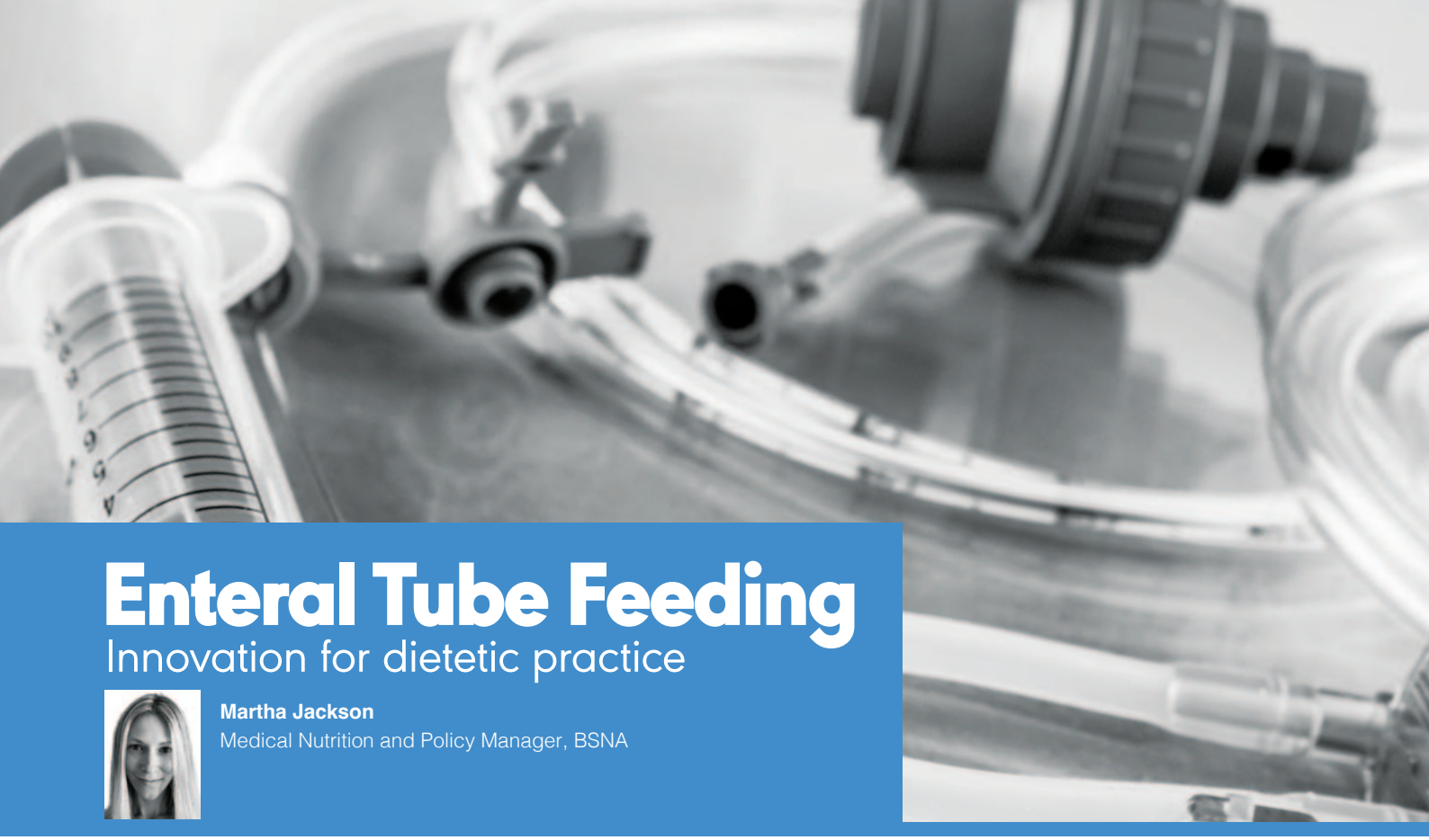

Enteral Tube Feeding

Innovation for dietetic practice

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Enteral tube feeding is fundamental for those patients who are unable to meet nutritional requirements orally but have a functional and accessible gastrointestinal (GI) tract.[1,2] It is most commonly used in patients with neurological conditions, upper GI obstruction, unconscious patients, GI dysfunction or malabsorption, psychological problems or for specific conditions (e.g. Crohn's disease).[1] The delivery of nutrition via a tube is not new, with various techniques to bypass inadequate swallowing mechanisms being around since the Middle Ages. However, over the years, enteral nutrition has advanced into evidence-based solutions supported by advances in nutritional science, medical devices and patient safety initiatives.

History of enteral feeding

Over the years enteral tube feeding has undergone significant innovation and although enteral feeding therapy has existed since ancient Egypt,[3] where infusions consisted of nutrient solutions into the rectum,[4] most of the major advances in techniques and formulas came much later.[5]

The first recorded attempt to feed into the upper gut using a hollow tube with a bladder filled with a nutrient solution inserted into the oesophagus was made by Capivacceus in 1598.[6] Fabricius used a silver tube into the back of the throat to feed patients suffering from tetanus in 1617.[7] John Hunter was the first to record bypassing the swallowing mechanisms with whale bone and eel skin attached to a bladder pump, to feed a mix of jellies, eggs beat up with a little water, sugar, milk and substantial amounts of alcohol in 1793. In 1837 the first gastronomy tube directly into the stomach was suggested, but it was Verneuil who performed the first surgical procedure in 1876.[8] Rectal feeding was still about and, in 1881, the US president James Garfield was kept alive after being shot by being rectally fed eggs, beef juice and whisky.[9] In 1918, Anderson reported passing a tube into the jejunum during surgery and feeding a solution of 200 ml peptonised milk, 15 g dextrose, and 8 ml whiskey. This regimen continued every 2 hours post-surgery to reach 2,500 kcal in 24 hours.[5]

