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Effect of Ambient Temperature and Humidity on Neonatal Body Temperature in Post Natal Wards

Sakshi Ojha[1], Yogendra Singh Verma[2*]
[1]PG student, Department of Pediatrics, Gajra Raja Medical College Gwalior, Madhya Pradesh, India
[2]Assistant Professor Department of Pediatrics, Gajra Raja Medical College Gwalior, Madhya Pradesh, India

Original Research Article

***Corresponding author**
Yogendra Singh Verma

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Abstract: The primary objective was to study the effect of ambient temperature and season changes on neonatal body temperature in post natal wards and to compare thermal stress prevalence in post natal wards of two different health centers. It is a hospital based analytical study carried out in Post natal ward of Medical College Hospital (health centre 1) and post natal ward of Prasuti wing under department of health (health centre 2) in central part of India. A total of 960 neonates on mother side in postnatal wards (480 in each health center) upto first seven days of life (168 hours) were studied for a duration of one year. Ambient temperature of postnatal wards and body temperature of neonates were simultaneously recorded twice a day (morning and afternoon), every week, alternatively in each institution, throughout the year. Also weather parameters of the day at different times, for the city were also recorded. More than one third (37%) of the neonates were hypothermic, out of which incidence of moderate hypothermia ranges from 7.7 to 18.8 %. Hypothermia was more in the colder months of December – February (61.2%), but a striking second peak of hypothermia was seen in the months of July and August (43.1%). Incidence of hypothermia increases when temperature of city [P<0.001] and of the postnatal wards falls $<25^0$C [P = 0.001 to 0.004]. A significant correlation of hypothermia and high humidity of the city was seen with rise in number of cases whenever the humidity shoots above 60%.[P<0.001]. Incidence of hypothermia found in health center- 2 (44.4%) was significantly higher than in health center- 1 (30.8%) [P<0.001] whereas incidence of hyperthermia was nearly same in both the institutions (9.4 – 9.6%) and was found more in the months of April – June.

Keywords: Neonatal Hypothermia, Hyperthermia, Ambient temperature, postnatal ward.

INTRODUCTION

The newborn infant is homeothermic but control of body temperature can only be achieved over a narrow range of ambient conditions. Ability to stay warm may easily be overwhelmed by extremes environmental temperature [1] and in our country where there are extremes of temperature, thermal stress of the baby need to be supervised.

Neonatal hypothermia is an important contributing factor to neonatal mortality and morbidity in both developed and developing countries [2]. The World Health Organization (WHO) Maternal and Child Health program has issued guidelines for prevention of neonatal hypothermia as one of the elements of essential care in newborn at birth and in the 1st day of life [3].

On the other side, newborns loose extracellular fluids in 1st few days of life. This may lead to high body temperature, probably because of inability to loose heat in the form of evaporation, i.e. due to dehydration, commonly referred as "dehydration fever". This is more common in summers and hyperthermia is likely to happen if environmental temperature is not taken care of [4], Hyperthermia, in infants, is usually caused by inappropriate environmental situation [5].

Babies presenting with hypothermia and hyperthermia are only the tip of the iceberg. Many neonates suffer from mild hypothermia and hyperthermia without being noticed. Newborn temperature is especially taken care of in intensive care units, but the status in mother side babies in postnatal wards is not reported correctly. Many of them have unnoticed thermal stress which may predispose them to septicemia, hypoglycemia, poor weight gain etc. leading to an overall increase in the burden of critical care units.

Neonatal health promotion programmes need to focus on behavioural changes necessary to optimize

thermal care in post natal wards especially of low resource settings. Keeping these facts in mind this study is being conducted.

METHODS

The present study was conducted in two different government health centers of one of the city of Central India**:** Post natal ward, of Medical College Hospital (health centre 1) and post natal ward of, prasutiwing, under department of health (health centre 2) between August 2014 to July 2015. Ethical approval for this study was obtained from Institutional Ethical Committee of hospital. The study was conducted in newborns with their mothers, in first week of life, in post natal wards of the health centers. Written and informed consent was obtained from the parents or legal guardians prior to study. All neonates with their mothers' in postnatal wards upto first seven days(168 hours) were included in the study whereas neonates admitted in SNCU and beyond seven days of age were excluded.

