ORIGINAL ARTICLE

THE EFFICACY OF THERMO SPOT IN DETECTING NEONATAL HYPOTHERMIA COMPARED TO RECTAL TEMPERATURE

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ABSTRACT: NEED FOR STUDY: Hypothermia during the newborn period is widely regarded as a major contributory factor of significant morbidity and mortality in developing countries. High prevalence of hypothermia has been reported from countries with the highest burden of neonatal mortality, where hypothermia is increasingly gaining attention and significance as a critical intervention for newborn survival. Use of a simple, cheap device like thermospot which gives continuous monitoring of neonatal temperature, which could be used even by illiterate care givers is the need of the hour and this study emphasizes the effectiveness of such a simple device in detecting hypothermia in newborn babies compared to standard rectal temperature. **METHODS:** This is a prospective study conducted in the Department of pediatrics, at R.L. Jalappa hospital and Research Centre attached to Sri DevarajUrs Medical College, Tamaka, Kolar from May 2012 to May 2013. All newborns delivered at R. L. Jalappa hospital and who were shifted to mother side was taken up for the study. After taking consent, Thermo spot was attached to right hypochondrium of the neonate and colour of thermo spot along with rectal temperature readings were checked twice a day for the first three days. Thermo spot turns green if the temperature is above 35.5˚c. If the temperature falls below 35.5˚c it turns black. Comparison was made between the rectal temperature readings and colour of the thermo spot. **RESULTS:** Among 2520 rectal temperature readings, hypothermia with temperature less than 35.5^{o}C was recorded 226 times and the thermospot was found to be Black in 219 occasions indicating hypothermia. A total of 7 times even when the temperature was <35.5^{o}C, the thermo spot was green. The study showed a sensitivity of 96.9% and a Specificity of 99.8% by thermo spot in detecting neonatal hypothermia compared to rectal temperature. **CONCLUSION:** The Thermo spot was found to be highly effective in detecting neonatal hypothermia compared with rectal temperature.
KEYWORDS: Thermo spot, Hypothermia, Rectal Temperature.

INTRODUCTION: Maintaining an adequate body temperature is essential for human survival, yet infants are born with significant thermal challenges. Due to their body proportions and immature thermoregulatory systems, human infants are substantially dependent on caregivers to help them maintain thermal balance. Thermoregulation of infants is achieved through both physiological processes and through the thermal care behaviour of their caregivers.

Ensuring that an infant maintains an adequate temperature involves an interaction of a) the infant's internal state and ability to thermoregulate, b) its care-giver's ability to interpret the infant's thermal needs, and c) the care givers beliefs regarding correct thermal care of infants and their thermal care priorities for a given set of environmental conditions.

Hypothermia during the newborn period is widely regarded as a major contributory factor of significant morbidity and mortality in developing countries.[1]Newborns in general and preterm infants in particular are prone to excessive heat loss because they have a relatively large surface area in relation to body mass and the surface to mass ratio is particularly high in low birth weight babies.[2]

High prevalence of hypothermia has been reported from countries with the highest burden of neonatal mortality, where hypothermia is increasingly gaining attention and significance as a critical intervention for newborn survival. The World Health Organization (WHO) adopted thermal control among the essential components of newborn care.[3]

Most high-risk babies are born in the home in low resource communities where the burden, health impact, and associations of hypothermia with newborn care practices and health outcomes have been insufficiently documented.[4] Smaller studies in both urban slums and the rural community in India have reported on the incidence of hypothermia[5], but large population-based investigations of the timing of episodes, cumulative incidence of neonatal hypothermia, and seasonality of risk among babies born at home have not been conducted.

In developing countries a mercury-in-glass thermometer is usually used to measure temperature of newborn infants. More recently, World Health Organization has recommended the use of low-reading thermometer to detect hypothermia in new-born infants. Unfortunately, the low-reading variety is difficult to obtain in many parts of the developing countries. The other problems are this instrument is fragile, cannot be sterilized and difficult to use without proper training.[6]

Thermo spot which is a liquid crystal thermometer could be used as it gives a continuous monitoring of temperature and easily available and affordable. Use of a simple, cheap device like thermo spot which gives continuous monitoring of neonatal temperature, which could be used even by illiterate care givers is the need of the hour and this study emphasizes the effectiveness of such a simple device in detecting hypothermia in newborn babies compared to standard rectal temperature.

MATERIALS AND METHODS: The cases in the present study were taken from the wards of department of Paediatrics, R L Jalappa Hospital and Research Centre, attached to Sri Devaraj Urs Medical College which is a constituent college under Sri Devraj Urs academy of higher education and Research tamaka Kolar. Study period was from MAY 2012 to MAY 2013. 500 newborn cases were taken for the study, carefully monitored for the temperature and thermo spot color change.

