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Management of traumatic urethral injuries in children using different techniques: A case series and review of literature



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ABSTRACT

INTRODUCTION: Most pediatric urethral injuries are a result of pelvic fracture after high-impact blunt trauma, mainly due to motor vehicle accidents. The management of urethral injuries depends on if the rupture is complete or partial as well as the timing of surgical intervention.

PRESENTATION OF CASES: Three male children with urethral trauma caused by motor vehicles accidents are presented in this article. Preoperative suprapubic catheterization was initially carried out in all patients. Each patient then received one of three different techniques during the deferred time to surgical intervention: anterior sagittal transanorectal approach (ASTRA) for end-to-end urethral anastomosis, perineal approach for urethroplasty using buccal mucosa, and urethroplasty with preputial skin flap. The three techniques were successfully performed.

DISCUSSION: In the initial management suprapubic cystostomy has been a good solution in urgent situations. Deferred urethroplasty is the procedure of choice for the definite treatment of posterior urethral distraction defects. The anterior sagittal transanorectal approach provides excellent exposure of the posterior urethra and retrovesicular region, and allows the surgeon to perform dissection under direct vision.

CONCLUSION: It's very important for the pediatric urologist to be familiar with the different techniques available in order to choose the best approach for each particular patient.

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1. Introduction

The incidence of posterior urethral injury after pelvic fracture in children is 2.4–7.5% [1,2]. Males more commonly sustain a urethral injury secondary to pelvic fracture than females, with a mean age of 9 years-old [3]. The orthopedic reports show that the most common mechanism of injury is trauma associated with pedestrian impact by motor vehicles (71%), followed by passen-

gers in motor vehicles (24%) [3]. Pelvic fracture is a major cause of post-traumatic posterior urethral stricture in children [4]. The management of posterior urethral injuries in blunt trauma depends on complete or partial rupture. In immediate management, insertion of a suprapubic catheter is a good temporary solution in urgent situations, especially in complete rupture [5]. Another possibility for the acute definitive treatment of complete posterior urethral rupture includes immediate realignment or urethroplasty, while partial rupture can be managed by fluoroscopic guided realignment or anastomotic urethroplasty [6].

The definite treatment of urethral trauma includes several techniques such as the anterior sagittal transanorectal approach (ASTRA), reconstructive management of urethral stricture with graft urethroplasty and single-stage preputial skin flap urethroplasty.

The objective of this case series is to demonstrate 3 different approaches for urethral trauma in male children that were suc-

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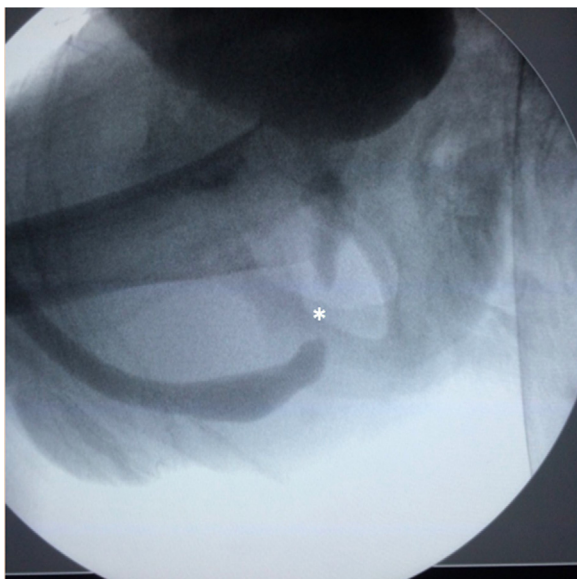


Fig. 1. Patient 1 preoperative urethrocytography showing a short urethral gap (*) between the urethral stumps with possibility of primary anastomosis.

cessfully performed. The work has been reported in line with the Surgical Case Report (SCARE) guidelines [7].

2. Materials and methods

In this retrospective observational study, we reviewed the medical records of three male patients with urethral trauma resulting from pelvic fracture due to being run over by a motor vehicle.

Information on trauma features and treatment modalities in the acute phase was obtained from the records of the receiving hospitals.

A review of the literature was performed on PUBMED database using the following terms: “pediatric posterior urethral trauma”, “graft urethroplasty”, and “flap urethroplasty”.

