

## Variation of body temperature after sponge bath in stable very low birth weight preterm neonates

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### ABSTRACT

**Aim:** To observe the variation of the body temperature after routine sponge bath in stable very low birth weight preterm babies.

**Methods:** 74 babies admitted to the neonatal intensive care unit (NICU) of a tertiary care teaching hospital were enrolled. The inclusion criteria were babies with corrected gestational age between 28 and 36 weeks, birth weight <1500 g during postnatal age of 14-28 days who were stable, on full feeds. All babies were in incubator at preset temperature. The babies received sponge bath within the incubator as a part of developmental care by a trained nurse. The axillary temperatures before bath and at 15, 30 and 60 min post bath were measured. The mean differences between the temperature before bath and after bath were analyzed using repeated measures analysis of variance. A  $p < 0.05$  was considered significant. **Results:** None of the babies receiving sponge bath developed hypothermia. There was a drop in the axillary temperature at 15 min post bath as compared to the temperature before bath ( $p = 0.00$ , mean difference =  $-0.174^{\circ}\text{F}$ , 95% confidence interval =  $0.119-0.229$ ). Subsequently, there was a rise in temperature at 30 min and the temperature normalized by 60 min after bath. The differences in temperature before and 15 min post bath were uniformly significant across all weight groups. **Conclusion:** Routine sponge bath in stable preterm babies causes a transient drop in temperature but does not lead to hypothermia. As it is a relatively simple technique and incorporates developmental care, it can be used as a part of routine care of stable preterm babies.

**Key words:** Hypothermia, Preterm, Sponging

Preterm infants constitute a unique population as they require special care mostly in the neonatal intensive care unit (NICU). Numerous technological advances over the years have contributed to improved survival rates of the preterm infants; however, they continue to be vulnerable to morbidities both due to their physiological immaturity as well as complications. Preterm babies are exposed to numerous stimuli and stressors in the NICU such as separation from the mother, excessive noise and light from the environment, and sleep disturbance which has a direct effect on their growth and holistic development. Globally, about 15 million preterm babies are born annually. Deaths due to various complications of prematurity constitute 14% of under-five mortality rates. India has a high incidence of 20% of births being preterm [1,2].

Hypothermia is one of the common causes of morbidity and mortality in preterm infants. It may directly or indirectly lead to complications such as respiratory disturbances, metabolic derangements such as hypoglycemia, acidosis, renal failure, coagulopathy, and even death [3]. Temperature regulation in preterm infants is much more challenging than in term babies. Preterm infants have a larger body surface area with respect to mass, less efficient non-shivering thermogenesis due to insufficient brown fat, thinner skin, and relatively extended

posture as compared to the flexed posture in term babies which makes them more vulnerable to hypothermia [4].

It is important to protect this vulnerable population as much as possible from the damaging effects of the unfamiliar extrauterine environment. Hence, the preterm babies require specialized developmentally supportive care to minimize stress levels and to promote optimal growth and development. One of the routine caregiving practices in the NICU is bath. Various bathing methods are practiced across the world. Various investigators have analyzed the merits and demerits of the different techniques of bath such as sponge bath and immersion baths. Sponge bath of stable preterm babies is a routine practice in our NICU as a part of developmental care. However, a seemingly harmless procedure such as sponge bath can itself be a stressful experience for the preterm baby and potentially cause hypothermia. Therefore, the aim of our study was to observe the variation of the body temperature after routine sponge bath in stable preterm babies.

### METHODS

This prospective, single-center observational study was conducted at the NICU of a tertiary care teaching hospital, located in Bengaluru, India. The study was conducted over a

3-month period from September to November 2016. Based on a pilot study, considering a power of 80% alpha error of 0.05 and effect size of 0.33, a sample size of 74 was calculated. The inclusion criteria were all babies with a corrected gestational age of 28-36 weeks, postnatal age of 14-28 days and with a birth weight of 1500 g or less in the NICU who were clinically stable. Only babies not requiring intravenous fluids, caffeine, or respiratory support and on full nasogastric or paladary feeds were included. The skin maturity in most preterm babies (>30 weeks) becomes comparable to that of term babies as early as 7 days and almost complete by 2 weeks of age; therefore, only babies with postnatal age of 14-28 days who were stable and fulfilling the other criteria were enrolled in our study [5]. Exclusion criteria were babies who did not fulfill the inclusion criteria, unstable or sick babies, evidence of Grade 2 or higher intraventricular hemorrhage (Volpe's classification), major congenital anomalies, chromosomal abnormality, and neurological impairment.

