A Study to Assess the Effectiveness of Vinyl Bags in Preventing Hypothermia among Preterms

M. Lakshmi Prasanna[1]*, Erna Judith Roach[2] and Ms. Angelin[3]

[1]Sister Tutor, College of Nursing, JIPMER, Puducherry, India

[2]Assistant Dean, Postgraduate Studies and Research, College of Nursing, Sultan Qaboos University, Sultanate of Oman

[3]Additional Professor, Manipal College of Nursing, Manipal, Karnataka, India

Greentree Group

ABSTRACT

Background: Many new born babies are more prone to hypothermia, during the transition period of their birth. This is more evident and is of concern specially in preterm new born when compared to full term babies for various reasons, major being the physiological immaturity to confront the change in temperatures. **Purpose:** Though many conventional methods such as radiant warmers are available, the effectiveness of vinyl bags in prevention of hypothermia among preterm babies when compared to Radiant warmer was evaluated. **Methods and Materials:** A quasi experimental study with post-test only design, using convenient sampling techniques was undertaken. The study included total 58 preterm babies, with 29 in Control group getting standard care under radiant warmer and 29 in Experimental group with vinyl bag for preventing hypothermia. Vital parameters like heart rate, respiratory rate and oxygen saturation were analysed with temperature being the main parameter for comparing between the standard care and as well as vinyl bag care. The intervention in both the groups is provided for a period of 6 hours immediately after the baby is born with temperature and oxygen saturation being analysed at an interval of each of hour with heart rate and respiratory rate at an interval of fifteen minutes. **Results:** The mean difference in temperature between the Standard care and vinyl bag care was found to be 1.31 at 95% confidence interval ('t' =4.17, p=0.01) concluding that Vinyl bags are effective in preventing hypothermia among Newborns.

KEYWORDS

Hypothermia, Preterm Babies, Vinyl Bags, Standard Care (Radiant Warmer)

INTRODUCTION

Prematurity is a major cause of concern in all the developing countries. It shares major part in Neonatal mortality rate, when compared to other causes. This is in relation to the fact that preterm babies are vulnerable to many factors that challenge the survival of them. One of the major challenge is being the Hypothermia. Therefore, in spite of the advanced technologies, preterm babies are often an unmet challenge in most of the clinical scenarios. The golden minute in the life of all neonates is the first five minutes immediately after birth. Based on various proven studies, Neonatal resuscitation guidelines are taking unconventional transformation for handling these delicate babies. Many studies across the globe had been undertaken to identify the major causes of Neonatal mortality and found that hypothermia is one of the major cause of concern. The concern of hypothermia is a concern to the extent that it has been in the top place of Neonatal resuscitation guidelines as proposed by the American Heart Association and as per the National Neonatal Forum Guide lines. In all the guidelines hypothermia is given due importance, because it leads to various metabolic complications including acidosis, which makes the tiny preterm difficult to handle the survival challenge. Therefore, it is imperative on the part of clinical professionals to control and

prevent hypothermia at the earliest and the study is aimed at preventing hypothermia using vinyl bags in comparison with the conventional radiant warmer[1-32].

AIM

To prevent hypothermia in preterm infants, decrease oxygen consumption and thereby prevent acidosis

To implement the intervention if successful, in health facilities, where it has not been practiced

To bring cost effective treatment within a short duration of time and with minimal resources, essentially where there are no adequate facilities (rural and under privileged areas).

OBJECTIVES

The objectives of the study are to:

Identify the preterm infants base line temperature, oxygen saturation, heart rate and respiratory rate at birth.

Determine the effectiveness of standard care in preventing hypothermia in preterm infants.

Determine the effectiveness of vinyl bags in preventing hypothermia in preterm infants.

Compare the standard care with the use of vinyl bags in preventing hypothermia in preterm infants.

MATERIALS AND METHODS

Research design

Quasi experimental method with Post-test only design was adopted in view of ethical constraints due to randomization.

Population

The population included were Preterm neonates. Purposive sampling technique is adopted in view of no randomization.

Tools

The following tools were developed in order to obtain the data.

Tool I: Demographic proforma

Tool II: Clinical proforma

Tool III: Physiological proforma

The tools were prepared after reviewing related literature, taking opinion of experts and reviewing existing tools. The tools were sent for content validity to 5 medical experts in the field of neonatology. The tools were also tested for inter rater reliability. The equipment used for the study such as the warmer, electronic thermometer, saturation and heart rate monitor were also checked for reliability by Bio Medical engineers and certificates of reliability and validity were obtained.

