CHAPTER 72
GAASTROINTESTINAL STOMAS IN CHILDREN

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Introduction

A stoma (or ostomy) is the deliberate creation of an opening that communicates between the GIT and the exterior. The purpose could be for feeding, drug administration, bowel decompression, protecting distal anastomosis or other gut lesions, controlling faecal effluent in some cases of incontinence, or a combination of these indications. The basic types of stomas derive their names from the gastointestinal segment in which they are sited. For example, gastrostomy is sited in the stomach, jejunostomy in the jejunum, ileostomy in the ileum, and colostomy in the colon. Stomas may be categorised on the basis of the purpose for their creation; specific examples of commonly used stomas in children are shown in Table 72.1.

The use and management of gastrointestinal stomas in children has evolved since the early success with colostomy formation in the 1800s. Improved surgical techniques, better understanding of the physiologic and psychological consequences of intestinal stomas, and advances in stoma care have contributed to a more rational use by paediatric surgeons and a wider acceptance in the medical and lay communities.[1,2].

Although creating a stoma may be life saving and necessary to maintain a child's health, the affected child and the child's family or caregivers need to understand why the surgeon is considering stoma creation and should have some input. They need to understand what a stoma is, why it is necessary, and how it will function.[3] It is also important that the child and the family understand the difficulties or complications that can be encountered. Discussions with the child's school during the planning phase can also be helpful, as this can ensure the child's smooth reintegration after surgery. The creation of a permanent stoma may need to be discussed openly, as some children and their families may believe that stoma creation is only a temporary measure.[3]

Common Types of Gastrointestinal Stomas

A good stoma is best obtained by careful preoperative planning, meticulous surgical technique, and detailed attention to skin care. Different types of stomas are created for a variety of clinical reasons. Colostomy, the most common enterostoma used in children in sub-Saharan Africa, is discussed in greater detail in this chapter.

Gastrostomy

Gastrostomy is the creation of an opening between the stomach and the skin for the purpose of feeding, drug administration, and proximal decompression of the GIT. Other clinical scenarios that may require a gastrostomy include oesophageal obstruction due to corrosive oesophageal stricture, severe maxillofacial trauma, achalasia of the cardia, and oesophageal carcinoma (in adults). A gastrostomy tube is most commonly placed by using the standard Stamm technique, but percutaneous endoscopic gastrostomy (PEG) and laparoscopic insertion are being introduced in a few centres.

Table 72.1: Categories of stomas with specific examples of common types in children.

Groups/purpose of enterostoma	Specific examples
Stomas created without entering through bowel wall	Nasogastric tube Nasogastrojejunal tube Nasojejunal tube Rectal tube Colonic tube
Minimally invasive stomas through bowel wall	Tunneled catheter Needle catheter T-tube Button, etc.
Isolated jejunal loop brought to abdominal wall	Roux-en-Y loop
Proximal decompression with distal loop for feeding	Nasogastric/nasojejunal tubes Double-barrel jejunostomy Double-barrel ileostomy
Antegrade irrigation and decompression	Caecostomy through appendix stump Catheter placement, T-tube, etc.
Colonic decompression, faecal/flatus diversion or evacuation	End stoma, single opening Double-barrel stomas End stoma with anastomosis below abdominal wall. Loop over a small rod or skin bridge. Open loop with occluding valve, T-tube device, etc. Catheterisable pouch

Jejunostomy/Ileostomy

Stomas of the small bowel are commonly used for feeding, bowel decompression, or diversion of distal disease. Specific indications include

- bypass of gastric outlet obstruction;
- protection of distal anastomosis;
- as a life-saving diversion procedure in clinically compromised children with obstructive distal bowel lesions; and
- to rest and/or decompress distal bowel in cases of perforation and severe enterocolitis with surgical complications.

Colostomy

Colostomy is a stoma of the colon with the aim of diverting faeces and flatus. It is the most common stoma used in children. Indications for creation of a colostomy may be either congenital or acquired.

Congenital indications are more common and include high anorectal anomalies and Hirschsprung's disease. More rare congenital indications are rectovesical/rectovaginal fistula, cloacal exstrophy, and severe spina bifida with incontinence. Colostomy may also be beneficial for faecal diversion prior to resection of large congenital intrapelvic masses.

Acquired indications include bowel perforation, high fissure-in-ano, severe perineal traumas, posttrauma paralysis, and to protect distal anastomoses (such as coloanal anastomosis of pull-through procedures).

