

Analysis of anastomotic urethroplasty for pelvic fracture urethral distraction defect: Decadal experience from a high-volume tertiary care center

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Abstract

Context: Pelvic fracture urethral distraction defect (PFUDD) may be challenging for the treating urologist. Anastomotic urethroplasty is the established surgical procedure for the treatment of PFUDD. Few studies in literature focus purely on PFUDD, and majority of the studies include anterior urethral stricture as well. The period of these studies is relatively short. We conducted a retrospective analysis of patients who underwent primary or redo anastomotic urethroplasty for PFUDD over a period of 12 years at a tertiary care center in northern India.

Aims: The aim is to study anastomotic urethroplasty for pelvic fracture urethral distraction defect with regard to long-term success rate and complications.

Settings and Design: This was a retrospective study. Subjects and

Methods: This retrospective study was conducted in the Department of Urology, King George's Medical University, Lucknow, India, from August 2004 to July 2016. All patients who underwent progressive perineal anastomotic repair of PFUDD were included in this study. Demographic findings, type of pelvic fracture, length of distraction defect as per retrograde urethrography (RUG) and micturating cystourethrography, any history of erectile dysfunction in the preoperative or postoperative phase, and urinary incontinence in postoperative phase were analyzed. Decision regarding catheter removal was taken after pericatheter RUG at 4 weeks. Follow-up was done at 3 and 6 months in postoperative period.

Results: A total of 226 anastomotic repairs were done in 221 patients. Of the 221 patients, 51 (23%) were redo urethroplasty. The mean age of patients was 27.6 years. The mean length of distraction defect was 2.7 cm. The mean duration of hospital stay was 6 days. Primary urethroplasty was successful in 163 (93.14%) of 175 patients and redo urethroplasty in 44 (86.27%) of 51 patients. Out of 165 patients, 18 (10.9%) patients reported occasional incontinence while 6 (3.63%) patients reported mild incontinence.

Conclusions: Anastomotic urethroplasty is the definitive procedure for PFUDD. Our success rate for primary deferred anastomotic urethroplasty is 93.14% and for redo anastomotic urethroplasty is 86.27%.

Keywords: Pelvic fracture urethral distraction defect, pelvic trauma, perineal anastomotic urethroplasty, posterior urethral injury

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INTRODUCTION

PFUDD may be challenging for the treating urologist. PFUDD may be complicated by associated fracture of the bony pelvis and injuries to the pelvic and abdominal viscera.^[1,2]

Anastomotic urethroplasty is the preferred surgical procedure for the treatment of PFUDD and has been reported to have a success rate of 77%–95%.^[3-5] There has a significant evolution in the understanding of the pathological anatomy and the surgical management of PFUDD.^[6] Badenoch's pull, through procedure described for stricture length <2 cm^[6] in earlier series, is obsolete now. Transpubic anastomotic urethroplasty^[7,8] or multistaged substitution urethroplasty^[9,10] remains the procedure of choice.

When perineal access to the defect is difficult due to associated bladder neck abnormalities, periurethral cavities, rectal injuries, and bony abnormalities, then abdominoperineal repair remains the preferred approach; these cases are termed as complex PFUDD.^[11,12]

In English literature, most of the studies on PFUDD have heterogeneous data and include different types of strictures. The period mentioned in these studies is relatively short. Ours is a retrospective analysis of 221 patients who underwent primary or redo urethroplasty for PFUDD over a period of 12 years.

India has one of the highest rates of road traffic accidents in the world due to various reasons including bad status of roads, poor training of drivers, old vehicles, and poor compliance to road safety.^[13,14]

Our state has the largest share of road traffic accidents in India. Since our center⁴ is the largest tertiary care center in the state, we cater to a large number of accident victims and PFUDD patients. Herein, we present their data.

