infections are due to *E faecalis*, with an estimated 5–10% due to *E faecium*,² and there are few reports of neonatal infection due to *E faecium*.³

Both our cases had gastrointestinal pathology, representing the likely source of infection, and neither had a central venous catheter. Standard antibiotic treatment on many neonatal units consists of penicillin/flucloxacillin and an aminoglycoside. Both infants initially received penicillin or flucloxacillin with netilmicin and metronidazole, which is not effective treatment for *E faecium* infection.⁴

Enterococci should be considered as a possible cause of septicaemia and meningitis in newborn infants with gastrointestinal pathology. Isolates should be identified to species level and antibiotic sensitivities performed to detect resistance to standard treatment regimens.

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A variable dextrose delivery system for neonatal intensive care

EDITOR,—Optimising glucose delivery and reducing fluctuations in blood glucose are important goals in the care of the sick newborn baby. Traditionally, neonates requiring intravenous treatment have received infusions of 10% dextrose. However, when water requirements are particularly high, as in the preterm baby with large insensible water losses or when water requirements are low, as in the baby in renal failure, the requirements for fluid volume and glucose delivery may clash, resulting in either hyperglycaemia or hypoglycaemia. In addition, both glucose tolerance and glucose requirements may show wide variation in the sick neonate, necessitating frequent changes in glucose concentrations. We describe a simple method allowing variable glucose delivery, independent of infusion volume, which also avoids the need to change solutions.

Two continuous infusions, containing 5% and 50% dextrose respectively, are administered via a Y connector close to the baby. Mixing of the two concentrations in different proportions delivers a variable amount of glucose in a fixed volume or a fixed amount of glucose in a variable volume.

When 5% and 50% dextrose solutions are used the following equations describe the volume of each solution required per hour:

$$X = 0.11[(A \times B)1.2 - Z]$$

where X=rate of 50% dextrose infused in ml/hour, Y=rate of 5% dextrose infused in ml/hr, Z=total hourly infusion volume of 5% and 50% dextrose in ml/hour, A=required dextrose infusion rate in mg/kg/min, and B=patient's weight in kg.

This formula is derived in the following way:

As 50% dextrose=500 mg dextrose per ml and 5% dextrose=50 mg dextrose per ml

$$[1] \quad 500X + 50Y = \text{total mg dextrose required per hour} \\ = (\text{total mg dextrose required per minute}) 60 \\ = (A \times B) 60$$

$$[2] \quad X + Y = \text{volume in ml of 50\% and 5\% dextrose} \\ \text{infused per hour} \\ = Z$$

Equations [1] and [2] are simultaneous equations containing the same variables. Therefore dividing equation [1] by 50 gives:

$$[3] \quad 10X + Y = (A \times B)1.2$$

and multiplying equation [2] by -1 gives:

$$[4] \quad -(X + Y) = -Z$$

Adding equations [3] and [4] together gives:

$$[5] \quad 9X = (A \times B)1.2 - Z$$

therefore

$$[6] \quad X = 0.11[(A \times B)1.2 - Z]$$

but

$$Z = X + Y$$

and so

$$Y = Z - X$$

Therefore from a knowledge of desired glucose infusion rate in mg/kg/min (A), the baby's weight in kg (B) and the total hourly infusion volume in ml/hour (Z), the respective infusion rates of 5% and 50% dextrose may be calculated, thus allowing independent alteration of glucose delivery and fluid volume. In our unit the calculations are run on a computer terminal situated in the intensive care area. The operator is required only to enter in the values for A, B, and Z. The computer screen displays the calculated flow rates for the 5% and 50% dextrose lines and also informs the operator of the concentration of the mixed solution. Although we were initially concerned that high glucose concentrations might lead to an increase in the number of intravenous lines requiring replacement, we did not in fact see this. This may be due to a streaming effect of mixing glucose solutions close to the site of venous entry.

We use a 500 ml bag of 5% dextrose running via a giving set and volumetric pump and 50% dextrose administered through a syringe pump. The system is easy to set up and after an initial introductory period was well understood by nursing and medical staff. Changes can be easily and quickly achieved simply by changing the rate of either or both infusions, without the need to change lines or solutions.

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Method for securing umbilical lines

EDITOR,—Several methods have been described for the adequate fixation of umbilical lines.^{1–5} All attempt to ensure that

catheters are anchored securely once sited in the optimal position (above or below D12–L4). Accidental displacement of arterial lines must be avoided as this can lead to rapid blood loss.

