



EPIDEMIOLOGY AND DIAGNOSIS OF PFUI REVIEW

The incidence, causes, mechanism, risk factors, classification, and diagnosis of pelvic fracture urethral injury



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Received 24 July 2014, Received in revised form 13 August 2014, Accepted 24 August 2014

Available online 16 September 2014

KEYWORDS

Pelvic fracture;
Urethral injury;
Classification;
Diagnosis

ABBREVIATIONS

PFUI, pelvic fracture urethral injury;
PFUDD, pelvic fracture urethral distraction defect;
MVC, motor vehicle collision;
BN, bladder neck;

Abstract Background: Pelvic fracture urethral injury (PFUI) is an uncommon but potentially devastating result of pelvic fracture. It ranges in severity based on the cause and the mechanism of injury.

Methods: We reviewed previous reports to identify the incidence, causes, mechanisms of injury and risk factors of PFUI. In addition, we reviewed the current classification systems and diagnostic methods that have been described to assess the severity of PFUI, to identify optimal management strategies and evaluate outcomes.

Results: PFUI occurs more commonly in men, but is more likely to be severe in children. The most common cause is motor vehicle collisions, and the mechanism is typically a ligament rupture at the attachment to the urethra. There is no reliable classification system to differentiate partial and complete PFUI. Retrograde urethrography is the standard imaging method but it has its limitations.

Conclusions: Despite many reports describing this injury, there is still a need to further clarify the incidence, aetiology and mechanism of injury to better determine optimal management strategies and evaluate outcomes. Consensus in the diagnosis

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Peer review under responsibility of Arab Association of Urology.



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RUG, retrograde urethrography

of PFUI is lacking, and outcomes of primary realignment and the role of flexible cystoscopy as a diagnostic method are still to be determined.

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Introduction

Pelvic fracture urethral injuries (PFUIs) often result from high-velocity injuries that are associated with disruption of the pelvic ring. Depending on the severity of the injury they can be isolated, or more likely, associated with non-urological injuries that often are more pressing [1]. Urethral injuries associated with PFUIs were initially termed pelvic fracture urethral distraction defects (PFUDDs) by Turner-Warwick [2] based on the assumption that they were usually complete injuries. However, the International Consultation on Urological Diseases recommended replacing PFUDD with PFUI, because these injuries are not complete disruptions in most cases, and that even when they are complete, they are not necessarily distracted [1]. Here we review previous reports on PFUI and summarise the available data on its incidence, causes, mechanisms, risk factors, classifications and diagnostic strategies.

Incidence

Pelvic fractures occur in $\approx 9.3\%$ of all blunt trauma cases presenting to the emergency department [3]. The reported incidence of PFUIs varies greatly, at 5–25% of pelvic fractures [1,3]. This variation is probably due to the heterogeneous nature of available prospective and retrospective reports [4,5]. Rapidly increasing populations in developing countries are more likely to have a greater incidence of vehicular accidents, leading to a higher prevalence of PFUIs. Stein et al. [6] reported vehicular accidents as a cause for nearly 36% of urethral strictures in India, vs. 15% in a cohort from the USA and Italy. PFUI is much more common in men than women (25% vs. 4.9%) due to a shorter urethra and lack of urethral attachments to the pubis in females [7]. Children suffering from falls sustain PFUIs that are often more severe than in adults because their pelvic fractures are often more severe [8]. Also, paediatric urethral injuries are more likely to be complete than in adults (69% vs. 42%) [8]. PFUI in children results in a higher incidence of stricture formation, is more likely to be proximal [8], and has a higher incidence of urinary incontinence [9,10].

Causes

Nearly half of pelvic fractures are considered mild to moderate in severity, and 95% of those fractures have

minor associated injuries [11]. More severe pelvic fractures are associated with a higher risk of and more severe urethral injury [5]. Motor vehicle collisions (MVCs) are the most common cause of pelvic fracture (68–84%). MVCs are four times more likely to cause a PFUI than the second most common cause, falling from a height (6–25%) [8,12–15]. Typically, pedestrians involved in MVCs are more likely than the occupants of the motor vehicle to sustain a severe pelvic fracture and PFUI [8,16]. Less common causes of pelvic fracture include slipping and falling, being thrown or hit by an animal such as a horse, or being injured by machinery [9]. Industrial and mining accidents were previously major causes of pelvic fractures but are now less common, given the increasing automation of machinery and safety standards in the work environment [17].

In 2002, Demetriades et al. [3] retrospectively reviewed 1545 patients with a pelvic fracture who presented to a major trauma centre. The leading causes of pelvic fractures were motorcycle accidents (15.5%), pedestrian injuries (13.8%), falls from heights of > 5 m (12.9%), and automobile occupants in a MVC (10.2%). Pedestrian and motorcycle accidents were associated with more severe pelvic fractures relative to occupants of the automobile in MVCs.

Mechanism of injury

The bulbar urethra lies distal to the perineal membrane. Contrary to the initial thought that most PFUIs are prostatomembranous disruptions [4,18], most injuries occur at the bulbomembranous junction [8,19,20]. Most pelvic fractures by themselves do not cause urethral injuries, but urethral injuries result from the rupture of ligamentous attachments during pelvic-ring disruption. A PFUI occurs when the ligament ruptures at its urethral attachment [20]. In complete urethral injuries, the periprostatic venous plexus can be injured, with subsequent large haematoma formation, displacing the prostate cephalad and posterior [21]. A less common mechanism of injury involves direct injury to the urethra by a bony fragment, which is more likely to occur in women [7]. In children, PFUIs are more likely to be proximal in location and commonly involve the prostate and the bladder neck (BN), because the prostate is underdeveloped and poorly supported in children. In adults, urethral injuries are more commonly longitudinal, whereas they tend to be transverse in children [1].

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