

Disease of the Bovine Stifle Joint

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Introduction

Eight out of every ten cattle are lame due to foot disease. Upper limb periarticular or articular disease accounts for much of the remainder, in particular stifle and hock joint disease. This paper considers the investigation of stifle lameness and discusses some specific conditions.

Anatomy

Several clinical entities occur primarily due to the unusual anatomy of this joint, which must be outlined first. It is a large joint, divided into femeropatellar and femerotibial compartments, which usually communicate with each other via the medial femerotibial joint capsule. This communication is of obvious importance in septic arthritis initially of one compartment. There are strong femerotibial collateral ligaments, and laterally the tendon of the long digital extensor affords additional support. The two cruciate ligaments pass from the femoral intercondyloid fossa to insert on the cranial or caudal parts of the tibial spine. The anterior (cranial) ligament runs lateral to the posterior (caudal). Two fibrocartilaginous menisci lie between the femoral and tibial articulating surfaces and correct their incongruity. The menisci are attached cranially and caudally to the tibial spine and also to the joint capsule, especially strongly caudally. The lateral meniscus also has a caudal attachment to the femur.

The femeropatellar joint is relatively capacious, so that the total volume of synovia with the stifle joint is about 15 ml. The patella, a sesamoid bone within the tendon of insertion of the quadriceps muscle, has an undulating articular surface which does not appose the femoral trochlea closely. The patella also has an extensive medial fibrocartilaginous lip which overlaps the medial trochlear ridge which is more prominent and more rounded than the lateral ridge. The trochlear groove is inclined rather obliquely, running medially and distally. The three straight patellar ligaments are well developed compared with the collateral patellar ligaments, and pass distally on to the tibial tuberosity.

Joint Movement

Movement is not simply flexion and extension, but also involves some rotation (6,17). While the lateral femerotibial surfaces rotate very little, relative to each other, the medial articular surfaces move considerably, so that, when the stifle is flexed the medial femoral condyle is far forward on the medial tibial condyle, over which it has slid to a greater extent than it has rolled. Section of the anterior cruciate ligament increases the possible cranial-caudal movement of the opposing articular surfaces by about 3 cm. Additional section of the posterior cruciate ligament increases it very slightly (< 1 cm.). Section of the posterior cruciate alone leads to little or no instability.

Patellar movement is relatively simple. It is at the proximal part of the trochlear ridge when the limb is extended, but, unlike the horse, the medial patellar ligament does not ride over and catch on the most proximal part of the ridge. When the stifle is flexed, the patella moves distally.

Investigation

Palpation:

After ascertaining the history, including the age of the animal and the suddenness or otherwise of the onset of lameness, a brief inspection is followed by palpation of both stifle joints simultaneously, standing behind the animal. The palpable landmarks are the patella, the tibial crest, and generally the straight patellar ligaments. The tension in the joint capsules may then be compared though variations may result from an alteration of weight-bearing as well as increased volume of synovia.

Movement:

The joint is next examined from the lateral aspect. The limb is pulled posteriorly with one hand, while the other hand rests on the cranial femerotibial area. Next the point of the hock is moved laterally and medially to assess any undue degree of rotational instability of the tibial condyles on the femur.

Crepitus may be felt or heard, and care must be

taken that crepitus originating from the hip or hock is not confused.

Investigation of any case of suspected stifle disease should include a brief examination of the foot.

Special Techniques:

Radiography is a very useful technique in the diagnosis of lameness in cattle but the size of the stifle joint restricts the use of small sets to calves under six months old. Larger machines can produce good lateral radiography of adult cattle. It is preferable that the animal be in lateral recumbency, with the affected limb to the ground. This is facilitated by the injection of xylazine ("Rompun" - Bayer). The lack of movement permits a longer exposure.

The simple examination of synovia may be useful in differential diagnosis of gonitis (13). Some changes are shown in Figure 1. Synovia is

and sensitivity of pathogenic organisms has been of limited value due to difficulties in culture.