Some techniques using adhesive tape applied directly to the infant's skin can cause problems. If vernix is present the tape may not stick. If the baby is very preterm removal of tape can lead to skin loss with subsequent risk of infection.

Some described methods are fiddly and time consuming especially in very tiny babies. Tying loops and purse strings can be difficult and gripping the catheter sufficiently to provide anchorage may lead to occlusion (particularly where fine lines are used).

We report a means of securing umbilical lines which avoids some of these pitfalls while remaining simple, rapid, and safe.

Method (see figure)

Step 1 – a 4/0 silk suture is looped through the skin of the cord close to the line to be secured. A knot is tied at the cord and the suture is cut leaving two threads about 5 cm in length parallel to the line.

Step 2 – a 1 cm × 1 cm length of adhesive tape is used to approximate the line and parallel threads.

Step 3 – the two ends of thread are folded down over the first piece of tape and a second similar piece of tape is used to fix the threads once more. Once the final position of the line is ascertained the tape and the line are pinched together to ensure security.

This method has proved useful for securing umbilical arterial and venous lines in particular but has also been used for the safe fixation of chest drains and dialysis catheters. It has the advantage of only requiring a single stitch, of avoiding tape adhered direct to the premature infant's skin, and of being easily adjusted should radiograph checks require this. The method has been widely used on this unit with babies of 23 weeks' gestation upwards and has proved consistently reliable.

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Massage in preterm infants

EDITOR,—I am uncertain that the conclusions of Acelot *et al* are secure from their report on the massage of preterm infants.¹
Any interventions in infants are liable to cause definite effects. These are most easily seen as physiological variation – for example in the heart rate, and such physiological changes will have a neuroendocrine basis. Handling and massage of babies causes an increase in the heart rate^{2 3} and in our experience also the blood pressure (see figure). These almost immediate responses, occurring within one minute, are most probably related to catecholamine surges. In the report by Acolet *et al* there was no significant change in the adrenaline or noradrenaline. This was to be expected from their study design with blood samples being taken 45 minutes before and one hour after the massage – the half life of circulating catecholamines is approximately 2 minutes. Thus even after such extremely stressful procedures as intubation, the catecholamine concentrations have fallen to baseline within 10 minutes.⁴ In contradistinction the half life of cortisol is approximately 60 minutes. The 45 minute premassage sample was stated to be carried out in ‘stable babies’. We are not told that they had received no handling or stress in the one hour before this sample was taken – such handling before the study period could account for the initial high values.
I believe that short term experiments such as those described by Acolet *et al* may gradually build up our knowledge of the potentially beneficial or harmful effects of our interventions, but such experiments must be carefully designed. It may be more useful to look at

Effect of two minutes massage on instantaneous systolic and diastolic blood pressures (above) and heart rate (below). Massage was started at 0734 and 55 secs and change in the blood pressure and heart rate are clearly evident by 0735 and 15 secs.

neuroendocrine excretion patterns in the urine than the concentrations present at a single moment of time in the blood when the half lives of such neurochemicals are so short.

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Drs Modi and Glover comment:
The primary purpose of our study was to examine more long term alterations in neuroendocrine status rather than immediate changes. Nevertheless the suggestion that it may be more useful to consider changes in urinary excretion patterns over the course of a

procedure is reasonable. However, Professor McIntosh's assertion that, on the basis of the small change in heart rate shown in the single infant he describes, our study is likely to have missed a significant response, is not supported by our observations.
We were able to measure urinary excretion of noradrenaline and lactate over the course of the massage in some of the babies described in our paper. We found no significant differences in urinary noradrenaline/creatinine ratio (n=9, median after-before difference 3.5, p=0.34), or lactate/creatinine ratio (n=9, median after-before difference -0.06, p=0.48) (table). Results are presented factored by urinary creatinine to allow for alterations in urinary flow rate.

Median (range) or urinary noradrenaline/creatinine and lactate/creatinine before, during and after massage

	Noradrenaline/ creatinine	Lactate/ creatinine
Before	15.9 (1.23-20.2)	0.38 (0.1-1.2)
During	15.3 (5.6-19.3)	0.32 (0.1-1.2)
After	15.6 (0.02-36.5)	0.32 (0.2-1.6)

Noradrenaline, ng/ml; lactate mmol/l; creatinine mmol/l.