Classifications of Stomas

Stomas may be classified by using temporal, anatomical, or constructional criteria.

Temporal Stomas

Temporal classification is based on the anticipated duration of the stoma and is either temporary or permanent. Most stomas in children are temporary and are reversed as soon as possible. Permanent stomas may be necessary for patients with spinal cord injury and resultant paralysis or severe spina bifida.

Anatomical Stomas

Anatomical classification is based on the anatomical portion of the colon in which the stoma is sited. Examples include sigmoid colostomy, when sited in the sigmoid colon; transverse colostomy, when sited in the transverse colon, which can be further subdivided into right-transverse, mid-transverse, and left-transverse colostomy; and caecostomy, when sited in the caecum.

Constructional Stomas

Constructional classification is based on how the stoma is constructed, and is of two major types: loop colostomy and divided colostomy.

Loop colostomy

An opening is made on the antimesenteric border of the colon without completely dividing it. A loop colostomy does not interrupt colon continuity and allows faecal material to pass beyond the stoma. Because some enteric material still enters the distal bowel, it is in essence a non-defunctioning stoma.[1] The stoma may be looped over a rod to prevent retraction. Loop colostomies are easy to create and are quite useful in clinically compromised children when prolonged anaesthesia is undesirable. Loop ostomies are associated with a higher rate of complications; therefore, most paediatric surgeons prefer divided stomas.[4]

Divided colostomy

In the divided stoma, the bowel is completely divided and the bowel continuity interrupted. Because intestinal content does not enter the distal bowel, divided stomas are also called defunctioning stomas. Divided stomas may be further subclassified based on what the surgeon does with the proximal and distal limbs. The most common variations are the double-barrel, Devine, and end stomas.

Stomas in which the distal limb is brought to the surface permit the release of secreted mucus, and provide access for contrast studies for the diagnosis of distal lesions and to assess the patency and integrity of the distal bowel before stoma closure. With end stomas, care must be taken to avoid leaving a Hartmann's pouch in which complete drainage through the anus is prevented by an obstructing lesion within the distal bowel. In such cases, mucous distention of bowel above the obstruction may lead to perforation of the Hartmann's pouch.

Double-barrel stoma

Both the proximal and distal limbs may or may not be plicated together but are brought out side-by-side through the same wound like a double-barrel gun. The proximal limb discharges faeces and flatus, and the distal limb discharges mucus. If the two ends are brought too close together, or are included in a single stoma pouch, enteric contents may pass into the distal bowel, and such a stoma may not be completely defunctioning.

Devine stoma

In a Devine stoma, both proximal and distal limbs are brought out separately, sometimes through different incisions, and are separated by a skin bridge. When complete diversion of stool from the distal bowel is desired, this type of stoma is preferred over the double-barrel variety.

End stoma

Here the proximal limb is brought out to evacuate faeces and flatus, and the distal limb is closed or oversewn and returned to the peritoneal cavity. The blind distal bowel, the Hartmann's pouch, opens distally into the anus.

Complications of Gastrointestinal Stomas

Major complications could occur in up to 75% of children following colostomy or ileostomy, with an overall revision rate of approximately 15% (Table 72.2). Skin complications, such as dermatitis, granuloma, and ulceration, are the most frequent problems with ostomies. Most surgeons in Africa will not have access to dedicated enterostomal therapists, and therefore they need to be knowledgeable in the care of stomas and in the prevention and management of skin problems and other complications.

Stomas made in the small intestine (enterostomas) are associated with more complications than colostomies. In addition, transverse colostomies cause more problems than sigmoid colostomies. With temporary stomas, the occurrence of complications should prompt consideration for closure of the ostomy, rather than revision.

Table 72.2: Stoma complications in children.

Complication	Incidence (%)
Ischaemia/necrosis	<1
Stenosis/stricture	3–6
Retraction	2–4
Prolapse	12–24
Parastomal hernia	1
Skin excoriation	20–30
Bleeding	1–10
Obstruction	1–6

Source: Nwomeh B. Reoperation for Stoma Complications. In: Teich S, Caniano DA, eds. Reoperative Pediatric Surgery. Humana Press, 2008, Pp 279–285.

