The failing gut: causes and consequences

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Implementation of sound nutritional practice has far reaching benefits for the individual, organisation and health on a national level.¹ Deleterious effects of malnutrition manifest rapidly in some patients and, not infrequently, go unrecognised. Consequently there is a delay in institution of nutritional support. The Malnutrition Universal Screening Tool (MUST) has helped to address this deficit. MUST has been successfully implemented nationally providing robust assessment methodology that can be used in many different settings by a wide range of healthcare personnel. MUST is a lever for instituting change within organisations and has helped expand the nutrition support service within many hospital trusts. Recognition of the importance of nutrition is evidenced by the incorporation of a nutritional syllabus into the General Medical Council's publication *Tomorrow's doctors*.² This guides curriculum development for medical schools but undergraduate knowledge needs to be reinforced once students becoming practising clinicians. Physicians have a duty to provide sound nutritional care and they face many challenges in trying to achieve this goal. These range from delivery of the most appropriate nutritional support for patients to the management of patients with a failing gut, whatever the cause. This report provides key points raised and theories behind the experts' recommendations.

Nutrition support

Use of the gastrointestinal (GI) tract wherever it is working and accessible is to be recommended. The enteral route is not invariably safer, however, with some studies showing no difference between enteral and parenteral nutrition (PN) support. Guidelines are widely available for use in clinical practice and facilitate in the interpretation of the published evidence. There are challenges, however, associated with the application of evidence-based medicine in nutrition support, with few trials to evaluate perioperative nutritional support. Of those that are published, often patients who would be the ideal treatment group are excluded from study groups on ethical grounds. It is worth mentioning that as a routine standard of care, if PN is provided it must be monitored correctly and appropriate steps taken to minimise risks of infection. Initiation of feeding is often over enthusiastic resulting in many metabolic complications. One study of PN showed overfeeding in 20% and suboptimal

feeding in a further 30%.³ This does not bode well for those outside the stringent monitoring conditions usually provided within the clinical trial environment.

Concerns surrounding feeding are often based on little, or out-of-date, evidence. The classical request for PN in the post-operative patient to protect an anastomosis is not supported by the literature. Despite this, it is a frequent reason for referral for intravenous nutrition. From meta-analyses of the published data, there is no evidence for anastomotic breakdown as a result of enteral feeding and indeed there are increased complications reported and a longer hospital stay with PN.^{4,5} A surgical anastomosis may be threatened, however, by effects of fluid overload. Ensuring optimal fluid management is essential to prevent gut oedema. Guidelines have now been published to assist in the management of this area.⁶ Focus on albumin is misguided, it is a marker of dilution and liver function and cannot be used to interpret nutritional status.

Enteral feeding is often unsuccessful and for patients who are severely malnourished, cautious PN in combination with enteral nutrition could be advocated. This has the potential to correct micronutrient status and allow metabolic switching and help repair damaged cellular mechanisms. Such beneficial effects of nutritional support are evident at an early stage of nutritional therapy and predate effects on lean muscle mass that cannot yet have been achieved.^{7,8}

Intestinal failure

The GI tract can be considered to function as an orchestra, each 'instrument' relying on those around it for best performance to be achieved. When there is breakdown of the complex physiological relationship, clinical features manifest depending on the area affected. Intestinal failure (IF) is defined as a 'reduction in functioning gut mass below the minimum necessary for adequate digestion and absorption of nutrients'.⁹ IF classically arises from absorptive failure and most with chronic IF have a short gut. In general, nutritional or fluid supplementation is likely, at least initially, if less than 200 cm of small bowel remains.¹⁰ Those with a shorter remaining small bowel length but in whom the colon is present have a higher chance of being nutritionally autonomous.¹¹ Restrictive failure as a result of conditions of dysmotility, such as pseudo obstruction or infiltrative diseases, such as systemic sclerosis, causes considerable morbidity. That major electrolyte and fluid deficiencies arise with IF should not be surprising. The challenge is to anticipate the problems that are likely to arise and either prevent their occurrence or manage them effectively. For example, the degree of negative sodium balance arising with a progressively shorter jejunal length should be anticipated and replaced by mouth whenever

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possible.^{12,13} Intake of hypo-osmolar solutions by mouth result in sodium and water losses that can exceed volumes taken in with resulting dehydration and electrolyte imbalance.¹⁴ The condition and length of remaining jejunum following resection is important for recovery and must be documented by the operating surgeon. This information also facilitates prediction of likely clinical course. It is the additional effect of losing the ileum and colon and thus the ability to compensate for the loss of jejunal function which is critical when managing patients with a jejunostomy. For some, IF can change in severity with functional adaptation of remaining intestine and after oedema has been allowed to settle, by anastomosis of remaining colon to jejunum. The optimum timing of surgery is estimated to be between three and six months after the initial event. Additional to its role in fluid and electrolyte balance, the lower small bowel plays an important role with regard to maintenance of bile salt concentration, vitamin B₁₂ absorption and the promotion of fat absorption, functions which are easily overlooked.

