



## Examining the Effect of Massage on Preterm Infants' Pain Caused by Invasive Procedures in Neonatal Intensive Care Unit

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### Abstract

**Introduction:** Preterm infants are exposure of many painful procedures during care and treatment, and applying non-pharmacological methods helps in decreasing pain effects and providing them with comfort and health. Therefore, this study investigated the effect of massage on preterm infants' pain caused by invasive procedures in neonatal intensive care unit.

**Method:** This study was a semi-experimental research conducted on 82 infants in the neonatal intensive care unit. The procedure of sampling was random and all infants have been allocated two groups including experimental and control. The pain score was assessed for both groups at the first session of conducting invasive procedure. Then, experimental group benefited from massage for 5 days while control groups just received routine care. After this period, the pain score was assessed before, during and after intervention. Descriptive and inferential statistics were employed to analyze NIPS questionnaire by using SPSS software.

**Results:** No statistically significant difference was detected in pain scores obtained before, during and after procedure for both groups before the intervention. In addition, there was a statically significant difference in pain scores gained by two groups during implementing procedure. After procedure implementation, pain score for experimental and control group was  $2.5 \pm 0.6$  and  $3.4 \pm 0.6$ , respectively. These values confirmed that the amount of pain during and after applying procedure was significantly different between the two groups.

**Conclusion:** massage can be used as an effective solution since infants can feel and remember pain and frequent exposure to painful and constant circumstances results in physiological, mental, and behavioral complications.

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### INTRODUCTION

The preterm birth is increasing prevalent to extent that it is considered as a serious problem in the healthcare system recently (1). Premature birth is defined as going into preterm labor before the 37th week of pregnancy (2). Approximately, the global rate of preterm birth was about 11.1 percent, equivalent to 14.9 million births per year (3). There are many reasons for neonatal death including congenital anomalies, reducing the gestational age (premenstrual syndrome), weight loss, and sudden neonatal death worldwide. Immaturity is a significant agent leading to the death of 60-80% of

infants lacking congenital anomalies (4). There are some common causes leading to premature birth such as, infection, and chronic conditions such as diabetes or high blood pressure in mothers and heredity (5).

Infants are under the effect of more than 10 painful procedures during their first two weeks of hospitalization (6). These hospitalized infants suffer from pain more than children because of low pain thresholds, sensitivity to pain regarding repeated painful procedures and immature system for balancing pain and keeping homeostasis (6).

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Infants are able to feel pain of vitamin K injections, vaccines, circumcision, and heel specimens since they were born.

Infants react to pain through facial expressions and behaviors. The more painful procedures they feel the more negative physiological, behavioral, and psychological-cognitive consequences they receive. Failure of neonatal pain management may lead to permanent changes in the process of brain organization, information learning, recalling them in the future, and making maladaptive behaviors in infants (7). A study conducted in France reported that infants were in exposure of 115 painful interventions in the first two weeks of life in neonatal intensive care unit (8).

The Painful procedure in treatment may impose a negative effect on infants' clinical condition and recovery and the repetition of pain and stress may modify the development of infant's brain (9).

Hospitalization exposes infants to stressful factors in neonatal unit (10). Stressful experiences lead to the release of stress hormones such as cortisol and adrenaline in infants, and may provide dangerous side effects including fear, irritability, sleep disturbances, and emotional relationships disturbances (11). Pain has immediate, short-term, and long-term detrimental effects in infants. Immediate effects of pain consisted of fear, irritability, sleep disturbances, and decreased nutrition. Its short-term impacts are delayed wound healing, altered immune function, and emotional damage. In addition, long-term impacts consisted of delayed development and different responses to similar painful experiences.

Non-pharmacological methods control pain and are effective for neutralizing pain in implementing painful procedures because their effect is short-term, convenient, and inexpensive. In addition, they can be used without prescription and are effortlessly endured by infants (7). Massage is a useful non-pharmacological method in reducing the serum levels of cortisol as well as epinephrine in infants (12, 13).