Skin Excoriation

Skin excoriation is one of the most common complications following colostomy creation. It usually occurs due to (1) continuous wetting of the surrounding skin by effluent, which results in maceration; (2) allergic reaction to effluent; (3) enzymatic digestion of macerated tissues; and (4) bacterial and fungal growth on the macerated exposed tissues. It is graded from 1 to 4, depending on the depth of excoriation. Management includes using a properly fitted colostomy bag, applying zinc oxide paste to the skin (or petroleum jelly when zinc oxide paste is not available), and keeping the skin dry as much as possible. In severe cases, it may be necessary to revise or relocate the stoma.

Wound Infection

Wound infection is most common when the stoma is sited within the main incision. To reduce the incidence of postoperative infection, the stoma should be placed at a separate location. Treatment is usually with antibiotics and good peristomal skin care. Drainage may be necessary if an abscess develops.

Retraction

Retraction occurs when the stoma retracts back to the peritoneal cavity. It is important to identify the cause of stomal retraction. The most common problem is undue tension on the stoma because the proximal bowel and its mesentery had not been adequately mobilised. Anchoring the bowel to the fascia with sutures cannot be relied upon to prevent retraction of the stoma because it does not mitigate the tension in the bowel. A second cause is stomal necrosis. Also, retraction may be due to prolonged serositis with subsequent shortening of bowel when the stoma has not been matured. The retracted stoma causes leakage of intestinal contents, which may interfere with the secure application of the appliance.

Revision of the retracted stoma is usually required. The retracted stoma is often fixed in position and the goal is to mobilise sufficient

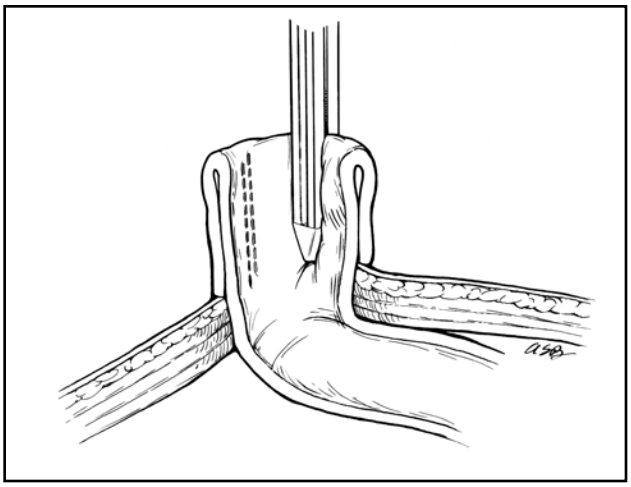
length of bowel and mesentery so that maturation of the stoma can be accomplished without tension. Additional mobilisation of bowel often requires a laparotomy, and limited bowel resection is performed to remove an ischaemic or stenotic segment. If the retracted stoma is sufficiently mobile to allow the bowel to be everted, the bowel walls can be fixed together by inserting several interrupted absorbable sutures with full thickness bites. The new stoma should be matured at the same site, except when retraction has resulted in significant skin excoriation or abdominal wall sepsis; in these cases, a new ostomy site should be established.[4]

If available, several firings of a noncutting linear stapler (e.g., the GIA stapler without the blade) will simplify the procedure (Figure 72.1). Adhesion between the serosal surfaces of the everted stoma will usually have occurred before the sutures are absorbed. The stapling technique involves the following steps:

1. The stoma is retracted to its full extent by placing three pairs of Babcock's forceps (not shown in Figure 72.1).

2. A noncutting linear stapler (without the blade) is placed with the jaws toward the mucocutaneous junction between the Babcock forceps. Care is taken to avoid the mesentery before firing the stapler.

3. Three parallel rows of staples fix the two walls of the ileum together.



Source: Nwomeh BC. Reoperation for stoma complications. In: Teich S, Caniano DA, eds. Reoperative Pediatric Surgery. Humana Press, 2008. Reproduced with permission.

Figure 72.1: The stapling technique for fixation of a retracted stoma. See text for procedure.

Prolapse

Stoma prolapse is a common and often frightening and distressing complication to the child and family. Loop stomas are more likely than end stomas to prolapse, and the distal segment of the loop stoma is most frequently affected. It often begins as a prolapse of the mucosa through the stoma, subsequently extending to the entire circumference of the bowel. Prolapse usually occurs when a skin opening is made to accommodate dilated bowel, which, upon shrinking, leaves a loose stoma. It may also be caused by inadequate fixation of the mesentery to the parietal peritoneum. A prolapsed stoma may be traumatised by desiccation or by an ill-fitting appliance, which may lead to mucosal ulceration and bleeding. In the early stage, spontaneous or manual reduction is usually possible, but in cases of persistent prolapse, intestinal obstruction, or strangulated bowel, surgical intervention is required.

