Penoscrotal Transposition to Achieve Urethral Continuity After Long-Segment Urethral Defect: A Case Report

Lin Wang1,2*, Hui-Quan Shu1*, Chong-Rui Jin1, Jie Gu1, and Ying-Long Sa1

Abstract
Penoscrotal transposition and pendulous-prostatic anastomotic urethroplasty for the treatment of long-segment bulbar and membranous urethral stenosis is rarely reported. This study reports the case of a 43-year-old man with dysuria resulting from pelvic fracture. The patient had a long-term history of multiple urethral reconstructions and presented a long-segment bulbar and membranous urethral stenosis at imaging. Penoscrotal transposition and pendulous-prostatic anastomotic urethroplasty was performed and completed in 170 min (blood loss: 400 ml). Postoperative treatment was uneventful with favorable short-term outcomes and high patient satisfaction without recurrence at 12-month follow-up. This surgical technique should be attempted in carefully selected patients with long-segment bulbar and membranous urethral stenosis and performed by an experienced urethral reconstruction specialist.

Keywords
complex, posterior urethra, urethral stenosis, anastomosis, urethroplasty

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The posterior urethra includes both the prostatic and membranous urethra. Posterior urethral stenosis is chronic fibrosis and narrowing of the posterior urethral lumen caused by acute injury, inflammatory conditions, and iatrogenic interventions including urethral instrumentation or surgery and prostate cancer treatment (Wessells et al., 2016). The incidence of posterior urethral stenosis is increasing gradually in developing countries (Fu, Zhang, Sa, Jin, & Xu, 2011; Xu et al., 2015), and it usually has a huge negative impact on patients’ quality of life. Pelvic fracture is the most common cause of posterior urethral stenosis. Surgical repair of pelvic fracture–related posterior urethral stenosis remains one of the most challenging problems in urology, especially for those patients with complicated posterior urethral stenoses who have undergone previous failed surgical treatments (Webster, Ramon, & Kreder, 1990). Moreover, multiple failed surgeries may lead to long-segment bulbar and membranous urethral stenosis, which is usually the result of lack of an effective treatment strategy. For the treatment of long-segment bulbar and membranous urethral stenosis, a novel procedure was selected: penoscrotal transposition and pendulous-prostatic anastomotic urethroplasty.

Case Report

Presentation and Diagnosis
In June 2016, a 37-year-old man, having experienced 14 years of dysuria, was diagnosed with a long-segment bulbar and membranous urethral stenosis in the clinic. The patient had suffered from posterior urethral rupture due to a traumatic pelvic fracture in 2002. Emergency urethral realignment was performed following the injury; at that time, the patient had accepted regular urethral dilation and micturition by himself without a suprapubic catheter. In 2013, he experienced the recurrent symptom...
The patient developed dysuria again a month later and then underwent direct vision internal urethrotomy. After removal of the catheter 2 weeks later, the symptom of dysuria was not significantly relieved. Pedicled scrotum flap urethroplasty with inferior pubectomy and perineal skin flap urethroplasty were performed in December 2014 and July 2015 for the lengths of 10 and 9 cm of urethral stenosis, respectively. But the two operations ended in failure because of the growth of hair in the urethral lumen and severe infection.

Preoperative flexible cystoscope and cystourethrography (Figure 1) showed that the length of urethral stenosis was about 9 cm, involving the entire bulbar and membranous urethra. After receiving povidone–iodine saline irrigation of the bladder and urethra twice daily for 1 week before operation, no obvious abnormality in urine culture and routine urine test was found. The patient was diagnosed with severe erectile dysfunction before operation. Penoscrotal transposition and pendulous-prostatic anastomotic urethroplasty was proposed, and the patient consented.

Surgery
The patient was placed in the lithotomy position under general anesthesia. The urethral dilator was used to mark the stricture position, and the urethral lumen was obstructed at the root of the penis. Through a perineal “inverted Y” incision, the anterior urethra was dissected and the fibrous scar tissue of the stenosis was completely excised and transected distally to the stricture. Through inferior pubectomy, the obliterated urethra and periurethral fibrotic tissues were completely excised until a healthy prostatic urethra was mobilized about 0.5 cm for the suture (Figure 2A). The length of the urethral defect was measured as 9 cm. The perineal incision was extended anteriorly to the scrotum and penoscrotal junction. After cutting the skin around the root of the penis, crural bifurcation of the corporal body separation was performed. Considering the preservation of the dorsal vessels of the penis, sufficient length of the corpus cavernosum was detached to ensure that the penis could be transpositioned to the perineum for tension-free anastomosis with the prostatic urethra (Figure 2B, C). The pendulous urethra was rerouted to the prostatic urethra. Tension-free pendulous-prostatic anastomotic urethroplasty was performed with the use of 4-0 polyglycolic acid sutures (Figure 2D, E). The perineal wound was closed with a drain (Figure 2F). Intraoperative blood loss was approximately 400 ml.

