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Research Article

Results of Cremasteric Interposition Flaps and Comparison to Gracilis Muscle Flaps for Rectourinary Fistula Repairs

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Abstract

Objective: To report our experience using a perineal approach with a Cremaster Muscle Interposition Flap (CIF) for treatment of patients with symptomatic RUF.

Materials and Methods: We identified all patients undergoing RUF repair at a single institution from January 2001 to June 2014. Demographic information, fistula etiology, surgical approach and outcomes were reviewed and compared.

Results: 26 patients who underwent RUF repair were identified. Initial repair was performed using CIF in 12 patients, Gracilis Interposition Flap (GIF) in 13 and Rectus Myocutaneos Flap (RMF) in one. Fistulas were categorized as complex in the setting of prior radiation therapy, salvage cryoablation, or when APR (abdominoperineal resection) was performed (69.2%), and simple in the setting of radical prostatectomy, hemorrhoidectomy or trauma (30.8%). In the CIF group, 3 (25%) patients had a successful initial repair. The majority of patients (88%) who failed initial repair with CIF had radiation-induced fistulas. In the GIF group, 11(84.6%) had successful repair with initial surgery. The use of GIF or RMF resulted in improved success in complex fistula repair as compared to CIF (p=0.004). There was no difference seen in success of simple fistula repair when comparing GIF and CIF (p=0.17).

Conclusions: Perineal repair of RUF using CIF is a novel approach with potentially less morbidity than larger muscle interposition flaps. The CIF is not indicated in complex RUF but can be an effective adjuvant tissue flap in patients with a simple fistula.

Introduction

Rectourinary Fistulas (RUF) are abnormal epithelialized tracts between the rectum and the urinary tract, specifically the bladder, urethra or ureter. This rare but potentially devastating complication can arise for various reasons including: iatrogenic injuries to the rectum during pelvic surgeries such as radical prostatectomy, or Abdomino-Perineal Resection (APR), as well as in the setting of pelvic radiation, malignancy, infection and trauma. RUF is reported in 0-3% of radical prostatectomies, with no difference in incidence based on surgical approach [1-4]. The incidence of RUF after other local therapy for prostate cancer varies depending on the procedure: cryosurgical ablation is reported to be 1-3.4% [5-9], brachytherapy approximately 0.3 to 3% [10-12] and External Bean Radiotherapy (EBRT) about 0-0.6% [13,14]

While successful conservative management of small fistulae has been reported, the majority of patients will ultimately require surgery [4]. In patients managed conservatively the combination of urethral catheterization with fecal diversion has been shown to be successful in up to 33% of patients at 3 months [4]. In patients who do not have spontaneous closure of the fistula after diversion, surgical repair is recommended. While repair may be approached through various incisions, the general principles remain the same including excision of the diseased or ischemic tissue, separation of the fecal and urinary tracts and the interposition of a well-vascularized tissue flap [1,4]. Options for tissue interposition traditionally include rectus abdominis, gracilis, or gluteus muscle, which require additional incisions, considerably increased OR time and are associated with potential significant morbidity with the harvest of such tissue. As such, some patients may be

poor candidates for these somewhat advanced and challenging procedures, and present a problem to the treating surgeon. The use of testicular and tunica vaginalis interposition flaps have been reported [15,16] We report our experience using a perineal approach with a novel cremasteric flap for the treatment of RUF, based off the principles of female Martius flap.

Materials and Methods

After obtaining IRB approval, we retrospectively reviewed the medical records of patients who underwent repair of a recto-urinary fistula by a single surgeon at our institution from January 2001 to June 2014. A total of 26 patients were identified as having undergone RUF repair. All were performed via a transperineal approach with a cremasteric interposition flap used in 12 cases, a gracilis flap in 13 cases and a myocutaneous rectus flap in one. Cremasteric muscle flaps were harvested by the Urologist, while gracilis and rectus muscle flaps were harvested by a single consulting Plastic surgeon. Choice of flap for each case was made by the Urologist, frequently in consultation with the Plastic Surgeon after exposure of the fistula was performed. Surgical technique for exposure of the fistula was similar for all flap harvests and did not vary with the interposition flap used. The patient was placed in an exaggerated lithotomy position. An inverted U was made from one ischial tuberosity to the other, joining at the junction between the squamous epithelium and the myocutaneous border of the rectum. The central perineal tendon was identified and transected. The rectal sphincter and levator ani were dissected free from the rectum and retracted anteriorly and laterally using a perineal Book Walter retractor. The rectourethralis, if still present, was then identified and divided. The fistula was identified, and the adjacent GU tissue and rectal tissue were completely separated. The resulting defect on both the urinary and the rectal side were then individually closed primarily with absorbable suture. A gracilis, rectus abdominis or a cremasteric flap was then harvested and interposed between the repaired urinary and GI tracts.

