Intestinal stomas

Richard N Saunders
David Hemingway

Abstract
Intestinal stomas are frequently necessary after abdominal surgery. A thorough understanding of this less than glamorous area of surgical practice can prevent complications and make a significant difference to patients. The first part of this review focuses on the basic principles underpinning the management of intestinal stomas (i.e. physiology, formation, common complications). The second part comments briefly on specific types of stoma and their role in current clinical practice.

Keywords colostomy; ileostomy; intestinal surgery; stoma

Intestinal stomas play a key part in elective and emergency surgery. They are often necessary to prevent potentially devastating complications or save life. Counselling of patients and careful construction prevent complications and minimize the effect of intestinal stomas.

Definition and classification of stomas

Intestinal stomas are surgically created openings of the bowel or urinary tract onto the anterior abdominal wall. These can be classified by anatomical site, i.e. ileostomy, ileal conduit or transverse/sigmoid colostomy. They can be further categorized according to stoma type. Those consisting of a single intestinal lumen are termed 'end stomas'; those giving access to an afferent and efferent limb may be 'loop' or 'double-barrelled' stomas. Either type may be temporary or permanent depending on their role.

Stoma physiology

The primary physiological role of the colon is absorption of sodium and water, converting the liquid contents of the terminal ileum to a stool. Thus, distal colostomies are not associated with metabolic disturbances unless there is proximal disease (e.g. pseudomembranous colitis). Ileostomies divert the faecal stream above the colon, allowing less absorption of sodium and water. As a result, there is a greater volume of liquid faeces and a lower total water and sodium in the body. This is accentuated the more proximal the ileostomy. In the early stages, a distal ileostomy typically discharges 1000–2000 ml/day, but can increase to 5000–6000 ml/day in exceptional circumstances, leading to dehydration and electrolyte abnormalities. Occasionally, this is driven by proximal disease (e.g. Crohn's disease), but a cause is not identified in many cases. The output can usually be reduced to 250–750 ml/day with supportive care and antidiarrhoeal agents.

In the longer term, the systemic effects of an ileostomy include an increased incidence of renal tract calculi (60% composed of uric acid). Some studies also suggest a threefold increase in the incidence of gallstones, but this remains controversial.

Principles of stoma formation

Discussion – the possibility of a stoma should be discussed with patients undergoing elective or emergency colorectal surgery. A Stoma Nurse should be involved as early as possible. The location and construction of the stoma is critical in ensuring good quality of life and avoiding management problems.

Assessment – preoperatively, patients are assessed lying down, sitting and standing, and the best sites marked. Ideally, the skin surrounding the proposed stoma should be flat and easily seen, so the umbilicus, skin creases, bony prominences, surgical scars/skin grafts and belt line should be avoided. In emergencies, when stoma sites may not be marked, the stoma should not be placed too low on the abdominal wall because it may be difficult to see and access (particularly in the obese).

Stoma creation – an opening (about the width of two fingertips) is created in the abdominal wall with good alignment between the incisions in the skin, fascia and peritoneum. A well-vascularized, tension-free segment of bowel should be delivered through the rectus abdominis; placement through the rectus muscle reduces the risk of parastomal herniation. After closure of any other wounds, the bowel is opened and secured to the skin with evenly spaced absorbable sutures.

Ileostomy effluent (frequently at alkaline pH and containing activated digestive enzymes) is discharged almost continuously and excoriates and digests unprotected skin if left exposed. Therefore, an ileostomy opening is elevated 2–3 cm from the skin to ensure the effluent passes directly into a stoma bag with minimal contact with skin. The ileum is everted on itself to form a spout (Brooke ileostomy).

A colostomy intermittently discharges formed faeces which, although capable of causing contact dermatitis, is not directly corrosive to skin. Furthermore, solid faeces usually falls directly into the stoma bag. Therefore, colostomies are sutured flush to the skin and allowed to pout slightly to prevent retraction after weight gain.

