

## The Impact of Blood Sampling Site on Pain Score in Preterm Infants: A Crossover Randomized Clinical Trial

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### Abstract

#### Background

Blood sampling is a usual and painful procedure on preterm infant. Repeating painful procedures may affect the process of normal brain development and Pain management is important for nurses. This study was conducted to evaluate and compare pain score in two sites of blood sampling in preterm infants.

#### Materials and Methods

Blood sampling is a usual and painful procedure on preterm infant. Repeating painful procedures may affect the process of normal brain development and Pain management is important for nurses. This study was conducted to evaluate and compare pain score in two sites of blood sampling in preterm infants.

#### Results

The pain score was significantly higher while sampling was conducted from hand veins compared to scalp veins ( $p=0.001$ ). The pain score was significantly higher in preterm infants with lower gestational age (28-30 weeks) than the infants with 30-32 weeks of gestation ( $p=0.048$ ).

#### Conclusion

The pain score in preterm infants according to ALPS-Neo method was significantly higher while sampling was conducted from hand veins compared to scalp veins. Preterm infants with lower gestational age had also higher pain score.

**Key Words:** Blood, Infant, pain, Premature, Venipuncture.

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## 1- INTRODUCTION

Pain management is an important part in care of infants, as the American Association for the Study of Pain has defined pain as the fifth vital sign in order to emphasize its importance and to increase the awareness of healthcare members about pain management (1, 2). The International Association for the Study of Pain (IASP) considers pain as an unpleasant feeling and an emotional experience relating to tissue damage (3). Until 1980, there was a doubt about infants' feeling of pain and it was believed that they do not feel any pain (4). Now, it has been recognized that sensitivity to pain in mature infants is similar to the children, but preterm infants are more sensitive to pain (5, 6). On the other hand, hospitalized infants in Neonatal Intensive Care Units (NICUs) are exposed to frequent painful therapeutic interventions and prolonged pains(7). Preterm or ill infants may undergo 1 to 21 heel punctures or venipuncture during a day (8). Number of invasive procedures and blood sampling processes is correlated with low gestational age and severity of illness (3). These procedures can cause acute pain and negatively affect infants' clinical condition and improvement (9).

Acute pain in infants has some short-term and long-term adverse effects. The short-term complications are: dropping in stands for peripheral capillary oxygen saturation (Spo<sub>2</sub>) level, increased blood pressure, tachycardia, irritability, sleep disturbance and decreased amount of feeding. The long-term complications include: delay in wound healing, changes in the immune system performance, delay in development and different responses to similar painful experiences (2, 10-12). In infants, pain impulses are transferred through unmyelinated nerves; consequently, behavioral responses to acute pain may be delayed. On the other hand, spinal receptive areas are broader in infants, ends

of skin nerves are more intense and closer to the skin surface and inhibitory descending neurotransmitters are not active enough to decrease pain. These factors may result in more intense feeling of pain in preterm infants (13, 14). Some researchers have found out that preterm infants do not have enough ability to respond to pain (15, 16); whereas, other researchers believe that immature infants have lower pain threshold and as a result, they would have more physiologic reactions following a painful procedure (17-19). Various studies have been conducted worldwide on different blood sampling methods, scoring of pain and different pain-relief methods such as use of sucrose (20, 21), vanilla odor (22) mother milk (23), positioning (24), etc., before painful procedures. A number of studies have compared the pain score on different sites of blood sampling such as dorsum of the hand and heel (25, 26),

For instance, the study by Ogava et al. showed that blood sampling from dorsal hand veins causes less pain compared to heel prick (27). In the study conducted by Zhiping (2003) on intravenous catheter durability in two sites of limbs and scalp veins in infants, no significant difference was found between groups (28). In Fang's study (2008) sites and duration of intravenous catheter were compared among infants and children. Consequently, scalp veins were selected as the best sites in infants (29). Various studies have also been conducted on blood sampling in Iran. Most of these studies have focused on pain management and relief (20-22, 30, 31); however, no study has been carried out comparing the impact of blood sampling sites on the pain score in preterm infants. Nowadays, in most NICUs, blood sampling from the dorsum of the hand is a common method and scalp veins are taken into account as venipuncture sites after hand and heel (1). On the other hand the process of establishment of the newborn

individualized developmental care and assessment program (NIDCAP) had begun since 3 years ago in the NICU of the Alzahra Teaching Hospital of Tabriz under supervision of the NIDCAP federation international (NFI), pain management and selecting a proper site for blood sampling was one of the priorities in the unit. The present study was conducted to evaluate and compare pain score in two sites of blood sampling in preterm infants.

