Arthroscopic exploration and biopsy for diagnosis of septic arthritis and osteomyelitis of the coxofemoral joint in a dog

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Summary
A five-year-old, spayed female mixed breed (38 kg) dog was referred for total hip replacement for an intermittently non-weight bearing lameness of the left hind limb. Radiographs and computed tomography suggested proliferative, osteolytic pathology of the left coxofemoral joint. Using arthroscopic exploration and biopsy, septic arthritis and osteomyelitis in the left coxofemoral joint were diagnosed. Treatment recommendations for antibiotic therapy and femoral head and neck excision were made based upon this diagnosis. Femoral head and neck excision resulted in pain relief and improved function and arthroscopy provided a minimally invasive, yet accurate, diagnosis in this case.*

Keywords
Septic arthritis, osteomyelitis, arthroscopy, coxofemoral joint, dog

Introduction
Septic arthritis of the hip has been recognized and described in dogs. Reported etiologies include direct penetrating injury, post-operative infection, extension from surrounding soft tissue infection or osteomyelitis, and haematogenous spread (1, 7, 14, 18, 21). Common bacterial isolates from septic joints are staphylococcus, streptococcus, coliforms, and anaerobes (4, 7, 8, 12, 18, 21). Staphylococcus intermedius has been indicated as the most common isolate in both septic arthritis and osteomyelitis (4, 14, 18). The clinical presentation is variable with acute to chronic duration, mild to severe lameness, sudden to gradual onset, and absent to severe systemic signs (4, 7, 12, 18). Typical clinical findings include lameness, joint swelling and thickening, and muscle atrophy (4, 12, 21). In some cases, systemic signs such as lethargy, anorexia, pyrexia, and depression may be present (4, 12, 14).

Based on historical, clinical and radiographic data, septic arthritis of the hip can be difficult to differentiate from non-septic arthritides of the hip. However, a diagnosis of septic arthritis of the hip greatly affects the treatment options and prognosis for the lame hip. Therefore, an early and accurate diagnosis is essential in order to minimize morbidity and complications and optimize outcome. The typical diagnostic approach for septic arthritis of the hip includes hematology and serum chemistry, radiography, and arthrocentesis for synovial fluid analysis and culture, and also may require exploratory arthrotomy (21). The collection of synovial fluid and tissue for fluid analysis, cytology, culture and histopathology can be performed at the time of arthrotomy (21), as well as by percutaneous arthrocentesis for synovial fluid collection and by ‘blind’ or computed tomography (CT)-guided needle biopsy for tissue collection. The ideal method for diagnosis of septic arthritis of the hip in dogs should be sensitive and specific, minimally invasive, and protective of all potential treatment options. Exploratory arthroscopy of the hip joint, for evaluation and tissue procurement appropriately addresses these criteria. While the use of exploratory arthroscopy for diagnosis of pathology in other joints of dogs has been reported (12), to the authors’ knowledge hip arthroscopy for evaluation and biopsy has not been described in the veterinary literature.

The purpose of this case report is to provide information on the clinical features, diagnosis by exploratory arthroscopy, and treatment of bacterial septic arthritis of the hip in a dog.

Case
A five-year-old, spayed female mixed breed (38 kg) dog was presented to the University of Missouri Veterinary Medical Teaching Hospital for evaluation for possible total hip replacement of the left hind limb. She had a history of left hind limb lameness for ap-
proximately a year and had been clinically and radiographically diagnosed with degenerative joint disease, secondary to bilateral hip dysplasia. The left hind limb was more severely affected than the right. The dog was intermittently non-weight bearing with a chronic, progressive lameness. Despite treatment with Cosequin DS\(^a\) and aspirin (17 mg/kg po SID), the lameness had progressed in the two months prior to presentation. The patient also had a long history of allergic dermatitis characterized by generalized pruritus and alopecia with chronic otitis externa. This condition had been treated for approximately five years with methylprednisolone acetate (2 mg/kg intramuscular injections administered every six to eight weeks). In the eighteen months prior to admission to the Veterinary Medical Teaching Hospital the corticosteroid injections had been discontinued and the patient had been treated with numerous tapering courses of oral prednisone (0.5 mg/kg), as well as doxepin (2 mg/kg po BID).

