Current management of male urethral stricture disease

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Introduction

Management of urethral stricture disease is a challenge for a general urologist and the best outcome will be obtained in the hands of a reconstructive urologist keeping in the mind that the first attempt of repair gives the best results. Urethral stricture management in Sri Lanka underwent contemporisation during last two and a half decades prior to which only repeated and often lifelong urethral recalibration or a supra-pubic catheter was the only available option. It is a timely need to review the current state of management options and controversies for the benefit of the general urologist to appreciate the limitations of the variety of techniques and to decide when to involve the services of a specialist reconstructive urological surgeon for the best outcome for the patient.

Morbid anatomy and pathology

Urethral stricture is defined as a narrow, non-expandable segment of urethra mainly caused by inflammatory or traumatic injury. Urethra being a biological conduit with a wall consists of smooth muscles and a lumen lined by transitional epithelium which is naturally in a collapsed state and could expand up to a size of 28F during micturition. Urinary continence is maintained by anatomical and functional urethral sphincters such as the Rhabdo (external) sphincter which consists of striated muscle and the Liso (internal) sphincter which consists of a circumferential condensation of deep trigonal smooth muscles. In males intra-prostatic spirally distributed smooth muscles create a prostatic urethral high-pressure zone which contributes to the continence. In addition, the coaptation of urethral lumen also by itself act as a weak sphincter mechanism. Contribution of pelvic floor muscles to male continence is debatable. When it comes to the pathological mechanism and response to injury there is a significant difference in the two main anatomical parts of the urethra, namely the anterior urethra which includes navicular fossa, penile

urethra and the bulbar urethra and the posterior urethra which comprises membranous and prostatic urethra. In the current nomenclature the word **stricture** refers to spongy urethral disease, and non-spongy urethral narrowing in the absence of spongiofibrosis is called pelvic fracture urethral distraction defects (PF-UDD) or simply pelvic fracture urethral injury (PFUI) (1).

Anterior urethral strictures

Anterior urethra is surrounded by the corpus spongiosum which consists of soft cavernous tissue filled with blood which cushions the entire length with expansions at the two ends namely bulb of the urethra proximally and glans of the penis distally.

Aetiopathogenesis

Injury to the urothelial lining caused by instrumentation or external trauma, will lead to leakage of urine or blood in to the spongy tissue which is followed by inflammation and fibrosis termed as 'spongiofibrosis' which ultimately leads to narrowing of the lumen. In addition to epithelial injury, recurrent urethral infection by gonococcal and non-gonococcal organisms will lead to spongiosal inflammation with the same outcome in more diffused nature. Prolonged catheterisation especially with oversized catheters could obliterate the ostia of the urethral glands leading to retention of secretions and subsequent infection ending up with spongiofibrosis. Bulbar urethra could sustain external crush injury during falling astride and iatrogenic instrumentation. Distal urethral strictures are associated with the dermatological diseases such as lichen sclerosus (older term balanitis xerotica obliterans) (2).

Congenital and idiopathic anterior urethral strictures are rare and usually due to embryological failure of recanalization of urethra and the diagnosis should be made by excluding the known causes.

Assessment

Ascending or retrograde urethrography act as the universal standard for diagnosing urethral strictures. In case of a total occlusion, descending or antegrade urethrography (or voiding cysto-urethrography) will add information regarding the proximal extent of the stricture. A combination of both is often used to measure the gap (Gapometry) which predicts the difficulty and helps to plan the method of repair. Pitfall of descending urethrography is involuntary spasm or closure of the sphincter during straining which in turn will prevent visualisation of the proximal urethral segment.

Futile attempts of catheterisation or realignment and blind dilatation would lead to distortion of the stricture segment. With contrast extravasation immediate urethrography might not reveal the true nature of the injury and unless there is a diagnostic uncertainty it's advisable to wait at least 4-8 weeks from the day of urethral injury to perform urethrography for more accurate assessment.

Other non-invasive methods of assessing the urethral stricture include urethral ultrasonography (sono urethrography) and three-dimensional (3D) reconstruction facility (virtual urethrography) in magnetic resonance (MR) and computerised tomography (CT) which may give more detailed information regarding periurethral soft tissue structures, which could facilitate the decision making in repair. However due to practical difficulties and non-superiority, routine use of these modalities in place of urethrography is uncertain (3,4).

