An In-Depth Look:

ARTHROSCOPY IN DOGS

Diagnostic and Surgical Applications of Arthroscopy in Dogs: Hindlimb Joint Diseases*

Francesca Capaldo, DVM
Robert Gilley, DVM, PhD, DACVS
Amy Kapatkin, DVM, DACVS
University of Pennsylvania

ABSTRACT:

This article discusses the diagnostic and therapeutic applications of arthroscopy for various hindlimb joint disorders. The advantages of arthroscopy over arthrotomy in diagnosing and treating hindlimb joint diseases are emphasized. Understanding joint pathophysiology can help prevent and treat joint diseases. As more specialists become familiar with arthroscopic instrumentation and techniques, patients will benefit from arthroscopy.

Use of arthroscopy in dogs—not only for diagnosing but also for treating common joint diseases—has become more frequent among veterinary specialists in the past few years. This article reviews the diagnostic and therapeutic applications of arthroscopy for various hindlimb joint disorders in dogs, emphasizing the usefulness of arthroscopy over arthrotomy (see box on page 597).

INDICATIONS FOR ARTHROSCOPY OF THE HIP JOINT

Hip Dysplasia

Cause and Clinical Signs

Canine hip dysplasia is an osteoarthritic disease that is most common in large-breed dogs. Dogs may have no clinical signs or lameness of variable degrees, depending on the severity of the disease. Affected dogs may also have difficulty rising and a bunny-hopping gait. In most clinical cases, there is hindlimb muscle atrophy and pain during manipulation of the hip. The Ortolani method of palpation may demonstrate hip instability.

Diagnosis

Radiographic evaluation is used to confirm the diagnosis. Radiographic views include standard ventrodorsal and lateral projections of the pelvis. As the disease pro-

*A companion article on general applications and forelimb joint diseases appears on page 580.

Send comments/questions via email **editor@CompendiumVet.com** or fax **800-556-3288**.

Visit **CompendiumVet.com** for full-text articles, CE testing, and CE test answers.

gresses, radiographic changes include coxofemoral subluxation and osteoarthritis. The PennHIP stress-radiographic method, as described by Smith et al,[1] can be used to evaluate the joint more completely and assist in the prognosis. The condition of the dorsal acetabular rim (DAR) can also be evaluated with a skyline view, as described by Slocum and Slocum.[2]

Conservative and Surgical Treatment

Medical management (i.e., administration of NSAIDs, nutraceuticals, and other chondroprotectants) provides symptomatic relief but may only be palliative. By improving joint congruity and stability, triple pelvic osteotomy (TPO) has reportedly decreased progression of osteoarthritis caused by hip dysplasia.[2] Juvenile pubic symphysiodesis purportedly results in significant improvement in hip joint conformation and hip laxity in dysplastic puppies treated at 15 and 20 weeks of age.[3] Total hip replacement[4] or femoral head and neck osteotomy[5] may be performed in dogs that do not meet the criteria for TPO or that have osteoarthritis that is not amenable to long-term medical management.

Arthroscopic evaluation of the articular surface, DAR, ligamentum teres, labrum, and joint capsule may be useful in assessing patients with hip dysplasia, especially if TPO is being considered (Figure 1). If the articular surfaces of the acetabulum or femoral head show excessive wear, TPO is not advisable. Other potential contraindications include tears of the cartilaginous labrum or joint capsular as well as wear on the DAR.[6] Thermal contraction of a stretched ligamentum teres or joint capsule can be performed arthroscopically with an electrothermal radiofrequency unit, but the clinical efficacy of this procedure is unknown.[3,6] Rupture of the ligamentum teres secondary to electrothermal contraction and consequent hip dislocation has been reported.[3]

INDICATIONS FOR ARTHROSCOPY OF THE STIFLE JOINT

Injuries of the Cranial Cruciate Ligament: Preoperative Cruciate Ligament Evaluation, Cruciate Repair Failure Evaluation, and Anterior Cruciate Repair

Cause and Clinical Signs

The causes of cranial cruciate ligament failure can be classified as traumatic or degenerative. In large-breed dogs with a complete or partial rupture of the cranial cruciate ligament, osteoarthritis advances rapidly (i.e., within weeks),[7,8] emphasizing the need for early diagnosis and treatment. Partial tears are difficult to diagnose because patients may have a minimal to no cranial drawer sign, thus requiring examination under general anesthesia. Partial tears may involve the anterior medial band or posterior lateral band. Both flexion and exten-

Diagnostic and Surgical Application of Arthroscopy in the Hindlimbs of Dogs

Hip
- Hip dysplasia (i.e., evaluation of the joint before TPO)
- Osteoarthritis
- Hip dislocation[a]
- Diagnostic examination (i.e., biopsy of bone, cartilage, or synovial membrane)
- Septic arthritis[b]

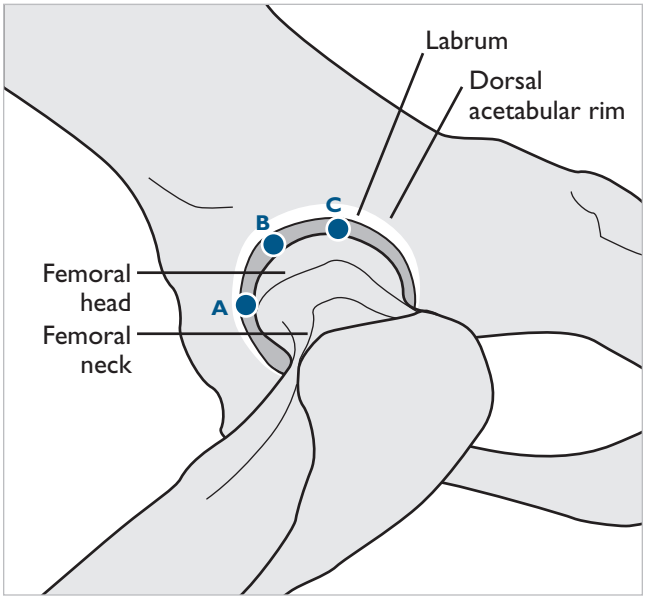
Stifle
- OCD lesions of the lateral and medial femoral condyle
- Injuries of the cranial cruciate ligament: preoperative cruciate ligament evaluation, cruciate repair failure evaluation, and cruciate ligament repair
- Injury of the caudal cruciate ligament
- Meniscal examination and treatment (i.e., meniscectomy, meniscal release)
- Repair and debridement of avulsion fractures of the cranial cruciate ligament and caudal cruciate ligament
- Osteoarthritis
- Acute traumatic medial patellar luxation and grade 1 and 2 congenital patellar luxation
- Diagnostic examination (i.e., biopsy of bone, cartilage, or synovial membrane)
- Septic arthritis[b]