These early enteral feeding practices were associated with numerous challenges, from varying nutrient composition, contamination and difficulty placing the tube.[10] By 1900 the notion that food plays a vital role in recovery was discovered with biochemists and physiologists identifying protein, fat and carbohydrates as the basic nutrients in food. By 1916 new data had led to the discovery that food contained vitamins, and the lack of 'vital amines' could cause disease and nurses were encouraged to take a close interest in their patients' nutrition.[3] The focus of nutrition programmes shifted in the second half of the century from disease prevention to control of chronic conditions, such as cardiovascular disease and obesity.[11] The life changing discovery of modern antibiotics in the 1940s changed the landscape of artificial feeding, and many of the surgeries that had failed because of infection were now viable.[12] The late 20th Century marked a significant shift in artificial feeding, with the introduction of softer, more flexible tubes to make artificial feeding more comfortable and more successful.[13] Since the tubes were so narrow, new feeds had to be designed and manufactured to enable easy passage down the tubes, along with new pumps and the development of continuous infusion to feed over 24 hours. This was a quiet revolution for enteral feeding for a large number of patients to be fed over the short and long-term in hospital and at home.[7]

So, until recent times, the concept of improving nutrition in those who could not swallow sufficient food for themselves but where the gut could still be used did not exist and therefore dehydration and starvation were the norm for these patients. This applied particularly for those suffering neurological conditions, including stroke, motor neurone disease (MND) and dementia.

Modern methods of enteral feeding

There are two main methods of enteral feeding: bolus feeding and pump feeding. Bolus feeding is used to describe a method of feeding where either a large syringe or gravity is used to deliver feed directly into the stomach over a 5-10 minute period, 4-6 times a day,[14] whereas pump feeding involves the enteral feed travelling through a giving set and through a feeding pump.

Enteral feeding formulas

Improved understanding of macronutrients and micronutrients enabled the development of nutritionally complete formulas with standardised composition in the late 1960s and early 1970s.[15] Commercially prepared enteral formulas emerged as a safer and more reliable alternative to homemade feeds, offering consistent nutrient delivery and improved tolerance. The 20th Century also saw a shift to the development of specialised products tailored to specific diseases and physiological conditions. Feeds available today can be broken down broadly into the following categories:[16-18]

- Standard formulas
  A standard tube-feeding formula is a formula that is designed for adults or children who have normal digestion. Standard formulas include all of the nutrients required to maintain health, usually with carbohydrates in the form of maltodextrin and corn syrup solids, protein as soy protein isolate or caseinates, and fats such as safflower, canola or soybean oil.[17] They are available in different concentrations, from 1 to 2 kcal/ml; more concentrated formulas may be appropriate for individuals with conditions which require fluid restrictions.[17] Some standard formulas can be used for both enteral feeding and as an oral supplement. They can contain added ingredients, such as fibre for digestive health and bowel management.
- Peptide-based formulas
  Peptide-based formulas, also referred to as elemental or semi-elemental, are also nutritionally complete and used in patients with malabsorption or who have demonstrated GI intolerance of standard formulas as they are easier to digest as some of the components, such as protein, are 'broken down' into smaller components.[17] Peptide-based formulas are generally high in protein; some may contain up to 25 to 35% of total calories from protein and are, therefore, of benefit in critically ill patients.[17]
- Disease specific formulas
  Specialised enteral formulas are available for adults and children with special nutritional needs, such as diabetes, kidney failure, respiratory disease or liver disorders.[17] The enteral formula should be selected by a physician or a dietitian who is familiar with the various formulas.
- Blended feeds
  The use of blended feeding formulas has increased as demand for more "natural" formulas has grown, especially for individuals on long-term enteral nutrition.[19] Blended feeds can be commercially prepared or non-commercially prepared (i.e., "homemade") formulas.[17] If non-commercial formulas are used, the patient and/or carer should always consult a qualified healthcare professional to ensure safety and nutritional adequacy.

For dietitians, these innovations have expanded the scope of individualised nutrition therapy and reinforced the importance of comprehensive nutrition assessment.

Safety innovations & standardisation

As enteral nutrition has become more prevalent, there has been more attention on patient safety. In 2001, a serious adverse event related to accidental administration of chemotherapy into the spine prompted global patient safety initiatives.[20] The National Patient Safety Agency (NPSA) stated that enteral feeding systems should not contain ports that could be connected to either intravenous syringes or to intravenous or other parenteral lines.[21] In response, standardised enteral connectors were mandated, such as ENFit, which was developed and implemented in 2017 to ensure incompatibility with non-enteral devices.

Growth of home enteral nutrition

Prevalence of home enteral nutrition (HEN) is increasing across the globe given significant evidence for utility, feasibility, efficacy, safety and reliability in helping patients meeting their nutrition needs.[22] Advances in portable feeding pumps, lightweight equipment and standardised training have supported the expansion of HEN, allowing patients to receive long-term nutrition support outside of institutional settings. This promotes independence and quality of life.[22]

The shift toward home-based care has further expanded the role of dietitians in patient education, monitoring, and coordination of care across settings.[23]

Conclusion

Enteral tube feeds have come on a long way since the 16th Century, supporting patients who are unable to meet nutritional requirements orally but have a functional and accessible GI tract. Modern practice has enhanced access to the stomach and small intestine and has provided a great variety of formulations that can be tailored to many diseases, disorders or medical conditions. Innovation of enteral nutrition techniques and feeds are likely to continue to occur in the future.

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