Diagnosis and Treatment of Ligamentous and Meniscal Injuries in the Equine Stifle

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The accuracy of the diagnosis of ligamentous and meniscal injuries in the equine stifle has improved significantly in the last 20 years. The introduction of arthroscopy, although limited by the close apposition of the tibial and femoral condyles, now provides the most information for intra-articular injuries. Through the increasing sophistication of equipment, ultrasonography has become valuable for the diagnosis of collateral and patellar ligament damage and, to a lesser extent, for meniscal and cruciate tears. Scintigraphy has a place in the identification of insertional desmopathies, bone injuries, and secondary osteoarthritis; radiography is still essential for the diagnosis of bone changes associated with soft tissue injuries. MRI may one day be available for stifle imaging in the clinical setting. There are, however, significant limitations in the diagnosis of stifle injuries because of the size and anatomy of the equine stifle.

Treatment of soft tissue injuries to the equine stifle has been empirical. There have been few large case studies describing and characterizing the clinical signs of specific conditions of stifle ligaments and menisci, and only retrospective case studies of the outcome of treatment have been published. No prospective evaluation of different treatment regimens has been reported. This article describes the diagnosis and treatment of ligamentous and meniscal injuries in the equine stifle using information from the author’s own experience and from reports in the scientific literature.

Clinical approach to diagnosis of soft tissue injuries

The importance of a clinical examination cannot be overemphasized, and diagnostic analgesia is an essential aid to diagnosis in many stifle injuries.
Diagnostic imaging or arthroscopy should be regarded as a corollary to the clinical assessment. A detailed history is essential and may be a guide to diagnosis, particularly if there has been direct trauma to the stifle [1].

The clinical examination should cover the entire horse to ensure that there is no concurrent injury. Structures palpable in the stifle joint include the patellar ligaments, the outline of the patella, the medial collateral ligament (MCL), the long digital extensor tendon, the tibial crest, and the medial and lateral femoral trochlear ridges. Distention of the stifle is most readily appreciated in the femoropatellar (FP) joint and the medial femorotibial (MFT) joint cranial to the MCL. In meniscal disease, this effusion is associated with more severe injuries [2]. Gait characteristics that are specific to stifle lameness are difficult to identify because of the reciprocal apparatus. Horses with stifle lameness often have a shortened cranial phase of the stride, a low arc of flight of the limb, and a worsening of the lameness with the limb on the outside during lunging; however, these findings are not consistent and are seen with other causes of hind limb lameness. Flexion tests are also nonspecific, although frequently positive. Manipulation tests for evaluation of cruciate ligaments and MCLs [3] are more likely to be positive in severe injuries; however, in most cases, guarding of the limb by the horse makes them difficult to perform and interpret.

Diagnostic analgesia should always be performed if there is any doubt about the site of lameness. In the horse, the stifle is divided into three compartments: the FP joint, the MFT joint, and the lateral femorotibial (LFT) joint. Although arthroscopic observation by this author has suggested that there is a synovial fold connecting most FP and both femorotibial (FT) joints, latex injection into 30 joints of cadaver limbs showed only 60% communication between the FP and MFT compartments and 3% communication between the FP and LFT compartments [4]. There was no communication between the MFT and LFT compartments. Diffusion of mepivacaine between the three compartments after one joint was injected has been shown to occur 85% to 100% of the time, however, although not necessarily at concentrations that would effect analgesia [5]. Because of this variation, simultaneous diagnostic analgesia of all three compartments is logical. The standard approach to the FP compartment is between the middle (MidPL) and medial (MedPL) patellar ligaments. The MFT compartment is entered over the medial tibial condyle between the MedPL and the MCL. A small outpouching of the joint capsule may be palpated. The lateral FT compartment is best approached just cranial or caudal to the long digital extensor tendon and close to the tibial plateau. Depending on the size of the horse, local anesthetic at a dose of 20 to 30 mL should be used for each compartment utilizing a 5-cm 19-gauge needle. After injection, improvement in lameness may be regarded as significant, because these joints are quite large, making it difficult to achieve complete anesthesia. Severe injuries or conditions like subchondral bone cysts or patellar and MCL injuries can show no response to intra-articular analgesia.
Radiography

