IVUSS Case of the Month -Feb 2023

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Abdominal trauma in Labrador Retriever

Drake is a 10 year old MN black Lab 46.6kg with a body condition score of 8/9 who presented for attempting to jump onto the truck tailgate and came up short, landing on his chest and abdomen. After that, he seemed weak and was shaking. On exam, he had normal mentation and a normal neurologic exam, but was panting. His abdomen on palpation was moderately tense, but no abdominal bruising was noted, and no abdominal fluid wave was appreciated.

Laboratory data soon after the incident showed a moderate azotemia (BUN = 45 mg/dL (normal = 7 - 27), Creat = 3.9 mg/dL (0.5 - 1.8), a mild hyperkalemia (K = 5.9 mmol/L (3.5 - 5.8), and a mild leukocytosis with mature neutrophilia (WBC = 16.62 K/µL (5.05 - 11.64), neuts = 14.5K/µL (2.95 - 11.64). He was given methadone and maropitant. Radiographs showed no fractures, nor any significant findings in the abdomen and thorax other than spondylosis.

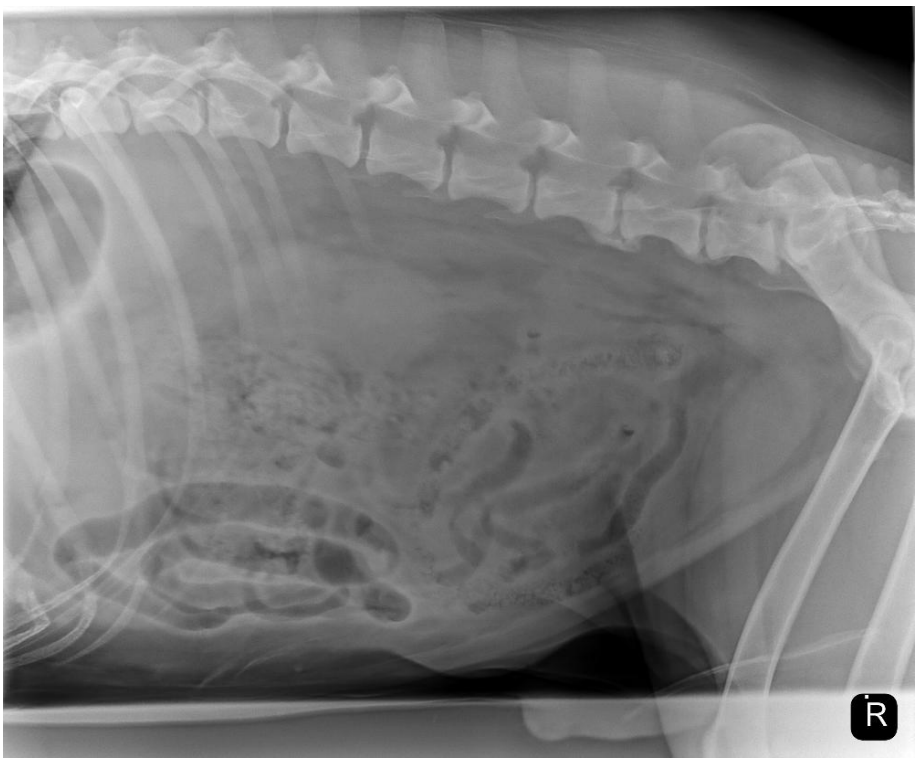

Image 1: Right lateral abdominal radiograph.

An AFAST was performed and showed abdominal free fluid. The abdominal fluid was sampled several hours after admission and revealed a K > 15.8 mmol/L, creat > 13.6 mg/dL and BUN > 130mg/dL.

He had a urinary Foley catheter placed and was started on IV fluids, given a lidocaine and fentanyl CRI during overnight care. A urinalysis from a catheter sample showed USG = 1.038, was dark yellow, and had a protein = 0.3

g/dL, with WBC = 19/HPF, RBC >50/HPF. After 786ml IV fluids administered, urine volume collected was only 300 mls.

The owner was informed of the presence of a uroabdomen, and an abdominal ultrasound was recommended over a contrast urethrocystogram. A recheck showed no azotemia or abnormal electrolytes prior to the ultrasound the day after presentation.

