Diagnostic findings and prognosis following arthroscopic treatment of subtle osteochondral lesions in the shoulder joint of horses: 15 cases (1996–1999)

Patricia S. Doyle, DVM, MS, and Nathaniel A. White II, DVM, MS, DACVS

EQUINE

Objective—To determine clinical, scintigraphic, radiographic, and arthroscopic findings and results of treatment in horses with lameness attributable to subtle osteochondral lesions of the shoulder joint.

Design—Retrospective study.

Animals—15 horses.

Procedure—Medical records were reviewed, and results of physical examination, scintigraphy, radiography, arthroscopy, and treatment were recorded.

Results—Severity of lameness ranged from grade 1 to 4. Response to shoulder flexion or extension was variable. Twelve horses had a narrow upright foot. Intra-articular anesthesia of the shoulder joint localized the cause of the lameness to the shoulder joint in 9 of 10 horses. Scintigraphic abnormalities were detected in 4 of 6 horses. Radiographic lesions were subtle and included glenoid sclerosis, focal glenoid lysis, small glenoid cysts, and alterations in the humeral head contour. Arthroscopic evaluation confirmed clefts in the glenoid cartilage, glenoid cysts, a humeral head cyst, fibrillation of the humeral head cartilage, cartilage fragmentation, or a nondisplaced fracture of the humeral head. After treatment, 12 horses returned to their previous level of performance, 1 was sound for light riding, 1 remained lame, and 1 was euthanatized because of chronic lameness.

Conclusions and Clinical Relevance—Results suggest that a combination of physical examination, scintigraphy, and radiography is necessary to diagnose subtle osteochondral lesions of the shoulder joint in horses. Arthroscopy can be used to confirm the diagnosis and treat cartilage and subchondral bone lesions. Young and middle-aged horses with subtle osteochondral lesions of the shoulder joints have a good prognosis for return to performance following arthroscopic treatment. (*J Am Vet Med Assoc* 2000;217:1878–1882)

Lameness originating from osteochondrosis lesions of the shoulder joint in young horses has been well-documented.[1-6] Although recognition and treatment of shoulder joint arthropathies has increased, the diagnosis and delineation of equine shoulder joint abnormalities can still be difficult. Unfortunately, a delay in diagnosis can increase the likelihood of secondary osteoarthritis, as these lesions have been reported to incite osteoarthritis much more rapidly than osteochondrosis in other joints.[7,8]

From The Marion duPont Scott Equine Medical Center, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Leesburg, VA 20177.

The cause of lameness in a horse can frequently be localized to a particular joint by use of intra-articular anesthesia. However, results may be misinterpreted if the anesthetic is mistakenly deposited periarticularly or if prolonged exposure to the local anesthetic is necessary before an improvement in the lameness is seen because of injury to the subchondral bone.[9] In addition, the response to intra-articular anesthesia can vary from 1 horse to the next, ranging from complete resolution of the lameness to only slight improvement.[5,9] Thermography has been helpful in assessing joint inflammation but appears most effective in localizing muscle strains or inflammation involving the proximal portion of the limb rather than subtle cartilage defects.[10]

Conventional radiography, although essential in evaluating abnormalities of the shoulder joint, is limited, as the synovial membrane and articular cartilage cannot be evaluated and changes in the subchondral bone may be subtle or delayed.[11] Furthermore, surrounding soft-tissue density in the region of the shoulder joint scatters radiation, limiting radiographic quality.[12] Although contrast arthrography may improve the chance of identifying shoulder joint lesions,[4] general anesthesia is recommended for this procedure. In addition, the contrast material induces a mild transient synovitis that lasts for 2 to 3 days.[4] The normal ultrasonographic anatomy of the shoulder region in horses has been described.[13] Although ultrasonographic detection of humeral head osteochondrosis has been reported, further investigation into that capability is suggested,[13] and evaluation of the glenoid is understandably limited.

Scintigraphy is a sensitive method of detecting increased bone metabolism and is frequently an excellent method for localizing lameness.[14-17] However, its usefulness is limited when evaluating chronic injuries, osteochondrosis,[18] and areas with overlying large muscle masses or normal bone, which increases the distance between the camera and the lesion.

