



Delayed Posterior Urethroplasty Following Pelvic Fracture Urethral Injury: Do We Have to Wait 3 Months?

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OBJECTIVE	To compare outcomes with early vs delayed reconstruction following pelvic fracture urethral injury (PFUI) to determine if a traditional 3-month delay is necessary. This delay has been advocated to allow resolution of traumatic inflammation and hematoma but has never been validated. We proceed to reconstruction at 3-6 weeks if the associated injuries are stable, the perineum is soft on rectal palpation, and the fracture is stable for lithotomy positioning.
METHODS	PFUI patients treated with a suprapubic tube and delayed urethroplasty from October 1991 to August 2016 were included. Patients with initial catheter realignment were excluded. We compared reconstruction failure, incontinence, and erectile dysfunction rates in patients reconstructed within 6 weeks after injury with those reconstructed after the traditional ≥ 12 weeks.
RESULTS	Thirty-nine patients were identified with a median age of 32 years (17 to 69). Overall, the median urethral gap was 2 cm (1-4.5) and median follow-up was 64 months (12-277). Stricture failure occurrence was 5.1%, incontinence rate was 7.7%, and erectile dysfunction rate was 56.4%. The 22 patients with urethroplasty ≤ 6 weeks post-injury were no more likely to experience erectile dysfunction (13 vs 9, $P = .70$), urinary incontinence (1 vs 2, $P = .40$) or reconstruction failure (2 vs 0, $P = .20$) than the 17 patients delayed ≥ 12 weeks.
CONCLUSION	We report similar outcomes following urethral reconstruction for PFUI patients repaired ≤ 6 weeks after injury compared with those delayed ≥ 12 weeks. This suggests that in selected cases reconstruction at 3-6 weeks is feasible, minimizing the morbidity of a suprapubic tube. UROLOGY 116: 193–197, 2018. © 2018 Elsevier Inc.

Posterior urethral injury complicates up to 25% of pelvic fractures arising from blunt pelvic trauma.¹ Placement of a suprapubic cystostomy tube (SPT) in the acute setting with delayed urethral reconstruction is a standard management option for pelvic fracture urethral injuries (PFUI).^{2,3} This is an effective temporizing measure allowing bladder drainage in patients who may have associated life-threatening injuries while avoiding the potential for further trauma to the damaged posterior urethra. An anastomotic posterior urethroplasty via a transperineal approach is performed after a traditional waiting period of 3-6 months. This waiting period is recommended to allow hematoma reabsorption and resolution of traumatic inflammation, resulting in an easier and safer operation.^{4,9} Additionally, this time period allows for recovery and

stabilization of associated traumatic injuries. However, this recommendation has never been investigated and is likely extrapolated from general principles of tissue healing and data on immediate open repair of PFUI which have been associated with a high rate (53%) of reconstruction failure.¹⁰

Since 1992, following a successful repair in a patient reconstructed at 9 weeks after initial injury, we adopted a new approach involving reconstruction as soon as the associated injuries have been stabilized, the perineum is soft on examination, and the patient can tolerate the required extended lithotomy positioning. We have noted that in many patients, these conditions are met 3-6 weeks after the traumatic event.

Herein we retrospectively analyze and compare the outcomes of PFUI patients who were reconstructed after the recommended 12 or more week delay with those treated as early as 3-6 weeks post-injury.

MATERIAL AND METHODS

After institutional review board approval, the charts of all male patients with PFUI reconstructed from October 1991 to August 2016 were reviewed. Only patients treated with placement of an SPT at the time of trauma with delayed urethroplasty were included to evaluate comparable patients in the analysis. Patients

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treated initially with an attempt at catheter realignment, including those with failed realignment with eventual SPT placement, were excluded. Patients with evidence of abscess formation or persistent perineal hematoma or those who were referred to our institution following previous urethral reconstruction procedures were additionally excluded. We included only patients with ≥ 12 months follow-up as stenosis recurrence is most common in the first year postoperatively.

Patient variables analyzed included demographic data, number and severity of associated injuries (as reflected by the Injury Severity Score [ISS]), elapsed time from injury to reconstruction, urethral gap (as determined by preoperative antegrade and retrograde urethrogram), complexity of the surgical reconstruction (eg, need for pubectomy or supracrural rerouting), operative time, complication rate, and transfusion rate. Functional outcomes were also assessed, including reconstruction failure, urinary incontinence, and erectile dysfunction (ED). Reconstruction failure was defined as the appearance of obstructive voiding symptoms requiring invasive studies (urethrography or cystoscopy) or invasive treatment (dilation, internal urethrotomy, or urethroplasty).

