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Redo inferior pubectomy for failed anastomotic urethroplasty in pelvic fracture urethral injury

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Abstract

Objectives: To assess the effect of redo inferior pubectomy on the management of complicated pelvic fracture urethral injury (PFUI) in patients with a history of failed anastomotic urethroplasty.

Materials and methods: We retrospectively reviewed all patients receiving redo anastomotic urethroplasty with redo inferior pubectomy for failed PFUI between January 2010 and December 2021. Patients with incomplete data and those who were lost to follow-up were excluded. Successful urethroplasty was defined as the restoration of a uniform urethral caliber without stenosis or leakage and further intervention. Functional results, including erectile function and urinary continence, were evaluated. Descriptive statistical analyses were then performed.

Results: Thirty-one patients were included in this study. Among them, concomitant urethrorectal fistula occurred in 2 patients, and concomitant enlarged bladder neck occurred in 1. The stenosis site was the bulbomembranous urethra in 2 patients and the prostatomembranous urethra in 29. The mean length of urethral stenosis in all patients was 3.1 cm (range, 2.0–5.0 cm). After a mean follow-up of 34.6 months, the final success rate was 96.8%. The incidence of erectile dysfunction reached 77.4% (24/31). Normal continence was achieved in 27 (87.1%) patients. One patient developed urinary incontinence of grade II requiring urinary pads because of an enlarged bladder neck. According to the Clavien-Dindo classification, postoperative complications of grade I occurred in 7 patients and grade II in 4.

Conclusions: Repeat anastomotic urethroplasty with repeat inferior pubectomy provides reliable success rates for failed PFUI. In complicated cases, it should be known and mastered.

Keywords: Pelvic fracture; Urethral injury; Urethroplasty; Inferior pubectomy; Redo

1. Introduction

Posterior urethral disruption injury occurs in approximately 10% of patients with pelvic fractures.[1,2] Transperineal anastomotic urethroplasty (TAU) with sequential ancillary procedures, such as corporal separation, inferior pubectomy, total pubectomy, and urethral rerouting, has become the standard treatment for pelvic fracture urethral injury (PFUI).[3–5] The success rates of anastomotic urethroplasty after PFUI vary from 77% to 95%, depending on different reports.[6,7] The failure of TAU is mostly attributed to incomplete excision of scars covering the proximal urethral stump or failure to achieve tension-free anastomosis.[8,9] In patients with failed urethroplasty, repeat urethroplasty is necessary.

Among ancillary techniques, inferior pubectomy is usually used to widen the exposure of the proximal disrupted urethral end and reduce anastomotic tension by shortening the urethral gap. In failed patients, especially those who had undergone anastomotic urethroplasty through the transperineal inferior pubectomy approach, redo-urethroplasty is relatively more difficult than primary surgery because of more severe scarring and a shift of the urethral curve to the ventral side. The stenosed urethra is located deeper and clung to the surface of the inferior pubic bone after partial resection. In redo-urethroplasty, adequate scar excision and tension-free anastomosis must be done no matter how difficult it is. Otherwise, failure will recur, and the stenosed urethra will become more complicated. Thus, repeat inferior pubectomy is necessary in some cases where scar resection and tension-free anastomosis are difficult. However, there is currently no consensus regarding repeat inferior pubectomy in cases of failed PFUI. In addition, no current studies have focused on repeat inferior pubectomies. Here, we describe our experience and techniques for performing inferior pubectomy in the management of failed PFUI.

2. Materials and methods

2.1. Patients

After obtaining institutional review board approval, the demographic and perioperative data of patients who underwent repeat inferior pubectomy to treat failed PFUI from January 2010 to December 2021 were retrospectively reviewed. Patients with incomplete data

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and those who were lost to follow-up were excluded. A suprapubic catheter was inserted in all patients. Furthermore, fecal diversion was maintained in patients with urethrorectal fistulas, and redo-urethroplasty was performed at least 3 months after the last failed urethroplasty. Preoperative evaluation included urinalysis, urine culture, flexible cystoscopy, and retrograde and voiding cystourethrography. Magnetic resonance urethrography or computed tomography urethrography was performed in selected cases.

2.2. Redo-urethroplasty and redo inferior pubectomy

After anesthesia, the patient was placed in the standard lithotomy position. The bulbar urethra was mobilized through an inverted Y-shaped incision in the perineum. Under the guidance of a metal sound in the proximal urethra passing through the suprapubic cystostomy tract, the stenotic urethral segment was further circumferentially mobilized. The urethra was transected close to the proximal side of the stenotic scar. To clearly expose the proximal urethra and shorten the distance between the 2 urethral stumps, an inferior pubectomy was performed. Furthermore, corporal separation was performed from the level of bifurcation of the corpus cavernosum toward the distal end for 4–5 cm along a relatively avascular plane in the midline. The soft tissues and periosteum on the surface of the inferior pubis were pushed aside using a periosteal stripper.

