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EFFECT OF TWO IMMERSION BATHING TECHNIQUES ON THE AXILLARY TEMPERATURE OF PRETERM NEWBORNS: A PILOT STUDY

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ABSTRACT

Objective: to compare post-bath axillary body temperature of preterm infants undergoing conventional and swaddled immersion bathing.

Method: a pilot study of a crossover randomized clinical trial design with 15 clinically stable preterm infants admitted to a neonatal unit. Infants were bathed using both immersion bath techniques in a time interval between 24 to 48 hours according to a randomized bath technique list . Data were analyzed by paired Student t-test assuming p-value ≤ 0.05, 95% CI.

Results: pre-bath room, bath water and axillary temperatures showed homogeneity between groups. The mean axillary temperatures at 10th and 20th minute post baths were similar. Regardless of the bathing technique used, preterm newborns presented mild post-bath hypothermia.

Conclusion: further studies that investigate bathing effects on vital signs and behavioral responses are recommended to evaluate procedural safety.

DESCRIPTORS: Infant, newborn. Tub bathing. Body temperature. Neonatal nursing. Infant, premature.

EFEITO DE DUAS TÉCNICAS DE BANHO DE IMERSÃO NA TEMPERATURA AXILAR DE RECÉM-NASCIDOS PRÉ-TERMOS: ESTUDO PILOTO

RESUMO

Objetivo: comparar as temperaturas axilares pós-banho de imersão de recém-nascidos pré-termos envoltos e não em lençol.

Método: estudo piloto, do tipo ensaio clínico cruzado; participaram 15 neonatos pré-termos, clinicamente estáveis internados na unidade neonatal, que receberam os dois tipos de banho em intervalo, entre 24 e 48 horas, seguindo uma lista de randomização da sequência dos banhos. O teste t-Student pareado e o valor p ≤ 0,05 e IC 95% foram adotados.

Resultados: as temperaturas do ambiente pré-banhos e da água do banho e axilar apresentaram homogeneidade entre os grupos. As médias da temperatura axilar dos recém-nascidos no 10°e 20° minutos após os banhos foram similares. Independente da técnica, os recém-nascidos apresentaram leve hipotermia pós-banho.

Conclusão: estudos sobre o efeito do banho de imersão nos parâmetros fisiológicos e comportamentais são necessários para avaliar a segurança do procedimento.

DESCRITORES: Recém-nascido. Banho de imersão. Temperatura corporal. Enfermagem neonatal. Prematuro.

TEMPERATURA AXILIAR DE RECIEN NACIDOS PRE-TERMINOS: ESTUDIO PILOTO

RESUMEN

Objetivo: comparar las temperaturas auxiliares post-baño de inmersión de recién nacidos pre-termino envueltos y no en sábana.

Método: estudio piloto del tipo ensayo clínico cruzado; participaron 15 neonatos pre termino, clínicamente estables, internados en la unidad neonatal; que recibieron dos tipos de baño en intervalo, entre 24 y 48 horas, siguiendo una lista de randomización de la secuencia de baños. El test t-Student pareado con el valor p≤ 0,05 e IC 95% fueron adoptados.

Resultados: las temperaturas del ambiente pre-baños y del agua de baños y axilar presentaron homogeneidad entre los grupos. Las medias de la temperatura de los recién nacidos en el 10º y 20º minutos después del baño fueron similares. Independiente de la técnica, los recién nacidos presentaron leve hipotermia post-baño.

Conclusión: estudios sobre el efecto del baño de inmersión en los parámetros fisiológicos y comportamentales son necesarios para evaluar la seguridad del procedimiento

DESCRIPTORES: Recién nacido. Baño de inmersión. Temperatura corporal. Enfermería neonatal. Prematuro.