All PFUI patients treated at our institution underwent preoperative evaluation with antegrade and retrograde urethrography with fluoroscopic guidance to evaluate urethral distraction length. Perineal and rectal examination was performed to ensure the perineum was soft without residual hematoma or abscess formation. Minor superficial ecchymosis was not significant if the perineum is soft (Fig. 1). Patients were cleared for extended lithotomy position for surgery by orthopedic surgery consultants. All patients underwent anastomotic posterior urethroplasty by a single surgeon via a perineal incision with complete resection of periurethral scar tissue and calibration of the urethra to 28 French as previously described.¹¹

Patient follow-up was performed at 1, 3, 6, and 12 months follow-up then annually thereafter. The urethral catheter was left for 2-3 weeks and removed if pericatheter voiding cystourethrography (VCUG) shows absence of extravasation. Early in our protocol, a VCUG was performed at 6 months. This was later replaced by uroflowmetry at 3 months, to be repeated if urinary symptoms arise.

Patients meeting the inclusion criteria were divided into 2 analysis groups: those reconstructed within 6 weeks after injury and

those reconstructed 12 or more weeks from the injury. Fourteen patients operated between 7 and 11 weeks were excluded from the comparison. Univariate associations were tested with the Fisher exact test, Pearson chi-square, and the 2-sided *t* test, as appropriate. Stata SE, version 13.0 (StataCorp, College Station, TX) was used to perform all statistical analyses. A *P* value of $< .05$ was used to determine statistical significance.

RESULTS

Thirty-nine patients underwent early (≤ 6 weeks) or delayed (≥ 12 weeks) posterior urethroplasty following initial management of their PFUI with SPT placement. The median age was 32 years (17-69). Twenty patients (51.3%) had significant associated injuries with a mean ISS of 22 (18-41). The median distraction gap was 2 cm (1-4.5 cm). The median follow-up time was 64 months (12-278). No patients were lost to follow-up.

Two patients required inferior pubectomy, but no patients required corporal re-routing at the time of operation. Mean operative time was 174 minutes, with 11 patients (28.2%) experiencing complication. Two patients experienced stricture failure (5.1%). Incontinence and ED rates were 7.8% and 56.4%, respectively.

There were 22 patients who underwent reconstruction between 3 and 6 weeks post-trauma and 17 patients whose reconstruction was delayed 12-141 weeks. Both groups were comparable in terms of age, severity of trauma, distraction gap, and follow-up (Table 1). Four patients experienced Clavien Grade I complications in the early group (18.1%) compared with 7 patients in the delayed group (41.2%) who experienced 1 Clavien Grade III complication with the remainder classified as Grade I. Median operative time, transfusion rate, and surgical complications did not differ between the early and delayed groups, respectively.

Rates of urinary incontinence and ED were comparable. Two patients in the early group (9.1%) and no patients in the delayed group experienced reconstruction failure ($P = .20$). The 2 patients who developed stricture recurrence had initial reconstruction at 20 and 26 days post-injury. Stricture recurrence was noted on VCUG following the development of obstructive voiding symptoms at postoperative days 78 and 145, respectively (Table 2). Both patients were operated in 2002, had a disruption gap of 1.5 cm noted preoperatively, and were without significant associated injuries reported at time of trauma.

DISCUSSION

Acute SPT placement with delayed anastomotic urethroplasty is a highly successful approach to repair of pelvic fracture urethral injuries with low stenosis recurrence rates reported (3%-14%).^{3,11-13} However, 1 drawback of this strategy is the recommended ≥ 3 -month interim waiting time. Our study suggests reconstruction can be performed as early as 3-6 weeks post-trauma with favorable conditions at the time of surgery and similar surgical outcomes.



Figure 1. Patient in extended lithotomy position using Allen stirrups 3 weeks after injury. Ecchymosis are still visible in the perineum. (Color version available online.)

