Proceedings of the Nutrition Society

Abstracts of Original Communications

A joint meeting of the Clinical Nutrition and Metabolism Group of the Nutrition Society and the British Association for Parenteral and Enteral Nutrition was held at Harrogate International Centre on 13–15 November 2001, when the following papers were presented.

All abstracts are prepared as camera-ready material.

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Fistuloclysis successfully avoids the need for total parenteral nutrition (TPN) in patients with acute intestinal failure. By H.R. RAVISHANKAR, A. RENSHAW, K. MORRISON, A. TEUBNER, I.D. ANDERSON and G.L. CARLSON, *Intestinal Failure Unit and Department of Academic Surgery, Hope Hospital, Salford M6 8HD*

A significant proportion of patients with acute intestinal failure (IF) due to enteric fistulation are referred to specialised intestinal failure units because of the nursing expertise required for total parenteral nutrition (TPN). This might be avoided if a more simple but effective means of nutritional support was available.

The aim of this study was to test the hypothesis that feeding via an intestinal fistula (fistuloclysis) would obviate the need for TPN in patients with acute intestinal failure secondary to enterocutaneous fistulae.

Fistuloclysis was attempted in all patients with jejuno- or ileocutaneous fistulae with muco-cutaneous continuity, provided that more than 75 cm of intact small intestine was available for absorption distal to the fistula. Feeding was achieved by screening radiologically a 16 FG catheter into the bowel distal to the fistula. Both polymeric and semi-elemental feeds were used but chyme from the proximal fistula limb was not reinfused. Energy requirements and nutritional status were assessed by one dietician on admission using a prediction equation, prior to initiating fistuloclysis and again at time of hospital discharge.

Between November 1997 and December 2000, eighteen consecutively admitted eligible patients were studied (13M, 5F, median (range) age 53 (20–79) years). All patients had developed enterocutaneous fistulae following abdominal surgery and all were receiving TPN (7 nights/week) at the time of admission. TPN had been administered for median (range) 4 (0.5–44) weeks prior to attempted fistuloclysis. Median estimated calorie and nitrogen requirements on admission were 7950 kJ (1900 kcal) (range 6700–9728 kJ (1600–2325 kcal)) with 1 g of nitrogen per 850 kJ (203 kcal) (range 594–1021 kJ (142–244 kcal)). Successful fistuloclysis was defined as the ability to maintain satisfactory fluid, electrolyte and nutritional status without the need for TPN.

Fistuloclysis successfully replaced TPN entirely in fourteen of the eighteen patients (77.7%).

	BM (kg/m^2)I	Number of	Oral kJ (kcal)	Fistuloclysis kJ (kcal)	TPN kJ (kcal) (kg/d)	Albumin
	Median (range)	patients on TPN	Median (range)	Median (range)	Median (range)	(g/l)
Admission	23.7 (15.6–36.9)	18	2300 (550 kcal) (0–6276 (0–1500))	Nil	111 (27) (71–166) (17.06–39.73))	29.8
Discharge	24.2 (18.4–36.1)	4	2510 (600) (1255–6276 (300–1500))	3680 (1725) (7220–9160 (880–2190))	106 (25) (105–106) (25–25)	35.0

Patients remained anthropometrically and biochemically stable over a median (range) follow up period of 152.5 d (48–385) during which eight patients (57.1%) successfully underwent intestinal reconstructive surgery. No patient had to resume TPN and no significant complication occurred.

TPN continued to be required in four patients (28.5%) due to failure to maintain nutritional status (*n* 3) and intolerance of enteral feeding (*n* 1).

Fistuloclysis can successfully replace TPN in the management of selected patients with acute IF. Increased safety and reduced cost may make fistuloclysis the form of nutritional support of choice in acute IF with enterocutaneous fistulae when there is mucocutaneous continuity, and may obviate the need for management of such patients in a specialised intestinal failure unit.

Glutathione status in liver disease. By A.E. WISKIN, G. CONSTABLE, J. JACKSON, M. STROUD and S. WOOTTON, *Institute of Human Nutrition, University of Southampton, Southampton, SO16 6YD*

Altered plasma glutathione status has been demonstrated in liver disease (Ookhtens & Kaplowitz, 1998) as plasma-reduced glutathione (GSH) is thought to reflect hepatic synthesis. There is little published data on whole-blood glutathione levels in liver disease, which may reflect a more systemic response to an oxidative load from liver disease, although low whole-blood GSH concentration has been demonstrated in six cirrhotic patients (Andersson *et al*. 1999). The objectives of this study were to explore the relationship between whole-blood and erythrocyte GSH, the activity of the glutathione redox cycle, liver disease and malnutrition.

Eighteen patients with chronic liver disease: nine alcoholic liver disease (ALD), four primary biliary cirrhosis, two chronic active hepatitis and three cryptogenic cirrhosis (eight men and ten women, aged 35–70 years) were recruited to the study and compared with a reference group of nineteen adults (ten men, nine women, aged 22–85 years). Nutritional status was assessed by a combination of clinical history, subjective global assessment and anthropometry. The severity of liver disease was classified according to the Childs-Pugh score. A fasted venous blood sample was taken by venepuncture from each patient and whole blood and erythrocyte GSH concentrations were measured by HPLC. Erythrocyte glutathione reductase (GR) and glutathione peroxidase (GPx) activity were measured by spectrophotometry.

Patient group	Whole blood GSH (μmol/l blood)		Erythrocyte GSH (μmol/l red cells)		GR U per G Hb		GPx U per G Hb	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Reference	828	70	2187	451	6.18	1.91	13.89	2.87
Non-ALD	874	219	2237	460	6.99	1.69	13.80	3.09
ALD	631	145	1942	566	9.12	1.78	11.36	3.30
ALD in-patients	516	69	1646	278	9.59	2.56	10.84	4.35

Patients with ALD had low whole-blood GSH compared with the reference group ($P<0.01$). However, GSH in whole blood resides almost completely within erythrocytes, so correction by haematocrit provides the erythrocyte GSH concentration. Patients with alcoholic and non-alcoholic liver disease showed no significant difference in erythrocyte GSH compared with the reference group. Within the ALD group, however, four had low erythrocyte GSH ($P<0.01$) and raised GR activity ($P<0.01$), but normal GPx activity compared with the reference group.

Results suggest that erythrocyte GSH is maintained in stable chronic liver disease. Four of the patients with ALD, however, had altered glutathione status. All of these patients had acute severe illness at the time of study. One patient had developed a spontaneous bacterial peritonitis and the other three all had acute alcoholic steatohepatitis. They were all malnourished, with severe disease (Charles-Pugh grade C), and had raised white-cell counts reflecting a systemic inflammatory response. These patients had low erythrocyte GSH despite an apparent upregulation of GR. These findings suggest that patients with severe complicated ALD, who are likely to have significant oxidant stress, may upregulate the activity of GR to maintain erythrocyte GSH levels. In this study, patients with severe ALD had low erythrocyte GSH despite an upregulation of GR, which may relate to poor nutritional status or the severity of the inflammatory response and consequent metabolic stress.

Andersson A, Lindgren A, Arnadottir M, Prytz H & Hultberg B (1999) *Clinical Chemistry* **45**, 1084–1087.
Ookhtens M & Kaplowitz N (1998) *Seminars in Liver Disease* **18**, 313–328.

Effect of different rates of weight loss in healthy lean men on total energy expenditure and physical activity. By E.R. GIBNEY[1,2], A.M. JOHNSTONE[2], P. FABER[2], R.J. STUBBS[2] and M. ELIA[3], [1]*Department of Biological and Nutritional Sciences, University of Newcastle, Newcastle Upon Tyne NE1 7RU*, [2]*Rowett Research Institute, Greenburn Road, Bucksburn, Aberdeen AB21 9SB*, [3]*Institute of Human Nutrition, Southampton General Hospital, Southampton SO16 6YD*

Weight loss has been reported to have variable and conflicting effects on lethargy, physical activity (PA) and total energy expenditure (TEE) (Keys *et al*. 1950; Taylor & Keys, 1950). This may be due to the confounding effects of disease and both the rate and magnitude of weight loss, which are affected by disease. The present study aimed to test the hypothesis that the rate of weight loss affects PA and TEE, independently of the magnitude of weight loss and in the absence of disease.

Six healthy lean men (mean age 39.8 (SD 11.6) years, weight 71.5 (SD 9.2) kg, height 1.8 (SD 0.1) m and BMI 22.3 (SD 2.6) kg/m^2) were admitted to a metabolic suite and stabilised on a diet at 1.4×BMR for 1 week (maintenance period). Subjects then starved (water only in starvation period), for a period of 4–5 d, which induced a mean weight loss of 5.2 (SD 1.3)%. The subjects' weights were then frozen whilst receiving a standard maintenance diet to maintain their reduced weight for 1 week (reduced maintenance period). They were then given *ad libitum* access to a selection of food for a period of 2 weeks (*ad libitum* feeding). A second group of five subjects (mean age 47.2 (SD 7.2) years, weight 67.0 (SD 8.2) kg, height 1.8 (SD 0.1) m and BMI 21.4 (SD 2.5) kg/m^2) was studied in the same manner, with the exception that they received a very low energy diet (VLED) containing 2.5 MJ/d over a period of 19–21 d, achieving a total weight loss of 9.0 (SD 0.9)%. Basal metabolic rate (BMR) was measured by the ventilated hood technique using a Deltatrac Metabolic Monitor (Datex). Measurements were taken at the end of maintenance, at 5% (Starvation – 5%, VLED – 5%), at 9% weight loss (VLED – 9%), at the end of the reduced maintenance, and at the end of the *ad libitum* feeding periods. TEE was measured daily using a Caltrac accelerometer and calculated using measured BMR. Dietary-induced thermogenesis (DIT) was assumed to be 10% of energy intake. PA energy expenditure (PAEE) was calculated as TEE–BMR–DIT. PA energy expenditure (PAEE) was also calculated as a percentage of TEE (PAEE/TEE×100).

	BMR (MJ/d)†	TEE (MJ/d)	PAEE (MJ/d)	PAEE (%TEE)
Starvation group				
Maintenance	6.6±0.4	9.6±1.0	2.3±1.0	20.9±7.1
Starvation – 5% weight loss	6.7±0.4	8.6±1.1*	1.3±0.8*	12.7±4.9*
Reduced maintenance	6.1±0.7***	9.6±2.1	2.6±1.6	21.7±8.5***
Ad libitum feeding	7.0±0.6	12.1±2.2	3.6±1.6	24.4±7.1
VLED group				
Maintenance	6.1±0.6	8.6±1.1	1.6±0.7	17.8±6.2
VLED – 5% weight loss	5.8±0.4	7.8±0.7	1.6±0.8	16.8±4.6
VLED – 9% weight loss	5.8±0.3	7.3±1.1*	1.2±0.5	15.8±6.0
Reduced maintenance	5.9±0.3	8.0±0.7	1.4±0.5	16.5±4.4
Ad libitum feeding	6.2±0.6	9.2±0.8	1.5±0.7	16.05±5.1

Results are expressed as mean and SD. *Significantly lower from maintenance (P<0.05; paired sample Student's t test). ***Significantly different from 5% weight loss (P<0.005; paired sample Student's t test) †Change in the VLED group is significantly less than in the starvation group at 5% weight loss (P<0.05; split plot design ANOVA (SPANOVA)).

There was a significant decrease in TEE and percentage of TEE due to physical activity during starvation, followed by a significant reversal during the reduced-maintenance period, when the rate of weight loss was reduced to zero by establishing weight stability. In the VLED group, in which rates of weight loss were slower than in the starvation group, there were no significant changes at 5% weight loss and no significant improvements during the reduced-weight maintenance period, which followed 9% weight loss.

This study suggests that in healthy lean men, PAEE and TEE, measured by an accelerometer, are affected by the rate of weight loss independently of the magnitude of weight loss.

This work was supported by The Medical Research Council, Rowett Research Institute and Abbot Laboratories.

Keys A, Brozek J, Henschel A, Mickelsen O & Taylor H (1950) *The Biology of Human Starvation*. Minneapolis, MN: University of Minnesota Press

Taylor H & Keys A (1950) *Science* **112**, 215–218.

Preoperative carbohydrate provision attenuates loss of lean body mass in elective surgical patients. By K. YUILL[1], R.A. RICHARDSON[2], R. PARKS[3], O.J. GARDEN[3] and H.I.M. DAVIDSON[2], [1]*Department of Dietetics, Royal Infirmary, Edinburgh EH3 9YW*, [2]*Faculty of Health Science, Queen Margaret University College, Edinburgh EH12 8TS and* [3]*Department of Clinical and Surgical Sciences, University of Edinburgh, Edinburgh EH3 9YW*

Traditionally, preoperative management of patients includes a significant period of fluid and nutrient deprivation. Recently, this approach has been challenged and it has been suggested that the provision of a utilisable energy source to meet the metabolic demand in the early post-surgical period improves time to recovery (Ljungqvist *et al.* 1998). This study assessed changes in body composition and length of stay in patients undergoing major open surgery.

Elective surgical patients (predominantly hepatico-pancreatic and upper gastrointestinal resections) were recruited to this double-blind study and randomised to the control group, who received a placebo drink (fluid and electrolytes) or the 'preOp' group (12.6 g carbohydrate/100 ml and electrolytes). Patients in both groups consumed 800 ml of the drink the evening prior to surgery and 400 ml 2–3 h before surgery. Indicators of nutritional status were measured preoperatively and on days 1 and 6 post-surgery and at discharge. These included BMI, arm anthropometry and time to discharge. Peri- and postoperative complications were recorded. Data from patients receiving control or 'preOp' drinks were compared using t tests.

In total, sixty-five patients were recruited, thirty-four randomised to the control (M:F=19:15) and thirty-one to the 'preOp' (M:F=20:11) groups, respectively. Patients were comparable in terms of age (Control: 52.1±2.4 years *v.* 'preOp': 52.8±2.5 years and surgical procedures undergone. Preoperatively, BMI was similar in both groups (Control: 25.1±1.7; 'preOp': 25.2±1.2) and did not differ at discharge. Loss of arm muscle circumference indicated by change from baseline to discharge was significantly greater in the control group (Control: –1.1±0.15 cm and 'preOp': –0.5±0.16 cm, P<0.05)). Change in triceps skinfold measurements were similar in the 'preOp' and control groups (Control: –0.9±0.47 mm *v.* 'preOp' –1.06±0.25 mm, NS). No complications (e.g. aspiration) were recorded as a result of drink consumption and clinical complications were recorded in six control and six 'preOp' patients. Length of stay was 10 (IQR=6) d in control and 8 (IQR=4) d in 'Preop' patients.

These results suggest that the provision of carbohydrate energy in fluid form immediately before surgery is well tolerated by the patient and accepted by the clinical team. In addition this energy source appears to attenuate the depletion of skeletal muscle mass normally associated with the metabolic stress of surgery. Whilst no changes in BMI were seen, the 'preOp' group showed preservation of muscle mass indicated by arm anthropometry when compared with patients in the placebo group. Arm muscle circumference has the advantage of being less affected by the fluid shifts and sub-clinical oedema that mask weight changes in the postoperative period. No significant reduction in length of stay was evident with administration of 'preOp' but there was a trend towards reducing the period of hospitalisation. These findings warrant further investigation and should focus on elucidation of the metabolic events associated with preservation of skeletal mass and whether this is paralleled by functional integrity.

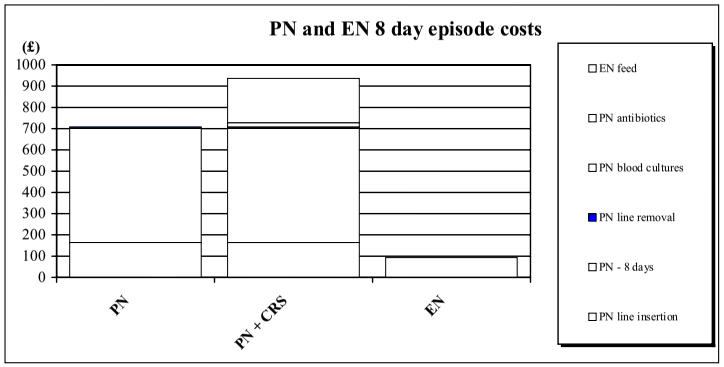
In conclusion, energy as carbohydrate provided preoperatively as a drink is well tolerated and may serve to reduce the loss of lean body mass associated with surgical stress.

Ljungqvist O, Nygren J & Thorell A (1998) *Clinical Nutrition* **17,** Suppl. 1, 65–71.

Cost benefits of a hospital nutrition support team. By J.F. KENNEDY, J.M.D. NIGHTINGALE, and M. CURRIE, *Gastroenterology Centre, Leicester Royal Infirmary, Leicester LE1 5WW*

A hospital nutrition support team (NST) commonly has to justify itself in terms of cost. A team that worked across all adult directorates of a teaching hospital was started in November 1999. Having agreed the team's aims and objectives, careful records of all patients seen and their outcome was recorded and compared to a retrospective audit of all patients given parenteral nutrition (PN) for the previous 12 months.

In the pre-team year there were eighty-two PN episodes (fifty-four patients), 665 PN days and a catheter-related sepsis (CRS) rate of 71% (seven infections per 100 PN days). In the NST year, there were 133 referrals for PN but only seventy-eight PN episodes (seventy-five patients; 59% of referrals), 752 PN days and a CRS rate of 29% (three infections per 100 PN days), although this was 7% (one infection per 100 PN days) in the last 3 months. The mean duration of PN increased from 8 to 10 d.



Tangible cost savings for the NST year are derived from costs associated with avoided PN episodes (PN line insertion, 8 d course of PN and line removal), associated reduction in CRS (blood cultures, PN line tip culture, intravenous antibiotics) and a reduced CRS for those patients receiving PN under the care of the NST in its first year. Fifty-five PN episodes (£708.98 per episode) were avoided, giving a saving of £38 958.70. The associated costs for these fifty-five patients, assuming the pre-team year 71% CRS rate, relates to thirty-nine avoided CRS episodes at £227.82 per episode, totalling £8884.98. As these patients received enteral nutrition (EN), EN episodes of 8 d duration (enteral feed tube, 1.5 litres EN for 8 d, pump set) cost £92.88 per episode, totalling £5108.40 for fifty-five patients. The effect of the NST in reducing CRS in its patients in the first year resulted in thirty-five avoided CRS episodes, saving £7973.70. The cumulative cost saving for the first year of the NST was £50 708.98.

Other cost benefits include a team-led service for bedside parenteral feeding line reduced wastage of PN bags, increased use of standard PN bags and a blood testing regimen that led to fewer tests.

The cost of a NST Nurse Specialist and Nutrition Team Dietitian can be justified in terms of tangible cost savings of £50 708.98 for the first year.

Identifying patients with nutritional problems: a comparison of two nutrition screening tools. By C.E. WEEKES[1] and M. ELIA[2], [1]*Department of Nutrition and Dietetics, Guy's and St Thomas' Hospital NHS Trust, London SE1 7RH and* [2]*Institute of Human Nutrition, Southampton General Hospital, Southampton SO16 6YD*

In view of the continuing high prevalence of unrecognised malnutrition in hospitals, recent reports have recommended that patients should be routinely screened using validated tools. One way of establishing validity is to compare different methods of screening (concurrent validity). This study aimed to examine the concurrent validity of the Malnutrition Advisory Group (MAG) tool (MAG, 2000) compared with a tool based on the BAPEN Four Questions (BAPEN4; Lennard-Jones *et al.* 1995) and with an independent assessment by a dietitian.

The study involved 100 patients admitted to General Medical and Elderly Care wards at St Thomas' Hospital. The group consisted of sixty-three men and thirty-seven women with a mean age of 59 (SD 5) years and BMI 25.2 (SD 9.9) kg/m^2. Nurses obtained the necessary information required by the BAPEN4 and MAG tools within 72 h of admission. The dietitian independently assessed the patients over the same period. The BAPEN4 was based on four variables (weight, height, recent weight loss and dietary intake) with a scoring system designed so that patients could be placed into one of two categories of undernutrition (low risk and higher risk; Weekes, 2000). The MAG tool assigned patients to one of three categories (low, high and medium risk) and also two categories (low and medium/high risk). Patients who were likely to have no intake for at least 5 d were placed in the high-risk category. The dietitian also graded patients into three categories (low, medium and high risk) and two categories (low and medium/high risk) according to routine dietetic practice. Agreement between the two methods was noted and used to calculate the kappa statistic (κ) and its standard error (SE(κ)), a chance-corrected measure of agreement. Sign test was used to assess whether there were significant differences between methods that employed two categories. The following results were obtained.

	Agreement (proportion)	κ	SE(κ)	Sign test (*P* value)
MAG tool *v.* BAPEN 4 (2 categories)	0.87†	0.728	0.069	0.022
MAG tool *v.* dietitian (2 categories)	0.91	0.804	0.062	0.508
BAPEN 4 *v.* dietitian (2 categories)	0.92	0.834	0.056	0.070
MAG tool *v.* dietitian (3 categories)	0.80	0.771*	0.060	1.000

†0.55 low risk, 0.32 higher risk. *Weighted kappa = 0.812.

Although the agreement between the two screening tools was good/very good (Landis & Koch, 1977), the McNemar test indicated there was a significant systematic difference between them, with the BAPEN4 classifying more patients into the higher-risk category. This may be because the BAPEN4 included a question on recent dietary intake, which assigned seven patients who were in the lower MAG risk category into the higher-risk category using BAPEN4. In addition, while the MAG tool allocated a score based on the quantity of weight loss, BAPEN4 did not. As a result, two patients with minimal weight loss (i.e. <5%), were assigned to the higher-risk category using BAPEN4.

This study suggests good/very good concurrent validity between the MAG and BAPEN4 screening tools, and very good concurrent validity between each of these and the assessment made by the dietitian. The significant systematic difference between the two tools is due to differences in the criteria used by the tools and/or their interpretation by the observers.

Landis JR & Koch GG (1977) *Biometrics* **33**, 159–174.
Lennard-Jones JE, Arrowsmith H, Davison C, Denham AF & Micklewright A (1995) *Clinical Nutrition* **14**, 336–340.
Malnutrition Advisory Group of the British Association for Parenteral and Enteral Nutrition (2000) *Guidelines for Detection and Management of Malnutrition*. BAPEN: Maidenhead.
Weekes CE (2000) *Proceedings of the Nutrition Society* **59**, 153A.

Comparison of saliva and urine samples for estimating total body water by ^{2}H dilution in children. By J.C.K. WELLS[1], O. DEWIT[2], M. ELIA[3] and N.J. FULLER[1], [1]*Childhood Nutrition Research Centre, Institute of Child Health, London WC1N 1EH,* [2]*Clinical Pharmacology Department, SmithKline Beecham Pharmaceuticals, Harlow CM19 5AW and* [3]*Institute of Human Nutrition, Southampton General Hospital, Southampton SO16 6YD*

^{2}H dilution is now routinely used to measure total body water (TBW) and hence body composition in both health and disease. Early studies in children used urine samples both for ethical reasons and for convenience. Studies in adults have shown that equilibration of tracer occurs in plasma and saliva by 3 h, and in urine by 5 h, but that saliva and plasma are more accurate than urine for individual measurements of TBW (Wong *et al*. 1988). This issue has not been investigated in children, despite their higher rate of water turnover compared with adults. In particular, children may urinate more frequently than adults during the equilibration period, but the effect of this on urine enrichment is not known. The aim of this study was to compare TBW values measured by saliva (TBW-S) at 3 h and urine (TBW-U) at 5 h in children, using TBW-S as the reference method.

Ten children aged 10–11 years volunteered for the study: five boys, mean weight 42.3 (SD 6.9) kg; height 1.47 (SD 0.07) m; five girls, mean weight 40.9 (SD 8.3) kg; height 1.48 (SD 0.05) m. Each child was given deuterium (^{2}H) oxide at 0.4 g per kg body weight. Saliva samples were collected hourly for 5 h post-dose, and a sample from all urinations was collected until 6 h post-dose. The first urine sample at or after 5 hours post-dose was termed TBW-U. The children were allowed to consume their usual school-day intakes of foods and fluids. Urine and saliva samples were analysed using isotope-ratio mass spectrometry (Micromass, Cheshire).

Equilibration of ^{2}H in saliva was completed by 3 h. Subsequent changes in TBW-S were related to food and fluid intakes. Girls urinated on average 3.2 times, and boys on average 2.2 times, up to and including TBW-U. The mean time of TBW-U was 5.5 (SD 0.4) h, range 5–6 h. Mean difference (U–S) relative to TBW-S was –0.6% (NS) for girls and 3.3% for boys (P=0.061). When the children were divided, regardless of sex, into those (n 5) who urinated only once prior to providing TBW-U and those (n 5) who urinated twice or more often (mean 2.4 times), the difference in agreement between TBW-U and TBW-S was significant (once: 3.6%; twice or more often: –0.9%; P<0.03). The overestimate of TBW-U in those who urinated only once before providing TBW-U was equivalent to a mean underestimation of fat mass by 15.8%.

Urine samples introduce inaccuracy when measuring TBW in children using the plateau method of calculation, as the post-dose pattern of urination influences enrichment of the urine. This problem may be compounded by the difficulty of collecting a urine sample at exactly 5 h post-dose, and may affect the sexes differently. Saliva, and by inference plasma, samples are more appropriate for measuring TBW in children when using the plateau method.

Wong WW, Cochran WJ, Klish WJ, Smith EO, Lee LS & Klein PD (1988) *American Journal of Clinical Nutrition* **47**, 1–6.

Energy turnover during home enteral tube feeding. By C. HENRY[1], A. WRIGHT[2], O. DEWIT[3], C. GREEN[4] and M. ELIA[5], [1]*Department of Nutrition and Dietetics, Addenbrooke's Hospital, Cambridge,* [2]*Elsie Widdowson Laboratory, Cambridge,* [3]*Neonatology Department, Addenbrooke's (Rosie) Hospital, Cambridge,* [4]*Nutricia Healthcare, Zoetermeer, The Netherlands and* [5]*Institute of Human Nutrition, Southampton*

There is little quantitative information about the energy requirements and physical activity of patients receiving home enteral tube feeding (HETF), despite its implications for nutrient status. When energy intake from feed is low, the intake of all other nutrients is low, which may predispose to specific deficiencies. The aims of the study were (1) to use the doubly labelled water and other techniques to measure energy turnover and its components (energy intake (EI), total energy expenditure (TEE), resting energy expenditure (REE) and physical activity level (PAL)) in a group of weight-stable patients receiving HETF, (2) to assess the value of accelerometers and activity diaries against these techniques, and (3) to assess EI, and the proportion derived from feed and oral intake, in all adult patients receiving HETF in a Health District.

The first group consisted of five patients (3F, 2M; three with cerebrovascular accident (CVA) and two with oesophageal obstruction), with a mean age of 75 (SD 13) years, weight 62 (SD 9) kg and weight stability, defined as <2 kg change in body weight in the previous 3–6 months (recorded every 1.5–2 months whilst on HETF). TEE was measured over a 14 d period using the doubly labelled water technique, and REE using open circuit indirect calorimetry over 30 min after a 6–8 h fast. PAL was assessed as a ratio of TEE:REE obtained by the above methods, as well as by activity monitors (Caltrac accelerometers) and activity diaries. EI was assessed over 7 d by dietary records and by measurements of the volume of feed administered. The second group consisted of all patients receiving HETF in a Health District (twenty-eight women (age 63 (SD 19) years and weight 54 (SD 12) kg) and twenty men (age 64 (SD 20) years and weight 67 (SD 14) kg), with the following diagnoses: CVA (n 14); ear, nose and throat tumours (n 7); cerebral trauma (n 4); motor neurone disease (n 6); multiple sclerosis (n 4); oesophageal stricture (n 4); oesophageal cancer and other diagnoses (n 9). All patients in this group had measurements of total EI which was expressed in relation to REE predicted by the Schofield equation (World Health Organisation, 1985).

