



A complex genitourinary injury following gunshot in a 12 Year old and systematic review

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ABSTRACT

We highlight the case of a 12 year old male who presented after sustaining a gunshot injury to the scrotum resulting in testicular, prostatic, and urethral transection in addition to pelvic fracture, extra peritoneal bladder injury, and transmural injury to recto sigmoid and ileum. The patient underwent a left orchiectomy, primary repair of the bladder and urethra, placement of universal plate on superior pubic rami, and segmental resectosigmoid and ileum resection. These findings illustrate the collaborative efforts of trauma surgery and urology to treat complex lower genitourinary (GU) injuries and how the direct prioritization of surgical efforts provides acceptable outcomes.

Introduction

Genitourinary (GU) injuries account for approximately 10% of all trauma cases with gunshot wounds (GSWs) representing the chief mechanism of penetrating GU traumas.¹ GU injuries are commonly a result of blunt trauma from motor vehicle accidents² while less frequently a result of penetrating trauma from GSWs.¹ GSWs to the GU system are commonly associated with concomitant injuries to abdominal organs.³ It is important to rule out bowel injuries in GU trauma due to devastating complications like rectovesical fistulas and abscess formation. We highlight the case of a 12-year-old who sustained multiple GSWs to the GU region, which resulted in complex injuries.

Case presentation

A 12-year-old male presented to the emergency department as a result of GSWs to the left scrotum and abdomen. Vital signs upon admission were blood pressure 110/70 mmHg, pulse 114 beats per minute, oral temperature 37° Celsius, respiratory rate of 20 breaths per minute, oxygen saturation (SpO₂) of 100%, and Glasgow Coma Scale of 15. Patient appeared distressed, with tenderness to the suprapubic area, distended abdomen, and ongoing hemorrhage from the left testicle/scrotal region.

Genitourinary exam showed multiple GSWs to the penis, scrotum,

and perineum, a wound on the left lateral mid penis, left scrotum with significant bleeding, and tenderness with avulsion of the left testicle. There were multiple exit wounds on the buttocks. A Foley catheter returned frank dark red blood. Pelvic X-ray revealed multiple bullet fragments in the pelvis with fracture of bilateral inferior pubic rami and diastasis of the pubic symphysis (Fig. 1A). The patient was taken to the operating room emergently for an exploratory laparotomy. A portion of the ileum and injured rectosigmoid (Fig. 1B) were resected and left in discontinuity. Left orchiectomy was performed. The proximal end of transected prostatic urethra was identified (Fig. 1C). The continuity between the neck of the urinary bladder and portion of urethra was achieved. The disrupted urinary bladder (Fig. 1D) was then closed in two layers, and a supra-pubic catheter placed. After successful reconstruction of the bladder and urethra, attention was paid to the hematoma within the space of Retzius (retro-pubic space). Diastasis was decreased by approximating both pubic rami medially and internally fixing a universal rib plate secured with locking screws (Fig. 1E). The abdomen was left open. The patient was kept intubated and taken to the pediatric ICU for further management.

On post-operative day 1, the patient was transferred to a tertiary care pediatric hospital for further management where the following interventions occurred during the hospital course: primary small bowel anastomosis with creation of ileostomy, creation of end colostomy, wide drainage of rectal injury, bilateral nephrostomy tubes, and multiple

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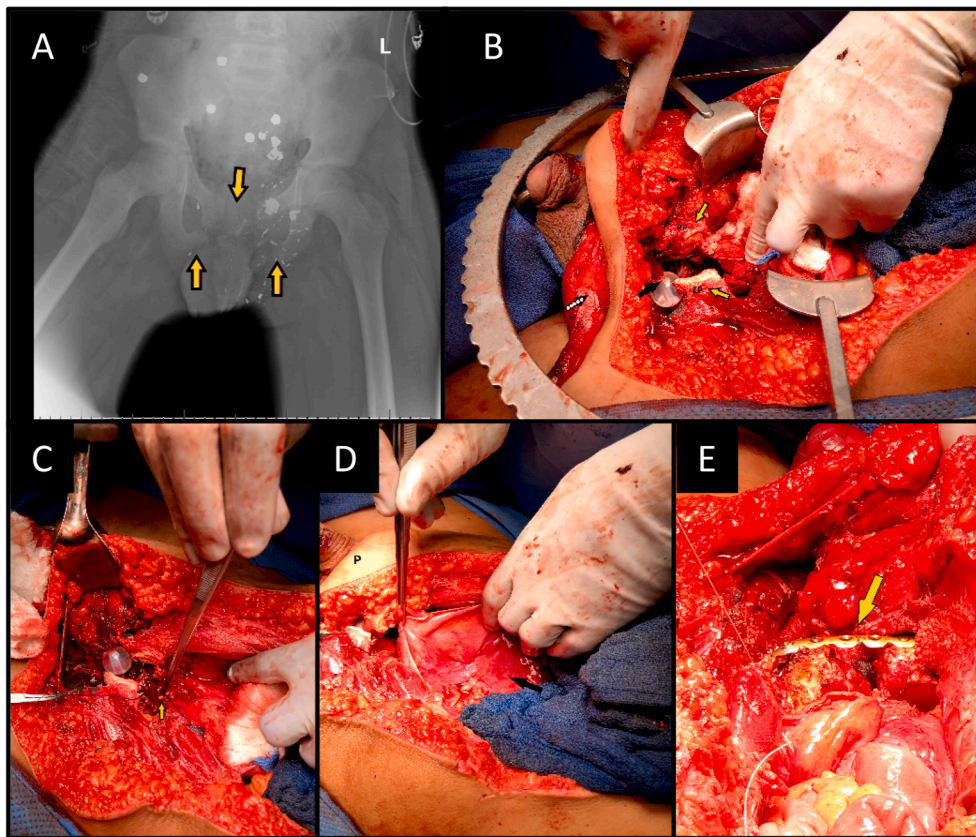


