ORIGINAL ARTICLE

Determination of methods used by the neonatal care unit nurses for management of procedural pain in Turkey

Melahat Akgün Kostak,[1] Sevil Inal,[2] Emine Efe,[3] Hatice Bal Yilmaz,[4] Zeynep Senel[5]

Abstract

Objective: To determine the pharmacological and non-pharmacological methods used by neonatal intensive care unit nurses to reduce procedural pain.

Methods: The cross-sectional study was conducted from September 2011 to June 2012 and comprised nurses employed in the paediatric departments, consisting of neonatal intensive care units and newborn units, of 15 hospitals in various cities of Turkey: 8 in Istanbul, 3 in Izmir and two each in Antalya and Edirne. Data was collected using a questionnaire and analysed using SPSS 15.

Results: The mean age of the 486 nurses was 28.19±5.14 years; 316(65%) had bachelor's degrees; 278(57.2%) had nursing experience greater than 6 years; and 322(72.5%) had newborn nursing experience greater than 6 years. Overall, 364(74.9%) nurses used non-pharmacological methods, and 145(29.8%) used pharmacological methods for pain relief. The most commonly used non-pharmacological methods were skin touch 364(75%) and giving a pacifier 269(55.3%). The most commonly used pharmacological methods were paracetamol and ibuprofen by 145(29.8%) nurses. A statistically significant difference was found between the level of education and use of pharmacological and non-pharmacological methods for pain relief ($p<0.05$).

Conclusion: Among the nurses in both groups, very little pain management was used for invasive procedures. Educational programmes for pain management in newborns should be arranged to develop an institutional culture. Guidelines for these patients' pain management should also be established.

Keywords: Procedural pain, Neonates, Pain management, Pharmacological methods, Non-pharmacological methods. (JPMA 65: 526; 2015)

Introduction

The definition, assessment and management of pain in newborns are among the most important responsibilities of neonatal intensive care unit (NICU) staff.[1,2] An effective pain management standard procedure should be present in all newborn units as these young patients are more sensitive to pain and its long-term negative effects.[2] Nurses working in NICUs are responsible for applying the best proven pain reduction methods in the most effective ways.[3]

Invasive interventions, such as bone marrow aspirations, lumbar punctures, injections and heel stick procedures, are the most commonly performed procedures on hospitalised newborns in NICUs.[3-6] Newborns who are hospitalised within the first 2 weeks of life are exposed to more than 10 invasive and painful procedures each day.[5,7] The evaluation of procedural pain and effective management are necessary due to the low pain thresholds and increased pain sensitivity of newborns.[4,7]

The most effective pain management is accomplished using a combination of pharmacological and non-pharmacological methods.[4,8] According to the guideline published by the Royal Australian College of Physicians (RACP), the most commonly used pharmacological methods for management of procedural pain in newborns are opioids, hypnosedatives and N-methyl-D-aspartic acid (NMDA) receptor antagonists.[2] Morphine and fentanyl are the most frequently used opioids for management of acute pain in NICUs. Non-opioid analgesics, propofol and ketamine are typically used together with opioids for management of procedural pain. Acetaminophen (paracetamol), ketamine and nitric oxide are considered primary analgesics.[1,2]

Local anaesthetics are useful for the reduction of procedural pain in newborns. Lidocaine and prilocaine eutectic mixture of local anaesthetics (EMLA) application is used safely and effectively for intravenous (IV) catheterisation, venepuncture, lumbar puncture, central venous catheter and circumcision procedures.[1,9,10] EMLA creme, topical amethicone and oral paracetamol are not effective alone in heel stick and intra-muscular (IM) injection procedures.[2] Therefore, they must be used

[1]Department of Child Health Nursing, Trakya University, Faculty of Health Sciences, Edirne, [2]Department of Midwifery, Istanbul University, Faculty of Health Sciences, Istanbul, [3]Faculty of Nursing, Akdeniz University, Antalya, [4]Faculty of Nursing, Ege University, Izmir, [5]Nurse, RTS Diyaliz Merkezi, Izmir, Turkey.