In the first group, TEE was 6.92 (SD 2.15) MJ/day (1654 (SD 514 kcal/day), REE was 5.27 (SD 0.57) MJ/day (1260 (SD 136) kcal/day), corresponding to 101 (SD 9)% of that predicted by the Schofield equation, EI was 6.49 (SD 1.91) MJ/day and PAL was 1.30 (SD 0.30). PAL assessed by activity monitors (1.27, SD 0.18) and activity diaries (1.27, SD 0.18) were also low compared with mean values of 1.5–1.8 reported in healthy subjects including the elderly (Elia *et al*. 2000). In the second group, total EI was 7.20 (SD 1.67) MJ/day (1720 (SD 239) kcal/day. Of the patients, 67% had no oral EI and the remainder obtained 42% of total EI from oral nutrition. A third of patients (13F, 3M; mean weight 53.3 kg) received a total EI of less than 6.28 MJ/day (1500 kcal/day) and 79% received less than 8.37 MJ/day (2000 kcal/day). In the group as a whole, the ratio EI:$REE_{predicted}$ was 1.33 (SD 0.24), but was lower in those with CVA (1.25, SD 0.17) than those with other diagnoses (1.37, SD 0.25). This ratio rose progressively in weight-losing (1.07, SD 0.25, n 4), weight-stable (1.29, SD 0.21, n 13), and weight-gaining patients (1.45, SD 0.12, n 5). In the remaining patients with fluctuating or uncertain weight, due to lack of documentation in the preceding months, the value was 1.37 (SD 0.24).

The study suggests (1) that energy turnover in a small group of weight-stable patients on HETF is amongst the lowest reported by tracer studies in 'free-living' conditions, (2) that accelerometers and activity diaries adequately predict the low mean PAL values obtained by the doubly labelled water technique, and (3) that enteral formula is the sole source of nutrition in two-thirds of the patients receiving HETF in a Health District and provides a variable contribution to total EI in the remaining one-third.

This study was supported by the MRC and Numico Research (The Netherlands).

World Health Organisation (1985) *A Report of a Joint FAO/WHO/UNU Expert Consultation. Technical Report Series* no. 724. Geneva: WHO.
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Effect of different degrees of energy restriction on subjective and objective measurements of fatigue in healthy lean males. By E.R. GIBNEY[1,2], A.M. JOHNSTONE[2], P. FABER[2], R.J. STUBBS[2] and M. ELIA[3], [1]*Department of Biological and Nutritional Sciences, University of Newcastle, Newcastle Upon Tyne NE1 7RU*, [2]*Rowett Research Institute, Greenburn Road, Bucksburn, Aberdeen AB21 9SB and* [3]*Southampton General Hospital, Southampton SO16 6YD*

Fatigue is a prominent feature of many diseases, but the contribution of malnutrition and recent weight loss to this fatigue is not clear (Hurny *et al.* 1993). The aim of this study was therefore to assess whether recent weight reduction uncomplicated by disease resulted in significant changes in fatigue during weight loss of up to 10% of body weight, and whether the changes were more marked when the weight loss was rapid.

Six subjects (mean age 39.8 (SD 11.6) years, weight 71.5 (SD 9.2) kg, height 1.8 (SD 0.1) m and BMI 22.3 (SD 2.6) kg/m^2) were admitted to a metabolic suite and stabilised on a diet at 1.4×BMR for 1 week (0% weight loss), before the start of starvation (water only). The starvation lasted for 4–5 d and induced a mean weight loss of 5.2 (SD 1.3)% (5% weight loss). A second group of five subjects (mean age 47.2 (SD 7.2) years, weight 67.0 (SD 8.2) kg, height 1.8 (SD 0.1) m and BMI 21.4 (SD 2.5) kg/m^2) was studied in the same manner except that they received a very low-energy diet (VLED) containing 2.5 MJ/d over a period of 19–21 d, achieving a total weight loss of 9.0 (SD 0.9)%. Objective measures of fatigue were assessed using critical flicker fusion (CFF), which tests central nervous fatigue, and hand-grip fatigue (HGF), which tests peripheral muscle function by recording the time taken to reach half the original strength during controlled contractions of fixed duration. Daily subjective feelings of fatigue were assessed using self-administered questionnaires (Epworth Sleepiness Scale (ESS; Johns, 1991), 'Lee' Fatigue Scale (LFS; Lee *et al.* 1991) and UWIST mood and activity checklist for energy (UWIST-E; Matthews *et al.* 1990). Measurements using these methods were made at the end of the initial maintenance period (0% weight loss), then at 5% weight loss (groups 1 and 2) and 9% weight loss (group 2 only). Visual analogue scales (VAS) were used hourly during waking hours to record subjective feelings of energy levels (VAS-EN) and fatigue (VAS-FAT) so that mean daily values could be calculated.

	Starvation group				VLED group					
	0% weight loss		5% weight loss		0% weight loss		5% weight loss		9% weight loss	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Objective measures of fatigue										
CFF (Hz)	60.2	5.9	57.8	4.4	59.3	5.5	57.3	5.7	56.3	5.6
HGF (s)	112.1	22.2	76.7	30.1*	116.2	9.0	84.0	21.0*	61.9	6.4*
Subjective measures of fatigue										
ESS (%)†	36.8	5.2	59.0	4.5*	43.3	6.4	50.0	5.8*	45.0	3.8
LFS (%)	38.2	16.8	52.6	23.3	45.5	10.6	41.7	15.1	40.2	17.0
UWIST-E (%)	62.0	13.3	66.7	9.0	62.5	4.4	63.8	6.1	56.8	6.1**
VAS – EN (%)	45.1	2.6	35.7	8.3*	45.7	1.4	40.8	13.8	39.1	5.1
VAS – FAT (%)†	43.0	5.8	61.5	14.0**	29.5	6.5	37.1	7.2	36.5	2.1

*Significantly different from 0% weight loss (P<0.05; paired sample Student's t-test), **significantly different from 0% weight loss (P<0.005; paired sample Student's t test). †Change due to 5% weight loss seen in VLED group is significantly different from change seen in starvation group (P<0.05, split-plot design ANOVA (SPANOVA)).

Hand-grip fatigue, and subjective feelings of fatigue (VAS-FAT), sleepiness (ESS), and energy levels (UWIST-E, VAS-EN) changed significantly in both the starvation and VLED groups. The changes in feelings of sleepiness (ESS) and VAS-FAT scores were more marked in the starvation group at 5% weight loss (P<0.05). No significant change was demonstrated in CFF in either group.

The results obtained in lean subjects in the absence of disease demonstrated that subjective and objective measures of fatigue and lethargy developed at 5% weight loss, and that the subjective measure of fatigue recorded on VAS and sleepiness were more pronounced during rapid weight loss than slower weight loss, independent of the magnitude of weight lost.

This work was supported by The Medical Research Council, Rowett Research Institute and Abbot Laboratories.

Hurny C, Bernhard J, Joss R, Schatzmann E, Cavalli F, Brunner K, Alberto P, Senn HJ & Metzger U (1993) *Support Care Cancer* **1**, 316–320.
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***Staphylococcus epidermidis* in infant surgical patients on parenteral nutrition: gut carriage and septicaemia.** By I. GHOSH, N. KLEIN, H.K.F. VAN SAENE and A. PIERRO, *Department of Paediatric Surgery and Immunobiology Unit, Institute of Child Health and Great Ormond Street Hospital for Children, London WC1N 1EH*

Parenteral nutrition (PN) is known to alter the gut flora and to promote microbial translocation. *Staphylococcus epidermidis* is responsible for most of the catheter-related sepsis in infants on PN. However the source of this infection is unclear.

The aims of this study were: (1) to characterise the gut carriage of *Staph. epidermidis* during PN in infants and (2) to establish whether the intestine could be a source for the development of septicaemia from this organism.

This was a prospective observational cohort study of newborn infants requiring PN for congenital or acquired gastrointestinal abnormalities. The study was conducted over a 2-year period in a tertiary referral paediatric hospital. Rectal swabs or stool samples were taken before PN was started, 72 h after PN was initiated, 72 h after starting enteral feeding and 72 h after full enteral feeding was achieved. Blood samples were taken when the patient developed signs of generalised inflammation. Coagulase-negative staphylococci (CNS) were isolated using standard microbiological techniques. CNS isolates were then examined by polymerase chain reaction (PCR) to identify *Staph. epidermidis*. The DNA of *Staph. epidermidis* isolated from rectal swabs/stools and blood was compared by random amplified polymorphic DNA (RAPD) analysis to establish the similarities between gut and blood isolates at a molecular level.

Sixty-eight infants (thirty-five males) were studied. Median age at onset of PN was 7 (range 1–198) d. Duration of PN was 12 (1–304) d.

Gut carriage: fifty infants carried CNS in the gut. The pattern of CNS carriage was as follows: 47% of the infants carried CNS before starting PN, 75% after starting PN, and carriage remained at 68% during PN with enteral feeding. Twenty-seven of the fifty infants with CNS carriage (54%) had *Staph. epidermidis* identified by PCR.

Septicaemia: twenty-seven infants (39%) developed positive blood culture and in twenty-six of these the causative organism was CNS: in twenty of these (74%) the organism was identified by PCR as *Staph. epidermidis*. Septicaemia developed after a median of 4 (1–35) d from the start of PN. In eleven infants, *Staph. epidermidis* was isolated from both gut and blood. RAPD analysis showed that in ten of these eleven patients the DNA profile of the organisms isolated from the intestine was identical to that of the organisms isolated from blood.

In our unit we found that *Staph. epidermidis* was the commonest organism causing septicaemia. More than half of the infants showed evidence of gut carriage with *Staph. epidermidis*. DNA matching would support the gut being a source of *Staph. epidermidis* septicaemia in infant surgical patients on PN.

Counter-regulatory responses to fish oil and antioxidant supplementation: effect on synthesis of prostaglandin E_2 and interferon-γ in healthy humans. By T. TREBBLE, S.A. WOOTTON, N. ARDEN, G.C. BURDGE, E.A. MILES, M.A. STROUD and P.C. CALDER, *Institute of Human Nutrition, University of Southampton University Hospital Trust, Southampton SO16 6YD*

Fish oils contain high concentrations of *n*-3 polyunsaturated fatty acids (PUFA). We have previously reported an enhanced proliferative response of peripheral blood mononuclear cells (PBMC) following increased *n*-3 PUFA intake in healthy subjects (Trebble *et al*. 2001*a*). This was accompanied by a decrease in the synthesis of the cytokines tumour necrosis factor-α and interleukin-6 (Trebble *et al*. 2001*b*), considered to be an anti-inflammatory effect. Previous studies suggest that increased *n*-3 PUFA intake may: reduce synthesis of prostaglandin (PG) E_2, an eicosanoid derived from *n*-6 PUFA whose effects include inhibition of both PBMC proliferation and interferon (IFN)-γ synthesis; and also increase generation of lipid peroxidation metabolites, an effect which may be countered by antioxidant co-supplementation. Such responses may be considered pro-inflammatory. The aims of this study were to investigate the response of arachidonic acid in plasma, erythrocytes and PBMC, and of the synthesis of PGE_2 and IFN-γ by PBMC, to increasing *n*-3 PUFA intake with or without antioxidant co-supplementation.

Sixteen healthy subjects were randomised to antioxidants (daily supplement equivalent to 200 µg selenium, 3 mg manganese, 450 ug vitamin A, 30 mg vitamin E, 90 mg vitamin C) or placebo for a 12-week period. All subjects additionally received identical regimens of fish-oil supplements, consisting of three consecutive 4-week courses providing 0.3 g, 1.0 g and 2.0 g of *n*-3 PUFA per day, respectively. Fasting venous blood samples were taken at baseline, 4, 8 and 12 weeks, centrifuged and the plasma layer removed. Plasma phosphatidylcholine (PC) and erythrocyte PC and phosphatidylethanolamine were isolated and analysed using capillary gas chromatography. PBMC were isolated and cultured in the presence and absence of the monocyte stimulant lipopolysaccharide (for PGE_2 synthesis) or the T-cell stimulant concanavalin A (for IFN-γ synthesis). PGE_2 and IFN-γ concentrations in cell culture supernatants were measured by ELISA.

All subjects completed the 12-week course, with no major side-effects reported. There was no significant effect of antioxidant co-supplementation on any of the outcomes measured and so groups were pooled for investigation of *n*-3 PUFA effects. The proportion of arachidonic acid in plasma and erythrocyte phospholipids decreased uniformly in response to increased *n*-3 PUFA intake (baseline *v*. 2 g d^{-1}, $P<0.0001$). A similar trend in PBMC fatty acid composition was seen. The proportion of eicosapentaenoic acid (EPA) in plasma and erythrocyte phospholipid increased uniformly in response to increased *n*-3 PUFA intake (baseline *v*. 2 g d^{-1} $P<0.0001$). A similar trend in PBMC fatty acid composition was seen. PGE_2 synthesis by both unstimulated and stimulated PBMC decreased significantly in response to an *n*-3 PUFA intake of 0.3 g d^{-1} (P 0.005), with further decreases at the higher intakes ($P<0.003$). IFN-γ synthesis by stimulated PBMC was increased at the two higher *n*-3 PUFA intakes (P 0.04 and 0.03, respectively).

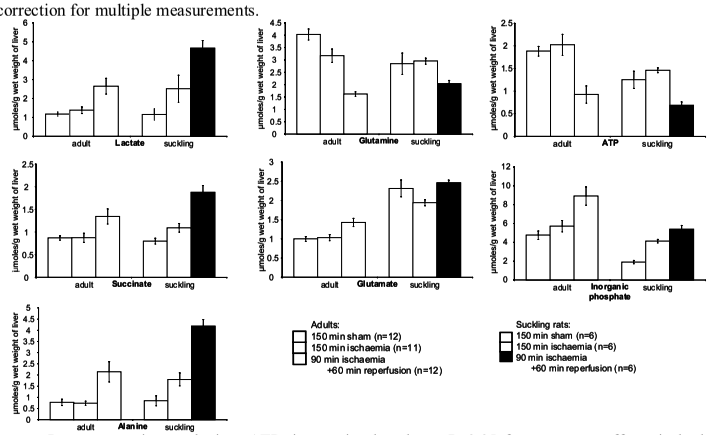
In summary, *n*-3 PUFA supplementation resulted in dose-dependent decreases in arachidonic acid content and increases in EPA content of plasma and erythrocyte phospholipid pools. These changes were associated with decreased PGE_2 production and increased IFN-γ production by PBMC. We propose that the decreased capacity of PBMC to synthesise PGE_2 (as a result of an altered ratio of arachidonic acid to EPA) removed the inhibitory effects of this mediator on IFN-γ production, and also on lymphocyte proliferation, as we reported previously (Trebble *et al.* 2001*a*).

Trebble T, Miles EA, Stroud MA & Calder PC (2001*a*) *Proceedings of the Nutrition Society* **60**, 116A.
Trebble T, Burdge GC, Miles EA, Wright P, Calder PC, Stroud MA & Wootton SA (2001*b*) *Proceedings of the Nutrition Society* **60**, 172A.

Hepatic metabolic responses to intestinal ischaemia-reperfusion in adult and suckling rats. By S.B.WILLIAMS[1,2], P.VEJCHAPIPAT[1,2], S.R.WILLIAMS[3], L.SPITZ[1] and A.PIERRO[1], [1]*Department of Paediatric Surgery and* [2]*RCS Unit of Biophysics, Institute of Child Health, 30 Guilford Street, London WC1N 1EH and* [3]*Imaging Science and Biomedical Engineering, Stopford Building, The University of Manchester, Oxford Road, Manchester M13 9PT*

Intestinal ischaemia-reperfusion is involved in several serious conditions seen in paediatric and adult surgical practice. A consequence of severe intestinal ischaemia-reperfusion may be multiple organ failure, in which the liver is usually affected early. It has been shown that intestinal ischaemia-reperfusion causes metabolic derangement in the liver in adult rats (Vejchapipat *et al.* 2001), but it is not known whether suckling rats show the same type or degree of hepatic metabolic derangement. In this study, the hepatic metabolic responses of adult and suckling rats to intestinal ischaemia-reperfusion were measured and compared.

Six groups of rats were studied under general anaesthetic (Home Office licence obtained). Intestinal ischaemia and reperfusion was produced by reversible occlusion of the superior mesenteric artery. Suckling rats (11–13 d) and adult rats (250–300 g) had: 150 min sham operation only; or 150 min intestinal ischaemia only; or 90 min intestinal ischaemia and 60 min intestinal reperfusion. Livers were freeze-clamped at the end of the experiment. Concentrations of hepatic metabolites were determined by magnetic resonance spectroscopy. Means (±SEM) are shown in the Figure. Treatment differences (same age) were compared using one-way ANOVA. Treatment/age interaction was tested for using two-way ANOVA. Significance was accepted at $P<0.05$, after application of Bonferroni's correction for multiple measurements.



Lactate, succinate, alanine, ATP, inorganic phosphate: $P<0.05$ for treatment effects in both ages groups. Glutamate and glutamine: $P<0.05$ for treatment effects in adult group only. Lactate, alanine and glutamine: $P<0.05$ for treatment/age interaction. Hence, hepatic lactate, alanine and glutamine show a different pattern of response to the treatments used in adults and suckling rats. ATP and inorganic phosphate show a similar pattern of response to the treatments used in adults and suckling rats.

In conclusion, intestinal ischaemia-reperfusion also has a profound effect on hepatic metabolism in suckling rats, but of subtly different degree and distribution from that seen in adult rats. These observations may reflect different biochemical pathways available in the liver to mature and immature animals when under biochemical stress, although both ultimately undergo energy failure.

Vejchapipat V, Williams SR, Proctor E, Lauro V, Spitz L & Pierro A (2001) *Journal of Paediatric Surgery* **36**, 269–275.

The effects of moderate hypothermia and perfluorocarbons on intestinal energy metabolism after ischaemia-reperfusion. By P. VEJCHAPIPAT[1,2], E. PROCTOR[2], A. PETROS[3], A. RAMSAY[4], L. SPITZ[1] and A. PIERRO[1], [1]*Surgery Unit,* [2]*RCS Unit of Biophysics,* [3]*Paediatric Intensive Care Unit and* [4]*Histopathology Units, Institute of Child Health and Great Ormond Street Hospital, University College London, 30 Guilford Street, London WC1N 1EH*

Intestinal ischaemia-reperfusion (IR) is a serious condition. In a previous study we showed that moderate hypothermia ameliorated hepatic energy failure during intestinal reperfusion. This study investigated the roles of moderate hypothermia and extraluminal oxygenated perfluorocarbons (PFC) on intestinal energy metabolism during ischaemia-reperfusion (Vejchapipat *et al*. 2001).

The model of 30 min intestinal ischaemia followed by 60 min reperfusion was studied. The animals were maintained at either normothermia (36–38ºC) or moderate hypothermia (30–32ºC). Four groups of adult rats were studied (*n* 8 per group): (A) sham operation at normothermia; (B) IR at normothermia; (C) IR at hypothermia; (D) IR with extraluminal oxygenated PFC perfusion during ischaemia at normothermia. Concentrations of intestinal phosphocreatine, ATP and lactate were measured. Histological changes were scored by an independent pathologist (grade 1 to 5, normal to transmural necrosis). A one-way ANOVA with multiple *post hoc* comparisons (metabolite data) or nonparametric tests (histological score) was used.

Intestinal IR at normothermia caused a marked reduction in phosphocreatine and ATP with an increase in lactate. Moderate hypothermia exerted beneficial effects by preserving phosphocreatine, attenuating the ATP depletion and lactate elevation. Extraluminal PFC perfusion during ischaemia failed to produce a protective effect on phosphocreatine and ATP although it reduced lactate accumulation (Fig. 1). Moderate hypothermia significantly decreased the degree of mucosal damage whereas extraluminal oxygenated PFC did not (Fig. 2).

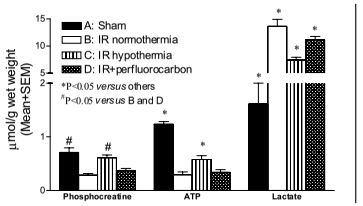


Fig. 1

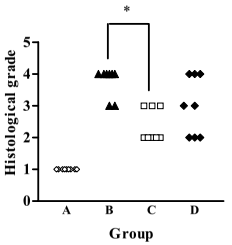


Fig. 2

In conclusion, whole-body moderate hypothermia protects the small intestine from IR injury by preserving its energy metabolism and attenuates the histological changes. Extraluminal oxygenated PFC administration during ischaemia did not protect the intestine from IR injury in this model.

Vejchapipat P, Williams SR, Proctor E, Lauro V, Spitz L & Pierro A (2001) *Journal of Pediatric Surgery* **36**, 269–275.

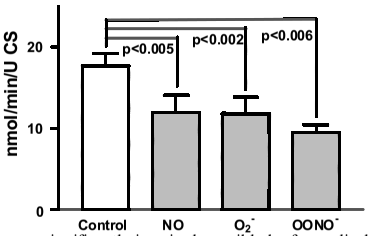
Neonatal endotoxaemia inhibits carnitine palmitoyl transferase I in heart but not kidney. By K. FUKUMOTO, A. PIERRO, L. SPITZ and S. EATON, *Institute of Child Health and Great Ormond Street Hospital for Children, London WC1N 1EH*

The heart and kidney are dependent on fatty acids during the neonatal period and are both affected in sepsis-related multiple organ failure. Our purpose was to determine the effects of sepsis on cardiac and renal carnitine palmitoyl transferase I (CPTI), important in controlling fat oxidation and fuel selection (Eaton *et al.* 2001*a*,*b*).

Suckling rats (11–13 d) were injected intraperitoneally with 300 μg/kg lipopolysaccharide (endotoxaemia) or saline (controls) and mitochondria were isolated from heart and kidney after 2 h. CPTI activity was measured radiochemically and M- and L-CPTI isoforms, both present in heart, by immunoblotting. Results (mean ± SEM) were compared by unpaired *t* test.

CPTI activity (*n* 30) was significantly decreased by endotoxaemia in heart (14.4 (SE 4.6 nmol/min/U citrate synthase *v.* 10.4 (SE 4.5), P=0.0007) but not kidney (20.7 (SE 7.3) *v.* 19.2 (SE 8.1)). As heart contains both M- and L- isoforms, whereas kidney contains only the L- isoform, it seemed possible that only the M- isoform was inhibited by endotoxaemia. To verify this, we carried out titrations of heart mitochondria with DNP-etomoxir-CoA, which at low concentrations specifically inhibits L-CPTI. Slopes of the titration curves with DNP-etomoxir-CoA were no different between control and endotoxaemia rats (*n* 15; P=0.25), suggesting that M-CPTI is specifically inhibited in the heart. This was supported by the finding that endotoxaemia increased the IC_{50} of malonyl-CoA on CPTI from 2.3 to 9.2 μM (the M- isoform has a lower IC_{50} than the L-, so inhibition of the M- isoform should increase the overall IC_{50}). Lower heart CPTI activity was not due to decreased immunoreactive protein (neither the M- nor the L-CPTI isoform was decreased in amount; *n* 14). To determine whether free radicals generated in the heart during sepsis could directly inhibit CPTI, control heart mitochondria were incubated with free-radical-generating systems. Hydrogen peroxide did not affect CPTI activity but nitric oxide (NO), superoxide (O_2^-) and peroxynitrite ($OONO^-$) significantly inhibited CPTI activity (see Figure).

Figure



CPTI activity was significantly impaired, possibly by free radical damage, in heart, but not kidney, during neonatal sepsis. This inhibition appears to be specifically an inhibition of the M- isoform of CPTI, but is not due to decreased amounts of immunoreactive protein. NO, O_2^- and $OONO^-$ are all important reactive species produced in the heart during sepsis. Peroxynitrite in particular has been implicated in sepsis-related myocardial damage through nitrosylation of proteins (Ferdinandy *et al.* 2000). Antioxidant strategies could be useful in preventing sepsis-related cardiac damage.

Eaton S, Fukumoto K, Duran NP, Pierro A, Spitz L, Quant PA & Bartlett K (2001*a*) *Biochemical Society Transactions* **29**, 245–250.
Eaton S, Bartlett K & Quant PA (2001*b*) *Biochemical and Biophysical Research Communications* **285**, 537–539.
Ferdinandy P, Danial H, Ambrus I, Rothery RA & Schulz R (2000) *Circulation Research* **87**, 241–247.

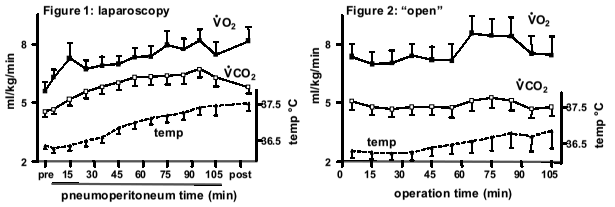
Intraoperative hypermetabolism in children undergoing laparoscopic surgery. By M. McHONEY[1], L. CORIZIA[1], S. EATON[1], L. SPITZ[1], D.P. DRAKE[2], E.M. KIELY[2], H.L. TAN[2] and A. PIERRO[1], [1] *Institute of Child Health and* [2]*Great Ormond Street Hospital for Children, London WC1N 1EH*

It is assumed that laparoscopic surgery is associated with minimal physiological and metabolic derangements. However, this assumption has not been tested in paediatrics.

The aim of this study was to compare the effects of laparoscopic surgery and "open" surgery on respiratory gas exchange and whole-body energy metabolism in children.

Two groups of children undergoing major abdominal operations of similar magnitude were studied: group A (*n* 20) had laparoscopic surgery; and group B (*n* 19) had "open" surgery. Laparoscopy was performed using unheated CO_2 insufflation. CO_2 production (VCO_2) and O_2 consumption (VO_2; an indirect measure of heat production) were measured during the operation by indirect calorimetry. Core temperature and end-tidal CO_2 were also recorded. Start of operation and subsequent time-points were compared using paired *t*-tests. Data were normally distributed and expressed as mean and standard error of the mean (SEM).

There were no significant differences between the groups in age at operation (laparoscopy 63.4 (SEM 10.7) months; open 47.2 (SEM 13.6) months) and weight (laparoscopy 20.0 (SEM 3.1) kg; open 14.4 (SEM 2.7) kg). During laparoscopy, significant rises in VCO_2 (15 min post-pneumoperitoneum), VO_2 and body temperature were observed, indicating a hypermetabolic response (Fig. 1). End-tidal CO_2 plateaued at 1 h and subsequently decreased in response to ventilatory adjustment. Open surgery was not associated with significant changes in respiratory gas exchange or body temperature (Fig. 2).



We found (1) that during laparoscopy VCO_2 increases, suggesting that children are able to efficiently eliminate the intraperitoneal CO_2 load; (2) that core body temperature increases despite insufflation of cold CO_2; and (3) perhaps surprisingly, that laparoscopic surgery in children is associated with an immediate intraoperative hypermetabolic response which is not observed during "open" surgery.

Retention of *Candida albicans* by a new intravenous lipid emulsion filter. By A.J. STEPHENS[1], V. VADUVA[2] and K. GRABOWSKI[2], *Scientific and Laboratory Services,* [1]*Pall Europe Ltd, Walton Road, Portsmouth PO6 1TD and* [2]*Pall Corporation, Ann Arbor, MI, USA*

Lipid-containing parenteral nutrition (PN) infusions are particularly susceptible to fungal contamination, with *Candida* species being most commonly involved (Vazquez *et al.* 1993). The Pall *Lipipor* TNA Filter (code TNA2) is a new 1.2 µm filter for use with lipid-containing PN preparations; this study assessed the ability of this filter to retain *Candida albicans* when challenged under extended use conditions.

Commonly used all-in-one admixtures were prepared and tested for sterility prior to inoculation with *C. albicans* at approximately 1×10^4 total organisms per 3000 ml bag. A sterile collection bag was connected downstream of each test filter and the flow rate set at 125 ml/h, to run for a maximum of 72 h. At the beginning and end of each day, a sample was removed from each admixture bag to confirm organism viability. At the end of the test period, the collection bags were detached and assayed for *C. albicans*.

