

7. SPECIAL POPULATIONS
A. Genitourinary Trauma

OBJECTIVE: Provide guidelines for the diagnosis and management of the trauma patient with genito-urinary injuries.

DEFINITIONS:

Gross hematuria: Blood in the urine that can be seen as a change in the urine color.
Microhematuria: Urine that appears normal but has tested positive for blood by either a dipstick technique or by microscopic examination.
Renal contusions: Defect(s) in perfusion of the kidney on CT or IVP that is consistent with a parenchymal contusion.
Renal fracture: A parenchymal defect of the kidney associated with hematoma or urinoma around the kidney.

Reno-vascular injuries: Occlusion(s) of the renal artery as evidenced by lack of perfusion to a kidney on CT, IVP, or angiogram.

Kidney Injuries

AAST Kidney Injury scale

Grade	Type of injury	Description of injury	AIS-90
I	Contusion	Microscopic or gross hematuria, urologic studies normal	2
	Hematoma	Subcapsular, non-expanding no parenchymal injury	2
II	Hematoma	Non-expanding perirenal hematoma confined to renal urethral peritoneum	2
	Laceration	< 1 cm parenchymal that of renal cortex without urinary extravasation	2
III	Laceration	< 1 cm parenchymal laceration of renal cortex without injury to the collecting system or urinary extravasation	3
	Laceration	Parenchymal laceration extending to renal cortex, medulla, and collecting system	4
IV	Vascular	Main renal artery or vein injury with contained hemorrhage	4
V	Laceration	Completely shattered kidney	5
	Vascular	Avulsion of renal hilum with devascularized kidney	5

1. All hemodynamically unstable patients with either isolated kidney injury and without associated intra-abdominal injuries should be taken directly to the operating room for the appropriate treatment.
 - a. If a nephrectomy is necessary and the patient has not had any confirmation of the presence and/or the function of the contralateral kidney before the laparotomy, a one-

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shot IVP to confirm the presence of the contralateral kidney and its function should be performed before performing the nephrectomy² (Level 3).

- The one-shot IVP is done by giving the patient 2 mL/kg (150 mL) of 50% contrast as a bolus and by obtaining a single shot flat-plate film within 5 minutes of completion of the bolus.
 - b. Non-pulsatile, non-expanding retroperitoneal hematomas, and perirenal hematomas from blunt injuries should not be explored at the time of the laparotomy. In contrast, all retroperitoneal hematomas, including perirenal hematomas from penetrating injuries, should be explored.
 - c. Partial nephrectomy should be considered in patients with penetrating injuries localized to upper or lower pole of the kidney. Mid-pole injuries can be treated with closure of the collecting system and individual ligation of the vessels in non-vascularized kidneys. An omental pedicle flap can be rotated to cover the defect after closure of the collecting system. With this approach one can expect a kidney salvage rate of 85% (Level 3).
2. Stable patients with grade I, II, and III renal trauma by CT scan can be observed with serial hematocrits, physical examination, and vital signs (Level 2). The presence of contrast blush/extravasation on CT scan should prompt strong consideration for angiography. If these patients develop fever, increasing abdominal pain and/or hypertension, they should undergo a repeat CT scan or alternatively an ultrasound.
 3. Patients with grade IV kidney injury without vascular pedicle injury can be observed while placed on bed rest. An interval CT scan at 72 hours should be done to reassess the injury for the presence of an urinoma. If a urinoma is present, it should undergo percutaneous drainage; if conversely, there is no urinoma, the patient can undergo continued observation.
 4. If the patient with grade IV kidney injury becomes unstable, he should be taken to the operating room for exploration. Patients with grade IV kidney injury involving the pedicle should undergo diagnostic angiography with possible angioembolization and/or stenting as appropriate. Of note, patients with shattered but perfused kidneys can be treated nonoperatively as long as they are hemodynamically stable³ (Level 2). Nonoperative management of these patients is associated with fewer complications, which can be managed with an endo-urological or a percutaneous approach when required (Level 2).

Hemodynamically stable patients with penetrating renal injuries, including GSWs, who have been completely staged by CT scan can be managed nonoperatively as long as the workup has excluded ureteral and associated intra-abdominal injuries⁴⁻⁵ (Level 3).

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Ureteral Injuries

Classification of Ureteral Injuries	
Grade	Description of injury
I	Hematoma only
II	Laceration < 50% of circumference
III	Laceration > 50% of circumference
IV	Complete tear < 2 cm of the de-vascularization
V	Complete tear > 2 cm of the de-vascularization

Ureteral injuries from trauma constitute less than 1% of all urinary tract injuries. Greater than 95% are caused by gunshot wounds. Urine analysis, IVP, as well as operative exploration may miss ureteral injuries; therefore, a high index of suspicion is required during laparotomy to avoid missing these injuries. A CT scan with delayed images between 5 and 8 minutes after infusion of contrast will increase the sensitivity in diagnosing ureteral disruption from blunt trauma. Of note, hematuria is not a consistent finding with ureteral injuries; therefore, the absence of blood in the urine does not exclude a ureteral injury. The treatment options are guided by the location and the extent of the injury.

