

# Mistakes in short bowel and how to avoid them

Siddhartha M. Oke, Jeremy M. Nightingale and Simon M. Gabe

**S**hort bowel is a condition that occurs after single or multiple intestinal resections. The incidence of short bowel in Europe is 2 per million of the population<sup>1-3</sup> and it carries with it lifelong morbidity and mortality. The initial recognition and management of short bowel in the adult population tends to occur in the postoperative period and in the secondary care setting, where specialist input from clinicians experienced in short bowel is often lacking.

Normal small bowel length is 275–850 cm.<sup>4-7</sup> It is accepted that when the length of small bowel is reduced to less than 200 cm it may be insufficient to enable adequate absorption of fluids and micronutrients. The symptoms of short bowel (often referred to in the literature as short bowel syndrome) are secondary to a reduction in intestinal surface area together with an increased motility of the remaining section of small bowel, with accompanying increased secretion into the lumen. These intestinal secretions vary in their electrolyte content and osmolality depending on the anatomical location, with the highest chloride and potassium loss from gastric secretions and high sodium loss from jejunal secretions.<sup>8</sup>

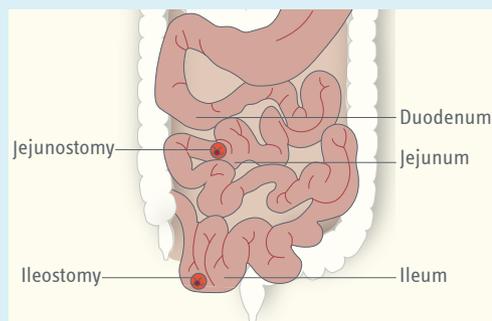
Clinically, short bowel manifests itself as a high stomal output or diarrhoea, dehydration and malnutrition. High stomal output or diarrhoea do not, however, necessarily equate immediately to short bowel; conversely, a small bowel longer than 200 cm may be insufficient if it is diseased.

Here, we discuss some of the pitfalls that are encountered in the recognition and management of short bowel and have suggested an algorithm for assessing and managing patients with a high stomal output. Although some of these pitfalls may appear obvious, they are addressed here because they are commonly encountered in clinical practice (summarised in table 1 at the end of the article).

## Mistake 1 Mislabelling a jejunostomy as an ileostomy

When any small bowel stoma is formed at surgery it is often labelled an ileostomy. Small bowel length, however, is often not measured proximal to the stoma, and we recommend that it should be part of good surgical practice to measure the residual bowel length (unless it is deemed too difficult to perform intraoperatively). Measuring the resected amount of small bowel alone is not enough to predict the risk of short bowel developing, owing to the variability of normal small bowel length in humans.

The duodenum, the most proximal part of the small bowel, is characterised by a lack of mesentery and only a partial covering of peritoneum. The remainder of the small bowel comprises the jejunum and ileum. Classically,



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the jejunum is the most proximal two fifths and the ileum the distal two fifths of the small bowel beyond the duodenum. While this division is not clear-cut, the jejunum is noted to be thicker and more vascular with more pronounced plicae circulares compared with the distal ileum.<sup>9</sup>

By definition, an ileostomy is when the ileum is brought through the abdominal wall in the form of a stoma, but if half to three quarters of the small bowel length is removed intraoperatively, it is likely that the patient actually has a jejunostomy. For patients who are undergoing repeated resections, the residual small bowel length proximal to the stoma should be measured and if it is <200 cm then the stoma is a jejunostomy. This distinction is important to make, because patients with a true ileostomy should not

develop the problems associated with having a short bowel, but mislabelling a jejunostomy as an ileostomy may lead to a delay in the diagnosis of short bowel and in early appropriate management. We suggest, from a practical standpoint, that if a patient has a small bowel length proximal to the stoma of <200 cm then this should be labelled as a jejunostomy.

In the immediate postoperative period, patients who have a high output from a true ileostomy are often correctly reassured that this will settle, and are given low doses of loperamide before discharge from hospital. Conversely, if the patient has a jejunostomy, stomal output will increase significantly as the patient starts to eat and drink. When increased stomal output occurs in a patient with a jejunostomy, a short bowel regimen should be started, with appropriate dietetic review and advice (see mistake 6). When a patient has a jejunostomy mislabelled as an ileostomy they can return to the hospital dehydrated with hypomagnesaemia and occasionally in renal failure.<sup>10</sup>

## Mistake 2 Not recognising a high stomal output

A high stomal output is defined as a stoma that produces more than 1.5 L per day.<sup>11</sup> Although stomal output may be high due to a short bowel with a small intestinal length of <200 cm, it is important to recognise that there are other causes.<sup>10</sup> It is also important to be aware that the stomal output must be considered in proportion to the intake. For example, 1.5 L per day is high stomal output

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for a patient drinking 500 ml per day, but it is not high for a patient who has an oral intake of 3 L per day.

