in the pain symptomatology and one in relation to the lack of knowledge of the use of these complementary therapies in pain relief.

Keywords: Balneology, Balneotherapy, Crenotherapy, Efficacy, Hydrotherapy, Pain.

RESUMO

JUSTIFICATIVA E OBJETIVOS: As Práticas Integrativas e Complementares foram institucionalizadas no Sistema Único de Saúde como modalidades coadjuvantes no tratamento da dor. Este artigo focalizou a utilização de crenoterapia e hidroterapia, cujos agentes são as águas minerais naturais, comum para a reabilitação de alterações funcionais. A escassez da literatura dessas práticas no tratamento da dor justifica esta revisão. O objetivo deste estudo foi verificar a produção científica sobre a eficácia da balneologia/balneoterapia/crenoterapia e da hidroterapia no tratamento da dor.

CONTEÚDO: Revisão integrativa, realizada em maio de 2018, cuja busca de artigos científicos disponíveis eletronicamente e na íntegra, na base de dados, LILACS, Pubmed, BVS e CINAHL em periódicos publicados nos últimos 10 anos enfocaram a crenoterapia e hidroterapia para o alívio da dor nos idiomas Português, Inglês e Espanhol. Os descritores utilizados foram: Dor, Balneologia, Crenoterapia, Hidroterapia, Eficácia; nos três idiomas, combinados com as expressões booleanas AND/Y/E e OR/O/U/OU encontrando 2306 artigos, identificados 111 e destes, apenas 27 atenderam aos critérios de inclusão, analisados e incorporadas as evidências emergidas no alívio da dor.

CONCLUSÃO: Este estudo mostrou que a maioria das evidências emergidas dos trabalhos analisados quanto à eficácia da hidroterapia e crenoterapia em processos algícos concentraram-se nos níveis 1 a 3. Dos 27 estudos, 18 mostraram a eficácia da hidroterapia e oito da balneoterapia e crenoterapia nos sintomas dolorosos, e um em relação ao desconhecimento do uso dessas práticas integrativas no alívio da dor.

Descritores: Balneologia, Balneoterapia. Crenoterapia, Dor, Eficácia, Hidroterapia.

INTRODUCTION

In 2002, the World Health Organization (WHO)¹ established the Pain Management Protocol for the relief of pain and in the document “WHO Traditional Medicine Strategy 2002-2005” recognizing the importance, efficacy, and quality of Complementary Medicine, encouraging the integration of their knowledge to those of the Western Medicine in health systems. The text of this Strategy continues with the encouragement of the use of Integrative and Complementary Practices (PICS) for the development of access policies, for rational, responsible, safe practice and at the same time, recommending the development of studies that validate them¹.
The PICS were institutionalized in the Unified Health System (SUS) by the National Policy on Integrative and Complementary Practices (PNPIC), approved by Ordinance GM/MS No. 971/5/3/2006. The purpose of the Ministry of Health (MS) is to offer the Brazilian population access to PICS by standardizing them to meet the demands of the public health network, being transversal in its actions in the Unified Health System (SUS), and present at all levels of health care, making available to the population modalities to follow: aromatherapy, art therapy, ayurveda, bio-dance, bioenergetics, family constellation, chromotherapy, circular dance, geotheraphy, hypnotherapy, homeopathy, imposition of hands, anthroposophic medicine/anthroposophy, applied to health, Traditional Chinese Medicine – acupuncture, auriculo-therapy, meditation, music therapy, naturopathy, osteopathy, ozone therapy, phytotherapy, reflexotherapy, reiki, shantala, integrative community therapy, floral therapy, social thermalism/cryotherapy and yoga. Except for acupuncture, that is minimally invasive; the others are characterized by non-invasive interventions and an important rebalancing of the physical, mental, and emotional energies. These PICS help the pharmacological treatment and alleviate the suffering caused by pain, considered one of the great public health problems, improving the quality of life (QoL). Pain is a symptom frequently present in the patient and requires physical, psychosocial, and psychoemotional evaluation determining the agent of his/her suffering by the multiprofessional team.

This article will specifically focus on the use of hydrotherapy (HT) (common water) and crenotherapy (CT) (thermal water) for pain relief, which have water as an essential element. The different modes of therapeutic application of water receive the names of social ther- malism, balneotherapy (BT), thalassotherapy, CT, and HT. The BT/CT designation refers to the therapeutic use of natural mineral waters whose chemical composition can be classified as sulphurated, radioactive, bicarbonate, ferruginous, among others, for the prevention, treatment, and rehabilitation of various diseases. It is a millenary practice introduced in Brazil by the Portuguese empire for the treatment of several organic signs and symptoms of patients, as a complementary therapy to other treatments.

The BT/CT designation refers to the therapeutic use of natural mineral waters whose chemical composition can be classified as sulphurated, radioactive, bicarbonate, ferruginous, among others, for the prevention, treatment, and rehabilitation of various diseases. It is a millenary practice introduced in Brazil by the Portuguese empire for the treatment of several organic signs and symptoms of patients, as a complementary therapy to other treatments.

HT consists of the external and therapeutic use of common water with different application and temperature forms. It is an important resource for the rehabilitation of functional alterations, having as a principle the physical, chemical, physiological, and kinesiological effects obtained by immersion of the body in a swimming pool, usually heated. Exercises in the heated water improve joint movement, relaxation, reduction of muscle tension, muscular spasms, an increase of muscle strength and endurance, besides benefiting the venous return, improving peripheral circulation and favoring the decrease of pain.

HT and CT do not present associated risks, being a convenient method, but they must be used with discretion, responsibility, and performed by trained professionals. HT and CT, although they are millenarian therapeutic methods, like PICS used for the treatment of pain, seem to have been little contemplated in scientific studies in the national and international literature. This study aimed to evaluate the efficacy of CT and HT in the treatment of pain through an integrative review of the literature.

CONTENTS

It is an integrative review that allows the search, the critical evaluation, the synthesis, analysis, and incorporation of the evidence of the national and international scientific productions emerged from the subject investigated, with a retrospective temporal cut, respecting the copyright of the literature used, according to Law No. 9610/1998 of the Ministry of Education and Culture (MEC).

After, the following steps were followed: 1. establishment of the guiding question; 2. objective; 3. criteria for inclusion and exclusion of articles; 4. information extracted from selected articles; 5. analysis and presentation of the studies. The guiding question was: “How does national and international scientific production evaluate the efficacy of HT and BT/CT in pain therapy?”

The databases used were: Latin American and Caribbean Health Sciences Literature (LILACS), Virtual Health Library (VHL); Cumulative Index to Nursing and Allied Health Literature (CI-NAHL) and National Library of Medicine (Pubmed) using controlled descriptors from the Health Sciences Descriptors (DeCS) and the Medical Subject Headings (MeSH), “dor (pain)” or “dolor (dolor)” or “eficácia (efficacy/effectiveness)” or “efetividade (effectiveness)” or “hidroterapia (hydrotherapy)” or “crenoterapia (crenotherapy)” and “hidroterapia (hydrotherapy)” (HT). Also used an uncontrolled descriptor: hidroterapia (crenotherapy) two or more DeCS/MeSH among those mentioned were combined and the Boolean expressions E/AND/Y/ and OU/OR/O/U (Table 1).

<table>
<thead>
<tr>
<th>EB</th>
<th>Combination of the descriptors with Boolean expressions used in the search strategy (EB)</th>
</tr>
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<tbody>
<tr>
<td>1a</td>
<td>Balneoterapia e dolor (balneology, balneologia and/y pain/dolor)</td>
</tr>
<tr>
<td>2a</td>
<td>Crenoterapia e dolor (crenotherapy/and/y pain/dolor)</td>
</tr>
<tr>
<td>3a</td>
<td>Hidroterapia e dolor (hydrotherapy/and/y pain/dolor)</td>
</tr>
<tr>
<td>4a</td>
<td>Balneoterapia e dolor ou crenoterapia e dolor (balneology balneologia and/y pain or crenotherapy and/y pain, dolor)</td>
</tr>
<tr>
<td>5a</td>
<td>Balneoterapia e dolor e eficácia ou crenoterapia e dolor e eficácia (balneology and pain, dolor and efficacy or effectiveness or crenotherapy and/y efficacy or effectiveness, or eficácia, efetividade and/y pain, dolor)</td>
</tr>
<tr>
<td>6a</td>
<td>Hidroterapia e dolor (hydrotherapy, and pain, hidroterapia dolor)</td>
</tr>
<tr>
<td>7a</td>
<td>Hidroterapia e dolor e eficácia ou terapia aquática, dolor e eficácia ou (hydrotherapy and pain, dolor and efficacy or effectiveness, eficácia, efetividade).</td>
</tr>
</tbody>
</table>

The review period was from May 2008 to May 2018, seeking to cover more recent studies of CT and HT and its efficacy in pain relief. The inclusion criteria were: scientific papers in English, Spanish and Portuguese available electronically and excluded editorials, letters, theses, dissertations, monographs, manuals, abstracts of congresses; articles duplicated in more than one database, counting only one; or that did not address the research question, the objective and descriptors.

After the critical and careful reading of the abstracts and a posteriori, of the complete articles, the information was organized and recorded in a specially structured form, composed to identify title, author, year of publication, objectives, methods and...
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results of articles analyzed, including or excluding them for the analysis, presentation of the main results and classification of the emerging evidence.

The precepts of the PRISMA checklist, 2009\textsuperscript{11} were considered to analyze meta-analyzes and systematic reviews that guide the eligibility, inclusion of articles, and the level of scientific evidence (LE), favoring the preparation of figure 1.

