

Neonatal Hypothermia in Uganda: Prevalence and Risk Factors

by Romano Byaruhanga,^{a,b} Anna Bergstrom,^b and Pius Okong^{a,b}

^aDepartment of Obstetrics and Gynaecology, St. Francis Hospital, Nsambya, Uganda

^bDivision of International Health (IHCAR), Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden

Summary

The aim of the study was to determine the prevalence of neonatal hypothermia and associated risk factors. A cross sectional, descriptive study of neonatal hypothermia was performed on 300 newborns consecutively recruited day and night during 2 months at a Ugandan periurban hospital. Parallel tympanic and rectal temperature measurements were made at 10, 30, 60, and 90 min *post partum*. Rectal temperatures taken at 10, 30, 60, and 90 min showed that 29, 82, 83, and 79 per cent of the newborns, respectively, were hypothermic. Newborns observed to have no body contact with the mother comprised 87 per cent of hypothermic newborns, whereas this was the case in 75 per cent of non-hypothermic newborns ($p=0.03$). The mean birthweight was 3218 g. Low birthweight newborns constituted 9/86 (10 per cent) among hypothermic newborns, whereas this was the case in 9/209 (4 per cent) among non-hypothermic newborns at 10 min ($p=0.08$). Adolescent mothers were encountered more often among mothers with neonatal hypothermia of the newborn than among non-hypothermic newborns ($p=0.025$). Parity, preterm delivery, daytime or night time delivery, rupture of membranes >24 h and location of newborns in theatre, labour ward, or nursery did not differ when hypothermic and non-hypothermic newborns were compared. A persistent pattern of high prevalence of neonatal hypothermia was confirmed and indicates that more vigorous efforts have to be undertaken, also in a tropical setting, to overcome problems of non-adherence to appropriate methods for thermo-protection of the newborn.

Introduction

Thermal protection of the newborn has turned out to be a significant perinatal problem contributing to increased morbidity and mortality.¹ Simple, appropriate intervention by skin-to-skin contact or kangaroo-mother care can prevent neonatal hypothermia² but has been difficult to introduce for various cultural reasons in countries where HIV infection is prevalent.³ Current hospital routines in high-income countries generally comprise skin-to-skin care, although this is a rather recent development introduced in such countries only in the 1970s.⁴ The problem of neonatal hypothermia has

for several decades been recognized to occur also in the tropics.⁵ However, neonatal care routines do not adhere to simple methods for thermal protection^{2,3} even if appropriate didactic material is widely accessible.⁶

Lack of knowledge amongst health workers and mothers of simple methods to maintain the warm chain from birth has been found to be the most common factor contributing to hypothermia.^{7,8} Appropriate policies, comprising simple practices such as establishing a warm delivery room, immediate drying at birth, skin-to-skin contact, early breastfeeding, delay in bathing the newborn, appropriate clothing, warm resuscitation, warm transportation, and training/awareness, are essential to prevent hypothermia.⁶

It is commonplace in tropical countries to disregard the concept of thermal protection of the newborn due to an assumed sufficiently warm climate. In addition, there is an empirical resistance among many health staff to support actively skin-to-skin care due to beliefs that this may enhance HIV transmission from mother to newborn or that may it be undesirable due to lack of hygiene in the

Acknowledgements

Special thanks are extended to all the doctors, midwives, and nurses in the departments of Obstetric/Gynaecology and Pediatrics for their participation in this study.

Correspondence: Romano Byaruhanga, Department of Obstetrics and Gynaecology, St. Francis Hospital, Nsambya, P.O. Box 7146, Kampala, Uganda.
E-mail <byaru-rn@africaonline.co.ug>.

delivery room. We opted to elucidate the prevalence of neonatal hypothermia and associated, potential risk factors in order to determine the magnitude of the problem and to find ways to introduce appropriate technology to achieve thermal protection of the newborn.

Materials and Methods

St Francis Hospital Nsambya, with an annual number of 5000–6000 deliveries, is a tertiary referral hospital located in Kampala in a periurban area. Frequent audits in the hospital have been initiated in different fields to assess and improve the type of medical service given.

