

# Index of suspicion with appropriate timing of CT scan helps prevent missed diagnosis in urologic trauma

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## SUMMARY

Ureteric and bladder injuries are uncommon, difficult to diagnose and rarely occur in isolation. Diagnosis is often delayed or missed at presentation. Therefore, high clinical suspicion and appropriate timing of computed tomography (CT) are of paramount importance. We report two cases (ureteropelvic junction avulsion and ruptured dome of bladder) whereby the presentations were subtle and would have been missed if not for high clinical suspicion. This article discusses the problems associated with these urologic injuries, as well as how to develop a high index of suspicion based on the pattern of anatomical disruption, mechanism of injury, physiological abnormality and comorbidity.

## INTRODUCTION

Genito-urinary tract (GUT) injury occurs in approximately 10% of all abdominal trauma cases.<sup>1</sup> However, ureteral and bladder injuries are uncommon, constituting 2.5% and 1.6% of all GUT trauma respectively.<sup>1</sup> They are rarely injured due to the protection provided by the vertebrae, adjacent muscles and bony pelvis.<sup>1,2</sup> The rarity, plus the lack of overt clinical signs make the diagnosis of both these injuries very difficult and are often missed at presentation.<sup>2</sup> We report our experiences with two of such cases, whereby the signs were subtle but were diagnosed early due to high index of suspicion.

## CASE 1

An 18-year-old boy had a fierce tackle with an opponent while playing soccer. Both players fell, with the opponent landing directly onto the boy's abdomen. The resultant trauma brought this young boy to the emergency department complaining of lower abdominal pain and a tinge of haematuria. A tender lower abdomen raised the possibility of a urologic injury.

Contrast-enhanced computed tomography (CECT) at portal-venous phase showed normal kidneys and bladder, but minimal fluid with fat streakiness at left perinephric region. At 5-minute delayed computed tomography (CT) (excretory phase), the left ureter was seen to be unenhanced.

Due to strong suspicion of a possible collecting system injury, a 20-minute delayed CT was performed. These delayed images showed contrast leak surrounding the left kidney

(Figure 1) and left proximal ureter, revealing a ureteropelvic junction (UPJ) avulsion.

## CASE 2

A 30-year-old man was involved in a high-speed motor vehicle collision, between two lorries, causing him to be trapped in the driver's seat. He sustained cerebral concussion and right femur fracture. Following urethral catheterisation, there was a transient episode of lightly blood-stained urine. Right iliac fossa tenderness prompted a CECT abdomen. FAST scan was negative and there was no pelvic fracture. The initial corticomedullary and nephrographic phases were unremarkable.

However, due to clinical suspicion of a bladder injury based on the mechanism of trauma, a 20-minute delayed CT (excretory phase) was carried out. The delayed images captured contrast leak from the ruptured dome of bladder into the peritoneal cavity (Figure 2).

## DISCUSSION

Timely recognition of the relatively uncommon ureteral and bladder injuries is fundamental to reduce morbidity and mortality.<sup>2,3</sup> The complications associated with missed or delayed diagnosis can be debilitating, if not life-threatening.<sup>1-3</sup> These include the formation of fistulas, strictures, difficult secondary repairs, renal failure, urinomas, abscesses, sepsis and death.<sup>1,4</sup> Unfortunately, early detection remains a challenge because the primary goal in managing trauma is to identify life-threatening injuries promptly.<sup>2</sup> As such, ureteral and bladder traumas which are not immediately life-threatening are often overlooked.<sup>2</sup>

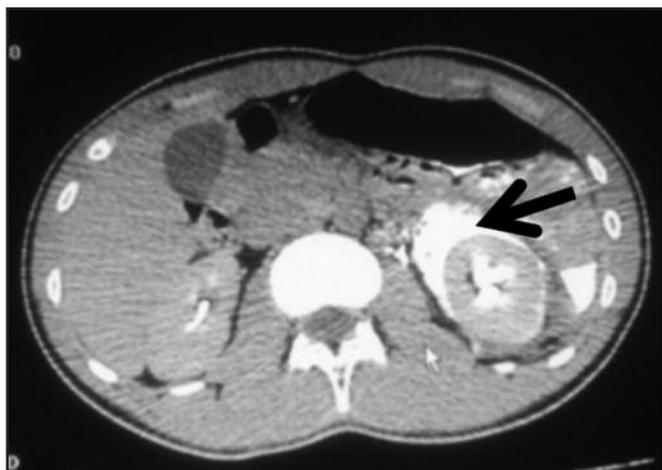
Furthermore, clinical signs are sparse and non-specific.<sup>1</sup> Haematuria is commonly associated with urologic trauma and is a cardinal sign of bladder injury.<sup>3</sup> However, ureteric and bladder injuries can occur with total absence of haematuria.<sup>1</sup>

