Original article

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Refeeding enteroclysis as an alternative to parenteral nutrition for enteric fistula

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Abstract

Aim Refeeding enteroclysis is one method of giving artificial nutritional support to patients with enterocutaneous fistula. This study compares the results of this technique with parenteral nutrition or nutrition given via a proximal stoma.

Method All patients admitted to our intestinal failure unit with a proximal enteric fistula and managed with refeeding enteroclysis over a 4-year period were included and compared with a matched group of patients managed without using this technique.

Results Twenty patients (15 men) with a proximal enteric fistula received chyme refeeding down the distal limb of the fistula. This was established at a mean of 14 days after admission to the unit and total parenteral nutrition could be weaned off by 20 days. The mean output from the proximal limb was 1800 ml and the mean volume refed down the distal limb was 1220 ml per day. Additional enteric feed was given to 12 patients. No patient was given pharmacological agents to delay gastrointestinal transit or additional intravenous water and electrolyte for most of the time after refeeding was established. There were no complications or deaths related to chyme refeeding.

Conclusion Refeeding enteroclysis is feasible in selected patients with a proximal enteric fistula or stoma. Adequate nutrition, water and electrolyte balance can be achieved without resorting to parenteral infusions.

Keywords Enterocutaneous fistula, refeeding, enteroclysis, intestinal failure

What does this paper add to the literature?
This paper demonstates the effectivenss of refeeding enteroclysis in adults with an enterocutaneous fistula in the largest series of patients hitherto reported.

Introduction

Intestinal failure is defined as the inability of the gut to maintain protein–energy, water, electrolyte and micronutrient balance [1]. Proximal postoperative enteric fistulae account for a significant proportion of referrals to intestinal failure units [2]. In these patients, intestinal continuity cannot be restored surgically until intra-abdominal adhesions have matured, a process that can take up to 6 months [3]. During this period nutritional support has to be maintained and parenteral nutrition with or without enteral nutrition enables this. Parenteral nutrition is expensive and is associated with significant morbidity and even mortality.

Levy *et al.* pioneered the reinfusion of chyme down the distal limb of the fistula or a stoma as a means of delivering nutrition to the patient [4,5]. This has potential cost benefits over the infusion of a standard polymeric feed to replace parenteral nutrition. The approach has also been described in the UK [6]. In their description of fistuloclysis, Teubner *et al.* limited the oral intake of liquids combined with omeprazole, loperamide and codeine phosphate to limit the output from the fistula, but discarded the effluent from the proximal limb. There are other reports of refeeding chyme from the proximal limb back into the distal limb, mostly in the paediatric literature [7–10], but also some in adults [11,12]. The use of chyme refeeding has not been reported from a developing country, where limitation in social support and home-based nursing often precludes home parenteral nutrition.

The technique of refeeding chyme has not gained popularity, probably because it might seem unpleasant, but it makes sense to mimic normal gastrointestinal function including maintenance of the enterohepatic

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circulation and absorption of vitamin B_{12}. This study reports a simple technique for refeeding enteroclysis and describes its efficacy in replacing parenteral nutrition in patients with an enteric fistula awaiting reconstructive surgery.

Method

Patients admitted to the intestinal failure unit at Groote Schuur Hospital, University of Cape Town, South Africa, who had an enteric fistula and were managed by refeeding enteroclysis according to a standard protocol from June 2009 to June 2013 were included in the study. The results were compared with those of patients managed without refeeding enteroclysis during the same period. All patients in the refeeding cohort had had an operation for intra-abdominal sepsis which had been followed by an enteric fistula in a laparostomy wound or as a double-barrelled stoma as described by Mikulicz [13]. Early nutrition during the resuscitation phase was given parenterally and enteroclysis was only introduced when patients had been stabilized and intra-abdominal sepsis adequately controlled. Successful refeeding enteroclysis was defined as a patient meeting all nutritional requirements via the enteral route with or without additional enteral feeding.