During a period of 2 months a consecutive number of 300 neonates were recruited for assessment of body temperature at regular intervals *post partum*. Pregnant women presenting in labour at the hospital were interviewed and informed consent was obtained prior to participating in the trial. Each delivery was monitored and managed according to the normal protocol in the hospital. After each birth, the newborns were assessed and the body temperature was measured in two ways: firstly, by using an infrared tympanic thermometer inserted in the left ear; and, secondly, a digital polythene-sealed rectal thermometer as previously described.³

Measurements were performed at 10, 30, 60, and 90 min *post partum* and a data sheet was filled in. Hypothermia was defined as a body temperature of less than 36.5°C. Temperatures between 36.0 and 36.4°C were defined as mild hypothermia, while those between 32.0 and 35.9°C as moderate hypothermia, and below 32.0°C as severe hypothermia.⁵

The study was approved by the research ethics committee at Karolinska Institutet in Stockholm and by the Nsambya Hospital ethical research committee.

The data was entered and analysed using the Epi-Info version 6.04 for epidemiology and disease surveillance.

Results

The mean maternal age was 24.5 years and the mean gestational age 38.5 weeks. Adolescent women comprised 18.3 per cent of all parturient women, of whom 3.7 per cent were primigravida. Ninety-five per cent of subjects were booked (Table 1). There were no early neonatal deaths. The caesarean section rate was 22.2 per cent and the vacuum extraction rate 3.2 per cent.

The mean birthweight was 3218 g with 6.4 per cent having a weight lower than 2500 g. Rectal temperatures taken at 10, 30, 60, and 90 min showed that 29, 82, 83, and 79 per cent, respectively, were hypothermic.

TABLE 1
Characteristics of parturient women and their newborns (n = 300) assessed for prevalence of neonatal hypothermia

Characteristics	n = 300
Mean maternal age, years (SD)	24.5 (5.4)
Maternal age distribution (%)	
<19 years	18.3
20–34 years	76.6
>34 years	5.1
Maternal parity distribution (%)	
0	3.7
1–4	87.2
≥5	9.1
Mode of current delivery (%)	
Spontaneous vaginal delivery	73.8
Vacuum extraction	3.0
Forceps delivery	0.3
Caesarean delivery	22.2
Vaginal breech delivery	0.7
Mean birthweight, g (SD)	3218 (496)
Birthweight distribution (%)	
NBW ≥ 2500 g	93.6
LBW < 2499 g	6.4
Newborn sex distribution (%)	
Male	55.3
Female	44.7
Apgar score <7 at 5 min (%)	2.2

Risk factors for neonatal hypothermia differed somewhat depending on the interval from birth to temperature measurement. At 10 min, the prevalence to hypothermia was comparatively low (86/300, 29 per cent). Newborns observed to have no body contact with their mother comprised 87 per cent of hypothermic newborns, whereas this was the case in 75 per cent of non-hypothermic newborns ($p=0.03$). Low birthweight newborns constituted 9/86 (10 per cent) among hypothermic newborns, whereas this was the case in 9/209 (4 per cent) among non-hypothermic newborns ($p=0.08$). Adolescent mothers were encountered more often among mothers with neonatal hypothermia of the newborn 10 min *post partum* than among non-hypothermic newborns ($p=0.025$). Parity, preterm delivery, daytime or night time delivery, rupture of membranes >24 h, and location of newborns in theatre, labour ward or nursery did not differ when hypothermic and non-hypothermic newborns were compared.

At 30 min, the pattern had changed somewhat and newborns without body contact with their mothers constituted 154/245 (63 per cent), whereas this was the case in 26/53 (49 per cent) of non-hypothermic newborns ($p=0.08$). None of the other potential risk factors alluded to at 10 min differed significantly between hypothermic and non-hypothermic newborns at 30 min.

TABLE 2
 Characteristics of newborns found hypothermic at different intervals post partum

	10 min (n = 86)	30 min (n = 245)	60 min (n = 249)	90 min (n = 238)
Location of newborns (%)				
General labour ward	75.9	75.0	66.0	59.8
Private labour ward	5.7	9.8	8.9	9.2
Theatre	18.4	4.2	0.4	0
Special care unit	0	9.8	17.8	21.8
Postnatal ward	0	1.2	6.9	9.2
Body contact with mother (%)	13.8	36.1	54.6	71.3

At 60 min, the difference between hypothermic and non-hypothermic newborns had disappeared completely and we did not find any of the previously mentioned factors over-represented among hypothermic newborns.