Tarsus
- OCD
- Malleolar and intraarticular fractures
- Osteoarthritis
- Joint instability
- Diagnostic examination (i.e., biopsy of bone, cartilage, or synovial membrane)
- Septic arthritis[b]

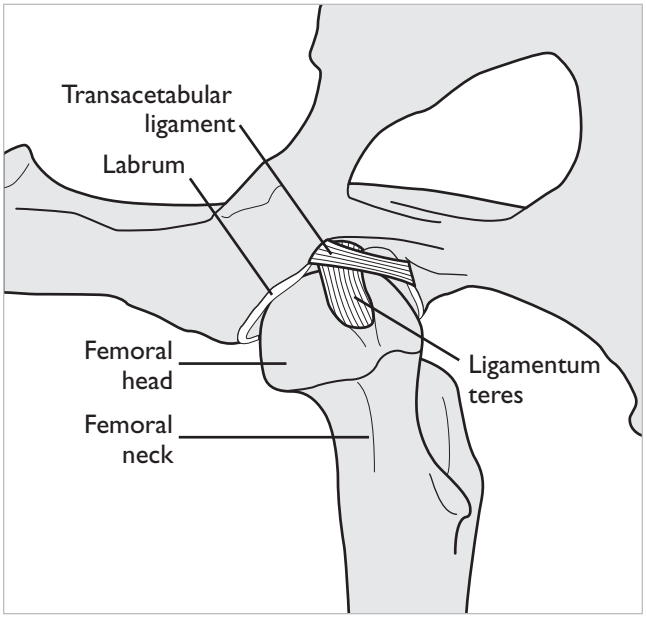
[a]In this case, arthroscopic intervention is useful in visualizing the condition of the articular surfaces of the coxofemoral joint and removing avulsion fragments when closed reduction is attempted. If possible, closed reduction should be performed before an arthroscopic evaluation.[6]

[b]Traditional treatment of septic arthritis in dogs has consisted of either nonoperative therapy via arthrocentesis or open drainage with associated potential wound complication.[46] Arthroscopy allows precise assessment of the articular surface and improves prognostic accuracy. Specimens can be collected for culture and sensitivity testing. Infected cartilage and diseased tissue can be aggressively and arthroscopically debrided. The prognosis is good to excellent if treatment is provided before significant articular cartilage damage occurs.[47]

Figure 1. Portal locations and pertinent anatomy for canine hip arthroscopy. (Illustrations by Felecia Paras)



Lateral view.
A—Egress portal
B—Instrument portal
C—Arthroscope portal



Ventral view.

sion should be tested and compared with the contralateral stifle. If the anterior medial band is markedly torn, an examination shows a subtle anterior drawer sign only in flexion with an ill-defined endpoint. It is important to realize that patients with partial tears frequently have stable knees in both flexion and extension.

Diagnosis

Radiographic findings are rarely normal in dogs with partial tears, although abnormal findings may be subtle. In acute cases, lateral radiographs show soft tissue swelling in the caudal joint causing obliteration or caudal deviation of the fat line of the gastrocnemius muscle planes in the popliteal fossa. Similar soft tissue swelling causes loss of the triangular detail of the infrapatellar fat pad in the cranial joint. In subacute cases (i.e., 3 to 6 weeks), early osteophyte formation may be noted, especially on the proximal and distal poles of the patella and the medial and lateral trochlear ridges of the femur. In chronic cases (i.e., months), these osteophytes may be large and accompanied by similar changes along the medial, lateral, and caudal aspects of the tibia. Subchondral sclerosis may also be present. Magnetic resonance imaging (MRI) is the diagnostic technique of choice for human knee disorders, and its usefulness in assessing canine stifle derangement has been documented.[9]

Arthroscopy allows confirmation of the diagnosis and classification of the cranial cruciate ligament injury as partial or complete (Figure 2). In the absence of palpable instability, arthrotomy may be difficult to justify. Therefore, arthroscopy may be preferable in these instances because it provides a minimally invasive way of obtaining an early diagnosis of partial tears before articular changes occur (Figure 3).

Conservative and Surgical Treatment

In cases of advanced osteoarthritis, conservative treatment (i.e., NSAID or chondroprotectant therapy, weight control, regular low-impact exercise) with 4 to 8 weeks of restricted activity should be considered for dogs less than 33 lb (15 kg). In one study,[10] conservative treatment resulted in a good clinical outcome in 85% of dogs evaluated. Arthroscopic evaluation of those patients can be used as a minimally invasive method of evaluating and treating meniscal damage.

Surgical treatment is typically required to achieve a satisfactory clinical result for dogs heavier than 33 lb (15 kg). Various surgical techniques have been described to restore joint stability by different means. Regardless of the surgeon's preference of stabilization technique, arthrotomy should always be performed to trim the tags of torn ligament and explore the joint for meniscal damage.

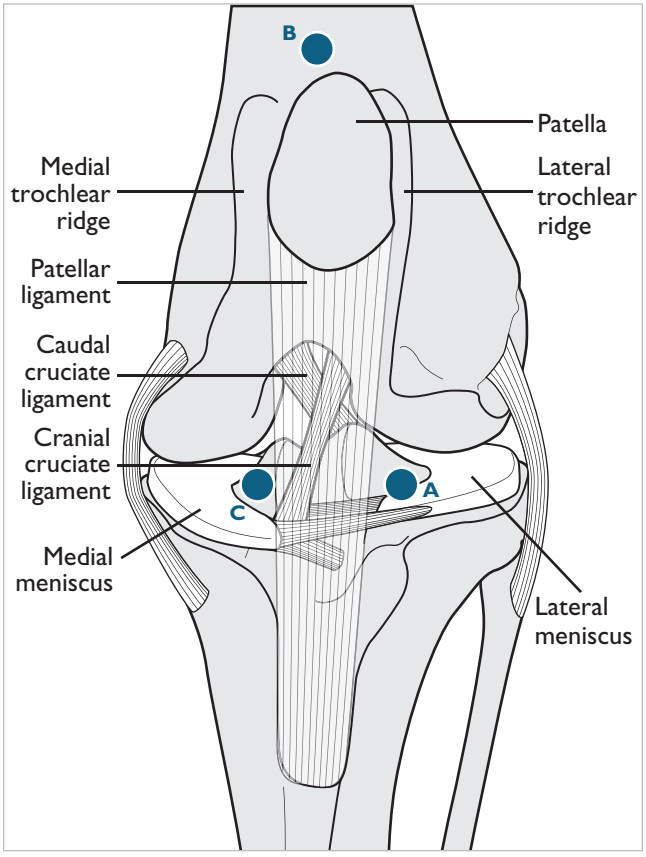


Figure 2. Portal locations and pertinent anatomy for canine stifle arthroscopy:
A—Arthroscope portal
B—Outflow and egress portal
C—Instrument portal
(Illustration by Felecia Paras)