Cysto-urethroscopy would only assess the luminal patency and it is a poor indicator of periurethral fibrosis. Uroflowmetry studies are unreliable when used for post repair assessment, as the flow rates might be maintained by strong bladder contractions up until 60-75% of urethral lumen is narrowed.

Management

a.) Urethral dilatation (recalibration, bouginage)

Blind urethral dilatation using various types of metal bougies (e.g. Lister, Liston) is a historical method of maintaining the urethral lumen. While it was considered as an art of a specialist in 19th century which relieved many men of their misery, it carried the grave disadvantage of causing false passages, rectal injuries and the temporary nature of the results which made this procedure to be abandoned by the modern urologist. The rupture of the stricture segment in an uncontrolled stellate manner leads to iatrogenic extensive spongiofibrosis with extension of the stricture.

However modern version of endoscopic guided dilatation using gum elastic filiform bougies over a endoscopically introduced guide wire has eliminated some of the complications and still being used widely for patients with short strictures and who are reluctant to undergo urethroplasty. European studies have shown that endoscopic urethral dilatation is still widely (56%-93%) used due to its simplicity, low morbidity, availability and the lack of necessary expertise in reconstructive urology (5).

In many studies, recurrence rates of blind urethral dilatation are almost 100% and 70% for endoscopic dilatation, hence exclusively reserved for anastomotic strictures after urethroplasty (5).

Self-dilatation of strictures has been advised and practised for recurrent strictures after endoscopic or surgical procedures. Systematic reviews have shown that there is very limited value in this method in a highly selected group of patients (6).

b.) Direct vision internal urethrotomy (DVIU) – optical urethrotomy

Incising the fibrotic stricture segment in full length and depth under direct urethroscopy vision using optical urethrotome and a cold knife is a widely practiced method which gives better stricture free periods compared to dilatation as the tissue injury is less and more controlled. Incision is made under direct vision at 12 O' clock position where a least amount of spongy tissue is found.

In many studies 66%-97% of general urologists used this method as the most acceptable treatment with a stricture free survival of 60-70% in highly selected short, uncomplicated strictures.

Currently, international guidelines recommend DVIU as a first-line therapy for short (i.e., <1-2 cm) isolated bulbar urethral strictures depending on the accessibility for reconstructive procedures and available infrastructural resources.

Repeating DVIU is recommended up to twice with an interval of 3 months. A repeat endoscopic treatment may be offered for favourable strictures with recurrence occurring later than 3 months after primary treatment. Repeated (i.e., more than two procedures) DVIUs or dilations are condemned due to the high recurrence rates which significantly increase with each endoscopic procedure (7,8).

c.) Urethral stents

Urethral metal stents such as UroLume™ or Memokath™ which were popular for a short period are no longer

used due the observation of high rate of complications during long term follow-up (40-55%) which include obstruction, stent migration, recurrent strictures and most worryingly the need for removal leading to complex and challenging urethral reconstruction (9,10). Currently a very limited group of patients who are neither medically suitable or not willing for urethroplasty might benefit from this modality of treatment (11).

d.) Substitution urethroplasty

Once spongiofibrosis has set in, incision or excision and substitution of whole stricturised segment with an allograft is the only hope of a long lasting cure with minimum recurrence rates. Utilisation of graft material has evolved over the years and non-hair bearing penile skin of the inner layer of the prepuce and buccal mucosal full thickness free graft remains as the most frequently used.

Other options such as scrotal skin, post auricular (extra genital) skin, bladder mucosa and colonic mucosa have not stood the test of time due to inferior durability of the skin exposed to acidic urine and the technical difficulties in obtaining the graft from bladder and colon (12).

The ability to withstand the toxicity of urine without long term histological changes, resistance to contractures or sacculation owing to its thickness and rapid neo vascularisation due to the presence of a thin lamina propria, full thickness buccal mucosal graft (BMG) has become the contemporary gold standard of anterior urethral replacement. Another attraction of the BMG is the technical feasibility of harvesting with minimal morbidity in the donor site. In the same context lateral lingual and labial mucosa also have been utilised less frequently.