## **2- MATERIALS AND METHODS**

### **2-1. Study design and population**

This randomized crossover clinical trial was conducted between March and September 2016 in the NICU of the Alzahra Teaching Hospital of Tabriz, North West of Iran. The participants consisted of 105 preterm infants with 28-32 weeks gestation who needed blood sampling from veins during 4<sup>th</sup> to 8<sup>th</sup> days of their birth. The infants were randomly allocated into 2 groups using Rand list software and binary blocking. In the both groups, the parents were allowed to support their infants by their hands, and if the parents were not in the unit or they refused one trained under nurse supported the infants. The flowchart of entering the infants in the study is shown in **Figure.1**.

### **2-2. Methods**

Blood sampling was performed by two experienced nursing staff, who had 10 years of work experience in the NICU, when the infants were awake and active between two feeding intervals. Both the nurses had agreement score calculated by Cohen's kappa (0.7) in the blood sampling procedure.

### **2-3. Measuring tools: validity and reliability**

Primary outcome of this study was evaluation and comparison of pain score while taking blood samples from veins of the scalp and hands and secondary

outcome was effect of gestational age on pain score. Data collection included a questionnaire to collect the mothers' and infants' demographic information (including infant's gestational age, gender and weight, risk factors of preterm delivery, and mothers' use of medicine during pregnancy), and pain scored by the ALPS-Neo pain assessment scale (32). ALPS-Neo 2013 (Astrid Lindgren Children's Hospital Pain Scale) is a new evaluative instrument to manage the pain and stress in mature or preterm infants in NICUs. It is an easy, fast and reliable instrument. It contains 5 items of face gestures, breath pattern, muscle tonicity, hands and feet movement and level of activeness. Every item in this instrument has been scored from zero to 2. The minimum and maximum scores are zero and 10 respectively. ALPS-Neo was confirmed to be a valid and reliable tool (33). The validity of the score were also investigated once again by 10 nursing faculty professors and neonatologists.

### **2-4. Intervention**

Venipuncture was performed on scalp veins and dorsal hand veins, according to the World Health Organization (WHO) guidelines on drawing blood (34). According to the type of study, blinding patients at the time of needling was not possible. Blood sampling was performed in all the infants between 8:00 to 14:00 at similar temperature (24-26 degrees Celsius). The infants were in supine position when venipuncture and received developmental cares including nesting and support of limbs in tucked position by their mothers' hand or another caregiver.

The nurse pricked by Angiocath™ (BIO.FLON, No.24 made in India) at (25 to 45 Degree) Angle in the direction of the blood flow and collected 2 milliliter of the infant's blood through the droplet method without using a syringe. In blood sampling from scalp veins, to make veins prominent,

the infant's head was at first tied with a soft elastic band (model Coban/3M HealthCare, D-41453 Neuss Germany) with 1.5 cm width. The Angiocath™ was pricked into the scalp vein at 15-20 degree angle in the direction of the blood flow and 2ml blood was collected. The infants' behavior was observed during the two stages of blood sampling and video recorded (Samsung, Full HD/1920\*1080) from 2 minutes prior to blood sampling until 6 minutes after it was finished.

The recorded videos were observed by 2 experts in neonatology certified in NIDCAP with good experience in evaluation of pain. The recorded videos were observed by the researcher at 5 stages (2 minutes before blood sampling, at the moment of pricking Angiocath, and 2, 4 and 6 minutes after that) and the infants' pain scores were calculated and recorded using the pain observation instrument (ALPS).

### 2-5. Inclusion and exclusion criteria

Inclusion criteria were inborn preterm infants without any congenital anomaly or skin disorders and physiologic cardio-respiratory stability (oxygen saturation over 88%, heart rate of 120-160 and respiratory rate of 40-60 per minute).

Infants who received sedative drugs 12 hours before blood sampling and infants with withdrawal syndrome were excluded from the study. Infants who received invasive procedures 6 hours prior to blood sampling or underwent blood sampling more than twice were also excluded from the study.

### 2-6. Ethical consideration

The Ethics Committee of the Tabriz University of Medical Sciences, Iran, approved the study (IR.TBZMED.REC.1395.136), and the

study was registered in the Iranian Randomized Clinical Trial Website (IRCT.2016042513691N6).