Arthroscopy allows more accurate assessment of partial tears of the cranial cruciate ligament, synovial pathology, articular cartilage pathology, and meniscal injuries. It also allows intraarticular debridement of the remnants of the cranial cruciate ligament and treatment of meniscal damage without the pain associated with traditional arthrotomy. When a tear is identified in a stable knee, the surgeon should debride only the torn portion, leave the remaining portion intact, and perform a surgical intervention to improve joint stability. Because stress on the remaining fibers of the cranial cruciate ligament is reduced with adjunctive stabilization, the ligament remains intact in most cases.[6] In some cases, arthroscopy shows a normal-appearing cranial cruciate ligament despite knee instability. In this instance, the cranial cruciate ligament must be carefully inspected for evidence of stretching

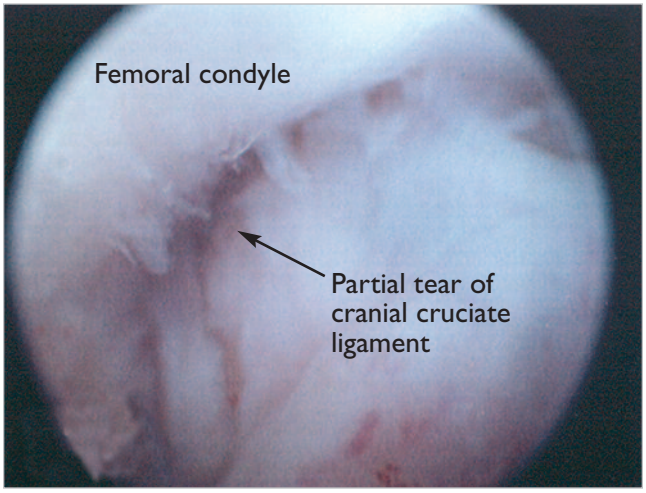


Figure 3. Arthroscopic view of a partial tear of the cranial cruciate ligament. Note the "stretched out" appearance of the remaining nonfunctional ligament.

and attenuation because significant interstitial tears are likely to be present. When palpable instability is present, these ligaments are nonfunctional and thus should be treated as those with complete tears.[6] As in humans, intraarticular allografts, autografts, and synthetic grafts are placed arthroscopically within bone tunnels with mixed results.[11–13] In one study,[14] stabilization was achieved using a combination of arthroscopic evaluation and intraarticular debridement along with percutaneous placement of an extracapsular prosthetic ligament anchored proximally in the caudolateral surface of the lateral femoral condyle using one or two suture anchors (Bone Biter, Androcles, Inc, Warsaw, IN). When tibial plateau leveling osteotomy (TPLO)[15] is performed on dogs with complete cranial cruciate ligament rupture and an intact medial meniscus, the meniscus can be released arthroscopically if the surgeon elects to do so.[16]

Caudal Cruciate Ligament Tears

Cause and Clinical Signs

Isolated caudal cruciate ligament tears are extremely rare and are caused by violent trauma to the cranial aspect of the tibia while the knee is in flexion. They are most common in conjunction with other, more serious ligamentous injuries, including instability of the collateral ligaments and meniscal injury. True isolated caudal cruciate ligament tears have a caudal drawer sign in flexion that has a sharp endpoint created by the intact cranial cruciate ligament. The knee is stable in extension.

In contrast, complete cranial cruciate ligament tears have a cranial drawer sign in both flexion and extension and usually have a positive result on the cranial tibial compression test, which is absent in caudal cruciate ligament injuries.

Diagnosis

Radiographic findings for caudal cruciate ligament tears are usually unremarkable but may include mild joint swelling.

Conservative and Surgical Treatment

If concurrent collateral ligament or meniscal injury is not present, most dogs do well without surgical stabilization.

Arthroscopic examination allows confirmation of the diagnosis and debridement of the damaged caudal cruciate ligament. In addition, the meniscus can be inspected and treated for concurrent injury. If avulsion of the proximal origin is present, surgical repair is recommended if the fragment is large and the ligament is intact. Postoperative management consists of lateral splintage and exercise control. The prognosis is good for full return to function, and progression of osteoarthritis, common with cranial cruciate ligament tears, does not typically occur.

Osteochondritis Dissecans Lesions of the Lateral and Medial Femoral Condyle

Cause and Clinical Signs

Although infrequent, osteochondritis dissecans (OCD) of the stifle has reportedly been a cause of lameness in young large-breed dogs. Clinical signs may be as subtle as early morning stiffness that partially resolves. However, the lameness is often exacerbated by exercise.[17] The lesion is located at the medial aspect of the lateral femoral condyle in more than 90% of cases. The medial condyle is affected in only 4% of cases.[17] The condition is often bilateral.

Diagnosis

This condition is diagnosed radiographically in acute cases by a radiolucent concavity or flattened area of the lateral or medial femoral condyle. In chronic cases, other degenerative changes, such as periarticular osteophyte formation and subchondral sclerosis, are typical.

Conservative and Surgical Treatment

Conservative management (i.e., antiinflammatory or chondroprotective therapy, moderate exercise, weight control) may be successful in some patients, especially those in which OCD is found as an incidental finding with no clinical signs of pain or lameness. Surgical intervention (i.e., arthrotomy or arthroscopy) is the treatment of choice but, in many cases, does not alleviate the need for concurrent conservative treatment.

Traditional arthrotomy consists of removal of cartilage fragments and curettage of the lesion bed, consisting of abrasion or microfracture of the subchondral defect.[18,19] Disadvantages include resultant tissue trauma with a relatively long recovery period (i.e., 4 to 6 weeks), possible postoperative instability, limited joint visualization, and long-standing degenerative changes.[20]

Arthroscopy involves removal of the osteochondral flap, abrasion or microfracture of the subchondral defect (as mentioned for arthrotomy), and partial synovectomy. Both stifles can be treated simultaneously in bilateral cases. In one report,[21] six dogs with OCD of the femoral condyle were evaluated; all patients treated arthroscopically were bearing weight the day following surgery, and complete resolution of the lameness occurred within 2 weeks of surgery. Large defects can be treated with osteochondral autografts harvested from the abaxial surface of the femoral trochlea.[3]

Arthroscopy is very effective in diagnosing and treating various hindlimb joint disorders.