After obtaining the approval of the institutional ethical committee, the study was begun. The parents were explained in detail about the objectives of the study, and a written informed consent was taken before the beginning of the study. The babies admitted during the study period and who satisfied the inclusion criteria were selected through continuous sampling. Basic demographic details, birth weight, gestation, and postnatal age were collected. All stable babies were under incubator care with the incubator temperature pre-set at 93.20 F (34°C) in air mode. The incubators were placed in a quiet region of the NICU which was free from air drafts.

All babies received sponge bath in the morning between 6 and 6.30 AM by a trained nurse. Baths were given 30 min after a feed when the infant was calm and stable. The infants were bathed within the incubator with door open and at the preset mode as defined. The water temperature was measured before bath with an electronic thermometer and adjusted to be 98.6-100.4°F (37-38°C) and sterile gauzes soaked in the water were used for sponge bath. The babies were undressed, and all probes and electrodes were removed except the pulse oximeter which monitored continuous saturation. The pattern of bath was head and neck followed by trunk, genitalia and limbs and the entire procedure took 2-3 min to be completed following which the babies were immediately dried with warm dry gauze and electrodes and probes were reattached.

Axillary temperatures of all babies were recorded for 2 min before bath and at 15, 30 and 60 min after the bath using an electronic thermometer. All temperature measurements of the babies were measured in Fahrenheit as a routine practice. The measurements in centigrade such as incubator temperature were converted to Fahrenheit using the formula ( $^{\circ}\text{F} = ^{\circ}\text{C} \times 9/5 + 32$ ). Hypothermia was defined at temperature  $<97.7^{\circ}\text{F}$  ( $36.5^{\circ}\text{C}$ ) [6]. Hemodynamic stability of the newborns was continuously monitored before, during and after the sponge bath. All the observations were recorded in a structured pro forma designed for the study.

The data collected were analyzed using SPSS software version 13. Quantitative variables such as birth weight, gestation body temperature before and after bath all followed

normal distribution and were expressed as mean with standard deviation (SD). The mean differences between the axillary temperature before bath and at repeated intervals after bath were analyzed for statistical significance within the group using repeated measures analysis of variance. A  $p < 0.05$  was considered significant.

## RESULTS

All 74 babies enrolled in the study were included for the analysis. The pre-bath temperatures of all babies were in the normal range of 97.7-99.5°F (36.5-37.5°C). Table 1 shows the demographic characteristics of the subjects. The mean corrected gestation age on the day of assessment was  $34.78 \pm 1.32$  weeks (range 31-36 weeks). The majority of the infants were 34-36 weeks corrected gestation age (82.4%) followed by 30-32 weeks corrected gestation age (9.5%) and 8% were less than 32 weeks corrected gestation age. All babies were more than 30 weeks corrected gestation age on the day of assessment. The mean birth weight of the babies was  $1226 \pm 112$  g (range 940-1460 g). Out of these, 54% (n=40) babies had a birth weight of 1000-1250 g, 41.9% (31) between 1250 and 1500 g and 4.1% (3) were extremely low birth weight, i.e.,  $<1000$  g. The mean axillary temperature before bath was  $98.58 \pm 0.107^{\circ}\text{F}$ . Mean temperatures before bath and at 15, 30, and 60 min post bath are depicted in Table 2.

None of the babies had hypothermia at 15 min post bath. All babies remained thermodynamically stable throughout the study. As depicted in Table 3, the mean temperature at 15 min after bath was  $98.410 \pm 0.159^{\circ}\text{F}$ . Although there was no hypothermia, there was a drop in temperature values from before bath to 15 min

**Table 1: Demographic characteristics of the subjects (n=74)**

Characteristics (%)	Range	Mean±SD
Corrected gestational age on the day of assessment (weeks)	31-36	34.78±1.32
28-32-8.1 (6)		
32.1-34-9.5 (7)		
34.1-36-82.4 (61)		
Total=100 (74)		
Birth weight (g)	940-1460	1226.2±112
<1000-4 (3)		
1001-1250-54 (40)		
1251-1500-41.9 (31)		
Total=100 (74)		

SD: Standard deviation

**Table 2: Mean temperatures before bath and at repeated intervals after bath**

Temperature (°F)	Mean±SD
Pre bath	98.5838±0.10730
15 min post bath	98.4095±0.15977
30 min post bath	98.6068±0.15468
60 min post bath	98.6608±0.11446

SD: Standard deviation

Table 3: Analysis of differences in mean temperature before bath and at 15, 30 and 60 min post bath

Mean pre bath temperature °F (I)	Mean post bath temperature °F (J)	Mean difference (I-J)	Standard error	p value	95% CI
98.584	15 min 98.410	0.174*	0.019	0.000*	0.119 to 0.229
	30 min 98.607	-0.023	0.019	1.000	-0.077 to 0.031
	60 min 98.661	-0.077*	0.016	0.000*	-122 to -0.032

