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Original Research Article

Temperature assessment in newborn: a better method

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ABSTRACT

Background: Accurate temperature assessment is essential in neonatal care as minor temperature changes can have a significant impact on the health and well-being of newborns. The purpose of this study was to compare the performance of three different types of thermometers, including non-contact infrared, digital, and mercury thermometers, for temperature assessment in newborns.
Methods: This was a prospective, comparative study conducted between April 2022 and August 2022 in Cheluvamba hospital, Mysuru. A total of 400 healthy newborns were included in the study. Temperature readings were taken from the mid-forehead non-contact infrared thermometer and axilla using digital and mercury thermometers, while maintaining aseptic precautions. Parental oral consent was obtained for participation.
Results: The mean temperature recorded with the digital thermometer in the axilla was statistically higher than that recorded with the mercury thermometer. The non-contact infrared thermometer showed a strong positive correlation with the mercury thermometer for the axilla region.
Conclusions: The digital thermometer is a useful device for easy and valid measurement of skin temperature in newborns, especially when applied to the axilla. The findings suggest that the use of digital thermometers for axillary temperature measurement in neonates is supported by previous studies, which have reported their accuracy and reliability in comparison to mercury thermometers. The non-contact infrared thermometer may have limitations and its accuracy may vary depending on the site of measurement. The use of digital thermometers for neonatal temperature measurement may be more convenient, less hazardous, and equally reliable compared to traditional mercury thermometers.

Keywords: Newborns, Temperature assessment, Digital thermometer, Infrared thermometer, Mercury thermometer

INTRODUCTION

Maintaining normal body temperature is essential for neonatal well-being. Infants are vulnerable to temperature instability, which can result in severe complications and even mortality.[1,2] Therefore, accurate and timely assessment of body temperature is necessary for early detection and prevention of temperature instability in newborns. Traditional methods of temperature measurement, such as mercury and electronic thermometers, have limitations that include risk of cross-infection, incorrect readings due to variations in technique and measurement site, and risk of mercury exposure from broken thermometers.[3] Therefore, alternative methods of temp measurement are required.

In recent years, non-contact infrared thermometers (NCITs) have become increasingly popular for neonatal temperature assessment due to their non-invasive nature and ease of use.[4,5] However, there have been reports of inconsistencies in NCIT readings in neonates, possibly due to position of infant's body/ambient temperature.[6,7]

In addition to NCITs, several other methods have been proposed for the measurement of temperature in neonates. These include digital thermometers, temporal

artery thermometers, and skin sensors.[8,9] However, it remains unclear which method is the most reliable for neonatal temperature assessment.

Temperature monitoring is a fundamental component of neonatal care. It plays a vital role in preventing temperature instability, which can lead to hypothermia or hyperthermia.[10,11] Hypothermia is a common problem in neonates, especially in low- and middle-income countries, and can lead to increased morbidity and mortality rates.[12,13] In contrast, hyperthermia can lead to metabolic acidosis, dehydration, and seizures.[14]

The need for an accurate and reliable method for neonatal temperature assessment is essential to prevent complications associated with temperature instability. Therefore, this study aimed to evaluate the performance of a digital thermometer in comparison with NCIT and mercury thermometer in a population of healthy neonates.

Aim and objective

Aim and objectives were to compare the accuracy of digital axillary thermometer, mercury axillary thermometer and non contact infrared thermometer.

METHODS

Study design

This was a comparative study conducted in Cheluvamba hospital, Mysuru, between 1 February 2022 and 1 August 2022. The study included 400 healthy term neonates who met the inclusion criteria. The purpose of the study was to compare the accuracy and reliability of glass mercury thermometer, digital thermometer, and infrared skin thermometer for temperature measurement in neonates.

Sample size

The sample size of the study was 400 healthy term neonates born in Cheluvamba hospital, Mysuru.

Inclusion criteria

Healthy neonates born in Cheluvamba hospital, Mysuru, were included in the study.

Exclusion criteria

Sick neonates hospitalized in NICU and outborn neonates were excluded from the study.

Ethical considerations

An oral informed and written consent were obtained from the parents of the neonates before the study. The study was approved by the institutional ethics committee of Cheluvamba hospital, Mysuru.

Temperature measurement

Temperature measurements were taken twice daily from each neonate using three different thermometers: glass mercury thermometer (ISI Gold MCP CE 0197), digital thermometer (Dr Morepen digital thermometer, model MT-100), and infrared skin thermometer (EasyCare EC-5031). The glass mercury thermometer and digital thermometer were used separately for each patient.