3. Case reports

3.1. Patient 1

A 9-year-old male was diagnosed with urethral trauma due to a pelvic fracture. Initially a suprapubic cystostomy was performed. After 2 months, he was referred to our hospital, and underwent a cystoscopy that showed a pervious urethra up to the membranous portion with hyperemic mucosa and a distance of more than 2 cm between the urethral stumps. A Mitrofanoff procedure was done as a temporizing measure until adequate growth was achieved. After 2 years, cystoscopy showed normal urethral mucosa and radioscopy demonstrated a 2 cm gap between the stumps (Fig. 1). The urethra was anastomosed through anterior sagittal approach without splitting the rectum (modified ASTRA) (Fig. 2). The patient has been followed for 18 months postoperatively and has preserved urinary and fecal continence. He has no complaints and his uroflowmetry is normal.

3.2. Patient 2

A 10-year-old male patient suffered pubic symphysis diastasis in complex pelvic trauma. Exploratory laparotomy with splenectomy, colostomy, cystostomy (due to an extensive urethral trauma) and orthopedic intervention were done in the receiving hospital. After 3 months, the external fixator was removed without pubic

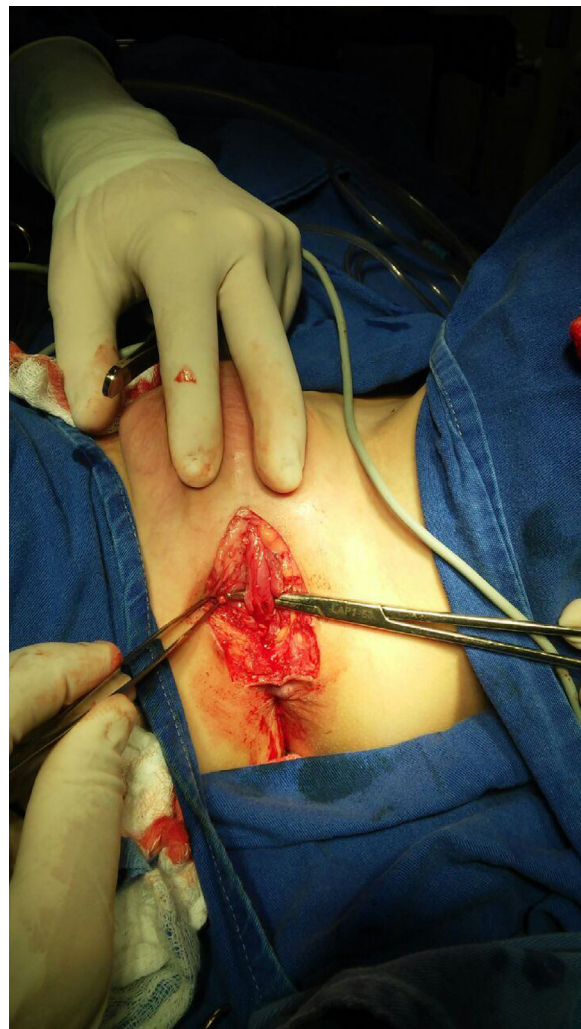


Fig. 2. Intraoperative photograph of patient 1 showing the urethral stricture. Anterior sagittal approach without splitting the rectal wall was performed and primary anastomosis between the two pervious urethral segments was successfully achieved.



Fig. 3. Patient 2 preoperative urethrocytography showing a long urethral gap (*) between the urethral stumps.

symphysis disjunction correction. After 1 year, colostomy reversal was performed. A urethrocytography done at that time showed a gap of more than 3 cm between the urethral stumps (Fig. 3). After 2 years post-trauma, a perineal urethroplasty with preputial

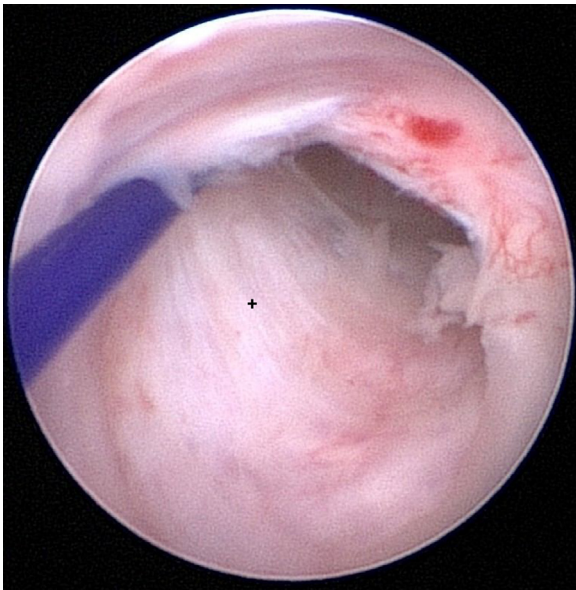


Fig. 4. Follow-up cystoscopy of patient 2 two weeks post-operatively demonstrating a pervious urethra without visualization of strictures. The hypochromic area (+) corresponds to the location where the graft was placed.

