Short reports

Effect of feed temperature and phototherapy on gastric emptying in the neonate

I BLUMENTHAL, G T LEALMAN, AND D R SHOESMITH

Department of Paediatrics, Bradford Royal Infirmary Maternity Unit, Bradford

SUMMARY The effect of feed temperature and phototherapy on the rate of stomach emptying was studied in healthy infants during the first week. Emptying rate was measured by the modified serial test meal technique using 10% Dextrose feeds. The results show that emptying rate is independent of feed temperature and is not affected by phototherapy.

In many nurseries, feeds are refrigerated after preparation and then are heated before they are given to the newborn infant. This practice is based more on custom than on reason since it has been shown that refrigerated feeds are well tolerated.¹ Also, it is said that stomach emptying is more rapid when feeds of low temperature are given.² The fact that small infants are likely to regurgitate and aspirate their gastric contents prompted us to study the effect of feed temperature on stomach emptying.

It has been our impression that newborn infants often develop abdominal distension during phototherapy and only recently has this been studied.³ Based on the assumption that such distension is caused by gastric retention, we studied the effect of phototherapy on the rate of stomach emptying.

Patients and methods

Test meals of three different temperatures: cold (0-4°C), room temperature (about 25°C), and body temperature (37°C) were given during the first week to 20 healthy infants. Mean ($\pm$ SE) birthweight was 1.97 ± 0.06 (range 1.55-2.53) kg, and gestation 35.6 ± 0.4 (range 32-39) weeks. Meals were given over a period of 24 hours. Temperature sequence was varied to obtain a balanced distribution and the volume retained at each temperature was compared.

Cold test meals (0-4°C) were given on day 3 or 4 to 12 healthy infants with jaundice (mean $\pm$ SE bilirubin $227 \pm 20.9 \mu\text{mol/l}$; $13.3 \pm 1.2 \text{ mg/100 ml}$). Mean ($\pm$ SE) birthweight was 2.75 ± 0.18 (range

1.49-3.38) kg, and gestation 37.7 ± 0.6 (range 34-41) weeks. After a period of continuous phototherapy ranging between 16 and 24 hours, meals were again given and the differences in gastric retention before and after phototherapy were compared.

Stomach emptying was measured by the modified serial test meal technique.⁴ Test meals of 10% Dextrose containing phenol red (0.12 mg/100 ml) were given by tube $1\frac{1}{2}$ to 3 hours after the last feed. After first washing out the stomach, 20 ml test feed was given over 1 to 3 minutes and the infant was placed in the prone position. 30 minutes later the stomach was emptied and the aspirate volume recorded. The stomach was then washed out with 20 ml sterile water. The true volume remaining was calculated by the following formula:

Volume retained = $aA + 20B/c$, where a is the volume of the aspirate after 30 minutes, A optical density of the aspirate, B optical density of washout, and c optical density of test meal.

Aliquots of A , B , and c were alkalinised with trisodium orthophosphate (pH 12) before measurement in a spectrophotometer at wavelength 560 nm. In order to satisfy fluid requirements and prevent hypoglycaemia infants were given milk feeds at the end of each study.

Approval for the study was obtained from the Bradford Area Health Authority Ethical Committee. Informed parental consent was obtained.

Results

The paired Student's t test was used for statistical analysis. Fig. 1 shows that in the newborn infant stomach emptying is not temperature dependent. The mean volume retained at room and body temperature was similar. The differences between cold and room temperature, and cold and body temperature were not significant ($P > 0.1$ and $P > 0.5$ respectively). Fig. 2 shows the feed volume retained before and after phototherapy. The difference is not significant ($P > 0.5$).

Fig. 1 Volume of test meal retained after 30 minutes at cold (0-4°C), room temperature (about 25°C), and body temperature (37°C). Bars show mean and SE for each group.

Discussion

This study shows that the stomach emptying rate is independent of feed temperature. In all infants cold feeds were well tolerated and produced no obvious clinical effects. We did not specifically study the effect of cold feeds on body temperature because this has previously been shown to be of little clinical significance,¹ moreover in some infants it would have been difficult as temperature was maintained by servo-control. However, as part of our nursery routine, the rectal temperatures of many infants were taken during the study period or shortly after and no hypothermia was detected. Heating feeds is inconvenient, requires nursing time, and in many nurseries has led to buying feed heaters. There is also the risk that mothers may inadvertently administer too hot a feed and burn the infant's mouth. Although there was no benefit in giving cold feeds in terms of stomach emptying, it was far more convenient to give cold feeds and they were well tolerated even by small infants. It should be emphasised however, that

Fig. 2 Volume of test meal retained after 30 minutes. Test meals given before phototherapy and repeated between 16 and 24 hours after phototherapy. Bars show mean and SE for each group.

the infants were healthy and the smallest one weighed 1.49 kg. The effect of cold feeds on neonatal circulation and metabolic rate is unknown and we do not recommend that cold feeds be given to sick infants or to those of very low birthweights (<1.50 kg).

