



# Robotic retro-rectus repair of parastomal hernias

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## Abstract

**Objective** To present our technique of robotic retrorectus parastomal hernia repair.

**Background** Parastomal hernias represent a significant problem with high recurrence and long-term complications. An estimated of 120,000 new stomas are created per year with a prevalence of up to 800,000 patients in the U.S. 40–60% of these ostomies will never be reversed. Parastomal hernias cause skin breakdown and make adherence of ostomy appliances difficult, creating the need for frequent bag exchanges. They can also cause pain, bowel obstruction and bowel incarceration or strangulation. All of these factors affect quality of life and represent a significant burden to our health care system. There is no definitive gold-standard technique to repair parastomal hernias. The use of prosthesis decreases the recurrence rates, yet using prosthetic material can result in long-term complications. Surgeons have developed techniques of pre-peritoneal mesh placement to provide long-lasting repairs and at the same time prevent complications associated with the mesh. We believe that a robotic retro-rectus approach provides a secure repair and avoids leaving prosthetic material in the abdominal cavity at the same time.

**Methods** A three-arm technique is used, inserting ports opposite to the target anatomy. Hernia contents are reduced protecting the ostomy loop and mesentery. The contralateral retro-rectus space is entered and this space is developed extensively across the midline and around the ostomy. The hernia defect is approximated. Concomitant ventral hernias are also repaired. A polypropylene mesh with a keyhole is used and wide coverage is ensured in all directions. The leaflets of the mesh are stitched together and the mesh is sutured to the abdominal wall. Finally, the retro-rectus space is closed.

**Results** We have performed this technique in two patients safely and at 1-year follow-up there were no recurrences in either. On conclusion, this is a novel minimally invasive technique to repair parastomal hernias that provides wide coverage of the defect and avoids leaving mesh intraperitoneally.

**Keywords** Robotic · Parastomal hernia · Peristomal hernia · Hernia · Retrorectus · Sublay · Keyhole

## Introduction

Parastomal hernia is a prevalent problem that general and colorectal surgeons encounter frequently in their clinical practices. It has been estimated that about 120,000 new stomas are created each year and a prevalence of up to 800,000 patients in the U.S. has been reported [1, 2]. Of those, as many as 40–60% of these new ostomies will never be

reversed [3]. This new artificial defect created in the abdominal wall contributes to the formation of a hernia and the risk increases the longer the ostomy is in place. Most parastomal hernias occur within the first 2 years after creation, but the risk of herniation continues through life [4]. Approximately 52% of patients with stomas have an associated parastomal hernia [4–7].

Parastomal hernias are clinically relevant because of their potential to cause significant problems such as inadequate adherence of stoma appliances, causing leakage, skin breakdown and creating the need for frequent bag exchanges [2, 8–10]. Parastomal hernias can also cause pain, bowel obstruction and most worrisome, bowel incarceration or strangulation [4, 8, 11]. Studies have reported that the chance of catastrophic complications has largely been underestimated and if a parastomal hernia repair is part of

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an emergent operation it is associated with worse outcomes, supporting the early repair of parastomal hernias [8, 12, 13].

All of these factors affect the patient's quality of life and represent a significant burden to our health care system by causing multiple hospital admissions as well as increased use of outpatient resources [2, 10, 14–18].

Many surgeons recognize the importance of finding an effective way to repair parastomal hernias, however, no definitive gold-standard technique has been identified [8, 9, 19, 20].

As with many other hernias, the use of prosthesis decreases the recurrence rates, yet using prosthetic material comes with a separate set of complications, including adhesions and fistulas related to the mesh [21–26]. Furthermore, retro-rectus mesh placement benefits from increased blood flow when compared with intraperitoneal placement, which in theory results in enhanced incorporation of the mesh and better ability to fight off infection [22].

The importance of implanting the mesh in the sublay position has been recognized by many authors [23, 27, 28]. It has also been found that sublay mesh placement is associated with decreased recurrence rate, infection rate, and it also prevents the prosthesis from being in contact with the intraabdominal viscera [27, 29, 30].

Even when laparoscopic intra-abdominal underlay techniques have proven to be safe and effective for certain cases, and regardless of the protective barriers the prosthesis may be covered with, long-term complications are being reported with increased frequency [23, 29, 31].

All of those findings have led surgeons to develop techniques of extra peritoneal mesh placement to provide long-lasting repairs and at the same time prevent complications associated to the mesh.

