Original Article

Outcome of anastomotic posterior urethroplasty with various ancillary maneuvers for post-traumatic urethral injury. Does prior urethral manipulation affect the outcome of urethroplasty?

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Abstract

Purpose: We present our success rate and complications of delayed anastomotic urethroplasty (DAU) in patients with post-traumatic posterior urethral injury.

Materials and Methods: This was a retrospective study of patients aged ≥17 years that underwent DAU for post-traumatic posterior urethral injury during 2010–2014. Stricture length was measured by ascending and descending urethrogram. Success of procedure was considered when the patient was free of stricture-ralated obstruction and needed no further intervention. Primary group includes patients who underwent first time delayed urethroplasty while secondary group included patients who had some sort of urethral manipulation in local hospital. Results were analyzed using unpaired *t*-test, Chi-square test, binary logistic regression, Kaplan–Meier curves, and log-rank test.

Results: Of the 80 male patients, 73 (91.25%) patients underwent primary DAU while 7 (8.75%) patients had secondary DAU. Median age, stricture length, and follow-up were 27.0 ± 12.7, 1.6 ± 0.9, and 3.2 ± 0.9, respectively. Overall, success rate was 83.75% while success rate in primary group was 89.04% and secondary group was only 28.57% ($P = 0.0059$). Regarding ancillary maneuvers, urethral mobilization alone was done in 29 (36.25%) patients with success rate (72.41%), corporeal body separation in 36 (45%) patients with success rate (91.66%), inferior wedge pubectomy in 13 (16.25%) with success rate (84.61%), supracrural rerouting in 1 (1.25%) with success rate (100%), and abdominoperineal approach in 1 (1.25%) with success rate of 100% ($P = 0.193$). Patients who had prior urethral manipulation affect the outcome of definitive anastomotic urethroplasty.

Conclusion: DAU has durable success rate with less morbidity. Ancillary elaborated maneuvers are frequently needed in patients with complex and elongated post-traumatic posterior urethral defect with successful outcome.

Keywords: Inferior wedge pubectomy, posttraumatic, urethral mobilization, urethroplasty

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Received: 10.11.2017, **Accepted:** 19.12.2107

Access this article online	
Quick Response Code:	Website: www.urologyannals.com
	DOI: 10.4103/UA.UA_168_17

How to cite this article: Mehmood S, Alsulaiman OA, Al Taweel WM. Outcome of anastomotic posterior urethroplasty with various ancillary maneuvers for post-traumatic urethral injury. Does prior urethral manipulation affect the outcome of urethroplasty?. Urol Ann 2018;10:175-80.

INTRODUCTION

Posterior urethral injuries are most commonly associated with pelvic fracture,[1,2] with an incidence of 5%–10%. With an annual rate of 20 pelvic fractures per 100,000 populations, these injuries are not uncommon.[3] Pelvic fracture posterior urethral injury (PFPUI) continues to be a surgical challenge in reconstructive urology. The mechanism of posterior urethral injuries due to pelvic fracture and emergency management of these injuries vary worldwide, especially in developing and developed world.[4-6] Complex posterior urethral injuries with pelvic fracture require a greater understanding of all available technique to reconstructive urologist.[7,8] Otherwise, it can lead to devastating complication such as urinary incontinence, urethracutaneous fistula, and restenosis.[9]

In the 1970s, Turner-Warwick devised a new technique to bridge the defect of 2.5 cm by a delayed one-stage perineal approach of bulboprostatic urethral anastomosis.[10,11] It is a procedure of choice for posterior urethral injury and provides a decreased incidence of postoperative morbidity, restenosis, and urinary incontinence for short segment post-traumatic urethral injury.[12] There is wide variety of technique available for posterior urethral injury management. Excision and spatulated end-to-end anastomosis is an ideal procedure for single short traumatic stricture of bulbar urethra and posterior urethral defect with varying degree of success in some series.[13,14]

In 1991, Webster and Ramon popularized the extended perineal approach using various ancillary maneuvers such as corporeal body separation, inferior pubectomy, and retrocrural urethral rerouting to reduce the gap between bulbar and the prostatic apex. These maneuvers allow better removal of scar tissues and tension-free anastomosis of posterior urethra.[15] Although these ancillary approaches became standard for simple and complex traumatic posterior urethral injury in era of 90s,[16,17] few studies from developed countries described the limited role of these maneuvers.[18,19]