The stifle should be radiographed once it has been diagnosed as the cause of the lameness. The value of radiology in the diagnosis of soft tissue injuries lies in the assessment of concurrent bone change in the acute case and chronic reactive change in the chronic case. This can have a significant bearing on the prognosis. In one study, the presence of radiographic changes in horses with meniscal tears worsened their chance of recovery by greater than 25% [2]. A high-powered x-ray generator is preferable for radiography of horses’ stifles because of their large size and the amount of surrounding muscle mass. The five standard views that are most commonly used are lateromedial (LM), flexed LM, caudocranial, caudolateral-cranomedial oblique, and (particularly if a patellar fracture is suspected) craniproximal-craniodistal oblique (skyline) [6]. Other views may be necessary for some injuries. The flexed LM view is useful for exposing the distal aspect of the femoral condyles and the proximal part of the medial intercondylar eminence of the tibia (MICET), which is a common site for soft tissue related changes. Enthesophyisis, soft tissue mineralization, remodeling, and osteoarthritic changes can all be indicators of chronic injury often associated with ligamentous or meniscal injury.

Ultrasonography

Ultrasonography is a useful diagnostic aid that should be part of the evaluation of an injured stifle. Good-quality equipment, practice, patience, and careful preparation of the horse are all required to achieve diagnostic images. Linear array, convex, and sector transducers ranging from 3.5 to 12 MHz have been used, but the more superficial tissues can be imaged with 5- to 7.5-MHz linear transducers [7–9]. A systematic approach has been described that commences on the medial aspect of the limb with the horse weight bearing and then moves cranially and laterally [7]. This allows imaging of the following: the MCL and the medial meniscus, the patellar ligaments, the trochlear ridges, the lateral meniscus, the long digital extensor tendon, and the lateral collateral ligament. The leg is then scanned in the flexed position from cranially to image the femoral condyles and the cranial attachments of the cruciate ligaments. Finally, with the horse weight bearing again, the caudal aspects of the cruciate ligaments and menisci are scanned.

Scintigraphy

The main role of scintigraphy in the diagnosis of meniscal and ligamentous injuries is in the evaluation of bone activity, which may be the result of bone injury, secondary osteoarthritis, or insertional desmopathy. For example, increased uptake of radioisotope has been reported in two horses with cruciate ligament disease [10], but soft tissue injuries in the stifle, even if severe, often show no abnormal uptake of radioisotope.
Meniscal injuries

The menisci perform crucial biomechanical functions in the mammalian knee; they stabilize the joint by providing congruency between the femur and the tibia, evenly distribute loads to the adjacent femur and tibia, act as shock absorbers for the articular cartilage, and contribute to the friction reduction mechanisms in the joint [11]. The dense matrix of the menisci is composed primarily of type I collagen fibers that are arranged in a circumferential pattern as well as a small amount of proteoglycans. In the horse, there are medial and lateral menisci that are attached on their abaxial borders to the joint capsule and have free axial borders. They are attached by their respective cranial ligaments to the cranial aspects of the medial or lateral intercondylar eminences of the tibia. The caudal ligament of the medial meniscus is attached to the caudal edge of the MICET. The caudal ligament of the lateral meniscus divides into the meniscofemoral ligament (which inserts proximally on the medial side of the caudal intercondyloid fossa of the femur) and the caudal ligament (which inserts in the popliteal notch).

The exact mechanism of meniscal injury in the horse may be different from the dog, where the meniscal damage is presumed to be caused by joint instability that is frequently preceded or accompanied by cranial cruciate ligament (CRCL) injury [12]. In a series of 110 meniscal tears diagnosed on arthroscopy at the Liphook Equine Hospital (LEH) as the lesion most likely to be causing lameness, only 15 (14%) were associated with cruciate injury; this suggests that primary meniscal injuries are more common in the horse (J.P. Walmsley, MA, VetMB, CertEO, and T.J. Phillips, BVetMed, CertEP, CertEO, DESTS, MRCVS, Hampshire, United Kingdom, unpublished data). A sudden compressive force acting on the meniscus with the joint in extension is a possible mechanism for primary meniscal injury [12].

