



Complications of Digestive Stomas: A Retrospective, Descriptive, and Analytical Study of 52 Cases at the Department of Visceral Surgery II, Mohammed V Military Teaching Hospital (HMIMV), Rabat, Morocco

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Abstract:

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Background and Significance: A digestive stoma, whether temporary or permanent, is a surgical procedure commonly performed in gastrointestinal surgery and is essential in the treatment of various conditions such as gastrointestinal cancers, abdominal emergencies, and chronic inflammatory bowel diseases. Although life-saving, this procedure remains associated with a substantial risk of both early and late postoperative complications. The increasing incidence of gastrointestinal cancers and diagnostic delays in certain regions reinforce the need for optimized management and a thorough understanding of the risk factors associated with complications. The primary objective of this study was to assess the complications associated with digestive stomas, whether early or late, while identifying the risk factors that may influence their occurrence. It also aimed to analyze patient characteristics, operative settings, and types of stomas in order to provide useful data for optimizing preoperative and postoperative management. This information could contribute to better prevention of complications and improved clinical outcomes in patients with digestive stomas. The primary objective of this study was to assess the complications associated with digestive stomas, whether early or late, while identifying the risk factors that may influence their occurrence. It also aimed to analyze patient characteristics, operative settings, and types of stomas in order to provide useful data for optimizing preoperative and postoperative management. This information could contribute to better prevention of complications and improved clinical outcomes in patients with digestive stomas. **Methods:** This retrospective, descriptive, and analytical study was conducted in our department and included 52 patients who underwent creation of a digestive stoma. Data were collected from medical records, telephone calls, and electronic archives, and were analyzed with consideration of patient-related characteristics, surgical factors, and the complications that occurred. Data collection was performed using Excel and analysis using SPSS, and the results were compared with the available scientific literature to better contextualize the conclusions. **Results:** The overall rate of stoma-specific complications was 39.2%, of which 60% were early complications (bowel obstruction, retraction, and stomal necrosis) and 40% were late complications (parastomal hernia and prolapse). The study identified significant comorbidities, including arterial hypertension ($p = 0.004$), diabetes ($p = 0.006$), a high ASA score ($p = 0.02$), and impaired nutritional status ($p = 0.001$), as major risk factors. By contrast, other parameters, such as sex and operative setting (emergency or elective), showed no statistically significant association. **Conclusion:** The findings highlight the crucial importance of a careful preoperative assessment that incorporates patients' comorbidities and nutritional status in order to prevent complications associated with digestive stomas. However, additional studies with larger cohorts are required to validate these findings and improve management strategies, particularly regarding stoma reversal and the management of late complications. **Keywords:** Digestive Stoma, Stoma Complications, Risk Factors, Nutritional Status, Gastrointestinal Surgery.

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INTRODUCTION

The term “stoma,” derived from the ancient Greek stoma, meaning “opening” or

“mouth,” refers to a surgical procedure commonly used in gastrointestinal surgery. The technique consists of creating a connection

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between a segment of the gastrointestinal tract and the skin surface, thereby allowing temporary or permanent diversion of the intestinal stream. Indicated in various clinical settings, it is an essential procedure in the management of neoplastic gastrointestinal diseases, abdominal emergencies such as perforation or peritonitis, and chronic inflammatory bowel diseases such as Crohn's disease and ulcerative colitis [1, 2].

Digestive stomas are mainly indicated when portions of the gastrointestinal tract must be removed or bypassed because of severe disease. The principal indications include colorectal and rectal cancer, which may require partial or total resection of the colon or rectum. Chronic inflammatory bowel diseases, such as Crohn's disease or ulcerative colitis, may also require a stoma, particularly after extensive intestinal resection. Other indications include severe bowel obstruction, perforation, or abdominal trauma that compromises normal intestinal function. Depending on the type of disease and the extent of resection, stomas may be temporary, allowing the intestine to heal, or permanent when the resection is irreversible [3].

Several types of digestive stomas exist, each with specific indications according to the affected organ and the condition being treated. Colostomy is one of the most common types. It consists of creating an opening in the colon, allowing stool to be evacuated through the abdominal wall. It is generally performed after partial or total colonic resection, as in colon cancer or severe inflammatory diseases such as ulcerative colitis. A colostomy may be temporary or permanent, depending on the extent of surgery. The discharged stool may be more or less solid depending on the location of the colostomy. Appropriate stoma management is essential, and patients must learn how to manage the fecal collection pouch, which may present both psychological and physical challenges.

Ileostomy is another common form of stoma. It consists of creating an opening in the ileum, the final portion of the small intestine. This type of stoma is often required after resection of the colon or rectum, particularly in patients with conditions such as Crohn's disease

or ulcerative colitis. Ileostomy output is generally more liquid than colostomy output, requiring close follow-up and adjustments to the type of collection pouch used. Ileostomy is often used when extensive colonic resection has been performed or when the small intestine remains functional, allowing patients to continue digesting part of their food [4].

Jejunostomy, which is less common, consists of creating an opening in the jejunum, another portion of the small intestine. It is often used to provide direct feeding in patients who can no longer absorb nutrients through their normal digestive tract. This type of stoma is generally reserved for patients with severe malnutrition or major intestinal malabsorption disorders. Although less frequent than colostomy or ileostomy, jejunostomy is essential when other parts of the intestine no longer function properly [5].

Digestive stomas may be temporary or permanent, and each type requires specific management. Patients must undergo regular follow-up to prevent complications such as stomal obstruction, skin irritation, or infection. Stoma management also involves patient education and rehabilitation to facilitate adaptation to the new situation, particularly by learning how to manage collection pouches and maintain proper hygiene. With rigorous medical follow-up and psychological support, patients with digestive stomas can continue to lead relatively normal lives despite the challenges associated with this procedure.

However, although these procedures may be life-saving, they are not without risk. Early postoperative complications include bowel obstruction and stomal retraction, whereas late complications, such as prolapse, parastomal hernia, or metabolic disorders, remain major concerns for clinicians and patients [6].