The search was carried out independently by 2 reviewers who after the refinement of the searches, classified the quality, scientific validity, and reliability of the articles by the Level of Evidence (LE)\textsuperscript{12,13}, that is, level 1: the evidence from systematic review or meta-analysis of relevant randomized controlled trials or from clinical guidelines based on systematic reviews of randomized controlled trials; level 2, evidence derived from at least one well-delineated randomized controlled trial; level 3, evidence obtained from well-delineated non-randomized controlled trials; level 4, evidence from well-delineated cohort and case-control studies; level 5, evidence originating from a systematic review of descriptive and qualitative studies; level 6, evidence derived from a single descriptive or qualitative study; level 7, evidence from the opinion of authorities and/or report of expert committees\textsuperscript{12,13}.

The analysis of table 2 shows that of the 1,160 articles screened in the databases, 1,049 were excluded because they did not meet the inclusion criteria, with 111 articles remaining eligible. After the evaluation of the full text, 84 were excluded, of which only 27 were included. One article (3.7%) was found in VHL (IBEC), and five articles (18.5%) were found in LILACS, none in CINAHIL database and 21 (77.8%) in Pubmed from a total of 27 analyzed.

**Figure 1. Flowchart with eligibility representation and inclusion of articles**

**Table 2. Summarized registry of titles, author, periodical, year, database, objectives, method, and results**

<table>
<thead>
<tr>
<th>Articles</th>
<th>Authors and database</th>
<th>Type of studies and n</th>
<th>Synthesis</th>
<th>Conclusion</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Ceylan e Bolşık\textsuperscript{14}</td>
<td>Crossover design, experimental, randomized controlled trial. n=35</td>
<td>35 socio-demographically homogeneous premature infants with 33-37 weeks’ gestation with a birth weight &lt;1,500 g in the NICU were selected from a public hospital in Denizli, Turkey. Two bath methods: 20 babies of the Experimental Group wrapped with tissue (EG) and 15 wrapped with a sponge of the Control Group (CG) were applied at intervals of 3 days. Vital signs and oxygen saturation levels were measured before and at minutes 1, 5, 15, 30 after bathing. The mean water temperature was 37.76±0.16°C for CG and 37.58±0.8°C for EG. Video-recorded baths evaluated pain and stress behaviors by independent observers. p&lt;0.05 was used for all statistical analysis; excluded babies with signs of infection, neurological problems, skin integrity, congenital defects, deterioration, use of analgesic drugs, sedatives or muscle relaxants. The bath application sequence was computer-randomized (Predictive Analytics Software, SPSS Inc., Chicago, IL, USA).</td>
<td>The baby’s bath wrapped with fabric has a positive effect on the baby’s vital signs, oxygen saturation levels, cry time, and level of stress and pain compared to the condition of the common bath. The pain scores of the babies during and after the tissue baths were smaller (p = 0.001) than the standard baths. Baby bath wrapped in fabric is a harmless and safe nursing practice</td>
<td>2</td>
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</table>

Continue...
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>Avila et al.(^{15}) Pubmed</td>
<td>Experimental before and after, non-randomized. n=20</td>
<td>20 women with fibromyalgia syndrome with pain and restriction of three-dimensional scapular movement underwent 3 evaluation sessions, one before, one after 8 weeks and at the end of 16 weeks of a hydrotheraphy treatment program with 2 sessions of 45 min/weekly/16 weeks. Data were analyzed by ANOVA for pain and quality of life variables. The effect on the scapular movement evaluated by Cohen's coefficient d. The pain intensity by VAS=8 at the time before compared with evaluations 2 and 3 at the time after, evolved to zero intensity.</td>
<td>The proposed HT program was effective in improving quality of life, pain intensity (p&lt;0.05), reflecting the improvement of the scapular movement from -1.93 to 1.61 and the impact of fibromyalgia in women with this disease.</td>
<td>3</td>
</tr>
<tr>
<td>A3</td>
<td>Batten et al.(^{16}) Pubmed</td>
<td>Experimental, non-randomized, before and after. n=43</td>
<td>The normal postpartum HT protocol without drug use was aimed at relieving the pain of 45 women who were immersed in hot water for 30 minutes and 1 hour postpartum. The pain scores were evaluated before the bath, 15 and 30 minutes later. There was a significant reduction in scores.</td>
<td>This treatment significantly reduced VAS pain = 8 between the onset of the bath and 2 (p&lt;0.001) at 15 and 30 minutes and (p=0.97) between the two times. It offered a non-pharmacological alternative, in which there are traditionally limited options.</td>
<td>3</td>
</tr>
<tr>
<td>A4</td>
<td>Cipriano and Oliveira(^{17}) LILACS</td>
<td>Experimental, prospective, non-randomized controlled trial. n=20</td>
<td>The authors verified the influence of elastic bandaging in the treatment of posterior pelvic pain and functionality in the activities of the daily life of pregnant women. It is a controlled and prospective clinical trial with 20 pregnant women, 10 in each group, aged between 18 and 39 years old: experimental group (EG) (elastic bandage and HT) and control group (CG) (HT). The pain was evaluated by the numerical visual scale (NVS) and the functionality through the Rolland-Morris disability questionnaire.</td>
<td>They concluded that there was no statistical difference between the two groups (p&lt;0.05) with these two evaluation instruments for the treatment of posterior pelvic pain and the improvement of functionality in daily activities in pregnant women. An elastic bandage can be used to treat low back pain during pregnancy safely.</td>
<td>3</td>
</tr>
<tr>
<td>A5</td>
<td>Matsumoto et al.(^{18}) Pubmed</td>
<td>Meta-analysis n=102</td>
<td>Meta-analysis performed in the databases: Medline, Embase, Cochrane Library and in the database of the Japan Medical Abstracts Society using two approaches, MeSH terms (Medical Subject Headings) and free words published from 2004 to 12/31/2016 in the English or Japanese languages of randomized controlled trials of 102 publications involving 734 patients(359 EG and 375 CG), analyzing the effect of balneotherapy/crenotherapy (BT/CT) for the treatment of pain, stiffness and improvement of physical function compared to patients with osteoarthritis of the knee lasting ≥2 weeks. The Osteoarthritis Index (WOMAC) and VAS for pain were used. They analyzed the improvement in the WOMAC score in the final follow-up ranging from 2 to 12 months postintervention.</td>
<td>This meta-analysis indicated that BT/CT was clinically effective in relieving pain, stiffness, and improvement of function, as evaluated by the WOMAC score, compared to controls with high heterogeneity (88 to 93%).</td>
<td>1</td>
</tr>
<tr>
<td>A6</td>
<td>Vanderlaan(^{19}) Pubmed</td>
<td>Retrospective cohort study, n= 164</td>
<td>The use of HT for pain management in labor in 268 participants. Of these, 80 were excluded by medical decision, and 24 evolved to pharmacological treatment. The mean duration of immersion use was 156.3min±122.7 at T ≤37°C.</td>
<td>The induction of labor was associated with a decline in the supply of HT during labor provided comfort, besides being a non-pharmacological strategy, low cost, safe and effective, promotes normal delivery.</td>
<td>4</td>
</tr>
</tbody>
</table>

**Table 2. Summarized registry of titles, author, periodical, year, database, objectives, method, and results – continuation**
### Table 2. Summarized registry of titles, author, periodical, year, database, objectives, method, and results – continuation

