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Robotic ventral mesh rectopexy for rectal prolapse: a single-institution experience

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Abstract
Background Robotic ventral mesh rectopexy (RVMR) is an appealing approach for the treatment of rectal prolapse and other conditions. The aim of this study was to evaluate the outcomes of RVMR for rectal prolapse.

Methods We performed a retrospective chart review for patients who underwent RVMR for rectal prolapse at our institution between July 2012 and May 2016. Any patient who underwent RVMR during this time frame was included in our analysis. Any cases involving colorectal resection or other rectopexy techniques were excluded.

Results Of the 24 patients who underwent RVMR, 95.8% of patients were female. Median age was 67.5 years old
(IQR 51.5–73.3), and 79.2% of patients were American Society of Anesthesiologists class III or IV. Median operative time was 191 min (IQR 164.3–242.5), and median length of stay was 3 days (IQR 2–3). There were no conversions, RVMR-related complications or mortality. Patients were followed for a median of 3.8 (IQR 1.2–15.9) months. Full-thickness recurrence occurred in 3 (12.4%) patients. Rates of fecal incontinence improved after surgery (62.5 vs. 41.5%, respectively) as did constipation (45.8 vs. 33.3%, respectively). No patients reported worsening symptoms postoperatively. Only one (4.2%) patient reported de novo constipation postoperatively.

Conclusions RVMR is a feasible, safe and effective option for the treatment of rectal prolapse, with low short-term morbidity and mortality. Multicenter and long-term studies are needed to better assess the benefits of this procedure.

Keywords Robotic rectopexy • Rectal prolapse • Ventral mesh rectopexy • Anterior rectopexy • Robotic surgery • Colorectal surgery

Introduction

Rectal prolapse, or rectal protrusion through the anus, is a rare condition of unknown etiology most commonly affecting elderly females and is associated with risk factors including pelvic floor dysfunction or weakness, connective tissue disorders or high parity [1, 2]. Symptoms of rectal prolapse are variable, but commonly include fecal incontinence, rectal bleeding, pain, tenesmus or obstructive defecation. The symptoms can be socially debilitating and have a significant impact on quality of life.

Laparoscopic ventral mesh rectopexy (LVMR) is emerging as the treatment of choice for rectal prolapse in Europe [3]. More recently, ventral mesh rectopexy has been performed using a robotic approach with evidence supporting feasibility, safety and good functional outcomes [3–

16]. A robotic approach is a particularly useful technique in the restricted space of the pelvis due to enhanced visibility from greater field magnification and three-dimensional imaging, as well as improved dexterity from the use of multiarticulated instruments, elimination of physiologic tremor and an improved eye–hand–target axis [17, 18]. In addition, there is evidence to suggest that compared to laparoscopic surgery, robotic surgery may provide ergonomic benefits for the surgeon [19, 20]. Most reports of robotic ventral mesh rectopexy (RVMR) come from single-institution reviews in Europe and typically include a combined analysis of RVMR along with other types of laparoscopic and/or robotic surgery for rectal prolapse [4–14]. To our knowledge, this report is the first to focus on outcomes of RVMR for rectal prolapse in the USA.

Materials and methods

Patient selection

A retrospective chart review of prospectively collected data was performed for patients with rectal prolapse who underwent RVMR at the University of California, Irvine Medical Center, between July 2012 and May 2016. The procedures were performed by 3 surgeons. Any patient who underwent RVMR during this time frame was included in our analysis. Any cases involving colorectal resection or other rectopexy techniques were excluded. This study was approved by the Institutional Review Board at the University of California, Irvine.

Data collection and analysis

Data collected included patients' demographic information, comorbidities, preoperative and postoperative symptoms, operative characteristics and postoperative complications. For perioperative symptoms, we focused specifically on the following symptoms of interest: fecal incontinence, rectal bleeding, pelvic/abdominal pain, constipation and diarrhea.