Filter ref.	Average inoculum (total CFU)	CFU detected in effluent	Cumulative time (h)	Cumulative volume infused (ml)
9576	1.3×10^4	0	67.33	6535
9577	1.3×10^4	0	71.83	7852
9578	1.3×10^4	0	71.83	7852

The results show that the filter is capable of retaining *C. albicans* at levels of approximately 10^4 organisms over a period of up to 72 h. Further testing with higher levels of *C. albicans* (approximately 10^8 organisms) was performed until the filters were completely occluded by fungal growth; no contamination was detected downstream of the filter in any of the tests.

The use of filters in PN is recommended by several authorities and expert groups, including the US Food and Drug Administration (1994), the American Society for Parenteral and Enteral Nutrition (ASPEN; National Advisory Group on Standards and Practice Guidelines for Parenteral Nutrition, 1998) and the British Pharmaceutical Nutrition Group (BPNG; Bethune *et al.* 2001), principally for the removal of unwanted particulate material including precipitates. Removal of enlarged lipid droplets and entrained air are further benefits. This study demonstrates that this new *Lipipor* filter retains *C. albicans* over a period of time in excess of that currently encountered in clinical practice, thereby providing an additional safety measure against accidental fungal contamination.

Bethune K, Allwood M, Grainger C, & Wormleighton C (2001) *Nutrition* **17**, 403–408.
National Advisory Group on Standards and Practice Guidelines for Parenteral Nutrition (1998) *Journal of Parenteral and Enteral Nutrition* **22**, 49–66.
US Food and Drug Administration (1994) *American Journal of Hospital Pharmacy* **51**, 1427–1428.
Vazquez JA, Sanchez V, Dmuchowski C, Dembry LM, Sobel JD & Zervos MJ (1993) *Journal of Infectious Disease* **168**, 195–201.

Lipid-emulsion filter challenge testing with *Malassezia furfur*. By A.J. STEPHENS and A.J. SEACOMBE, *Scientific and Laboratory Services, Pall Europe Ltd, Walton Road, Portsmouth PO6 1TD*

Parenteral nutrition (PN) preparations are susceptible to fungal contamination, with *Malassezia furfur* being highlighted as an emerging pathogen in neonates (Robinson & Ball, 1996). Pall *Lipipor* filters are 1.2 µm filters for use with nutrient preparations containing lipids. This study assessed the removal capabilities of the Pall *Lipipor* NEO filter (code NLF1E) for use in neonatal and paediatric care, and the *Lipipor* TNA filter (code TNA1E), when challenged with *M. furfur*.

Freeze-dried *M. furfur* (Mycology Reference Laboratory, Bristol, UK) was revived on Leemings medium and Sabouraud Dextrose Agar with Tween 80. Identification was confirmed and 2.0×10^8 CFUs/ml were added to 200 ml of 20% Intralipid (Fresenius-Kabi) or 200 ml sterile water for irrigation (Baxter). This was pumped through the filters at 2ml/hour for 24 h with commonly used intravenous pumps. Samples were taken pre- and post-filtration, pulled through 0.8 µm disc membranes and incubated for 7 d at 38°C. Plates were inspected daily for growth.

Filter reference	Inoculum (CFU/ml)	Total CFUs in effluent	Volume infused (ml)
TNA1E 1	1.0×10^6	0	47.9
TNA1E 2	1.0×10^6	0	48.4
TNA1E 3	1.0×10^6	0	47.9
NLF1E 4	1.0×10^6	0	48.0
NLF1E 5	1.0×10^6	0	47.9
NLF1E 6	1.0×10^6	0	47.9
NLF1E 7	1.0×10^6	1	47.0
NLF1E 8	1.0×10^6	0	47.9
NLF1E 9	1.0×10^6	0	48.0
NLF1E 10	1.0×10^6	0	47.9

The results showed that both filters retain high levels of *M. furfur*. When infusing Intralipid, one colony was detected in the effluent from one filter; however, the full challenge was retained by all filters when infusing water.

The use of filters during the administration of PN preparations is recommended by several authorities and expert groups, including the US Food and Drug Administration (1994), the American Society for Parenteral and Enteral Nutrition (ASPEN; National Advisory Group on Standards and Practice Guidelines for Parenteral Nutrition, 1998) and the British Pharmaceutical Nutrition Group (BPNG; Bethune *et al*. 2001); principally for the removal of unwanted particulate material including precipitates. Removal of enlarged lipid droplets and entrained air are further benefits. This study demonstrates that these *Lipipor* filters are also able to provide an additional safety measure against accidental fungal contamination with *M. furfur*.

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Lyophilised amino acid preparations containing glutamine. By G. HARDY[1], A. MARIN[1] and A. TORRE[2], [1]*Pharmaceutical Nutrition Group, School of Biological and Molecular Sciences, Oxford Brookes University, Oxford OX3 0BP and* [2]*Torre Farmaceutici, Milan, Italy*

Glutamine (Gln) is the most abundant amino acid in the body since it constitutes about 50% of the free intracellular amino acid pool of muscular tissue. However Gln concentrations decrease rapidly in sepsis, trauma or other serious diseases, which can cause a reduction in protein synthesis, a decrease in the immune defences and atrophy of the intestinal mucosa. Supplementation of parenteral nutrition (PN) with L-Gln improves the outcome of critically ill patients (Griffiths *et al.* 1997).

Infusion solutions of amino acids containing L-Gln are not commercially available since it is relatively insoluble and unstable when heated in aqueous solution, forming NH_3 and pyroglutamic acid (PyGlu). This reaction occurs slowly at room temperature but is dramatically accelerated at autoclave sterilisation temperature. More soluble Gln derivatives such as N-acetylglutamine (NAG) and Gln dipeptides have been developed (Furst *et al.* 1990). These are heat stable but NAG has low bioavailability and Gln dipeptides supply equimolar amounts of glycine or alanine which make the overall amino acid pattern of the mixture unbalanced.

Filter-sterilised solutions of 2.5% w/v L-Gln stored at low temperature have acceptable stability (McElroy *et al.* 2001) but concentration is not always sufficient for PN regimens. A freeze-dried Gln product, which can be reconstituted immediately before use, has obvious attractions although it also has limitations. The poor Gln solubility makes the lyophilisation process relatively expensive. Moreover, lyophilised Gln is a soft powder with very low density and poor flowability, which makes filling difficult.

We have therefore investigated the alternative of preparing mixtures of amino acids plus Gln in lyophilised form. These have a density of >0.3 g/ml and improved aqueous solubility. This enables the preparation of PN regimens with a high L-Gln content in a balanced amino acid formulation, avoiding the use of excipients, preservatives and stabilisers.

Solutions containing the eight essential amino acids (EAA) six non-essential amino acids (NEAA) plus Gln from 20% to 50% by weight of total amino acids (TAA) were filter sterilised, freeze-dried and filled into pre-sterilised 500 ml glass bottles. All operations were carried out under strictly aseptic conditions.

The results of studies with a 30% Gln mixture ("LioGlutamix II") providing 22.5 g L-Gln per 75 g TAA (12.4 g N) are presented. During storage, individual EAA and NEAA content did not decrease by >5% in the sterile lyophilised powder, confirming its stability for more than 12 months at room temperature (Gln >97% of original). Samples of this lyophilised mixture were reconstituted with (1) sterile water, (2) normal saline, (3) 5% dextrose, (4) 20% dextrose, (5) 30% dextrose, then stored for 48 h at room temperature. Reconstituted mixtures were analysed immediately (T_0), after 24 h (T_{24}) and after 48 h (T_{48}) for Gln and glutamic acid (Glu) by standard enzymatic analysis; PyGlu by HPLC; pH and particle counts by pharmacopoeial methods.

After reconstitution, Gln content remained at 99.6% of original at T_{24} and 98.4% at T_{48}. There were no significant increases in Glu and PyGlu and particle counts were within pharmacopoeial limits (4 >20 µm/ml, 100 >5 µm/ml). The pH remained constant at 7.1 in sterile water (1) and normal saline (2) but in the dextrose mixtures (3–5) the pH ranged from 6.4 to 6.6. Subsequent storage of mixture (1) at 4–8ºC for 28 d confirmed long-term aqueous stability, with Gln content 96.4% of original (P=0.548 compared with initial assay).

Our results confirm that pharmaceutically stable lyophilised amino acid preparations containing up to 50% w/w glutamine can be manufactured aseptically. Reconstitution with a variety of infusion solutions, prior to pharmacy compounding, increases the scope for specifically tailored L-glutamine-enriched clinical nutrition regimens.

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McElroy B, Marin A & Hardy G (2001) *Proceedings of the Nutrition Society* **60**, 101A.

The provision of phosphate in parenteral nutrition: a national BPNG survey. By W. HICKS, M. ALLWOOD, K. BETHUNE, A. COSSLETT, S. DUNNETT, C. GRANGER, H. MARTIN, B. McELROY, C. WORMLEIGHTON and G. HARDY *for the British Pharmaceutical Nutrition Group (BPNG), PO Box 5784, Derby DE22 3ZH*

Calcium phosphate precipitation within parenteral nutrition (PN) mixtures is a compatibility problem that affects the safe provision of the recommended intake of phosphate (P) and calcium (Ca). Many different products, practices and pharmaceutical procedures have evolved to overcome the stability problems but, as yet, there are no definitive guidelines. BPNG has therefore formed a working party to survey the current practices in the UK.

A total of 600 questionnaires were distributed to BPNG members in two mailshots over a 2–3 month period. The questionnaires were designed to establish the significance of P interactions in PN admixtures, to raise awareness of quality issues and develop best practice guidelines.

The overall response approached 40% of the total number of compounding units in the UK (130 out of approximately 350). All responders were well or reasonably well informed about Ca/P incompatibilities in PN and 69% claimed to be aware of guidelines (although only 48% could state references). Just under half (49%) had experienced precipitation problems but, interestingly, only 42% of returns indicated that organic P is being used to alleviate this problem.

Respondents perceived that 'intensive-care adult' (34%), paediatric (28%) and neonatal (71%) regimens pose the greatest potential risk for precipitation. Of the respondents, 49% indicated that 0–10% of their adult regimens received additional P and 22% add P to virtually all (90–100%) of their paediatric regimens. Although the majority (54%) rarely add additional P to pre-mixed bags or amino acid solutions, this may well contravene clinical recommendations for optimum P intake (Pennington *et al*. 1996). A broad range of clinical P values is used (from 4.5 to 30 mmol/l for adults and 4–40 mmol/l for children), with most respondents quoting the amounts present in Kabimix®, Kabiven® and Clinomel®. Phospholipid content of fat emulsions is included in total P calculations by 56% whilst 31% do not include it, with the remaining 10% unsure. The general consensus (81%) said that order of mixing is important with most (80%) following standard operating procedures, first adding P, then other additives and lastly Ca.

Currently used P sources were varied, with the majority using different inorganic salts (74%), organic glycerophosphate (40%), glucose-1-phosphate (2%) and fructose-1,6-diphosphate (1%). Interestingly, one of the main reasons for not using organic phosphates is the lack of licensed products (18%) and, because of this, the fact that pharmacists are unaware of these products (20%). Ca sources remain relatively evenly split between Ca chloride and Ca gluconate despite the documented superior stability of the latter, although the lower concentration and reported higher aluminium (Al) loading of gluconate salts may explain this (Allwood, 1999). We found that 67% were aware of the potential for Al contamination in Ca and P additives (Vallo *et al*. 2000) but that 81% did not know whether the products they use meet the United States FDA limits for Al content of injectables (no UK or European standards exist).

Most stability data are derived from industry (90%) or computer programs (53%) although 83% of respondents would accept stability data from other sources. Many commented that the current computer programs, stability curves and matrices are limited by the increasing number of drugs and PN additives becoming commercially available.

This survey confirms the difficulties encountered by UK pharmacists in trying to avoid CaP precipitation when preparing PN admixtures and clearly demonstrates that the potential for serious clinical incidents involving CaP precipitation still remains a real threat in the safe provision of PN to neonatal, paediatric and intensive-care patients. The wide range of optimum clinical values, disagreement regarding phospholipid bioavailability and use of organic P are some of the inconsistencies highlighted. Ongoing research by the working party is aimed at clarifying these issues in order to publish BPNG recommendations for best pharmaceutical practice.

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European survey of current practice in the delivery of parenteral nutrition to neonates and children. By B.U. KLÜTTGENS[1], G.J. SEWELL[1] and A.J. NUNN[2], [1]*University of Bath, Bath BA2 7AY and* [2]*Alder Hey Royal Liverpool Children's NHS Trust, Liverpool L12 2AP*

As part of a project to determine whether standard parenteral nutrition admixtures could be used more widely in neonatal and paediatric practice, a survey has been undertaken in five European countries: Spain, Italy, France, Germany and the UK. The objective was to characterize current practice in the provision of parenteral nutrition for neonates and children. A total of 90 hospitals were included in this study, covering nearly 10 000 paediatric beds.

The survey was undertaken in the form of a postal questionnaire aimed at clinicians and pharmacists. The overall response rate was 45%; UK 71%, Germany 44%, France 45%, Italy 29% and Spain 36%.

In order to define the delivery of parenteral nutrition, the following questions were addressed:

- Where are the parenteral nutrition solutions compounded?
- Is fat infused separately or as All-in-One mixtures?
- When are vitamins and trace metals commenced?
- Are filters and light protection used during drug administration?
- Is any form of standard admixture used?

The results showed that the five countries differ considerably on some issues: for instance, in the UK 90% of hospitals have a compounding unit for parenteral nutrition; in Germany and Italy parenteral nutrition is still regularly compounded on wards with only one-third of hospitals providing a pharmacy compounding unit; and in France and Spain commercial manufacturers often provide the compounding service, with only half of the hospitals providing a pharmacy-based service.

The lipid emulsion is usually given as a separate infusion to neonates (81%) and to most children (51%).

Vitamins and trace metals are usually given from day 1 for 7 d per week. A minority of hospitals only include the micronutrients for 3–4 d a week and some start the supply 7 d after starting parenteral nutrition support.

Filters are used in 54% of hospitals. The parenteral nutrition bag is frequently protected from light (47%), but the use of light-protecting tubing is less common (14%).

Despite the lack of international recommendations regarding the use of standard formulations, 43% of hospitals have indicated that they have introduced some kind of standard bag. The reasons for the introduction of standardized bags are: convenience (24%), capacity problems regarding the compounding of individual bags (19%) and increased safety with the use of standard bags (11%), although 29% indicated that they would not be prepared to introduce standard regimens for their neonates and children.

The practice of parenteral nutrition delivery varies considerably throughout Europe. Although little has been published on the use of standardized parenteral nutrition, many hospitals have introduced standard regimens and there continues to be lively discussion regarding this issue.

Further work is required to explore different European practices and to establish whether tailored or standard regimens provide better nutritional intake.

A survey of protocols relating to drug administration via enteral feeding tubes. By R. WHITE[1] and R. O'NEILL[2], [1]*Pharmacy Department, Middlesex Hospital, London W1T 3AA and* [2]*London School of Pharmacy, Brunswick Square, London WC1N 1AX*

Administration via the enteral feeding tube is frequently the preferred route for delivery of essential drug therapy to patients with limited gastrointestinal (GI) access or dysphagia. This route of drug administration is fraught with complications such as interactions between the drug and the enteral feed and the risk of tube blockage. Despite the increasing use of this route of administration there is still little published data relating to interactions or administration advice. Some hospitals have addressed these issues by producing their own guidelines based on the data currently available.

A postal survey was undertaken to establish the number and the scope of protocols in existence relating to all aspects of drug administration via enteral feeding tubes. Establishments with protocols were asked to send a copy with their reply to enable a detailed content analysis to be carried out.

A total of 362 questionnaires were sent out to all hospitals in England, Scotland and Wales listed in the Medicines Information Directory (*n* 247) and to all the Health Authorities listed in Bourne's Directory (*n* 115). The results are detailed in the table.

	Hospitals (*n* 247)	Health Authorities (*n* 115)
Responses received	187 (75.7%)	82 (71.3%)
Existing protocol	48 (26%)	10 (12%)
Plans to write protocol	38 (20%)	14 (17%)
No plan to write protocol	94 (50%)	42 (51%)
Incomplete response	4 (2%)	16 (20%)

Despite the increasing use of enteral feeding tubes to administer drugs, less than 26% of those hospitals responding had a protocol in existence; this dropped to 12% in the primary-care sector. The protocols returned for content analysis varied widely in length, detail and content, from a single paragraph in an enteral feeding policy to a 35-page specific document. A multidisciplinary team was involved in the production of a substantial proportion of the protocols written. From the fifty-eight respondents with protocols, forty-six (79%) were written with the involvement of a pharmacist, thirty-six (62%) were written with the involvement of a dietitian, nineteen (33%) with the involvement of a nurse and thirty-eight (66%) were written with the involvement of more than one discipline.

Less than 15% of the total number of respondents had any plans to write a protocol. Those who added comments cited a lack of resources as the main reason for not writing a protocol. It is suggested that this is a suitable topic for national guidelines.

This survey forms part of an MSc project in pharmacy practice, London School of Pharmacy.

Body mass index and a comparison of bedside body composition methods using dual energy X-ray absorptiometry as a reference in ileostomy patients. By D.H.L. NG, A.N.J. MAY, M. ELIA, S.A. WOOTTON, AA JACKSON and M.A. STROUD, *Institute of Human Nutrition, University of Southampton, Southampton General Hospital, Tremona Road, Southampton SO16 6YD*

Ileostomy patients may suffer from undernutrition caused by loss of normal colonic functions, but the overall risk of becoming underweight and developing chronic protein-energy malnutrition is unclear. The extent to which body composition differs in ileostomists with small bowel resection compared to those without small bowel resection is also unclear. The aims of this study were (1) to assess whether ileostomists are more likely to be underweight (BMI <20 kg/m^2) compared with a reference population, and whether body composition in ileostomists with small bowel resection differs from those without small bowel resection, and (2) to test the hypothesis that body fat percentage (BF%) determined by bioelectrical impedance analysis (BIA) and skinfold thickness (SFT) measurements are better than a predictive equation based only on BMI and age (PE(BMI)) using DEXA as a reference technique.

A cohort of fifty-seven unselected ileostomists (26–85 years; 24F, 33M) were recruited with more than 90% success from a surgical database. Thirteen (7F, 6M) had small bowel resection but the extent of the resection could not be adequately assessed. BF% was determined using the following methods: dual energy X-ray absorptiometry (DEXA), using Hologic QDR2000 and software version 4.7; SFT at four sites (Durnin & Womersley, 1974), BIA at 50kHz using Bodystat 1500; and separate predictive equations for males and females based on BMI and age (Deurenberg *et al*. 1991). The reference population for BMI was a nationally representative sample of adults (16 to over 75 years) adjusted for female and male ratios (Health Survey for England, 1998).

There was a higher proportion of ileostomists with BMI<20 compared with the reference population (10.5% *v*. 4.9%; $P<0.05$). There were more obese (BMI>30) than underweight ileostomists, although the proportion with obesity was similar to the reference population (17.5% *v*. 18.9%). The ratio of female and male and the BF% in those with and without small bowel resection did not differ significantly (7F:6M, 35.1%, SD 10.2 and 17F:27M, 33.2%, SD 9.48, respectively). The correlation of BF% between DEXA and PE(BMI) was not significantly different from those obtained by correlating BF% by DEXA with BIA and SFT. The difference in BF% between DEXA and PE(BMI) (DEXA-PE(BMI)) was significantly smaller than DEXA-BIA and DEXA-SFT.

Methods	Body fat (%)		Correlation with DEXA BF%	DEXA-other methods (BF%)	
	Mean	SD	*r*	Mean	SD
BIA	30.52*	7.90	0.728	3.15†	6.78
SFT	28.80*	7.48	0.896	4.88‡	4.58
PE(BMI)	31.85**	7.66	0.808	1.83	5.80

*$P<0.001$, **$P<0.05$ (significantly different from DEXA, Student's paired *t* test).
†$P<0.05$, ‡$P<0.001$ (significantly different from DEXA-PE(BMI), Student's paired *t* test).

This study suggests that the proportion of underweight ileostomists was greater than a reference population, although there were more obese than underweight ileostomists. BF% was similar in those with and without small bowel resection. Under the conditions of the study, SFT and BIA offered no significant advantage over simple equations based only on BMI and age in predicting BF% obtained by DEXA.

This work is supported by a grant from the Kingston Trust.

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The potential of upper-arm bioelectrical impedance analysis to predict whole-body fat and fat-free mass in children. By N.J. FULLER[1], M.S. FEWTRELL[1], O. DEWIT[2], M. ELIA[3] and J.C.K. WELLS[1], [1]*MRC Childhood Nutrition Research Centre, Institute of Child Health, London WC1N 1EH,* [2]*Clinical Pharmacology Department, SmithKline Beecham Pharmaceuticals, Harlow CM19 5AW and* [3]*Institute of Human Nutrition, Southampton General Hospital, Southampton SO16 6YD*

Measurements of body weight (BWt) and height (Ht) may be difficult to obtain in children exposed to some clinical circumstances, such as those confined to hospital beds; and skinfold thickness (SFT) calipers may be perceived as threatening, especially by the very young. Therefore, attempts to assess children's body composition and protein/energy status using traditional techniques may be hindered or impossible. The aim of this study was to examine the potential utility of upper-arm bioelectrical impedance analysis (BIA) for predicting reference four-component model (4-CM) estimates of body fat (as %BWt) and fat-free mass (FFM; kg) in children (Wells *et al*. 1999). Measurements were undertaken on thirty-seven healthy children (eighteen boys, nineteen girls) aged 8–12 years and mean (SD) BMI 17.2 (2.3) kg/m^2, including BWt, Ht, biceps and triceps SFT, upper-arm length (L), mid-upper-arm circumference (MUAC), and upper-arm impedance (Z) and resistance (R) at 50 kHz. Mid-upper-arm cross-sectional area (MUACSA) and muscle area (MUAMA), L^2/Z, and specific resistivity (SR=R×MUACSA/L) were calculated. Strengths of relationships between the simple measurements, BIA or indices of SFT (biceps plus triceps and MUAMA) and 4-CM estimates of fat and FFM were evaluated using Pearson's correlation coefficient (*r*). Although age was strongly related to FFM (*r* 0.77 for the boys; 0.67 for the girls), it was not related to fat (%) and, as the effect of age did not significantly confound the other relationships, partial correlations to account for age are not reported.

		Correlation coefficients (*r*)					
		BWt	Ht	BMI	SFT/MUAMA	L^2/Z	SR
Fat (%)							
	Boys	0.73	0.47	0.82	0.81	0.56	0.78
	Girls	0.61	0.21	0.60	0.84	0.29	0.76
FFM (kg)							
	Boys	0.94	0.94	0.77	0.84	0.86	0.53
	Girls	0.85	0.66	0.47	0.64	0.91	0.01

This study has shown that, although generally not related to 4-CM estimates to a significantly (Fisher's *z*-transformation) greater or lesser extent than BWt, Ht or SFT, the differential use of upper-arm indices of BIA (L^2/Z for FFM and SR for %fat) may be utilised for predicting whole-body composition in circumstances in which the more traditional measures may be difficult to obtain in children. Therefore, parallel studies in children exposed to certain clinical conditions are required to establish whether or not upper-arm BIA indices may have value in such situations.

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Synbiotics and Crohn's disease: preliminary serum cholesterol results. By C.E. MCNAUGHT, D. PALMER, A. WALKER, P. POON, C.J. MITCHELL and J. MACFIE, *Combined Gastroenterology Research Group, Scarborough Hospital, Woodlands drive, Scarborough, North Yorkshire YO12 6QL*

There is increasing evidence that pre- and probiotic preparations can modify mucosal inflammation and nutritional status in patients with inflammatory bowel disease (Rembacken *et al.* 1999). Previous studies have also shown that probiotics can have beneficial effects on serum cholesterol levels (Agerholm-Larsen *et al*. 2000).

As part of a year-long, prospective study of synbiotics (pre- and probiotic) in Crohn's disease patients, we monitored serial lipid levels in addition to other nutritional and clinical parameters.

Patients with inactive Crohn's disease were randomised to receive two probiotic Trevis capsules (Chr. Hansen Bio Systems; containing 4×10^9 colony-forming units *Lactobacillus acidophilus* La5, *Bifidobacterium lactis* BB12 and *Streptococcus thermophilus*) and 15 g oligofructose (Raftilose) per day for 12 months, or a corresponding placebo. After a baseline dietary assessment, fasting blood levels of total cholesterol and HDL were measured using a standard enzymatic end-point reaction (Integra 700; Roche). Body weight (kg) and BMI were also recorded. These measurements were repeated after 3 months. Changes from the baseline within each group were tested using a Wilcoxon signed-rank test.

Of the forty patients entered into the study, twenty-six have completed the 3-month assessment. Eleven patients received the synbiotic (M:F 2:9, median age 42years) with fifteen controls (M:F 9:6, median age 54years). The median BMI on entry to the study was 19.5 in the synbiotic group and 24 in the control group. There was no significant change in BMI over the study period in either of the groups. Three control patients and one study patient had an elevated baseline total cholesterol >5 mmol/l. The results of serum lipid analysis are shown in the table. There was no significant change in total cholesterol, HDL or LDL cholesterol in the synbiotic or control group at 3 months.

	Mean serum lipid levels (mmol/l)					
	Total cholesterol		HDL		LDL	
	Day 0	3 months	Day 0	3 months	Day 0	3 months
Synbiotic	4.20	4.12	1.90	1.87	1.87	1.87
Control	4.51	4.60	1.49	1.54	2.20	2.40

Our preliminary results suggest that synbiotics have no effect on cholesterol profiles in patients with Crohn's disease.

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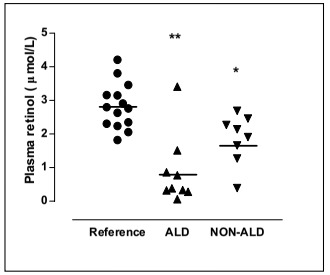
Agerholm-Larsen L, Raben A, Haulrik N, Hansen AS, Manders M & Astrup A (2000) *European Journal of Clinical Nutrition* **54**, 288–297.

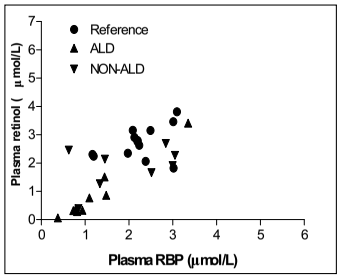
Plasma retinol and retinol binding protein concentrations in patients with chronic liver disease. By G. CONSTABLE, A. CAWOOD, J. L. MURPHY, D. CRUDDINGTON, K. GILMARTIN, J. JACKSON, S. WOOTTON and M. STROUD and *Institute of Human Nutrition, Southampton University Hospital, Southampton, SO16 6YD*

Low circulating vitamin A (as retinol) concentrations are observed in many liver diseases and may result from poor dietary intake, failure of mobilization from the liver of retinol bound to retinol binding protein (RBP), depleted hepatic stores or protein-calorie malnutrition resulting in defective RBP synthesis. Several studies have shown that alcoholic liver disease (ALD) is associated with both reduced plasma and hepatic concentrations of vitamin A (Bell *et al*, 1989). Some patients with normal plasma retinol and RBP concentrations may have low hepatic vitamin A concentrations (Leo & Lieber, 1982). Previous studies have suggested that low plasma vitamin A may reflect poor synthesis of RBP in the liver of cirrhotic patients (Kanematsu *et al,* 1989). The purpose of this study was to examine the concentrations of both plasma retinol and RBP in patients with ALD and non-alcoholic liver disease (non-ALD).

Nine patients with ALD (six men, three women; aged 35-70 years) and eight patients with non-ALD (one man, seven women, aged 33-70 years) were recruited to the study and compared with a reference group of fourteen adults (eight men, six women; aged 22-76 y). None of the patients or reference group were taking routine vitamin A supplements. A fasted venous blood sample (10ml) was taken by venepuncture from each patient and plasma retinol concentrations were measured by HPLC. Serum RBP concentrations were measured by radial immuno-diffusion (RID).