INTRODUCTION

Since 2002, the Ministry of Health has been promoting actions to strengthen and transform care given to preterm (PTNB) and low birthweight newborns. One of the strategies is the Kangaroo Mother Care (KMC) method, considered as a humanized model of care that combines several care practices aimed at the promotion and protection of the newborn's health and their family. Health professionals and especially nurses have been seeking transformations in their clinical practice in accordance with the recommendations of this care model. One of these is the adoption of immersion baths wrapping the infant in a blanket or sheet.[1]

Swaddled immersion bath differs from the conventional bathing technique described in the literature and routinely adopted in the neonatal units; the conventional technique involves the immersion of the newborn in a bathtub, sink or acrylic basin.[1] In the KMC immersion bath method, the newborns are immersed swaddled into the water in a tub in order to protect them against heat loss.[1]

Unlike term infants, the maintenance of preterm newborns' temperature is a critical aspect due to their greater risk of developing hypothermia episodes; this is a result of changes in heat regulation caused by a combination of factors such as lack of brown adipose tissue for thermogenesis, (skin) surface and body mass ratio, thinning of the skin, and inability to maintain flexion of the extremities, in addition to the immaturity of the central thermoregulatory control.[2-4] It is recommended that the body temperature of the neonate is maintained between 36.5°C and 37.5°C, and that its measurement is performed using a thermometer in the axillary region.[5-7] Temperature maintenance is essential for the recovery, growth and development of preterm newborns with health problems.[7] Neonatal hypothermia is common in premature births, as its prevalence varies between 32% and 85% in hospital deliveries, even in tropical countries. Although hypothermia is rarely a direct cause of neonatal death, it induces metabolic increases and it is associated with hypoglycemia, hypoxia, severe neonatal infections and asphyxia.[8-9]

Among the care procedures, corporal hygiene exposes the newborn to the loss of body temperature, especially in preterm newborns. For this reason, it is necessary to confirm evidence that supports its indication.[2,10-11] This evidence indicates that immersion baths in preterm newborns is safer than sponge baths with regard to post-bath thermal loss.[12] Swaddled immersion baths in preterm newborns showed lower thermal loss than conventional immersion baths, although the clinical trial sample[13] was limited to 50 preterm newborns, and environmental stimuli such as manipulation of the newborn during data collection was not controlled.[13]

Since the nursing team is responsible for the direct care of preterm newborns, including the evaluation of their clinical condition and bathing them, the importance of seeking evidence to support clinical practice and to verify whether the immersion bath technique recommended by the Ministry of Health interferes less in the thermal stability of the neonate than the conventional immersion bath. Thus, the objective of the study was to evaluate the effect of two bathing techniques on the axillary temperature of preterm newborns.

METHODS

A pilot study of a randomized, crossover clinical trial conducted at the neonatal unit of the University of Sao Paulo Hospital between January and March 2014, after approval of the research project

by the Research Ethics Committees of the Nursing School and by the University of São Paulo Hospital (CAAE 17696913.3.0000.5392), and included in the Brazilian Registry of Clinical Trials (UTN: U1111-151-5469).

Preterm newborns with gestational age at birth up to 36 weeks and five days (36.71 weeks) with postnatal age ≥ 24 hours, axillary temperature between 36.0°C and 37.5°C, with spontaneous breathing, without congenital anomalies or previous surgeries, nor the use of sedatives were included. Generalized cyanosis, vomiting, or cardiorespiratory arrest during the tested interventions were previously defined as exclusion criteria, although none of these occurrences were observed.

The sample consisted of 15 preterm newborns (corrected gestational age <37 weeks) who were exposed to two immersion bath techniques: swaddled (experimental group - EG) and conventional (control group - CG), with a time interval between 24 and 48 hours between the first and second interventions. The immersion bath sequence denominated as group 1 (experimental and control baths) and group 2 (control and experimental baths) was randomly generated on a computer by a statistics professional of the statistical service of the institution proposing the study. The responsible researchers as well as the statistician were unaware of the sequence of the immersion bath techniques used for groups 1 and 2, identified as Group 1 (Bath A and Bath B) and Group 2 (Bath B and Bath A), thus ensuring masking of the interventions.