Patient assessment before enteroclysis

Patients were only considered for refeeding enteroclysis once adequate oral intake had been established. Nutritional requirements were calculated by a dietician using standard calculations from the European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines [protein 1.5–2.0 g/kg and non-protein energy (NPE) 30–35 kcal/kg of the ideal body weight] [14]. Oral intake was measured daily and dietary energy, nitrogen and fluid intake were calculated. Patients not able to meet water, electrolyte and nutritional homeostasis via the enteral route because of high fistula output were considered for refeeding.

Technique

The length and patency of the distal gut was determined by contrast radiography in all cases. The distal limb of the fistula was intubated with a 16 French Foley catheter under fluoroscopic guidance and contrast injected through through the catheter to confirm patency (Fig. 1). The catheter balloon was then inflated with 5 ml of water. An appropriate stoma appliance was applied to the fistula (Figs 2 and 3) and the catheter was brought out through the plastic of the appliance.

Figure 1 Contrast radiography to delineate the anatomy and confirm the patency of a distal fistula.

Figure 2 Preparing the skin.

The appliance was then secured around the catheter with a tie.

The stoma effluent collected in the appliance was emptied every 3 h. It was strained through a porous cloth to remove larger particles. The strained effluent was then introduced down the distal limb of the fistula via the Foley catheter using a standard feeding pump and administration set (APPLIX pump set, Fresenius Kabi, Hamburg, Germany) at a rate of 20 ml/h (Fig. 4). The rate of administration was increased the following day if refeeding was tolerated. The rate of refeeding was adjusted to match stoma effluent. Refeeding was interrupted if diarrhoea or abdominal pain

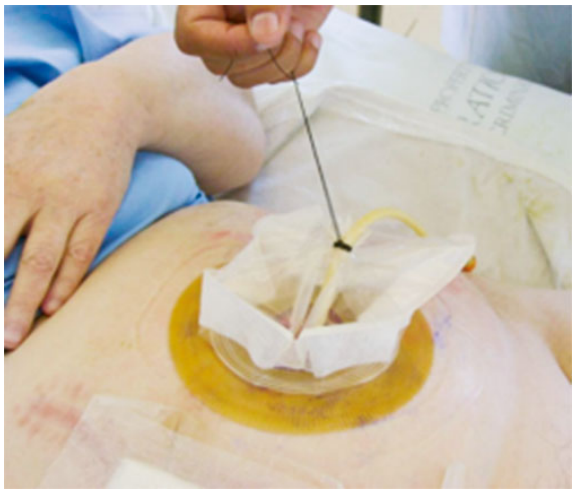

Figure 3 Securing the stoma appliance.

Figure 4 Stoma effluent infused.

occurred. Once refeeding was established parenteral nutrition was gradually stopped. When necessary additiona enteral nutrition was given down the distal limb of the fistula (Fig. 5). Successful establishment of refeeding was defined as a patient tolerating the total volume of stoma effluent infused into the distal limb of the fistula without abdominal symptoms or profuse diarrhoea.

Serum electrolytes, albumin and weight were measured weekly. All patients were trained to manage the refeeding process independently. Those with adequate

Figure 5 Two-way catheter in the fistula allowing infusion of chime and enteral nutrition.

social support and motivation were discharged with the necessary equipment to refeed at home. Surgical reconstruction of gastrointestinal continuity was offered when the patient was considered to be nutritionally replete, sepsis-free and adhesions were likely to have become mature.

Results

During the 4 years of the study 54 patients were admitted to the unit of whom 21 were managed with refeeding enteroclysis. The results are based on 20 patients since the records of one patient were unobtainable. This patients were compared with 22 others managed without enteroclysis in the same unit and during the same period. All patients had been referred to our unit after experiencing formation of the fistula elsewhere.

Refeeding enteroclysis

Fifteen of the 20 patients were men. The mean age was 47 ± 16.16 years (SD). Twelve had fistula through the laparostomy wound and eight had double-barrel stoma bearing ther fistula. The causes for the fistula are shown in Table 1. Parenteral nutrition was required for a median of 20 (0–95) days and successful refeeding was established at a median of 15 (0–94) days after admission to the unit. Patients received refeeding for a mean of 41 ± 16 days. The mean output from the proximal limb was 1940 ± 606 ml and the mean volume refed was 1360 ± 460 ml. In 12 patients, additional enteral nutrition (Servimed, Frezineus-Kabi) was given along with the refeeding. All patients were managed without any supplementary intravenous fluids for most of the time after refeeding was established. If additional water and electrolyte was necessary, additional oral rehydration solution was given.