Redo inferior pubectomy was performed using an osteotome. First, both sides of the inferior pubic symphysis were chiseled using an osteotome that width of 2 cm wide. Second, the osteotome was placed on the midline of the pubic symphysis, 1–2 cm from the inferior border of the pubis, maintained at 90° to the longitudinal axis of the pubis, and the inferior pubis was chiseled. The length of the excised pubic bone was determined based on its distance from the urethral defect. Third, when the pubis was chiseled to approximately half of the depth, the angle was adjusted to 30°, and the inferior pubis was completely resected in an obliquely downward direction (Video 1, http://links.lww.com/CURRUROL/A45). The remaining scars covering the proximal urethral stump were trimmed to expose the healthy urethral mucosa. The distal urethra was trimmed and mobilized without exceeding the penoscrotal junction. Finally, tension-free anastomosis was performed using a 16F/18F silicone catheter.

The urethrorectal fistula was identified after exposing the proximal urethra by performing inferior pubectomy and fully resecting the scar tissue. The fistula tract is resected to freshen the rectal margin. The rectal wall was repaired in 2 layers. Subsequently, urethral anastomosis was performed. A pedicled subcutaneous Dartos flap or the gracilis muscle was interposed to separate the anastomosed urethra from the repaired rectum.

2.3. Postoperative management

The urethral catheter was left indwelling for 3–4 weeks after the redo-urethroplasty. After catheter removal, patients were re-examined at 1, 3, and 12 months and annually thereafter. Uroflowmetry was performed at each clinical re-examination. Retrograde and voiding cystourethrography or flexible cystoscopy was performed in patients with urinary obstruction. A successful urethroplasty was defined as the restoration of a uniform urethral caliber without stenosis or leakage, requiring no further interventions. In addition, the anastomotic site allowed the smooth passage of a 16F flexible cystoscope into the bladder.[10,11]

Functional results were assessed 3 months postoperatively. Erectile function was evaluated using the 5-item International Index of Erectile Function. It can be divided into 4 levels: normal, mild, moderate, and severe erectile dysfunction (ED).[12] Depending on the symptoms, urinary continence was also classified into 3 grades: normal continence (normal), occasional urinary incontinence not needing a urinary pad (grade I), and incontinence requiring the use of urinary pads (grade II).[13]

3. Results

After excluding 4 patients who were lost to follow-up, 31 patients with a mean age of 42.6 years (range, 18–72 years) were included, and 2 patients who had undergone redo inferior pubectomy for the treatment of failed PFUI were also included. Demographic and perioperative data are shown in Table 1. Concomitant urethrorectal fistula occurred in 2 patients, and concomitant enlarged bladder neck occurred in 1 patient. The mean length of urethral stenosis in all patients was 3.1 cm (range, 2.0–5.0 cm). In 93.5% (29/31) of patients, the stenosis site was the prostatomembranous urethra. The intraoperative blood loss was in the range of 150–800 mL (mean, 308.3 mL).

All patients were followed-up for an average of 34.6 months (range, 13–137 months). The final success rate of redo-urethroplasty with redo inferior pubectomy was 100% (31/31). The incidence of ED after surgery was 77.4% (24/31), including mild ED in 6 patients, moderate ED in 9, and severe in 9. Normal continence was achieved in 27 (87.1%) patients. One patient developed grade II urinary incontinence, requiring the use of urinary pads because of an enlarged bladder neck. Postoperative complications included wound bleeding in 1 patient, delayed wound healing in 1, wound numbness in 2, hematoma in 4, epididymo-orchitis in 2, and wound infection in 1 patient. According to the Clavien-Dindo classification, 7 patients were classified as grade I, and 4 patients were classified as grade II (Table 2).

Table 1

The demographics, perioperative data, and follow-up data of patients.

Variables	Results
Patients, n	31
Age, mean ± SD (range), yr	42.6 ± 14.6 (18–72)
BMI, mean ± SD (range), kg/m^2	25.2 ± 3.1 (19–32)
Disease course, mean ± SD (range), mo	16.4 ± 11.1 (8–66)
Immediate urethral management, n (%)	
Realignment	4 (12.9)
Cystostomy	27 (87.1)
Prior DVIU, n (%)	2 (6.5)
Prior TAU with inferior pubectomy, n (%)	31 (100)
Concomitant urethrorectal fistulas, n (%)	2 (6.5)
Concomitant enlarged bladder neck, n (%)	1 (3.2)
Stenosis length, mean ± SD (range), cm	3.1 ± 0.6 (2.0–5.0)
Stenosis site, n (%)	
Bulbo-membranous	2 (6.5)
Prostatomembranous	29 (93.5)
Operation time, mean ± SD (range), min	116.2 ± 17.7 (90–180)
Blood loss, mean ± SD (range), mL	308.3 ± 121.8 (150–800)
Postoperative ED, n (%)	
Normal	7 (22.6)
Mild	6 (19.4)
Moderate	9 (29.0)
Severe	9 (29.0)
Postoperative UI, n (%)	
Normal	27 (87.1)
Grade I	3 (9.7)
Grade II	1 (3.2)

BMI = body mass index; ED = erectile dysfunction; DVIU = direct visual internal urethrotomy; TAU = transperineal anastomotic urethroplasty; UI = urinary incontinence.