Digital thermometers were used to take the axillary temperature of the neonates, which were timely standardized with mercury thermometers for accuracy and Standard room mercury thermometers were used to note the ambient temperature of the post natal wards. Also the weather conditions of the city, i.e, temperature and humidity were noted both in the morning and noon from the government meteorological department of city in study.

Readings were taken on a randomly selected day, every week, alternatively in the two institutions, thus 4 times in a month, throughout the year, both in the morning (at 5:30 a.m.) and in the noon (at 2:30 p.m.). Each time 10 neonates were enrolled by random selection method in the post natal ward. Thus making 20 each day and 80 each month with an enrollment of total 960 neonates for the whole year (480 in each health center). Conclusions were drawn statistically to correlate the outcome.

RESULTS

Incidence of hypothermia in health centre 1and health centre 2 was 30.8% and 44.40% respectively with a P <0.001, showing significantly more hypothermia in health centre 2.

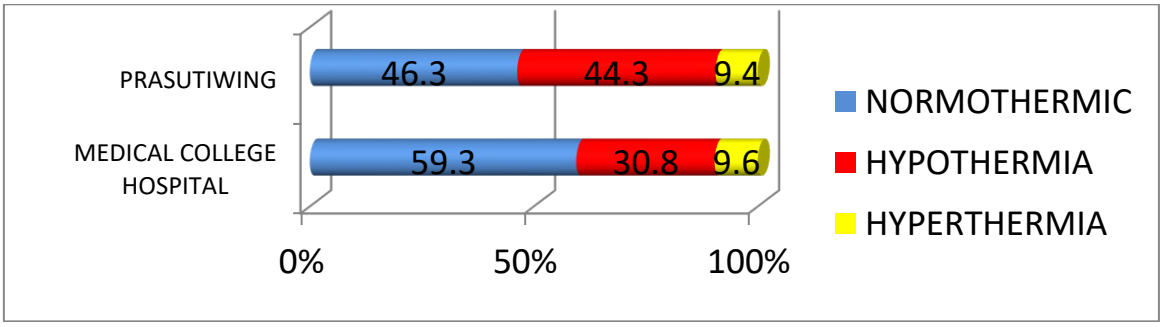

Fig-1: Incidence of Thermal Stress in the Two Health Centres
p<0.001 - significantly more hypothermia in Prasutiwing

Incidence of hypothermia increases as the temperature of postnatal ward falls below 25^0C with hypothermia found in 47.5% neonates in health centre 1 and 75.3% in health centre 2, when ambient temperature was below 25^0C. Hypothermia was found more when the temperature of the city dropped to $<25^0$C (P <0.001) and humidity rises to >60% (P <0.001).

Table-1: Temperature Status of Neonates throughout the Year

INSTITUTE	NORMAL	COLD STRESS	MODERATE HYPOTHERMIA	SEVERE HYPOTHERMIA	HYPER THERMIA	TOTAL
MEDICAL COLLEGE HOSPITAL	286	111	37	0	46	480
	59.6%	23.1%	7.7%	0.0%	9.6%	100.0%
PRASUTIWING	222	122	89	2	45	480
	46.3%	25.4%	18.5%	0.4%	9.4%	100.0%
TOTAL	508	233	126	2	91	960
	52.9%	24.3%	13.1%	0.2%	9.5%	100.0%
P value	**<0.001**	**0.41**	**<0.001**	**0.15**	**0.91**	

65% of the newborns were found to be hypothermic when combinedly lower temperatures $<25^0$C and higher humidity >60% was seen (Odds ratio=4.8).

Table-2: Effect of Weather Parameters on Hypothermia

MEAN TEMPERATURE OF CITY	NORMAL No.	%	HYPOTHERMIA No.	%	HYPERTHERMIA No.	%	TOTAL No.	%
<25^{0}C	157	41.3	202	53.2	21	5.5	380	100
>=25^{0}C	351	60.5	159	27.4	70	12.1	580	100
Total	508	52.9	361	37.6	91	9.5	960	100
P value			**<0.001**		0.132			
HUMIDITY OF CITY	**NORMAL No.**	**%**	**HYPOTHERMIA No.**	**%**	**HYPERTHERMIA No.**	**%**	**TOTAL No.**	**%**
<=60%	277	64.6	93	21.7	59	13.8	429	100
>60%	231	43.5	268	50.5	32	6.0	531	100
Total	508	52.9	361	37.6	91	9.5	960	100
P value			**<0.001**					

Moderate hypothermia was more common in the months of December, January and February (26.3% - 45.0%)[P ranging from <0.001 – 0.004] with two peaks of incidence for cold stress(mild hypothermia) , i.e., in the months of February- March (32.5%) and July- August (36.3% -38.8%).