Methodology

The proposal of the study was presented before the Proposal committee of Manipal College of Nursing, later the proposal went through the Institutional Ethics Committee.

A subject information sheet and informed consent forms were prepared in the local languageof the people of Kadapa district, for a detailed description of the research study. The study was conducted in the labour room and collected 58 samples with 29 in experimental and 29 in control group. For the preterm infants included under standard care, data was collected quickly on temperature, heart rate, respiratory rate and oxygen saturation, immediately after the birth. The preterm infants were then immediately wiped and dried thoroughly and kept under the radiant warmer (standard care). Temperature and oxygen saturation were observed at an interval of one hour for a period of six hours. Heart rate and respiratory rate were observed at an interval of 15 minutes for a period of six hours.

The preterm infants were given the intervention with a prior oral explanation of the intervention to the parents and an informed consent form duly signed by the parents was also taken. A subject information sheet, written in the local language was also given to the parents for further information and future reference. For the preterm infants whose parents agreed to include in the experimental group, a quick recording of temperature, oxygen saturation, heart rate and respiratory rate was immediately made after the birth. Immediately after the initial observation, the infant was wrapped in a vinyl bag until the neck that was tested and sterilized to be used on preterm infants. The head of the preterm infant was covered with a stockinet cap. Temperature and oxygen saturation were observed at an interval of one hour for a period of six hours. Heart rate and respiratory rate were observed at an interval of 15 minutes for a period of six hours.

RESULTS AND DISCUSSION

The data gathered was analysed using SPSS 11.5 version. In order to examine empirical evidence and explore the significance of findings both descriptive and inferential statistics were computed on the basis of the objectives and hypothesis. The data analysed were plotted on the following tables and graphs:

Table 1 Frequency and percentage distribution of preterm infants on selected sample characteristics
(n = 29+29 = 58)

S. No	Sample characteristics	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
		Control group		Experimental group	
1.	Gestational age (in weeks)				
	a. 28-31	5	17.3	6	20.7
	b. 32-35	24	82.7	23	79.3

2.	Place of observation	21	72.4	21	72.4
	a. Delivery room	5	17.2	4	13.8
	b. Delivery room and OT	3	10.4	4	13.8
	c. Delivery room and NICU				
3.	Sex				
	a. Female	13	44.8	18	62.06
	b. Male	16	55.2	11	37.94
4.	Weight (in grams)				
	a. <1500	8	27.6	9	31
	b. 1501-2000	21	72.4	20	69
5.	Apgar score (1 minute)				
	a. 5-7	7	24.	9	31
	b. 8-10	22	75.9	20	69
6.	Apgar score(5 minutes)				
	a. 5-7	3	10.3	3	10.3
	b. 8-10	26	89.7	26	89.7

Data presented in table 1, shows that

- The sample consists of equal number of subjects (29+29) in both the control and the experimental groups.

- Majority of the preterm infants were between 32-35 weeks of gestation with 82.7% in the control group and 79.3% in the experimental group.

- Most of the deliveries took place in delivery room, with 72.4% of deliveries under the control group and 72.4% under the experimental group.

- Male preterm infants were more in the control group (55.2%) and female preterm infants were more in the experimental group (62.06%).

- Majority of the preterm infants were between the birth weight of 1501g to 2000g, with 72.4% under the control group and 69% under the experimental group.

- Majority of the preterm infants had Apgar scores between 8 to 10 at one minute, with 75.9% in the control group and 69% in the experimental group.

- Majority of the preterm infants had Apgar score between 8 to 10 at five minutes, with 89.7% in the control group and 89.7% in the experimental group.

Effectiveness of vinyl bags on physiological parameters of preterm infants

Comparison between the mean values of physiological parameters of experimental and control group

- To compare the means of the physiologic parameters of both the control and experimental groups, the average of all the physiological parameters (temperature, oxygen saturation, heart rate, and respiratory rate) were calculated, following which normality was observed. The normality of the physiologic parameters was observed using Shapiro Wilk, as the sample was less than 50 in each group.

- As the average temperature and heart rate followed normality, two sample independent 't' test was done to compare the means of two independent samples.

