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## Pain response during heel prick blood sampling while using adjustable lancing device versus hypodermic needle among neonates

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### Abstract

**Background:** Neonatal Pain is the distress and discomfort experienced by newborn. Blood sampling by heel prick procedure is commonest painful procedure performed on newborn and neonatal pain by heel prick method is a significant concern in healthcare of newborns.<sup>3</sup>

**Objective:** To compare the neonatal pain during heel prick blood sampling by using adjustable lancing device and hypodermic needle.

**Methods:** A comparative study was conducted over 06 weeks duration and hemodynamically stable sixty four neonates were randomized into two groups {neonates receiving heel prick using adjustable lancing device (n=32) and hypodermic needle (n=32)} using lottery method. The neonates under hypodermic needle were pricked by 26 gauge Dispovan needle and neonates under adjustable lancing device were pricked by 28 gauge one touch simple select lancing device. The primary outcome was measured using Neonatal Infant pain scale score and secondary outcome was assessed by the duration of audible cry. The statistical analysis was done using the Mann Whitney U Test, Anova and Chi Square test.

**Result:** The mean pain score of neonates receiving heel prick using adjustable lancing device ( $2.03 \pm 2.265$ ) was less as compared to neonates receiving heel prick using hypodermic needle ( $6.00 \pm 1.566$ ), with a p value  $< 0.0001$ . The mean duration of audible cry among neonates receiving heel prick using adjustable lancing device ( $4.84 \pm 10.12$  Sec) was less as compared with neonates receiving heel prick using hypodermic needle ( $25.94 \pm 19.72$  Sec) gives p value  $< 0.0001$

**Conclusion:** Heel prick blood sampling using adjustable lancing device cause less pain among neonates than by using 26- gauge hypodermic needle.

**Keywords:** NIPS, duration of audible cry, heel prick

### Introduction

Pain is a ubiquitous human experience, intricately woven into fabric of our existence. Pain is an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage<sup>[1]</sup>.

Neonatal Pain is the distress and discomfort experienced by the newborn, still it is not much catered in NICUs, largely due to the fact that neonates lack the ability to verbally communicate their discomfort and are often believed less likely to be experiencing pain, by the healthcare professionals<sup>[2, 3]</sup>. Neonatal pain is of particular concern due to the vulnerability of newborns.

Neonates underwent more than 300 painful procedure and surgeries throughout their hospitalization<sup>[2]</sup>. Blood sampling by heel prick procedure is the highest and commonest painful procedure performed on newborn<sup>4</sup> Repeated exposure to pain during early neurodevelopmental stage has shown to have long term altered effects on emotional, behavioural and cognitive development of the newborns<sup>[2, 3, 5, 6, 7, 8, 9, 10]</sup>. Their immature nervous systems make them more sensitive to pain. Painful procedure may lead to brain damage, through increase in arterial and intracranial pressure, oxygen desaturation and free radical generation<sup>[11]</sup>. Free radical toxicity in neonates have a high damaging potential for the fast growing tissue, leading to condition such as chronic lung disease, ROP, necrotizing enterocolitis and periventricular leukomalacia<sup>[11]</sup>.

Hypodermic Needle heel prick is the conventional method which is carried out in many NICUs and postnatal wards of various hospitals. An adjustable lancing device allow user to

change the depth of penetration depending on the thickness of the skin and calluses and the sensitivity of the fingertips. In this way enough blood can be obtained without causing unnecessary pain<sup>[12]</sup>. Adjustable lancing device has been associated with benefits such as reduce blood collection time, heel wounds, bruising, pain and need for repeated heel puncture<sup>[3, 12]</sup>.

Adjustable lancing device have been reported to be superior to Hypodermic Needle puncture in terms of pain and treatment time. The objective of this study is to compare the pain response of neonates receiving heel prick using the adjustable lancing device and Hypodermic Needle at the time of heel blood sampling.