Table 1 Summay of patieints managed with refeeding enteroclysis.

Precipitating pathology	Operations prior to referral	Fistula anatomy (cm from Treitz)	Days on TPN	Days until successful refeeding	Days refed	Mean output (ml)	Mean refed (ml)	Additional enteral feed (days)	Last operation to closure (days)	Hospital stay after closure (days)	Morbidity/mortality
Open abdomen											
Cystectomy	9	120	13	10	39	1500	1250	Nil	112	6	SSI
MVA	4	130	12	10	53	1370	900	800	93	16	SSI
Small bowel lymphoma	1	80	15	12	31	2010	1550	Nil	70	8	Nil
Incisional hernia	7	125	0	0	50	2700	1900	Nil	90	7	SSI
Unexplained small bowel perforation	1	160	18	4	24	1850	1500	Nil	63	7	SSI
Appendicitis	3	95	27	10	17	1200	750	1000	59	6	Nil
Adhesive small bowel obstruction	4	60	16	12	31	1900	1300	2000	112	81	Critical Illness polyneuropathy
Reversal of Hartmann's	3	130	14	6	46	1800	1000	Nil	66	9	Pneumothorax, SSI
Mesenteric ischaemia	2	70	29	19	52	1600	1200	1000	73	7	Bowel infarction, death
Gunshot abdomen	13	80	97	103	56	1200	1000	1000	66	14	Nil
Appendicitis	2	110	16	9	32	1400	1000	1000	68	14	SSI
Gunshot abdomen	7	30	35	30	78	2800	2100	1000	111	16	Osteitis, SSI
Stoma											
Appendicitis	2	150	20	10	47	2400	2000	1500	NA	NA	MRSA, renal failure, death
Peutz–Jeghers	2	120	28	20	28	1350	950	Nil	68	5	Stroke
Adhesive small bowel obstruction	3	80	14	6	55	3000	2000	Nil	66	5	Pneumothorax, SSI
Abdominal tuberculosis	1	30	17	8	40	3000	2350	2000	29	14	Nil
Large bowel obstrucion (sigmoid cancer)	1	135	0	4	28	1650	1500	2000	NA	NA	Pulmonary embolism, death
Appendicitis	2	50	14	12	16	2700	2000	2000	79	6	Nil
Adhesive small bowel obstruction	2	100	8	5	55	1600	1000	Nil	76	6	SSI
Mesenteric ischaemia	3	165	0	8	42	1750	1000	1500	51	6	Nil

TPN, total parenteral nutrition; MVA, motor vehicle accident; SSI, surgical site infection; NA, not applicable; MRSA, methicillin-resistant *Staphylococcus aureus.*

Definitive surgery was performed at a mean of 75 ± 22 days after the last surgical procedure. Patients were discharged at a median of 9 (5–86) days after the definitive procedure.

Complications

Minor complications such as skin excoriation, leaking of stoma appliances and blockage of feeding catheters were not recorded. Two patients developed iatrogenic pneumothoraces from central line placement. One patient developed critical care polyneuropathy resulting in a long postoperative stay for rehabilitation (86 days), with normal gastrointestinal continuity. One patient developed chronic osteitis of the iliac blade that was fractured by the bullet from a high velocity gunshot. This resulted in a chronic sinus in the right iliac fossa that persisted after definitive surgery. One patient had an embolic stroke while in the ward, the source of which was never identified. Nine patients had superficial surgical site infection of the definitive closure wound, all managed conservatively. There were no complications directly related to refeeding fistuloclysis.

Three patients died during the management in the ward. One died from renal failure due to drug-induced nephropathy secondary to vancomycin for methicillin-resistant *Staphylococcus aureus* (MRSA) central line sepsis that was acquired prior to establishing refeeding. The second died from a pulmonary embolism. The third patient, who was managed after resection for ischaemic small bowel, died 2 weeks after definitive surgery due to another infarction of most of the remaining small intestine.