Another controversial issue is the timing of posterior urethral injury management. The objective of immediate management is to effectively divert urine to expedite the early recovery of patient. Increase rate of erectile dysfunction (ED) and urinary incontinence with immediate management direct reconstructive surgeons to delayed urethroplasty,[20,21] but primary urethral alignment appears to reduce the incidence of stricture formation after posterior urethral injury due to pelvic fracture.[6,22,23]

In this study, we report the outcomes of a series of patients who underwent delayed perineal anastomotic urethroplasty by various ancillary maneuvers and compare surgical success rate with published series.

MATERIALS AND METHODS

After the Institutional Review Board approval, retrospective chart reviews were perforformed in all adult patients with PFPUI who underwent delayed anastomotic urethroplasty (DAU) in our tertiary care referral center by a single surgeon. In all patients, history, physical examination, retrograde, and voiding cystourethrography was performed. Intravenous antibiotics were administered perioperatively and then tailored according to urine sensitivity. Patient's data were reviewed by age, etiology of stricture, prior treatment, and ancillary treatment while doing anastomotic urethroplasty. Preoperative stricture length on ascending and descending urethrogram was noted. Pre- and postoperative sexual functional statuses of patients were assessed and documented. Peri- and postoperative complications mentioned in charts were noted.

Surgical techniques

All patients underwent transperineal excision and anastomotic urethroplasty after taking informed consent. The patients were placed exaggerated lithotomy position and an inverted Y-shaped incision was made in perineum. Incision deepened and bulbar urethra was mobilized from proximal end and transected at the distal end of strictured segment. After excising all scared tissues, the distal urethral end was spatulated. A stepwise approach for urethral mobilization was performed with mobilization of bulbar urethra, separation of cavernosal bodies, and inferior pubectomy was performed in those cases who had a urethral defect of >3 cm in length to achieve tension-free mucosa to mucosa reanastomosis with 5/0 polyglycolic acid sutures over a 16 French silicon catheter. Abdominoperineal approach and supracrural rerouting were reserved for recurrent complex cases of posterior urethral stricture. Procedure was completed by closing the wound with or without drain placement. Suprapubic catheter was retained. Patients were usually discharged at postoperative day 5–7. Pericatheter urethrogram was performed at day 21 to make sure that there was no leakage at anastomotic site. We usually do an uroflowmetry by infusing 200 ml of water through urethral catheter in outpatient clinic and then take out folly catheter. Suprapubic catheter was taken out next day if patient passed urine satisfactorily.

Follow-up

Patients were followed up at regular interval at 3, 6, and 12 months with a history of urinary symptoms,

uroflowmetry, and retrograde urethrogram. The surgical success was defined as asymptomatic voiding with no obstructive symptoms, good flow rate on uroflowmetry, and absence of narrowing on urethrogram.

Statistical analyses

Statistical analyses were performed using SPSS 20.0 software (SPSS, Chicago, IL, USA). Descriptive statistics were analyzed as mean ± standard deviation, postoperative complication like ED; stress incontinence and urethroplasty failure were analyzed by Chi-squared test. Quantitative variable like age was measured with independent samples *t*-test. Kaplan–Meier curve was used for success rate between patients with primary delayed urethroplasty and patients with prior manipulation and compared with log-rank test. Statistical significance was considered as $P \leq 0.05$.

RESULTS

Eighty male patients were included in the study. Median age at the surgery was 30.56 ± 5.06 years and median follow-up was 3.2 ± 0.9 years. Median length of urethral stricture was 2.7 ± 0.6 cm. Seventy-three (91.25%) patients underwent primary DAU and 7 (8.75%) patients had a history of either primary realignment ($n = 3$), visual internal urethrotomy (VIU) ($n = 2$), and urethroplasty ($n = 2$) done in other center before referral to our institution as shown in Table 1.

Regarding etiology, 64 (80%) patients had motor vehicle accident, 8 (10%) with a history of fall from height, 6 (7.5%) straddle injury, and 2 (2.5%) with iatrogenic trauma as shown in Figure 1.

