method. Babies immunised by the different methods and different doctors did not differ significantly in demographic variables, weight, method of feeding, or the number and timing of other routine immunisations. The intradermal method was recorded as difficult on 36 occasions and very difficult on four; the percutaneous method was recorded as difficult once. A small amount of bleeding at immunisation was noted in 14 babies from each group. Ulceration was reported only in those who had had intradermal immunisation (five cases). None of the babies developed lymphadenopathy. A scar was visible in 95 of those immunised intradermally and 63 of these immunised percutaneously ($\chi^2=30.6$, $df=1$, $p<0.05$). The proportion of positive results on Heaf testing was similar among the different ethnic groups—for example, 69% of Asians (108/157) and 70% of white Europeans (12/17). The table shows the number of positive results according to the method of immunisation and the doctor giving the immunisation. The two methods gave similar rates of conversion. The rate of conversion differed significantly among doctors when the intradermal method was

used but not when the percutaneous method was used. Babies with negative results on Heaf testing will be tested again when they are 1 year old.

Comment

The percutaneous method of immunising infants with BCG is safe and effective,³ although it is rarely used (unpublished data). We have reported a considerable number of cases of tuberculosis in unimmunised children.⁴ We currently immunise all babies of Asian origin but only white babies and children who have been in contact with patients with tuberculosis before they start school, and perhaps this policy needs reappraisal.

We recommend the use of the percutaneous method, particularly if large numbers of infants are to be immunised. This method is less dependent than the intradermal method on the doctor giving the immunisation, produces less scarring, and has a similar rate of conversion.

We thank the parents, health visitors, and staff of the chest clinic for help with this study.

Results of Heaf tests according to doctor who gave immunisation and method of immunisation. Values are expressed as number of positive results/number of babies immunised (percentage)

	Doctor who gave immunisation			Total
	A	B	C	
Percutaneous	26/36 (72)	27/42 (64)	15/22 (68)	68
Intradermal*	26/41 (63)	28/40 (70)	19/19 (100)	73

* $\chi^2=9.02$, $df=2$, $p<0.02$.

- 1 Curtis HM, Leck I, Bamford FN. Incidence of childhood tuberculosis after neonatal BCG vaccination. *Lancet* 1984;i:145-8.
- 2 Packe GE, Innes JA. Protective effect of BCG vaccination in infant Asians: a case-control study. *Arch Dis Child* 1988;63:277-81.
- 3 Lorber J. Freeze dried BCG vaccination of newborn infants by the multiple puncture method. *Tubercle* 1959;40:21-5.
- 4 Cundall DB, Pearson SB. Inner city tuberculosis and immunisation policy. *Arch Dis Child* 1988;63:964-6.

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Withdrawal of continuous ambulatory peritoneal dialysis to treat mild peritonitis

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To limit admission to hospital and the use of costly or toxic antibiotics we treated patients who developed peritonitis during continuous ambulatory peritoneal dialysis by temporarily interrupting the dialysis, as suggested by Guiberteau *et al.*¹ We restricted this method of treatment to generally healthy patients with mild peritonitis.

Patients, methods, and results

Between 1 June 1986 and 31 July 1987 patients who developed peritonitis at home were treated by temporary interruption of dialysis unless they had one of several contraindications (box). The decision to interrupt dialysis or to use classic treatment was taken on admission purely on clinical grounds. Selected patients had three rapid exchanges of 2 litres without dwell time; if the third bag of effluent was cloudy the patient was not treated by interrupting the dialysis. The catheter was then filled with 500 mg cephalothin in saline, which is necessary to avoid persistence of bacteria,¹ and closed. No attempt was made to inject cephalothin into the peritoneal cavity, and no systemic antibiotics were given. Patients were discharged and seen again 48 hours later. Two rapid 2 litre exchanges were then given, and dialysis was resumed as usual.

