EFFECTIVENESS OF POLYETHYLENE SKIN WRAP IN PREVENTION OF HYPOTHERMIA IN PRETERM AND LOW BIRTH WEIGHT NEONATES

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ABSTRACT

Objective: To establish the effectiveness of polyethylene skin wrap in prevention of neonatal hypothermia in preterm and low birth weight neonates.
Study Design: Quasi-experimental study.
Place and Duration of Study: Department of Pediatrics, Combined Military Hospital Quetta, from May 2015 to Apr 2017.
Methodology: A total of 176 neonates were enrolled according to the inclusion and exclusion criteria, through non-probability consecutive sampling. Eighty eight newborns were randomly distributed to each of group "A" and "B" by lottery method. The intervention group "A" infants were wrapped in a polyethylene skin wrap from shoulders down while the control group "B" newborns were wrapped with conventional blankets. After shifting to neonatal intensive care unit, axillary temperatures were recorded with similar pediatric digital thermometers upon admission and after one hour and two hours following admission in the two groups.
Results: The mean temperatures measured at one hour and two hours after admission showed significant statistical improvements in the intervention group as compared to the control group (<0.05).
Conclusion: The use of polyethylene skin wrap in preterm and low birth weight neonates potentially offers a useful intervenetion in prevention of neonatal hypothermia.

Keywords: Hypothermia, Low birth weight, Preterm, Polyethylene skin wrap.

INTRODUCTION

Birth, especially in preterm and low birth weight (LBW) neonates, is associated with many physiologic challenges to the neonatal body. One of the challenges is to maintain body temperature. Neonatal hypothermia is a well-known factor associated with significant morbidity and mortality[1]. Up to half of all preterm neonates experience some degree of hypothermia. The degree of hypothermia is directly proportional to the degree of prematurity[2]. A multitude of physiological risk factors contribute to the hypothermia like inappropriate vasomotor control, deficient subcutaneous fat, increased body surface area to body weight ratio, mal adjustment from the fetal to neonatal blood circulation, and a keratin deficient immature superficial skin layer [3]. There are also a number of pathological risk factors including neonatal infections/sepsis, coagulopathies, neonatal acidosis, and respiratory distress syndrome (RDS). The heat loss from the neonatal body is governed by the four classic mechanisms namely radiation, conduction, convection, and evaporation[4]. The last one takes special importance in neonates with LBW and the effects of evaporation are more so if the neonate is preterm as well. For neonates the normal range of body temperatures is considered to be between 36.5-37.7°C. Temperatures between 32-36°C are consistent with moderate degree of hypothermia and temperature <32°C is considered severe hypothermia[5]. The physiologic complications that occur as a result of neonatal hypothermia comprise increased oxygen consumption, metabolic acidosis, hypoglycemia, lowered cardiac output and increased peripheral vascular resistance[6]. These all then contribute to deterioration of neonatal condition especially in newborns with LBW. A newborn's body reacts differently to hypothermia compared to that of an adult[7]. Particularly notable phenomenon is the lack of shivering. A neonate's body responds to hypothermia by increasing sympathetic activity that results to an increase in noradrenaline and thyroid stimulating hormone that resultantly increases levels of thyroid hormones T3 and T4[8]. Thyroid hormones boost body's heat production through enhanced fat oxidation. Prevention of hypothermia in hospital setup starts with simple measures including maintaining a higher delivery room temperature, skin to skin contact between mother and newborns, and placing a cap on the newborn's head[9]. Some of the more sophisticated methods to prevent hypothermia include use of

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incubators, radiant warmers, and warming mattresses. Perhaps a single method that has shown effectiveness for prevention of neonatal hypothermia is polyethylene occlusive skin wrapping of the wet newborn[10]. In this rather simple method, which is being adopted widely, the newborn is not dried and is immediately wrapped from shoulders down with a clear polyethylene skin wrap. Polyethylene skin wraps work by reducing the evaporative and convective heat losses, and the insensible water losses. They also reduce the rate of metabolic heat production.

