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OUTCOME OF URETHRAL RECONSTRUCTIVE SURGERY IN A SERIES OF 74 WOMEN

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ABSTRACT

Purpose: We evaluated the results of vaginal flap reconstructive surgery of the female urethra.

Materials and Methods: A series of 74 consecutive women who presented with urethral pathology requiring surgical reconstruction were assessed for anatomical and functional outcome. Followup was 1 to 15 years (median 1.5). Outcome assessment included success or failure of the anatomical repair based on physical examination as well as voiding habits and continence assessed by voiding diary, questionnaire and patient self-assessment.

Results: A total of 74 procedures were performed, including 72 vaginal flap repairs (56 with a concomitant pubovaginal sling). Five vaginal flap repairs were performed with a concomitant modified Pereyra procedure and 1 was done with Kelly plication. A patient in whom vaginal flap repair was planned underwent a Tanagho anterior bladder flap procedure, 1 underwent extensive lysis of urethral and periurethral scarring with primary urethral repair and 12 underwent vaginal flap repair without an incontinence procedure. A total of 72 women with an average age ± SD of 54 ± 13 years were followed a median of 1.5 years after vaginal flap reconstruction and 2 were lost to followup. Of the 62 patients with preoperative incontinence 54 (87%) considered themselves cured or improved. Successful anatomical repair by single procedure vaginal flap repair was achieved in all except 5 patients (93%).

Conclusions: Single stage vaginal flap reconstruction with concurrent pubovaginal sling and Martius flap graft has a high degree of anatomical and functional success for treating a difficult surgical problem.

KEY WORDS: urethra, surgical flaps, reconstructive surgical procedures, vagina

It is uncommon for urethral pathology in women to require reconstructive surgery. However, when anatomical disorders of the bladder neck and urethra result in persistent incontinence or urinary tract obstruction, surgical intervention can potentially restore anatomy and function. It is well known that worldwide the most common cause of severe lower urinary tract damage in women is obstetric trauma secondary to prolonged obstructed labor in the absence of available operative intervention. In the developed world the more common causes of urethral injury include trauma, iatrogenic injury at urethral diverticulectomy, bladder neck suspension, endoscopic surgery and gynecologic surgery, such as vaginal hysterectomy or anterior vaginal repair.[1] Urethral erosion can result from synthetic materials used in these procedures or from anti-incontinence surgery, or it may be due to long-term indwelling catheters in neurologically impaired or comatose patients.[2] Urethral damage is also a potential sequela of radiotherapy for pelvic malignancy and related procedures.[3]

There are several surgical approaches to the reconstruction of the urethra, vagina and bladder neck, including anterior and posterior bladder flaps and vaginal flap reconstruction.[4] We report our cumulative experience with urethral reconstructive surgery and outcome in 74 women.

MATERIALS AND METHODS

The medical records of 74 consecutive women who underwent reconstructive surgery of the urethra between January 1983 and July 2001 were reviewed. Followup was 1 to 15 years (median 1.5). In all patients the preoperative history was obtained, and physical examination, urinalysis, urine culture, cystoscopy and videourodynamic study were done. Bilateral retrograde pyelography was performed in patients with urinary fistulas.

In cases of minimal disruption anatomy and function were restored by primary repair with a single layer of simple interrupted sutures. If the extent of the injury or defect precluded this repair, vaginal flap reconstruction was performed. Bilateral incisions were made parallel to the urethra to mobilize the vaginal wall, which was then sutured together in the midline over a 14Fr urethral catheter (fig. 1). If lateral tissue appeared insufficient, a U-shaped vaginal wall incision was made and rotated anteriorly to create the posterior wall of the neourethra. Finally, if extensive scarring of the anterior vaginal wall precluded the creation of a local flap, an oval-shaped incision in the labia minora was made as the base of a rotational flap, which could then be used as a neourethra (fig. 2). Vaginal wall defects created by the flaps were closed primarily or using rotational flaps of adjacent vaginal wall or labia minora. In 1 case at the beginning of the series gracilis myocutaneous flaps were used, and in most cases a Martius labial fat pad graft was used to bolster the closure.