Mean and individual values for plasma retinol in reference, ALD and non-ALD groups. Significant difference from reference * p<0.05; ** p<0.001 (ANOVA)



Association between plasma retinal and RBP in reference, ALD and non-ALD groups, r 0.70, p <0.001

Plasma retinol concentrations were significantly lower in patients with ALD (P < 0.001) and non-ALD (P < 0.05) when compared to reference group. Taking the groups together, there was a strong association between plasma retinol and RBP concentrations (r 0.70, P < 0.001). These results were independent of nutritional status. These observations suggest that patients with ALD have the lowest concentrations of circulating retinol. This is most likely to result from either impaired synthesis of RBP or reduced mobilization of the retinol-RBP secretory complex. Further studies are required to determine if the low concentration of retinol results from defective synthesis of RBP or a failure of mobilization from the liver. Vitamin A is hepatotoxic and routine use of supplements cannot be recommended until metabolic handling is fully elucidated.

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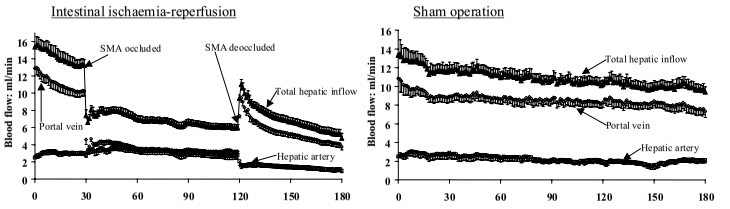
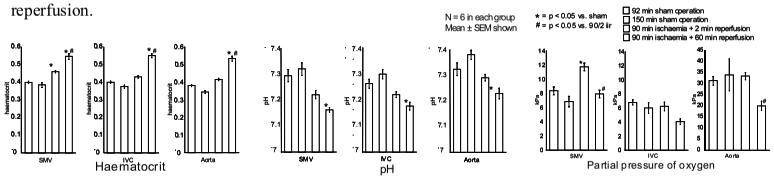
Hepatic blood flow and portal and systemic blood gases during intestinal ischaemia-reperfusion. By S.B. WILLIAMS[1,2], S.R. WILLIAMS[3], L. SPITZ[1] and A. PIERRO[1], [1]*Department of Paediatric Surgery and* [2]*RCS Unit of Biophysics, Institute of Child Health, 30 Guilford Street, London WC1N 1EH and* [3]*Imaging Science and Biomedical Engineering, Stopford Building, University of Manchester, Oxford Road, Manchester M13 9PT*

Severe intestinal ischaemia-reperfusion may lead to multiple organ failure, in which the liver is affected early. Intestinal ischaemia-reperfusion causes liver metabolic derangement in rats (Vejchapipat *et al*. 2001), but it is not known whether this is due to a reduction in delivery of oxygen to the liver, or to toxic outflow from reperfused gut. In this study we document the effects of intestinal ischaemia-reperfusion on hepatic inflow and portal and systemic blood gases.

Six groups of adult rats were studied under general anaesthetic (Home Office licence obtained). Intestinal ischaemia-reperfusion was produced by reversible occlusion of the superior mesenteric artery (SMA). Two groups had transit-time ultrasound measurement of portal venous and hepatic arterial blood flow. Group A had a 180 min sham operation; group B had 30 min run-in, 90 min intestinal ischaemia, and 60 min intestinal reperfusion. Total hepatic inflow was calculated (portal vein flow + hepatic artery flow). Four groups had a blood sample taken from the superior mesenteric vein (SMV), inferior vena cava (IVC) and aorta at the end of the experiment. Group I had a 92 min sham operation; group II had a 150 min sham operation; group III had 90 min intestinal ischaemia and 2 min reperfusion; group IV had 90 min intestinal ischaemia and 60 min reperfusion. Blood samples were analysed (haematocrit, pH, pO_2) immediately, using an iSTAT portable clinical analyser. Means were compared using paired and unpaired Student's t tests. Significance was accepted at P<0.05, after application of Bonferroni's correction for multiple measurements.



Total hepatic inflow during the sham operation (n 8) showed a gradual decline, amounting to a drop of 27% over 180 min, due mainly to a slow decrease in portal venous flow. Total hepatic inflow during intestinal ischaemia-reperfusion (n 13) showed a marked decrease on occlusion of the SMA, due to a rapid drop in portal venous flow only partially compensated for by a hepatic arterial buffer response. Total hepatic inflow fell gradually during intestinal ischaemia, but recovered to near pre-ischaemic levels on deocclusion of the SMA. During intestinal reperfusion, both portal venous and hepatic arterial flow declined over time, resulting in a total hepatic inflow not significantly different from that during intestinal ischaemia, after 60 min of intestinal reperfusion.



In conclusion, hepatic inflow is as low after prolonged reperfusion as it is during intestinal ischaemia. Blood delivered to the liver during intestinal reperfusion is initially haemo-concentrated and oxygen-rich. Both portal and systemic blood become acidic and viscid with prolonged intestinal reperfusion, and aortic blood becomes oxygen depleted.

Vejchapipat V, Williams SR, Proctor E, Lauro V, Spitz L & Pierro A (2001) *Journal of Paediatric Surgery* **36**, 269–275.

Home-managed nutritional supplementation amongst pre-school children with cerebral palsy: effect upon short-term weight gain. By A. BOYCE, H. HARTLEY and J.E. THOMAS, *Department of Child Health, University of Newcastle upon Tyne, Newcastle upon Tyne NE1 4LP*

Cerebral palsy is often associated with poor growth throughout childhood (Reilly & Skuse, 1992; Sullivan *et al.* 2000). Undernutrition is the underlying cause of this growth faltering in most cases, but the effect upon growth of home-managed nutritional supplementation amongst young children with cerebral palsy has not previously been assessed. This study aimed to assess whether such an intervention was both feasible and likely to lead to weight gain.

Twelve children aged 2–4 years with cerebral palsy completed the study, divided into either a control or supplementation group by minimisation. Control children received their estimated average requirement (EAR) for energy, whilst supplemented children received an additional 20% above their EAR for energy for 3 months. This was achieved by producing an individual management plan for each child, which included providing family support.

Control children exhibited no significant change in weight standard deviation score over the study period, but supplemented children showed a significant increase in weight gain (mean rise in standard deviation scores 0.63, P=0.04). Family stress levels decreased over the course of the study, with parental stress scores associated with the child showing a negative correlation with the degree of weight gain during the study (r^2 0.4, P=0.02).

This study demonstrates that home-managed dietary supplementation amongst pre-school children with cerebral palsy can result in significant short-term weight gain, and that this is associated with a corresponding decrease in parental stress levels.

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Sullivan PB, Lambert B, Rose M, Ford-Adams M, Johnson A & Griffiths P (2000) *Developmental Medicine and Child Neurology* **42**, 674–680.

Is the current service for the insertion of endoscopic feeding tubes appropriate and acceptable? A UK survey. By A.J. HUGHES and T.E. BOWLING, *City General Hospital, Newcastle Road, Stoke on Trent ST4 6QG*

We were concerned that gastroenterologists may be putting themselves in a vulnerable position, in terms of clinical governance, by inserting endoscopic feeding tubes purely as a service for other clinicians. A questionnaire was therefore sent out to hospitals in the UK to clarify current practice. Responses were received from 195 of 242 units (80%).

In over 95% of hospitals medical gastroenterologists are involved with inserting endoscopic feeding tubes, 38% have surgical gastroenterologists involved and geriatricians, radiologists and specialist nurses are involved in <8% of hospitals. The number of endoscopic feeding tubes placed varied widely between hospitals and ranged from 1 to 100/100 000 population covered per year.

We found that 60% of our responding hospitals have a nutrition team. Patients are assessed for suitability of endoscopic feeding tube placement by a variety of health care professionals: 23% by their own team alone, 14% by a nutrition team alone, 27% by a medical gastroenterology team alone, 9.4% by a combination of nutrition and gastroenterology teams and the remainder by a combination of assessors. Despite these figures, the inserter of the feeding tube does not know the details of the assessment in 25% of the hospitals.

For patients incapable of consenting for themselves, there is a hospital consent policy in 65% of hospitals and in the remainder there is either no policy (24%) or the operator does not know of one (11%). For the 65% of hospitals with a consent policy, this follows accepted national standards in two-thirds of them. Therefore, overall in the UK at least 60% of hospitals have inadequate consent mechanisms for patients incapable of consenting, which is known to or followed by the operators.

In most hospitals, gastroenterologists simply provide the service of inserting feeding tubes; 71% do not either routinely review the patients following endoscopic feeding-tube insertion nor do they provide a mechanism for review if complications arise. Only 19% provide a review in the week following feeding tube insertion and also if complications arise. Only 7.3% of hospitals have a multidisciplinary PEG clinic in which patients are followed up. However, 80% of patients are followed up by other health care professionals, usually hospital and community dietitians, although our questionnaire did not clarify the details surrounding this practice.

It is clear that current practice is highly variable and, in many hospitals, unacceptable. As a result, are gastroenterologists placing themselves at unnecessary risk (for example, of litigation) and should efforts be made to determine best practice?

The impact of restructuring a percutaneous gastrostomy service. By J.R. BOULTON-JONES, H. TORAMEN, J.C. JOBLING and K. TEAHON, *Nottingham City Hospital, Hucknall Road, Nottingham NG5 1PB*

Patients who cannot swallow are frequently fed by the placement of a percutaneous gastrostomy (PG) tube. Until 1998 the percutaneous gastrostomy (PG) service at Nottingham City Hospital was provided on an open access, technical service basis, provided that the patient was fit for the procedure and there were no obvious contraindications. After 1998, because of concerns about the mortality and morbidity of patients after PG placement and the appropriateness of referral for gastrostomy, we introduced a number of changes to the service. The multidisciplinary nutrition support team (NST) coordinated access to the service. All patients referred for consideration of PG tube placement were reviewed before the procedure by a nutrition nurse specialist to assess whether the patient was fit for the procedure. All procedures were performed on dedicated lists by a limited number of operators. The equipment used was standardised. All patients were re-assessed after the procedure by the clinical nurse specialist and, if required, by the NST to advise on introducing feeding and to monitor for potential complications. These changes were introduced in a step-wise manner.

Here we report on the outcome of patients undergoing PG tube insertion in 1998 and, after these changes had been implemented, in 2000. In 1998, all patients undergoing PG tube insertion were identified from endoscopy records or, if the tube was inserted under radiological guidance, by ward referral to the nutrition nurse specialist. In 2000, all patients were referred to the NST directly. Data were collected on in-patient mortality at 28 d and septic complications at the PG site.

There were sixty-nine patients who had a gastrostomy tube inserted in 1998 and sixty-six in 2000. There were eleven (16%) in-patient deaths within 28 d in 1998 compared with nine (14%) in 2000. In 1998, nine died from chest infections and two from underlying stroke disease. In 2000, six died from chest infections, two from underlying stroke disease and one from a bleeding duodenal ulcer which was identified at the time of PEG insertion. There was thus no significant improvement in the mortality rate. Twenty-two (32%) patients developed stomal infections, defined by the presence of pus, exudate or significant inflammation at the stoma site, while an in-patient in 1998. Of these one patient developed a local abscess and one developed peritonitis. Ten (15%) patients had stomal infections in 2000, with no significant sequelae. This is a significant improvement (P=0.02). Prophylactic antibiotics were not given to either cohort at the time of procedure.

We conclude that the involvement of a multidisciplinary team can reduce the number of local infections after the insertion of a PG tube by improving patient preparation, technical success rate of procedure and post-procedure recovery. Improvements in patient selection may be needed to improve the high in-patient mortality after PG insertion.

Mortality risk factors for patients on home parenteral nutrition: the St Mark's experience. By R.S. HODGSON, N. LATIF, C. MURRAY, A. FORBES and S.M. GABE, *St Mark's Hospital, Northwick Park, Watford Road, Harrow HA1 3UJ*

The overall mortality for home parenteral nutrition in the UK is 6% per year (BANS data). Reports from the USA and Italy suggest that 80–90% of these deaths are attributable to the underlying disease. We performed a retrospective analysis of patients who died on home parenteral nutrition (HPN) over the last 5 years. There were thirty-seven patients who died in this period and thirty-three complete sets of notes were traced (89%). Notes that were not retrieved had been misplaced during the relocation of St Mark's.

Of the thirteen male and twenty female patients identified (median age 58 (30–77) years, median time on HPN 543 (7–6777) d), twenty five (76%) died of their original disease, four (12%) died from complications of HPN (three liver failure, one septicaemia), four (12%) died from other causes (one subdural haematoma, one suicide, one postoperative, one cardiac failure). Aetiology resulting in HPN requirement was: malignancy six (18%) (two gastrointestinal, two carcinoid, one Hodgkin's lymphoma, one ovarian), connective tissue disease six (18%) (five scleroderma, one mixed), Crohn's disease eight (25%), pseudoobstruction five (15%), mesenteric infarction three (9%), radiation enteritis four(12%) and pancreatitis one (3%).

The median length of HPN treatment was 543 (7–6777) d. Table 1 shows HPN duration, intestinal anatomy and cause of death according to the aetiology.

Table 1

Aetiology	Intestinal anatomy			Length of HPN (range)	Cause of death		
	Any resection	Any stoma	Fistulae		Disease related	HPN related	Other
Crohn's disease	7	6	6	2421 (41–6777)	6	2	
Mesenteric infarction	3	3		300 (63–543)	1	1	1
Neoplasia	3	4	1	65 (7–144)	6		
Pancreatitis				1038		1	
Pseudoobstruction	1	1	1	1497 (62–5092)	3		2
Radiation enteritis	1	2		2778 (308-6068)	3		1
Systemic sclerosis	1	1		541 (166–1173)	6		

Three patients died of liver failure. Two had normal liver function before HPN and developed cirrhosis (biopsy proven), one had abnormal liver function prior to HPN. Two patients had chronic cholestasis while on HPN (bilirubin and alkaline phosphatase >1.5 upper limit of the normal range for >6 months). Nine patients received >1 g/kg per d lipid parenterally, including both patients with chronic cholestasis. Complications related to the central feeding catheter (CVC) are shown in Table 2, expressed as complication rate per HPN day.

Table 2

Aetiology	Total HPN days	CVC complication			
		Infective	Infections/100 HPN days	Thrombosis	Thrombosis/100 HPN days
Crohn's disease	19371	15	0.08	6	0.03
Mesenteric infarction	899	5	0.56	0	0
Neoplasia	392	6	1.53	0	0
Pancreatitis	1038	2	0.19	1	0.10
Pseudoobstruction	7487	7	0.09	3	0.04
Radiation enteritis	11110	6	0.05	3	0.03
Systemic sclerosis	3248	6	0.18	2	0.06

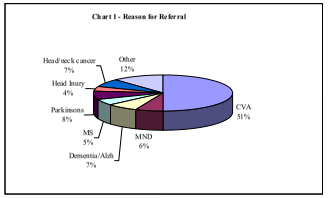
There were only 4/33 HPN-related deaths and most patients died of their underlying disease. Patients with neoplasia died more rapidly from their disease. Infective complications directly attributed to HPN were more frequent in patients with a mesenteric infarction and neoplasia. CVC complications resulting in extensive venous thrombosis was not different according to disease aetiology. HPN cholestasis occurred more frequently in patients receiving >1g/kg/day lipid parenterally. This information may be helpful in trying to anticipate future intestinal transplantation demand.

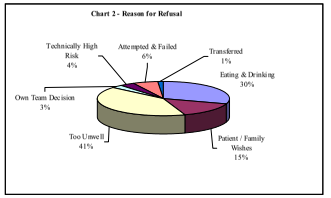
An audit of the percutaneous endoscopic gastrostomy (PEG) service provided by a nutrition support team in a District General hospital over a three-year period. By T.A. CHALMERS-WATSON, C.A. McKENZIE, S.P. BURNHAM, G. ROBERTS, J. FENNELL, K. BORLAND, G.M. SPENCER and W.R. BURNHAM, *Nutrition Support Team, Oldchurch Hospital, Waterloo Road, Romford RM7 OBE*

To review the insertion rates, 30-d mortality and morbidity rates for PEG insertion, a retrospective cohort study of the notes of all PEG referrals made to the nutrition team from 1 April 1998 to 31 March 2001 was undertaken.

	1998/99	1999/00	2000/01	Total
No of patients referred	180	139	104	423
Mean age of referrals (years)	73.68	72.16	73.18	73.01
No of patients receiving PEG	97	66	43	206
% PEG insertion rate	53.9	47.5	41.3	48.7
30-d mortality	7	4	4	15
Mortality rate (% of those PEGed)	7.2	6.1	9.3	7.3
30-d morbidity rate (%)	15.5	12.1	7.0	12.6
30-d PEG site infection rate (%)	10.3	10.6	7.0	9.7

Our findings show that both referrals for and rates of insertion of PEGs declined over the 3 year period, with 48.7% of referrals being accepted for PEG by the team. This may be due to the fact that there is increasing doubt about the appropriateness of PEG for dementia (Gillick, 2000). The most common indication for referral for PEG was cerebrovascular accident (211, 51%). Others included dementia (31, 7.3%), Parkinson's disease (32, 7.6%), motor neurone disease (27, 6.4%), head and neck neoplasms (31, 7.3%) and multiple sclerosis (23, 5.4%) (see chart 1).





The average age of referral was 73 years (range 17–98 years) and there was a slight female predominance (218 women, 51.3%), reflecting the underlying pathology. The most common reason (ninety people, 41%) for declining to insert a PEG was that they were judged by the medical staff on the team to be too unwell to be subjected to an invasive procedure. Of these, 82.2% died within 30 d. Other reasons for not having a PEG were patient and/or family wishes, after explanation of the risks and benefits of the procedure (thirty-two patients, 15%), improvement in swallow (sixty-five patients, 30%) and miscellaneous reasons (see chart 2).

The 30-d mortality was similar over the 3 years with an overall mortality for our service of 7.3% (fifteen patients) (see table). No deaths were attributable to complications of the procedure itself. Published 30-d mortality figures vary between 4.1% and 26% (Abuksis *et al*. 2000).

The most common morbidity from the procedure was a PEG site infection (classified by positive swab culture and requiring antibiotic treatment; see table 1). These were similar over the 3 years with an overall rate of 9.7 % (twenty patients). Other published data record PEG site infection rates of up to 39% in patients not receiving prophylactic antibiotics (Yim *et al.* 2000). Other morbidity included PEG site pressure sores (two patients, 1%) and chest infections (three patients, 1.5%).

In summary, 48.7% of referrals were accepted for PEG by the team and this figure is falling. The mortality rate is one of the lowest in the literature. Constant review of outcomes in this type of procedure is essential.

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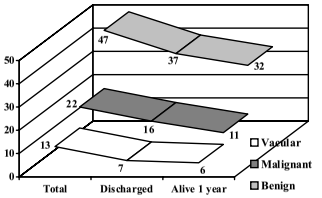
What really happened to those TPN patients? By R.F. McKEE and S.M. ROBERTSON, *Department of Colorectal Surgery, Glasgow Royal Infirmary, Glasgow G4 OSF*

Total parenteral nutrition (TPN) is effective in providing hospital patients with nutritional support when enteral feeding cannot meet nutritional requirements. However, the literature provides little data on the short-term survival of this patient group. The aims of this study were (1) to calculate in-patient and 1-year mortality rates, (2) to examine the relationship between admission type, primary diagnosis and patient prognosis, and (3) to assess the requirement for formal nutritional support after discharge.

Eighty-two patients received TPN under the supervision of our nutrition support team between April 1998 and April 2000. The clinical details of all patients were recorded prospectively in a computer database. To assess patient outcome after discharge, a retrospective analysis of case-notes was then undertaken. Telephone interviews were also performed to collect follow-up data unavailable from case-notes.

As shown in the table, twenty-two of the eighty-two patients died in hospital (in-patient mortality rate 27%). However, forty-nine (83%) of the sixty patients discharged were alive at 1 year. Emergency admission was significantly associated with death, mainly from surgical complications (χ^2 6.46, P<0.05). As shown in the figure, deaths after discharge were significantly associated with malignancy or vascular disease (χ^2 6.07, P<0.05). Only two new patients were discharged on home TPN and three on home enteral feeding. Thirty-three of the forty-nine patients alive to date had both a current and an in-patient body mass value available from the case-notes. Twenty-one of these patients had gained a median of 7 kg in body mass since discharge, whilst eleven had lost a median of 3 kg.

	Total	Discharged	Alive at 1 year
All	82	60	49
Admission type			
Emergency	42	27	19
Elective	27	20	19
Transfer	13	13	11
Disease			
Malignant	22	16	11
Benign, not ischaemia/vascular	47	37	32
Bowel ischaemia/vascular	13	7	6



Patient selection remains vital to the success of TPN. Elective patients and those with benign disease have the best prognosis after discharge. These patients are not likely to require further nutritional support in the community and have a relatively good prognosis once discharged.

Do routine oral protein and energy supplements improve survival in elderly people: a systematic review for the Cochrane Collaboration. By A.C. MILNE[1], J.M. POTTER[2] and A. AVENELL[1], [1]*Health Services Research Unit, University of Aberdeen, Foresterhill, Aberdeen AB25 2ZD and* [2]*The Victoria Infirmary, Langside Road, Glasgow G42 9TY*

Malnutrition is common in elderly people admitted to hospital or in long-term care, and furthermore deterioration of nutritional status occurs during their stay (McWhirter & Pennington, 1994). Oral supplements are often prescribed as a means of improving nutritional status and clinical outcomes for this age group; however, evidence of their effectiveness is limited. A systematic review in 1998 concluded that further evidence was required for adults (Potter *et al*. 1998). This review examines the evidence from trials for improvement in nutritional status and clinical outcomes for older people when extra protein and energy were provided, usually in the form of commercial 'sip-feeds'.

Electronic internet database searches using the Cochrane Library, MEDLINE, EMBASE, Healthstar, CINAHL, BIOSIS and CAB abstracts were carried out, plus hand-searching of nutrition journals and reference lists. Trials which had been found for previous reviews were also included (Potter *et al*. 1998; Avenell & Handoll, 2000). Randomised controlled trials and quasi-randomised controlled trials of protein and energy supplementation were selected. Participants had a minimum average age of 65 years. All diagnostic groups were included, with the exception of groups exclusively of older people in critical care or recovering from cancer treatment.

Over 200 potential trials were found. Both reviewers independently assessed these trials and as a results of mutual agreement thirty-two trails with 2492 randomized participants have been included. Both reviewers also independently extracted data and assessed trial quality; any differences were resolved by consensus. Authors of trials were contacted for further information as necessary.

Participants (78%) were on long-stay care of the elderly wards, nursing homes or were acute medical or surgical patients. Overall, the quality of trials was poor, with nearly half of the studies not achieving 50% of the maximum quality score.

Mortality data were pooled for meta-analysis from twenty-two trials with 1755 participants. The Peto odds ratio for death showed a reduced mortality in the supplemented group compared with the control group of 0.62 (0.45 to 0.84, $P<0.005$) with no significant heterogeneity. The results were consistent when analysis was restricted to trials with clearly concealed randomisation, although this only included five trials. However, the results also suggested that one large study had a major influence on the outcome, and without it the results were of borderline significance; Peto odds ratio 0.69 (0.46 to 1.03, $P=0.07$).

The results of the present review, which included a more comprehensive literature search and looked specifically at oral supplements for elderly people, support the findings of a previous review of protein and energy supplementation in adults (Potter *et al*. 1998), that there was a beneficial effect on mortality. However there are doubts, due to most included trials having poor study quality. Large-scale multi-centre pragmatic trials of interventions to improve the nutritional status of elderly people are required.

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A clinical audit measuring enteral feed prescribed *versus* feed delivered in head-injured patients on a neurosurgical intensive care unit. By E. SEGARAN, *Department of Nutrition and Dietetics, The National Hospital for Neurology and Neurosurgery, UCLH NHS Trust, London WC1N 3BG*

It is well documented that head-injured patients have an induced hypermetabolic and hypercatabolic state (Clifton *et al*. 1986; Weekes & Elia, 1996). It is also known that early adequate nutritional support reduces nitrogen loss (Twyman *et al*. 1985; Cerra *et al*. 1987) and is associated with improved clinical outcome (Young *et al*. 1987) and fewer infections (Taylor & Fettes, 1998). Unfortunately, several problems can affect the delivery of enteral nutrition to head-injured patients on intensive care units, e.g. high intracranial pressure (Norton *et al*. 1988), intensive care practices and drugs used (McNeil *et al*. 1990; Taylor & Fettes, 1998) and delayed gastric emptying (Norton *et al*. 1988; Power *et al*. 1989; McArthur *et al*. 1995;Weekes & Elia, 1996). However, there have been few studies which have actually assessed enteral feed practices; in particular, the measurement of feed prescribed *versus* delivered in head-injured patients.

The aims of this audit were to measure the enteral feed volume prescribed *versus* the feed volume delivered, to identify reasons for any discrepancies and also to establish any possible changes to clinical practice, which would lead to improved delivery of enteral nutrition.

A prospective audit was carried out on enteral feed practices in a neurosurgical intensive care unit in a London teaching hospital. Data collection took place over a 6-month period. The patients included in the study were any surgical patients who were over 18 years old and were enterally fed for a minimum of 48 h. Data were collected on a daily basis on the volume and type of feed prescribed and delivered in a 24-h period, any deficit, the reasons for this (e.g. feed stopped and duration, feed rate decreased, incidence of gastrointestinal problems, procedures undertaken) and the drugs used.

Fifty-three patients (thirty one male, twenty-two female) were studied over 511 d. Most had sustained a subarachoid haemorrhage. On average, only 72% of the quantity of feed prescribed was delivered to the patient. The main reasons preventing full delivery of feed were poor gastric emptying and stoppages for procedures. Seven patients received 50% or less of the prescribed volume. Forty-five (85%) experienced some form of intolerance to the enteral feed (large aspirates, vomiting or diarrhoea). Although thirty-one patients experienced large gastric aspirates, enteral feeding was not abandoned in any patient. Of these patients, 76% were on prokinetic agents; metoclopromide and erythromycin. The main reason that feed was stopped was due to fasting for procedures, with tracheostomy insertion being the most frequent. On average, feeds were stopped for 8 h.

The main factors associated with under-delivery of feeds is poor gastric emptying and stopping feeds prior to and during procedures. The majority of patients receive at least 75% of feeds prescribed over the duration of their admission.

As a result of the audit findings, some areas of clinical practice have been identified for change. Using a multidisciplinary team, a unit enteral feed protocol has been devised. The practice of 'resting' from the feed for 4 h (which was being done in addition to fasting for procedures) has been changed to 24-h feeding to optimise nutritional care in this hypermetabolic/catabolic group of critically ill patients. There are also guidelines for the use of prokinetic agents. In addition to this, it is recommended that the practice of fasting for procedures be reviewed.

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Concurrent validity of three nutrition screening tools for use in the community. By R.J. STRATTON and M. ELIA, *Institute of Human Nutrition, Southampton General Hospital, Southampton SO16 6YD*

Although there are many nutrition screening tools for use in the community, many of them do not have concurrent validity (Elia, 2000). The aim of this study was to assess the concurrent validity of three community screening tools: the MAG tool (Elia, 2000); the MEREC tool (MEREC, 1998); and the Hickson & Hill (1997) tool (HH, originally developed for hospital use; Reilly *et al*. 1995).

Information for the three screening tools was obtained from fifty patients (31 female; 19 male; mean age 56 (SD 16) years; BMI 28.4 (SD 10.1) kg/m^2) attending a gastroenterology outpatient clinic. The information included BMI, history of weight loss, loss of appetite and diagnosis/disease activity. Patient diagnoses included oesophageal stricture, cerebrovascular accident, obesity, colitis, diverticular disease and gluten-sensitive enteropathy. The MAG tool was completed immediately by a nurse but the relevant data were used to complete the other two tools subsequently by an independent investigator. Each of the three tools categorised patients into low (no action), medium (monitor) and high (intervention) risk groups. Chance-corrected agreement between two tools was assessed using the kappa (κ) statistic and its standard error (SE). The results are shown in the table. Systematic differences in scores between tools were examined using the Sign test.

Comparison	Agreement (proportion)	Weighted κ	κ	SE (κ)
MAG *v*. MEREC	0.92*	0.893	0.825	0.077
MAG *v*. HH	0.84	0.711	0.647	0.105
MEREC *v*. HH	0.82	0.583	0.595	0.109

* 0.70 low risk, 0.10 medium risk, 0.12 high risk.