Arthroscopy has become an accepted technique for evaluation of joints in the lower portion of the limbs as well as for evaluation of the shoulder joint in horses.[2,11,19-24] Although shoulder joint arthroscopy is technically demanding, its use has eliminated the need for shoulder joint arthrotomy and has allowed many young horses to return to soundness.[1,2,7]

The purpose of the study reported here was to determine clinical signs, radiographic and scintigraphic abnormalities, and outcome in young and middle-aged horses in which lesions of the shoulder joint cartilage and subchondral bone were seen arthroscopically.

Criteria for Selection of Cases

Medical records of all horses undergoing arthroscopic surgery of the shoulder joint at the Marion duPont Scott Equine Medical Center between March 1996 and February 1999 were reviewed. Horses were included in the study if an osteochondral lesion was identified during arthroscopy of the shoulder joint, there was a history of lameness, and only minimal changes were seen on radiographs of the affected joint. Horses with distinct radiographic lesions were excluded.

Procedures

Information obtained from the medical records included history; signalment; physical evaluation findings; scintigraphic, radiographic, and arthroscopic findings; postoperative treatment; complications; and outcome. All horses were evaluated while walking in a straight line on a smooth surface. Most were also evaluated while trotting in a straight line and while circling in both directions on soft and hard surfaces. Pertinent limb flexion tests were also performed on a selected basis.[25] Lameness was graded based on the accepted scale of 0 to 4.[25] Improvement in the severity of lameness was recorded if intra-articular anesthesia had been performed.

Individual horses underwent nuclear scintigraphy before the lameness was localized to the shoulder joint with intra-articular anesthesia or after surgery to monitor healing. For scintigraphy, horses were sedated, and technetium Tc 99m medronate was administered IV (200 mCi). The gamma camera used was a rectangular large-field-of-view camera with a low-energy high-resolution parallel hole collimator[a] or a round-field-of-view camera with a low-energy all-purpose collimator.[b] The counts obtained ranged from 100,000 to 150,000 and were equivalent to the count for the contralateral shoulder joint.

Radiographic evaluation of the shoulder joint involved obtaining a mediolateral view of the joint with the horse standing or anesthetized. Radiographs were examined for evidence of subchondral bone lucency or sclerosis, subchondral bone cyst formation, osteophyte formation, and osteochondral fragmentation. Horses were classified as having no radiographic lesions, suspect lesions, or subtle lesions.

The decision to evaluate the shoulder joint arthroscopically was made on the basis of results of scintigraphy or the owner's desire to have a definitive diagnosis and prognosis. Arthroscopic evaluation of the shoulder joint was performed, as described.[2,22,23] Cartilage damage was classified as fibrillation, fragmentation, or a partial- or full-thickness erosion. The size of each defect was estimated, and the cranial-caudal and lateral-medial dimensions were recorded. Subchondral bone was described as malacic (softened) or sclerotic (dense). Partial-thickness cartilage damage was debrided without penetrating the subchondral bone, whereas full-thickness lesions were excised to normal-appearing subchondral bone.

Outcome was determined by means of reexamination or telephone interview with the owner or trainer. During telephone interviews, the owner and trainer were asked whether the horse was lame, whether the horse had returned to work, and whether the lameness had resolved.

Results

Fifteen horses with unilateral shoulder joint abnormalities were included in the study. Breeds represented included Thoroughbred (n = 7), Dutch Warmblood (4), Warmblood (1), Oldenburg (1), Thoroughbred cross (1), and Belgian cross (1). Four horses were used for racing, 3 were used for show jumping, 3 were used for dressage, 2 were used for 3-day eventing, 1 was a field hunter, 1 was a carriage horse prospect, and 1 was a 3-day event prospect. Age at the time of surgery ranged from 1 to 11 years (median, 4.7 years). Duration of the lameness prior to surgery ranged from 1 month to 3 years.

Lameness localized to the shoulder joint ranged from an intermittent subtle lameness (grade 1) with a shortened anterior phase of stride to an obvious lameness at the walk (grade 4). Response to flexion and extension of the shoulder was variable. Twelve horses had an upright hoof-pastern angle with a narrow small foot. Intra-articular anesthesia of the shoulder joint was performed in 10 horses. Following intra-articular administration of carbocaine, lameness did not improve in 1 horse, improved by 1 grade in 2, and improved by 2 or more grades or resolved completely in the remaining 7. Scintigraphy was performed in 6 horses, and 4 had scintigraphic abnormalities. Mild diffuse localization of the radioisotope to the humeral growth plate was evident in 1 horse; the other 3 had focal intense localization of the radioisotope to the humeral head (**Fig 1**). The site of radioisotope local-