Forty six episodes of peritonitis occurred during the study; 22 episodes in 12 patients were treated by

Contraindications to using temporary interruption of continuous ambulatory peritoneal dialysis to treat peritonitis

- Long delay before referral (>12 hours)
- Fever
- Purulent effluent (and third lavage bag cloudy)
- Obvious infection around the catheter
- Poor general condition (malnutrition)
- Immune suppression
- Recent abdominal surgery (for example, catheter insertion)
- Recent peritonitis (<15 days)
- Abnormal peritoneal cavity (for example, hernia)
- Abnormal peritoneum (for example, asbestosis)
- Disconnect systems for attachment of lavage bags

interruption of dialysis. Initial cell counts in the dialysis fluid ranged from 0.13 to 16×10⁹/l (mean 28×10⁹/l) with more than 50% neutrophils. Interruption of dialysis for 48 hours was well tolerated in all cases. When dialysis was resumed the first lavage bag was often cloudy, but the second bag was clear in all but one patient. Eighteen episodes in 10 patients were cured by interrupting dialysis, and the patients stayed free from peritonitis for at least 15 days without intraperitoneal or systemic antibiotic treatment.

Several organisms were isolated—namely, *Staphylococcus epidermidis* (four patients), *Staph aureus* (two), *Streptococcus faecalis*, and non-groupable streptococcus and *Escherichia coli* (one each). Three patients with *Staph epidermidis* peritonitis required conventional antibiotic treatment in the 15 days after dialysis was interrupted. One had pus in her catheter, which was aspirated, though the lavage bags were clear when dialysis was resumed. The two other patients developed peritonitis again after being free of it for

one week; one of them had a vaginocoele after four operations for megaureters. In one patient all bags remained cloudy when dialysis was resumed, and cultures of the fluid grew *Candida parapsilosis*.

Comment

Our results confirm that the natural defences of the peritoneum can deal successfully with infection if unhampered by the dialysis fluid.¹ Temporary interruption of dialysis avoids protein loss and fluid retention due to peritoneal inflammation, limits the use of costly or toxic antibiotics, and preserves remaining renal function. We found that our patients, having been treated by interruption of dialysis once, subsequently tended to refer themselves early in the hope of being able to receive this short treatment again. The treatment avoids the loss of phagocytic cells and opsonins that occurs during dialysis and allows these cells to be concentrated into a small volume of peritoneal fluid, thus increasing the chance of phagocytosis. It also avoids the detrimental effect of dialysis fluid on phagocytic cells,² which may enhance survival of bacteria within leucocytes,³ and on the mesothelial cells.⁴

Interruption of dialysis was regularly effective and was not detrimental to peritoneal function. We believe that this was because of our careful selection of cases and recommend that the treatment is used only in the absence of contraindications. Immediate failure of this treatment was unusual. If not due to the presence of unusual pathogens it would suggest persisting infection from colonisation of the catheter or, if infection were present at the exit site, covert infection around the catheter. In either case the catheter should be removed, as in relapse of peritonitis after conventional treatment.⁵

- 1 Guiberteau R, Chapois D, Nony A, d'Eyzac AT. Treatment of peritoneal infection by the natural defences of the peritoneal cavity. *Contrib Nephrol* 1987;57:92-100.
- 2 Duwe AK, Vas SI, Weatherhead JW. Effects of the composition of peritoneal dialysis fluid on chemiluminescence, phagocytosis, and bactericidal activity in vitro. *Infect Immun* 1981;33:130-5.
- 3 Buggy BP, Schaberg DR, Swartz RD. Intraleucocytic sequestration as a cause of persistent *Staphylococcus aureus* peritonitis in continuous ambulatory peritoneal dialysis. *Am J Med* 1984;76:1035-9.
- 4 Gallimore B, Gagnon RF, Stevenson MM. Cytotoxicity of commercial peritoneal dialysis solutions towards peritoneal cells of chronically uremic mice. *Nephron* 1986;43:283-9.
- 5 British Society for Antimicrobial Therapy. Diagnosis and management of peritonitis in continuous ambulatory peritoneal dialysis. *Lancet* 1987;i:845-8.

