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Mamdouh M. Koraitim

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DELAYED REPAIR OF PFUI
REVIEW

Optimising the outcome after anastomotic posterior urethroplasty

Mamdouh M. Koraitim *

Urology Department, Faculty of Medicine, University of Alexandria, Egypt

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KEYWORDS

Pelvic fracture;
Urethral injury;
Outcome;
Delayed repair

ABBREVIATION

PFUI, pelvic fracture urethral injury

Abstract ***Objectives:*** To develop a plan that would optimise the outcome after an anastomotic repair of a pelvic fracture urethral injury (PFUI).

Methods: Data on the delayed repair of PFUI from reports in English were critically reviewed. The search criteria included reports by high-volume surgeons and those from tertiary centres of reconstructive urethral surgery.

Results: The delayed repair of a PFUI should not be attempted within 4–6 months of the initial trauma. A tension-free, scar-free and mucosa-to-mucosa urethral anastomosis is critically important for a successful outcome. Urethral defects shorter than a third of the bulbar urethral length can usually be repaired by a simple perineal operation, while longer defects usually need an elaborated perineal or perineo-abdominal transpubic procedure. The finest suture that provides adequate strength should always be used for a urethral anastomosis, generally 3/0 polyglactin 910 for adult patients and 4/0 for children. In transpubic urethroplasty, an omental wrapping of the intra-abdominal segment of the bulbar urethra and the site of anastomosis is mandatory.

Conclusions: Anastomotic repair of a PFUI entails various surgical components, and the importance of each of these should not be underestimated. Careful attention to these surgical components is mandatory for a successful outcome after repair.

* Address: Faculty of Medicine, Alexandria University, Alexandria, Egypt. Tel.: +20 122 340 9512; fax: +20 3 49 54 794.
E-mail address: koraitim_mm@yahoo.com.
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Introduction

The delayed repair of a pelvic fracture urethral injury (PFUI) continues to be a surgical challenge and can be considered as one of the most difficult management problems in urology. This is not only because of the

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awkward location behind the pubic bone, but also more importantly because urological and sexual problems might result from inappropriate management [1]. A PFUI is usually in the form of a fibrous segment formed between the distracted urethral ends. Thus excision of this segment and an end-to-end urethral anastomosis is generally accepted as the ideal treatment in this case. Success rates after a sufficiently long follow-up have often been reported from specialised centres to be >90% [2–6]. In pursuit of a successful outcome there should be careful attention to certain perioperative details. This review is an attempt to develop a plan that would optimise the results of posterior urethroplasty.

Timing of the repair

The interval between the initial urethral injury and definitive repair of the resulting urethral stricture or defect depends on the magnitude of the pelvic trauma. Generally, the repair should be postponed until the local healing reaction is complete. Turner-Warwick [5] suggested that this process takes at least 3–4 months, and longer if the haematoma is large. Webster [6] advised that repair should be delayed for 4–6 months. In the present author's experience the minimum interval is 6 months after most PFUIs, and in cases of severe injuries, the interval can be extended to ⩾8 months. If an earlier repair is attempted, as was done in one of my patients after an interval of 5 months, the surgical dissection will be more difficult and the chance of a successful result might be less [7].

Patient's position at surgery

Under epidural or caudal anaesthesia and a cover of antibiotic according to the result of urine culture, and with the patient in the lithotomy position, the perineum and subumbilical regions are prepared as a single operating field. This is not only because of the probability of using the already present suprapubic tract for antegrade cysto-urethroscopy, but also because the progression of a perineal operation into a combined perineo-abdominal procedure might be deemed necessary [5]. Some authors advocate the exaggerated lithotomy position for this procedure. Others, including the present author, use the ordinary lithotomy position, as exposure of the prostate should be limited to the anterior aspect, to reduce the risk of erectile dysfunction attributable to injury of the nervi erigentes surviving the original trauma.