Meniscal Examination, Meniscectomy, and Medial Meniscus Release

The meniscal cartilages play several roles in proper knee function, including load transmission, shock absorption, joint stability, joint lubrification,[22] and proprioception.[23,24] Meniscal injuries are common sequelae to cranial cruciate ligament injuries and have been implicated in lameness and degenerative changes that develop in affected dogs.[22,23,25] The prevalence of reported meniscal injuries is 50% to 70% in dogs with

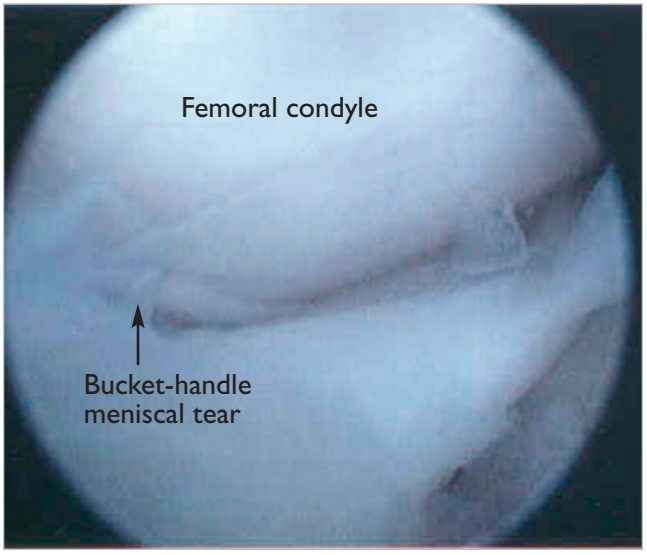


Figure 4. Arthroscopic view of a bucket-handle meniscal tear.

cranial cruciate ligament injuries; these injuries (i.e., longitudinal vertical tears or bucket-handle tears) are almost exclusively confined to the medial meniscus and most commonly involve the caudal horn[24–26] (Figure 4). An increased incidence of arthroscopically evaluated lateral meniscal tears has recently been reported.[26]

In humans, meniscectomy leads to significant long-term osteoarthritis. Therefore, in young patients in which the tear is neither complex nor macerated, it is usually repaired with sutures or staples. The same sequela to meniscectomy exists for the canine stifle.[22,23,27] However, primary repair techniques are not typically used; thus partial meniscectomy of damaged tissue is performed.[23,28]

Arthroscopy may play a major role in diagnosing and treating meniscal injury in dogs. The principles of arthroscopic meniscectomy in dogs are as follows[28]:

- Mobile fragments that displace beyond the normal rim of the meniscal edge are removed because they may become caught between joint surfaces, causing pain and propagating the tear.
- Only damaged portions of the meniscus should be excised.
- Probing should be performed frequently to evaluate the area for mobility and texture. The surgeon should blindly probe the underside of the meniscus and apply cranial traction to test for an unstable but hidden tear.
- The texture of the meniscus should guide evaluation and treatment. Soft, friable tissue should be excised, whereas firm areas should be left undisturbed.
- The meniscocapsular junction must be protected to preserve the hoop stress mechanism of the meniscus. This principle is violated when meniscal release is performed.

Meniscal release can be considered to prevent tearing of the medial meniscus when the knee is unstable and the medial meniscus is intact. The technique is controversial and the efficacy and long-term effects of the procedure on the articular cartilage are unknown. Some argue that meniscal release renders the meniscus nonfunctional and predisposes patients to osteoarthritis, whereas others argue that the incidence of meniscal tears is unacceptably high without release. In dogs that have partial tears but palpably stable knees, TPLO usually saves the ligament, and some consider meniscal release unnecessary.[16] This claim is supported by the occurrence of meniscal tears in some dogs that had undergone a previous meniscal release. In addition, tears do not always occur in other dogs that do not undergo the procedure.[6]

Arthroscopy can be used to obtain biopsy specimens of bone, cartilage, or synovial membrane.

Release of the medial meniscus can be performed arthroscopically in two ways[6]:

- By transecting the caudal meniscotibial ligament, which is achieved by placing a probe beneath the meniscotibial ligament and performing the transection with a fine-tipped radiofrequency probe
- By transversely incising the meniscus caudal to the attachment of the medial collateral ligament with a number 11 blade that is inserted percutaneously and guided by an arthroscopically visualized needle inserted just caudal to the medial collateral ligament

It is unknown whether a certain location of release is superior or whether meniscal release is superior or inferior to prophylactic partial ablation of the caudal horn of the medial meniscus.

Instead of meniscal release, some surgeons elect to perform arthroscopic prophylactic partial meniscectomy on uninjured menisci. A prophylactic partial meniscal ablation can be performed with a radiofrequency probe at the caudal aspect of the outer third of the meniscus. Compared with meniscal release, this procedure better preserves meniscal function by maintaining the hoop-stress mechanism that is lost when transverse tearing of the meniscus occurs. This technique is typically used to prevent meniscal tears after TPLO; however, tears may still occur despite its use.[6]

Repair of Avulsion Fractures of the Cranial Cruciate Ligament and Caudal Cruciate Ligament

Cause and Clinical Signs

Avulsion fractures occur almost exclusively in dogs younger than 1 year of age. These fractures occur predominantly in young animals as a result of the soft nature of juvenile bones compared with adult bones.[29]

Avulsion fractures sometimes occur in older dogs and may be related to violent trauma, such as a car accident. During physical presentation, lameness ranges from partial to non–weight bearing. Avulsion is often associated with effusion or hemarthrosis, and the joint is often painful during manipulation. Instability is usually pronounced and depends on the ligament (i.e., cranial or caudal) that is avulsed.

Diagnosis

Acute bony avulsion is usually apparent on radiographs with standard projections. Other radiographic findings include swelling of the posterior joint capsule, loss of triangular detail of the infrapatellar fat pad, and formation of periarticular osteophytes, if bony avulsion is chronic. Cranial and proximal translation of the tibia in relation to the femur is appreciated.

Arthroscopy can be useful in confirming the diagnosis.

Conservative and Surgical Treatment (Arthrotomy and Arthroscopy)

Conservative treatment (i.e., NSAID or chondroprotective therapy, weight control, restricted exercise) may be initiated; however, without surgical intervention, most dogs have persistent lameness. Small dogs are usually treated with open arthrotomy for fragment removal and extracapsular stabilization. In larger dogs, options include the following:

- Open arthrotomy for fragment removal and stabilization
- Open arthrotomy for repair with lag-screw fixation, pins, or wire along with adjunctive lateral imbrication or external coaptation[29]
- Arthroscopic debridement and extracapsular stabilization[6]
- Arthroscopic primary repair with pins and wires as well as temporary external coaptation[6]

Dogs usually do well with caudal cruciate ligament–deficient stifles if the bony avulsion fragment is removed. However, when feasible, it is preferable to repair the avulsion and save the ligament.

In addressing avulsion fracture injuries, it is important to confirm that the ligament has not been torn in conjunction with avulsion. If the ligament has been torn, the avulsion fragment should be debrided and stabilization performed when indicated. The most common complication is pull out of the avulsion fragment, which is most likely to occur when pin fixation is used without cerclage wire and a tension band. Overactivity in young animals may also contribute to this complication and must be avoided.