Two professional nursing technicians from the institution's neonatal unit (the study field) who agreed to collaborate with the trial were trained in the procedures of the two types of baths prior to the beginning of data collection. Only these two collaborators had access to the randomization list that defined the bathing sequence.

The studied variables were: gender, Apgar at 1 and 5 minutes of life, gestational age at birth (GA) and at the date of data collection, weight, weight classification versus gestational age at birth, and clinical diagnosis. The analyzed covariables were room temperature measured before and after the bath with an Incoterm® ambient thermometer, the bath water temperature measured with a G-Tech Diva-Go® thermometer immediately, before and after bathing, bath duration and the type of bed of the newborn. The primary outcome was body temperature, which was measured in the axillary region (T) with a GTech® digital thermometer at three moments: immediately before the bath (T0), at 10 minutes (T10) and at 20 (T20) minutes after the bath. All axillary temperature measurements were performed with the newborn dressed, kept in the horizontal dorsal position in the crib. Axillary temperature gauging periods of the newborns as well as the sample size of the pilot study were based on the only clinical trial related to thermal variation in preterm newborns submitted to immersion baths that had been published up to the beginning of the data collection.[2]

Regarding the procedure for bathing prior to the infant being immersed, the newborn's clothing and diaper were removed and they were wrapped in a towel. The perineal region was hygienized with cotton swabs soaked in water. The newborn was then immersed in the water, keeping the trunk and limbs in the water; the cervical region was supported on the inside of the caregiver's forearm; and the gluteus of the infant supported on the bottom of the bathtub. The palm and fingers of the caregiver's left hand involved the axillary region of the left arm of the newborn. Next, face and the head hygiene was performed using cotton balls dampened in the bath water and glycerinated soap. The infant's torso and limbs immersed in water were washed, and keeping the sheet around its body in the case of the swaddled bath. The newborn was subsequently removed from the bathtub, placed on a surface and wrapped in a dry towel, and then its diaper and clothing were put on. The umbilical stump was cleaned with cotton swabs soaked in 70% alcohol solution, and the infants were placed in the supine position in its crib or incubator.

Data were collected and recorded in a proper instrument by a research assistant after training by the responsible researcher, and who was unaware of the study purpose. Data were stored in Microsoft Office Excel 2010 worksheet and analyzed in Epi-Info 3.5.1 software. Continuous variables were analyzed with descriptive statistics and the categorical variables as means of absolute and relative frequency. For the outcome variable, the existence of difference between the groups according to the type of bath was determined by the paired Student's t-test. The level of statistical significance adopted was $p \leq 0.05$ with a 95% confidence interval. It was established *a priori* that differences of up to 0.2°C in the mean post-bath temperatures between the groups would confirm the null hypothesis.[1,14-15]

