Genitourinary trauma

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Abstract

Genitourinary (GU) organs are commonly injured in trauma patients. Although the kidney is the most commonly injured organ, other GU structures such as the bladder and urethra are also susceptible to injury. GU trauma is broadly divided into blunt and penetrative based on the mechanism of injury. Prompt diagnosis and recognition of iatrogenic GU injury are also paramount. A delay in diagnosis and treatment can have significant consequences – for example, abscess formation, fistulae and permanent renal impairment in the case of ureteric injury. Not all GU injuries require urgent surgery. Some can be managed with minimally invasive techniques (such as angiographic embolization) whilst others are managed entirely conservatively. The immediate management of these patients is geared towards haemodynamic stability. Haemodynamic shock that is resistant to the usual resuscitative measures often suggests ongoing bleeding and need for immediate intervention. The early management of most GU injuries with delayed presentation includes urinary diversion (through insertion of nephrostomy tube or suprapubic or urethral urinary catheter insertion) with delayed and definitive surgical reconstruction taking place at a later stage. Using the most up-to-date guidelines and published data we summarize the management of GU trauma by affected organ.

Keywords Bladder injury; renal trauma; trauma images; ureteral injury; urethral injury; urological injury

Background and epidemiology

Genitourinary (GU) trauma is seen in men and women of all ages. However, it is more common in young males. Urological organs are involved in about 10% of abdominal trauma patients and the kidney is the most commonly injured organ.[1] Isolated GU injury is uncommon, and when it occurs it is most frequently seen in multi-trauma patients. Following a systematic emergency assessment, the first priority in these patients is securing the airway, controlling external bleeding and managing haemodynamic shock. Physical examination, blood tests and radiological investigations are often carried out alongside haemodynamic resuscitation. GU trauma is broadly classified into blunt and penetrative injuries. Below we summarize the management of GU trauma by affected organ.

Renal trauma

The kidney is the most commonly injured urological organ, accounting for up to 5% of all trauma cases and almost a quarter of solid abdominal organ injuries.[2] The kidney is particularly susceptible to deceleration injuries due to its relatively fixed pelvis and vascular pedicle. Over 90% of injuries are due to blunt trauma, including road traffic accidents, falls and sport injuries. The majority of these patients can be managed conservatively as bleeding is usually self-limiting and controlled within the retroperitoneal space. Renal vascular injury is seen in less than 5% of blunt abdominal trauma cases.[3] Gunshot and stab wound injuries are rarer mechanisms of trauma. They tend to be more unpredictable and cause significant parenchymal destruction and are often associated with injury of other organs. Haematuria, although present in the vast majority of renal trauma patients, gives little indication of the severity of injury. Patients with renal trauma are assessed and resuscitated according to Advanced Trauma Life Support (ATLS) principles, with the primary goal of haemodynamic stabilization.

Classification of renal trauma

The most widely used and validated classification system for renal injury is the American Association for the Surgery of Trauma (AAST) scale (Table 1). This helps to predict morbidity and guides the need for intervention. It is often based on computed tomography (CT) images but the scale of injury can also be determined using surgical explorative findings.

Initial assessment

A thorough history from conscious patients and any witnesses in the unconscious is crucial as the mechanism of injury gives a good indication of the severity of the assault. Sudden deceleration, such as falls and high-speed motor vehicle accidents, suggest significant trauma. In penetrating injuries, a detailed history including the type of weapon and the velocity of the projectile such as a knife or a bullet, will help to predict the extent of injury. Details of any pre-existing renal disease must be obtained early, as their co-existence can complicate the outcome of an otherwise minor assault to the kidney. Renal diseases to be aware of include the presence of a solitary kidney, hydronephrosis, and renal cysts and tumours, as well as intrinsic medical disease affecting the kidney.

Clinical examination in a trauma setting is usually carried out alongside obtaining the history. Vital signs are monitored throughout the clinical assessment. Early signs of shock include tachycardia, and later a drop in blood pressure. If shock is resistant to the usual resuscitative measures it could indicate ongoing bleeding requiring emergency intervention. Penetrating trauma to the lower posterior thorax, flank and upper abdomen should raise the suspicion of renal injury. In blunt trauma, haematuria, flank bruising, fractured ribs, abdominal tenderness or the presence of a palpable mass may indicate underlying injury to the kidney.