Other causes of a high output state include:

- Intermittent mechanical obstruction due to adhesions or complications such as stomal stenosis
- Intra-abdominal sepsis
- Enteritis (this may be infective [e.g. due to *Clostridium difficile*], inflammatory, ischaemic or autoimmune [e.g. coeliac disease])
- Changes in medications, including the starting of prokinetics or the weaning of opiate medications or steroids
- Bowel wall oedema associated with hypoalbuminaemia

The consequences of short bowel include:

- Sodium and water depletion (dehydration)

- Hypomagnesaemia
- Weight loss
- Deficiencies of trace minerals (e.g. copper, zinc, selenium), fat-soluble vitamins and vitamin B12

It is important to measure serum magnesium and random urine sodium concentrations in all patients who have a jejunostomy. Often just urea and creatinine concentrations are measured and they can be normal in patients with mild dehydration (see mistake 3). The magnesium concentration is often not measured and hypomagnesaemia can present as muscle cramps when levels are very low. Hypomagnesaemia can be detected early, prior to becoming symptomatic, and so prevented (see mistake 4).

Our suggested algorithm for assessing and managing patients with a high stomal output is shown in figure 1.

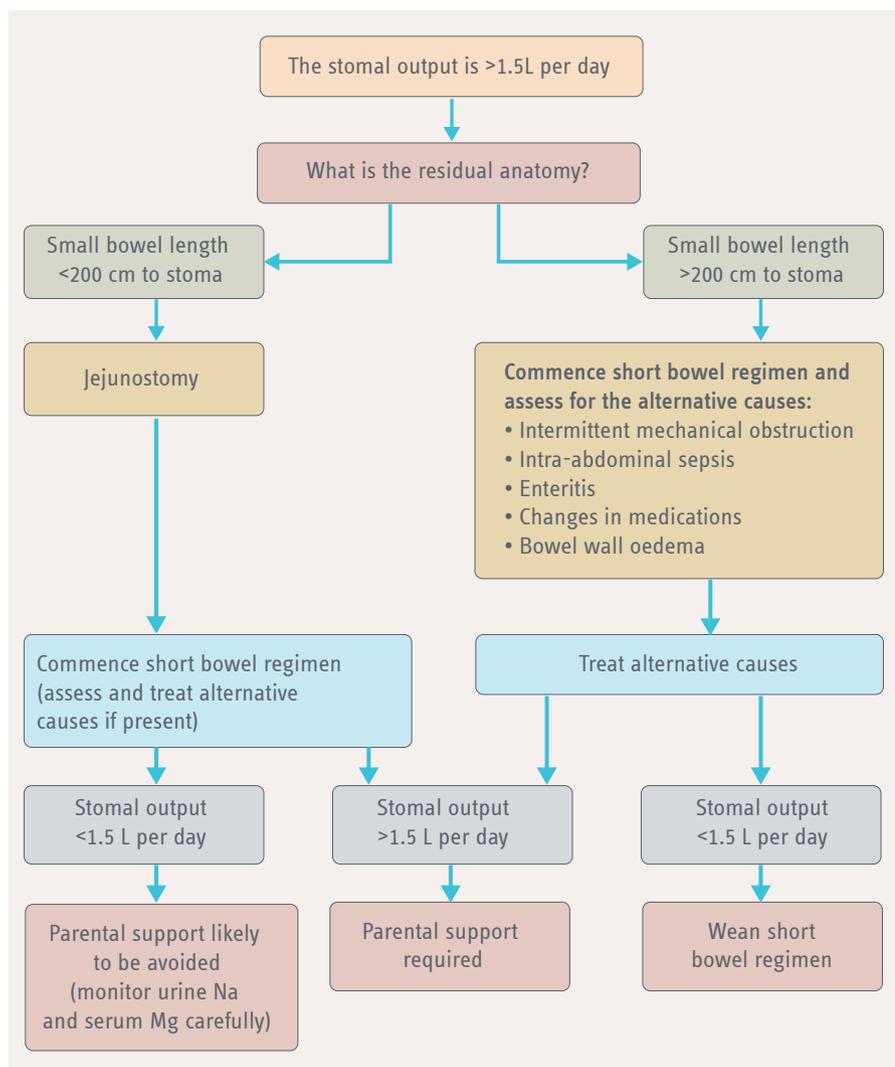


Figure 1 | Suggested algorithm for assessing and managing high stomal output.

