Laparoscopic Harvest of the Rectus Abdominis for Perineal Reconstruction

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Summary: The rectus abdominis is a workhorse flap for perineal reconstruction, in particular after abdominoperineal resection (APR). Laparoscopic and robotic techniques for abdominoperineal surgery are becoming more common. The open harvest of the rectus abdominis negates the advantages of these minimally invasive approaches. (Sentence relating to advantages of laparoscopic rectus deleted here.) We present our early experience with laparoscopic harvest of the rectus muscle for perineal reconstruction. Three laparoscopic unilateral rectus abdominis muscle harvests were performed for perineal reconstruction following minimally invasive colorectal and urological procedures. The 2 patients who underwent APR also had planned external perineal skin reconstruction with local flaps. (Sentence deleted here to shorten abstract.) All rectus muscle harvests were performed laparoscopically. Two were for perineal reconstruction following laparoscopic APR, and 1 was for anterior vaginal wall reconstruction. This was done with 4 ports positioned on the contralateral abdomen. The average laparoscopic harvest time was 60–90 minutes. The rectus muscle remained viable in all cases. One patient developed partial necrosis of a posterior thigh fasciocutaneous flap after cancer recurrence. There were no pelvic abscesses, or abdominal wall hernias. Laparoscopic harvest of the rectus appears to be a cost-effective, reliable, and reproducible procedure for perineal with minimal donor-site morbidity. Larger clinical studies are needed to further establish the efficacy and advantages of the laparoscopic rectus for perineal reconstruction. *(Plast Reconstr Surg Glob Open 2017;5:e1581; doi: 10.1097/GOX.0000000000001581; Published online 13 November 2017.)*

INTRODUCTION

The traditional complication rate of abdominoperineal resection (APR) without soft-tissue coverage can be high as 25–60%.[1–3] In 2007, a landmark study performed by Butler et al.[4] demonstrated that the use of the vertical rectus abdominis myocutaneous (VRAM) flap led to a drastic reduction in the complication rate of perineal abscess, major wound dehiscence, and pelvic fluid collections after APR. This robust, versatile flap has become the workhorse of perineal reconstruction. As minimally invasive techniques for APR have become more prevalent, the traditional open harvest of a VRAM is losing its appeal, as it defeats the purpose and advantages of a laparoscopic or robotic APR. Also, the skin paddle complication rate of a VRAM can be high depending on the ratio between the patient's pelvic inlet and thickness of the adipocutaneous portion of the VRAM.

The earliest reports of endoscopic harvest of the rectus describe a technically difficult and lengthy dissection and violation of the anterior sheath.[5–7] The first report of an anterior sheath sparing laparoscopic harvest of the rectus abdominis was in 2000, where it was harvested as a free flap for a heel wound.[8] Reports for its utility in perineal reconstruction are scarce, with its use in perineal reconstruction first reported in a cadaver model in 2015.[9] Its use in perineal reconstruction has been reported in only 2 articles to date.[10,11] Advantages of the laparoscopic harvest include reduced incisional morbidity, sparing of the anterior rectus sheath, utilization of the same port sites and laparoscopic instruments, enhanced recovery, decreased

Supplemental digital content is available for this article. Clickable URL citations appear in the text.

postoperative pain, superior aesthetics, ability for simultaneous harvest in certain cases, and decreased postoperative pain.[11]

We present our experience with laparoscopic harvest of the rectus abdominis muscle for perineal reconstruction with the goal of expanding the literature on the utility of minimally invasive harvest of the rectus abdominis in perineal reconstruction.

METHODS

Three laparoscopic harvests of the rectus abdominis muscle were performed at a single institution by a single plastic surgeon (J.L.) and colorectal surgeon (S.B.). See Table 1 for patient descriptions and indications.

Technique
Port Placement
All ports were placed in the contralateral abdominal wall. A 10-mm port was placed over the left abdominal wall in the subxiphoid region following the use of a Veress needle for peritoneal access and insufflation. Three, 5-mm ports were placed in a W-configuration allowing optimal angles for dissection and visualization (Fig. 1).

Rectus Abdominis Harvest
Supplemental Digital Contents 1 and 2 demonstrate the intraperitoneal laparoscopic harvest after APR, and for vaginal wall reconstruction, respectively (**see video, Supplemental Digital Content 1,** which displays the laparoscopic rectus harvest after laparoscopic APR on patient 1, *http://links.lww.com/PRSGO/A610*; **see video, Supplemental Digital Content 2,** which displays the laparoscopic rectus harvest for vaginal wall reconstruction on patient 3, *http://links.lww.com/PRSGO/A611*).