Increased abdominal girth during phototherapy occurs if protective eye pads are used, suggesting that increased girth is related to the method of eye protection rather than to phototherapy.³ If eye protection is given by a light screen and visual stimulation is allowed to occur, there is no increase in girth. It is therefore suggested that lack of visual stimulation may affect autonomic function of the gastrointestinal tract with a consequent increase in abdominal girth. In this study eye pads were used, yet phototherapy did not produce gastric retention, thereby excluding this as a cause for the increase in girth. Although there was no increase in stomach motility during phototherapy, a decrease in gut

transit time has previously been shown,⁵ photo-therapy-induced lactose intolerance being implicated as a cause.⁶

We thank Miss M White of the Haematology Department, St Luke's Hospital, Bradford, for use of the spectrophotometer, and Mrs J Doyle for typographical assistance.

References

- ¹ Gibson J P. Reaction of 150 infants to cold formulas. *J Pediatr* 1958; **52**: 404-6.
- ² Davidson M. Gastrointestinal tract. In: Rudolph A M,

ed. *Pediatrics*. New York: Appleton-Century-Crofts, 1977; 977-1062.

- ³ Preis O, Rudolph N. Abdominal distension in newborn infants on phototherapy—the role of eye occlusion. *J Pediatr* 1979; **94**: 816-9.
- ⁴ Husband J, Husband P. Gastric emptying of water and glucose solutions in the newborn. *Lancet* 1969; **ii**: 409-11.
- ⁵ Rubaltelli F F, Largajolli G. Effect of light exposure on gut transit time in jaundiced newborns. *Acta Paediatr Scand* 1973; **62**: 146-8.
- ⁶ Bakken A F. Temporary intestinal lactase deficiency in light treated jaundiced infants. *Acta Paediatr Scand* 1977; **66**: 91-6.

Correspondence to Dr I Blumenthal, Department of Paediatrics, St James's Hospital, Leeds LS9 7TF.

Management of leukaemic infiltration of the testis

A OAKHILL, D MAINWARING, F G H HILL, P GORNALL, R E CUDMORE, A J BANKS, J E S BROCK, J MARTIN, AND J R MANN

Children's Hospital, Birmingham, and Alder Hey Hospital, Liverpool

SUMMARY Of 95 boys treated for acute lymphoblastic leukaemia 25 have developed leukaemic infiltration of the testes. In 15 children relapse was apparently confined to the testes, and since treatment 7 of these boys remain in remission. The median duration of remission after testicular relapse was 72 weeks, considerably longer than that reported after other forms of leukaemic relapse.

Now that long haematological remissions occur in children with acute lymphoblastic leukaemia (ALL) greater attention is being paid to extramedullary sites of leukaemic relapse. Prophylactic therapy to the central nervous system has reduced the incidence of meningeal leukaemia, but in boys residual disease in the testis now presents an important obstacle.¹

The management and prognosis of boys with leukaemic infiltration of the testis may depend on whether the relapse is confined to the testis or associated with previous or concurrent relapse elsewhere. We report our experience with 'isolated' testicular relapse.

Patients and treatment

Between December 1970 and June 1976, 95 boys were treated for ALL at our two centres, and leukaemic infiltration of the testis was detected in 25 of them.

15 (17%) had no evidence of leukaemia elsewhere and had had no previous relapses, so the disease was apparently confined to the testes. All had been

treated according to current Medical Research Council UKALL I-V protocols, and 13 of them had features at diagnosis that suggested good prognoses. Two boys, one with a white cell count $>20 \times 10^9/l$ and one aged over 14 years, were thought to have a poorer outlook (Table). In 13, testicular relapse (TR) was suspected clinically while in 2 it was discovered by routine testicular biopsy at the end of 2 years' treatment. The diagnosis was confirmed by needle biopsy in 9 patients and by wedge biopsy in 6. Testicular disease was diagnosed during 'maintenance' chemotherapy in 3, and between 1 and 24 (mean 7.8) months after stopping treatment in the remaining 12 boys. Both testes were affected in 9 boys and 6 had only unilateral infiltration.

Since 1975, we have used a standard treatment for isolated TR consisting of irradiation to both gonads and cords to a total tumour dose of 2500 rad (given in 10 fractions), and 2 years' intensive chemotherapy usually with the UKALL II 'maintenance' protocol.² Three early cases had lower doses of radiotherapy (Case 4 had 1800 rad in 6 fractions, Cases 10 and 11 1500 rad in 5 fractions). No further prophylaxis to the central nervous system was given.

The 10 children with previous or concurrent haematological or meningeal relapse were individually treated and all died of leukaemia (median survival 38 weeks); they will not be described further.

Treatment results. All 15 boys with isolated TR showed a clinical response to treatment but 5 suffered