BJU Int 2024; **133:** 365–374 doi:10.1111/bju.16236

BJUI
BJU International

Review

Bladder trauma: a guideline of the guidelines

Deshin Reddy[1], Abdullah E. Laher[1], Maeyane Moeng[2] and Ahmed Adam[3]

[1]*Department of Emergency Medicine, Faculty of Health Sciences,* [2]*Department of Surgery, Faculty of Health Sciences, and* [3]*Division of Urology, Department of Surgery, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa*

Objectives

To identify and review the most up-to-date guidelines pertaining to bladder trauma in a unifying document as an updated primer in the management of all aspects relating to bladder injury.

Methods

In accordance with the PRISMA statement, the most recent guidelines pertaining to bladder injury were identified and subsequently critically appraised. An electronic search of PubMed and Scopus databases was carried out in September 2023.

Results

A total of six guidelines were included: European Association of Urology (EAU) guidelines on urological trauma (2023), EAU guidelines on paediatric urology (2022), Urotrauma: American Urological Association (AUA) (2020), Kidney and Urotrauma: World Society of Emergency Surgery and the American Association for the Surgery of Trauma (WSES-AAST) guidelines (2019), Management of blunt force bladder injuries: A practice management guideline from the Eastern Association for the Surgery of Trauma (EAST) (2019), and EAU guidelines on iatrogenic trauma (2012). Recommendations were summarised with the associated supporting level of evidence and strength of recommendation where available.

Conclusion

Several widely recognised professional organisations have published guidelines relating to the diagnosis, investigation, classification, management, and follow-up related to bladder injury. There is consensus amongst all major guidelines in terms of diagnosis and management but there is some discrepancy and lack of recommendation with regards to the follow-up of bladder injuries, iatrogenic bladder injury, paediatric bladder trauma, and spontaneous bladder rupture. The role of increasing minimally invasive techniques seem to be gaining traction in the select haemodynamically stable patient. Further research is required to better delineate this treatment option.

Keywords

bladder trauma, bladder injury, bladder rupture, spontaneous bladder rupture, iatrogenic bladder injury

Introduction

Bladder trauma is a relatively uncommon presentation, with a variation in its incidence across various age groups. In adults, an estimated 65–86% of bladder injury is as a result of blunt trauma. In contrast, penetrating trauma accounts for 14–35% of bladder injuries in adults [1]. The incidence of iatrogenic bladder injury ranges from 0.04% to 58%, depending on the type of procedure [2]. The overall incidence of bladder injury in children following abdominopelvic trauma is higher than the adult population as the bladder is less well protected [3].

The most widely recognised practical classification of bladder injury relates to the site of injury, i.e., intraperitoneal, extraperitoneal, or both. This plays a key role in guiding patient management [4]. In contrast, the American Association for the Surgery of Trauma (AAST) classification of bladder injuries is based on the size and site of injury (Table 1) [5]. However, this classification has not been adopted by any of the other guidelines included in this review.

Methods

A systematic review was conducted in September 2023 in accordance with the framework outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement for reporting of systematic reviews [6]. An electronic search of the literature was performed using the terms: 'Bladder Trauma or Injury or Rupture', 'Paediatric', 'Iatrogenic', 'Follow-up' and 'Guidelines'. The PubMed and Scopus Databases were searched. No automated search limitations were used.