Principles of Repair of Grade III-V Injuries

1. Debride both ureteral ends to fresh tissue
2. Spatulate the ureteral ends
3. Place an internal double-J stent
4. Reconstruct the ureter with a watertight closure using 4-0 Vicryl
5. Drain the site with a JP
6. Isolate the injury, if possible, with either peritoneum or omentum

Stable patients

Injury to the lower third of the ureter can be treated easily by direct re-implantation of the ureter into the bladder or with the use of a psoas hitch, if necessary, to decrease the tension on the suture line. Mid-ureteral injuries can be treated with resection and primary anastomosis over a double- J stent as long as the segment injured is less than 2 cm. An alternate technique for injuries at this level includes the creation of a Boari bladder flap. A third technique is to perform a transuretero-ureterostomy. Injuries to the proximal third of the ureter can be treated with ureteropyelostomy, ureterocalycostomy, or, if necessary, within ileal segment interposition. In a very stable patient, an autotransplantation is always feasible⁶.

Unstable patients

If the patient is unstable and has suffered a high-grade ureteral injury, you should either ligate the ureter and then proceed with a percutaneous nephrostomy, or establish temporary external drainage. If you can, avoid a cutaneous ureterostomy.

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Bladder injuries

Classification of bladder injury	
Type	Description
1	Bladder contusion
2	Intraperitoneal rupture
3	Interstitial bladder injury
4	Extra peritoneal rupture: A. Simple B. Complex
5	Combined injury

The diagnosis of bladder injury cannot be made with conventional CT alone even if the Foley is clamped and the bladder is distended (Level 2). The diagnosis of bladder injury in patients at risk of injury, which typically includes patients with pelvic fractures and complex acetabular fractures, is made by either conventional cystography or by CT cystography (Level 2).

Extraperitoneal rupture of the bladder can be generally managed nonoperatively with a Foley catheter in place for 7-10 days with a repeat cystography to confirm healing. Contraindications to nonoperative management of extraperitoneal bladder injuries include:

- Associated injuries to the urethra, rectum, and vagina
- Presence of bone fragments in the bladder
- Open reduction internal fixation of the pubic symphysis with hardware
- Open pelvic fractures
- Inadequate bladder drainage via the Foley catheter
- Penetrating injuries

Intraperitoneal bladder rupture requires operative intervention and repair. The bladder repair consists of a 2 layer repair with a Vicryl or Chromic suture. Suprapubic cystostomy is not necessary since bladder drainage via Foley catheter is sufficient for adequate bladder decompression⁷. A cystogram done 7 -10 days after the repair is necessary to confirm healing before the removal of the Foley catheter. Continued antibiotic regimen is not necessary while the Foley is in place (Level 2).

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Urethral Injuries

AAST Grading

Type	Description	Appearance
I	Contusion	Blood at the urethral meatus; normal urethrogram
II	Stretch injury	Elongation of the urethra without extravasation on urethrogram
III	Partial disruption	Extravasation of contrast at injury site with contrast visualization of the bladder
IV	Complete disruption	Extravasation of contrast at injury site without visualization of the bladder; < 2 cm of urethral separation
V	Complete disruption	Complete transection with > 2 cm urethral separation, or extension into the prostate or vagina

The diagnosis of urethral injury should be suspected in all patients with pelvic fractures and, in particular, in patients with anterior and posterior pelvic ring fractures (Level 2). Although blood at the urethral meatus, gross hematuria, and a high-riding prostate are suggestive of urethral injury in the setting of pelvic fracture, their absence does not exclude a urethral injury. While the female urethra is more resistant to injury in patients with pelvic fractures, still, the presence of vaginal bleeding and/or external genitalia injury in female patients with pelvic fractures should raise suspicion of urethral injury.

The posterior urethra is injured in males and females in association with pelvic fractures. In contrast, the male anterior urethra may be injured in penetrating injuries or in straddle-type injuries, causing a crush on the bulbar urethra against the pubic ramus. A retrograde urethrogram is indicated in patients with blunt pelvic trauma and inability to void, blotted the urethral meatus, a high-riding prostate, and ecchymosis at the base of the penis involving the scrotum. Injuries to the posterior urethra are managed with bladder decompression via a suprapubic cystostomy. Primary repair is contraindicated due to the high incidence of complications, including incontinence, impotence, and stricture formation. Anterior urethral injury can be managed with endoscopic or fluoroscopic urethral catheter placement followed by pericatheter urethrogram 10- 14 days later to assess for healing before removal of the catheter.

Scrotal injuries

All penetrating scrotal injuries must be explored surgically and may require a Urology consultation. Blunt scrotal injuries require evaluation via ultrasound examination and exploration when there is testicular rupture, torsion, presence of a large hematocele, and testicular dislocation.

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References

1. Baverstock R et al. severe blunt renal trauma: A 7 year retrospective review from a provincial trauma center. *Can J Urol* 8(5): 1372-6, 2001
2. Gonzalez RP et al. Surgical management of renal trauma: is vascular control necessary? *J Trauma* 47(6):1039-42, 1999.
3. Altman AL et al. Selective nonoperative management of blunt grade 5 renal injury. *J Urol* 164(1):27-30, 2000.
4. Velmahos GC et al. Selective management of renal gunshot wounds. *Br J Surg.* 85(8):1121-4, 1998.
5. Wessells H et al. Criteria for nonoperative treatment of significant penetrating renal lacerations. *Journal of Urology.* 157(1):24-7, 1997.
6. Lynch TH et al. EAU Guidelines on Urological Trauma *European Urology* 47: 1-15, 2005
7. Parry NG et al. traumatic rupture of the urinary bladder: Is the suprapubic tube necessary? *J Trauma* 54:431-436, 2003.
8. Koraitim MM et al. Risk factors and mechanism of urethral injury in pelvic fractures. *Br J Urol* 77:876, 1996.

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