Resident and Fellow Education Feature

Bladder Injury: Types, Mechanisms, and Diagnostic Imaging[1]

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Bladder perforations may be divided into two groups according to whether they are traumatic or spontaneous in origin. The majority of bladder injuries are due to trauma; these may be further subcategorized according to whether the trauma was blunt, penetrating, or iatrogenic. Blunt and penetrating trauma to the bladder are usually seen in cases of pelvic fracture or gunshot wound to the pelvis. Iatrogenic causes of injury include pelvic surgery, suprapubic or urethral placement of a Foley catheter (especially a long-term indwelling catheter), bladder biopsy, and ureteral stent manipulation. Spontaneous bladder rupture may occur in the setting of a urinary tract infection, urinary retention, vaginal delivery, alcoholism, bladder calculi, or previous radiation therapy.

Traditionally, bladder injuries often have been evaluated with dedicated conventional cystography. However, due to the often complex nature of these injuries and the associated broad spectrum of findings, computed tomography (CT) and CT cystography have proven invaluable and have largely replaced conventional cystography as the imaging studies of choice. One advantage of CT over conventional cystography is the ability to review multiplanar reformatted images, which may be especially helpful when bladder injury is not suspected and a cystographic study is not performed. Subtle clues that may be seen at CT without the instillation of contrast solution into the bladder include unusual fluid collections, unusual gas collections, an abnormal location of a Foley catheter (Fig 1), and a defect in an enhancing bladder wall.

TEACHING POINTS

- In patients with suspected bladder injury due to trauma, even if the findings at initial CT are negative, cystography (CT or conventional) must be performed to rule out a bladder tear.
- CT cystography allows accurate diagnosis of the type of bladder rupture, including complex extraperitoneal and mixed intra- and extraperitoneal tears.
- Iatrogenic bladder ruptures may be clinically occult and detected only on the basis of subtle or indirect findings at CT, or occasionally, ultrasonography.
- Spontaneous bladder rupture occasionally occurs in patients with an infection, an indwelling Foley catheter, or a history of radiation therapy.

Figure 1. Coronal image from intravenous contrast material–enhanced CT of the abdomen and pelvis shows a malpositioned Foley balloon (arrow) superior to and outside the urinary bladder. This finding was not clearly visible on the axial CT images. Note the lack of contrast material within the bladder.

Figure 2. Axial image from CT cystography shows an accumulation of extravasated bladder contrast solution resembling the shape of a molar tooth in the prevesical space (Retzius space), a finding indicative of a simple extraperitoneal bladder rupture.

Bladder injuries must be correctly classified so that appropriate therapy can be undertaken. CT cystography is an excellent diagnostic tool for determining the type of bladder injury present. Bladder tears can be classified as extraperitoneal, intraperitoneal, or combined. Extraperitoneal bladder tears may be further categorized as simple or complex.

Extraperitoneal bladder tears constitute approximately 80%–90% of all bladder tears. Most extraperitoneal tears are associated with pelvic fractures that cause perforation of the bladder wall. Simple extraperitoneal bladder ruptures are limited to the perivesical space, with the resultant collection of blood, urine, and contrast solution forming the classic "molar-tooth" appearance at CT cystography (Fig 2). In complex extraperitoneal bladder tears, urine extends beyond the perivesical space and may enter the thigh, scrotum, or perineum. These injuries are often treated with a Foley catheter.

Intraperitoneal bladder tears account for approximately 10%–20% of bladder injuries. This type of injury occurs at the dome of the distended bladder, which is the only part that is covered by peritoneum. Intraperitoneal perforations result in a communication between the urinary bladder and the peritoneal cavity, with resultant extravasation of contrast solution into the paracolic gutters or the rectovesical or rectouterine pouch or around multiple loops of bowel. Intaperitoneal bladder tears often require surgical intervention. The extravasated bladder contrast solution seen in a patient with an intraperitoneal bladder tear often is less concentrated than that seen in the presence of an extraperitoneal tear. This is presumably because the relatively larger intraperitoneal space allows more extensive mixing and greater dilution of the contrast material by urine.

Accurate classification of these injuries is important; prompt diagnosis and management have been shown to result in decreases in overall morbidity and mortality. The online presentation shows examples of different causes and anatomic types of bladder perforations, and provides clues to enable their accurate diagnosis.

Suggested Readings

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