For temporary relief, a nonabsorbable monofilament material (polypropylene or nylon) is used to place a simple purse-string suture, similar to the Thiersch technique for rectal prolapse (Figure 72.2). If this procedure is used in permanent stomas, however, the fixed ring may produce stenosis as the child grows. The procedure for the purse-string suture technique follows:

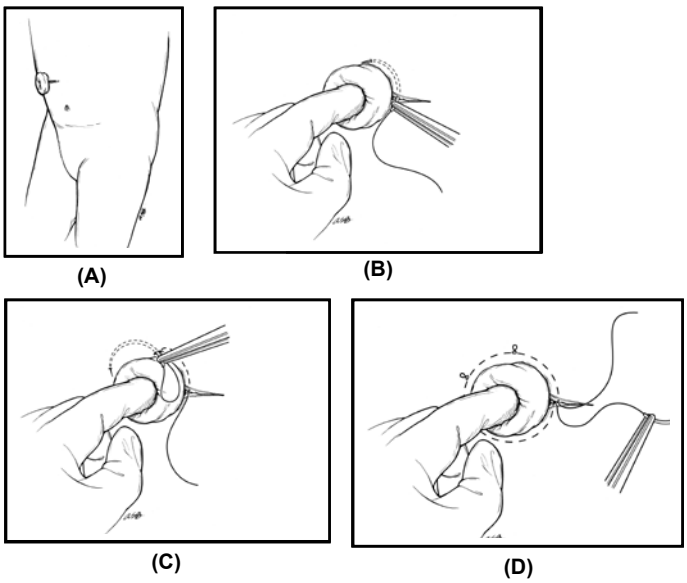
1. A 1-cm skin incision is made at the medial angle of the stoma down to the subcutaneous tissue (Figure 72.2(A)).

2. A finger is inserted into the stoma as a guide, and a 1-0 monofilament nonabsorbable suture with a round cutting needle is passed around the colostomy, staying within the subcutaneous layer (Figure 72.2(B)). The needle is placed as far as it can comfortably go, usually about a quarter of the circumference, then brought out through the skin.

3. The needle is passed again through the same skin exit site toward the lateral corner (Figure 72.2(C)).

4. One or two more passes of the needle are made as it marches circumferentially around the stoma until it is brought out through the medial incision. With a finger remaining in the lumen, the suture is tied, causing puckering of the stoma without completely occluding the lumen (Figure 72.2(D)).

Another technique for temporary control of prolapsed stoma, described by Gauderer,[5] involves the placement of a "U" stitch from the lumen of the reduced bowel through the abdominal wall with a double-armed needle (Figure 72.3). Before tying the suture ends, each needle is passed through a pledget, thus creating an internal and external bolster that attaches the bowel to the body wall and prevents the suture from cutting through. The pledget made from a rubber catheter may be used. This technique has the following steps:



Source: Nwomeh BC. Reoperation for stoma complications. In: Teich S, Caniano DA, eds. Reoperative Pediatric Surgery. Humana Press, 2008. Reproduced with permission.

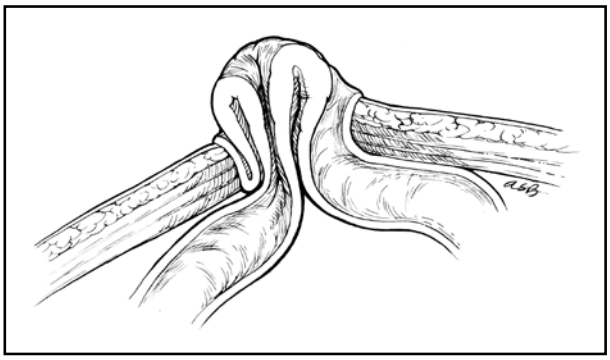
Figure 72.2: Purse-string suture technique for correcting prolapsed stoma. See text for procedure.