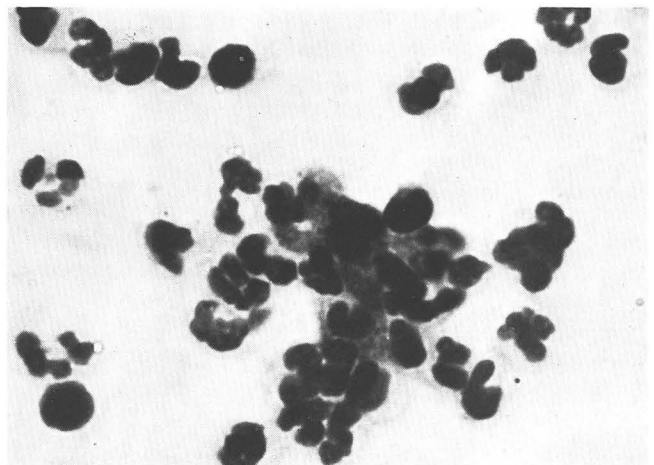


Figure 2: May-Grünwald-Giemsa stained film of synovial fluid in case of septic arthritis showing high percentage of neutrophil leucocytes.

Figure 1
Synovial Fluid Changes in Stifle Joint Disease in Cattle

	Appearance		Total WBCs per cu.mm.	% Polymorphs	Protein gm. %	Mucin Precipitate
Septic Arthritis	very turbid	clots	100,000	95	8.5	very abnormal
Suspect Septic	very turbid	clots	70,000	90	6	abnormal
Aseptic Arthritis	slightly turbid	variable	3,000	variable	3.5	normal or slightly abnormal
Osteoarthritis = Degenerative Arthritis	clear or slightly turbid	non-clotting	200	10	3	normal or slightly abnormal
Hydrops	clear or slightly turbid	non-clotting	350	10	2	normal

obtained by inserting a 14-gauge needle through a sterilized and anaesthetized site between the medial and middle straight patellar ligaments (femoropatellar joint) or between the middle and lateral straight patellar ligaments (femorotibial joint). Collection should be made into the heparinised or EDTA tubes. Of the variety of examinations of synovia which are possible, the most useful are the visual appraisal and the percentage of polymorph neutrophil leucocytes in a Giemsa-stained film. A cloudy sample or one which rapidly clots, indicates a septic arthritis. A hemorrhagic sample indicates recent trauma. The percentage of polymorphs is normally 10% or less (1,13). Any increase is generally into the 60-80% range (Figure 2) and denotes a septic arthritis (Figure 1). The total cell count is invariably increased from a normal of less than 1,000 cells per cubic mm. to the 10,000 - 80,000 range. The so-called mucin test (3) is simple and may help differentiation of the type of arthritis (Figure 1) while bacteriological examination for the isolation

Biopsy of the joint capsule using a Polley-Bictel needle has also been advocated for the differentiation of suspect septic arthritis from aseptic arthritis before there have been significant changes in the synovial fluid, and, though described for the hock joint (18) this technique can be adapted to the stifle. It is nevertheless experimental at this stage.

Conditions of the stifle joint can be considered in three groups: a) calves; b) growing animals; c) mature animals. The relative incidence of certain conditions in terms of age is shown in Figure 3.

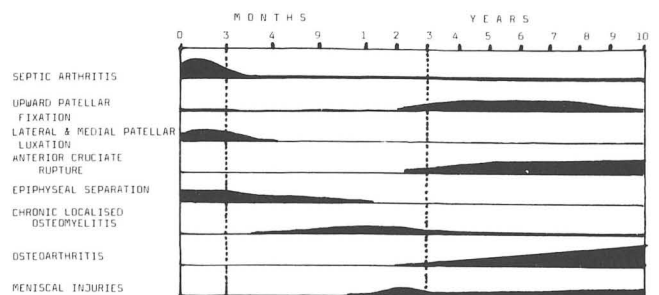


Figure 3: Age incidence of different types of stifle disease.

a) Disease in calves (0-3 months): In calves the bulk of stifle disease falls into the category of "joint ill" caused by a systemic streptococcal infection. A polyarthritis is usual, often with one or both hock joints also being affected. Disease control is on a systemic basis (2). Differential diagnosis is only necessary when a single joint is swollen, whereby traumatic damage must be ruled out.

Both medial and lateral patellar luxation may occur in young calves (21) and is probably congenital, though the abnormality may not be noticed until some weeks after birth. The permanent or intermittent displacement of the patella from the trochlea leads to an inability of the quadriceps muscle to maintain normal extension, and one or both stifles is flexed, so that the calf has a crouching stance. The patella may often be manually replaced but soon redislocates. The abnormality may be successfully corrected by surgery, which involves a parapatellar joint capsule overlap operation (21). Differential diagnosis includes femoral paralysis, quadriceps muscle rupture, acute septic gonitis and separation of the tibial crest.