Fig. 1. A) Anterior-Posterior (AP) pelvis x-ray demonstrating bilateral pubic rami fracture and pubic symphysis diastasis (yellow arrows) with multiple metallic foreign bodies consistent with bullet fragments, B) pubic rami fracture with pubic diastasis (yellow arrows), complete transection of prostatic urethra with protrusion of Foley catheter balloon (black arrow) and avulsion of left testicle (dotted arrow), C) grade V urethral injury (AAST urethral injury grading) with complete transection with >2 cm urethral separation, D) grade V urinary bladder injury (AAST urinary bladder injury grading) with extension of laceration to the neck of the urinary bladder without disruption of the trigone (for orientation P represents pelvis), and E) internal fixation of pubic fracture with packing of space of Retzius. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

negative pressure therapy device exchanges. The hardware over the pubic symphysis was ultimately removed as the orthopedic team considered the pelvic fracture to be stable. Hospital course was complicated by low pelvic abscess requiring drainage, acute kidney injury (AKI) which resolved without hemodialysis, and mood disorder (depression). He remains incontinent of feces and urine. At his last follow-up with pediatric surgery he remains incontinent to feces and colostomy reversal could not be recommended. They did note that he may benefit from pelvic floor PT. During his last urology clinic follow-up, both his suprapubic and nephrectomy tubes had been removed. Options going forward were discussed. The patient was not keen to proceed with urologic surgery currently. Any urologic surgery would be pending general surgery's plans for possible undiversion.

Methods

A search of all original studies was conducted using Ovid in January of 2019. Search words consisted of wounds, penetrating or wounds gunshot or stab and genitalia or female or male. Initially the search was limited to patients younger than 15 years of age but was extended to include adult patients due to lack of literature. Publication was limited to English. Search was limited to full text. Abstracts reviewed, and those that met the selection criteria specified later were imported into a Microsoft excel spreadsheet. Prisma IPD flow diagram shown in Fig. 2.

Discussion

In our systematic review a total of 158 titles and abstracts were screened. Twenty articles met the selection criteria, this included 1081 patients (Table 1). Penetrating trauma accounts for a minority of GU trauma and is chiefly due to GSWs.² The external genitalia comprised 40–60% of the cases of penetrating injuries with GSWs accounting for 55% of penetrating scrotal injuries.² Regarding testicular injuries the

testicular salvage rate was noted to be 53%. Suprapubic tubes were placed in 59 patients.

The use of suprapubic tubes in bladder repairs is only beneficial in treating complex bladder repairs or injuries that cause extended periods of immobilization and require long term catheterization.⁴ This allows for urinary diversion and clean healing of sites of injury prior to open delayed urethroplasty.¹ Patients with concomitant bladder and posterior urethral injuries have been managed with suprapubic catheters until urethral reconstruction was performed. Penetrating anterior urethral injuries are usually managed with primary surgical repair and is preferred in cases of concomitant bladder neck or rectal injury or with complete urethral disruption.⁵ Prolonged attempts likely worsen incontinence and erectile dysfunction. If realignment is not feasible, suprapubic tube should be placed and reconstruction should be attempted 3–6 months after the injury.^{1,5}

Complex urethral injuries such as the one presented in this report may require multistage patch urethroplasties. Pediatric series show that repairing bladder neck injuries does not improve continence, but it does avoid sequelae of pelvic infection. Initial primary repair of urethral injuries has been associated with higher rates of strictures, incontinence and impotence.¹ It is important in lower urinary tract injuries to check for associated abdominal injuries.

Conclusion

Penetrating GU injuries are rare and therefore required a well-coordinated multidisciplinary approach with efforts from trauma surgery, urology and orthopedic surgery as needed. Penetrating urinary bladder injuries should be explored and repaired given the high rate of concomitant gastro-intestinal injuries. Penetrating urethral injuries with a gap of less than 2 cm can be repaired immediately. However, urethral injuries with greater than 2 cm gap and staged reconstruction is considered an adequate management strategy.