<table>
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<th>Articles</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>A7</strong> Koyuncu et al.</td>
<td>Pubmed</td>
<td>Experimental randomized controlled trial, n=60</td>
<td>The authors investigated the efficacy of BTCT in relieving chronic neck pain of 60 patients, randomized into two groups: experimental (EG) (n=30) and control (CG) (n=30). All patients in both groups were treated with a physiotherapy program (FT) of 15 standard sessions consisting of hot pack, ultrasound and TENS. The EG patients were also treated by the BT/CT program of 15 sessions lasting 20 minutes/day. VAS, modified neck disability index (mNDI) and Nottingham health profile score (NHT) were used for all patients, being evaluated at three different times as pretreatment, posttreatment and the third week after treatment. The 2 groups were homogeneous both socioeconomically and clinically. Intergroup analysis revealed the superiority of EG in all parameter.</td>
<td>The authors conclude that combined therapy of BT/CT and FT provided clear clinical improvement and remains long-term. All EG parameters were superior to FT alone in reducing pain and improving the quality of life of patients with chronic neck pain.</td>
<td>2</td>
</tr>
<tr>
<td><strong>A8</strong> Branco et al</td>
<td>PubMed</td>
<td>Experimental, blinded, randomized controlled trial, n=140</td>
<td>140 adult patients of both genders were evaluated for the efficacy of hot sulfurous (AS) and non-sulfurous waters (ANS) in the treatment of knee osteoarthritis (OAK). Randomized in three groups: AS group (n=47), ANS (n=50) and control group pharmacological treatment (n=43). The AS group received 30 individual thermal baths (three baths/20min/week for 10 weeks) at 37-39 °C. The pain was measured by the VAS, physical function Index WOMAC; Lequesne Algo functional Index, LAFI; Stanford Health Evaluation Questionnaire (SHAQ) and analgesic drug use. The patients were evaluated before treatment (T1), at the endpoint of treatment (T2) and two months after intervention (T3). The significance level (p&lt;0.05) for intra and intergroup comparisons.</td>
<td>Pain intensity decreased significantly during movement, at rest and at night, as well as analgesic use, with even better WOMAC, LAFI and HAQ scores from baseline to T2 and T3 (p&lt;0.001). Both AS and TM methods were effective in the treatment of OAK. AS baths produced a good impact of clinical rehabilitation in reducing pain and improving physical function in OAK patients.</td>
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<td><strong>A9</strong> Kümpel et al</td>
<td>LILACS</td>
<td>Before and after experimental, non-randomized controlled trial, n=26</td>
<td>A prospective study, in which 26 patients with knee osteoarthritis (OAK) received hydrokinesitherapy treatment, 2 times/week with a duration of 50 minutes each session in 4 phases: warm-up, stretching, strengthening and relaxation. They were evaluated before and after treatment, using goniometric evaluation, pain=VAS, and Six-Minute Walk Test.</td>
<td>There was an improvement in the ability to perform ADL and physical capacity, as well as a decrease in pain with a mean pre-treatment of 8.9±1.2 and 5.1±1.7 (p&lt;0.0001) and significant improvement in capacity to increase range of movement.</td>
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<td><strong>A10</strong> Fonseca et al</td>
<td>Pubmed</td>
<td>Before and after, non-randomized controlled trial, n=4</td>
<td>Four athletes with age = 24.0±3.6 years old, mass=78.4±2.4kg, body fat =13.1±3.6% were randomly selected for post-training recovery using HT (6.0°C±0.5°C) for 19 min; the control group received a passive recovery. All completed the study. Serum levels of lactate dehydrogenase, creatine phosphokinase, LDH, aspartate aminotransferase, and alanine aminotransferase were measured; muscle pain and recovery perceived by VAS and muscular power of the upper and lower limbs in the pre-workout, post-recovery, 24 and 48 hours. Significance level p &lt;0.005.</td>
<td>HT decreased muscle pain (3.1±1.0 versus 1.5±1.1 (p=0.004) and improved post-workout recovery, increased muscle strength compared to passive recovery (p=0.0058), LDH levels were lower than those in the control group (p=0.03). Higher perceived muscle power in HT than in control for both upper limbs p=0.001, HT has been widely applied as a recovery method; however, there are few publications demonstrating the evidence of its efficacy.</td>
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<td>A11</td>
<td>Forestier, Erol Forestier and Francon</td>
<td>Systematic review of randomized experimental studies</td>
<td>n=36</td>
<td>A review of 36 randomized controlled trials covering 2833 patients with high heterogeneity (88 to 93%) showed that HT and CT treatment performed in SPA centers in Europe and the Middle East seem to improve pain and the function of patients with OAK. When CT is associated with exercise program demonstrates superiority to home exercise only for pain and function at 3, 6 and 9 months with no difference in the quality of life and drug consumption.</td>
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<td>A12</td>
<td>Chen et al.</td>
<td>Meta-analysis</td>
<td>n=15</td>
<td>Chinese herbal bath therapy may be effective in reducing OAK pain (mean difference -0.59 points, p&lt;0.00001), when compared to standard Western treatment. No serious adverse events have been reported.</td>
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<td>A13</td>
<td>Ezheltha Suji and Sharmila Jansi Rani</td>
<td>Before and after experimental, non-randomized controlled trial.</td>
<td>n=60</td>
<td>There was a significant association between age, disease duration, family history of osteoarthritis, physical mobility, and any condition associated with osteoarthritis and the level of pre-test pain among patients. The results showed that foot bath (0.52) had a better effect on reducing joint pain in knees and ankles than in exercises (1.20) (p &lt;0.001). (1.20) (p&lt;0.001).</td>
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<td>A14</td>
<td>Ibarra Cornejo et al.</td>
<td>Systematic review of experimental, randomized controlled trials</td>
<td>n=6</td>
<td>The authors inferred that the primary studies included showed strong evidence that HT was effective in reducing pain in all (mean p&lt;0.003) and improved quality of life and physical function in patients with osteoarthritis of the knee at 6 to 12 weeks of follow-up</td>
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<td>A15</td>
<td>Karagülle and Karagülle</td>
<td>Systematic review of randomized controlled trials n=8</td>
<td>The objective was to evaluate the recent evidence on the efficacy of BT and SPA therapy for patients with low back pain. The databases for RCT published in Pubmed and Cochrane Central Register between 07/2005 and 12/2013. The Jadad scale was used to classify the methodological quality of eligibility, and of the total of 114, left 8, being three with scores&gt; 3, indicating good quality. All trials tested the efficacy of BT/CT versus common water in SPA for low back pain. Of the 8 RCTs: 2 in BT and 6 in SPA therapy.</td>
<td>Evidence from all RCTs indicates that the efficacy of BT/CT in low back pain is encouraging and reflects the consistency of previous evidence. All reported that BT/CT was superior in long-term therapy with tap water in pain reliever. Although when SPA therapy is combined with CT, geotherapy and/or exercises, and/or education is effective in the treatment of low back pain, it is superior or equally effective to short- and long-term control treatments.</td>
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<td>A16</td>
<td>Liu et al.</td>
<td>Experimental, non-randomized controlled trial. n=108</td>
<td>108 healthy primiparous women with single gestations in labor in China were studied. Of these, 80 progressed to normal delivery, 38 (EG) (mean of 28.66 ± 3.08 years old) were immersed in water maintained at 35-38°C and 70 (CG) (mean of 27.89 ± 2.99 years old) underwent conventional labor. Pain scores were evaluated (VAS) when cervical dilatation was 3 cm before entering the bathtub, and 30 and 60 min after.</td>
<td>The authors concluded that immersion of water during labor reduces pain with lower scores than in the control group at 30 min and 60 min after cervical dilatation of 3 cm respectively in both, p &lt;0.001). The symptoms of stress urinary incontinence (SUI) at 42 days postpartum were also higher in the CG (25.5% to 6.1% (EG) p = 0.035 and the rate of cesarean section was lower (p=0.026). There was no significant difference (p&gt;0.05) in the duration of labor and postpartum bleeding and Apgar Index.</td>
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<td>A17</td>
<td>Baena-Beato et al.</td>
<td>Experimental, randomized controlled trial n=49</td>
<td>To understand the physical and psychological factors and reduction of disability after the aquatic/HT exercise of 49 patients of both genders sedentary with chronic low back pain. The patients were randomized: in EG-E1 (n=24, two months, five times/week) and CG (n=25) according to the aquatic space program.</td>
<td>The authors concluded that the two-month intensive program of high-frequency (five times/week) HT significantly decreased levels of chronic low back pain and increased the mobilization of sedentary people; there were no changes in the standardized mental component (p&lt;0.114); increased quality of life (p&lt;0.001) and improved body composition and physical fitness of p&lt;0.01 of EG. The CG did not present a significant change in any parameter.</td>
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<td>A18</td>
<td>Baena-Beato et al.</td>
<td>Before and after, experimental, non-randomized controlled trial n=60</td>
<td>Sixty patients were included 30 of each gender; between 50 and 60 years old; body mass index, between 21 and 27 kg/m² with chronic low back pain. The 8-week aquatic/HT therapy program was conducted in a 25×6m indoor pool, 140cm deep and 30/31°C of T of water, and patients exercised 2 to 5 days/week. Each session lasted from 55 to 60 minutes, (10 minutes of warm-up, 20 to 25 minutes of aerobic exercises, 15 to 20 minutes of resistance exercises, and 10 minutes of recharge).</td>
<td>Significant correlations were found between change in disability and VAS (resting, flexion and extension), curl-up and ranged from -0.353 to 0.582, all other parameters p &lt;0.01. Significant predictors of change in disability after treatment were improvement of resting pain, flexion and extension and abdominal muscle resistance with HT.</td>
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Table 2. Summarized registry of titles, author, periodical, year, database, objectives, method, and results – continuation

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<td>A19</td>
<td>Bender et al., Pubmed</td>
<td>Meta-analysis n=18</td>
<td>A meta-analysis of randomized controlled trials with Hungarian hot springs, published between 1989 and 2012 in the Pubmed, Web of Science, Scopus, PEDro and Web of Knowledge databases. A total of 122 studies were identified, and 18 clinical trials were included. Of these, 5 evaluated the effect of HT and CT on chronic low back pain, 4 on OAK and 2 on hand osteoarthritis and 1 evaluated BT/CT on chronic pelvic inflammatory diseases, the others verified its effect on several laboratory parameters.</td>
<td>CT significantly reduces pain caused by different musculoskeletal diseases, regardless of the qualitative and quantitative composition of mineral water, evidencing the beneficial effect of CT in pain with weight support and at rest in patients with joint and degenerative spinal diseases, as well as, in chronic pelvic inflammatory disease and antioxidant states.</td>
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<td>A20</td>
<td>Larmer et al., Pubmed</td>
<td>Systematic review of randomized controlled trials, n=24</td>
<td>A systematic review was conducted at databases: EBSCO Health Databases (including Medline, CINAHL and SPORT Discus and Ovid), AMED Aliado and Complementary Medicine, Scopus, Cochrane Library and PEDro including only randomized controlled trials in English that investigated the effect of HT on adult pain in any form of arthritis who had not undergone joint replacement surgery and that all had at least one patient-reported outcome (PRO) or VAS, published up to 08/2012 for a total of 375 intervention studies, systematic reviews and critical reviews. 149 studies were excluded, 122 documents of these were identified, only 24 were included.</td>
<td>Exercise in water has been shown to be effective in reducing pain by improving the function and performance of ADL in people with arthritis. Few studies have demonstrated that HT is superior to other forms of exercise. More research is needed to develop a valid and reliable and reproducible method. Inadequate outcome measures may have affected HT research, possibly explaining the lack of high-quality evidence for this intervention.</td>
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<td>A21</td>
<td>Lee et al., Pubmed</td>
<td>Experimental, randomized controlled trial n=80</td>
<td>In order to verify the efficacy of hot HT in labor pain and delivery experiences during the first stage of labor, 80 women were randomized: 41 in the CG and 39 in the EG in the teaching maternity hospital of Taipei City. The EG was showered at a controlled temperature of 37 °C for 20 minutes. After a full 5-minute bath, in the sitting or standing position, the women spent 15 minutes directing the shower water to any region of the body they desired. The CG received standard care. The pain and the delivery experience were evaluated using the VAS and the Labour Agency Scale (LAS), respectively.</td>
<td>HT with hot water is economical, convenient, easy to implement, and the authors further stated that this PIC reduced pain (p&lt;0.001). This non-pharmacological intervention has helped women in labor to participate fully in this process, with the continued support of health professionals, to feel comforted and to have a more positive overall delivery experience.</td>
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<td>A22</td>
<td>Cechetti, Fabro and Martini, LILACS</td>
<td>Systematic review of clinical trials n=8</td>
<td>They analyzed the efficacy of HT in patients with hip and knee osteoarthritis (OAQJ) by reviewing clinical studies, with data collection in the Scielo, Medline, LILACS and Pubmed systems, listing articles in full, from 2003 to 2011. 8 articles were found, of these, 3 address HT in treatment for OAQJ, and 5 only for OAK. From the collected articles, the tests that served as parameters for analysis were the WOMAC, Lequesne Index, VAS-pain, physical function, and muscle strength.</td>
<td>The authors showed that the studies analyzed show that HT in osteoarthritis is effective when used to alleviate discomfort and pain, reflecting on the improvement of the quality of life of patients with this disease. The lack of studies related to HT makes it difficult the approach of the professional.</td>
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Table 2. Summarized registry of titles, author, periodical, year, database, objectives, method, and results – continuation

