

Newborn friendly thermometry – Comparative study of body temperature with an infrared versus digital thermometer

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Abstract

Background: Accurate measurement of body temperature is of great importance in day to day neonatology practice. One touch infrared thermometry is safe, accurate, and easy to use. **Objective:** We aimed at comparing infrared forehead thermometer with an axillary digital thermometer to assess the accuracy. **Methods:** Axillary and forehead temperatures were measured simultaneously in normal newborn babies using digital and infrared thermometers respectively at a tertiary level teaching hospital in northern Kerala, India and the mean temperature measured by these two methods were compared. Those babies with fever or admitted at Neonatal Intensive Care Unit were not included in the study. **Results:** Totally, 193 newborns were included in the study with the mean birth weight of 2600 ± 400 g. There was no significant difference in temperature measured by digital and infrared thermometers ($97.74\pm 0.91^\circ\text{F}$ vs. $97.81\pm 0.89^\circ\text{F}$, $p=0.44$). There was a significant positive correlation between axillary and forehead temperature ($r=0.94$) and mean difference between two readings was $0.07\pm 0.25^\circ\text{F}$ ($p=0.11$). **Conclusion:** Infrared forehead thermometry is as reliable and accurate as axillary digital thermometry. Thus, infrared forehead thermometry can be used in clinical practice, especially in neonatal and postnatal wards where ease of use and speed of obtaining the temperature readings are important.

Key words: Axillary temperature, Forehead thermometry, Infrared, Newborn

Measurement of body temperature still remains an important indicator of health and disease [1]. Axillary temperature measurement is recommended by American Academy of Pediatrics and National Association of Neonatal Nurses. Mercury glass thermometer has been replaced by the digital thermometer that is safer and more convenient [2]. The forehead is an excellent area to measure temperature as it is supplied by superficial temporal artery which demonstrates necessary requirements for skin thermometry. It has unique properties as compared to other accessible cutaneous blood vessels e.g., it is easily accessible, contains no mucous membranes, and notably, it has no or very few arteriovenous anastomoses (AVA). Due to lack of AVA, perfusion rate is reliable under essentially all conditions, and blood flow is relatively free of vasomotor control in response to thermoregulatory stimuli [3,4].

The concept of measuring forehead temperature with the help of infrared thermometer seems promising as a simple, fast, and convenient method, both for the doctor/nurse and the patient [5]. In this context, we aimed at comparing the temperature of neonates using two different instruments i.e., forehead temperature using an infrared thermometer and axillary temperature with a digital thermometer.

METHODS

This prospective comparative study was conducted in postnatal wards of the neonatal division of tertiary level teaching hospital between January 2014 and March 2014. Neonates were included in this study irrespective of their gestational age and diagnosis through convenience sampling. Parents of newborns who fulfilled the criteria were approached to get the consent, and axillary and forehead temperature were measured simultaneously after obtaining consent. Sample size was 193 calculated on the basis of 2-sided hypothesis tests using Epi-info software with 80% power and a confidence interval of 95%. Those babies who had fever or required admission in Neonatal Intensive Care Unit (NICU) due to any reason were excluded from the study. The study protocol was approved by Institutional Ethical Committee.

Forehead temperature was measured using temporal scanner device (Exergen Corporation, Model 2000C). Axillary temperature was measured using a digital thermometer (Cipla). One junior resident and one staff nurse were received training on the proper use of temperature measuring devices. Room temperature was kept at $25\text{--}30^\circ\text{C}$ for uniformity. Forehead temperature was measured by placing the instrument over forehead for one second and displayed reading taken as