The MAG and MEREC tools had the highest agreement (weighted κ 0.893, indicating 'excellent' agreement (Landis & Koch, 1977)), possibly due to their simplicity and the use of a number of common screening criteria (BMI, percentage weight loss). Agreement of both the MAG and the MEREC tools with the HH tool was poorer (weighted κ 0.711 and 0.583, respectively, indicating 'fair–good' agreement (Landis & Koch, 1977)). This could be because the HH tool employs a greater total number of criteria (HH 5 criteria; MAG 2; MEREC 3) and more subjective criteria than the other two tools. In addition, the HH tool was originally developed for hospital and not community use. Between tools, those scores that differed did not do so in a systematic way.

This study suggested that there was 'fair–good' to 'excellent' concurrent validity between the MAG, MEREC and HH screening tools, with the best agreement obtained between the two simplest tools (MAG and MEREC), which were originally designed for community use.

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Current practice in the assessment and management of children with cerebral palsy: a national survey of paediatric dietitians. By H. HARTLEY, *Newcastle Nutrition, Royal Victoria Infirmary, Queen Victoria Road, Newcastle upon Tyne NE1 4LP*

Cerebral palsy (CP) is a common cause of disability amongst children. It is associated with impaired feeding skills, which lead to poor nutritional intake (Reilly & Skuse, 1992). Consequently many children become undernourished and exhibit poor growth (Stallings *et al.* 1993). Dietitians can play a key role in the assessment and management of children with CP. However, in a previous study (Sullivan *et al.* 2000) it was found that 83% of their study population had never been assessed by a dietitian although over half were identified with feeding and nutritional problems. The survey was undertaken with the aim of generating baseline information on the current practice of dietitians in the UK with this group of patients.

The questionnaire was circulated to the members of the Paediatric group of the British Dietetic Association (BDA). A request for non-members to participate was advertised via the BDA monthly newsletter, and a further seven questionnaires were subsequently distributed. The distribution and return of questionnaires took place between May and October 2000.

Of the 349 questionnaires sent out, 147 completed forms were returned (42%). Many respondents had relatively few children with CP on their caseload. Eighty-eight (59.9%) had less than twenty, 32% had between twenty and thirty-nine and only 7.5% had over forty. Respondents who were members of a multi-disciplinary team were more likely to have a caseload of more than twenty (χ^2 5.25, *P* 0.02). There were eighty-three (56.5%) respondents who were members of a multi-disciplinary team. One hundred and seven (72.8%) respondents reported that over 50% of their caseload were severely disabled. The proportion of respondents with over 50% severely disabled children in their caseload increased as the caseload number increased (r^2 0.996, *P*=0.04).

Weight was assessed by 98.6% of respondents, and height or length by 91.2%. Other anthropometric measures were used less commonly. Mid-upper arm circumference (MUAC) was assessed by 21.1% of respondents, triceps and subscapular skinfold thickness by 8.2% and 4.8%, respectively. Segmental measures of length were conducted by 10.2% of respondents. These other measures were more likely to be used if the respondent had a caseload greater than twenty (χ^2 7.83, *P*=0.005). Dietary intake was usually assessed by 24-h recall (85.7%), and/or estimated food intake diaries (63.9%). Home visits were conducted by 33.3% of respondents and of these approximately two-thirds observed mealtimes (21.1% overall). Dietitians who were members of a multi-disciplinary team were more likely to visit children at home (χ^2 4.2, *P* 0.04), two-thirds of these also observed mealtimes.

This survey provides an overview of current dietetic practice and management of children with CP. The majority of dietitians have small caseloads but a larger caseload size and/or membership of a multi-disciplinary team is linked to aspects of practice which reflect a greater degree of specialisation. This survey highlights a potential shortfall in these specialist dietitians. As understanding of the benefit of nutritional support for children with neurodisability grows, there will be an increasing need for more specialist dietitians to be involved in the management of children with CP.

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Incidence of undernutrition within intermediate care. By E. WALLACE[1], P. MARSHALL[2] and C. BLACKBURN[3], [1]*Intermediate Care, South West London Community Trust, Surrey SM5 3DB,* [2]*Community Dietetic Service, South West London Community Trust, London SW17 7DJ and* [3]*Epsom and St. Helier NHS Trust, Surrey SM5 1AA*

Intermediate care is a major facet of the NHS Plan (DoH, 2000) and the National Service Framework for Older People (DoH, 2001). Intermediate care aims to prevent unnecessary hospital admission and premature entry into long-term care within a nursing or residential home, to facilitate timely discharge and to enhance rehabilitation. To our knowledge, this is the first study attempting to measure the incidence of undernutrition within this population. It was carried out as an audit of the implementation of a nutritional screening tool.

Nutritional training was provided to members of the intermediate care teams serving four Primary Care Groups and one Primary Care Trust. The training addressed the nutrition within the elderly population and how to use the screening tool.

All patients aged 65 and over referred to intermediate care were subsequently screened using the Screening in Practice (SIP) tool (Ward, 1998). This tool was chosen because of its validity and ease of use, including the fact that no instruments or extra resources were required. The tool also appeared very acceptable to community nurses. The SIP categorises patients as either "not at risk", "probable risk" or "undernourished". Patients deemed to be undernourished were referred to a dietitian in the team.

This paper reports on the first 100 patients screened within the first 2 months of implementation of the tool.

	% (*n* 100)		*n*	%
Not at risk	49	Male	28	28
Probable risk	40	Female	72	72
Undernourished	11	Age range	65–100	
Total	100	Mean	81	

Patients referred to intermediate care have a high risk of being undernourished or demonstrate risk factors associated with undernutrition. Only one of the patients classified as undernourished was known to the dieticians. The incidence of undernutrition found was higher than that reported for the general over-65 population (Finch, 1998), similar to that of patients with chronic illnesses (Edington, 1996), yet lower than the incidence among patients admitted to hospital (Edington, 2000). Forty percent of the sample demonstrated some risk factors of undernutrition. These may relate to the impact of the current acute episode or be the beginning of nutritional decline. Advice and support, along with reassessment, is vital for these patients.

Given the remit of intermediate care, these results are very important, as previous studies have demonstrated the importance of nutritional status in rehabilitation (Williams, 1990) and the increased use of NHS resources of individuals who are undernourished (Martyn *et al.* 1998). It is therefore essential that patients referred to intermediate care receive nutritional screening and assessment.

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Health care utilisation according to malnutrition risk in the elderly: an analysis of data from the National Diet and Nutrition Survey of people aged 65 and over. By R.J. STRATTON, R.L. THOMPSON, B.M. MARGETTS, M. STROUD, A.A. JACKSON and M. ELIA, *Institute of Human Nutrition, Southampton General Hospital, Southampton, SO16 6YD*

Although malnutrition is a common problem amongst elderly individuals in the community (Elia, 2000), there is remarkably little information about its impact on the utilisation of health care resources. The aim of this study was to test the hypothesis that elderly subjects with increased risk of malnutrition utilise health care resources to a greater degree than those with no or low risk.

To test this hypothesis, an analysis of data from the National Diet and Nutrition Survey (NDNS) of people aged 65 years and over (Finch *et al.* 1998) was undertaken. Of the 1632 NDNS respondents (75% of total sample), 1355 subjects provided suitable data on body mass index (BMI) and weight change (three reported categories of weight change) over the previous 6 months. Using these data, subjects were categorised into the following three groups: high risk (H: BMI <18.5 kg/m^2 or BMI 18.5–20.0 kg/m^2 and weight loss of ≥3.2 kg or BMI >20.0 kg/m^2 and weight loss >6.4 kg); medium risk (M: BMI 18.5–20.0 kg/m^2 and weight loss of <3.2 kg or BMI >20.0 kg/m^2 and weight loss of 3.2–6.4 kg); and low risk (L: BMI >20 kg/m^2 and no weight loss). These categories are similar to those used by the MAG community tool (Elia, 2000).

Utilisation of health care resources was assessed by analysing the responses to the following questions: (1) During the past 12 months have you been in hospital as an in-patient overnight or longer? (*n* 1353 respondents). If yes, (1a) How many separate stays in hospital as an in-patient have you had in the past year? (*n* 269); (2) During the past 3 months, have you seen your GP about your health at all? (*n* 1333). If yes, (2a) How many times in the past 3 months? (*n* 760); (3) Do you attend any kind of clinic on a regular basis (at least twice a year)? (*n* 1352).

Statistical comparison (see footnote to table) was undertaken between the three risk groups (L, M, H) and also between the low risk group (L) and a combined medium and high (M+H) risk group. The data from questions 1a and 2a were log-transformed (for normalisation) and the results presented in the table as geometric means.

Question	Risk group (% or *n* in each risk group) L	M	H	*P* <	Risk group L	M+H	*P* <
1. Hospital inpatient (12 months) (%)	19	24	55	0.0005¶	19	29	0.002§
1a. Hospital stays (12 months)†† (*n***)	1.02	1.39	1.47	0.04*†	1.02	1.45	0.03*
2. GP visit (3 months) (%)	57	72	84	0.0005¶	58	67	0.02§
2a. GP visits (3 months) †† (*n***)	1.55	1.78	2.34	0.0005*†	1.55	2.04	0.0005*
3. Regular clinic visit? (%)	22	21	24	0.88	22	23	0.92

Significant difference with ¶ Pearson χ^2; § Fischer's exact test; * Univariate ANOVA († with linear contrasts);
** *n* = geometric mean; †† Results only for patients who were hospitalised or visited a GP.

The combined proportion of subjects with medium (7.3%) and high (6.5%) risk of malnutrition was 13.8%. This proportion tended to increase with age (10.4% of those aged 65–74 years; 14.6% of those aged 75–84 years; 17.6% of those aged >85 years; $P<0.054$) and was almost twofold higher in those living in institutions compared with the free living (20% *v.* 12%, $P<0.002$). With the exception of clinic attendance, health care utilisation significantly rose with increasing risk of malnutrition.

This analysis of the NDNS data of people aged 65 years and over demonstrated that individuals with an increased risk of malnutrition had greater utilisation of health care resources, with potential economic implications for the health care system.

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What factors influence whether children admitted to a cardio-thoracic paediatric intensive care unit (PICU) are enterally fed within 12 hours of admission? By N. TWAITES[1], C. ANDERSON[2], D. MACCRAE[1] and S.J. ILLINGWORTH[1], [1]*Royal Brompton and Harefield NHS Trust, Sydney Street, London SW3 6NP and* [2]*Great Ormond Street Hospital for Children NHS Trust, Great Ormond Street, London WC1N 3JH*

When investigating malnutrition in a Children's hospital, a study observed that the most malnourished populations were cardiac and respiratory children, thus emphasizing the need for better nutritional status in this patient population (Hendriekse *et al.* 1997). Another study has shown that cardiac and respiratory hospital in-patients are malnourished, of these 26% and 25% were wasted and 42% and 36% were stunted, respectively (Moy *et al.* 1990). Early enteral feeding has been shown to improve clinical outcomes in critically ill paediatric patients (Kirklin *et al.* 1991).

At the Royal Brompton and Harefield NHS Trust approximately 300 cases per year require paediatric intensive care. Data were collected to assess how soon enteral feeding began and what factors influenced this decision. The aim was to identify whether children admitted to PICU were being enterally fed within 12 h of admission.

Fifty consecutive cardiac and respiratory (male and female) patients admitted to PICU were assessed. A paediatric dietitian and nursing sister collected data. The remainder of the staff were blind to the study's objectives.

The results showed that 38% of patients were challenged with enteral feeds within 12 h. Of those patients who were not enterally fed, 32% were nil by mouth for extubation or elective surgery and in 14% enteral feeding was contraindicated due to necrotising enterocolitis (NEC) or a high risk of developing NEC. Of the variables studied, none were found to be individually significant by Bonferroni correction, given a P value for comparison to be significant at $P<0.004$.

Although the results did not attain significance, the main finding was that failure to feed within 12 h of admission had a clinical basis. The study highlights the fact that the multidisciplinary team has a good awareness of the importance of early enteral feeding in critically ill paediatric patients. This may have been aided by the increased input created by a newly developed cardiac paediatric dietitian post.

In view of these findings, a further study should be completed on critically ill infants who require intensive therapy for longer than 24 h, to ascertain whether optimum nutrition is achieved. This will continue to promote an excellent standard of nutritional care in PICU patients.

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An audit of metabolic abnormalities and complications in parenterally fed patients managed by a nutritional support team. By S.T. BURDEN, K. WARD, A. HOLT and A.J. MAKIN, *Manchester Royal Infirmary, Oxford Road, Manchester M14 9WL*

Guidelines for biochemical monitoring of patients on parenteral nutrition (PN) are outlined by Pennington (1996). The aim of regular biochemical monitoring is to identify abnormal trends early, allowing correction and prevention of metabolic complications which may result in symptomatic events. These may arise from metabolic abnormalities are listed by Dodds *et al*. (2001). The aim of this audit was to establish the incidence of biochemical abnormalities, determine how often treatment was required, other than modification of the PN prescription, and determine the frequency of symptomatic events.

A retrospective audit was undertaken on a prospectively maintained database of all parenterally fed patients managed by a nutritional support team (NST) over a 3 year period. The NST organise and record all biochemical monitoring for patients on PN. Abnormal values are noted along with complications and symptomatic events when patients are visited by members of the NST. Patients are visited each weekday by a dietitian and nutrition specialist nurse and a gastroenterologist is consulted regarding potential complications and related symptomatic events. Results were considered abnormal if the value was outside the reference ranges used by the Trust on one or more occasion or were outside the reference ranges and supported by the general trend of the results.

The audit included 120 patients, seventy-one males and forty-nine females; their mean age was 57 (range 16–85) years and the length of time on PN was a mean of 15 (range 1–97, SD 16) d. The most usual indication for PN was bowel surgery, which accounted for 48% of patients. Complications required treatment other than the manipulation of the PN prescription were seen in 14% of patients. The incidence of re-feeding syndrome was 6%; half of all complications. The metabolic complications which required treatment included hyperglycaemia, hypoglycaemia, elevated liver function tests, lipid intolerance and elevated potassium. Only 1% of patients suffered a symptomatic event, which included one episode of palpitations and one episode of dizziness, with cold clammy skin and altered mental status consistent with hypoglycaemia.

Abnormality	Incidence (%) n 103
Hypophosphataemia	11
Hyperphosphataemia	8
Hyponatraemia	47
Hypernatraemia	7
Hypokalaemia	37
Hyperkalaemia	8
Elevated triacylglycerols	25
Hypomagnesaemia	13
Hypermagnesaemia	1

Hyponatraemia was the most frequent abnormality. This was rarely due to sodium depletion but the result of over-zealous prescribing of extra fluids by junior doctors. The NST is an advisory service and is not currently solely responsible for fluid balance in patients on PN. The incidence of re-feeding syndrome was lower then expected for the percentage of severely malnourished patients fed parenterally. An incidence of 6% can be attributed to the anticipation of re-feeding syndrome in high-risk patients prior to parenteral feeding and close observation of phosphate, potassium and magnesium in the first week of feeding. A NST is effective for the identification of abnormalities at an early stage, thus minimising complications which require extra treatment with additional resources. This keeps the incidence of symptomatic events which can be attributed to metabolic abnormalities to a minimum.

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Benefits of implementing enteral feeding guidelines on a paediatric bone marrow transplant ward. By S. MURRAY[1], V. WIGG[1] and N. BENNETT REES[2], [1]*Dietetic Department, Great Ormond Street Hospital for Children NHS Trust, London WC1N 3JH and* [2]*Bone Marrow Transplant Unit, Great Ormond Street Hospital for Children NHS Trust, London WC1N 3JH*

In 1997 a review of the parenteral nutrition services identified that 11% of the requests for parenteral nutrition (PN) were for bone marrow transplant (BMT) patients (Internal report). All of the PN requests were compared against guidelines for appropriate PN use (devised by a project team). 71% of BMT patients for whom PN was requested had an inadequate consideration of enteral feeding. At this time there was uncertainty associated with nasogastric tube (NGT) feeding due to problems with mucositis, vomiting and diarrhoea which these patients frequently experience. Since then, enteral feeding guidelines have been agreed by the dietetic and nursing teams. These include the routine insertion of NGT on all patients around day +1 of the BMT after post-conditioning nausea has been controlled and before mucositis has developed. All patients are advised of the guidelines pre-admission and prepared by the nursing and play specialist team on admission.

The aims of the present audit were to assess the usefulness of the enteral feeding guidelines for patients receiving BMT and to compare the effect of this with 1997 data by reviewing: (1) patients' acceptance of NGT, (2) number of patients receiving parenteral nutrition, appropriateness of PN requests and duration received.

Thirty-eight prospective BMT patients were admitted to the ward between 1 February 2000 and 31 January 2001. The ward dietitian collected data on the use of NGT and PN. The request for PN was normally initiated by the medical team and this review included an assessment of appropriateness of each PN request by comparing against original guidelines and categorising as 'adequate' or 'poor trial' of enteral feeding.

Thirty-six subjects had allogeneic and two had autologous transplants. The mean age was 4.7 years (range 0.2–11.1 years). Thirty-three patients had a NGT passed according to guidelines (median day of insertion was day 0), three refused a NGT and two were admitted on long-term nasogastric tube feeds with parenteral nutrition (the latter were excluded from PN analysis). Nine patients did not receive PN, twenty-seven did and four of these had two episodes of PN. Data are presented on the thirty-one episodes of PN and compared with twenty-eight episodes of PN reviewed in 1997.

	1997 (9 months)	2000/1(12 months)
Nasogastric tube use per number on ward	5/28 (18%)	35/38 (92%)
PN episodes per total number in hospital	28/251 (11%)	31/415 (7.5%)
Duration PN (days)		
Median	15	27
Range	0–56	5–126
SD	11	30
PN received ≤ 5 days	3(11%)	2 (6%)
Appropriateness of PN request		
Adequate enteral feeding trial	8 (29%)	18 (58%)
Poor trial of enteral feeding	20 (71%)	9 (29%)
Data unavailable	0	4 (13%)

Thirteen patients discontinued NG tube feeding on the ward because they achieved an adequate oral intake, fifteen were discharged home with NGT feeds because of a prolonged poor food and fluid intake.

BMT patients are prone to poor appetite and malnutrition. When a nutritional care plan is included as the treatment plan, NGTs can be successfully passed and used during treatment. NGTs enable patients to have a proper trial of enteral feeding before PN is considered necessary and consequently reduce the inappropriate use of this expensive form of nutrition support.

An audit of prescribed *versus* received enteral feeds in a critically ill population. By M. BROOKE and A. SCOTT, *Department of Nutrition and Dietetics, Middlesex Hospital, UCLH NHS Trust, London WIN 8AA*

Intensive care units with well-defined feeding protocols deliver significantly greater volumes of enteral feed (P<0.00001) than those without (Adam & Batson, 1997).

Total parenteral nutrition (TPN) provokes the acute inflammatory response (Windsor *et al*. 1998) and is implicated in direct initiation of free radical activity, mainly due to its *n*-6 fatty acid content. However, although enteral nutrition has been cited as a contributor to improved gastric perfusion and mucosal integrity (Kudsk, 1994; Buchman *et al*. 1995), successful enteral feeding can be variable.

Consequently, it has been our intensive care unit (ICU) practice to attempt enteral nutrition first in patients with a functioning gastrointestinal tract. An algorithm based on best practice/evidence was developed (Armstrong *et al*. 1991) and subsequently a diarrhoea protocol as well.

The aims of this audit were to compare the prescribed volumes of enteral feeds with the delivered volumes, to identify the reasons for the discrepancies, if any, and to determine whether there was adherence to the algorithm and protocol.

A prospective audit was carried out on an 18-bed general intensive care unit in a London teaching hospital over a period of 6 months. Patients who were over 18 years of age and fed for more than 48 h were included. Data were collected on the volume and type of feeds prescribed and delivered in a 24 h period. Any discrepancies between prescribed and received volumes were noted and the reasons for these (e.g. procedures undertaken, gastrointestinal problems) were recorded.

Seventy-four patients (forty-two male) were studied over 905 d, during which 60.8% received 75% or more of the feed prescribed.

The main reasons for feed stoppages were due to feed intolerances (42 patients, 56.8%), tracheostomy placements (32 patients, 43%) and accidental tube removal (22 patients, 30%). On average, feeds were stopped for 6.7 h for tracheostomies (range 2–14 h) and 4.9 h for tube removal (range 1–24 h). Only four patients (5%) received less than 50% of the feed prescribed.

Gastrointestinal problems	Incidence (no. of patients) (%)	Average time feed stopped (range) (h)
Abdominal distension	23.8 (10)	3.6 (1–10)
Diarrhoea	38 (16)	8.6 (1–24)
Nausea	4.7 (2)	5 (1–13)
N/g aspirates >200 ml	2.4 (1)	2.5 (2–3)
Vomiting	30.9 (13)	10.6 (1–24)

The main factors associated with feed underdelivery were gastrointestinal intolerances combined with poor adherence to unit protocols. Multidisciplinary education initiatives are required to improve unit practice and to ensure that optimal nutrition delivery is achieved.

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Effect on patient energy intakes of adding snacks to the patient menu at a District General hospital. By K.J. LORD, *Nutrition and Dietetic Service, Royal United Hospital, Bath BA1 3NG*

It has been shown that malnutrition is a common problem in hospital (McWhirter & Pennington, 1994; Potter *et al*. 1998). Weighed food intakes at the Royal United Hospital, Bath in 1994 and 1999 (unpublished results) showed that 81% and 76% of patients, respectively, did not achieve their full energy requirements. 45% and 39%, respectively, took less than 70% of their requirements. However, the 1999 data showed a significant positive correlation between the number of between-meal snacks eaten and overall energy intakes.

The aim of this study was to test the hypothesis that offering between-meal snacks and making additions to the meal choices would increase patient energy intakes. An initial pilot study showed that digestive biscuits, orange juice, cake and an energy-supplemented soup were the most popular and most frequently consumed energy supplements.

Patients were selected from one medical ward, one surgical ward and one orthopaedic ward and their permission sought to record their food intake over 24 h. Eligible patients (*n* 147) were adults able to eat all day (i.e. not being fasted for tests) and at least 2 d post-operative. Some patients (*n* 88) were offered a variety of extra items: orange juice with breakfast and lunchtime meals, cake with the mid-afternoon drink, digestive biscuits with the mid-morning and evening drinks and a soup supplemented with an energy supplement (Procal). On days four and five following introduction of extra items, actual patient food intakes over 24 h were measured by weighing all food served and noting wastage. Dietary intakes were analysed for nutrient composition using Dietplan5 [3] and additional manufacturer's data. Intakes of both groups of patients (offered snacks and not offered snacks) were measured on the same days of the hospital menu cycle to ensure that the meal choices available did not differ.

There was a significant difference ($P<0.05$) between the overall energy intakes of those patients offered snacks and those not offered snacks. Overall energy intake was broken down into energy from meals, patients' own food, snacks offered by the hospital and milk drinks and nutritional supplements. No correlation was found between energy intakes and age, sex, medical condition or length of hospital stay.

	Mean total energy intake MJ (kcal)	SD MJ (kcal)	Mean energy from provided snacks, fruit juice and Procal MJ (kcal)	Mean energy from hospital meals (excluding fruit juice and Procal) MJ (kcal)	Mean energy from milk drinks/ supplements MJ (kcal)	Mean energy from patient provided food MJ (kcal)
Patients not offered snacks (n 59)	6.67 (1588)	2.78 (661)	0 (0)	5.49 (1308)	0.47 (113)	0.70 (166)
Patients offered snacks (n 88)	7.47* (1778)	2.52 (600)	0.58 (137)	5.93 (1412)	0.41 (98)	0.55 (130)

Significantly different from the no-snacks group *$P< 0.05$.

Patients offered snacks also had higher energy intakes from meals but the differences were not statistically significant within this sample size. Since this report is part of an ongoing project, there will be the opportunity to determine whether this trend continues.

These results suggest that between-meal snacks are helpful in increasing patient energy intakes and do not prejudice patient energy intakes from meals, milky drinks and supplements or from patients' own food. The snacks offered were popular with the patients and could be offered within this hospital's current ward staffing, facilities and organisational systems. There was, however, a cost implication in increasing patient energy intakes.

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Inequalities in healthcare: an investigation into service provision to home-based enterally tube-fed patients in Greater Manchester. By S.T. BURDEN[1], K. WARD[1], R. PARKER[2], T. GRANT[2] and J. SHAFFER[3] on behalf of the Greater Manchester Home Enteral Feeding Group, [1]*Manchester Royal Infirmary, Oxford Rd, Manchester M14 9WL,* [2]*Crumpsall Clinic, Humphrey St, Manchester M9 4BE and* [3]*Hope Hospital, Salford M6 8HD*

A group in Greater Manchester was established to share local experiences with home enteral tube feeding (HETF). The main issues identified were the discrepancies in service delivery between areas, long-term management of feeding devices and the roles and responsibilities of acute and community Trusts. The aim of this investigation was to collate some baseline information and identify areas of good practice relating to service provision, replacement of feeding devices, role allocation and monitoring.

A survey of professionals closely involved in the planning, organisation and aftercare of patients discharged from hospital on a HETF was conducted over 4 months. Those surveyed included hospital and community dietitians (CD) and endoscopy units (EU). The questionnaires were circulated by representatives from the group to colleagues working locally in the area of HETF. There are twelve areas in Greater Manchester and eleven were represented at the meetings and surveyed. Three questionnaires were designed for hospital dietitians (HD), CD and EU managers. In total, sixty-six questionnaires were circulated and the overall response rate was 68% (*n* 45). The response rate from EU was 90% (*n* 9), from HD 60% (*n* 25) and 73% (*n* 11) from CD.

The questionnaires from the CD revealed that four areas had no funded time for HETF and eight areas had no community paediatric cover. There were large differences in the amounts of time individuals had to manage their caseload. This varied from 51 to 263 (mean 105) minutes per patient, inclusive of travel and patient-related administration time; two-thirds indicated that the time allocation in relation to caseload was insufficient. Half of the CD who responded aimed to see patients within 5 days. The length of time from the initial contact in the community to the follow-up visit varied from 1 to 6 months; 25% of respondents relied on telephone contact to monitor patients.

Questions	% responses from CD			
	5 d	7 d	2–4 weeks	4 weeks
How soon should a patient be visited when discharged to own home?	50	37	12	12
How soon should a patient be visited when discharged to a nursing home?	0	75	12	12
When are they actually visited when discharged to own home?	12	62	25	0
When are they actually visited when discharged to a nursing home?	0	50	37	12

Three-quarters of EU had used the same type of gastrostomy tube for >3 years and 88% of units indicated that ease of placement was the priority in deciding on the type of tube. Seventy per cent of the units supplied replacement gastrostomy tubes, 80% were involved in the replacement and half of the units had procedures in place for replacing tubes. Button gastrostomies were placed by 80% of units and only four Trusts placed radiologically inserted gastrostomies.

The results from HD indicated that 95% had a policy for discharging patients on a HETF, although 78% of respondents indicated that they were not informed of all discharges on a HETF. The length of notice given prior to a discharge varied from 1 to 7 d with 43% receiving >5 d notice of the discharge of a patient on an enteral feed. Monitoring of patients in the community was undertaken by 34% of HD who responded.

The survey revealed that follow-up support from a CD for patients discharged on a HETF in Greater Manchester is dependent on the area the patient lives in. Also, where dietetic time is available the level of service provision is variable, with some patients only receiving telephone contact. The results from EU showed that the service provided is generally consistent and rationalised, although more development is needed on procedures and pathways for replacing feeding tubes. Only a small proportion of HD are involved in monitoring HETF patients in the community and this is often crisis management.

Systematic review of nutrition support for bone marrow transplant patients. By S. MURRAY and S. PINDORIA, *Systematic Reviews Training Unit, Institute of Child Health, 30 Guilford Street, London WC1N 1EH*

Bone marrow transplantation involves toxic chemotherapy regimes and infusion of autologous or allogeneic marrow cells. Within a few days of commencing treatment, patients can develop a poor appetite, mucositis and gastrointestinal failure making them prone to malnutrition. Nutrition support is often necessary and parenteral nutrition (PN) has traditionally been the first choice. However, enteral nutrition (EN) is receiving greater consideration, as is the addition of novel substrates such as glutamine to enteral and parenteral solutions. The benefits of any type of nutrition support for these patients have not been adequately evaluated.