We incise the posterior sheath longitudinally and identify the rectus muscle. Similar to an open approach, we then transect the superior rectus muscle and then dissect the rectus off the anterior sheath. The deep inferior epigastric pedicle is visualized and protected during the dissection.

The harvest was performed at the same time as the urological procedure in 1 patient, and following the APR in the APR patients. In the urologic patient, the urologists gained exposure transvaginally, and the rectus muscle was pulled through the transvaginal space. It was sutured superiorly to support the bladder neck over the anterior vaginal wall defect using 3-0 Vicryl sutures (Fig. 2). We harvested posterior fascia above the arcuate line to provide the urologists with fascia to perform a pubovaginal sling for concomitant stress incontinence. In the patients undergoing laparoscopic APR, we secured the rectus to the pelvic opening after external perineal extirpation in the prone position. The rectus muscle was sutured with 3-0 Vicryl over the perineal defect (Fig. 3). In the APR patients, the soft-tissue perineal defect was closed with local tissue flaps (Table 1; **see figure, Supplemental Digital Content 3**, which displays patient 1, shown after bilateral gluteal fasciocutaneous advancement flaps, *http://links.lww.com/PRSGO/A612*).

RESULTS

The average harvest time was 60–90 minutes. One patient had partial necrosis of 1 of the posterior thigh fasciocutaneous flaps after cancer recurrence, requiring debridement and delayed closure. The rectus muscle remained viable and intact in all cases. There were no other complications, and no patients developed abdominal wall bulges.

DISCUSSION

The advent and refinement of minimally invasive techniques in surgery has been 1 of the greater paradigm shifts in surgery and are increasingly finding a role in plastic surgery.[12–22] As colorectal surgeons begin to perform more APRs laparoscopically, it is imperative

Table 1. Patient Characteristics/Demographics

Patient No.	1	2	3
Age (y)	34	50	20
BMI (kg/m²)	30.4	25.7	38.7
Diagnosis	Anal squamous cell carcinoma	Anal squamous cell carcinoma	Anterior vaginal wall defect, stress urinary incontinence
Indication	Perineal defect after APR	Perineal defect after APR	Anterior vaginal wall defect with bladder neck prolapse
Procedure	Laparoscopic APR, laparoscopic harvest of rectus, bilateral gluteal V-Y fasciocutaneous advancement flaps	Laparoscopic APR with partial excision of vaginal wall, laparoscopic harvest of rectus, bilateral posterior thigh flaps	Transvaginal repair of bladder prolapse with pubovaginal sling, laparoscopic harvest of rectus
Complications	None	Unilateral posterior thigh flap necrosis following cancer recurrence	None
Surgery date	5/12/16	1/12/16	5/9/17
Length of stay	12 d	24 d	5 d
Length of follow-up	13 mo	17 mo	1 mo
Comorbidities	HIV	HTN	PCOS
Prior XRT	Yes	Yes	No
Prior chemo	Yes	Yes	No
Prior abdominal surgery	Yes (diverting colostomy)	Yes (appendectomy, cholecystectomy, bilateral tubal ligation, colostomy)	No

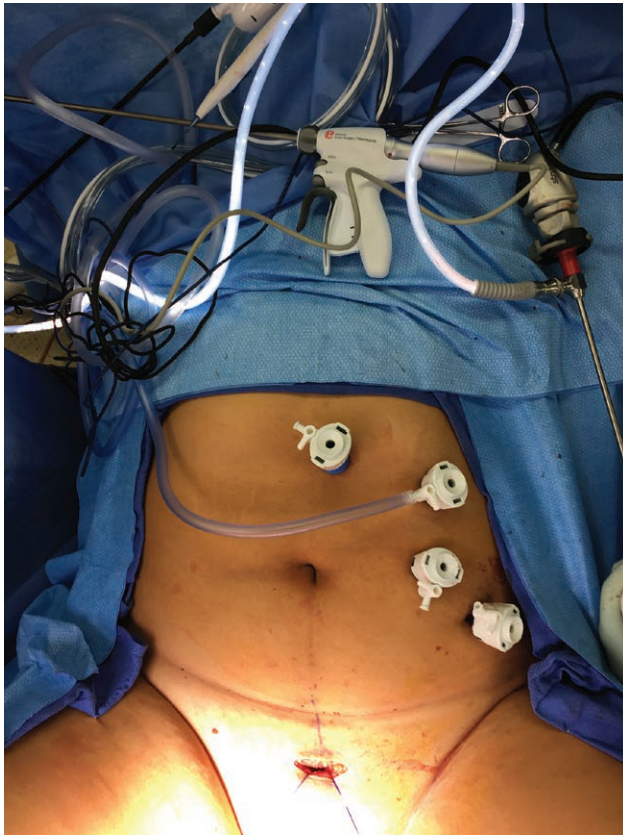HTN, hypertension; PCOS, polycystic ovarian syndrome.