Traumatic injuries to the stifle joint in calves are common, and include separation of the distal femoral or less commonly the proximal tibial epiphysis and separation of the tibial crest. The increasing value of calves make it economical in some instances to undertake surgical repair. Rush pins have proved very effective in correcting distal femoral epiphyseal separation, while intramedullary pins and screwing techniques have been employed respectively on the separated proximal tibial epiphysis and the tibial crest separation (14). Radiography before and after surgery of such cases is a vital requirement for precise diagnosis and satisfactory replacement.

The incidence of these traumatic injuries decreases with age and they are rare after two years old, though ossification is only complete at about 3½-4 years (8).

b) Disease in growing animals (three months - three years): The incidence of well-defined stifle joint disease is low in this period. Epiphyseal separations occur as described above but to a decreasing extent. Septic gonitis is rare, but may develop secondary to a pyogenic focus elsewhere (e.g. reticuloperitonitis, pyometra, mastitis), or following extension from periarticular decubital lesions (Figure 4), as following postpartum paraplegia. At this age, too, meniscal injuries may occur following sudden joint sprain during oestrus activity. Most animals suddenly lame in such



Figure 4: Hind quarter of Ayrshire cow showing decubital lesions over lateral aspect of stifle, as well as over hock and greater femoral trochanter.

circumstances have only a strain of the collateral ligaments since they become sound in a few days, an event impossible in the event of meniscal tear.

Occasionally cases of a chronic localized osteomyelitis ("Brodie's abscess") (4) of the proximal tibial metaphysis or epiphysis are encountered in growing cattle. Diagnosis of these cases which may present as an acute lameness, is difficult, and surgical drainage may be successful (20).

In the future it appears that the significance of certain "defects" of the distal femoral articular cartilage and bone may be clarified. Synovial grooves are found in various joints of several domestic species, including cattle (15). One site is the lateral trochlear ridge. Examination of normal - i.e. non-lame - cattle of various ages shows that this groove is not present at birth, appears at a few months old and is generally but not invariably absent in mature animals. In fattening animals under intensive conditions this groove may be quite large and of possible clinical significance in

that an aseptic arthritis would develop. Figure 5 shows such a defect (which was bilateral), in the trochlea of a yearling Friesian "barley beef" steer. Similar defects may be found in other joints.



Figure 5: Boiled-out specimen of distal end of femur of one-year-old Friesian bullock, reared under intensive conditions ("barley beef"), showing bone defects on trochlea.

c) Disease in mature animals (over three years): Intermittent or permanent upward patellar fixation, unilateral or bilateral, occurs in mature dairy cows and is characterized by posterior extension of the leg followed in the intermittent form by a sudden forward jerking of the leg as the patella is released from the proximal and medial aspect of the trochlea (19). The gait is characteristic, but differentiation should be made from luxation of the biceps femoris tendon, progressive posterior paresis and acute gonitis in which the stance, but not the gait, may be similar. Medial patellar desmotomy achieves an instant correction of the condition. The site is located near the distal end of the medial straight patellar ligament, a site which avoids possible damage to the femoropatellar joint capsule. The operation, performed best in the standing animal under sedation and local analgesia, consists of a skin incision just cranial to the ligament which is then transected by a tenotome. This abnormality appears to be particularly common in Germany (7) and India (16).

Rupture of the anterior (cranial) cruciate ligament has frequently been found at autopsy of cases of severe chronic gonitis where the rupture may have been secondary. Recently the clinical features of primary anterior cruciate rupture have been described, so that a firm diagnosis can be

made (6). Most cases have occurred in cattle at least five years old, often in cows in late pregnancy or the early postpartum phase, being turned out to grass in the spring. The lameness is of sudden onset and moderate degree. Crepitus occurs as the tibia moves forward underneath the femur, and the tibial crest is unduly prominent. The excessive mobility of the femorotibial joint is demonstrated by manual lateral movement of the hock, so rotating the proximal end of the tibia. Lateral radiographs of the stifle in the weightbearing position can confirm the forward displacement of the tibia (Figures 6 and 7). The differential