This review aimed to appraise all randomised controlled trials which compared any form of nutrition support, given enterally or parenterally to patients receiving allogeneic or autologous bone marrow transplantation, for their effect on duration of hospitalisation, nutrition intervention and neutropaenia. The effect on incidence of mucositis, line infections, change in body weight, graft *v.* host disease, and survival was also examined.

A computerised search of MEDLINE, EMBASE, CINAHL, and the Cochrane Controlled Trial Register and DARE databases was performed. Reference lists of included trials and conference proceedings of nutrition support and bone marrow transplant research were also hand-searched. Outcome data was extracted by the authors. Where more than one study reported data for a particular outcome, a pooled estimate of treatment effect was calculated using meta-analysis. Study investigators were contacted for unpublished outcome data or details relating to study quality if necessary.

Thirty-one potentially eligible studies were identified. Eleven were excluded because they were not randomised controlled trials. Twelve of the included studies were allocated to four subreviews.(1) oral glutamine *v.* placebo (four studies including 343 patients); (2) PN with glutamine *v.* standard PN (three studies, 108 patients); (3) PN *v.* intravenous hydration (two studies, 154 patients); (4) PN *v.* EN (three studies, 148 patients). The other eight studies compared various other interventions and were not grouped.

The statistically significant results of the four subreviews were as follows:

- Oral glutamine *v.* placebo: only two of the four studies in this review reported duration of neutropaenia. It was significantly reduced by 6.82 d for patients receiving a placebo mouthwash compared with patients receiving a glutamine mouthwash (95% CI 1.67, 11.98, P=0.009). No other outcomes in this group showed significant effects.
- PN with glutamine *v.* standard PN: patients receiving PN with glutamine had their hospital stay reduced by 6.62 d (95% CI 3.47, 9.77, P=0.00004). Two of the three studies in this group reported the incidence of positive blood cultures. This was reduced in patients receiving PN with glutamine (odds ratio 0.23, 95% CI 0.08, 0.65, P=0.006), compared with those receiving standard PN.
- PN *v.* intravenous hydration: only data from one of these studies could be evaluated. The most notable outcome was the higher incidence of line infections for patients receiving PN (odds ratio 21.23, 95% CI 4.15,108.73, P=0.0002).
- PN *v.* EN: inadequate provision of data meant that the effects of neither could be evaluated.

Despite trying to retrieve unclear or unpublished data from the authors, it was difficult to judge the benefits of the various types of nutrition interventions. A number of studies with a relatively large number of patients were found for the two subreviews comparing oral glutamine with oral placebo and PN with EN, the relevant data need to be retrieved rather than further studies being performed. Until then the benefits of either cannot be ruled out.

Patients receiving PN compared with intravenous hydration are more prone to line infections, but when given PN with glutamine instead of standard PN patients benefit from a reduced incidence of positive blood cultures and are able to go home earlier. When bone marrow transplant patients develop prolonged gastrointestinal failure and enteral feeding is not possible, PN with the addition of glutamine should be considered.

A pilot study to investigate the appropriate prescribing and use of oral nutritional supplements within the community. By A. KYLE, *Mendip PCT, St. Aldhelm's Hospital, Green Lane, Frome, Somerset BA11 4JW*

The use of nutritional supplements in primary care has increased steadily in the last few years. However, there is little clinical evidence that patients are assessed prior to commencing sip feeds or that this nutrition intervention is beneficial. A large-scale systematic review looking at these products has revealed that many patients receiving sip feeds do not undergo any nutritional assessment prior to commencing the feed, the continued use of the feed is not monitored, and no clinical outcome as a result of the treatment intervention is identified (Stratton & Elia, 1999). The present study looks at the prescribing of sip feeds in fifteen GP practices in the county of Somerset. Somerset is a popular holiday destination and many people tend to retire to the area. As a consequence of the latter there is a slightly higher than average elderly population (DoH, 2000), which may have some impact on sip feed usage locally.

Twenty GP practices were invited to participate in the study and fifteen agreed to be included. An audit was carried out to assess how many patients were currently receiving sip feeds and also the number who had received a prescription within the previous 12 months. Subsequently from these a small computer-generated random sample (n 30) was invited to attend for a nutritional assessment with a dietitian.

717 patients, from a practice population of approximately 164 500 currently received or had received sip feeds in the previous 12-month period. The greatest use was in the elderly, 75 years and above. A significant number of prescriptions were 'one-off' prescriptions, which have been shown to be least effective (Stratton & Elia, 1999). Among patients invited for assessment by a dietitian, sip feeds were used most frequently in patients with a BMI <20, where there is evidence that most clinical benefit is derived. Nutritional assessment by a dietitian also agreed closely with the results obtained using a nutrition-screening tool for malnutrition in adults (Elia, 2000). The widespread use of the BAPEN nutrition screening tool and agreed guidelines on when to initiate sip feeds could realistically eliminate many of these 'one-off' prescriptions, which we know to be of limited long-term benefit in many patients. While the sample size was small, it was an opportunity to use the new screening tool and it is envisaged that it will be incorporated into prescribing guidelines for nutritional supplements across Somerset. An unexpected finding of the study was that 24% of the patients identified were in the 0–4 age group, and here the majority of prescriptions were for soya infant formula.

There are around 1500 adult patients in the community in Somerset who require dietetic advice for nutritional support every year. There is a need for nutrition education for primary health care staff on implementing nutrition screening more widely and on the use of nutritional supplements. Also the high prescribing of soya infant formula suggests the need for more community paediatric dietetic support for both health professionals and patients.

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Feeding jejunostomy inserted during gastrointestinal surgery: extra risk or nutritional safety net? A retrospective review of 55 cases. By A.J. FAIRHURST, A. SCHMIEDEL, P. DEEL-SMITH, G. GADD, R.P. GRIMLEY, H.C NORCOTT, T. DIGGER, N.C. FISHER and B.J.M. JONES, *Upper Gastrointestinal Cancer Multidisciplinary Team, Russells Hall Hospital, Dudley, West Midlands DY1 2HQ*

It has been suggested that routine use of feeding jejunostomies inserted during upper gastrointestinal surgery is associated with increased morbidity, outweighing any nutritional benefits (Daly *et al*. 1995; Watters *et al*. 1997; Lawlor *et al*. 1998). We therefore performed a 3-year retrospective review of morbidity and weight loss following upper gastrointestinal surgery during which a fine-needle jejunostomy (FNJ) was placed. Between June 1998 and June 2001, fifty-five FNJs were inserted (oesophageal cancer 34, gastric cancer 16, benign pathology 5). Seven procedures were palliative, whilst five patients were inoperable apart from the insertion of a FNJ in anticipation of chemotherapy. At the surgeon's discretion, a polymeric feed infusion was started at 25 ml/h, increasing every 12 hours to meet calculated requirements. Feeding was continued until oral nutrition was resumed.

30-d mortality was 7/55 (12.7%) including palliative procedures. Complications occurred in 34/55 (62%). Twenty-four of these (44%) were as a result of the primary procedure, including twelve anastamotic leaks. There were ten (18.2%) complications of FNJ feeding. Only one of these was considered serious (suspected feeding site leakage). This was never proven and the feed was allowed to continue. Minor complications included blocked tubes (3), peristomal cellulitis (1), tube displacement (2) and discomfort (4). Mean 30-d postoperative weight loss was 2.3 kg (SD 4.9; median 2.1). There was no significant weight loss with and without postoperative morbidity related to the primary procedure (1.8 kg, SD 5.7 *v.* 3.2 kg, SD 4.1). Fine-needle jejunostomy feeding was started 2.2 (SD 1.6) d postoperatively and was continued for 16.3 d (median 12.5 d, range 0–66 d). There was no correlation between length of hospital stay and weight loss (Pearson correlation coefficient = –0.1) nor between the day of starting feed and weight loss (Pearson correlation coefficient = –0.08). We have no comparative data on patients who did not have a jejunostomy tube placed, but weight losses of 6 kg have been recorded in similar patients receiving no nutritional support (Beattie *et al*. 2000).

Fine-needle jejunostomies placed during major upper gastrointestinal surgery, mainly for cancer, were associated with a low morbidity and no mortality. Weight loss was minimised in this uncontrolled series, even in those patients with a delayed return to oral nutritional intake due to complications from the primary procedure. FNJ is a safe and effective modality of postoperative nutritional support in upper gastrointestinal surgery in a District General hospital.

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Evaluation of a multidisciplinary feeding clinic for home enterally-fed children. By C.T. DUNLOP[1], L. RUSSELL[2,5], L. CRAMPIN[3], A. RENNIE[4,5], P. GALLOWAY[6], L.T. WEAVER and J.J. REILLY, [1]*Department of Nutrition and Dietetics, Yorkhill NHS Trust, Glasgow G3 8SJ,* [2]*University Department of Human Nutrition, Yorkhill NHS Trust, Glasgow G3 8SJ,* [3]*Glasgow Dental Hospital and School, Department of Speech Therapy, Glasgow G2 3JZ,* [4]*Department of Community Child Health, Yorkhill NHS Trust, Glasgow G3 8SJ,* [5]*University Department of Child Health, Yorkhill NHS Trust, Glasgow G3 8SJ and* [6]*Department of Biochemistry, Yorkhill NHS Trust, Glasgow G3 8SJ*

Home enteral feeding (HEF) has increased dramatically in recent years (McCarey *et al*. 1996; Elia *et al*. 2000; Puntis, 2001). However, the costs and consequences of HEF in children remain unclear. Following a study identifying this increase in the Glasgow area (McCarey *et al*. 1996), issues regarding the adequacy of follow-up for certain HEF populations were raised. The aim of the present study was to determine whether a multidisciplinary team could improve growth and nutritional status, quality of life and patient satisfaction in patients who are tube-fed. Many previous studies have suggested that a multidisciplinary team approach is preferred (Couriel *et al*. 1993; Manikam & Perman, 2000; McNamara *et al*. 2001). The Yorkhill multidisciplinary feeding clinic was established in 1999 to test the effect of a multidisciplinary team (consisting of a dietitian, nurse, speech therapist and community paediatrician) on the following variables: nutritional status (change in weight standard deviation score, SDS): growth (change in lower leg length); change in quality of life; patient satisfaction (questionnaire). Children were eligible for inclusion if they were >1 and <18 years old, on HEF, and not receiving follow-up at specialist clinics (e.g. patients with cystic fibrosis, renal, metabolic and gastrointestinal disease were excluded).

A total of eighty patients were eligible for inclusion in the study. Of these, twenty-six children attended all three research clinics. These patients did not differ significantly from those eligible for key variables such as duration of HEF, diagnosis, age or level of social deprivation. Of the patients who participated, seventeen (65%) had a neurological primary diagnosis and nine (35%) had a variety of other primary diagnoses. Mean age of participants was 5.4 years. Participants were monitored for a 3-month 'run-in' period, with no intervention. This was followed by intervention which consisted of advice based on assessments by all the professionals involved at the feeding clinic, and a variety of alterations to clinical management supported by home visits by the nurse.

At baseline, mean weight SDS was –1.95 (SD 1.76), close to the second centile. Weight SDS increased significantly post-intervention (mean paired difference in weight SDS +0.34, $P<0.001$; 95% CI 0.16, 0.52). Lower leg length also increased significantly. Of fifty-two attempts at venepuncture, twenty (38%) samples were obtained. Routine biochemical screens at the first clinic showed minimal abnormalities; however, 79% of samples showed abnormally low carotene levels α-carotene (<14mg/l) and β-carotene (<90mg/l). In addition, 75% of samples showed abnormally low levels of vitamin C (<11 mmol/l).

There was a trend towards improved quality of life (paired *t*-test, $P=0.05$). Patient satisfaction with the clinic was high. In two patients complete cessation of HEF was achieved. This could have important financial benefits to the health service as well as to the patients and their families. The patient satisfaction questionnaire revealed strong support for the clinic amongst families.

This study suggests that a multidisciplinary team approach involving systematic follow up of children who are enterally fed does provide substantial improvements in various indices and has the potential to make economic savings.

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A survey of problems ward managers perceive they have with the delivery of effective nutritional care at ward level. By H. TORAMAN[1], H. REAM[2] and J. LEGGOTT[3], [1]*Joint GI Directorate,* [2]*Department of Dietetics and Nutrition and* [3]*Director of Nursing, Nottingham City Hospital NHS Trust, Hucknall Road, Nottingham NG5 1PB*

The role of the nurses is fundamental in the delivery of nutritional care to patients but studies have identified that there can be a lack of nurses available to supervise at mealtimes (Hungry in Hospital, 1997). An audit of nine nutrition standards at Nottingham City Hospital (International Congress of Dietetics, 2000) identified problems with the delivery of effective nutritional care to patients. In an effort to tackle these problems, nursing action plans were developed by a nurses' nutrition steering group in order to set standards about nutritional care at ward level. Although the action plans were ratified by senior nurse managers, they were not implemented at ward level and changes did not appear to take place. As a result of this the Director of Nursing took a different approach, and asked ward managers to attend an interview to identify the problems they faced on a day-to-day basis in ensuring patients' nutritional requirements are met. The results of this would then be fed back to them in an effort to motivate them to implement change using the benchmarking process in Essence of Care (Department of Health, 2001).

In June 2000, ward managers were invited to arrange an interview with the Nutrition Nurse Specialist and Nutrition Facilitator. In some cases, only one person was available to interview, but both attended whenever possible. Three reminders were sent to ward managers to ask them to arrange an interview before the deadline. The interviews were semi-structured and ward managers were asked by the interviewers to talk about the problems they had delivering all aspects of nutritional care to patients. These comments were recorded, and a list of prompts was used to ensure that all aspects were covered during the interview. Records were typed and returned to the ward managers to check for accuracy.

Twenty-seven out of a possible fifty interviews took place with ward managers between July and October 2000. Twenty-three ward managers did not make contact with the interviewers to arrange a time. The statements made by the ward managers were grouped into eight categories.

Communication issues between nurses and ward waitresses featured heavily in the responses. Ward managers reported that they rely on ward waitresses to seek out the nurse to gain information about patients' dietary needs rather than nurses making the time to seek out the waitresses. Communication was reported to be better between regular ward waitresses rather than relief staff.

Eighteen ward managers reported that nutrition screening occurred on admission but four thought that it was repeated during the patient's hospital stay. One ward manager stated that 'although nutrition screening charts are completed on admission they are not regularly reviewed. If nutritional problems are identified they are acted upon, but this isn't a formalised system and nutrition documentation tends only to be revisited if there is a problem'.

Ward managers stated that the number of staff available to assist patients as necessary or to direct the meal service was insufficient. Eleven ward managers thought that informal systems existed for identifying and monitoring nutritional problems and that these systems worked.

Despite being a small qualitative study, every ward manager interviewed thought that there were problems at ward level in the provision of nutritional care to patients. Their comments suggested that there are few organised practices at ward level for nutritional care. This was reinforced by the number of ward managers who made reference to the informality of systems used to identify nutritional problems and references to the reliance on ward waitresses to seek them out to gain essential information. Although problems were identified, there is a lack of urgency to address these problems and a sense of inability to create change at ward level.

We hope, however, that this project will aid implementation of the clinical practice benchmarking, as similar problems identified in 1998 still appear to exist.

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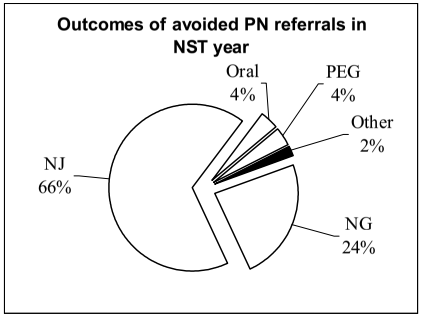
Quality benefits of a hospital nutrition support team. By J.F. KENNEDY, J.M.D. NIGHTINGALE and M. CURRIE, *Gastroenterology Centre, Leicester Royal Infirmary, Leicester LE1 5WW*

A hospital nutrition support team (NST) commonly has to justify itself in terms of cost and quality benefits. This study aimed to show quality benefits of a NST in a university hospital.

A team that worked across all adult directorates of a teaching hospital was started in November 1999. Having agreed the team's aims and objectives, careful records of all patients seen and their outcome was recorded and compared to a retrospective audit of all patients given parenteral nutrition for the previous 12 months.

Team referrals (*n* 263), including adult parenteral nutrition (PN) patients, patients fed via the jejunum and some fed via the stomach, nasogastrically or orally, had Consultant-led review within 24 h. Total PN days rose (665 pre-NST *v.* 752 with NST); short-term PN (=5 d) fell by 35%. Of PN referrals, 42% were fed enterally (67% via nasojejunal (NJ) tube). NJ tubes were inserted by the NST; referral-to-insertion time was often as low as 15 min.



The NST inserted 39% of PN catheters with no insertion-related complications. Catheter insertion done in the radiology department fell (28% (pre-NST) to 10% (NST)), thus waiting time for catheter insertion was reduced. With the NST, PN was managed well in low-dependency areas (ICU PN fell from 41% to 28% in the NST year). The number of tunnelled PN catheters rose by 118%, single-lumen catheters rising to 81%. PN catheter-related sepsis (CRS) fell from 71% to 29% (7% in the last 3 months) with fewer interruptions to PN (mean number of catheters per patient 1.52 pre-NST, 1.04 with NST). Mean length of hospital stay for PN patients fell (40 d pre-NST, 31 d with NST). Staff education sessions (*n* 75) included PN training for nurses, enteral nutrition training, education meetings for medical staff and teaching in the university. Successful training has been established for patients to go home on PN.

The NST positively impacted on PN patient outcome, including fewer interruptions for CRS. Long-term PN is now administered safely and external referrals are attracted for home-PN training. The NST has enhanced staff support and the reputation of the hospital.

Effect of starvation and a very low energy diet (VLED) on subjective feelings of hunger in healthy lean males. By E.R. GIBNEY[1,2], R.J. STRATTON[1], A.M. JOHNSTONE[2], P. FABER[2], R.J. STUBBS[2] and M. ELIA[3], [1]*Department of Biological and Nutritional Sciences, University of Newcastle, Newcastle Upon Tyne NE1 7RU,* [2]*Rowett Research Institute, Greenburn Road, Bucksburn, Aberdeen AB21 9SB and* [3]*Institute of Human Nutrition, Southampton General Hospital, Southampton SO16 6YD*

Studies on the effect of dietary restriction on appetite sensations in lean subjects are few, often anecdotal, and conflicting in nature. Whilst some studies suggest an increase in appetite sensations, others suggest little change or even a decrease (Keys *et al*. 1950; Silverstone *et al*. 1966; Rosen 1981) This study aimed to assess whether these apparent striking discrepancies can be explained by differences in the magnitude of dietary restriction and qualitative differences in the pattern of hunger sensations after varying periods of dietary restriction.

Six subjects (mean age 39.8 (SD 11.6) years, weight 71.5 (SD 9.2) kg, height 1.8 (SD 0.1) m and BMI 22.3 (SD 2.6) kg/m^2) were admitted to a metabolic suite and stabilised on a diet at 1.4×BMR for 1 week (0% weight loss), before the start of starvation (water only). The starvation lasted for 4–5 d and induced a mean weight loss of 5.2 (SD 1.3)% (nominally 5% weight loss). A second group of five subjects (mean age 47.2 (SD 7.2) years, weight 67.0 (SD 8.2) kg, height 1.8 (SD 0.1) m and BMI 21.4 (SD 2.5) kg/m^2) was studied in the same manner except that they received a VLED containing 2510 kJ/d over a period of 19–21 d, achieving a total weight loss of 9.0 (SD 0.9)%. Using a portable electronic Apple Newton Message Pad, which incorporated a visual analogue scale (range 0–100), subjects recorded feelings of hunger every hour during waking hours of each day. Mean daily values were then calculated for statistical analysis, which was carried out using paired sample Student's *t*-test, repeated measures ANOVA, linear trend analysis and split-plot design ANOVA (SPANOVA).

	Starvation	VLED
At 0% weight loss	38.3±6.4	28.4±12.1
At 5% weight loss	16.6±11.3*	49.1±14.5^{+}
During 0–5% weight loss	42.2±15.8**†	43.4±13.9^{++}††
Change at 5% weight loss$^{\#}$	–21.7±12.5	20.7±17.4

Results are expressed as mean ± SD.*Denotes significantly different from 0% weight loss at *P=0.008, **P=0.07, ^{+}P=0.098, ^{++}P=0.07. P (trend) during 0–5% weight loss †P=0.011 and ††P=0.304. $^{\#}$Difference between starvation and VLED group P=0.008.

In the starvation group, hunger increased on day 1 (57.8±23.7 compared with 38.3±6.4 at 0% weight loss, P=0.05). It then progressively decreased so that values at 5% weight loss were well below those on day 1 and baseline values (P (trend) for days 1–4 = 0.011, see table). In the VLED group, hunger increased at 5% weight loss and continued to do so thereafter (64.3±20.1 at 9% weight loss; P<0.05). The changes at 5% weight loss in the starvation and VLED groups were qualitatively and quantitatively different (P=0.008).

This study is the first to formally track subjective feelings of hunger in healthy lean men undertaking rapid weight loss at different rates. It suggests qualitatively different temporal patterns between starvation (0–5% weight loss), in which hunger increases on day 1 and progressively decreases thereafter, and semi-starvation (VLED group), in which hunger tends to increase.

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A protein- and energy-dense, *n*-3 fatty-acid-enriched oral nutritional supplement improves dietary intake and weight in patients with cancer cachexia. By R. RICHARDSON[1], M. FERGUSON[2], K. RIED[2], K. YUILL[3], A. MOSES[3], K. FEARON[3] and A. VOSS[2], [1]*Queen Margaret University College, Edinburgh EH12 8TS, UK,* [2]*Abbott Laboratories, Columbus, Ohio, USA and* [3]*Royal Infirmary of Edinburgh, Edinburgh EH3 9YW*

Conventional nutritional support has failed to reverse weight loss in patients with cancer cachexia. *n*-3 Polyunsaturated fatty acids, such as eicosapentaenoic acid (EPA), have been shown to downregulate pro-inflammatory cytokine production, which has been implicated in the pathogenesis of cancer cachexia (Wigmore *et al*. 1997). The aim of this study was to examine the role of a protein- and energy-dense, *n*-3 fatty-acid-enriched oral nutritional supplement on spontaneous food consumption in patients with cancer cachexia.

Sixty-one patients (31 C, 30 E) with unresectable adenocarcinoma of the pancreas who had lost >5% of their body weight were enrolled in Edinburgh as part of an international, multi-centre, randomized, double-blind study. Patients were asked to consume two cans per day of either a protein- and energy-dense, *n*-3 fatty acid (1.1 g EPA) and antioxidant-enriched oral nutritional supplement (E) or an isoenergetic, isonitrogenous control supplement without *n*-3 fatty acids and enhanced antioxidants (C). Each can provided 1300 kJ (310 kcal) and 16 g protein. Dietary intake, weight and other measures were assessed at baseline, and at 4 and 8 weeks.

On average, patients had lost 12–15% of their usual body weight before entry into the study. Patients in both groups had similar consumption of the oral supplements at 8 weeks (C 1.3 and E 1.5 cans/day; NS). There was a significant decrease in meal intake at 8 weeks from baseline in the control group. In addition, the E group significantly increased their total energy and protein intake (from meals and supplement). The E group also gained weight over the 8-week study period (C –0.39 and E 0.91 kg; NS).

	Control (n 19)	Experimental (n 16)
Baseline		
Meal intake kJ (kcal)/d)	6600 (340) (1578 (81))	6610 (410) (1580 (99))
Meal intake (g pro/d)	67 (4)	59 (5)
Δ Baseline to 8 weeks		
Suppl. intake (kcal/d)	1650 (170) (395 (40))	1970 (160) (471 (38))
Suppl. intake (g pro/d)	21 (2)	24 (2)
Meal intake (kcal/d)	−1040 (410) (–249 (97))*	−950 (460) (–226 (110))
Meal intake (g pro/d)	–14 (4)*	–8 (5)
Total intake (kcal/d)	610 (380) (146 (92))	1030 (520) (246 (124))*
Total intake (g pro/d)	7 (4)	17 (6)*

Significantly different from baseline: *P<0.05. Mean (SEM).

Despite similar consumption of the oral supplements, patients in the E group had improved total dietary intake and did not entirely displace meal intake with the supplement. Therefore, when consumed as recommended, a protein- and energy-dense, *n*-3 fatty-acid-enriched oral supplement improved total dietary intake and weight.

Wigmore SJ, Fearon KCN, Maingay JP & Ross JA (1997) Clinical Science **92**, 215–221.

_n_-3 Polyunsaturated fatty acid status in paediatric Crohn's disease: relationship to disease activity. By T. TREBBLE, M.D.S. ERLEWYN-LAJEUNESSE, A.N.J. MAY, S.A. WOOTTON and R.M. BEATTIE, *Institute of Human Nutrition, University of Southampton SO16 6YD and Department of Paediatric Gastroenterology, Southampton University Hospital Trust, Southampton SO16 6YD*

Crohn's disease is a chronic relapsing inflammatory disease of the gastrointestinal tract of unknown aetiology where poor dietary intake, nutritional deficiencies and malnutrition are recognised manifestations. *n*-3 Polyunsaturated fatty acids (PUFA) are obligate dietary constituents, with increased demand during growth. Paediatric patients with Crohn's disease may therefore be at increased risk of *n*-3 PUFA deficiency due to inadequate supply in the face of increased demands, although the only previous study failed to demonstrate any differences in *n*-3 PUFA status compared with a control population (Levy *et al*. 2000). Furthermore, studies in malnourished children without Crohn's disease have produced markedly conflicting results. We propose that variation in *n*-3 PUFA phospholipid composition may reflect disease activity and not nutritional status. We therefore compared plasma *n*-3 PUFA phospholipid composition in active and inactive paediatric Crohn's populations.

Paediatric Crohn's patients with active disease were identified in paediatric gastroenterology outpatients departments based on a paediatric Crohn's disease index (PCDAI) of >10 and a C-reactive protein (CRP) of >6 g/l and/or an ESR of >20 mm/h. A comparative group with inactive disease was also recruited. Patients receiving formulae, enteral, or parenteral feeding were excluded. Patients completed a medical history questionnaire and underwent an assessment of nutritional status. A 20 ml sample of venous blood was withdrawn for lipid composition studies. Plasma was separated by centrifugation, and phosphatidylcholine (PC) was isolated by standard methods of solid-phase extraction with fatty acid composition determined by gas chromatography.

Six patients with active disease (five male, one female) and six patients with inactive disease (three male, three female) were recruited. The groups were well matched for age (mean 14.2), body weight, body mass index, body composition (% body fat, lean tissue and water) and steroid use.

Plasma PC content of the essential fatty acid α-linolenic acid (18:3) of the Crohn's patients with active disease was significantly lower than that observed in the inactive patient group; both patient groups exhibited lower values than that previously reported for control children (Levy *et al*. 2000). No differences in other *n*-3 PUFA fatty acid contents were observed. In the active disease group, α-linolenic acid content was found to correlate negatively with CRP (Pearson's, r –0.926, P 0.024).

PC *n*-3 PUFA fatty acid (mol%)		18:3		20:5		22:5		22:6	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
Active Crohn's disease	*n* 6	0.23*	0.034	0.67	0.1	0.97	0.09	2.63	0.27
Inactive Crohn's disease	*n* 6	0.5	0.085	0.77	0.15	0.93	0.13	2.42	0.31

*Indicates significant difference between mean value for active compared to inactive disease (P 0.016; independent t-test).

Despite the small population groups, our results suggest that active Crohn's disease is associated with a significant reduction in α-linolenic acid content of plasma phospholipid, and that this was found to reduce proportionate to increasing CRP. The significance of this finding in terms of the inflammatory response is unexplained and further studies are required to determine the value of supplementation in active disease.