However, in 4 cases omental flaps or gracilis myocutaneous flaps were used. An autologous fascia pubovaginal sling was used in all patients with preoperative sphincteric incontinence, in the majority of whom extensive dissection in the vicinity of the bladder neck (that is fistula repair) was a risk factor for postoperative incontinence, and in those with a urethrovaginal fistula and sphincteric incontinence in whom urine leaked through the fistula and/or urethra. In patients

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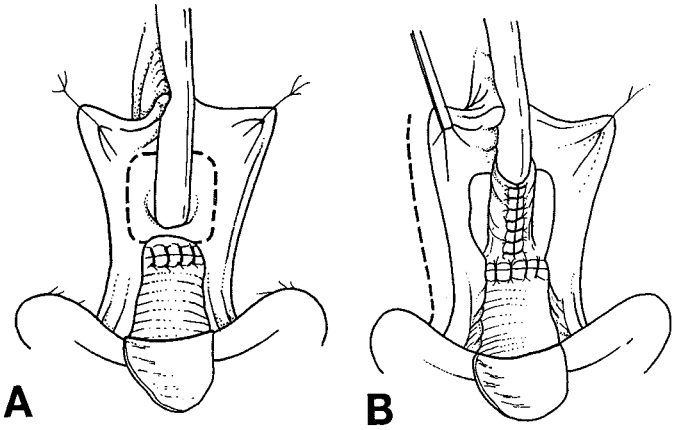

FIG. 1. Vaginal flap urethral repair. *A*, 2 parallel incisions are made on either side of urethra and inverted "U" incision is made just cephalad to urethral defect. *B*, resulting flaps are sutured in place around catheter using 3 or 4-zero chromic catgut.

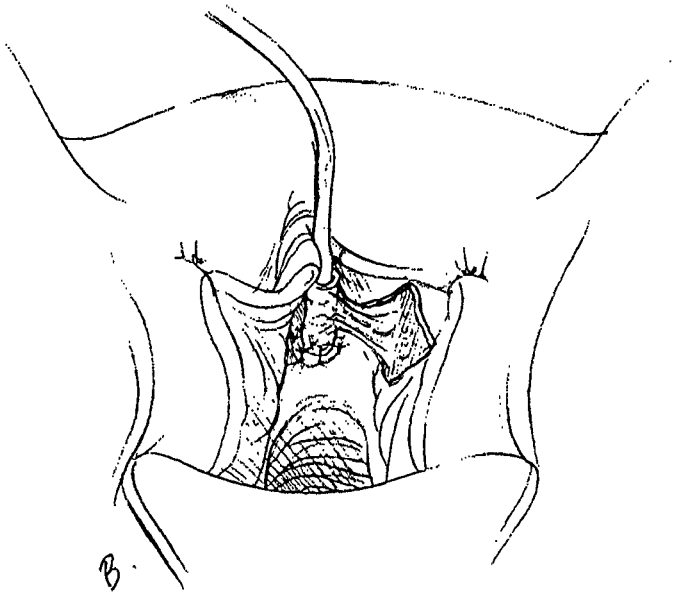

FIG. 2. Incision in labia minora frees flap of tissue that is rotated into neourethra.

who received a pubovaginal sling with a Martius flap the sling was placed overlying the graft.

Five patients underwent vaginal flap repair with modified Pereyra needle suspension. However, this procedure was abandoned early in the series in favor of a pubovaginal sling after a high postoperative incontinence rate was observed. A single patient underwent vaginal flap repair with Kelly plication and 1 underwent Tanagho anterior bladder flap repair.

Postoperatively bladder drainage was accomplished with a suprapubic tube (14Fr Malecot catheter) and a urethral catheter that was sutured to the anterior abdominal vaginal wall to stabilize the repair. If a Martius flap was used, a Penrose drain was used in the labial wound for 24 to 48 hours. Vaginal packing was removed on postoperative day 1. The urethral catheter was removed within week 1 postoperatively. A voiding cystourethrogram was performed at about 2 weeks through the suprapubic tube to test for successful voiding and assess extravasation. The suprapubic tube was removed if the patient could void successfully without extravasation. If not, voiding cystourethrogram was repeated in 1 to 2 weeks.

Patients were encouraged to present for followup annually.

TABLE 1. *Etiology of urethral pathology*

	No. Pts.
Diverticulum or injury from diverticulectomy	28
Urethral injury from Pereyra procedure	18
Anterior repair	10
Fistula from other gynecologic surgery	3
Fistula or erosion associated with synthetic material	5
Urethral obstruction from previous surgery	3
Trauma	3
Obstetric injury	2
Ectopic ureter	1
Primary urethral stricture	1
Total	74

Outcomes included the success or failure of anatomical repair and continence, which was assessed subjectively and objectively at the most recent patient followup by history, physical examination, voiding diary and in some a 24-hour pad test.[5] Patients who described themselves as continent but who had greater than 8 gm. urinary loss on the 24-hour pad test were considered improved but not cured.

