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Analgesic protocol for procedural pain treatment of second-degree burns in children

Analgetski protokol u ublažavanju proceduralnog bola kod dece sa opekotinama drugog stepena

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Abstract

Background/Aim. Children with burns are submitted to multiple painful and anxiety-related procedures during the change of wound dressing, treatment, and rehabilitation. The objective of analgesic treatments for procedural pain is the safe and efficient management of pain and emotional stress, which requires a careful, balanced, and systematic approach. The aim of this study was to determine the effectiveness of analgesic and/or local anesthetic in relieving the intensity of procedural pain. **Methods**. The study included 120 pediatric patients with second-degree burns who were allocated into four groups of 30 children (control group, groups I, II, and III). During the change of wound dressings, children in the control group did not receive any analgesics, while in the remaining three groups, 30 minutes prior to the change of wound dressing, oral nonsteroidal anti-inflammatory drug (group I), local anesthetic (group II), or both medications (group III) were administered. **Results.** The average visual analog scale (VAS) score for assessing pain was statistically significantly higher in the control group on all tested days compared with children in the other three treated groups. On the first test day (24 hrs after sustaining the burn injuries), all children had high VAS scores, and according to the receiver operating characteristics (ROC) analysis, the boundary value was 89.50/100. There was a remarkable difference in the VAS score between the groups on the fifth day of dressing change with the boundary value of 57.50/100 and on the seventh day when the boundary value was 43.50/100. Children who experienced the lowest intensity pain during dressing changes of burn wounds for all test days were those from the group who received both systemic analgesic and local anesthetic. **Conclusion.** The study confirmed the importance of introducing the complex polymodal protocol in treating procedural pain in second-degree burns. The protocol should include analgesics as well as anesthetics since they both contribute to achieving the best results in pain reduction and treatment outcomes.

Key words:
analgesics; anesthetics, local; burns; child; pain measurement; pain, procedural.

Apstrakt

Uvod/Cilj. Deca sa opekotinama su tokom previjanja, nege i rehabilitacije podvrgnuta višestrukim, bolnim procedurama koje izazivaju anksioznost. Primena analgetika za ublažavanje proceduralnog bola, ima za cilj bezbedno i efikasno upravljanje bolom i emocionalnim stresom, što zahteva pažljiv, balansiran i sistematičan pristup. Cilj rada bio je da se utvrdi u kojoj meri primena analgetika i/ili lokalnog anestetika ima uticaj na smanjenje intenziteta proceduralnog bola. **Metode.** U studiju je uključeno 120 pacijenata dečijeg uzrasta sa opekotinama drugog stepena koji su razvrstani u četiri grupe od po 30 dece (kontrolnu grupu i grupe I, II i III). Tokom previjanja, deca iz kontrolne grupe nisu primala analgetike, a deca u preostalim grupama su 30 minuta pre previjanja primali: nesteroidni antiinflamatorni lek, oralno (grupa I), lokalni anestetik (grupa II) ili oba leka (grupa III). **Rezultati.** Prosečni skor vizuelno analogne skale (VAS) za procenu intenziteta bola bio je statistički značajno veći u kontrolnoj grupi, tokom svih ispitivanih dana, u odnosu na preostale tri grupe dece koje su primile analgetike. Prvog dana (24 časa nakon zadobijanja opekotina), sva deca su imala visoke vrednosti VAS skora i prema *receiver operating characteristics* (ROC) analizi granična vrednost bila je 89,50/100. Vidna razlika između grupa u pogledu vrednosti VAS skora uočena je petog dana previjanja, sa graničnom vrednosti od 57,50/100 i sedmog dana kada je

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granična vrednost iznosila 43,50/100. Najmanji intenzitet bola prilikom previjanja, tokom svih ispitivanih dana, prijavljivala su deca u grupi koja je primila i sistemski analgetik i lokalni anestetik. **Zaključak.** Istraživanje je pokazalo značaj uvođenja složenog polimodalnog protokola u lečenju proceduralnog bola prilikom previjanja opekotina parcijalne debljine kože. Najbolji rezultati u smanjenju intenziteta bola i izlečenju postižu se primenom protokola koji uključuje i sistemsku analgeziju i lokalnu anesteziju.

Ključne reči:
analgetici; anestetici, lokalni; opekotine; deca; bol, merenje; bol, proceduralni.