Massage therapy has several benefits including blood circulation, the stimulation of gastrointestinal tract, better weight gain, a positive effect on neural development, better child-mother relationships, improving and reducing stressful behaviors, increasing skin integrity, and better sleep. Massage therapy is known as a useful method without any risk (5, 14). Mothers felt high levels of stress and anxiety in the process of infants' hospitalization in neonatal intensive care unit.

Nurses can reduce dominant pressure and facilitate bonding between mother and infant by encouraging communication, participation in infants' care, massage or breastfeeding(15).

The emotional attachment between mother and preterm infants can be kept strongly by mothers'

daily massage. Findings revealed that massage and prone position in experimental group were influential in reducing HR and increasing SaO<sub>2</sub> equally in compare to their counterpart group.(11) Regarding the review of existed literature, the present study examined the effect of massage on preterm infants' pain caused by invasive procedures in neonatal intensive care unit.

## METHODOLOGY

### Design of the study

The present study was performed on 82 preterm infants hospitalized in the intensive care unit of Hazrat Ali Asghar Hospital during the years 2019-2020. The sampling procedure was first randomly applied by using the random number table of the statistics reference book. Before that, researcher received proposal approval and applied for permission from the ethics committee. Then, researcher again received parents' permission in written and obtained approval of the treating physician in terms of stabilizing the physiological or clinical condition of the infants. Participants took part in this study under certain circumstances including researcher's sufficient and clear explanations for mothers about the goals and type of research, and giving detailed explanation of assessing pain. Researcher received written consent from all participants.

### Inclusion and exclusion criteria

There are some criteria for contributing in this study including Iranian nationality of mother and possibility of her presence with the infant during 24 hours a day for feeding her infant. Mothers should not be addicted to drugs or alcohol, and infants' birth should not be the result of IVF or infertility after years. The participated infant should be the first child in the family and be singleton. The mother's pregnancy should be with the previous desire. (The baby should not be born unintentionally.) The birth weight of the baby should be 2,500 grams or more. Infants should be in a stable clinical condition. The infants under the study should not be attached to equipment such as the chest tube or ventilator preventing massage therapy of the entire body.

This study ignored infants taking narcotics or sleeping pills as a result of surgery, or whose surgical incision prevents massaging the entire body, or if bleeding may occur after massage procedure. On the other hand, some infants are not accepted if doctor will not give permission for the massage and will not recognize it as effective for the clinical conditions of infants. Moreover, there are some other conditions for this study; first, infants should not be under phototherapy, all participants' admission in neonatal care units should be 3 days ago, and during this hospitalization period, infants

should be visited by her/his mother 3 times in 3 intermittent days. Exclusion criteria consisted of discharging infant before finishing the intervention, disturbing stability and general condition of the mother and the infant.

### Instruments

For collecting data, researcher took advantage of a demographic questionnaire containing mother's education level, type of insurance, family income status, mother's occupation, family residence, infant's gender, and the relationship of infants' mother with her mother. This questionnaire was completed by all mothers. In addition, the researcher filled other remaining items such as the number of pregnancies, the age calendar, gestational age of the baby, the birth weight of the infant, the weight before the massage, the weight after the massage in the first day, the weight after the massage in the third day, the fifth day weight after the massage.

### Data collection procedure

The massage training video was played for mothers. Massage training classes were held in the conference hall of above mentioned hospitals. These classes were held in 2 sessions and every session took long for one hour. In these sessions, mothers practiced massage therapy on a model practically in the presence of researcher. Indeed, these sessions were face to face and researcher explained more accurately to ensure that mothers have a better perception of massage therapy.

The researcher controlled massage therapy by mothers and checked their perception of this knowledge by observing massage procedures on available model. The researcher gave more explanations to mothers while they were watching videos on massage therapy and practicing it. In addition, for answering probable questions 24 hours a day, the researcher provided mothers with his/her mobile phone number to be in contact. The infants in experimental group received massage by their mothers for five days while control group received just routine care in unit. Then, the pain score of two groups was calculated in the first session of invasive procedure such venipuncture before, during and after this intervention with employing the NIPS tool.