Clinical signs

Clinical signs of meniscal tears are not specific to the condition. Definitive diagnosis can only be made ultrasonographically or arthroscopically. In some horses, there may be a history of direct trauma or a fall, although onset of lameness is often insidious with mild injuries. Lameness can be pronounced at first in more severe cases but often settles to a moderate grade. The median lameness grade in the LEH case series in which the median duration was 8 weeks was 3/10 (with 10/10 being non-weight bearing). Joint distention in the MFT or FP joint or both (Fig. 1) was recorded in 31 (39%) of 80 cases, but in 14 of these cases, only FP distention was noted. The relative risk for the presence of joint distention was nine times greater with more severe lesions [2]. Flexion of the affected limb worsened the lameness in 66% of cases. Intra-articular analgesia of all three compartments of the stifle significantly improved or abolished the lameness in 93% of the affected horses [2]. Pain on palpation over the medial meniscus was rarely encountered, but few horses were examined in the acute phase.
Radiography

A direct association between the severity of the injury and the presence of radiographic changes has been demonstrated, and the published incidence was 38 (48%) of 80 cases at the LEH [2]. It should be noted that no radiographic signs were recorded in 20 (43%) of 46 horses with the more severe grades of injury. New bone on the MICET was seen in 23 (29%) of 80 horses, signs of osteoarthritic changes in 18 (23%) of 80 horses, and mineralization of soft tissue structures of the FT joint in 6 (8%) of 80 horses [2]. Although it is often attributed to CRCL injury [6], new bone on the MICET (Fig. 2) has been seen more commonly in association with meniscal tears than with cruciate injuries at the LEH (25 [23%] of 110 meniscal injuries and 5 [7%] of 71 CRCL injuries) (J.P. Walmsley, MA, VetMB, CertEO, and T.J. Phillips, BVetMed, CertEP, CertEO, DESTS, MRCVS, Hampshire, United Kingdom, unpublished data). In another study 24 (83%) of 29 cases showed radiographic abnormalities [13].

Ultrasonography

Ultrasonography is an important diagnostic tool for meniscal tears. In a series of 29 cases of meniscal tears reported by Schramme and colleagues [13], three horizontal tears in the medial or lateral abaxial part of the menisci were diagnosed ultrasonographically but could not be seen arthroscopically, whereas in 10 cases, only arthroscopy diagnosed the lesion. This stresses the importance of ultrasonography in stifle injuries. Abnormalities that may be encountered include loss of the normal triangular shape, changes in

Fig. 1. A 6-year-old Thoroughbred stallion with a severe meniscal injury showing FP and FT joint distention.
echogenicity, extrusion from between the femoral and tibial condyles, fragmentation of the meniscus, separation from the collateral ligaments, and loss of the FT joint space [14,15].

Arthroscopy

Arthroscopy provides the most information on the tissue damage within the joint, although, unlike the case in human beings [16], it is limited by the inability to view between the femoral and tibial condyles in the horse. A skillful ultrasonographer may image the meniscus that is inaccessible arthroscopically, allowing for the most comprehensive examination of the menisci through a combination of ultrasonographic and arthroscopic examination. The author has three criteria for recommending arthroscopy of the stifle: (1) lameness abolished by intra-articular analgesia of the stifle that shows no radiographic or ultrasonographic abnormalities and that has not responded to 6 weeks of rest and anti-inflammatory treatment, (2) lameness in which there are significant radiographic or ultrasonographic abnormalities for which an arthroscopic investigation is indicated, and (3) acute stifle injuries with joint effusion and severe lameness. After acute severe injury, arthroscopy should be delayed until the worst of the inflammatory process has subsided and care should be taken to ensure the absence of a hairline fracture before anesthetizing the horse. The techniques for complete arthroscopic exploration of the FT joints have been described [10,17–24], and the author prefers the cranial approach [10,18,24]. A detailed examination of all visible aspects of the joint is undertaken, and inspection of the cranial parts of the menisci and their cranial ligaments can be assisted by palpation of the tissues with a right-angled arthroscopic probe. With this, the cranial poles of the menisci may be retracted a short distance to allow examination of their cranial axial borders. The caudal aspect of the medial meniscus and its
caudal medial ligament can be examined in the caudal MFT joint pouch [23,24]. Examination of the caudal LFT joint pouch is more difficult technically and is restricted by the popliteal tendon, but a limited view of the caudal lateral meniscus can be obtained [23,24].

