Original Article

Assessment of pain intensity and its persistence following common needle prick procedures in newborns

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Abstract

Background and Aim: Newborns undergo a lot of needle prick procedure, but the exact intensity of pain and its persistence due to these procedures is not known. The present study was planned to estimate the pain intensity and its persistence following common procedures involving needle pricks in early neonates.

Methods: We observed 200 early neonates from the nursery and immunization center of a tertiary care teaching hospital, with 50 participants each, for exposure to needle pricks by intravenous (IV), intramuscular (IM), intradermal (ID) and heel pricks. Intensity of pain was estimated using neonatal infant pain scale score measured at baseline and then continuously for 60 s or more till it returned to the baseline. Duration of pain was measured in seconds to the nearest 1 s.

Results: Pain following IV prick persisted for 100.7 ± 47.2 s, was found to be significantly ($P < 0.001$) high when compared with 62.3 ± 22.4 s, 53.2 ± 23.6 s and 52.3 ± 24.1 s for IM, ID and heel pricks, respectively.

Conclusion: From the present study, it is suggested, that among the four different needle pricks in newborns, IV prick is the most painful in intensity and pain persists for a longer period in IV followed by IM, ID and heel prick.

Key words: Needle pricks, neonatal infant pain scale score, neonate, pain

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INTRODUCTION

Pain in newborn is an enigma that is under-evaluated for long. The concept of neonatal pain has been a recent focus in health care. Historically, it was thought that newborns lack pain transmission mechanisms, which along with immaturity of the nervous system rendered them incapable of experiencing pain.[1,2] Recent studies have, however, shown that newborns are capable of experiencing pain and respond to noxious stimuli. Healthy full-term newborns display vigorous gross movement and withdrawal from the painful stimuli[2] and this formed the basis of development of neonatal infant pain scale (NIPS),[3] which is a behavioral scale for estimating the intensity of pain in newborn.

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Pain is a physiological stress, and untreated pain can have short- and long-term effects, including sensitization to pain episodes in later life. There is evidence that in general, pain is not appropriately managed in acute care institutions.[4,5] Pain management is affected by individual factors such as knowledge, personal beliefs and the ability to cooperate in inter-disciplinary decision-making.[6-8] Newborns undergo many needle prick procedures such as intravenous (IV), intramuscular (IM), intradermal (ID) and heel prick, but the exact pain intensity experienced by neonates to these painful stimuli is not documented in studies. Therefore, we planned this study to estimate the pain intensity and persistence of pain associated with various needle pricks during routine care procedures among early neonates.

MATERIALS AND METHODS

We conducted this observational cohort study among 200 full-term early neonates (0-7 days) at newborn nursery and immunization center of a tertiary care hospital in North India from September 2013 to February 2014. The study protocol was approved by the institutional ethics committee. We

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evaluated the pain intensity using NIPS score to four types of exposure to needle pricks: IV, IM, ID and heel pricks selecting 50 study participants in each exposure group. Neonates getting IV pricks (for serum bilirubin assessment) and heel pricks (for blood sugar estimation) were selected from newborn nursery and those getting ID Bacille Calmette-Guerin (BCG) vaccine and IM hepatitis B vaccine were selected from the immunization clinic of the hospital. Sick, asphyxiated and septic neonates were excluded from the study. Each participant was assessed only to one type of needle prick exposure. Before administering the prick, the first observer ensured that the neonate was in the correct state of alertness (Brazelton stage 4, 5).[9] Baseline scoring on NIPS was done by this observer. Neonates in baseline score of 0-2 were then administered the prick by the second observer and were assessed for pain intensity continuously for at least 60 s or till the score reached the baseline again, whichever was later.

Statistical analysis of data

We analyzed the data using Epi info software version 7.0.9 for windows from center for disease control and prevention, United States. We calculated the proportions for qualitative variables and compared them by applying Chi-square test. We calculated means and standard deviations (SD) for NIPS scores at 10, 30 and 60 s, and the time taken for the score to return to the baseline values. We compared mean ± SD of the pain intensities across different time interval using one-way ANOVA. $P \leq 0.05$ was considered as statistically significant.

RESULTS

We studied 200 participants with 50 participants in each exposure group (i.e., IV, IM, ID and heel pricks). Of these 94 (47.0%) were boys. All four groups were identical at baseline with reference to age, sex, NIPS score ($P > 0.05$) as depicted in Table 1.

The intensity of pain as evidenced by NIPS at 10 s after prick was highest for IV group (median 6) and lowest for ID group (Median 4) and persistence of pain as suggested by NIPS at 30 s, 60 s and return to baseline score before prick is summarized in Table 2. The pain intensity was found to be significantly high in the IV group at 10 ($P = 0.003$), 30 ($P < 0.001$) and 60 ($P < 0.001$) s after the needle prick compared with IM, ID and heel pricks [Table 2]. Pain persisted for 100.7 ± 47.2 s for IV group and was longest while corresponding time or heel prick which was 52.3 ± 24.1 the shortest time to return to the baseline NIPS score before the prick.