Postoperative drainage was accomplished with a suprapubic catheter and a urethral silicone catheter. Intravenous levofloxacin was administered 3 days preoperatively, intraoperatively, and for 7 days postoperatively (0.5 g/day), and then oral levofloxacin was used for 7 days (0.5 g/day).

Outcomes
After removal of the urethral catheter 3 weeks later, the patient voided satisfactorily, and maximal flow rate (MFR) was 30.6 ml/s, 28.8 ml/s, 25.3 ml/s, 26.5 ml/s, with no postvoiding residual urine, after the operation and at 3 months (Figure 3), 6 months, and 12 months, respectively. The patient still suffered from severe erectile dysfunction and had no sexual life.

Discussion
Urethral stricture could be caused by many factors including trauma, iatrogenic injury, infection, and lichen scleroses (Xu et al., 2015). Different from anterior urethral stricture, almost all cases of posterior urethral stenosis are caused by pelvic fracture. In addition, long-segment bulbar and membranous urethral stenosis usually results from multiple failed surgical treatments of posterior urethral stenosis. Surgical options for urethral stenosis are based primarily on the location and length of the stenosis (Fu et al., 2015). Excision of the scarred urethral segment and end-to-end anastomosis is considered the gold standard for treatment, with a long-term success rate of over 90% in most cases (Cooperberg, McAninch, Alsikafi, & Elliott, 2007; Gomez et al.,
Considering the length of bulbar or membranous urethral stenosis, different surgical methods could be selected, such as a simple transperineal approach for a short stenosis and transperineal inferior pubic approach for a longer stenosis (Barbagli, 2007; Xu, Sa, Fu, Zhang, & Jin, 2010). The most important goal is achieving mucosa-to-mucosa tension-free anastomosis. In few cases, pedicled perineal or scrotum flap may be a choice for the treatment of complicated long urethral stenoses (Provet, Surya, Grunberger, Johanson, & Brown, 1989). For patients with very long and complex bulbar and membranous urethral stenoses, especially for those who have experienced repeated failed urethral surgeries and who lack sufficient healthy skin grafts, the treatment is very challenging.

It was difficult to perform routine anastomotic urethroplasty without tension for this patient because of a long distance (9 cm) between the urethral stumps. It is almost impossible to perform pedicled perineal skin or scrotum flap urethroplasty as the available skin graft was not enough and graft bed was poor. Ten years ago, staged pendulous-prostatic anastomotic urethroplasty followed by reconstruction of the anterior urethra was first proposed and practiced successfully in two cases (Wu et al., 2007). On this basis, a few technical changes were made to better protect the blood supply. The anterior urethra was mobilized down to penoscrotal junction with the dorsal vessels of the penis preserved. Therefore, sufficient blood supply was guaranteed for the pendulous urethra to avoid ischemic necrosis. Inferior pubectomy was performed in order to shorten the distance of urethral stump and expand the operation space. Then the pendulous urethra was rerouted to the perineum and tension-free pendulous-prostatic end-to-end anastomosis was performed easily.

Figure 2. (A) Obliterated urethra and periurethral fibrotic tissues were completely excised; (B, C) the skin around the root of penis was cut and crural bifurcation of the corporeal body separation was made with the dorsal vessels (the black arrow) of the penis preserved; (D, E) the pendulous urethra was rerouted to the prostatic urethra and pendulous-prostatic anastomotic urethroplasty was performed; and (F) the perineal wound was closed.

Figure 3. Three-month follow-up after operation.
The principles of bulbar and membranous urethral reconstruction remain unchanged, including good exposure to clearly identify and excise periurethral scar tissues and restore the continuity of the urethral lumen. For this patient, almost all scar tissue around the obstructed urethra was removed to improve the blood supply of the surrounding tissue. A successful outcome is also dependent on perioperative treatment and care, such as preoperative bladder irrigation and postoperative wound care.

Twelve months later, the patient was very satisfied with the status of the penis and urination and unwilling to accept further straightening of the penis and urethroplasty, as he was afraid of the risk of failure. Respecting the patient’s opinions, a long period of follow-up was chosen to observe changes in urine flow.

Generally, a patient with a long-segment bulbar and membranous urethral stenosis is uncommon, and this procedure is not commonly used. In most patients, surgery can be performed through a simple transperineal or transperineal inferior pubectomy approach and tension-free anastomosis can be achieved easily. But in extreme cases of long segment of the bulbar and membranous urethral stenosis, which could not be anastomosed without tension, the technique of penoscrotal transposition and pendulous-prostatic anastomotic urethroplasty is still not obsolete. The operation can satisfy the patient’s demand of urination in standing position and restore the usual urination habit of males.

The limitations have to be acknowledged that genital deformity caused by penoscrotal transposition may have some negative effects on the patient’s social behavior and psychology.

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