SUBJECTS AND METHODS

This retrospective study was conducted in Department of Urology, King George's Medical University, Lucknow, India, from August 2004 to July 2016. Ethical approval was taken from the institutional review board, and it was in accordance with the Declaration of Helsinki. All patients who underwent progressive perineal anastomotic repair of PFUDD were included in our study. Patients with bulbomembranous stricture due to other etiologies (inflammatory stricture, postprostatectomy stricture, and postirradiation stricture), who underwent

alternative repair (substitution urethroplasty) and who did not give consent to participate in the study, were excluded from the study.

The length of defect was measured by a combined study of retrograde urethrography (RUG) and micturating cystourethrography (MCU). Urethroscopy and antegrade cystourethroscopy through suprapubic tract were carried out in selected cases in whom delineation of the posterior urethra was inadequate following MCU.

Case sheets and other patient-related documents were reviewed. Findings related to clinical history, physical examination and investigations such as blood examination, RUG, MCU, ultrasonography, and x-ray KUB (Kidney, ureter and bladder) were noted. If the findings of retrograde cystourethroscopy and antegrade cystourethroscopy mentioned in the case sheets, they were included in our study.

Postprocedural assessment and follow-up

At our center, urethral catheter is removed if contrast extravasation is not visualized on the pericatheteric RUG performed at 4 weeks following urethroplasty. If extravasation is seen, then catheter is kept for further 2 weeks. The suprapubic catheter is removed after successful voiding trial, usually on the same day. Findings related to voiding trial are also noted.

At 3 months, clinical history (urinary incontinence, erectile dysfunction, and ejaculatory dysfunction), RUG, and uroflowmetry are recorded. At 6 months, the clinical history (urinary incontinence, erectile dysfunction, and ejaculatory dysfunction) and uroflowmetry findings are again recorded. Then, the patients were followed up every 6 months. If there is any adverse event during follow-up, it is also recorded. All these findings were included in our study.

Surgical technique

The standard operative protocol in our department is as follows:

Patients are placed in exaggerated lithotomy position; inverted Y incision is given over the midline of the perineum. After the distal and proximal urethra is mobilized, sequential maneuvers are performed to achieve tension-free anastomosis.

Circumferential urethral mobilization of the bulbar urethra

This maneuver is performed till the point of obliteration proximally and the suspensory ligament of the penis distally. Further distal mobilization may result in chordee.

Following this curved urethral (Van Buren), sound is passed through the suprapubic cystostomy tract and negotiated into the posterior urethra through the bladder neck. Incision of perineal scar is then performed in the midline until the tip of the urethral sound is come across.^[15]

Separation of the corporal bodies

Performance of this maneuver gives additional 1.5–2.0 cm of length. The separation is started at the level of the crus and progressed distally for approximately 4–5 cm along a relatively avascular midline plane. A more intimate connection between the corporal bodies distally hinders further separation. After this maneuver, urethra lies between the separated corporal bodies, which helps to decrease the distance to anastomosis.

Inferior pubectomy

Sometimes, even after performing the above-mentioned maneuvers, tension-free anastomosis is still difficult to achieve. Additional 1–2 cm of urethral length can be gained by inferior pubectomy. A wedge of bone is excised from the inferior aspect of the pubis after the dorsal vein is either ligated or displaced laterally. This is also helpful for better exposure of anteriorly displaced prostate.

Supracrural rerouting

To perform this maneuver, a bony defect is created in pubic bone by further pubectomy and urethra is rerouted around the corporal body through this defect. It gives additional 2 cm of urethral length for the anastomosis.

Transpubic anastomosis

If even after the above-mentioned maneuvers, tension-free anastomosis is not possible, a midline suprapubic incision is made up to the base of the penis coursing over the pubic symphysis. Bladder is opened on anterior wall and prostatic urethra is identified. Dissection of the anterior surface of pubic symphysis is performed and the suspensory ligament of the penis is divided. For dissection on the posterior surface of pubic symphysis, a plane is created below the periosteum to avoid scar tissue. Then, both pubic rami are excised with the help of Gigli saw. Scar over the prostatic apex is resected until urethral sound can be passed. During this procedure, spatulation of prostatic urethra is done on the anterior surface.

