Journal of Robotic Surgery (2019) 13:339–343
https://doi.org/10.1007/s11701-018-0854-x

CASE REPORT

Robotic-assisted laparoscopic repair of rectovesical fistula after Hartmann's reversal procedure

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Received: 11 April 2018 / Accepted: 23 July 2018 / Published online: 30 July 2018

Abstract
The case is of a 59-year-old male with history of severe ischemic colitis following emergent intervention for a ruptured infrarenal aortic aneurysm who subsequently underwent left hemicolectomy, partial proctectomy, and Hartmann colostomy. The patient later underwent reversal of the Hartmann colostomy with diverting ileostomy. The surgery was complicated by a right ureteral and posterior bladder injury that resulted in a large rectovesical fistula involving the right hemitrigone and right ureteral orifice. An attempt to repair the rectovesical fistula at an outside facility was unsuccessful. Then, he underwent a robotic-assisted laparoscopic repair of rectovesical fistula, including simple prostatectomy, excision of rectovesical fistulous tract, rectal closure, peritoneal and omental flap interposition, bladder neck reconstruction, vesicourethral anastomosis and right ureteral reimplantation. There were no intraoperative or postoperative complications, and the patient was discharged at postoperative day 4; cystoscopy at 6-week follow-up demonstrated a successful closure of the fistula, at which time the ureteral stents were removed.

Keywords Fistula · Rectovesical · Robot · Hartmann · Surgery

Introduction

Hartmann's procedure (HP), which is the resection of the rectosigmoid colon with closure of the anorectal stump and formation of an end colostomy, is the treatment of choice for acute and life-threatening cases (i.e. hemodynamic instability, sepsis, or gastrointestinal malignancies). Having a colostomy has an impact on patients' quality of life such as skin irritation, parastomal hernias, leakage, and psychological distress. However, despite the fact that colostomies are reversible, due to the perioperative mortality and leakage rates that have been described (10 and 15%, respectively), only 50–60% of the patients undergo the colostomy reversal surgery [1, 2].

Hartmann's reversal (HMR) can be performed laparoscopically. In a number of cases, an open surgical approach is necessary, which can make this a very challenging procedure with significant perioperative morbidity (up to 50%) [3]. Several studies report bladder injury as a complication of HMR [4, 5]. Herein we describe a complicated case of RVF that was successfully repaired with a robotic approach.

Case report

A 59-year-old male, ASA III, underwent an emergent aortic aneurysm repair in July 2013 for a ruptured infrarenal aortic aneurysm. Postoperatively, he developed ischemic colitis and underwent an emergent left hemicolectomy and partial proctectomy with creation of an end colostomy. The patient developed multi-organ failure and acute limb ischemia requiring right below-the-knee amputation. In October 2015, a HMR was performed to restore intestinal continuity. This procedure was complicated by right distal ureteral and bladder injuries that resulted in a large rectovesical fistula and,

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s11701-018-0854-x) contains supplementary material, which is available to authorized users.

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a re-diversion by means of a loop ileostomy was necessary (Fig. 1). After conservative management failure, an open repair was attempted in March 2016, which was unsuccessful. The patient reported drainage of urine per rectum following the initially attempted fistula repair. Bilateral percutaneous nephrostomy tubes and a urethral Foley catheter were placed.

Preoperative cystoscopy demonstrated two large fistulous tracts between the bladder and rectum; staples and remnants in the fistula tract were also seen. During sigmoidoscopy, the flexible scope passed directly into the bladder and then back into the rectum through a second fistula approximately 2 cm apart (Fig. 2a).

The patient underwent a robotic-assisted laparoscopic reconstruction at our institution in December 2016 (Table 1).