Although this simple intervention for neonatal hypothermia is increasingly being employed all over the world including our part of the world, but to our knowledge studies determining its efficacy are limited in Pakistan. Our current study aims to determine the effectiveness of polyethylene skin wraps in prevention of neonatal hypothermia in preterm and LBW newborns.

METHODOLOGY

This quasi-experimental study was carried out at NICU of a tertiary care teaching Hospital namely Combined Military Hospital Quetta, from May 2015 to April 2017. After acquiring authorization from the hospital ethics committee, 176 newborns of either gender who fulfilled the inclusion criteria of having gestational age between 28-36 weeks, and birth weight between 1-2.5 kg, were enrolled, through non-probability consecutive sampling, who's parents had consented to take part in the study. Gestational age was determined using last menstrual period, fundal height, and ultrasonography by qualified obstetrician/radiologist. Excluded from the study were the infants born with major open congenital anomalies like myelomeningocele, gastroschisis, and congenital dermatological diseases. The sample size was calculated using sample size calculator of world health organisation keeping level of significance at five percent and power of the test at eighty percent[5].

After explaining the aims and advantages of the research study, informed permission was acquired from parents of every neonate. Eighty eight newborns were randomly distributed each to group "A" and "B" by lottery method. The intervention group "A" infants were wrapped in a polyethylene skin wrap from shoulders down wrapping the trunk and all four limbs. The control group "B" newborns were similarly wrapped with blankets provided by the family. Newborns in both the groups received same standard care including a short-lived period of drying on their mother's abdomen while their umbilical cord was being dealt with and the placenta was being delivered. Next, all the neonates were transferred from the labour / operating room to the NICU and were put under a warmer after recording their vital signs making sure that the newborns were medically stable. Next, axillary temperatures were recorded with similar pediatric digital thermometers upon admission and after one hour and two hours of admission in both the groups. Data were collected using especially deliberated forms and were then analysed using the statistical analysis program namely Statistical Package for the Social Sciences (SPSS version 17). Frequency and percentages were used for measuring qualitative variables like gender while for quantitative variables like temperature, mean and standard deviations (SD) were calculated. Independent student's t-test was used to compare the results between the two groups, and *p*-values ≤0.05 were taken as statistically significant.

RESULTS

All 176 patients finished the study with none withdrawn. Basic features of the participants are depicted in table-I. Out of total 176 neonates distributed in to the two groups, most were males (52.27% in group A and 51.13% in group B). Mean gestational age was 25.5 ± 1.6 weeks in group A while it was 25.6 ± 1.6 weeks in group B. Mean birth weight of the infants was 0.765 ± 0.231 kilograms in the intervention group while it was 0.787 ± 0.254 kilograms in the control group. The mode of delivery was mostly Caesarian (92.04% for group A and 89.77% for group B). While mean temperatures at admission as measured in degree Celsius were comparable in the two groups, the mean temperatures measured at one hour and two hours after admission showed significant statistical improvements in the intervention group "A" as compared to the control group "B" (<0.05) (table-II).

DISCUSSION

Maintaining adequate body temperature is one of the well recognized foremost and fundamental necessities for the health of all neonates[11,12]. Neonatal hypothermia continues to haunt neonatal healthcare professionals even at the very best of the centers. It is defined as a core body temperature lower than the normal range of 36.5-37.7°C[5]. Various associated risk factors for neonatal hypothermia include prematurity, LBW, intra-uterine growth restriction, central nervous system diseases, and some congenital anomalies like gastroschisis and exomplalos[13]. Of these the first two are often the substantially contributing factors. Immedia-