Regardless of the maneuvers used (except transpubic anastomosis) to bridge the defect, the urethra is prepared by spatulation of the distal urethral stump at the 12 o'clock position and the proximal urethra at the 6 o'clock (posterior) position to achieve an anastomosis of at least 24Fr. The anastomosis is accomplished with 6 radially placed 3-0 or

4-0 polyglycolic acid sutures. A corrugated drain is placed lateral to anastomosis in all patients. Postoperative urinary drainage is accomplished with a 16 Fr silicone urethral catheter in addition to a 12–18 Fr suprapubic catheter.

RESULTS

A total of 278 patients underwent perineal anastomotic urethroplasty for PFUDD, out of which data for analysis were available for 221 patients. Deferred transperineal bulboprosthetic end-to-end urethroplasty was performed in all the patients. One hundred and seventy-five patients had a history of primary end-to-end urethroplasty while 51 patients had a history of redo end-to-end urethroplasty [Table 1]. Out of these 51 patients, 46 had previous operations done at other hospitals and 5 cases underwent operation at our center.

The mean age of patients was 27.6 years (ranges 7–70 years); 10 (4.5%) patients had comorbidities including hypertension (4 patients), diabetes mellitus (5 patients), and coronary artery disease. Road traffic accident was the most common etiology and the most common associated injuries involved abdominal viscera. The mean follow-up period was 34 months (range 5–110 months).

Pelvic radiographs taken at the time of initial injury were available for 44 patients. Single ramus fracture was present in 14 patients, ipsilateral ischiopubic rami fracture in 8 patients, fracture of both ischiopubic rami with disruption of ipsilateral sacrum or sacroiliac joint or ilium (Malgaigne's fracture) in 6 patients, straddle fracture in 1 patient, and miscellaneous types of fractures in 15 patients.

In 226 urethroplasties, corporal separation was done in 89 (39.38%), inferior pubectomy was performed in 41 (18.14%), 1 patient required corporal rerouting, and 3 patients underwent transpubic anastomotic urethroplasty. The mean time between injury and repair was 7 (range from 3 to 51) months. The mean length of distraction defect was 2.7 (range from 0.5 to 8) cm.

End-to-end anastomotic urethroplasty was successful in 163 (93.14%) of 175 patients in whom primary urethroplasty was done at our center. Redo urethroplasty was successful in 44 (86.27%) of 51 patients. All failures

Table 1: Results of urethroplasty

Patient distribution	Primary urethroplasty	Redo urethroplasty	Total
Number of cases	175	51	226
Success after urethroplasty	163	44	207
Failure after urethroplasty	12	7	19

of urethroplasty occurred in the 1st year. Of the 12 failures in primary end-to-end urethroplasty, 3 were salvaged by direct vision internal urethrotomy (DVIU), 4 patients required DVIU with regular urethral dilatation, and 5 patients were subjected to redo urethroplasty who are included in subsequent data of redo urethroplasties. Of these 5 redo urethroplasties, 1 patient had failure to void and is on suprapubic cystostomy till the last follow-up. After redo urethroplasty in rest of 46 patients, 6 had failure to void. Of these 6 patients, 1 was salvaged with DVIU, 2 patients continue to require urethral dilatation, 1 underwent Mitrofanoff urinary diversion and is doing well in follow-up, while 2 are still on suprapubic cystostomy and waiting for next surgical intervention. Overall 7 patients had failure after redo urethroplasty.

The mean duration of hospital stay was 6 days. The mean duration of urethral catheterization was 4.2 weeks.

Data on preoperative and postoperative erectile function were available in 180 patients. Preoperatively, 76 patients had an erection of whom 27 had good erections while 49 patients had partial erections and were unable to perform sexual intercourse. Of these 49 patients, 9 had improvement in erection after urethroplasty. Thirteen patients of 27 having good erections in the preoperative phase reported diminished erection after urethroplasty.

