Original Article

Progressive Perineal Urethroplasty in Paediatric Population with Posterior Urethral Distraction Defects Associated with Pelvic Fractures

Vishal Kadeli, Ashwin Bokare, Rajendra B. Nerli, Shreyas Rai, Shridhar C. Ghagane, Shweta Rao, Radha Lote, Nishant Setya
Department of Urology, JN Medical College, KLE Academy of Higher Education and Research, JNMC Campus, Belagavi, Karnataka, India

Abstract

Introduction: A pelvic fracture posterior urethral distraction defect (PFPUDD) can present in varying lengths and degrees of complexity in paediatric population due to several reasons. Today, most if not all PFPUDD can be reliably managed through the perineal approach except the most complex cases. In this retrospective study, we have reviewed our series of paediatric population (≤18 years) with PFPUDD and report the long-term outcome following repair. **Materials and Methods:** We retrospectively reviewed the outpatient, inpatient and imaging records of all male paediatric population ≤18 years of age, undergoing surgical treatment for posterior urethral distraction defects secondary to trauma at our hospital. The age, history of injury, nature of injury, associated injuries, initial treatment, subsequent procedures and complications were noted in detail. **Results:** A total of 28 children with a mean age of 12.46 ± 2.30 years underwent surgical treatment for posterior urethral distraction defects. Retrograde urethrogram showed complete blind end at the level of trauma in 24 (85.71%) children. The level of block was at the proximal bulbar urethra. All children were explored through perineal approach, with patient positioned in the modified lithotomy position. The mean duration of surgery was 242.5 ± 37.76 min and 24 (85.71%) children needed intraoperative/post-operative blood transfusions. The mean blood loss was 600 ± 40.91 cc. Fifteen (53.5%) children needed inferior pubectomy to bring about anastomosis between the proximal and distal cut ends of the urethra. **Conclusions:** The management of paediatric PFPUDD presents a challenge for paediatric urologists. The ultimate goal in managing a PFPUDD is to avoid long-term sequelae and achieve adequate voiding function, continence and sexual potency. Progressive perineal approach is feasible in children and associated with successful long-term outcomes including continence, voiding and sexual function.

Keywords: Elaborated urethroplasty, pelvic fracture, simple perineal, urethral distraction defect

Introduction

Posterior urethral injury in a child differs from those in adults in a number of ways. A pelvic fracture in a child is more likely to be unstable and associated with a severely and permanently displaced prostatic urethra. The severely displaced prostate off the pelvic floor is more likely to lead to complete disruption of the posterior urethra in a child, than in an adult. Urethral injuries in children are likely to be associated with bladder injuries in up to 20% of the patients. Coexisting anterior longitudinal tears through the bladder neck and sphincteric complex are twofold more common in children than in adults. Moreover, lastly, pelvic fractures are four times more likely to be associated with a urethral injury in pre-pubertal girls, than in adult women.[1-6] These differences have a tremendous impact on the clinical outcome in these children.

The severe and permanent displacement of the prostate off the pelvic floor is likely to result in an increased need for either a transpubic, trans-symphyseal, or combined transpubic and perineal dissection for urethral reconstruction. Moreover, the severe displacement of the prostate off the pelvic floor also

Address for correspondence: Dr. Rajendra B. Nerli, Department of Urology, JN Medical College, KLE Academy of Higher Education and Research, JNMC Campus, Belagavi - 590 010, Karnataka, India.
E-mail: rbnerli@gmail.com

Received: 18-10-2023 **Revised:** 18-12-2023 **Accepted:** 03-04-2024 **Available Online:** 15-07-2026

Access this article online

Quick Response Code;

Website: https://afrjpaedsurg.com

DOI: 10.67481.ajps.v22i2.1246

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: editor@afrjpaedsurg.com

How to cite this article: Kadeli V, Bokare A, Nerli RB, Rai S, Ghagane SC, Rao S, *et al*. Progressive perineal urethroplasty in paediatric population with posterior urethral distraction defects associated with pelvic fractures. Afr J Paediatr Surg 2025;22:81-84.

raises the concern of erectile dysfunction.[1,2,7] Permanent urinary incontinence is more likely to occur in children, as a result of the increased risk of combined injuries to the posterior urethra, bladder neck and sphincteric complex.[3-5,8]