skin flap without orthopedic approach was performed (Fig. 4). On follow-up 16 months postoperatively, he had no signs of anastomosis stricture (normal cystoscopy) with urinary continence, and normal uroflowmetry.

3.3. Patient 3

A 10-year-old male patient suffered a pelvic trauma after being run over by a motor vehicle. At the time of the accident, suprapubic cystostomy and colostomy at the level of the sigmoid colon were performed at another hospital. He was referred to our service 3 months later and underwent colostomy reversal and cystostomy closure. Cystostomy closure was performed and since he had a stenotic urethra, he underwent serial urethral dilations. Due to difficulty in voiding 5 months post-trauma, he underwent a cystoscopy that visualized a bulbar urethral stricture without cystoscopic progression. After methylene blue injection into the urethra, contrast leakage through the rectum was detected, demonstrating a recto-urethral fistula. The patient underwent a loop colostomy and correction of the recto-urethral fistula by perineal approach, followed by intestinal reconstruction. Postoperatively he again underwent multiple urethral dilations.

After this, he was lost to follow-up, returning to our service at the age of 17 due to significant ventral penile curvature (Figs. 5 and 6) secondary to urethral shortening. He then underwent a urethroplasty which was done by perineal approach using a buccal mucosa graft into the distal urethra. After 7 months from the urethroplasty, he evolved symptoms of stricture that needed serial dilations for 6 months (Fig. 7). Since he presented with reduced caliber of the urinary stream, internal urethrotomy was performed 1 year after the surgery. On the last follow-up, although he remains continent, voiding difficulties had not improved and the need for a new surgical procedure is being discussed. He has a satisfactory aesthetical result (Fig. 8) with no recurrence of the acquired penile curvature.



Figs. 5 and 6. Patient 3 intraoperative photographs showing ventral penile curvature as result of urethral shortening (Fig. 5) and resolution of curvature after the buccal mucosa graft (Fig. 6).



Fig. 7. Patient 3 follow-up cystoscopy five months post-operatively of the buccal mucosa graft showing stricture in the proximal anastomosis.

4. Discussion

4.1. Initial management

The initial approach to the posterior urethral injury due to pelvic fracture may vary and has evolved through time. Approximately 45 years ago, the most widely recommended treatment of



Fig. 8. Aesthetical aspect of the erect penis of patient 3, five months post-operatively of the buccal mucosa graft, without any curvature.

posterior urethral disruption was primary realignment over a urethral catheter. More recently, this realignment has been performed endoscopically and under fluoroscopic guidance, without the need for invasive surgery [8].

Suprapubic cystostomy and delayed repair was first advocated by Johanson in 1953 [9]. Despite the high rate of stricture formation, perceived advantages of this technique include avoiding entry into the pelvic hematoma with the risk of infection and excessive blood loss, speed and simplicity of suprapubic tube placement, and avoiding acute mobilization of the prostate and urethra with resultant lower impotence and incontinence rates [8].

4.2. Urethroplasty

Most posterior urethral distraction defects are short and can be treated using a perineal anastomotic repair [10]. In cases of long strictures, the management was initially a two-stage repair [9]; however, as the field of urethral reconstruction has developed, there has been a paradigm shift towards one-stage repair using free grafts made of skin or buccal mucosa, pedicle-based flaps or combined approaches [11].

