Traumatic Coxofemoral Luxation & Prepubic Tendon Rupture in the Dog

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Introduction

Coxofemoral Luxation is a common injury in dogs, and is usually the result of trauma (specifically vehicular accidents). For this reason, many dogs who present for coxofemoral luxation suffer from concurrent injuries that could be life-threatening, as in the case discussed here. The emergent nature of these cases makes treatment of coxofemoral luxation highly dependent on the severity of concurrent injuries. With so many surgical procedures available to treat this condition, clinical reasoning must be relied upon to a certain extent to make the best decision for a given patient.

History & Presentation

Lucy, a 7-year-old spayed female Border Collie, presented to MSU-CVM on February 19. 2018 after being hit by a car on February 17, 2018. Lucy was taken to her primary care veterinarian where bloodwork, radiographs (abdominal, pelvic, and thoracic), and abdominal ultrasound were performed. A CBC and Chemistry Panel were within normal limits. Radiographs revealed a possible ventral abdominal wall hernia, and a prepubic tendon rupture was suspected due to lack of continuity of the body wall on the lateral abdominal projection. Pelvic radiographs revealed craniodorsal luxation of the right coxofemoral joint, but no fractures or additional orthopedic comorbidities were appreciated. The right hip was manually reduced and stabilized with an Ehmer sling prior to referral. An abdominal focused assessment by sonography for trauma (aFAST) scan revealed no evidence of free fluid and an intact bladder. Lucy was medically managed with her primary care veterinarian throughout the weekend on cefpodoxime (200 mg orally every 24 hours) and Tramadol (100 mg orally every 8 hours as

needed), and referred to MSU-CVM on Monday for further evaluation. Prior to this trauma, Lucy had been doing well at home and had no previous health concerns.

On presentation to the MSU CVM Surgery Service, Lucy was bright and alert, and responsive. Her vital parameters were within normal limits, with a temperature of 102.2 F, a heart rate of 88 beats/min, and a respiratory rate of 24 breaths/min. A triage exam revealed pink, moist mucus membranes with a normal capillary refill time. Auscultation of Lucy's heart and lungs revealed no murmurs, arrhythmias, crackles, or wheezes. Lucy's right hip was still reduced, and was maintained in an Elastikon Ehmer sling, although she was non-ambulatory. There were locally extensive paintbrush hemorrhages across the ventral abdomen and there was severe swelling of the inguinal region and vulva. An ultrasound was used to identify the urinary bladder herniated through the body wall, and an abdominal herniorrhaphy was scheduled for that afternoon.

Herniorrhaphy

On the afternoon of February 19, 2018, Lucy was placed under general anesthesia and prepped for a ventral body wall herniorrhaphy, and the suspicions of a prepubic tendon rupture were confirmed. The prepubic tendon, also referred to as the cranial pubic ligament, connects the rectus abdominis, pectineus, and abdominal oblique musculature to the iliopubic eminence on either side of the pelvis. The structure it provides allows the abdominal pressure required for urination, defecation, and parturition.[1]

Lucy's abdomen was incised on midline from umbilicus to pubis, where a defect was immediately identified in the caudal body wall. The urinary bladder and omentum were protruding through the defect. A portion of the omentum was noted to be dark in color, and was

removed from the abdomen. The linea alba was identified and stay sutures were placed at the caudal end of the intact body wall. The abdominal musculature was cranially retracted to the level of the xiphoid bilaterally. The ventral pubic tubercle was visualized and traumatized tissue excised to expose the surface of the bone. Two holes were then drilled on either side of midline through the floor of the pelvic canal using an 0.062" pin and Jacob's chuck. Arguably the most important consideration for repair of a prepubic tendon rupture is tension relief, due to the anatomical tension at the site of rupture, as well as the duration of healing of the tendon itself. The prepubic tendon requires 3 weeks to reach 20% of its previous strength, and can take up to a year to regain 80% of pre-trauma function.[1] Non-absorbable 60# nylon was used on either side of the ventral pubic eminence to secure the caudal portion of the musculature to the pubis in two simple cruciate sutures. These sutures further alleviated tension and the nylon serves as long-term support throughout the extended healing process, as nylon has been shown to maintain 72% of its tensile strength even two years after surgery.[1,2] The body wall was then closed with 2-0 PDS in a Y-shape, with simple interrupted patterns used to close the most caudal aspect to aide with tension-relief, and a simple continuous pattern used cranially. There was a small area which could not be closed at the caudal most aspect of the defect, so a small piece of porcine small intestinal submucosa (SIS) was placed inside the musculature. SIS provides a collagen matrix that has been shown to resist infection, and be biocompatible in most tissues, making it useful for stimulation of healing in hernia repairs.[1,12,3] Prior to skin closure, a Jackson-Pratt drain was placed in the subcutaneous tissue and secured with a purse string and Chinese finger trap suture exiting through the skin to the left of the abdominal incision.