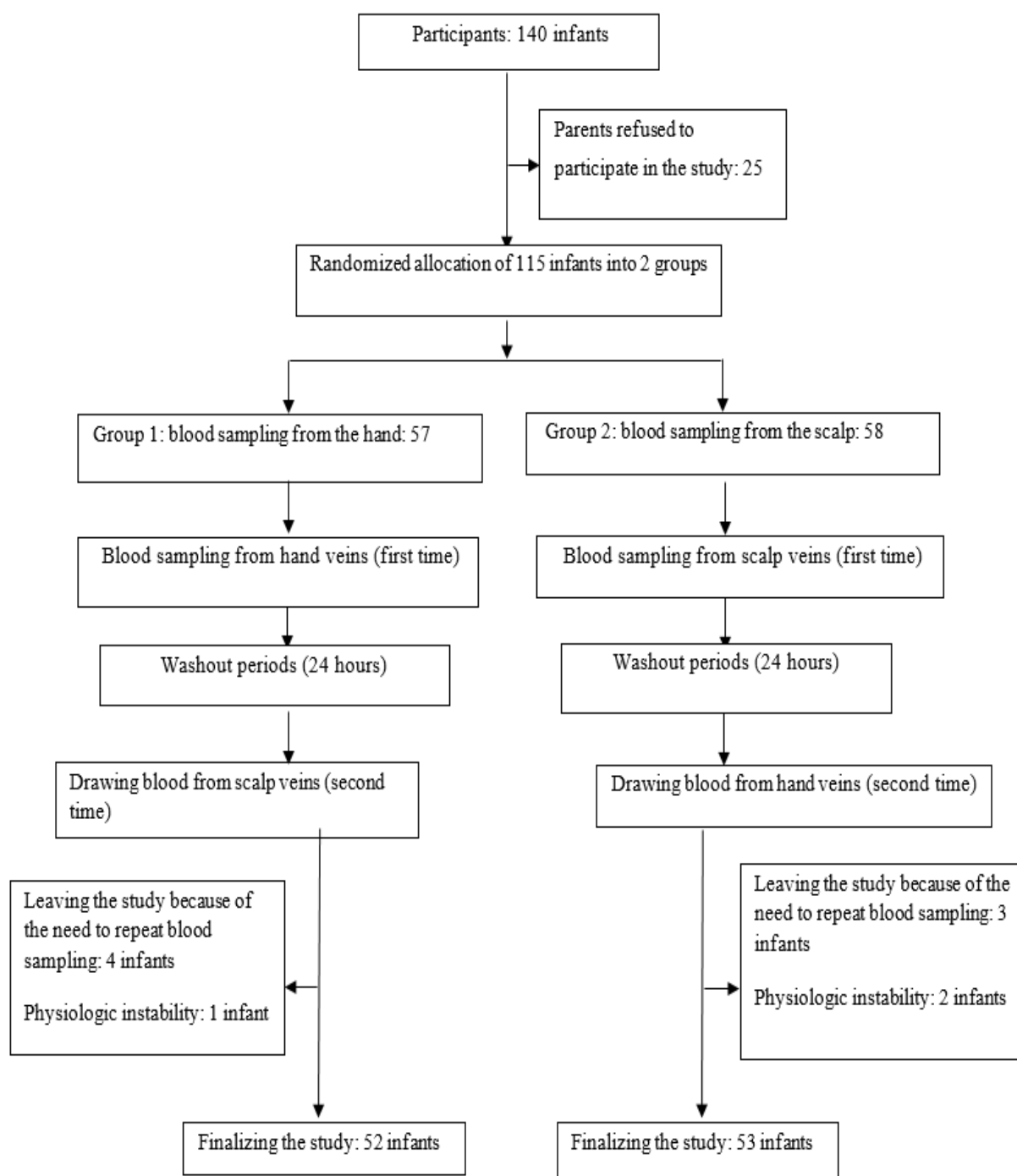
Written consent was obtained from the parents after explaining the aim and procedure in two the groups head and hand. The parents who accepted blood samples to be taken from scalps of their infants were assured that the procedure is safe and their infant's scalps were not needed to be shaved.

