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Comparing the behavioral and physiological signs of pain between the first and the second tries of the aggressive procedures in neonates admitted to Ramhormoz hospital in 2018

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Abstract

Introduction: Pain monitoring of newborns during aggressive interventions and painful procedures has often been limited to the first time of the invasive procedures, and pain monitoring during the repetition of procedures has been neglected. This research aims to determine and compare the behavioral and physiological signs of pain in newborns during the first and the second consecutive invasive procedures.

Methods: In this quantitative and descriptive study, 100 infants were selected conveniently from Mother Hospital of Ramhormoz city based on the inclusion criteria. Data was collected by demographic questionnaire, standard infant-infant pain assessment tool, and objective measurement tools during five months. Data analysis was done with descriptive statistics and t-test at the error level of 0.05.

Findings: The results showed that in the first round of diagnostic and therapeutic measures, the most reactions to the painful procedure were frowning (97%), leg flexion/extension (96%) and arm flexion/extension (94%) and in the second round the most reaction was in the form of no change in face (99%), normal breathing pattern change (96%), and flexion/extension of legs and arms (96%). The average number of heart rate and breathing during the procedure was increased in both the first and the second time compared to before the procedure. The average score of pain behavior symptoms in the second round was significantly higher than the first round.

Conclusion: It is necessary for all nurses to evaluate the symptoms of pain during repeated interventions in order plan for controlling and reducing the pains in both times of performing consecutive procedures

Key words: Neonate, pain, painful procedures, painful interventions, physical sign, behavioral sign

Introduction

The neonatal period refers to the first four weeks of life and is a very vulnerable time for babies because they are in the stage of physiological adaptation to extra uterine needs (1). The infant mortality rate is one of the most important indicators of health in today's world. Although the mortality rate of infants and children under 5 years has decreased in Iran over the past 15 years, the infant mortality rate has remained almost constant. The global average of infant mortality rate in 2017 was 18 per 1,000 live births (2). Due to the vulnerability of neonates, neonatal care should be done in the best way and in a multifaceted and comprehensive way (3).

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One of the important issues in the care of newborns is the problem of pain and its relief (4). Pain is an unpleasant feeling that is experienced throughout a person's life and can be aggravated by an illness or medical procedures. The American Pain Association names pain as the fifth vital sign and emphasizes on the importance of frequent pain assessment (5). Management of neonatal pain is very important because the sensory area in their brain is the most active part in their brain and the pain transmission pathway is fully developed, but the inhibitory systems in their brain are not well developed (6). Until 1980, there were doubts about whether babies feel pain or not, and it was even accepted that babies do not feel pain, and as a result, the study of Pain and its relief were not taken into consideration (7), but nowadays the evidence shows that babies feel pain, it is even possible that their sensitivity to pain and its long-term effects are higher compared to older children (8). Since pain is a destructive and hurtful experience, it has immediate, short-term, and long-term effects on the physical and mental health of the baby (9). Unrelieved pain in infants can lead to short-term and long-term harmful effects (10), among its short-term effects, changes in the sleep-wake cycle, disturbance in behavioral states up to more than 22 hours after the painful act, the child stops crying and falls asleep, and its long-term effects are changes in the infant's behavior in the future and disturbance in its growth and development (2). The tension caused by pain, even short and brief, leads to problems such as hypermetabolic state, heart and lung failure, cardiac arrhythmia, as well as complications and delays in the recovery of the baby. Prevention of these harmful effects can lead to a reduction in the length of hospitalization and hospital costs (11). Therefore, it can be said that the written identification of the signs of pain in the newborn and then its correct interpretation is of great use in the clinical activities of nurses, including increasing awareness about pain and performing individual care to reduce pain in the neonatal wards (12); because even when babies are born healthy, they may undergo painful operations (10). On the other hand, regular and systematic monitoring of pain as the fifth vital sign along with other vital signs such as pulse, blood pressure, temperature, and breathing are the duties of nurses. During hospitalization, term or premature babies are repeatedly exposed to invasive and painful procedures such as blood sampling from the heel and venipuncture, which results in behavioral, physiological, and hormonal responses (13).

