

Initial Management of Blunt Bladder Injury

Bladder injury is uncommon after blunt trauma. It is typically seen after high energy events, most commonly a motor vehicle crash with a lap belt in place. During the initial evaluation, the patient may complain of abdominal pain, but this is not universal.

FAST results are also inconsistent. Free fluid may be seen, and an irregular bladder outline may also be appreciated. The key to diagnosis is placement of a urinary catheter. Bloody urine is found nearly 100% of the time.

The character of the bloody urine suggests what type of injury is present. Here are some pointers:

- Faint hematuria, primarily shades of pink, is usually associated with renal injury or a bladder contusion
- A moderate amount of darkly bloody urine is frequently associated with extraperitoneal bladder injury
- A small amount of very dark, bloody urine may mean an intraperitoneal bladder injury
- Scant and very dark blood in the catheter suggests a urethral injury or a catheter balloon inflated in the urethra.

INSIDE THIS ISSUE

- 1 **Initial Management of Blunt Bladder Injury**
- 2 **How To: CT Cystogram For Bladder Injury**
- 2 **Extraperitoneal Bladder Injury**
- 3 **Followup Cystogram After Bladder Injury**
- 3 **How To: Retrograde Urethrogram In Catheterized Patients**
- 4 **Renal Injury Grading Update**

TRAUMA CALENDAR OF EVENTS

MEDICAL DISASTER RESPONSE

PLACE: CAESAR'S PALACE, LAS VEGAS, NV

DATE: MARCH 18, 2013

TRAUMA, CRITICAL CARE, AND ACUTE CARE SURGERY

PLACE: CAESAR'S PALACE, LAS VEGAS, NV

DATE: MARCH 19-21, 2013

TRAUMA HISTORY

History Of The Tourniquet

Tourniquets have been around for a very long time. Unfortunately, our attitudes toward them tend to wax and wane over time. Their use fell into relative disfavor during the latter part of the last century. But this valuable piece of equipment has seen a resurgence in the last decade, thanks to combat experience and impressive successes in the field. It is now standard issue equipment for our troops.

First described in the 6th century BC, tourniquets were used to treat snakebite, but not to control hemorrhage. The most noted surgeon in Rome, Galen, criticized tourniquet use in the 2nd century AD because of complications from their use. All was forgotten until 1517, when a Prussian surgeon described tourniquet use in amputation. But credit for the first description of tourniquets for battlefield use goes to Etienne Morel, a French army surgeon in 1674.

Unfortunately, examination of the urine is suggestive of but not completely diagnostic for the type of injury. Determining the real diagnosis requires imaging, and evaluation of the entire GU tract is essential. CT scan is used to evaluate the kidneys, ureters, and these days, the bladder as well. Cystogram is required to fully evaluate the bladder, and a CT technique is now preferred. Bladder imaging using passive filling by clamping the catheter is accurate only 50% of the time. Therefore, the bladder must be pressurized using contrast instilled into the bladder by gravity. When performed in this manner, the CT cystogram is 97% accurate.

Once a diagnosis of bladder injury is made, the treatment is usually straightforward. Extraperitoneal injuries usually do not usually require repair and will heal on their own. However, if the symphysis pubis needs instrumentation to restore anatomic position, concomitant repair of the bladder is frequently necessary to keep the hardware from being contaminated by urine.

Intraperitoneal injuries require operative repair. If possible, the injured area should be opened and the inside visually inspected. If the injury extends anywhere near the trigone, a urology consult should be obtained. Most repairs are simple two layer closures. The mucosal layer must be made with absorbable suture; the outer layer is surgeon's choice.

For either type of bladder injury, the urinary catheter should be left in place for about 10 days. A cystogram should be obtained, and in most cases there will not be any leakage of urine and the catheter can be removed. In the event of a leak, another 7 days with the catheter is in order and the cystogram can be repeated.

The vast majority of bladder injuries can be easily handled by the trauma surgeon and are healed completely within two weeks.