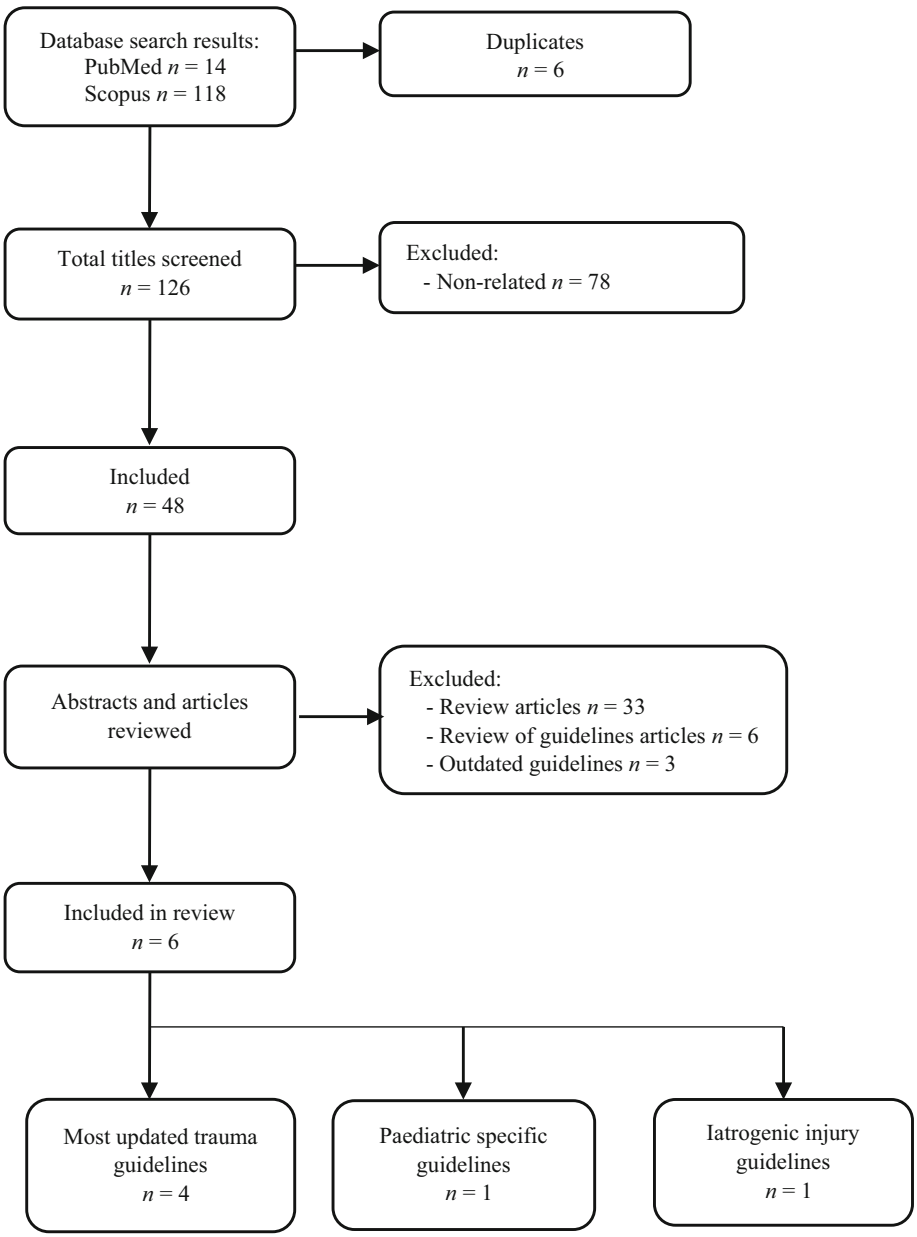
Table 1 The AAST classification of bladder injuries.

Grade	Injury
1	Contusion, intramural haematoma, or partial thickness laceration
2	Extraperitoneal bladder wall laceration <2 cm
3	Extraperitoneal >2 cm or intraperitoneal <2 cm bladder wall laceration
4	Intraperitoneal bladder wall laceration >2 cm
5	Intra- or extraperitoneal bladder wall laceration involving the trigone or bladder neck

Results

The results of the search are summarised in Fig. 1. The electronic search of the two databases yielded a total of 126 articles after duplicates were removed. A total of 78 unrelated articles were removed after title review. After abstract review and article screening, a further 41 articles were excluded (33 review articles, six reviews-of-guidelines type articles, and three articles that were guidelines that were superseded by updated versions). The remaining six articles were included in this review.

Fig. 1 Search strategy flow diagram.



Guidelines Reviewed

Guidelines reviewed in this article include: European Association of Urology (EAU) guidelines on urological trauma (2023) [7], EAU guidelines on paediatric urology (2022) [3], Urotrauma: AUA (2020) [2], Kidney and Uro-trauma: World Society of Emergency Surgery and the American Association for the Surgery of Trauma (WSES-AAST) guidelines (2019) [1], Management of blunt force bladder injuries: A practice management guideline from the Eastern Association for the Surgery of Trauma (EAST) (2019) [8], and EAU guidelines on iatrogenic trauma (2012) [27]. The EAU published updated guidelines in March 2023 but there are no changes related to bladder trauma from the 2022 edition.

In addition to blunt and penetrating bladder trauma, this review also includes aspects of guidelines pertaining to other forms of bladder injury including iatrogenic injuries, paediatric trauma, and spontaneous bladder rupture. Relevant recommendations reported in the included guidelines are summarised in Table 2.

Blunt and Penetrating Bladder Injury

Diagnosis

There is consensus among the EAU (level of evidence [LoE] 3, strength of recommendation [SR] Strong) [7], AUA (Grade B) [2] and WSES-AAST (grade of recommendation [GoR] 1C) [1] guidelines that retrograde cystography (either plain film radiography or CT) should be performed to diagnose bladder injury in the setting of visible or gross haematuria and/or fracture of the pelvis, provided the patient is haemodynamically stable. Compared to plain film radiography, CT has the added advantage of diagnosing and defining other concomitant injuries [9]. However, delayed, or excretory phased CT is inferior to CT with cystography in delineating bladder injury (GoR 1B, WSES-AAST) [1]. The EAST guidelines base its imaging recommendations on the injury severity, with no investigation being recommended in low-risk patients (microscopic haematuria only) (Conditional recommendation) and retrograde CT cystography recommended in moderate (gross haematuria) and high-risk (gross haematuria and pelvic fracture) patients (Strong recommendation) [8].

> Guideline: in cases of suspected bladder injury, CT with retrograde cystography is the investigation of choice. CT is superior at delineating injury and has the advantage of diagnosing concomitant injuries.