Correspondence: Melahat Akgün Kostak. Email: akgunmel@yahoo.com

together with non-pharmacological methods to relieve procedural pain. Opioids, sedatives and other analgesics are indicated in painful procedures, such as bone marrow aspiration, biopsy and lumbar puncture procedures.[2,7]

Many specific non-pharmacological methods are available that may be used for pain management in newborns. These include oral sucrose, kangaroo care, giving breast milk, breast-feeding, clothing, skin touch, swinging, swaddling, giving pacifier, hugging, massage, positioning, music and arrangement of the environment.[7] The application of many combined non-pharmacological methods during painful interventions in all newborns in neonatal care units, mainly in premature newborns, reduce stress reactions and pain.[11,12] Breast milk,[13] kangaroo care,[5,14-17] swaddling,[11,12,18] hugging,[19] clothing,[18] oral sucrose[6,20] and breast-feeding[13] were also effective for the relief of procedural pain in preterm newborns.

A large number of studies have indicated that pain management and treatment are not always sufficient in invasive interventions in newborns despite developments in the understanding of pain.[3,4,6,21] The absence of standard methods for the estimation of pain, lack of education about pain treatment, erroneous beliefs about opioid addiction, lack of staff for pain assessment and treatment and high costs of new technologies have hindered pain treatments from reaching optimum effectiveness.[11,22]

In previous studies, nurses' beliefs about pain and pain management in children, their education levels, theoretical knowledge, work burdens, levels of experience with pain management, decision-making strategies, and the service and organisational cultures of their workplaces affected the applications of pain management.[22,23] In addition, nurses were determined to follow their role models for pain management.[4,7,22,23]

Studies investigating the pain management practices of nurses are limited in Turkey. In one study,[13] breast-feeding and skin-to-skin contact during immunisation injections significantly reduced pain in healthy neonates. Another randomised, controlled study[14] indicated that kangaroo care was effective in decreasing pain during and after invasive procedures in premature infants. A study[19] found that newborns who were held in their mothers' arms throughout the heel stick procedure experienced less pain than those in the control group. There were no studies investigating the use and affecting factors of pharmacological and non-pharmacological methods by NICU nurses in Turkey.

One study[8] reported that nurses did not make routine pain assessments and did not use non-pharmacological pain reduction methods though they did use analgesics. In a study conducted in Australia, regular pain assessments were not done in the NICU, there was no guideline for pain management and effective methods were not routinely used during painful procedures.[6] Pharmacological and behavioural pain relief methods in newborn units were also rarely used in a Swedish study.[21] A comprehensive study was not available in Turkey examining the use of pharmacological and non-pharmacological methods in newborn units.

The present study was planned to determine the pharmacological and non-pharmacological methods used by NICU nurses in Turkey to reduce procedural pain in neonates.

Subjects and Methods

The cross-sectional study was conducted from September 2011 to June 2012 and comprised nurses employed in the paediatric departments, consisting of NICUs and newborn units, of 15 hospitals in various cities of Turkey. Eight of the hospitals were in Istanbul: Istanbul Medical School Hospital of Istanbul University, Cerrahpasa Medical School Hospital of Istanbul University, Okmeydani Research and Training Hospital, SadiKonuk Research and Training Hospital, Kanuni Sultan Süleyman Research and Training Hospital, SisliEtfal Research and Training Hospital, Haseki Research and Training Hospital and Zeynep Kamil Research and Training Hospital. Three were in Izmir: Ege University Research and Training Hospital, Tepecik Research and Training Hospital and Dr BehçetUz Children's Research and Training Hospital. Two hospitals were in Antalya: Medical School Hospital of Akdeniz University and Antalya State Hospital. And two were in Edirne: Trakya University Hospital Medical School and Edirne State Hospital. Approval was obtained from Istanbul No 9 Clinical Researches Ethics Committee, while necessary permissions to collect data were obtained from each institution. We planned to reach all of the neonatal nurses employed at all the 15 hospitals.

Data was collected using a questionnaire based on a review of the research concerning pain in newborns and children,[3,7,21-23] and consisted of 18 questions related to basic characteristics (age, level of education years, working years, etc.) and the pharmacological and non-pharmacological methods each nurse used for pain relief during invasive interventions in newborns (opioids, local anaesthetics, skin touch, giving pacifier, hugging, swinging, swaddling, giving sucrose, breast milk, etc.).