On the abdominal ultrasound, the liver, gall bladder, spleen, kidneys, abdominal lymph nodes, and GI tract were unremarkable. There was moderate anechoic free fluid seen between the liver lobes and the diaphragm, between the spleen and abdominal wall, and in the caudal abdomen. There was bilateral adrenomegaly with the left measuring 9.7 mm and the right at 11.4 mm at the caudal poles. The left limb of the pancreas was mildly hypoechoic.

The urinary bladder was not well distended due to the indwelling Foley catheter, but it was not completely involuted. Image quality was much lower in this area despite the fluid in the bladder and surrounding the bladder. The bladder wall was 5.7 mm thick, 2-3 mm thicker than normal in its involuted state. There was a suggestion of a stair step in the dorsal bladder wall slightly left of midline about 2.35 cm for the cranial apex of the bladder, but this was not evident in multiple other imaging planes. All views are sagittal unless labeled transverse.

Select Ultrasound Images

Image 2: Transverse urinary bladder

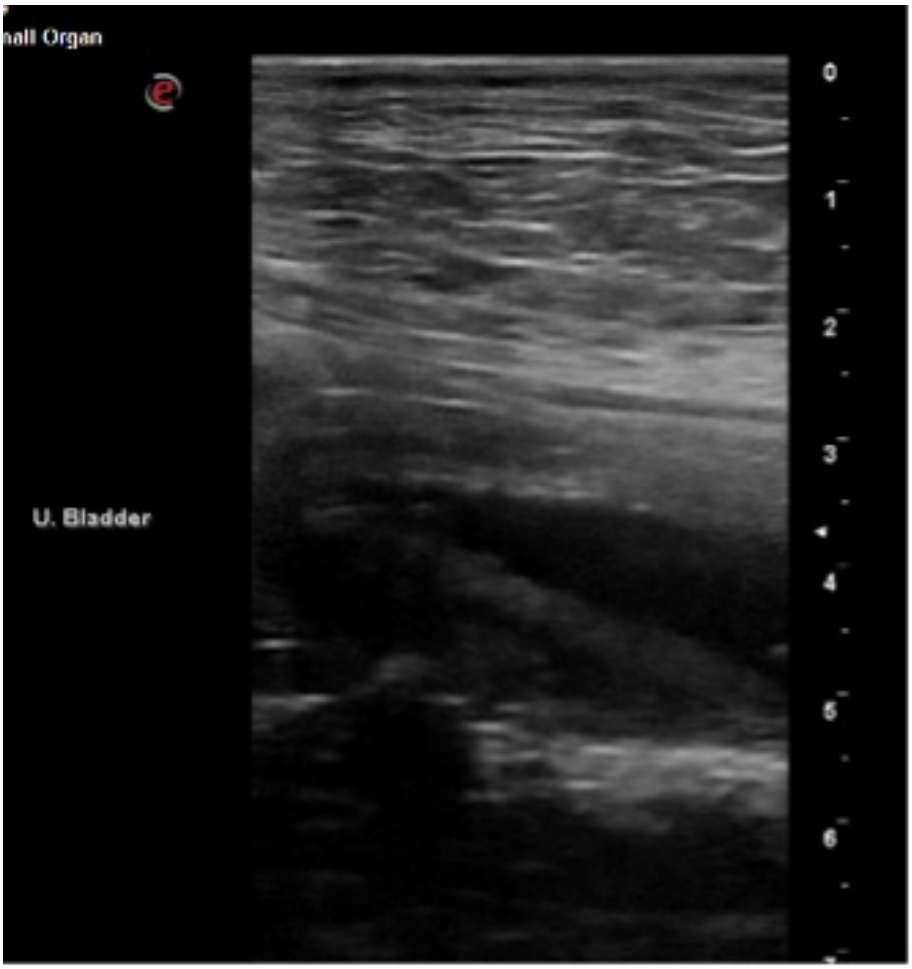

Image 3: Sagittal urinary bladder

Abdominal fluid was sampled from the left caudal quadrant and yielded 3ml of hemorrhagic fluid suggestive of ongoing abdominal bleeding. Fluid PCV=7.0%, TS-0.8g/dL. Since a definitive bladder rent could not be confirmed with regular imaging, agitated saline was infused through the catheter gently. The first 10ml did not demonstrate any leakage through the bladder wall, it just filled the bladder slightly, while that dorsal stairstep was interrogated further. The bubbles collected at the non-dependent portion, but were not leaking out.