Table 2 Comparison of means of temperature and heart rate between the groups   **(n = 29+29 = 58)**

Physiological parameters	Mean (SD)		Mean difference	't' value	df	p value	Significance
	SC	V					
Temperature	93.75 (1.21)	95.07 (1.18)	1.31	4.17	56	0.001	S
Heart rate	133.37 (8.88)	135.93 (10.01)	2.5	1.03	56	0.30	NS

- **SC= Standard care**
- **V= Vinyl bag care**
- **SD= Standard Deviation**

- **S= Significant**
- **NS= Not significant**

Data presented in Table 2 show that the mean difference in temperature between the control group and experimental group is 1.31 and the 'p' value of temperature average is <0.05, which indicates that the increase in the mean temperature of the experimental group is statistically significant. Mean difference of the average heart rate between the control group and experimental group is 2.5 and the 'p' value is 0.30 which is > 0.05, this infers that the difference between the two groups is not statistically significant. The average of O2 saturation and respiratory rate did not follow normality, as per Shapiro Wilk test. Hence, Non-Parametric test (Mann Whitney 'U' Test) was used for comparing means.
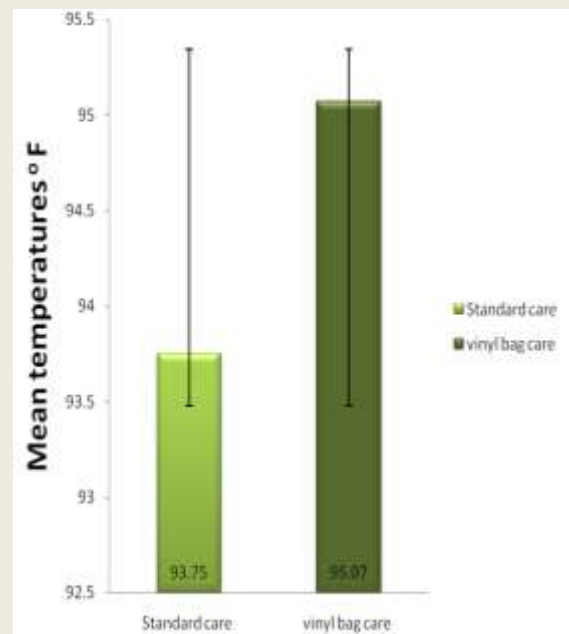

Figure 1: Comparison of means of temperature of both the standard care group and vinyl bag care group

Table 3 Comparison of means of oxygen saturation and respiratory rate of the two groups

(n = 29+29 = 58)

Physiological parameters	Median (IQ)		Z value	p value	Significance
	SC	V			
Oxygen Saturation	94.28(3.14)	95.57(3.00)	2.08	0.037	S
Respiratory rate	50.72(8.20)	50.56(8.44)	0.614	0.539	NS

IQ=Inter Quartile Range

The data presented in table 3 show the median of oxygen saturation and respiratory rate of both the groups. The 'p' value for the oxygen saturation is 0.037 which is < 0.05 which infers that the difference is statistically significant and the

p value for respiratory rate was 0.539 that is >0.05, which infers that the difference is not statistically significant.

Association between the gestational age and mean values of physiological parameters:

The association between the physiological parameters and the gestational age and birth weight were checked for normality through Shapiro-Wilk method. The association between temperature and heart rate, with the gestational age of the preterm infant, were done using two sample independent 't' test, as it followed normal distribution. The association between oxygen saturation, respiratory rate with gestational age of the preterm infant, was done using non-parametric Mann Whitney U test, as it did not follow normal distribution.

Table 4 Association between gestational age with temperature and heart rate (n=29+29=58)

Gestational age in weeks	Mean (SD)		Mean difference	't' value	df	p value	Significance
	28-31	32-35					
Temperature	93.15 (1.31)	94.76 (1.20)	1.55	3.77	56	0.001	S
Heart rate	127.81 (8.76)	136.25 (8.97)	8.44	2.82	56	0.007	S

The data presented in table 4 show that the 'p' value of both the temperature and oxygen in association with the gestational age is <0.05 level of significance, which indicates that there is a significant association between the gestational age and temperature and gestational age and heart rate.

Table 5 Association between gestational age and Oxygen saturation and respiratory rate (n = 29+29 = 58)

Gestational age in weeks	Median (IQ)		Z value	p value	Significance
	28-31	32-35			
Oxygen Saturation	90.42(15)	95(2.57)	3.49	0.001	S
Respiratory rate	50.56(15.92)	50.56(6.56)	0.496	0.620	NS

- **IQ=Inter Quartile Range**

The data represented in table 5 show that the 'p' value of O_2 saturation in association with the gestational age is <0.05 level of significance, which indicates that there is a significant association between gestational age and O_2 saturation and, and the 'p' value of respiratory rate in association with the gestational age is >0.05 level of significance, which indicates that there is no significant association between gestational age and respiratory rate.