Arthroscopy can be used in treating osteoarthritis and septic arthritis.

Osteoarthritis

Cause and Clinical Signs

In most cases, osteoarthritis of the stifle joint is secondary to cranial cruciate ligament insufficiency but may occur in any dog as a result of traumatic, infectious, immune-mediated, or developmental causes. It is rarely primary in young patients and is usually present to some degree in older patients.[30] Some dogs have subtle to

severe lameness; others have difficulty rising without lameness. Physical examination findings depend on the cause and chronicity of the condition.

Diagnosis

Diagnostic tools include radiography and arthrocentesis. Radiographic signs vary with the severity of the disease. The degree of osteophytosis and sclerosis increases as osteoarthritis progresses. Arthrocentesis usually shows cell counts of 2,000 to 5,000/µl, with predominantly mature mononuclear cells.

Conservative and Surgical Treatment

Medical treatment consists of antiinflammatory medication and control of activity and body weight. Surgical treatment should be directed toward the underlying cause of osteoarthritis in conjunction with arthroscopic treatment of identified articular cartilage and synovial pathology. In humans, pain is significantly reduced by aggressive removal of hyperplastic synovium. Aggressive subtotal synovectomy has been used successfully in dogs with mixed but generally favorable results.[6] Regardless of the cause, the arthroscopic appearance of osteoarthritis is similar. Areas of chondromalacia and mild fibrillation are generally left undisturbed. A curette or burr should be used to remove severely damaged cartilage. The resulting subchondral bone bed should be treated via abrasion or light curettage with a hand burr or power shaver to expose bleeding subchondral bone. Microfracture technique with a micropick or forage may be added for larger lesions. The forage technique is performed with a K-wire to drill small, equally spaced holes in the lesion. If eburnation is present, the forage technique can be used in lieu of microfracture to allow deeper penetration of subchondral bone. When diffuse bleeding is observed from the lesion bed, the joint should be lavaged and routine closure performed. The procedure may be repeated periodically if results are rewarding and clinical signs return, but some cases may require corrective osteotomy, arthrodesis, or joint replacement.[6]

Acute Traumatic Medial Patellar Luxation and Grade 1 and 2 Congenital Patellar Luxations

Cause and Clinical Signs

Any age, sex, or breed may be affected. If the cause is traumatic, weight-bearing lameness may be severe and is often intermittent; swelling and discomfort is often present. Grade 1 and 2 congenital patellar luxation may cause low-grade weight-bearing lameness that may be chronic or intermittent and associated with exercise.

Diagnosis

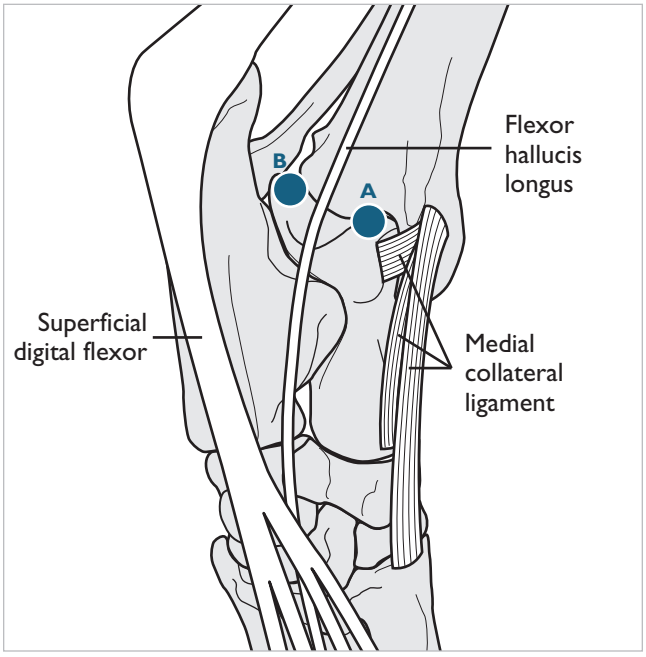
Diagnosing luxations is usually based on palpation of the affected stifle and patella. Radiographs are usually normal or show mild effusion.

Medical and Surgical Treatment

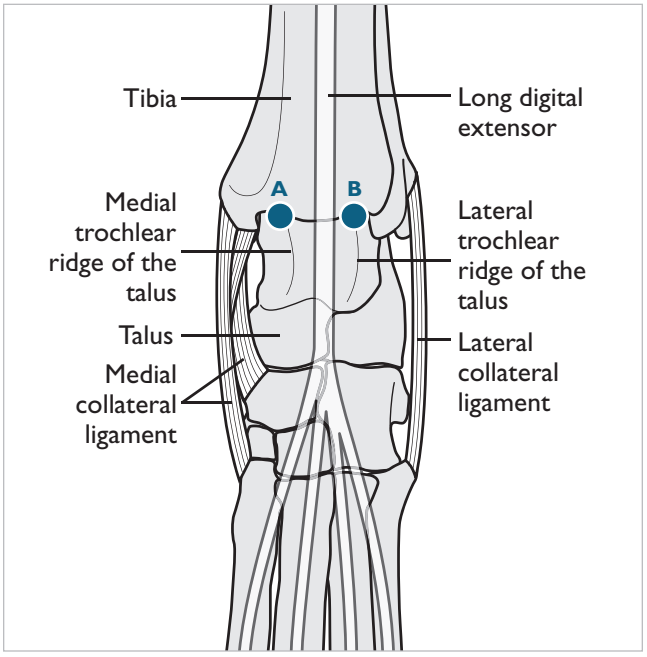
Conservative treatment with NSAIDs should be attempted before surgical intervention is performed, especially in patients with grade 1 luxation. Acute traumatic medial patellar luxation and grade 1 and 2 congenital patellar luxation in dogs that have good conformation may be treated arthroscopically.[6] However, case selection is critical and results are mixed in a small number of cases. The technique consists of arthroscopic release of the medial retinaculum. To accomplish this, the superior portal should be placed lateral instead of medial to the quadriceps tendon. A hook-tipped electrocautery or radiofrequency probe should then be inserted through the instrument portal and placed just medial to the cranial pole of the patella. The joint capsule and medial retinacular tissue, including the medial fibrocartilage wing of the patella and the medial femoropatellar ligament, should be incised from inside to outside. If the incision is adequate, there will be extravasation of fluid into the subcutaneous tissue. An obvious dark subcutaneous cavity can be seen arthroscopically as fluid fills the subcutaneous space. The goal of the procedure is to release the tissues medially to allow dynamic realignment of the patella.