Since pain is subjective in nature, the assessment of infant pain can challenge health care professionals in relation to recognizing non-verbal signs of infant pain, especially when pain is perceived as a subjective event (14). It is very difficult to assess pain in children, especially in infants, and the only way is to base this assessment on physiological changes and behavioral observations (15). Some of these behaviors and signs include crying, facial expressions, the general state of the body and limbs, as well as the heart rate and breathing (16). In fact, babies are not able to express pain, but in response to painful stimuli, a set of visible and measurable behavioral and physiological reactions such as changing facial expressions (raising eyebrows, squeezing eyes, folding nasolabial folds), crying, increased heart rate and decrease in arterial blood oxygen saturation show that they are the definite reasons for the presence of pain in them (15,17,18). Therefore, as mentioned before, it seems necessary to regularly monitor the pain of babies who face painful invasive procedures from birth, and the best way to identify the presence or absence of pain and also to check the intensity of pain in this age group is attention and monitoring of specific physiological and behavioral signs (9). The review of the literature also shows that most of the investigations of pain in infants have been limited to the first times of performing painful procedures and the characteristics of pain in repeating the procedures

have been neglected. In other words, there is not much information about the amount of pain induced in the subsequent rounds of invasive procedures such as venipuncture, which failed in the first round. While considering that in the next times the procedure is performed, the baby has previous experience of pain and the amount and intensity of perceived pain may be different under the influence of this experience. Therefore, this study was conducted with the aim of determining the behavioral and physiological signs of pain in infants during invasive procedures in two consecutive times and comparing them in the first and second times of performing these procedures. The results of this research can lead to drawing the attention of nurses to investigate the amount of pain induced to babies in the first and second order of invasive procedures, so that they can play an effective role in reducing the amount of pain in painful procedures by using appropriate supportive and therapeutic methods to reduce pain.

Method

This descriptive and analytical study was conducted with the aim of comparing the behavioral and physiological symptoms of pain during the first and second rounds of invasive procedures in infants admitted to the neonatal department of Ramhormoz mother hospital in 2016. The population of this research included all hospitalized infants who needed to perform any invasive procedure in the mother hospital of Ramhormoz city in 2018. In this study, actions such as taking blood from the heel, venipuncture, vein replacement, and gastric tube placement were considered as invasive procedures.

To determine the sample size for the test of the difference between the average response before and after, to perform a two-sided test at a significance level of 5% ($\alpha = 0.05$), with a power of 80% ($\beta = 0.2$) and to detect a difference of one Fourth, the standard deviation of the examined attribute ($\sigma=0.25$), using the formula n=((〖(z_(α⁄2)+z_(β))〗 ^2×σ^2)/ε^2), the required number of samples was estimated to be 100 people. The criteria for entering this study include: babies who needed vein extraction, blood sampling, and any invasive procedure, not receiving sedatives within 4 hours before observation, having an Apgar score above 7 at birth, having no respiratory problems and congenital abnormalities. The gestational age was 42-37 weeks. In addition, if for any reason a procedure was not successful and it was extended to the second time, it was re-evaluated. If the procedure was successful the first time, the sample was excluded from the study, and the next sample was used. The data collection tool in this research included three parts. The first part of the infant's personal characteristics questionnaire included information such as date of birth, weight, fetal age, Apgar score in the first and fifth minutes, gender and type of delivery, and gestational age. In the second part, the newborn-infant pain assessment tool was used, which measures the behavioral signs of pain in full-term and pre-term babies during acute invasive procedures. The mentioned tool consists of six options, the option of crying has a score of zero, one, and two, and the other five options, namely facial expressions, breathing pattern, hand movement, leg movement, and level of consciousness, have scores of zero and one. A higher score indicates a greater severity of symptoms. This is a standard tool and various researchers have used it to investigate the pain of newborns in their research (19, 20). The reliability of this tool has been checked in previous studies so that the simultaneous observation method of two observers was used for its reliability, and Pearson's correlation coefficient indicated the reliability of the tool (r=0.89). In the third part, to check the physiological signs of pain, such as heart rate, the baby was connected to a pulse oximetry device, and the rest of the signs, such as paleness, sweating of the body, sweating of the palms, flushing of the face and breathing rate during the

procedure was done through observation. In order to determine the scientific validity of the pulse oximetry device, the sensitivity of the device before use was measured and checked by two people separately with two traditional measurement methods by touching the pulse and measuring by pulse oximetry, and one device was used for all newborns. In addition, to determine the reliability of the pulse oximeter device that was used to determine the heart rate of babies, it was confirmed and controlled by the responsible engineer, and the device was used three times in a row for one baby and it showed stable numbers.