Parastomal hernia repair is an area of continuous study and debate, and is discussed frequently in journals and colorectal meetings around the world. We believe that a robotic retrorectus approach provides an adequate repair with the advantage of being able to close the hernia defect, provide great mesh overlap and avoiding leaving prosthetic material in the abdominal cavity at the same time.

## Materials and methods

Our institution is a large community hospital which receives referrals from throughout the state. As a result, we evaluate large numbers of patients with parastomal hernias. Until now, the surgical options that we could offer were far from perfect, and knowing the recurrence rates and morbidity of all of them, we offered surgical repair only to very few of our patients. However, as we gained more experience with other robotic extraperitoneal mesh techniques, we decided to offer retro-rectus (sublay) mesh repairs to selected parastomal

hernia patients. Inclusion criteria were: any adult patients that were cleared for minimally invasive parastomal hernia repair, and had a parastomal hernia no larger than 5 cm but was causing significant symptoms. Emergent cases were excluded. The surgery was performed by a robotic surgeon (T.G.) with over 20 years of experience with minimally invasive hernia and colorectal surgery. Till March 2017 we had performed this technique in only 2 patients.

## Description of the technique for a robotic retro-rectus parastomal hernia repair

The patient is placed on the operating table with both arms tucked to the sides. The port location and docking of the robot depend on the previous surgical scars and location of the stoma. A three-arm technique is typically used, inserting ports opposite to the target anatomy. We utilize a DaVinci Si or a Xi model (Intuitive Surgical, Sunnyvale Ca.) and the technique is the same regardless of the model. Two 8 mm ports and a 12 mm port with an 8 mm piggyback are used, this allows to insert the mesh and suture materials through the 12 mm port and dock a robotic arm when the 8 mm port reducer is inserted. The robot is docked from the side of the ostomy. Side tilting of the table is sometimes helpful. Figure 1 demonstrates a typical port position for a repair of a parastomal hernia on the left lower quadrant. Modifications of this port placement need to be made by the surgeon depending on the type and location of hernia he or she may be repairing and the previous surgical scars.

The first step is to take adhesions down and delineate the hernia defect or defects, because frequently there is a concomitant midline hernia. The hernia contents are reduced in the usual fashion, but special attention has to be paid to

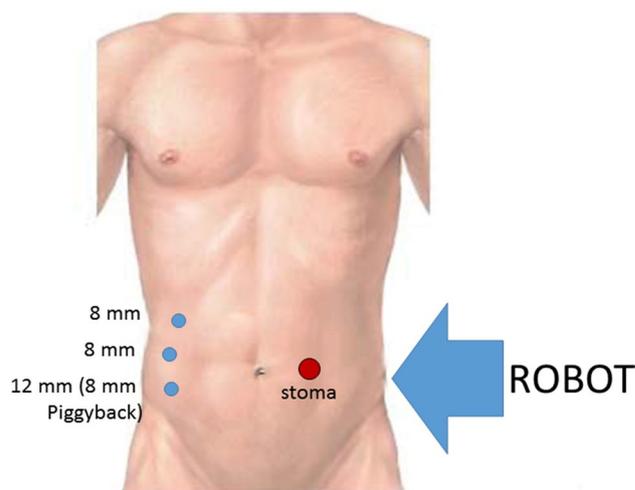
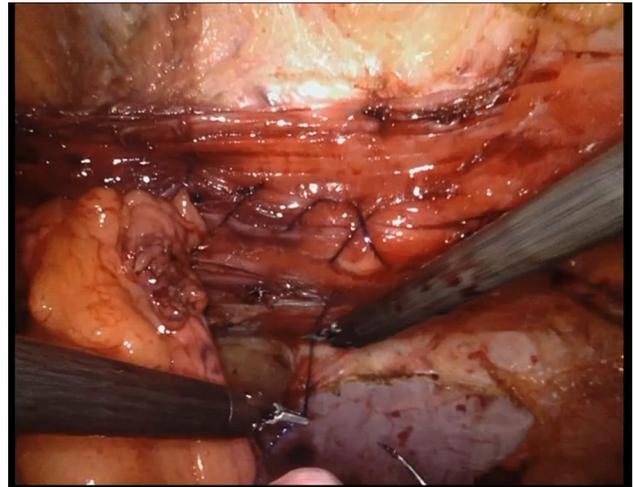


Fig. 1 Typical port placement for repair of a LLQ parastomal hernia

carefully preserve the ostomy loop and its mesentery. Sometimes this can be confusing due to the presence of more than one loop of bowel within the hernia. Catastrophic complications can result from injury at this step, therefore, we cannot emphasize caution enough. One way to help differentiate the ostomy loop is to insert a Foley catheter and inflate the balloon inside the lumen.

