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Robotic Repair of Supratrigonal Vesicovaginal Fistula with Sigmoid Epiploica Interposition

Derrick J. Sanderson, DO, John Rutkowski, MD, Bashir Attuwaybi, MD, Abeer Eddib, MD

ABSTRACT

Introduction and Hypothesis: In the United States, vesicovaginal fistula (VVF) most often results from gynecologic surgery causing significant morbidity and distress to both the patient and surgeon. The use of tissue interposition at time of primary repair has been advocated to decrease the risk of recurrence. The aim of this study is to describe our experience with interposition of sigmoid epiploica during robotic extravesical repair of supratrigonal VVF.

Methods: This is a retrospective case series from June 2015 to September 2016. Features of the surgical technique include 1) cystoscopic ureteral catheterization, 2) cannulation of the fistula, 3) mobilization of the bladder from the vagina, 4) removal of the epithelialized edges of the fistulous tract, 5) single-layer closure of the vagina, 6) tension-free layered closure of the bladder, 7) retrograde fill of the bladder to ensure water-tight repair, 8) interposition of sigmoid epiploica appendage(s), and 9) prolonged bladder drainage with indwelling transurethral catheter.

Results: In total, 5 women underwent successful robotic VVF repair with epiploic appendage interposition. Mean surgical time was 218 minutes with an average console time of 147 minutes and an estimated blood loss of 49 mL. Most the patients were discharged to home on postoperative day 1 with no untoward effects due to the epiploica interposition. There have been no recurrences to date.

Conclusions: Robotic repair of VVF with sigmoid epiploica interposition is efficient and well tolerated. Use of this technique may increase the number of patients eligible for tissue interposition.

Key Words: Robotic, Sigmoid epiploica, Vesicovaginal fistula.

Millard Fillmore Suburban Hospital, Williamsville, New York, USA (Dr. Sanderson).

Western New York Urology Associates, Cheektowaga, New York, USA (Drs. Eddib and Rutkowski).

Buffalo Medical Group, Colorectal Surgery Department, Williamsville, New York, USA (Dr. Attuwaybi).

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Address correspondence to: Abeer Eddib, MD, Western New York Urology Associates, 3085 Harlem Road, Suite 200, Cheektowaga, NY 14225. Telephone: 716-844-5000, Fax: 716-844 Telephone 5050, E-mail: aeddib@wnyurology.com

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INTRODUCTION

Vesicovaginal fistula (VVF) is an abnormal epithelialized communication between the bladder and vagina.[1] In the United States, VVF most commonly occurs after gynecologic surgery.[2,3] Surgical correction of vesicovaginal fistulae (VVF) has been burdensome to both the patient and surgeon.[2–6] Successful repair is dependent upon a multitude of factors including fistula size, location, timing of antecedent injury, previous radiation, use of tissue interposition, surgeon skill, repair technique, surrounding tissue quality, and postoperative bladder drainage.[3,6–8]

Increased utilization of laparoscopy for repair of VVF has decreased patient morbidity and convalescence compared to an open abdominal approach, without increasing the risk of surgical failure or recurrence.[9–14] The use of robotic surgical platform in VVF repair has gained popularity since the first case was reported by Melamud et al[16], citing the advantages of 3-dimensional visualization and improved dexterity afforded by the wristed instruments.[15,16]

Although controversial, the use of tissue interposition during primary repair of a simple VVF has been advocated to improve healing and decrease the risk of recurrence.[18,19] Vascularized omentum is the most commonly used tissue for interposition, but poses technical limitations due to flap formation and access to the upper abdomen.[3,7,13,20] Interposition of sigmoid epiploica appendage(s) during

VVF repair has been successful but there is limited perioperative data associated with this technique.[14,17]

The aim of this study is to describe our technique and experience with sigmoid epiploica interposition during robotic repair of supratrigonal VVF using an intraperitoneal extravesical technique.

MATERIALS AND METHODS

After receiving approval from the University of Buffalo (Buffalo, New York, USA) Institutional Review Board, we identified all women who had undergone robotic VVF repair with sigmoid epiploica tissue interposition performed at Millard Fillmore Suburban Hospital (Williamsville, New York, USA) prior to the time of chart review in January 2017. Patients were identified using diagnosis code (ICD-10 N82.0 for vesicovaginal fistula) and surgical procedure code (CPT51999 for laparoscopic vesicovaginal repair). Clinical and surgical data was extracted from the outpatient and hospital electronic medical records. The study manuscript was prepared using the recommendations provided in the Preferred Reporting of Case Series in Surgery; the PROCESS guidelines.[21]

Preoperative fistula evaluation is not standardized. Outpatient identification of the VVF was made by the patient's gynecologist who then referred the patient for further urologic evaluation and repair. Fistula evaluation included physical examination, cystourethroscopy and retrograde cystogram, or contrast-enhanced computed tomography.

