A 2-year-old intact male beagle was referred to our institution for evaluation and surgical consultation 3 days after being hit by a car. On physical examination, the patient was laterally recumbent with pale mucous membranes, tachycardic (heart rate: 150 bpm) with moderate femoral pulses, and eupneic with clear lung sounds in all fields. Scrotal, prescrotal, and inguinal bruising was present, along with palpable crepitus in the left pelvic/coxofemoral region and pitting edema of the right hindlimb. In addition, the patient had a midline ventral abdominal incision from surgery 3 days previously to stabilize an acute abdomen for suspect urinary bladder rupture; a Foley catheter exited the caudal portion of the incision and was attached to a closed urinary collection system. The catheter was patent, draining dark yellow, slightly blood-tinged fluid. It was assumed that the catheter was draining the urinary bladder; however, the urinary bladder was not visualized during previous laparotomy. Emergency stabilization, including a fluid bolus, pain medication, and blood pressure monitoring, was performed to address the hemodynamic instability of the patient before additional diagnostics were pursued.

A lack of clinical improvement despite the previous surgery, including persistent azotemia, decreased urine production, and development of abdominal pain, indicated a need for continued diagnostics. Positive contrast studies of the urinary system were conducted, and radiographs (A and B) were obtained.

1. Provide an interpretation of A and B and, if possible, a diagnosis.
2. What additional imaging studies may be conducted to aid in evaluating the remainder of the urinary tract?
3. What are the typical etiology and clinical presentation of this condition?
4. What are the treatment options for this case?

SEE PAGE 531 FOR ANSWERS AND EXPLANATIONS.
**Answers and Explanations Case Presentation #1**

SEE PAGE 503 FOR CASE PRESENTATION.

1. A represents an attempt at positive contrast cystography using a urethral catheter, with subsequent leakage of the contrast medium into the peritoneum (*thin black arrows*). There is overall loss of serosal detail in the caudodorsal abdomen due to fluid opacity (*thick black arrows*); the urinary bladder cannot be identified. In addition, slight pleural effusion (*thin white arrows*) and a dilated, air-filled esophagus (*thick white arrows*) are present. B is an intravenous pyelogram 5 minutes after contrast medium injection. Opacification of the kidneys (*K*), ureters (*U*), and urinary bladder (*B*) is seen. The ureters are mildly dilated and tortuous, and they enter a cranially displaced urinary bladder in a normal “J-hook” fashion (*white arrow*). The apex of the urinary bladder is at the level of L4 and is only mildly distended. The normal anatomic location of the urinary bladder in an adult dog is just cranial to the pubis.1 In addition, multiple pelvic fractures are visible in A and B (*black arrowheads*). The diagnosis was urinary bladder rupture secondary to trauma, with a cranially displaced urinary bladder and normally positioned ureters; secondary uroabdomen; and multiple complex pelvic fractures. An orthogonal view of the abdomen (C) was obtained, but visualization of the ureters at the trigone...
region of the urinary bladder was obscured by contrast medium within the peritoneum.

2. Contrast urethrogram was performed after the intravenous pyelogram, and D was obtained. This image shows an avulsion (A) of the bladder (B) just cranial to the pelvis. The penile and prostatic portions of the urethra appear intact. Contrast medium leakage is seen in the peritoneum just cranial to the fractured pubis (arrow). This image confirms a diagnosis of urinary bladder avulsion.

3. Urinary bladder avulsion with resultant uroabdomen is commonly seen secondary to sustaining blunt force trauma to the abdomen, particularly vehicular trauma with pelvic fractures.2 Urinary bladder rupture is the most common cause of uroabdomens in dogs and cats, and rupture of the urethra in male dogs is most frequently associated with pelvic fractures.2 Penetrating abdominal or perineal wounds or iatrogenic injury from improper cystocentesis or rigid urinary catheter placement may also result in urinary tract trauma and urine leakage.3 Urinary bladder rupture is more frequently encountered in male dogs than in female dogs, possibly because male dogs have long, narrow urethras that cannot dilate rapidly and subsequently rupture.2

The clinical signs of urinary tract trauma are generally nonspecific and are often overlooked, especially in trauma patients suffering from shock. A common physical examination finding in these patients is a distended, painful abdomen with fluid accumulation along the ventral abdomen. Vehicular trauma may cause significant bruising around the perineum and abdomen, especially with fractures of the pelvis. Animals with uroabdomen may be azotemic and dehydrated and/or have metabolic acidosis. Untreated, uroabdomen leads to life-threatening hyperkalemic bradycardia and shock. Results of complete blood counts and biochemical profiles are often nonspecific and consistent with inflammation and abdominal trauma.

Abdominocentesis may lead to a definitive diagnosis of uroperitoneum when the concentration of creatinine and/or potassium in the abdominal fluid is compared with the corresponding concentration in serum. In dogs, an abdominal fluid:serum creatinine ratio >2:1 is suggestive of uroperitoneum; an abdominal fluid:serum potassium ratio >1.4:1 is definitive for uroperitoneum.2,4 In cats, an abdominal fluid:serum potassium ratio of >1.9:1 is suggestive of uroperitoneum.

4. Immediate management of a patient with a urinary bladder rupture or avulsion consists of placement of a cystostomy tube or peritoneal catheter to foster urine drainage until the patient is stable enough for a prolonged anesthetic procedure.3 Surgical correction of the bladder avulsion is the therapy of choice for this patient. The decision to repair the urinary bladder by primary anastomosis should be based on the degree of damage to the urethra and bladder observed at the time of surgery. Due to the level of the injury in this case, it is likely that the blood supply to the urethra provided by the caudally located internal pudendal artery would be preserved.6 Severe damage to, or necrosis of, the bladder or urethra may indicate a need for a permanent tube cystostomy.2 Surgical options for repair of urethral defects include autografts,7 trigonal-colonic anastomosis,8 and ureterocolonic anastomosis.9 The prognosis for recovery is excellent for traumatic bladder rupture; however, there are few published data for the prognosis associated with bladder avulsion. C

References