The cremasteric flap was harvested by delivering the testicle via a transverse incision in the scrotum and dissecting the cremaster muscle fibers from the spermatic cord structures. Attempt was made at isolating the cremaster muscle on a wide pedicle while carefully preserving any feeding blood vessels. The muscle was then delivered into the perineal wound through a subcutaneous tunnel and interposed between the urinary tract and rectum. The perineal incision was then closed in multiple layers (Figure 1).

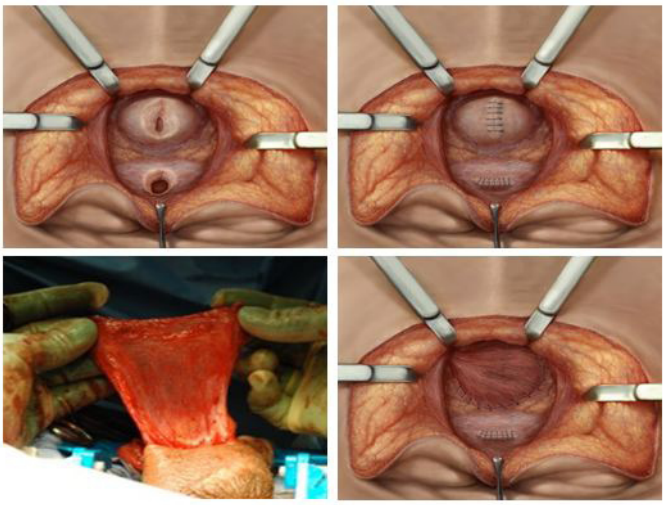

Figure 1: Cremasteric myocutaneous interposition flap: **A:** The fistula is identified and the adjacent GU tissue and rectal tissue are completely separated. **B:** The resulting defects on both the urinary and rectal side are individually closed primarily with absorbable suture. **C:** A highly vascularized thin muscle cremasteric flap is harvested by delivering the testicle via a transverse incision in the scrotum and dissecting the cremaster muscle from the spermatic cord. **D:** The cremaster flap is delivered into the perineal wound through a subcutaneous tunnel and interposed between the repaired urinary tract and rectum. Drawings by RE Schneider, MS. Medical Illustrator University of Toledo.

A urethral foley and suprapubic catheter were left in place for urinary diversion and a Penrose drain was left in the perineal incision and removed prior to discharge. No strict activity restrictions were instituted after a cremasteric muscle flap, however after gracilis flap, patients were restricted from applying pressure directly to the ischial tuberosity for the first 2-4 weeks. All patients underwent voiding cystourethrography 6 weeks postoperatively to confirm successful repair, at which time the urethral catheter was removed with subsequent suprapubic tube removal the following week. Successful RUF repair was defined based on a post-operative voiding cystourethrogram without evidence of contrast extravasation. Statistical analysis was performed using the statistical package SPSS (version 21, IBM Corp.), and $P<.05$ was considered statistically significant.

Results

A total of 26 patients underwent fistula repair; 12 by

cremasteric interposition flap, 13 by gracilis interposition flap, and 1 by rectus myocutaneous flap. All patients underwent proximal fecal diversion prior to repair. Initial repair was performed at a median age of 63 (21-83) years. Fistulas were categorized as complex where radiation therapy, salvage cryoablation or APR were performed (69.2%) and simple in the setting of radical prostatectomy, hemorrhoidectomy or trauma (30.8%). Etiology of the RUF is seen in (Table 1).