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<td>A23</td>
<td>Marques et al.36</td>
<td>Descriptive qualitative and quantitative cross-sectional study, n=35</td>
<td>In order to investigate the knowledge and acceptance of PICS by physicians and SUS users. Three physicians and 35 SUS users were investigated for future implantation of PICS in the Basic Health Units (BHU). This study demonstrated that 100% did not know the PICS in general, and after a clear explanation of the researcher, 31.42% knew and would accept the use of phytotherapy, 51.42% acupuncture, 37.1% homeopathy, and none knew and would use CT. The 3 BHU physicians showed indifference, not acceptance, and acceptance, respectively, the implementation of outreach programs for patients and especially for physicians prescribing PICS.</td>
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<td>A24</td>
<td>Stark and Miller37</td>
<td>Before and after, experimental, non-randomized controlled trial n=24</td>
<td>They explored the effects of bathing during labor using a single post-test pre-test group design at a small community hospital in Michigan. 24 women were observed for pain and comfort level. They used vital signs, VAS for pain, and the Gagge thermal comfort scale. The contractions were palpated in the shower by the physician. There were significant differences in cervical dilatation (p=0.001), tension and pain (p=0.003) and fetal heart rate (p=0.001) after HT, although effective in relieving pain, reducing anxiety, inducing relaxation, HT is rarely used during labor.</td>
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<td>A25</td>
<td>Ferreira et al.38</td>
<td>Before and after, experimental, non-randomized controlled trial n=8</td>
<td>To evaluate the effect of HT on pain and quality of life of patients with rheumatoid arthritis (RA), nine patients were selected, aged 56.4 ± 5.2 years old, but only 8 were included, excluding those that were contraindicated. After physical therapy evaluation, also performed before and after treatment, including the application of the Short-Form-36 Questionnaire (SF-36) and evaluation of morning stiffness, pain and sleep quality by VAS. The treatment consisted of 10 HT sessions of 45 min each, 2 times/week. The data were treated statistically, with p&lt;0.05. They concluded that HT is a very used resource in the rehabilitation of these patients with RA due to the physical properties and physiological effects of water and the proposal made possible an improvement in health-related quality of life (p&lt;0.05), reduction of pain symptoms (p=0.004), morning stiffness (p=0.003), and improvement in sleep quality (p=0.006). After the treatment, it was possible to verify the reduction of morning stiffness and pain besides the improvement in sleep quality.</td>
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<td>A26</td>
<td>Silva et al.39</td>
<td>Experimental, blinded, randomized clinical trial n=57</td>
<td>They aimed to evaluate the efficacy of HT in 64 individuals of both genders with OAK compared to individuals with OAK in floor exercises. Randomized homogeneously from the Rheumatology Outpatient Clinic of the Hospital São Paulo (UNIFESP/EPM), performing exercises for 18 weeks. Patients with clinical and radiographic diagnosis of OAK were included with the American College of Rheumatology criteria in Western Ontario and WOMAC with 3 subscales: pain, stiffness and physical function and pain ranging from 30 to 90mm in VAS the previous week. They were evaluated during walking, by VAS at rest and immediately after a walking test (50FWT) 50 feet (15.24m), walking time measured in quick and comfortable steps during and the Lequesne Index. Measurements recorded by a blinded investigator at the beginning and at the 9 and 18 weeks after the intervention commenced. 57 patients concluded the study. HT was superior to ground exercise in pain relief (p &lt;0.001) before and after walking during the last follow-up. The authors concluded that both types of exercises (HT and terrestrial) reduced knee pain and increased their function in participants with OAK. Water-based exercises are a suitable and effective alternative for pain reduction and improvements in WOMAC and Lequesne scores. Pain before and after 50FWT decreased significantly in both groups, but there was no significant difference in pain in the previous week between groups.</td>
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The critical analysis of the results (Table 2) showed that LEs ranged from 1 to 5, with 8 (29.6%) three meta-analyses, five systematic reviews of RCTs (SRRCT), and 6 (22.2%) randomized clinical trials (RCT) were found in LE 1 and 2 respectively; non-randomized controlled trials (NRCT) were found in LE 3 and 4, and five (27.7%) SRRCT solidly demonstrated the efficacy of HT with Chinese herbs may be effective in reducing OAK pain parameters, increasing blood flow and muscle relaxation. Also, HT in several painful situations, as in pain in fibromyalgic women, in puerperae, in the pelvic pain of pregnant women, in labor, as in of the newborn (NB), musculoskeletal and osteoarticular. All showed a significantly better effect not only on the intensity of pain and stress but also on other parameters evaluated in comparison to the baseline condition of each one, demonstrating that these PICS are economical, harmless, effective in improving physical fitness, but TENS (p<0.007) provided better pain scores and in a greater number of analyzed variables than HT (p<0.076), suggesting to be more effective in the treatment of fibromyalgia. However, patients treated with HT could present better results if the treatment time was longer, since the therapeutic pool may have greater effect on conditioning and long-term functional capacity.

The PICS in question were included in PNPIC in 2006 in Brazil, whose scientific studies in the country are still incipient. However, therapies are present in 9,350 establishments in 3,173 municipalities, of which 88% are offered in basic care. In 2017, 1.4 million individual visits were recorded in PIC. In addition to the collective activities, the estimate is that about 5 million people per year participate in these practices in the SUS. Scientific evidence has shown the benefits of integrated treatment between conventional medicine and PICS. The three meta-analyses analyzed (LE1) evidenced the efficacy and beneficial results of CT(2) and HT(1) for pain control in knee osteoarthritis (OAK) and hand (OAH), chronic low back pain, chronic pelvic pain, degenerative joint and spinal diseases, antioxidant occurrences, metabolic and inflammatory parameters, increasing blood flow and muscle relaxation. Also, HT with Chinese herbs may be effective in reducing OAK pain the comparison to standard western treatment. Similarly, the five (27.7%) SRRCT solidly demonstrated the efficacy of CT(2) and HT(5), when combined or even isolated, in labor pain, in the low back pain, arthritis and OAK, and in the hip and ankle.

Regarding the RCT, the six (22.2%) analyzed the efficacy of CT(2) and HT(4) concerning pain in labor, as in of the newborn (NB), musculoskeletal and osteoarticular. All showed a significantly better effect not only on the intensity of pain and stress but also on other parameters evaluated in comparison to the baseline condition of each one, demonstrating that these PICS are economical, harmless, effective and safe.

Analyzing the 11 NRCT, all investigated HT in several painful situations, as in pain in fibromyalgic women, in puerperae; in the pelvic pain of pregnant women; in osteoarticular and musculoskeletal pain, pain during labor, all of which are effective in improving painful symptoms.
This review also included a qualitative and quantitative cross-sectional study that investigated the knowledge and acceptance of PICs by SUS physicians and users to show the lack of knowledge of users and professionals, and also considering that such article could stimulate further research since 100% of the respondents ignored the existence of most PICs. This study finds resonance in another, eight years later, that verified the knowledge, and the use of PICs for pain control by the population of the larger cities of Vale do Paraíba Paulista with similar results, since of 100 respondents, only 17.5% knew and 82.5% did not know them. The population still does not know the PICs that the SUS offers, using in greater number the older therapy, acupuncture, which was already part of the SUS, which shows the importance of studying, explaining, disseminating and presenting the PICs and its advantages the community. Therefore, systematic, randomized and controlled studies are needed that result in high, strong and sufficient evidence of PICs in the treatment of pain, which render people partially or totally disabled, transiently or permanently, triggering stress, suffering, and loss of quality of life (QoL). The limiting factors for the actual realization of the use of PICS are the scarce scientific evidence of a strong and sufficient level and the lack of knowledge about their use by health professionals. However, even limited, it seems correct to say that this study showed the efficacy of CT and HT in the treatment of pain in organic changes such as the knee, hand and ankle osteoarthritis; the musculoskeletal; those of obstetric origin. It also warns of the need for further research on how PICs may contribute to pain relief and reiterates that it is now mandatory to measure, control and record it by EAS health professionals as the Fifth Vital Sign. Given the above, including PICs in the treatment of pain, is an important issue to ensure comprehensive health care.