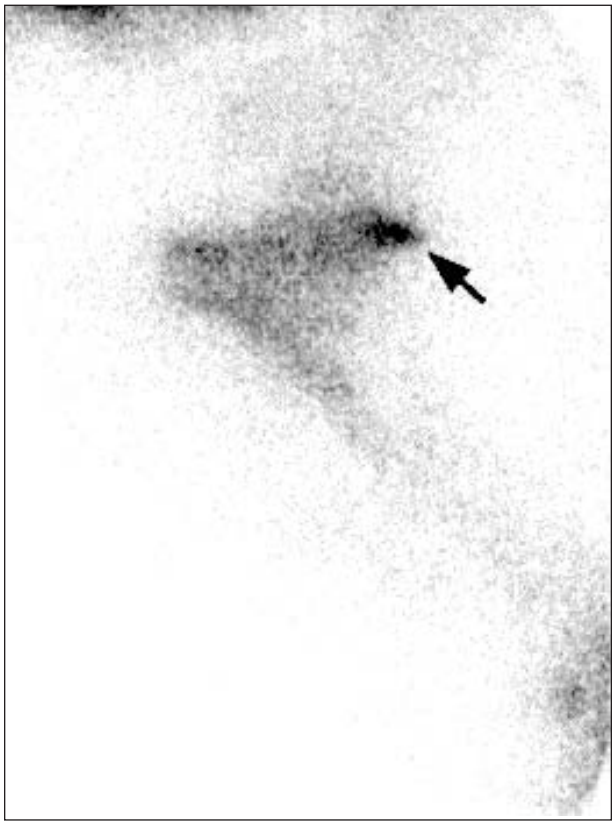

Figure 1—Lateral scintigraphic view (bone phase) of the left shoulder of a horse. Notice the area of focal intense radioisotope uptake in the caudal aspect of the humeral head (arrow).

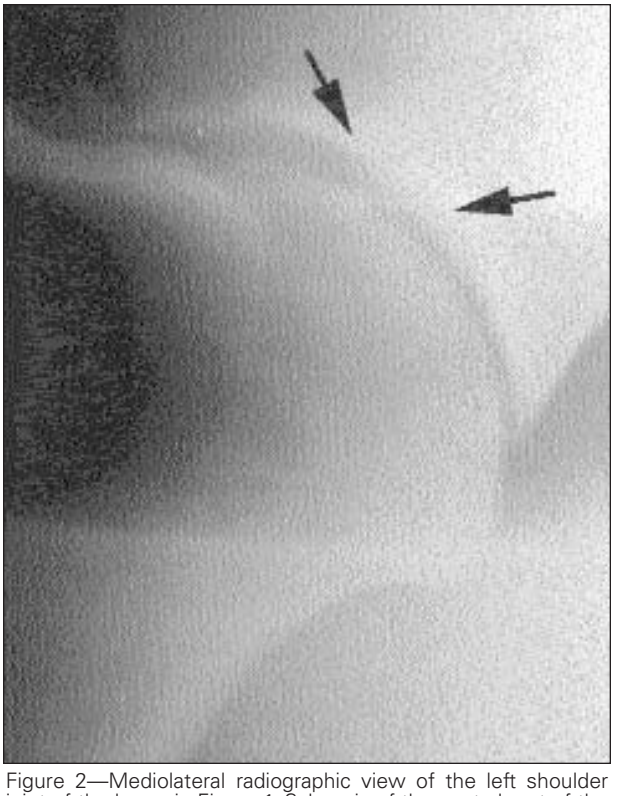

Figure 2—Mediolateral radiographic view of the left shoulder joint of the horse in Figure 1. Sclerosis of the central part of the glenoid cavity is evident (arrows).