The sampling method in this research was non-random and available sampling. In this way, after receiving the letter of introduction and code of ethics from the Faculty of Nursing and Midwifery of Islamic Azad University, Isfahan branch (Khorasgan), while attending the mother hospital of Ramhormoz city, the researcher introduced himself to the desired unit and explained the importance and objectives of the research. In this study, 249 babies were included in the study and 149 babies were excluded from the study due to various reasons, including the mother's lack of consent to continue cooperation and the nurse's success in performing the procedure in the first stage. The researcher was present at the hospital in different shifts and if the baby needed invasive measures, while obtaining informed consent from its parents, by being at its bedside and using the mentioned tools, the baby's pain was evaluated and the relevant checklists were completed by the researcher. To investigate the pain of the studied babies, each baby was evaluated separately in a quiet environment and away from the crying of other babies, and there was no intervention by the researcher and only the observation technique was used to record the symptoms. However, non-pharmacological pain reduction techniques were explained to the nurses and mother after observation and recording. Two minutes before the procedure, when the baby was in a calm state, a pulse oximetry prop with an adhesive piece, without any pressure, was attached to the big toe to the baby. Heart rate was recorded and breathing rate was counted for one minute. The average breathing rate and heart rate were also recorded during the procedure, so that immediately after the start of the procedure, the breathing rate was counted for one minute, and the average heart rate was also recorded from the start to a few seconds after its completion. Other behavioral and physiological signs that could be scored were also recorded during the procedure. In this research, since the aim was to compare the infant's pain during invasive procedures on two occasions, the second and third parts of the tool, which were related to behavioral and physiological symptoms, were also designed in several columns for two occasions of invasive procedures, so that the pain changes is register in the relevant form. After collecting information, data analysis was done at two descriptive and inferential levels. At the descriptive level, mean, standard deviation, and frequency distribution tables were used, and at the inferential level, paired t-test and chi-square were used. The tests were performed at a five percent error level using SPSS software version 22, and a significance level of $p<0.05$ was considered significant.

Results

100 newborns with an average age of 10.19 days participated in this research. The average weight of the babies was 2952.66 ± 869.25 grams. The results show that the majority of infants, 58 (58%) were male, and most of the studied infants, 79 (79%) were born by cesarean section. In addition, the average Apgar score in the fifth minute after birth is higher than the average Apgar score in the first minute. Other results related to physiological and behavioral signs of pain are shown in the following tables:

As shown in Table 1, in the first round, the most reactions in response to the painful procedure were

frowning (97%), moaning (50%), and changes in the normal pattern of breathing (83%), and flexion/extension of the legs. (96%), flexion/extension of arms (94%) and shouting (88%) and in the second time the most reaction in response to the painful procedure in the form of not changing the face (99%), intense crying (68%), change In the pattern of natural breathing (96%), flexion/extension of legs (96%), flexion/extension of arms (96%) and shouting (96%) took place. Also, according to the analysis, among the behavioral symptoms of pain, facial expression (p=0.97) and breathing pattern (p=0.13) on the first and second days of invasive procedures, there was no statistically significant difference. However, there was a statistically significant difference in the crying condition in each of the invasive procedures, so the crying intensity of the babies was higher the second time compared to the first time (p<0.001).