RESULTS

The patients were 22 to 80 years old (median age 54) and followup was 1 to 15 years (median 1.5 years). Table 1 lists the etiologies of urethral pathology. The most common causes of urethral pathology for which urethral reconstructive surgery was performed were urethrovaginal fistula or urethral injury from previous surgery, most commonly diverticulectomy (28 patients), followed by needle suspension procedures (18) and anterior repair (10). Fistulas ranged in size from pinpoint to those that engulfed the whole anterior vaginal wall. All were located at or within 2 cm. of the bladder neck. Other etiologies included gynecologic procedures, including vaginal and abdominal hysterectomy, and erosion from a synthetic pubovaginal sling or vaginal mesh. Obstetric causes accounted for only 2 cases. A single patient sustained extensive bladder injury at tertiary repeat cesarean section and another had urethral damage resulting from obstetric forceps. No patients had previously received pelvic irradiation. In 1 case urethral reconstruction was done after wide excision of a distal squamous cell cancer.

A total of 74 procedures were performed, including 72 vaginal flap repairs, of which 56 were done with a concomitant pubovaginal sling (table 2). Early in the series 5 vaginal flap repairs were performed with a concomitant Pereyra procedure and 1 was done with Kelly plication. A patient in whom vaginal flap repair was planned underwent a Tanagho anterior bladder flap procedure because local tissue was thought to be insufficient for repair and 1 underwent extensive lysis of urethral and periurethral scarring with primary urethral repair. A total of 12 patients underwent vaginal flap repair without an incontinence procedure.

Vascular pedicle flaps were used in 62 patients (table 3). Martius flaps were used in 58 cases, omental flaps were used in 3 and a gracilis myocutaneous flap was used in 1. Laparotomy was not generally done for the specific purpose of harvesting omental grafts and in all 3 cases omentum was accessed through the fascial incision made for the pubovaginal sling.

TABLE 2. *Procedures performed*

	No. Pts.
Vaginal flap repair with autologous fascial pubovaginal slung	56
Vaginal flap repair alone	10
Vaginal flap repair with modified Pereyra procedure	5
Vaginal flap repair with Kelly plication	1
Urethrolysis + primary urethral repair	1
Tanagho anterior bladder flap	1
Total	74

Preoperative incontinence was the indication for vaginal flap reconstruction in 62 patients. The remaining patients underwent surgery for symptomatic urethral diverticula (2), bladder neck obstruction (4) and urethrovaginal erosion from synthetic material (2). Postoperatively 54 women (87%) considered themselves cured or improved with respect to incontinence. In 4 patients treatment failed due to persistent stress urinary incontinence, of whom 3 had a failed modified Pereyra procedure. All were later cured by secondary procedures. Two cases failed due to de novo urge incontinence. Two patients were lost to followup and treatment was considered to have failed.

Successful anatomical repair by single procedure vaginal flap repair was achieved in all except 5 patients (93%) with success defined as repair resulting in a functioning urethra that permitted the volitional passage of urine. Two continent urinary diversions were performed due to flap necrosis. A patient with flap necrosis underwent secondary vaginal repair using a gracilis flap that was ultimately successful, 1 who refused reoperation was treated with an indwelling Foley catheter and 1 was lost to followup.

Six of the 8 patients who were not incontinent and who underwent reconstructive surgeries due to stricture, erosion or symptomatic diverticula were continent following the procedure. One patient had de novo urge incontinence and 1 later underwent continent diversion due to malignancy.

A woman required intermittent catheterization for 6 months and 3 others catheterized for less than 6 weeks. One patient with preoperative symptomatic partial obstruction continued to have partial obstruction following surgery and 1 had urinary obstruction with severe urge incontinence, which was cured by operative revision of the pubovaginal sling. The symptomatic obstruction rate was 1.3%. A total of 12 patients (16%) had severe urinary urgency or urge incontinence postoperatively and 2 (3%) reported persistent vaginal pain. Two patients had recurrent fistulas (3%).