CONCLUSION

Most of the evidence emerged from the studies analyzed focused on levels 1 to 3 regarding the effective use of PICS, CT, and HT. Of the 18 articles on the efficacy of HT, eight on CT in the pain charts of knee, hand and ankle and musculoskeletal osteoarthritis and one in obstetric pain. In most studies, evidence for the efficacy of PICS, CT, and HT was focused on levels 1 to 3. The efficacy of HT was demonstrated in 18 articles: five in labor pains, two in fibromyalgia, ten in patients with musculoskeletal and pain caused by osteoarthritis of the knee, hand, hip and ankle, and in an article concerning the pain of newborns. The efficacy of CT was evidenced in eight articles of musculoskeletal pain due to knee, hand, hip and ankle osteoarthritis; and a qualitative article that shows the lack of knowledge of users and professionals about the use of PICS in SUS. It also showed that there are few scientific subsidies to scientifically substantiate the use of HT and CT in the treatment of pain, needing to increase the knowledge of these PICs with actions of permanent education, and at the same time, stimulate the increase of the scientific production by the health professionals for the effective use of these PICS.

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ABSTRACT

BACKGROUND AND OBJECTIVES: The cauda equina syndrome is a neurological condition prevalent in dogs which neurological signs are caused by the compression of the nerve roots located in the lumbosacral spinal canal and is frequently associated with pain, claudication, paresis or paralysis of the hindlimbs and changes in the functioning of the sphincters. The objective of this study was to check the effects of the epidural injection with the combination of dexamethasone, bupivacaine and morphine on the relief of pain and neurological signs in a dog with traumatic cauda equina syndrome.

CASE REPORT: Case study of a 2-year old Red Heeler dog, weighing 16kg with a diagnosis of post-trauma cauda equina syndrome. The evaluation consisted of neurological and pain assessment (visual analog scale), quality of life (“5H2M”) and infrared thermography. After the initial evaluation and authorization of the tutor, the dog was submitted to general anesthesia and a lumbosacral epidural block, guided by electrostimulation, with the association of dexamethasone, bupivacaine and morphine. After the procedure, the dog showed immediate remission of claudication, paresis and satisfactory analgesia on days 0, 15, 30 and 60 after the intervention.

CONCLUSION: The epidural block was effective in improving pain, quality of life and neurological signs and may be an excellent alternative in dogs with pain syndromes associated with the spinal canal.

Keywords: Epidural anesthesia, Cauda equina syndrome, Pain, Polyradiculopathy, Veterinary.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A síndrome da cauda equina é uma afecção neurológica prevalente em cães cujos sinais neurológicos são causados pela compressão de raízes nervosas localizadas no canal espinal lombossacral sendo frequentemente associada à dor, claudicação, paresia ou paralisia de membros pélvicos e alterações do funcionamento dos esfíncteres. O objetivo deste estudo foi verificar os efeitos da injeção peridural com a associação de dexametasona, bupivacaína e morfina no alívio da dor e dos sinais neurológicos em um cão com síndrome da cauda equina de origem traumática.

RELATO DO CASO: Estudo de caso de um animal da espécie canis familiaris, raça red heeler, fêmea, 2 anos de idade e 16kg de peso corporal com diagnóstico de síndrome da cauda equina pós-trauma. A avaliação consistiu no exame neurológico completo, avaliação de dor (escala analógica visual), de qualidade de vida (“5H2M”) e por termografia infravermelha. Após a avaliação inicial e autorização do tutor, a cadela foi submetida à anestesia geral e a um bloqueio intervencionista peridural lombossacral, guiado por eletroestimulação, com a associação de dexametasona, bupivacaína e morfina. Após o procedimento, a cadela apresentou imediata remissão da claudicação, da paresia e uma satisfatória analgesia nos dias 0, 15, 30 e 60 após a intervenção.

CONCLUSÃO: O bloqueio peridural intervencionista foi eficaz na melhora da dor, da qualidade de vida e dos sinais neurológicos, podendo ser uma excelente alternativa em cães com síndromes dolorosas associadas ao canal espinal.

Descritores: Anestesia peridural, Cauda equina, Dor, Polirradiculopatia, Veterinária.

INTRODUCTION

Cauda equina syndrome (CES) is a neurological condition prevalent in dogs whose signs appear due to the compression of the nerve roots called cauda equina. Anatomically, these roots, located between the 7th lumbar vertebrae and the 5th coccygeal vertebrae, may be the target of multifactorial compressions 1. The clinical signs most observed in these animals are associated with pain in the lumbosacral region, limb claudication of the pelvic limbs, with or without muscle weakness 2, and may present paresis or paralysis. Also, the presence of changes in proprioception and urinary and/or fecal incontinence is not uncommon 3. The syndrome usually happens with changes in the animal’s daily activities such as running, jumping, climbing stairs, and exercise usually exacerabtes these signs 4.
Conventional diagnosis usually associates the animal's history with clinical and neurological findings. However, imaging scans such as radiography and computerized tomography are essential for determining the exact location of the injury. In addition, infrared thermography may contribute to the determination of peripheral and central neuropathic syndromes in humans⁴,⁷, so that, it is possible that it has good predictive value in the diagnosis of CES in dogs. Among the clinical findings, the presence of proprioceptive deficits, muscular atrophy, paraparesis, and urinary and fecal incontinence are notorious⁸.

In veterinary medicine, the conservative treatment with the use of anti-inflammatories is one of greater adhesion among the professionals. However, depending on the severity of the injuries, decompression surgery may be critical to the positive outcome. The prognosis depends on the etiology, time elapsed of the disease, the degree of neurological impairment and the type of treatment used⁹.

The objective of this study was to verify the effects of epidural injection with the association of dexamethasone, bupivacaine, and morphine on pain relief, on quality of life improvement and neurological signs in a dog with traumatic CES.

CASE REPORT

This is a case report study, which the Free and Informed Consent Form (FICT) of the Valença Higher Education Center of the Dom André Arcoverde Educational Foundation has been explained and signed by the person responsible for the animal, who was aware of all the stages of the study. Interventionist analgesic blockade was performed in the operating room on the day scheduled with the guardian of the animal after signing the FICT.

On evaluation day, the evaluator A performed basic neurological examinations such as superficial and deep pain tests, panniculus reflex, patellar tendon reflexes, and proprioception. Evaluator A observed severe limb claudication in the left pelvic limb, bilateral patellar hyperreflexia and conscious proprioception deficit in the left pelvic limb. There was no change in urinary and anal sphincter function.

The evaluator B evaluated pain and quality of life (QoL) using the visual analog scales (VAS) and QoL “5H2M”, respectively, and a complete infrared thermography examination. The VAS is a numerical scale from zero (absence of pain) to 10 (worst pain imaginable), in which the tutor was asked to indicate, quantitatively, the pain presented at the time of evaluation. The QoL scale is an instrument developed to assist tutors and veterinarians in bioethical decisions related to life and death. This scale is known as “5H2M” which evaluates the clinical status of the animal through the parameters H-hurt, H-hunger, H-hydration, H-hygiene, H-happiness), M-mobility and M-more good than bad days. The 5H2M is a numerical scale from zero to 70 with the score of 35 being the minimum acceptable to attest adequate QoL⁰." Infrared thermography was performed with a FLIR T420 camera in an air-controlled environment at 21°C, 60% relative humidity, with no light and respecting the acclimation period of 20 minutes as recommended by the American Infrared Thermography Guidelines for Animals¹¹.

The pain score defined by the tutor’s evaluation was VAS=8, and the QoL score was “5H2M”=20. In the thermographic examination, there were significant changes in the thermal patterns in the dermatomeres (secondary hypo radiation to the sympathetic neurovegetative hyperreactivity) of the left pelvic limb (affected) in different segments, namely: EI1 and EI2 = knee medial facet; EI3 and EI4 dorsal aspect of the tibiotarsal joint; EI5 and EI6 dorsal aspect of the metatarsus (Figure 1).

After initial evaluations and data collection, the animal was referred to the operating room for an interventionist analgesic blockade. The technique chosen in this study was based on the data observed in humans¹² and also on the difficulty of the tutor in adhering to the conservative treatment with oral anti-inflammatory because it is a herding dog whose dwelling in a rural area would interfere with the administration of the drug.

Thus, electro stimulation-guided epidural administration combining dexamethasone (4mg)¹³, bupivacaine 0.125% (0.22mL.kg⁻¹), and morphine (0.1mg.kg⁻¹)¹⁴ was the selected approach. Based on the above, the technique proposed in the study followed the order below:

- Intravenous catheterization with a 22G device and anesthetic induction with 4mg.kg⁻¹ of propofol. The animal was kept in 100% oxygen under an orofacial mask; electrocardiographic monitoring in DII, pulse oximeter, plethysmography, and noninvasive blood pressure; rigorous trichotomy and antisepsis of the lumbosacral region. A 50mm gage neurostimulation needle was introduced in the lumbosacral region (L7-S1) with the neuro localizer calibrated at 0.7mA, 0.1ms and 1Hz¹⁵; localization of the epidural space after motor responses of abduction of the pelvic limbs and tail lateralization; infiltration of the dexamethasone, bupivacaine and morphine solution with slow injection for about 60 seconds.
- After the analgesic blockade, the animal was taken to the post-anesthetic recovery room and discharged after 60 minutes of observation. Besides, the need for a veterinary reassessment was clarified to the tutor on 15, 30 and 60 days after the intervention, since in case of no remission of symptoms, further epidural infiltration may be necessary.

Figure 1. Thermography of the dog’s pelvic limbs in the position of two supports
EI1 (mean 31.9°C); EI2 (mean 29.5°C); EI3 (mean 30.7°C); EI4 (mean 28.0°C); EI5 (mean 29.8°C); EI6 (mean 27.3°C). Temperature variation (EI1 - EI2) = 2.4°C; (EI3-EI4) = 2.7°C; (EI5-EI6) = 2.5°C.
The clinical signs, pain scores, and QoL were reassessed 15, 30 and 60 days after the procedure and the skin temperature and thermographic image were repeated 60 days later. The data collected in the pre- and post-intervention phases were registered in the Windows Microsoft Excel, Software version 2016.