Turner-Warwick was the first to introduce the term posterior urethral distraction defect due to a pelvic fracture (PFPUDD). The term 'complex' is to be used only when one or more of the following features are present: (a) there exists a long distraction defect (≥3 cm) surrounded by extensive pelvic fibrosis and (b) when accompanied by para-urethral diverticula, false passages, fistulas, rectal tears or simultaneous bladder neck lesion. These urethral distraction defects usually require a wider surgical exposure to restore urethral continuity and to correct associated adjacent traumatised structures.[9] In children, urethral distraction defects tend to be longer than in adults because of marked upward displacement of the bladder and prostate. Double injuries at the bladder neck and the membranous urethra are more frequently observed in paediatric group as compared to adults, and moreover, the small sized pre-pubertal perineum makes it difficult to reach a high lying proximal urethral end.[10-12] We retrospectively reviewed our series of paediatric population (≤18 years) with PFPUDD secondary to trauma and injury and analysed the long-term outcome following repair of the same.

Materials and Methods

We retrospectively reviewed the outpatient, inpatient and imaging records of all male paediatric population ≤18 years of age, undergoing surgical treatment for posterior urethral distraction defects secondary to trauma at our hospital. The age, history of injury, mechanism of injury, associated injuries, initial treatment, subsequent procedures and complications were noted in detail. This study was undertaken taken after clearance from the University/Institutional ethics committee.

The details of surgery such as the approach, position of the patient, duration of surgery, blood loss, early and late complications were specially noted. The follow-up details such as urinary flow, infections, gait following surgery, uroflowmetry and continence were noted in detail. Patients who had crossed the age of 18 years during the follow-up period were asked to answer a survey wherein questions related to erections, ejaculation and urinary continence were included.

Results

During the period January 2000 to December 2020, a total of 28 children ≤18 years of age underwent progressive perineal urethroplasty at our hospital. The mean age of the study population was 12.46 ± 2.30 years (range = 9–17 years) at the time of repair/urethroplasty at our hospital. A road traffic accident was the most common cause of injury in 16 (57.14%) patients, followed by a fall from running tractor 7 (25%) or bullock cart 5 (17.85%). All these study population had associated pelvic fractures.

Table 1: Imaging details in all the children

Imaging workup	*n* (%)
Retrograde urethrogram	24 (85.71)
Incomplete block or diverticulum at posterior urethra	4
Voiding cystourethrogram	
Open bladder neck	2
Intact bladder neck	26
Proximal urethral length cm	3.47±0.33
Opposing urethrogram (cm)	
Length of defect or narrow segment 1	1
1–3	2
3–<5	20
5	5
Plain X-ray KUB - fracture pelvis	28
Pelvic tilt	6 (21.42)

KUB: Kidney, ureter and bladder

Table 2: Operative details

	Total (*n*=28), *n* (%)
Operative approach	
Perineal	26
Combined perineal/abdominal	2
Steps of PPU	
Distal urethral mobilization alone	1 (3.5)
Crural separation	27 (96.4)
Inferior pubectomy	15 (53.5)
Blood transfusions	24 (85.71)
Blood loss (mean cc)	600±40.91
Duration of surgery (min)	242.5±37.76

PPU: Progressive perineal urethroplasty

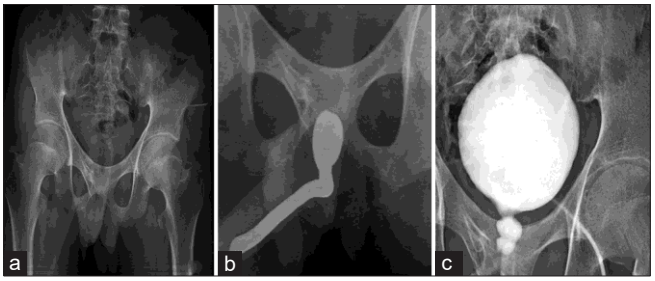


Figure 1: (a) Plain X-ray pelvis (of one of the patients) shows a fused symphysis pubis with an upward tilt on the right side, (b) Retrograde urethrogram (of one of the patients) shows complete obliteration at the level of proximal bulbar urethra, (c) Voiding cystourethrogram shows contrast within the prostatic urethra