Patients managed without enteroclysis

The control group consisted of 22 patients with similar presenting pathologies and is summarized in Table 2. The control group consisted of 15 men and seven women. The mean age of this cohort was 44 ± 10.94 years. All the patients in this cohort had a contraindication for refeeding enteroclysis (no usable distal limb, $n = 4$; multiple fistulae, $n = 9$; unable to cannulate the distal limb, $n = 5$; gastrocutaneous fistula, $n = 4$). Parenteral nutrition was required for a median of 48 days (range 9–294 days). Eighteen patients had septic episodes related to central lines, with 62 organisms isolated on blood or central line cultures (Table 3).

Complications other than line sepsis occurred in 10 patients. Two patients developed an acute kidney injury due to sepsis and dehydration. There were two deaths in this cohort. One patient died postoperatively from septic complications and the other from line sepsis before definitive surgery could be offered.

Discussion

The study has demonstrated that in about half of patients with an enteric fitula refeeding by enteroclysis is practicable and can greatly reduce requirements for parenteral nutritional. Polk and Schwab described a three-phase approach to metabolic and nutritional support, which is commonly used in intestinal failure units [15]. During initial resuscitation, the emphasis is on diagnosis, source control and drainage of sepsis, rapid correction of water and electrolyte balance and antibiotics. Nutritional requirements during the resuscitation phase are usually met using the parenteral route, with enteral nutrition used mainly to prevent villous atrophy.

In the second phase the anatomy of the gastrointestinal tract and the fistula is delineated and sustainable nutritional routes should be established. The gastrointestinal tract has regained motility and should be used to maintain nutrition [14]. Parenteral nutrition may still be used, but specialized nursing care is necessary. In developed countries it is often successfully administered at home after adequate training of the family or carers [16]. Where social support is limited this is not possible.

Use of the small intestine distal to the fistula has great potential in such patients. Teubner *et al.* reported the use of fistuloclysis of enteral nutritional products as well as its favourable cost implications [6]. In their series, where 12 patients were managed with fistuloclysis, they showed a 10-fold cost saving when using enteral feeds rather than total parenteral nutrition. The fistula effluent in these patients was discarded and pharmacological agents were used to limit fistula output. The authors did not report on the administration of additional intravenous fluid. However, refeeding chime, as was performed in the present study, mimics normal gastrointestinal physiology. Avoidance of parenteral nutrition has considerable psychological advantages for the patient who can drink and who does not require pharmacological suppression of the fistula output. Refeeding can be done by nurses who are less skilled than those who administer parenteral nutrition. Line sepsis, which occurred in 18 of the 22 patients managed parenteraly in the present study, is also avoided. One death in the series was due to line sepsis and this would have been avoided by fistuloclysis. Nevertheless careful monitoring of nutritional requirements and intake is still required, and if they are not met supplementary enteral nutrition can given by mouth as was necessary in 60% of patients in the present study. Fistuloclysis should only be done if there is clear evidence that a fistula will not close spontaneously, as intubation

Table 2 Summary of patients managed without refeeding enteroclysis.

