Diseases of the Musculoskeletal System

EXAMINATION OF THE MUSCULOSKELETAL SYSTEM

The clinical examination of the musculoskeletal system and the feet of farm animals includes the following special examinations.

1- Analysis of Gait and Conformation

Inspection of the gait of the animal is necessary to localize the site of lameness. Evaluation of its conformation may provide clues about factors that may contribute to lameness. Information related to gait and abnormalities of the nervous system. Computer-assisted analysis of gait (kinematics) and hoof loading (via force plates) are commonly used in equine practice and are increasingly being used in research studies related to lameness in cattle and pigs.

2- Close Physical Examination

A close detailed physical examination of the affected area is necessary to localize the lesion. This includes passive movements of limbs to identify fractures, dislocations, and pain on movement. Muscles can be palpated for evidence of enlargement, pain, or atrophy

3- Radiography

Radiography remains an extremely useful diagnostic method for diseases of bones and joints and soft tissue swelling of limbs, which cannot be easily defined by physical examination. Detailed radiographic information about the joint capsule, joint cavity, or articular cartilage can be obtained using negative (air), positive, or

double-contrast arthrography. The widespread availability of digital imaging systems (direct radiography [DR]) now permits radiographs to be immediately examined on-site, rather than following development in the clinic. This ensures that good-quality images are obtained in all views, and the information is used in real time to direct treatment. The price of digital radiography systems continues to decrease but is still significant relative to ultrasonography

4- Ultrasonography

Most large animal veterinary practices have an ultrasound machine that is used for diagnosis in cattle and horses and use of these machines with a 5.0- or 7.5-MHz linear transducer provides a rapid on-farm method for evaluating musculoskeletal, tendon, and joint diseases. Ultrasonography is cheaper and provides different information than that provided by radiography; it is also less invasive than joint fluid aspiration and analysis. Detailed information about the use of ultrasonography to diagnose bovine musculoskeletal disorders is available.

Recent advances in ultrasound technology, including harmonic imaging, compound imaging, three-dimensional (3D) imaging, elastography, and fusion imaging will increase the clinical utility of ultrasonography in ambulatory practice. Ultrasonographic examination of the stifle region in cattle has successfully imaged homogeneously echogenic patellar and collateral ligaments, the combined tendon of the long digital extensor and peroneus tertius muscles, the popliteal tendon, the anechoic articular cartilage of femoral trochlea, the echogenic menisci, and the hyperechoic bone surfaces were imaged successfully. The boundaries of the joint pouches became partially identifiable only when small amounts of anechoic fluid were present in the medial and lateral femorotibial joint pouches.

The main indication for ultrasonography of the bovine stifle is evaluation of acute septic and traumatic disorders of the region, when specific radiographic signs are often nonspecific or absent. The cruciate ligaments could not be imaged in live cattle. The cruciate ligaments are identifiable using ultrasonography in the horse, in which flexion of the hindlimb is a routine procedure necessary for identification of these structures. The main indication for ultrasonographic examination of the carpal region in cattle is the evaluation of septic and traumatic disorders of the carpal joints and tendon sheaths. Each tendon and tendon sheath in the carpal region must be scanned separately. The use of a stand-off pad is recommended because it permits adaptation of the rigid transducer to the contours of the carpus. The carpal joint pouches and tendon sheath lumina are not clearly defined in healthy cattle. Thus the ability to image these structures indicates the presence of synovial effusion. **Ultrasonographic imaging can be used to differentiate the pathologic changes in the soft tissue structures of digital flexor tendon sheaths of cattle. Ultrasonography is a valuable diagnostic aid for septic arthritis. Joint effusion, which is one of the earliest signs of septic arthritis; the accurate location of soft tissue swelling; the extent and character of joint effusion; and involvement of concurrent periarticular synovial cavities or other soft tissue structures can be imaged by ultrasonography. The ultrasonogram can image the presence of small hyperechogenic fragments within the joint, which appear very heterogeneous. Normal synovial fluid is anechoic and appears black on the sonogram. A cloudy appearance is usually associated with the presence of pus.** Ultrasonography has been used to evaluate the anatomy of the elbow, carpal, fetlock, and stifle joints of clinically normal sheep using a 7.5-MHz linear transducer with a stand-off pad. The anatomic structures that could be consistently identified in normal ovine joints

included bone, articular cartilage, ligaments, and tendons. In sheep with chronic arthritis/synovitis, the gross thickening of the joint capsule is visible as a hyperechoic band up to 20 mm thick.