Overall success rate was 83.75% with a Q_{max} of >18.0 ± 3.2 ml/s at median follow-up of 3.2 ± 0.9 years. Primary group had a success rate of 89.04% while patients in secondary group had a success rate of 28.57% only as shown in Table 2 and Graph 1. Most of the patients with failed urethroplasty referred to our tertiary care center for further management. Thirteen (16.25%) patients underwent redo surgery in which 4 (30.76) patients had redo anastomotic urethroplasty and 9 (69.23%) patients with direct visual internal urethrotomy (DVIU) as mentioned in Table 3.

Fifty-one (63.75%) patients required ancillary maneuvers to fill the gap to do tension-free anastomosis. These elaborated maneuvers for perineal anastomotic urethroplasty were solely based on complexity and length of strictures as urethral mobilization alone was not sufficient in these patients. The data of these patients are shown in Table 4 and Graph 2.

Regarding early and late complications, almost all complications were managed conservatively except recurrent stricture which developed in 13 (16.25%) patients. These patients were successfully managed with redo urethroplasty in four and VIU in nine patients. These complications are mentioned in Table 5.

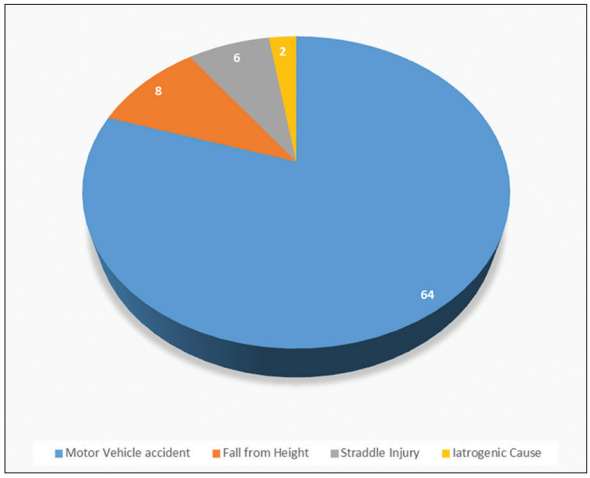


Figure 1: Number of patients with etiology of urethral stricture defect

Table 1: History and clinical data of patients

Variables	Results
Number of patients	80
Number of patients with primary delayed urethroplasty, *n* (%)	73 (91.25)
Number of patients with prior manipulation, *n* (%)	7 (8.75)
Primary realignment	3
VIU	2
Urethroplasty	2
Median age (years)	27.0±12.7
Median follow-up (years)	4.2±1.4
Median length of urethral stricture (cm)	1.6±0.9
Follow-up Q_{max} (ml/s)	18.0±3.2

VIU: Visual internal urethrotomy

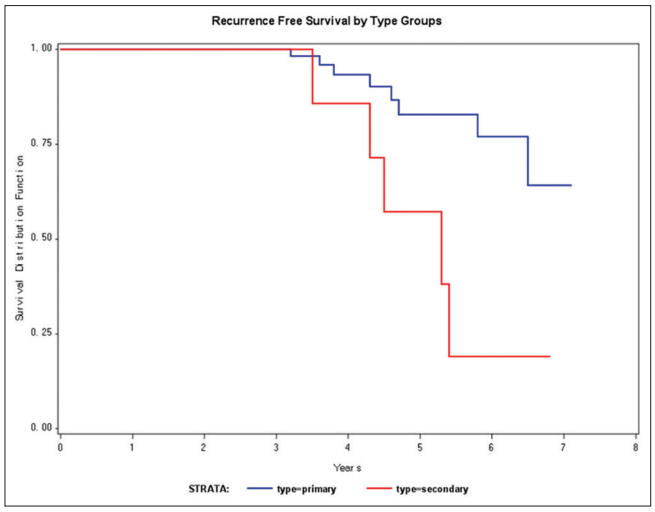
Table 2: Overall primary and secondary urethroplasty outcome

Variables	Number of patients (%)	Success rate (%)	Failure rate (%)	*P*
Overall success	80	77 (83.75)	13 (16.25)	
Primary group	73 (91.25)	65 (89.04)	8 (10.95)	0.0059
Secondary group	7 (8.75)	2 (28.57)	5 (71.42)	