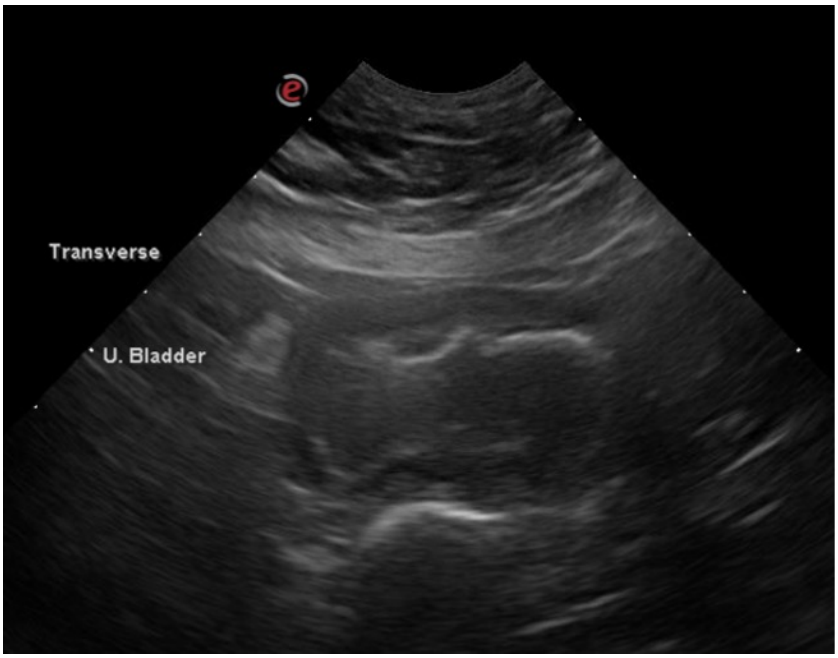

Image 4: Transverse urinary bladder after instillation of air-agitated saline.

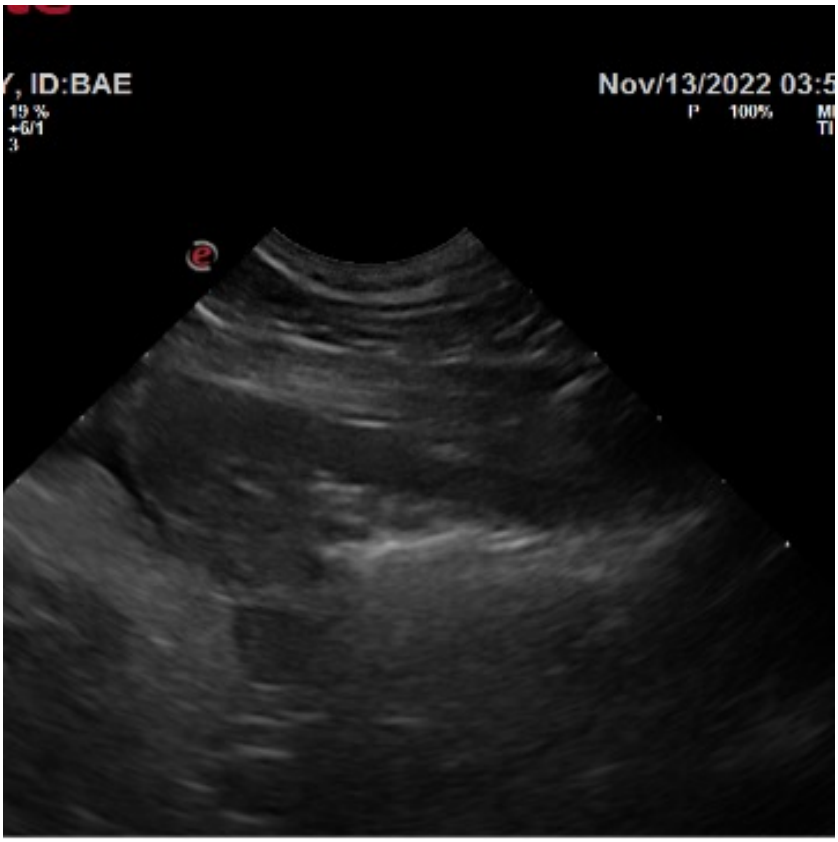

Image 5: Sagittal urinary bladder after instillation of air-agitated saline.