Table 1. Time to reconstruction

	≤6 Weeks	≥12 Weeks	All
Characteristics			
Patients	22	17	39
Delay to repair (wk), median (range)	5 (2-6)	34 (12-141)	6 (2-141)
Age (y), median (range)	32 (17-66)	26 (17-69)	32 (17-69)
Associated injuries, patients (%)	10 (45.5)	10 (58.8)	20 (51.3)
Injury severity score, mean (range)	21 (18-29)	23 (18-41)	22 (18-41)
Follow-up (mo), median (range)	76 (11-231)	40 (12-277)	64 (12-277)
Urethral gap (cm), median (range)	1.5 (1-3)	2 (1-4.5)	2 (1-4.5)
Outcomes			
Operative time (min), mean	161	191	174
Transfusion (%)	1 (4.5)	3 (17.6)	4 (10.2)
Complications (%)	4 (18.1)	7 (41.2)	11 (28.2)
Stricture recurrence (%)	2 (9.1)	0 (0)	2 (5.1)
Incontinence (%)	1 (2.6)	2 (11.7)	3 (7.7)
Erectile dysfunction (%)	13 (59.0)	9 (52.9)	22 (56.4)

Table 2. Characteristics of patients with stricture recurrence

	Patient 1	Patient 2
Initial repair delay (d)	26	20
Age	51	66
Injury Severity Score	18	18
Associated injuries	None	None
Urethral gap (cm)	1.5	1.5
Operative time (min)	120	220
Complications	None	None
Days to stricture recurrence	145	78
Salvage technique	Preputial flap	DVIU × 1
Incontinence	No	No
Erectile dysfunction	No	Yes

High complications rates, including a significant risk of stenosis recurrence (53%-69%), ED (36%-44%), and incontinence (5%-21%), have been reported with immediate open repair of PFUIs.^{1,7,10,12} Subjecting a patient with an acute pelvic fracture to the lithotomy position for repair can cause displacement and retraction of the severed ends of the urethra and is likely associated with further soft tissue damage and hemorrhage resulting in the unsatisfactory outcomes reported.¹⁴ As such, immediate open repair has fallen from favor with guideline statements recommending a ≥3-month wait period prior to reconstruction to allow resolution of local injury, hematoma, and traumatic inflammation, in addition to allowing time for associated orthopedic injuries to heal.^{7,15}

Early in the urologic experience at our institution, a typical 12-24 week wait time was observed following SPT placement for PFUI. In 1991, this study's surgeon performed a delayed posterior urethroplasty on a gentleman 9 weeks after injury with favorable local conditions noted. Since 1992, the urology department policy has been to schedule reconstruction as soon after significant associated injuries have been stabilized, the perineum is noted to be soft on rectal examination, and the pelvic fracture is stable enough for the patient to be placed safely in lithotomy position. In our experience, around 40% of

patients meet these criteria by 6 weeks post-injury with posterior urethroplasty performed as early as 3 weeks following PFUI in our study.

Despite our intentions for early repair, many patients had their reconstruction delayed longer than planned. The most typical reason for urethroplasty delay >6 weeks included late referral to our institution or the presence of unresolved associated injuries that required more time for recovery. We included patients delayed 12 weeks or more in our study as a control group for direct comparison of those who met the historic standard of care with those who underwent early repair. Although patients with significant hematoma or abscess were excluded from the study, this control group did include patients whose reconstruction was delayed owing to a pelvic fracture initially determined to be too unstable for the extended lithotomy position, as well as 3 patients whose initial rectal palpation revealed perineal induration requiring a longer period of observation to resolve. Inclusion of these patients in the ≥12 week delayed group is a limitation of our study design, given the potential for more severe stenosis or worse local conditions at the time of surgery, and may explain a trend toward a longer mean operative time, more operative complications, and fewer reconstructive failures in the delayed group. Despite these potential confounding differences, very similar rates of associated injuries, ISS, and urethral gap lengths were observed between these 2 groups.^{16,17} Additionally, the high success rates of 90.9% in the early group and 100% in the delayed group are both comparable with long-term success rates of 86%-97% reported in the PFUI literature.¹⁶⁻¹⁸

Of the patients in our series who experienced stricture recurrence, 1 patient was able to be salvaged with a single direct vision internal urethrotomy procedure with no recurrence after 12 months of follow-up, whereas the other required an additional open reconstructive procedure with a preputial flap with no recurrence after 3 years of follow-up. In previous reports, the most typical cause of stenosis following posterior urethroplasty is the inability to remove all periurethral scar tissue, with disruption of the vascular supply as a potential secondary mechanism.¹¹ For both