To improve content validity, the instrument was pilot-tested and revised by nurses with at least 5 years of experience in newborn care. To determine whether the language of the

questions was understandable, the questionnaire was given to 20 nurses in a pilot study, wherein it was determined that the questions were understandable; therefore, no changes were made. Each nurse independently completed the questionnaire after it was explained to them. Each questionnaire was accompanied by a cover page, which briefly described the study, provided an assurance of anonymity, and indicated voluntary participation. No time limit was imposed. To avoid potential observational bias, we asked the nurses to refrain from communicating with one another about the topic of the questionnaire. The questionnaires were collected the same day. To ensure there were no missing data, the researcher checked each questionnaire during the collection phase. If a form had some data missing, the researchers requested the nurse concerned to provide the missing data.

Statistical analysis was conducted using SPSS 15. Chi-square test was used to analyse the differences between characteristics, including age, years of experience and level of education, as well as the pharmacological and non-pharmacological methods used.

Results

Of the 574 nurses approached initially, 88(15.33%) refused voluntary participation, and the final sample was 486(84.^^%) nurses. The overall mean age was 28.19±5.14 years; 316(65%) nurses had bachelor's degrees; 278(57.2%) had nursing experience greater than 6 years; and 322(72.5%) had newborn nursing experience greater than 6 years (Table-1).

Table-1: Characteristics of the sample (n=486).

Variable		n (%)
Age, Mean±SD		28.19±5.14
Level of education	Vocational high school	97 (20.0)
	Associate degree	73 (15.0)
	Bachelor degree	316 (65.0)
Province	Istanbul	307 (63.2)
	Izmir	103 (21.2)
	Edirne	41(8.4)
	Antalya	35 (7.2)
Hospital	University hospital	142 (29.2)
	State hospital	344 (70.8)
Unit	Newborn unit	124 (25.5)
	NICU	362 (74.5)
Years of experience in the hospital	Shorter than 6 years	278 (57.2)
	Longer than 6 years	208 (42.8)
Years of experience in newborn unit	Shorter than 6 years	322 (72.5)
	Longer than 6 years	134 (27.5)

NICU: Neonatal intensive care unit.

Table-2: Distribution of pharmacological and non-pharmacological pain relief methods.

Methods	The most commonly applied 3 interventions	Frequency of application n (%)
Non-pharmacological		
Skin touch	Venipuncture	364 (74.9)
	Removal of a sticking plaster	349 (71.8)
	Obtaining capillary blood	344 (70.8)
Giving pacifier	Venipuncture	269 (55.3)
	Obtaining capillary blood	260 (53.5)
	Obtaining arterial blood	258 (53.1)
Hugging	Removal of a sticking plaster	212 (43.6)
	Obtaining capillary blood	175 (36.0)
	Venipuncture	172 (35.4)
Swaddling	Insertion of an arterial catheter	207 (42.6)
	Removal of a sticking plaster	121 (24.9)
	Ocular examination	111(22.8)
Feeding	Removal of a sticking plaster	133 (27.4)
	Venipuncture	78 (16.0)
	Obtaining capillary blood	71 (14.6)
Music	Insertion of an arterial catheter	124 (25.5)
	Removial of a plaster	31 (6.4)
	Ocular examination	18 (3.7)
Clothing	Removal of a sticking plaster	119 (24.5)
	Venipuncture	88 (18.1)
	Ocular examination	87 (17.9)
Giving sucrose	Insertion of a peripheral catheter	18 (3.7)
	Lumbar puncture	17 (3.5)
	Removal of a chest tube	16 (3.3)
Pharmacological		
Other analgesics	Ocular examination	145 (29.8)
	Insertion of a chest tube	142 (29.2)
	Lumbar puncture	101 (20.8)
Opioids	Insertion of a chest tube	132 (27.2)
	Removal of a chest tube	77 (15.8)
	Lumbar puncture	76 (15.6)
Topical drug (EMLA)	Removal of a plaster	66 (13.6)
	Lumbar puncture	60 (12.3)
	Venipuncture	39 (8.0)

*The nurses indicated several pharmacological and non-pharmacological methods (more than one methods).
EMLA: Eutectic Mixture of Local Anaesthetics.