Intraperitoneal Injury

There is consensus among all guidelines that, in general, intraperitoneal bladder injury, whether due to blunt or penetrating trauma, should be repaired via open surgical exploration (EUA: LoE 3, SR Strong; AUA: Grade B; WSES-AAST: GoR 1B; EAST: Strong recommendation) [1,2,7,8]. Conservative management is only recommended in cases of minor uncomplicated intraperitoneal bladder injuries that are predominantly encountered during endoscopic bladder procedures (EAU: LoE 3, SR Weak) [7]. WSES-AAST is the only guideline to recommend laparoscopic management of intraperitoneal bladder injury, which may be considered in haemodynamically stable patients with isolated intraperitoneal injury and no other indications for exploratory laparotomy (GoR 2B) [1].

The role of laparoscopic nephrectomy in the setting of renal trauma has previously been explored [10]. Several case reports/series have also reported on the usefulness of laparoscopy in haemodynamically stable patients with intraperitoneal bladder injuries [11–16]. Minimally-invasive surgery has distinct advantages in terms of postoperative wound sepsis, hospital length of stay and pain reduction [11]. Important considerations prior to using this modality include operator skill and experience, haemodynamic stability of the patient, and the presence of other injuries [17].

Robot-assisted laparoscopic bladder repair has also been described in several cases; however, the majority of these cases were due to iatrogenic bladder injury [18]. The method of repairing extraperitoneal penetrating bladder injury has previously been described [19]; however, none of the guidelines provide any recommendation on the use of minimally invasive surgical repair of non-iatrogenic bladder injuries.

> Guideline: in general, intraperitoneal bladder injury should be primarily repaired via open surgical approach. Where expertise is available, minimally invasive surgery may be considered in haemodynamically stable patients with isolated bladder injury.

Extraperitoneal Injury

Again, there is general consensus among guidelines that uncomplicated extraperitoneal bladder injury may be managed conservatively with catheter drainage (EAU: LoE 3 SR Weak; AUA: Grade C; WSES-AAST: GoR 1C; EAST: Conditional recommendation) and that complex extraperitoneal injury must be managed surgically (EAU: LoE 3 SR Strong; AUA: Grade C; WSES-AAST: GoR 1C; EAST: Conditional recommendation) [1,2,7,8]. Complex extraperitoneal injury is defined as injuries involving the bladder neck, injuries associated with pelvic fractures, or injuries involving other neighbouring organs [1,7]. Although there is no explicit guidance on bladder injury management

Table 2 A summary of current guidelines relating to bladder trauma.

Guideline	Grading adopted	Diagnosis and investigation	Management		Follow-up
			Intraperitoneal	Extraperitoneal	
EAU guidelines on urological trauma (2023) [7]	SR*: Strong or Weak LoE†: 1a: evidence obtained from meta-analysis of randomised trials 1b: evidence obtained from at least one randomised trial 2a: evidence obtained from one well-designed controlled study without randomisation 2b: evidence obtained from at least one other type of well-designed quasi experimental study 3: evidence obtained from well-designed non-experimental studies, such as comparative studies, correlation studies and case reports 4: evidence obtained from expert committee reports or opinions or clinical experience of respected authorities	Perform cystography in the presence of visible haematuria and pelvic fracture (LoE 3, SR Strong). Perform cystography with active retrograde filling of the bladder with dilute contrast, 300–350 mL (LoE 3; SR Strong)	Manage blunt intraperitoneal injuries by surgical exploration and repair (LoE 3; SR Strong)	Manage uncomplicated blunt extraperitoneal injuries conservatively (LoE 3; SR Weak). Manage blunt extraperitoneal bladder injuries operatively in cases of bladder neck involvement and/or associated injuries that require surgical intervention (LoE 3; SR Strong) Penetrating bladder injury is managed by emergency exploration, debridement of devitalised bladder wall and primary bladder repair	Perform cystography to assess bladder wall healing after repair of a complex injury or in case of risk factors for wound healing (LoE 2a; SR Strong)
EAU guidelines on paediatric urology (2022) [3]	SR*: Strong or Weak	Use retrograde cystography to diagnose suspected bladder injuries (SR Strong). Ensure that the bladder has been filled to its full capacity and an additional film is taken after drainage (SR Strong)	Do not delay the treatment of intraperitoneal bladder ruptures with surgical exploration and repair as well as postoperative drainage for 7–10 days (SR Strong)	Manage extraperitoneal bladder ruptures conservatively with a transurethral catheter left in place for 7–10 days (SR Strong)	
AUA guidelines on urotrauma (2020) [2]	AUA three-tier evidence grading†: A: High—well-conducted RCTs or exceptionally strong observational studies B: Moderate—RCTs with some weaknesses of procedure or generalisability or generally strong observational studies C: Low—observational studies that are inconsistent, have small sample sizes, or have other problems that potentially confound the interpretation of data AUA statements based on grading of evidence: Standard: based on Grade A or B evidence Recommendation: based on Grade C evidence Option: non-directive statements based on either Grade A, B or C evidence	Clinicians must perform retrograde cystography (plain film radiography or CT) in stable patients with gross haematuria and pelvic fracture (Standard; evidence strength: Grade B). Clinicians should perform retrograde cystography in stable patients with gross haematuria and a mechanism concerning for bladder injury, or in those with pelvic ring fractures and clinical indicators of bladder rupture (Recommendation; evidence strength: Grade C)	A surgeon must perform surgical repair of intraperitoneal bladder rupture in the setting of blunt or penetrating external trauma (Standard; evidence strength: Grade B)	A surgeon should perform surgical repair in patients with complicated extraperitoneal bladder injuries (Recommendation; evidence strength: Grade C). Clinicians should perform catheter drainage as a treatment for patients with uncomplicated extraperitoneal bladder injuries. (Recommendation; evidence strength: Grade C) Clinicians should perform urethral catheter drainage without suprapubic cystostomy in patients after surgical repair of bladder injuries (Standard; evidence strength: Grade B)	