Buccal mucosa graft was popularized in 1992 by Burguer et al. [12] and its use has increased in the last two decades [13]. Comparing buccal mucosa graft and penile skin graft, a meta-analysis conducted by Lumen et al. found that the former has a significantly better outcome than the latter, supporting the statement of several experts that buccal mucosa graft is superior in urethral reconstruction [14,15]. There are several reasons suggesting the superiority of buccal mucosa to the skin. Oral mucosa prevents negative aesthetic consequences because it leaves a concealed donor skin site [16,17]. Oral mucosa has a thick epithelium with a thin but well vascularized lamina propria that facilitates inosculation and

imbibition and is resistant to infection due to its local microorganisms and multiple immunologic processes, making it impervious to native flora colonization. Compared with skin, oral mucosa is more elastic and resilient, and when exposed to compression, stretching, and shearing forces, it is highly resilient, due to its particular lamina propria-oral epithelium interface [16,17]. Finally, oral mucosa is rarely affected by lichen sclerosus disease [16,17]. Nevertheless, the need of an additional operative field and donor site-related complications, such as transient oral pain in the first postoperative days, perioral numbness, alterations in saliva production, oral tightness and risk of retraction of the lower lip are the disadvantages of this graft [18].

In cases in which buccal mucosa cannot be used because of smoking habits, oral cancer or cultural habits (consumption of gutkha, tobacco, khaini, betel nut and pan masala), Mathur et al. reported the use of preputial skin flap as a good option with overall complication rates similar to those of buccal mucosal grafts [19]. Dorsal onlay urethroplasty using preputial/distal penile skin is a satisfactory procedure. Preputial/distal penile skin is very thin, supple, devoid of fat and hair and therefore an ideal graft material for urethroplasty. In circumcised patients distal penile skin can be harvested without interfering with sexual life. Long-term follow up is required in judging results of patients with stricture urethra. Overall, preputial reconstruction does not seem to increase the risk of urethroplasty complications and the overall reoperation rate [20].

In our case series the outcomes of perineal urethroplasty with preputial skin flap were satisfactory without signs of anastomosis stricture or urinary incontinence. The patient who underwent urethroplasty with buccal mucosa graft however showed urethral stricture on cystoscopy and needed dilations and urethrotomy. Nevertheless, we have to acknowledge that the patient who underwent the buccal mucosa graft was lost to follow-up for 9 years and also presented with other comorbidities, such as the rectal-urethral fistula, which could have interfered in the outcome of the procedure.

4.3. ASTRA

A technique proposed by Dómini et al. and Benedetto et al. in 1997 involved sectioning only the anterior rectal wall in an anterior sagittal transanorectal approach (ASTRA) to treat a urogenital sinus in adrenogenital syndrome [21,22]. Since its description, this technique has alternatively been performed without the splitting of the rectum and good results have been reported in current literature [23]. ASTRA provides excellent exposure of the posterior urethra and retrovesicular region, and allows the surgeon to perform dissection under direct vision. Moreover, it avoids neurological damage with maximal preservation of important functional structures in the perirectal area, such as the autonomous nerves and ganglia, which are essential for normal erectile and vesical function [21].

Our patient that underwent urethral reconstruction by the anterior sagittal approach without splitting the rectum has presented good outcomes, with urinary and fecal continence preserved and normal uroflowmetry after 18 months of follow-up.

5. Conclusion

In conclusion, urethral trauma can present in many forms, thus the surgeon has to keep in mind different techniques and approaches to treat each case individually, in order to achieve a successful reconstruction.

Conflicts of interest

None.

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No sources of funding were necessary for this study.

Ethical approval

The study has been approved by the Human Research Ethics Committee of the University Hospital of the Federal University of Paraná.

Consent

Written informed consent was obtained from the patients for publication of this case series and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contributions

Ricardo Torres da Silveira Ugino – Study concept, drafting and writing of the manuscript, data collection and literature review.

Suzane Pasqual – Study concept, drafting and writing of the manuscript, data collection and literature review.

Adria Karina Farias – Involved in the operation and treatment.

Andre Ivan Bradley dos Santos Dias – revised the report and contributed in editing.

John D. Stratigis – revised the report and contributed in editing.

Bruno Pinheiro Falcão – Involved in the operation and treatment.

Antônio Carlos Amarante – Involved in the operation and treatment.

Marcelo Stegani – Involved in the operation and treatment.

Miguel Angelo Agulham – Involved in the operation and treatment.

Camila Girardi Fachin – Involved in analysis and literature, and also assisted with manuscript preparation and its final publication decision.

Guarantors

Camila Girardi Fachin.

Ricardo Torres da Silveira Ugino.

Suzane Pasqual.

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