1. The prolapse is reduced with a gentle inward pressure (Figure 72.3(A)).

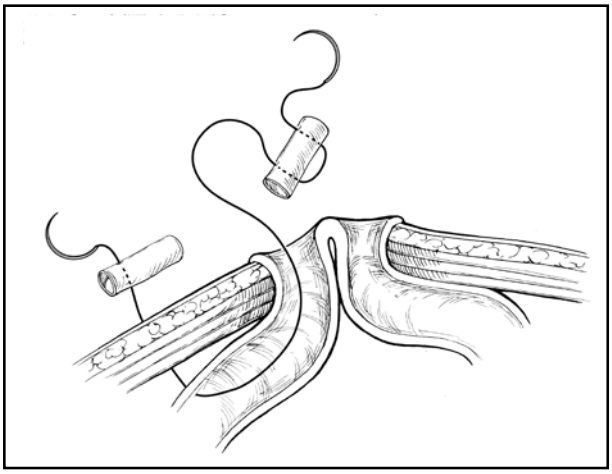
2. A double-armed 3-0 nonabsorbable monofilament suture is used. One needle is placed through a latex bolster (or pledget) and a second needle is passed 2–3 cm into the reduced limb of the stoma, then through the bowel wall and out the abdominal wall an equal distance from the stoma. The needle is then placed through a separate bolster (Figure 72.3(B)).

3. The suture is tied without undue tension, sandwiching the bowel and abdominal wall between the bolsters (Figure 72.3(C)). The inset in the figure shows the bowel adherent to the abdominal wall following removal of the bolsters 2 weeks later.

Definitive relief may require resection of the prolapsed bowel and fixation of the mesentery. This procedure usually requires reopening the main abdominal incision. A prolapsed loop ostomy may be divided with the closed distal end returned into the abdomen, thereby converting the loop to an end ostomy that is less likely to prolapse. When appropriate, closure of the ostomy is the best option.[4]



(A)



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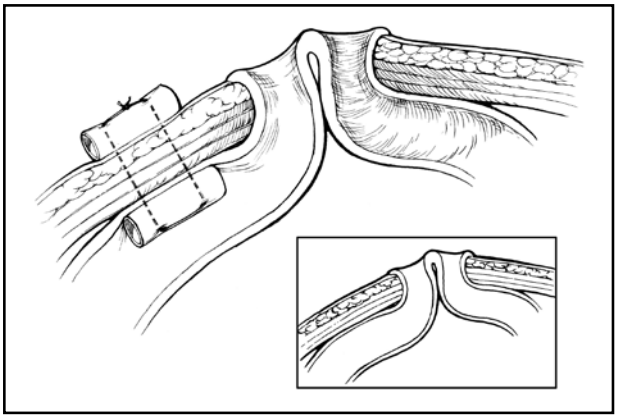


(C)

Source: Nwomeh BC. Reoperation for stoma complications. In: Teich S, Caniano DA, eds. Reoperative Pediatric Surgery. Humana Press, 2008. Reproduced with permission.

Figure 72.3: An alternative technique for temporary control of prolapse of one limb of a looped ostomy. See text for procedure.

Colostomy Dehiscence

When prolapse occurs before the colostomy is matured (a minimum of 2 weeks after formation), it may detach from the skin and allow evisceration of the intraabdominal content. This is a serious complication that requires emergency revision.

Ischaemia or Necrosis

The complication of significant ischaemia or frank necrosis is apparent early in the postoperative period. The cause is devascularisation from excessive stripping of the mesentery, venous congestion due to tension on the bowel, or a tight fascial opening. Some degree of oedema and venous congestion normally occurs with new stomas, especially if previously distended bowel is used, but this usually resolves within 48 hours. If mucosal necrosis is limited to the portion superficial to the fascia, an expectant approach may be employed, but the stoma should be monitored closely for progressive necrosis or subsequent development of stenosis, stricture, or retraction.[4]

Haemorrhage

Bleeding may occur from the mucosa or the stoma edge itself. Haemorrhage may occur postoperatively due to dislodgement of a clot or suture following crying or an increase in blood pressure when adequate haemostasis was not achieved in the operating room. Pressure with a gauze pad is usually sufficient to control the bleeding, but endoscopy or operative intervention may be necessary. Areas of the abdominal wall with major vessels, such as epigastric vessels, should be avoided when choosing the stoma site.

Stoma Stenosis or Stricture

Stenosis or stricture of the stoma may occur at the skin or fascial level and is clinically apparent as reduced stoma output or frank bowel obstruction. This may occur when the skin or fascial opening is tight, leading to ischaemia at the mucocutaneous junction. If the stoma had not been matured, prolonged serositis with subsequent fibrosis may also lead to stenosis. Serial dilatation with anal (or Hegar) dilators may resolve the obstruction, but this procedure carries the risk of bowel perforation. In many cases, a formal surgical revision is needed.