Table 2 (continued)

Guideline	Grading adopted	Diagnosis and investigation	Management		Follow-up
			Intraperitoneal	Extraperitoneal	
WSES-AAST guidelines on kidney and urological trauma (2019) [1]	GoR[†]: 1A: strong recommendation, high-quality evidence 1B: strong recommendation, moderate-quality evidence 1C: strong recommendation, low-quality, or very low-quality evidence 2A: weak recommendation, high-quality evidence 2B: weak recommendation, moderate-quality evidence 2C: weak recommendation, low quality, or very low-quality evidence	Retrograde cystography (conventional radiography or CT scan) represents the diagnostic procedure of choice in bladder injuries (GoR 1C). Retrograde cystography should always be performed in haemodynamically stable or stabilised patients with suspected bladder injury (GoR 1C). Intravenous contrast-enhanced CT with delayed phase is less sensitive and specific than retrograde cystography in detecting bladder injuries (GoR 1B). In pelvic bleeding amenable to angioembolisation associated with suspected bladder injuries, cystography should be postponed until the completion of the angiographic procedure to avoid affecting the accuracy of angiography (GoR 2A). Whenever feasible, direct inspection of the intraperitoneal bladder should always be performed during emergency laparotomy in patients with suspected bladder injury. Methylene blue or indigo carmine could be useful in intraoperative investigation (GoR 1C)	Intraperitoneal bladder rupture should be managed by surgical exploration and primary repair (GoR 1B). Laparoscopy might be considered in repairing isolated intraperitoneal injuries in case of haemodynamic stability and no other indications for laparotomy (GoR 2B). In case of severe intraperitoneal bladder rupture, urinary diversion via the bladder and perivesical drainage or external ureteric stenting may be used during damage control procedures (GoR 1C)	Uncomplicated blunt or penetrating extraperitoneal bladder injuries may be managed non-operatively, with urinary drainage via a urethral or suprapubic catheter in the absence of other indication for laparotomy (GoR 1C). Complex extraperitoneal bladder ruptures should be explored and repaired (GoR 1C). Surgical repair of extraperitoneal bladder rupture should be considered during laparotomy for other indications and during surgical exploration of the prevesical space for orthopaedic fixations (GoR 1C) Bladder contusion requires no specific treatment and might be observed clinically (GoR 1C). In adult patients, urinary drainage with urethral catheter (without suprapubic catheter) after surgical management of bladder injuries is mandatory (GoR 1B). For paediatric patients suprapubic cystostomy is recommended after surgical repair (GoR 2C)	CT with delayed phase imaging is the method of choice for the follow-up of ureteric and bladder injuries (GoR 2A)
EAST guidelines on the management of blunt force bladder injuries (2019) [8]	Based on GRADE*: Strong recommendation, Conditional recommendation	In low-risk patients (microscopic haematuria only) no radiography is recommended (Conditional recommendation, very low-quality evidence). In moderate-risk patients (gross haematuria), CT cystography should be performed (Strong recommendation, very low-quality evidence). In high-risk patients (gross haematuria and pelvic fracture) CT cystography should be performed (Strong recommendation, very low-quality evidence)	In patients sustaining blunt abdominopelvic trauma with intraperitoneal bladder rupture, recommend operative management (Strong recommendation, very low-quality evidence)	In patients sustaining blunt abdominopelvic trauma with simple extraperitoneal bladder rupture, recommend non-operative management (Conditional recommendation, very low-quality evidence). In patients with complex extraperitoneal injuries, recommend operative repair (Conditional recommendation, very low-quality evidence)	In low-risk patients (operative repair of simple intraperitoneal or extraperitoneal bladder rupture), recommend against routine follow-up cystography in the absence of clinical signs or symptoms concerning for urinary leakage (Conditional recommendation, very low-quality evidence). In patients at moderate risk (operative repair of complex intraperitoneal bladder rupture) or high risk (non-operative management of simple extraperitoneal bladder rupture) of urine leak on follow-up cystography, recommend follow-up cystography to evaluate for successful bladder closure (Strong recommendation, very low-quality evidence)

Table 2 (continued)