Precipitating pathology	Operations prior to referral	Fistula anatomy (cm from Treitz)	Days on TPN	Mean output (ml)	Last operation to closure	Hospital stay after closure (days)	Central line complicaations	Morbidity/mortality
Abdomen not open								
Bowel infarction	2	100 cm small bowel. Fistula at 40 cm	32	450	Spontaneous closure	NA	Two line sepsis	Acute kidney injury
Perforated gastric ulcer	2	Gastrocutaneous fistula	16	405	Spontaneous closure	NA	Nil	Nil
Clostridium difficile colitis, chronic renal failure	1	Subtotal colectomy and end-ileostomy	10	920	126 days	33	Two line sepsis	Nil
Closure of Hartmann's	2	Two small bowel fuistulae	48	1160	126 days	9	One line sepsis	Nil
Tuberculosis ileitis	1	End ileostomy at 230 cm	27	1210	429 days	6	Two line sepsis	Nil
Ileo-sigmoid knot	3	End ileostomy	9	1975	110 days	9	Nil	Nil
Bowel infarction	1	Fistula at 60 cm	40	1686	74 days	17	Three line sepsis	Prolonged ileus
Unexplained small bowel perforations	1	Fistula at 100 cm	54	2780	103 days	8	One line sepsis	Nil
Stab abdomen	5	Fistulae 20 and 260 cm	84	3610	107 days	8	Six line sepsis	SSI
Abdominal tuberculosis	2	Three fistulae	23	1450	Spontaneous closure	NA	Nil	Nil
Iatrogenic small bowel injury during laparoscopy for ovarian pathology	3	Fistula at 20 cm and three more distal fistulae	294	3700	169 days	119	Six line sepsis	Frozen abdomen. Postoperative bowel obstruction
Early postoperative small bowel obstruction	1	Distal small bowel obstruction	61	N/A	80 days	12	Nil	Nil
Small bowel obstruction with massive resection	3	80 cm small bowel fistulae at 40 and 80 cm	250	3200	140	221	Eight line sepsis	SSI
Open abdomen								
Small bowel obstruction	2	Fistulae at 130, 160 and 220 cm	79	1219	120 days	15	Two line sepsis	Postoperative SSI
Gunshot abdomen	4	Gastrocutaneous fistula	64	778	113 days	6	Four line sepsis	SSI
Gastrinoma, perforated gastric ulcer	3	Gastrocutaneous fistula	148	3200	136 days	9	Eight Line sepsis	Died on ninth postoperative day from sepsis
Small bowel obstruction	3	Fistulae at 100, 110 and 260 cm	61	1580	87 days	9	Four line sepsis	Adominal wall seroma

Table 2 (Continued).

Precipitating pathology	Operations prior to referral	Fistula anatomy (cm from Treitz)	Days on TPN	Mean output (ml)	Last operation to closure	Hospital stay after closure (days)	Central line complicaations	Morbidity/mortality
Reversal of Hartmann's	5	Fistula at 90 cm	19	1700	128 days	24	One line sepsis	Acute kidney injury. Anastomotic leak requiired percutaneous drain
Stab abdomen	2	Fistula at 110 cm	34	1500	63 days	7	Two line sepsis	Nil
Unexplained small bowel perforations	10	Multiple fistulae	201	1810	NA	NA	Six line sepsis	Died from sepsis day 256
Gunshot abdomen	3	Fistulae at 20 and 200 cm	75	1280	109 days	19	One line sepsis	Prolonged ileus
Appendicitis	8	Two small bowel fisulae	18	1200	140 days	6	Three line sepsis	Nil

SSI, surgical site infection; NA, not applicable.

Table 3 Microbiological isolates from infected central lines.

Organism	Number of patients	Number of isolates
Acenetobacter baumanii	5	9
Bacillus cereus	1	1
Candida albicans	2	5
Candida glabrata	1	2
Candida parpasiliosis	1	1
Enterobacter faecalis	1	1
Escherichia coli	1	1
Klebsiella pneumoniae	2	4
Methicillin-resistant *Staphylococcus aureus*	3	7
Methicillin-sensitive *Staphylococcus aureus*	4	9
Staphylococcus capitis	1	3
Staphylococcus epidermidis	11	19
Total		62

of a fistula tract could potentially prevent spontaneous closure. Refeeding was only started once mucocutaneous continuity of the fistula was established and when patency of the distal intestine had been demonstrated by imaging [15].

Managing these patients with complex needs is labour intensive and requires dedication from the entire intestinal failure team. The success of refeeding enteroclysis in our unit is a tribute to the dedication and energy of the multidisciplinary team that we are part of. In selected patients with proximal enteric fistula, water, electrolyte and nutritional requirements can be met by simple chyme refeeding enteroclysis, with or without supplementary enteral nutrition, thereby eliminating the need for parenteral nutrition and intravenous access.

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Conflicts of interest

No conflicts of interest to declare.

Auhor contributions

E. Coetzee was responsible for the study design, data collection and interpretation writing the manuscript. Z. Rahim and A. Boutall collected data. A. Boutall and P. Goldberg were responsible for critically editing and formulating the manuscript.

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