Stomas are usually fashioned at a laparotomy, but they can also be created via a small transverse skin incision or trephine without undertaking a full exploration of the abdomen. This may be because a laparotomy is not indicated (e.g. perineal sepsis) or because the patient is unfit for definitive surgery. Occasionally, the limited incision is problematic because the bowel may be tethered and require mobilization to allow satisfactory delivery into the wound. Furthermore, it is difficult to be certain that the correct anatomical segment has been delivered. This may be significant, e.g. if proximal rather than terminal ileum is used to

Richard N Saunders *is a Specialist Registrar in Colorectal Surgery at the Leicester Royal Infirmary, Leicester, UK. Conflicts of interest: none declared.*

David Hemingway ***MBChB MD FRCS(gen)*** *is Consultant Colorectal Surgeon at the Leicester Royal Infirmary, Leicester, UK. Conflicts of interest: none declared.*

make a loop ileostomy because a high-output stoma would be created. Therefore, some surgeons advocate laparoscopically-assisted stoma formation. This allows selection of the appropriate segment of bowel and also permits mobilization under direct vision. This can be achieved via a 3–4-port technique depending on the amount of mobilization necessary. The selected mobile loop of bowel is held using an atraumatic grasper and a window made in an avascular portion of the mesentery. A rubber sling is introduced into the abdomen, passed through the window and held with a grasper inserted via a 15 mm port placed at the proposed stoma site. The pneumoperitoneum is released and the bowel delivered through this port site, allowing stoma creation as described above.

End stomas

An end ileostomy is conventionally sited in the right iliac fossa and is usually a permanent stoma. Electively, proctocolectomy for inflammatory bowel disease or familial adenomatous polyposis coli is the most common indication, though ileo-anal pouch surgery has reduced the necessity for this. An end ileostomy is usually temporary in the emergency setting. The small bowel may be oedematous and friable and it can be difficult to create an everted 2–3 cm spout. Incisions along the serosa of the ileostomy may facilitate eversion. Subtotal colectomy with end ileostomy is the first-line procedure in fulminant or perforated ulcerative colitis and in distal obstruction of the large bowel where the caecum is non-viable or perforated. An end ileostomy is also necessary after a segmental resection of the small bowel where it is unsafe to undertake a primary ana-stomosis (e.g. perforated Crohn's disease, thromboembolic bowel ischaemia). The distal bowel is closed and left in the abdomen or exteriorized as a mucus fistula (Figure 1). A relaparotomy is necessary to restore intestinal continuity and is done when the patient has recovered (usually 3–4 months later).

End colostomies (Figure 2) are frequently sigmoid colostomies and are usually sited in the left iliac fossa. Electively, abdominoperineal excision for anorectal tumours is a common indication. In the emergency setting, a Hartmann's procedure is frequently done for ischaemia, perforation or obstruction of the distal colon or rectum. The end colostomy formed is potentially reversible 3–4 months later, but this is a significant undertaking in often elderly patients (mortality 4–5%), and up to 40% of stomas are not reversed. Laparoscopic reversal is advocated by some surgeons but is a complex procedure, currently done by relatively few UK surgeons.

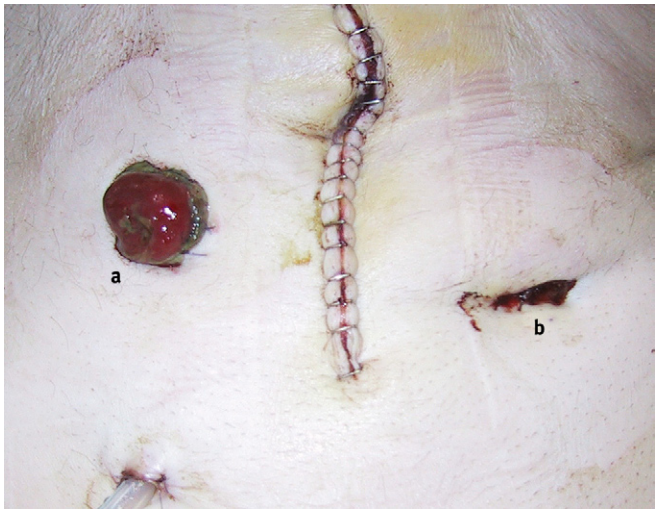

Figure 1 End ileostomy (a) and mucus fistula (b).