Guideline	Grading adopted	Diagnosis and investigation	Management		Follow-up
			Intraperitoneal	Extraperitoneal	
EAU guidelines on iatrogenic trauma (2012) [9]	Same as the 2022 EAU guidelines on urological trauma (see above)	Perform cystography in case of suspected iatrogenic bladder injury in the post-operative setting (LoE 3; SR Strong). Risk of bladder perforation during mid-urethral sling operations is lower for obturator compared to the retropubic route. Perform cystoscopy to rule out bladder injury during retropubic sub-urethral sling procedures (LoE 1a; SR Strong). Cystoscopy optional after other types of sling procedure or transvaginal mesh procedure (Grade C). For diagnosing iatrogenic foreign bodies, cystoscopy is the method of choice (Grade C)	Small uncomplicated intraperitoneal injuries during endoscopic procedures can be managed conservatively (LoE 3; SR Weak). Intraperitoneal bladder perforations not recognised intraoperatively, standard of care is surgical repair (Grade B)	Extraperitoneal bladder perforations not recognised during surgery or are caused by endourological procedures should be treated conservatively (Grade B)	

*RCT, randomised controlled trial. *Based on modification of the Oxford Centre for Evidence-Based Medicine: Levels of Evidence (March 2009). Phillips B, et al. Oxford Centre for Evidence-based Medicine Levels of Evidence. Updated by Jeremy Howick March 2009. 1998. [Internet]. https://www.cebm.net/2009/06/oxford-centre-evidence-based-medicine-levels-evidencemarch-2009/. †Based on the GRADE system for strength of recommendations in guidelines Guyatt et al. [21].*

in patients requiring pelvic fixation, the assumption is that these patients should undergo surgical exploration.

> Guideline: uncomplicated extraperitoneal bladder injuries may be managed conservatively. Complicated extraperitoneal bladder injuries should undergo surgical exploration.

Post-Surgical Bladder Drainage

Both, the EAU [7] and EAST [8] guidelines do not make any recommendation regarding post-surgical bladder drainage. However, there is consensus among the AUA (Standard; Grade B) [2] and WSES-AAST (GoR 1B) [1] guidelines that bladder drainage post-surgical repair should preferentially be managed with transurethral catheterisation alone. Although the efficacy of both transurethral and suprapubic catheter drainage is comparable, the former is associated with fewer complications [7].

With regards to the duration of indwelling catheterisation, the only guidance is from the AUA who recommend catheter drainage for a period of 2–3 weeks (AUA: Grade C) for cases of extraperitoneal injuries being managed conservatively [2]; EAU guidelines suggest urinary catheter removal within 5–10 days in healthy patients undergoing operative bladder repair and removal at Day 5 and 7 respectively for uncomplicated extraperitoneal and intraperitoneal bladder injuries being managed conservatively. It must be noted that these are not formal recommendations [7].

In cases where the repair is complex or concurrent trauma is significant, indwelling catheter time may need to be extended. The use of a drain and tailored antibiotics are also factors that will need consideration but there is currently no guideline that makes any strong recommendations for this.

Guideline: bladder drainage post-surgical repair should preferentially be managed with transurethral catheterisation for a duration of about 5–7 days. In patients being managed conservatively, transurethral catheterisation should be maintained for at least 7 days, with the exact duration to be tailored to the patient and the extent of injuries sustained.

Follow-Up

The AUA guidelines provide no guidance regarding the follow-up of patients with bladder injury. However, the EAU guidelines recommend that patients with complex injuries (involvement of the bladder trigone or ureteric re-implantation) or those with risk factors for impaired wound healing should undergo cystography to assess bladder wall healing or in patients with risk factors for impaired wound

healing. (LoE 2a, SR Strong) [7]. Furthermore, the EUA guidelines suggest that bladder injuries being managed conservatively should be followed up with cystography at ~10 days after injury. If a leak persists, the patient should undergo cystoscopy to exclude the presence of bony fragments in the bladder with a repeat cystogram to be performed 7 days thereafter [7]. The WSES-AAST guidelines recommend the performance of a contrast enhanced CT with delayed phase when following-up patients with bladder injuries (GoR 2a) [1]. Besides these, there is a paucity of formal guidance pertaining to follow-up, specifically with regards to the investigation of choice and timing [7].