Association between birth weight and the mean physiological parameters

The association between birth weight and physiological parameters were checked for normality through Shapiro Wilk method. The association between birth weight and temperature and heart rate of the preterm infant, were done using Two sample

independent 't' test, as it followed normal distribution. The association between birth weight and oxygen saturation and respiratory rate of the preterm infant, were done using non-parametric Mann Whitney 'U' test, as it did not follow normal distribution.

Table 6 Association between birth weight and temperature, heart rate (n = 29+29 = 58)

Birth weight	Mean (SD)		Mean difference	't' value	df	p value	Significance
	ELBW	**MLBW**					
Temperature	93.40 (1.31)	94.82 (1.20)	1.55	3.77	56	0.001	S
Heart rate	127.81 (8.76)	136.25 (8.97)	8.44	2.82	56	0.007	S

- **ELBW= Extremely low birth weight**
- **MLBW= Moderately low birth weight**

The data represented in table 6 show that the 'p' value of both the temperature and heart rate in association with is <0.05 level of significance, which indicates that there is a significant association between the birth weight and temperature, birth weight and heart rate.

Table 7 Association between birth weight and oxygen saturation and respiratory rate (n = 29+29 = 58)

Birth weight	Median (IQ)		Z value	p value	Significance
	ELBW	**MLBW**			
Oxygen Saturation	91.85(14.14)	95.14(2.71)	3.76	0.001	S
Respiratory rate	51.20(50.32)	50.56(7.08)	0.521	0.601	NS

The data presented in table 7 show that the 'p' value of oxygen saturation in association with birth weight is <0.05 level of significance, which indicates that there is a significant association between birth weight and oxygen saturation, and the 'p' value of respiratory rate in association with birth weight is >0.05 level of significance, which indicates that there is no significant association between birth weight and respiratory rate.

CONCLUSION

The purpose of the study was to evaluate the effectiveness of vinyl bags in preventing hypothermia among preterm babies as well to implement the intervention if successful, in health facilities, where it has not been practiced and to bring cost effective treatment within a short duration of time and with minimal resources, essentially where there are no adequate facilities (rural and under privileged areas).

All the findings of the study were analysed at 0.05% level of significance and

- The results of the study showed that There was a significant difference in the mean temperature of preterm infants in the control group and preterm infants of the experimental group ('t' =4.17, p=0.01).

- There was a significant association between gestational age and mean temperature ('t'=3.77, p=0.001).

- There was a significant association between birth weight and mean temperature ('t'=3.77, p=0.001).

REFERENCES

1. Baumgart S. (2008). Iatrogenic hyperthermia and hypothermia in the neonate. *Clinical Perinatology,*35, 183–197.

2. Mance M. (2008). Keeping infants warm: challenges of hypothermia. *Advanced Neonatal Care,* 8, 6–12.

3. Besch N, Perlstein P, Edwards N.(1971). The transparent baby bag: A shield against heat loss. *Neonatal English Journal of Medicine,* 284, 121–124.

4. Bissinger R, Annibale D. (2010). Thermoregulation in very-lowbirth- weight infants during the golden hour: Results and implications. *Advanced Neonatal Care,*10, 230–238.

5. Costeloe K, Hennessy E, Gibson A. (2000). The EPICure study. Outcomes to discharge from hospital for infants born at the threshold of viability. Journal of *Pediatrics,* 106, 659–671.

6. World Health Organization. Thermal protection of the Newborn. (1997). A practical guide. Geneva, Switzerland.

7. Laptook A, SalhabW, Bhaskar B.(2007). Admission temperature of low birth weight infants: Predictors and associated morbidities. Journal of *Pediatrics,*119, 643-649.

8. McCall EM, Alderdice F, Halliday HL. (2010). Interventions to prevent hypothermia at birth in preterm and/or low birthweight infants. *Cochrane Database Syst Rev.* 2010 Art. No.: CD004210.

9. Miller S, Lee H, Gould. (2011). Hypothermia in very low birth weight infants: distribution, risk factors and outcomes. *Journal of perinatology*,31, 49-56.

10. Buetow KC, Kelein SW. (1964).Effects of maintenenance of "normal" skin temperature on survival of infants of low birth weight. Journal of Pediatrics, 33, 163–169.

11. Costeloe K, Hennessy E, Gibson AT, Marlow N, Wilkinson AR. (2000).The EPICure study: outcomes to discharge from hospital for infants born at the threshold of viability. Journal of Pediatrics,106, 659–671.