Image 6: Another 5ml of agitated saline was infused and microbubbles were noted coming from the most cranial portion of the bladder into the peritoneal cavity, mixing with the rest of the abdominal fluid. The bladder was then emptied via the catheter.

Sonographic assessment:

There was a rent at the cranial portion of the bladder, but the dorsal wall needed to be inspected as well intraoperatively. There was also bilateral adrenomegaly in this older overweight Labrador, which may be early hyperadrenocorticism vs benign hyperplasia. Given normal liver enzymes and normal liver appearance, hyperadrenocorticism is unlikely, but could not be ruled out.

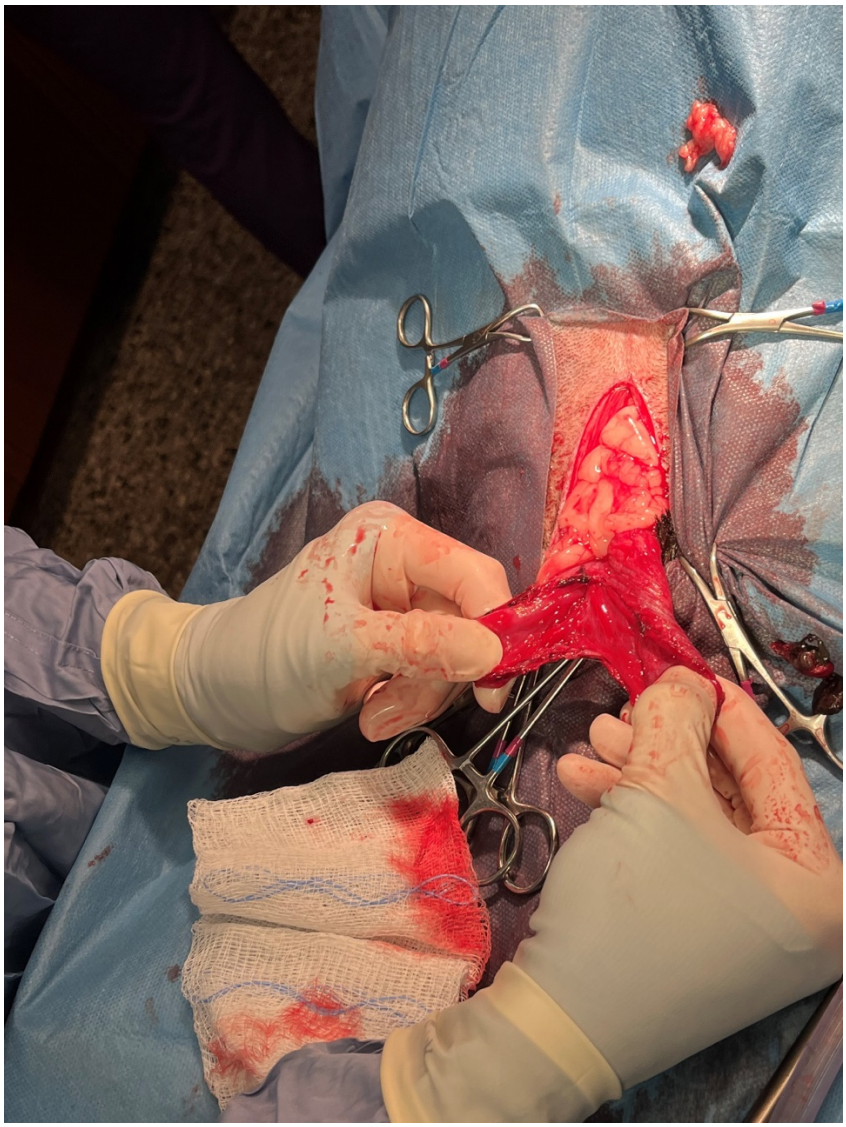

Image 7: Appearance of traumatic rupture in the urinary bladder during surgery

Surgery was performed to repair the ruptured bladder. Intraoperatively, the bladder was ruptured from mid-dorsal to the cranial apex to the ventral midline affecting the cranial half of the bladder. It was repaired and the dog recovered uneventfully, with normalization of all laboratory abnormalities within the next 24 hours.

