

# Nasogastric compared with nasoduodenal feeding in low birthweight infants

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**SUMMARY** One hundred successive infants weighing less than 1500 g at birth were allocated alternately to intermittent nasogastric or continuous nasoduodenal feeding regimens. Eighty were appropriate for gestational age, and of these 25 fed successfully by nasogastric tube and 16 tolerated nasoduodenal feeding until 1600 g. No significant differences in either calorie intake or growth rates were identified throughout the seven weeks of the study. Because of the increased complexity and radiological exposure involved with feeding transpylorically, nasogastric feeding may be preferred as a method of feeding the low birthweight infant.

The very low birthweight infant requires a protein and calorie input sufficient to sustain growth and brain development.<sup>1 2</sup> Parenteral nutrition has been widely used to achieve this goal,<sup>3</sup> but the risks of cholestasis and sepsis<sup>4 5</sup> associated with this method have caused renewed interest in enteral feeding. Concern about mild aspiration associated with nasogastric feeding of the preterm infant<sup>6</sup> has encouraged the use of transpyloric routes—both nasoduodenal and nasojejunal—but studies do not concur over which method carries better growth rates and fewer complications.<sup>7-9</sup>

The present study compares two groups of infants of birthweight less than 1500 g. In one group feeding was by nasogastric tube, while the other group was fed initially by the nasoduodenal route.

## Patients and methods

Between September 1982 and February 1984 all infants of birthweight 750 to 1500 g admitted to the Neonatal Intensive Care Unit, Simpson Memorial Maternity Pavilion, Edinburgh, within 24 hours of birth were entered into the study. All 100 infants were allocated alternately to nasogastric or nasoduodenal feeding regimen on a rigidly observed basis uninfluenced by the clinical condition of the infant. On completion of the trial infants appropriate for gestational age (between 10th and 90th centiles)<sup>10</sup> were selected from both groups for comparison of outcome.

Fluid intake targets were the same. Soon after birth a peripheral intravenous infusion was started

based on a 9.5% dextrose cocktail with sodium content 2 mmol/100 ml. No amino acid nor lipid solutions were given. At three hours a feeding tube was passed and, if positioned successfully, milk feeds began at 0.5 ml/hour (for infants of birthweight less than 1000 g at birth) or 1 ml/hour (for infants of birthweight between 1000 and 1500 g). Similarly, six hourly increments of milk intake were by 0.5 ml/hour or 1 ml/hour according to weight. Planned fluid requirements in both nasogastric and transpyloric groups began at 50 ml/kg/day on day one, and increased by 25 ml/kg/day to 150 ml/kg/day. Decisions to increase still further were taken on an individual clinical basis.

In the group fed nasogastrically a 5 gauge (Argyle) feeding tube was passed at three hours and the position checked by acid reaction of the aspirate with litmus paper. Hourly bolus feeds were given by syringe administration. In the group fed transpylorically initial passage of a 5 FC silastic nasoduodenal tube (Vygon) was attempted at three hours of life, and continuous feeding was begun when the tube was in position, which was confirmed radiologically. The optimum tube end site used was the second part of the duodenum. Primary failure of passage was defined as inability to pass a tube through the pylorus on any occasion. In some infants, previously intubated successfully, the tube became displaced: subsequent failure to reposition the transpyloric tube was termed secondary failure. In both groups intravenous dextrose electrolyte solution supplemented the infants' planned fluid requirements until full enteral feeding was established. At 1600 g

both groups were fed by intermittent hourly nasogastric feeding, progressing to two hourly feeds at 1750 g weight, three hourly feeds at 1800 g, and thereafter full bottle or breast feeding on an individual basis.

Infants were weighed naked on admission and then daily until discharge using an integrated electronic balance (Mettler 515). Crown-rump and crown-heel lengths were measured weekly using a Harpenden neonatometer, and occipitofrontal circumference was also documented on a weekly basis. Mortality and number of outborn versus inborn infants were compared by 2×4 contingency tables. All other statistical analysis was by Student's *t* test.

