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Objective—To determine arthroscopic findings in lame horses with subtle radiographic lesions of the medial femoral condyle.

Design—Retrospective study.

Animals—15 horses examined because of lameness that had subtle radiographic evidence of osteochondral lesions involving the medial femoral condyle in at least 1 joint.

Procedure—Medical records were reviewed, and results of physical examination, radiography, and arthroscopy were recorded. Follow-up information was obtained through reexamination of the horses or telephone conversations with the referring veterinarians, owners, or trainers.

Results—Lameness severity ranged from grade 1 to 3 on a scale from 0 to 5. Radiography and arthroscopy were performed on 28 stifle joints. The 4 unaffected joints in 4 horses with unilateral hind limb lameness that underwent bilateral arthroscopy had no radiographic lesions, but 2 of the 4 had arthroscopic lesions. Of the remaining 24 joints, 20 had radiographic evidence of flattening of the apex of the medial femoral condyle and 4 had minimal subchondral lucency. Lesions were identified arthroscopically in 18 of the 20 joints with flattening of the condyle and in all 4 joints with subchondral lucency. Treatment consisted of abrasion arthroplasty or microfracture. Seven of the 9 horses with focal cartilage lesions and 2 of the 6 horses with generalized cartilage lesions were reportedly sound without any evidence of joint effusion at the time of final follow-up.

Conclusions and Clinical Relevance—Results suggest that horses with hind limb lameness and subtle radiographic lesions of the medial femoral condyle are likely to have arthroscopically apparent cartilage lesions and subchondral bone defects. (J Am Vet Med Assoc 2004;224:1821–1826)

Damage to the cartilage of the medial femoral condyle has long been recognized as a cause of lameness in horses.1–5 Delays in the diagnosis of such damage may increase the likelihood that osteoarthritis will develop; however, noninvasive evaluation of the articular surface of the medial femoral condyle can be problematic. Radiography is the standard technique for evaluation of the stifle joint in horses; however, it does not provide images of the synovial membrane or articular cartilage. Thus, lesions of the articular cartilage that are not associated with subchondral bone injury will not be apparent.1–3 Ultrasonography is useful for evaluating superficial soft tissue structures of the stifle joint1 and may be used to image the condylar surface.4–6 However, it requires good equipment and expertise in its use.6 Similarly, magnetic resonance imaging is useful in detecting pathologic changes in articular cartilage, menisci, ligaments, and subchondral bone in horses7 but is not widely available. At present, the most definitive method for detecting lesions of the articular cartilage of the medial femoral condyle is arthroscopic evaluation of the joint.

A previous study11 reported that horses with subtle radiographic lesions of the shoulder joint had arthroscopically apparent lesions, and we believe that the same may be true in horses with subtle radiographic lesions of the medial femoral condyle. The purpose of the study reported here was to determine arthroscopic findings in horses with subtle radiographic lesions of the medial femoral condyle. We hypothesized that horses with subtle radiographic evidence of flattening of the subchondral bone of the medial femoral condyle would have arthroscopically evident lesions of the articular cartilage in this area.

Criteria for Selection of Cases

Medical records of all horses that underwent arthroscopy of the medial aspect of the femorotibial joint at the Young-Crawford Veterinary Clinic in Innisfail, AB, Canada (1995–2000) or the University of Florida Veterinary Medical Teaching Hospital (2001–2002) were reviewed. Horses were included in the study if they had a history of unilateral or bilateral hind limb lameness localized to the stifle joint on the basis of physical examination findings (eg, joint effusion) and results of intra-articular anesthesia of the femorotibial joint and if they had radiographic evidence of subtle flattening of the subchondral bone of the medial femoral condyle in 1 or both hind limbs. Horses with radiographically obvious subchondral bone cysts were excluded from the study.