### 2-7. Data Analyses

The data was analyzed using SPSS version 13.0 software and Minitab 17 software packages. After entering the data, outliers were removed and exchanged with suitable methods. Normality was checked using K-S test and related transform if necessary. The nested repeated measure model with controlling confounding variables was used to compare crossovers formed in five time periods with two minutes intervals (-2, 0, 2, 4, 6), which were nested in two sites (hand and head), and two age groups (28-30 and 30-32 weeks).

Four p-value were estimated; the first P-value was  $P_{\text{Matching}}$  for checking the correlation between the groups before intervention; the second P-value was  $P_{\text{method}}$  for comparing the two sites (hand and head); the third p-value was  $P_{\text{Age-group}}$  for showing cross effect in each group (28-30 and 30-32 weeks); the final P-value was  $P_{\text{Time}}$  for comparing five time periods in each group and at each site.

The confounding effects were controlled and removed from the model. The results were formed in Mean  $\pm$  SE (standard error) and 95% CI (Confidence interval). The statistical significant level was p-value less than 0.05.



**Fig.1:** The flowchart of entering the cases into the study.

### 3-RESULTS

#### 3-1. Characteristics

Hundred and five preterm infants were investigated in two groups (28-30 weeks and 30-32 weeks with birth weight  $1096.73 \pm 8.83$  gram and  $1710.94 \pm 13.17$

gram, respectively). In two age groups fifth minute after birth Apgar-score was 7-10. According to **Table.1**, birth weight, gestational age, severity of illness, preeclampsia and demographic characteristics were matched between groups ( $p < 0.05$ ).

### 3-2. Primary outcomes

The pain scored at different blood sampling periods every 2 minutes, from 2 minutes before sampling (-2) the procedure to 6 minutes after completion of the procedure (every two minutes once) Time of inserting the needle in the skin was considered (0 minute). **Table.2** shows the score of the pain according to the ALPS-Neo pain assessment scale; when blood was sampled from the scalp or dorsal hand veins. According to **Table.2**, the pain score according to ALPS-Neo method, was significantly higher while sampling was conducted from dorsal hand

veins compared to scalp veins ( $p=0.001$ ). Furthermore in the group where blood sampling was carried out from scalp veins compared to the group where sampling was conducted from the hand, less time was needed for the pain reduction, which was statistically significant.

### 3-3. Secondary outcomes

The pain score was significantly higher in preterm infants with gestational age of 28-30 weeks than the infants with 30-32 weeks of gestation ( $p=0.048$ ). As a result Preterm infants with lower gestational age had also higher pain score.

**Table-1:** The demographic characteristics in the two groups of preterm infants and comparison of the pain score in two the blood sampling sites (the scalp and dorsum of the hand).

Variables	Variable Type	Age group,		Total	P-value, Chi-square Test
		28-30	30-32		
		Number (%)	Number (%)	Number (%)	
Gender	Male	26(5)	30(56.6)	56(53.33%)	0.338
	Female	26(5)	23(43.4)	49(46.67%)	
Delivery type	NVD	14(26.92)	9(16.98)	23(21.9%)	0.082
	C/S	38(73.08)	44(83.02)	82(78.1%)	
Preeclampsia	No	31(59.62)	34(64.15)	65(61.9%)	0.499
	Yes	21(40.38)	19(35.85)	40(38.1%)	
Maternal diabetes	No	48(92.31)	47(88.68)	95(90.48%)	0.371
	Yes	4(7.69)	6(11.32)	10(9.52%)	
Maternal thyroid disorders	No	45(86.54)	47(88.68)	92(87.62%)	0.638
	Yes	7(13.46)	6(11.32)	13(12.38%)	
Multiple birth	No	38(73.08)	33(62.26)	71(67.62%)	0.094
	Yes	14(26.92)	20(37.74)	34(32.38%)	

NVD: Natural vaginal delivery; C/S: Cesarean section.

**Table-2:** The comparison of the pain score in preterm infants during blood sampling from two sites (the scalp and dorsum of the hand) at different time periods and sampling sites

Age groups		28-30 (n=52)		30-32 (n=53)	
Method		Scalp	Hand	Scalp	Hand
Variables	Time	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Pain	-2	0.77±0.11	0.98±0.17	0.55±0.1	0.81±0.12
	0	3.56±0.14	4.65±0.14	3.45±0.15	5±0.14
	2	2.42±0.18	3.37±0.18	2.09±0.15	2.75±0.13
	4	1.46±0.13	2.54±0.18	1.06±0.16	2.26±0.14
	6	1.02±0.15	1.96±0.18	0.57±0.1	1.42±0.13
	Total	1.85±0.09	2.7±0.11	1.54±0.09	2.45±0.11
P-value	Model	Maching=0.123, Time=0.000, Method=0.000, Age-group=0.048			

Nested Repeated Measure with controlling confounding variables.