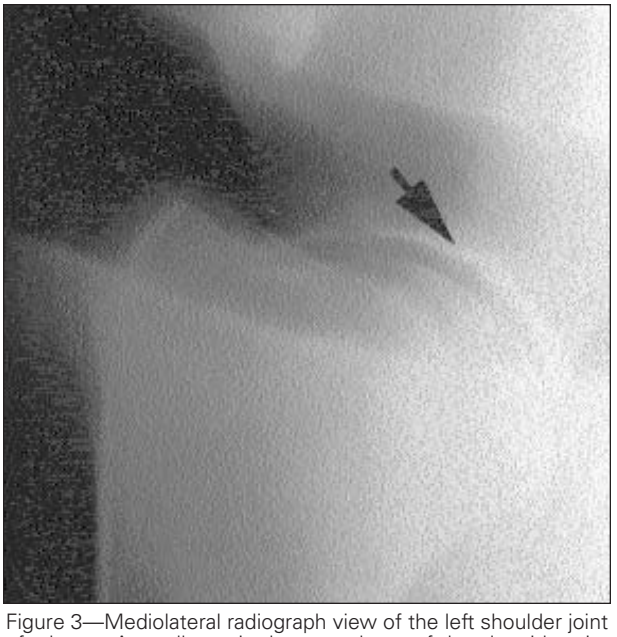

Figure 3—Mediolateral radiograph view of the left shoulder joint of a horse. A small cyst in the central part of the glenoid cavity is evident (arrow).

ization did not always correlate with the site of radiographic or arthroscopic lesions. Radiographic lesions were subtle and included glenoid sclerosis (3 horses), focal glenoid lysis (2), glenoid cysts (7), and alterations in the humeral head contour (4; **Fig 2** and **3**). Arthroscopic abnormalities included clefts in the glenoid cartilage (4 horses), glenoid cysts (8), a humeral

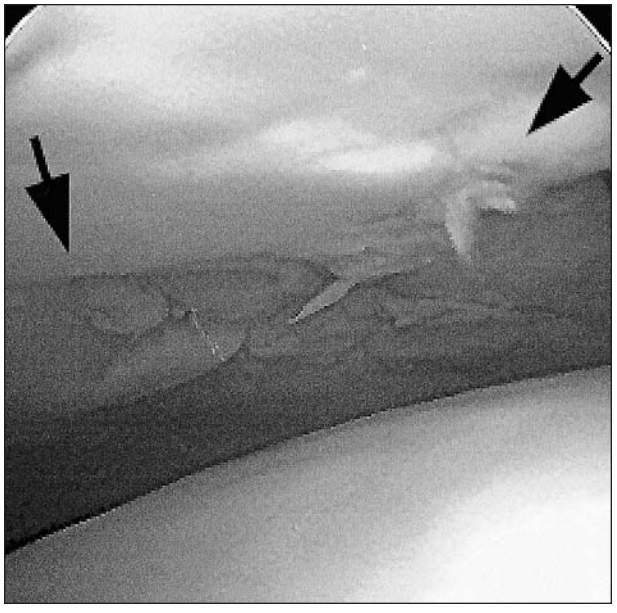

Figure 4—Arthroscopic view of the left shoulder joint of the horse in Figure 1. Irregular cartilage formation and fragmentation is evident in the central part of the glenoid cavity (arrows).

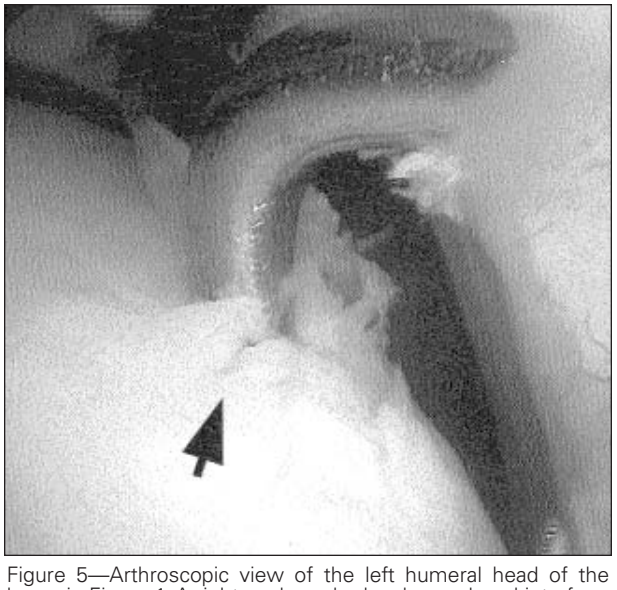

Figure 5—Arthroscopic view of the left humeral head of the horse in Figure 1. A right angle probe has been placed into fragmented cartilage (arrow) on the caudal aspect of the humeral head at the site of increased radioisotope uptake on the scintigram.

head cyst (1), fibrillation of the humeral head cartilage (3), cartilage fragmentation (1), and a nondisplaced fracture of the humeral head (1; **Fig 4** and **5**). Abnormal cartilage was removed from each joint, and the lesion was debrided to the level of healthy-appearing subchondral bone. The entire glenoid lesion could not be completely debrided in 1 horse. The humeral head fracture in another horse was not disturbed.