Introduction

Burns continue to represent an important medical, social, and economic issue in modern society. The consequences of burn injuries are especially harsh in children since the functional, aesthetic, and psychological sequels are much more severe than in adults. Burns are experienced as traumatic events related to high stress and anxiety levels. Pain is an unpleasant subjective experience with sensory, emotional, and behavioral components [1–4].

Patients with burns are subjected to high levels of "expecting" pain before wound dressing, which is repeated daily and increases the patient's perception of pain. This anticipated treatment-related distress leads to an increased subjective perception of pain, which in turn reinforces the anxiety experienced by patients as a feedback loop. That explains the occurrence of intensified pain in burn victims during their hospitalization and follow-up [1, 5].

Nowadays, pain management in burn patients encompasses a wide spectrum of pharmacological and non-pharmacological treatment methods. Opioids, non-opioids [non-steroidal anti-inflammatory drugs (NSAIDs), acetaminophen, and topical lidocaine], antidepressants, anxiolytics, sedatives, alpha-adrenergic agonists, and others are used as pharmacological treatment. On the other hand, various adjuvant techniques (psychotherapy, distraction, music, virtual reality, massage, and others) are used as a non-pharmacological treatment to meet the patient's needs [1–3]. In the outpatient setting, pain relief is most commonly managed by NSAIDs [5, 6]. Despite numerous options for managing procedural pain, especially in the pediatric population, the lack of implementing pain relief techniques or their inadequate implementation is still quite common [7, 8].

The aim of this study was to evaluate whether the use of analgesics and/or local anesthetics had an effect on relieving the intensity of procedural pain in children.

Methods

In this study, 120 children were treated for burns for two years at the Clinic for Pediatric Surgery, Institute for Child and Youth Health Care of Vojvodina in Novi Sad, Serbia.

Patients included in the study were selected randomly and were divided into four equal groups of 30 children alternatively.

Inclusion study criteria were as follows: children of both genders aged 6 to 15 years with second-degree (IIa – partial thickness) burns which covered less than 10% of total body surface area located on the body and extremities (excluding the face, genitalia, and hands). After a detailed explanation of the methodology to the parents, written consent for the study was obtained.

Exclusion criteria were the following: burns on the face, genitalia, and hands; children who have taken antibiotics for any reason at least two weeks before hospitalization; all children with chronic illnesses, especially of the liver and kidneys; patients with previous diseases at least one month before being admitted to hospital; all patients treated with immunosuppressive therapy; patients with congenital anomalies; patients with psychomotor disturbances; patients with multiple injuries and traumas; patients with signs of wound infection during the study; patients without written consent for participation in this study.

Common clinical practice in the treatment of deep dermal and subdermal burns includes pain treatment, while minor burns (superficial dermal burns – level IIa, which do not require surgical treatment) are usually treated with daily dressing changes but without planned psychological preparation or analgesics. The dressing changes procedure consists of removing the dressing, washing the wound, applying the medication (silver sulfadiazine), and placing a new dressing. Since this type of treatment is associated with repeated painful experiences of different intensities and durations, we investigated to which extent the use of analgesics as standard procedure for dressing changes of level IIa burns (superficial dermal burns) had an impact on the patient's perception of pain during treatment and healing process.

The following medications were used in the study:

1. Ibuprofen (Brufen®, oral suspension 100 mg/5 mL, 100 mL, Galenika a.d.), an NSAID used for systemic analgesia.
2. Xylocaine® gel 5%, 30 g, galenic formulation, Pharmacy Belgrade, used as a topical anesthetic.

This prospective study was conducted at the Institute for Child and Youth Health Care during the two years from 2012 to 2014 and was approved by its Ethics Committee (Decision No 403-6).

All patients received standard primary surgical treatment of the burn upon obtaining the burns (day zero), and an absorptive bandage was applied.

Local treatment of the burn began 24 hrs after the injury, and afterward, the children were randomly divided and assigned to one of the following groups: a control group and groups I, II, and III.

The control group did not receive any analgesics before the change of wound dressing. Only regular distraction methods, such as talking, singing, or cartoon playing, were applied. The wound care started with toilette and debridement, and silver sulfadiazine was applied to the wound (a common manner of dressing minor burns).

Group I – the patients were treated with a 30 mg/kg dose of ibuprofen, and thirty minutes later, the wound was dressed, and silver sulfadiazine was applied.

Group II – when dressings were removed, Xylocaine® gel was applied to the burn, and the wound was wrapped; after thirty minutes, the wound was cleaned, silver sulfadiazine was applied, and the wound was then redressed.