Fig. 1. Image demonstrating laparoscopic port setup on patient 3.

that we, the reconstructive surgeons, have the ability to shift our paradigm and adopt new techniques "to decrease morbidity and enhance patient recovery from these complex surgeries."

Benefits of the laparoscopic harvest include use of the same laparoscopic equipment, ability to simultaneously harvest muscle in the case of concomitant urologic/gynecologic procedures, and low donor-site morbidity. Additionally, in cases of external wound breakdown or necrosis, the rectus muscle is not compromised due to the fact that
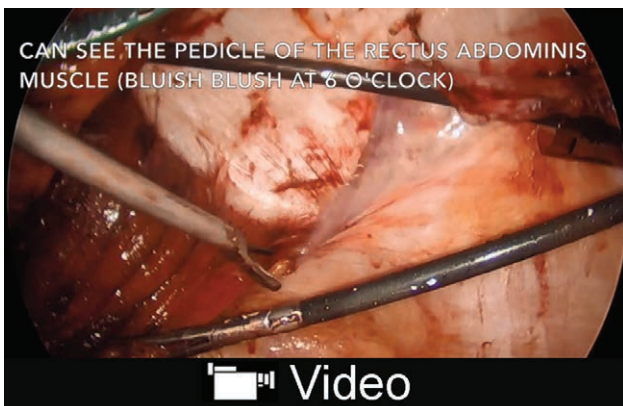
Video Graphic 1. See video, Supplemental Digital Content 4, which displays the laparoscopic rectus harvest after laparoscopic APR on patient 1. This video is available in the "Related Video" section of PRS-GlobalOpen.com or at *http://links.lww.com/PRSGO/A610*.
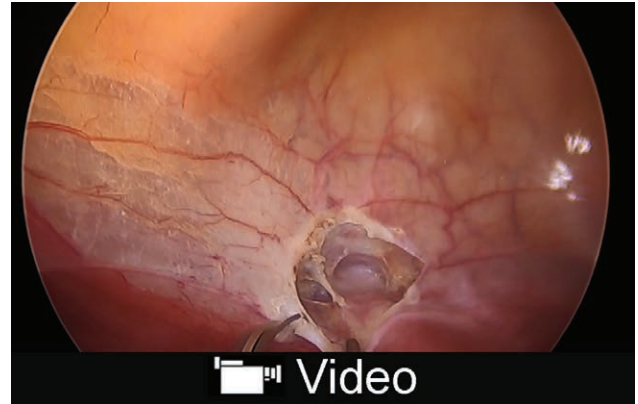
Video Graphic 2. See video, Supplemental Digital Content 5, which displays the laparoscopic rectus harvest for vaginal wall reconstruction on patient 3. This video is available in the "Related Video" section of PRSGlobalOpen.com or at *http://links.lww.com/PRSGO/A611*.

it is a separate entity. In the patient who developed necrosis of the posterior thigh flaps, the rectus remained viable.

APRs yield complex defects that are fairly hostile environments for reconstruction due to irradiation, patient habitus, and the inherent difficulty with perineal wound care. Using muscle and skin distant to the surrounding tissue, such as a VRAM, is an excellent solution in certain cases. However, VRAMs have a significant adipocutaneous component in obese patients. Passing the thicker adipocutaneous flap through the pelvis increases tension on the skin, jeopardizing its viability. Furthermore, complex and delicate reconstruction of the vaginal vault is next to impossible with a thick adipocutaneous paddle. Muscle can be easily contoured to a vaginal defect and allowed to mucosalize with time (**see figure, Supplemental Digital Content 4**, which displays patient 3, shown 1-month postoperatively with mucosalization of rectus muscle over anterior vaginal wall defect, *http://links.lww.com/PRSGO/A613*; **see figure, Supplemental Digital Content 5**, which displays patient 3, healed abdominal port sites, *http://links.lww.com/PRSGO/A614*).

This is preferable to a skin paddle that requires significant maintenance hygiene due to the constant epithelial shedding. Another significant advantage of the laparoscopic harvest is the sparing of the anterior rectus sheath. In our study, similar to prior reports of minimally invasive harvest of the rectus, no patients had mesh reinforcement of the abdominal wall, and none developed abdominal wall bulges. Additional minimally invasive options for reconstruction of the perineum following APR include a laparoscopic harvest of the omentum (although this may not reach for deep pelvic defects) and a laparoscopic harvest of the gracilis.

