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Guidelines

Review of the Current Management of Lower Urinary Tract Injuries by the EAU Trauma Guidelines Panel

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Abstract

Context: The most recent European Association of Urology (EAU) guidelines on urologic trauma were published in 2014.

Objective: To present a summary of the 2014 version of the EAU guidelines on urologic trauma of the lower urinary tract with an emphasis on diagnosis and treatment.

Evidence acquisition: The EAU Trauma Panel reviewed the English-language literature via a Medline search for lower urinary tract injury (LUTI) up to November 2013. The focus was on newer publications and reviews, although older key references could be included.

Evidence synthesis: A full version of the guidelines is available in print (EAU Guidelines 2014 edition, ISBN/EAN 978-90-79754-65-6) and online (www.uroweb.org). Blunt trauma is the main cause of LUTI. The preferred diagnostic modality for bladder and urethral injury is cystography and urethrography, respectively. In the treatment of bladder injuries, it is important to distinguish between extra- and intraperitoneal ruptures. Treatment of male anterior urethral injuries depends on the cause (blunt vs penetrating vs penile-fracture-related injury). Blunt posterior urethral injuries can be corrected by immediate/early endoscopic realignment. If this is not possible, such injuries are managed by suprapubic urinary diversion and deferred (>3 mo) urethroplasty. Treatment of female urethral injuries depends on the location of the injury and is usually surgical.

Conclusions: Correct treatment of LUTIs is important to minimise long-term urinary symptoms and sexual dysfunction. This review performed by the EAU trauma panel summarises the current management of LUTIs.

Patient summary: Patients with trauma to the lower urinary tract benefit from accurate diagnosis and appropriate treatment according to the nature and severity of their injury.

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1. Introduction

This paper provides a comprehensive overview of the current management (diagnosis and treatment) of clinically relevant injuries to the lower urinary tract (bladder and urethra). Although iatrogenic injuries are the most common

cause of lower urinary tract injuries (LUTIs), they are not discussed here because they were the subject of a previous European Association of Urology (EAU) Trauma Panel publication [1]. Detailed information on LUTI diagnosis and treatment is available in the full EAU guidelines (www.uroweb.org).

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For this purpose, the EAU Trauma Panel reviewed the English language literature via a Medline search on LUTI up to November 2013. The focus was on newer publications, although older key references are included.

2. Incidence and aetiology

The major cause of LUTIs is blunt trauma. Injuries to the bladder (60–90%) and posterior urethra (75%) are mainly associated with pelvic fractures [2,3]. A combination of bladder and urethral injury is present in 4.1–15% of cases [2,4]. The bulbar urethra is most commonly injured by a straddle injury [5]. Injuries to the penile urethra are most frequently related to penile fractures [5,6]. Penetrating injuries, mostly gunshot wounds, can occur throughout the LUT, but are rare in the civilian setting [7].

3. Diagnosis

Clinical signs and symptoms of bladder and urethral injury are summarised in Table 1.

Diagnostic approaches are described in the following subsections.

3.1. Bladder

Plain and computed tomography (CT) cystography, with bladder filling up to 350 ml, are the preferred diagnostic modalities for injury to the bladder [2,3,8–10]. CT cystography has the advantage of diagnosing coexisting pelvic or abdominal injuries [2,3,10].

Table 1 – Clinical signs and symptoms related to bladder and urethral injury

Location	Clinical signs	Remarks
Bladder injury	Haematuria	
	Inability to void	
	Abdominal tenderness	
	Suprapubic bruising	
	Abdominal distension	In cases of urinary ascites
	Entrance/exit wounds at the lower abdomen, perineum, or buttocks	If the injury is penetrating
	Male urethral injury	Blood at the meatus
Inability to void		
Haematuria and dysuria		In the case of partial rupture
Scrotal, perineal, and/or penile swelling		
	High-riding or impalpable prostate	On rectal examination; unreliable sign
	Difficulty/inability to insert a catheter	
	Female urethral injury	Blood at the urethral meatus and/or vaginal introitus
Inability to void		
Labial swelling		
Vaginal laceration		
	Haematuria	In the case of partial rupture

3.2. Urethra

Retrograde urethrography is the preferred diagnostic modality for injury to the urethra [3,5,6]. In unstable cases, retrograde urethrography should be deferred until the patient has been stabilised [5–7]. Retrograde urethrography will help to distinguish between anterior and posterior injury and between partial and complete disruption. It should be recognised that in partial injuries, spasm of the sphincter may mimic a complete disruption on imaging [5–7].

Urethroscopy is an option for diagnosing (and managing) an acute urethral injury [5,11,12]. Urethroscopy is also recommended over retrograde urethrography if urethral injury is suspected in the context of a penile fracture [13,14]. In females, in whom the short urethra precludes adequate retrograde urethrography, urethroscopy and vaginoscopy are important for identification and staging of urethral and vaginal injuries [5,6,11].

4. Treatment

4.1. Bladder injuries

If bladder repair is performed, the preferred method is closure of the bladder wall in two layers with absorbable sutures [2].