At the time of admission, the physical examination revealed bilateral corneal dystrophy, mild bilateral otitis externa, alopecia, superficial dermatitis characterized by scaling lesions, and severe muscle atrophy of the left hind limb. The orthopaedic examination revealed pain and crepitus on manipulation of the left coxofemoral joint without other abnormalities being noted. The dog alternated between toe-touching and non-weight bearing in the left hind limb at a walk and trot.

The patient was sedated with a combination of atropine (0.02 mg/kg IV), morphine (0.4 mg/kg IV), and xylazine (0.4 mg/kg IV), and ventro-dorsal and lateral radiographic views of the pelvis were obtained. Radiographs of the pelvis revealed: bilateral coxofemoral joint subluxation, more severe on the left than the right, remodeling of the right acetabulum, remodeling of the right femoral head and neck, thickening of the right femoral neck, new bone proliferation in the concavity of the left acetabulum, small punctate luencies present within the left femoral head, and severe gluteal and thigh muscle atrophy bilaterally (Fig. 1).

Ventrudorsal and right and left lateral radiographs of the thorax were considered to be within normal limits based on the dog’s age. The radiographs (ventrodorsal and lateral) of the abdomen were considered to be within normal limits.

Based on the radiographic findings, differentials for the left coxofemoral joint abnormalities included: an immune-mediated arthropathy, infectious arthropathy, severe osteoarthritis, and neoplasia. Computed tomography (CT) of the coxofemoral joints was performed to further investigate the pathology associated with the left hip, and revealed a large amount of soft tissue thickening surrounding, and apparently invading, the left coxofemoral joint with atrophy of the soft tissue muscles on the left thigh (Fig. 2). The left femoral head was flattened and luxated and there was also new bone formation in the left acetabular margin. Bilaterally, the cranial and caudal margins of the acetabulae were flared with periarticular new bone formation with the left greater than the right. Punctate luencies were visualized within the left femoral head and neck region. These findings were consistent with chronic severe osteoarthritis of the left coxofemoral joint and moderate to severe hip dysplasia of the right coxofemoral joint. However, other differentials based on imaging of the left hip included septic arthritis and neoplasia.

A complete blood count and urinalysis were within normal limits and serum chemistry revealed lipaemia with slightly elevated alanine transference and globulins. *Ehrlichia canis* and Rocky Mountain Spotted Fever
Fever titers, antinuclear antibodies, and an LE cell prep were all submitted to rule out potential infectious or immune-mediated arthropathies.

The physical examination, imaging, and bloodwork results did not provide sufficient data to definitively differentiate among osteoarthritis, infectious or immune-mediated arthropathy, or neoplasia. Further diagnostic options were then discussed with the owner and included arthrotomy or arthroscopy to explore the joint and obtain tissue samples for histological assessment and microbial culture. Arthroscopy was the method of choice for joint exploration as it provided an increased operative visualization of the joint, shorter duration of anesthesia and surgery, and decreased postoperative morbidity.

After induction of general anaesthesia and standard hanging limb preparation for aseptic surgery of the left hip, arthroscopy of the left coxo-femoral joint was performed using a modification of the technique described by Beale et al. (2). The dog was placed in right lateral recumbency with the left hip in a neutral position and the femur parallel to the table. A 1.2 mm gauge hypodermic needle was inserted into the joint at the cranio-proximal aspect of the greater trochanter. Synovial fluid was aspirated and submitted for cytological evaluation and culture. The joint was then distended with approximately 10 ml of physiological saline injected through the same needle. The needle was removed, and a 1 cm skin incision was made, and a camera portal was established at the same point as the needle was inserted. Arthroscopic exploration of the coxo-femoral joint revealed severe proliferation of the synovium, femoral head eburnation and fibrillation, absence of the ligament of the femoral head with osteophytosis and cartilaginous proliferation at the acetabular fossa, and fibrillation and erosion of the acetabular articular cartilage (Fig. 3). An arthroscopic instrument portal was then created 2 cm cranial and 2 cm distal to the camera portal to permit insertion of arthroscopic biopsy forceps into the joint (Fig. 4).