No incisional complications occurred. Postoperative treatment consisted of stall confinement and phenylbutazone for all horses. Five horses were treated with triamcinolone[c] and sodium hyaluronate[d] by intraarticular injection 1 month after surgery, 8 were treat-

ed with polysulfated glycosaminoglycan[e] IM, and 11 were treated with sodium hyaluronate[f] IV. At the time of final follow-up, 12 horses were sound and were able to perform at their previous level. One horse was sound for light riding; 1, although improved, remained lame; and 1 was euthanatized because of continued lameness attributed to shoulder joint abnormalities.

Discussion

In horses, a diagnosis of lameness attributable to an abnormality of the shoulder joint can frequently be made by observing the character of the horse's gait and the results of limb manipulation and intra-articular anesthesia.[3,5-7,9] Often, however, lameness is attributed to an abnormality of the upper portion of the limb by excluding problems involving the distal portion. In the present study, 12 of 15 horses had a narrow upright foot, and as suggested,[5,25] this foot configuration should probably be considered an indicator of a possible shoulder joint abnormality in horses with forelimb lameness. Radiography is often used to make a definitive diagnosis of subchondral bone defects caused by cartilage damage or osteochondrosis in horses,[4,5,26] but in the horses described in the present report, arthroscopic examination of the shoulder joint was necessary to make a definitive diagnosis. This is similar to findings for horses with occult lesions involving other joints.[19,24]

The distribution of breeds included in the present study was similar to the distribution of breeds of horses examined at the hospital during the study period, and neither a particular breed nor a particular use of horse appeared to be overrepresented. Although osteochondrosis is more common in young horses,[2] the broad age range of horses included in the present study suggests that remnants of osteochondrosis may cause problems in older horses or that trauma is a primary cause of cartilage damage in sites that are reported to have a predilection for osteochondrosis.[25] Our results suggest that young and middle-aged horses can have subtle cartilage and subchondral bone lesions causing lameness localized to the shoulder joint. Although a definitive conclusion could not be reached, the history suggested that physical injury may have played a role in the lameness.

Scintigraphy was helpful in localizing the cause of lameness in several horses in the present study with subtle or intermittent lameness, which made routine lameness evaluation difficult or impossible. Although focal intense radiopharmaceutical uptake definitively isolated the cause of the lameness to the shoulder joint in 3 horses, the remaining horse had only mild diffuse radioisotope localization in the growth plate. However, findings in this horse were sufficiently different from findings for the contralateral limb to warrant further evaluation by radiography and arthroscopy. Because radioisotope localization is dependent on blood flow and osteoblastic activity,[14] subchondral bone cysts and small areas of cartilage damage may not be detected unless osteoblastic activity in the surrounding bone is activated or degeneration along the joint surface has been initiated. Other causes for the lack of definitive radioisotope localization in an affected joint include patient motion associated with the long acquisition times and an increased lesion-to-camera distance because of the overlying muscle and bone.[27] In the present study, the site of increased radioisotope uptake was sometimes adjacent to the actual location of the radiographic and arthroscopic lesions. This likely represents adaptive bone remodeling seen with exercise in some performance horses or nonadaptive remodeling associated with subchondral bone lesions that were undetectable radiographically or arthroscopically.[28] Scintigraphic lesions directly adjacent to the osteochondral lesions identified at surgery were likely evident as a result of other sites of damaged subchondral bone.[29] The relationship of these distant subchondral bone injuries with the articular lesions seen arthroscopically was not known.

Delays in detecting subchondral bone changes radiographically after bone or joint injury have been described.[15] In the present study, subchondral bone changes detected scintigraphically in 2 horses as focal sites of intense radioisotope uptake in the caudal part of the humeral head were not evident radiographically until 6 weeks later. For all horses in the present study, radiographs of the affected joints appeared normal or had equivocal subchondral bone changes. Although radiography could be performed with the horse standing in most instances, some horses had to be anesthetized for optimal shoulder joint radiography.