The primary objective of this study was to analyze complications related to digestive stomas, whether occurring early or late, while identifying the risk factors that may influence their development. It also aimed to examine patient characteristics, operative conditions, and stoma types in order to provide information that

could optimize preoperative and postoperative management. These data could contribute to further prevention of complications and improved clinical outcomes in patients with a digestive stoma.

Materials and Methods

This retrospective, descriptive, and analytical study was conducted in our department. Its objective was to assess complications of digestive stomas and identify their risk factors. The study included 51 patients who underwent creation of a digestive stoma during the study period. The inclusion criterion was the availability of complete clinical data. Incomplete or unusable records were excluded from the analysis. Data were extracted from medical records and grouped into several categories: demographic data (age, sex, medical and surgical history), operative characteristics (type of stoma, indications, operative setting, surgical approach, and reversibility), early complications (<1 month), such as necrosis or retraction, and late complications (>1 month), such as parastomal hernia or stenosis. Postoperative follow-up procedures, including resumption of oral intake and the consultation schedule, were also documented.

Statistical analysis was performed using Excel and SPSS software. Continuous variables were described using means and standard deviations, whereas categorical variables were expressed as frequencies and percentages. Risk factors were analyzed using appropriate statistical tests, with the level of significance set at $p < 0.05$. From an ethical standpoint, all patient data were anonymized to ensure confidentiality, and the study was conducted in accordance with the applicable ethical principles. Finally, a literature search was conducted in the PubMed, Google Scholar, and ScienceDirect databases to compare our findings with data from the existing literature.

RESULTS

A retrospective study was conducted in our department over a three-year period. The aim was to assess complications related to digestive stomas and identify the main risk factors involved in their occurrence. The findings provide a better understanding of the

various clinical and surgical aspects associated with these complications.

A total of 51 patients were included in the study, comprising 20 women (39.2%) and 31 men (60.8%), with a mean age of 62.00 years and a standard deviation of 14.472. Among these patients, 27 (52.9%) had hypertension, 12 (23.5%) had diabetes, and 19 (37.3%) were smokers. Some had a history of extra-gastrointestinal tumors (1 patient, 2%), previous surgical conditions (11 patients, 21.6%), previous laparotomies (4 patients, 7.8%), or inflammatory bowel disease (IBD) (7 patients, 13.7%).

The main surgical indications were rectal tumors (25 cases, 49%) and colonic tumors (14 cases, 27.5%). Regarding the type of stoma, 28 patients (54.9%) underwent ileostomy and 15 patients (29.4%) underwent colostomy.

The postoperative complications observed were as follows: 5 cases of bowel obstruction (9.8%), 3 cases of retraction (5.9%), 3 cases of fistula (5.9%), 3 cases of parastomal hernia (5.9%), 2 cases of prolapse (3.9%), 1 case of necrosis (2%), and 1 case of hemorrhage (2%).

Regarding the ASA (American Society of Anesthesiologists) score, 10 patients (19.6%) were classified as ASA 1, 30 patients (58.8%) as ASA 2, 9 patients (17.6%) as ASA 3, and 2 patients (3.9%) as ASA 4. With regard to the Glasgow score (GN), 35 patients (68.6%) were classified as GN 2 and 16 patients (31.4%) as GN 4.

From a surgical standpoint, 37 patients (72.5%) underwent midline laparotomy, whereas 14 patients (27.5%) underwent elective laparotomy. Surgery was performed mainly in an elective setting in 35 patients (68.6%), whereas 16 procedures (31.4%) were performed as emergencies. Regarding the purpose of the stomas, 23 patients (45.1%) underwent creation of a decompressive stoma and 28 patients (54.9%) underwent creation of a protective stoma.

In our study, the distribution of stoma types was varied. Ileostomy accounted for the majority of cases at 54.9%, followed by colostomy at 29.4%. Double stomas represented 7.9% of procedures. Regarding stoma configuration, a large proportion, 84.3%, were loop stomas, whereas 15.7% were end stomas. Finally, regarding stoma

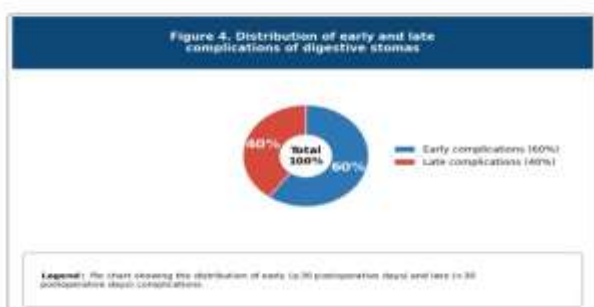
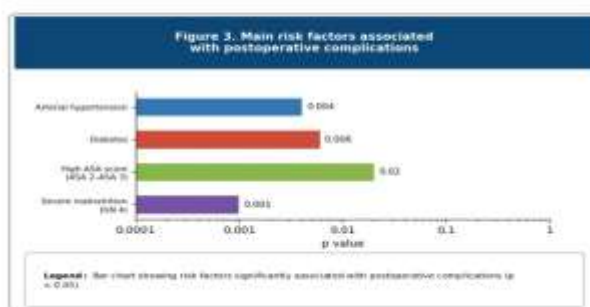
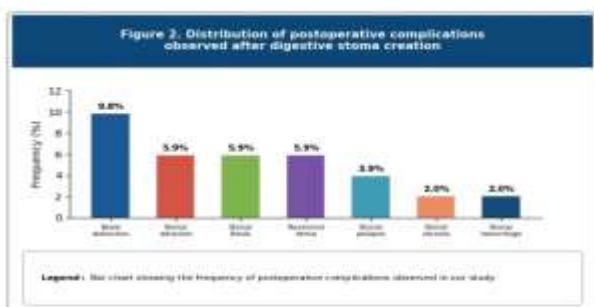
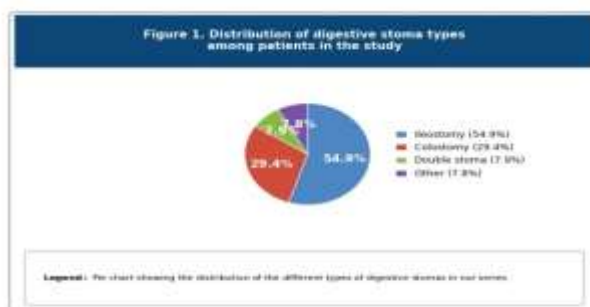
duration, 88.2% were temporary and 11.8% were permanent.