Surgical steps

1. A right subcostal incision was made, pneumoperitoneum to 15 mmHg was created using open Hasson technique. A 5-mm EndoEYE camera port was inserted through the anterior abdominal wall and four ports were inserted under direct vision.
2. An extensive adhesiolysis was carried out, lasting approximately 3 h long with harvesting of the omental flap.
3. 8-mm da Vinci trocars were placed bilaterally in approximately the midclavicular line, 1 cm below umbilicus. A 12-mm assistant port was placed in the upper left abdominal quadrant midclavicular line.
4. The patient was then placed in Trendelenburg position and the robot was docked.
5. Hook electrocautery and Monopolar scissors were used in the right robotic arm, the bipolar forceps in the left one, and the laparoscopic grasp forceps in the fourth arm.
6. Seminal vesicle-sparing prostatectomy was performed. Cul-de-sac access and dissection of posterior plane to separate the anterior wall of the rectum from the bladder were done first. Then, using an anterior approach in the prevesical space, the bladder was mobilized and a simple prostatectomy was completed.
7. A longitudinal cystotomy of the anterior bladder wall was made to identify the ureteral orifices and the fistulous tracts.
8. The posterior bladder wall was resected including both fistulous tracts and the right ureteral orifice, which was in close proximity to one of the fistulous tracts (Fig. 2b).
9. The rectum was mobilized to decrease tension on the tissue and allow for an easier primary closure of the rectal wall.
10. Indocyanine green (ICG) and fluorescence imaging were used to ensure adequate rectum irrigation.
11. A chest tube was then inserted into the rectum in a retrograde fashion to prevent back walling of the posterior wall during closure of the rectal defect. Then, a running 2–0 PDS suture was used to close the rectum in a longitudinal fashion over the chest tube (Fig. 2c).
12. Peritoneal and omental flaps were interposed between the rectum and bladder, through an opening in the cul-de-sac (Fig. 2d).
13. Bladder closure of the posterior wall was performed in two layers with V-Loc 3–0, and a left double-J stent was placed (Figs. 2e, f).
14. A standard vesicourethral anastomosis was performed with V-Loc 3–0.
15. A 20-fr urethral foley catheter was inserted.
16. The right ureter was reimplanted into the dome of the bladder over a double-J stent, and a 19-fr Jackson–Pratt drain was placed. (Fig. 2g)

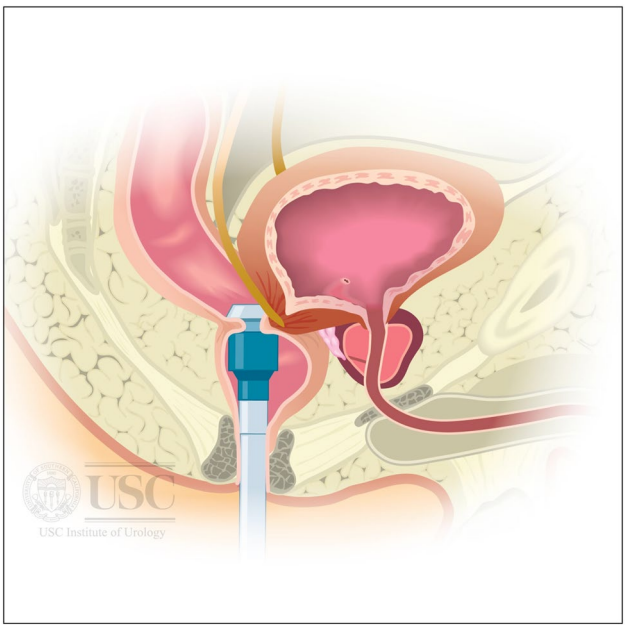

Fig. 1 Rectovesical fistula (RVF) as a result of a Hartmann reversal (HMR) procedure

Intraoperative and postoperative courses

Operative time was 11 h, which included 3 h of adhesiolysis and omentum harvesting. There were no intraoperative complications, the estimated blood loss was 200 ml, and no intraoperative transfusion was needed. Biopsy of the prostate reported 26 grs benign prostatic hyperplasia with acute and chronic inflammation.