Operative technique

The patient is positioned supine in modified lithotomy and undergoes vaginal (as indicated) and perineal preparation in addition to the standard abdominal preparation. After insufflation of the abdominal cavity, ports are placed as shown in Fig. 1. In order to facilitate access to the perineum, we dock the 4-arm da Vinci Si robotic surgical system (Intuitive Surgical Inc., Sunnyvale, CA, USA) via a left-hip approach. Trendelenburg position is necessary to move the small bowel out of the pelvis prior to docking. When present, the uterus is retracted against the anterior abdominal wall using an externally tied suture. Monopolar scissors are used to dissect through the anterolateral aspect of the mesorectum, taking care to preserve the hypogastric nerves. Dissection continues distally toward the pelvic floor and moves anteriorly across the rectum in a ''lazy J-shape'' dissection line. Vaginal and rectal manipulators are used as necessary for additional retraction and exposure. There is no posterior rectal mobilization, and the lateral rectal stalks are preserved to minimize the risk of postoperative pelvic floor dysfunction and constipation. A composite polypropylene surgical mesh measuring 18 cm in length is tapered from a width of 3 cm distally to 2 cm proximally. The presacral fascia is dissected to expose the periosteum of the sacral promontory, and the mesh is suspended without tension between the sacral promontory and the distal anterior rectum using sutures (Fig. 2).

Titanium tacks can also be used on the promontory. The peritoneum is then closed over the mesh.

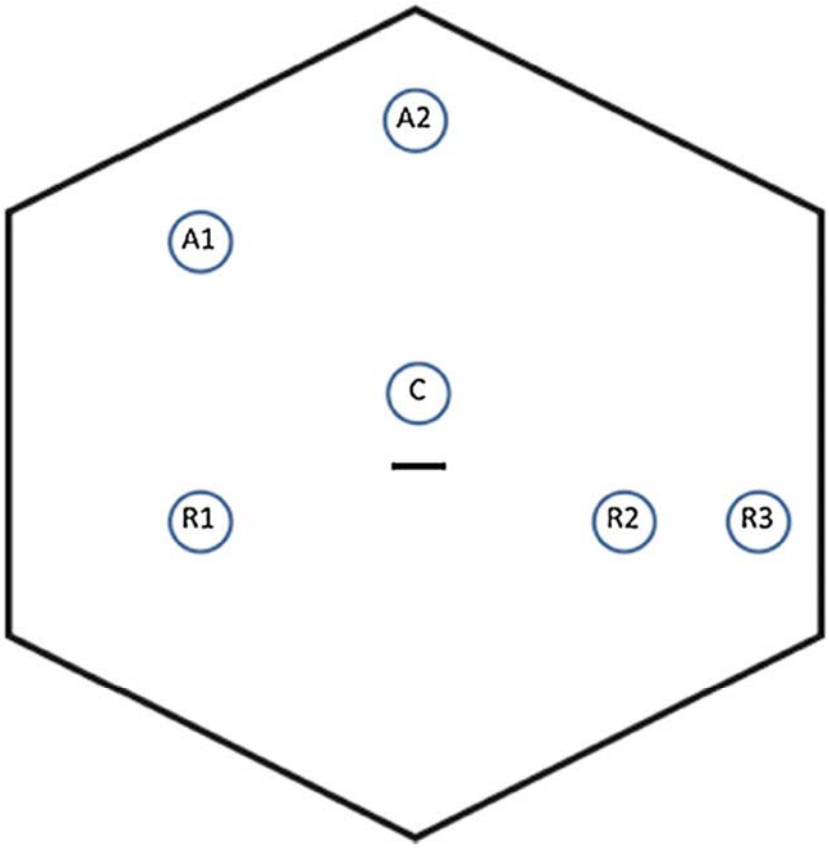

Fig. 1 Port placement. *A1* 12-mm assistant port; *A2* 5-mm assistant port; *C* 12-mm camera port; *R1* 8-mm robotic port for Arm 1—monopolar scissors; *R2* 8-mm robotic port for Arm 2—fenestrated bipolar grasper; *R3* 8-mm robotic port for Arm 3—atraumatic grasper

Results

Twenty-four patients with rectal prolapse underwent RVMR at our institution with a median duration of followup of 3.8 [interquartile range (IQR) 1.2–15.9] months. A summary of patient demographics and characteristics is given in Table 1. The vast majority of patients were female (n = 23, 95.8%). Median age was 67.5 (IQR 51.5–73.3) years, and median body mass index (BMI) was 23.7 (IQR 20.7–26.7) kg/m2. The majority of patients had an American Society of Anesthesiologists (ASA) classification of III (n = 18, 75%) or IV (n = 1, 4.2%). The most common comorbidities included hypothyroidism (n = 6, 25%), hypertension (n = 5, 20.8%) and chronic obstructive pulmonary disease (n = 5, 20.8%). There were 19 (79.2%) patients who had a history of pelvic surgery and 8 (33.3%) patients who had a history of recurrent rectal prolapse after previous surgical treatment.

