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TECHNICAL NOTE

Robotic modified Sugarbaker technique for parastomal hernia repair: a standardized approach

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Abstract

Parastomal hernia (PSH) is a prevalent long-term morbidity associated with stoma construction, and the optimal operative management remains uncertain. This study addresses the need for a standardized approach to symptomatic PSH repair, focusing on the robotic-assisted modified Sugarbaker technique with composite permanent mesh. The study, conducted in a high-volume colon and rectal surgery referral practice, outlines a systematic approach to patient selection, surgical procedures, and postoperative care. Preoperative evaluations include detailed medical and surgical histories, impact assessments of PSH, and oncological history reviews. The surgical technique involves the Da Vinci Xi™ robotic platform for adhesiolysis, hernia content reduction, stoma revision if needed, narrowing of the enlarged stoma trephine, lateralization of the stoma limb of bowel, and securing the mesh to the abdominal wall. Outcomes are reported for 102 patients undergoing robotic parastomal hernia repair from January 2021 to July 2023. Conversion to open surgery occurred in only one case (0.9%). Postoperative complications affected 39.2% of patients, with ileus being the most frequent (24.5%). Recurrence was observed in 5.8% of cases during an average follow-up of 10 months. In conclusion, parastomal hernia, a common complication post-stoma creation, demands surgical intervention. The robotic-assisted modified Sugarbaker repair technique, as outlined in this paper, offers promising results in terms of feasibility and outcomes.

Keywords Robotic surgery · Minimally invasive surgery · Parastomal hernia · Ileal conduit · Sugarbaker technique

Introduction

Parastomal hernia (PSH) is a common long-term morbidity associated with stoma construction, with rates ranging from 0 to 48.1% [1].

There is little consensus on the optimal operative management of symptomatic PSH, and various PSH repair options have been described, including primary repair, relocation of the stoma, and mesh, synthetic and biologic, on-lays or sub-lays repairs [2, 3]. The two most common mesh PSH repairs are the "keyhole" and the Sugarbaker repairs [4, 5]. The original Sugarbaker repair involved sewing a piece of mesh circumferentially to the edges of the PSH defect, with the stoma limb of bowel coming out a small defect in that circumferential closure [6]. Modification of the original Sugarbaker repair includes the abdominal wall defect being closed and the stoma limb of bowel physically lateralized to the abdominal wall followed by placement of a large sheet of mesh that covers the stoma trephine defect and lateralized bowel segment with significant overlap on the abdominal wall [4]. Both laparoscopic and robotic Sugarbaker PSH repairs have been reported [7, 8]

In our high-volume colon and rectal surgery referral practice, we have chosen to standardize our approach to the modified PSH repairs, performing a robotic modified Sugarbaker repair with composite permanent mesh.

Davide Ferrari and Tommaso Violante have contributed equally to this work.

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Patient selection

Preoperative evaluation includes a detailed medical and surgical history, including details of the intervention leading to stoma formation, such as the operative approach used, the impact of the PSH on stoma function, appliance fit, and impact on the patient's quality of life are documented, review of oncological history, and preoperative cross-sectional imaging. Patient factors affecting outcomes are assessed and optimized, if possible, to reduce postoperative complications and recurrence. The main modifiable risk factor is obesity. All patients with BMI greater than 30 kg/m^2 are encouraged to lose weight and are offered a consult with an expert. However, morbid obesity is not an absolute contraindication to offering surgery especially if the PSH is causing serious appliance fit issues or repeated hospitalizations for small bowel obstruction. These patients are counseled that they are at significantly higher risk for PSH recurrence. Smoking cessation is also strongly recommended, along with exercise [9]. Patient comorbidities and health status are also addressed, along with nutritional status, and functional status. Diabetic patients are required to have reduced their HbA1C to below 7.5% and blood glucose levels in normal range prior to elective repair.

Approach used in previous abdominal surgery is not considered an exclusion criteria for a robotic parastomal hernia repair.