Due to these factors, inasmuch as 40% of ureteral injuries and 10% of bladder injuries have been reported to be missed.<sup>4</sup> These incidences can be lowered by having a high index of clinical suspicion.<sup>2</sup> Thus, the ability to predict injury patterns is necessary, wherein the anatomy, mechanism of injury, physiology and comorbidity may provide valuable clues in raising its suspicion.

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**Fig. 1:** 20-minute delayed CT (excretory phase) Arrow showing contrast leak. The left kidney was stented and patient recovered well.



**Fig. 2:** 20-minute delayed CT (excretory phase) Arrow showing contrast leak. The bladder was repaired and patient recovered well.

**Anatomy**

The entire length of ureter runs retroperitoneally, cushioned by the large psoas muscle posteriorly and the intraperitoneal organs anteriorly.<sup>1</sup> The middle and distal parts of the ureter are further shielded by the bony pelvis.<sup>1</sup> Invariably, the proximal ureter is more commonly injured (71%) compared to its mid (8%) and distal (21%) counterparts.<sup>1</sup> When there is a disruption to any part of this protective anatomical shield, ureteric injury should be suspected.<sup>2</sup>

The bladder is a pelvic organ when it is empty, lying behind the symphysis pubis.<sup>3</sup> When it is full, it rises well above the symphysis.<sup>3</sup> It is located extraperitoneally with the peritoneum covering the superior surface.<sup>3</sup> Therefore, injury can be either extraperitoneal or intraperitoneal. Up to 90% of bladder trauma is associated with pelvic injury.<sup>1</sup> Hence, the presence of a pelvic fracture should raise the suspicion of a bladder injury.

**Mechanism of Injury**

- The ureters can be injured by the following mechanisms:
- 1) hyperextension of the body which causes the kidneys to be pulled upwards, thus stretching the ureters.<sup>4</sup>
  - 2) sudden deceleration, in which the continued forward motion of the mobile kidney against the fixed UPJ or ureterovesical junction (UVJ) produces a shearing force, causing tears at the point of fixations.<sup>2</sup>

The bladder, on the other hand, can be injured by the following mechanisms<sup>1,3</sup>:

- 1) laceration from the pelvic bony fragments.
- 2) avulsion due to disrupted pelvic ligamentous attachments.
- 3) direct blow to a full bladder.

**Physiology**

Ureteric or bladder injury either isolated or combined, will not cause hemodynamic instability in acute trauma setting.<sup>1</sup> Nevertheless, patients with ureteral and bladder injuries are commonly in shock from multiple organ injuries.<sup>1</sup>

**Comorbidity**

Known anatomical variations and congenital anomalies of the urinary tract system as well as the presence of a transplanted kidney should be considered in injury-prediction. There is yet to be a documented anomalous or transplanted ureteric injury, thus far.

Index of suspicion should be conveyed to the radiologist. The delayed-phase in standard CT abdomen following blunt abdominal trauma is normally carried out between 3-5 minutes after intravenous contrast administration.<sup>5</sup> Unless the radiologist is alerted, focus will be placed in detecting life-threatening injuries. The ureters are best visualized at 10-minute excretory phase, whereas bladder is best visualised at 20-minute excretory phase.<sup>5</sup>

**CONCLUSION**

Ureteric and bladder injuries are rare and difficult to diagnose. Missed or delayed diagnosis is associated with poor urologic and overall outcomes. This can be prevented by having a high index of suspicion based on the pattern of anatomical disruption, mechanism of injury, physiological abnormality and comorbidity, along with appropriate timing of CT.

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