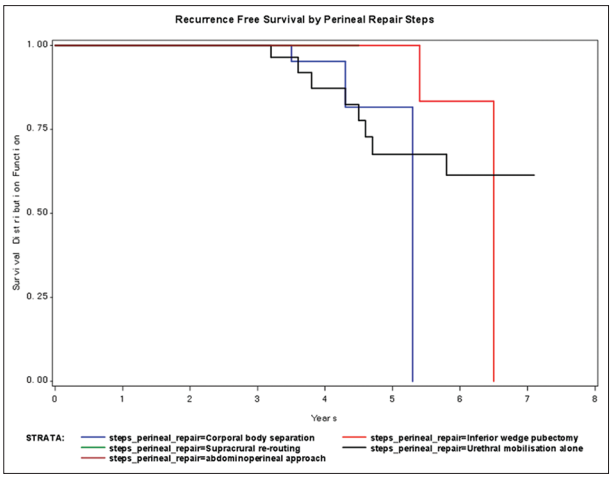
Table 3: Second surgery of patients with recurrence and its outcome

Type of surgery	Number of patients	Success rate	Failure rate
Redo urethroplasty	4 (30.76)	4 (100)	0
DVIU	9 (69.23)	9 (100)	0

DVIU: Direct visual internal urethrotomy



Graph 1: Kaplan–Meier curve for success rate: primary group versus secondary group (log-rank *P* = 0.0059)



Graph 2: Kaplan–Meier curve for success rate with various ancillary maneuvers (log-rank *P* = 0.193)

Table 4: Steps in urethroplasty and success rate

Steps in urethroplasty	Number of patients	Success rate (%)	Failure rate (%)	*P*
Urethral mobilization alone	29 (36.25)	21 (72.41)	8 (27.58)	0.193
Corporal body separation	36 (45)	33 (91.66)	3 (8.33)	
Inferior wedge pubectomy	13 (16.25)	11 (84.61)	2 (15.38)	
Supracrural rerouting	1 (1.25)	1 (100)	0	
Abdominoperineal approach	1 (1.25)	1 (100)	0	

Table 5: Complication of surgery

Type of complication	Number of patients
Scrotal swelling	8
Wound infection	5
Urethrocutaneous fistula	1
Stress incontinence	1
Erectile dysfunction	
Preoperative (post-traumatic)	3
Postoperative	4

DISCUSSION

Posterior urethral disruption is one of the most challenging dilemmas for reconstructive urologist following pelvic fracture. Surgery for posterior urethral stricture has its own inherent problems because of its difficult access; limited urethral length, surrounding fibrosis, and small diameter of urethra render it susceptible to ischemic insults.[24] Depending on the site, stricture length and possible previous surgery underwent by patients are the factors which determine the type of procedure.[17,25,26] These include dilatation, VIU, perineal urethral anastomosis, elaborated perineal, and abdominoperineal procedure for urethral reconstruction.[15,27,28] Similarly, VIU is only feasible in true stricture with intact epithelium and not appropriate in distraction defects where urethral ends are separated by fibrotic tissue.[29] All of our patients had a traumatic urethral stricture underwent perineal anastomotic urethroplasty with elaborated ancillary maneuvers.

Important steps that need to consider avoiding recurrence include maintaining the vascurity of urethra, complete excision of the fibrous tissue, and tension-free anastomosis.[30] Hafez *et al*.[11] found a success rate of 88% with delayed anastomotic perineal urethroplasty for post-traumatic posterior urethral stricture. He further explained that majority of complications with perineal anastomosis can be avoided by meticulous preoperative evaluation to define anatomy and intraoperative careful manipulation.[8] In our result, we observed a similar result of 89.3% success rate with delayed primary perineal anastomosis. Similarly, Al-Qudah and Santucci[31] reported 100% success rate for posterior anastomotic urethroplasty and Flynn *et al*.[32] investigated a recurrence rate of 5% in their 109 patient series who underwent perineal anastomotic urethroplasty. The major cause of recurrent stricture was inadequate excision of fibrotic tissue and mobilization of urethra at the time of surgery. Hence, it is mandatory to completely excise the fibrotic tissue to achieve tensionless, complete, and healthy mucosal anastomosis.[8]