Inner preputial hairless skin as a full thickness or dartos based pedicle graft comes next to the BMG with inferior results due to long term contractures, lesser tolerability of skin exposed to urine (13,14).

Technique

Once the stricturised segment is studied with the urethrography anterior urethra is exposed through a vertical perineal incision (for the bulbar urethra) or ventral penile urethral incision after retracting the skin proximally with a sub coronal circumferential incision. Stricturised segment could be opened ventrally dorsally or laterally. Depending on the calibre of the stricture buccal mucosal or inner preputial graft can be attached to the ventral or dorsal incision or to the both in case as dual grafts (14,15).

While systemic reviews have failed to demonstrate any superiority of one technique over the other, overall success rates of 90% are quoted. Single-stage BMG showed nearly 100% success in patients with distal penile and navicular fossa lichen sclerosus strictures and 91% in bulbar reconstructions (14,16).

e.) Excision with primary end to end anastomosis (EPA)

When the stricture is totally circumferential excision of the segment becomes mandatory. With adequate mobilisation anastomosis can be achieved in a short bulbar and proximal penile urethral strictures.

Due to the firm adherence of the urethra to the cavernosal bodies in the mid and distal penile urethra, this technique is impossible and can cause urethral ischemia due to over dissection and penile curvature. Recommended safe length of the stricture for this method is 1-4 cm of proximal penile urethra (17).

f.) Staged urethroplasty

Two staged urethroplasty which was introduced in 1950's included initial lay opening of stricture substituted with BMG, followed by retubularisation after 3-6 months. This has fallen out of favour due to the high success rate of single stage graft surgery, need of several operations, and inferior results when local skin grafts are used. For bulbar strictures single and multiple staged urethroplasty give equal results.

Staged urethroplasty is still useful in distal complex strictures in the glans region especially caused by Lichen sclerosus or multiple failed hypospadias repair. In these cases formation of a new urethral plate using the BMG or less commonly the penile skin followed by delayed second stage tabularisation has given good results.

Outcomes of patients after staged urethroplasty with oral mucosa and split-thickness skin grafts (mesh graft urethroplasty) has shown similar overall success (84%) up to 1 year with satisfactory postoperative ejaculatory function (68%) and satisfaction (79%), without significant complications (18).

Future developments

Novel tissue engineering techniques have successfully produced larger sheets of bioengineered oral mucosa which can be used when the buccal mucosa is not available due to presence of oral mucosal disease, irradiation, or technical difficulties in harvesting. However, durability and the long term success rates are not fully assessed and these techniques are categorised under "experimental" and to be used only in setting of clinical trials (19).

Complications

While initial perioperative complications include graft rejection, infection and donor site discomfort which are rare, the most dreaded complication is the stricture recurrence.

Although the exact cause for recurrence is not totally understood, several risk factors which include long stricture length, patient comorbidity, obesity, and infectious aetiology, diabetes, tobacco, lichen sclerosis, pelvic irradiation and failed hypospadias can be outlined. Underlying microangiopathy and ischaemia with poor wound healing is considered as the universal common factor in most of the above-mentioned risk factors (20).

Management of complications

Regular follow-up is essential in detecting recurrence at an early stage. Although a strict follow-up strategy is not laid down in many guidelines, ascending urethrography in 3 weeks combined with validated questionnaire (IPSS) and simple urodynamics (Ultrasound post void residual and flowmetry measurements) could be used to detect early failures. It has been shown that early signs of failures with poor flow rates and large post void residuals are associated with higher chance of long-term recurrence (21).

It has been demonstrated that recurrences within 6 months poorly respond to urethrotomy or dilatation. Available literature indicates success rates after revision urethroplasty are significantly higher compared to DVIU following urethroplasty (which is only 40%-60%). DVIU may only be offered to unfit patients or those not willing to undergo immediate open surgical revision.

Elective revision repair should be considered early and preferably done at a specialised centre. Excision and anastomosis or BMG are both effective depending on the stricture length and the preference of the operator (22,23).