Laboratory investigations

Urinalysis, haemoglobin and haematocrit estimation and creatinine levels are crucial early tests in patients with suspected renal injury. Absence of haematuria does not exclude major injury, such as disruption of the pelvi-ureteric junction or injury to the vascular pedicle. Urine dipstick performed at the bedside is rapid and sufficiently reliable for evaluation of haematuria. Serum creatinine level taken within an hour of the trauma often reflects

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AAST grading system for renal injury

Grade	Injury description
1	No laceration
	Contusion or non-expanding sub-capsular haematoma
2	Cortical laceration of <1 cm, no urinary extravasation
	Non-expanding peri-renal haematoma
3	Cortical laceration >1 cm, no urinary extravasation
4	Cortical laceration into collecting system
	Segmental vascular injury, partial vessel laceration, vessel thrombosis
5	Shattered kidney
	Avulsed vascular pedicle

Table 1

renal function prior to the injury and therefore a raised creatinine level may indicate pre-existing renal impairment.

Serial haematocrit measurements and patient response to resuscitative measures along with need for blood transfusion are crucial in the decision-making process. In those with suspected ongoing bleeding, the source of haemorrhage should be radiologically investigated, assuming the patient is stable enough to do so.

Radiological investigations

All patients with penetrating renal injury, suspected clinically on the basis of an entry and/or exit wound, regardless of whether haematuria exists or not, should undergo renal imaging. In blunt trauma, the presence of any degree of haematuria and haemodynamic shock is associated with a 12.5% incidence of major renal injury. In contrast, this figure falls to 0.2% in those with only non-visible haematuria and absence of shock.[3] Therefore, patients with suspected blunt renal trauma require radiological imaging if they have visible or non-visible haematuria and haemodynamic shock. Exception to this rule includes adults with deceleration injuries and children with any degree of haematuria who require investigation regardless of haemodynamic status.

Computed tomography

Computed tomography (CT) with intravenous contrast is the gold standard radiological modality of choice for investigation of suspected renal injury (Figure 1). It is superior to ultrasonography, intravenous pyelography and angiography because as well as accurately defining the location of injury, it also detects contusions, segmental renal vascular injuries and shows the location, presence and to a degree the functional status of the contralateral kidney. It visualizes any retroperitoneal haematomas, associated abdominal and pelvic injuries, as well as showing a detailed anatomy of the kidney including the depth of any renal lacerations.[4] Without intravenous contrast administration, a full renal injury assessment cannot be made, as pedicle injury is classically diagnosed on a contrast CT when there is no renal contrast enhancement.[3] For an accurate assessment of the collecting system, urographic phase images at 10–15 minutes post injection of intravenous contrast are required. Most urologists are very familiar with interpreting and making a reasonable assessment of CT renal images due to the frequency with which this investigation is used in routine day-to-day practice.

Other imaging modalities

Ultrasonography (US) is used in the initial assessment of trauma patients to look for intra-peritoneal free fluid and is often referred to as Focused Assessment with Sonography for Trauma or FAST scan. Its use in the assessment of renal injury is limited and although it can detect renal lacerations, it does not provide information in regards to the depth of laceration, urinary excretion or leakage. Despite this, US scan has its place in the follow up of stable renal injuries. As the majority of renal injuries are minor parenchymal lesions, they can be followed up with serial US scans looking for resolution of parenchymal and perinephric haematomas and urinomas. Contrast sonography with air-bubbles is described but not routinely used.[5]

Intravenous pyelography (IVP) has been superseded by contrast CT as the gold standard imaging modality of choice. Due to its lower specificity and sensitivity for renal injury and its inability to visualize associated intra-abdominal pathology, IVP is only recommended when CT and angiography are unavailable. As well as establishing the extent of injury of the affected kidney it also reveals the presence or absence of the contralateral kidney. IVP clearly visualizes the parenchyma and the collecting system when images are taken at various intervals. Therefore, a complete or partial non-visualization is highly indicative of a shattered kidney or pedicle injury. The other significant finding on IVP is extravasation of contrast, which implies injury to renal capsule, parenchyma and/or collecting system. Any of these findings on IVP should be further investigated with contrast CT scan. Patients who undergo emergency surgical exploration should have a one shot IVP on the operating table to ensure the presence of a functioning contralateral kidney. This will guide further surgical management of the injured kidney. It involves injection of 2 ml/kg of contrast medium, followed by a plain X-ray image at 10–15 minutes.

Magnetic resonance imaging (MRI) although sufficiently sensitive, is not ideal in trauma patients, as it requires a longer time and access to patient during scanning is limited. It is therefore only appropriate in patients with iodine allergy, when CT scan is unavailable or in the rare cases when CT finding is indeterminate.

Management of renal injury

Conservative management: the main factor which influences the management of patients with renal trauma is haemodynamic stability. Conservative management has become the accepted treatment approach of the majority of these patients. The high rate of nephrectomy has been the main precursor for the move away from surgical exploration of haemodynamically stable patients.

Conservative management includes bed rest, fluid resuscitation, close monitoring of vital signs and administration of antibiotics when clinically indicated. This conservative approach to management has been shown to be associated with a lower rate