Table-3: Monthly Variations in Thermal Stress

Month	NORMAL	COLD STRESS	MODERATE HYPOTHERMIA	SEVERE HYPOTHERMIA	HYPERTHERMIA	TOTAL
Jan	26	16	36	1	1	80
	32.5%	20.0%	45.0%	1.3%	1.3%	100.0%
Feb	28	26	24	0	2	80
	35.0%	32.5%	30.0%	0.0%	2.5%	100.0%
March	34	26	16	0	4	80
	42.5%	32.5%	20.0%	0.0%	5.0%	100.0%
April	48	14	3	0	15	80
	60.0%	17.5%	3.8%	0.0%	18.8%	100.0%
May	60	4	0	0	16	80
	75.0%	5.0%	0.0%	0.0%	20.0%	100.0%
June	56	9	0	0	15	80
	70.0%	11.3%	0.0%	0.0%	18.8%	100.0%
July	44	29	3	0	4	80
	55.0%	36.3%	3.8%	0.0%	5.0%	100.0%
AUG	33	31	6	0	10	80
	41.3%	38.8%	7.5%	0.0%	12.5%	100.0%
Sep	54	18	3	0	5	80
	67.5%	22.5%	3.8%	0.0%	6.3%	100.0%
Oct	43	19	7	0	11	80
	53.8%	23.8%	8.8%	0.0%	13.8%	100.0%
Nov	47	19	7	0	7	80
	58.8%	23.8%	8.8%	0.0%	8.8%	100.0%
Dec	35	22	21	1	1	80
	43.8%	27.5%	26.3%	1.3%	1.3%	100.0%

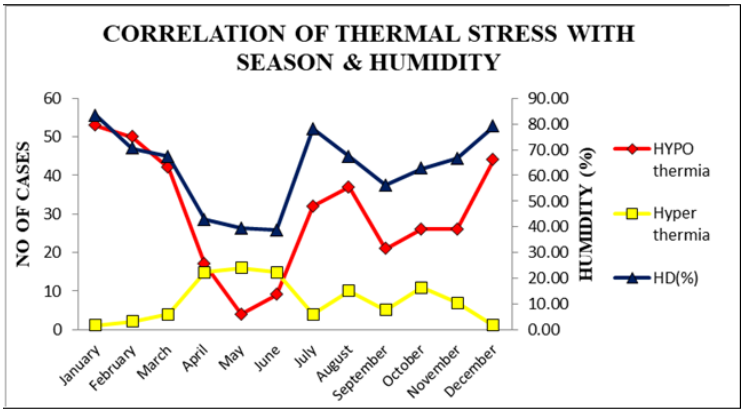

Fig-2: Correlation of Thermal Stress with Season Changes and Humidity

Incidence of hyperthermia was 9.6% and 9.4% in health centre 1 and health centre 2 respectively with a P= 0.91. Hyperthermia was found more in the months of April, May and June (18.8% - 20%) [P ranging from <0.001 – 0.0074].

DISCUSSION

Incidence of hypothermia reported in the present study is very high which ranges from 30.8 % - 44.4% [FIGURE 1] in the post natal wards of the study hospitals which is similar to the incidence (37%) found in a hospital based study done by Suman RP *et al.* in Mumbai [6]. Incidence of moderate hypothermia ranges from 7.7%-18.8% in the present study (TABLE 1) which is higher than those reported by Kaushik *et al.* in 1999 in Shimla (2.9%) [7]. This could be because of lesser sensitivity to ambient temperature variability in this part of the country. A more recent population based study done by Darmstadt *et al.* in Uttar Pradesh, reported hypothermia in 45% of the infants which is higher than the incidence found in this study, which could be the effect of institutional care of the neonates in this study [8].