Group III – thirty minutes prior to dressing, ibuprofen was administered; thirty minutes later, dressings were removed, and Xylocaine® gel was applied to the wound; thirty more minutes later, the wound was cleaned, and silver sulfadiazine was applied along with bandages.

The intensity of pain was measured by a visual analog scale (VAS) score (0–100), in which 0 indicated the absence of pain, while value 100 was explained as the worst possible pain. The pain was measured on the first, third, fifth, and seventh day after obtaining burns during the change of wound dressing. VAS values less than 30 were considered mild pain; VAS values ranging from 30–70 denoted moderate pain intensity; VAS values estimated at higher than 70 were considered severe pain.

Statistical Data Analysis

Descriptive statistics determined the average value, standard deviation (SD), or absolute frequency of occurrence with the corresponding percentages. The difference in percentages was tested using the Chi-squared (χ^2) test. The normality of distribution was determined using the Shapiro-Wilk test. Pain intensity in relation to the treatment group for each day of dressing changes was analyzed by one-way analysis of variance (ANOVA), Schaeffer's test. Key points for the first, third, fifth, and seventh day were determined based on receiver operating characteristic (ROC) curve analysis. Linear regression analysis was used to estimate the effects of therapy, age, and gender on the VAS score. All analyses were done using SPSS Statistics 23.0 (IBM, Chicago, USA), and the statistical significance was assessed at the level of p less than 0.05.

Results

Results of the regression analysis showed that the combined effects of the treatment method, gender, and age increased with the increasing time after burn injury (Table 1). There were no significant differences regarding gender and age. Only the treatment method had a significant effect on all examined days.

On the first day, during dressing changes, the average pain values were very high for all the children in all the groups (Table 2). Children from the control group reported pain significantly ($p < 0.05$) more intensively than children from groups I and III, while this difference between groups I and III was not significant. The pain was significantly ($p < 0.001$) less intensive after analgesic application on the third, fifth, and seventh day after burn injury in all the groups compared to the control. Children who experienced the intensity of pain the least during dressing changes after burn injury belonged to group III during the whole observed period.

Further results of the repeated measures analysis showed that VAS score values significantly decreased ($p < 0.001$) in all analyzed groups as time progressed (Table 3). On the first and the third day during dressing changes, all children from the control group had a VAS score higher than 70, which indicated severe pain, while after the fifth day, only 40% of children had severe pain, and after the seventh day all children in this group had moderate pain. In the groups of treated children, severe pain was noted in 80 out of 90 (88.9%) children on the first day and 66 out of 90 (73.3%) children on the third day. However, the pain significantly decreased on the fifth examined day, when only 6 out of 90 (6.7%) children reported severe pain. No child from the control group had a VAS score less than 30 (mild pain) during all examined days, while in all treated groups

Table 1

Effects of group, gender, and age on the visual analog scale scores during wound dressing changes

Time after burn injury (day)	Regression analysis						r
	group		gender		age		
	beta	p-value	beta	p-value	beta	p-value	
First	-0.204	**0.027**	0.041	0.651	0.058	0.527	0.214
Third	-0.293	**0.001**	0.050	0.573	0.002	0.980	0.295
Fifth	-0.449	**0.000**	0.138	0.095	0.069	0.403	0.470
Seventh	-0.508	**0.000**	0.052	0.513	-0.116	0.147	0.521

***p* – significance; *r* – multiple correlation coefficient. Bolded values are statistically significant.**

Table 2

Average visual analog scale score during wound dressing changes in the study groups

Time after burn injury (day)	Control	Group I	Group II	Group III
First	93.00 ± 5.43*	83.60 ± 16.16	89.47 ± 10.88	93.00 ± 5.43
Third	87.90 ± 7.04***	76.67 ± 15.92	79.83 ± 12.72	75.17 ± 13.61
Fifth	66.73 ± 10.33***	46.07 ± 13.52	52.60 ± 15.17	44.47 ± 10.78
Seventh	51.57 ± 7.53***	34.53 ± 14.75	30.50 ± 10.95	31.77 ± 11.12

Control – group without analgesic treatment; Group I – group treated with ibuprofen; Group II – group treated with Xylocaine® gel; Group III – group treated with ibuprofen + Xylocaine® gel.

Results are expressed as mean ± standard error. Statistical significance: *$p < 0.05$ compared to group II and III; ***$p < 0.001$ compared to group I, II, and III (One-way analysis of variance, Schaeffer's test).

(I, II, and III), 6 out of 90 (6.7%) patients on the fifth day and 43 out of 90 (47.8%) patients on the seventh day experienced mild pain.

