PostScript

LETTERS

Changes in body temperature after birth in preterm infants stabilised in polythene bags

Low admission temperature is an independent risk factor for morbidity and mortality in preterm infants.[1] Thermal stability is enhanced by use of polythene bags during stabilisation,[2] but it has been suggested that this may induce potentially harmful hyperthermia.[3] We have measured the changes in body temperature during the first 15 minutes after birth in infants stabilised in polythene bags.

For an eight month period, infants born at <29 weeks gestation in the Simpson Centre for Reproductive Health, Edinburgh were studied prospectively. They were laid on a temperature probe within a polythene bag immediately after birth and stabilised under a radiant heater set to maximum. Interscapular temperature was recorded every minute for the first 15 minutes of life.

Transcutaneous temperature taken at a thermally insulated site (in this instance the baby's back, insulated by a non-conducting mattress) represents core body temperature once the insulated skin warms to body temperature.[4 5] Our observations suggested that this equilibration took around seven minutes (fig 1). We took the temperature at seven minutes as representative of the baseline and attributed all changes in temperature that occurred after seven minutes to the postnatal thermal care. Fetal temperature is higher than maternal temperature.[6] We defined the upper limit of normal temperature at birth as 37.5℃. Hypothermia was defined as <36℃.

Twenty seven infants (14 boys and 13 girls) were studied. Mean (range) birth weight and gestation were 916 g (490–1470) and 26+4 weeks (24−28+5). Mean (range) temperature at 15 minutes was 37.3℃ (36.3–38.1). No infant became hypothermic. Sixteen infants had temperatures that never exceeded 37.5℃. Three infants with normal baseline temperature were warmed to temperatures above 37.5℃ during stabilisation. The increases in temperature were 0.2℃, 0.6℃, and 0.6℃ with the maximum temperature reached being 38.1℃. Eight (30%) infants had baseline temperatures above 37.5℃: of these, five gradually cooled towards 37℃ during stabilisation and the remaining three warmed by 0.2℃, 0.3℃, and 0.4℃ with a maximum temperature of 38℃. Figure 2 categorises temperature progression of the infants during the 15 minute study period.

These data confirm that early neonatal hypothermia can be eliminated by the use of polythene bags during initial stabilisation of small preterm infants. A significant proportion (30%) of infants are probably hyperthermic at birth. Iatrogenic temperature increases occurred in a minority of the infants in this study and were small. The significance of transient small temperature increases is uncertain.

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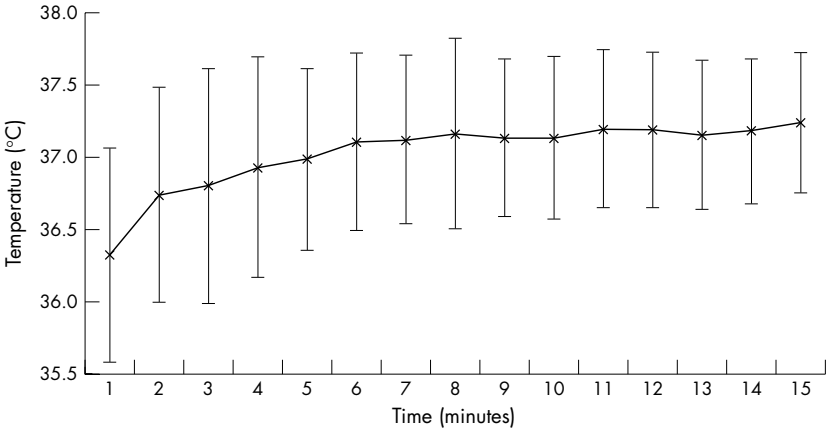

Figure 1 Interscapular temperature during stabilisation. Values are mean (SD).