Table 1 presents the pain data, measured by VAS and QoL evaluated by the “5H2M” pre- and post-analgesic intervention. Through VAS, it was observed that the dog had a decrease in pain intensity after 15 days of the intervention (VAS=2), reaching a zero score as of day 30. In the QoL assessment, the score reached 70 points in the day 60 evaluation.

Table 2 presents data referring to the cutaneous thermometry of the EI1 and EI2 regions (medial face of the knee); EI3 and EI4 (dorsal aspect of the tibiotarsal joint) and EI5 and EI6 dorsal aspect of the metatarsal before and after the intervention. Figure 2 shows the thermal image of the affected and contralateral limbs performed 60 days after the intervention. Infrared thermography monitoring showed a significant improvement in the sympathetic vasomotor hyperreactivity of the left pelvic limb (affected) in segments 2, 4 and 6 with a temperature difference of 1.0°C, 0.1°C and 0.4°C, in relation to the contralateral limb, respectively.

In general, the animal presented clinical improvement in all domains evaluated, including neurological signs (proprioception, patellar reflex, claudication, and cutaneous panniculus reflex) and pain and QoL scores.

Table 1. Neurological signs, pain score, and quality of life pre- and post-intervention

<table>
<thead>
<tr>
<th>Domains</th>
<th>Pre-intervention (Day 0)</th>
<th>Post-intervention (Day 15)</th>
<th>Post-intervention (Day 30)</th>
<th>Post-intervention (Day 60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claudication</td>
<td>Present in LPL</td>
<td>Discrete in LPL</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Pain (VAS)</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Reflex of the Panniculus</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Proprioception</td>
<td>Decreased in LPL</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Quality of Life</td>
<td>20</td>
<td>50</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Patellar Reflex</td>
<td>Increased in RPL/LPL</td>
<td>Increased in RPL/LPL</td>
<td>Normal</td>
<td>Normal</td>
</tr>
</tbody>
</table>

VAS = visual analog scale; LPL = left pelvic limb; RPL = right pelvic limb.

Table 2. Cutaneous thermometry of the EI1 and EI2 regions (medial face of the knee); EI3 and EI4 (dorsal aspect of the tibiotarsal joint)

<table>
<thead>
<tr>
<th>Regions</th>
<th>Pre-intervention (Day 0)</th>
<th>Post-intervention (Day 60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EI1</td>
<td>31.9°C</td>
<td>32.0°C</td>
</tr>
<tr>
<td>EI2</td>
<td>29.5°C</td>
<td>31.0°C</td>
</tr>
<tr>
<td>EI1-EI2</td>
<td>2.4°C</td>
<td>1.0°C</td>
</tr>
<tr>
<td>EI3</td>
<td>30.7°C</td>
<td>31.2°C</td>
</tr>
<tr>
<td>EI4</td>
<td>28.8°C</td>
<td>31.1°C</td>
</tr>
<tr>
<td>EI3-EI4</td>
<td>2.7°C</td>
<td>1.1°C</td>
</tr>
<tr>
<td>EI5</td>
<td>29.8°C</td>
<td>29.8°C</td>
</tr>
<tr>
<td>EI6</td>
<td>27.3°C</td>
<td>29.4°C</td>
</tr>
<tr>
<td>EI5-EI6</td>
<td>2.5°C</td>
<td>0.4°C</td>
</tr>
</tbody>
</table>

DISCUSSION

CES in dogs is a neurological condition whose clinical signs are related to the nerve root lesion of the 7th lumbar vertebra, sacral or coccygeal vertebrae, caused by dorsoventral stenosis of the vertebral canal. Congenital stenosis, disc protrusions, and spondylosis are among the most frequent disorders of the syndrome. However, traumatic situations such as vertebral fractures and displacements and diskitis (spondylodiscitis) are also associated with this syndrome.

In the present report, it was observed dorsoventral stenosis of the vertebral canal in the lumbosacral region without the involvement of sacral or coccygeal vertebrae. Clinical signs are inherent to the affected segment of the medulla and/or involved nerve, so, depending on the affected region it is common to observe the presence of lumbosacral pain, claudication, muscular atrophy in the area inherent to the sciatic nerve, paresis, tail weakness, urinary and/or fecal incontinence disorders and paresthesia.

Lumbosacral pain is the most prevalent clinical characteristic in these animals. Therefore, the presence of an antalgic posture with hyperkyphosis of the spine is notorious. In the present report, the tutor’s search for pain and palliative care was due to the animal’s reluctance to perform common activities such as running, playing or jumping. Also, it was reported by the tutor the refusal of food in the days before the appointment. In addition to the notorious presence of lumbosacral pain, the animal in this report presented severe claudication in the left pelvic limb. This clinical sign is the second most frequent in this syndrome, which is associated with pain referred by the incarceration of the nerve roots of L6, L7, and S1. These roots contribute to the formation of the sciatic nerve, and its compromising may lead to motor deficits.
The motor activity contributes to the increase in the circulatory demand of the spinal cord and cauda equina. However, due to spinal canal stenosis, hypoperfusion results in ischemia of the nerve roots and subsequent root pain and/or referred pain in the limbs, tail, and perineum. The images obtained by infrared thermography corroborate this statement since an intense area of hyporadiation was observed in the left pelvic limb, secondary to sympathetic neurovegetative hyperreactivity, probably due to the incarceration of the nerve roots of L7 and S1.

Paresis or paralysis of the pelvic limbs only occurs when the nerve roots of L4 to S2 are affected or even in the traumatic injuries of the nerves that make up the limb. However, if the sciatic nerve roots of L4 to S2 are affected or even in the traumatic injuries of the nerves that make up the limb. However, if the sciatic nerve is affected, the animal can support the weight of the resting limb on the back of the paw. In the present report, intermittent paresis of the left pelvic limb was observed, which was totally eliminated after the interventionist blockade.

The urination and defecation reflexes were not altered in this study. Usually, they will be absent when lesions occur in the nerve roots or segments of the spinal cord from S1 to S3 whose sites contribute to the formation of the pudendal nerve. The injuries inherent to the cranial segments in this region do not compromise the functioning of these sphincters. When lesions are associated only with the sacral and coccygeal nerve roots, the presence of atonic tail is also prevalent, which was also not observed in the dog of this study.

Paresthesia occurs as a result of irritation of sensitive fibers of the cauda equina which are derived from dermatomes innervated by the sciatic and pudendal nerves, due to the compression of the vertebral canal. These abnormal sensations can occur with burning, stinging, tingling or shock, which induces the animal to lick and/or bite the affected areas causing dermatological abrasions and self-mutilation. After the appointment, the tutor reported an excess of bite in the lumbosacral region. However, due to the presence of ectoparasites, it was not possible to attest the reliability of this information. The treatment of animals affected by CES is directed to the cause and severity of the injury, being classified as conservative or surgical. Usually, conservative treatment in veterinary medicine is based on the systemic use of anti-inflammatory/analgesic and confinement. However, due to the long period of treatment, the known adverse effects inherent in non-steroidal anti-inflammatory drugs and corticosteroids are frequent in these animals. Thus, due to recent advances in the area of pain interventionist medicine, this study preconized the use of anti-inflammatory and analgesic drugs directly at the site of the injury to optimize anti-inflammatory and analgesic therapy and minimizing long-term use of these drugs and their subsequent adverse effects. Interventionist pain medicine is a broad area of medicine that offers many possibilities for diagnosis and treatment of many types of pain, through minimally invasive procedures, usually with the use of needles. Imaging tests such as ultrasound and radiographs are critical to the accuracy of drug infusion into the desired target and to minimize the risks of iatrogenic injuries and failures. In the present report, epidural analgesic blockade (lumbosacral translaminar) with the combination of dexamethasone, bupivacaine, and morphine was chosen. Bupivacaine is a local anesthetic that promotes long-term motor and sensory blockade. However, the use of low-concentration bupivacaine (0.125%) was preconized to avoid motor blockade of the pelvic limbs. The association of morphine with the analgesic combination aimed at the installation of long-term analgesia because, due to its low degree of ionization, it is estimated that its analgesia is of nearly 16 hours when administered via epidural.

The use of epidural dexamethasone is not a common practice in veterinary medicine. However, it has been highly explored in interventionist blockades in humans. Corticosteroids exert their anti-inflammatory action, interrupting the arachidonic acid pathway of the damaged cell membrane. Its epidural use is associated with the reduction of the edema, fibrin deposition, capillary dilatation, leukocyte migration, capillary fibroblast proliferation, and collagen deposition. In addition, some studies suggest that corticosteroids may reduce the hyperexcitability of the nerve cell by directly affecting the cell membrane conduction. Thus, since CES often presents with edema of the nerve roots and an intense inflammatory process, the choice of interventionist analgesic treatment has substantial support since the mechanism of action of these drugs leads to the reduction of the edema of the nerve roots and even the adjacent tissues.

Among the corticosteroids described for use in epidural injection in humans stand out the methylprednisolone acetate, triamcinolone salts, and dexamethasone. In humans, methylprednisolone is the most widely used drug with doses ranging from 40 to 120mg per injection. Dexamethasone has been frequently used in analgesic blockades with the main advantage being its high potency and duration. In veterinary medicine, only one study reports the use of epidural dexamethasone. This work evaluated the analgesic influence of different doses of dexamethasone (2, 4 and 8 mg) associated with lidocaine in dogs submitted to ovary salpingohysterectomy. It was observed in this study that there was a growing potentiation of postoperative analgesia with the use of epidural dexamethasone in a dose-dependent manner. The first veterinary clinical study with epidural corticosteroids evaluated 38 dogs with Hansen lumbosacral disc protrusion type II after epidural infiltration of methylprednisolone acetate. In that study, the epidural infiltration, performed by fluoroscopy, was carried at standard intervals for the first three treatments and, subsequently, on demand, which improvement was perceived by the tutor in 79% of the animals and 53% were considered totally cured.