Once the hernia contents are fully reduced, the retro-rectus space is entered on the contralateral side medial to the semilunaris line (Fig. 2). The retro-rectus space is developed, the midline is crossed dissecting through the pre-peritoneal fat into the contralateral retro-rectus space, making sure that the peritoneum is not violated. The retro-rectus space around the ostomy site is developed to allow for wide coverage of the mesh. Once the space is developed, measurements are taken to ensure wide coverage of the mesh in all directions. The hernia defect is approximated using a #1 braided non-absorbable suture in a running fashion (Fig. 3). If there is a concomitant ventral incisional hernia, its edges are approximated using a similar technique (Fig. 4). A polypropylene macroporous mesh of adequate size is chosen and a keyhole is created at the side table, then it is introduced through the 12 mm port. The mesh is positioned around the ostomy and then the two leafs of mesh are secured together with 3-0 prolene sutures. This step is critical to prevent recurrences and the surgeon needs to be careful to take adequate size bites of the mesh. 3-0 Vicryl sutures are used to secure the mesh and to keep it flat against the abdominal wall (Fig. 5). The last step is to close the peritoneal defect around the ostomy and the incision created to access the retro-rectus space. Figure 6 demonstrates the wide coverage and overlap achieved with this technique. The final aspect of the repair is

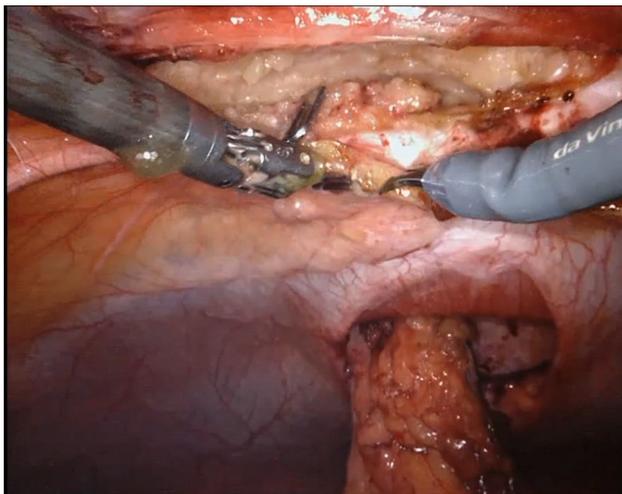


**Fig. 3** Closure of the parastomal hernia defect from the retrorectus space

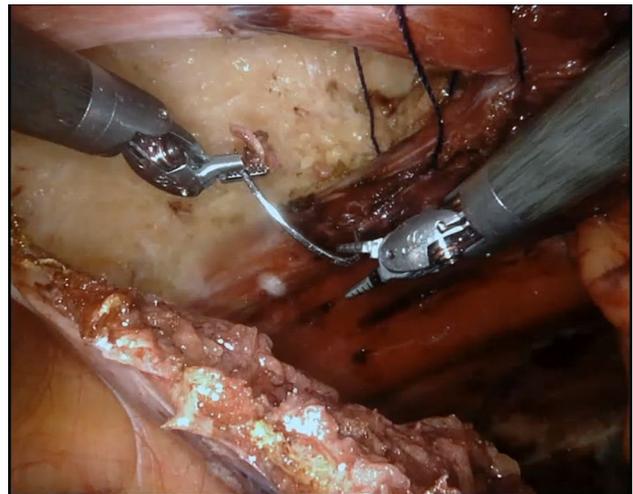
seen in Fig. 7. The entirety of the mesh is covered by native tissue and isolated from the peritoneal contents.

## Results

We have performed this technique in two patients so far. Patient #1 is a 71-year-old female who had chronic fecal incontinence and she decided to have a terminal colostomy done. She developed a parastomal hernia that was symptomatic causing her difficulties with her appliances. We discussed the details of the surgery and she agreed to proceed. A retro-rectus robotic parastomal hernia and midline incisional hernia repair was performed using a