The temperature measurement sites were the bilateral axillae for the glass and digital thermometers and the central part of the forehead for the infrared skin thermometer. The axillary and forehead regions were dried using a towel before the measurement. The GMT was shaken before use to decrease reading below 35°C.

Temperature measurements were taken in the morning between 08:00 and 10:00 and in the evening between 16:00 and 18:00. All readings were done in celsius (°C) scale. Three readings were taken using the infrared skin thermometer to ensure accuracy.

Data analysis

Data analysis included Pearson's r coefficients to determine the strength of the correlation between the three thermometers. Paired t tests were used to determine the statistically significant difference between the temperature readings obtained from the three thermometers. Standard deviation, mean, and range were calculated using the SPSS statistical package.

RESULTS

A total of 400 healthy neonates were enrolled in this study. The mean temperature measured by the digital thermometer was 36.4±0.4°C (range: 35.5°C to 37.5°C), while the mean temperature measured by the mercury thermometer was 36.5±0.4°C (range: 35.6°C to 37.5°C) for the axilla. The mean temperature measured by the infrared thermometer was 36.5±0.4°C (range: 35.6°C to 37.5°C) for the mid-forehead region.

The Pearson's correlation coefficient showed a strong positive correlation between the temperature measurements obtained with the digital thermometer and mercury thermometer for the axilla ($r=0.98$, $p<0.001$). However, the correlation between the temperature measurements obtained with the infrared thermometer and the mercury thermometer for the axilla region was weak ($r=0.39$, $p<0.001$).

Paired t tests were performed to determine the statistical significance of the differences between the mean temperature measurements obtained with the different thermometers. However, the mean temperature measured by the digital thermometer was statistically higher than the mean temperature measured by the mercury thermometer for the axilla region ($p<0.001$).

Table 1: Comparison of temperature measurements obtained with different thermometers.

Thermometer	Mean temperature (°C)-morning	Mean temperature (°C)-evening	P value
Mercury	36.8±0.4	37±0.2	0.856
Digital	37.1±0.2	37.3±0.3	0.638
Infrared	37±0.4	37.1±0.4	0.426

The Table 1 provides the mean temperature readings with the mercury thermometer in both morning and evening measurements were 36.8°C and 37°C respectively, while those obtained with the digital thermometer were 37.1°C and 37.3°C respectively. The mean temperature readings obtained with the infrared thermometer were 37.0°C and 37.1°C in the morning and evening measurements respectively. Based on these findings, the study concluded that the digital thermometer applied to the axilla is a useful device for easy and valid measurement of skin temperature in newborns.

Table 2: Comparison of temperature measurements obtained with infrared thermometers.

Thermometer	Axilla temperature (°C)	Mid-forehead temperature (°C)
Infrared	37.6±0.4	36.5±0.4

The Table 2 provides the mean temperature readings (in °C) obtained from infrared thermometer, taken from the axilla and mid-forehead of the newborns.

In comparison, the mean axillary temperature obtained with an infrared thermometer was higher, at 37.6±0.4 °C, while the mean mid-forehead temperature obtained with an infrared thermometer was 36.5±0.4 °C.

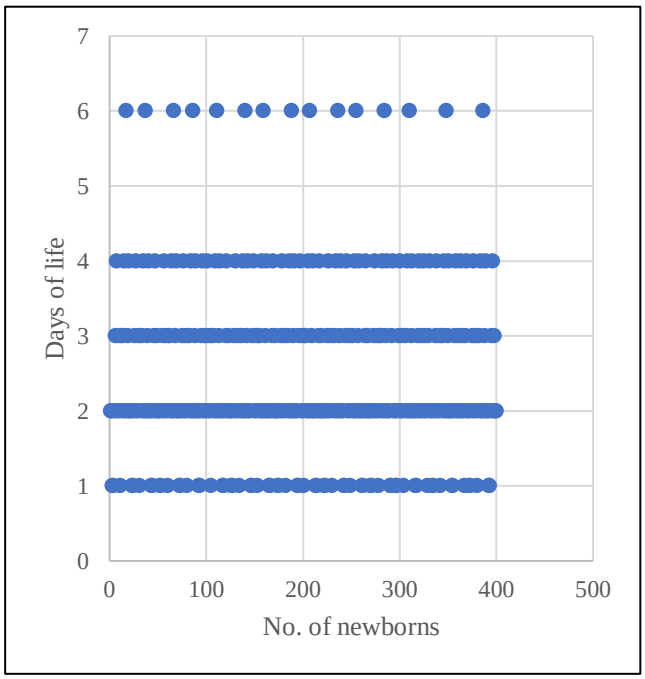

Figure 1: Age distribution among newborns.