Finally, the study showed that 20 stomas (39.2%) developed postoperative complications. These findings provide valuable information for a better understanding of the risk factors associated with complications of digestive stomas and emphasize the importance of appropriate management of these patients to reduce such risks.

The overall analysis of complications identified the factors most frequently involved and highlighted avenues for improving patient management. The data underscore the importance of preoperative assessment and surgical planning in reducing the risk of complications and optimizing outcomes.

Risk factors were assessed by distinguishing patient-related parameters from those related to surgical procedures. The data were analyzed using appropriate statistical tests, with the level of significance set at $p < 0.05$. To ensure confidentiality, all patient information was anonymized in accordance with the applicable ethical principles. The analysis showed a significant association between the occurrence of complications and several comorbidities, including arterial hypertension, diabetes, a high ASA (American Society of Anesthesiologists) score, and impaired nutritional status. Among the 20

patients who developed postoperative complications, an unequal sex distribution was observed, with men accounting for 60% of cases (12 patients) and women for 40% (8 patients). However, sex had no statistically significant effect on complications ($p = 1.000$). With regard to arterial hypertension, a significant association was identified ($p = 0.004$), with 80% of complicated cases (16 patients) affected by this condition. The ASA score also showed a significant correlation ($p = 0.02$), with complications occurring predominantly in patients classified as ASA 2 (50%) and ASA 3 (40%). By contrast, the WHO (World Health Organization) score showed no significant association with the occurrence of complications ($p = 0.831$), although WHO 1 patients were the most frequently affected (70%). Diabetes emerged as an important risk factor, with $p = 0.006$ and a prevalence of 45% among complicated cases (9 patients). Analysis of nutritional status revealed a highly significant association ($p = 0.001$), with complications occurring predominantly in patients with a GN (nutritional grade) score of 4 (65%), compared with those with a GN score of 2 (35%). Conversely, the other factors studied showed no statistically significant relationship with the occurrence of complications. These findings emphasize the importance of a thorough preoperative assessment, including comorbidities and nutritional status, in the management of patients with stomas.



DISCUSSION

Digestive stomas, used to divert intestinal contents temporarily or permanently to the outside of the body, are commonly performed in the treatment of various severe gastrointestinal disorders. They are mainly indicated for colorectal cancer, Crohn's disease, ulcerative colitis, complicated diverticulitis, and cases of intestinal trauma or perforation. These procedures may also be required when temporary diversion of intestinal contents is needed, for example to protect an anastomosis or treat a fistula.

The digestive process varies according to the anatomical site of the stoma, directly influencing the characteristics of the stool and the potential complications. Indeed, the location of the stoma plays an essential role in intestinal transit time and the properties of fecal output. Notable differences are observed particularly between ileostomies and colostomies.

In patients with an ileostomy, the bowel is brought to the skin at the level of the ileum, the terminal portion of the small intestine. This configuration produces fecal effluent rich in digestive enzymes, which may cause peristomal skin irritation. In the absence of the colon, the normal process of dehydration and concentration of stool is interrupted, resulting in frequent liquid output that is often increased after meals. Furthermore, digestion in the ileum promotes fermentation and putrefaction, although the gases produced are generally only mildly odorous and the stool is often odorless.

In patients with a right transverse colostomy, the stoma is located closer to the small intestine. This results in stool with a semi-liquid to pasty consistency. Colonic reabsorption is only partial, leaving some digestive enzymes in the stool, which may also cause skin irritation. In addition, stool evacuation may be irregular and often varies after meals.

A left transverse colostomy allows greater fecal concentration than a right transverse colostomy. The stool becomes thicker and pasty, and bowel regularity improves. This intermediate location provides a better balance

between water reabsorption and frequency of bowel movements.

Finally, in patients with a left colostomy, the stool is generally well formed and of normal consistency because most water and electrolyte absorption has already occurred in the proximal colon. The output is non-corrosive and relatively infrequent, averaging two to three evacuations per day. However, despite this regularity, voluntary control of defecation remains impossible, requiring appropriate day-to-day management [7].

An ileostomy is a surgical procedure that creates an opening in the abdomen through which the end of the ileum, the final portion of the small intestine, is exteriorized and sutured to the skin. Stool is evacuated outside the body through this opening. During the postoperative period, the output remains liquid because the colon, which is normally responsible for water reabsorption, has been bypassed or removed. This feature, combined with the presence of digestive enzymes in the effluent, may cause peristomal skin irritation. Careful and regular local care is therefore required, together with an appropriate diet providing adequate water and electrolytes to prevent dehydration.

After three to four weeks, the small intestine begins to adapt and can partially compensate for the absence of the colon, reducing the volume of output and improving its consistency. An ileostomy may be temporary or permanent. When temporary, it is often used to divert the fecal stream, particularly to protect colorectal or ileoanal anastomoses during the postoperative period. It is also indicated in cases of colonic stenosis, Crohn's disease, ulcerative colitis, acute toxic megacolon, necrotizing enterocolitis, ileocecal or right-colonic lesions, or to prevent certain colonic complications during acute necrotizing pancreatitis [8].

Permanent ileostomy is less common and is reserved for situations in which gastrointestinal continuity cannot be restored, particularly after proctocolectomy. The main indications include severe inflammatory colitis, such as Crohn's disease or ulcerative colitis, familial adenomatous polyposis, certain severe

injuries of the rectum or colon, and multiple colonic cancers.

Colostomy is another form of digestive stoma and consists of bringing a portion of the colon to the abdominal skin to allow fecal evacuation through an artificial opening. It may be temporary or permanent, depending on the disease being treated and the possibility of restoring intestinal continuity. Depending on the segment of colon mobilized, the colostomy may be right-sided (ascending colon), transverse, or left-sided (descending or sigmoid colon). It may be a loop colostomy when the bowel is brought to the skin without complete transection, or an end colostomy when the colon is completely divided.