4.1.1. Blunt extraperitoneal rupture

Most patients with uncomplicated extraperitoneal rupture can be managed safely via catheter drainage alone [2,3]. However, bladder neck involvement, the presence of bone fragments in the bladder wall, concomitant rectal and/or vaginal injury, or entrapment of the bladder wall (eg, by reduced pubic symphysis) will necessitate surgical intervention [2,3].

There is an increasing trend towards treating pelvic fractures with open stabilisation and internal fixation with osteosynthetic material. During operative stabilisation with the use of osteosynthetic material, an extraperitoneal rupture of the bladder should be sutured concomitantly to reduce the risk of infection [2,3,15].

4.1.2. Blunt intraperitoneal rupture

Blunt intraperitoneal rupture of the bladder should always be managed by formal surgical repair [2,3,15]. The rationale for this is that intraperitoneal extravasation of urine can lead to peritonitis, sepsis, and death.

4.1.3. Penetrating injuries

Emergency exploration with debridement of devitalised bladder detrusor and subsequent bladder repair is strongly recommended for penetrating injuries to the bladder [2,7].

4.2. Male anterior urethra

4.2.1. Blunt anterior urethral injuries

Blunt anterior urethral injuries are associated with spongy contusion, which makes it more difficult to evaluate

the limits of urethral debridement and define the accurate anatomy of adjacent structures. Acute or early urethroplasty is therefore not indicated [11]. Therapeutic options include suprapubic diversion or attempted early endoscopic realignment [5]. Studies have shown a worse outcome for early endoscopic realignment and trans-urethral catheterisation compared to suprapubic diversion alone [16,17]. In subsequent stricture formation, urethroplasty is advised over direct-visualisation internal urethrotomy because of significantly superior success rates [16].

4.2.2. Anterior urethral injuries related to penile fracture

Penile fractures require early exploration and repair of the tear in the cavernosal tunica albuginea and, if involved, the urethra [14,18]. A small laceration can be repaired by simple closure, and a complete rupture by anastomotic repair [13,18,19].

4.2.3. Penetrating anterior urethral injuries

Immediate exploration of penetrating anterior urethral injuries is advised except when this is precluded by other life-threatening injuries [11,14,20]. For small lacerations and stab wounds, simple urethral closure might be sufficient [11]. Defects of up to 2–3 cm in the bulbar urethra and up to 1.5 cm in the penile urethra can be treated by anastomotic repair [5,20]. In the case of larger defects or apparent infection (especially bite wounds), a staged repair with urethral marsupialisation and a suprapubic catheter is needed [5,11,20]. There is no role for the use of a graft or a flap in the acute management setting [11,14].

4.3. Male blunt posterior urethral injuries

For blunt posterior urethral injuries, it is important to distinguish between complete and partial rupture to proceed with treatment. The timing of an intervention is classified as [5,11]:

- (1) Immediate: <48 h after injury;
- (2) Delayed primary: 2 d–2 wk after injury; or
- (3) Deferred: >3 mo after injury.

4.3.1. Immediate management

Although urinary diversion is not essential during the first few hours after trauma, suprapubic catheterisation is mandatory in urgent situations unless urethral catheterisation can be achieved [6,11,14,21]. However, insertion of a suprapubic catheter is not without risk, and ultrasound guidance or direct placement during laparotomy is recommended [5,6,11,21].

4.3.1.1. *Partial posterior urethral rupture.* Therapeutic options for partial posterior urethral rupture are suprapubic or urethral catheterisation [12,14,22–26]. Injuries may heal without significant scarring [12,14,21,22,24]. Subsequent stricture should be managed with internal urethrotomy or urethroplasty depending on the degree of narrowing and the stricture length [22,23].

4.3.1.2. *Complete posterior urethral rupture.* Acute treatment options for complete posterior urethral rupture include:

- (1) Realignment, with apposition of the urethral ends over a catheter;
- (2) Exploration and primary repair; and
- (3) Suprapubic catheterisation alone.

The aim of realignment is to correct severe distraction injuries rather than to prevent a stricture [14]. Other reported benefits of realignment are as follows:

Realignment has a lower stricture rate than suprapubic catheter placement alone, for which stricture formation is almost certain. Realignment might thus avoid a prolonged period of suprapubic catheter drainage and a second operation for urethral reconstruction in some patients [3,12,22,23]. If scarring and subsequent stricture formation occur, restoration of urethral continuity is simplified. Koraitim [26] reported a larger proportion of patients with a urethral gap of ≤ 2 cm after realignment compared to patients initially treated with suprapubic deviation only (67% vs 42%) [26]. For short (<2 cm) nonobliterative strictures, internal urethrotomy can be attempted, with a 50–90% success rate [22,23]. For longer strictures and in cases of complete obliteration or failed internal urethrotomy, urethroplasty is required [22]. If urethroplasty is required later, the procedure is technically easier when the prostate and urethra are well aligned [22,23,26,27].