Number of hypothermic neonates are more in the colder months from December – February (61.2%) with a second peak of incidence found in the months of July and August (43.1%)[FIGURE 2,TABLE 3]. Data's collected from a population based cohort study done by Kumar R *et al.* in villages of Haryana reported incidence of hypothermia in winters to be 19.3% [9], which is lower than the present study. On the other hand, study done in Uttar Pradesh by Darmstadt *et al.* [8] found 70% of the infants to be hypothermic in the coldest quarter of the year.

Incidence of hypothermia in the warmest quarter (from April –June) was 12.5% which reflects the protective effect of higher ambient temperature and is less as reported in other study done by Darmstadt *et al.* to be 32.1% [8]. (TABLE 3)

Incidence of hypothermia was significantly more whenever the temperature of the city as well as the postnatal wards dropped below 25^0C in both the institutes. This value is lesser than the recommended postnatal ward temperature. (TABLE 2)

The present study shows a second peak of incidence of hypothermia in the months of July and August (43.1%) in contrast to other studies. This could be the effect of higher humidity in July and August which causes increased perception of warmth by caretakers leading to their decreased sensitivity to protection of neonates from cold temperatures during these months.(FIGURE 2).This is in contrast to the common belief that newborns require higher humidity to reduce the evaporative losses and maintain normal temperature, which is true only for critical care units where incubators and radiant warmers are used.

The study found significant difference in incidence of hypothermia in the two study health centers with a P <0.001.This may be attributable to the low resource availability at health centre 2 and in comparison to 1. [FIGURE 1].

Overall incidence of hyperthermia in this study ranges from 9.4% - 9.6% and cases were found throughout the year, with no significant difference seen in both institutes which can be attributable to the presence of sepsis. (FIGURE 1).

During the warmest quarter, i.e, in the months of April – June, incidence of hyperthermia was 19.16% which is lower as reported from a study done by Kumar R *et al.* in north India where the incidence was 36.8% [9]. Another study done in 2010, during the heat wave in Ahmedabad, in which out of total admissions in NICU, with hyperthermia as a complaint, 83.3% were from post natal ward itself [10]. The low incidence of hyperthermia in this study may probably be due to better maintenance of ambient temperature due to lower floor location and better air conditioning in the study hospitals, during summer months.

CONCLUSION

Incidence of neonatal thermal stress is very high in postnatal wards. Ambient temperature has a

direct correlation with incidence of hypothermia.It rises with fall in environmental temperature and increase in humidity.

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REFERENCES

1. Budin PC. La Mortalité infantile dans les Bouches-du-Rhône. C. Hérissey; 1908.
2. Kumar V, Shearer JC, Kumar A, Darmstadt GL. Neonatal hypothermia in low resource settings: a review. Journal of Perinatology. 2009 Jun;29(6):401.
3. World Health Organization. Department of Reproductive Health and Research.(1997). Care in normal birth: A practical guide. Geneva, Switzerland: Author.
4. Bissinger RL, Annibale DJ. Thermoregulation in very low-birth-weight infants during the golden hour: results and implications. Advances in Neonatal Care. 2010 Oct 1;10(5):230-8.
5. Fellows, P. Management of thermal stability. In G. Boxwell. (2ndEd) Neonatal Intensive Care Nurisng (pp.87-120). London, Routledge; 2011.
6. Suman Rao PN, Udani R, Nanavati R. Kangaroo mother care for low birth weight infants: a randomized controlled trial. Indian pediatrics. 2008;45(1):17.
7. Kaushik S, Grover N, Parmer VR, Grover PS, Kaushik R. Neonatal morbidity in a hospital at Shimla. The Indian Journal of Pediatrics. 1999 Jan 1;66(1):15-9.
8. Darmstadt GL, Kumar V, Yadav R, Singh V, Singh P, Mohanty S, Baqui AH, Bharti N, Gupta S, Misra RP, Awasthi S. Introduction of community-based skin-to-skin care in rural Uttar Pradesh, India. Journal of Perinatology. 2006 Oct;26(10):597.
9. Kumar R, Aggarwal AK. Body temperatures of home delivered newborns in north India. Tropical doctor. 1998 Jul;28(3):134-6.
10. Express News Service, Ahmedabad.com. Heatwave kills 29 in 3 days in Ahmedabad. 24 May 2010 http://www.expressindia.com/latestnews/heatwave-kills-29-in-3-days-inahmedabad/622821.