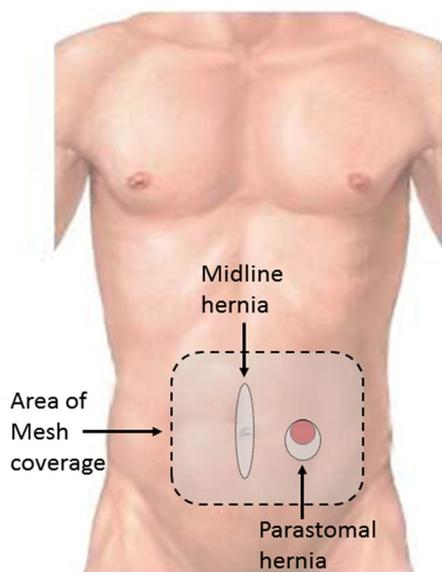
**Fig. 2** Accessing the retrorectus space on the contralateral side of the parastomal hernia



**Fig. 4** Closure of the ventral incisional defect from the retrorectus space

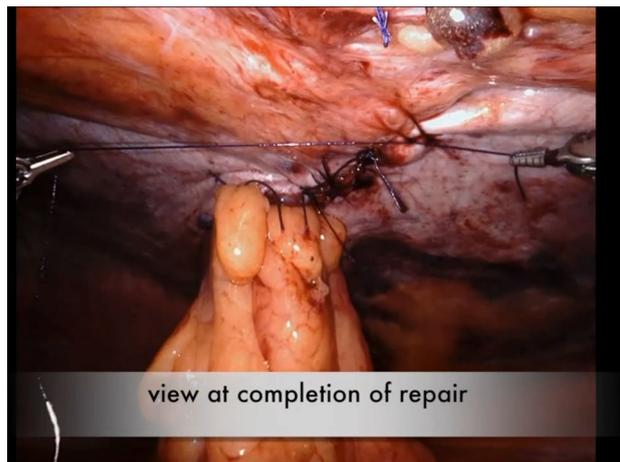


**Fig. 5** Wide coverage of the mesh around the ostomy



**Fig. 6** Demonstration of the wide coverage of the mesh achieved

20 × 20 cm macroporous polypropylene mesh. The patient tolerated the surgery well and there were no immediate complications. She was sent to the floor after recovering from anesthesia and she was started on a clear liquid diet. She developed obstructive symptoms on POD#3 and she underwent endoscopic evaluation of the ostomy on POD#8. No obstruction was found and digital dilatation was performed. Subsequently, the patient started passing flatus and stool through the ostomy. She was restarted on a clear liquid diet and advanced slowly. She was discharged on POD#13. At 1-year follow-up, she is doing well and has no evidence of recurrence.



**Fig. 7** The mesh is completely isolated from the peritoneal contents

Patient #2 is a 75-year-old male who underwent chemoradiotherapy for a low rectal cancer. He then underwent an abdominoperineal resection with a terminal colostomy. A year after his surgery he developed a parastomal hernia which was symptomatic and enlarging. We discussed the details of the surgery and he agreed to proceed. He also had a retro-rectus robotic parastomal hernia and midline incisional hernia repair with a 20 × 20 cm macroporous polypropylene mesh. He tolerated the surgery well and there were no immediate complications. He was sent to the floor after recovering from anesthesia. He was started on a clear liquid diet on POD#0 and advanced quickly. He was discharged on POD#3. At 1-year follow-up, he has no evidence of recurrence and he is doing well.

## Discussion

Even though surgeons are very familiar with the morbidity that accompanies the creation of an ostomy, sometimes this is inevitable as part of the management of the patient's disease. The first step in evaluating a patient with a parastomal hernia is to ask ourselves if the ostomy can be reversed. The next step is more complicated because it requires to make a decision about whether the symptoms are worth operating on the hernia or not. Most of the patients we evaluate have been putting up with significant problems related to the parastomal hernia, however, due to the well-known poor results of available techniques [8, 12, 24] the decision to not operate was frequently chosen. We believe that our robotic retro-rectus approach for parastomal hernia repair addresses all of our technical concerns and we have offered it to selected patients.

Our technique has several advantages including the retro-rectus placement of the mesh, wide overlap and tissue

coverage of the prosthesis, the possibility of repairing the hernia defects easily and securely, and the benefits of accomplishing all the above with a minimally invasive procedure.

With the information available today, it is impossible to negate that meshes react and interact differently with the host depending on where the mesh is placed. Even authors have proposed to give as much importance to the location of the mesh as it is given to the choice of mesh implanted [32]. We decided to place the mesh in the retro-rectus space based on the literature reports of higher complication rates with intra-peritoneal mesh implantation and the identification of the lack of tissue coverage as a predisposing factor for mesh infection [23, 25, 27]. Furthermore, in a meta-analysis by Holihan, sublay mesh placement was ranked the best mesh placement option with a high probability of being the best treatment. Sublay had a 94.2% probability of having the lowest odds of recurrence and a 77.3% probability of having the lowest odds for surgical site infection [29]. Other authors have reported on the safety of a laparoscopic preperitoneal ventral hernia repair and achieved low complication and recurrence rates [33, 34]. We believe that covering the mesh with native tissue provides excellent mesh integration, helps preventing mesh infections by enveloping it in a well-vascularized tissue, and prevents direct contact with intraabdominal viscera and decided to apply those benefits to parastomal hernia repair.