Identifying the proximal urethra

The proximal urethra is traditionally identified by the blind passage of an antegrade sound through a suprapubic catheter tract in the course of perineal urethroplasty. However, this method is not reliable in the presence of a para-urethral bladder-base fistula, because the sound might slip into the false passage, which will be mistaken for the prostatic urethra and will be wrongly anastomosed to the anterior urethra [5]. Certainly the false passage can be diagnosed on urethrography and MRI by detecting two parallel tracts within the prostate. However, it is not easy to discriminate the false tract from the true prostatic urethra on either imaging study [8]. In such cases a correct anastomotic repair can be made by using suprapubic cysto-urethroscopy to recognise the prostatic urethra by identifying the verumontanum [5,9].

Excision of scar tissue

The complete excision of scar tissue is an essential component of a successful anastomotic repair of a PFUI [3–5,10,11]. Importantly, scar tissue usually implicates the apex of the prostate [3,5,10]. This requires meticulous retrograde excision of the prostatic apex until healthy-looking prostatic tissue is reached before making the urethral anastomosis (Fig. 1). The widely accepted strategy for making the anastomosis once the lumen of prostatic urethra is visible, after cutting on the antegrade sound and without excising scar tissue, should be abandoned. In a previous study using a multivariate analysis, the complete excision of scar tissue had an independent significant effect on the outcome after perineal posterior urethroplasty, with an odds ratio of 122 [12]. This means that a patient who has had the scar tissue completely excised is >120 times more likely to have a successful outcome than a patient with an incomplete excision. The scar tissue can be completely excised via the perineum in most cases. However, in the presence of a para-urethral false passage extending into the bladder base, a perineo-retropubic approach is required for complete excision of the scar tissue [9].

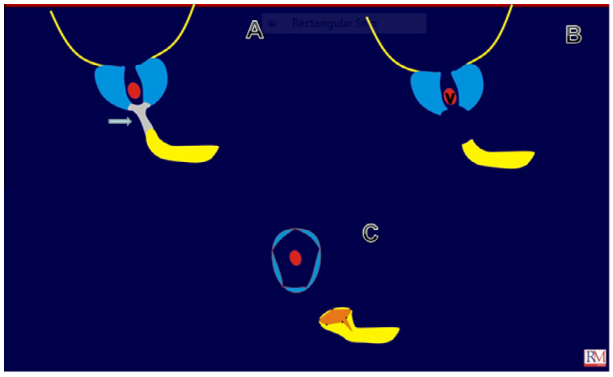

Figure 1 Complete excision of scarred tissue (grey) including the apex of the prostate (blue) to a level just short of the verumontanum (red). Then spatulation of the two urethral ends and fixation of their mucosae before anastomosing the bulbar urethra (yellow) to the prostate. From [3] with permission.

Fixation of the prostatic mucosa

After completely excising the scar tissue, the two urethral ends are spatulated and the mucosae fixed laterally with 4–6 absorbable 4/0 sutures (Fig. 1) [3]. On excising the scarred prostatic apex, including its adherent mucosa, the free edge of the healthy pliable mucosa (if this really is reached) has the tendency to retract proximally [13]. It should be pulled down by using forceps and fixed laterally to the prostatic edge. This component of the operative technique is a prerequisite for a mucosa-to-mucosa urethral anastomosis. Inadequate fixation of the healthy prostatic mucosa might result in a localised soft mucosal narrowing at the site of the anastomosis. In such cases the chances of success after a single optical urethrotomy are high because the scar tissue was already excised during urethroplasty [3,14].

Tension-free anastomosis

Apart from the complete excision of scar tissue, nothing is more important than the tension-free approximation of the two urethral ends over the bulbo-prostatic gap. Obviously, the upwardly displaced prostate cannot be moved down and the only way to restore urethral continuity is to bring the bulbar urethra up to the prostate. This is done by taking advantage of the extra length provided by the elasticity of the mobilised bulbar urethra. In this regard a liberal circumferential mobilisation of the anterior urethra can be done as far as the penoscrotal junction. However, over-extensive mobilisation of the penile urethra should be avoided because of the risk of both proximal ischaemia and chordee [5]. The tension might be further relieved off the suture line by fixing the bulbar urethra near the site of the anastomosis to the perineal fascia with three absorbable 4/0 sutures on both sides (Fig. 2) [3].