Table 1: Frequency distribution and comparison of behavioral symptoms of pain in the first and second stage of invasive procedures in infants admitted to the neonatal department of the mother hospital in 2016

Invasive turn / Behavioral symptoms		First round		Second round		
		Abundance	percentage	Abundance	percentage	P value
facial expression	Quiet	3	3	0	0	
	to frown	97	97	1	1	
	normal	0	0	99	99	
	Total	100	100	100	100	0.97
	without crying	10	10	3	3	
	moaning	50	50	29	29	
	hard cry	40	40	68	68	
	Total	100	100	100	100	<0.001
	normal	17	17	4	4	
	Changes in normal breathing	83	83	96	96	
	Total	100	100	100	100	0.13
	calm down	4	4	4	4	
	Flexion/extension	96	96	96	96	
	Total	100	100	100	100	0.007
	calm down	6	6	4	4	
	Flexion/extension	94	94	96	96	
	Total	100	100	100	100	0.017
	half-awake half asleep	12	12	4	4	
	Yelling	88	88	96	96	
	Total	100	100	100	100	<0.001

As shown in Table No. 2, most of the babies experienced paleness (65%), no sweating of the body (95%) and palms (85%) and no flushing of the face (52%) during the first time they were exposed to the painful procedure. In the second time, most of the babies were pale (75%), lack of body sweating (91%), sweaty palms (74%) and facial flushing (75%) when faced with the painful procedure. The results of Fisher's exact test showed that this difference was statistically significant on two occasions so that in the second stage of the invasive procedure, the babies had paleness, more body sweating and facial flushing and less palm sweating.

Table 2: Frequency distribution and comparison of physiological signs of pain in the first and second stage of invasive procedures in infants admitted to the neonatal department of the mother hospital in 2016

Invasive turn		First round		Second round		Test type	P value
Physiological symptoms		Abundance	percentage	Abundance	percentage		
paleness	yes	65	65	75	75	Fisher exact test	0.012
	no	35	35	25	25		
	total	100	100	100	100		
body sweating	yes	5	5	8	8	Fisher exact test	0.003
	no	95	95	91	91		
	total	100	100	100	100		
Sweating palms	yes	15	15	26	26	Fisher exact test	<0.001
	no	85	85	74	74		
	total	100	100	100	100		
Facial flushing	yes	48	48	75	75	Fisher exact test	<0.001
	no	52	52	25	25		
	total	100	100	100	100		

As shown in Table No. 3, in this study, the average number of heartbeats and breathing during the procedure increased in both the first and second rounds compared to before the procedure, and this increase was greater in the second round. The results of the chi-square test showed that only the difference between the number of breaths in the previous phase and during the first and second rounds was statistically significant.

Table 3: Frequency and comparison of physiological signs of pain (heart rate and breathing rate) before and during the first and second stage of invasive procedures in infants admitted to the neonatal and emergency department of the mother hospital in 2016

Invasive turn		First round		Second round		Test type	P value
Physiological symptoms		mean	Standard deviation	mean	Standard deviation		
Heart rate	before	135.44	18.01	137.57	16.01	Chi square	<0.078
	during	177.23	23.51	188.13	23.89		
Breathing count	before	52.28	10.80	54.21	12.83	Chi square	<0.039
	during	69.11	16.41	75.54	19.18		

As Table No. 4 shows, the mean behavioral signs of pain in the second round are higher than the first round, and the results of the paired t-test show that this difference is significant.

Table 4: Comparison of the scores of the behavioral symptoms of the first and second round of aggressive measures in infants admitted to the neonatal and emergency department of the mother hospital in 2016

Invasive turn	First round		Second round		Statistical Test
symptoms	mean	Standard deviation	mean	Standard deviation	
Behavioral symptoms	5.85	1.50	6.49	1.01	T=4.607 Df=99 P=0.000

Discussion and conclusion

The results of the study showed that the mean difference and standard deviation of behavioral signs of pain in infants in the first round of invasive procedures were 50 statistically significant. In addition, the most behavioral reactions in response to the painful procedure on both occasions were changes in the pattern of natural breathing and extension/flexion of hands and feet and screaming. At the same time, in the first round of aggressive prescriptions, changing the shape of the face (frowning) was one of the most common behavioral signs, while in the second round, not changing the face got a higher score.

In line with the present study, the results of Azizi et al.'s study (9), which was conducted with the aim of investigating the behavioral signs of pain caused by aggressive actions in 75 infants, showed that a change in the natural breathing pattern was the most common behavioral sign of pain, which was associated with The present study is consistent. In the study of Sohrabi et al. (19) which investigated the pain of newborns, the most observed behavioral signs were changes in the face and changes in the breathing pattern. In addition, the results of Cheraghi's study (11) also showed that changes in facial expression, crying, and changes in breathing patterns are the most observed behavioral signs in infants when they perceive pain.