Twenty-eight study population were admitted/referred to our hospital for the management of injuries following trauma. Ten of these 28 (35.71%) patients had other genito-urinary injuries that included extraperitoneal rupture of bladder in three, bladder neck injuries in two, renal injury in one, scrotal laceration in three and penile laceration in one. A supra-pubic catheter was inserted to drain the bladder and the associated injuries were managed as per the trauma protocol of the hospital. Following a period of 12–18 weeks, all these 28 patients

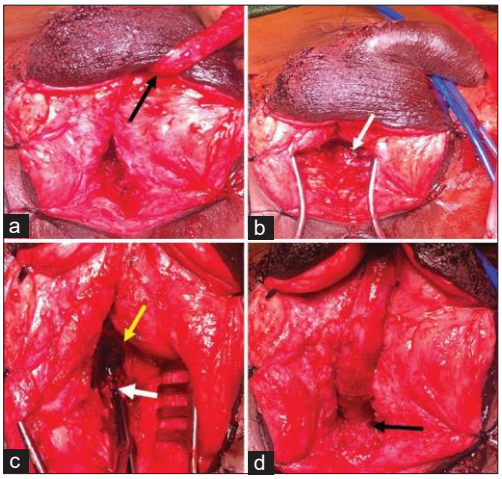


Figure 2: (a) Progressive perineal urethroplasty Step 1 shows distal urethral mobilisation, The arrow signifies extent of the mobilization of distal urethra till penoscrotal junction, (b) Step 2 arrow shows crural separation, (c) Step 3 yellow arrow shows inferior pubectomy and the white arrow shows proximal urethra, (d) Step 4 arrow shows completed bulbo-prostatic anastomosis

were evaluated further with imaging [Figure 1] (retrograde urethrogram, voiding cystourethrogram, plain X-ray pelvis and computed tomography). The findings of the imaging and other investigations are shown in Table 1.

Retrograde urethrogram showed a complete blind end at the level of trauma in 24 (85.71%) patients. The level of the block was at the proximal bulbar urethra. Voiding cysto-urethrogram showed an intact bladder neck in 26 (92.85%) patients and the mean length of the proximal urethra was 3.47 ± 0.33 cm. Opposing urethrogram showed that majority of the children 25 (89.28%) had a defect or stricture of ≥3 cm. In 6 (21.42%) children, there was evidence of pelvic tilt on the plain X-rays which was responsible for the abnormal gait in these children.

All these children underwent progressive perineal urethroplasty [Figure 2] in view of the initial injury and pelvic bone fractures. All children were explored through perineal approach, with patient positioned in the modified lithotomy position. Two children with bladder neck injuries needed additional lower abdominal midline incision to correct bladder neck. The mean duration of surgery was 242.5 ± 37.76 min and 24 (85.71%) children needed intraoperative/post-operative blood transfusions. The mean blood loss was 600 ± 40.91 cc. Fifteen (53.5%) children needed inferior pubectomy to bring about anastomosis between the proximal and distal cut ends of the urethra [Table 2].

The per-urethral catheter was removed after a period of 14 days. Peri-catheter urethrogram was done in all and none of them showed urethral leak. All children were able to void freely after catheter removal. The follow-up ranged between 12 and 80 months (72.03 ± 7.11 mean follow-up in months). Early complications were noted in four children that included superficial wound infection and fever which subsidised on treating with appropriate antibiotics. Long-term complications included recurrence of stricture in one patient and needed to undergo optical urethrotomy and were advised self-calibration for a period of 6 months. Uroflowmetry done at 3 monthly intervals in the 1st year and yearly thereafter showed a maximum flow of ≥15 mL/s in all. One of the two children having a bladder neck injury complained of Grade I incontinence and retrograde ejaculation. At present, this patient has been advised pelvic floor exercises and will be reassessed in future. Ten of these patients are married and have no erectile dysfunction. None of the remaining patients have complained of erectile dysfunction.