The results of the χ^2 test showed a statistically significant difference in the intensity of pain between the groups with and without treatment on the third ($\chi^2 = 10.000$, df = 2, $p = 0.007$), fifth ($\chi^2 = 20.667$, df = 2, $p = 0.000$), and seventh day ($\chi^2 = 23.158$, df = 2, $p = 0.000$) after a burn injury.

The ROC analysis of the VAS score for 90 children who received analgesic treatment and thirty children without it showed that on the first day during bandaging, sensitivity was 0.800, and specificity was 0.544. The area under the ROC curve (AUC) of the first day showed a bad separation of children with applied treatment and children without it. All children had high VAS score values, and the boundary value was 89.50 [area under curve (AUC) = 0.656, 95% confidence interval (CI) = 0.558–0.753]. On the third day, there was acceptable separation (AUC = 0.750, 95% CI = 0.660–0.841). On the fifth day, separation was excellent (AUC = 0.863, 95% CI = 0.798–0.927), with a boundary value of 57.5. The results obtained on the seventh day after the burn injury showed exceptional separation during dressing changes. The boundary value was 43.50 (AUC = 0.900, 95% CI = 0.846–0.954) (Figure 1, Table 4).

Table 3

Distribution of children with and without treatment who experienced mild, moderate, or severe pain according to average visual analog scale score

Time (day)	Pain intensity	Group	
		without treatment (n=30)	with treatment (n=90)
First	Mild		1 (1.1)
	Moderate		9 (10)
	Severe	30 (100)	80 (88.9)
Third	Mild		1 (1.1)
	Moderate		23 (25.6)
	Severe	30 (100)	66 (73.3)
Fifth	Mild		6 (6.7)
	Moderate	18 (60)	78 (86.7)
	Severe	12 (40)	6 (6.7)
Seventh	Mild		43 (47.8)
	Moderate	30 (100)	46 (51.1)
	Severe		1 (1.1)

The results are given as n (%).

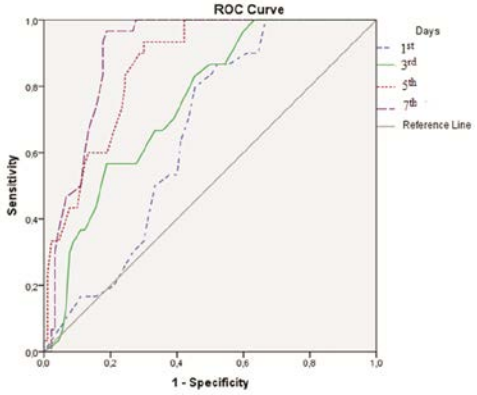

Fig. 1 – Receiver operating characteristic (ROC) curve shows the correlation of visual analog scale scores on the first, third, fifth, and seventh day after burn injury during wound dressing changes between patients with and without analgesics.

Table 4

Receiver operating characteristic analysis of visual analog scale scores during wound dressing changes with applied analgesic treatment

Parameter	Time after burn injury (day)			
	first	third	fifth	seventh
AUC	0.656	0.750	0.863	0.900
SE	0.050	0.046	0.033	0.027
Significance	0.011	0.000	0.000	0.000
95% CI	0.558–0.753	0.660–0.841	0.798–0.927	0.846–0.954
Cut-off value	89.50	84.00	57.50	43.50
Sensitivity	0.800	0.667	0.833	0.933
Specificity	0.544	0.667	0.756	0.822

AUC – area under curve; SE – standard error; CI – confidence interval.

Discussion

The study was conducted to assess the effectiveness of analgesic therapy for procedural pain in patients with superficial dermal burns. Children included in the study were 6 to 15 years old. A numerical VAS score was used to evaluate the intensity of pain. Literature supports the use of the VAS scale as it is simple, easy to use, reliable, and appropriate for this age group [8–10].

Since some studies emphasized the significance of gender and age on the perception of pain [11, 12], we have analyzed whether these variables had an impact on pain perception in our study. When observing gender differences, the results we obtained showed that during dressing changes, girls had a higher VAS score than boys, but the difference was not statistically significant. Van der Heijden et al. [1], Shahi et al. [5], and Khan et al. [13] examined the pediatric population exclusively in their studies and came to a similar conclusion, where no difference in the perception of pain regarding gender was noticed. When taking into account that some studies (Sorge and Strath [11], Mogil [12]) highlight the significance of physiological and psychosocial differences between genders in the adults' perception of pain, it is clear that this difference is subtler or nonexistent for children, which explains our results.