5- Arthrocentesis and Synovial Fluid Interpretation

Joint fluid is collected by needle puncture of the joint cavity (arthrocentesis) and examined for the presence of cells, biochemical changes in the joint fluid, and the presence of infectious agents. Analysis of synovial fluid is a fundamental requirement for differentiating septic arthritis from degenerative arthritis, and fluid parameters. A number of inflammatory biomarkers in synovial fluid have been evaluated in research studies, but the leukocyte counts and differential, erythrocyte count, total protein concentration, and an index of viscosity usually provide sufficient information for clinical use. Arthrocentesis can result in joint contamination with hair when a 20-g needle is inserted. Angled needle insertion reduces joint contamination relative to perpendicular insertion. Insertion of a spinal needle with the stylet in place also reduces joint contamination with hair, relative to insertion without the stylet. A larger-diameter needle (19 g) had a higher risk of hair contamination after arthrocentesis than a 20-g needle

6- Arthroscopy

Special endoscopes are available for inspection of the joint cavity and articular surfaces (arthroscopy). Diagnostic and surgical arthroscopy are now commonplace in specialized equine practice.

Surgical arthroscopy is rapidly replacing conventional arthrotomy for the correction of several common surgical conditions of the musculoskeletal system of the horse. Accurate quantification of equine carpal lesions is possible when the procedure is

performed by an experienced arthroscopist. Convalescent time following surgery is decreased and the cosmetic appearanceimproved compared with arthrotomy. A synovial membrane biopsy can be examined histologically and for infectious agents and may yield useful diagnostic information. Surgical arthroscopy is being increasingly used in referral cattle practice.

7- Serum Biochemistry and Enzymology

When disease of bone or muscle is suspected, the serum concentration of calcium and phosphorus, the serum alkaline phosphatase activity, and the serum activity of two muscle-derived enzymes, creatinine kinase (CK) and aspartate aminotransferase (AST), also known as serum glutamic oxaloacetic transaminase (SGOT), may be useful. Both CK and AST are sensitive indicators of muscle cell damage, with CK also being specific. Equations have been developed that relate the change in serum CK activity to grams of skeletal muscle tissue damaged; this methodology should be widely applied in the clinical management of livestock with musculoskeletal injury because it is sufficiently sensitive to pick up skeletal muscle damage as a result of an intramuscular (IM) antibiotic injection. Other serum biochemical indicators of muscle damage that have been used in experimental studies include myoglobin, a lowmolecular-weight protein that is an early marker of muscle damage, and two indices of muscle damage: myosin, a high-molecular weight protein, and 3-methylhistidine, a posttranslationally modified amino acid released after myosin or actin degradation. In normally hydrated animals with normal renal function, it is important to understand that serum creatinine concentration provides a useful index of skeletal muscle mass. The serum

concentrations of calcium and phosphorus and the serum alkaline phosphatase activity are much less sensitive indicators of osteodystrophy.

8- Muscle Biopsy

A muscle biopsy may be useful for microscopic and histochemical evaluations

9- Infrared Thermography

Infrared thermography has been increasingly applied to the diagnosis of inflammatory conditions of muscles and tendons, in that acute inflammation is associated with localized heat that can be detected by using a camera capable of imaging the infrared spectrum.

10- Nuclear Scintigraphy

Technetium-labeled bone scanning has been available for decades at major referral institutions, but the use of nuclear scintigraphy has declined with the increased availability and resolution of ultrasonographic and magnetic resonance imaging (MRI) units. Nevertheless, scintigraphy is still a valuable diagnostic method for bone diseases such as osteomyelitis of the vertebral column in adult horses and cattle when the lesion is surrounded by a large mass of superimposing muscle.

11- Magnetic Resonance Imaging

MRI is increasingly being used for the diagnosis of musculoskeletal disease and related research studies. As a cross-sectional imaging modality, it provides outstanding tissue contrast and multiple views of the region of interest. Because of the high cost of purchasing and maintaining MRI equipment, this modality is only available at large referral centers, and even then, specially constructed tables have to be made to permit imaging of adult horses and cattle under general anesthesia.

High-quality images can usually be obtained from the carpus and hock to the hoof or foot. It is anticipated that rapid advances will be made in the clinical application of MRI to the diagnosis of specific musculoskeletal injuries, such as evaluating cartilage damage and navicular disease in horses.

12- Computed Tomography

Computed tomography (CT) has not been used much for the clinical analysis of musculoskeletal tissue. It is anticipated that continued advances in MRI technology will continue to make this the preferred anatomic technology, despite the development of CT units in Europe that can accommodate the standing horse.

13- Nutritional History

Because the most important osteodystrophies and myopathies are nutritional in origin, a complete nutritional history must be obtained. This should include an analysis of the feed and determination of the total amount of intake of each nutrient, including the ratio of one nutrient to another in the diet.

14- Environment and Housing

When outbreaks of lameness occur in housed cattle, sheep, and goats, the quality of the floor must be examined to evaluate the possibility of floor-related injuries.