Discussion

Trauma is a major cause of morbidity and mortality in children.[13] Trauma to urethra that often leads to urethral stricture disease, most often results from fracture of the pelvis, straddle injuries or iatrogenic urethral manipulation.[14] The incidence of urethral injuries associated with pelvic fractures is estimated to be between 1 and 5%, although Tarman *et al*. reported that the occurrence of urethral lesions was <1% based on a series of 212 children with fracture of the pelvis.[15,16] The majority of pelvic fracture associated urethral injuries in children occur as pedestrians hit by a motor vehicle rather than as passengers.[6,12,17]

The pathogenesis of pelvic fracture posterior urethral distraction defects (PFPUDD) in children seems to be similar to those seen in adults; however, several key elements need to be remembered such as (a) urethral distraction defects tend to be longer in children than in adults because of marked upward displacement of the bladder and prostate, (b) injuries to the bladder neck and the membranous urethra are more frequently observed in children, and (c) the size of the pre-pubertal perineum makes it difficult to reach a high lying proximal urethral end.[1,11] All paediatric patients need to be re-evaluated before definite repair to define the size and length of the urethral defect, bladder neck morphology and anatomic delineation of the anterior urethra and whether local complications such as fistulas, pseudo diverticula or stones are present.[12,13] A plain radiography of the kidney, ureter and bladder region is done to rule out urolithiasis. A retrograde urethrogram, voiding cystourethrogram and an opposing/combined urethrogram would be able to define the anatomical features of the distraction defect. A cystoscopic examination of the proximal urethra would also help plan surgery properly.

Morey and McAninch advocated the use of magnetic resonance imaging (MRI) to define the length and location of the urethral defect and considered it a better option.[18] Similarly, Koraitim and Reda too affirmed that MRI was helpful in evaluating the anatomical features of the urethral gap and the severity of the prostatic displacement in 86% and 89% of 21 patients with PFPUDD, respectively.[19] However, MRI studies in children have their own limitations, as it is necessary for the child to have a full bladder and a distended anterior urethra, in a claustrophobic scenario.[20]

The aim of urethral reconstruction in children with PFPUDD is to restore urethral continuity with an adequate calibre and minimal life-long complications. There is almost complete consensus as of today that, restoration of urethral continuity in children with PFPUDDs by anastomotic bulbo-prostatic repair is the gold standard procedure.[1,6,17] Success in anastomotic urethroplasty is dependent on adequate surgical exposure, excision of all fibrous tissue occupying the distraction defect, mobilisation of the normal bulbar urethra, fixation of healthy mucosa at the edges of the bulbar and prostatic urethral ends and performing a tension-free spatulated anastomosis.[13,21]

Delayed anastomotic repairs by an abdomino-perineal approach was championed by Waterhouse *et al*.[22] and separately by Turner-Warwick.[23] The Waterhouse procedure entailed removing an entire wedge of anterior pubis, commonly using a Gigli saw, whereas Turner–Warwick resorted to pubectomy only if he could not make the anastomosis perineally, and only removed a portion of the abdominal surface of the pubis, sufficient to gain access to the apex of the prostate. It was in 1985, that Webster and Goldwasser[24] reported a variation in the procedure that avoided abdominal exposure and pubectomy for long urethral defects. He entailed only a limited wedge excision of the inferior portion of the pubis through the perineum, after separating the posterior aspect of the corporeal bodies for a length of 3–5 cm. This limited inferior pubectomy allowed for improved perineal exposure of the apex of the prostate for anastomosis and allowed the bulbar urethra to take a more direct route, reducing anastomotic tension. We have used this procedure to repair defects of even 5 cm in length through the perineum alone. Webster and Ramon[25] added a further manoeuvre, supra-corporal re-routing, to address even the longest defects through the perineal approach. This procedure became known as the 'elaborated perineal approach'. An abdominoperineal approach may still be necessary when dealing with intrapelvic complicating features, such as bladder base fistula, pelvic floor cavity and some patients with a urethrorectal fistula.[26]

The scientific basis for the progressive and elaborated perineal approach is to approximate the bulbar urethral end to the dislocated proximal urethral stump by altering the geometry of the path. It is important to achieve this goal as it relies on a healthy elastic distal (bulbar) urethra. The progressive elaborated approach is relevant only in cases wherein a tension-free anastomosis by urethral mobilisation alone is insufficient.