In terms of age, in our study, when all patients are considered as unique specimens (disregarding the group membership), younger children are found to experience a higher intensity of pain during dressing changes compared to older children, but the difference is not significant as well. The study conducted in South Africa reported a significantly higher intensity of pain perception in younger children. In this study [1], parents were not allowed to be with the children during dressing changes, while our practice is to encourage parents' presence during treatment. Another study measuring the levels of pain and distress in children with burns after dressing changes revealed no statistical significance concerning age. All the patients in this study reunited with their parents after the treatment when the measurement was conducted [2].

The underestimation of analgesic needs in children is quite widespread despite common knowledge of its negative effects on the physiologic (delayed wound healing, reduced mobility, hyperalgesia) and psychologic (anxiety, posttraumatic stress, depression) status of patients [3, 5, 14]. Even though experts stress the importance of analgesia for burn patients, many difficulties are encountered in providing pain management. Pain assessment in the pediatric population is particularly challenging due to the difficulty in differentiating pain from anxiety, hunger, or fear. Inadequate training of the staff, lack of knowledge concerning the safety and efficiency of analgesia, and established clinical malpractices are other important issues. The literature unanimously suggests the introduction of polymodal analgesic protocols to overcome the neglected pain [14–16].

We have chosen to investigate the effects of Xylocaine® gel and ibuprofen, which are the most frequently used treatment options for pain control in minor burns. Xylocaine® gel, cream, spray, or patch is widely employed as a topical anesthetic with effective pain control and rarely causes side effects [17, 19]. Ibuprofen is a commonly prescribed medication for burn victims. As a cyclooxygenase inhibitor, it strongly inhibits the pro-inflammatory interleukin-1 beta in cerebrospinal fluid and brain structures, resulting in a hypersensitivity decrease [7, 13, 20, 21]. Although opioid analgesics are mostly used in pain therapy for burns, we have left them out of the study. The main reason for doing so is the fact that only superficial dermal burns treated in outpatient conditions were included in the study, and in such situations, opioids are avoided due to possible negative side effects, such as respiratory depression, physical dependence, or tolerance.

While observing the intensity of pain, a significant decrease in its values could be noticed in all the groups from the first to the seventh day of dressing changes, when an epithelialization of the burn wound would gradually occur, and the burned area would become smaller. Similarly, Resch et al. [22] recorded a continuous decrease in pain intensity in the course of dressing changes in all the participants during the period they observed.

Children who did not receive any therapy during dressing changes (the control group) had a significantly higher VAS score than all the children in other groups. The only exception was on the first day when the VAS score in the control group was not significantly higher in comparison to the group of children treated with local anesthetic (group II). Better results in terms of analgesia were achieved in the groups treated with ibuprofen (groups I and III) compared to the group treated with a local anesthetic (group II). These results may be due to both the anti-inflammatory and analgesic effects of ibuprofen [20].

Van der Heijden et al. [1] divide different phases of wound care into four actions: removing the bandages, washing the wound, applying the wound care medication, and placing a new bandage. This classification into separate phases of dressing change may explain the higher intensity of pain in group II. In this group, the anesthetic was applied after the removal of the bandages; thus, the initial painful stimuli could not be inhibited.

The presence of intense pain during dressing changes indicates a need for the applied analgesic regime, and the best results in our study were achieved by combining local anesthetic and oral analgesic. There are suggestions for the potential use of opioid analgesics, especially in the first few days after injury [3].

Although the literature suggests that pain in minor burns could be successfully treated with either local anesthetic (lidocaine) or oral analgesic (NSAID) [6, 17], our experience suggests that the combination of those two offers better results in terms of patient satisfaction and overall treatment outcome.

Conclusion

The results of our study show that gender and age are not playing a significant role in pain perception, so they should not be used as indicators for predicting pain intensity

in the pediatric population. The importance of complex polymodal protocol introduced in the treatment of minor burns in children was confirmed. The protocol should include analgesics as well as local anesthetics since they both contribute to achieving a satisfactory treatment outcome. To improve clinical practice, continuing research is essential to explore different pharmacological and non-pharmacological approaches in dealing with procedural pain in burn patients.