High Stoma Output

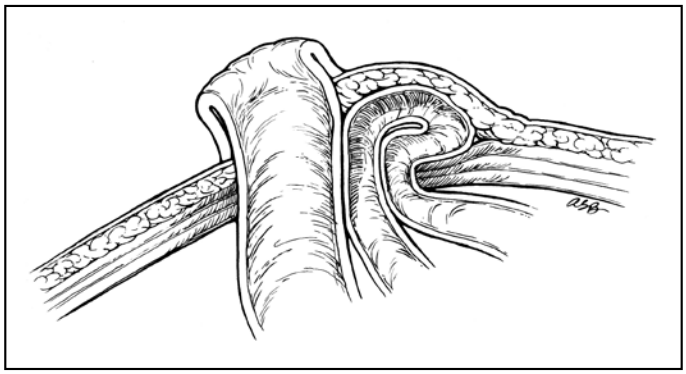
Excessive stoma output occurs in more proximal stomas. Stoma losses can cause profound fluid and electrolyte derangement. Adequate monitoring and replacement of losses are important.

Faecal Impaction

Faecal impaction should prompt the evaluation for stomal stenosis. It may be relieved with enemas administered through the stoma or by manual disimpaction, which should be done under sedation or general anaesthesia.

Parastomal Hernia

A parastomal hernia is a herniation that occurs at the site of the colostomy (Figure 72.4). Parastomal hernia appears to occur less frequently in children than in adult patients, with an incidence of less than 1%. The most likely cause is the creation of a fascial aperture relatively larger than the bowel used for the ostomy. Other factors predisposing to parastomal hernia include wound infection, malnutrition, and obesity. Fortunately, more serious complications, such as intestinal obstruction and strangulation, are rare. The stoma appliance is more difficult to retain, and persistent leakage may occur. In such cases, operative repair should be considered. The simplest procedure is to mobilise the stoma, repair the hernia snugly around the bowel, and then mature the ostomy at the same site. Alternatively, the hernia could be repaired and the stoma relocated to another site. It is often best to relocate or close the stoma because recurrence is frequent after local revision.[4]



Source: Nwomeh BC. Reoperation for stoma complications. In: Teich S, Caniano DA, eds. Reoperative Pediatric Surgery. Humana Press, 2008. Reproduced with permission.

Figure 72.4: Parastomal hernia, with a bulge in the abdominal wall to one side of the stoma.

Other Complications

Peritonitis may be a caused by early stoma retraction or wound infection and may lead to intraperitoneal abscess, particularly in neonates. Antibiotic treatment or operative drainage may be indicated. Bowel obstruction may occur due to improper alignment and twisting at the time of stoma construction. This requires urgent surgical correction to prevent necrosis and resection and possible sepsis.

Exteriorisation of the wrong bowel segment may occur. For example, the small intestine may be mistakenly used instead of the colon, or the distal limb of the colon may be used as the stoma while the proximal limb is closed and returned to the peritoneal cavity as the Hartmann's pouch. When performing a left-sided colostomy, it is recommended to place a rectal tube to aid the identification of the colon. The problem usually manifests as a complete bowel obstruction and requires immediate surgical correction.

Other, less serious complications include granulation and/or polyp formation and ulceration. These are typically managed with local cauterisation therapies and observation. Psychological trauma, which may be a serious problem for families and school-age children, can be mitigated by adequate preoperative counselling and constant support.

Stoma Care

In most African hospitals, specialised nurses, such as enterostomal therapists, are not available. The paediatric surgeon is therefore the primary source of care and support for children with stomas and their families.

Management at Home

Children and their families adapt to stomas in various ways. Adequate planning by families is needed, and older children should be incorporated into care planning for their stomas. The use of an adequate size stoma bag is important to prevent the effluent from making contact with the skin. The nonavailability of stoma bags for children with colostomy is a major problem in this subregion. Some innovation may be needed, given the resources available locally. For example, a cut-off leg portion of a thick cotton pant slid over a soft napkin can be applied over the stoma.[6] This must be cleaned regularly to reduce offensive odour, and zinc oxide paste or petroleum jelly should be applied to protect the peristomal skin.