## Results

Of the 50 infants allocated to the primarily nasogastric regimen, 35 were appropriate for gestational age, while 45 were appropriate for gestational age in the nasoduodenal group. Table 1 shows that there were no significant differences between the groups in sex, birthweight, crown-heel length, and occipitofrontal circumference. The original transpyloric group seemed to be of an earlier gestation and

smaller crown-rump length ( $p=0.05$ ). The proportion of inborn to outborn infants was similar in both groups, nine of the inborn infants being fed nasogastrically having been transferred in utero from other hospitals, while 14 of the inborn infants being fed transpylorically were similarly antenatal transfers (not significant). The original transpyloric group had significantly poorer Apgar scores at one and five minutes.

Table 2 shows that of the 35 infants appropriate for gestational age fed nasogastrically, six died. Five of these had massive intraventricular haemorrhage, and the sixth was severely birth asphyxiated. Four of the infants originally fed nasogastrically developed necrotising enterocolitis, which was treated successfully by total parenteral nutrition and intravenous penicillin, gentamicin, and metronidazole. Of the 45 infants appropriate for gestational age allocated to transpyloric feeding, 21 died, 16 of whom had an intraventricular haemorrhage, three of whom were severely asphyxiated but postmortem permission was refused, one who was of 24 weeks' gestation, and one who died of bronchopulmonary dysplasia. Table 2 also shows that 13 of the original nasoduodenal group failed to tolerate nasoduodenal

Table 1 Characteristics of infants appropriate for gestational age at birth. Values are mean (SD)

	Nasogastric group	Original transpyloric group	<i>p</i> value
No of infants	35	45	
Boys/girls	23/12	32/13	NS
Birthweight (g)	1223 (229)	1132 (213)	NS
Gestation weeks	28.5 (2.0)	27.7 (1.6)	0.05
Crown-rump length (cm)	25.9 (1.5)	25.2 (1.6)	0.05
Crown-heel length (cm)	38.7 (2.5)	37.9 (3.1)	NS
Occipitofrontal circumference on third postnatal day (cm)	26.9 (1.7)	26.1 (2.0)	NS
Inborn/outborn	31/4	36/9	NS
Apgar score at: one minute	6.2 (2.7)	3.6 (2.6)	<0.001
five minutes	8.3 (1.5)	6.3 (2.4)	<0.001

Table 2 Outcome (No of infants) of feeding methods of infants appropriate for gestational age

	Feeding method		<i>p</i> value
	Nasogastric	Nasoduodenal	
No of infants	35	45	
Successful feeding to 1600 g	25	16	
Total no of deaths	6	21	<0.01
No of deaths before tube passage attempted	2	10	
Failure of method	4	13	
Cause of failure of method:			
Necrotising enterocolitis	4	0	
Therapeutic use of pancuronium	0	6	
Primary failure of tube passage	0	1	
Secondary failure of tube passage	0	3	
Recurrent misplacement	0	1	
Bile vomits	0	2	
Hazards:			
X ray films for tube positioning mean (SD)	0	10.6 (7.9)	

feeding. Six had severe respiratory distress, tolerated ventilation poorly, and required to be paralysed: five of these subsequently died, but the other was fed successfully by nasogastric tube four days later. No infant developed necrotising enterocolitis while a nasoduodenal tube was in place, although one of the transpyloric group, after secondary failure of passage of the nasoduodenal tube, was switched to nasogastric feeding, and necrotising enterocolitis was diagnosed three days later. The increased radiological exposure of the 34 infants who had successful passage of at least one nasoduodenal tube is shown.

Twenty five infants were fed successfully by nasogastric tube until 1600 g, and 16 of the original transpyloric group also achieved this weight by the nasoduodenal route. Table 3 shows that these two groups were similar in all variables measured. In addition, as is shown in Table 4, no differences in growth velocities were identified between the two groups. Furthermore, no differences between the two successful groups were shown when mean daily fluid and calorie intakes were compared for each of the first seven postnatal weeks. The mean rate of

displacement of nasoduodenal tube into stomach was 13 times for these 16 infants.

## Discussion

In this study 100 successive infants of birthweight less than 1500 g were allocated alternately to initial nasoduodenal or nasogastric regimens independent of their clinical condition at birth. However, highly significant differences in Apgar scores at one and five minutes were obtained by attending staff who were generally unaware to which method of feeding the infant would be allocated. This chance occurrence may largely account for the greater mortality in the group fed nasoduodenally.