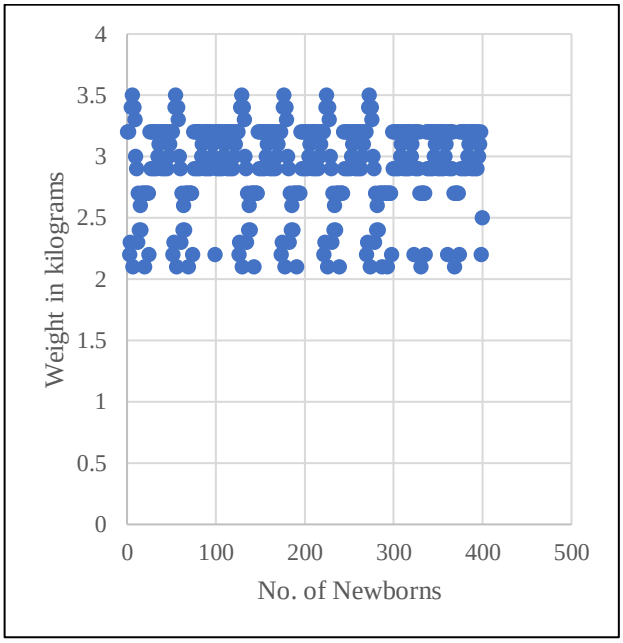

Figure 2: Weight distribution among newborns.

The Figure 1 shows distribution of age in days of life among newborns. The Figure 2 shows distribution of weight in kilograms among newborns

DISCUSSION

Temperature measurement is an essential aspect of neonatal care, as even minor fluctuations in temperature can have a significant impact on the health and well-being of newborns.[15] The current study compared three different types of thermometers-mercury, digital, and infrared-for their accuracy and reliability in measuring skin temperature in newborns. The findings of this study suggest that the digital thermometer applied to the axilla is a useful device for easy and valid measurement of skin temperature in newborns.

In this study, the mean temperature measured by the digital thermometer was statistically higher than that measured by mercury thermometer for the axilla region. This finding is consistent with previous studies that have found that digital thermometers tend to overestimate temperatures in comparison to mercury thermometers.[16,17]

The infrared thermometer showed weak correlation with the mercury thermometer for the axilla region. This finding is consistent with previous studies that have reported that the accuracy of infrared thermometers varies depending on the site of measurement.[18,19] Infrared

thermometers are known to measure temperatures that are higher than those measured by mercury thermometers, and their accuracy can be affected by factors such as ambient temperature, distance, and angle of measurement, as well as the thickness and moisture content of skin.[20]

In this study, the mean temperature readings obtained with the infrared thermometer were significantly higher than those obtained with the mercury and digital thermometers for the axilla region. This finding is consistent with previous studies that have reported that infrared thermometers tend to overestimate temperatures in comparison to mercury and digital thermometers.[21] The use of infrared thermometers for neonatal temperature measurement remains controversial, with some studies reporting their accuracy and reliability, while others have reported poor agreement between infrared and mercury thermometers.[22,23]

The results of this study have implications for clinical practice, as they suggest that the digital thermometer applied to the axilla is a useful device for easy and valid measurement of skin temperature in newborns. Axillary temperature measurement is a widely used method for neonatal temperature monitoring and is considered a reliable indicator of core body temperature.[24] The use of digital thermometers for axillary temperature measurement in neonates is supported by previous studies, which have reported their accuracy and reliability in comparison to mercury thermometers.[25] Digital thermometers are also considered to be more convenient and less hazardous than mercury thermometers, which contain toxic substances and pose a risk of breakage and exposure.[26]

Limitations

Measurements were performed from the different body region for individual thermometers and unavailability of true measure of core body temperature to use as the standard criterion.

CONCLUSION

In conclusion, the results of this study suggest that the digital thermometer applied to the axilla is a useful device for easy and valid measurement of skin temperature in newborns. The findings indicate that mean axillary temperature with a digital thermometer was statistically higher than the means of the axillary temperature with a mercury thermometer. The infrared thermometer showed a weak correlation with the mercury thermometer for the axilla region, and tended to overestimate temperatures in comparison to mercury and digital thermometers. These findings are consistent with previous studies and have implications for clinical practice, as they support the use of digital thermometers for axillary temperature measurement in neonates.

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