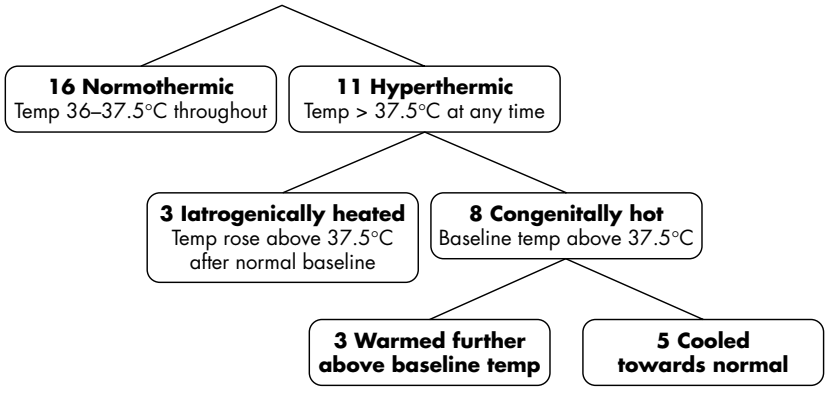

Figure 2 Flow chart categorising temperature progression from baseline to 15 minutes of age.

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Inadvertent overdosing of neonates as a result of the dead space of the syringe hub and needle

Chappell and Newman[1] have asked for urgent initiatives to ensure the manufacture of neonatal targeted products to reduce the risks associated with intravenous drug administration. We endorse their view and report a little recognised problem with the use of adult formulations in neonatal nurseries.

This investigation was conducted after we noticed symptoms of digoxin overdose (bradyarrhythmia) in a neonate. Retrospective

Table 1 Inadvertent overdose for different drugs

Drug (concentration of drug in vial/ ampoule)	Dose (mg/kg)	Amount of drug for a neonate weighing 2 kg (mg)	Drug volume taken in a 1 ml syringe (ml)	Volume of drug in dead space (ml)	Amount of drug in dead space (mg)	Total amount of drug neonate is getting (mg)	Inadvertent overdose factor
Digoxin (1 ml = 0.25 mg)	0.025	0.005	0.02	0.07	0.0175	0.005+0.0175 = 0.0225	4.5
Digoxin (1 ml = 0.1 mg)	0.025	0.005	0.05	0.07	0.007	0.005+0.007 = 0.012	2.4
Adrenaline (1 ml = 1 mg; 1:1000)	0.03	0.06	0.06	0.07	0.07	0.06+0.07 = 0.13	2.16
Furosemide (1 ml = 10 mg)	1	2	0.2	0.07	0.7	2+0.7 = 2.7	1.35
Dexamethasone (1 ml = 4 mg)	0.1	0.2	0.05	0.07	0.28	0.2+0.28 = 0.48	2.4
Midazolam (1 ml = 5 mg)	0.1	0.2	0.04	0.07	0.35	0.2+0.35 = 0.55	2.75

Assuming the drug for a 2 kg neonate is drawn up in a 1 ml syringe and diluted by drawing up the diluent into the same syringe. Doses of drugs taken from *Pediatric drugs and nursing implications*.[2] Digoxin is available in two formulations: 250 μg/ml 100 μg/ml.

review of the case suggested that the overdose received was due to the unaccounted for drug in the dead space of a 1 ml syringe.

The nursing drug dose manual *Pediatric drugs and nursing implications*[2] gives the maintenance dose of intravenous digoxin as 2.5 μg/kg/dose. The nursing instruction[3] states that the dose must be diluted, with at least four times the volume, using normal saline or 5% dextrose, and the drug must be given over five minutes. In practice, for a 2 kg neonate who is to receive a 5 μg digoxin intravenous injection (250 μg/ml), the drug volume required is 0.02 ml. This is drawn up in a 1 ml syringe up to the 0.02 ml mark. The nursing practice in our nursery was to draw up normal saline to dilute this four times and give it intravenously, slowly over five minutes. Cognizance is not taken of the dead space in the needle hub and syringe.