Patients were excluded from the study if they denied Minnesota research authorization.

Surgical procedure

The patient is placed supine on the operating table with split leg extensions, with the outline of the standard ostomy appliance traced with an operative marker, so that any incision that is made near the stoma does not lie under the appliance postoperatively. The stoma is covered with radio-opaque gauze for colostomies and ileostomies, and a Foley catheter is placed into urinary conduits.

After the abdomen is fully insufflated, the sites for trocar placement are marked as far lateral as possible on the side opposite the stoma. It is important to mark these lateral trocars sites after pneumoperitoneum is established as it frequently provides 2–3 cm of additional working space within the abdomen. Three 8 mm robotic trocars robotic are placed 8.5 cm apart and at least 1.5 cm from a boney prominence. An AirSeal™ (ConMed, Utica, USA) trocar is placed in the upper quadrant opposite the ostomy site. The Da Vinci Xi™ (Intuitive Surgical Inc., Sunnyvale, USA) robotic platform is then placed between the patient's legs and docked (Fig. 1). A 30° camera is inserted in the central trocar.

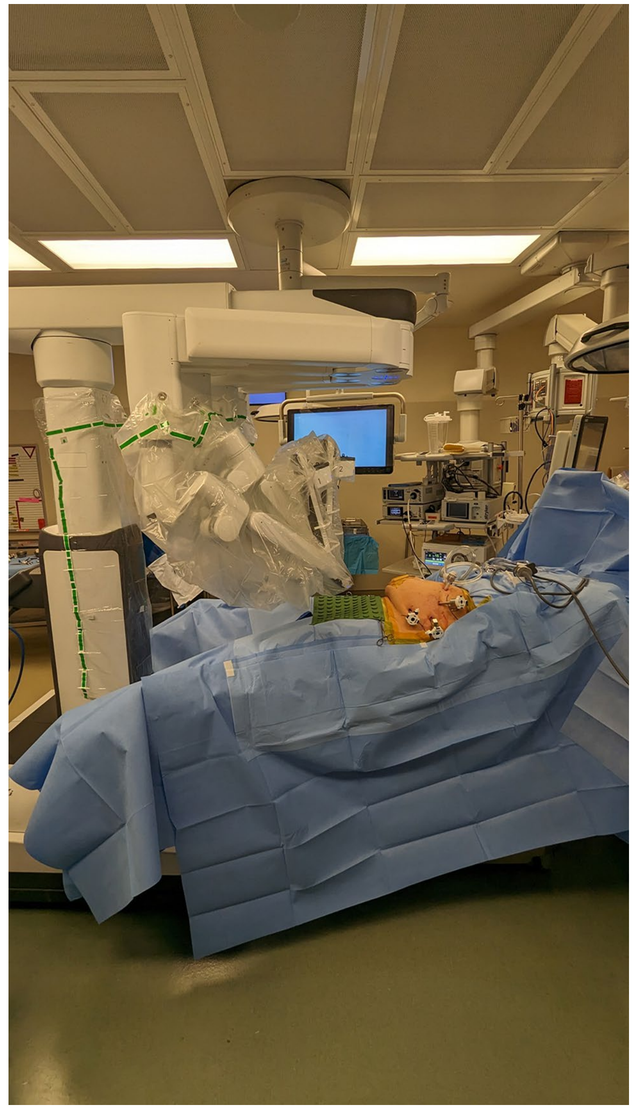

Fig. 1 Operative room setting and trocar disposition

Adhesiolysis and hernia content reduction with possible stoma revision

Adhesiolysis and reduction of the hernia sac contents are performed with a tip-up grasper in the left hand, and a monopolar curved scissor in the right hand. It is important at this point of the operation to determine the orientation of the stoma limb of bowel (Fig. 2). If the stoma bowel limb is oriented in such a way that the serosal surface of the bowel cannot be lateralized to the peritoneal surface of the anterior and lateral abdominal wall, then the stoma must be revised, to avoid any contact of the bowel serosa with the non-coated