Data on postoperative incontinence were available in 165 patients. Eighteen (10.9%) patients reported occasional incontinence while 6 (3.63%) patients reported mild incontinence [Figure 1].

DISCUSSION

Over the last few decades due to better understanding of pathophysiology of PFUDD and better surgical

techniques, there is an improvement in results of anastomotic urethroplasty. Most patients belong to young age group. In India, youngsters ride motorcycles due to financial reasons and are prone to pelvic injuries in road traffic accidents.

There is a controversy in the literature surrounding the appropriate timing of surgery (delayed versus immediate) in the management of PFUDD. Being a third world country, resources are not available for primary realignment. At our center, we perform deferred urethroplasty after referral from other centers. Usually, patients have suprapubic cystostomy *in situ* at the time of referral. A patient with pelvic fracture has 10% chance of having associated PFUDD.^[1,2] Bleeding, fracture instability, and friability of the edematous tissue are the major concerns during early repair. Early management includes urethral realignment or the use of stenting catheter,^[16,17] but the most common initial management is placement of a suprapubic cystostomy at the time of injury followed by deferred reconstruction.^[18] Koraitim^[19] reported a high rate of impotence among patients undergoing primary realignment. Till date, no study in the English literature has prospectively assigned or randomized patients to primary versus delayed surgical management.

Fractures of inferior and superior pubic rami are most commonly associated with PFUDD. In our study, 28 out of 44 cases were having the fractures of either superior or inferior pubic rami [Table 2]. Similar results have been described in the literature by Aihara *et al.*^[20] Other types of pelvic fractures which are associated with PFUDD include Malgaigne's fracture, straddle fracture, pubic diastasis, and sacroiliac joints.^[20] Approximately 50% of pelvic fractures are mild to moderate in severity, with >90% having minor associated injuries.^[21] The severity of pelvic fracture has relationship with the severity of associated urethral injuries as the severity of pelvic fracture increases so does the chance of PFUDD.^[2] The most common reported cause of pelvic fracture is road traffic accidents (68%–84%), and it is four times more likely to be associated with PFUDD than fall from height, the second most common cause seen in 6%–25% cases.^[1,22–25] Other etiologies of pelvic fracture are slipping, attack by animals, and industrial accident.^[26] Due to improvement in safety standards and automation of machinery for industrial workers, industrial accidents have taken a back seat as etiologies for pelvic trauma and are rare nowadays.

Delayed endoscopic approach (cut-to-the-light, stenting procedure, core-through) does not remove fibrosis such as urethroplasty and results are poor. We do not perform delayed endoscopic management of PFUDD.

