THE USE OF JOINT ULTRASONOGRAPHY FOR THE EVALUATION OF CHRONIC OVINE POLYARTHRITIS

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Introduction

Lameness caused by arthritis is a common condition of sheep in the U.K., which has important economic and welfare implications. In lambs, infectious polyarthritis is frequently encountered (Angus 1991) and commonly isolated bacteria include *Streptococcus dysgalactiae* (Blakemore *et al* 1941), *Erysipelothrix rhusiopathiae, Actinomyces pyogenes, Staphylococcus aureus* and *Fusobacterium necrophorum* (Angus 1991). Diagnostic methods including radiography and synovial fluid analysis, used in other species to confirm the clinical diagnosis, are cost-prohibitive and largely unrewarding in farm animal practice. Many practitioners use ultrasonography routinely for applications such as pregnancy diagnosis in most species, and the use of ultrasonography has been described in the diagnosis of joint disease in the dog, horse and cow (Kofler 1996). This report describes the use of ultrasonography in the diagnosis and prognosis of ovine joint disease.

Materials and Methods

The hair over the joint was clipped, and the skin soaked with water. Ultrasound coupling gel was liberally applied to the wet skin. The joints were scanned using a real-time B-mode scanner with a 7.5 MHz linear transducer. A 1cm thick flexible offset device ("stand-off") was used to optimally visualise superficial structures - this device is also used during ultrasound examination of equine tendons and the eye.

The ovine joints examined were the elbow, carpus, fetlock and stifle. The tarsus was examined but its complex nature, numerous ligaments and small size in sheep made meaningful interpretation impossible. The elbow joint was visualised in the longitudinal (or sagittal) plane on the medial and lateral aspects of the humeroradial joint. The carpus and fetlock were visualised on the dorsal aspect because collateral ligaments, the accessory carpal bone and sesamoid bones on the other aspects of these joints disrupted visualisation of the joint. The stifle was viewed in the longitudinal and transverse planes, with the transducer placed on the cranial, craniolateral and craniomedial aspects of the joint.

Joints were examined from 6 normal cadaver sheep to determine their normal ultrasonographic anatomy, and then 7 sheep with chronic joint disease were scanned (12 abnormal joints in total). The joint pathology was investigated at post-mortem.

Results

Interpretation of joint ultrasound images is dependent on knowledge of the relevant anatomy and the principles of diagnostic ultrasound. Bone reflects and absorbs sound waves and appears as a bright white (hyperechoic) line with acoustic shadowing below (black or anechoic). Fluid transmits sound waves and is anechoic (black) except where pus or particles are present. Soft tissue appears as various shades of grey. Collagen fibres, present in fibrous tissue, tendons and ligaments, are readily identifiable due to the longitudinal striations. These structures are only seen if the fibres are parallel and perpendicular to the transducer. It must be remembered that a stand-off was used which appears as an anechoic area adjacent to the transducer head.

In the normal joint, the skin and bone surface are readily identifiable and help to orientate the view of the sonogram. Other structures that can be consistently identified are ligaments, tendons and other superficial structures (e.g. subcutaneous tissue). The joint capsule and presence of synovial fluid cannot be visualised in normal joints, except after distension of the joint with saline when the joint capsule appears as a 1-2 mm thick hyperechoic band. The joint space is visible as a gap between the bone surfaces.

The carpus consists of three joints - the antebrachiocarpal joint is the largest with the maximum range of movement, whereas the midcarpal and carpometacarpal joints are smaller. The joint capsule cannot be distinguished in normal joints, except upon distension of the joints with 5ml saline. The extensor tendons overlying the carpus are visible by their longitudinal fibres. In sheep that spend a lot of time in sternal recumbency (e.g. footrot problems), a subcutaneous hygroma develops over the carpus which can be distinguished from joint pathology due to its superficial position overlying the extensor tendons. The fetlock joint was poorly visualised due to its small size. Once again distension of the joint with 5ml saline helped visualise the joint capsule.

The patella ligament was identified in transverse section as an oval hyperechoic structure, and in the sagittal plane by its longitudinal fibres. The trochlea groove and the lateral and medial ridges of the femoral condyle of the stifle joint were identifiable in transverse section, appearing as hyperechoic lines with acoustic shadowing below. The soft tissue structures between the patella ligament and bone included joint fluid, patella fat pad, synovium and joint capsule but could not be separately identified. Lateral and medial longitudinal sonograms of the femorotibial joint enabled visualisation of the bone, skin and joint space.

In the seven sheep with polyarthritis of 3 months duration examined ultrasonographically, *Streptococcus dysgalactiae* was isolated at post-mortem from joint fluid in 3 out of 12 joints. There was a history of *S. dysgalactiae* polyarthritis on the farm of origin in five sheep. Extensive joint capsule synovial hypertrophy and hyperplasia (visible as a hyperechoic band up to 20mm thick) were consistent findings. Fibrosis was often visualised by the longitudinal fibres on the sonogram. There was little or no evidence of synovial effusion in affected joints, but the joint space was increased. These findings were confirmed at post-mortem.

Discussion

It is generally believed that chronically infected ovine joints are swollen due to massive joint effusions, and are painful due to the pus/ fluid in the joint, and the development of osteomyelitis. However, all cases examined in this study presented with little joint effusion but pronounced joint capsule thickening, which was associated with considerable pain because the joint capsule is very sensitive. The pain contributes to prolonged recumbency, loss of condition and compromised welfare.

The use of diagnostic ultrasonography in the evaluation of joint disease has readily demonstrated extensive soft tissue pathology in ovine polyarthritis. The chronic synovitis that developed was seen as a marked hypertrophy and hyperplasia of the synovial membrane to form thickened villi, with fibrosis of the joint capsule (Doige and Weisbrode 1995). Articular cartilage erosions and the formation of "joint mice" were also encountered, but the development of osteomyelitis and periarticular osteophytes (as seen in other species) in chronic infective polyarthritis was rare in these authors' experience. Thus radiography has reduced value due to the minimal bony changes present; the only findings being non-specific soft tissue swelling. Radiology is also expensive. Thus most practitioners rely on clinical examination alone, with confirmation at post-mortem. Many practices have an ultrasound machine with a linear probe that can be used quickly and easily to scan sheep joints.

It has been postulated that the chronic inflammatory process in ovine polyarthritis is due to either persistence of bacteria and/or bacterial products in the joint or an immune-mediated arthritis due to cross-reactivity between antigens in the bacterial cell walls and normal joint antigens. Streptococcal cell wall-mediated arthritis in rats (used as a model for chronic human arthritis) can be reactivated in a "flare-up" reaction by unrelated bacteria (e.g. from the gastrointestinal tract), leading to chronicity of the inflammation (Van den Broek *et al* 1988). It is interesting to note in our small study that we only isolated bacteria (namely *Strept. dysgalactiae*) from 3 out of 12 arthritic joints, but these sheep had received antibiotic therapy as lambs.

Ovine polyarthritis requires early and aggressive treatment before localisation of bacteria or bacterial products in the joint sets up chronic inflammatory processes. These authors' treatment regime is high dose penicillin (44 mg/kg twice daily = 0.75 ml Depocillin : Intervet UK for a 5 kg lamb) for five consecutive days. However, once joint capsule thickening is evident, treatment gives very poor results and humane destruction is advisable on welfare grounds. Diagnostic ultrasonography is a cheap, easy and non-invasive means of evaluating soft tissue pathology, especially joint capsule thickening. In chronic ovine joint disease, the extent of joint pathology and in particular the chronicity of the disease process (observed as joint capsule thickening) will deem whether treatment is worthwhile.

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