Right-sided or transverse colostomies are generally indicated for unresectable right-sided colon cancer or obstruction, as well as for perforation or trauma of the cecum or cecal volvulus. Left-sided colostomies, which are more common, may be used to treat various conditions, including colorectal cancer, inflammatory diseases of the colon and rectum such as diverticulitis, ulcerative colitis, or Crohn's disease, and other disorders such as rectal or colonic fistulas, pelvic trauma, ischemic or necrotizing colitis, radiation proctitis, or certain congenital malformations, including imperforate anus, megacolon, and sigmoid volvulus. Permanent colostomy is considered a last resort, particularly after rectal resection for advanced cancer, severe trauma, or severe and uncontrollable rectal bleeding.

A double stoma consists of creating two separate digestive openings in the abdominal wall. It is performed when extensive resection of the gastrointestinal tract prevents immediate restoration of continuity. The two stomas may represent the two ends of the same intestinal segment or two different segments, for example the small bowel and the colon. Depending on the distance between the two ends, they may be brought out separately or joined at the same site, a configuration often referred to as a “double-barrel stoma.” This arrangement facilitates a planned reoperation to restore gastrointestinal continuity when the patient's local and general conditions permit.

Loop ileostomies are generally constructed using the so-called “end-loop” technique, with a supporting rod placed subcutaneously. This method completely excludes the downstream intestinal segment and everts the wall of the proximal small bowel to facilitate appliance fitting. It is particularly indicated to protect an ileorectal or ileoanal anastomosis, often created after total colectomy. Its success depends on a relatively unaltered ileal wall.

The choice of small-bowel loop depends mainly on two criteria: ease of bringing the bowel to the skin and a short distance, approximately 30 cm, between the ileostomy and the downstream intestinal anastomosis. The afferent limb is positioned at the lower aspect of the incision to allow the small bowel to lie properly. A plastic supporting rod, generally shortened to 5 or 6 cm, is used to maintain the loop in position.

When the condition of the small bowel prevents adequate eversion, a simple loop ileostomy may be constructed. This technique is reserved for difficult situations such as severe peritonitis or massive obesity. If the mesentery is thickened, extensive mobilization is required to avoid excessive tension that could compromise blood supply. In cases of major infection, the supporting rod may be placed on the skin surface rather than subcutaneously to avoid infectious inoculation. Appliance fitting then becomes more difficult but may be facilitated by the use of rubber drains.

An alternative is to use a linear stapler placed 2 to 3 cm distal to the ileostomy site to exclude the downstream small bowel without eversion. This method effectively blocks distal transit but makes access to the downstream segment impossible.

Ileostomy closure begins with excision of the skin collar, followed by dissection of the small-bowel loop into the peritoneal cavity. The supporting rod is removed, a short resection is performed, and an end-to-end anastomosis is fashioned using two continuous absorbable sutures. The abdominal wall is closed in layers, and the skin is generally closed immediately.

A Brooke end ileostomy is mainly indicated in Crohn's disease requiring total colectomy with proctectomy. The small bowel is brought out through the rectus abdominis muscle, usually 3 to 4 cm below the umbilicus. The exit tract follows a bayonet-shaped course to prevent prolapse. Once the segment has been exteriorized, projecting 4 to 5 cm above the skin, it is everted using a blunt dissector and secured.

A variant uses a circular anastomotic stapler to attach the ileum to the skin, thereby reducing operating time. After stapling, a cuff is formed, and the muscular layer is fixed to the peritoneum to prevent retraction of the cuff.

Temporary end ileostomies are created after small-bowel resections performed in severe pathological settings. It is preferable to place both ends of the small bowel in the same abdominal region to simplify subsequent restoration of gastrointestinal continuity. This configuration may be created through two separate openings or a single double-barrel opening.

When two separate openings are used, the ends are placed 5 to 6 cm apart, and the mesentery is fixed to prevent internal herniation. This arrangement provides greater safety but makes restoration of continuity more difficult. When a single opening is used, the afferent limb is everted and the efferent limb lies flush with the skin, facilitating appliance fitting but preventing access to the downstream small bowel if it remains closed.

For colostomy, opening the colon and fixing it to the skin require careful submucosal hemostasis. The colon is sutured to the skin with eight to ten extramucosal stitches passing through the intestinal wall, ensuring precise mucocutaneous apposition. A transparent self-adhesive pouch is applied immediately.

Loop colostomies, most often temporary, are created using mobile segments such as the transverse or sigmoid colon. Their location depends on the underlying disease. The skin incision must be carefully selected, away from bony prominences and in a flat area to facilitate appliance fitting.

If the colon is distended, decompressive puncture may be required before the bowel is brought to the skin with an atraumatic forceps. A supporting rod or drain is then passed through the mesocolon to maintain exteriorization.

Fixation of the colon is essential to prevent complications such as retraction or evisceration. The colon is fixed to the peritoneum with several seromuscular sutures. A colonic spur is created by apposing the two limbs of the loop. The colon is opened by a transverse colotomy, sometimes extended with a T-shaped incision, with meticulous submucosal hemostasis. A pouch is then positioned beneath the supporting rod to fit the stoma appliance.

Closure of a colostomy should not be considered before 2 to 3 months, allowing time for the stoma to mature. The procedure begins with a circular excision around the stoma, followed by complete mobilization of the colon. Once the edges have been properly prepared, an extramucosal colonic suture is performed. The colon is returned to the abdomen, the abdominal wall is closed in layers, and drainage is sometimes required.

End colostomies, created after intestinal transection, may be isolated procedures or may complete a resection. Certain techniques, such as bridge or double-barrel colostomies, are less commonly used today. The Bouilly-Volkman procedure following sigmoid resection is a classic example: after resection and peritonealization of the mesocolon, the two colonic ends are placed side by side, sutured posteriorly, and then matured to the skin.