An important factor in the administration of corticosteroids via epidural is the choice of the diluent. Usually, the association should be performed with an isotonic physiological solution or local anesthetic. Some authors have been recommending dilution in local anesthetic because it gives the patient better comfort after epidural injection. The volume of the epidural solution is also the subject of intense discussion in veterinary medicine. Traditionally, it is recommended the use of an average volume of about 0.25mL.kg⁻¹. However, larger volumes are used when more cranial dermatomes are desired. In humans, the discussion of this subject is also wide and controversial. Some authors believe that small volumes of the solution are insufficient to reach the ventral aspect of the epidural space. However, other authors believe that the effect of the corticosteroid is independent of the volume injected but is due to the closest possible administration to the affected site.
Interventional epidural blockade was effective in pain relief, 
QoL, and neurological signs, and may be an excellent alternative 
in dogs with pain syndromes associated with the spinal canal.

CONCLUSION

In case only one corticosteroid epidural injection is enough to relieve pain, and neurological signs of the patient usually are not indicated to repeat the procedure\(^1\). In the present report, the remission of clinical signs associated with pain and neurological components were solved with a single injection of the proposed combination. In humans, some patients respond well to the second or third epidural corticosteroid injection\(^12\). However, there are no reports of repeated injections into companion animals. Because this is an exclusively interventionist analgesic procedure, the failure of the technique becomes more severe than the anesthetic epidural blockade performed by surgery because, in case of perioperative technique failure, another analgesic modality is promptly put in place. Therefore, it is essential that the procedure is performed with equipment that minimizes the risk of erratic injection, such as the peripheral nerve stimulator and/or ultrasound. In the present report, the epidural injection was performed with the aid of the peripheral nerve stimulator regulated at 0.7mA, 0.1ms, and 1Hz\(^15\). In humans, the use of fluoroscope has gained prominence in the last decade and has been used in almost all interventionist blockades.

The wide clinical epidural use of corticosteroids in humans is generally related to the relief of pain syndromes resulting from inflammation of the neural structures of the epidural and peripheral neural structures\(^12\), which may be used for low back pain, sciatic pain, sacral pain, radicular pain, radiculopathy, lumbosacralgia, nerve root compression, protrusion, prolapse or disc hernia and lumbar canal stenosis. Thus, it is valid the discussion about the complications inherent to interventionist epidural blockade in these syndromes mentioned in dogs and cats since the result is likely to be similar to those obtained in humans.

The complications inherent to interventionist epidural blockade are associated with the technique itself and the side effects of the selected drugs. The complications of the technique are perforation of the dura-mater, accidental subarachnoid or intravascular injection. The minor complications, when the interventionist blockade is associated with the local anesthetic, are arterial hypotension, motor block, and prolonged sensory block. Major complications include menigitis, systemic infection, epidural hematoma, abscess, CES, neurotoxicity, and the development of hyperadrenocorticism when corticosteroids are used\(^12\).

REFERENCES

Orofacial manifestations of chikungunya infection. Case report

Manifestações orofaciais após infecção por vírus da chikungunya. Relato de caso

Ana Paula Varela Brown Martins¹, Juliana Stuginski-Barbosa², Paulo Cesar Rodrigues Conti²

ABSTRACT

BACKGROUND AND OBJECTIVES: The chikungunya virus is a human pathogen responsible for a disease characterized by fever, headache, myalgia, skin rash and acute and persistent arthralgia. The purpose of this case report was to describe the orofacial manifestations of a patient infected with the chikungunya virus.

CASE REPORT: A female patient was referred to the Universidade Federal de Juiz de Fora, MG dental clinic due to severe facial pain. Two weeks earlier, she had been diagnosed with chikungunya virus infection by ELISA. After the febrile period and skin rash, the patient presented severe pain in the shoulders, knees, and face, which made it difficult to move and perform daily activities. She was diagnosed with temporomandibular disorders (arthralgia and myofascial pain in the masseter muscle on the right side). The patient was counseled about diet free of pain, hot packs and massages in the painful region. She was already self-mediated with corticosteroids. In addition, she was instructed to seek a specialist for her body pain. The manifestations caused by infection were healed after 10 days of the beginning of the use of corticosteroids and counseling.

CONCLUSION: To date, no reports have been published in the literature about the orofacial manifestation of chikungunya virus, which could serve as a basis to aid in diagnosis temporomandibular joint disorders secondary to chikungunya virus or resulting from possible psychological alteration due to constant generalized pain) and treatment. The detailed anamnesis provided information about a probable temporomandibular joint disorder secondary to Chikungunya virus infection, and it was remarkable as improvement of the systemic factors resulted in the remission of orofacial symptomatology.

Keywords: Chikungunya virus, Facial pain, Temporomandibular joint disorders.

RESUMO

JUSTIFICATIVA E OBJETIVOS: O vírus chikungunya é um patógeno humano responsável por uma doença caracterizada por febre, dor de cabeça, malária, erupção cutânea e artralgia aguda e persistente. O objetivo deste relato de caso foi descrever as manifestações orofaciais de uma paciente infectada pelo vírus chikungunya.

RELATO DO CASO: Paciente do sexo feminino foi encaminhada para a clínica odontológica da Universidade Federal de Juiz de Fora, MG, devido à dor orofacial grave. Duas semanas antes, ela havia sido diagnosticada com infecção por vírus chikungunya. Após período febril e erupção cutânea, a paciente apresentou dor intensa nos ombros, joelhos e face, que dificultava a movimentação e realização das atividades diárias. Foi diagnosticada com desordens temporomandibulares (artralgia e dor miofascial com referência do músculo masseter no lado direito). A paciente foi orientada sobre dieta livre de dor, compressas quentes e massagens na região dolorosa. Ela já se automedicava com corticosteróides. Foi instruída a procurar especialista para suas dores no corpo. As manifestações provocadas pela infecção foram curadas após 10 dias do início do uso de corticosteroides e aconselhamento.

CONCLUSÃO: Até o momento, nenhum relato foi publicado na literatura sobre a manifestação orofacial do vírus chikungunya, que poderia servir de base para auxiliar no diagnóstico de disfunção temporomandibular secundária ao vírus chikungunya ou resultante de possível alteração psicológica por dor generalizada constante) e tratamento. A anamnese detalhada forneceu informações sobre uma provável disfunção temporomandibular secundária à infecção pelo vírus chikungunya e foi notável, pois a melhora dos fatores sistêmicos resultou na remissão do sintoma orofacial.

Descritores: Dor facial, Vírus chikungunya, Transtornos da articulação temporomandibular.

INTRODUCTION

Orofacial pain can occur as a sequel of various causes, for example of infectious disease. Chikungunya virus (CHIKV) is a mosquito-transmitted virus in the Alphavirus genus in the family Togaviridae, which is readily transmitted to humans by infected mosquito vectors, Aedes aegypti and Aedes albopictus.² 3 It is a debilitating viral illness of global concern due to its escalating outbreaks in different parts of the world.² In the human organism, the virus causes an acute infection characterized by high fever, debilitating polyarthralgia causing intense pain and swelling, myalgia, rigor, myositis, headache, chills, fatigue, photosphobia, and skin rash.² 3 In addition, severe neurological and
hemorrhagic diseases and deaths were associated with an outbreak of CHIKV.

However, the infection is self-limiting and usually resolves within 3-4 days except for the joint symptoms that may persist for a longer period; many patients experience recurring disabling pain for months to years. The long-term chronic arthralgia and myalgia can have an enormous impact on the individual's quality of life, and on society in terms of morbidity and economic productivity.

Despite the pathological significance of CHIKV infection, the physiological and molecular mechanisms occurring during viral infection are still not well-defined.

Thus, the objective of this study was to report a clinical case of orofacial manifestations after CHIKV infection.

**CASE REPORT**

A 38 years old female came to the Dentist Department of the Juiz de For a Federal University, Governador Valadares campus, with a complaint of severe pain on the right side of her face. About 2 months before the first dentistry visit, the patient was diagnosed with a Chikungunya virus infection, through clinical diagnosis: high fever, skin rashes, and joint pain, especially knees, shoulders, and hands. The medical history showed a diagnosis of osteoarthritis in the knees several years ago.

For the first phase of the systemic treatment, analgesic was prescribed by the physician to control pain and fever, in addition to rest. The treatment was not successful in reducing pain. She sought other physicians, and non-steroidal anti-inflammatory (NSAIDs) and muscle relaxants were prescribed. The patient reported pain improvement only during the drug effects. After remission of the acute phase, pain in the knees, especially the right, and in the shoulders remained, resulting in difficulty in locomotion and execution of activities at work.

Additionally, 10 days at the end of the acute phase, the patient reported severe pain in rest in the right ear region, upper posterior teeth on the right side, which got worse during function, with severe intensity (8/10), a burning and in stitches quality, lasting 30 minutes if she did not take medications. The orofacial pain was daily (about 3 episodes a day), and no parafunctional habits were reported.

During palpation of the right temporomandibular joint (TMJ) and masster muscle, it was possible to reproduce the pain reported by the patient in the right region: in front of the ear and upper posterior teeth. The diagnosis was arthralgia and myofascial pain with reference (to the superior posterior teeth). As well as clinical findings of muscle pain in the left masster, bilateral sternocleidomastoid (SCM) and bilateral trapezius.

The patient received advice and home care that included verbal and written instructions about the TMD etiology and diagnosis, pain-free diet, relaxing exercises of the jaw muscles, maintain a good posture, use of reminders to avoid possible parafunctional habits, avoid stimulant substances and cervical stretching, application of a heating pad on painful masticatory muscles (for 15 minutes) followed by stretching and self-massage twice a day. The patient was instructed to look for a rheumatologist or orthopedist physician because the pains of the knees and shoulders were more intense (10/10) than those of the face.