Management at School

The psychological effect on the school-age child is important. Some children will be open and discuss the stoma with their friends and classmates, but others may choose to conceal it. In some cases, however, the whole class and schoolmates may be told about the child's stoma so as to avoid subjecting the child to manual labour and overzealous play and physical contact in the playground. The child should be taught how to change the stoma bag and clean it regularly, even at school, to reduce offensive odour.

Stoma Closure

In temporary stomas, closure is imperative to restore bowel continuity as the last step in the treatment of the child. Provided there is no distal obstruction, the majority of tube stomas require no surgical closure. Removal of the tube (e.g., gastrostomy tube) with pressure dressing applied over the stoma results in spontaneous closure in most cases. However, if a persistent gastrocutaneous fistula develops, surgical closure is indicated.

Stomas should be closed when the underlying condition has resolved. Although there is no urgency to the timing of stoma closure, the psychological stress and cost of providing stoma care should be considered. A contrast study (distal loopogramme) and/or endoscopic assessment of the distal bowel may be done to ascertain normalcy (and patency) before closure. In cases of Hirschsprung's disease and anorectal anomalies, a stoma is usually in place at the time of definitive pull-through. After the anastomosis has healed, it is helpful to begin anal dilatation for up to a week before stoma closure. As mentioned previously, the occurrence of complications in temporary stomas should prompt consideration for closure of the ostomy rather than revision.

Complications of closure include:

1. wound infection;
2. anastomotic leak;
3. enterocutaneous fistula;
4. stenosis/stricture at the site of anastomosis;
5. intestinal obstruction; and
6. abdominal scars.

Evidence-Based Research

Table 72.3 presents a retrospective review of colostomy complications in children.

Table 72.3: Evidence-based research.

Title	Colostomy complications in children
Authors	Mollittt DL, Malangoni MA, Ballantine TV, Grosfeld JL
Institution	James Whitcomb Riley Hospital for Children, Indianapolis, Indiana, USA
Reference	Arch Surg 1980; 115:455–458
Problem	Intestinal stomas.
Comparison/ control (quality of evidence)	Single institution retrospective review.
Outcome/ effect	Analysis of 146 paediatric patients with colostomies, specifically related to formation, management, and subsequent closure of colostomies. The majority of the colostomies were performed for congenital diseases (Hirschsprung's and imperforate anus). There were more loop colostomies than divided colostomies, but also more complications noted with loop versus divided colostomies. No deaths were related to colostomy closure. Sigmoid colostomies were associated with the lowest rate of complications.
Historical significance/ comments	This study underscores the importance of location and type of colostomy (specifically sigmoid colostomy), attention to technical details, principles of stoma care, and proper instruction for parents in minimising complications from colostomies.

Key Summary Points

1. Gastrointestinal stomas are rare in children.
2. Stomas are typically created in emergency surgery situations, but may be necessary in the treatment of congenital abnormalities.
3. Stomas may be classified as temporary or permanent, as well as by where they occur in the intestinal tract.
4. Divided stomas are more common in paediatric patients and tend to have a lower risk of complications compared to loop ileostomies or colostomies.
5. The majority of complications from gastrointestinal stomas require some surgical intervention; however, initial nonoperative management is often appropriate.
6. Prolapse or retraction of temporary stomas may best be treated by restoring intestinal continuity, if possible, rather than revision of the stoma.

References

1. Gauderer MWL. Stomas of the small and large intestine. In: O'Neill JA, Rowe MI, Grosfeld JI, Fonkalsrud EW, Coran GA, eds. Pediatric Surgery, 5th ed. Mosby Year Book, 1998, Pp 1349–1359.
2. Minkes RK, Mazziotti MV, Langer JC. Stomas of the small and large intestine. eMedicine Specialties→Pediatrics: Surgery→General Surgery. Available at emedicine.medscape.com/article/939455-overview. Accessed 26 June 2009.
3. Sanders C, Bray L. Managing children with stomas. Charter Stoma Care. Hayword Medical Communications, 2007; 29:9–10.
4. Nwomeh B. Reoperation for Stoma Complications. In: Teich S, Caniano DA, eds. Reoperative Pediatric Surgery. Humana Press, 2008, Pp 279–285.
5. Gauderer MW, Izant Jr RJ. A technique for temporary control of colostomy prolapse in children. J Pediatr Surg 1985; 20(6):653–655.
6. Osifo OD, Osaigbovo EO, Obeta EC. Colostomy in children: indications and common problems in Benin City, Nigeria. Pak J Med Sci 2008; 24:199–203.