Non-pharmacological methods of pain relief were used by 364(74.9%) nurses, and pharmacological methods by 145(29.8%). The most commonly used non-pharmacological methods were skin touch by 364(75%) nurses giving pacifier 269(55.3%), hugging 212(43.6%), swaddling 207(42.6%), feeding (133(27.4%), listening to music 124(25.5%), clothing 119(24.5%) and giving sucrose 18(3.7%). The frequency of pharmacological methods were analgesics paracetamol and ibuprofen by 145(29.8%), opioids 132(27.2%) and topical analgesics 66(13.6%).

When the non-pharmacological methods were analysed,

Table-3: Use of pain relief methods by nurses according to level of education, their hospitals and duration of working at newborn unit.

Methods		Association degree and below	Bachelor degree and above	χ^2 , p
Opioid	Used	17 (10.1)	59 (18.6)	5.928
	Not used	151 (89.9)	259 (81.4	0.015
Topical drug	Used	30 (17.9)	36 (11.3)	4.002
	Not used	138 (82.1)	282 (88.7)	0.045
Skin touch	Used	68 (40.5)	190 (59.7)	16.394
	Not used	100 (59.5)	128 (40.3)	<0.001
Pacifier	Used	39 (23.2)	147 (46.2)	24.641
	Not used	129 (76.8)	171 (53.8)	<0.001
Swaddling	Used	17 (10.1)	72 (22.6)	10.701
	Not used	151 (89.9)	246 (77.4)	0.001*
Hugging	Used	19 (11.3)	86 (27.0)	16.068
	Not used	149 (88.6)	232(73.0)	<0.001
Feeding	Used	35 (20.8)	98 (30.8)	5.513
	Not used	133 (79.2)	220 (69.2)	0.019
Clothing	Used	20 (11.9)	68 (21.4)	6.037
	Not used	148 (88.1)	250 (78.6)	0.014*
		University Hospital	**State Hospital**	
Opioid	Used	19 (13.4)	18 (5.2)	8.363
	Not used	123 (86.6)	326 (94.8)	0.004
Other analgesics	Used	9 (6.3)	86 (25.0)	21.088
	Not used	133 (93.6)	258 (75.0)	<0.001
Swaddling	Used	32 (22.5)	29 (8.4)	18.218
	Not used	110 (77.5)	315 (91.6)	<0.001
Pacifier	Used	67(47.2)	109 (31.7)	10.450
	Not used	75 (52.8)	235 (68.3)	0.001
Hugging	Used	45(31.7)	62 (18.0)	10.935
	Not used	97 (68.3)	282 (82.0)	0.001
Skin touch	Used	91 (64.1)	148 (43)	17.838
	Not used	51(35.9)	196 (57)	<0.001
		0-5 years	**6 years and above**	
Opioid	Used	85 (24.1)	47 (35.1)	6.102
	Not used	267 (75.9)	87 (64.9)	0.014
Topical drugs	Used	22 (6.3)	17 (12.7)	4.611
	Not used	330(93.7)	117 (87.3)	
0.032*				
Pacifier	Used	130 (36.9)	36 (26.9)	4.373
	Not used	222 (63.1)	98 (73.1)	0.037
Feeding	Used	35 (9.9)	5 (3.7)	4.170
	Not used	317 (90.1)	129 (96.3)	0.041

*Yates correction was done.

skin touch was the most common method applied most often during venepuncture by 364(74.9%) nurses, giving pacifier during venepuncture 269(55.3%) and hugging was used most during sticking plaster removal by 212(43.6%). Swaddling was most often used when obtaining arterial blood by 207(42.6%) and feeding was used most during plaster removal by 133(27.4%). Listening to music was most commonly used during insertion of an arterial catheter by 124(25.5%). Clothing was most commonly used during plaster removal by 119(24.5%), and giving sucrose was most often done during insertion of a peripheral venous catheter by 18(3.7%) (Table-2).

The most commonly used pharmacological methods of pain relief were paracetamol and ibuprofen which were most often used during ocular examinations by 145(29.8%) nurses. Opioids were most often used during the insertion of a chest tube by 132(27.2%) and topical drugs were most often used during sticking plaster removal by 66(13.6%).