A left iliac end colostomy is generally created after a midline laparotomy. The stoma site is selected carefully and is preferably marked before surgery in the case of a permanent colostomy. It must be accessible to the patient and located away from skin folds and bony prominences.

The colon may be brought out through a direct route for temporary colostomies or through an extraperitoneal route for permanent colostomies. In the latter case, the peritoneum is dissected to create a tunnel, and the colon is

brought to the skin without initially opening the peritoneum.

The colon is opened only after closure of the midline incision. Hemostasis is achieved by coagulation, and the bowel is fixed to the skin with eight to ten sutures to ensure a watertight mucocutaneous junction. The stoma is then immediately fitted with a self-adhesive pouch.

Despite their effectiveness, digestive stomas carry a risk of complications that may have a considerable impact on patients' quality of life. These complications vary according to the type of stoma and the patient's general condition and include mechanical problems such as bowel obstruction, parastomal hernia, retraction, and stomal prolapse, as well as infectious complications such as peristomal infection and stomal fistula.

Although stoma creation is often regarded as a simple procedure, it is frequently complicated, affecting approximately one third of patients. These complications are classified into two categories: early complications, which may be life-threatening, and late complications, which generally cause difficulties with appliance fitting.

Intraoperative complications may relate to abdominal surgery in general or may be specific to stoma construction. Injuries to abdominal viscera, including the small bowel, colon, bladder, stomach, liver, and spleen, are the most common. Such injuries may go unrecognized, particularly during laparoscopy, thereby increasing postoperative mortality. Specific complications include inability to perform resection, particularly in duodenal lesions, and difficulty exteriorizing the intestinal loop in patients with a short mesentery, obesity, or post-inflammatory adhesions. In certain complex situations, three-lumen intubation may be necessary to control fistulization and allow healing.

Early postoperative complications occurring within 30 days are common and potentially severe. Peristomal suppuration is the most frequent and should be treated with antibiotics, drainage when necessary, and

improvement of the stoma appliance. Stomal ischemia or necrosis is a major cause of mortality. It results from impaired blood supply, often related to excessive traction or constriction at the abdominal wall. Monitoring the color and viability of the stoma is essential. In cases of severe necrosis, reoperation is required to exteriorize a new intestinal segment.

Stomal retraction may occur in the presence of a short mesentery, obesity, or infectious complications. It may progress to cellulitis or fistula and may require local surgical revision. Laparotomy is indicated when the stoma has completely disappeared beneath the abdominal wall. Evisceration, although rare, is a surgical emergency requiring reduction of the small-bowel loops and narrowing of the stomal aperture. Fistulas, often related to full-thickness sutures, require surgical unroofing and peritoneal lavage. Obstruction may result from several mechanisms, including torsion, strangulation, or technical error in stoma construction. Treatment depends on the identified cause and may require reoperation through a midline approach.

Stomal bleeding is rare but may compromise stoma viability. Management ranges from observation to local reoperation for hemostasis.

Among late complications, stomal prolapse is common and generally well tolerated, although it may sometimes interfere with appliance fitting. It may be mucosal or full-thickness. Several surgical techniques are available depending on the type of prolapse, including local resection, colopexy, or conversion of the stoma to a double-barrel stoma. Parastomal hernia is a common long-term complication, promoted by an excessively large abdominal wall aperture, increased intra-abdominal pressure, or infection. Treatment options vary according to severity, ranging from local repair to prosthetic reinforcement, sometimes performed laparoscopically.

Thus, prevention of stomal complications depends on meticulous stoma construction, appropriate intraoperative assessment, and careful postoperative

surveillance. The surgeon's experience is decisive in the management of complex situations.

Stenoses may be cutaneous, accompanied by some degree of retraction and giving the stoma a funnel-shaped appearance, or fascial when caused by an excessively narrow abdominal wall aperture. The diagnosis is generally straightforward on clinical examination, particularly by digital examination of the stoma, which accurately identifies the level of stenosis. Although some stenoses may remain well tolerated for a long time, they can nevertheless impede colonic evacuation. This may cause upstream stasis, manifested by abdominal distension, and make stomal irrigation impossible.

The causes of these stenoses are varied. They may result from poor mucocutaneous apposition at the time of stoma construction, an inadequate skin or fascial opening, or sequelae of partial retraction or distal necrosis. In addition, progressive underlying colonic diseases, such as Crohn's disease, ulcerative colitis, ischemic colitis, or radiation colitis, may cause these strictures. In some cases, stenosis is also associated with a parastomal hernia or prolapse. Treatment is required when the stenosis becomes symptomatic.

Instrumental dilation with Hegar dilators is commonly used. However, it provides only temporary relief. Simple incision of the stenosis is ineffective because secondary healing often leads to recurrence. Similarly, multiple radial peristomal incisions do not provide satisfactory results. In practice, cutaneous stenosis should be treated by complete excision of the skin surrounding the stoma. This procedure, performed under local anesthesia, may consist of circular or semicircular peristomal excision followed by renewed apposition of the colon to the skin.

The Goligher technique is often used. It consists of a 25- to 30-mm peristomal skin re-excision with mobilization of the colon down to the fascia. The colon is then re-exteriorized, the previous colocutaneous junction is excised, and the colon is refixed to the skin. In cases of

fascial stenosis, complete revision of the stoma is required.

Hemorrhage is one of the possible complications, and two types of bleeding may occur at a stoma. The first is bleeding caused by injury to the colonic mucosa, often resulting from local trauma during irrigation. This type of bleeding is generally minor and is effectively treated by simple compression. The second type is more serious and results from rupture of a stomal varix.

Stomal varices occur mainly in patients with portal hypertension, with an estimated prevalence of 27.3%. However, the risk of stomal hemorrhage remains relatively low, at approximately 1% according to published studies. The pathophysiological mechanism involves formation of a portosystemic shunt between the inferior mesenteric venous system and the veins of the abdominal wall, facilitated by the presence of the stoma. These varices are particularly prominent in patients with hepatic cirrhosis associated with sclerosing cholangitis, a combination frequently observed in ulcerative colitis.