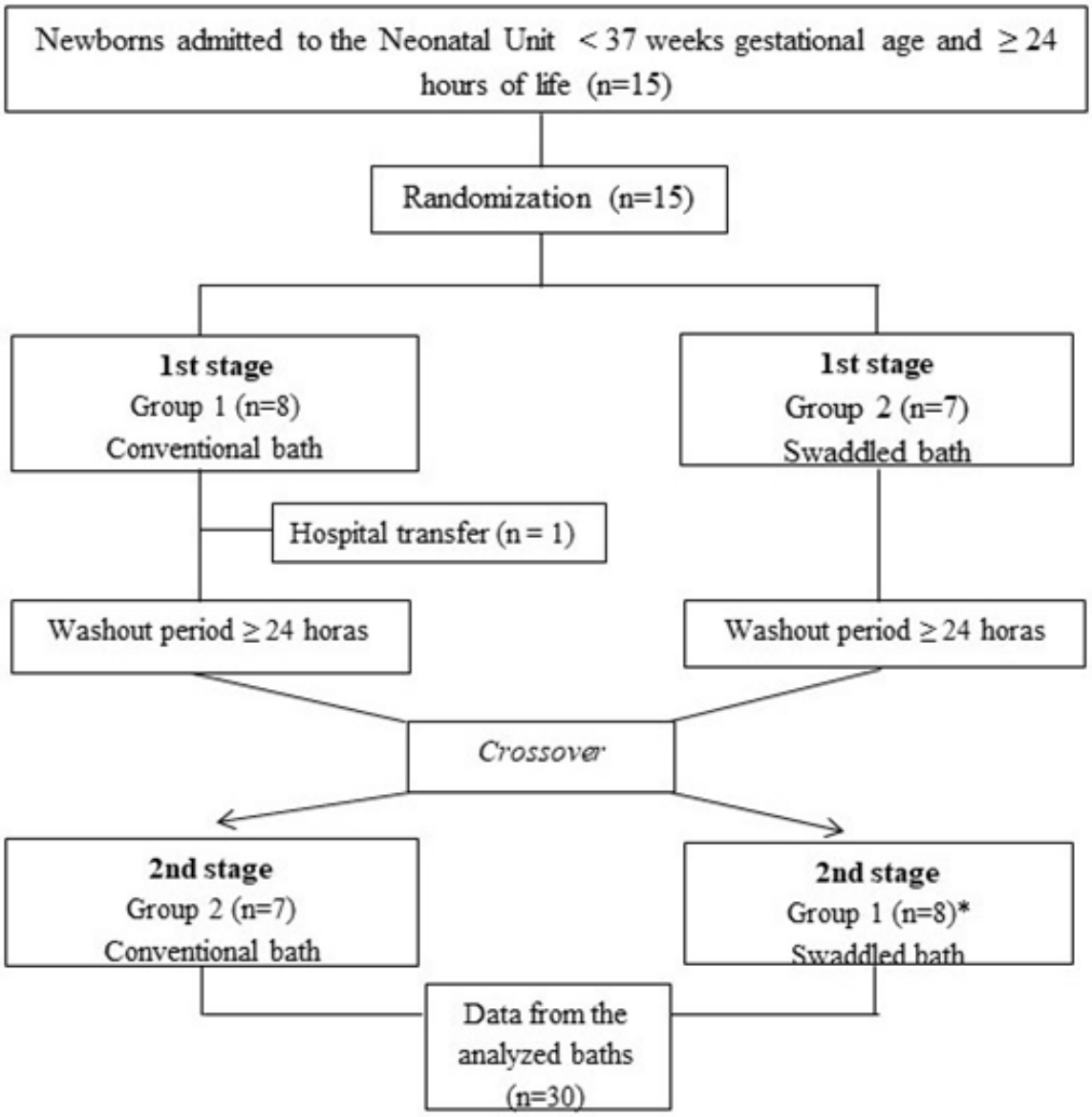
Due to the loss of a preterm newborn in the experimental group who received the conventional bath but not the swaddled bath due to hospital

transfer, the statistical analysis employed was the Intention-to-treat-analysis.[16-17] Thus, the worst possible scenario was chosen for all lost variables, considering the minimum values obtained in the experimental group. For the weight variable, the same value obtained in the first bath was considered.

Bathing type identification was performed only after concluding the statistical analysis of the data, ensuring double masking.

RESULTS

Fifteen (15) selected preterm newborns participated in the study, as shown in Figure 1.



* The data from the newborn not included in the second phase of Group 1 was treated by the intention-to-treat analysis.

Figure 1 - Flowchart for participant inclusion

The majority of preterm newborns were female (53%), born vaginally (73.4%), diagnosed with respiratory discomfort (53.3%), with gestational age at birth averages of 34.2 weeks and a birth weight of 2.119 g. The majority (80%) had Apgar higher than 7 at the 1st and 5th minutes of life, and all newborns were classified as having adequate weight for their gestational age.

No differences were observed regarding the type of bed occupied by the newborns between the first and second baths. Most were incubated (53.3%), followed by a warmer crib (40.0%) and a common crib (6.7%). Room temperature and the bath temperature before and after bath, as well as

weight, gestational age and bath duration were similar among the newborns submitted to the conventional baths and those submitted to swaddled baths (Table 1).