The superiority of a minimally invasive approach over open surgery is well established, however, the debate of which laparoscopic technique to use (e.g., Sugarbaker vs. keyhole) is still ongoing [8–10, 12, 24, 35]. Many surgeons consider that the Sugarbaker technique is superior, however, we found widely variable outcomes reported in the literature and believe that are a result of variations in technique. For example, the majority of the studies have reported the lowest recurrences with a Sugarbaker technique, but Köhler and colleagues favor the sandwich technique after having high recurrence rates with the laparoscopic Sugarbaker operation [8]. McLemore et al. provide a wide coverage with both of their laparoscopic techniques (Keyhole and Sugarbaker) however, they do not close the hernia defects and that could explain why they have seen higher recurrences with the keyhole technique and prefer the Sugarbaker [35]. Hansson had high recurrence rates with the keyhole technique even when he approximated the fascial edges but he used a PTFE prosthesis to cover the defect [36]. Similarly, Mizrahi had a high recurrence rate with his slit mesh repair. His technique does not close the parastomal defect and uses only a single stitch to re-approximate the slit made in a polypropylene/PTFE prosthesis, possibly compromising the repair at the center [37]. In summary, the techniques reported include a wide variety of mesh selection, placement, technique and fixation making comparisons difficult and preventing us to make a definitive decision on which technique is the best.

In our literature review, we could not find any published reports of a minimally invasive keyhole technique with defect closure of a parastomal hernia. Even when several hernia experts advocate for closing hernia defects we do not believe it has been tried. We strongly advocate for closing the hernia defects too and we believe that by closing the parastomal hernia defect and suturing the mesh leaflets with non-absorbable suture the recurrence rates should be low.

A potential disadvantage is that we use a keyhole technique that historically has been reported to have higher recurrence rates than a Sugarbaker technique. Even when we are careful to not make the hole larger than 3 cm, the potential for a recurrence at the slit or the hole in the mesh is real. Other potential disadvantage is that the surgeon has to carefully wrap the mesh around the ostomy without making it too tight to prevent obstructive symptoms as our first patient had and at the same time not leaving it too loose to prevent central recurrences. We also recognize that the findings of Holihan's study refer to complete closure of the hernia defect, which is impossible when an ostomy is to be preserved. We will only be able to draw definitive conclusions on how this technique compares to the Sugarbaker technique after we have more data from larger studies to evaluate.

One of the largest studies on laparoscopic keyhole parastomal hernia repairs and with the longest follow-up (72 patients, mean follow-up of 3 years) reported low recurrence rates but a long-term complication rate associated with intraperitoneal mesh of 7%. This occurred as late as 34 months after surgery [24]. This study demonstrated that the keyhole technique can result in a low recurrence rate, but having to accept the risks of leaving a dual-layer polypropylene/PTFE prosthesis and titanium tacks intraperitoneally. Synthetic mesh and fixation material have both been implicated in complications when left intraperitoneally [21, 23–26]. Our technique provides a similarly robust repair but hopefully will avoid those complications related to intraperitoneal placement of mesh and fixation material.

In this study, we present our technique and its feasibility, but we recognize that to evaluate how it compares to other published techniques we need a larger study to answer the questions of whether a robotic retro-rectus repair of a parastomal hernia is as effective in the long-term and whether recurrence rates are similar than what is reported for other techniques.

## Conclusion

Our technique is challenging and requires familiarity with the retro-rectus and retro-peritoneal dissections. It requires more dissection and is more time consuming than a laparoscopic Sugarbaker. We would like to see how our novel

robotic parastomal hernia repair compares to other techniques in terms of short and long-term complications and recurrence rates before we can routinely recommend it to our patients. We recognize its challenging nature but we believe that it offers many advantages and may improve the outcomes of parastomal hernia repairs.

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### Compliance with ethical standards

**Conflict of interest** Drs. Maciel, Mata, Arevalo and Zeichen have no disclosures. Dr. Glass is a proctor for Intuitive Surgical.

**Ethical standards** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee.

**Informed consent** Informed consent was obtained from all individual participants included in this article.

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