When bleeding is recurrent, several surgical procedures may be considered. Peristomal mucocutaneous disconnection may be performed, with resection and reinsertion of the stoma at the same site or after transposition. Another option is transstomal portosystemic disconnection using an EEA stapler, a technique inspired by procedures used for esophageal varices. These relatively simple local procedures may be attempted as first-line treatment.

However, their effectiveness is limited over time. Because portal hypertension persists, the rate of recurrent bleeding reaches 50%. For this reason, some authors recommend more radical solutions, such as portosystemic shunting, potentially by a transjugular intrahepatic shunt. In the most severe cases, liver transplantation may be considered. Compared with local treatment, these approaches provide better hemorrhage control and significantly improve long-term survival.

Stomal perforation is a rare complication occurring immediately proximal to the stoma. In a series published by Michot *et al.*, only one perforation was reported among 555 colostomies. These perforations are most often caused by

traumatic insertion of an irrigation catheter. Their occurrence is favored by excessive angulation of the bowel in the subcutaneous or extraperitoneal tract, a parastomal hernia, or fragility of the intestinal wall in certain inflammatory diseases. The clinical presentation is typical: severe pain occurs during irrigation, accompanied by failure to recover the instilled fluid. If the perforation is extraperitoneal, peristomal suppuration develops. By contrast, an intraperitoneal perforation requires urgent surgery with resection of the affected colonic segment and construction of a new stoma.

Peristomal skin lesions are common and vary in severity from simple erythema to more severe forms, such as ulcerated and infected eczema. They are often caused by repeated contact between the skin and stool, which is particularly irritating in ileostomy because the digestive effluent is highly liquid, acidic, and rich in enzymes. Stoma appliance materials, especially adhesive barriers, may also cause skin reactions, as may certain skin-care products. Pre-existing dermatologic disorders such as psoriasis may also worsen in the peristomal area. In all cases, prevention is based on an appropriately fitted appliance, the use of non-irritating care products, and regular monitoring of skin condition.

Metabolic disorders represent another important category of complications, particularly in patients with ileostomies. These patients continuously lose water and sodium through the stoma, which may lead to severe dehydration and hypovolemia if intake is inadequate, even when renal function is normal. These disorders are more frequent and severe with a preterminal ileostomy. For example, a 70-kg patient with clinically apparent dehydration has probably lost at least 4 liters of isotonic saline equivalent. Loperamide is the treatment of choice for reducing high ileostomy output. When losses exceed 4 liters per day, the condition may become life-threatening, and somatostatin analogues may be required. Primary potassium losses are uncommon and are generally secondary to sodium depletion, which causes compensatory urinary potassium loss. Magnesium deficiency may also occur in high-output ileostomies and may produce signs of tetany due to secondary hypocalcemia. This

deficiency requires intravenous magnesium replacement. Distal ileal resections may also cause folate and vitamin B12 malabsorption, requiring lifelong replacement therapy. Patients with ileostomies are also at increased risk of urinary calculi, accounting for up to 60% of stone cases in this population. This is related to acidic, concentrated urine, which promotes uric acid crystal formation. Prevention is based on adequate hydration and urine alkalinization. By contrast, continent ileostomy does not appear to increase the risk of urinary calculi. Gallstones are more common after ileal resection exceeding 10 cm, but treatment with bile acids is contraindicated because it worsens diarrhea. Again, patients with continent ileostomies do not appear to have an increased risk.

The psychoaffective and social complications associated with stoma formation are substantial. Their impact depends on many factors, including the clinical context: severity of the underlying disease, psychological preparation for the stoma, other associated surgical procedures, and effects on sexual life. Individual experience is also crucial. A young patient may experience the event more painfully at a symbolic level but may be able to adapt more rapidly. The appearance of a stoma profoundly alters body image. It entails genuine psychological restructuring because the stoma becomes a kind of new external, visible organ associated with loss of control over a normally private function. This often initiates a grieving process for natural defecation, physical integrity, and a sense of belonging to social normality. The initial reaction may be very intense, even in a well-prepared patient. Conversely, apparent acceptance may conceal deeper rejection, manifesting as persistent psychological disorders. The most frequent problems are depression, anxiety, depersonalization, guilt related to loss of control, and social withdrawal due to fear of rejection. Support from relatives and the quality of the therapeutic relationship play a fundamental role in adaptation. Sexuality may also be affected, either by nerve injury, particularly after pelvic surgery, or by psychological barriers such as loss of self-esteem, shame, or fear of rejection. Psychiatric or psychotherapeutic support may be essential to help patients overcome these difficulties.

Complications specific to pseudocontinent perineal colostomy (PCPC) are related to the surgery itself, particularly rectal amputation, to the risks inherent in stomas, including necrosis, prolapse, and hernia, and to certain complications specific to PCPC. Necrosis of the perineal colonic end is one of the most severe complications. It may be prevented by meticulous wrapping of the colon through a mesocolic window to ensure adequate blood supply. This complication is considered a failure of PCPC and requires conversion to a permanent iliac colostomy. In a study by Elias *et al.* involving 23 patients, two conversions were required because of this complication, which occurred before the wrapping technique had been standardized. Traumatic perforation during irrigation is another reported complication, with an estimated frequency of 2.5% to 4%. It may be prevented by having the initial irrigations performed by trained staff and by properly teaching patients the technique. Perineal hernia has also been reported, with a frequency of 3% to 6%, as has mucosal prolapse, which may affect up to 20% of cases in some series. Management of these complications does not differ from that used for conventional abdominal stomas.

