Short reports

Cord blood gases, birth asphyxia, and intraventricular haemorrhage

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SUMMARY The relation between intraventricular haemorrhage, Apgar scores, and cord blood gases was determined prospectively in 150 infants of 34 weeks' gestation, or less. Although there was no significant relation between birth asphyxia and subsequent haemorrhage, a consistent trend for lower Apgar scores in infants who developed haemorrhage was shown.

Intraventricular haemorrhage occurs commonly in the preterm neonate, and infants who sustain it are born with lower Apgar scores than those who do not.¹⁻³ The conclusion has been that birth asphyxia is related to the subsequent occurrence of intraventricular haemorrhage. It has been shown, however, that there is a poor correlation between Apgar scores and acid base status in the cord blood of neonates.⁴ The purpose of this study was to determine prospectively the relation between intraventricular haemorrhage, Apgar scores, and cord blood gases.

Patients and methods

St Joseph's Hospital is a regional perinatal centre serving south west Ontario. High risk pregnancies are closely monitored by consultant obstetric staff; all deliveries are inborn and high risk deliveries are attended by both consultant obstetric and paediatric perinatologists. Approximately 650 neonates are admitted to the neonatal intensive care unit each year, half of whom are of low birthweight. Between June 1982 and April 1983, 150 neonates of 34 weeks' gestation or less were examined consecutively. At delivery the umbilical cord was double clamped; heparinised blood was obtained from both the umbilical artery and vein, placed on ice, and taken for immediate blood gas analysis. The Apgar score was assigned by the neonatologist and neonatal research fellow present at the delivery. The gestational age was determined by the date of the

mother's last normal menstrual period, early in utero ultrasound scan of the fetus, and Dubowitz score.⁵ Serial cranial ultrasound scans were performed at regular intervals throughout the first week of life to determine the presence of intraventricular haemorrhage.

Results

There was no significant difference in cord arterial gas measurements between the infants with and without intraventricular haemorrhage. There was no change with gestational age in any of the blood gas parameters measured (Table 1). Six infants (16.6%) with intraventricular haemorrhage had cord arterial pH less than 7.2, compared with 14 (14.4%) in infants without haemorrhage. Similarly, 10 infants (27.7%) with intraventricular haemorrhage had cord arterial base deficits greater than 12 mmol/l compared with 24 (24.7%) in the no haemorrhage group. There was a trend for the base deficit to be greater in the intraventricular haemorrhage group, but none of the above differences reached statistical significance. The results for the cord venous gas samples were similar.

There was no statistical difference in the 1 and 5 minute Apgar scores between infants with and without intraventricular haemorrhage except in the neonates born at 33 to 34 weeks' gestation, in whom those with haemorrhage had lower Apgar scores at 1 minute (mean (SD) 6.57 (2.8) v 8.12 (1.49) $P<0.05$) and 5 minutes (mean (SD) 8.29 (2.14) v 9.04 (0.74) $P<0.05$) (Table 2). The infants who subsequently developed intraventricular haemorrhage showed no change in the 1 and 5 minute Apgar score with gestational age, but in those free of haemorrhage there was a significant increase in Apgar score with gestational age at 1 minute ($F=10.92$ $P<0.01$) and 5 minutes ($F=5.61$ $P<0.01$) (Table 2).

We were unable to show any relation between Apgar score, cord blood gas analysis, gestational age, and the postnatal age at which the intraventricular haemorrhage was first detected. Simi-

Table 1 Relation between gestational age, cord arterial gas analysis, and intraventricular haemorrhage (IVH). Results shown as mean (SD)

Cord arterial gas											
Infants with IVH						Infants without IVH					
Gestation (weeks) (n)	pH	Paco ₂ (KPa)	PaO ₂ (KPa)	HCO ₃ (mmol/l)	Base deficit (mmol/l)	Gestation (weeks) (n)	pH	Paco ₂ (KPa)	PaO ₂ (KPa)	HCO ₃ (mmol/l)	Base deficit (mmol/l)
<26 (10)	7.20 (0.18)	5.12 (3.55)	2.28 (1.48)	17.6 (5.7)	11.2 (6.5)	<26 (4)	7.24 (0.17)	5.83 (2.84)	1.99 (1.24)	17.8 (5.3)	6.0 (7.2)
27–28 (7)	7.30 (0.04)	4.75 (1.89)	2.16 (1.13)	16.9 (6.1)	9.1 (5.5)	27–28 (7)	7.25 (0.51)	5.60 (0.95)	2.52 (0.83)	17.9 (2.7)	6.0 (3.0)
29–30 (7)	7.18 (0.16)	5.55 (1.33)	2.28 (1.39)	16.1 (5.1)	11.3 (7.2)	29–30 (9)	7.21 (0.09)	6.49 (2.13)	2.28 (1.13)	19.0 (4.8)	9.0 (4.9)
31–32 (6)	7.27 (0.01)	4.96 (1.56)	1.77 (0.75)	16.6 (5.1)	9.4 (4.6)	31–32 (18)	7.26 (0.09)	5.35 (1.61)	1.87 (0.80)	17.8 (4.0)	9.8 (5.1)
33–34 (6)	7.26 (0.01)	4.77 (2.17)	1.91 (0.39)	15.4 (6.1)	9.5 (5.5)	33–34 (59)	7.27 (0.003)	5.23 (1.63)	2.21 (0.89)	18.4 (7.0)	8.9 (4.7)