Posterior urethral injury and distraction defects

Aetiopathogenesis

Posterior urethra which comprises of membranous and prostatic urethra, anatomically differs from the anterior urethra by the absence of corpus spongiosum. Presence of the two main urethral sphincters in this anatomical region makes the urinary incontinence a major complication following the injury and subsequent attempts of repair (24).

In the posterior urethra which is fixed at the bulbo-membranous junction, strictures are caused by either

disruption or stretching and fibrosis of the urethral wall almost exclusively caused by mechanical forces associated with disruptive pelvic fractures and rarely by transurethral instrumentation or endoscopic procedures.

Earlier it was believed that the pelvic fractures lead to disruption of the bladder neck from the membranous urethra which is fixed to the urogenital diaphragm and perineal membrane. Recently the concept of "urogenital diaphragm" was rejected with its contribution to the function of the urethra and several studies with radiological evidence have demonstrated that the disruption takes place at the junction between bulbar and membranous urethra just inferior to the perineal membrane. Hence in many occasions the urethral sphincter mechanisms are intact. Furthermore, during repair, the proximal dissection has to be carried out extremely carefully by an experienced operator not to injure the sphincter mechanisms during the repair process (25,27).

It has been shown that although the urethra is partially (6-90%) or completely (6-100%) separated during the pelvic fracture injury, contrary to earlier beliefs, there is hardly any fibrous tissue block found in-between the edges which made it be called as urethral distraction defects (PF-UDD). Hence currently these injuries are called pelvic fracture urethral injury (PFUI) (26).

Assessment

With the clinical suspicion (bleeding per urethra) of urethral injury retrograde contrast urethrography with 30 mL of water-soluble contrast media using an aseptic technique is recommended. Patient is positioned in 30° oblique position and X-ray images are obtained. Extravasation of contrast with or without filling of the bladder will decide the completeness of the injury. It could be unreliable in certain occasions when bladder neck goes in to spasm preventing the free flow of contrast even though the injury is partial, leading to over-diagnosis of complete rupture (28,29).

A variety of classification systems have been proposed for PFUI based on urethrographic findings out of which the EAU classification is widely used. However due to above mention discrepancies in differentiating partial from complete rupture, it is difficult for this classification to be utilised for decision making in acute situations.

During the initial workup of urethral repair "Gapometry/urethrometry index" (length of urethral gap/length of bulbar urethra) could be adopted as a significant predictor for surgical approach and technique to be used. A value of <0.35 predicts that a simple perineal approach could be used (30).

As modern imaging modalities CT and contrast enhanced MRI urethrography has emerged as the most reliable future with the possibility of 3D urethral reconstruction which could greatly assist the treatment strategies (31,32).

Management

Historically PFUI outcome was almost fatal due to bladder outflow obstruction, urinary extravasation leading to sepsis and renal failure. It was Verguin in 1757, who introduced suprapubic cystostomy with railroading of a catheter into the bladder lead to better though uncertain survival outcomes during next one and a half centuries. In the early nineties' mortality dropped from close to 100% in 1757 to 23% in 1942 (33).

Although there are some clear guidelines regarding early and late management, it is still evolving as there is a lack of comparative trials. Few long terms follow up data available for meta-analysis with some worrying reports of late recurrences or new stricture formation (34).

Initial management of the urethral injury

In contrary to the earlier non evidence-based beliefs, a single attempt of a gentle catheterisation with a 12 or 14 Fr soft latex catheter, by an experience operator is acceptable without the fear of converting a partial injury to a total injury. In 50% of partial injuries this attempt will be successful and in case of difficulty and non-drainage, catheter should be removed and suprapubic catheterisation should be done (35).

Suprapubic cystostomy /catheterisation (SPC)

In case of urethral catheterization failure, urgent suprapubic catheterisation with ultrasound guidance, stab cystostomy with a sheath and trocar (if the bladder is palpable) or open method is the gold standard of urinary diversion.

Introduced by Johanson in 1953, SPC will not only relieve the patient's distress but also avoid urinary extravasation in to perineal spaces and further to extra anatomical spaces in the abdomen, chest and the thighs resulting in fatal sepsis. It also prevents urethrocutaneous fistulae, peri-urethral diverticula, necrotising fasciitis and septic shock leading to death.