The present study and the results of the aforementioned studies all show that the change in breathing pattern is always one of the most common behavioral signs of pain in infants, while the change in facial expression has only been confirmed in some studies. In the present study, the change of face was evident in the first stage of invasive procedures, but in the second stage, such behavior was almost not observed. One of the reasons for the difference between the results of the studies regarding facial changes and the current study can be explained by the fact that the mentioned studies measured all the pain in the first round, which obtained results similar to the results of this study in the first round, and as in the statement of the problem, It was also mentioned that it seems that the manifestations and intensity of pain are different in different times of the procedures.

In addition, the results of Azizi et al.'s study (9) on examining the condition of legs and arms showed that 74.7% of infants reacted to pain with flexion and extension of legs and 76% with flexion and extension of arms. In addition, in the study of Sohrabi et al. (19), 86.5% of the infants extended and flexed their arms and legs. Although the percentage of this behavioral sign in the aforementioned studies is lower than in the present study, the results of the studies show that extension/flexion of limbs is one of the most common behavioral signs of pain in infants.

In the present study, only 40% of infants in the first round and 68% in the second round had severe crying in response to pain, and a total of 13% did not cry at all in the two rounds. In terms of crying status, Azizi et al.'s study (9) showed that 8% of babies did not cry at all in response to painful procedures, 10.7% of them moaned and only 81.3% of babies had severe crying and in Sohrabi's study et al. (19), about half of the babies had severe crying and 3.5% of them responded to pain without crying. than heel piercing with a needle, the pain intensity was not significantly different in these two groups.

Paying attention to this result is important from the point of view that most mothers or nurses unconsciously consider crying as the main criterion for the existence of pain in babies and children, while the results of studies show that crying cannot be a definitive criterion to prove the existence or absence of pain in infants. It should also be noted that some babies might only respond to pain with

sounds like whining, so we should not expect loud cries like in older children.

In addition, the results showed that the most physiological symptoms in this study on two occasions were facial paleness or facial flushing. In this way, in the second stage of the invasive procedure, the babies became pale, body sweating and their face flushed more, and their palms sweating less. In the study of Sohrabi et al. (19), among the physiological signs, facial flushing was the most observed sign, which confirms the results of the present study. Therefore, along with behavioral symptoms, these physiological indicators can also be used to examine pain in infants.

In the continuation of the data analysis in this study, the average number of heart rate and breathing during the procedure was increased both in the first and the second time compared to before the procedure, and this increase was higher in the second time, although statistically The only difference between the number of breaths before and during the procedure was different in two stages. In line with the results of the present study, in the study of Sohrabi 23. (19), the average heart rate and the average number of breaths increased significantly during the procedures compared to before. In the study of Erkot and Ildiz (22) in Turkey, the average heart rate before, during and after the invasive procedure was 121.57, 128.57, and 145.85, respectively, and the oxygen saturation level was 98.94, 97.97, and 95.44, respectively, both of which indicate physiological changes caused by pain in infants in line with the present study. In the study of Kermilios et al. (23), which was conducted with the aim of investigating the relationship between the parasympathetic evaluation index of infants and two pain instruments during painful procedures in premature infants, the heart rate changes during invasive procedures was significantly higher than before.

The results of this study show that pain is always an important issue in babies and it has complications, in order to prevent these complications, it is necessary for all nurses to know about these symptoms and evaluate them during invasive procedures. By evaluating these signs and symptoms, nurses can plan and take action to reduce and control pain. In addition, the results showed that crying, which is our dominant perception of pain, is not used as a determining factor for the presence or absence of pain in babies, and many babies may not cry at all or only react to pain in the form of moaning. Therefore, simply not crying cannot determine the absence of pain. Increased heart rate and breathing rate are also valid objective physiological indicators that can be considered in pain assessment. The results of this study also showed that the behavioral and physiological signs of pain are different in the first and second rounds of invasive procedures and the intensity of pain in the second round is higher than in the first round. Therefore, it is necessary for nurses to pay attention to the issue of pain in babies in repetitive painful procedures.

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Conflicts of interest

The authors declared that there is no conflict of interest.

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