Procedures

Information obtained from medical records included signalment, occupation of the horse, affected
limb, duration and severity of lameness, and whether there was evidence of joint effusion. Responses to a hind limb flexion test and to intra-articular anesthesia of the femorotibial joint were recorded along with radiographic and arthroscopic findings, postoperative treatment, complications, and outcome.

In all horses, severity of lameness was evaluated while horses were walked and trotted in a straight line and while circling to the left and right. Lameness severity was graded on a scale from 0 (no evidence of lameness) to 5 (minimal weight bearing). Whether there was effusion in the medial compartment of the femorotibial joint was evaluated by means of palpation, and results were recorded as no effusion or mild, moderate, or prominent effusion. Hind limb flexion tests were performed on all horses, and results were recorded as positive if increased lameness was observed.

For the present study, radiographs of the stifle joints obtained prior to arthroscopy were reviewed. Contour of the medial femoral condyle was assessed on the caudocranial radiographic projection. Appearance of the subchondral bone of the medial femoral condyle was graded from 0 to 2, as described. A grade of 0 was assigned if there were no radiographic lesions of the subchondral bone of the medial femoral condyle (Fig 1), a grade of 1 was assigned when there was flattening of the apex of the medial femoral condyle, and a grade of 2 was assigned when minimal subchondral lucency was visible. Grades were assigned by the primary author and supervising surgeon. Individuals assigning grades were aware of the arthroscopic findings at the time grades were assigned and were in agreement on the assigned grade.

Surgical procedure—The medial compartment of the femorotibial joint was evaluated arthroscopically by use of a lateral approach as described, allowing examination of the articular surface of the medial femoral condyle, cranial pole of the medial meniscus, and cranial cruciate ligament. Phenylbutazone (4.0 mg/kg [1.8 mg/lb], IV) was given prior to surgery. Arthroscopic examination was performed initially with the limb flexed. Cartilage damage was described as local or extensive, and the medial meniscus and cranial cruciate ligament were assessed for evidence of traumatic injury. Lesions involving the weight-bearing surface of the medial femoral condyle were treated by means of abrasion arthroplasty or microfracture. For abrasion arthroplasty, defective cartilage was debrided and the superficial surface of the subchondral bone was abraded until mild bleeding was induced. Focal areas of malacic subchondral bone were removed by means of curettage. For the microfracture technique, defective cartilage was removed by means of curettage to create a perpendicular edge on the remaining healthy cartilage, allowing blood to pool in the defect. An orthopedic awl was used to create multiple holes in the exposed subchondral bone, resulting in multiple microfractures at the base of the defect. With both techniques, particular attention was paid to completely excising the calcified cartilage layer, as determined by the more granular appearance of the abraded subchondral bone after removal of the calcified cartilage.

Postoperative care—Horses were treated with phenylbutazone (2 mg/kg [0.9 mg/lb], PO, q 12 h) for 7 to 10 days after surgery. At discharge, owners were instructed to confine the horses to a stall for 30 days after surgery and then to a small paddock for an addi-
tional 60 days. Horses were allowed to resume light exercise 90 days after surgery, but regular exercise was not resumed for at least 6 months after surgery.

Follow-up evaluation—Outcome was determined by means of reexamination or through telephone interviews with the referring veterinarian, owner, or trainer. Follow-up information that was obtained included whether joint effusion had resolved, whether the horse was lame, and whether the horse had resumed its previous activity without recurrence of lameness. Outcome was considered successful if horses were no longer lame and had been able to return to their previous level of performance or their previous intended use. Outcome was considered unsuccessful if lameness persisted or returned during exercise.

Results

Fifteen horses met the criteria for inclusion in the study. In 2 horses with unilateral hind limb lameness, arthroscopy was performed only on the affected joint. In the remaining horses, arthroscopy was performed on both stifle joints, regardless of whether the horses had unilateral (n = 4) or bilateral (9) hind limb lameness. Thus, arthroscopy was performed on 28 stifle joints. Preoperative radiographs for all 28 joints on which arthroscopy was performed were available for review.