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Laxative properties of indigestible plastic particles

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The effects of wheat bran on faecal mass and transit time through the colon have been attributed to stimulation of bacterial growth and retention of water by the fibre matrix. Neither explanation is entirely satisfactory: bran can accelerate transit time in germ free rats,¹ and its water holding capacity is quite low and likely to be further reduced by the action of colonic bacteria. The fact that coarse bran has a greater laxative effect than fine bran suggests that the particles themselves may stimulate the colon. To test this theory we compared the effect of supplementing the diet with either coarse wheat bran or indigestible plastic particles cut to the same size as the flakes of bran.

Subjects, methods, and results

The study was carried out on 12 healthy male volunteers and consisted of three randomised 10 day periods, during which the men ate their normal diet either by itself or supplemented with 15 g plastic particles (<2 mm in diameter) daily or 37.5 g coarse wheat bran daily (calculated to provide 15 g undigested residue to the caecum daily).

All stools expelled in the last seven days of each period were collected in plastic bags and weighed. The volunteers kept daily records of their food intakes and episodes of flatulence. They assessed the consistency of all stools by comparison with standard photographs² and rated the ease of defecation on a visual analogue scale. To calculate the transit time through the whole gut the excretion of 15 radio-opaque markers ingested daily by each volunteer was measured fluoroscopically.³

The results from each 10 day period were compared with Student's paired *t* test and Wilcoxon's signed rank sum test. Both tests gave identical levels of significance.

The composition of the subjects' normal diet did not alter throughout the three study periods. Supplementation of the diet with plastic particles significantly increased faecal mass by about 40 g a day, increased the frequency of defecation, and reduced the transit time through the whole gut (table). The consistency of the stools was significantly softer when the volunteers ingested plastic. Differences in ease of defecation and episodes of flatulence compared with the period of normal diet alone were not significant.

Ingestion of wheat bran also significantly increased faecal mass and reduced the transit time through the gut (table). Frequency of defecation and the consistency of the stools were not significantly different from those during the period of normal diet alone. They were, however, similar in magnitude to those observed when plastic particles were ingested. There were no significant differences in any variable when the volun-

Mean (SE) measurements of bowel function in 12 volunteers during three study periods (ingestion of normal diet alone or plus plastic particles or wheat bran)

	Normal diet alone	Normal diet plus plastic particles	Normal diet plus wheat bran	Differences between periods		
				Plastic particles v normal diet alone	Wheat bran v normal diet alone	Wheat bran v plastic particles
Mass of faeces (g/week)	1060 (120)	1350 (140)	1560 (160)	287 (88)*	419 (181)*	161 (155)
Transit time through whole gut (h)†	54.2 (6.2)	38.2 (5.2)	42.3 (4.4)	-10.0 (3.5)*	-10.7 (3.7)*	-4.9 (3.1)
Stool frequency/week	6.9 (0.9)	8.3 (0.7)	9.1 (0.8)	1.4 (0.3)*	1.5 (0.8)	0 (0.7)
No of flatulent episodes/week	55 (19)	64 (23)	76 (27)	10 (10)	9 (10)	-3 (19)
Rating of stool consistency‡	5.6 (0.3)	5.1 (0.3)	5.1 (0.3)	-0.4 (0.2)*	-0.3 (0.2)	0.1 (0.2)
Rating of ease of defecation§	3.2 (0.6)	2.6 (0.5)	2.5 (0.5)	-0.6 (0.5)	-0.8 (0.5)	0.1 (0.2)

**p* < 0.05, Wilcoxon's signed rank test and Student's *t* test.

†Median of values obtained on days 6-10.

‡Scale ranging from 1 (liquid) to 8 (hard pellets).

§Visual analogue scale ranging from 0 (no effort) to 10 (extreme effort).