All surgeries were performed under the guidance of a board certified urogynecologist (author AE), who has expertise in robotic surgery. Patients eligible for the procedure elected to proceed with robotic VVF repair after surgical counseling and failing bladder drainage with a transurethral catheter. Preoperatively, all patients received appropriate prophylactic antibiotics at induction of anesthesia. Patients were then positioned in low lithotomy using Allen stirrups (Allen Medical Systems, Acton, Massachusetts, USA) with arms tucked and padded at their sides and antiskid measures employed. After routine sterile prep and draping, cystoscopy was performed with placement of bilateral ureteral catheters and the fistulous tract was cannulated with an open-ended catheter.

Five port intraperitoneal access was established. The da Vinci Surgical System (Intuitive Surgical, Sunnyvale, California, USA) was docked in routine fashion. If needed, adhesiolysis was performed to provide adequate exposure of the operative field. The bladder was mobilized from the vagina using sharp dissection with minimal electrosurgery, allowing for a tension-free double-layered closure of the bladder. The epithelialized edges of the fistula were resected and the cannulating catheter was cut and removed. The vagina was closed in a single-layer using 0-Vicryl (Ethicon, Cincinnati, Ohio, USA) and double-layer bladder closure was performed with 3-0 Vicryl (Ethicon, Cincinnati, Ohio, USA). The integrity of the suture lines was then tested by back-filling the bladder > 250 mL of sterile water. The bladder was drained and sigmoid epiploica appendage(s) were selected. It is important to choose epiploica that are long enough to span the suture lines of the repair without displacing the colon, allowing the appendage(s) to be anchored to the distal vagina with delayed absorbable sutures, while avoiding relocation of the sigmoid colon between the bladder and vagina. Ureteral catheters were removed and cystoscopy was performed to confirm ureteral patency and the absence of injuries. An indwelling transurethral catheter placed for prolonged post op bladder drainage. Patients underwent outpatient examination, catheter removal, and cystourethrography 10 to 14 days postoperatively.

Patients were seen again at 6 weeks from surgery for routine follow up and then scheduled as needed for symptomatic complaints.

RESULTS

Five robotic VVF repairs with sigmoid epiploica interposition were identified during the study period. The first procedure was performed in June 2015. Patient demographics are described in Table 1. Mean age at time of surgical repair was 51.8 years (range, 43–67 years) with a mean body mass index of 32.4 kg/m^2 (range, 31.0–33.5 kg/m^2). Median gravidity was 3 (range, 1–5) and a median parity of 3 (range, 1–4).

Documentation of fistula dimensions was not reliably present within the medical record. All fistulas were reported as being <1 cm in the available documentation.

Perioperative robotic VVF repair data are presented in Table 2. Median time to repair was 77 days (range, 60–129 days) from the antecedent procedure. Mean surgical time was 218 minutes (range, 151–353 minutes) with a mean robotic console time of 147 minutes (range, 94–231 minutes). All but one of the cases required extensive adhesiolysis. Patients experienced an average Estimated Blood Loss (EBL) of 49 mL (range, 30–70 mL) during robotic fistula repair. On average patients were administered 5.2 morphine-milligram equivalents (range, 0–10) in the post anesthesia care unit

Table 1.
Patient Demographics

Patient Number	Age	ASA	BMI	Gravidity	Parity	Obstetric History	Surgical History	Medical History	Tobacco Use
1	53	2	33	5	3	Vaginal ×3	Laparoscopic sleeve gastrectomy, laparoscopic appendectomy	OSA	Current
2	46	2	33	2	2	Cesarean ×2	Laparoscopic sleeve gastrectomy, laparoscopic cholecystectomy	Neurocytoma, hypothyroid	Former
3	43	2	31	5	4	Cesarean ×4	Open appendectomy, tubal ligation, fulguration of endometriosis	Hypothyroid, Chiari malformation, Endometriosis	Denies
4	67	3	33.5	1	1	Vaginal	Supracervical hysterectomy, midurethral sling	COPD, RA, breast cancer	Current
5	50	2	31.6	3	3	Cesarean ×3	None	Hypothyroid	Current
Mean	51.8		32.4						

ASA, American Society of Anesthesiologists; BMI, body mass index (kg/m^2); COPD, chronic obstructive pulmonary disease; OSA, obstructive sleep apnea; RA, rheumatoid arthritis.

Table 2.
Perioperative Fistula Repair Data

Patient Number	Days to Repair	Surgical Time (minutes)	Console Time (minutes)	EBL (mL)	Adhesiolysis	Location	PACU Time (minutes)	MME in PACU	LOS (days)
1	75	239	176	50	Extensive	Supratrigonal	118	8	2
2	129	196	130	75	Extensive	Supratrigonal	201	10	1
3	115	151	103	30	Extensive	Supratrigonal	317	8	3
4	77	152	94	40	Minimal	Supratrigonal	107	0	1
5	60	353	231	50	Extensive	Supratrigonal	85	0	1
Mean	91.2	218.2	146.8	49			165.6	5.2	1.6

ASA, American Society of Anesthesiologists; LOS, length of stay in days; MME, morphine-milligram equivalents; PACU, post anesthesia care unit.

and 3 of patients were discharged on postoperative day 1 (range, 1–3 days).