After 30 days, the patient attended for reevaluation. She reported that she had already started using corticosteroids (prednisone) by herself (35mg/day). She had a global improvement and didn't complain of pain in knees, shoulders or face. She had already returned to daily activities. She also reported sleep bruxism. During palpation, there was bilateral sensitivity in the masster, temporal and SCM, of moderate to severe intensity – no pain in TMJ. A maxillary full-coverage occlusal appliance was made of hard acrylic and was fabricated in a dental laboratory. Counseling was reinforcement.

Twenty days later, the patient returned, and she had begun the process of reducing corticosteroid intake. She didn't report pain, but during palpation, it was still perceived moderate pain in the same muscles. The splint was delivered and adjusted immediately, with instruction to wear only at night while sleeping. After 30 days of splint use, the patient returned reporting that she is in the final phase for the complete withdrawal of the corticosteroid and with the absence of symptomatology. During palpation, the patient reported little sensitivity in the masster and temporal muscles, with slight intensity (not familiar to the patient). Counseling has been strengthened.

**DISCUSSION**

The purpose of this study was to report an unusual case of Chikungunya infection where, after the acute phase of this pathology, the patient was diagnosed with TMD. To date, no reports have been published in the literature on the orofacial manifestation of Chikungunya infection.

The Chikungunya fever is one of the epidemics around the world. Acute chikungunya symptoms in humans appear 3-12 days after a bite by an infected mosquito. CHIKV replicates in the skin, and disseminates to the liver, muscle, joints, lymphoid tissue and brain, presumably through the blood. The symptoms of CHIKV infection in humans joint are debilitating arthralgia that affects the peripheral joints, causing intense pain and swelling. Besides, it includes high fever, headache, myalgia, conjunctivitis, periarticular pain, erythematous rash, and petechial spots. Research in animals evidenced arthritis, tenosynovitis, and myositis in CHIKV infected neonatal and adult mice. CHIKV is also primarily arthritogenic, and muscle tissue has been proposed to be their target. Most infected individuals complain of severe joint pain which is often incapacitating. The arthralgia usually occurs in more than one joint, usually symmetrical and almost any joint can be affected, particularly in peripheral joints are affected more frequently. Synovitis or periarticular swelling has been reported in 32-95% of patients, with large joint effusions occurring in 15% of individuals infected with Chikungunya. The inflammatory response in the joint is very similar to that in rheumatoid arthritis, with leukocyte infiltration, cytokine production, and complement activation. However, there is no data about TMJ pain in literature.

A study was done on muscle biopsies of CHIKV infected patients with myositis syndrome has identified muscle satellite cells.
and not muscle fibers as the primary target viral infection. The outbreak of CHIKV in the Réunion has documented 97.7% of myositis incidence upon CHIKV infection. In this case report, during palpation, the clinical findings were the presence of active trigger points in the masticatory muscles that reported pain in the upper posterior teeth, reproducing one of the patient's main complaints. There was no clinical evidence supporting a myositis diagnosis of masticatory muscles: the presence of edema, erythema and/or increased temperature over the muscle. The explanations for this may be the end of the acute phase of the pathology or the effect of the drugs for the systemic symptomatology since there are no reasons for the masticatory muscles not to be affected by CHIKV infection.

The acute phase of CHIKV infection typically lasts from a few days to a couple of weeks. The convalescent phase of CHIKV infection is associated with the resolution of fever and viremia, an induction of adaptive immunity. However, arthralgia and/or myalgia may persist for weeks, months or even years, as in this case. About 43-75% of CHIKV-infected patients experience persistent symptoms, including fatigue and joint pain, stiffness, and swelling, for about years. Risk factors for developing chronic joint pain after acute CHIKV infection include increased age, hypertension and disease severity during the acute stage, besides immunosuppressed organisms. Diabetes, cardiovascular disease, neurological disorders, and chronic pulmonary diseases are risk factors for developing severe CHIKV disease.

The ability of CHIKV to replicate and persist in the joints and muscle tissues is not clear. The pain led our patient to have difficult locomotion. Most working adults become disabled with loss of mobility, hand impairment, and depressive reaction, which can last for weeks to months. This loss of mobility was one of the main complaints associated with the difficult to raise her arms reported by the patient. Besides, the patient also reported difficulty in performing the mandibular movements, which may be justified by arthralgia and myofascial pain. Pre-existing arthritis (including rheumatoid arthritis and osteoarthritis) has been associated with prolonged rheumatic symptoms after infection with Ross River virus, chikungunya virus, or the related alphavirus Pogosta virus. Several of the shared cytokines such as tumor necrosis factor, interleukin-1, interleukin-6, and interleukin-17 are established therapeutic targets during rheumatoid arthritis, showing their importance in pathogenesis. The expression of this pro-inflammatory cytokines correlates with the severity of CHIKV-induced disease in patients. Based on these similarities, Burt, Chen, Mahalingam suggested that arthropogenic viral infection could exacerbate pre-existing joint pathology. This pain exacerbation in the patient’s knee could be explained by the presence of a previous osteoarthrosis diagnose some years ago.

There is no information in the literature about CHIKV virus infection in TMJ and/or masticatory muscles. However, as CHIKV has a high ability to spread and replicate in various tissues of the human body, an infected patient may have orofacial manifestations as there is no plausible explanation that the virus does not affect the masticatory muscles and TMJ, characterizing temporomandibular disorder (TMD). In this case, we could point that TMD was secondary to CHIKV infection, as there is a temporal pattern with infection some days before the orofacial complaints. Systematic pathophysiologic conditions, such as this infectious condition caused by CHIKV, may influence local TMDs and should generally be managed in cooperation with the patient’s primary care physician or other medical specialists. Pre-existing conditions of pain, as happened with this patient with severe pain widely spread after the CHIKV infection, may be considered as an independent risk factor for the early onset of TMD.

Another aspect to be analyzed regarding the TMD is the fact that their onset may be associated to possible psychological alteration present in the patient due to the long period with strong symptoms of continuous pain in several structures of her body. Thus, orofacial alterations would be consequences of psychosocial factors and not due to the direct action of CHIKV in the structures of the masticatory system. CHIKV could be considered as the initiating factor that might cause the onset of TMD because it has a multifactorial etiology; this infection may have interacted with other preexisting factors.

A critical issue associated with CHIKV infection refers to the management of patient complaints, since, there are no double-blind, placebo-controlled studies to suggest the best therapeutic approach to these cases. Since nowadays, there are not enough studies to determine the evolution of muscle involvement associated with CHIKV, although it appears that viral myositis, in general, tends to remission. Good responses to high doses of steroids have been reported in many cases of arthropathy. Steroids could regulate gene function and inactivate the related proteins involving pro-inflammatory cytokines, which could attenuate inflammatory myopathy. The patient stated that the pain only relieved after she had started taking the corticoid.

Due to the high prevalence and the cyclical appearance of the outbreak of CHIKV infection, it is necessary to control the proliferation of the infected mosquito and more studies related to the treatment. The association of corticosteroids, counseling and home therapy has proven to be effective for symptomatic remission. A detailed anamnesis and physical examination could provide information about the secondary origin of the TMD. The case emphasizes the importance of a comprehensive evaluation of a patient with preexisting pain when new symptoms arise, worsening the systemic condition. In this case, the improvement of the systemic disease (CHIKV infection) associated with counseling and splint resulted in the remission of the orofacial symptomatology.

REFERENCES


Dear Editor,

We’ve read with great interest the paper “Immediate analgesic effect of the 2KHz interferential current in chronic low back pain: randomized clinical trial”. Neuromodulation is based on the concept that the electrical stimulation-induced paresthesia can be analgesic. Its historical basis emanates from the gate control theory of pain proposed by Melzack and Wall in 1965. Neuromodulation gave us access to pain modulation systems and helped to mature the understanding of the pathophysiology of pain. However, the current understanding of pain is still rudimental and the evidence that neuromodulation works, is modest. A current review conducted by Cochrane concluded that “we are still unable to conclude with confidence that in people with chronic pain, the transcutaneous electrotherapy is detrimental or beneficial to control pain, disability, health-related quality of life, drug use for pain relief or overall perception of change”. However, the results presented by this study have convinced us that the interferential current has its role in the management of chronic low back pain; not because of its long-term analgesic effect but because of its immediate analgesic effect that proved to be satisfactory in the preparation of the patient to receive kinesiotherapy, which has more robust levels of evidence in the control of chronic low back pain. That is, electrotherapy is not a panacea, much less the basis of the non-surgical management of low back pain, but it can play its role as a bridge to access more robust therapies, relieving immediate pain, thus allowing the beginning of other therapies. We encourage the authors to continue the work investigating the behavior of pain in other frequencies and perhaps to elaborate a protocol for the adjuvant use of the interferential current in the treatment of chronic low back pain.

Keywords: Analgesia, Low back pain, Electrical stimulation therapy.

Conflict of interests: none - Sources of support: none.

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The Brazilian Journal of Pain (BrJP), printed version: ISSN 2595-0118, electronic version: ISSN 2595-3192, is the multidisciplinary medical journal of the Brazilian Society for the Study of Pain (SBED). This is a journal focusing on the study of pain in clinical and research contents, gathering scientists, physicians, dentists, veterinaries, epidemiologists, psychologists, physiotherapists and other health professionals aiming at publishing their basic or applied research in this area of knowledge. Articles are of full responsibility of the authors and its periodicity is quarterly. All submitted papers are reviewed and the journal follows the Uniform Requirements of Manuscripts submitted to Biomedical.

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