	Cremaster Flap	Gracilis Flap
Mean Age (range)	75 (60-92) years	62 (24-84) years
Race (N, %)		
African American	7 (58.3)	8 (61.5)
Caucasian	4 (33.3)	5 (38.5)
Asian	1 (8.3)	0
Etiology of Fistula (N, %)		
Radiation therapy	5 (41.7)	4 (30.8)
Salvage cryo s/p radiation	4 (33.3)	4 (30.8)
Prostatectomy	3 (25.0)	3 (23.0)
Hemorrhoidectomy	0	1 (7.7)
Gunshot wound	0	1 (7.7)
Hyperbaric Oxygen (N, %)	7 (58.3)	8 (61.5)
Location of Fistula (N, %)		
Prostate	6 (50.0)	9 (69.2)
Bladder neck	4 (33.3)	4 (30.8)
Bladder	2 (16.7)	0
Mean EBL (range)	147.7 (25-400)	148.8 (20-420)
Mean Days in Hospital (range)	2.1 (1-3)	2.3 (1-10)

Table 1: Patient Demographics.

The prostatic urethra was the most common site of fistula (61.5%), followed by bladder neck (30.8%), and bladder trigone (7.7%). Hyperbaric oxygen was performed in 57.7% of patients prior to RUF repair and was not associated with improved success in initial closure for either complex or simple fistulas (p=0.16, 0.69). Median follow-up was 8.8 (1-44) months. In the CIF group, 3 (25%) patients had a successful initial repair. Of the 9 that failed, 2 subsequently undergoing successful second CIF, 4 with successful subsequent GIF and 2 lost to follow-up. One patient failed a repeat CIF. Radiation was the cause of RUF in 88% of patients who failed initial repair compared to 33% in patients with successful initial repair (p= 0.12). In the GIF group, 11 of 13(84.6%) had successful repair with the initial surgery. One patient in the GIF group underwent repeat successful GIF repair and one patient was lost to follow-up. History of radiation was present in 54% of patients who were successfully treated with GIF (Table 2).

	Cremaster Interposition Flap		Gracilis Interposition Flap	
	Successful Repair	Fistula Recurrence	Successful Repair	Fistula Recurrence
Mean Age (range)	70.3 (66-78)	76.1 (60-92)	61.4 (24-84)	66 (58-74)
Race (N, %)				
AA	2 (66.7)	5 (55.6)	7 (63.6)	1 (50.0)
Caucasian	1 (33.3)	3 (33.3)	4 (36.4)	1 (50.0)
Asian	0	1 (11.1)	0	0
Etiology (N, %)				
Radiation	1 (33.3)	4 (44.4)	2 (18.2)	2 (100)
XRT + Cryo	0	4 (44.4)	4 (36.4)	0
Surgery	2 (66.7)	1 (11.1)	4 (36.4)	0
Trauma	0	0	1 (9.0)	0
HBO (N, %)	0	7 (77.8)	6 (54.5)	2 (100)
Location (N, %)				
Prostate	1 (33.3)	5 (55.6)	8 (72.7)	1 (50.0)
Bladder neck	1 (33.3)	3 (33.3)	3 (27.3)	1 (50.0)
Bladder	1 (33.3)	1 (11.1)	0	0

Table 2: Patient Characteristics associated with successful fistula repair.

Initial repair of simple fistulas was more successful than complex fistulas (p=0.04). Eight (44.4%) complex fistulas had successful initial repair (6 GIF, 1 CIF and 1 rectus myocutaneous flap). Of the 10 that failed initial complex fistula repair, 8 (80%) had undergone primary CIF and 2 (20%) had undergone primary GIF. The use of GIF or RMF resulted in improved success in complex fistula repair as compared to CIF (p=0.004). Of those who underwent repair of a simple fistula, 7 (87.5%) had successful initial repair (5 GIF and 2 CIF), and one failed CIF. There was no difference seen in success of simple fistula repair when comparing GIF and CIF (p=0.17).

Complications included post-operative stress urinary incontinence which occurred in 8 patients (30.8%) managed with condom catheters and/or pads in 6 patients, AUS in one patient and urethral sling in one patient. Two patients had post-operative urethral strictures, one managed with indwelling suprapubic catheter and one treated with a single dilation of the stricture. There were no post-operative testicular complications with no reported post-operative testicular pain, atrophy or need for scrotal exploration. Of the patients who had successful fistula repair, 20 of 22 patients (90.1%) underwent reversal of their colostomy. One patient failed initial attempt at reversal of the colostomy and was lost to follow up, and the second patient was lost to follow-up. Of the eleven initial unsuccessful fistula repairs, seven (63.6%) underwent successful repeat closure. Four patients (15.4%) failed attempts at fistula closure: two were lost to follow-up, one failed repeat attempt at repair with a third attempt deferred due to significant cardiopulmonary comorbidities, and one elected for conservative management with fecal and urinary diversion.