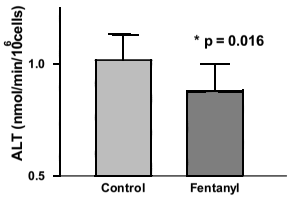
Levy E, Rizwan Y, Thibault L, Lepage G, Brunet S, Bouthillier L & Seidman E (2000) *American Journal of Clinical Nutrition* **71**, 807–815.

Fentanyl has a beneficial effect on neonatal hepatocyte function. By M. ZAMPARELLI, A. PIERRO, L. SPITZ and S. EATON, *Institute of Child Health and Great Ormond Street Hospital for Children, London WC1N 1EH*

Hypothermia is common after major surgery in newborn infants and can be triggered by intraoperative fentanyl analgesia (Okada *at al.* 1998). Recent studies have demonstrated that fentanyl inhibits hepatocyte oxidative metabolism (Zamparelli *et al.* 1999). We hypothesised that fentanyl could have a protective effect on liver function by decreasing metabolism and free radical production. Our aim was to determine whether fentanyl affects hepatocyte free radical production and cellular integrity.

Hepatocytes (>85% viability) were isolated from suckling rats (11–12 d) by collagenase digestion. 3.5×10^6 cells were incubated with 0.5 mM palmitate as substrate in the presence and absence of fentanyl (2 ng/ml; equivalent to serum analgesic level). After 15 min incubation, 10 μM of dichlorodihydrofluorescein diacetate was added and free radical production measured fluorimetrically as production of dichlorofluorescein (DCF). In parallel incubations, hepatocytes were centrifuged (13 000 rpm×5 min) and alanine aminotransferase (ALT) and lactate dehydrogenase (LDH) measured in the supernatant as measures of cytoplasmic leakage and cellular integrity. Data were compared by paired t-test and are expressed as mean ± SEM.

Fentanyl did not affect hepatocyte free radical production (control 0.124 (SE 0.009), fentanyl 0.120 (SE 0.009) nmol DCF/10^6 cells, n 17). However, incubation of cells with fentanyl significantly protected cells against loss of cellular integrity as assessed by ALT leakage (see Figure, n 11). Conversely, LDH leakage was not affected by fentanyl incubation (control 69.48 (SE 7.75), fentanyl 67.93 (SE 7.35) nmol/min/10^6 cells, n 11).



It has been shown that fentanyl inhibits hepatocyte oxidative metabolism, which may have deleterious effects because of lower cellular ATP and decreased thermogenesis. However, this inhibition may also be beneficial through protection from hepatocellular injury.

Okada Y, Powis M, McEwan A & Pierro A (1998) *Pediatric Surgery International* **13**, 508–511.
Zamparelli M, Eaton S, Quant PA, McEwan A, Spitz L & Pierro A (1999) *Journal of Pediatric Surgery* **34**, 260–263.

Intestinal and hepatic metabolic derangement during the early stage of endotoxaemia in the neonatal period. By P. VEJCHAPIPAT[1,2], S. EATON[1], K. FUKUMOTO[1], H. PARKES[2], T. REYNOLDS[3], L. SPITZ[1], A. PIERRO[1], [1]*Department of Paediatric Surgery,* [2]*RCS Unit of Biophysics,* [3]*Department of Chemical Pathology, Institute of Child Health and Great Ormond Street Hospital, University College London, 30 Guilford Street, London WC1N 1EH*

The small intestine and liver are both prime organs involved in multi-system organ failure during sepsis. We investigated the biochemical changes that occur in small intestine, liver and blood during early stage of endotoxaemia.

Two groups of neonatal rats (11–13 d) were studied: control and early endotoxaemia. Rats received an intraperitoneal injection either 300 µg/kg of 12.5 µg/ml lipopolysaccharide, *E. coli* 055:B5 (endotoxaemia) or isovolaemic normal saline (control). Two h after injection, animals were sacrificed. The small intestine and liver were removed and the metabolites were extracted into perchloric acid. Concentrations of intestinal glucose, glutamate, alanine and β-hydroxybutyrate (BHB) as well as hepatic glucose, glutamine, glutamate, alanine, BHB, ATP and ADP were measured. Blood glucose, lactate, pyruvate, acetoacetate and BHB were measured in some animals. Unpaired *t*-tests were used. Data are expressed as mean±SEM.

No mortality occurred during the first 2 h after injection. Intestine: endotoxaemia caused a decrease in intestinal glucose, glutamate, alanine and BHB (Fig. 1). Liver: endotoxaemia induced a significant fall in hepatic glutamine, glucose and BHB (Fig. 2). There was no difference in hepatic glutamate, alanine, ATP or ADP. Whole blood: endotoxaemia caused an increase in blood glucose (control 5.9 (SE 0.9); endotoxaemia 9.3 (SE 1.3) mM) and acetoacetate:BHB ratio (0.1 (SE 0.01) *v.* 0.3 (SE 0.06) mM), *n* 5 per group. There were no changes in the lactate:pyruvate ratio.

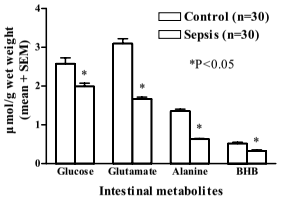


Fig. 1

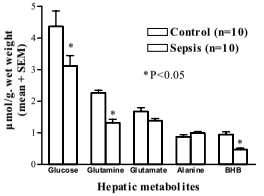


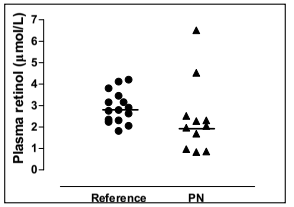
Fig. 2

The early stage of endotoxaemia in neonatal rats caused substantial metabolic derangement. We suggest that hyperglycaemia occurs due to increased hepatic gluconeogenesis in order to provide glucose for macrophage oxidative burst. Intestinal glucose, glutamate, and alanine are consumed. Hepatic glutaminase is activated, fatty acid oxidation increased to provide ATP and NADH for gluconeogenesis from lactate and glycerol carbon. The hepatic intramitochondrial redox state is impaired. The changes were unlikely to have been due to endotoxaemic shock as hepatic ATP and ADP, as well as the blood lactate:pyruvate ratio, were maintained.

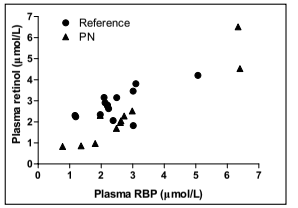
Circulating retinol concentrations in patients given total parenteral nutrition. By K. GILMARTIN, A. CAWOOD, J.L. MURPHY, G. CONSTABLE, M. STROUD, J. JACKSON and S.A. WOOTTON, *Institute of Human Nutrition, University of Southampton, Southampton SO16 6YD*

Patients given parenteral nutrition (PN) receive vitamin A (as retinyl palmitate) within the feed, often in excess of 2 mg/d retinol equivalents or 3600 IU in an attempt to meet increased demands and overcome impaired gastrointestinal function. However, the evidence base underlying this practice remains poorly defined. Little is known about the handling of vitamin A in these patients and the few studies that have examined circulating concentrations of retinol are contradictory (Davis *et al.* 1987; Labadarios *et al.* 1988). In this study we aimed to examine the factors that might influence plasma retinol concentrations in patients with gastrointestinal problems receiving PN in comparison with a reference group of adults.

Eleven patients (five men, six women, aged 27–66 years, BMI median 23.8 (range 17.6–33.8) kg/m^2) given PN, attending the Southampton University Hospitals Trust (SUHT), and a reference group of fifteen subjects (nine men, six women, aged 22–72 years, BMI median 29.0 (range 21.6–32.3) kg/m^2), who did not have impaired gastrointestinal or liver function, were recruited to the study. The patients had been given PN for between 4 and 2000 d (median 160 d) following SUHT guidelines. A fasted venous blood sample (10 ml) was taken by venepuncture from each patient and plasma retinol was measured by HPLC. Serum retinol binding protein (RBP) concentrations were measured by radial immuno-diffusion. Plasma urea, creatinine and C-reactive protein were measured by the SUHT chemical pathology department. Associations between the variables were assessed by Spearman's rank correlation.



Median and individual values for plasma retinol in PN and reference groups. Significant difference between groups $P<0.05$ (Mann-Whitney *U*).



Association between plasma retinol and RBP in PN patients and reference group, r 0.54, $P<0.01$.

Plasma retinol concentrations were significantly lower in the patients receiving PN than in the reference group. Of the eleven PN patients, six (55%) had values that fell outside the range for plasma retinol in the reference group. There were four patients who had values below the lower limit of the reference range who were identified as those given PN for the shortest period of time (<80 d). Plasma retinol was significantly associated with plasma RBP (r 0.54, $P<0.01$), urea (r 0.82, $P<0.01$) and creatinine concentrations (r 0.86, $P<0.01$). Plasma retinol was poorly associated with C-reactive protein (r –0.35, NS) and duration of PN was administered (r 0.30, NS). These results suggest that despite supplementation in the early stages of PN, low circulating retinol concentrations may be due to reduced synthesis of RBP or impaired mobilisation of the nutrient–carrier complex from the liver. During longer term PN feeding (>80 d) circulating levels of retinol are more likely to be maintained within an acceptable range. The role that renal function may have upon plasma retinol concentrations in patients fed PN requires further study.

Davis AT, Franz FP, Courtnay DA, Ullrey DE, Scholten DJ & Dean RE. (1987) *Journal of Parenteral and Enteral Nutrition* **11**, 480–485.

Labadarios D, O'Keefe SJD, Dicker J, Stuijvenberg LV, Visser L, Louw MEJ & Shepherd GS (1988) *Journal of Parenteral and Enteral Nutrition* **12**, 205–211.

An audit of nutritional screening at Harefield hospital. By G. RAVENHILL and S.J. ILLINGWORTH, *Royal Brompton and Harefield NHS Trust, Hill End Road, Harefield, Middx UB9 6JH*

The audit was completed between June 2000 and January 2001 at Harefield hospital to assess the use of the current nutritional screening tool, produced in 1992.

Nutritional screening is defined as a simple and rapid process of identifying clinical characteristics known to be associated with malnutrition. The process identifies patients at risk of malnutrition who require referral to a state-registered dietitian for a comprehensive nutritional assessment (Macintosh *et al*. 1999).

Routine nutritional screening should be introduced as part of medical and nursing assessment. This method of screening should be for the duration of the hospital admission. Screening should be simple and have a linked plan of action (Allison *et al*. 1999).

Nutritional screening is established within the admission process at Harefield hospital. A standard audit tool was designed to assess how frequently the nutritional screening form was being used, the accuracy of completion and whether appropriate action was taken on completion.

Seven adult wards were included in the study and 142 nutritional screening forms were assessed. The results showed that three different screening tools were in use with variations within the risk categories. One version did not have details of appropriate action to take after completion of nutritional screening.

Parameter measured	Average result as percentage of forms completed
Number of screening tools completed	60%
Accuracy of screening process	28%
No action taken on completion of the form	10%

Any error noted in the completion of the form was marked as an inaccuracy. Common mistakes were: incomplete scores, inaccuracies in recording scores, incorrect mathematical additions and blank screening tools, but a final score provided.

Nutritional screening is an essential part of the essence of care benchmarking and should be seen as the first step to further assessment for all patients/clients identified as at risk (DoH, 2001). Recognizing patients who are nutritionally at risk and taking appropriate action will improve quality of patient care and clinical outcome and will shorten hospital stays (Allison *et al*. 1999).

The audit has revealed that the existing screening tool should be redesigned to remove ambiguity and improve accuracy in identifying those who are nutritionally at risk. A clearer layout and validated risk factors will also improve accuracy (Macintosh *et al.* 1999). A training pack should be designed to explain the use of the screening tool to assist in accurate completion of the form (Macintosh *et al*. 1999). Evaluated training sessions on nutritional screening should be provided for new nursing staff as part of their induction. Nursing staff who are established within the Trust should be educated about the use of the current screening tool (Allison *et al.* 1999). Evaluation of the form by nursing staff should be included in the training sessions (Allison *et al.* 1999).

Only the updated screening tool should exist and be available in printed form from a central source to avoid other versions appearing.

The updated nutritional screening tool will be part of the Trust's patient nutrition policy, ensuring that all patients in the Trust will have their nutritional status screened on admission (Allison *et al*. 1999).

The final stage in improving practice and ensuring evidence-based clinical care will be to validate the nutritional screening tool, using anthropometric measurements as a gold standard (Macintosh *et al*. 1999).

Allison SP, Baxter JP, Curry R, Davison C, Dickerson J, Edwards J, Howard JP, Kondrup J, Markan M, Micklewright A, Oliver G, Page M, Richardson K, Rollins H, Sorenson K & Wilson R (1999) *Hospital Food as Treatment. A Report of the Working Party of BAPEN*. Maidenhead: BAPEN.

Department of Health (2001) *Essence of Care, Patient-focused Benchmarking for Health Care Professionals.* London: HMSO.

Macintosh M, Williams A, Goudge D, Bryan F, McAtear CA, Ogilvie M & Murray A (1999) *Nutrition Screening Tools, Professional Development Committee, Briefing Paper No.9*. British Dietetic Association.

A three-year audit of stroke patients receiving enteral nutrition. By P. BARKER, A. WALKER, C.E. MCNAUGHT, C.J. MITCHELL and J. MACFIE, *Combined Gastroenterology Unit, Scarborough Hospital, Woodlands Drive, Scarborough, North Yorkshire YO22 5ER*

The role of enteral nutrition in patients with neurological disease remains controversial (Dennis M, 2000). Our aim was to evaluate the outcome of patients who received enteral nutrition (EN) following a cerebrovascular accident (CVA). We performed a prospective audit of all CVA patients who received enteral nutrition between August 1997 and August 2000. Our main outcome measures were: (1) time to the commencement of EN; (2) route of EN; (3) success of feeding (>80% of prescribed amount consumed); (4) duration of feeding; (5) complications related to EN; and (6) mortality.

This audit comprises a total of fifty-eight patients (M:F 30:28). The median age of patients was 77 years (range 54–99) with 67% aged over 75 years. Twenty-one patients commenced feeding within 1 week of the CVA. The enteral diet was delivered via a NG tube in forty-four patients and a PEG in fourteen patients. 70% of patients were successfully fed, the median duration being 24 d (0–237 d). Failure to meet nutritional requirements was most commonly due to NG tube dislodgement and delay in PEG insertion. 16/58 patients (27%) developed a feeding-related complication, including aspiration pneumonia (*n* 8) and PEG site infection (*n* 8). Overall hospital mortality was 53%.

The decision to institute or withhold enteral nutrition in patients following a CVA remains a clinical and ethical dilemma. This study has demonstrated that there is considerable morbidity associated with the administration of an enteral diet in this patient group.

Dennis M (2000) *British Medical Bulletin* **56**, 466–475.

Recycling of chyme: a possible alternative to the use of parenteral nutrition? By J.P. MORLEY and A.M. MYERS, *Intestinal Failure Unit, Hope Hospital, Stott Lane, Salford, Manchester M6 8HD*

Intestinal failure is defined as the 'reduction in functioning gut mass below the minimal amount necessary for adequate digestion of nutrients' (Fleming & Remington, 1981).

Eighty-three per cent of new patients admitted to the Intestinal Failure Unit at Hope Hospital had discontinuity of their bowel due to abdominal surgery and/or enterocutaneous fistulae and, as a result, required nutritional support. Cosnes *et al*. (1990) suggest that patients who have interruption of the bowel with high enterostomy usually need parenteral nutrition. Parenteral nutrition, although well established, is expensive and can be problematic (Richards & Irving, 1996). Expert opinion is that the bowel should be used whenever possible to maximise its integrity and maintain nutritional and electrolyte balance. There is evidence that the reinfusion of chyme via a distal loop of bowel can improve nutritional status, fluid losses and metabolic disturbances (Rinsema, 1988). Despite this, 42% of patients are discharged home on parenteral nutrition.

The aim of the study was to devise a way to:

- assess patient suitability/feasibility for enteral feeding and/or reinfusion of chyme
- promote the use of this treatment in suitable patients
- consequently reduce the numbers receiving parenteral nutrition.

A retrospective audit of new admissions to the unit by case-note review was undertaken to determine the number of patients who received enteral feeding and/or reinfusion of chyme via a distal loop of bowel, during a 12-month period between 1 April 2000 and 31 March 2001.

Due to the aesthetically unpleasant nature and infancy of this procedure, the nursing staff's knowledge, attitudes and confidence to carry out this procedure were questioned to assess staff perceptions and likelihood of compliance. This included the subjective evaluation of patient suitability by three nurses on three patients. In addition, the same nurses carried out a prospective pilot study of the algorithm that was developed as an objective evaluation of patient suitability.

The retrospective audit showed that of the fifty-two new patients admitted, seven (13.5%) patients received enteral nutrition only via a distal loop of bowel and reinfusion of chyme via a distal loop of bowel was not attempted in any of the population. Retrospective use of the algorithm showed that thirteen (25%) of the patients would have been potentially suitable for reinfusion of chyme.

Use of the bowel is important. Audit has shown that more patients could feed or receive reinfusion of chyme via a distal loop of bowel. In addition, the questionnaire administered to the nursing staff showed that, subjectively, staff lacked confidence and knowledge in this technique.

It is intended to implement the algorithm as a routine component of the patients' assessment, and evaluate its use. Concurrently, an educational package for staff will be produced to encourage the institution of the reinfusion of chyme as an alternative to parenteral nutrition.

Cosnes J, Baux F, Gendre JP, Quintrec M, Frileux P, Parc R & Qiuntrec Y (1990) *Gastroenterology and Clinical Biology* **14**, 146–152.
Fleming CR & Remington M (1981) *Nutrition and the Surgical Patient.* Edinburgh: Churchill Livingstone
Richards DM & Irving MH (1996) *British Journal of Surgery* **83**, 1226–1229.
Rinsema W, Gouma D, von Meyenfeldt MF & Soeters PB (1988) *Surgery, Gynaecology & Obstetrics* **167,** 372–376.

Patients the focus of care: educational nurse-led clinics. By C.E. HOLDEN, E SEXTON, and D.A. CANEY, *Nutritional Care, Birmingham Children's Hospital NHS Trust, Diana, Princess of Wales Children's Hospital, Steelhouse Lane, Birmingham, B4 6NH*

Recent advances in high technological care have led to more children surviving major illnesses, but with complex nursing and nutritional needs. The nutritional care department at Diana, Princess of Wales Children's Hospital, Birmingham, identified an increasing need to support nurses and multi-disciplinary teams in the care of children requiring nutritional support (Holden, Sexton, & Caney).

The teams were overloaded by ad hoc telephone calls from professionals in hospitals and the community who required educational and practical support. A weekly educational clinic was therefore set up in 1999 to improve and develop the skills of staff associated with nutritional care, to improve access to the department for all staff and to develop communication. Clinics for staff are booked through the Department Secretary. Following the clinic, staff are requested to complete an evaluation form and identify the need for follow-up or further training.

Staff attending the clinic	Number	Percentage
Nursing students (University of Birmingham/UCE)	51	16
Nursing staff	90	28
Community nursing staff	67	22
Respite nurses (i.e. hospices, continuing care team).	32	10
Play therapists	5	2
Medical students	20	6
Dietitians/dietetic students	12	4
Nutrition nurses (from other hospitals)	7	2
Pharmacists	2	1
Overseas visitors (nursing/medical)	14	5
Physiotherapists	3	1
Parkview Child Adolescent Mental Health Service (CAMHS) Directorate	8	3
Total *n*	311	100

In total, 201 evaluation forms were returned. Staff said they became more aware of the nutritional care services available and developed and improved their practical skills; 82% said that the sessions were relevant and expected that they would incorporate what they had learned into practice. All (100%) said that their objectives were met by the clinic.

A positive impression of the clinic was given by:

1) Improvements in access to our time in a structured fashion which has ensured effective use of the department's time.
2) Collective sharing of responsibility, ensures that the patient is the key focus of care (May 1999).
3) The encouragement of professional openness and sharing of information has been developed (Mullally, 2001).
4) The process of 'clinical benchmarking, a process in which best practice is identified and continuous improvement pursued through comparison and sharing' is being developed.
5) Services to staff have improved through the development of clinics individually tailored to needs.
6) The department has become more aware of the individual needs of staff. Collectively we are striving to develop evidence-based practice and to reduce variations in services available to parents and staff (Holden & MacDonald, 2000), (Vanclay, 1998).

Holden CE & MacDonald A, (co-editors) (2000) *Nutrition and Child Health.* London: Bailliere Tindall.
Le May A (1999) *Evidence-Based Practice - Nursing Times Clinical Monographs*. London: Emap Healthcare.
Mullally S/Department of Health (2001) *Essence Of Care: Patient-Focused Benchmarking For Healthcare Practitioners.* London: Department of Health.
Vanclay L (1998) *Team-working In Primary Care.* Nursing Standard **12,** 37–38.

Enteral feeding in patients with significant burn injury: nasojejunal tube feeding is superior to nasogastric tube feeding. By E.J. SEFTON, J.R. BOULTON-JONES, A. FLETCHER, D. WILSON, D. ANDERTON, F. BAILEY, K. TEAHON and D. KNIGHTS, *Nottingham City Hospital, Hucknall Road, Nottingham NG5 1PB*

Burns patients have increased protein and energy requirements and early feeding is an established part of these patients' management. The optimal method of feeding is unknown. Nasogastric feeding is often unsuccessful because of gastric stasis and total parenteral nutrition has a number of potential disadvantages. Post-pyloric feeding is a potential alternative method of enteral feeding. We report our experiences of enterally feeding patients with significant burn injury. Twenty-two consecutive patients with more than 15% burns were identified. Of these, nineteen case-notes were available for review and were included in the study.

There were twelve men and seven women aged from 8 to 79 (median 48) years. The percentage area affected by the burn ranged from 16% to 65% (median 25%). Seventeen patients were initially fed by nasogastric tube feeding. Only seven (41%) were successfully fed by this route for the duration of time that they required supplementary nutrition. Nasogastric feeding failed because of gastric stasis demonstrated by excessive gastric aspirates or vomiting. The ten patients that failed nasogastric feeding were converted to nasojejunal feeding and a further two patients were fed exclusively by nasojejunal feeding. Ten of these twelve patients (83%) were successfully fed by the nasojejunal route for the duration of time that supplementary nutrition was required. The differences in success rate between the two methods of feeding were statistically significant (P=0.002, by the chi squared test).

Nasojejunal feeding failed in one patient who developed intestinal ileus and had to be fed parenterally for 14 d. Subsequently, when the ileus resolved, nasojejunal tube feeding was successfully used for a further 60 d before oral diet was reintroduced. In the other patient, who had 60% burns, a nasojejunal tube could not be sited and he was subsequently fed parenterally for 8 d before he died.

Nasojejunal feeding was used for between 0 and 60 d (median 13.5 d). In those in whom it was used successfully, it was used for between 4 and 30 d (median 13.5 d). Nasogastric feeding was used for between 1 and 90 d (median 5 d). In those in whom nasogastric feeding was successful, the duration of feeding ranged from 2 to 90 d (median 12 d). There were no statistical differences between the length of time nasogastric and nasojejunal feeding was given either for those in whom the feeding was attempted or for those in whom it was used successfully. There were no significant adverse events related to nasojejunal feeding, a nasojejunal tube was successfully placed in all but one patient and the tubes were well tolerated. Only one patient, an 8-year-old boy, pulled out his nasojejunal tube and it was promptly resited.

We conclude that nasojejunal tube feeding is superior to nasogastric tube feeding in patients with significant burn injury and should be considered in all such patients.

Is dietary fibre necessary in sip feeds for young children? By A.D. DALY and A. MACDONALD, *Dietetic Department, Birmingham Children's Hospital, Steelhouse Lane, Birmingham B4 6NH*

Young children with chronic diseases eat little fibre in their diets. There is evidence to suggest that children with chronic illness eat even less fibre. These children are reliant on dietary supplements but few have added fibre. Although there are no dietary reference values for fibre intake for children in the UK, it has several important functions such as stool bulking and the production of short-chain fatty acids. The aim of this controlled trial was to investigate the efficacy, safety and tolerance of a paediatric fibre supplement in chronically sick children. Sixty children (thirty-five girls and twenty-five boys) with chronic illness and failure to thrive received at least 20% of their energy intake from either a fibre containing 2 g/100 ml trial group (TG) or a fibre-free (control group, CG) supplement for 12 weeks. The children had a median age of 4.7 years (range 18 months–6 years). A 3 d dietary diary, stool diary, anthropometric measurements, and nutritional biochemistry were taken at the start and end of the study.

Fibre intake was significantly better in the TG group (median total intake of fibre in the CG was 6 g (range 1–14 g), TG 11 g (range 5–21 g) (P 0.005). Laxative medication was reduced in five out of the seven subjects in the TG group and in none out of the two subjects in the CG group. No abnormal biochemistry, including zinc, copper, and selenium, was noted in either group at the end of the 12 weeks. The TG supplement was well tolerated and acceptable to children.

The high-fibre supplement was safe and effective in increasing fibre intake and there was a trend to reduce laxative medication in the TG children. Additional fibre should be added to paediatric nutritional supplements designed for chronically sick children.

Oral nutritional supplement flavour preferences of weight-losing patients with cancer. By J. EDINGTON[1], M. HOLLINGSWORTH[2], L. RHOADES[2], S. CAMPBELL[2], M. FERGUSON[2], K. MAYER[2] and A. VOSS[2], [1]*Abbott Laboratories, Norden Road, Maidenhead SL6 4XE and* [2]*Abbott Laboratories, Columbus, Ohio 43215, USA*

Patients with cancer often develop taste and smell aberrations that contribute to anorexia and decreased dietary intake. These alterations may result from the disease itself, as well as the treatment modality. Taste changes may be specific to each patient, but highly sweet or spicy flavours are typically not well tolerated. Clinicians report poor compliance with current oral medical nutritional supplements. One reason may be that the flavour systems for these products are too sweet and were not designed specifically for people with cancer. A protein- and energy-dense, low-fat, low-sucrose medical nutritional supplement containing *n*-3 fatty acids has been developed specifically for patients with cancer experiencing weight loss. In a recent randomised trial (Fearon *et al*. 2001) improved weight and lean body mass were shown in patients consuming this novel product. However, for the supplement to be effective it must be acceptable and palatable to the patient with cancer, to ensure continued compliance.

The supplement contains ingredients that present a number of sensory challenges such as:

- *n*-3 fatty acids produce a fishy smell and taste
- Protein decreases flavour intensity
- Vitamins and minerals cause a bitter and metallic taste and mouth feel
- Compatibility of the colour, which was yellow due to ingredient content, with the flavour.

Another challenge was to create flavours that would be acceptable across different cultures.

To participate in this sensory research, patients (*n* 70) had to be 21 years of age or older, have a solid tumour (excluding breast), and be undergoing treatment for cancer in the London area. Approximately 150 flavours were screened, and six were selected for taste-testing. Patients were asked to rate five out of the six flavours (banana cream, vanilla, mango melon, orange, praline, spicy vanilla/aniseed) for taste preference. In addition, patients were asked to indicate the acceptability of each product based on flavour, thickness, sweetness and the likelihood of drinking a 237 ml serving, on a 1–9 hedonic scale. A 90 ml sample was served at room temperature in a monadic presentation according to a pre-specified random sequence. Because patients tasted five out of the six flavours, not all seventy patients tasted each of the six flavours, hence the variation in sample size.

The results of the taste preference evaluation are shown below.

Preference (5 out of 6)	Percentage	*n*
Banana	33	19/58
Orange	24	14/58
Vanilla	22	13/58
Spicy vanilla/aniseed	19	11/59
Mango melon	12	7/59
Praline	9	5/58

The results of the acceptability evaluation are shown below.

Flavour	Mean score (scale of 1–9)	*n*
Banana	5.9	58
Vanilla	5.8	58
Orange	5.5	57
Spicy vanilla/aniseed	5.0	59
Praline	4.7	58
Mango melon	4.5	58

The information from this sensory research was used to select the most acceptable flavours for a novel, moderately sweet, oral nutritional supplement designed specifically for a patient population with cancer.