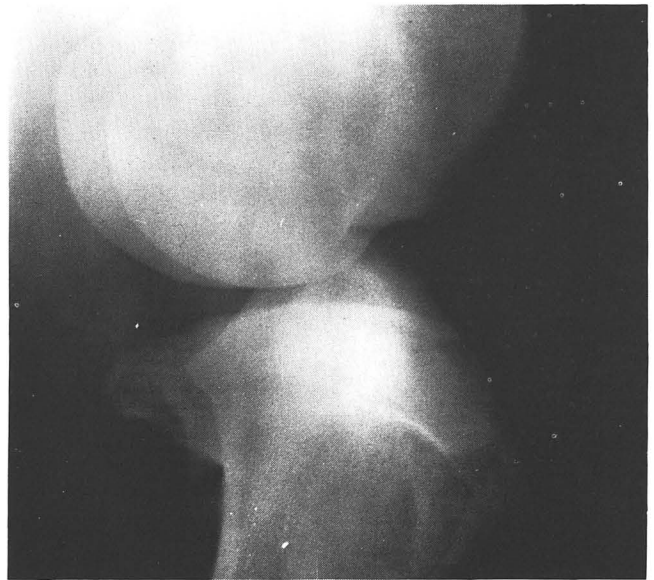


Figure 6: Radiograph (lateral projection) of stifle in cow. Normal.



Figure 7: Radiograph (lateral projection) of stifle of cow with recent rupture of anterior cruciate ligament. The tibia is displaced forward, and bone fragments are evident in the cranial part of the joint.

diagnosis involves hip dislocation, meniscal injury and sprain of the collateral ligaments. The condition is necessarily progressive, so the prognosis is poor. Autopsy examination of several cases within two weeks of the initial lameness revealed that extensive erosion of bone and associated meniscal abrasion had taken place over the caudal part of the tibial articular surface. Various prosthetic materials have been investigated experimentally (9). Surgical repair of anterior cruciate rupture may be successful in isolated clinical instances (10).

A degenerative osteoarthritis often affects the stifle joint of mature cattle, especially bulls. Surprisingly severe pathological changes may be seen in animals which have never shown any lameness. Other joints such as the hip and hock may also be affected. In some Jersey and Friesian herds it can be inherited (11). Generally the lesions are a result of acute injury or recurrent sprain of ligamentous structures. The classical features are as in man (4) and include a varying degree of loss of cartilage and bone from the major weight-bearing articular surfaces, an increase followed by a decrease in the volume of synovia, proliferation of the synovial villi, thickening of the joint capsule, and, with increasing joint instability, peripheral osteophyte formation. Exostoses are particularly well developed at the caudal border of the tibial articular surface and may form a large wedge of new bone four cm. deep. Diagnosis of advanced cases is simple, but problems arise with early cases where there is no crepitus and little joint swelling. Meniscal injury is usually found in cases of osteoarthritis but appears generally to be a secondary result.

Medical Treatment of Gonitis

Medical treatment may be adopted in cases of acute aseptic gonitis. Antibiotics may be injected parentally, and those drugs which achieve thereby a therapeutic concentration in synovial fluid include penicillin, chloromycetin, erythromycin and the tetracyclines. Local application of antibiotics, i.e. intra-articular injection, is limited to penicillin and streptomycin in aqueous solution or oily suspension, or achromycin. The local and systemic routes should both be adopted in early cases of septic gonitis, but results have been poor (5,12).

Corticosteroids are the second form of medical treatment in acute gonitis. Betamethasone (30 mg. of "Betsolan" - Glaxo) has been effective parentally, while the preferred preparation for local injection is methylprednisolone acetate (200 mg. of "Depomedrone" - Upjohn, i.e. 5 ml.).

Corticosteroids should never be injected into the stifle joint without accompanying antibiotic cover. The indication for corticosteroid therapy is the attempted interruption of the vicious cycle involving inflammation of the synovial membrane, the production of abnormal synovia, subsequent poor nutrition of cartilage followed by cartilaginous destruction, the formation of debris within the joint and its phagocytosis by the synovial membrane which becomes still further inflamed (12). The anti-inflammatory activity of corticosteroids results in a reduction in the reaction of the synovial membrane. It is clear that such therapy can only be of transient benefit in cases of chronic osteoarthritis.

Other drugs which have been used for treatment of stifle joint disease in cattle include phenylbutazone ("Butazolidone" - Jensen-Salsbery Labs) in doses of two-three gm., administered intravenously or intramuscularly and dimethyl sulphoxide ("Demaret" - Squibb) applied topically to the skin over the joint at a rate of 10 ml. twice daily for three days. Neither preparation has found widespread acceptance.

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