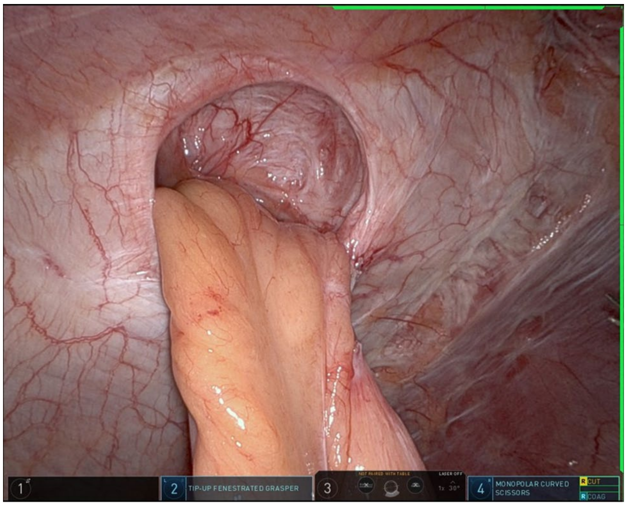

Fig. 2 Abdominal exploration and evidence of parastomal hernia defect, with correct orientation of the stoma limb

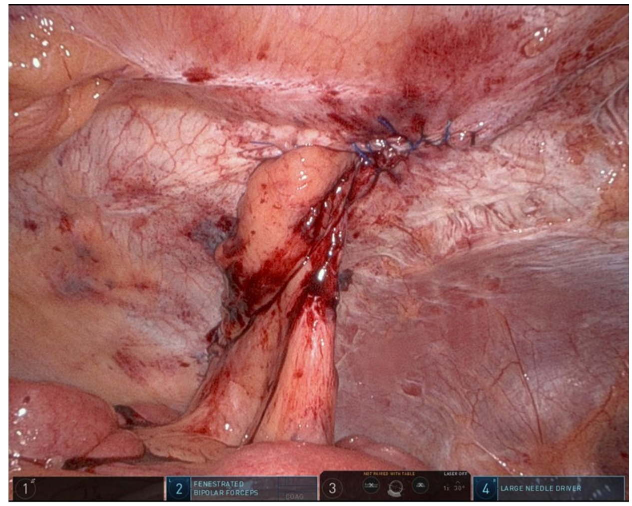

Fig. 3 Hernia trephine closure with running non-absorbable suture

side of the composite mesh. However, if the stoma requires revision to change the orientation of the mesentery or if the contents of the PSH sac cannot be reduced robotically, the robot is undocked, and an incision into the hernia sac is made lateral to the marked edge of stoma appliance. This incision is made in the cranial–caudal direction and can be enlarged as needed. Once the hernia sac in entered, the content of the hernia sac is reduced under direct vision. In cases where the stoma limb of bowel needs to be re-oriented, the stoma is disconnected at the skin level and the bowel limb is re-oriented appropriately and the stoma is re-matured in the same location.

Narrowing of the enlarged stoma trephine

If the stoma does not require revision and the contents of the hernia can be reduced robotically, the enlarged hernia trephine is closed robotically with running non-absorbable 0 barbed suture (Fig. 3). Lowering the intra-abdominal pressure to 8–10 mmHg often eases closure. In cases where an incision is made lateral to the stoma to help with reduction of the hernia sac content or to re-orient the stoma, the enlarged stoma trephine is then closed using an open approach with a running non-absorbable 0 barbed suture. It is important to avoid excessive narrowing of the fascial defect, causing stomal outflow obstruction or ischemia. At this time, any midline hernia defects are closed with running permanent 0 barbed sutures.