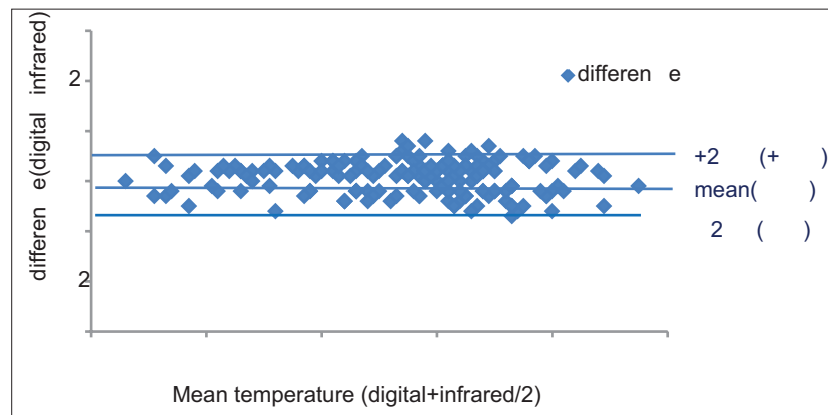


Figure 1: Bland and Altman plot of the differences between infrared tympanic thermometry and digital temperature measurements

infrared forehead temperature (IRFT). For axillary temperature measurement, axilla was wiped with a dry towel and digital thermometer tip was placed in contact with the skin in armpit and temperature displayed after the beep sound was recorded. Single reading by both methods was obtained daily at 8 am in all newborns in postnatal ward.

Results were analyzed using SPSS, version 16.0. Linear correlations were made between forehead and axillary temperatures. Differences between sets of data were plotted as described by Bland and Altman [6]. Based on previously pre-defined clinically acceptable limits, the agreement between forehead and axillary measurement methods was accepted when the mean ± 2 standard deviations was within $\pm 0.5^\circ\text{F}$ [7].

RESULTS

The body temperature was measured in total 193 patients including 114 (59.07%) males and 79 (40.93%) females. Mean birth weight was 2600 ± 400 g. Mean axillary temperature was $97.74 \pm 0.91^\circ\text{F}$, and forehead temperature was $97.81 \pm 0.89^\circ\text{F}$ ($p=0.44$). There was a positive correlation between temperature measured using digital and infrared thermometer ($r=0.94$, $p=0.00$). The mean difference was -0.07 with limits of agreement -0.71 to 0.57 . Bland – Altman plot showing the differences between temperatures is given in Figure 1

DISCUSSION

The present study showed a positive correlation between axillary and forehead temperatures. Infrared forehead thermometer takes seconds only to measure the natural emission of infrared radiation from forehead which is supplied by the temporal artery. Similar results were obtained by Chiappini et al., [8] Osio and Carnelli [9], and Chue et al. [10] in their studies. Chiappini et al. [8] reported good agreement (mean difference = 0.07°C , 95% limits of agreement - 0.62 , 0.76) between IRFT and axillary thermometry using glass mercury thermometer. Chue et al. took more than one reading which was in contrast to our study where we took only one reading [10].

However, Sethi et al. [7] found that measurements by axillary and forehead methods in newborns cared under radiant warmer did not agree well. Mean difference was -0.5°C (95% limit - 2.3 , 1.2). In another study, Fortuna et al. [11] compared IRFT to rectal thermometry and concluded that infrared forehead thermometer provides unsatisfactory accuracy as compared to a digital thermometer. Petersen-Smith et al. [12] compared infrared tympanic thermometer (First temp[®]) in rectal and oral modes with mercury thermometer in 232 children aged 0-33 months and obtained a mean temperature difference (rectal minus tympanic) of 0.05°C (-1.28 to 1.38) and 0.47°C (-0.82 to 1.76) for rectal and oral modes, respectively. Authors concluded that the device cannot be recommended in this age group.

One of the limitations of the present study was small sample size. Second, we have not included newborns admitted in NICU cared under radiant warmer and those with fever. Further studies addressing these issues should be carried out to support the wider use of infrared thermometers.

CONCLUSION

Infrared forehead thermometry is as reliable and accurate as axillary digital thermometry. Therefore, method of measuring body temperature in normal newborns can be changed to an easy, safe, and convenient method using forehead infrared thermometer.

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