The 15 horses included 7 Warmbloods, 5 Quarterhorses, and 3 Thoroughbreds. Horses ranged from 10 months to 11 years old (mean, 4.4 years) at the time of arthroscopy. All horses were lame at the time of initial examination, with duration of lameness ranging from > 6 months to < 1 week. Seven horses were classified as having grade-1 lameness, 6 were classified as having grade-2 lameness, and 2 were classified as having grade-3 lameness. Mild effusion of the medial compartment of the femorotibial joint was evident in 10 joints, moderate effusion was evident in 10, and prominent effusion was evident in 4. The remaining 6 joints did not have palpable evidence of effusion (4 of these joints were the unaffected, contralateral joints in the 4 horses with unilateral hind limb lameness that underwent bilateral arthroscopy, and 2 were the unaffected joints in horses that underwent unilateral arthroscopy).

Intra-articular anesthesia of the medial compartment of the femorotibial joint improved the gait in 6 horses and eliminated the lameness in 5. Intra-articular anesthesia was not performed in the 4 remaining horses for behavioral or other reasons, but all 4 of these horses had evidence of joint effusion. Responses to hind limb flexion tests were variable.

The 4 unaffected joints in the 4 horses with unilateral hind limb lameness that underwent bilateral arthroscopy were assigned radiographic grades of 0 (no radiographic lesions). Of the remaining 24 joints, 20 were assigned a radiographic grade of 1 (flattening of the apex of the medial femoral condyle) and 4 were assigned a radiographic grade of 2 (minimal subchondral lucency). Subjectively, there did not appear to be any relationship between lameness scores and radiographic lesions scores. Three joints had radiographic evidence of mild osteophyte formation at the medial margin of the proximal aspect of the tibia; 6 joints had smoothly margined modeling in this area.

Abnormalities were identified in 24 of the 28 stifle joints that were examined arthroscopically. Cartilage and subchondral bone defects were found in all 4 joints with grade-2 radiographic lesions and in 18 of 20 joints with grade-1 radiographic lesions. Defects were also identified in 2 of the 4 joints without radiographic evidence of lesions (grade 0).

Cartilage lesions identified arthroscopically were characterized as focal or extensive lesions on the weight-bearing surface of the medial femoral condyle. During exploration with a blunt probe, areas of chondromalacia, cartilage delamination, fibrillation, and full-thickness fissures or cracks were identified. Fibrocartilage tags were identified in 2 joints. Eighteen joints had focal areas of cartilage damage on the weight-bearing surface of the medial femoral condyle. In the remaining 6 joints, extensive lesions of the cartilage of the medial femoral condyle were identified (Fig 2). Abnormalities in these 6 joints included frag-
mentation of the cartilage, areas of exposed subchondral bone, chondromalacia, and delamination. Three of these 6 joints had vertical tears in the cranial pole of the medial meniscus. Two of the joints with extensive lesions had grade-2 radiographic lesions; the remaining 4 had grade-1 radiographic lesions.

One of the horses with extensive lesions had received multiple injections of triamcinolone and hyaluronic in the affected joint. Another was a 10-month-old horse with large areas of cartilage damage and subchondral bone defects in both joints. The subchondral bone plate was soft and red and had a granular texture.

Cartilage lesions were identified in 22 of 24 joints in which synovial effusion in the medial compartment of the femorotibial joint was evident prior to surgery.

Follow-up information was available for all 15 horses. There were no reported postoperative complications. Six horses were reexamined by the authors, and in 3 of these, the follow-up examination included arthroscopic examination of the joint. Three of these 6 horses were sound without any evidence of joint effusion and had returned to their intended uses. The remaining 3 continued to be lame and were reexamined arthroscopically. In 1 horse, no improvement of the joint surface was evident and little fibrocartilage repair tissue was present. Another horse that had had extensive articular cartilage damage and a subchondral bone defect had marked synovitis and loose fibrocartilage in the form of fronds at the site of the original lesion. In the third horse, islands of firmly attached fibrocartilage were evident at the site of the original lesion.