Table 2 Relation between gestational age, Apgar scores, and the occurrence of intraventricular haemorrhage (IVH)

Infants with IVH			Infants without IVH			Significance
Gestation (weeks) (n)	Apgar score Mean (SD)		Gestation (weeks) (n)	Apgar score Mean (SD)		
	1 min	5 mins		1 min	5 mins	
<26 (11)	5.2 (3.46)	7.0 (2.45)	<26 (4)	5.5 (2.65)	7.25 (0.96)	NS
27–28 (9)	4.00 (2.83)	7.11 (2.80)	27–28 (8)	5.38 (1.41)	8.38 (1.06)	NS
29–30 (7)	5.43 (1.90)	8.14 (1.21)	29–30 (11)	5.18 (2.93)	7.91 (1.58)	NS
31–32 (6)	6.33 (2.50)	8.17 (1.47)	31–32 (21)	7.52 (1.72)	8.57 (1.47)	NS
33–34 (7)	6.57* (2.88)	8.29† (2.14)	33–34 (66)	8.2‡ (1.49)	9.04‡ (0.74)	* <i>t</i> = 2.37 <i>P</i> < 0.05 † <i>t</i> = 2.04 <i>P</i> < 0.05
<i>F</i>	1.02	0.67		10.92	5.6	
Significance	NS	NS		<i>P</i> < 0.01	<i>P</i> < 0.01	

larly there was no correlation between Apgar score, cord gas analysis, and the subsequent grade of haemorrhage.

Discussion

We were unable to substantiate the hypothesis that birth asphyxia was related to the formation of intraventricular haemorrhage. The significant relation between Apgar scores and intraventricular haemorrhage reported previously^{1–3} could be attributed to a gestational effect, the less mature infants having lower Apgar scores. We found this gestational age effect particularly significant in the neonates without intraventricular haemorrhage.

It is possible that the results we report do not reach significance because of the small numbers of neonates in some of the gestational age groups analysed. This lack of statistical significance per-

sisted, however, when some of the groups were combined.

Despite the fact that there were no significant differences between the haemorrhage and non-haemorrhage groups' Apgar scores at 1 and 5 minutes, except at 33 to 34 weeks' gestation, there was a consistent trend for lower Apgar scores in those infants subsequently shown to have intraventricular haemorrhage. We report elsewhere that 50% of the haemorrhages were detected within eight hours of delivery.⁶ We suggest that the initiating event in some instances of intraventricular haemorrhage coincides with the birthing process, resulting in central nervous system depression and lower Apgar scores, without biochemical evidence of birth asphyxia.

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Heat shield reduces water loss

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SUMMARY A heat shield covered by polyvinyl chloride film greatly reduced insensible water loss and radiant energy requirements in 12 preterm infants on a radiant cradle. Measured transmittance of radiant energy emitted by the radiant heater was impeded minimally by various thin film plastics but was blocked significantly by Perspex.

The principal objective of a heat shield for infants on radiant warmer beds is reduction of insensible water loss, but a shield should neither impede transmittance of radiant energy appreciably nor impair patient visibility and accessibility. A shield used in our nursery fulfills these objectives. The effect on insensible water loss and radiant energy requirements was assessed by this study. We also measured transmittance of radiant energy through five common plastic materials.

Patients and methods

The shield is in two sections which telescope to adjust for length. The Perspex walls are 4 mm thick and measure 13 cm (high) × 22 cm (wide) × 35 cm (long) for each section; the top is covered by a thin film of polyvinyl chloride. Small semicircular openings along the bottom permit passage of apparatus (Figure).

Twelve well preterm infants were studied. Their birthweight was mean (SD) 1.33 (0.2) kg (range 0.92 to 1.65 kg) and their gestational age was mean (SD), 33 (1.3) weeks (range 30 to 34 weeks). At the time

Figure Preterm neonate enclosed in heat shield on radiant cradle. The cover (polyvinyl chloride film) does not touch the skin, and the telescoping sections permit easy adjustment for infant's size. Openings along bottom margin allow passage of ventilator connections and support apparatus.

of the study their ages ranged from 8 to 76 days (mean 29.8 days) and weights from 1.38 to 1.72 kg (mean (SD), 1.51 (0.11) kg). Infants were studied on the same radiant warmer (Cavitron KDC Model IW-10A) placed away from outside walls and windows. Each infant was studied for two consecutive 90 minute intervals, one shielded (period I) and one unshielded (period II). The heat source, a metal clad quartz tube, emits radiant energy around a peak wave length of 3 µm. It was proportionally servocontrolled to maintain abdominal skin temperature at 36.0 to 36.5°C. Abdominal skin and rectal temperature and air temperatures inside and outside the shield were monitored continuously by thermis-

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