At 90 min, the adolescent mothers were slightly over-represented ($p=0.02$) among mothers to hypothermic newborns (51/235, 22 per cent) versus non-hypothermic newborns (3/49, 6 per cent). No other potential risk factors alluded to above showed any significant difference among hypothermic and non-hypothermic newborns at 90 min *post partum*.

The location of hypothermic newborns and the type of body contact with the mother could only partly explain the high prevalence of hypothermia at 30–90 min (Table 2). In spite of an increasing trend of maternal body contact, reaching 71.3 per cent at 90 min, there was no significant decline of hypothermia over the study period (10–90 min). This indicates that other factors, such as proper, sustained skin-to-skin care, was not adhered to, despite existing nursing care rules of thermo-protection of the newborn and despite attempts to recommend mothers to keep their newborns skin-to-skin.

Discussion

The principal finding of this study was that neonatal hypothermia occurred in eight of 10 newborns carefully monitored with tympanic and rectal thermometry *post partum*. Although the hospital is located in a tropical area, with room temperatures ranging between 20 and 27°C, neonatal hypothermia occurred frequently, as in other studies undertaken in tropical countries.^{5,7–19} Such loss of thermal control is potentially detrimental to the health of the newborn causing both morbidity and mortality with increased risk of infection and impaired growth being particularly harmful to low birthweight newborns.^{20–25}

The high prevalence of hypothermia witnessed in this setting might be attributed to a lack of awareness

and sensitization among the staff, lack of proper maintenance of the warm chain, and work overload with an average ratio of trained midwife to patient of 1:3 during daytime and even higher at night. We found that the observed separation of the newborn from the mother had a negative impact on thermoregulation of the newborn, but we could not confirm operationally relevant risk factors to act upon beyond those already recognized in the literature.

The 'gold standard' of neonatal body temperature cannot be easily settled.^{26–28} The usefulness of the tympanic approach is obvious in a busy, overburdened labour ward like the one under study here.³ Whether or not rectal temperature is more valid than tympanic temperature is unclear. The fact that tympanic temperature measurements occur close to the thermoregulatory centres of the brain²⁶ makes it at least as interesting as a rectal thermometry for the judgement of the body temperature of the newborn. It is also of potential value for monitoring purposes in settings with high prevalence of hepatitis B and HIV infection,³ although availability of the equipment still might constitute a problem in low-resource settings.

The study acted as an audit on the perinatal preventive services given within the unit and demonstrated the urgent need of more information, education, and communication to providers of neonatal care and to mothers regarding simple measures for thermal protection of the newborn. There is also a need for follow-up interventions in the community to determine the magnitude of the problem among newborns delivered at domestic births.

References

1. Christensson K, Bhat GJ, Eriksson B, Shilalukey Ngoma MS, Sterky G. The effect of routine care on health of hypothermic newborn infants. *J Trop Pediatr* 1995; 41: 210–14.
2. Christensson K, Bhat GJ, Amadi BC, Eriksson B, Höjer B. Randomised study of skin-to-skin versus incubator care for rewarming low-risk hypothermic neonates. *Lancet* 1998; 352: 1115.