DISCUSSION

The etiology of urethral injury in the developed world is mainly a primer of surgical complications and as such the reporting and exact incidence of this problem is difficult to define with precision. Hilton compared 2 series of urogenital fistulas from England and Nigeria, and observed that 71% of fistulas in the English series were related to surgery compared with 4% in the Nigerian series. He estimated the overall incidence of surgical genitourinary fistula in the United Kingdom at 0.08% and of radiation related fistula at 1 to 4%.[1]

In our series urethral diverticulectomy and urethral needle suspension were the 2 most common causes of urethral injury requiring repair. Erosion of synthetic pubovaginal slings is a new and more common etiology in the most recent patients in the series, probably due to the increased popularity of this procedure in the last several years.[6,7]

Urethral injuries from diverticulectomy or erosion of synthetic materials share a common location but show widely different characteristics. In our experience the scarring associated with synthetic material frequently requires more extensive and more difficult urethral repair complicated by removal of the remaining graft material compared with injuries from urethral diverticulectomy that did not widely affect the surrounding tissue.

TABLE 3. *Reconstructive vascular flaps*

	No. Pts.
Martius	58
Omental	3
Gracilis myocutaneous	1
None	12
Total	74

The diagnosis of urethrovaginal fistula begins with a complete medical history with attention to risk factors, such as previous surgery and trauma. Careful physical examination frequently detects urogenital fistulas. Cystoscopy is usually definitive but a dye test performed by instilling methylene blue dye into the bladder combined with cystoscopic examination is occasionally helpful in questionable cases. Obstructing the urethral meatus with a Foley catheter or the finger while the patient coughs or strains can also reveal fistulas that have otherwise gone undetected. Due to the high frequency of complicated fistulas we recommend retrograde pyelography in our patients with urovaginal fistulas.

Others have presented case series of reconstructive surgery for urethrovaginal fistulas and similar defects. In our experience staged procedures and bladder flap reconstructive techniques were unnecessary. Our series was consistent with other published results of anatomical and functional success. Mundy achieved anatomical success and continence in 93% of a case series of 30 patients with an obstruction rate of 41%.[8] Tancer reported continence and anatomical success in 82% of his series of 34 patients.[9] Elkins et al reported that 90% of his 20 patients underwent successful anatomical repair with 50% continent and 10% obstructed.[10] Hamlin and Nicholson described 50 patients in whom obstetric trauma caused urethral injury.[11] They achieved an anatomical success rate of 98% and continence in 80% of cases. Fall described vaginal wall flap repair in 30 patients who often underwent multiple procedures, including 91% who ultimately achieved successful repair and 70% who were continent.[12] These results emphasize the difficulties of reconstructive surgery since continence may be achieved at the cost of obstruction. Furthermore, using a rigorous subjective and objective definition of continence (patient self-assessment and pad test less than 8 gm.) may decrease the number of patients thought to be cured by surgery.

The reporting of preoperative and postoperative vaginal dimensions could potentially illustrate the effects of repair on vaginal caliber and bladder support. We also note that subjective symptoms, such as dyspareunia and urinary urgency, often have a significant impact on patient satisfaction. However, these data were not available for analysis in this retrospective series.

The use of the Martius graft has been reported to improve the outcome of fistula surgery,[10] preventing breakdown of the repair and recurrent fistula in a significant number of patients. In 139 cases of fistula resulting primarily from obstructed labor Arrowsmith reported 81% continence after 1 procedure with severe vaginal scarring the best predictor of failure.[13]

We advocate urethral repair by the vaginal flap technique in association with a pubovaginal sling as an antiincontinence procedure. Due to the variable nature of urethral injury and the availability of local tissue for vaginal flap repair we suggest that the surgical approach to the fistula should be planned first and all vaginal incisions for the subsequent parts of the procedure should be deferred until successful fistula closure to ensure viable tissue for use in the repair. Only after the urethral tissues are reapproximated should vaginal incisions for the sling or other procedures be made, so as to prevent inadvertent incision through vaginal tissues that are required as covering flaps. Also, we recognize that the relatively short followup in this group of patients leaves open the possibility that with time the success rate from a functional and anatomical standpoint may not be as high. Further analysis of these outcomes is necessary to examine the long-term rate of success.

CONCLUSIONS

Single stage vaginal flap reconstruction with a vascular pedicle and autologous fascia pubovaginal sling compares

favorably with other urethral reconstruction techniques with respect to anatomical and functional outcome for the repair of urethral damage due to a number of etiologies. Despite a high probability of success patients are still at moderate risk for persistent or de novo incontinence after urethral reconstruction.

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