There are very few studies which have shown that application of adjustable lancing device on heel prick blood sampling will reduce the pain perception, time taken to complete the blood collection and the presence of bruising<sup>[3, 13, 14, 15, 16, 17]</sup>.

### Materials and Methods

The experimental trail was carried out in level 3 NICU, postnatal wards of tertiary care hospital of western Maharashtra over a period of 6 weeks. The newborn who are hemodynamically stable, with birth weight more than 2.0 kg, gestational age more than 37 weeks and advised for random blood sugar monitoring were included in the study. Newborn who are on ventilator support, neurological abnormalities, congenital abnormalities and who are exposed to analgesics medication were excluded.

Data collected from 64 newborn admitted in NICU and postnatal ward for blood sugar monitoring. Sample size was calculated to be 64 based on Goto Tatenobu study by taking confidence interval 95% and absolute precision 20%<sup>[3]</sup>. All demographic and base line detail were collected. After a written informed parental consent, the eligible newborn randomized into two group- Hypodermic needle group and adjustable lancing device group using lottery method. Newborn in hypodermic needle group were pricked by Dispovan 26 Gauge needle and newborn in adjustable lancing device were pricked by 28 gauge one touch select

adjustable lancing device. All the heel prick was done by the nursing officer who is not the part of study. The heel prick was done using all the sterile precaution. The principal investigator video recorded the whole procedure for NIPS scoring and duration of cry after heel prick. All video analyses for NIPS scoring and duration of audible cry were done by another pediatric trained nursing officer who was not the part of the study.

### Outcome Measures

The primary outcome measure were NIPS scores and secondary outcome measure were duration of audible cry.

### Statistical Tests

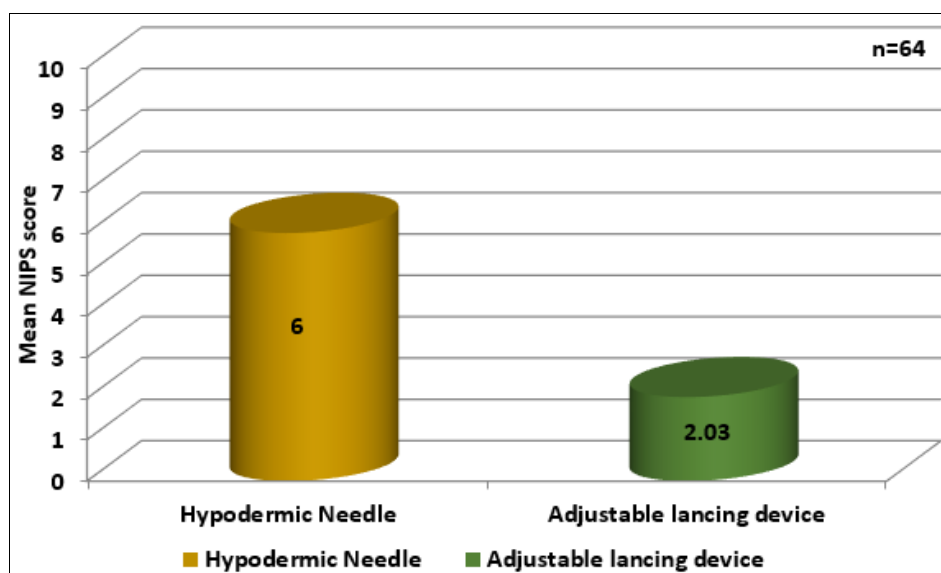
Statistical analysis was done using SPSS software. The NIPS score of both the group were compared using Mann Whitney U test. The duration of audible cry of both the group compared using Chi Square test as well as Mann Whitney U test. A p value of <0.05 was taken as significant.