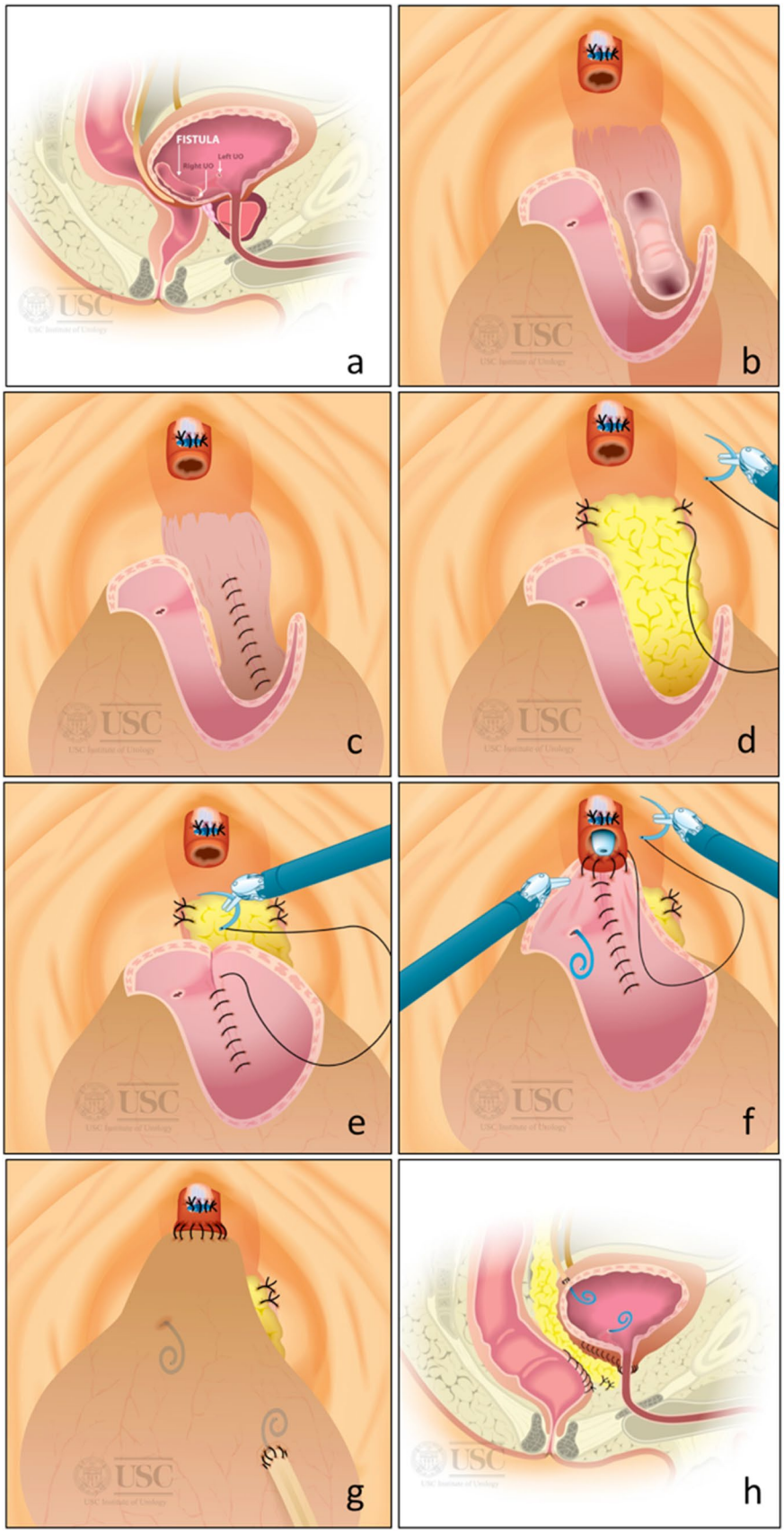

Fig. 2 **a** RVF as a result of a HRM procedure; configuration of the fistulous tract. **b** Excision of fistulous tracks, including right hemi-trigone and separation of bladder from rectum. **c** Closure of the rectal defect. **d** Interposition of omental flap. **e** Bladder reconstruction. **f** Left side ureteral JJ stenting and urethrovesical anastomosis. **g** Right-sided ureteroneocystostomy with stent. **h** Final patient anatomy after completions of the fistula repair, repair of rectal defect, right ureteral reimplantation bladder reconstruction, and omental flap interposition