A statistically significant difference was found between the level of education and use of pharmacological and non-pharmacological methods for pain relief ($p<0.05$). Nurses with bachelor's degrees or above used opioids ($p=0.015$), skin touch ($p<0.001$), pacifier ($p<0.001$), swaddling ($p=0.001$), hugging ($p<0.001$), feeding($p=0.019$) and clothing ($p=0.014$) more often. Nurses with associate's degrees and below used topical drugs ($p=0.045$) more often (Table-3).

Nurses who worked at university hospitals used opioids ($p=0.004$) more often, while nurses who worked at state hospitals used other analgesics ($p<0.001$). In addition, nurses who worked at university hospitals used swaddling ($p<0.001$), pacifier ($p<0.001$), hugging ($p=0.001$) and skin touch ($p<0.001$) significantly more than did nurses who worked at state hospitals.

When the use of pharmacological and non-pharmacological methods for pain relief were analysed, nurses with 6 or more years of experience were found to use opioids ($p=0.014$) and topical drugs more often ($p=0.032$), and nurses with 5 years or less experience were found to use pacifiers ($p=0.037$) and feeding more often ($p=0.041$).

Discussion

This study provides an informative and detailed picture of neonatal nurses' knowledge about pain management and certain pain management practices in all the 15 universities and government hospitals in the study. The most commonly used non-pharmacological methods for pain relief were skin touch, pacifier, hugging and swaddling. The most commonly used pharmacological methods were analgesics paracetamol and ibuprofen. The National Health and Medical Research Council recommends non-pharmacological methods, such as skin touch, pacifier, swaddling, positioning and the provision of a quiet environment.[1] In our study, nurses used skin touch most during venepuncture, removal of sticking plaster and capillary blood collection procedures. In literature, the use of pacifiers, breast milk, sweet solutions and all non-pharmacological methods (swinging, skin touch, presence of parents) were recommended during venous

procedures, arterial blood collection, heel sticks and removal of sticking plaster procedures.[2] Kangaroo care,[5,14-17] pacifiers and sweet solutions,[6,9] skin touch, swaddling, holding in arms and positioning[11,12] were shown to have analgesic effects during heel stick procedures, while the use of combined oral sucrose and EMLA showed analgesic effects during venous procedures[24] in newborns.

In this study, analgesics were most commonly used during ocular examinations and the insertion of chest tubes; opioids were used during insertion/removal of chest tubes and lumbar puncture procedures; and EMLA creme was used during removal of sticking plaster, lumbar punctures and venous procedures. In literature, while non-pharmacological techniques, EMLA crème and lidocaine use were recommended before the insertion of a chest tube, sedation and analgesia (opioids, propofol and ketamine) were recommended during the procedure.[2] One study[25] recommended EMLA creme during arterial and venous procedures, insertion of percutaneous venous and arterial catheters, lumbar punctures and subcutaneous and intramuscular (IM) injections. In this study, the nurses rarely used the above-mentioned methods. Pharmacological and non-pharmacological methods used by the nurses during invasive procedures were similar and used insufficiently.

Sweet solutions and breast milk had analgesic effects in term and preterm babies during all painful procedures.[6,21] Sucrose is recommended particularly during capillary blood collections and venous procedures. In previous studies, sucrose was shown to be more effective than EMLA[9] and breast milk.[20] In a study carried out with preterm infants, the combined use of EMLA creme and sucrose was more effective than sucrose alone.[24] In this study, sucrose and feeding/breast milk were used very little for relief of procedural pain. This result shows that nurses' knowledge of non-pharmacological methods, including sweet solutions/sucrose are lacking. Although the importance of pain relief in newborns has been emphasised in many studies, non-pharmacological pain relief methods were not sufficiently used in many of these studies,[4,6,21] which is consistent with our results. Levels of knowledge and attitudes toward pain management affect the quality of care. Nurses must be informed about non-pharmacological methods for pain management and should be encouraged to use combined methods to support the development of an institutional culture of pain relief. In addition, guidelines for relief of procedural pain in newborns must be established.