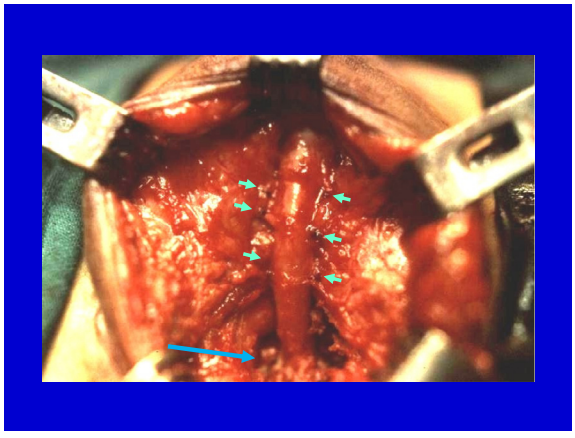

Figure 2 The bulbar urethra is fixed to the underlying tissues by three sutures on each side (short arrows). Note the wide bulbo-prostatic urethral anastomosis (long arrow). From [3], with permission.

An appropriate surgical approach to the repair

The anastomotic repair of a PFUI can be done using a simple perineal operation in most cases, or by an elaborated perineal or a combined perineo-abdominal transpubic procedure. Currently, most authors accept that a bulbo-prostatic urethral gap of < 2.5 cm indicates a simple perineal repair, while a gap of > 2.5 cm indicates an elaborated perineal or a transpubic procedure [5,13]. However, the type of surgical approach to repair is necessarily influenced not only by the length of urethral gap but also by the length of bulbar urethra that must bridge this gap [15].

The available elongation of the mobilised bulbar urethra would vary in different individuals, particularly in children compared with adults, as well as in patients in whom the anterior urethra had been shortened by previous failed surgical repairs. It seems that the allowable maximum extra length provided by a mobilised normal bulbar urethra is about a third of its length, beyond which the urethral anastomosis would be under tension [16]. Accordingly, urethral gaps shorter than a third of the bulbar urethral length can usually be corrected by a simple perineal operation. However, in cases with longer gaps the anterior urethra must circumvent the long gap and reach the prostate by a more direct and shorter route, using the elaborated perineal or transpubic procedure [9,13,17]. Thus, a tension-free anastomosis could be made in these cases using the same elastic lengthening that was inadequate for a simple perineal repair. Although the final decision to determine the correct procedure is generally made according to the actual findings at surgery, it can be predicted by a preoperative concomitant measurement of the length of the urethral gap and that of the bulbar urethra, as represented by the index of 'gapometry' and urethrometry [15,16].

The size, type and number of sutures

Turner-Warwick [5] advised that the smallest suture that provides adequate strength should always be used for a urethral anastomosis, generally 4/0. He also suggested that catgut suture could be abandoned because it has a relatively low tensile strength and requires a greater suture thickness to be used, which creates an excessive tissue reaction. Roehrborn and McConnel [18] noted that, except for the mostly poor results achieved with 2/0 sutures, results with 3/0, 4/0 and 5/0 sutures were almost identical. This corroborates with the findings of a previous study [10] that there is no significant difference between 3/0 and 4/0 polyglactin 910 sutures on the outcome ($P = 0.780$). I suggest that 3/0 sutures can be used for adult patients and 4/0 sutures for young children. It seems that the number of sutures used for urethral anastomosis has no significant effect on the outcome of anastomotic posterior urethroplasty ($P = 0.382$), provided a

mucosa-to-mucosa, tension-free and scar-free anastomosis is made [10]. The use of 3–12 sutures has been reported, with successful outcomes [2,10]. Nevertheless, I suggest that six sutures of polyglactin 910, including two in the midline anterior and posterior and two each on the right and left sides, are usually sufficient to create a sound anastomosis.