### Mistake 3 Believing 'normal' creatinine and urea concentrations exclude dehydration

Dehydration in patients with short bowel occurs if stomal output is greater than 1.5 L per day.<sup>10</sup> It is a common misconception that if a patient has normal blood parameters of renal function, including urea and creatinine levels, this excludes dehydration. These values are often affected by the fact that patients may be sarcopenic and their creatinine and urea levels may be below the normal range. As a result, when the creatinine concentration is above the normal range, this indicates that there is significant renal impairment. We would suggest that a combination of several parameters—symptoms, signs and laboratory test results—be used to assess a patient for dehydration (figure 2).

The symptoms and signs of dehydration are well known but often overlooked; however, a urine sodium level of <20 mmol/L reflects dehydration or sodium depletion, and can identify patients with dehydration earlier than other parameters. The aim of treatment should be to keep the urine sodium concentration >20 mmol/L and urine output to >800 ml/day.<sup>10</sup>

### Mistake 4 Not recognising a low magnesium concentration and other mineral deficiencies

Patients with short bowel are often magnesium deplete.<sup>11</sup> This depletion occurs due to a reduction of its absorption and an increase in its renal excretion due to hyperaldosteronism. Frequently, the only symptom that patients manifest is cramps<sup>12</sup>, but other symptoms, including coarse tremor, poor concentration, seizures and arrhythmias, have been reported.<sup>13</sup> Hypomagnesaemia can sometimes be corrected with oral magnesium salts (up to 24 mmol of magnesium per day<sup>14-16</sup>); however, these salts can be poorly absorbed and occasionally intravenous or subcutaneous replacement is needed.

Another important point to remember is that the proton pump inhibitors (PPIs) used as part of the small bowel regimen are often associated with hypomagnesaemia. A trial of an H<sub>2</sub> antagonist (e.g. ranitidine), as a PPI substitute, should be considered prior to the administration of intravenous or subcutaneous magnesium.

Mineral and vitamin deficiencies are also common in patients with short bowel and should be checked. The check should include the fat-soluble vitamins (i.e. vitamins A, D, E and K) as well as minerals such as selenium and zinc, and vitamin B12.<sup>15-17</sup>

**Symptoms**

- Thirst/feeling 'dry'
- Reduced urine output
- Feeling 'light-headed' on standing

**Signs**

- Reduced skin turgor
- Dry mucus membranes
- Drop of 10 mmHg when postural blood pressure is measured

**Laboratory tests**

- Urine sodium level of <20 mmol/L (assuming no diuretic use and no acute tubular necrosis)
- Urea and creatinine levels above the normal range

Figure 2 | Parameters that can be used to assess for dehydration.

**Mistake 5 Telling patients who have a high output stoma to drink more**

The fluid secretions of the proximal small bowel total more than 4 L,<sup>18</sup> and the majority of this fluid is absorbed in the distal small bowel and colon. In short bowel, the absence of the absorptive distal bowel results in patients being in a secretory state. Hypotonic fluid or solutions with a sodium content of <90 mmol/L lead to a net secretion of sodium and water into the proximal small bowel lumen, which leads to sodium and water depletion.<sup>19</sup> This depletion manifests itself clinically as significant thirst. The belief, therefore, that drinking more will lead to increased water absorption is incorrect. This concept is difficult for patients to accept as it is only natural to want to drink more when thirsty. The correct management of sodium and water depletion and the accompanying thirst is to drink less and to drink an electrolyte mix with a sodium concentration of ≥90 mmol/L.

We suggest the following regimen:

- Patients should restrict the amount of hypotonic and commercial isotonic fluids that they drink to less than 1 L per day. This includes all beverages—tea, coffee, juices, 'isotonic' sports drinks and alcoholic beverages etc.
- Patients should drink 1 L per day of a glucose/saline solution with a sodium content of >90 mmol/L.<sup>20–22</sup> Examples include an electrolyte mix (e.g. St Mark's electrolyte mix [figure 3]) or other commercial preparations. It is important

for the clinician to remember that the palatability of these solutions is a significant issue. To try and overcome this, patients should add concentrated flavourings (e.g. neat fruit-flavoured cordials) when making up the solution. Pre-constituted glucose/saline solution should not be further diluted as this renders the electrolyte mix less effective.

