Transpyloric feeding in small preterm infants*

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Wolfsdorf, J., Makarawa, S., Fernandes, C., Fenner, A. (1975). *Archives of Disease in Childhood*, 50, 723. **Transpyloric feeding in small preterm infants.** In 20 preterm infants, birthweight ranging from 775 to 1540 g, transpyloric feeding was carried out using expressed human milk as the sole nutrient (study group). 10 further infants, birthweight range 910–1500 g, were also fed with human milk via nasogastric tube (control group). The group fed transpylorically had higher fluid intakes during the early days of life. Body weight loss after birth was similar in both groups, but subsequent weight gain was more rapid in the study group. Thus transpyloric feeding is considered to offer the following advantages in comparison with nasogastric feeding. (1) No danger of aspiration after vomiting. (2) More rapid weight gain.

As the survival rate of preterm infants increases, more hospital days are spent in neonatal nurseries per patient than before, causing increased costs, more specialized care from doctors and nurses, and additional occupancy of space. There is also increasing awareness of the psychological effects of prolonged mother-child separation due to hospitalization. It therefore seems important to seek ways to reduce the length of stay of preterm infants. One method is to discharge infants at a lower body weight than has been deemed feasible. In our own nursery this approach has been practised over the past 2 years and the results have been satisfying despite the primitive environment into which many are being discharged.

In 1973, two reports on nasojejunal feeding indicated that in by-passing the stomach the intake of food could be increased without the risk of aspiration (Cheek and Staub, 1973; Heird, 1973; Rhea, Ghazzini, and Weidman, 1973). This latter aspect was especially attractive to us, since in our own nursery vomiting and subsequent aspiration occurs frequently. We attribute this to the fact that all preterm infants, once having overcome initial adaptation to extrauterine existence, are fully cared for by their mothers. These mothers are usually inexperienced in the care of preterm infants, particularly in dealing with feeding tubes. Therefore, we decided to try nasojejunal feeding in our

unit. The results of the first 20 successful trials are reported.

Materials and methods

Twenty small preterm African infants, most of whom were moderately ill on the first day of life, were selected for transpyloric feeding. Clinical data are given in Table I. A tube was inserted on the first day of life in

TABLE I
Clinical data of 20 infants fed by transpyloric route (study group). (Mean birthweight 1233.5 g $\pm$ 202.7 SD).

Case no.	Sex	Birthweight (g)	Diagnosis
1	M	1500	Preterm
2	M	1400	Preterm
3	F	1200	Preterm
4	M	1495	Mild RDS
5	F	1050	RDS
6	F	1265	Preterm
7	M	1225	RDS
8	F	1300	Hyperbilirubinaemia
9	F	1160	RDS
10	F	775	Preterm
11	F	1225	Preterm
12	F	1150	Preterm triplet
13	F	1025	Preterm triplet
14	F	1000	Preterm triplet
15	F	1010	Preterm
16	F	1175	Preterm
17	F	1525	Preterm triplet
18	F	1175	Preterm triplet
19	?	1475	Aspiration pneumonia
20	M	1540	RDS

RDS, respiratory distress syndrome.

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3 infants, on day 2 in 8, on day 3 in 4, on day 4 in 2, and on day 5 in 2 infants. In one infant the date was not recorded.

The technique required skill and patience. The time needed to place a tube decreased from an initial 40 minutes to 10 minutes, as experience was acquired. The infant was positioned on its right side and was measured from glabella to heel with the legs extended. The tube was then marked at that length, approximating the distance from the nostril to the jejunum (Cheek and Staub, 1973). A no. 5 sterile premature infant feeding tube (Argyle, catalogue No. AR-33R), 91 cm long and radiopaque was threaded through one nostril into the stomach. When the first resistance was met, the tube was withdrawn about 2 mm and then advanced very slowly in fractions of 1 mm at a time. Occasionally a slight pull was noticed which indicated spontaneous

advancement through the pyloric canal, probably by a peristaltic wave. The tube was then advanced more quickly until the mark on the tube was reached. Occasionally resistance was felt just before the mark was reached. X-ray studies indicated that this was usually the site of the ligament of Treitz where there is a sharp kink in the course of the jejunum. As routine x-rays of the abdomen were not taken jejunal intubation could not be guaranteed in all cases; however, a transpyloric position was certain when aspiration produced green-stained material. Equivocal results were usually obtained with red or blue litmus paper. X-ray confirmation of proper location (Fig. 1) was needed in exceptional cases only. Frequently the x-ray technician was asked to include the upper abdomen when a chest film was taken for diagnostic purposes. In about half the cases one loop of the tube was seen in the stomach on x-ray examination. The tube was always positioned successfully, though more than one attempt was sometimes necessary.