Detection of subtle radiographic changes requires experience with the normal radiographic appearance. Central glenoid sclerosis and small glenoid cysts can easily be overlooked, but as in the present study, they can be associated with cartilage defects. Sclerosis and adjacent osteophyte formation were sometimes seen radiographically and were associated with cartilage clefts that reached the level of the subchondral bone.[24]

In the present study, horses < 4 years old had a fracture or lesions suspected to be a result of osteochondrosis. Conversely, horses between 4 and 11 years old had small cartilage lesions that appeared to be old osteochondrosis lesions or a result of damage associated with a traumatic insult. Eight horses > 4 years old had a history of a traumatic insult that may have caused the cartilage fracture, fibrillation, malacia, and subchondral bone damage that was seen. Secondary arthritic changes were evident as diffuse cartilage fibrillation, osteophyte formation, and subchondral bone sclerosis. Because of the location of the cartilage lesions, results of the arthroscopic evaluation did not always correlate with the scintigraphic or radiographic findings. In general, the cartilage damage was more extensive than suspected from the scintigraphic or radiographic findings.[1,19,24] In addition, cartilage infolding and small subchondral cyst formation were seen, particularly in the glenoid cavity, without distinct radiographic or scintigraphic changes. Osteochondral defects visibly similar to osteochondrosis lesions were seen in the glenoid cavity in horses with damage to the caudal aspect of the humeral head. Although some of these defects appeared to be incidental findings, specific debridement of these cartilage defects resolved the lameness.

Outcome of the horses in the present study sug-

gests that the prognosis for young and middle-aged horses with osteochondral defects of the shoulder joint is good following arthroscopic surgery. Previous reports[7,8] of horses with shoulder joint abnormalities that did not respond well to conservative treatment and rapidly developed secondary osteoarthritis has deterred owners and veterinarians from pursuing arthroscopic evaluation. Results of the present study, however, suggest that most such articular abnormalities are focal and in a position to allow arthroscopic treatment. Therefore, the authors suggest that arthroscopic surgery should be considered as an alternative to early retirement or when initial intra-articular treatment fails, even in horses > 4 years old.

In conclusion, horses with lameness possibly attributable to osteochondral lesions of the shoulder joint benefit from a thorough evaluation, which includes a thorough lameness examination, scintigraphy, radiography, and arthroscopy. Horses with subtle radiographic lesions, scintigraphic abnormalities, or a positive response to intra-articular anesthesia of the shoulder joint should be suspected to have cartilage and subchondral bone lesions. Furthermore, subtle radiographic changes that previously were considered to be unimportant or to represent bone changes not requiring surgical treatment should be considered evidence of shoulder joint lesions. Horses with traumatic lesions and old osteochondrosis lesions involving the shoulder joint can benefit from arthroscopic treatment of the lesions, potentially enabling them to return to their previous level of performance.

[a]Omega 500, Technicare, Cleveland, Ohio.
[b]GE, Maxicamera, Hoersholm, Denmark.
[c]Vetalog, 6 mg/ml, ER Squibb & Sons, Mendota Heights, Minn.
[d]Legend, 10 mg/ml, Bayer, Shawnee Mission, Kan.
[e]Adequan, 100 mg/ml, Luitpold Pharmaceuticals, Shirley, NY.
[f]Legend IV, 10 mg/ml, Bayer, Shawnee Mission, Kan.

