

Diagnostic Imaging in Bovine Orthopedics

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KEYWORDS

- Radiology • Ultrasonography • Computed tomography
- Magnetic resonance imaging • Musculoskeletal disorders • Cattle

KEY POINTS

- Ultrasonography is an imaging modality that can be applied anywhere in bovine practice and allows rapid, noninvasive differentiation of soft-tissue structures of the bovine musculoskeletal system.
- Ultrasound units with 5.0- to 7.5-MHz linear transducers, commonly used in large animal reproduction, are well suited for rapid and straightforward differentiation of soft-tissue swelling in the limbs. In addition, ultrasonography can be very helpful for detection of foreign bodies in the limbs or trunk that cannot be diagnosed radiographically.³⁹
- Ultrasonography provides accurate information about the location, size, and the nature of the content of lesions or fluid-filled cavities and the surrounding tissues, making puncture precise and safer.
- The physiologic amount of synovial fluid of normal synovial cavities in cattle cannot be imaged by ultrasonography; visualization of effusion is easy and usually indicates an inflammatory process.
- Ultrasonography can detect early stages of inflammation of synovial cavities based on an increased amount of effusion and distension of the synovial pouch.
- However, radiography remains still the method of choice for evaluation of bone lesions, such as fractures, luxation, and osteomyelitis.
- An early diagnosis, accurate anatomic differentiation of the soft-tissue structures involved, characterization of the lesions, and a thorough preoperative inspection of incriminated regions are of enormous benefit in determining an accurate prognosis and for planning surgery and treatment.

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INTRODUCTION

A careful clinical and orthopedic examination is always the first step in making a diagnosis of bovine limb disorders before diagnostic imaging techniques are applied.^{1–5} A radiographic unit is not standard equipment for bovine practitioners in hospital or field situations.^{6,7} However, ultrasound machines with 7.5-MHz (multifrequency) linear transducers have been used in bovine reproduction for many years, and are eminently suitable for evaluation of orthopedic disorders.^{8,9}

The goal of this article is to encourage veterinarians to use radiology and ultrasonography for the evaluation of bovine orthopedic disorders. These diagnostic imaging techniques improve the likelihood of a definitive diagnosis in every bovine patient, but especially in highly valuable cattle, whose owners demand increasingly more diagnostic and surgical interventions that require high-level specialized techniques.¹⁰

RADIOGRAPHY IN BOVINE ORTHOPEDICS

During the last years and decades radiography has established itself as a standard diagnostic procedure in veterinary medicine. Nevertheless, up to now it has not become a routine procedure in bovine practice, particularly because of its cost. This situation is also reflected in the scientific literature. Until now, only few books and articles have been published about diagnostic radiography in cattle. To date only 2 cattle radiography reference works have appeared: the textbook *Bovine Radiology* by Uri Bargai from 1989,¹¹ and the other recently published DVD “Bovine Radiology: Digital Diagnostic Atlas” from the Vetsuisse-Faculty of the University of Berne, Switzerland.⁷ One finds otherwise several articles and publications which deal with orthopedic topics in cattle radiography.^{6,12–23}

Radiography Equipment and Imaging Systems

In practice, portable machines with a performance of 3.5 to 4 kW are used to produce radiologic images of cattle. These devices are very practical for taking radiographic images in the area of the distal limbs and the skull of adult cattle, as well as for imaging calves. However, when one wishes to examine the proximal limb skeleton, the limits of this equipment's performance is reached very soon, owing to the very thick layers of tissue to be penetrated by the x-rays. Only with very powerful, mainly stationary radiologic equipment, such as one finds in large clinics, is it possible to produce reasonable images of these body parts. The imaging systems used in farm animal radiography are not different from those in equine radiography. In addition to conventional film-screen combinations, digital imaging systems (computed radiography or direct radiography) are being used increasingly more frequently.

Radiation Protection

There are 3 main principal recommendations made by the International Commission on Radiological Protection (ICRP) to minimize the radiation exposure of persons involved in radiographic studies,²⁴ namely:

- Justification
- Optimization
- Dose limitation

Justification implies that any radiologic examination must yield a benefit sufficient to justify the risks of the radiation exposure. Radiography should only be performed if,

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