Figure 2 End colostomy.

Several attempts have been made to create a continent end colostomy. Implantable devices and colostomy plugs are unpopular as a result of infective complications and ulceration, respectively. The most effective technique may be colonic irrigation via a Foley catheter passed per colostomy, after which patients may have 6–8 hours with minimal colostomy output.

A mucus fistula (Figure 1) is a defunctioned segment of bowel sutured to the skin as a non-functioning stoma. It is created in the emergency setting after subtotal colectomy or segmental resection and end ileostomy (when the closed distal end of bowel may break down if left inside the abdomen). A mucus fistula may be exteriorized at a separate site to an end stoma or sutured to this and exteriorized as a double-barrelled stoma (e.g. von Mikulicz double-barrelled colostomy). Reversal of a double-barrelled stoma can often be achieved without a laparotomy, but they are bulky and difficult to manage.

Diverting loop stoma (loop ileostomy/colostomy): loop stomas (Figure 3) are most common in the terminal ileum, transverse and sigmoid colon. Loop colostomies are fashioned over a plastic rod to limit early retraction. This is removed when the mucocutaneous anastomosis has matured (after 5–7 days). In general, these are temporary stomas used to divert the faecal stream and can be reversed usually via the stoma site 2–3 months after formation. They are common in elective colorectal surgery to protect a distal anastomosis after distal colonic/anterior resection or repair of the anal sphincter. Traditionally, a loop transverse colostomy or an ileostomy is fashioned. There has been considerable debate regarding the merits of each (Figure 3). Reversal of a loop colostomy may damage the marginal artery, potentially compromising the blood supply to the distal colon/anastomosis. Therefore, most specialist surgeons favour loop ileostomy (Table 1).

Figure 3 Loop sigmoid colostomy with a skin bridge.

In the emergency setting, loop stomas are occasionally necessary in the management of obstruction, trauma or severe sepsis. The faecal stream must be diverted as distally as possible if the bowel is unprepared.

Rare stomas

Koch 'continent' ileostomy: most patients cope satisfactorily with a Brooke end ileostomy, but a stoma bag must be worn permanently. In 1969, Koch (Gothenberg, Sweden) advocated an internal ileal reservoir with a nipple valve that could be catheterized by patients 4–6 times/day to drain the reservoir. This produced a 'continent' ileostomy, hence stoma bags were not required. However, the nipple valve everted in 20–40% of patients, causing incontinence. Therefore, it is rarely used.

An appendicostomy is created to administer antegrade colonic enemas in patients with slow-transit constipation. The appendix is mobilized, maintaining its blood supply, and exteriorized via the umbilicus or right iliac fossa. This is intermittently catheterized to irrigate the colon. The main complication is stenosis, which may necessitate revision using the terminal ileum as an alternative conduit.

Caecostomy has been popular for the decompression of distal obstruction of the colon or pseudo-obstruction, and for fixation after a caecal volvulus. It has a high complication rate and is rarely diverting. A loop stoma or resection is preferable.

Ileal conduit: implantation of the ureters into an isolated segment of terminal ileum and exteriorization as a urostomy is common after total cystectomy. This topic is beyond the scope of this review.

Complications of intestinal stomas

Intestinal stomas may develop similar potential complications, although these vary in prevalence according to stoma type. Obesity, poor cardiorespiratory function and emergency surgery increase the risk of complications.