- Patients should be advised to add salt to their meals to the limits of palatability.
- If the stomal output is >5 L/24 h and the above measures have not worked, patients should consider a period of 24–48 h of 'nil-by-mouth'.

**Mistake 6 Not prescribing an adequate short bowel regimen**

As already mentioned, short bowel is characterised by a high stomal output. To reduce the loss of water, electrolytes, minerals and nutrition, a short bowel regimen can be effective. This regimen comprises restricting oral hypotonic fluids to <1 L per day, drinking ≥1 L of a glucose/saline solution per day, taking antimotility agents before food, taking antisecretory medications, involving a dietitian to give tailored dietary advice, and separating food and fluid at mealtimes.

In terms of antimotility agents, loperamide is an opioid receptor agonist<sup>23,24</sup> that is not readily absorbed from the bowel and, thereby, has no addictive or sedative side effects, and in this regard should be considered the first-line treatment.<sup>16</sup> Higher than standard dosages of loperamide are often required as transit through the small bowel in patients with short bowel is often very rapid. These dosages are up to 24 mg four times a day.<sup>15,16,24,25</sup> Loperamide capsules can be

opened if they are found to pass into the effluent unchanged. Of note, there has been a safety warning regarding ECG abnormalities and mortality with very-high-dose loperamide in patients taking it for nonlicensed usages.<sup>26,27</sup> We therefore suggest that it would be prudent to check an ECG and measure the QT interval in all patients who require regular loperamide. Codeine (30–60 mg four times a day) can be used for a similar effect to loperamide,<sup>15,25</sup> but should be considered as a second-line treatment, ideally in combination with loperamide. This preference is due to the systemic side effects of codeine, which include drowsiness and dependence.

For the antisecretory medications, PPIs (e.g. omeprazole) and H<sub>2</sub> antagonists (e.g. ranitidine) reduce gastric secretions and are effective at reducing stomal output with no effect on energy or micronutrient absorption.<sup>28</sup> Ranitidine should be given at a dosage of 300 mg orally twice a day, whereas omeprazole should be given at a dosage of 40 mg orally once or twice a day, or 40 mg intravenously twice a day (if small bowel length is less than 50 cm).<sup>15</sup> The side effects of these classes of drugs include hypomagnesaemia in patients on a PPI and CNS side effects for H<sub>2</sub> antagonists, in particular in elderly patients.<sup>15</sup>

Somatostatin analogues are also antisecretory medications that can reduce intestinal output while maintaining micronutrient and energy absorption.<sup>29</sup> In practice they should only be tried in patients who have a resistant high output, starting at a dose of 50 µg of octreotide twice a day, administered subcutaneously, and titrated up to a dose of 100 µg three times a day. There are several disadvantages to octreotide: the clinical response is unpredictable; it is suggested that it affects postresectional



Figure 3 | St Mark's electrolyte mix.

intestinal adaptation; it predisposes patients to cholelithiasis;<sup>30</sup> it is expensive, and injections are uncomfortable for patients. For these reasons, octreotide is best reserved for patients in whom other attempts to reduce stoma output have been unsuccessful. In patients for whom octreotide is effective, long-acting depot preparations of octreotide can be used. Note that PPIs and somatostatin analogues have only been shown to reduce secretion in patients who are net 'secretors'.<sup>15</sup>

Other management options such as intestinal lengthening, transplantation and growth factors (e.g. Teduglutide®) may be considered in patients who are stable, in a tertiary setting, but the focus is always ensuring that patients are on an optimal short bowel regimen.

### Mistake 7 Thinking that an elemental diet is better absorbed in short bowel patients

Elemental diets are high osmolality feeds that contain very little sodium, thus increasing stomal water and sodium losses, they also have low caloric content, compared with polymeric

diets. Large volumes of an elemental diet also need to be consumed to meet the nutritional requirements of the patient, which will also increase stomal output.

For patients with a short bowel and a jejunostomy, it is recommended that they have a low osmolality diet that has a high lipid and carbohydrate content and is high in complex polysaccharides and proteins, with salt added to meals to the limits of tolerability.<sup>16,31</sup> The aim of an enteral feed is to have an osmolality near to 300 mOsm/kg and sodium 90–120 mmol/L.<sup>15</sup>

### Mistake 8 Not having a multidisciplinary approach when treating a patient with short bowel

Patients with short bowel are well known to have a significantly lower quality of life compared with the general population.<sup>32</sup> This reduction in quality of life occurs as a consequence of both the physical and psychological aspects of the condition. It is important to understand and, where possible, to provide appropriate multidisciplinary support for patients. Stoma management,

dietetic input and psychological input should always be covered as part of patient management, but patients' needs should be addressed on an individual basis.