For the remaining 9 horses, follow-up information was provided by the referring veterinarian or owner. Six of these horses were reported to be sound and to have returned to their intended use. Two horses were reported to be chronically lame and had been retired from active use. The remaining horse had been euthanized because of deterioration in its condition.

Seven of the 9 horses with focal cartilage lesions and 2 of the 6 horses with generalized cartilage lesions were reportedly sound without any evidence of joint effusion; follow-up time for these 9 horses was at least 32 weeks. Six horses with damage to the medial meniscus or generalized cartilage lesions continued to be lame.

**Discussion**

Results of the present study suggest that horses with hind limb lameness and subtle radiographic lesions of the medial femoral condyle are likely to have arthroscopically apparent cartilage lesions and subchondral bone defects. In horses with lameness localized to the stifle joint, the caudocranial radiographic projection of the medial femoral condyle should be carefully examined for any flattening of the apex of the condyle or subchondral lucency, as the appearance of such lesions suggests that arthroscopic exploration of the joint is warranted. Given that 2 of 4 clinically unaffected joints in the present study had arthroscopic evidence of cartilage lesions, there is justification for radiography and arthroscopy of both stifle joints, even in horses with unilateral lameness.

The radiographic grading system used in the present study was similar to the grading system used in a previous study to classify subchondral bone changes in the medial compartment of the femorotibial joint. Findings in the present study support those of the previous study in which the lateral trochlear ridge and medial femoral condyle were examined. The age range of horses in the present study was similar to the age range of horses in the previous study. Warmbloods may have been overrepresented in the present study by virtue of the case population. Authors of the previous study found arthroscopically identifiable cartilage lesions of the lateral trochlear ridge in 7 of 9 joints with grade-1 radiographic lesions (mild subchondral bone flattening) and 8 of 8 joints with grade-2 radiographic lesions (smooth subchondral bone concavity).

Similarly, arthroscopically identifiable cartilage lesions of the medial femoral condyle were identified in 5 of 6 joints with grade-2 radiographic lesions.

In the present study, cartilage lesions were identified arthroscopically in 18 of 20 joints classified as having grade-1 radiographic lesions and in 4 of 4 joints classified as having grade-2 radiographic lesions. Surprisingly, 2 of 4 joints without radiographic evidence of lesions were identified arthroscopically as having cartilage lesions.

Cartilage lesions observed in the present study likely had more than 1 cause. Cartilage lesions can develop secondary to ligament injury, arthritis, trauma, and osteochondrosis. For the young horses included in the present study, the early age at which lameness became apparent and the fact that lesions were identified bilaterally would suggest that osteochondrosis was a likely cause of the cartilage lesions. Failure of endochondral ossification in a small area on the femoral condyle could have resulted in the focal lesions identified in some horses in the present study, whereas cartilage lesions in the older performance horses were most likely a result of traumatic cartilage injury. Blunt trauma has been reported to cause articular cartilage damage in dogs, and subfracture loads have been reported to cause disruption of cartilage and subchondral changes that lead to arthritic-like degeneration of cartilage within 6 months. Chondral delamination injuries involving fracture of the cartilage surface and separation of uncalcified articular cartilage from calcified cartilage can cause pain in the knees of human athletes, and this delamination injury most commonly involves the medial femoral condyle in these athletes. Finally, soft tissue and meniscal injuries may also predispose to cartilage damage because they may cause joint instability, which may increase joint inflammation and the likelihood of mechanical damage to articular cartilage.