Omental wrapping

In perineo-abdominal transpubic urethroplasty, the intra-abdominal segment of the bulbar urethra and the site of anastomosis should be wrapped by an omental pedicle. In the opinion of Turner-Warwick [19], the reliability of an anastomotic transpubic repair of a PFUI can be greatly increased by obliterating the peri-anastomotic dead space with a pedicled omental graft. The omentum is a highly specialised tissue specifically evolved to resolve the inflammatory processes to which the abdominal contents are naturally prone. Also, after resolving a local infection the omentum regains its suppleness, whereas other fat, such as the perirenal tissue, develops dense 'frozen' adhesions. Consequently, it ensures the freedom of the functional movement of any part of the urinary tract that it envelops. These characteristics of the omentum arise not only because of its blood supply, but also because of its abundant lymphatic drainage, which absorbs inflammatory cell debris and exudates that would otherwise result in a purulent accumulation [5].

Fine-tissue handling

Apart from personal surgical expertise, and in addition to a careful attention to the above-mentioned surgical components, fine-tissue handling need not be over-emphasised [5]. For example, the technique of urethral suturing is important to guard against the inherent tendency of urethral anastomosis to stenose. In this regard the mucosal margins of the two urethral ends must not only be aligned, but also the inclusion of a bulk of well-vascularised submucosa in the suture is essential for sound healing [5]. Also, fine-tissue handling includes the use of fine surgical instruments and the minimal application of diathermy for haemostasis around the urethra.

Catheter drainage

The urethral anastomosis is usually made over a Silastic Foley catheter, of 16 F for adults and 8–12 F for children [3]. It is important that the catheter should not be a tight fit in the urethra, so that if the catheter drainage becomes obstructed urine can leak freely from the external meatus around the catheter. Turner-Warwick [5] recommended the use of a catheter with fenestrations in the part of the shaft that lies in the bulbar urethra. The pericatheter space can be positively drained by using this catheter. Turner-Warwick noted that urethral secretions and exudates drain directly into the lumen of the catheter, and the space around it is washed clean by the flow of urine. Also, monitoring the progress of the healing of a reconstructed urethra is simplified by radiographic contrast-medium studies of the fenestrated-catheter. Thus, premature removal of the catheter is avoided. The operation is completed by inserting a suprapubic catheter, usually through the tract ordinarily present in these patients. The urethral catheter is used mainly as a stent for the anastomosis rather than as a tool for urine drainage. Thus, for the patient's convenience, it may be kept closed in after surgery unless there is trouble draining the suprapubic catheter. The urethral stent is usually removed at 3–4 weeks after surgery, according to the neatness of the urethral anastomosis. Before its removal pericatheter urethrography is advised to exclude leakage at the site of repair [3]. In the presence of leakage it should be left indwelling for one more week and the pericatheter urethrography repeated.

After removing the urethral stent, the suprapubic catheter is closed and the patient is encouraged to void via the urethra, followed by retrograde and voiding urethrography. If the patient voids normally and urethrography shows free urethral passage, the suprapubic catheter is removed 1 day later. Otherwise, the suprapubic catheter is left in place and the patient further assessed.

Conclusions

The delayed repair of a PFUI should not be attempted within 4–6 months of the initial trauma. The complete excision of scar tissue before making a tension-free mucosa-to-mucosa urethral anastomosis is critical and essential for a successful repair.

Urethral gaps shorter than a third of the bulbar urethral length usually can be corrected by a simple perineal operation, while longer gaps usually need an elaborated perineal or perineo-abdominal procedure. The finest suture size that provides adequate strength should always be used for a urethral anastomosis, usually 3/0 polyglactin 910 for adult patients and 4/0 for children. It seems that the number of sutures used for urethral anastomosis has no significant effect on the outcome. In transpubic urethroplasty, omental wrapping of the intra-abdominal segment of the bulbar urethra and the site of anastomosis is mandatory.

Conflict of interest

None.

Source of funding

None.

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