Enteral feeding: techniques of administration

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The objective of nutritional support is to provide sufficient nutrients to maintain or improve nutritional state.¹ These aims may be difficult to achieve using enteral nutrition² as positive nitrogen balance may not be established consistently throughout a course.³ This finding has little to do with the formulation of the diet itself as up to one third of a prescribed diet may never reach the patient.^{2,4}

Although much emphasis has been placed on the absorption characteristics of various substrates used in enteral feeds, their full potential can only be achieved if proper attention is paid to the more mundane subject of their administration. It is essential that the complete volume prescribed reaches the small bowel while minimising feed related complications such as vomiting, aspiration, diarrhoea and ostomy losses. Equipment must be safe, simple, and inexpensive. Greater emphasis than hitherto must be placed on the training of medical and nursing staff in nutritional support techniques. The choice of equipment should be rationalised according to local requirements, preferably under the auspices of a "nutrition team."

Equipment

Continuous infusion of feed from a reservoir via a fine bore nasogastric or nasoenteric tube with or without an infusion pump is now commonplace and has largely replaced bolus feeding.¹

RESERVOIRS

The trend away from "home brew" formulations to commercially prepared sterile products has allowed much larger reservoirs to be used. A two litre container may need refilling only once a day, provided that the feed and container are both sterile. The fewer refills required during the day, the more likely the prescribed amount will reach the patient's gut.²⁻⁴ The reservoir should not be compatible with intravenous infusion sets. Ideally a range of commercially prepared bags containing one to two litres of sterile feeds of varying nitrogen and energy contents should be available for "off the shelf use."

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There is already ample evidence to show that home brew feeds are associated with unacceptable bacterial contamination⁵ and lead to an increased incidence of diarrhoea.⁶ Any additions to sterile feeds must also be sterile. Effervescent electrolyte sources tend to curdle whole protein feeds, so that only simple sterile preparations of sodium or potassium chloride should be added. It is not necessary to infuse feeds at body temperature as refrigerated feeds rapidly equilibrate with intra-abdominal temperature and have little effect on gastric motility.⁷

GIVING SETS

The giving set should be incompatible with intravenous solution containers and should preferably be integral with the reservoir. A satisfactory flow regulator is required. The lower end of the set must be incompatible with intravenous catheter hubs, and this is most easily achieved by a reversed luer connection of different gauge from intravenous luer systems. A recent case⁸ highlights the risks associated with failure to observe these regulations, as inadvertent intravenous infusion of enteral feeds has serious bacteriological and biochemical consequences. Giving sets and reservoirs are best changed daily as infection may ascend from the patient.

INFUSION PUMPS

Simple gravity assisted infusion is satisfactory for most patients, provided a continuous 24 hour infusion is maintained.⁹ There remain a small number of patients, however, in whom gravity feeding is associated with variations in flow rate sufficient to provoke regurgitation, vomiting, aspiration, discomfort or diarrhoea.⁹ In these patients a simple enteral feeding pump may allow continuation of enteral feeding, thus obviating the need for parenteral feeding.^{9,10} Patients most likely to prove sensitive to variations in flow rates (including bolus feeding) are those with a gastrectomy, short gut, or severe impairment of pancreatic or small bowel function. Most authors favour pump control for intraduodenal or jejunal feeding.⁷ The pump need not be as complicated as an intravenous model but should be incompatible with intravenous

at the time of the initial operation, although neither need to be used if oral intake can be restarted without undue delay. Such tubes can be used for early postoperative nutrition now that it has been recognised that small bowel function returns much earlier than gastric emptying.^{24 25} A clinical nutrition team must be able to offer advice and expertise in all aspects of tube feeding if enteral rather than parenteral nutrition is to be offered to the maximum number of patients.

Bolus or continuous infusion?

Traditional bolus feeding requires a large bore tube to assess residual gastric contents before the next feed and to enable rapid administration. This requires one hour/day more nursing time than continuous feeding²⁶ and carries with it the risks of large bore tubes. Furthermore, if pre-feed residuum is considerable and discarded it may be impossible to satisfy nutritional requirements. Bolus feeding, however, may be more physiological with regard to insulin secretion but may be less effective in promoting nitrogen repletion and weight gain.⁷ The main objection to this method is the incidence of gastrointestinal side effects such as regurgitation and diarrhoea.^{1 26} There is now general agreement that jejunal feeding should be by continuous infusion,^{1 7 17} but the intragastric route remains controversial. It has been shown that nasogastric boluses of 500 ml given at 60 ml/minute are well tolerated and small volumes may be given even faster.⁷ Early rapid phase gastric emptying of 500 ml boluses, however, may allow part of the meal to reach the ileum.⁷ Any colonic spillage could result in diarrhoea. Although bolus feeding is cheap and simple, there are now several studies providing clear evidence in favour of continuous nasogastric infusion in infants²⁷ and adults.²⁸

Particular care must be taken, however, with unconscious patients, or those with neurological dysphagia, or endotracheal tubes who are at high risk of regurgitation and aspiration.²⁹ In one necropsy series of neurological patients pulmonary aspiration was underdiagnosed and commoner in nasogastrically fed patients.³⁰ The incidence of aspiration, however, was only 1.4% of 634 patients fed by continuous nasogastric infusion, and there was a high percentage of patients at risk.³¹ To prevent this complication transpyloric feeding has been advocated with simultaneous aspiration of gastric contents.²⁹ If nasogastric feeding is to be given to high risk patients it seems prudent to do so via large bore tubes initially, so that frequent assessment of gastric emptying can be made. Continuous infusion is less likely to overwhelm gastric

emptying and provoke vomiting or regurgitation,^{17 32} but feeding should probably be discontinued before chest physiotherapy. No controlled trials of continuous intragastric versus transpyloric feeding have yet been performed with high risk patients, although nutrient delivery is similar by the two routes.³³

Patients with loss of pyloric control and those with impaired small bowel function should always be fed by continuous infusion, and a pump may be necessary to ensure this.⁹ Despite continuous infusion diarrhoea still occurs in up to 25% patients receiving polymeric or elemental diets, but concurrent broad spectrum treatment with antibiotics can be implicated in all but a few cases^{3 34 35}

STARTER REGIMENS

The most controversial topic at present is the value of incremental starter regimens in avoiding gastrointestinal side effects. Such problems are traditionally attributed to the hyperosmolality of undiluted feeds.¹⁶ Traditional starter regimens may prevent satisfaction of nutritional demands over the first three to four days of feeding.^{35 36} Controlled data now available have cast doubt on this practice, there being no difference in the incidence of diarrhoea between a hypotonic starter regimen, an isotonic regimen, and an undiluted hypertonic polymeric diet

given by gravity assisted continuous infusion.³⁵

The final volume of feed required will depend on its energy and nitrogen density, which in turn must be based on water requirements (or restrictions) and nutritional needs.

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