Table 1 Timeline of the clinical history of the patient

Date	Event
July 2013	Emergent aortic aneurysm repair due to ruptured infrarenal aortic aneurysm
	Emergent left hemicolectomy + proctectomy + colostomy creation due to postoperative ischemic colitis
	Right below the knee amputation due to acute limb ischemia after postoperative multi-organ failure
October 2015	Hartmann's reversal procedure is performed to restore bowel continuity but is *complicated with ureteral and bladder injuries*
	Loop ileostomy and conservative trial are done
May 2016	Open fistula repair is attempted but was not successful
December 2017	Robot-assisted laparoscopic repair of rectovesical fistula

Overall, the patient had an uneventful postoperative course. He was discharged home on postoperative day 2 with the urethral catheter and JP drain. The drain was removed on postoperative day 4. The only complication was a fungal UTI that was treated with oral antifungal medication. He had antibiotic prophylaxis while the Foley catheter was in place, which was removed at 2 weeks. After 6 -week follow-up, the double-J stents were removed and cystoscopy revealed a patent urethral anastomosis with proper posterior sphincter coaptation. The right reimplanted ureter was patent with visible ureteral jets. The patient was able to be void to completion following removal of Foley catheter, and had complete continence within 2 weeks after catheter removal. Colonoscopy and CT scan with rectal contrast reported adequate rectal caliber at 6 months of follow-up. The patient is scheduled for ileostomy reversal. Follow-up of 6 months reported no recurrence (Fig. 2h).

Discussion

Vesicoenteric fistulas usually occur in the setting of bowel disease, such as diverticulitis, colorectal carcinoma, and Crohn's disease [6]. Fistulas can also be iatrogenic, following colorectal procedures such as Hartmann's reversal (HMR) procedure. Although the current trends in colorectal surgery favor primary anastomosis with or without ileostomy for complicated diseases of the sigmoid colon, Hartmann's procedure is still a valuable tool for emergency situations [4, 7]. Hartmann's takedown procedure is also a major operation with several potential intraoperative complications including injury to bowel, blood vessels, ureters, or the bladder, with a reported risk of injury up to 16% [5, 8].

Incidence of fistulas as a consequence of inadvertent injuries during reversal procedures has been reported to be around 4.08% [8]. Laparoscopic repair of vesicoenteric fistulas has been published [9–11], but robotic robotic repairs remain scant [12–14].

In our technique, the use of the prostatectomy is intended to facilitate the identification of the fistulous plane, the rectal closure and the mobilization of the organs. In addition to that it enables an adequate tissue interposition [15, 16].

Given the patient's extensive past surgical history, we had to perform an extensive adhesiolysis prior to the repair. The fistula was initially approached from the rectovesical pouch to separate the rectum from bladder and facilitate flap advancement. We then proceeded anteriorly, and after mobilizing the bladder, we performed a seminal vesicle sparing prostatectomy. In this case, the right ureteral orifice was involved within one of the fistula tracts, necessitating a right ureteral reimplantation. Excision of fistula, multi-layered closure of rectum, and interposition of peritoneal and omental flaps were carried out using the fundamental principles of fistula repair.

In rectovesical fistulas in which no prostate is present, we usually perform a transvesical approach described laparoscopically and robotically [13, 17]. This patient had two large adjacent fistulous tracts. Hence, mobilization of the posterior bladder wall from the anterior rectum was crucial. The prostate was removed to maximize surgical exposure, ensure proper mobilization of bladder, and perform a tension-free vesicourethral anastomosis, following resection of the right hemitrigone and right posterior bladder wall. The rectal defect was closed in a longitudinal fashion, since there was not enough rectal length to perform a tension-free transverse closure. During follow-up, the patient was found to have a proper rectal diameter to ensure bowel transit. Postoperative cystoscopy demonstrated a patent urethral anastomosis with appropriate posterior sphincter coaptation. The patient was able to void to completion and had complete continence within 2 weeks after Foley removal. This case report provides a description of a robotic approach for the repair of RVF after HMR, hence illustrating the usefulness of the already-known qualities of the robotic system in the management of complex surgical scenarios.

Conclusion

RVF is a complication of Hartmann's reversal procedure that can be managed with a robotic-assisted laparoscopic approach.

Funding This study was not funded by the institution.

Compliance with ethical standards

Conflict of interest Authors declare no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent Informed consent was obtained from all participants in the study. This study was approved by the institutional IRB. Written informed consent was obtained from the patient for publication of this Case Report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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