In a study conducted in newborn units in Sweden, behavioural non-pharmacological methods were used in 95% of heel stick procedures, glucose was used in 90.6% of venous procedures, non-pharmacological methods were used in 16.1% and glucose was used in 86.2% of lumbar punctures; and non-pharmacological methods were used in 93.8% of sticking plaster removals.[21] A study found that in 105 NICUs in Australia, giving a pacifier was the most commonly used method, followed by comfort methods (swinging, swaddling, skin touch), for pain relief during minor invasive interventions in newborns. In addition, nurses used pacifiers most often during heel stick procedures. In the same study, breast milk was used little during venous procedures, heel sticks and subcutaneous (SC) applications. Topical anaesthetics were also rarely used.[6] In our study, nurses used skin touch most often, followed by pacifiers; however, topical anaesthetics were used by a very small percentage of the nurses (13.6%).

A Canadian study detected that nurses used physical, behavioural and environmental non-pharmacological methods during invasive procedures. Opioids were mostly used during endotracheal aspirations and ocular examinations (23.2%) and sucrose was used only during lumbar punctures (2%). Non-pharmacological methods were used during heel stick procedures, IV procedures, endotracheal aspirations, ocular examinations and IM/SC injections, lumbar punctures and sticking plaster removals.[3] Consistent with these results, our study showed that giving sucrose was the least used non-pharmacological method (3.7%) and was employed most often during peripheral venous catheter insertions, lumbar punctures and chest tube removals.

In this study, nurses with bachelor's degrees and above-used opioids, skin touch, pacifiers, swaddling, hugging, feeding and clothing more often. However, nurses with associate's degrees or lower used topical drugs more often. A study reported that nurses' levels of education and knowledge affected their applications of pain relief.[4] In our research, nurses with associate's degrees tended to use the ordered pharmacological methods and nurses with bachelor's degrees or higher preferred non-pharmacological methods. Therefore, we may assume that level of education affects nurses' pain-relief preferences. In our study, nurses who worked at university hospitals used opioids, and those who worked at state hospitals used paracetamol and ibuprofen more often. This difference in use of pharmacological methods between hospitals could be attributed to working policies. In our research, nurses who worked at university hospitals used non-pharmacological methods, such as swaddling, pacifiers, hugging and skin touch, more often. This could indicate that the nurses who worked at university hospitals

believed that these non-pharmacological methods were more effective for pain relief in newborns.

In our research, nurses with 6 or more years of experience used opioids and topical drugs, and nurses with 5 years or less experience used pacifiers and feeding more often. Previous studies reported that nurses' pain management applications were influenced by their beliefs about pain management, their levels of education, theoretical knowledge, workloads, experiences with pain management, decision-making strategies and service and organisational cultures.[22,23] In addition, nurses tended to mimic their co-workers' pain management methods.[4,7,22,23] This could have been the result of experienced nurses using the analgesics ordered by the physicians and deciding to use non-pharmacological methods independently.

Conclusion

Nurses who worked at NICUs and newborn units used pharmacological and non-pharmacological methods very little during invasive procedures. Use of these methods by the nurses was affected by their levels of education, years of experience and the hospitals where they worked. Therefore, educational programmes on the definitions, evaluation and management of pain in newborns should be developed. These programmes should consider the ages, levels of education and years of experience of the nurses and should be designed to support the development of an institutional culture. Guidelines for pain management in newborns should be established, and larger studies investigating other factors affecting the application of pain management among neonatal nurses should be conducted.