Immediately upon completion of surgery, Lucy’s hip was found to be re-luxated, and a closed manual reduction was performed under anesthesia. She was then transferred to the

intensive care unit, where she recovered uneventfully from anesthesia. Lucy's right coxofemoral joint was monitored closely and remained reduced in an Ehmer sling until the afternoon of February 22, 2018 when it again re-luxated.

Pathophysiology

Coxofemoral joint luxations are exceedingly common in dogs, accounting for approximately 90% of all canine joint luxations.[4] The coxofemoral joint is the ball-and-socket articulation between the head of the femur and the acetabulum, allowing a wide range of motion and, under normal circumstances, strong stability.[5] The stability of the coxofemoral joint is a joint effort of the primary stabilizers, including the ligament of the head of the femur, the joint capsule, and the dorsal acetabular rim. Together, these stabilizers function to prevent luxation, and in turn, luxation occurs due to functional loss of at least two of the three.[5] Secondary stabilization is provided by the acetabular labrum, the hydrostatic pressure of the joint fluid within the joint capsule, and the musculature that surrounds the joint itself. The most notable of these muscles are the gluteal muscles (deep, middle, and superficial) that allow extension, internal rotation, and abduction of the coxofemoral joint.[5]

The overwhelming majority of coxofemoral luxations are a result of vehicular trauma, but can occur due to severe hip dysplasia as well. Once diagnosed, the luxation can be classified by the relative position of the femoral head to the acetabulum. Approximately 75% of reported coxofemoral luxations have been identified as craniodorsal, with caudoventral luxation occurring much less commonly.[5,7] The cause of this predisposition has not been definitely proven, but is thought to be due to the fact that during trauma an animal tends to fall laterally causing adduction of the distal femur and pulling the femoral head away from the acetabulum. This

subsequently stretches the primary stabilizers (specifically the joint capsule and ligament of the head of the femur), and the impact of the greater trochanter hitting the ground causes the femoral head to displace over the acetabular rim, thus disrupting all three primary stabilizers.[5,6] Rupture of the joint capsule also causes the articular cartilage to lose the nourishment of synovial fluid, meaning reduction options should be discussed as soon as other life-threatening injuries have been adequately addressed.

Treatment Options/Considerations

In most cases of coxofemoral luxation, closed reduction is attempted under general anesthesia prior to open reduction techniques. Closed reduction can be performed by externally rotating the limb, pulling the femoral head back over the dorsal acetabular rim, and internally rotating the femoral head back into the acetabulum. After successful reduction, the femoral head should be held in the acetabulum with one hand while the hip is put through full extension and flexion for 10-15 minutes. This serves to expel debris from the acetabular groove, and an Ehmer sling should be used to prevent weight bearing, provide abduction and external rotation of the limb, which prevents re-luxation in some cases.[8] When closed reduction cannot be performed or when re-luxation occurs after closed reduction, open (surgical) reduction techniques should be considered.

Many procedures have been used successfully to treat coxofemoral luxation including capsulorrhaphy, DeVita Pinning, transposition of the greater trochanter of the femur, toggle pin stabilization, femoral head and neck ostectomy (FHO), and total hip arthroplasty (THA), among others.[4] One important determinant when selecting a procedure is the patient's joint health prior to surgery, including any radiographic evidence of hip dysplasia or osteoarthritis. In fact, hip

dysplasia is the most common complicating factor in dogs presenting with traumatic coxofemoral luxation, and can steer the course of treatment towards a salvage procedure such as a THA or FHO.[10] These procedures are appealing in this scenario because they treat both the luxation and the discomfort associated with existing dysplasia and osteoarthritis in one surgical procedure.