A summary of operative characteristics and outcomes is given in Table 2. Median operative time was 191 (IQR 164.3–242.5) min with median estimated intraoperative blood loss

of 25 (IQR 13.8–50.0) ml. Median length of stay was 3 (IQR 2–3) days. There were no conversions, mesh complications or deaths. Full-thickness recurrence occurred in 3 (12.4%) patients at a median of 5 (IQR 3.5–7.5) months postoperatively. There were no perioperative complications related to RVMR. However, 1 patient who had concurrent midurethral sling, perineorrhaphy and cystoscopy was treated empirically for symptoms of a postoperative urinary tract infection. Another patient who had a concurrent ventral hernia repair had a superficial surgical site infection of the midline incision associated with the hernia repair.

Table 1 Patient characteristics

Patient characteristics	$N = 24$ (%)
Age, median (IQR)	67.5 (51.5–73.3)
Female	23 (95.8)
BMI, median (IQR)	23.7 (20.7–26.7)
ASA class	
I–II	5 (20.8)
III–IV	19 (79.2)
History of pelvic surgery	
Gynecologic	10 (41.7)
Rectal prolapse repair	5 (20.8)
Both gynecologic and rectal prolapse repair	3 (12.5)
Other pelvic surgery	1 (4.2)

ASA American Society of Anesthesiologists, *BMI* body mass index, *IQR* interquartile range

Table 2 Operative characteristics and outcomes

Operative characteristics and outcomes	$N = 24$ (%)
Operative time, median (IQR)	191 (164.3–242.5)
Estimated blood loss, ml, median (IQR)	25 (13.8–50.0)
Conversions	0 (0)
Length of stay, days, median (IQR)	3 (2–3)
Postoperative complications	0 (0)
Full-thickness recurrence	3 (12.4)
Mortality	0 (0)

IQR interquartile range

Compared to preoperative rates, there were decreased postoperative rates of all reported symptoms of interest (Table 3). The fecal incontinence rate decreased from 62.5% (n = 15) preoperatively to 41.7% (n = 10) postoperatively, and the constipation rate decreased from 45.8% (n = 11) to 33.3% (n = 8). No patients reported worsening symptoms. Only 1 (4.2%) patient complained of new symptoms, which in this case was constipation attributed to the use of opioid pain medications without concurrent use of stool softeners.

Discussion

Most of the current literature on RVMR comes from single- institution retrospective reviews in Europe [4–12]. Our study is the first to focus on outcomes of RVMR for rectal prolapse in the USA. Our results corroborate findings from previous studies demonstrating that patients undergoing RVMR for rectal prolapse have symptomatic improvement with minimal morbidity or mortality [3–14].

In this series, we found recurrence of full-thickness rectal prolapse in 3 (12.4%) patients. Recurrence rates for abdominal approaches to rectal prolapse repair range from 0 to 46% in the literature depending on the technique used and the duration of follow-up [2, 3, 13, 14, 21, 22]. However, when review of recurrence rates is limited to specifically RVMR (i.e., not LVMR or combined analyses with other robotic techniques for rectal prolapse repair), reported recurrence rates are 0–7% [6, 9–12]. This is lower than our reported rate of 12.4%, a discrepancy that may be attributable to our inclusion of more medically and surgically complex patients, and the fact that the surgeons participating in this study were at the beginning of their learning curve. Our series includes an unusually high percentage of ASA III/IV patients (79.2%), in comparison with only 4–19% ASA III/IV patients reported in other RVMR series [7, 23]. In addition, as our institution is a tertiary referral center, many of our patients are referred to us for complex or refractory rectal prolapse. Indeed, one-third of our patients had a history of attempted rectal prolapse repair with recurrence prior to referral, and nearly 80% of patients had a history of prior pelvic surgery. These rates are higher than the reported 14–16% history of recurrent prolapse and 14–63% history of previous pelvic surgery in cases analyzed in other RVMR series [5, 7–10].