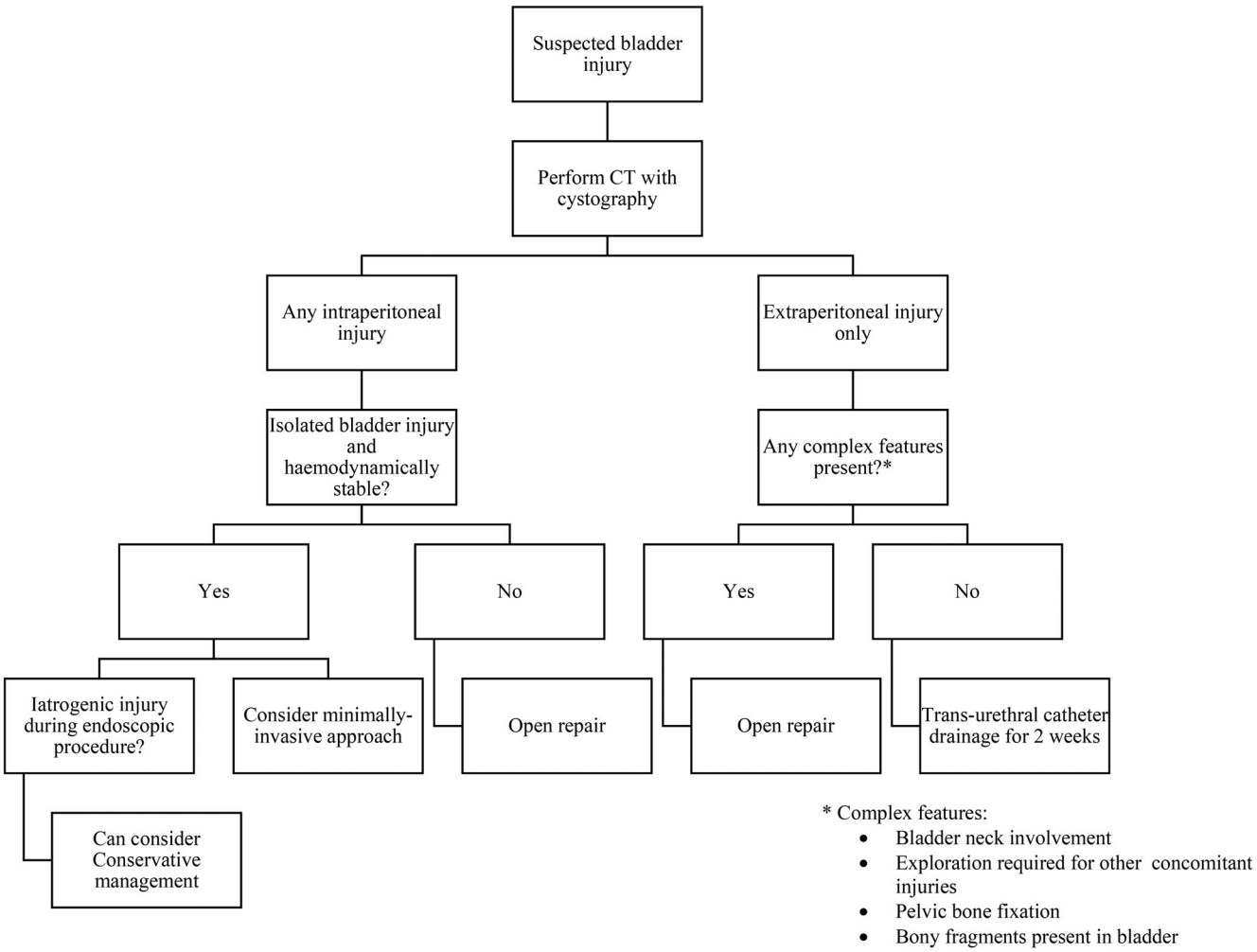
The EAST guidelines base their recommendations on the risk of urinary leakage with low risk described as operative repair of simple intraperitoneal or extraperitoneal bladder rupture, moderate risk described as operative repair of complex intraperitoneal bladder rupture and high risk described as nonoperative management of simple extraperitoneal bladder rupture. The guidelines recommend against routine follow-up cystography in low-risk patients (Conditional recommendation) and recommend routine follow-up cystography in moderate and high-risk patients (strong recommendation) [8]. See Fig. 2 for a summary of the suggested approach to bladder trauma.

> Guideline: patients with simple injuries and no suspected leak being managed either conservatively or operatively do not routinely require cystography. Patients with complicated injuries, simple injuries with suspected persistent leak, complex repairs, or patients at risk of poor wound healing should have routine follow-up cystography performed at 7–10 days after repair.

Spontaneous (Idiopathic) Rupture of the Urinary Bladder

None of the current guidelines address the management of spontaneous or idiopathic bladder rupture. Although this condition is a distinct entity, the diagnosis and management

Fig. 2 Suggested approach to management of suspected bladder trauma.



should be based on the current standard of care as recommended by trauma guidelines until such time when there is more evidence to inform guideline recommendations. Although this entity is managed on an individual case by case basis, we have recently outlined various associations and risk factors that should alert the attending emergency team in this scenario [20].

Paediatric Bladder Injury

The bladder is the second most common urological organ that may be injured in paediatric trauma. It is widely recognised that the paediatric bladder is less protected than the adult bladder with injury commonly manifesting as a result of significant blunt abdominopelvic trauma [7]. In some estimates, paediatric bladder rupture may be associated with concomitant pelvic ring fractures in 57% of cases; however, the incidence of bladder injury in the setting of pelvic fractures may vary from 0.5% to 16.8% [7].

The EAU is the only body to have published standalone guidelines that pertain to paediatric trauma. This guideline was recently updated in March 2022, with no new changes or recommendations from the 2020 update [3]. The guideline includes management recommendations; however, due to the paucity of evidence there is no LoE provided, only grades of recommendation based on the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) system [21].

Diagnosis

Children with a history of blunt trauma, suprapubic pain and tenderness, an inability to void, haematuria and/or concomitant pelvic ring fractures must be investigated for bladder injury. Patients should undergo retrograde cystography (either plain film radiography or CT) with the bladder integrity to be interrogated at both full distention and when empty (EUA: SR Strong) [3].

Management

Management recommendations are similar to those of adult guidelines. Uncomplicated extraperitoneal injuries should be managed with catheter drainage for 7–10 days, while for complicated extraperitoneal injuries or intraperitoneal rupture surgical exploration and repair is recommended (EUA: SR Strong). Compared to the adult recommendation, the major difference is that drainage after surgical repair should be facilitated by placement of a mandatory suprapubic catheter [3]. This recommendation is also supported by the WSES-AAST guidelines (GoR 2C) [1]. However, the guidelines do acknowledge that there is limited data to indicate that transurethral drainage may be as effective and result in a shorter period of diversion [22–25].