However, if no radiographic evidence of hip dysplasia or osteoarthritis exits, other procedures can be performed to repair the joint. For example, capsulorrhaphy can be performed by itself or in conjunction with another technique. However, in most cases of coxofemoral luxation, the joint capsule is so damaged, primary suturing is impossible. A toggle pin stabilization procedure can be used to maintain coxofemoral reduction while the damaged capsule heals. In addition to these procedures, if the gluteal musculature is intact, the greater trochanter of the femur can be translocated distally and caudally to provide added stability to any repair.[8]

A toggle pin stabilization procedure is commonly chosen for dogs with no radiographic evidence of joint disease or hip dysplasia, and has shown high success rates when proper post-operative care is adhered to. A toggle pin attached to non-absorbable suture is passed through the medial acetabular wall. A bone tunnel is made from the fovea capitis to the distal end of the greater trochanter through which the suture is passed and secured. The non-absorbable suture then acts as a prosthetic ligament of the head of the femur serving to keep the femoral head seeded in the acetabulum while the joint capsule and musculature heals around the joint. One study suggested that the use of a bone anchor rather than a toggle rod through the acetabular wall provided adequate stabilization.[11]

Case Outcome

Since an Ehmer sling with closed reduction failed to maintain Lucy's right hip joint, surgical intervention was scheduled for the next morning. Lucy's pelvic radiographs with her referring veterinarian showed no evidence of hip dysplasia or osteoarthritis of either coxofemoral joint, so a toggle pin stabilization procedure was determined to be her best option for luxation repair. On February 23, 2018, four days post-op from her prepubic tendon rupture herniorrhaphy, Lucy was taken to surgery for a toggle pin stabilization of her right coxofemoral joint. A 7.5 cm incision was made using a craniolateral approach to the right coxofemoral joint, exposing the fascia latae. The superficial leaf of the fascia latae was incised and the biceps femoris was retracted. The deep leaf of the fascia lata was incised between the superficial gluteal and the tensor fascia latae. The joint capsule was visualized and was noted to be severely torn. A 3.2 mm drill bit was used to bore a hole through the medial acetabulum for placement of a toggle pin loaded with 60 lb clear nylon suture using a mosquito hemostat and wire passing instrument. The toggle pin was flipped parallel to the axis of the pelvis, securing it in place. A C-guide was used to aim from the fovea capitis of the femoral head, along the femoral neck to distal to the 3rd trochanter. A 3.2 mm drill bit was used to drill a hole along the C-guide, forming a bone tunnel from the fovea capitis to the distal end of the 3rd trochanter of the femur. The nylon suture was passed through the bone tunnel and the coxofemoral joint was manually reduced. The nylon suture was tied to a polypropylene button at the exit point of the femoral diaphysis. The right hindlimb was rotated through a complete range of motion to ensure normal movement and appropriate stability. The joint capsule was sutured closed with 2-0 PDS, and the subcutaneous tissue and skin were closed appropriately. Post-operative radiographs showed

adequate joint reduction and appropriate toggle placement, and Lucy recovered uneventfully from anesthesia.

Lucy's abdominal incision and Jackson-Pratt drain output continued to be closely monitored in the immediate post-operative period. The drain fluid was consistently red and watery, with small amounts of blood clots sporadically, but no purulence or flocculent material was noted. Her drain output steadily declined until plateauing around Day 7 post-op. Her drain continued to produce 5.5-6.0 mL/kg/day for two days, and the JP drain was pulled on the morning of February 26th (8 days post-op herniorrhaphy). Lucy became febrile the next morning, and over the next two days, her drain site continued to produce a red, watery fluid. An abdominal bandage was placed to keep her clean and dry, and she was started on Amoxicillin + clavulanic acid (16.7 mg/kg orally every 12 hours). Her fever resolved, and Lucy was discharged on February 28th with instructions to return the next day for a bandage change.

The next day, Lucy returned for her bandage check, and the discharge from the drain site had not improved, and two subcutaneous pockets of fluid had developed in her inguinal area. These pockets were found to be communicating with the drain site, so they were sterilely aspirated and the resulting fluid was submitted for culture. Lucy was sent home with instructions to obtain daily bandage changes from her primary care veterinarian over the weekend, and to continue the Clavamox while awaiting culture results.

By Monday, the culture results were finalized and indicated a faint growth of *Enterobacter cloacae*, sensitive to amikacin and imipenem, but resistant to most antimicrobials including Clavamox. Due to the increased renal risk and cost of monitoring associated with amikacin usage, Lucy was started on meropenem injections (8.5 mg/kg subcutaneously every 12 hours). Lucy was seen at MSU-CVM twice for a bandage change, staple removal, and boarding.

Over the course of her meropenem treatment, several eschars formed on her ventral abdomen near, but not involving, her abdominal incision. These eschars healed by second intention as the infection resolved.

Lucy returned on April 5th for a recheck of her right hip. She was doing well at home, and was walking unassisted. The eschars on her ventral abdomen had healed over with only a small scab remaining. Pelvic radiographs were performed, showing proper reduction of her right coxofemoral joint and no evidence of infection or migration of the toggle pin. Lucy was sent home with instructions to continue cage rest over the next two weeks as her injuries continued to heal.

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