Disadvantages of these minimally invasive approaches include the technical challenge, as laparoscopic surgery lacks tactile feedback for the surgeon who is used to open surgery. An additional cutaneous flap may be needed in addition to the rectus, in APR cases. It should be noted, however, in the 2 reports of the use of the laparoscopic rectus in perineal reconstruction, no additional flap was used.[10,11]
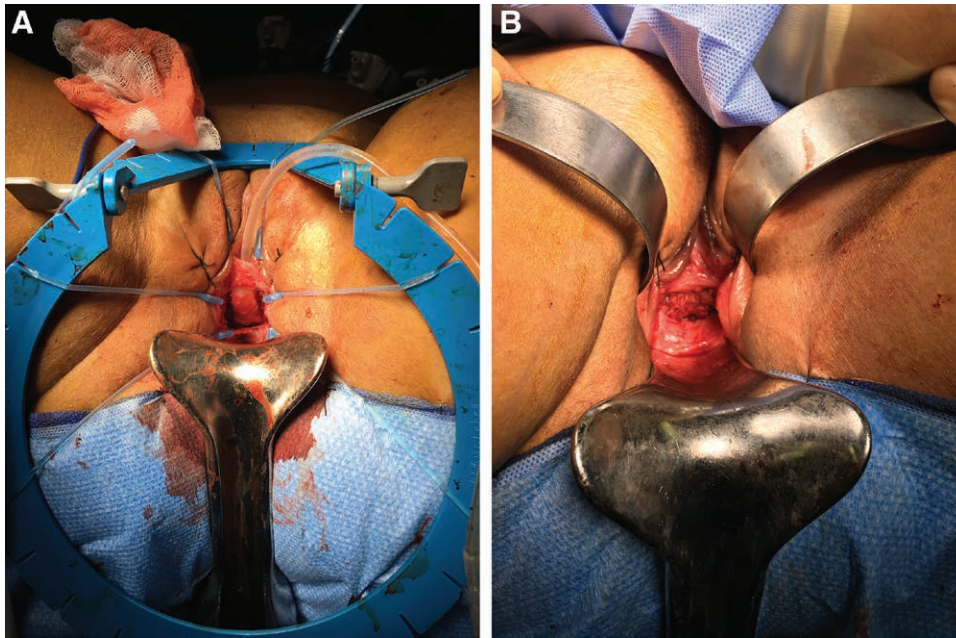
Fig. 2. A, Anterior vaginal wall defect before repair. B, Anterior vaginal wall defect after repair and rectus muscle inset.
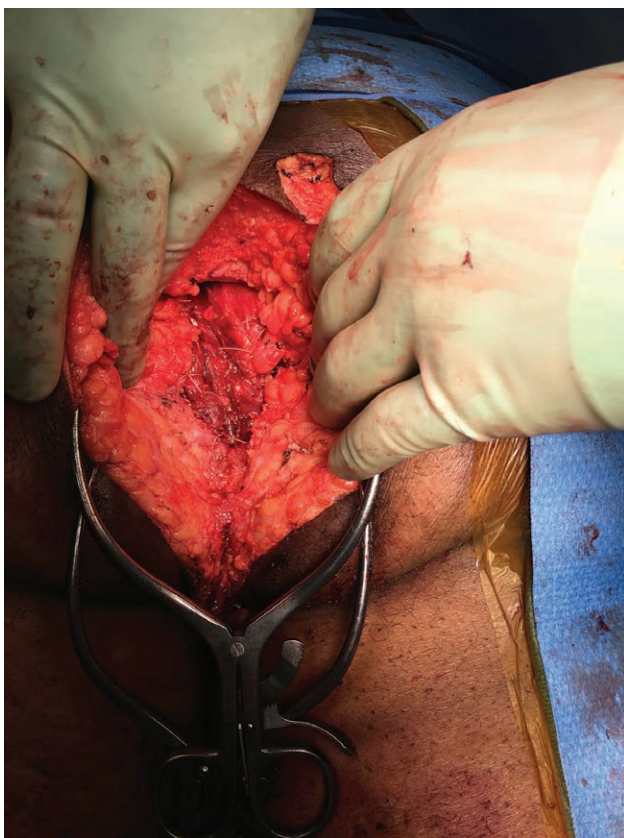

Fig. 3. Rectus muscle in situ over perineal defect after inset on patient 1.

CONCLUSIONS

In this preliminary study, we have shown that the laparoscopic harvest of the rectus abdominis appears to be a feasible, reproducible technique that decreases the mor-bidity associated with the traditional harvest of this versatile flap in perineal reconstruction. Minimally invasive techniques are finding a new home in plastic surgery and represent a new paradigm shift in the modern day practice our specialty. With the current focus on enhanced recovery after surgery, minimally invasive techniques are playing an increasingly significant role in other surgical specialties, and we as reconstructive surgeons, need to follow suit. More and larger clinical studies, including randomized control trials, are needed to further validate and establish this technique and its efficacy for perineal reconstruction.

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