Moreover, it is still debatable whether primary realignment or urethral manipulation impact on overall success rate of salvage anastomotic urethroplasty. Our center is referral center from all over the kingdom. Few of our patients referred to our after several attempts of endoscopic or open repair. In our series, success rate in these patients with previous urethral manipulation was only 28.58% in the first attempt as compared to primary delayed urethroplasty in success rate was 91.25% (log-rank *P* = 0.0059). Mundy experienced that early endoscopic realignment impedes delayed urethroplasty because of extensive inflammatory

fibrotic process in up and down of that urethral part and on either side of injury.[33] Similarly, Wadhwa *et al*. reported the record of 23 patients in whom perineal anastomotic urethroplasty was unsuccessful for traumatic urethral stricture. Hence, final success rate after salvage urethroplasty was only 14% and satisfactory results were gained in only 28.5% of cases.[34] Hence, previous railroading or urethroplasty decreases the success of subsequent urethroplasty.[35,36] It can be concluded from above-mentioned studies that immediate manipulation should be avoided in suboptimal conditions and these posterior urethral distraction cases after pelvic trauma should be referred to specialized center with such expertise.

The objective for progressive elaborated perineal maneuvers is to change the geometry of the path required for tension-free anastomosis of dislocated proximal urethral stump to bulbar urethral end. We have used all four progressive perineal maneuvers in our series on the basis of length of distraction defect and complexity of urethral stricture with similar success rate as in published series. Koraitim[37] reported elaborated maneuvers using clinicoradiological parameters, including a "gapometry"/urethrometry index, urethral gap length, and prostate displacement, to predict which patients need elaborated perineal or transpubic approach and which patients required simple perineal urethroplasty alone. We think that surgeon performing pelvic fracture urethral distraction defect surgeon should be capable of performing all types of elaborated maneuvers. As we have seen in our series, simple looking defect on preoperative radiograph might be totally different on surgical exploration. Similar observation was reported by Andrich *et al*.,[38] who described that 62 men out of 100 there was no association between preoperative measured defect length and scale of surgery required.

Singh *et al*.[39] reported his progressive elaborated perineal approach in 172 patients, with an overall success rate of 91% while Fu *et al*.[40] reported an overall success rate of 87.4% in 301 patients. Simple perineal anastomosis was done in 103 (34.2%), perineal anastomosis with separation of the corporal bodies in 89 (29.6%), perineal anastomosis with inferior pubectomy in 95 (31.6%), and perineal anastomosis with supracrural rerouting of the urethra in 14 (4.7%). Of the 301 delayed transperineal bulboprostatic anastomosis procedures, 263 (87.4%) were successful. Simple perineal anastomosis with no ancillary procedures had an 89.3% success rate, perineal anastomosis with separation of the corporeal body an 86.5% success rate, perineal anastomosis with inferior pubectomy an 84.2% success rate, and perineal anastomosis with urethral rerouting an 85.7% success rate. Our series results are very similar with above-mentioned study. We had 72.41% success rate in urethral mobilization alone, 91.66% in corporeal body separation, 84.61% in inferior wedge pubectomy, 100% in supracrural rerouting, and 100% success rate in abdominoperineal approach.

Urinary incontinence is the most common complication after urethroplasty. The incidence of urinary incontinence is <10% and even much lower in some series.[8,41,42] We have only 1 patient (1.25%) who developed mild stress urinary incontinence which was successfully managed conservatively. Another common complication of posterior urethroplasty is ED. Pelvic fracture is associated with urethral dysfunction and ED. Many studies suggest that it is the primary injury which causes neurovascular damage that leads to ED rather than urethral surgery itself. Clinicians postulate that cavernous nerves and branches internal pudendal artery are located near the apex of prostate and supply the corporeal bodies after entering through the urogenital diaphragm. These neurovascular bundles got damage during pelvic fracture, especially pubic symphysis diastasis.[43-46]

Limitations in this study need to be considered. The main limitation of our series was its retrospective nature and small number of study patients. Potential bias and reporting errors are the main risks of any retrospective study. We assured that many of these ambiguities were mostly avoided during data collection.

CONCLUSION

DAU has durable success rate with less morbidity. Ancillary elaborated maneuvers are frequently needed in patients with complex and elongated post-traumatic posterior urethral defect with successful outcome.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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