Early complications

Ischaemia is secondary to impairment of the blood supply to a stoma (Figure 4). It is more common in colostomies than ileostomies (particularly if the left colic artery is ligated). Mechanical factors (e.g. excessive tension on the bowel secondary to insufficient mobilization), an inadequate incision in the abdominal wall fascia or the use of vasopressors (e.g. noradrenaline) contribute to ischaemia. A stoma should be pink and moist. Some superficial duskiness is acceptable; further investigation is necessary if it is grey or black and dry. Insertion of a flexible sigmoidoscope allows assessment of the length of the ischaemic segment. The stoma will require urgent revision if the ischaemia is proximal to the fascia.

Retraction (Figure 5) is most common in obese individuals if there has been insufficient mobilization of the bowel or if the

Advantages and disadvantages of loop ileostomy versus transverse colostomy

	Loop ileostomy	Transverse loop colostomy
Size/effluent	small/liquid	bulky/semi-formed stool
High-output stoma	++	+
Retraction	+	++
Prolapse	+	++
Parastomal hernia	+++	+++
Obstruction of the small bowel	+++	+

+ rare; ++++ common

Table 1

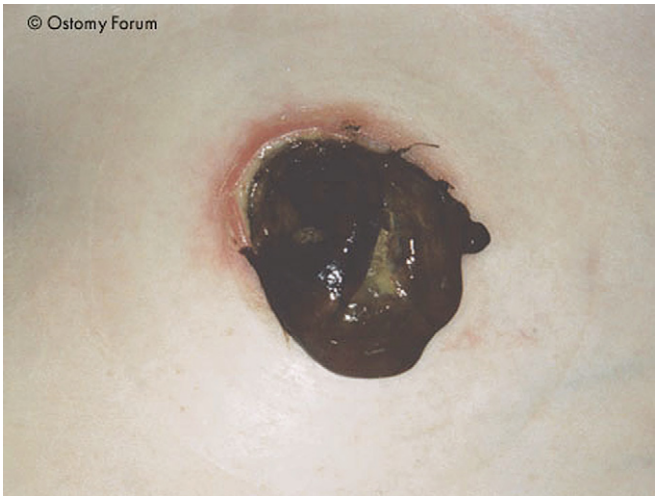

Figure 4 Infarcted end colostomy.

Figure 5 Retracted end colostomy.

stoma becomes ischaemic with separation of the mucocutaneous junction. It occurs in end and loop stomas. Complete retraction into the peritoneal cavity leads to peritonitis, and urgent reoperation is indicated. Partial retraction can result in exposure of the subcutaneous tissue to faecal contents with variable results, ranging from mild peristomal cellulitis to the development of abscesses and fistulae within the abdominal wall. If clinically significant, resiting of the stoma to an alternative area on the abdominal wall and debridement of the superficial tissue around the original stoma site may be necessary. Retraction may also lead to overflow of bowel effluent from proximal to distal limbs in loop stomas (particularly ileostomies). This negates their diversionary role and may have significant implications if, for example, an anastomosis is not secure.

Long-term complications

Stenosis: an ischaemic stoma often becomes stenosed (Figure 6), usually at the level of skin or subcutaneous tissue. This is seen most frequently in end colostomies. Alternatively, a tight aponeurotic opening in the abdominal wall can cause a short stricture at this point. The possibility of recurrence should be considered in patients with Crohn's disease. In most instances, symptoms are minimal but, if severe, stenosis can cause intestinal obstruction. Manual or balloon dilation of the stenosis can provide some improvement, but only in the short term. A stoma revision with resection of the stenosed segment is necessary in most circumstances.

Stomal prolapse: a large fascial opening, an excessive mobile length of redundant intra-abdominal bowel and raised intra-abdominal pressure predispose to stomal prolapse (Figure 7). It is common in loop colostomies (particularly transverse) and is often associated with a parastomal hernia. Intervention is not necessary if the prolapse is mild and non-progressive. Urgent intervention is indicated for painful, irreducible prolapse or a gangrenous prolapse, as well as electively for progressive chronic prolapsing with ulceration or bleeding. Restoring intestinal continuity is ideal if the stoma is temporary. If this is not possible or the stoma is permanent, it should be mobilized, redundant bowel excised and any associated hernia defect repaired. A loop stoma is probably best converted to an end stoma with or without a mucus fistula, while end stomas are refashioned (ideally at an alternative site).