SPC with monthly or 3 monthly revisions can be kept until the definitive repair is done. Presence suprapubic or urethral catheter cause no increase in infection rates

in instances where there is a need of open pelvic fracture fixation, and it should not affect the timing of the urethral reconstruction (36,37).

Definitive management of posterior urethral injuries

Primary versus delayed surgical strategies are adopted in the definitive care of posterior urethral injuries. Both strategies include open or endoscopic methods to achieve realignment or repair (urethroplasty).

a.) Delayed repair with anastomotic urethro-plasty

The most favoured method of managing the posterior urethral injury is initial SPC followed by delayed repair of the resulting urethral defect. This concept is supported by meta-analysis of over 3000 cases in the literature. It comprises of open resection of the fibrotic segment through the perineum and anastomosis of the healthy ends with or without mobilisation of the peno-bulbar urethra. In most occasions it is carried out as a single stage procedure.

It has to be emphasised that substitution urethroplasty is contraindicated as a primary procedure in PFUI. Substituting this particular urethral segment with autologous tissue does not give good results as there is no spongiosum or healthy tissue with a blood supply for a graft to settle (38).

Principles of anastomotic urethroplasty

Success of anastomotic urethroplasty (AU) depends on identification and excision of the diseased segment followed by tension free end to end anastomosis of fresh ends. Antibiotic coverage and urethral catheter for 3-4 weeks with prolonged SP drainage until patient voids satisfactorily is recommended. Post-operative pericatheter urethrogram (optional) will be needed in difficult cases to confirm proper healing.

Accurate assessment of the extent of the affected urethral segment

Affected segment is studied using the urethrography ("Gapometry"). Longer the segment more difficult to get a tension free anastomosis and may require inferior pubectomy. "Urethrometry index" (length of urethral gap/length of bulbar urethra) is a significant predictor of the need of technical modifications such as urethral rerouting, pubectomy and crural separation. A value of <0.35 predicts possibility of a simple perineal approach (38).

Simple perineal anastomosis is unsuccessful in 10-26% and trans pubic or abdomino perineal approach may be needed for complex strictures, especially following failed previous surgery, severe injury or war injuries. The main indications for the combined approaches are; to improve visualisation, remove fistulous tracts or cavities, repair bladder neck tears and allow a tension-free anastomotic bulbo-prostatic urethroplasty (BPA).

Some authors quote a stricture length of >2.5 cm as a prerequisite for a trans-pubic approach. This approach can cause problems with the penis dropping back into the gap in the pubis created by wedge pubectomy, gait abnormalities and pelvic girdle pain (38,39).

Technique

I. Adequate dissection and exposure of the urethra through the perineal approach

Perineal vertical incision through the skin and the raphe of the bulbospongiosus muscle will expose the urethra. Lateral dissection with separation of it from the proximal crura can be done up to proximal 1/3 rd of the penile urethra.

Passage of an antegrade sound (Hey grove's dilator) through a suprapubic catheter tract in the course of perineal urethroplasty will give an idea about the available proximal urethral length. However, this method is not reliable in the presence of a para-urethral bladder-base fistula or false tract, because the sound might slip into the false passage. Suprapubic cysto-urethroscopy to recognise the prostatic urethra by identifying the verumontanum and healthy mucosa will be a useful adjunct.

II. Excision of the diseased segment

Once urethra is mobilised and the extent of the narrow segment is assessed total excision of the diseased segment is a crucial step for success.

III. Tension free anastomosis of healthy ends

When excising the scarred prostatic apex, including its adherent mucosa, the free edge of the healthy pliable mucosa could retract proximally and should be pulled down and fixed laterally to the prostatic edge. This technique is a requirement for a mucosa-to-mucosa urethral anastomosis. The two urethral ends should be spatulated and anastomosed with 4-6 absorbable 4/0 sutures (41,26).

In an instance where bulbar urethra is too short, techniques such as inferior pubectomy, rerouting of

urethra behind the left crus and midline corpora cavernosal splitting could facilitate bridging the gap.