Poor weight gain of infants fed nasojejunaally has been described,<sup>7,9</sup> but a nasoduodenal approach has been claimed to be more physiological and to carry a lower risk of complications.<sup>6</sup> In our 41 infants appropriate for gestational age who fed successfully to 1600 g by the routes originally allocated no significant differences in growth rates were identified, an observation in keeping with the findings of Pereira and Lemons.<sup>8</sup>

Concern has been expressed about the association between transpyloric feeding and the development of necrotising enterocolitis and perforation.<sup>11,12</sup> Necrotising enterocolitis can occur with nasogastric feeding, however,<sup>13</sup> and all five infants with this disorder in the present study were being fed nasogastrically at the time of diagnosis. No episode of aspiration of milk was identified in any of the original 100 very low birthweight infants and no child fed nasogastrically required to be changed to the transpyloric regimen.

Thirteen of the infants allocated to the original transpyloric regimen did not tolerate it. In one child the tube failed to pass in seven attempts over 36 hours. Three infants were successfully transpylorically intubated, but the technique failed thereafter when a further tube was required. One infant was recurrently intubated without difficulty, but on eight occasions in four days the tube tip fell back from the second part of the duodenum into the stomach, resulting in poor weight gain because of recurrent method failure. Two infants had frequent bile vomits on two successive days, and, although no aspiration of vomit was identified, the feeding method was changed to nasogastric, and the problem promptly resolved. The high rate of displacement of nasoduodenal tube into stomach (mean 13 times) compares poorly with results previously achieved in our unit (mean 2.7 times) using the third part of the duodenum as the optimal endtube site.<sup>5</sup>

While the tip of a transpyloric tube can be positioned by ultrasound techniques, in many units

Table 3 Details of infants appropriate for gestational age fed successfully to 1600 g. Values are mean (SD)

	Feeding method	
	Nasogastric	Nasoduodenal
No of infants	25	16
Boys/girls (no)	18/7	11/5
Outborn/inborn (no)	2/23	4/12
Gestation weeks	28.9 (2.1)	28.8 (1.5)
Birthweight (g)	1259 (199)	1303 (140)
Crown-rump length at birth (cm)	25.9 (1.4)	25.9 (1.3)
Crown-heel length at birth (cm)	38.9 (2.3)	39.1 (1.9)
Occipitofrontal circumference at birth (cm)	27.2 (1.6)	27.2 (1.6)

p=NS for all values.

Table 4 Growth variables of infants appropriate for gestational age successfully fed to 1600 g. Values are mean (SD)

	Feeding method	
	Nasogastric	Nasoduodenal
No of infants	25	16
Postnatal weight loss (%)	14.6 (5.4)	17.5 (4.6)
Day of maximal postnatal weight loss	5.2 (2.3)	5.4 (2.2)
Day to regain birthweight	15.9 (5.1)	16.6 (5.9)
Day to achieve 1600 g	29.8 (11.5)	28.6 (8.6)
Growth of occipitofrontal circumference (cm/week)	0.8 (0.3)	0.8 (0.4)
Growth of crown-rump length (cm/week)	0.6 (0.7)	0.7 (0.3)
Growth of crown-heel length (cm/week)	0.8 (0.2)	0.7 (0.4)

p=NS for all values.

Growth velocities are calculated over the first six weeks of life.

x ray films are used for this purpose. The mean of 10.6 x ray films required in our study specifically for siting the nasoduodenal tube is recognised as a disadvantage of the method. One attempted passage of a nasoduodenal tube resulted in intubation of the right main bronchus: this was identified radiologically, no milk was administered, the tube was removed, and the infant remained asymptomatic.

In the present study the group that tolerated nasoduodenal feeding showed no benefits in either fluid and calorie intake or growth rate when compared with the infants given intermittent nasogastric feeds. Furthermore, the nasoduodenal method is of greater complexity and in many centres requires an x ray film to confirm end tube site. Intermittent nasogastric feeding should be considered as a suitable method of feeding low birthweight infants.

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