SOURCE OF DATA: All the cases were taken from the pediatric ward, R L Jalappa Hospital and Research Centre, attached to Sri DevarajUrs Medical College which is a constituent college under Sri Devraj Urs academy of higher education and Research tamaka Kolar were closely monitored for temperature and thermo spot colour change.

INCLUSION CRITERIA: Term, pre-term and post-term neonates delivered at R. L. Jalappa hospital and research centre.

EXCLUSION CRITERIA: Neonates admitted to NICU.

METHOD OF COLLECTION OF DATA: The study was prospective in nature, in which 500 newborn babies from May 2012 to May 2013 were included. Parents of neonates under study were informed and after getting an informed consent, the thermo spot is placed over the neonates right hypochondrial region and the colour of the thermo spot along with rectal temperature is measured two times a day.

THERMO SPOT READINGS:

- Thermo spot is a 12 mm plastic disc, black in appearance with two white dots on top and its back is self-adhesive.
- At 35.5°C the dark side begins to turn green and a smiling face will become visible. At 36.5–37.4°C a bright green face will be clearly seen. As the temperature drops below 35.5°C, the smiling face will fade away completely.
- Thermo Spot discs were attached to the abdomen over the right hypochondrium because they were not easily removed and the measured temperature may rep-resent the central temperature.
- The area of skin, on which Thermo Spot to be attached, was sterilized using 70% alcohol-soaked cotton before it was attached and sometime was allowed to let the area dry.
- If the Thermo Spot is accidentally removed before the examination is completed, it can be reattached using a piece of tape.

The Thermo Spot reading was done at the time when the rectal temperature was measured. The nursing staff noticed the color of thermo spot, whether the Thermo Spot color was green with clear smiling face, pale green with unclear smiling face or dark without smiling face.

Colour	Temperature range	Manufacturer instructions
	> 36.5 °C	Body temperature in 'safe zone'
	35.5-36.4 °C	Seek advice if the 'smiling face' begins to fade or reverts to black
	< 35.5 °C	Seek advice if the 'smiling face' begins to fade or reverts to black

RECTAL TEMPERATURE MEASUREMENT:

- The rectal temperature was measured using mercury in glass thermometer.
- The rectal mercury-in-glass thermometer was lubricated with a water-soluble lubricant and inserted to a depth of 2-3 cm and left for 3 min.
- Care was taken in each case to prevent breakage of the thermometers.

- Rectal measurements were carried out by nursing staffs trained to do so with-out causing any injuries or discomfort to the study group.

Comparison is made between the rectal temperatures with the colour change in thermo spot to determine the accuracy of thermo spot in detecting hypothermia.

RESULTS: A total of 500 babies were taken into the study. The expected number of rectal temperature readings were 3000, but a total of 2520 readings were taken and corresponding Thermo spot color were noted. Reasons include Discharge before the end of study period and parental refusal for subsequent rectal temperature recording.

Out of 500 babies included in the study, 269 were males accounting for 53.8% of the population group.421 babies belonged to term gestational age accounting for 84.2% of the population studied. Among the study population,314 babies were weighing more than 2.5 kgs accounting for 62.8% of the total babies.

Out of 2520 temperature readings;

a) 224 times the Thermo spot was black and 219 times it corresponded to rectal temperature readings less than 35.5 with a positive predictive value of 97.8%.
b) 2296 times the Thermo spot was green and only 7 times the temperature was less than 35.5, which corresponds to negative predictive value of 99.7%.
c) During 5 occasions even when the rectal temperature was more than 35.5, the Thermo spot was black, falsely predicting hypothermia.
d) The sensitivity and specificity of thermo spot in detecting hypothermia was found to be 96.9% and 99.8% respectively.

DISCUSSION: In this prospective study, we have studied the efficacy of thermo spot, a liquid crystal device in detecting hypothermia compared to standard rectal temperature. We have taken normal neonates admitted to wards irrespective of the weight and whose parents gave consent for recording rectal temperature and for the placement of thermo spot.

Neonatal hypothermia is defined as an abnormal thermal state in which newborns body temperature drops below 35.5˚c.WHO categorized hypothermia into 3 stages based on core temperature, prognosis and action required.[7]

1. Cold stress: 36 to 36.4˚c,cause for concern, warm the baby and seek to identify Cause
2. Moderate hypothermia: 32to35.9˚c, danger, immediate warming needed
3. Severe hypothermia: LESS than32˚c, grave, skilled care is urgently needed.

Until the development of the clinical thermometer, human touch remained the only mode of thermometry and still continues to play an important role in temperature detection throughout the world. Various studies done on the efficacy of human touch in detecting hypothermia found that use of touch underestimated hypothermia. The results of various studies indicate a poor co-relation between human touch and hypothermia detection. WHO recommends the use of a low-reading mercury-in-glass thermometer, but it is fragile and difficult to obtain in many parts of the world.