Parastomal herniation (Figure 8) occurs in up to 30% of stomas. Factors predisposing to parastomal hernias are similar to those for prolapse. Most are sliding herniae, usually containing small bowel or omentum. In most cases, patients have minimal symptoms and can be reassured because the risk of strangulation is low. Intervention is necessary for painful irreducible/strangulated herniae and large herniae causing difficulties with fitting of stoma appliance or quality of life. Local repair with sutures, prosthetic mesh and stoma relocation have been advocated. Suture repair has a high recurrence rate (60–70%), with resiting or mesh repair being more successful (5–35% recurrence). There is a risk of sepsis if a mesh is used, but this is a major problem in only 5–15%.

Obstruction of the small bowel is not uncommon (10–15%), particularly in those with loop stomas. This usually occurs in the first year after stoma creation, often settles with conservative

Figure 6 Stenosed end colostomy.

Figure 7 Prolapsed end colostomy.

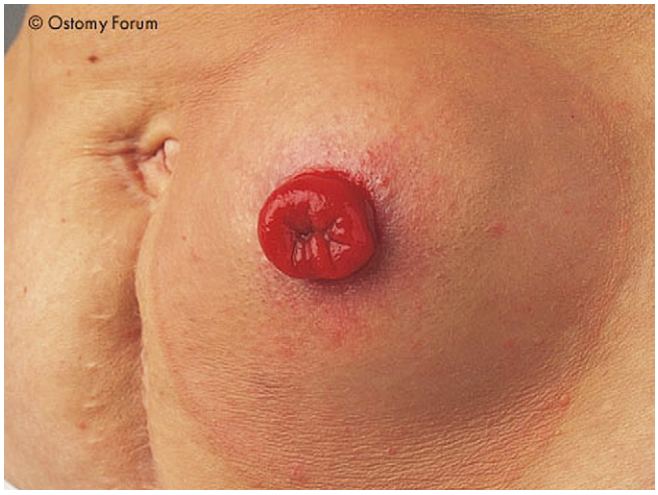

Figure 8 Parastomal hernia.

measures, and is attributed to intra-abdominal adhesions. Occasionally, it does not resolve and at laparotomy the bowel is found to be twisted or 'kinked' around the stoma.

Haemorrhage from a stoma is unusual. It is often trivial (e.g. arising from a fragile granuloma and easily treated by local excision/cautery). If not, the possibility of recurrent or novel gastrointestinal disease should be considered. Rarely, in patients with portal hypertension, parastomal varices develop between the veins of mesenteric and anterior abdominal wall, and may bleed profusely. Drugs to reduce portal pressure (e.g. propanalol), sclerotherapy, transjugular intrahepatic portosystemic shunt and surgical shunts are potential therapeutic options.

Diversion colitis: after creation of a stoma, the faecal stream is diverted away from any distal bowel left *in situ*. This may lead to chronic inflammatory changes known as diversion colitis. Patients are often relatively asymptomatic but may develop bloody discharge *per rectum*. Withdrawal of the colonic mucosa from contact with short-chain fatty acids in the faecal stream may be responsible, and replacement via enemas has been advocated.

Dermatitis: peristomal skin is subject to chemical dermatitis from faecal effluent, contact dermatitis from occlusive appliances, allergic responses to adhesives, as well as fungal and bacterial infections. Careful stoma care coordinated by a qualified Stoma Nurse is crucial to prevent and treat such problems. Common skin problems (e.g. psoriasis), and manifestations of inflammatory bowel disease (e.g. pyoderma gangrenosum, fistulae associated with Crohn's disease) may further compromise peristomal skin and specialist intervention may be required.

Psychological: many patients feel their quality of life is reduced and this is exacerbated if the stoma is poorly sited or constructed. Regular advice from a physician and Stoma Nurse is crucial. ◆