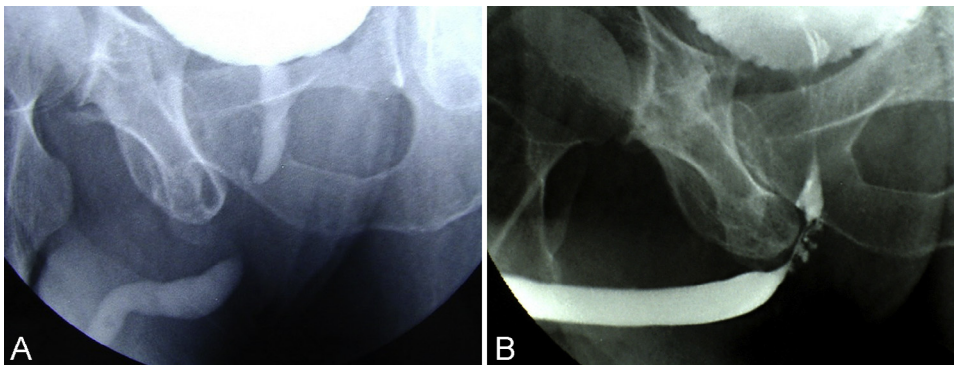


Figure 2. (A) Preoperative retrograde urethrogram and (B) follow-up retrograde urethrogram at 3 months demonstrating a long bulbar stricture most consistent with ischemic failure of the repair. (Color version available online.)

patients who experienced failure, there was not thought to be any particular difficulty in the dissection that may have led to either of these outcomes and tension-free anastomosis was adequately achieved; therefore, a vascular etiology secondary to the initial traumatic injury was suspected. In fact, the retrograde urethrogram revealing the recurrent stricture in one of them (Fig. 2) exhibits a long bulbar stricture pattern typical of an ischemic failure. Interestingly, both these failures occurred in 2003 and were our last reported failures. Soon after, we adopted the bulbar artery-sparing technique¹⁹ for posterior urethroplasty to prevent ischemia and have not had such a failure since.

ED is common following PFUI with a rate of 56.4% in our study, which is comparable with rates of 44%-72% reported in patients evaluated preoperatively.^{3,20} Studies with intracorporeal vasoactive drug injections have shown ED following pelvic fracture to result primarily from nerve damage, although vasculogenic or mixed ED does occur.²⁰ Further injury to the penile neurovascular supply during urethroplasty could worsen the risk of ED in this patient population, particularly if an inflammation in the operative field exists. Our series of 22 patients treated at 3-6 weeks following injury showed there to be no worse local conditions at time of reconstruction compared with those treated at 12 or more weeks post-trauma. No increased risk of ED (59%) was experienced as a result.

Urinary incontinence is an uncommon occurrence following PFUI reconstruction with a rate of 7.7% reported in our series, which is comparable with the literature reported rates of 2.7%-4%.^{1,10} Injury to the external urethral sphincter following traumatic disruption of the membranous urethra can result in incontinence, with the greatest risk observed in patients with a concomitant open bladder neck secondary to direct injury or associated neurologic dysfunction.²¹ Subsequent reconstruction can result in further traumatic injury to the external sphincter's continence mechanism, particularly if dissection must be carried proximal to the bulbomembranous junction for adequate scar removal and anastomosis.²² Injury to the sphincter mechanism with dissection into unfavorable local inflammatory conditions is the proposed mechanism of high

incontinence rates (21%) in patients who underwent immediate open repair,¹ but no worse incontinence rates were observed in our series of patients who underwent urethroplasty as early as 3-6 weeks post-injury (2.6%).

This report details 25 years of experience with 22 patients who underwent anastomotic urethroplasty following a delay of only 3-6 weeks following suprapubic catheter placement for a PFUI. Poor tissue quality or inflammation in the operative field was not observed in these patients. Morbidity associated with the extended time with an SPT includes patient discomfort, urine leakage, risk of urinary tract infection, and delay to return to work and normal quality of life following trauma. Our study suggests that the limiting factor to timely reconstruction following PFUI is clearance for the extended dorsal lithotomy position following recovery from their orthopedic injuries, barring that patients do not have local complications such as hematoma, abscess, or fistula. As most pelvic fractures have stabilized between 3 and 4 weeks post-injury, many patients may be spared additional months of morbidity associated with their suprapubic catheter.

Limitations of this study are its retrospective nature and small sample size precluding more robust statistical analyses. Outcomes recorded on patients who underwent reconstruction up to 25 years ago could potentially limit the ability to generalize these results to trauma patients cared for in a contemporary era. However, this is a single-institution, single-surgeon series of patients managed under the same principles and protocol, with a very extended and complete follow-up, which gives power to our observations.

CONCLUSION

Our single-institution series shows that patients reconstructed within 6 weeks after PFUI have rates of success comparable with patients repaired after a delay of 12 or more weeks. If the patient is stable from his associated injuries, the perineum is soft on rectal palpation, and there is no contraindication for the lithotomy position, we proceed with reconstruction as early as 3-6 weeks post-injury, minimizing the morbidity of a suprapubic tube. A prospective,

multi-institutional study would further clarify the safety and efficacy of this approach.

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