Patients with short bowel often have a high stomal output, which can lead to problems with bursting and leakage of the stoma bags and associated skin irritation. This is most problematic at night when sleep may be interrupted multiple times for the stoma bag to be emptied. These issues can affect a patient's confidence and ability to socialise and travel. We recommend early input from stoma care nurses and consideration of commercially available overnight flow collectors to help achieve an uninterrupted night's sleep.<sup>33</sup> Care should be taken to ensure that the collectors are at least 2 L in volume, and ancillaries are from the same manufacturer as the flow collectors to avoid incompatibility issues that may lead to leakage.

Early input from a dietitian and regular nutritional assessment is essential for patients with short bowel. The role of the dietitian is twofold—to support and advise the patients on the dietary modifications required as part of the short bowel regimen and to recognise malnutrition. Being able to recognise malnutrition is particularly important in patients who are overweight or obese prior to developing short bowel. In these patients, malnutrition may not be recognised early as their weight and BMI remains within the normal range despite losing a significant quantity of muscle mass.

The trauma of the surgical procedure that led to the short bowel is compounded by a new and significant burden of symptoms for the patient. This burden is accompanied by the realisation that these symptoms may never be reversible. In this situation, it is not a surprise that anxiety, depression and poor quality of life are common. Recognition of this fact with early psychological and psychiatric intervention is recommended.<sup>16,34</sup>

Finally, don't forget that if patients with a high stomal output miss or stop treatment for one day, they risk sodium and water depletion and hospital management may be required.

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Mistake	Appropriate management
Mislabelling a jejunostomy as an ileostomy	<ul style="list-style-type: none"> <li>• Measure small bowel length proximal to the stoma where possible</li> <li>• If between half to three-quarters of small bowel is resected then it is probably a jejunostomy</li> <li>• If the small bowel length proximal to the stoma is &lt;200 cm then the patient has a jejunostomy</li> </ul>
Not recognising high stomal output (>1.5 L/day)	<ul style="list-style-type: none"> <li>• Consider alternative causes for high output if bowel length is &gt;200 cm</li> <li>• Monitor for consequences of short bowel</li> <li>• Monitor urine sodium and serum magnesium levels</li> </ul>
Not recognising a low magnesium level and other mineral deficiencies	<ul style="list-style-type: none"> <li>• Monitor serum magnesium levels and correct them if low</li> <li>• Monitor fat soluble vitamins</li> <li>• Monitor zinc and selenium levels</li> </ul>
Telling patients with high output to drink more	<ul style="list-style-type: none"> <li>• Restrict hypotonic fluids to &lt;1 L per day</li> <li>• Drink 1 L of a glucose/saline solution</li> <li>• Add salt to meals</li> </ul>
Not prescribing an adequate short bowel regimen	<ul style="list-style-type: none"> <li>• Restrict oral hypotonic fluids to &lt;1 L per day</li> <li>• Drink 1 L of a glucose/saline solution per day</li> <li>• Prescription of appropriate preprandial antimotility agents</li> <li>• Prescription of appropriate preprandial antisecretory medications</li> <li>• Early dietitian input</li> <li>• Separate mealtimes from times for oral intake</li> <li>• Avoid octreotide</li> </ul>
Thinking that an elemental diet is better absorbed in short bowel patients	<ul style="list-style-type: none"> <li>• Avoid an elemental diet</li> </ul>
Not having a multidisciplinary approach when treating a patient with short bowel	<ul style="list-style-type: none"> <li>• Early dietitian input</li> <li>• Early stoma nurse input</li> <li>• Early psychological input</li> </ul>

Table 1 | Mistakes in short bowel and appropriate management strategies.

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## Your short bowel briefing

### UEG Week

- “Best clinical practice for patients with chronic intestinal failure” session at 25th UEG Week 2017 [<https://www.ueg.eu/education/session-files/?session=1830&conference=149>].
- “Drug treatment in short bowel syndrome” presentation at UEG Week 2014 [<https://www.ueg.eu/education/document/drug-treatment-in-short-bowel-syndrome/109273/>].
- “Short bowel syndrome: Medical and nutritional management” presentation at UEG Week 2012 [<https://www.ueg.eu/education/document/short-bowel-syndrome-medical-and-nutritional-management/100322/>].
- “Nutrition in IBD and other GI disorders” session at UEG Week 2012 [<https://www.ueg.eu/education/session-files/?session=476&conference=30>].

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