If realignment is chosen, the preferred technique is endoscopic [14,23,24,27]. Concomitant bladder neck and/or rectal injuries must be repaired immediately and any bony fragments inside the bladder removed. Realignment can be performed at the same time. Immediate endoscopic realignment can also be performed when the patient is on the operation table for other surgery [12,28]. Early endoscopic realignment (immediate or delayed primary; see below) is also possible in a stable patient without significant concomitant injuries [12,22]. With modern endoscopic realignment procedures, stricture rates and impotence rates are 14–79% and 10–55%, respectively, with an acceptable incontinence rate ($\leq 5\%$) [3,22,28].

Immediate exploration and primary repair are difficult and even hazardous and therefore not recommended. This is because of the risk of entering the pelvic haematoma with subsequent decompression, loss of tamponade, and uncontrolled rebleeding [5]. An extensive review reported disturbingly high impotence (56%), incontinence (21%), and resticture rates (69%) [24].

4.3.2. Delayed primary realignment

In the absence of indications for immediate exploration, posterior urethral disruption can be managed in a delayed primary fashion. This approach requires placement of a suprapubic catheter at the time of the initial injury, with endoscopic realignment performed within 14 d, when patients are stable and most pelvic bleeding has resolved [24,29]. As most series [12,22] are a mix of immediate and delayed primary realignment, we refer to Section 4.3.1.2 for the results.

Experience with delayed primary urethroplasty is very limited and this approach is therefore not recommended [11,30–32].

4.3.3. *Deferred treatment*

For a complete rupture treated with an initial period of ≥ 3 mo of suprapubic diversion, obliteration of the posterior urethra is almost inevitable [21,24]. Treatment options for these posterior urethral stenoses are deferred urethroplasty and deferred endoscopic optical incision.

4.3.3.1. *Deferred urethroplasty.* Deferred urethroplasty is the procedure of choice for posterior urethral distraction defects if no realignment was performed or possible [5,11,14]. After 3 mo of suprapubic diversion, the pelvic haematoma has resolved, the prostate has descended into a more normal position, and the scar tissue has stabilised [5,11,14,31]. This technique also has the advantage that the patient has recovered from any associated injuries and is able to lie in the lithotomy position [5,11].

Most posterior urethral distraction defects are short and can be treated with a perineal anastomotic repair [11,31]. The key objective is to achieve a tension-free anastomosis between two healthy urethral ends [11,14,31,33]. Restricture rates reported are approximately 10% [31,33–35].

For large distraction defects and/or complicated cases (bladder neck injuries, fistula, redo-urethroplasty), a sequential step repair with inferior pubectomy or corporal rerouting or even a combined abdominoperineal approach might be necessary, with similar results [33,35].

Deferred urethroplasty is unlikely to result in additional erectile dysfunction [31,33,34]. On the contrary, a meta-analysis showed that erectile dysfunction was reduced after deferred urethroplasty [36]. Erectile dysfunction therefore appears to be caused by the trauma itself, and not the urethroplasty. Incontinence is rare with deferred urethroplasty (<4%) [24,31,33], and is usually due to incompetence of the bladder neck [14,33].

4.3.3.2. *Deferred endoscopic treatment.* Deferred endoscopic treatment has been proposed for complete obliteration, but with disappointing results [37,38]. For short, nonobliterative strictures following realignment or urethroplasty, direct-visualisation urethrotomy can be performed [22,23,27,35]. Repeated urethrotomies and/or dilations must be discouraged because these do not represent curative treatment [39]. Stents are not recommended for patients with strictures following pelvic trauma, as fibrotic tissue tends to grow through into the lumen of the stent [11].

4.4. *Penetrating posterior urethral injuries*

If possible, immediate exploration via the retropubic route and primary repair or realignment can be performed for penetrating posterior urethral injuries [7,14,40]. Life-threatening associated injuries often preclude direct urethral repair. In these cases, suprapubic diversion with delayed urethroplasty is advised [7,20,40].

4.5. *Female urethra*

Proximal and mid-urethral disruptions need early exploration and primary repair via the retropubic and transvaginal route, respectively, with primary suturing of the urethral ends. Concomitant vaginal laceration is repaired transvaginally at the same time [3,5]. Distal urethral injuries can be managed vaginally by primary suturing or can be left untreated and hypospadiac.

5. **Conclusions**

Bladder and urethral injuries are usually the result of blunt trauma and are often associated with pelvic fractures. The preferred diagnostic modality is cystography and urethrography, respectively. Intraperitoneal bladder rupture usually requires formal surgical repair. Extraperitoneal injuries may be managed conservatively, with bladder drainage the mainstay. Treatment of male anterior urethral injuries depends on whether they have been caused by blunt or penetrating trauma or are associated with a penile fracture. Blunt posterior urethral injuries can be corrected by immediate/early endoscopic realignment. If this is not possible, these injuries are managed by suprapubic urinary diversion and deferred (>3 mo) urethroplasty.

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Study concept and design: Lumen, Kuehhas, Djakovic, Kitrey, Serafetinidis, Sharma, Summerton.

Acquisition of data: Lumen, Kuehhas, Djakovic, Kitrey, Serafetinidis, Sharma, Summerton.

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Drafting of the manuscript: Lumen.

Critical revision of the manuscript for important intellectual content: Lumen, Kuehhas, Djakovic, Kitrey, Serafetinidis, Sharma, Summerton.

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