#### 4- DISCUSSION

Our study showed pain score in preterm infants was significantly higher while sampling was conducted from hand veins compared to scalp veins. Although we found a few articles in which pain score from scalp veins was compared with that at other sites, scalp veins provide a secondary option for peripheral intravascular access in small children and infants because of minimal subcutaneous fat, less movement and lack of flexible joints; this reduces the likelihood of dislodging the catheter, which is common with IV catheters placed in arms or legs (35). The same benefits may influence pain score in this group of patients. There are similar studies comparing pain score at the time of venipuncture at different sites. In the study by Manuprakash and Varadarajshenoy (2012), in which the response to pain venipuncture on dorsal hand veins and heel prick in term infants was compared at the first week of their birth, the more intense pain had been reported in sampling from hand veins rather than the heel prick (36). The results of this study were relatively consistent with our study, showing that the response to venipuncture at two different sites in infants was different and blood sampling

from the hand veins was more painful. The difference between the two studies was that in our study, preterm infants were investigated and blood sampling was performed from the scalp veins and hand veins, whereas that study was performed on mature infants on hand veins and heel prick. In Schlueter et al. study, in which blood sampling was performed on temporal arteries in order to analyze arterial blood gases, it was shown that multiple venipuncture could be done with less side effects on scalp veins of infants, especially preterm infants, because of less subcutaneous tissue (37). The results of this study were consistent with those obtained in our study; we also found that it was easier and less painful for the infant when blood sampling was taken from the scalp. However, in that study, blood sampling was performed on arteries. In addition, fang (2008) in his study pointed to scalp veins for intravenous catheterization and introduced this site as the most proper area for catheterization in infants and children in terms of the pricking position and possibility of preservation for longer time (29). Yushaki Sato et al. studied pain score during blood sampling on the forearm and heel of infants over 32 weeks of gestation.

The results showed that duration of cry and pain score in the group of sampling from the forearm was less than that in the group of the heel prick (38). Sato et al.'s study conducted a comparison similar to our study on the two blood sampling sites in preterm infants (38). However, the results of this study were consistent with our study in terms of lower pain score in sampling from the forearm. In addition, the study had been done in infants over 32 week's gestation without using any scalp veins. In our study, it was indicated that infants with lower gestational age in the both groups showed higher pain score based on the ALPS-Neo evaluation. Kurdahibadar et al. (2010) investigated the pain score in 72 infants with 27-40 weeks of gestation when blood sampling was from the heel. In their study, the pain score calculated based on the PIPP scale was reported to be higher in infants with lower gestational age (39).

The results of this study were consistent with those of our study, showed that although in very preterm infants behavioral and physiologic signs are not apparent, the pain severity is higher; therefore, it needs to be precisely investigated and managed. Regarding the importance of pain management in preterm infants and emphasis on infants' accurate neurological development, this way of blood sampling can be educated and utilized in NICUs as a low-pain and safe method. One of the study limitations was the infants' gestation (28-32) which makes it impossible to generalize the results to all preterm infants.

It also seems that the parents, who wanted to stay with their infants while blood sampling from the scalp veins, were more anxious compared to the group of sampling from dorsal hand veins. This may be resulted from abnormality of the method or a fear of damaging other organs such as brain, and is better to be investigated. Considering the limitations of

the study, it is suggested that another study be conducted in infants with various condition and gestation.

## 5- CONCLUSION

In the present study, according to ALPS-Neo pain assessment scale, in preterm infants pain score was significantly higher while sampling was conducted from hand veins compared to scalp veins. Preterm infants with lower gestational age had also higher pain score.

## 6- CONFLICT OF INTEREST

None of the authors had any personal or financial conflicts of interest.