Table 1 – Room temperature, bath water temperature, weight and gestational age of the newborn and duration of the procedure for the two immersion bath techniques. São Paulo-SP, 2014

Variable	Conventional immersion bath (n=15)	Swaddled immersion bath (n=15)	p
	Mean (SD)	Mean (SD)	
Room temperature before the bath (°C)	27.6 (1.26)	27.6 (1.5)	0.90
Room temperature after the bath (°C)	27.6 (1.5)	27.3 (1.6)	0.61
Water temperature before the bath (°C)	37.9 (0.6)	37.8 (0.6)	0.50
Water temperature after the bath (°C)	37.2 (0.7)	37.1 (0.7)	0.70
Weight at the intervention (grams)	2.098.6 (404)	2.111.0 (415)	0.90
Post-conception gestational age (weeks)	35.2 (1.5)	35.4 (1.4)	0.80
Bath duration (minutes)	10.6 (2.4)	11.2 (1.4)	0.40

Neonates of both groups had normal axillary temperature before the bath ranging from 36.1°C to 37.0°C. A drop in the neonates' temperature after bathing was noticed, regardless of the implemented technique. No significant differences were observed between the mean axillary temperature of the newborns in comparing conventional baths and swaddled baths (Table 2).

Table 2 - Axillary temperature of the newborns according to the type of immersion bath. São Paulo-SP, 2014

Newborns' axillary temperature	Conventional immersion bath (n=15)	Swaddled immersion bath (n=15)	P value
	Mean (SD)	Mean (SD)	
Prior to the bath (T0)	36.5 (0.3)	36.7 (0.4)	0.30
10 minutes after bath (T10)	36.2 (0.3)	36.3 (0.3)	0.53
20 minutes after bath (T20)	36.3 (0.3)	36.3 (0.3)	0.90

Mean temperatures 20 minutes after the bath were similar between groups, although the decrease was higher when compared to the mean pre-bath values for swaddled baths, being 0.4°C; while the temperature drop for the conventional bath was 0.2°C. Mean post-20 minute temperatures did not reach pre-bath baseline values. It is worth remembering that the average ambient temperature for swaddled immersion bath was 0.3°C lower than for conventional baths, which may explain the greater drop in post-bath temperature in swaddled newborns, although this difference was not significant.

DISCUSSION

This pilot study compared the temperature of preterm newborns exposed to the conventional immersion bath and swaddled immersion bath. The findings showed no significant statistical and clinical difference between both bathing techniques in the first 20 minutes post-bath.

The maximum variation in the pre and post-bath temperature averages were -0.3 and -0.4ºC, respectively, in the control and experimental groups, indicating that regardless of the technique employed, the immersion baths produce thermal loss in preterm newborns.

Findings on the temperature of the newborn at the 10th minute post-immersion bath differed from those found in a randomized clinical trial conducted in Iran[13] which compared the axillary temperature of 50 preterm newborns subjected to the conventional and swaddled immersion baths. The mean temperature 10 minutes after bathing for swaddled baths was superior to the group that received the conventional bath (36.42°C *versus* 35.96°C). This study also showed a lower temperature drop compared to baseline in the group of neonates submitted

to swaddled bath (0.59°C *versus* 0.08°C). However, data on bath duration and temperature of the bath water were not evaluated for the temperature beyond 10 minutes post-bath.[13] These results diverge from the findings of the present study, which found lower temperature drops among preterm newborns submitted to conventional bath compared to swaddled bath; however, with no significant difference. This is possibly attributed to the fact that newborns submitted to swaddled baths were exposed to environmental temperature when undressed and then swaddled, while those who received conventional baths were undressed and immediately immersed into warm water.