Follow-Up

Follow-up should be carried out at 7–10 days after the procedure or drainage and should include a repeat cystogram [3].

Iatrogenic Bladder Injury

The bladder is the most frequently injured urological organ during surgical procedures [26]. Iatrogenic trauma is classified as either external or internal iatrogenic bladder trauma (IBT). External IBT occurs most commonly during obstetric and gynaecological procedures, while internal IBT occurs most commonly during transurethral resection of bladder tumour (TURBT) [27].

The EAU is the only body to have published standalone guidelines pertaining to iatrogenic urological injury [27]. These guidelines were first published in 2012, with some recommendations being included in the March 2022 limited update of comprehensive urological trauma and no new changes in the latest 2023 update [7].

Diagnosis

Suspicion of external IBT should be confirmed by direct inspection. Signs include the presence of urinary extravasation, visualisation of blood and or gas in the urinary catheter or bag during the procedure [28]. Perioperative internal IBT should be excluded during cystoscopy. Signs include the presence of a dark space between detrusor muscle fibres, fatty tissue, or visualisation of bowel through a bladder wall defect [28]. Bladder injury not recognised intraoperatively presents similarly to traumatic bladder injury with abdominal pain, distention, and urinary symptoms. Cystography is the investigation of choice to exclude IBT (EAU: Grade B) [27].

Management

Due to a lack of evidence that two-layer vesicorraphy is superior to single-layer watertight closure, the former technique is no longer recommended (EAU: upgraded by panel consensus to Grade A) [7]. The management of IBT is still in keeping with the standard of care described in trauma guidelines. Injury recognised during the procedure should be primarily closed. The management of missed IBT depends on the site of perforation and the complexity of the injury [27]. Extraperitoneal injuries are generally managed conservatively, except in cases that are complicated with symptomatic extravesical collections. These patients require drainage with or without closure of the defect [27]. In cases of internal IBT due to TURBT, the bowel should be thoroughly examined to rule out other concomitant injuries [27].

Urologists should be vigilant of endoscopic bladder trauma and be sensitive to any sudden change in the irrigation, lighting, abdominal distention encountered during TURBT. A high index of suspicion should be present if the cystoscopic appearance is 'out of the norm'. A standard whole bladder 'cystoscopy check' is thus recommended after any TURBT procedure.

Conclusion

Current urological trauma guidelines provide comprehensive guidance on the recognition, diagnosis, management, and follow-up of patients with bladder injury. The guidelines reviewed provide recommendations through panel consensus after reviewing the available research and thereafter assigning the appropriate LoE. Importantly, the major aspects of diagnosis and management are similar across all guidelines. There is consensus between all guidelines about those injuries that should be managed operatively and those that should be managed conservatively, which is largely evidence-based. However, there does appear to be some lack of consensus in terms of follow-up of bladder injuries, namely a paucity of guidance related to timing and the investigation of choice. There is also a lack of guidance relating to paediatric bladder injury and iatrogenic bladder injury, as this was only covered in detail by the EAU guidelines. In addition, there is no standard of care prescribed by any current guideline for the management of spontaneous or idiopathic bladder rupture. These are potential areas for future research.

Acknowledgements

None.

Funding

None.

Author Contributions

Deshin Reddy performed the literature search, write up of the initial draft, and proof reading. Abdullah E. Laher was responsible for the conceptualisation of the study, assisted with write up and proof reading. Maeyane Moeng assisted with write up and proof reading. Ahmed Adam was responsible for the conceptualisation of the study, assisted with write up and proof reading.

Disclosure of Interests

The authors hereby certify that this submission is not under publication consideration elsewhere and that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