The researcher took advantage of Neonatal Infant Pain Scale for measuring the pain of premature and mature infants up to six weeks after birth. This instrument consisted of Facial posture (zero score indicates relaxation and score one for frowning); infant crying (zero score for Non-crying state, score one for moaning and score 2 for severe crying); Respiratory pattern (zero score for relaxation mode and score one for breathing change); hand mobility (zero score for relaxation and score 1 for folding and opening hands); 5 leg mobility (zero score for relaxation or lying down and score one for straddling or opening); state of consciousness (zero score for sleeping or waking and score one for screaming). Generally, score of 0-3 indicates no pain, score of 3-5 represents moderate pain, and score of 5-7 is an indication of severe pain.

**Table 1: Demographic information**

Individual characteristics		Experimental 42		Control 40		P value
		P	F	P	F	
Mother age	Less than 25	33/3	14	37/5	15	0/34
	25-30	38/1	16	37/5	15	
	Up to 30	28/5	12	25	10	
Marriage age	Less than 25	47/6	20	40	16	0/25
	25-30	33/3	14	37/5	15	
	Up to 30	19	8	22/5	9	
Mother job	housewife	66/6	28	60	24	0.01
	employee	33/3	14	40	16	
Education	High school	28/5	12	35	14	0.43
	M.A. & up to M.A.	71/4	30	40	16	
Infant gender	girl	52/3	22	45	18	0/61
	boy	47/6	20	55	22	

**Table 2: Descriptive statics of demographic characteristics**

Individual characteristics	Experimental 42		Control 40		P value
	M	SD	M	SD	
Gestational age	34/5	0/65	34/8	0/8	0/64
Age Calendar	11/4	4/2	12	3/3	0/09
Duration of Hospitalization	6/6	2/5	7/45	4/13	0/45

### DATA ANALYSIS

In this study, SPSS software (version 22) was employed for comparing two groups. Descriptive, central, and dispersion indices have been calculated for descriptive purposes and T-test has been run. The significance level of 0.05 was considered.

### Findings

Results revealed that there was no significant difference between experimental and control groups regarding contextual and intervention variables such as mother's age, marriage age, mother's occupation, education, and infant's gender. Indeed, both groups were similar in most items mentioned in questionnaire (Table 1).

**Table 3: T-test results of massage score**

			P value	Mean	Std. Error Difference	95% Confidence Interval of the Difference
						Lower Upper
Amount of pain before procedure	Experimental group (with massage)		.671	.5476	.11158	-1.7443 .26966
	control group (without massage)		.671	.5000	.11159	-1.7446 .26970
Amount of pain during procedure	Experimental group (with massage)		.005	6.0238	.14587	-7.1648 -1.13590
	Control group (without massage)		.004	6.4500	.14523	-7.1528 -1.13710
Amount of pain during procedure	Experimental group (with massage)		.000	2.5476	.13530	-1.12164 -.58312
	Control group (without massage)		.000	3.4000	.13507	-1.12118 -.58358

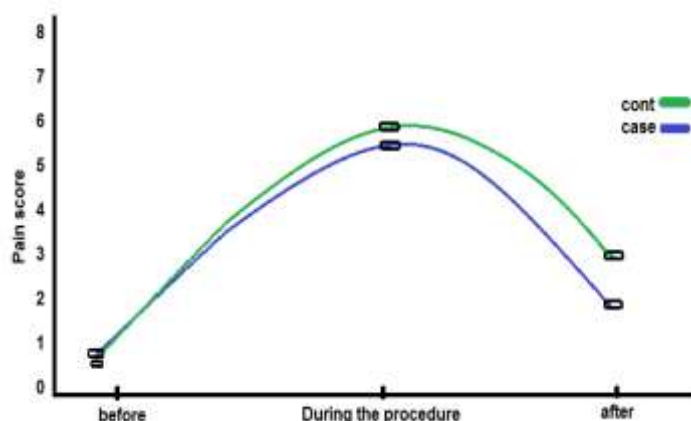
As depicted in table 2, the gestational age of neonates in the experimental group was  $34.5 \pm 0.65$  and this value for the control group was  $34.8 \pm 0.8$ . In addition, the age calendar of neonates in the experimental and control group was  $11.4 \pm 4.2$  and  $12 \pm 3.3$ , respectively.