Fearon KCH, von Meyendeldt M, Moses AGW, van Geenan R, Roy A, Gouma D, Giacosa A, van Gossum A & Tisdale M (2001) *European Journal of Cancer* **37**, Suppl. 6, S27.

Nutrient fortification of the purée menu at the Royal Bolton hospital. By Z.M. ANSARI, *Nutrition and Dietetic Department, Royal Bolton Hospital, Minerva Road, Farnworth, Bolton BL4 OJR*

Almost 50% of stroke patients admitted to a stroke unit for rehabilitation suffer from malnutrition, with dysphagia being the most common link associated with poor nutritional status (Finestone *et al*. 1995). It is widely known that some nutrient degradation and depletion results from prolonged cooking and processing of foods. A prolonged intake of a diet that is of substandard quality can therefore compromise nutritional status. Many of these patients are chronically ill as a consequence of their CVA and require a long-term rehabilitation period. Other patients in hospital may have gastrointestinal or cognitive/behavioural problems, which dictate the necessity for a purée diet.

The aim of this investigation was to improve the overall nutrient quality, presentation, consistency and taste of the purée menu. The purée menu was assessed for nutrient content using a computer software program (Microdiet) which found it to be low in energy, protein and several vitamins and minerals. A two-course purée meal was then fortified with specific comparable clinical nutritional products and reassessed for the percentage enhancement.

Nutrient	Purée A	Purée B	Purée C	Purée D	Purée E
Energy	No change	Control	+48%	+77%	+45%
Protein	No change	Control	+29%	+46%	+14%
Vitamin D	No change	Control	+200%	+100%	No change
Vitamin C	No change	Control	+70%	+17%	No change
Folic acid	No change	Control	+149%	+45%	No change
Iron	No change	Control	+185%	+4%	No change
Zinc	No change	Control	+121%	+37%	No change
Calcium	No change	Control	+256%	+388%	+109%

Purée A + Nutilis*, Purée B (control), Purée C + Nutilis + 10g Neutral Build-Up, Purée D + Nutilis + 20g Maxijul SuperSoluble +10g skimmed milk powder, Purée E = Nutilis + 10g ProCal.
*Nutilis (thickener) was used as required to create a holding consistency.

A tasting session was organised and attended by ten (*n* 10) hospital staff. All purée meals scored an average to good response on presentation. When asked about consistency, seven subjects (70%) said Purée B was the least smooth, whilst nine (90%) agreed that Purée C and Purée D were the smoothest. Purée C and Purée E both scored the highest in taste; *n* 6 (60%) and *n* 7 (70%), respectively. Purée D was rated as having a poor taste by four testers (40%) due to its "sweet taste". Purée D improved the most in energy, protein and calcium content. Purée A and Purée B were not fortified and so remained unchanged. Purée E showed a moderate increase in energy, protein and calcium but with little or no change observed in other nutrients. The greatest overall improvement was observed with Purée C since all nutrients were substantially increased.

This short investigation highlighted the nutritional inadequacy of the purée menu currently available from the standard hospital menu and the need to improve its quality. Recommendations were made to use Neutral Build-Up to fortify the menu. Doing so would contribute to an improved clinical outcome for the significant number of in-patients who need to eat puréed food.

Finestone HM, Greene-Finestone IS, Wilson ES, Teasell RW (1995) *Archive Medical Rehabilitation* **77**, 340–345.

Prospective randomized controlled single-blind trial of the effects of multidisciplinary nutrition team follow-up for 12 months after percutaneous endoscopic gastrostomy insertion. By H.F. SCOTT[1], F. SMEDLEY[1], L. TIMMIS[1], R. BEECH[2], C. ROFFE[3] and T. BOWLING[1], [1]*Department of Gastroenterology,* [2]*North Staffordshire Hospital and Health Planning and* [3]*Medicine, Keele University, Stoke-on-Trent ST4 6QG*

Long-term follow-up after percutaneous endoscopic gastrostomy (PEG) insertion in the acute and community settings is variable and largely dependent on available resources. This study is intended to examine the benefits or otherwise of close follow-up from a multidisciplinary nutrition team (NST) in terms of clinical course, cost and quality of care.

All adult patients referred for PEG insertion were eligible. Subjects were randomized to intervention of regular follow-up by the nutrition team (**A**); or control (**B**) with no routine review unless specifically requested. The investigating dietitian (H.F.S.) was working blind. Endpoints were 12 months, PEG removal or death. Data were collected on complications, hospital stay, readmissions, anthropometrics, and detailed costings of all aspects of care and quality of life.

*P<0.05		A (n 63)	B (n 64)
Age (median (range))		74 (16-92)	74 (16-93)
Indications (% CVA/cancer/other)		54/13/33	52/17/31
Mortality over 12 months (%)		56	52
PEG removal over 12 months (%)		19	19
Complications	Diarrhoea (%)	43	38
	Vomiting (%)	33	48*
	Peristomal infection (no. episodes)	58	72
	Chest infections (no. episodes)	79	105
	Days on antibiotics (mean/SD)	11 (12)	17 (24)*
Length of stay	Acute hospital (total days)	1590	1668
	Community hospital (total days)	2485	3821
Readmissions	Number (median LOS in days)	18 (5.4)	35 (10)*
Cost (average per surviving patient)		£20,258	£25,923*

The impact of the PEG on quality of life was better for the intervention group using a validated tool (Bannerman *et al.* 2000). Overall quality of life scores (SF36) and anthropometrics favoured the intervention group but were not statistically significant.

Regular follow-up by a multidisciplinary NST after PEG insertion has significant benefits for the quality and cost of patient care.

Bannerman E, Pendlebury J, Phillips F & Ghosh S (2000) *European Journal of Gastroenterology and Hepatology* **12**, 1101–1109.

Outcomes in home parenteral nutrition: positive trends for the future. By F.C. LESLIE, M.A. BRADLEY and J.L. SHAFFER, *Intestinal Failure Unit, Hope Hospital, Stott Lane, Salford, Manchester M6 8HD*

The British Artificial Nutrition Survey (BANS) reported a point prevalence in 1999 of 317 adult patients on home parenteral nutrition (HPN) (Elia *et al.* 1999). Hope Hospital is currently responsible for 115 patients on HPN. Of these patients (seventy-five female) the duration of HPN varies between 1 and 252 months (mean 60.9±5.4 months) and only fourteen (12.2%) require any additional input into line care and feeding, e.g. from partner or district/home care nurses.

In 1998 it was decided to review patients and in particular look at all new patients commencing on HPN, initially to study morbidity and mortality. An average of twenty-seven patients started on TPN each year (range 27–28). No patients were lost to follow-up. Over this time we treated patients previously thought unsuitable for HPN, e.g. those not self-caring and older age groups.

Eighty-five patients commenced HPN between 15 February 1998 and 15 May 2001. Ages (in months) ranged from 19 years 11 months to 76 years 11 months, mean age 50 years 2 months ±16.8 months; there were fifty females. Of these patients seventy-six are still alive, fifty-seven on HPN (one of these has been transferred to the care of another hospital), nineteen have discontinued HPN and nine have died. There was an average of three deaths per year (range 0–5), giving mortality rates of 0% at 1 year and 10.6% at 3 years. This compares to a 1-year mortality of 7–15% and a 3-year mortality of 30–32% in published British and European series (Messing *et al.* 1995; Elia *et al.* 1999; De Francesco *et al.* 2001). None of the nine deaths were attributable to HPN; four died of malignancy (three previously recognised and one new case), and five of unrelated conditions, i.e. three patients died of their underlying diagnosis and six of unrelated causes. Those patients treated with HPN with an indication of active malignancy had a 100% mortality rate (2/2), but in those patients with a diagnosis of inactive malignancy (e.g. radiation enteritis or those treated for surgical complications of cancer surgery) the mortality was only 12.5% (1/8), a rate almost comparable for those treated for all indications.

Nineteen patients (22.3%) developed a line complication including ten (11.8%) with catheter-related sepsis, seven with line or venous thrombosis and five with other line complications (seven of these patients developed more than one complication). No patients developed significant liver disease.

Nineteen (22.3%) patients came off HPN during this period, having been on HPN for an average duration of 9.15±1.05months (range 4–21 months). There was no clear diagnosis associated with an increased chance of discontinuing HPN. Those patients who discontinued HPN were younger (47 years ±37.5 months) than those who died (55 years 4 months ±64.4 months) and those that continued on HPN (50 years 9 months ±19.4), but this did not reach statistical significance.

The main diagnoses of those patients treated with HPN were Crohns disease (29), mesenteric vascular disease (20) and a group collectively described as surgical complications e.g. short bowel syndrome or severe fistulating disease following surgery for e.g. ulcerative colitis or colorectal malignancy (18). This diagnosis appears to be increasing in our group. Conditions such as radiation enteritis, scleroderma and volvulus made up smaller numbers. Only two patients were treated with HPN with an active diagnosis of malignancy.

Despite increasing numbers of patients being considered suitable for HPN and new methods, e.g training carers, there does not appear to be a significant increase in morbidity or mortality and there have been no HPN-related deaths in this group since February 1998. We therefore appear to be widening the net without worsening the outcome.

Elia M, Russell CA, Stratton RJ, Scott DW, Shaffer JL, Micklewright A, Wood SR, Wheatley C, Holden CE, Meadows NJ, Thomas AG & Jones BJM (1999) *Trends in Home Artificial Nutrition Support in the UK during 1996-1999. A Report by the BANS.* Maidenhead: BAPEN.

De Francesco A, Boggio Bertinet D, Fadda M, Gallencia P, Malfi G & Palmo A (2001) *Clinical Nutrition* **20,** Suppl. 2, 3–5.

Messing B, Lemann M, Landais P, Gouttebel M-C, Gerard-Boncompain M & Saudin F (1995) *Gastroenterology* **108**, 1005–1010.

How does a simple validated nutritional risk assessment compare with the Mini Nutritional Assessment in elderly women with hip fracture? By D.G. DUNCAN[1], K. HOOD[2], S.J. BECK[3] *and* A. JOHANSEN[3], [1]*Department of Nutrition and Dietetics, University Hospital of Wales, Health Park, Cardiff CF14 4XW,* [2]*Department of General Practice, University of Wales College of Medicine, Llanederyn Health Centre, Cardiff CF23 9PN and* [3]*Trauma Liaison Team, University Hospital of Wales, Heath Park, Cardiff CF14 4XW*

Identification of patients who may benefit from nutritional support challenges the health care team in acute hospitals, as limited time is available to undertake full nutritional assessment in all patients admitted. A nutritional risk assessment (NRA) tool, named the WAASP (Weight history, Appetite, Ability to Eat , Stress factors and Pressure sores) Test developed in our department, is now routinely used for patients admitted with hip fracture. It is clinically acceptable in this particular group, as they cannot be weighed until the hip fracture is stable postoperatively. The WAASP Test was previously validated for use in an acute hospital trust to identify patients at low, moderate and high nutritional risk from routinely available admissions data (Barlow *et al*. 1999). The validation was carried out against objective clinical measures routinely available but fell short of a comprehensive nutritional assessment.

In elderly patients, the relationship between nutritional status measured by a comprehensive nutritional assessment including anthropometric measurements, nutritional biological markers, evaluation of dietary intake and the Mini-Nutritional Assessment (MNA) has been investigated (Vellas *et al*. 2000). If there is a relationship between the WAASP Test and the MNA in elderly women with hip fracture this will provide further evidence of the WAASP Test's validity.

The participants, 113 women over 65 years old (mean age 82), admitted to an acute trauma ward with hip fracture, had a WAASP score and MNA completed. The WAASP Test was completed on admission as was the information and measurements required for the MNA but the patients could not be weighed until they were allowed to mobilise postoperatively. In hospital, mortality and referral to the dietitian were also recorded.

Using a two-tailed Spearman's ρ the WAASP Test scores have been found to be significantly correlated with MNA scores ($P<0.01$). The level of agreement between categories was assessed using Cohen's κ statistic, a chance-corrected measure of agreement. There was a good level of agreement between the WAASP Test and MNA (κ 0.4). There was a significant difference in mean rank on both NRAs between those patients who were referred/not referred to the dietitian ($P<0.001$ for both) and between those patients who died/survived ($P=0.001$ for WAASP and $P=0.002$ for MNA).

This comparison demonstrates that a simple, practical, non-invasive nutritional risk assessment instrument, the WAASP Test, is as valid a measure of nutritional risk as the MNA. In addition, as weighing is not required, it can be completed on admission, allowing appropriate nutritional intervention in the perioperative period to maximise the benefits of nutritional support.

Barlow R, Duncan D, Hood K, Jenkins J & Mehmet U (1999) *Proceedings of the Nutrition Society* **58**, 119A.
Vellas B, Guigoz Y, Baumgartner M, Garry PJ, Lauque S & Albarede JL (2000) *Journal of the American Geriatric Society* **48**, 1300–1309.

Evaluation of a nutrition education programme in a Primary Care Trust: a pilot study. R.A. RICHARDSON[2], K. COWBOROUGH[1], V. TODOROVIC[1] and K. BUCKNER[2], [1]*Bassetlaw Hospital, Worksop S81 0BD and* [2]*Partnerships in Active Continuous Education, Queen Margaret University College, Edinburgh EH12 8TS*

Education is central to maintaining and enhancing the abilities of staff to deliver optimal nutritional care but the importance of its role in clinical governance is often not formally recognised. This in part may be due to the complexities of evaluation as well as the time-consuming nature of the process but in the current climate it is now considered important (National Audit Commission, 2001). This study assessed the value of an open and flexible education programme by determining changes in knowledge in key domain areas of clinical nutrition.

Ten staff members from Bassetlaw Primary Care Trust (Practice and Community Nurses *n* 7, Health Visitor *n* 1, Manager *n* 1 and Occupational Therapist *n* 1) underwent 6 h of open and flexible work-based learning. Five key domains were covered: (**A**) Overview of malnutrition in the community; (**B**) Prevalence of undernutrition in the community; (**C**) The burden of undernutrition; (**D**) Aetiology undernutrition; (**E**) Identifying patients at risk; (**F**) Implementation of screening; (**G**) Improving nutritional care. Within each domain there were related subtopics. Using a visual analogue scale (10 cm) anchored at its extremities by 'very well' and 'not at all', subjects were asked to use the scale to rate their knowledge (before and on completion of the module) of concepts within each domain. This was performed prior to undertaking the learning programme and on completion. Differences in knowledge were tested using a Wilcoxon signed-rank test.

Domain area	Change in knowledge (%)	*P* value
A: Overview malnutrition	194.3 (41.2)	<0.01
B: Prevalence of undernutrition	132.2 (35.9)	<0.05
C: The burden of undernutrition	98.4 (13.2)	<0.01
D: Aetiology of undernutrition	123.0 (33.1)	<0.01
E: Identifying patients at risk	227.4 (59.7)	<0.01
F: Implementation of screening	317.4 (64.4)	<0.01
G: Improving nutritional care	110.2 (30.7)	<0.01

Mean (±SEM).

On examining changes in knowledge in the subtopics within domains, it is evident that the greatest change in knowledge was observed in areas requiring integrative and problem-solving skills, i.e. 'the integration of clinical and nutritional information': change 298.8%, $P<0.01$.

This pilot study has shown significant improvements in the staff members' knowledge following completion of an open and flexible learning (OFL) nutrition programme. The observed improvement in their ability to deal with complex nutritional concepts is encouraging and should impact positively on practice. Future work should focus on assessing the longevity of this improvement in knowledge and its effect on practice.

National Audit Commission (2001) *Hidden Talents*. Abingdon: Audit Commission Publications.

A randomised, controlled study of the incidence of phlebitis in patients with short teflon cannulas electively changed at 48 h intervals. By P. BARKER, S. MORREA, C.E. MCNAUGHT, J. MACFIE and C.J. MITCHELL, *Combined Gastroenterology Unit, Scarborough Hospital, Woodlands Drive, Scarborough, North Yorkshire YO22 5ER*

Peripheral vein cannulation is associated with a high incidence of phlebitis, which may vary from mild erythema, oedema and pain, to septicaemia with phlebitis occurring in 75% of hospitalised patients (Bass *et al.* 1985). Our aim was to investigate whether the elective change of a short teflon cannula (Vygon, UK) every 48 h was implicated in a reduction in the incidence of phlebitis.

On admission to hospital, patients were randomised into either the study or control group. The study group had their cannulae changed electively at 48 h intervals. Patients in the control group had standard treatment, their cannulae remaining *in situ* and only being replaced if they became dislodged or painful. Each patient was assessed daily for the occurrence of phlebitis, using a modified Maddox score (Maddox *et al*. 1977). The site of cannula insertion and cannula diameter were recorded. All intravenous therapy administered via the cannula was documented.

A total of forty-seven patients were entered into the trial, twenty-one in the study group with twenty-six controls. There was no significant difference between the groups in terms of sex (M:F, 14:7 *v*. 15:11, P=0.74) or age distribution (63.9 *v*. 61.4 years, P=0.64). The incidence of phlebitis was significantly decreased in the study group compared with the control group (1/21 study patients *v*. 11/26 controls, P=0.009). Phlebitis severity ranged from 1 to 3 using the modified Maddox Score. The site of cannula insertion and cannula diameter (12Fr–22Fr) were unrelated to the development of phlebitis. There was no significant difference in the occurrence of phlebitis between patients admitted acutely or electively to hospital (7/24 *v*. 5/23, P=0.80).

The elective replacement of intravenous cannulae at 48 h intervals is strongly recommended in all hospital patients to reduce the morbidity associated with phlebitis.

Bass J, Makarewicz P, Sproule P & Fairfull-Smith R (1985) *Canadian Journal of Surgery* **28**, 124–125.
Maddox RR, Rush DR, Rapp RP, Foster TS, Mazella V & McKean H (1977) *American Journal of Hospital Pharmacy* **34**, 29–34.

Endoscopic placement of nasojejunal tubes avoids parenteral nutrition. By S.M. SHAH, M. CURRIE, J.F. KENNEDY, T. PODAS and J. NIGHTINGALE, *Gastroenterology Centre, Leicester Royal Infirmary, Leicester LE1 5WW*

Enteral nutrition (EN) is less expensive and is associated with fewer serious complications than parenteral nutrition (PN). A dedicated hospital nutrition support team (NST) is pioneering and promoting the early use of EN. We aimed to determine reasons for the use of, and patient outcome of, all nasojejunal (NJ) tubes inserted by the NST. Between November 1999 and June 2001, fifty-six out of 221 patients (thirty-three men; mean age 55 years) referred for PN had an endoscopic over-the-guide-wire insertion of a 10 FG Abbott NJ tube. Post-pyloric tube position was confirmed with an abdominal radiograph. Data were collected on time to review by NST, reason for placement, feed duration, tube-related problems and patient outcome. All patients were seen within 1 day of referral. Of the fifty-six tubes initially inserted, thirty-five NJ tubes were inserted in the endoscopy unit and twenty-one in the intensive care unit.

Reasons for NJ tube placement	*n* 56	(%)
High nasogastric aspirates	24	(42)
Nausea/vomiting	20*	(36)
Enterocutaneous fistula	2	(4)
Mucositis	4	(7)
Pancreatitis	4	(7)
Other	2	(4)

*2 hyperemesis gravidarum

We found that twenty-two (39%) patients had had abdominal/aortic aneurysm surgery, and eleven (20%) had oncological malignancy. Forty-eight (86%) had post-pyloric position on immediate abdominal radiograph. Eight (14%) tubes were pre-pyloric. Endoscopic re-positioning was successful in six (unsuccessful in one) cases and one advanced to the jejunum under radiological control. 61% were beyond the DJ flexure. Overall fifty-five patients were established on NJ tube feeding by 24 h after referral. Median feed duration was 7 d (range 1–52). Tube blockage occurred in ten (18%) patients at a median 11 d (range 2–17) and displacement in fifteen (27%). Only eleven (20%) required reinsertion. Fifteen patients died of unrelated causes, thirty-three were discharged home and seven transferred to other hospitals before subsequent discharge.

A NST rapidly assessed and inserted NJ tubes in 25% of patients referred for PN. NJ tubes can effectively deliver nutrition to patients with high gastric output and vomiting, thus avoiding PN.

Catheter-related sepsis: standardisation of definition and reporting. By S.M. SHAH, J.F. KENNEDY and J.M.D. NIGHTINGALE, *Gastroenterology Centre, Leicester Royal Infirmary, Leicester LE1 5WW*

At present there is wide variation in the criteria used to define and report catheter-related sepsis (CRS). This fact may contribute to the under- or over-reporting of incidences. This study aimed to examine prospective clinical and microbiological data in cases of suspected CRS against strict criteria allowing clearer documentation and reporting of results.

Prospective data were collected for all parenteral nutrition (PN) episodes across all directorates (excluding paediatrics) between November 1999 and June 2001. Peripheral and central blood cultures were performed on patients with a raised temperature suspected of CRS while receiving PN, and these were processed using a Bactec system. Upon removal, the tip of the catheter was cultured using Maki roll plating. Catheter-related sepsis was defined as positive central venous and peripheral blood culture of the same organism with subsequent culture of the catheter tip and no other source of infection.

Of a total of 126 PN episodes occurring during this period, nine were excluded because of incomplete data retrieval. CRS was not suspected in 49 PN episodes of which twenty-three patients died due to their underlying disease with no subsequent microbiological data collection. CRS was suspected in 68 PN episodes in fifty-eight patients (thirty-seven men; mean age 54 years) and established in only seventeen (25%). Most of the organisms identified were coagulase-negative *Staphylococcus* (59%) and methicillin-resistant *Staphylococcus aureus (35%)* except one (*Candida albicans;* 6%). Mean duration of PN was 15 days (range 1–64 d) with a total of 998 PN days. There was a CRS rate of 15%. The incidence of CRS equates to 1.7 cases per 100 catheter days with a mean of 59 days between infections.

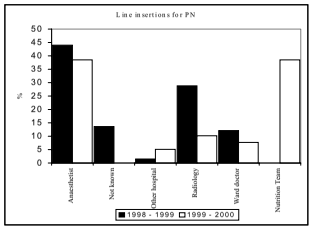
CRS occurs when a parenterally-fed patient has a fever and blood cultures grow the same organism, which is subsequently found in significant quantity on the catheter tip. Data regarding CRS in hospitals need to include a time denominator for infections per 100 catheter days to allow a more direct comparison of results. A significant proportion of our patients were critically ill with additional central venous catheters being used for purposes other than feeding and this may account for an above-average infection rate. Most suspected infections in patients receiving PN are not catheter-related. Other diagnostic techniques not necessitating catheter withdrawal, such as differential quantitative blood cultures, may improve the diagnosis of CRS but these are currently not used widely.

The effect of a hospital nutrition support team on catheter-related sepsis rates in patients receiving parenteral nutrition. By J.F. KENNEDY and J.M.D. NIGHTINGALE, *Gastroenterology Centre, Leicester Royal Infirmary, Leicester LE1 5WW*

A hospital nutrition support team (NST) must prove its effectiveness in terms of both cost and quality to secure long-term support from hospitals. Commonly, this relates to clear performance indicators such as catheter-related sepsis (CRS) rates in patients receiving parenteral nutrition (PN).

A team that works across all adult directorates of a teaching hospital was started in November 1999. A retrospective audit (pre-NST year) was performed to identify PN-CRS rates and associated factors. These data were compared with data on patients receiving PN during the first NST year. The audit aimed to identify essential strategy points to help the NST to tackle CRS.

The pre-NST CRS rate was 71% (58 PN episodes) (mean 7 infections per 100 PN days) for 82 PN episodes (fifty-four patients)). Staff inserting catheters for PN were identified. Single-lumen catheters for PN were only used for 41% of episodes. No formal or informal PN education for staff was evident.



CRS decreased to 29% (23 CRS cases (mean 3 infections per 100 PN days) for 78 PN episodes (seventy-five patients)) in the NST year. In the last 3 months of the year it fell to <7% (0.8 infections per 100 PN days). The NST inserted 40% of the PN catheters in the hospital. Single-lumen dedicated feeding catheters rose to 81%. The average number of catheters per patient fell from 1.52 in the pre-NST year to 1.04 in the NST year.

The hospital adopted a competency-based PN learning pack for Registered Nurses (RNs) developed by the Nutrition Nurse Specialist (NNS). This was supported by NNS-led training sessions (up to four times per week) for RNs including indications, management and complications of PN, in addition to one-to-one working on developing practical competency in PN-related procedures. This training addressed a knowledge deficit of PN-related management. Staff were also invited to attend the NST round and to work with the NNS. Uptake for this training was variable (*n* 105) but was good in areas using most PN. The NST weekly meeting, open to all staff, raises awareness of nutrition within the hospital and provides a forum for information for staff.

The reduced CRS has led to the development of an in-house home PN training service. The NST has trained and discharged seven patients on home PN (range 103–47 d). There were no PN-related infections. Confidence that CRS rates are controlled is growing and staff are supported by education which is ongoing.

CRS is reduced by NST insertion and care, the use of more single-lumen catheters for PN and education of nurses. The success of these measures has led to the development of home PN training services.

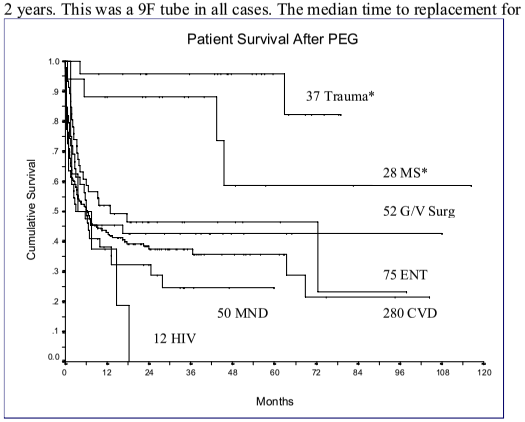
Percutaneous endoscopic gastrostomy insertion: a 10-year experience. By B.L. LITCHFIELD, A. SINHA and J.M.D. NIGHTINGALE, *Gastroenterology Centre, Leicester Royal Infirmary, Leicester LE1 5WW*

Percutaneous endoscopic gastrostomies (PEG) are commonly used to feed patients with a functioning gut but an inadequate oral intake. This retrospective study reviews the indications, outcomes and documented complications of PEG inserted over 10 years (1991–2000) at Leicester Royal Infirmary. Data were collected from computerized endoscopy records and patient case records. 606 PEG (569 Freka 9F, 37 Freka 15F) were inserted in 561 patients for various indications.

Indication	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Cerebrovascular accident (CVD) (%)	0	71	55	39	43	48	43	57	51	53	50
Motor neuron disease (MND) (%)	0	0	15	19	20	7	11	10	3	6	9
General/Vascular surgery (G/V Surg) (%)	50	0	0	3	18	16	15	4	12	4	9
Ear, nose, throat Surgery (ENT) (%)	0	29	10	10	2	9	15	12	16	18	13
Trauma/head injury (Trauma) (%)	0	0	10	16	9	9	5	5	2	7	7
Multiple Sclerosis (MS) (%)	50	0	5	10	5	8	5	6	3	3	5
HIV infection (HIV) (%)	0	0	5	3	2	3	3	1	1	2	2
Other (%)	0	0	0	0	0	0	3	6	11	7	5
Total (%)	100	100	100	100	100	100	100	100	100	100	100

Four patients developed leakage around the PEG entry site and five had entry site infections in the first 2 months. Prophylactic antibiotics were not used. Eleven patients were reported to have developed aspiration pneumonitis in the 2 months following PEG insertion. Patient survival was significantly better in the trauma ($P<0.001$) and MS ($P<0.05$) groups than the other groups.

139 PEG tubes (23%) were used for 30 d or less. Thirty-eight patients (7%) had the same tube for more than 2 years. This was a 9F tube in all cases. The median time to replacement for 9F PEG tubes was 10 months.



The total number of PEG showed a steady increase. CVA patients formed the majority (50%) of patients needing a PEG, and this proportion appeared to be constant. ENT patients constituted an increasing proportion. Patient survival was poor for CVA, MND and HIV patients, but better for trauma, MS and ENT patients. The use of 9F PEG tubes was associated with few complications.