How To: CT Cystogram For Bladder Injury

Bladder injury after blunt trauma is relatively uncommon, but needs to be identified promptly. Nearly every patient (97%+) with a bladder injury will have hematuria that is visible to the naked eye. This should prompt the trauma professional to obtain a CT of the abdomen/pelvis and a CT cystogram.

The CT of the abdomen and pelvis will identify any renal or ureteral (extremely rare!) source for the hematuria. The CT cystogram will demonstrate a bladder injury, but only if done properly!

During most trauma CT scanning of the abdomen and pelvis, the bladder is allowed to passively fill, either by having no urinary catheter and having the patient hold it, or by clamping the catheter if it is present. Unfortunately, this does not provide enough pressure to demonstrate small intraperitoneal bladder injuries and most extraperitoneal injuries.

The proper technique involves infusing contrast into the bladder through a urinary catheter. At least 350cc of dilute contrast solution must be instilled for proper distension and accurate diagnosis. This can be done prior to the abdominal scan. Once the initial scan has been obtained, the bladder must be emptied and a focused scan of just the bladder should be performed (post-void images). Several papers have shown that this technique is as accurate as conventional retrograde cystography, with 100% sensitivity and specificity for intraperitoneal ruptures. The sensitivity for extraperitoneal injury was slightly less at 93%.

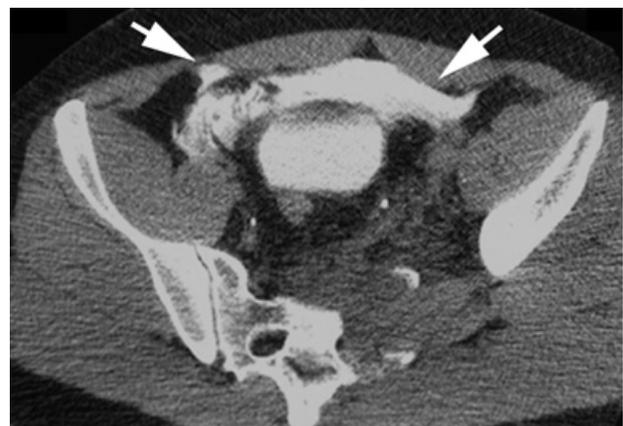
Bottom line: Gross hematuria equals CT of the abdomen/pelvis and a proper CT cystogram, as described above. Don't try to cheat and passively fill the bladder. You will miss about half of these injuries!

Extraperitoneal Bladder Injury

This injury is likely to occur in patients who have a full bladder and sustain anterior pelvic trauma that typically leads to fractures. They generally present with gross hematuria upon placement of the bladder catheter. This should prompt an abdominal CT scan with cystogram technique.

CT cystogram involves pressurizing the bladder with contrast prior to the study. This differs from the usual method of clamping the catheter and allowing the bladder to passively fill. The literature here is clear: failure to use cysto technique will miss 50% of these injuries.

Arrows show extraperitoneal contrast extravasation



The majority of extraperitoneal bladder injuries can be treated nonoperatively, and probably do not need Urology involvement. The bladder catheter is left in place 10-14 days (we do 10 days), and a repeat cystogram is obtained. If there is no leak, the catheter can be removed. If there is still some leakage, Urology consultation should then be obtained.

There are a few cases where operative management is required:

- There is some intraperitoneal component of bladder injury
- Fixation of the pubic rami is required (bathing the orthopedic hardware with urine is frowned upon)
- Failure of conservative management

Followup Cystogram After Bladder Injury

Management of extraperitoneal bladder injuries is generally straightforward. One of the tenets is that every injury needs to have a routine followup cystogram to ensure healing and allow removal of any bladder catheter. I routinely like to question dogma, so I asked myself, is this really necessary? A retrospective registry review from the Ryder trauma center in Miami helped to answer this question.