IV. Long term regular follow-up to detect early and late recurrences

The urethral anastomosis is usually made over a Silastic Foley catheter, of 16 F for adults and 8-12 F for children. The urethral (catheter) stent is usually removed at 3-4 weeks after surgery, considering the neatness of the urethral anastomosis. Before its removal, pericatheter urethrography is advised to exclude leakage at the site of repair.

b.) Alternative Less favoured methods

Primary surgical (open) repair

Young et al originally described primary anastomotic repair of PFUI in 1929 (42). The rationale was to evacuate the pelvic haematoma and produce a watertight repair of the urethra thus preventing urine extravasation and subsequent infection and death, which were otherwise inevitable (42,43,44).

Later it was found that primary open repair carried a high stricture rate (54%) erectile dysfunction (23%) and incontinence (14%) in addition to perioperative morbidity (intra-operative blood loss >3 L on average and prolonged hospital stay ->28 days on average) and mortality due to uncontrolled haemorrhage following disturbance of the pelvic haematoma in an unstable patient.

It is now rarely used and largely abandoned even at the occasion when the haematoma is exposed for internal fixation of the pubis (43).

Delayed acute primary repair

Originally described by Mundy et al, in 1991 for the "pie in the sky" appearance of the bladder in cysto-urethrography. The principle was that with a severe disruptive urethral injury, with prolonged recovery, result of SP drainage alone would result in a long stricture making subsequent repair difficult with high failure rate. Bulbo-prostatic anastomosis was performed 7-10 days after the initial injury, evacuating the haematoma and joining the urethral ends when acute bleeding had ceased and the patient is stabilised (45).

However, this method was never repeated by any other author due to very high rates of erectile dysfunction and the small number of subjects included in the initial study.

Primary open realignment (POR)

First reported by Ormond and Cothran in 1934 as a modification to Young's primary open repair, POR was popular because of its ease. Primary realignment and passage of a catheter in to the bladder after open cystostomy was achieved in a number of ways such as rail-roading with antegrade and retrograde urethral bougies where retrograde bougie is guided with a finger at the bladder neck. The urethral catheter was kept for 4-8 weeks prior to urethrogram and trial of void if healed (46).

It was shown that POR does not actually produce anatomical realignment of the urethra but just realign the urethral edges ultimately resulting defect. Disadvantages of POR are increased blood loss, infection of haematoma and possible worsening of the urethral injury (47).

Primary endoscopic realignment (PER)

PER includes antegrade or retrograde catheter insertion over a guidewire using flexible cystoscopy and rendezvous procedure. Operative time duration is reported 50 to 280 minutes. Primary objective is to prevent or shorten any resulting strictures (48,49).

Similar to open realignment the term realignment is a misnomer as the result is restoration of urethral continuity without actual 3D realignment. The theoretical advantages of endoscopic realignment are not apparent in clinical practice. Patients subjected to primary realignment were significantly more likely to have a stricture <2 cm than those managed solely with SPC diversion (50).

It may be more difficult to treat complete PFUI with PER. Failure due to lack of patient suitability has been reported in up to 20% of cases. Other complications include perineal abscess and urethral fistulae, related to extravasation of irrigation fluid or contrast into the haematoma with consequent infection (49).

As PER becomes more popular number of PFUI urethroplasty after failed endoscopic realignment has increased. There is no consensus as to whether or not previous treatment has an effect on the success of future urethroplasty. Some authors claim good results with failure rates of 9.6-24% whilst others indicate higher recurrence rates of 57% in this group (50).

Delayed endoscopic stricture management after primary SPC insertion

A suprapubic cystostomy is performed at time of PFUI and then any subsequent stricture is managed by direct

visual internal urethrotomy (DVIU), laser urethrotomy or "core through" and "cut to the light" techniques whereby the proximal end of the PFUI is illuminated via suprapubic tract cystoscopy light and an antegrade stiff guidewire is passed to guide a second operator to perform DVIU from the urethral end (51-54). This technique has been reported by few authors but is mostly utilised by general urologists.

However, all "successful" patients needed to perform self-catheterisation to empty the bladder, meaning in reality the failure to achieve long lasting relief was 100% (54).