The present study showed a sensitivity of 96.9% and specificity of 99.8% by thermo spot in detecting hypothermia compared to standard rectal temperature. The present study is in agreement with other studies done by Pejaveret al[8] and Kennedy et al[9] where rectal temperature was used in defining hypothermia similar to our study, which showed high sensitivity and specificity of thermo spot in detecting hypothermia.

In developing countries, hypothermia is identified only when it is already in extreme condition. Several conditions may contribute to this situation, such as lack of incubator with servo control, inadequate nursing staff, lack of awareness of the important of temperature control, shortage of clean and warm linen, unavailability of affordable thermometers and frequent breakages of thermometers. Therefore, it is needed to find an alternative temperature detector which is simple, affordable and can be used by mothers and other caregivers.[10]Our study has shown that Thermo spot is a valid method to diagnose hypothermia in neonates.

CONCLUSION: Thermo spot is highly efficacious with high sensitivity and specificity in detecting neonatal hypothermia.

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TABLES AND FIGURES:

Color of Thermo spot	Temp		Total
	<35.5	>=35.5	
Black	219	5	224
	97.8%	2.2%	100.0%
	96.9%	0.2%	8.9%
Green	7	2289	2296
	0.3%	99.7%	100.0%
	3.1%	99.8%	91.1%
Total	226	2294	2520

Comparison of color of Thermo spot with Rectal temperature measurements

Sensitivity=96.9% Specificity=99.8% NPV=99.7% PPV=97.8% Accuracy=99.5%

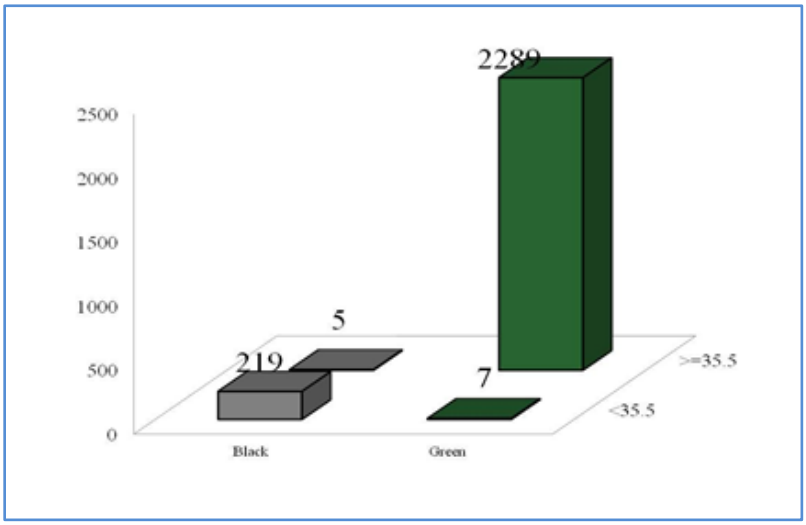

Fig. 1: Comparison between color of Thermo spot and Rectal temperature

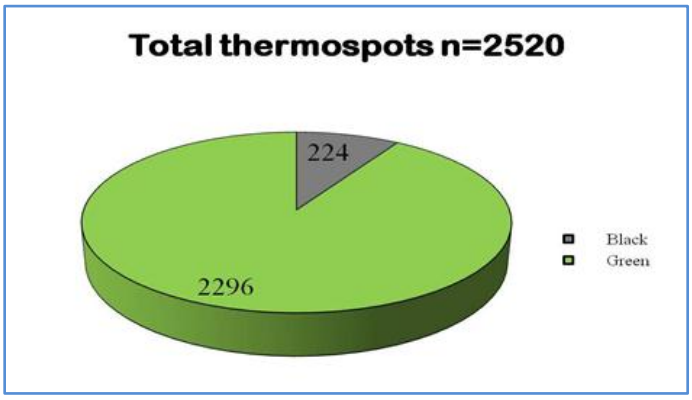

Fig. 2: Colour of Thermo spot

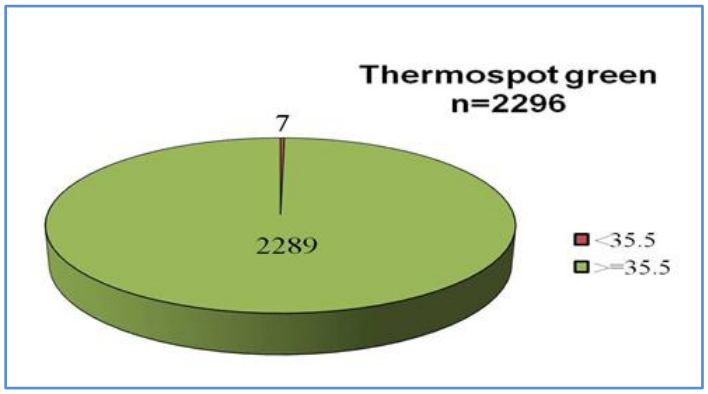

Fig. 3: Thermospot Green

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