Over 20,000 records were screened for bladder injury and 87 were found in living patients. Fifty were intraperitoneal injuries, and half of them were caused by pelvic fractures (interesting). All were operated on, and 47 were classified as simple (dome disruption or through and through penetrating) and 3 were “complex” (involving trigone). All trackable patients (42 of the 50) had followup cystograms 9-16 days later. All of the simple injuries had a normal followup exam, but a leak was detected on one of the complex injuries.

There were 42 patients with extraperitoneal bladder injuries. All were due to blunt trauma, and 92% were associated with pelvic fractures. Most were found with CT cystogram. Two patients had operative repair, probably due to the need to fix the pubic bones with hardware. 37 of the 42 were available for followup, and 22% of repeat cystograms were positive (average study done on day 9). In the studies that showed a leak, repeat cystograms were done, and they took an average of 47 days to fully heal.

Bottom line: Patients with extraperitoneal or complex intraperitoneal bladder injuries (trigone) really do need a followup cystogram before removing the bladder catheter. Those who underwent a simple repair of their intraperitoneal injury do not.

Reference: Cystogram follow-up in the management of traumatic bladder disruption. J Trauma 60(1):23-28, 2006.

How To Perform A Retrograde Urethrogram In A Catheterized Patient

You're seeing a trauma patient, probably a transfer from somewhere else. Either they told you there “may have been” some blood at the tip of the urethra, or maybe you see it smearing the outside of a urinary catheter that's already in place! **How do you proceed from here?**

First, try not to get into that situation. Make sure that everyone on your team knows that gross blood at the meatus, male or female, means urethral injury until proven otherwise. If it's not gross blood, it could be that the patient was incontinent and has hematuria from other causes. The fear with passing a catheter across a urethral injury is that it may convert a partial tear to a complete one. Reconstruction and complications from the latter are far more serious.

But the catheter is there. What to do?

First, leave the catheter in place. You must assume that the injury is present, and you need to rule it in or rule it out in order to decide what to do with the catheter. If the injury is not really there, then you can remove the catheter when indicated. If it really is present, then the urethral injury is being treated appropriately.

Next, do a urethrogram. In a previous issue, I described how to perform a retrograde urethrogram, but the technique I described is only appropriate for uncatheterized patients. The technique must be modified to use thin contrast and a method to inject alongside the catheter. To do this, fill a 20-30cc syringe with contrast (Ultravist or similar liquid) and put an 18 gauge IV catheter on the tip (no needles, please). Slide the IV catheter alongside the urinary catheter, clamp the meatus with your fingers, pull the

penis to the side and inject under fluoroscopy. The contrast column will not be as vivid as with a regular urethrogram because it is outlining the urinary catheter, so there is less volume.

If the contrast travels the length of the urethra and enters the bladder without leaking out into soft tissue, there is no injury. If there is contrast leakage, stop injecting and plan to call a urologist.

Finally, be on the lookout for associated injuries.

Urethral injuries are frequently found in patients with anterior pelvic fractures and perineal injuries.

Renal Injury Grading Update

Organ injury scaling was developed to give clinicians and researchers a common language for describing and studying the effects of trauma. The Organ Injury Scaling classification for kidney injuries was developed by the AAST in 1989. Over time, it was recognized that grades IV and V were somewhat confusing, and some injuries were not originally included. An updated grading system was published this month to correct these shortcomings.

Grades I, II, and III remain unchanged. Grades IV and V were updated. Here's a summary of the grading system as it now stands:

- Grade I – subcapsular hematoma without parenchymal injury, or hematuria of any degree
- Grade II – contained, non-expanding peri-renal hematoma, or a laceration < 1cm in depth without urinary extravasation
- Grade III – laceration > 1cm in depth without involvement of collecting system or urinary extravasation
- Grade IV - originally encompassed contained injuries to the main renal artery and vein, and collecting system injuries. Revision: adds segmental arterial and venous injury, and laceration to the renal pelvis or ureteropelvic junction. Multiple lacerations into the collecting system used to be considered a shattered kidney (Grade V), but now remains Grade IV.
- Grade V - originally included main renal artery or vein laceration or avulsion, and multiple collecting system lacerations (shattered kidney). The revised