Biopsy samples were obtained from synovium, proliferative cartilage and bone at the acetabular fossa, and grossly abnormal acetabular articular cartilage. Due to the diagnostic differentials and the appearance of the biopsy samples, tissues samples were also submitted for microbial isolation and antimicrobial susceptibility testing. The joint was thoroughly lavaged prior to routine closure of the skin incisions.

The dog was recovered from anaesthesia and given morphine (0.5 mg/kg IM) for post-operative pain management. Empirical antibiotic therapy (Cephalexin 20 mg/kg po BID) was instituted pending results of microbial culture and sensitivity testing. The patient was discharged to the owner the day following arthroscopic surgery.

_Ehrlichia canis_ and Rocky Mountain Spotted Fever titers, antinuclear antibodies, and an LE cell prep were all negative. The synovial fluid sample (0.5 ml) had a pale yellow appearance with a specific gravity of 1.041, a total protein of 6.8 g/dL (reference range, less than 2.5 g/dL), and a PCV of less than 2%. The smear consisted of predominantly non-degenerate neutrophils with low numbers of macrophages. Examination of haematoxylin and eosin (H&E) stained sections of biopsy tissues was consistent with fibrino-purulent arthritis and synovitis. _Staphylococcus intermedius_ was isolated from both the joint fluid and the synovial, cartilage, and bone tissue samples submitted. Osteomyelitis and septic arthritis of the coxo-femoral joint was the final diagnosis.

Antimicrobial therapy with clavulanic acid-amoxicillin (15 mg/kg PO BID) was instituted based on antimicrobial sensitivity results. The owner of the dog was given the option of medically treating the infection while monitoring for improvement or deterioration, or a second option of treating the infection and performing a concurrent femoral head and neck excision. The prognosis given for the latter was superior in terms of resolution of the infection and pain-relief with increased function. The owner opted to pursue surgery. The patient was returned 11 days later for a femoral head and neck excision arthroplasty (22). Sections of the resected femoral head and neck, as well as synovium, were submitted for histopathological examination, microbial isolation, and antimicrobial susceptibility testing. Histological examination of H&E stained sections of the femoral head revealed a bone cyst without any evidence...
of neoplasia or inflammation. The culture did not produce any growth.

Post-operatively there were not any complications. The dog was continued on Clavamox (15 mg/kg) PO BID for four additional weeks and started on etodolac (12 mg/kg PO SID). Following FHNE, the owner of the dog reported that she began using the limb the day of release from the hospital (two days after surgery). Approximately one week following surgery, the owner reported that use of the limb continued to improve such that the dog was weight bearing without apparent discomfort. Based on the owner’s subjective evaluation, the dog’s function and quality of life was markedly improved. Good, apparently pain-free, use of the limb continued until the day post surgery was noted at any time after surgery. The owner of the dog was completely satisfied with the diagnostic and therapeutic approach to this case, as well as the outcome of treatment for the hip problem.

Discussion

The clinical features of interest in the present case include not only the rarity of the disease process itself, but also the diagnosis and management of septic arthritis specific to the hip joint. Bacterial infection of the hip may be the result of a penetrating joint injury, joint surgery, haematogenous spread, or extension from surrounding tissues (1, 7, 14, 18, 21). In this case, previous surgery had not been performed, nor was there any history of trauma to the affected hip. While the definitive aetiology of the coxofemoral joint infection was undetermined, the dog had a long history of allergic dermatopathies and otitis externa, and skin sepsis has been indicated as a source of infection for haematogenous spread to joints (4, 8, 9, 20). In addition she had a long history of systemic corticosteroid administration, which is likely to decrease host resistance in cases of septic arthritis (6, 8, 21). Another possible contributing factor involves the structure of the synovium and the vasculature of the articular tissues. Degenerative joint disease results in changes in synovial filtration, production of inflammatory and immune system mediators, and local blood flow in synovium and subchondral bone, which may be predisposing factors for septic arthritis (8, 12, 19). There were changes consistent with severe osteoarthritis in the affected hip.