12. Costeloe KL, Hennessy EM, Haider S, Stacey F, Marlow N, Draper ES. (2012). Short term outcomes after extreme preterm birth in England: Comparison of two birth cohorts in 1995 and 2006 (the EPICure studies). BMJ, 345, 76-79.

13. da Mota Silveira SM, Gonçalves de Mello MJ, de Arruda Vidal S, de Frias PG, Cattaneo A. (2003). Hypothermia on admission: A risk factor for death in newborns referred to the Pernambuco Institute of Mother and Child Health. Journal of Tropical Pediatrics, 49, 115–120.

14. Daga AS, Daga SR, Patole SK. (1991). Determinants of death among admissions to intensive care unit for newborns. Journal of Tropical Pediatrics,37, 53–56.

15. de Almeida MF, Guinsburg R, Sancho GA, Rosa IR, etal. (2013). Brazilian Network on Neonatal Research. Hypothermia and early neonatal mortality in preterm infants. Journal of Pediatrics,164, 271–275.

16. Garcia-Munoz Rodrigo F, Rivero Rodriguez S, Siles Quesada C. (2013). Hypothermia risk factors in the very low weight newborn and associated morbidity and mortality in a neonatal care unit. A journal of Pediatrics,80, 144–150.

17. Harms K, Osmers R, Kron M, Schill M, Kuhn W, Speer CP, Schroter W. (1994) Mortality of premature infants 1980-1990: Analysis of data from the Gottingen perinatal center. Journal of Perinatology,198, 126–133.

18. Hazan J, Maag U, Chessex P. (1991). Association between hypothermia and mortality rate of premature infants–revisited. American Journal of Obstetrics and Gynecology, 164, 111–112.

19. Jones P, Alberti C, Jule L, Chabernaud JL, Lode N, Sieurin A, Dauger S. (2011). Mortality in out of hospital premature births. Jouranl of Acta Paediatrics, 100, 181–187.

20. Kalimba E, Ballot D. (2013). Survival of extremely low-birth-weight infants. South African Journal of Child Health, 7, 13–16.

21. Kambarami R, Chidede O. (2003). Neonatal hypothermia levels and risk factors for mortality in a tropical country. Cent African Journal of Medicine, 49, 103–106.

22. Kent AL, Williams J. (2008). Increasing ambient operating theatre temperature and wrapping in polyethylene improves admission temperature in premature infants. Journal of Paediatric Health, 44, 325–331.

23. Lee HC, Ho QT, Rhine WD. (2008). A quality improvement project to improve admission temperatures in very low birth weight infants. Journal of Perinatology, 28, 754–758.

24. Wong D L, Hockenberry M J. (2003).Wong'sNursing care of infants and children. (7th edition). Mosby.

25. Manani M, Jegatheesan P, DeSandre G, Song D, Showalter L, Govindaswami B. (2013). Elimination of admission hypothermia in preterm very low-birth-weight infants by standardization of delivery room management. Journal of Perinatology, 17, 8–13.

26. DeMauro SB, Douglas E, Karp K, Schmidt B, Patel J, Kronberger A, Scarboro R, Posencheg M. (2013). Improving delivery room management for very preterm infants. Journal of Pediatrics,132, 1018–1025.

27. De Almeida MF, Guinsburg R, Sancho GA, Rosa IR, Lamy ZC, Martinez FE, da Silva. (2014). Hypothermia and early neonatal mortality in preterm infants. Journal of Pediatrics. 164 (2), 271-275.

28. American Academy of Pediatrics and American Heart Association. (2011). Textbook of Neonatal Resuscitation. (6th ed.). Elk Grove Village.

29. Blencowe H, Cousens S, Oestergaard M, Chou D, Moller AB, Narwal R, Adler A, Garcia CV, Rohde S, Say L, Lawn JE. (2012). National, regional and worldwide estimates of preterm birth. The Lancet, 9, 379(9832), 2162-2172.

30. Chellani Harish. (2007). Prematurity-An unmet challenge. Journal of Neonatology, 21(2), 1977-2179.

31. Melinda K. Loughead, Jeffrey L. Loughead, Mary Jane Reinhart. (1997). Incidence and physiologic characteristics of hypothermia in the very low birth weight infant; Journal of pediatric nursing, 25(12), 763-769.

32. American Academy of Pediatrics and American Heart Association. (2008). Textbook of Neonatal Resuscitation. (3rd ed.). Elk Grove Village.