Bacterial contamination of enteral diets

I H DE LEEUW AND M F VANDEWOUDE

Division of Clinical Nutrition, University of Antwerp, Antwerp, Belgium

SUMMARY Enteral feeding solutions can be contaminated by bacterial micro-organisms already present in the ingredients, or introduced during preparation or transport, or in the hospital ward. During jejunostomy feeding without pump or filter, ascending bacterial invasion of the feeding bag is possible. In patients with lowered immune response contaminated feedings can cause serious septic clinical problems. The progressive loss of the nutritional value of the enteral feeding solution by bacterial contamination has to be considered for all patients.

One of the best known and clinically important complications of parenteral nutrition is catheter related sepsis. This is usually caused by exogenous bacterial contamination of the feeding system.¹ As a consequence, we have learnt of the importance of using strictly aseptic techniques during preparation and administration of parenteral nutrition solutions.

Most enteral feeding solutions also represent an ideal growth medium for bacterial micro-organisms. Various bacteria have now been isolated and cultured from enteral diets.¹⁻³ These include *Enterobacter*, *Escherichia coli*, *Klebsiella*, *Proteus*, *Salmonella enteridis*, *Pseudomonas aeruginosa*, *Moraxella*, *Bacillus cereus*, *Staphylococcus aureus* and *Staphylococcus epidermidis*, β haemolytic streptococci and yeasts.

Clinical consequences of bacterial contamination

In general, bacterial contamination has not been shown to cause serious clinical problems.⁴ A close survey of the published reports, however, highlights the potentially severe consequences associated with the presence of bacteria in enteral feeds. Thus Caswell⁵ reported a case of septicaemia caused by an enteral diet contaminated with *Enterobacter cloacae*, and Baldwin,⁶ in a further case report, related fever, hypotension, leucocytosis and tachycardia to contamination of an enteral diet infused via a needle catheter jejunostomy.

It has been suggested that colonisation and subsequent infection of the digestive tract with *E. Coli*, *Klebsiella*, and *Pseudomonas* can occur with

counts as low as 10^4 organisms/ml of feed,⁷ particularly in patients in intensive care units who have been treated with antibiotics, steroids, or immunosuppressive agents. Furthermore, bacterial overgrowth in the stomach, which may occur in patients receiving cimetidine and fed contaminated diets, can be followed by transmission of bacteria to the upper airway and colonisation of the respiratory system.⁸

Finally, gastroenteritis caused by the presence of enterotoxin producing bacteria in contaminated diets^{9 10} is clearly a special hazard for neonates, children, and critically ill underweight patients.

SOURCES OF CONTAMINATION

Ingredients

Commercially made feeds are mostly sterile and can be used safely. Home made feeds, however, may be contaminated from the outset. Pasteurised milk may be contaminated with *B. cereus*¹¹; raw eggs with *salmonella* sp¹²; and distilled water with *E. coli*, *Pseudomonas* sp, or *Enterobacter* sp.¹³

Kitchen preparations

Even when prepared in the diet kitchen under aseptic conditions contamination can occur during preparation, by mixing and diluting in contaminated machines (mixers, liquidisers, homogenisers), on working surfaces, or by contaminated staff.¹⁴ Delay in transport to the ward without refrigeration provides a further opportunity for bacterial growth.

Ward environment

From hospital flower vases to air and dust,¹⁴ considerable amounts of various bacterial species have been isolated and cultured in wards where patients are receiving enteral nutrition. One report highlighted how the same micro-organisms present

Correspondence to: Dr I H de Leeuw, Division of Clinical Nutrition, University of Antwerp, (UIA), 10 Wilrijkstraat, B-2520, Edegem, Belgium.

on the hands of nurses or patients can be cultured from the enteral diets used.¹⁵

Physical and technological factors

Bastow *et al*¹⁶ showed that if sterile commercial feeds are carefully emptied into diet containers on the ward they remain sterile, whereas if a diet is blended with additives in the diet kitchen it is likely to become contaminated, and subsequent bacterial multiplication occurs (10^{8-10} organisms/ml after 24 hours' exposure to ward temperatures of 21–24°C). It seems likely, therefore, that exogenous sources and mechanisms are responsible for bacterial contamination. In this context it is interesting to note that although bacteria have been shown to be trapped in nasogastric tubes during insertion¹⁷ and that adhesion of micro-organisms to the solid surfaces of hardened feeding tubes has been shown,¹⁸ some reports show that endogenous bacteria do not contaminate feeding reservoirs in a retrograde fashion when fine bore nasogastric feeding tubes are used.^{2 18}

With some types of jejunostomy feeding, however, ascending contamination of the reservoir has been suggested.¹⁹ Bacteria from the normal faecal flora can travel through the broad lumen catheter, especially as some of them (*E. Coli*, *Enterobacter cloacae*, *Proteus*, *Serratia*) are mobile. Without the use of an infusion pump or an antibacterial filter, invasion of the feeding bag thus becomes possible.

Until recently very little attention was paid to the loss of the nutritional value of the feeding secondary to bacterial contamination. In the above mentioned case¹⁹ glucose concentrations were compared in contaminated and control enteral diets. After 12 hours glucose concentration dropped to 87% of the start value, to 21% after 24 hours, and to 1% after 36 hours, while remaining at 100% in the control solution. Most probably, this phenomenon applies to other essential nutrients and deserves further investigation.

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