References

1. Bertone AL, McIlwraith CW. Osteochondrosis of the equine shoulder: treatment with arthroscopic surgery, in *Proceedings*. Am Assoc Equine Practitioners 1987;33.
2. Bertone AL, McIlwraith CW, Powers BE, et al. Arthroscopic surgery for the treatment of osteochondrosis in the equine shoulder joint. *Vet Surg* 1987;16:303–311.
3. Dyson S. Shoulder lameness in horses: an analysis of 58 suspected cases. *Equine Vet J* 1986;18:29–36.
4. Nixon AJ, Spencer CP. Arthrography of the equine shoulder joint. *Equine Vet J* 1990;22:107–113.
5. Nyack B, Morgan JP, Pool R, et al. Osteochondrosis of the shoulder joint of the horse. *Cornell Vet* 1981;71:149–163.
6. Schmidt GR, Dueland R, Vaughan JT. Osteochondrosis dissecans of the equine shoulder joint. *Vet Med Small Anim Clin* 1975;70:542–547.
7. Nixon AJ. Osteochondrosis of the shoulder and elbow. In: White NA, Moore JN, eds. *Current practice in equine surgery*. Philadelphia: JB Lippincott Co, 1990;516–526.
8. Trotter GW, McIlwraith CW. Osteochondritis dissecans and subchondral cystic lesions and their relationship to osteochondrosis in the horse. *J Equine Vet Sci* 1981;1:157–162.
9. Dyson S. Diagnostic techniques in the investigation of shoulder lameness. *Equine Vet J* 1986;18:25–28.
10. Turner TA. Thermography. In: White NA, Moore JN, eds. *Current techniques in equine surgery and lameness*. 2nd ed. Philadelphia: WB Saunders Co, 1998;606–612.
11. Moore RM, Schneider RK. Arthroscopic findings in the carpal joints of lame horses without radiographically visible abnormalities: 41 cases (1986–1991). *J Am Vet Med Assoc* 1995;206:1741–1746.
12. Butler JA, Colles CM, Dyson SJ, et al. The shoulder, humerus and elbow. In: *Clinical radiology of the horse*. 1st ed. Cambridge, Mass: Blackwell Science Inc, 1996;173–175.
13. Tnibar MA, Auer JA, Bakkali S. Ultrasonography of the equine shoulder: technique and normal appearance. *Vet Radiol Ultrasound* 1999;40:44–57.
14. Devous MD Sr, Twardock AR. Techniques and applications of nuclear medicine in the diagnosis of equine lameness. *J Am Vet Med Assoc* 1984;184:318–325.
15. O'Callaghan MW. The integration of radiography and alternative imaging methods in the diagnosis of equine orthopedic disease. *Vet Clin North Am Equine Pract* 1991;7:339–364.
16. Seeherman HJ, Morris E, O'Callaghan MW. The use of sports medicine techniques in evaluating the problem equine athlete. *Vet Clin North Am Equine Pract* 1990;6:239–274.
17. Williams J, Miyabayashi T, Ruggles A, et al. Scintigraphic and ultrasonographic diagnosis of soft tissue injury in a Thoroughbred horse. *J Vet Med Sci* 1994;56:169–172.
18. Seeherman H. Clinical applications of bone scanning. In: White NA, Moore JN, eds. *Current techniques in equine surgery and lameness*. 2nd ed. Philadelphia: WB Saunders Co, 1998;592–605.
19. Kannegieter NJ, Burbidge HM. Correlation between radiographic and arthroscopic findings in the equine carpus. *Aust Vet J* 1990;67:132–133.
20. Kannegieter NJ, Colgan SA. The incidence and severity of intercarpal ligament damage in the equine carpus. *Aust Vet J* 1993;70:89–91.
21. McIlwraith CW, Fessler JF. Arthroscopy in the diagnosis of equine joint disease. *J Am Vet Med Assoc* 1978;172:263–268.
22. McIlwraith WC, Bertone AL. Diagnostic and surgical arthroscopy of the scapulohumeral (shoulder) joint. In: McIlwraith CW, ed. *Diagnostic and surgical arthroscopy in the horse*. 2nd ed. Philadelphia: Lea & Febiger, 1990;196–209.
23. Nixon AJ. Diagnostic and surgical arthroscopy of the equine shoulder joint. *Vet Surg* 1987;16:44–52.
24. Schneider RK, Jenson P, Moore RM. Evaluation of cartilage lesions on the medial femoral condyle as a cause of lameness in horses: 11 cases (1988–1994). *J Am Vet Med Assoc* 1997;210:1649–1652.
25. Stashak TS. Diagnosis of lameness. In: Stashak TS, ed. *Adams' lameness in horses*. 4th ed. Philadelphia: Lea & Febiger, 1987;106, 120–122.
26. Dyson S. Interpreting radiographs 7: radiology of the equine shoulder and elbow. *Equine Vet J* 1986;18:352–361.
27. Daniel GB, Poteet B, Kowalsky RD. Image artifacts and quality control. In: Berry CR, Gregory GB, eds. *Handbook of veterinary nuclear medicine*. San Antonio, Tex: QRSystems Inc, 1996;36–44.
28. Ehrlich PJ, Seeherman HJ, O'Callaghan MW, et al. Results of bone scintigraphy in horses used for show jumping, hunting, or eventing: 141 cases (1988–1994). *J Am Vet Med Assoc* 1998;213:1460–1467.
29. Steckel RR. The role of scintigraphy in the lameness evaluation. *Vet Clin North Am Equine Pract* 1991;7:207–239.