## 7- ACKNOWLEDGMENT

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## 8- REFERENCES

1. MacDonald M, Ramasethu J, Rais-Bahrami KH. Procedures in neonatology. 5<sup>th</sup> ed. Philadelphia: Lippincott Williams and Wilkins ; 2012.
2. Mansor MN, Rejab MN, Jamil SH, Jamil AH, Junoh AK, Ahmad J. Fast infant pain detection method. In Computer and Communication Engineering (ICCCE), 2012 International Conference On 2012 Jul 3 (pp. 918-921). IEEE.
3. Verklan MT, Walden M. Core curriculum for neonatal intensive care nursing. 5<sup>th</sup> ed. United States: Mosby; 2014.
4. Kassab MI, Roydhouse JK, Fowler C, Foureur M. The effectiveness of glucose in reducing needle-related procedural pain in infants. *Journal of pediatric nursing*. 2012; 27(1):3-17. doi:10.1016/j.pedn.2010.10.008
5. Celebioglu A, Akpınar RB, Tezel A. The pain response of infants in Turkey to vaccination in different injection sites. *Applied*



- Nursing Research. 2010; 23(2): 101-5. doi:10.1016/j.apnr.2008.03.003
6. Fitzgerald M, Walker SM. Infant pain management: a developmental neurobiological approach. *Nature Reviews Neurology* 2009; 5(1):35-50. doi:10.1038/Ncpneuro0984
  7. Stevens B, Yamada J, Lee GY, Ohlsson A. Sucrose for analgesia in newborn infants undergoing painful procedures. *Cochrane Database Syst Rev*. 2013;1(1): CD001069. .
  8. Kapellou O. Blood sampling in infants (reducing pain and morbidity). *BMJ Clin Evid*. 2011; 2011: 0313. PMID: PMC3275293
  9. Brummelte S, Grunau RE, Chau V, Poskitt KJ, Brant R, Vinall J, et al. Procedural pain and brain development in premature newborns. *Annals of Neurology* 2012;71(3): 385-96. doi: 10.1002/ana.22267
  10. Vignochi C, Teixeira PP, Nader SS. Effect of aquatic physical therapy on pain and state of sleep and wakefulness among stable preterm newborns in neonatal intensive care units. *Brazilian Journal of Physical Therapy*. 2010;14(3):214-20. doi: 10.1590/S1413-35552010000300013
  11. Lago P, Garetti E, Pirelli A, Merazzi D, Bellieni CV, Savant Levet P, et al. Sucrose for procedural pain control in infants: should we change our practice. *Acta Paediatr*. 2014; 103(2):e88-90.
  12. Anand JS, Ennis M. Early experience of pain has lasting effects [Internet]. [Cited 2016 27 Feb]. : United States: Urban Child Institute. 2011:1-3. Available at: <http://www.urbanchildinstitute.org/articles/editorials/early-experience-of-pain-has-lasting-effects>.
  13. Cong X, McGrath JM, Cusson RM, Zhang D. Pain assessment and measurement in neonates: an updated review. *Advances in Neonatal Care*. 2013 Dec 1;13(6):379-95.
  14. Reyhani T, Mohebi T, Boskabadi H, Gholami H. The effect of facilitated tucking during venipuncture on pain and physiological parameters in preterm infants. *Evidence Based Care*. 2012;2(2):47-56.
  15. Bartocci M, Bergqvist LL, Lagercrantz H, Anand K. Pain activates cortical areas in the preterm newborn brain. *Pain*. 2006;122(1):109-17.
  16. Evans JC, McCartney EM, Lawhon G, Galloway J. Longitudinal comparison of preterm pain responses to repeated heelsticks. *Pediatric nursing*. 2005; 31(3):216-21.
  17. Anand K, Aranda JV, Berde CB, Buckman S, Capparelli EV, Carlo WA, et al. Analgesia and anesthesia for neonates: study design and ethical issues. *Clinical Therapeutics*. 2005; 27(6):814-43. Doi:10.1016/j.clinthera.2005.06.021
  18. Chimello JT, Gasparido CM, Cugler TS, Martinez FE, Linhares MBM. Pain reactivity and recovery in preterm neonates: latency, magnitude, and duration of behavioral responses. *Early human development*. 2009;85(5):313-8. doi:10.1016/j.earlhumdev.2008.12.005
  19. Anand KJS. Pain assessment in preterm neonates. *Pediatrics*. 2007;119(3):605-7.
  20. Keshavarz M, Amirkhazadeh Bz, Ashayeri H, Montazeri A. Effectiveness of oral sucrose in pain relieve at different stages of venipuncture in preterm infants. *Payesh* 2015; 14(6): 697-702.
  21. Razzaghi N, Ramezani M, Mohebbi T, Hoseini A, Baskabadi D. Survey the Effect of 30% Oral Glucose Solution on pain intensity following blood sampling in term neonates. In *Proceeding of the 11th National Congress of Pediatric Nursing by Hosseinpour M*. Iran J Pediatr 2013;23:28.
  22. Jebreili Mahnaz, Neshat Hanieh, Seyyedrasouli Aleheh, Ghojzade Morteza, Hosseini Mohammad Bagher, and Hamishehkar Hamed. *Breastfeeding Medicine* 2015; 10(7): 362-65. doi: 10.1089/bfm.2015.006
  23. Campbell-Yeo M, Fernandes A, Johnston C. Procedural pain management for neonates using nonpharmacological strategies: part 2: mother-driven interventions. *Advances in Neonatal Care*. 2011;11(5): 312-8. doi: 10.1097/ANC.0b013e318229aa76
  24. Reyhani T, Mohebi T, Boskabadi H, Gholami H. The effect of facilitated tucking during venipuncture on pain and physiological