The duration of infants' hospitalization prior to their attendance at this research was  $6.6 \pm 2.5$  and  $7.45 \pm 4/13$  for experimental and control group, respectively. This difference was not detected significant.

The researcher assessed pain scores resulting from the first invasive procedures before, after, and during the intervention before sample's attending in this study. There was no statistically significant difference between both groups with respect pain rate ( $p = 0.656$ ). However, massage by the mother in the experimental group and conducting invasive

procedure had a significant effect on the amount of pain. Therefore, the pain score for this group during the intervention was  $0.6 \pm 0.7$  and  $6.45 \pm 0.6$  in the control group which was significantly different ( $p=0.04$ ). The pain score after performing procedure was  $2.5 \pm 0.6$  and  $3.4 \pm 0.6$  in the experimental and control group, respectively; which was statistically significantly different ( $p = 0.000$ ). Generally, results indicated that pain in infants increase during and after employing procedures, but it decreases significantly with massage ( $p < 0.05$ ).

Regarding Figure 1, massage therapy imposed on infants' pain during and after conducting procedure. The following chart attributed to pain score for two groups illustrates difference in pain score during and after applying procedures.



**Figure 1:** Chart of pain scores of the two groups; blue chart shows the experimental group and the green chart shows the control group. Changes in pain scores are observed in both groups.

## DISCUSSION

Findings revealed that massage can reduce infants' pain. Results showed that there was a significant difference between mean of pain scores of massage for two groups in the first five days. Massage conducted by the mother in the experimental group and performing invasive procedure had a significant effect on the amount of pain. Therefore, the pain score for this group during the applying procedure was  $0.6 \pm 0.7$  and  $6.45 \pm 0.6$  in the control group which was significantly different. The pain score after performing procedure was  $2.5 \pm 0.6$  and  $3.4 \pm 0.6$  in the experimental and control group, respectively; which was statistically significantly different.

With respect to this research, a study conducted by Elataief et al. in 2017 indicated that massage therapy imposed a positive effect on the premature infants' weight and short duration of their stay in hospital (16). Findings of this study showed that both groups were similar in the amount of pain score before applying procedures, but a significant difference was observed between two groups during and after performing procedures.

Similar study examined the effect of massage therapy on the physiological responses of pain caused by bleeding in infants. Results showed that the severity of pain caused by bleeding in the experimental group immediately after this procedure and later 5 minutes was less than the control group. There was a statistically significant difference between two groups regarding the number of heartbeats, the number of breaths after removing the needle, and 5 minutes after removing it ( $p < 0.05$ ). In addition, there was a significant difference between two groups in the duration of infants crying due to severe pain (17).

Massage and touch reduce stress hormones and have a great effect on nerves and relaxation (18). There are various types of massage for reducing pain. A study examined the effects of human gentle touch and field massage on urinary cortisol levels in

premature infants. Its' results indicated that field massage reduced the blood cortisol levels, but GHT technique had a similar effect (19).

Mirzarahim pointed that gentle massage decreases infants' pain through activating pathways reducing stress hormones. In addition, this positive effect is along with regulating heartbeat, reducing SaO<sub>2</sub> levels and pain among infants (20). A bulk of research studies is available in examining pain response, reducing SpO<sub>2</sub>, and heart beat (21).

The present study examined the effect of massage on pain score, but considering other interventions such as breastfeeding can reduce pain effectively, Zargham-Boroujeni et al. did a research on the impact of massage and breastfeeding in response to the pain resulting of intravenous blood sampling in infants in 2017. This study was done on 75 hospitalized infants.