Discussion:

This case is interesting because ultrasound imaging did not reveal the extent of the bladder rupture. In fact, image quality in the area was poor, definition was poor, and bladder walls appeared to be continuous except for a stair step at the dorsal wall, and this defect was not evident in all views.

Uroabdomen in dogs and cats is most often associated with trauma. This condition may also result from urinary tract obstruction, traumatic bladder expression or catheterization, neoplasia, and postoperative leakage following abdominal or urogenital surgery.

Disruption to the urinary tract should be considered when a patient is diagnosed with azotemia, hyperkalemia, and abdominal effusion. By comparing the creatinine concentration of the abdominal fluid to the serum or plasma creatinine concentration, a diagnosis of uroabdomen can be made if the creatinine ratio is ≥ 2:1. Potassium may also be used to compare abdominal fluid levels to serum levels, and a ≥ 1.4:1 potassium ratio is also diagnostic for uroabdomen. In most patients, imaging studies with contrast are necessary to identify the exact source of urine leakage and to determine therapeutic options (1).

The urinary bladder is the most common site of rupture. Renal trauma is rare unless there are spinal fractures or one or more of the last three ribs are fractured. Cranial ureteral trauma happens in similar traumatic events. Both situations cause retroperitoneal fluid accumulation. Caudal ureteral trauma can cause uroabdomen, but tends to only happen with pelvic fractures or vehicular trauma i.e. extremely high impact (1). In humans, most intraperitoneal ruptures associated with blunt trauma are large "blow out" injuries to the dome of the bladder (5).

Positive contrast retrograde cystourethrogram is the preferred method of diagnosing rupture of the urethra or urinary bladder. On ultrasound, the ruptured urinary bladder wall is thickened, there is abdominal free fluid, and a hypoechoic bladder wall defect or tract may be seen occasionally, but not reliably (2). Patients with urinary tract leakage may have a collapsed, empty urinary bladder, exhibiting reduced definition of the wall (1). Discontinuity of the wall may be falsely suspected due to echo dropout from the curved bladder wall with peritoneal fluid, but that happens with a more distended bladder with a normally thin curvilinear wall (3). Other diagnostic modalities include cystoscopy, computed tomography, magnetic resonance imaging, contrast excretory urography, and surgical exploration (4). CT oftentimes will need contrast to confirm.

This case needed contrast to confirm in the form of agitated saline. A Foley urethral catheter was already in place, materials to perform this procedure were readily available and of relatively low cost, and real time imaging allows the amount of saline infused to be titrated until a diagnosis can be made. Ultrasound contrast cystography involves infusion of microbubbled saline solution (1). In this case microbubbles were created in the saline by connecting a 20 ml syringe with 19 ml saline and 1 ml of air to a 3-way stopcock connected to the urinary catheter and an empty 20 ml syringe. The saline was manually injected vigorously back and forth between the two syringes 3-5 times, then slowly bolused (over 10-15 seconds) into the urinary bladder via the catheter while the bladder was imaged. The static images do not convey the dramatic swirling motion of the microbubbles as the momentum of their infusion propels them into the ascitic fluid. This vigorous motion of the bubbles clearly helped to establish a positive diagnosis yet did not precisely localize the site nor the extent of the bladder rupture (6). Microbubbles in agitated saline rapidly dissolve, and if the agitated saline is not infused within 15 seconds, the process of microbubble creation should be repeated (6). This procedure is considered very safe (6).

References:

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Thank you to Dr. Amanda Ford and the veterinarians and staff at Bend Animal Emergency.