Endoscopic skin graft urethroplasty

A skin patch held dorsally following DVIU using a special retaining catheter (199-201) was placed after incising the stricture. As the long-term results were less satisfactory it still remains as an experimental method (55).

Management of complications

The three main long-term complications are recurrence, erectile dysfunction and incontinence (Table1).

Recurrence or re-stricturing

Failure in excision of all fibrous tissue and anastomotic dehiscence due to faulty technique are the main reasons for stricture recurrence. Lowest re-stricture rates are found in delayed repair. The mean recurrence rate after delayed anastomotic urethroplasty was 14% (range 0-67%) as compared with 31% after substitution urethroplasty. Observations depended on the period of long-term follow-up. Mean time to recurrence was 34 months (range 58).

Most of the other above-mentioned alternative methods carry high mean re-stricture rates varying from 58% to 82% which requires repeated urethral manipulations and re-repair (56-58).

Erectile dysfunction (ED)

As expected by the anatomical proximity of cavernosal neurovascular bundle there is a significant chance of erectile nerve injury in all pelvic fractures involving the ischio-pubic region. It is more common than previously thought and could be as high as 30% reported when specifically enquired. As survival after major pelvic injuries has increased due to better trauma support, long-term complications such as ED are reported more frequently.

Table 1. Systematic review on complications of posterior urethral injury management (58)

Treatment Method	Total Number (n=)	Follow up, mean	Stricture, %	Erectile dysfunction %	Incontinence, %
SPC alone	379	46.3 m	97.9	25.6	6.7
Primary open repair	258	29.4 m	53.9	22.5	13.6
Delayed primary open repair	17	>12 m	18	71	0
Primary open realignment	883	61 m	58.3	37.2	14.5
Primary endoscopic realignment	401	31.4 m	62	23.6	4.1
Delayed endoscopic treatment	955	31.8 m	80.2	31.9	4.1
Delayed urethroplasty	3,520	54.9 m	14.4	12.7	6.8

Association of ED in PFUI appear to increase due to injury of the cavernosal neurovascular bundle and veno-occlusive dysfunction (59,60).

Post-operative ED varies from 12% to 37% and lowest recorded with delayed repair and the highest with primary open realignment. Interestingly 6-20% of patients have been reported to recover from erectile function after BPA urethroplasty. New onset ED may be reduced by the newer bulbar artery sparing techniques (61,62).

For this reason, it is essential to record pre or post-injury ED prior to delayed repair, ideally with nocturnal penile tumescence (NPT) studies to avoid medico-legal consequences. When pre repair ED is detected, surgically correctable vascular lesions should be sorted by penile Doppler studies and pudendal arteriography when indicated (63).

A non-transecting bulbar artery preserving technique has been described by some authors with the claim of lesser incidence of ED compared to standard anastomotic urethroplasty. However, it is feasible only in a selected group of patients and need more evidence before practiced more widely (64).

Urinary incontinence (UI)

Pelvic fracture urethral injury often spares the urethral sphincter mechanisms and rarely causes incontinence

when the bladder neck is involved at the time of pelvic fracture.

As to be expected incontinence will be unmasked only after the urethral repair. Post repair incontinence rates vary from 4%-15% and the lowest reported with delayed repair. Despite the varying degrees of involvement of external sphincter, invariable preservation of the internal sphincter seem to be the reason for this low incidence of incontinence after delayed anastomotic urethroplasty (65-67).

Conclusions

Urethral stricture disease has a significant morbidity and impact on the quality of life.

Early diagnosis with appropriate imaging and repair has to be preferably done by a specialist in reconstructive urology to avoid complications such as recurrence, erectile dysfunction and incontinence. Anterior urethral strictures are best managed with substitution urethroplasty and there is a limited place for endourological procedures in a selected group of patients.

Posterior urethral injuries and distraction defects should be managed by delayed repair with anastomotic urethroplasty, preceded by suprapubic urinary diversion. Endourological treatment has not provided convincing long-term outcomes to replace urethroplasty.

There is a scarcity of high-level evidence regarding the superiority of one urethroplasty method over the other, patient related outcomes and exact follow-up protocol which opens the path for multicentred, randomised control trials in future.

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