References

1 **Coccolini F, Moore EE, Kluger Y et al.** Kidney and uro-trauma: WSES-AAST guidelines. *World J Emerg Surg* 2019; 14: 54
2 **Morey AF, Broghammer JA, Hollowell CMP, McKibben MJ, Souter L.** Urotrauma Guideline 2020: AUA Guideline. *J Urol* 2021; 205: 30–5
3 **Radmayr C, Bogaert G, Burgu B et al.** *EAU Guidelines on Paediatric Urology – Limited Update March 2022.* The Netherlands: Anheim, 2022
4 **Figler B, Edward Hoffler C, Reisman W et al.** Multi-disciplinary update on pelvic fracture associated bladder and urethral injuries. *Injury* 2012; 43: 1242–9
5 **Moore EE, Cogbill TH, Jurkovich GJ et al.** Organ injury scaling III: chest wall, abdominal vascular, ureter, bladder, and urethra. *J Trauma – Injury, Infect Crit Care* 1992; 33: 337–9
6 **Page MJ, McKenzie JE, Bossuyt PM et al.** The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021; 372: n71
7 **Kitrey ND, Campos-Juanatey F, Hallscheidt P et al.** EAU guidelines on urological trauma. *EAU Guidelines Edn presented at the EAU Annual Congress Milan March 2023.* 2023
8 **Yeung LL, McDonald AA, Como JJ et al.** Management of blunt force bladder injuries: A practice management guideline from the Eastern Association for the Surgery of Trauma. *J Trauma Acute Care Surg* 2019; 86: 326–36
9 **Chan DPN, Abujudeh HH, Cushing GL, Novelline RA.** CT cystography with multiplanar reformation for suspected bladder rupture: experience in 234 cases. *AJR Am J Roentgenol* 2006; 187: 1296–302
10 **Bokhari AA, McDowall J, Gaibie Z et al.** The emerging role of laparoscopic nephrectomy in the operative management of renal trauma: is less really more? *Int Surg J* 2021; 8: 2140–4
11 **Roos R, Makhadi S.** Slow down with that full bladder: a case report describing an intraperitoneal bladder rupture repaired laparoscopically. *Int J Surg Case Rep* 2021; 1: 105901
12 **Al-Aghbari S, Al-Harthy A, Ahmed M, Al-Reesi A, Al-Wahaibi K, Al-Qadhi H.** Laparoscopic repair of traumatic intraperitoneal bladder rupture. *Sultan Qaboos Univ Med J* 2011; 11: 515–8
13 **Kim B, Roberts M.** Laparoscopic repair of traumatic intraperitoneal bladder rupture: case report and review of the literature. *Can Urol Assoc J* 2012; 6: E270–3
14 **Marchand T, Cuadra R, Ricchiuti D.** Laparoscopic repair of a traumatic bladder rupture. *J Soc Laparoendosc Surg* 2012; 16: 155–8
15 **Arnold MR, Lu CD, Thomas BW et al.** Advancing the use of laparoscopy in trauma: repair of intraperitoneal bladder injuries. *Am Surgeon* 2019; 85: 1402–4
16 **Heo Y, Kim DH.** Laparoscopic repair of traumatic intraperitoneal bladder rupture: a case series. *J Acute Care Surg* 2021; 11: 86–8
17 **Wirth GJ, Peter R, Poletti PA, Iselin CE.** Advances in the management of blunt traumatic bladder rupture: experience with 36 cases. *BJU Int* 2010; 106: 1344–9
18 **Kumar S, Modi P, Mishra A et al.** Robot-assisted laparoscopic repair of injuries to bladder and ureter following gynecological surgery and obstetric injury: a single-center experience. *Urol Ann* 2021; 13: 405–11
19 **Griffin C, Crute W, White W.** Robotic-assisted laparoscopic repair of a penetrating extraperitoneal bladder injury. *Urology* 2023; 181: e205
20 **Reddy D, Laher AE, Lawrentschuk N, Adam A.** Spontaneous (idiopathic) rupture of the urinary bladder: a systematic review of case series and reports. *BJU Int* 2023; 131: 660–74
21 **Guyatt GH, Oxman AD, Vist GE et al.** GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008; 336: 924–6
22 **Alli MO, Singh B, Moodley J, Shaik AS.** Prospective evaluation of combined suprapubic and urethral catheterization to urethral

drainage alone for intraperitoneal bladder injuries. *J Trauma* 2003; 55: 1152–4

23 **Margolin D**, **Gonzalez R**. Retrospective analysis of traumatic bladder injury: does suprapubic catheterization alter outcome of healing? *Am Surg* 2004; 70: 1057–60

24 **Parry NG**, **Rozycki GS**, **Feliciano DV et al.** Traumatic rupture of the urinary bladder: is the suprapubic tube necessary? *J Trauma* 2003; 54: 431–6

25 **Volpe MA**, **Pachter EM**, **Scalea TM**, **Macchia RJ**, **Mydlo JH**. Is there a difference in outcome when treating traumatic intraperitoneal bladder rupture with or without a suprapubic tube? *J Urol* 1999; 161: 1103–5

26 **Cordon BH**, **Fracchia JA**, **Armenakas NA**. Iatrogenic nonendoscopic bladder injuries over 24 years: 127 cases at a single institution. *Urology* 2014; 84: 222–6

27 **Summerton DJ**, **Kitrey ND**, **Lumen N**, **Serafetinidis E**, **Djakovic N**. EAU guidelines on iatrogenic trauma. *Eur Urol* 2012; 62: 628–39

28 **Gomez RG**, **Ceballos L**, **Coburn M et al.** Consensus statement on bladder injuries. *BJU Int* 2004; 94: 27–32

Correspondence: Deshin Reddy, Department of Emergency Medicine, Faculty of Health Sciences, University of Witwatersrand, 7 York Road, Parktown, Johannesburg, 2193, Gauteng, South Africa.

e-mail: deshinr@gmail.com

Abbreviations: AAST, American Association for the Surgery of Trauma; EAST, Eastern Association for the Surgery of Trauma; EAU, European Association of Urology; GoR, grade of recommendation; GRADE, Grading of Recommendations, Assessment, Development, and EvaluationIBT, iatrogenic bladder trauma; LoE, level of evidence; SR, strength of recommendation; TURBT, transurethral resection of bladder tumour; WSES-AAST, World Society of Emergency Surgery and the AAST.