Discussion

Management of RUF is highly variable; with over 40 different techniques described for fistula repair and no general consensus as to optimal treatment [17,18]. Principles of successful fistula repair include complete excision of the fistula tract, watertight closure of the involved urinary and GI viscera in a multilayered and non-overlapping fashion, and interposition of healthy vascularized tissue to maintain adequate blood flow to the repair. Historically, the favored technique for repair of RUF has been the posterior transanosphincteric transluminal approach, with reported success rates of 75-100% for repair of simple fistulas less than 2cm in size [19-21]. Failure rates utilizing this technique approach 50% in patients with large or complex fistulas.[20-21] Exposure of the bulbar and membranous urethra is difficult with the posterior transanosphincteric approach, making repair of larger, more complex fistulas challenging. With a reported 9-26% incidence of fecal transanal fistulization and fecal incontinence, this approach is reserved for small, simple, surgically-induced fistulas in patients with no known risk of anorectal dysfunction [20,22].

Radiation causes damage to pelvic microvasculature and results in tissue fibrosis placing these patients at an increased risk of fistula recurrence. With increased use of brachytherapy and external beam radiation, over 50% of all fistula cases reported in the literature have involved exposure to radiation therapy [20]. In these patients, the transperineal approach for RUF repair is preferred. This approach allows for wide exposure of the rectum and urethra for urethral reconstruction and tissue interposition. Interposition of healthy, vascularized tissue by means of a myocutaneous flap is critical for the repair of RUF in irradiated patients as this separate suture lines, provides ample vascular supply, and fills dead space [20,23]. A number of tissue interposition options exist, with the gracilis muscle interposition flap being the most commonly utilized. The gracilis muscle, located far out of the radiation field at the medial aspect of the thigh, with a consistent proximal blood supply from branches of the medial circumflex femoral artery, has only vestigial function making it a convenient flap choice for perineal reconstruction with only minimal associated functional deficits when harvested [24,25]. The use of these flaps is not without risk however, with minor complications including hematoma and seroma formation, local wound infection, minor dehiscence, partial flap loss and paresthesia reported in 19-43% of patient who undergo gracilis flap reconstruction and major complications including fluid collections requiring drainage, wound dehiscence and total flap loss reported in 12-42% [26-30]. Vertical Rectus Abdominis Myocutaneous (VRAM) flaps are an alternative myocutaneous flap, however as the size of the defect decreases, the ability to fit the flap into the perineum can be challenging. VRAM flaps pose an additional risk in patients who already have or may require future colostomy or urostomy creation as removal of the rectus muscle limits stoma locations and increases the risk of parastomal hernia formation [25]. VRAMS are also associated with patient morbidity with subsequent weakening of the abdominal wall and hernia rates up to 10%, minor complication rates of up to 50% and major complication rates of up to 29% [26,30]. As such, many surgeons have sought alternative interposition flaps to use during transperineal repair of a RUF.

The cremasteric flap, based off the female Martius flap, obtains its blood supply from the cremaster artery, a branch of the inferior epigastric artery, which remains outside of the radiation field, making it an ideal choice for an alternative interposition flap. Harvest of this flap is a straightforward technique that has less potential associated morbidity and is less invasive than other interposition flaps. In our novel series, it proved to be successful for simple fistulas when there is no history of prior radiation therapy, and with no reported harvest site complications. The CIF flap is a thinner, more delicate tissue flap than the GIF or RIF and is ideal for smaller, surgical RUF. In our novel series, the CIF is not sufficient for interposition during repair of complex RUF where a

larger tissue volume with a more robust blood supply is required to fill the resulting dead space and promote tissue healing. Our fistula closure success rates with GIF of 84.6% overall (100% success for simple fistula repair and 77.8% success for complex fistula) are consistent with the reported success rates in the literature of 81-100% for simple fistula and 67-87% for complex fistula [20,21,23]. Our study is limited by the retrospective nature, relatively small sample size and significant heterogeneity of our study population. The choice of flap was left to the discretion of the primary surgeon, biasing which patients received one flap versus another. Larger, prospective, randomized controlled studies would be required to directly compare the efficacy of various RUF techniques.

Conclusions

Perineal repair of RUF using CIF is a novel approach with potentially less morbidity than larger muscle interposition flaps. This technique is useful for simple RUF but is not indicated complex fistulas. For complex, ischemic fistulas, a bulkier, more vascularized flap such as GIF or RMF is effective.

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