Table 3 Preoperative versus postoperative symptoms

Symptom	Pre-op, *N* (%)	Post-op, *N* (%)
Fecal incontinence	15 (62.5)	10 (41.7)
Rectal bleeding	17 (70.8)	4 (16.7)
Abdominal/pelvic pain	13 (54.2)	9 (37.5)
Constipation	11 (45.8)	8 (33.3)
Diarrhea	10 (41.7)	9 (37.5)

Despite the complexity of our patient population, we did not have any complications related to the use of mesh or the use of the RVMR technique in our study, whereas reports of complications in the literature on robotic rectal prolapse repair range from 0 to 11% [3, 6, 9, 12–15]. However, greater patient complexity may have contributed to a relatively prolonged median operative time of 191 (IQR 164.3–242.5) min in our study. Our median operative time is consistent with reported mean operative times ranging from 125 to 223 min for robotic rectal prolapse procedures in the literature [4–7, 9–15], but our true median operative time is likely less than 191 min. Five (20.8%) of our cases included concurrent procedures other than RVMR, and the median operative time for these cases was 267 (IQR 206–268) min. When we exclude cases with concurrent procedures from analysis, our median operative time is only 176 (IQR 156–221) min, even with our complex patient population. Furthermore, our analysis comprised all RVMR cases performed at our institution, including those at the beginning of the participating surgeons' learning curve. When we compare the median operative time between 2012–2014 and 2015–2016, we find a decrease from 208 to 191 min.

Regarding functional outcomes of our patients, there were decreased rates of all symptoms evaluated preoperatively versus postoperatively, including rates of fecal incontinence (62.5 vs. 41.7%, respectively) and rates of constipation (45.8 vs. 33.3%, respectively). There was only 1 patient (4.2%) who complained of any new postoperative symptoms, which in this case was constipation attributed to use of opioid pain medications without stool softeners. Another study reporting functional outcomes specifically for RVMR for rectal prolapse in France likewise found a decrease in preoperative versus postoperative rates of fecal incontinence (68.7 vs. 12.5%, respectively) and constipation (56.2 vs. 12.5%, respectively), with a 25% de novo constipation rate [11]. Most other studies on various robotic rectopexy procedures also demonstrate an improved fecal incontinence after surgery based on Wexner scores, which range from 9.8–14 preoperatively to 4.5–8.7 postoperatively [4, 9, 10, 12]. In our series, we noted decreased postoperative rates of rectal bleeding, abdominal/pelvic pain and diarrhea, but the effect of RVMR on these symptoms is rarely reported in the literature.

There are several limitations to this study. Given its retrospective nature, this study is subject to the limitations inherent to retrospective analyses, including selection bias and missing data. For example, only overall operative times were available from chart review; thus, we were unable to differentiate between robotic setup and console time, or account for operative time due to concurrent procedures that took place in addition to RVMR. In addition, this study comprises a small number of patients undergoing RVMR at a single tertiary-care hospital and results may not be generalizable. Furthermore, while almost a third of our patients had over 1 year of follow-up, the majority had less than 6 months of follow-up, limiting our ability to comment on long-term outcomes. Despite these limitations, our study is the first to focus on results after RVMR for rectal prolapse in the USA.

Conclusions

RVMR is a feasible, safe and effective option for the treatment of rectal prolapse, associated with good shortterm functional outcomes and minimal morbidity and mortality. Multi-institutional studies and long-term followup studies would be desirable to better assess the benefits and risks of this procedure.

Compliance with ethical standard

Conflict of interest JCC and AP are MedRobotics consultants. AP is an Intuitive consultant and was provided institutional support to host educational conferences. MDJ, SDM, JCC, MJS and AP were provided Ethicon institutional support to host educational conferences. MJS is an Ethicon consultant and lecturer, and received a grant.

Ethical approval This study was approved by the Institutional Review Board at the University of California, Irvine. All procedures performed were in accordance with the ethical standards of the Institutional Review Board and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent This study did not require formal consent, as determined by our Institutional Review Board.

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