We estimated this dead space by drawing up saline in the 1 ml syringe and flushing out the syringe (Syringe and Precision Glide Needle; 1 ml; 26 G; 0.5 inch; Becton-Dickinson, Singapore). The syringe piston was then withdrawn again, and the volume of saline in the dead space was drawn into the syringe barrel. This volume was noted. The dead space volume is 0.07 ml in this syringe. When the diluent is drawn up, the drug in the dead space is also drawn up resulting in toxicity. In the case of digoxin, the baby received 0.09 ml digoxin instead of 0.02 ml.

Ordinarily if the digoxin is drawn up to the 0.02 ml mark and injected directly, the drug in the dead space is retained in the syringe, and there is no overdose delivered. However, when the diluent is drawn up into the syringe for dilution, the drug in the dead space is also drawn up, and this results in the overdosing.

We looked at the magnitude of error induced by the dead space in some of the drugs routinely used in the nursery. Table 1 shows the standard volume of drug required for a 2 kg neonate and the magnitude of error introduced by the dead space of a 1 ml syringe. Its is assumed that these drugs were first drawn in a 1 ml syringe and then diluted in the same syringe. The neonate will get 4.5 times the recommended dose if 250 μg/ml digoxin is used, and 2.4 times the recommended dose if 100 μg/ml digoxin is used. The inadvertent extra dosing factors using a 1 ml syringe for different drugs used in the neonatal unit have been calculated. The dose of adrenaline can be exceeded by a factor of 2.16, for furosemide by 1.35, for dexamethasone by 2.4, and for midazolam by a factor of 2.75.

To avoid this inadvertent overdosing of neonates, prediluted drug formulations are required. Until such drug formulations are more widely available, especially in developing countries, awareness of this error can help circumvent the problem.

A method that can be used to circumvent the problem is to draw up the required volume in a 1 ml syringe and transfer it to a larger volume syringe, leaving the dead space drug behind in the first syringe. This is a crude method and it is not a closed system (as it requires transfer of the drug from one syringe to another).

The insulin syringe (U-40 insulin; 29 G; 0.5 inch ultra-fine 1 ml needle; Becton-Dickinson Consumer Products, Franklin Lakes, New Jersey, USA) does not have a dead space and its needle is fixed to the syringe. Use of this syringe can also obviate the problem.

Another way would be to add the drug contained in this dead space (0.07 ml) to the calculation for dilution.

Although no reports of life threatening adverse effects have been reported in the literature, this inadvertent dosing error has the potential of being serious.

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BOOK REVIEWS

Managing newborn problems: a guide for doctors, nurses and midwives

Edited by World Health Organization. Published by World Health Organization, Geneva, 2004, £27.00, pp 274. ISBN 9241546220

It is a sobering thought that world wide there are more than four million neonatal deaths per year, the majority occurring in the first week of life with an equal number of stillbirths. Most of these deaths are preventable and the result of a combination of poor maternal health and nutrition and inadequate perinatal care. This manual is the result of a collaboration between the WHO, UNFPA, UNICEF, and the World Bank and represents a renewed effort to address this problem. It forms one of the WHO IMPAC (Integrated Management of Pregnancy and Childbirth) series. Its remit is to complement the Integrated Management of Childhood Illness (IMCI) guidelines and expand these into a comprehensive evidence based perinatal care manual with the emphasis on illnesses in the first week of life. It is targeted at health professionals (doctors, nurses, and midwives) in under-resourced settings where the vast majority of these deaths occur.

The guide has four distinct sections. The first, ''Assessment, findings, and management'', is in the IMCI emergency management style. It guides the recognition and diagnosis of sick neonates and the institution of appropriate management of a range of common clinical scenarios such as fast breathing, maternal fever, poor feeding. In section 2 (''Principles of newborn care'') the basics of safe general care from temperature management to immunisation are reviewed. Section 3 describes frequently used procedures including resuscitation, and section 4, the appendices, deals with medical record keeping. Many management pathways will begin in section 1, the scenario/problem, and will be followed through by cross referencing the later sections. There are also additional training packages to accompany the IMPAC guides.