In this study, participants were randomly divided into three groups including breastfeeding, massage, and control. The intravenous blood sampling was done 2 minutes after breastfeeding in the first group. Regarding finding, the least score was observed in massage, breastfeeding, and in the control group, respectively.

This study suggested that massage and breastfeeding can be considered in treating and controlling pain during the process of conducting painful procedures on infants because these procedures are natural, helpful, and inexpensive interventions that do not require special facilities (16). The procedure quality as an important issue can be increased by considering proper training strategies (22).

This study revealed infants' pain increases during and after the procedure, but massage done by mother decreases this pain significantly. Pain is a destructive and damaging experience. Pain cannot be treated just by individual observations and ignoring infant's physiological responses to painful stimuli (23).



The effect of massage therapy on reducing infant' pain is significant and its' positive effect on other procedures is evident in last decades' literature.

The positive effects of massage are observed on some pains and complications including on infants' premature growth, psychological problems such as aggression, gastrointestinal problems such as constipation and diarrhea, painful conditions such as burns and anemia, cerebral palsy and Down syndrome and chronic diseases such as diabetes, asthma, and HIV (24-27). Massage plays an important role in infants' health as a therapeutic solution.

This study like other examination has some limitations such as infant's facial reactions to pain. Infants' physiological reactions are under the effect of many imperfect factors including infant hunger or discomfort, mood, sleep / wakefulness, and previous painful experiences. In this study, some variables were controlled in the process of data analysis, but future studies should take into account these elements in infants' selection and data analysis. In addition, longitudinal studies are required in examining the lasting effect of massage or clarifying whether massage impact will be reduced or disappear after it is done.

## CONCLUSION

Clinical and therapeutic procedures create pain for infants in the intensive care unit and massage is one of the inexpensive convenient procedures in reducing pain. It should be mentioned that infants can feel and remember pain. Therefore, exposure to painful and constant conditions leads to some physiological, mental, and behavioral consequences. This study made an effort in examining the effect of massage on preterm infants' pain caused by invasive procedures in neonatal intensive care unit and suggested nurses to consider massage as an effective intervention for reducing pain in infants.

## REFERENCES

1. Rangey PS, Sheth M. Comparative effect of massage therapy versus kangaroo mother care on body weight and length of hospital stay in low birth weight preterm infants. *International journal of pediatrics*. 2014;2014.
2. Verklan M, Walden M. *Neonatal intensive care nursing*. USA: Elsevier; 2015.
3. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller A-B, Narwal R, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. *The lancet*. 2012;379(9832):2162-72.
4. Martin RJ, Fanaroff AA, Walsh MC. *Fanaroff and Martin's neonatal-perinatal medicine e-book: diseases of the fetus and infant*: Elsevier Health Sciences; 2014.
5. Smith SL, Haley S, Slater H, Moyer-Mileur LJ. Heart rate variability during caregiving and sleep after massage therapy in preterm infants. *Early human development*. 2013;89(8):525-9.
6. Liaw J-J, Yang L, Wang K-WK, Chen C-M, Chang Y-C, Yin T. Non-nutritive sucking and facilitated tucking relieve preterm infant pain during heel-stick procedures: a prospective, randomised controlled crossover trial. *International journal of nursing studies*. 2012;49(3):300-9.
7. iaw J-J, Zeng W-P, Yang L, Yuh Y-S, Yin T, Yang M-H. Nonnutritive sucking and oral sucrose relieve neonatal pain during intramuscular injection of hepatitis vaccine. *Journal of pain and symptom management*. 2011;42(6):918-30.
8. Badr LK, Abdallah B, Hawari M, Sidani S, Kassar M, Nakad P, et al. Determinants of premature infant pain responses to heel sticks. *Pediatric nursing*. 2010;36(3).
9. Montirosso R, Del Prete A, Bellù R, Tronick E, Borgatti R, Group NACfQoLS. Level of NICU quality of developmental care and neurobehavioral performance in very preterm infants. *Pediatrics*. 2012;129(5):e1129-e37.
10. Werner SE. Does Neonatal Massage Lead to Reduced Stress Behavior in Medically Stable Preterm Infants in the NICU? 2013.
11. mollahadi m, sarhangi f, EBADI A, tadrisi sd. Comparing blood cortisol level in infants with and without pain in neonatal intensive care unit: A preliminary study. 2011.
12. Elsagh A, Lotfi R, Amiri S, Gooya HH. Comparison of massage and prone position on heart rate and blood oxygen saturation level in preterm neonates hospitalized in neonatal intensive care unit: A randomized controlled trial. *Iranian journal of nursing and midwifery research*. 2019;24(5):343.
13. Wolever RQ, Caldwell KL, McKernan LC, Hillinger MG. Integrative medicine strategies for changing health behaviors: Support for primary care. *Primary Care: Clinics in Office Practice*. 2017;44(2):229-45.
14. Álvarez MJ, Fernández D, Gómez-Salgado J, Rodríguez-Gonzalez D, Rosón M, Lapena S. The effects of massage therapy in hospitalized preterm neonates: A systematic review. *International journal of nursing studies*. 2017;69:119-36.
15. Medina IMF, Granero-Molina J, Fernández-Sola C, Hernández-Padilla JM, Ávila MC, Rodríguez MdML. Bonding in neonatal intensive care