4. Discussion

Many reports have demonstrated redo-urethroplasty for failed TAU in PFUI, and high success rates can be achieved.[7,14] In complicated cases, repeat inferior pubectomy is necessary to bridge this gap. However, the feasibility and effectiveness of repeat inferior pubectomy have not yet been clarified. To our knowledge, our study is the first to demonstrate that repeat inferior pubectomy is a viable and reliable technique.

Inferior pubectomy is 1 of the 4 approaches of TAU (simple anastomosis after mobilization, separation of the corporeal bodies, inferior pubectomy, and rerouting of the urethra around the corporeal body) first reported by Webster and Ramon in 1991.[3] Unlike resection of the pubic symphysis, inferior pubectomy avoids pelvic destabilization and, consequently, gait instability. The lower part of the pubic symphysis was chiseled off to create a wide channel underneath the bone bridge to enlarge surgical field exposure and shorten the distance between the 2 urethral stumps. Webster and Ramon[3] successfully treated PFUI of up to 6.5 cm using separation of corporeal bodies and inferior pubectomy. In addition, for some patients with failed multiple transperineal surgeries, the Austoni transperineal-prerectal approach may be a viable option.[15]

However, regardless of the surgical difficulty or technical details, redo inferior pubectomies are not the same as primary inferior pubectomies. Undoubtedly, reperforming an inferior pubectomy is more difficult. First, the original anatomy was destroyed, and the pubic surface was covered with a large amount of scar tissue. Second, there is a greater chance of injuring the dorsal vein complex (DVC) during redo-pubectomy because the pubic bone is resected closer to the DVC. Preoperative magnetic resonance imaging may be used to assess the anatomical relationship of the DVC to the pubic bone and whether it has atrophied[16] to evaluate the risk of intraoperative bleeding fully. During surgery, the corporeal body was dissected further distally along the septum to expose the pubic surface. The inferior pubis was then chiseled off. The depth of the pubic resection must be controlled to avoid bleeding or unnecessary tissue damage. Therefore, what is the maximum urethral defect length that repeated pubectomies can bridge? According to our experience in the treatment of 31 patients, urethral defects of up to 5 cm can be bridged by repeat inferior pubectomy, which is different from the primary surgery reported by Webster et al. In patients with failed primary inferior pubectomy, the bridgeable urethral defect length is usually related to the defect length and size of the pubic bone resection in the last surgery.

Table 2

Postoperative complications (n = 31).

Variables	Results
Clavien-Dindo, n (%)	
I	7 (22.6)
II	4 (12.9)
III	0 (0)
IV	0 (0)
V	0 (0)
Total	11 (35.5)
Type, n (%)	
Wound bleeding	1 (3.2)
Delayed wound healing	1 (3.2)
Wound numbness	2 (6.5)
Hematoma	4 (12.9)
Epididymo-orchitis	2 (6.5)
Wound infection	1 (3.2)

Is the risk of bleeding from repeat inferior pubectomy higher? In this study, the average intraoperative blood loss was 308.3 mL (range, 150–800 mL), which was slightly higher than that in common PFUI cases reported earlier.[4] According to the anatomical characteristics, it can be considered that the probability of damage to the DVC is much higher in the redo inferior pubectomy than in the primary surgery. However, the difference in the amount of blood loss between the 2 patient groups was not significant. We speculate that the pelvic fracture and failed urethroplasty may have resulted in a certain degree of DVC atrophy. Will redo inferior pubectomy further impair erectile function in these patients? The incidence of ED for redo patients was higher than common PFUI cases (77.4% vs. 69.9%).[4]

Although this study is the first to provide a detailed analysis of patients undergoing repeat inferior pubectomy, it has some limitations. First, the retrospective study design and single-center features may have introduced bias. Second, there is a lack of specific patient-reported outcome measures for assessing the prognosis of surgery. Third, owing to the specificity of such cases, the sample size included in the study was limited. No definite conclusions can be drawn from this small cohort. Readers can only obtain the references for the treatment of complicated PFUI cases in this study. Fourth, it must be admitted that the decision-making process for recurrent and complicated cases may not be universal, and there is much controversy about treatment algorithms for posterior urethral reconstruction.

5. Conclusions

Repeat urethroplasty with repeat inferior pubectomy can provide reliable success rates in complicated cases of PFUI. Although redo inferior pubectomy may increase the surgical difficulty and lead to greater surgical trauma, it still needs to be known and mastered.

Acknowledgments

None.

Statement of ethics

This study was approved by the Ethics Committee of Renji Hospital, School of Medicine, Shanghai Jiao Tong University. No participant's consent was taken, for it was a retrospective review on the electronic database. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflict of interest statement

XL is amember of the early career editorial board of *Current Urology*. This article was accepted after a normal external review. No conflict of interest has been declared by the other authors.

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Author contributions

LW, YL, YS: Participated in research design;
LW,WS, XP: Participated in the writing of the manuscript;

RL, JW, CJ, CF, YL: Participated in the performance of the research; and LW, XL: Participated in data analysis.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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