### Ethics

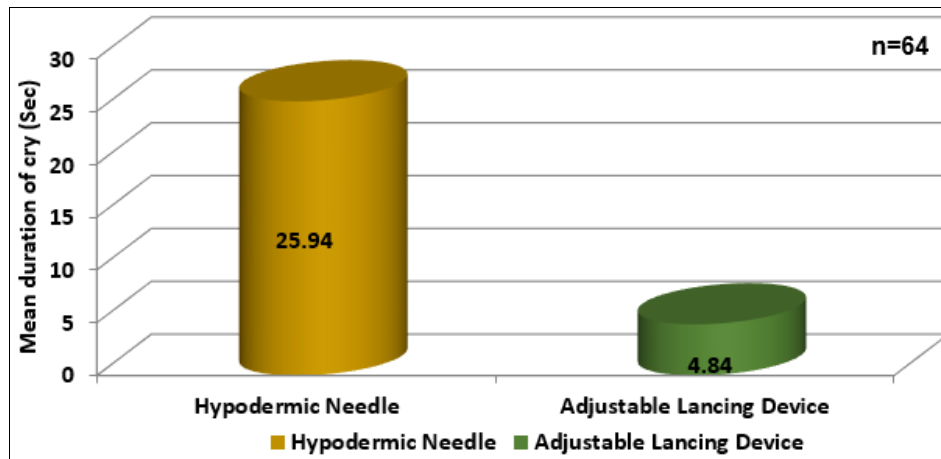
The study was carried out after ethical approval from the institutional ethical review board. (IEC/2023/229).

### Observations and Results

There were 64 neonates included in the study. The hypodermic needle group and adjustable lancing device group had comparable gestational age 84.38% and 71.88% (37-39weeks), Sex 40.63% and 53.13% (male), day of life 59.38% and 68.75% (Day of life 0-1) & birth weight 43.75% and 59.38% (more than 2.5 kg). There was a significant difference in mean pain score among neonates receiving heel prick using hypodermic needle and adjustable lancing device. (Fig 1). There was significant difference in mean duration of audible cry receiving heel prick using hypodermic needle and adjustable lancing device. (Fig 2). There was no association of pain response with the selected demographic variable both in hypodermic needle group and adjustable lancing device group.



**Fig 1:** There was significant difference in mean duration of audible cry receiving heel prick using hypodermic needle and adjustable lancing device



**Fig 2:** There was no association of pain response with the selected demographic variable both in hypodermic needle group and adjustable lancing device group

### Discussion

The result study point toward significant difference in the pain response of neonates while using adjustable lancing device and hypodermic needle. The finding is congruent to the study conducted in Japan on 105 neonates which shows that the adjustable lancing device causes less pain than hypodermic needle<sup>[3]</sup> but the findings of the present study was contrary to the study conducted on 40 neonates in Bangalore which revealed that there is no statistically significant difference in PIPP score between adjustable lancing device and hypodermic needle<sup>[13]</sup>. The study finding was also contrary with the findings of the study conducted on 180 neonates in Rishikesh where there was no significant difference in PIPP score of hypodermic needle group and automatic lancet group<sup>[14]</sup>. The reason could be explained by small sample size and inclusion of very preterm babies. Cry is anguish signal by the neonates which can be easily assessed by the health care providers. The present study findings shows that there is significant reduction in the mean duration of audible cry in neonates receiving heel prick using adjustable lancing device and hypodermic needle. The finding was supported by the study conducted in Bangalore on 40 neonates, where it was found a significantly lower duration of cry with the use of lancet<sup>[13]</sup>. The finding was congruent with the study conducted on 105 neonates in Japan which shows significantly shorter duration of cry in automatic lancet group<sup>[3]</sup>.

The findings are inconsistent with the study conducted on 60 term neonates which also shows the manual lancet cause more crying than automatic lancet<sup>[40]</sup>.

The limitation of the study is the small sample size, term neonates and random blood sugar monitoring.

### Conclusion

Neonates underwent more than 300 painful procedure throughout their hospitalization<sup>[2]</sup>. Heel prick is the commonest procedure performed on neonates. And the heel prick by using adjustable lancing device pointed toward lower NIPS score and duration of audible cry.

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