A Robert Jones bandage should be applied for the first 24 hours to reduce swelling and then changed and maintained for an additional 5 days. The patella may reluxate during the first 1 to 2 weeks after surgery. As discomfort resolves and muscle function improves, realignment usually ensues. Complications include cutting through the skin as a result of an overaggressive electrosurgical incision. Scarring is minimal, but this procedure is more painful than a routine arthroscopic examination because the highly innervated joint capsule is incised. The dynamic realignment provided by this procedure requires adequate reestablishment of muscle function for success. Thus physical therapy should be provided for 1 month before the result is considered a failure.

Figure 5. Portal locations and pertinent anatomy for canine tarsal arthroscopy. (Illustrations by Felecia Paras)



A—Plantaromedial arthroscope portal
B—Plantarolateral arthroscope portal



A—Dorsomedial arthroscope portal
B—Dorsolateral arthroscope portal

INDICATIONS FOR ARTHROSCOPY OF THE TARSAL JOINT

Osteochondritis Dissecans

Cause and Clinical Signs

In growing dogs, OCD of the tarsocrural joint is a rare cause of lameness. Dogs may present with unilateral or bilateral weight-bearing or non–weight-bearing hindlimb lameness that is exacerbated by exercise.[31] The most common location for osteochondral lesions is the medial trochlear ridge of the talus.[31] Involvement of the lateral trochlear ridge is less common and more difficult to confirm with routine radiographic views.[32–35] In most cases, crepitation or palpable swelling of the joint is evident during physical examination. Pain is typically elicited during hyperextension or hyperflexion of the tarsus, and loss of range of motion is common, especially in flexion.

Diagnosis

Osteochondrosis of the tarsocrural joint can be evaluated by radiography, computed tomography (CT), and arthroscopy[36] (Figures 5 and 6). The radiographic examination includes craniocaudal, mediolateral, oblique, and skyline views, which are sufficient to make a diagnosis. However, radiography may show only secondary bony changes (i.e., flattening of the trochlear ridge, widening of the tibiotarsal joint space, calcified flap, detached flap, osteophytes),[37] which are usually evident only in chronic cases. Arthroscopy allows an earlier diagnosis than does radiography. Thus arthroscopy is indicated in young dogs when lameness is localized to the tarsal joint, even when radiographic changes are absent.

Conservative and Surgical Treatment

Medical treatment (i.e., antiinflammatory therapy) and control of activity and body weight are commonly suggested,[38] but surgical intervention (i.e., arthrotomy or arthroscopy) is the treatment of choice.[31,38] Arthrotomy consists of removal of fragments and curettage of the lesion bed.[39]

Arthroscopy consists of removal of all osteochondral fragments (i.e., joint mice) and treatment of the subchondral bed by surface abrasion or microfracture until the underlying bone bleeds freely. Both tarsi can be treated simultaneously if the condition is bilateral. In the arthroscopic exploration, either a plantar or dorsal portal can be used, depending on the site of the lesion: In OCD of the lateral ridge, the dorsal, dorsoplantar, or plantar part can be affected,[32,34,35] and in OCD of the medial ridge, lesions occur on the dorsal and plantar part[40,41]; therefore, a plan-

tarolateral or dorsolateral approach should be used in OCD of the lateral trochlear ridge, and a plantaromedial or dorsomedial approach should be used in OCD of the medial trochlear ridge.[6,36,42] Arthroscopic evaluation allows visualization of both the lateral and medial trochlear ridges when using either a medial or lateral portal. Surgeon's preference is a factor in deciding the chosen arthroscopic portal. Dogs that have small lesions that are treated early have excellent short-term outcomes with a rapid return to normal activities.[43,44] Large osteochondral defects and advanced osteoarthritis may be associated with long-term intermittent or persistent lameness. However, many dogs have adequate function if strenuous activity is avoided.[45] Arthroscopic surgery may fail if the fragments are too large or have an unfavorable position (e.g., a lateral ridge covered by the tibia). Nevertheless, their exact location can be determined by the arthroscopic examination, thus facilitating easy removal by miniarthrotomy. This approach minimizes disruption of the medial collateral ligament complex, which could create postsurgical instability.[44]

Fractures and Tarsal Instability

Cause and Clinical Signs

Fractures and tarsal instability are generally associated with trauma. Swelling, discomfort, and crepitus are usually evident during tarsal palpation. Collateral instability can be assessed in flexion and extension. Injury to the plantar ligaments leads to hyperextension of the intertarsal and tarsometatarsal joints. Injury to multiple ligaments may cause subluxation or luxation at any level of the tarsus.

Diagnosis

Lateral and anteroposterior views show soft tissue swelling and may reveal an avulsion fragment in the area of the collateral ligament, if damaged. To detect injury to the lateral and medial collateral ligaments, respectively, varus or valgus stress can be applied while an anteroposterior view is obtained. Injury to the plantar ligament can be shown by a lateral view while the tibiotarsal joint is hyperflexed. A skyline or oblique view may also be helpful in assessing tarsal fractures. CT performed in ventral recumbency can help determine the exact site as well as the number and size of any bone fragments.

Medical and Surgical Treatment

Medical management relieves pain, but definitive therapy with coaptation or surgical stabilization, depending on the severity of the injury, is necessary. Tarsal instability or fracture is usually treated with an open approach. Repair may include ligamentous reconstruction, fracture reduction and stabilization, or arthrodesis.

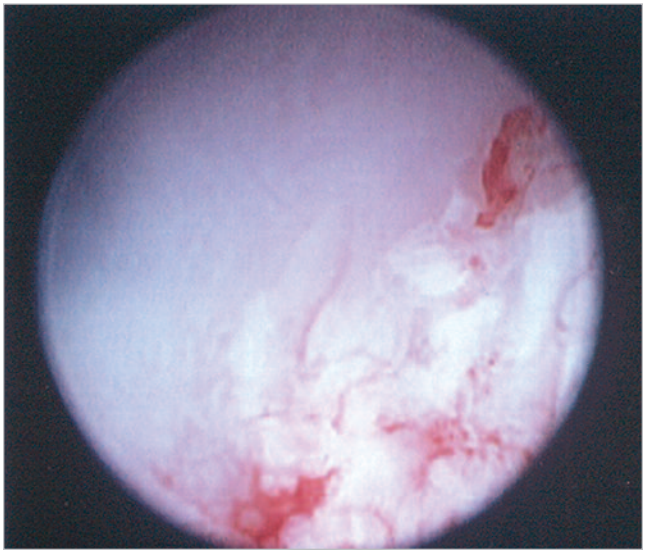


Figure 6. Arthroscopic view of tarsal OCD. Note the cartilaginous debris.