\*: The mean difference is significant at  $p=0.05$  level, CI: confidence interval

post bath which was statistically significant. ( $p=0.00$ , mean difference=-0.174°F, 95% confidence interval=0.119-0.229). Further, the temperatures recorded post bath showed a significant rise in the temperature at 30 min ( $p=0.00$ ) and 60 min ( $p=0.42$ ) which depicts the normalizing of the infant's temperature within the incubator at the pre-set mode and temperature. The differences in the mean temperature before bath and 15mins after bath were uniformly seen across all weight groups when split wise analysis of the weight groups (<1000 g, 1000-1250 g and >1250 g). This shows that the sponge bath causes a drop in axillary temperature of the preterm babies at 15 min as compared to before bath irrespective of the weight but did not amount to hypothermia.

## DISCUSSION

We conducted this study to observe the variation in the stable preterm infant's axillary temperature before and after a sponge bath given within the incubator which is a routine practice in our NICU. Our study population consisted of 74 preterm babies in the age group of 31-36 weeks which is similar to the study conducted by Tapia-Rombo et al., who had studied 79 preterm between 28 and 36 weeks [7]. The birth weight of the infants in our study was 940-1460 g. Similar studies done by Tapia-Rombo et al. had enrolled babies with birth weights varying from 800-1770 g [8]. Bathing of preterm neonates is always associated with a perception that the babies may develop hypothermia. The preterm infants are more vulnerable to hypothermia due to the larger body surface area compared to mass, less brown fat for non-shivering thermogenesis and less ability to maintain flexed posture which helps in conserving heat.

The results of our study indicated that the axillary temperature in the babies 15 min after the bath was significantly lesser than the pre-bath temperature ( $p=0.00$ ); however, none of our babies developed hypothermia at any point during the study. Several similar studies conducted previously have observed hypothermia after sponge bath in preterm babies. Tapia-Rombo et al. [8]. conducted a prospective quasi-experimental study in which 48 preterm newborns were given sponge bath, and the rectal temperatures were measured 10 min before and after bath. They found a significant drop in the mean rectal temperature after bath from 37°C to 35.5°C ( $p<0.001$ ). Our study was similar to this study with respect to patient composition, but we used axillary temperature instead of rectal temperature due to its feasibility and avoidance of trauma to the anal canal and rectum which by themselves act as additional stressors to the infants.

Montes Bueno et al. [9] conducted a study on 26 preterm newborns weighing 500-1000 g. The babies received sponge baths in the incubator, and the axillary and sole temperatures were measured before, during and till 180 min after bath. They found a significant decrease in the body temperatures after bath ( $p<0.001$ ) with 87.4% of the infants developing hypothermia which persisted for more than an hour during the first week of life and up to an hour during the second week. In our study, though there was a drop in the temperature at 15 min, the temperature started rising by 30 min post bath ( $p=0.00$ ) and by 60 min post bath, the temperature was normalized ( $p=0.042$ ). As only babies aged 14-28 days postnatal age were included in our study, they were comparable in terms of skin maturity which could explain the more rapid increase in the temperature after 15 min of bath as compared to the study by Montes Bueno et al.

Another study by Tapia-Rombo et al. [7] observed the effects of sponge bath in 79 newborns with gestational age between 28 and 36 weeks and sponge baths were given within the incubator for babies weighing <1800 g and outside the incubator for those weighing >1800 g. However, they did not observe any significant loss in temperature before and after bath irrespective of the location and weight of the babies. Other analytical studies comparing the effects of sponge bath versus other techniques such as immersion baths also showed that the babies receiving sponge bath experienced significant drop in temperature after bath as compared to tub baths or swaddled baths.

Loring et al. [4] studied 100 newborns with gestational age between 35 and 36.9 weeks aged 4-36 h with a weight >2000 g. They compared the differences in the body temperature in those receiving sponge bath as a control group with an experimental group receiving immersion baths. Axillary temperatures were measured 10 min before bath and at 10 and 30 min post bath in both the groups. At 10 min post bath, the babies receiving sponge bath had a significantly lower mean temperature (98.164°F) as compared to 98.322°F in those receiving immersion baths ( $p<0.001$ ). A similar trend was found at 30 min after bath where the mean temperature in infants receiving sponge bath was lower (98.41°F) than those receiving immersion baths (98.60°F).

## CONCLUSIONS

Sponge bathing method which incorporates developmental care appears to be a safe and feasible technique of routine cleansing in stable preterm newborns in the NICU. There is an initial dip in the temperature soon after bath but not to an extent of

causing hypothermia. Dose this initial dip in temperature has any untoward effect on the newborn health needs to be evaluated with further studies.

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