Ultrasonography can be used to image the patellar ligaments, menisci, and collateral ligaments of the stifle joint, and ultrasonography and radiography are complementary diagnostic procedures that are considered critical for complete evaluation of the joint. Ultrasonography was not performed on any of the horses included in the present study but may have identified some of the lesions identified arthroscopically.
One horse in the present study that had received multiple intra-articular injections of triamcinolone and hyaluronic had generalized cartilage lesions with minimal subchondral bone involvement. This treatment presumably allowed the horse to continue to compete at a high level, leading to continued mechanical trauma and extension of focal lesions to generalized areas of damaged cartilage. A previous report described 2 horses with generalized damage to articular cartilage of the medial femoral condyle that had received intra-articular cortisone treatment.

The youngest horse (10 months) in the present study had severe bilateral cartilage lesions. Both stifles joints were classified as having grade-2 radiographic lesions, and lesions seen arthroscopically appeared to consist of soft, red, devitalized tissue. There was no recognizable subchondral bone plate. A previous study suggested that osteochondral lesions develop prior to 7 months of age and that ischemic necrosis of cartilage secondary to a defect in vascular supply is an important factor. We speculate that lesions in this young horse were the early development of subchondral bone cysts.

Cartilage lesions identified during arthroscopy in the present study were treated by means of abrasion arthroplasty or microfracture. Both of these techniques expose subchondral bone and produce a fibrin clot containing mesenchymal stem cells capable of differentiating into either bone or cartilage. Variable results have been reported for abrasion arthroplasty techniques, which involve superficially abrading the subchondral bone to produce bleeding and a fibrin clot. Positive clinical results have been reported by some authors, but others have questioned the inclusion criteria that were used.

The microfracture technique is thought to produce a rough surface with small bone spicules at the periphery of the microfracture site to which the clot adheres, and in 1 study, this technique resulted in an increase in tissue volume and percentage of type-II collagen in full-thickness chondral defects in exercised horses. Because of the small number of horses treated with abrasion arthroplasty in the present study and the variation in severity of lesions that were treated, it was not possible to compare the outcome of 1 technique versus the other in the present study.

Previous reports have revealed that incomplete removal of calcified cartilage impairs healing, although the specific mechanism responsible for this has not been defined. Removal of the calcified cartilage appears to play a role in the attachment of reparative fibrocartilage to the subchondral bone. For the horse in the present study in which follow-up arthroscopy revealed only islands of firmly attached fibrocartilage on the exposed subchondral bone, we speculate that incomplete removal of the calcified cartilage layer inhibited fibrocartilage attachment. This horse subsequently underwent debridement of the lesion with a microfracture technique and eventually became sound.

Synovitis and capsulitis resulting from debris in the joint or fragmentation of the articular cartilage can contribute to the degenerative process of osteoarthritis by causing the release of enzymes, inflammatory mediators, and cytokines. Therefore, it is likely that even in horses in which subchondral bone change is not evident, synovial inflammation may be present. In the present study, all joints with arthroscopically apparent cartilage lesions also had some degree of inflammation of the synovial membrane.

As in a previous study, the severity of radiographically evident changes did not appear to correspond to severity of the arthroscopically visible lesions in the present study, in that horses with grade-2 radiographic lesions did not necessarily have the most severe arthroscopic lesions. Additionally, the degree of lameness did not correspond to the severity of lesions. This may have been influenced to some degree by the fact that there is a tendency to assign lower lameness grades to horses with bilateral lameness than to horses with unilateral lameness, because bilateral lameness produces a less asymmetric gait.

At present, arthroscopy provides the most accurate means of identifying the extent of cartilage lesions and subchondral bone defects. In the present study, it appeared that the best indicator of success was the amount of cartilage surface affected, with horses with focal lesions more likely to have a successful outcome than horses with generalized lesions. This is in agreement with findings in a previous study that examined the correlation between lesion size and racing performance after arthroscopic treatment of subchondral cystic lesions of the medial femoral condyle. In that study, it was found that the amount of cartilage surface disrupted by the lesion was more important than the depth of the lesion.

References