References

1. Spence K, Henderson-Smart D, New K, Evans CC, Whitelaw J, Woolnough R, Australian and New Zealand Neonatal Network. Evidenced-based clinical practice guideline for management of newborn pain. J Paediatr Child Health 2010; 46: 184-92.
2. Walter-Nicolet E, Annequin D, Biran V, Mitanchez, D, Tourniaire B. Pain management in newborns from prevention to treatment. Pediatr Drugs 2010; 12: 353-65.
3. Stevens B, McGrath P, Ballantyne M, Yamada J, Dupuis A, Gibbins S, et al. Influence of risk of neurological impairment and procedure invasiveness on health professionals' management of procedural pain in neonates. Eur J Pain 2010; 14: 735-41.
4. Byrd PJ, Gonzales I, Parsons V. Exploring barriers to pain management in newborn intensive care units. Adv Neonat Care 2009; 9: 299-306.
5. Cong X, Ludington-Hoe SM, McCain G, Fu P. Kangaroo care modifies preterm infant heart rate variability in response to heel stick ain: Pilot study. Early Hum Dev 2009; 85: 561-7.
6. Harrison D, Loughnan P, Johnston L. Pain assessment and procedural pain management practices in neonatal units in Australia. J Paediatr Child Health 2006; 42: 6-9.
7. Oakes LL. Compact clinical guide to infant and child pain management. New York, NY: Springer Publishing Company; 2011
8. Twycross A.Why managing pain in children matters. In: Twycross SJ, Dowden E, Bruce (Eds.). Managing pain in children. United Kingdom: Wiley- Blackwell; 2009, PP 1-15
9. Gradin M, Eriksson M, Holmqvist G, Holstein A, Schollin, J. Pain reduction at venipuncture in newborns: Oral glucose compared with local anesthetic cream. Pediatrics 2002; 110: 1053-7.
10. Weise KL, Nahata MC. EMLA for painful procedures in infants. J Pediatr Health Care 2005; 19: 42-7.
11. Prasopkittikun T, Tilokskulchai F. Management of pain from heel stick in neonates. J Perinat Neonat Nurs 2003; 17: 304-12.
12. Huang CM, Tung WS, Kuo LL, Chang YJ. Comparison of pain responses of premature infants to the heelstick between containment and swaddling. J Nurs Res 2004; 12: 31-9.
13. Efe E, Özer ZC. The use of breastfeeding for pain relief during neonatal immunization injections. Appl Nurs Res 2007; 20: 10-6.
14. Akcan S, Yi?it R, At?c? A. The effect of kangaroo care on pain in premature infants during invasive procedures. Turkish J Pediatr 2009; 51: 14-8.
15. Johnston CC, Stevens B, Pinelli J, Gibbins S, Filion F, Jack A, et al. Kangaroo care is effective in diminishing pain response in preterm neonates. Arch Pediatr Adoles Med 2003; 157: 1084-8.
16. Kostandy R, Cong X, Abouelfettoh A, Bronson C, Stankus A, Ludington SM, et al. Effect of kangaroo care (skin contact) on crying response to pain in preterm neonates. Pain Manag Nurs 2008; 9: 55-65.
17. Ludington-Hoe SM, Hosseini RB. Skin-to-skin contact analgesia for preterm infant heel stick. AACN Clin Issues 2005 ;16: 373-87.
18. Cignacco E, Hamers, JP, Stoffel L, Lingen RA, Gessler P, McDougall J, et al. The efficacy of non-pharmacological interventions in the management of procedural pain in preterm and term neonates. Eur J Pain 2007; 11: 139-52.
19. Savaser S. Coming to arms, calming newborns during heel stick procedures.A Turkish Perspective. AWHONN Lifelines 2001; 5: 43-6.q
20. Örs R, Özek E, Baysoy G, Cebeci D, Bilgen H, Türküner M, et al. Comparison of sucrose and human milk on pain response in newborns. Eur J Pediatr 1999; 158: 63-6
21. Eriksson M, Gradin M. Pain management in Swedish neonatal units - A national survey. Acta Paediatr 2008; 97: 870-4.
22. Twycross A, Dowden S J. Where to from here. In: Twycross A, Dowden SJ, Bruce E. (Eds.). Managing pain in children. United Kingdom: Wiley-Blackwell; 2009, 219-33.
23. Twycross A. Non-drug methods of pain relief. In: Twycross A, Dowden SJ, Bruce E (Eds.). Managing pain in children. United Kingdom: Wiley-Blackwell; 2009, 67-84
24. Biran V, Gourrier E, Cimerman P, Walter-Nicolet E, Mitanchez D, Carbajal R. Analgesic effects of EMLA cream and oral sucrose during venipuncture in preterm infants. Pediatr 2011; 128: e63-70.
25. Mathew PJ, Mathew JL. Assessment and management of pain in infants. Postgrad Med J 2003; 79: 438-43.