Conclusions

The four-step progressive/elaborated approach helps to repair a urethral distraction defect in children, avoiding the abdominal/transpubic approach or staged repairs. The abdominal or a combined abdominoperineal approach may be necessary for uncommon, associated bladder-neck injuries or other abdominal pathologies. Progressive perineal repair is feasible and associated with minimal complications in children.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Koraitim MM. Post-traumatic posterior urethral strictures: Preoperative decision making. Urology 2004;64:228-31.
2. Chapple CR. Urethral injury. BJU Int 2000;86:318-26.
3. Hemal AK, Dorairajan LN, Gupta NP. Posttraumatic complete and partial loss of urethra with pelvic fracture in girls: An appraisal of management. J Urol 2000;163:282-7.
4. Ashley RA, Husmann DA. Artificial urinary sphincters placed after posterior urethral distraction injuries in children are at risk for erosion. J Urol 2007;178:1813-5.
5. Routh JC, Husmann DA. Long-term continence outcomes after immediate repair of pediatric bladder neck lacerations extending into the urethra. J Urol 2007;178:1816-8.
6. Nerli RB, Koura AC, Ravish IR, Amarkhed SS, Prabha V, Alur SB. Posterior urethral injury in male children: Long-term follow up. J Pediatr Urol 2008;4:154-9.
7. Basiri A, Shadpour P, Moradi MR, Ahmadinia H, Madaen K. Symphysiotomy: A viable approach for delayed management of posterior urethral injuries in children. J Urol 2002;168:2166-9.
8. Rosenstein DI, Alsikafi NF. Diagnosis and classification of urethral injuries. Urol Clin North Am 2006;33:73-85, vi-vii.
9. Turner-Warwick R. Prevention of complications resulting from pelvic fracture urethral injuries – And from their surgical management. Urol Clin North Am 1989;16:335-58.
10. Kardar AH, Sundin T, Ahmed S. Delayed management of posterior urethral disruption in children. Br J Urol 1995;75:543-7.
11. Osman NI, Mangera A, Inman RD, Chapple CR. Delayed repair of pelvic fracture urethral injuries: Preoperative decision-making. Arab J Urol 2015;13:217-20.
12. Chethan JV, Nerli RB, Abhijit M, Shankar K, Shridhar G, Murigendra BH. Pelvic fracture urethral distraction defects: Early outcome of progressive perineal repair. Int J Med Health Res 2016;2: 71-4.
13. Podesta M, Podesta M Jr. Traumatic posterior urethral strictures in children and adolescents. Front Pediatr 2019;7:24.
14. Kaplan GW, Brock WA. Urethral strictures in children. J Urol 1983;120:1200.
15. Silber JS, Flynn JM, Koffler KM, Dormans JP, Drummond DS. Analysis of the cause, classification, and associated injuries of 166 consecutive pediatric pelvic fractures. J Pediatr Orthop 2001;21:446-50.
16. Tarman GJ, Kaplan GW, Lerman SL, McAleer IM, Losasso BE. Lower genitourinary injury and pelvic fractures in pediatric patients. Urology 2002;59:123-6.
17. Podesta M, Podesta M Jr. Delayed surgical repair of posttraumatic posterior urethral distraction defects in children and adolescents: Long-term results. J Pediatr Urol 2015;11:6.e1-6.
18. Morey AF, McAninch JW. Reconstruction of posterior urethral disruption injuries: Outcome analysis in 82 patients. J Urol 1997;157:506-10.
19. Koraitim MM, Reda IS. Role of magnetic resonance imaging in assessment of posterior urethral distraction defects. Urology 2007;70:403-6.
20. Ranjan P, Ansari MS, Singh M, Chipde SS, Singh R, Kapoor R. Post-traumatic urethral strictures in children: What have we learned over the years? J Pediatr Urol 2012;8:234-9.
21. Koraitim MM. On the art of anastomotic posterior urethroplasty: A 27-year experience. J Urol 2005;173:135-9.
22. Waterhouse K, Abrahams JI, Gruber H, Hackett RE, Patil UB, Peng BK. The transpubic approach to the lower urinary tract. J Urol 1973;109:486-90.
23. Turner-Warwick R. Complex traumatic posterior urethral strictures. J Urol 1977;118:564-74.
24. Webster GD, Goldwasser B. Perineal transpubic repair: A technique for treating post-traumatic prostatomembranous urethral strictures. J Urol 1986;135:278-9.
25. Webster GD, Ramon J. Repair of pelvic fracture posterior urethral defects using an elaborated perineal approach: Experience with 74 cases. J Urol 1991;145:744-8.
26. Koraitim MM. Complex pelvic fracture urethral distraction defects revisited. Scand J Urol 2014;48:84-9.