REFERENCES

1. *van der Heijden MJE, de Jong A, Rode H, Martinez R, van Dijk M.* Assessing and addressing the problem of pain and distress during wound care procedures in paediatric patients with burns. Burns 2018; 44(1): 175–82.
2. *van der Heijden MJE, Jeekel J, Rode H, Cox S, van Rosmalen J, Huninк MGM,* et al. Can live music therapy reduce distress and pain in children with burns after wound care procedures? A randomized controlled trial. Burns 2018; 44(4): 823–33.
3. *Nosanov LB, Brandt JL, Schneider DM, Johnson LS*. Pain management in burn patients. Curr Trauma Rep 2020; 6: 161–73.
4. *Le May S, Hupin M, Khadra C, Ballard A, Paquin D, Beaudin M,* et al. Decreasing Pain and Fear in Medical Procedures with a Pediatric Population (DREAM): A Pilot Randomized Within-Subject Trial. Pain Manag Nurs 2021; 22(2): 191–7.
5. *Shahi N, Meier M, Phillips R, Shirek G, Goldsmith A, Recicar J,* et al. Pain Management for Pediatric Burns in the Outpatient Setting: A Changing Paradigm? J Burn Care Res 2020; 41(4): 814–9.
6. *Chu H, Sen S*. Pre-attendance analgesia advice for small acute paediatric burns in the British Isles: A National Survey. Burns 2020; 46(6): 1318–9.
7. *Wall SL, Clarke DL, Nauhaus H, Allorto NL*. Barriers to adequate analgesia in paediatric burns patients. S Afr Med J 2020; 110(10): 1032–5.
8. *Zieliński J, Morawska-Kochman M, Zatoński T*. Pain assessment and management in children in the postoperative period: A review of the most commonly used postoperative pain assessment tools, new diagnostic methods and the latest guidelines for postoperative pain therapy in children. Adv Clin Exp Med 2020; 29(3): 365–74.
9. *Baghele A, Dave N, Dias R, Shah H*. Effect of preoperative education on anxiety in children undergoing day-care surgery. Indian J Anaesth 2019; 63(7): 565–70.
10. *Susam V, Friedel M, Basile P, Ferri P, Bonetti L*. Efficacy of the Buzzy System for pain relief during venipuncture in children: a randomized controlled trial. Acta Biomed 2018; 89(6–S): 6–16.
11. *Sorge RE, Strath LJ*. Sex differences in pain responses. Curr Opin Physiol 2018; 6: 75–81.
12. *Mogil JS*. Qualitative sex differences in pain processing: emerging evidence of a biased literature. Nat Rev Neurosci 2020; 21(7): 353–65.
13. *Khan A, Parikh M, Minhajuddin A, Williams T, Abrams R, Kandil E*, et al. Opioid prescribing practices in a pediatric burn tertiary care facility: Is it time to change? Burns 2020; 46(1): 219–24.
14. *Wall SL, Clarke DL, Allorto NL*. A comparison of analgesia requirements in children with burns: do delayed referrals require higher procedural analgesia doses? Burns Open 2020; 4(3): 103–9.
15. *Jeffs D, Dorman D, Brown S, Files A, Graves T, Kirk E*, et al. Effect of Virtual Reality on Adolescent Pain During Burn Wound Care. J Burn Care Res 2014; 35(5): 395–408.
16. *Wall SL, Clarke DL, Allorto NL*. Analgesia protocols for burns dressings: challenges with implementation. Burns 2019; 45(7): 1680–4.
17. *Abid S, Hussain T, Nazir A, Khenoussi N, Zahir A, Riaz S*. Development of nanofibers based neuropathic patch loaded with Lidocaine to deal with nerve pain in burn patients. 2018 IOP Conf Ser: Mater Sci Eng 2018: 414 012019.
18. *Van Straten A, Murray AA, Levin AI*. Xylocaine® 10% pump spray as topical anaesthetic for venepuncture pain. South African J Anaesth Analg 2018; 24(3): 75–8.
19. *Trottier ED, Doré-Bergeron MJ, Chauvin-Kimoff L, Baerg K, Ali S*. Managing pain and distress in children undergoing brief diagnostic and therapeutic procedures. Paediatr Child Health 2019; 24(8): 509–21. (English, -french)
20. *Barbagallo M, Sacerdote P*. Ibuprofen in the treatment of children's inflammatory pain: a clinical and pharmacological overview. Minerva Pediatr. 2019; 71(1): 82–99.
21. *Storey K, Kimble RM, Holbert MD*. The Management of Burn Pain in a Pediatric Burns-Specialist Hospital. Paediatr Drugs 2021; 23(1): 1–10.
22. *Resch A, Staud C, Radtke C*. Nanocellulose-based wound dressing for conservative wound management in children with second-degree burns. Int Wound J 2021; 18(4): 478–86.

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