Arthroscopy is performed to evaluate the collateral ligaments and remove small avulsion fragments. It can also help reduce an avulsed fragment and examine the articular surfaces of the tibiotarsal joint.[6]

CONCLUSION

Diagnosing and treating joint disorders in dogs is a major part of canine orthopedics. In addition to radiography, CT and MRI have greatly improved the diagnostic abilities of orthopedists. Arthroscopy has recently become available for veterinary use and is increasingly popular. Using arthroscopic techniques, clinicians now have a minimally invasive diagnostic tool and a valuable new treatment modality.

Arthroscopy is rapidly replacing arthrotomy in treating a variety of orthopedic conditions in dogs. In particular, arthroscopy is becoming a promising replacement to classic surgical methods of treating OCD lesions. Furthermore, arthroscopy is an excellent choice when it is necessary to simultaneously treat two or more joints.

Arthroscopy has numerous advantages compared with arthrotomy (see box, p. 581). Veterinarians are beginning to appreciate these advantages and are encouraged to consider how their patients may benefit from the versatile applications of this relatively new technique. As

with most procedures, there is a learning curve for performing arthroscopy, even for surgeons experienced with traditional methods. However, early difficulties associated with arthroscopy decrease with the experience of the arthroscopist.

In the future, the development of smaller arthroscopes and refinement of instruments and techniques may facilitate use of arthroscopy in small-breed dogs.

REFERENCES

1. Smith GK, Beiry DN, Gregor TP, et al: New concepts of coxofemoral joint instability and the development of a clinical stress-radiographic method of quantitating hip joint laxity in the dog. *JAVMA* 196:59–70, 1990.
2. Slocum B, Slocum TD: Pelvic osteotomy for axial rotation of the acetabular segment in dogs with hip dysplasia. *Vet Clin North Am Small Anim Pract* 22:645–682, 1992.
3. Patricelli AJ, Dueland RT, Adams WM, et al: Juvenile pubic symphysiodesis in dysplastic puppies at 15 and 20 weeks of age. *Vet Surg* 31:435–444, 2002.
4. Olmstead M: The canine cemented modular hip prosthesis. *JAAHA* 31:109–124, 1995.
5. Mann FA, Tanger CH, Wagner-Mann C, et al: A comparison of standard femoral head and neck excision and femoral head and neck excision using a biceps femoris muscle flap in the dog. *Vet Surg* 16:223–230, 1987.
6. Beale BS, Hulse DA, Schulz K, Whitney WO: *Small Animal Arthroscopy*. Philadelphia, WB Saunders, 2003.
7. Marshall KW, Chan AD: Arthroscopic anterior cruciate ligament transection induces canine osteoarthritis. *J Rheumatol* 23:338–343, 1996.
8. Brandt KD, Myers SL, Burr D, et al: Osteoarthritic changes in canine articular cartilage, subchondral bone, and synovium after transection of the anterior cruciate ligament. *Arthritis Rheum* 34:1560–1570, 1991.
9. Widmer WR, Buckwalter HA, Braunstein EM, et al: Principles of magnetic resonance imaging and application to the stifle joint in dogs. *JAVMA* 198:1914–1922, 1991.
10. Vasseur PB: Clinical results following conservative management for rupture of CCL in dogs. *Vet Surg* 13:243–251, 1984.
11. Person MW: Prosthetic replacement of the cranial cruciate ligament under arthroscopic guidance: A pilot project. *Vet Surg* 15:37–43, 1987.
12. Whitney WO: Arthroscopic reconstruction of the cranial cruciate ligament in the dog. *Proc Eighth Annu ACVS Symp*, 1998.
13. Hulse DS, Beale BS: Arthroscopically assisted "under and over" reconstruction of the cranial cruciate ligament in the dog. *Proc Vet Orthop Soc 27th Annu Conf Special Symp*, 2000.
14. Beale BS, Hulse DS: Arthroscopic-assisted stabilization of the cruciate-deficient stifle in dogs using a percutaneous prosthetic ligament-suture anchor technique. *Proc Vet Orthop Soc 27th Annu Conf Special Symp*, 2000.
15. Slocum B, Slocum TD: Tibial plateau leveling osteotomy for repair of cranial ligament rupture in the canine. *Vet Clin North Am Small Anim Pract* 23:777–795, 1993.
16. Chandler JC, Whitney WO, Beale BS: Management of partial cranial cruciate ruptures with arthroscopic assisted tibial plateau leveling osteotomy. *Proc 29th Annu Conf Vet Orthop Soc*, 2002.
17. Montgomery RD, Milton JL, Henderson RA, et al: Osteochondritis dissecans of the canine stifle. *Compend Contin Educ Pract Vet* 11:1199–1205, 1989.
18. Trostel CT, McLaughlin, Pool RP: Canine lameness caused by developmental orthopedic diseases: Osteochondrosis. *Compend Contin Educ Pract Vet* 24:836–854, 2002.
19. Rodrigo J, Steadman J, Sillman J: Improvement of full thickness chondral defect healing in the human knees after debridement and microfracture using continuous passive motion. *Am J Knee Surg* 4:109–116, 1994.
20. Miller CW, Presnell KR: Examination of the canine stifle: Arthroscopy versus arthrotomy. *JAAHA* 21:623–629, 1985.
21. Bertrand SG, Lewis DD, Madison JB, et al: Arthroscopic examination and treatment of osteochondritis dissecans of the femoral condyle of six dogs. *JAAHA* 33:451, 1997.
22. Jackson J, Vasseur PB, Griffey S, et al: Pathologic change in grossly normal menisci in dogs with rupture of the cranial cruciate ligaments. *JAVMA* 218:1281–1284, 2001.
23. Arnoczky SP: Pathomechanism of cruciate ligament and meniscal injuries, in Bojrab MJ (ed): *Disease Mechanisms in Small Animal Surgery*, ed 2. Philadelphia, Lea & Febiger, 1993, pp 764–776.
24. Flo GL: Meniscal injuries. *Vet Clin North Am Small Anim Pract* 23:831–843, 1993.
25. Moore KW, Read RA: Rupture of the cranial cruciate ligament in dogs—part I. *Compend Contin Educ Pract Vet* 18:223–232, 1996.
26. Ralphs SC, Whitney WO: Arthroscopic evaluation of menisci in dogs with cranial cruciate ligament injuries: 100 cases (1999–2000). *JAVMA* 221:1601–1604, 2002.
27. Bolano LE, Grana WA: Isolated arthroscopic partial meniscectomy. *Am J Sports Med* 21:432–437, 1993.
28. Whitney WO: Principles of arthroscopic meniscal treatment and stifle debridement. *Proc 2001 Adv Int Arthroscopy Workshop*, 2001.
29. Brinker WO, Piermattei DL, Flo GL: Diagnosis and treatment of orthopedic conditions of the hindlimbs, in Brinker WO, Piermattei DL, Flo GL (eds): *Handbook of Small Animal Orthopedics and Fracture Treatment*, ed 2. Philadelphia, WB Saunders, 1990, pp 341–470.
30. Hulse DA, Aron DN: Advances in small animal orthopedics. *Compend Contin Educ Pract Vet* 16(7):831–832, 1994.
31. Breur GJ, Spauldin KA, Braden TD: Osteochondritis dissecans of the medial trochlear ridge of the talus in the dog. *Vet Comp Orthop Trauma* 4:168–176, 1989.
32. Goring RL, Beale BS: Exposure of the medial and lateral trochlear ridges of the talus in the dog, part II: Dorsolateral and plantarolateral surgical approaches to the lateral trochlear ridge. *JAAHA* 26:19–23, 1990.
33. Van Ryssen B, van Bree H: Arthroscopic evaluation of osteochondrosis lesions in the canine hock joints: A review of two cases. *JAAHA* 28:295–299, 1992.
34. Carlisle CH, Robins GM, Reynolds KM: Radiographic signs of osteochondritis dissecans of the lateral ridge of the trochlear talus in the dog. *J Small Anim Pract* 31:280–286, 1990.
35. van Ee RT, Gibson K, Roberts ED: Osteochondritis dissecans of the lateral ridge of the talus in a dog. *JAVMA* 193:1284–1286, 1988.
36. Gielen I, van Bree H, Van Ryssen B, et al: Radiographic, computed tomographic and arthroscopic finding in 23 dogs with osteochondrosis of the tarsocrural joint. *Vet Rec* 150:442–447, 2002.
37. Lewis DD, Goring RL, Parker RB, et al: A comparison of diagnostic methods used in the evaluation of early degenerative joint disease in the dog. *JAAHA* 23:305–315, 1987.
38. Smith MM, Vasseur PB, Morgan JP: Clinical evaluation of dogs after surgical and nonsurgical management of osteochondritis dissecans of the talus. *JAVMA* 187:31–35, 1985.
39. Smith CW: Osteochondrosis in the dog: Diagnosis, treatment, and prognosis. *Canine Pract* 16:15–22, 1991.
40. Goring RL, Beale BS: Exposure of the medial and lateral trochlear ridges of the talus in the dog, part I: Dorsomedial and plantaromedial surgical approaches to the medial trochlear ridge. *JAAHA* 26:13–18, 1990.
41. Mason TA, Lavelle RB: Osteochondritis dissecans of the tibial tarsal bone in dogs. *J Small Anim Pract* 20:423–432, 1979.
42. Van Ryssen B, van Bree H, Vyt Ph: Arthroscopy of the canine hock joint. *JAAHA* 29:107–115, 1993.
43. Ferkel RD, Fischer SP: Progress in ankle arthroscopy. *Clin Orthop* 240:210–220, 1989.
44. van Bree HJ, Van Ryssen B: Diagnostic and surgical arthroscopy in osteochondrosis lesions. *Vet Clin North Am Small Anim Pract* 28:161–189, 1998.
45. Cook JL, Tomlinson JL, Stoll MR, et al: Arthroscopic removal and curettage of osteochondrosis lesions on the lateral and medial trochlear ridges of the talus in two dogs. *JAAHA* 37:75–80, 2001.
46. Marchevsky AM, Read RA: Bacterial septic arthritis in 19 dogs. *Aust Vet J* 77:233–237, 1999.
47. Fearnside SM, Preston CA: Arthroscopic management of septic polyarthritis in a dog. *Aust Vet J* 11:681–683, 2002.