3. Bergström A, Byaruhanga R, Okong P. Tympanic and rectal thermometry in the diagnosis of neonatal hypothermia in Uganda. *J Neonat Nurs* 2004; 10(3): 76–9.
4. Bystrova K, Widström AM, Matthisen AS, *et al.* Skin-to-skin contact may reduce negative consequences of ‘the stress of being born’: a study on temperature in newborn infants, subjected to different ward routines in St. Petersburg. *Acta Paediatr* 2003; 92: 320–26.
5. Morley D. Cold injury among children severely ill in the tropics. *Lancet* 1960; 279: 1170–71.
6. World Health Organization. Thermal Protection of the Newborn: A Practical Guide. Maternal and Newborn health/Safe motherhood unit. WHO/RHT/MSM/97.2, 1997.
7. Chintu C, Sukhani S. Perinatal and neonatal mortality and morbidity in Lusaka. *Med J Zambia* 1978; 12: 110–15.
8. Christensson K, Ransjö-Arvidson AB, Kakoma C. Midwifery care routines and prevention of heat loss in the newborn: A study in Zambia. *J Trop Pediatr* 1988; 34: 208–12.
9. Tafari N, Olsson EE. Neonatal injury in the tropics. *BMJ* 1973; 11: 57–65.
10. da Mota Silveira SM, Goncalves de Mello MJ, de Arruda VS, de Frias PG, Cattaneo A. Hypothermia on admission: a risk factor for death in newborns referred to the Pernambuco Institute of Mother and Child Health. *J Trop Pediatr* 2003; 49: 115–20.
11. Manji KP, Kisenge R. Neonatal hypothermia on admission to a special care unit in Dar-es-Salaam, Tanzania: a cause for concern. *Cent Afr J Med* 2003; 49: 23–7.
12. Choudhary SP, Bajaj RK, Gupta RK. Knowledge, attitude and practices about neonatal hypothermia among medical and paramedical staff. *Indian J Pediatr* 2000; 67: 491–96.
13. Johanson RB, Malla DS, Tuladhar C, Amatya M, Spencer SA, Rolfe P. A survey of technology and temperature control on a neonatal unit in Kathmandu, Nepal. *J Trop Pediatr* 1993; 39: 4–10.
14. Johanson RB, Spencer SA, Rolfe P, Jones P, Malla DS. Effect of post-delivery care on neonatal body temperature. *Acta Paediatr* 1992; 81: 859–63.
15. Kumar R, Aggarwal AK. Body temperatures of home delivered newborns in north India. *Trop Doct* 1998; 28: 134–36.
16. Cattaneo A, Davanzo R, Worku B, *et al.* Kangaroo mother care for low birth weight infants: a randomised controlled trial in different settings. *Acta Paediatr* 1998; 87: 976–85.
17. Dragovich D, Tamburlini G, Alisjahbana A, *et al.* Thermal control of the newborn: knowledge and practice of health professionals in seven countries. *Acta Paediatr* 1997; 86: 645–50.
18. Ellis M, Manandhar N, Shakya U, Manandhar DS, Fawdry A, Costello AM. Postnatal hypothermia and cold stress among newborn infants in Nepal monitored by continuous ambulatory recording. *Arch Dis Child Fetal Neonatal Ed* 1996; 75: F42–5.
19. Mir NA, Faquih AM, Legnain M. Perinatal risk factors in birth asphyxia: relationship of obstetric and neonatal complications to neonatal mortality in 16,365 consecutive livebirths. *Asia Oceania J Obstet Gynaecol* 1989; 15: 351–57.
20. Dawodu AH, Effiong CE. Neonatal mortality: effects of selective pediatric interventions. *Pediatrics* 1985; 75: 51–7.
21. Schulman H, Laufer L, Berginer J, *et al.* CT Findings in neonatal hypothermia. *Pediatr Radiol* 1998; 28: 414–17.
22. Kaushik S, Grover N, Parmer VR, Grover PS, Kushik R. Neonatal morbidity in a hospital at Shimla. *Indian J Pediatr* 1999; 66: 15–9.
23. Cheah FC, Boo NY. Risk factors associated with neonatal hypothermia during cleaning of newborn infants in labour rooms. *J Trop Pediatr* 2000; 46: 46–50.
24. Loughhead MK, Loughhead JL, Reinhart MJ. Incidence and physiologic characteristics of hypothermia in the very low birth weight infant. *Pediatr Nurs* 1997; 23: 11–5.
25. Rutter N. Temperature control and its disorders. In: Robertson N (ed.), *Textbook of Neonatology*, 2nd edn. Churchill Livingstone, Edinburgh, 1992.
26. Robertson N. *A manual of neonatal intensive care*. Edward Arnold Ltd, London, 1996.
27. Shinozaki T, Diane R, Perkins F. Infra-red tympanic thermometer: evaluation of a new clinical thermometer. *Crit Care Med* 1988; 16: 148–50.
28. Edge G, Morgan M. The ingenious infra-red tympanic thermometer. *Anaesthesia* 1993; 48: 604–07.