Despite this thermal loss, evidence indicates that immersion baths keep the temperature more stable when compared to sponge bath,[15,18] which is characterized by a technique of corporal hygiene using cotton balls dampened in liquid soap without immersion of the newborn in water. A further drop in temperature occurs at 10 minutes after bathing, after which temperature stabilization occurs.[19]

The results of the present study show that the temperature of the newborn did not reach the pre-bath temperature at the 20th minute after the bath, remaining around 36.0°C and 36.5°C. These values can be classified as mild hypothermia with potential stress by cold.[5] However, this classification is not a consensus in the literature, with hypothermia being defined when the axillary temperature below 36.0°C.[20-21] Literature indicates a high incidence of hypothermia among preterm newborns with low birth weight, affecting up to 25% of newborns weighing less than 2,500 grams and 56% or more of those weighing less than 750 grams.[22] One of the potential causes for hypothermia in neonates is attributed to the evaporation that occurs from moisture of the skin, clothing or blanket, which is the cause for heat loss in the preterm newborns exposed to the immersion bath.

It is worth pointing out that in this study we included preterm newborns with axillary temperatures higher than 36.0°C, meaning that newborns with mild hypothermia (T ≥ 36.0°C and <36.5°C) were included, considering that these infants could benefit from the immersion bath due to the temperature of the bath water, which at the beginning of the procedure ranged from 37°C and 40°C. This factor contributed to the outcome data found in the post-bath (mean axillary temperature below 36.5°C), classified as mild hypothermia.[3,23] Thus, the results found evidence that immersion baths contributed to heat loss, regardless of the adopted technique, and it is therefore recommended that the immersion bath in preterm hypothermic newborns be postponed and indicated to those with axillary temperature greater than or equal to 36.5°C.

Another relevant fact was that the average room temperature at the moment of the immersion bath varied between 27.3°C and 27.6°C. The recommended room temperature for neonatal intensive care units is between 22°C and 26°C;[24] therefore, below what was found in the present study.

Another aspect is related to the face and head hygiene procedures performed. The cephalic segment was exposed to evaporation for a longer period compared to the torso and limbs, which may explain the drop in post-bath temperatures. Moreover, the newborns did not receive any head protection such as a hat after the bath, remaining with their heads uncovered. Protecting the head with a hat after bathing is an effective measure to reduce heat loss by evaporation, which should be replaced by another dry hat after 15 minutes.[15] There is also evidence that the hygiene of the cephalic region should be performed at the end of the bath.[25]

The findings showed that both immersion techniques contributed to the hypothermia of newborns, even 20 minutes after the end of the procedure. It is important to emphasize that the nursing team can intervene in the prevention of hypothermia through actions that help the preterm newborn achieve thermal stability such as: dressing them immediately with clothing appropriate to the room temperature of the neonatal unit; subtly raising the temperature of the incubator or heated crib until the temperature of the NB is at least 36.5°C; adjusting the room temperature using heaters close to common cribs, if possible; minimizing stress-generating stimuli such as noise, light and handling, seeking to reduce metabolic expenditure; promoting skin-to-skin contact with the parents of the newborn, since this procedure favors heat exchange with beneficial repercussions on preterm newborn's body temperature, in addition to providing interaction with parents. Another recommendation is an indication of the immersion bath to preterm newborns with axillary temperature equal to or higher than 36.5°C.

Generalizing the results of this study should be done with caution since this is a pilot study, considering the sample size of 15 subjects; as a pilot crossover, 30 subjects were considered in the statistical analysis. The crossover can theoretically achieve the same precision as parallel group trials, with only half the sample size. The required sample size is further reduced by the results to be measured

in the same individual, which generally show less variation than those measured between individuals.[26] The obtained results significantly contribute to conceiving the research problem, as well as for constructing a procedure protocol for immersion baths in preterm newborns at the unit.

CONCLUSION

The results indicate that conventional or swaddled immersion baths do not significantly differ regarding their effect on the body temperature of preterm newborns. However, future studies addressing the effects of protective strategies for growth and development of these newborns are necessary, as well as studies investigating more indicators of effectiveness and safety of swaddled immersion bath for premature infants such as: physiological indicators of stability, behavioral responses such as facial expressions and crying time, and hormonal indicators such as the salivary cortisol level which determine the stress resulting from this procedure.

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