parameters in preterm infants. Evidence Based Care. 2012;2(2):47-56. (Persian)

25. Shah VS, Taddio A, Bennett S, Speidel BD. Neonatal pain response to heel stick vs venepuncture for routine blood sampling. Archives of Disease in Childhood-Fetal and Neonatal Edition. 1997;77(2):F143-F4. doi:10.1136/fn.77.2.F143

26. Hammermeister M, Baskin L, Lemaire C, Naugler C. Comparison of two infant lancet devices on ease of use and post lance bleeding times. Journal of Neonatal Nursing. 2013; 19 (2): 71-5. doi:10.1016/j.jnn.2012.10.003

27. Ogawa S, Ogihara T, Fujiwara E, Ito K, Nakano M, Nakayama S, et al. Venepuncture is preferable to heel lance for blood sampling in term neonates. Archives of Disease in Childhood-Fetal and Neonatal Edition. 2005; 90(5):F432-6.

28. Zhiping C. Contract analysis for indwelling catheter between neonate limb vein and scalp vein [J]. Journal of Nurses Training. 2003;7:004.

29. Fang A. Study on Position Choice and indwelling time of intravenous catheter system in children [J]. Medical Information. 2008;8:062.

30. Sabety F, Yaghoobi M, Torabizadeh M, Javaherizadeh H, Haghighizadeh MH, Muhammadian F. Which is better for pain reduction before venipuncture: glucose, lidocaine or expressed breast milk. Journal HK J Paediatr (new series). 2013;18:19-23.

31. Jebreili M, Sayyedrassooli A, Salimi S, Ghojzadeh M. Swaddling Effect on Pain of Nasogastric Tube Insertion in Premature Infants: A Crossover Design, Randomized Clinical Trial. Iran Journal of Nursing. 2013;26(85):76-85. (Persian)

32. Lundqvist P, Kleberg A, Edberg AK, Larsson BA, Hellström-Westas L, Norman E. Development and psychometric properties of the Swedish ALPS-Neo pain and stress assessment scale for newborn infants. Acta Paediatrica. 2014;103(8):833-9.

33. Ceylan SS, Bolışık B. Validity and reliability of ALPS-Neo pain and stress assessment scale in newborns 2017; 1: 45-52

34. World Health Organization. WHO guidelines on drawing blood: best practices in phlebotomy. 1st ed. Switzerland: World Health Organization; 2010.

35. Bergvall E. Scalp vein catheterization [Internet]. [Cited 2016 12 Jun]:Medscape; 2016. Available at: <http://emedicine.medscape.com/article/1348863-technique>.

36. Manuprakash SK, Varadarajshenoy KK. Comparison of pain response to heel prick and venepuncture in term babies. Indian Journal of Public Health Research and Development. 2012;3(3): 80-4.

37. Schlueter MA, Johnson BB, Sudman DA, Wang LY, Namkung P, Heasley SV, et al. Blood sampling from scalp arteries in infants. Pediatrics. 1973;51(1):120-2. PMID: 4684430

38. Sato Y, Fukasawa T, Hayakawa M, Yatsuya H, Hatakeyama M, Ogawa A, et al. A new method of blood sampling reduces pain for newborn infants: A prospective, randomized controlled clinical trial. Early human development. 2007;83(6):389-94.

39. Badr LK, Abdallah B, Hawari M, Sidani S, Kassar M, Nakad P, et al. Determinants of premature infant pain responses to heel sticks. Pediatr Nurs. 2010; 36 (3): 129-36. PMID: 20687304