DISCUSSION

Intensity of pain as assessed by NIPS at 10 s after needle prick was highest for IV group followed by IM, ID and heel prick and the difference was statistically significant [Table 2]. This finding is in turn supported by the pain intensity that was observed to be significantly high even at 30 and 60 s in the IV group compared with the other type of needle

Table 1: Baseline characteristics of the study population

Characteristic/ variable	Route of injection (*n*=50)				*P*
	Intra-dermal	Intra-muscular	Intra-venous	Heel-prick	
Age (mean±SD) days	1.76±1.10	2.18±1.73	2.36±1.58	1.96±0.83	0.135
Sex *n* (%)					
Boys	22 (44.0)	25 (50.0)	24 (48.0)	23 (46.0)	0.940
Girls	28 (56.0)	25 (50.0)	26 (52.0)	27 (54.0)	
NIPS (mean±SD)					
Boys	0.18±0.50	0.08±0.28	0.83±0.28	0.26±0.62	0.661
Girls	0.25±0.59	0.20±0.58	0.31±0.62	0.19±0.40	0.850
All participants	0.22±0.55	0.14±0.45	0.20±0.50	0.22±0.51	0.836

*P value calculated by ANOVA to compare means and by Chi-square test to compare proportions. SD: Standard deviation, $NIPS_0$: Neonatal Infant Pain Scale at baseline (before the needle prick)

Table 2: Comparison of pain intensity at 10, 30 and 60 s after the type of needle prick and time taken to return to the baseline after the prick

Route of injection	NIPS 10		NIPS 30		NIPS 60		Return to baseline (seconds)	
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median
Heel prick	4.42±1.49	5.0	2.70±2.45	2.0	1.26±2.02	0.0	52.3±24.1	45.0
Intradermal	4.50±1.53	4.0	2.58±1.96	2.0	1.10±1.79	0.0	53.2±23.6	47.5
Intramuscular	5.10±1.46	6.0	3.32±2.04	3.5	1.04±1.41	0.0	62.3±22.4	60.0
Intravenous	5.40±1.57**†	6.0	4.82±1.85$^{***,\#\#,\dagger\dagger\dagger}$	5.5	2.54±2.16$^{***,\#\#\#,\dagger\dagger}$	2.0	100.7±47.2$^{***,\#\#\#,\dagger\dagger\dagger}$	90.0
P	0.003		<0.001		<0.001		<0.001	

SD: Standard deviation, NIPS: Neonatal infant pain scale. The subscript denotes the duration in seconds after the needle prick. Statistical analysis was done by one-way ANOVA test followed by *post-hoc* Tukey test among 3 phases. *Comparison with heel prick: *P<0.05, **P<0.01, ***P<0.001. #Comparison with intradermal: #P<0.05, ##P<0.01, ###P<0.001. †Comparison with intradermal: †P<0.05, ††P<0.01, †††P<0.001

pricks [Table 2]. Thus, the findings of the present study suggest IV prick to be the most painful in intensity, and then IM, ID and heel prick. In a multi-centric study from four European neonatal intensive care units, intensity of pain for 27 common neonatal procedures was calculated using 10 points visual analog scale, found that pain intensity for IM, heel prick and IV blood sampling was similar (median of 6) but range of intensity score was highest for IM and IV group as compared to that for heel prick group.[10] The results, however, are difficult to compare as the pain scale used was different for the latter study. In our study as well, the median for IM group and intravascular group was 6 each, but in heel prick group it was 5. This slight difference could be attributed to use of different scales of pain assessment in two studies and also, in our study only two observers did all the recording while in European study all the staff, including physicians and nurses did the scoring.

Neonatal infant pain scale scores at 30 s and 60 s and time taken to return to baseline were suggestive of persistence of painful stimuli after needle prick and as depicted in Table 2, pain persisted for longer time in IV group, followed by IM, ID and heel prick group. After extensive literature search, we could not find any similar study where duration of pain persistence after needle pricks was studied. Hence, we cannot compare the duration of pain component with any other available studies.

Pain perception and sensitivity develop early in life. Response to pain is vital for protecting the body from external stimuli that are potentially harmful.[11] The withdrawal reflex, the reflex withdrawal of body parts in response to the painful stimulus, is the fundamental reflex that develops during neonatal life, and may be the first reflex response to develop. This is because, neonates cannot speak or communicate with the environment, and, therefore, nature has provided them the mechanism to protect the body parts from noxious stimuli. Thus, in patients with paralysis, the first response to appear in the recovery phase is the withdrawal reflex response that is highly protective in nature.[12] However, no detailed study is available to elucidate the responses in neonate to different painful stimuli. Therefore, the newness of the present study was to understand the body's response to pain induced by different type of injections in early neonatal life.

Limitations of the study

We have not differentiated the pain perception in units in term and pre-term deliveries. Also, pain induced physiological changes have not been studied.

CONCLUSION

We conclude that in newborns among the four different needle pricks studied by us, IV prick is the most painful in intensity, in which pain persists for a longer period, followed by the pain induced in by IM, ID and heel prick. Further research should be considered to understand pain perception in neonates to various noxious stimuli, which may help provide better neonatal care during this critical period of human life.

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