The initial signs at admission of the dog included chronic, progressive, and asymmetrical joint involvement. The affected hip had signs of pain, crepitus, and muscle atrophy. Neither heat nor swelling was palpable in the joint in this case, probably a result of the relatively deep position of the hip joint (21). The CBC and serum chemistry did not give an indication of systemic disease and this is often the case with infected joints (4). Radiographic evaluation and CT revealed severe pathological changes in the left hip, but could not definitively distinguish among osteoarthritis, neoplasia, or an infectious process. Although neutrophils were present in a synovial fluid aspirate, they were non-toxic. One study questions the value placed on the presence of toxic neutrophils in synovial fluid and advises culture in all cases of monoarticular inflammation (18). In this case fluid aspiration and tissue culture were both done via arthroscopy, so the absence of toxic neutrophils was not taken into consideration before culturing.

The definitive diagnosis in this case of coxofemoral septic arthritis and osteomyelitis was achieved through arthroscopy. Arthroscopy allows for improved visualization of articular structures and assessment of joint surfaces (12); is less invasive than arthroscopy, creating less trauma to exacerbate inflammation (9); allows for earlier return to function and resultant decreased morbidity (10, 12); and in many instances, is a method of concurrent diagnosis and treatment (12). Taking into consideration that neoplasia was a differential in this case, another advantage of arthroscopy included decreasing the risk of seeding tumour (3, 5, 15, 16). Lesions of the femoral head, synovium and acetabular articular cartilage were visualized, biopsies were taken for histopathology and culture, and the joint was debrided and thoroughly lavaged. Culture of the synovial membrane has been established as the definitive diagnostic method in cases of septic arthritis (4, 17, 18). In the present case, arthroscopic exploration with biopsy provided the most accurate and minimally invasive means for obtaining a diagnosis and determining appropriate treatment options and prognoses. This approach also allowed for avoidance of inappropriate treatment modalities, such as total hip arthroplasty or excisional or radical biopsy, which may have been recommended if the definitive diagnosis of septic arthritis and osteomyelitis was not made.

While medical management alone may have been sufficient to resolve the infection in this case, based on the degree of pain and lameness in this dog, it is unlikely that medical management alone would have resulted in return to pain-free use of the affected limb. Therefore, surgical treatment of the hip was recommended to address the pain and dysfunction for which the dog was initially presented. The diagnosis of septic arthritis is a contraindication for total joint replacement (11, 13, 21). FHNE has been reported as an appropriate salvage procedure for cases in which a total hip arthroplasty is contraindicated (21). In addition to arthroscopic lavage and antimicrobial therapy, a FHNE was performed due to the advanced stage of the articular damage. Considering the relatively rapid return to pain free function in this case the FHNE appears to be an appropriate salvage procedure for dogs with hip pain associated with septic arthritis.

Conclusion

Septic arthritis and osteomyelitis in the coxofemoral joint of dogs can be difficult to diagnose and distinguish from other causes of hip pain. Exploratory arthroscopy with tissue procurement provided a minimally invasive, yet accurate, diagnosis in this case. Arthroscopy of the hip also allowed for determining appropriate treatment options and
prognoses, while avoiding inappropriate treatment. Antibiotic therapy and femoral head and neck excision resulted in pain relief and improved function in this patient. Exploratory arthroscopy is an important diagnostic modality in dogs with pathology of the hip in which a definitive aetiology is difficult to determine.

**References**


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*Feline Medicine and Therapeutics*

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This is the third edition of this text, published 10 years after the second edition. The knowledge of feline medicine and therapeutics has advanced considerably in the last 10 years since the second edition and the authors remain true to their objective: to help veterinarians and students practice the art and science of feline medicine. The third edition contains up-to-date information on all aspects of feline medicine.

The comprehensive text covers everything from special considerations in feline therapeutics, chemotherapy in the treatment of neoplasia, toxicology, to common feline behavioural problems. It covers all of the major systems including paediatrics and inherited diseases, the oral cavity and dentistry, and contains 11 chapters on infectious diseases. The text is thorough, well written and illustrated, covering clinical signs, diagnoses and treatments in a reader-friendly manner.

Having made good use of the previous edition, which was very successful, this reviewer is convinced that the third edition will be equally as successful for the authors and the over 40 expert contributors. This new edition is an asset for veterinarians in mixed or small animal practice, and for students intending to practice small animal medicine.