Rare complications include adenocarcinoma arising in an ileostomy. This is an exceptional event, with 18 cases reported by 1990, mainly in patients with a longstanding ileostomy after colectomy for ulcerative colitis or familial adenomatous polyposis. The mean interval to onset is 23 years after stoma creation, and the mean age at diagnosis is 60 years. Management consists of wide excision of the ileostomy, including the surrounding skin, abdominal wall, and a segment of small bowel, followed by transposition of the stoma. Peristomal pyoderma gangrenosum is also rare. It occurs preferentially in the setting of chronic inflammatory disorders such as Crohn's disease or ulcerative colitis. Treatment is based on high-dose corticosteroids or, if these fail, clofazimine. Artificial nutrition may be considered to reduce stoma output and

improve healing. Finally, a case of non-Hodgkin lymphoma arising in an ileostomy was described in a patient with AIDS. The lymphoma appeared two years after stoma creation, emphasizing the need for prolonged vigilance in immunocompromised populations.

Postoperative complication rates associated with digestive stomas vary in the literature from 25% to 40%. The most frequent complications include bowel obstruction, parastomal hernia, and stomal prolapse. Bowel obstruction, which affects approximately 5% to 10% of patients, may delay resumption of oral intake and require medical or surgical management. Infectious complications, such as infection of the skin surrounding the stoma, are also common and may affect 10% to 15% of patients. Stomal retraction, in which the stoma retracts below skin level, affects approximately 2% to 5% of patients and may cause pain and difficulties with stoma care. Stomal fistulas, which are abnormal communications between the stoma and other portions of the gastrointestinal tract, are less frequent but often more complex to treat, with reported rates of 2% to 5%. Other complications, such as stomal ischemia or necrosis, although less common, sometimes require surgical revision to address loss of tissue viability.

Risk factors associated with complications after creation of a digestive stoma include specific clinical and surgical factors. Comorbidities, particularly arterial hypertension and diabetes, play a major role in the development of postoperative complications. Hypertension is a recognized risk factor because it may impair wound healing and tissue perfusion, thereby increasing the likelihood of infection or mechanical complications. Diabetes impairs the immune response and delays healing, making patients more susceptible to infection and postoperative complications. Available data indicate that up to 80% of patients with postoperative complications are hypertensive and approximately 50% are diabetic. In

addition, the patient's general condition, as assessed by the ASA (American Society of Anesthesiologists) score, is an important predictor. Patients classified as ASA 2 or ASA 3, often characterized by multiple comorbidities, are at higher risk of severe complications. Nutritional status also plays a key role. Malnourished patients or those with a low body mass index (BMI) are more likely to develop complications, particularly infection and delayed wound healing. Older patients are also considered more vulnerable because of reduced immune and healing capacity, and age is often associated with higher complication rates, particularly after 60 years.

The distribution of complications also varies according to stoma type. Patients undergoing ileostomy have a higher complication rate than those undergoing colostomy, although colostomies involving portions of the colon also carry substantial risks, particularly in colorectal cancer. Some studies show that complications such as bowel obstruction are more frequent after ileostomy because of the more liquid stool consistency and the increased risk of dehydration. By contrast, colostomies, which are more common, are associated with a lower risk of bowel obstruction but may cause mechanical complications such as retraction and parastomal hernia. Management also varies according to stoma type. Bowel obstruction may require medical treatment or surgery, whereas stomal fistulas and retractions may sometimes be treated by further surgery to reposition or revise the stoma.

Complication-prevention strategies require comprehensive early assessment of risk factors, particularly comorbidities, nutritional status, and medical history. Rigorous postoperative follow-up, with appropriate stoma care and regular reviews, is also essential to minimize risk. When complications occur, treatment is based on an individualized approach tailored to their nature and severity. Some complications may be managed with noninvasive measures, such as local care or adjustment of medical therapy,

whereas others require surgery to revise the stoma or treat associated complications. Strategies for preventing and managing postoperative complications are therefore crucial for improving outcomes after digestive stoma creation and reducing the impact on patients' quality of life.

Digestive stomas, used to divert intestinal contents temporarily or permanently to the outside of the body, are commonly performed in the treatment of various severe gastrointestinal disorders. They are mainly indicated for colorectal cancer, Crohn's disease, ulcerative colitis, complicated diverticulitis, and cases of intestinal trauma or perforation. These procedures may also be required when temporary diversion of intestinal contents is needed, for example to protect an anastomosis or treat a fistula. Despite their effectiveness, digestive stomas carry a risk of complications that may have a considerable impact on patients' quality of life. These complications vary according to the type of stoma and the patient's general condition and include mechanical problems such as bowel obstruction, parastomal hernia, retraction, and stomal prolapse, as well as infectious complications such as peristomal infection and stomal fistula.

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Recommendations for the management of digestive stomas vary but may be structured as follows:

Preoperative therapeutic education for patients undergoing stoma formation, delivered by a specialized team including stoma care nurses, is strongly recommended. This approach may incorporate multimedia resources and practical simulations to prepare patients and their families effectively. It promotes autonomy, improves quality of life, and reduces length of hospital stay. The studies by Chaudhri *et al.*, (2005) and Lo *et al.*, (2010) confirm these benefits.

Preoperative stoma-site marking, performed in collaboration with a stoma care nurse or surgeon, improves adaptation to the stoma and limits skin complications. Several

meta-analyses (Kim *et al.*, 2021; Hsu *et al.*, 2020; Ambe *et al.*, 2022) have shown that appropriate positioning significantly reduces postoperative risks and improves quality of life.

For end colostomies, an extraperitoneal route should be preferred because it reduces the risk of parastomal hernia compared with a transperitoneal route. The studies by Dong *et al.*, and Heiying *et al.*, support this recommendation.

With regard to stoma height, insufficient protrusion is a risk factor for complications such as leakage and skin irritation. An English national audit (Cottam *et al.*,) recommends protrusion of at least 1 cm for colostomies and 2 cm for ileostomies to reduce these risks.

The use of supporting rods for loop stomas is not recommended. Several studies, including a meta-analysis by Du *et al.*, (2020), have shown that their use increases the risk of stomal necrosis and peristomal dermatitis without a proven benefit in preventing retraction.

Routine placement of a prophylactic mesh in the retromuscular position is not justified. Although some studies, such as that by Janes *et al.*, have reported potential benefits, others, such as the study by Fleshman *et al.*, have not demonstrated effectiveness, precluding a general recommendation.