The house staff was instructed only to give a volume of 200 ml/kg per day as quickly as possible. The first feed was always given with boiled water. Breast milk expressed into a presterilized metal cup for each meal was then introduced at 3-hourly intervals following the normal nursery routine. The mothers were instructed to give the milk in the same way as for those infants on nasogastric feed, i.e. by gravity drainage from an open-ended syringe.

The infants were carefully observed and fluid intake, daily weight change, incidence of vomiting, and the number and appearance of stools passed were noted. Occasional random blood samples for serum urea, electrolytes, and osmolality were taken. From a group of low birthweight infants fed nasogastrically, a control group of 10 was selected and studied in a similar manner

FIG. 1.—Case 10. X-ray at age 1 month. The radiopaque transpyloric feeding tube is properly located in the upper jejunum.

TABLE II

Clinical data of 10 infants fed by nasogastric tube (control group). (Mean birthweight 1230.5 g $\pm$ 207.7 SD)

Case no.	Sex	Birthweight (g)	Diagnosis
21	M	1450	RDS
22	F	1180	RDS
23	F	995	RDS
24	M	1345	Preterm twin
25	M	1250	Preterm
26	M	925	Preterm
27	F	1400	Preterm
28	M	1350	Preterm
29	F	1500	Aspiration pneumonia
30	F	910	Aspiration pneumonia

RDS, respiratory distress syndrome.

(Table II). Resident staff did not know which infants were being studied.

Results

Fig. 2 shows the mean amounts of fluid intake

FIG. 2.—Fluid intake in ml/kg body weight. Solid line shows results of study group (transpyloric feeding), broken line control group (nasogastric feeding). Results are given as mean values ± 1 SD.

in ml/kg body weight per 24 hours, for both study and control groups. In spite of reluctance on the part of the house staff to increase the feeds rapidly in the study group, a mean of 200 ml/kg per day was achieved by day 7 in this group, as compared to day 10 in the controls. Changes in

FIG. 3.—Body weight changes in infants fed by transpyloric tube (solid line) and by nasogastric tube (broken line). Results are given as mean values for each group ± 1 SD. Note that infants fed by transpyloric route regain their birthweight by 8.5 days, while this takes 21–22 days in the control group.

body weight, expressed in absolute terms as weight gained or lost (Fig. 3), show that mean maximum weight loss was similar in both groups (approximately 75 g or 5% of birthweight). Time of onset and speed of weight gain were, however, significantly different, the study group regaining their birthweight in a mean of 8.5 days, while the control group took a mean of 22 days. Random samples analysed for serum electrolytes, urea, and osmolality were always normal. Except for occasional abdominal distension, no symptoms were observed in the study group. In particular, there was no vomiting and there were no abnormal stools in spite of the high volume of milk given.

Discussion

Our results may be summarized as follows. (1) Transpyloric feeding of preterm infants appears to be a simple, safe and effective method of nutrition. (2) Comparison with our control group shows that administration of fluids at greater volumes can be achieved during the first few days of life and that weight gain is more rapid once birthweight has been regained.

Our two groups are not entirely comparable, since there was no fixed protocol as to selection of babies nor was there a rigid feeding regimen for either group. But this was purposely omitted as we wished to carry out the study while the nursing staff and the mothers caring for their infants were unaware of it.

Vomiting and aspiration occurred in some of the controls but never in the study group, confirming experimental data in animals in which reflux into the stomach could nearly be eliminated when feeds were introduced into the upper jejunum (Gustke, Varma, Soergel, 1970). Early and adequate protein intake has been recommended as a necessary prerequisite to adequate development of rapidly growing neuronal tissue. In our neonatal population transpyloric feeding may serve as a means of providing such protein requirements during the first few days of life by giving human milk through the transpyloric feeding tube. Obviously there is a need for careful biochemical studies to find out whether or not absorption from the jejunum is equal to that from the more proximal intestinal portions. The few random samples of serum electrolytes, urea, and osmolalities only exclude gross biochemical abnormalities.

Recently there have been reports of complications either due to or in association with transpyloric feeding, small bowel perforation being the most serious one (Boros and Reynolds, 1974;

Challacombe, 1974; Chen and Wong, 1974; Heird, 1974; Loo, Gross, and Warshaw, 1974). We have therefore taken another careful look at 8 infants not included in the present report, who had a transpyloric intubation performed and died from various causes. Necropsy was performed in all of them. There were 2 cases in which gastrointestinal findings were noted: mild inflammatory infiltration and cysts containing gas in the *large* bowel and enterocolitis. We believe that the large bowel pathology may be purely coincidental, whereas the enterocolitis in the other case could conceivably be related to jejunal intubation as suggested by Chen and Wong (1974). It may be emphasized, however, that necrotizing enterocolitis is a frequent occurrence in our nursery for unknown reasons.

Thus, from our own experience it seems reasonable to continue transpyloric feeding for very small low birthweight infants as outlined. Certainly a larger series is required to assess the true incidence of complications.

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