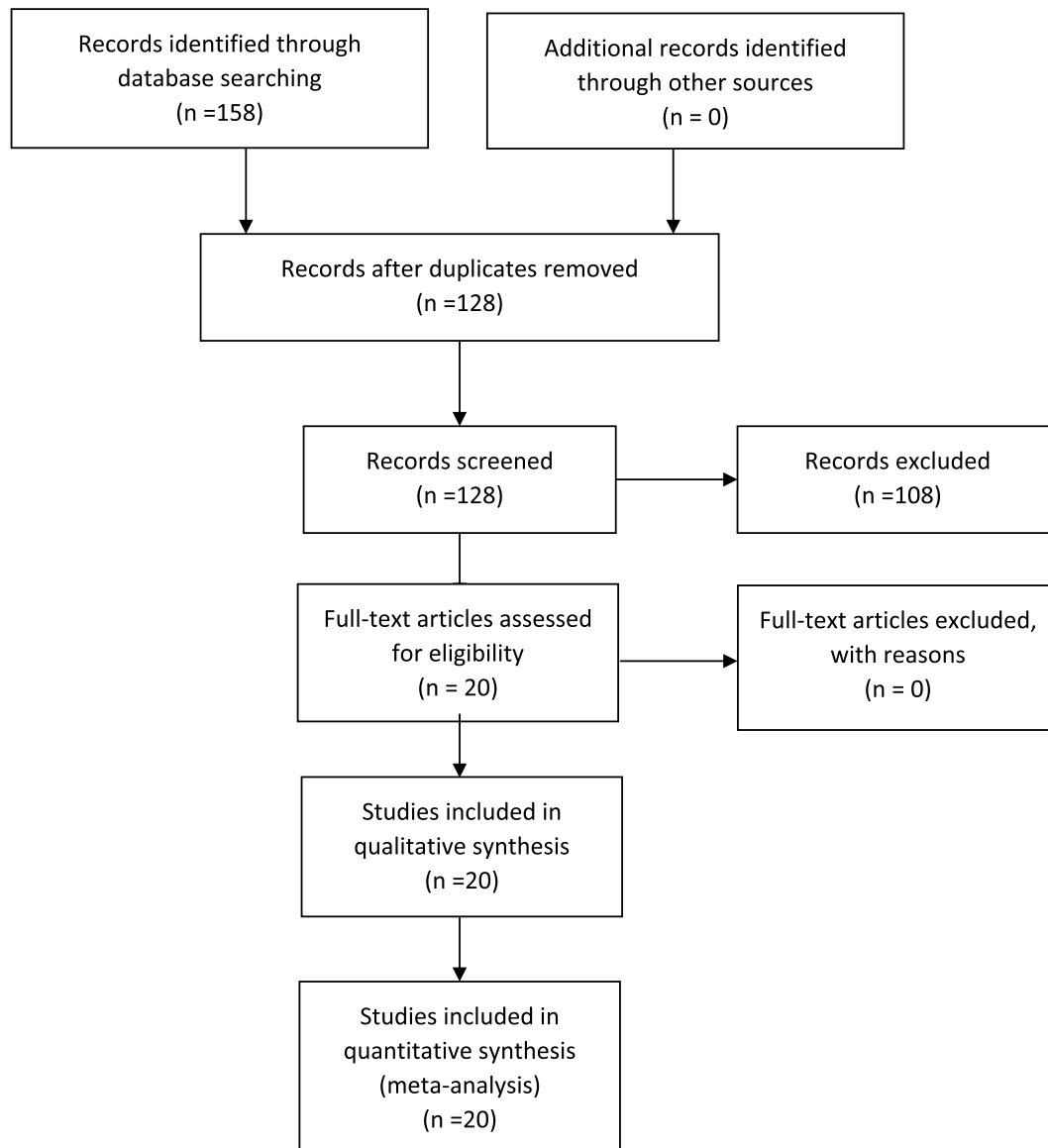


Fig. 2. PRISMA flow diagram for methods and patient selection.

Table 1
Independent patient data from the systematic review yielding 20 articles meeting the selection criteria.

Genitourinary Injury Review	
Age, years	27 (SD \pm 3.73)
	(n)
Male	1029
Female	52
Patients	1081
Location of Injury	
Bladder/ureter	224
Bladder Repair	147
Ureter only	18
Scrotum	420
Testicle	371
Avg. Testicle Salvage Rate	53%
Orchiectomy	36
Penile	273
Scrotal & penile	45
Cavernosum	144
Urethra	157
Primary urethra repair over catheter	45
Conservative treatment for urethra	12
Delayed urethra repair	16
Anterior Bulbar Urethra	34
Posterior Urethra	8
Suprapubic tubes	59
Managed conservatively	83
Mortality	55

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