Provision of parenteral nutrition

Patients with prolonged GI tract failure that prevents absorption of adequate nutrition to sustain life should be considered for PN. The gut could be short, perforated, non-functional, obstructed or inaccessible. Nutrition support for malignant causes is less frequently provided in the UK than the USA and Europe. From the European Society of Nutrition guidelines, home PN (HPN) is not recommended in the case of incurable cancer and short life expectancy, but is recommended if malignant obstruction is present, provided there are no other severe organ failures that may complicate PN treatment, that the patient be free of liver and lung metastases, and that they have a Karnofsky score that suggests they are at least able to take care of most personal requirements. To succeed with HPN patients need to undergo a period of training. This requires knowledge of asepsis, anatomy and complications and the physical skills such as strength and dexterity to administer PN. They should be motivated to administer it properly, adapt their lifestyle accordingly and have an appropriate home environment in which to give PN.¹⁵

Small bowel length determines need for long-term nutrition and fluid. It is achievable with just 50 cm of jejunum, parenteral requirement may be for saline alone and if the colon is present the oral and or enteral route may be successful.^{16,17} There is an expectation from referring hospitals that more will go home on HPN from the IF centre. This is not always the case with only 24% of new patient discharges from St Marks IF unit discharged home on HPN. These results can be achieved by maximising oral and/or enteral nutrient intake and use of drug therapy along with promotion of adaptation if the colon is present. Cumulative effect of loperamide, codeine and electrolyte solution can reduce or even allow PN to stop in some cases. Maximising drug benefits can help reduce the frequency and duration of the feed, which has important quality of life implications.

Currently the hospital component of HPN is not funded and there is little quality control nationwide. IF centres are saturated

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and small units sporadic with no national coordination. The future of IF is likely to bring more HPN for different diseases and indications. There are more surgical complications due to treatment of older and sicker patients and also the likelihood of increased bariatric complications. There will be more patients treated with cancer and dysmotility and more patients from paediatrics. Less Crohn's disease is likely to result in IF as medical treatment improves and less vascular cases are predicted as vascular disease reduces. These reductions, however, are not predicted to result in a reduced workload. The home IF network (HIFNET) is to be introduced in England to address many of the issues that surround HPN provision. Stakeholder meetings are currently in progress. The network will provide quality assurance that standards are maintained and all hospitals will be required to meet standards according to the level of service they are providing.

Alternatives to parenteral nutrition

Intestinal transplantation is now a viable therapy with a one-year survival of small bowel transplant alone of 80% and of 70% for a multivisceral transplant. Transplantation has had a slower development in the UK compared with in Europe and the USA. This may be due to a high quality HPN service, but could also be due to doctors not being aware of the use of small bowel transplantation (SBT) for IF patients, referrals being made too late, for example after vascular access has been lost, the preoperative state of these patients being important for outcome. Also, those who cannot be trained in HPN may not be being considered for transplantation. Constraints on the transplant programme itself have been surgical, immunological, timing and malignancy related. The current demand in the USA for SBT would equate to 70 procedures per year in the UK. While it is a rapidly developing therapy, SBT is not yet the treatment of choice for all patients. In the future developments in tissue engineering would be welcomed such that it may be possible to seed intestinal cells onto biodegradable scaffold.

Management of abdominal fistulae

For patients and clinicians alike, management of abdominal fistulae is one of the most challenging aspects in the management of IF. When faced with this situation a multidisciplinary approach to patient care is vitally important. Local services should be organised such that they can draw on regional surgical support, discuss complex cases in the multidisciplinary team setting, involve stoma nurses and aim to minimise surgical intervention. Rehabilitation and consideration of long-term sequelae, including psychological effects, should be standard practice.

The aim in a patient with an enterocutaneous fistula is to prevent a fixed frozen abdomen and to remember that prevention is better than cure given that the natural history of an open abdomen is to deteriorate.

Surgeons and physicians agree that the first priority is to treat sepsis, correct fluid and electrolyte imbalances and reduce fistulous output. PN should be avoided in the septic patient. Of those

who die, 75% are septic and this should be managed non-surgically where possible. Stomal output is driven by sepsis therefore by addressing sepsis, control over GI losses can be obtained. Closure of the abdominal defect is much more likely when sepsis is eradicated. Hypo-osmolar fluids are restricted and an oral electrolyte mix given along with the appropriate sodium concentration. Anti-secretory agents can be used at doses much higher than those quoted in the British National Formulary as, for these individuals, the enterohepatic circulation is not intact. These drugs have benefit not only in reducing fistulous output but through effects on the pH, skin excoriation can be reduced if leakage occurs. A simple test of stomal fluid pH can confirm if proton-pump inhibitors are having a maximal anti-secretory effect and, if not, omeprazole can be titrated to stomal pH. Good active stoma care is crucial as is addressing pain and the psychosocial effects of the condition and of the situation the patient finds themselves in. Successful management of GI fluid losses is more likely when patients comply and to achieve this patient understanding of rationale behind fluid management is essential.

Once sepsis has been addressed, nutrition is the next most important step in management of the patient with a fistula. Standard care involves six weeks of total PN with restricted oral intake and a somatostatin analogue, although there is very little evidence to support this approach. It is worth remembering that if it is going to work, octreotide usually does so early and has moderate effects through the SSTR₃ receptor. Forty-five to fifty per cent of fistulae will close using standard care. Thirty-eight per cent will close with EN.¹⁸ Those which are going to close spontaneously do so within the first three months, 90% in the first month, 10% in the next two months and none thereafter.¹⁹ Closure is more likely to occur if the fistula is long and narrow, the patient was previously fit and well and there is no active disease in the small bowel or distal obstruction.

Defining the anatomy is essential not only to allow an estimation of likely chance of closure but also to plan the strategy and timing of future surgery. Wound care with the careful use of vacuum dressings should be considered part of surgery and be performed in theatre. There is a case to support use of regenerative biological mesh. The aim of surgery is to restore bowel continuity and the abdominal wall.

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