- units: Experiences of extremely preterm infants' mothers. *Women and Birth*. 2018;31(4):325-30.
16. Zargham-Boroujeni A, Elsagh A, Mohammadzadeh M. The effects of massage and breastfeeding on response to venipuncture pain among hospitalized neonates. *Iranian journal of nursing and midwifery research*. 2017;22(4):308.
  17. Rafati S, Rejeh N, Tadrissi S, Karimi M, Molodi A. Effect of massage on physiological pain responses of blood sampling in infants. 2015.
  18. PAIN STMC. *Massage Therapy Research Conference*.
  19. Asadollahi M, Jabraeili M, Mahallei M, Jafarabadi MA, Ebrahimi S. Effects of gentle human touch and field massage on urine cortisol level in premature infants: A randomized, controlled clinical trial. *Journal of caring sciences*. 2016;5(3):187.
  20. Mirzarahimi Mehrdad, Mehrnoush Nasrin, Shahizadeh Sahife, Samadi Nasrin, AmaFirouz. Effect of non-nutritive sucking and leg massage on physiological and behavioral indicators of pain following heel blood sampling in term neonates. 2013. 2.2.
  21. Jain S, Kumar P, McMillan DD. Prior leg massage decreases pain responses to heel stick in preterm babies. *Journal of paediatrics and child health*. 2006;42(9):505-8.
  22. KhoshnezhadEbrahimi H, Jafarnejad S, Sohrabi S, Abbasi A, Esmailian S. Effect of simulation-based suction education on the knowledge and performance of pediatric intensive care unit nurses. *Journal of Critical Reviews*. 2020;4(7):685-94.
  23. Karimi R, Shabani F, Dehghan Nayeri N, Zareii K, Khalili G, Chehrazi M. Effect of music therapy on physiological pain responses of blood sampling in premature infants. *Journal of hayat*. 2012;18(2):76-86.
  24. Field T. *Pediatric Massage Therapy Research: A Narrative Review*. *Children*. 2019;6(6):78.
  25. Field T. Infant massage therapy research review. *Clinical Research in Pediatrics*. 2018;1(2):1-9.
  26. Gao L, Jia C, Huang H. Paediatric massage for treatment of acute diarrhoea in children: a meta-analysis. *BMC complementary and alternative medicine*. 2018;18(1):257.
  27. Zhang M, Wang L, Wang Y, Tang J. The influence of massage on neonatal hyperbilirubinemia: A meta-analysis of randomized controlled trials. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2019;32(18):3109-14.