Comprehensive postoperative follow-up by a stoma care nurse improves adaptation to the stoma and reduces readmission for complications. The studies by Forsmo *et al.*, (2016) and Zhang *et al.*, (2013) emphasize the importance of extended follow-up, including teleconsultation, to provide effective support to patients.

Management of high-output stoma is based mainly on dietary and lifestyle measures, including restriction of hypotonic fluid intake and a sodium-enriched diet.

According to Duchalais *et al.*, loperamide administration under electrocardiographic monitoring is also recommended to reduce fluid losses and prevent hospitalization.

In the elective setting, stoma relocation is preferred for repair of parastomal hernias because it is associated with a lower recurrence risk than other methods. Clinical studies support this approach as first-line treatment.

For complicated parastomal hernias, the laparoscopic Sugarbaker technique is recommended. It has demonstrated a significant reduction in recurrence and provides durable outcomes in the management of these complex cases.

The primary objective of this retrospective study was to assess complications related to digestive stomas and identify the risk factors associated with their occurrence. Our findings revealed several significant aspects that highlight the complexity of stoma management and the importance of a thorough preoperative assessment.

The risk-factor analysis, which distinguished clinical parameters from surgical factors, identified important associations between comorbidities and postoperative complications. One of the most notable findings concerned the relationship between arterial hypertension and postoperative complications. Indeed, 80% of patients with complications were hypertensive ($p = 0.004$), which is consistent with the literature showing that hypertension impairs healing and increases the risk of infectious and mechanical complications through its effects on tissue perfusion and the inflammatory response. Diabetes was likewise identified as a major risk factor, with a significant association ($p = 0.006$). These findings are consistent with several studies suggesting that diabetes impairs the immune response and prolongs healing time, thereby increasing the risk of postoperative complications.

Analysis of the ASA score also revealed a significant correlation with the occurrence of complications ($p = 0.02$), particularly among patients classified as ASA 2 and ASA 3. These findings emphasize that the patient's general condition, as assessed by the ASA score, is a relevant indicator of postoperative complication risk. Patients in these categories frequently have multiple comorbidities and compromised general health, which increases their vulnerability to complications.

Patients' nutritional status, assessed using the GN score, showed a strong association with postoperative complications, particularly among patients classified as GN 4, who accounted for 65% of the observed complications ($p = 0.001$). These findings confirm the importance of preoperative nutritional assessment. Poor nutritional status is well documented as a factor contributing to delayed healing and increased risk of infection and postoperative complications.

Regarding sex, no statistically significant relationship was found with the occurrence of complications ($p = 1.000$), although a trend toward a predominance of men among patients with complications was observed. This suggests that, although the distribution of complications differs between the sexes, other factors such as age, comorbidities, and the surgical indication may have a greater influence than sex itself.

With regard to the WHO (World Health Organization) score, although 70% of patients with complications were classified as WHO 1, this parameter showed no significant relationship with complications ($p = 0.831$). This suggests that the patient's general condition, although contributory, is not necessarily a determining factor in the occurrence of stoma-related complications.

Analysis of surgical factors, including operative technique, stoma type, and operative setting, did not establish significant associations with complications. However, the

diversity of the procedures and the complexity of the underlying diseases probably influence the variability of the findings, making these factors more difficult to interpret.

CONCLUSION

In conclusion, this study highlights the importance of a comprehensive preoperative assessment, particularly of comorbidities and nutritional status, in the management of patients with digestive stomas. Our findings emphasize that hypertension, diabetes, a high ASA score, and poor nutritional status are major risk factors for postoperative complications. These factors support an individualized approach to patient management, with particular attention to control of comorbidities and optimization of nutritional status before surgery. Adoption of targeted preventive strategies based on these risk factors could reduce complications and improve clinical outcomes in patients undergoing creation of a digestive stoma.

Regarding the demographic characteristics of patients with stomas, our study showed a male predominance (60.8%), similar to the Chinese study (62%) and slightly higher than that reported in the Portuguese study (61.4%). The mean age of patients was 62 years, comparable to that in the Brazilian study (56.7 years) but lower than that in the Portuguese study (70.5 years). Most patients were older than 60 years (59.32%), a trend consistent with data from the other studies, although slightly lower than the rate reported in Portugal (80.8%). These variations may be attributable to regional differences or to specific stoma indications.

Regarding the distribution of stoma types, our study found 54.9% ileostomies, 29.4% colostomies, and 7.9% double stomas, suggesting a more diverse approach adapted to local characteristics. By comparison, previous studies have reported variable distributions, with a predominance of ileostomies in the Brazilian study (89.4%) and higher rates of colostomy in the Portuguese and Chinese studies.

The main indications for stoma formation reported in the literature include cancer with bowel obstruction, diverticular disease, inflammatory bowel disease, trauma, perforation, and malnutrition. In our study, the principal indications were rectal cancers (51% of ileostomies), which is consistent with the data reported by Rajput, who also noted a high frequency of intestinal perforation (76%). Regarding colostomy, 31.5% of cases were related to colon cancer, which differs slightly from the findings of Engida, who reported a higher prevalence of sigmoid volvulus (46.5%).

The overall rate of stoma complications observed in our study was 39.2%, which is consistent with the literature (35% according to Sabbagh and 26% according to Saghir). The incidence of individual complications varies, but rates of bowel obstruction (9.8%) and parastomal hernia (5.9%) were reported. These rates are consistent with the findings of other studies, although certain complications, such as stomal retraction and stomal fistula, occurred at rates that differed slightly from those reported in the literature.

Management of stoma complications requires a multifaceted approach. Treatments include antibiotic therapy, local care, use of an appropriately fitted appliance, and, in some cases, surgical drainage. More severe complications, such as ischemia, stomal necrosis, retraction, and stomal fistula, may require additional surgical procedures, including laparotomy or laparoscopy. Management of metabolic complications is based on appropriate dietary measures and specific supplementation to correct electrolyte imbalances.

The findings of this study emphasize the need for individualized preventive strategies targeting the main identified risk factors and for proactive management of stoma complications in order to improve clinical outcomes and patients' quality of life.

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