ARTICLE #2 CE TEST

This article qualifies for 2 contact hours of continuing education credit from the Auburn University College of Veterinary Medicine. Subscribers may purchase individual CE tests or sign up for our annual CE program. Those who wish to apply this credit to fulfill state relicensure requirements should consult their respective state authorities regarding the applicability of this program. To participate, fill out the test form inserted at the end of this issue or take CE tests online and get real-time scores at ***CompendiumVet.com****.*

1. OCD lesions of the stifle are most commonly located via arthroscopy in the _____ femoral condyle.
a. medial aspect of the lateral
b. medial aspect of the medial
c. lateral aspect of the lateral
d. lateral aspect of the medial
e. all of above

2. The indication(s) for arthroscopy of the hip is
a. dysplasia and dislocation.
b. osteoarthritis.
c. septic arthritis.
d. biopsy of bone, cartilage, or synovial membrane.
e. all of above

3. Which statement regarding arthroscopy of the tarsal joint is true?
a. Arthroscopy allows evaluation of ligamentous damage, intraarticular fractures, and tarsal instability.
b. Arthroscopy can be used to remove small bone fragments, reduce an avulsed fragment, and treat osteoarthritis and septic arthritis.
c. Arthroscopy can be used to obtain a biopsy specimen of bone, cartilage, or synovial membrane.
d. all of above
e. a and c

4. Which of the following is an advantage of arthroscopy compared with arthrocentesis in treating septic arthritis?
a. Arthroscopy allows precise assessment of the articular surface.
b. Arthroscopy improves prognostic accuracy.
c. Arthroscopy allows collection of specimens for culture and sensitivity testing.
d. Arthroscopy allows aggressive debridement of infected cartilage and diseased tissue.
e. all of the above

5. Which grade(s) of patellar luxation can be treated with arthroscopy?
a. grade 3
b. acute traumatic medial
c. grade 1 congenital
d. grade 2 congenital
e. b, c, and d

6. Which of the following is the most common type of medial meniscal injury associated with cranial cruciate ligament rupture?
a. horizontal tear
b. radial tear
c. bucket-handle tear
d. caudal meniscotibial ligament tear
e. parrot beak tears

7. Injury to the medial meniscus occurs in _____ of canine cases of cranial cruciate ligament rupture.
a. 20% to 30%
b. 20% to 40%
c. 40% to 50%
d. 50% to 60%
e. 50% to 70%

8. The indication(s) for arthroscopy of the stifle is
a. cruciate ligament evaluation.
b. cranial cruciate ligament repair.
c. meniscal examination and treatment.
d. to perform a biopsy of bone, cartilage, or synovial membrane.
e. all of the above

9. Which statement(s) regarding prognosis after treatment of stifle OCD with arthroscopy is true?
a. Osteoarthritis may continue to progress after surgical arthroscopy.
b. Lameness resolves within 2 weeks following arthroscopy.
c. Arthroscopy does not alleviate the need for concurrent conservative treatment (i.e., NSAID or chondroprotective therapy, weight control, and regular low-impact exercise).
d. all of above
e. a and b

10. Partial or complete cranial cruciate ligament tears can be diagnosed with
a. radiography.
b. MRI.
c. arthrotomy.
d. arthroscopy.
e. all the above