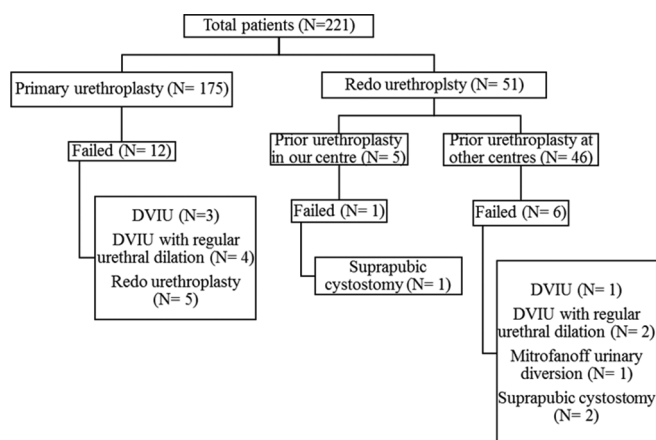


Figure 1: Flow chart of patients

Table 2: Patient characteristics and clinical data

Characteristics	Number of patients (%)
Age group	
<20	75 (33.93)
20-29	59 (26.69)
30-39	37 (16.74)
40-49	27 (12.21)
50-59	9 (4.07)
>60	14 (6.33)
Mean±SD	27.6±14.6
Associated injuries	
Abdominal viscera	36 (16.3)
Pelvic viscera	76 (34.7)
Extremities	24 (11)
Head	6 (3)
Thorax	5 (2.4)
Type of bone fracture	
Single ramus	14 (31.8)
Ipsilateral rami	8 (18.18)
Malgaigne's	6 (13.63)
Straddle	1 (2.2)
Other	15 (34.09)
Maneuvers	
Mobilization of bulbar urethra	92 (40.70)
Mobilization of bulbar urethra + corporal separation	89 (39.38)
Mobilization of bulbar urethra + corporal separation + inferior pubectomy	41 (18.14)
Mobilization of bulbar urethra + corporal separation + inferior pubectomy + corporal re-routing	1 (0.44)
Transpubic anastomotic urethroplasty	3 (1.32)
Mean time since injury in months (range)	7 (3-51)
Follow-up in months, mean (range)	34 (6-110)
Length of stricture in cm, mean (range)	2.7 (0.5-8)
Mean duration of stay in days	6 (4-17)
Mean duration of catheterization in weeks	4.2 (4-6)

SD: Standard deviation

During deferred anastomotic urethroplasty, incomplete excision of scar tissue results in postoperative scar contracture which is the most important cause recurrent stenosis. Extensive distal urethral mobilization may lead to ischemia, compromising the anastomosis. Less bleeding from the distal urethra is a sign of ischemia. Conversely adequate mobilization of distal urethra can be observed by seeing constant trickling of blood. The high vascularity of prostatic urethra usually gives excellent results in end-to-end anastomotic urethroplasty.

We considered urethroplasty to be successful if the patient was voiding well and did not require any auxiliary procedure after urethroplasty. Our results are comparable to that mentioned in literature with success rate of 93.14% for primary urethroplasty and 86.27% for redo urethroplasty. Some studies have included one attempt of DVIU or urethral dilation following PFUDD repair to define success with documented success rates of 77%–95%.^[20-23]

PFUDD repair by anastomotic urethroplasty is often complicated by urinary incontinence and erectile dysfunction. Continence after anastomotic urethroplasty

for PFUDD is maintained by bladder neck and incontinence occurs only when the bladder neck function is impaired. Bladder neck injury may be the cause of impaired function in most of the cases, but sacral nerve injury or injury to pelvic plexus may also be the cause.^[27] In our study, incontinence was considered as occasional when it occurred only with increased abdominal pressure and was present in 10.9% cases while mild incontinence was reported in 3.63% cases. The incidence of urinary incontinence is approximately 10% in the literature.^[28,29]

Exact cause of erectile dysfunction in PFUDD patient not known, but it can be of vascular, neurogenic, or psychogenic origin.^[30] In our study, 104 (57.77%) of 180 patients had erectile dysfunction preoperatively, and in remaining 76 patients which had erections, 49 were having only partial erections and were not able to do sexual intercourse. Following urethroplasty, 9 of 49 patients improved whereas 13 of 27 patients had new onset erectile dysfunction following surgical repair. A study by Mundy reported 7% incidence of erectile dysfunction after PFUDD repair^[31] and another study has reported erectile dysfunction in only 2 of 155 patients.^[32] However, many studies in recent literature show erectile dysfunction in 18%–72% after anastomotic urethroplasty for PFUDD.^[33-36] This wide variation in incidence of erectile dysfunction is due to different definitions of erectile dysfunction used in different studies. In his study, Anger^[33] defined erectile dysfunction using IIEF questionnaire and another study used brief male sexual function inventory (BSFI) tool to define erectile dysfunction.^[37] However, majority of studies have defined erectile dysfunction as inability to achieve erection sufficient enough to perform vaginal penetration.^[34,36]

The strength of our study is that we have included patients suffering from PFUDD and we have excluded other types of stricture. We have included a large number of patients in our study with long follow-up period.

CONCLUSION

Deferred anastomotic urethroplasty results in satisfactory success rate over long term with minimal complications

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Conflicts of interest

There are no conflicts of interest.

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