tely following delivery, heat loss gradually sets in at a rate of 0.1°C per minute for term neonates, and at even faster rates for preterm and LBW neonates[14]. A neonate's body responds to hypothermia in a different way compared to that of an adult[7]. Predominantly noteworthy phenomenon is the lack of shivering. A newborn's body reacts to hypothermia by increasing sympathetic activity that results in an increase in noradrenaline and thyroid stimulating hormone that subsequently increases serum levels of thyroid hormones T3 and T48. Thyroid hormones enhance body's heat production through increased fat oxidation. Prevention of neonatal hypothermia in hospital setup begins with the simplest of measures including maintaining a higher delivery/operating room temperature, encouraging skin to skin contact between mother and newborns, and placing a cap on the newborn's head[9]. Some of the more advanced options available to prevent hypothermia include use of incubators, radiant warmers, and warming mattresses. Perhaps a single method that has shown effectiveness for prevention of neonatal hypothermia is the use of polyethylene occlusive skin wrapping of the wet newborn[10]. Impending hypothermia warrants prompt use of heat loss prevention strategies to prevent potential complications. Such strategies generally act either by providing heat from external heat sources or by interventions to prevent indigenous heat loss by barrier methods[15]. One such barrier intervention is the use of polyethylene skin wraps which work by reducing the evaporative and convective heat losses, and the insensible water losses. Such occlusive skin wrappings also reduce the rate of metabolic heat production[16]. Polyethylene skin wraps have proven to be simple and effective in reducing the risk of neonatal hypothermia in both term and preterm neonates without any associated adverse reactions save for possible hindrance in the process of resuscitation, should need arises[17,19].

The results of our study showed an insignificant variation in temperature of neonates at admission between the two groups (p=0.25), while there was a significant variation in temperature of neonates at one hour and two hours after admission between the two groups (p=0.01 & 0.02). Mean temperature of neonates reached to nearly 37°C in the intervention group at two hours after admission. The results of our current study are in general agreement with a number of other international research studies. A meta-analysis concluded that plastic skin wrapping was linked to a reduction in hypothermia both in preterm and term infants[13]. A randomized controlled trial from India also showed that polyethylene skin wrapping offered rapid and persistent temperature control and was effective at preventing neonatal hypothermia in preterm infants[15]. Another meta-analysis from China considered plastic wraps to be effective and safe additional intervention for prevention of hypothermia in preterm neonates[16]. Another multicenter randomized controlled trial concluded that total body wrapping was effective at preventing neonatal hypothermia in very preterm newborns[18]. Yet another clinical trial from Iran similarly concluded that the combined usage of a plastic bag and a plastic hat was more efficacious at preventing neonatal hypothermia as compared to the use of a plastic bag and a cotton hat cmbined[20,21].

Table-I: Basic demographics.

Characteristic	Group "A" (Intervention group) (n=88)		Group "B" (Control group) (n=88)		p-value*
	n (%)	Mean ± SD	n (%)	Mean ± SD	
Gestational age (weeks)	-	25.5 ± 1.6	-	25.6 ± 1.6	0.65
Gender (Female/Male)	42(47.72)/46(52.27)	-	43(48.86)/45(51.13)	-	0.73
Birth weight (Kgs)	-	0.765 ± 0.231	-	0.787 ± 0.254	0.75
Delivery mode (Vaginal/Caesarian)	7(7.95)/81(92.04)	-	9(10.22)/79(89.77)	-	0.63

*$p<0.05$ is statistically significant, *Independent Student's t test*

Table-II: Outcome results of the patients.

Outcome Variable	Group "A" (Intervention group) (n=88)	Group "B" (Control group) (n=88)	p-value*
	Mean ± SD	Mean ± SD	
Temperature at admission (°C)	36.1 ± 0.7	35.2 ± 0.6	0.25
Temperature at 1 hour after admission (°C)	36.6 ± 0.5	36.3 ± 0.5	0.01
Temperature at 2 hours after admission (°C)	36.9 ± 0.6	36.3 ± 0.7	0.02

*$p<0.05$ is statistically significant, *Independent Student's t test*

RECOMMENDATION

Polyethylene skin wraps should be used to prevent hypothermia and its associated complications

to minimize the length of hospital stays and reduce the associated costs.

CONCLUSION

To sum up, our results suggest that the use of polyethylene skin wrap is effective in prevention of hypothermia and its associated complications in preterm and LBW infants.

CONFLICTS OF INTEREST

This study has no conflict of interest to be declared by any authors.

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