Lateralization of the stoma limb of bowel

The stoma bowel limb is lateralized to the abdominal wall peritoneum, for a length of 10–12 cm, with running non-absorbable 2–0 barbed suture. The mesenteric edge at the interface with the bowel serosa is carefully secured to the peritoneum on both sides of the stoma bowel limb. This lateralization with the mesentery facing medially allows a large panel of composite mesh to be secured to the abdominal wall without concern for the stoma limb serosa contacting the mesh. These running sutures cannot be too tight as it can compress the limb against the abdominal wall resulting in an obstruction.

Securing the mesh to the abdominal wall

We perform a mesh overlap of 7–8 cm from the stoma trephine or edge of the defect closure line (Fig. 4). When midline hernia defects are being addressed concurrently, a single sheet of synthetic mesh is used for the PSH and midline hernia repair. The type of mesh used is at the discretion of the operating surgeon, but our preference is Parietene™ DS Composite Mesh (Medtronic, Minneapolis, USA). The barrier side of the mesh is marked with a permanent surgical marker to ensure that it is secured to the abdominal wall facing the abdominal contents. Mesh placement begins with two absorbable tacks placed on each side of the lateralized stoma limb, using the laparoscopic SecureStrap absorbable fixation device (Ethicon, Johnson & Johnson, New Brunswick, USA). More tacks are then placed running parallel on both sides of the lateralized stoma limb, ensuring enough laxity of the mesh as it crosses over the lateralized bowel. Once the mesh is secured, multiple running non-absorbable 0 barbed sutures are sewn around the circumference of the mesh. Where the mesh crosses the mesentery of the stoma limb, it is secured to the mesentery with a 2–0 non-absorbable running bowel suture, to reduce recurrence risk at the mesh interface with the mesentery.

Fig. 4 Final view of the modified Sugarbaker repair

Perioperative management

Patients follow an enhanced recovery program, which includes education on recovery expectations, preemptive and multimodal pain management, minimized intravenous fluid intake, early return to a regular diet, scheduled postoperative ambulation, planned catheter removal, and discontinuation of intravenous fluids [10].

Follow-up

Patients are seen every 3, 6, and 12 months in the first year, and annually thereafter. Cross-sectional imaging is obtained in case of suspected recurrent hernia. Patient education about signs of recurrence is emphasized.

Results

At our institution, 102 patients underwent robotic parastomal hernia repair for a permanent stoma with the described technique from January 2021 to July 2023, 45 patients for an end ileostomy, 41 patients for an end colostomy, and 16 for ileal conduits, and most frequent causes of stoma formation were colorectal cancer ($n=30$), ulcerative colitis ($n=22$), Crohn's disease ($n=15$), and bladder cancer ($n=12$). One patient was converted to open surgery (0.9%). Forty patients (39.2%) experienced postoperative complications, with ileus being the most frequent ($n=25$, 24.5%) and recurrence was reported in six patients (5.8%), with an average follow-up of 14 months (±8 months).

While the complication and recurrence rates are certainly improvable, our results are comparable to other previously published series [5, 11]. Moreover, in many previously published papers, no cases of ileus are reported, which is the main determinant of our complication rate [12, 13]. Thus, we hypothesize a difference in definition of this complication, accounting for the complication rate.

Conclusion

Parastomal hernia, a common complication after stoma creation, necessitates surgical repair to alleviate symptoms and prevent severe complications, and robotic-assisted modified Sugarbaker repair technique shows promising results.

This paper outlines a standardized approach for assessing efficacy and refining treatment approaches.

Author contributions All authors gave substantial contributions to the conception or design of the work, to the draft of the work, gave final approval, and agree to be accountable for all aspects of the work.

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Data availability Data are not publicly available for patient privacy but will be made available on reasonable request.

Declarations

Conflict of interest The authors declare no conflict of interest.

Ethical approval Ethics approval and consent to participate ethical approval was waived by the local IRB in view of the retrospective nature of the research and all the procedures being performed were part of the routine care.

Informed consent Informed consent was obtained from all individual participants included in the study.

Research involving human participants and/or animals Ethical approval was waived by the local IRB in view of the retrospective nature of the study and all the procedures being performed were part of the routine care.

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