Details about the antecedent procedure are presented in Table 3. Outside of the Loop electrosurgical excision procedure (LEEP), benign hysterectomy was the most common antecedent procedure with 3 of the 4 (75%) hysterectomies performed using an open approach. The mean estimated blood loss in the inciting hysterectomy was 190 mL (range, 50–600 mL). Post procedure cystoscopy was performed following the laparoscopic hysterectomy.

There were no adverse events or perioperative readmissions. There have been no recurrences to date.

DISCUSSION

The use of the robotic surgical platform in VVF repair has gained popularity since the first case series by Melamud et al[16] due to the enabling wristed instrumentation and decreased morbidity when compared to an open approach.[22,26] Safety and feasibility of the procedure have been confirmed through multiple publications.[15–16,26–28]

The mean surgical time of 218 minutes and a robotic console time of 147 minutes (range, 94–231 minutes) in this case series is comparable to the 233 min reported by Sundaram et al[22] and 214 minutes reported by Agrawal et

Table 3.
Inciting Procedure Data

Patient Number	Antecedent Procedure	Surgical Time (minutes)	EBL (mL)	Concomitant Procedures	Intraoperative Cystoscopy
1	TAH	Unavailable	200	BSO	No
2	SCH	Unavailable	50	None	No
3	TAH	204	600	BSO	No
4	LEEP	Unavailable	0	N/A	No
5	TLH	139	100	Ureteral catheters	Yes
Mean			190		

BSO, bilateral salpingo-oophorectomy; EBL, Estimated blood loss (mL); LEEP, loop electrosurgical excisional procedure; SCH, supracervical hysterectomy; TAH, total abdominal hysterectomy; TLH, total laparoscopic hysterectomy.

al.[23] Bora et al[17] reported a mean surgical time of 133 minutes for robotic VVF repair in a case series of 30 patients. Eighteen patients in that series had tissue interposition, with sigmoid epiploica interposed in 10 cases.[17] Unfortunately, there is no delineation of perioperative data by use and type of tissue interposition.

There were no adverse events or perioperative readmissions following our case series. Average estimated blood loss (EBL) was 49 mL, which is similar to other published data on robotic VVF repair.[16,17,22,23] Analgesia requirements in post anesthesia care unit were minimal with an average of 5.2 morphine-milligram equivalents administered. Three of the 5 patients were safely discharge on postoperative day 1, consistent with previously published reports.[22,23]

Based upon review of in-patient and outpatient electronic medical records across multiple health care systems within the western New York region, all patients within our data set remain without symptomatic recurrence postoperatively (range, 5–19 months at manuscript submission). These findings are consistent with a recent systematic review by Miklos et al[14] noting a success rate of 98.4% robotic VVF repair, but this data must be interpreted with caution due to the limitation of post-procedure followup. All patients were evaluated 10 to 14 days following surgery for catheter removal and cystourethrography to assess the integrity of the repair. An additional examination is performed 6 weeks after surgery with further evaluation as needed based upon return of symptoms. Admittedly, given the nature of this clinical practice VVF recurrence may have occurred following the primary surgery that we are unable to capture.

Although controversial, tissue interposition during primary VVF repair has been advocated as it may decrease recurrence risk.[18,19] Sigmoid epiploic appendage(s) are conveniently located tissue providing an excellent buttress with vascular and lymphatic access.[24,25] Outcomes data are limited on VVF repair with sigmoid epiploica tissue interposition due to study design and data reporting.

To our knowledge, this is the first analysis including only VVF repairs with epiploic appendage interposition. These physiologic, pedunculated fatty structures range from 0.5 to 5 cm in length and contain 2 arterioles and one venule, providing vascular support for the appendage and local lymphatic support.[24,25] Potential disadvantages for interposition of epiploica appendages include torsion of the appendage with resultant ischemia or infarction, acute epliploic appendagitis, secondary inflammation, and infarction.[24] These complications occur rarely[24] and have not been reported in relation to interposition during VVF repair. Another potential disadvantage is the increased operative time associated with tissue interposition, however it is the authors' opinion that the incorporation of the technique is efficient and the potential for a decreased recurrence rate outweighs the marginal benefits one may experience due to the decreased operative time.

Limitations of this study include the retrospective nature, small sample size, and the single-surgeon design, which may introduce effect bias and decrease the generalizability. Additionally, fistula size dimensions and surrounding tissue health were not reliably present within the medical record. However, given the overall rarity of VVF and the aim of this study, the authors feel that the data from this analysis can be additive to the overall knowledge regarding VVF repair.

Use of sigmoid epiploic appendage interposition during robotic repair of supratrigonal VVF is well tolerated and provides an effective primary surgical option for repair of iatrogenic VVF. It may provide an opportunity for improved efficiency and increase the number of patients eligible for tissue interposition. Further research is needed to elucidate the potential benefits of epiploica interposition compared to interposition of other tissues.

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