Meniscal tears are more frequently seen in the cranial aspect of the FT joint, although lesions are occasionally encountered caudally, especially in the medial compartment. In the human knee, it is possible to identify the morphology of meniscal injuries between the femoral and tibial condyles [16]. In the horse, this is impossible; thus, a grading system that describes the visible damage in the cranial joint has been devised: grade I is a tear in the cranial ligament extending into the meniscus but without significant separation of the tissues (Fig. 3), grade II is a complete tear in the cranial pole of the meniscus and the cranial ligament whose limits are visible arthroscopically (Fig. 4), and grade III is a severe tear of the meniscus and cranial ligament that extends caudally beneath the femoral condyle and whose limits cannot be seen [2]. Fibrillation of the axial borders of the cranial meniscal ligaments is a relatively common finding of which the significance is unknown. Roughening of the most cranial part of the axial borders of the menisci is also sometimes present and may be associated with chronic wear. At the LEH, 110 meniscal tears have been recorded; 87 (79%) involved the medial meniscus, and 61 (55%) of the cases were grade I, 28 (25%) were grade II, and 21 (19%) were grade III. Articular cartilage disease was seen in 78 (71%) of these horses (Fig. 5) and concurrent CRCL injury was seen in 15 (14%) of them, which emphasizes the importance of a complete examination of the joint.

**Treatment**

Acute stifle injuries for which there is no definitive diagnosis should be treated with rest and anti-inflammatories, followed by controlled exercise.

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**Fig. 3.** A grade I tear in the right cranial meniscal ligament and medial meniscus in a 10-year-old Thoroughbred eventer. The axial border of the cranial meniscal ligament is on the left of the picture. MFC, medial femoral condyle.
Diagnosed meniscal tears are currently treated by partial meniscectomy; however, to the author’s knowledge, no comparisons between this and conservative treatment in the horse have been reported. It is well established in human surgery that as much meniscal tissue as possible should be preserved to reduce the established risk of subsequent osteoarthritis [16]. A range of repair and replacement techniques, including suturing, augmentation repair, and replacement, are used in human patients [25], but the configuration of the equine knee, the inaccessibility of meniscal tears, and the difficulties of

Fig. 4. A grade II tear (arrow) in the left medial meniscus of the 9-year-old Thoroughbred-cross gelding whose radiograph is shown in Fig. 2. The medial aspect of the meniscus is on the left of the picture. MFC, medial femoral condyle.

Fig. 5. A full-thickness articular cartilage lesion in the left medial femoral condyle (MFC) of a 9-year-old Thoroughbred-cross eventer. This lesion is secondary to a grade II medial meniscal tear (arrow). The medial aspect of the meniscus is on the left of the picture.
postoperative management in horses do not lend themselves to the use of these techniques. The author has attempted to suture a grade I tear in the medial meniscus with the FasT-Fix system (Smith and Nephew, Huntingdon, Cambridgeshire, United Kingdom) but was unable to complete the suture because of the poor access and difficulty of passing the instrument through the tissue. Torn meniscal tissue is most easily removed using a pair of arthroscopic scissors or a punch and a motorized synovial resector; occasionally, a meniscal knife may be required for large fragments of meniscus (Figs. 6–8). Electrosurgical dissection is also possible, but care is required to avoid charring of the tissues. Rongeurs are not appropriate because they tend to tear meniscal tissue. Debridement should be carefully performed to avoid damaging the adjacent articular cartilage. Concurrent articular cartilage disease can be treated by removal of loose tissue and micropicking of any areas of denuded bone that may be indicated [26].

For postoperative management, the author recommends stall rest with short periods of hand walking twice daily for the first 6 weeks. If there is good improvement at this stage, the horse is turned into a small corral until 6 months after surgery, when low-grade riding work can commence. Horses are not turned out to pasture until they have returned to full work and remain sound.

Outcome

A retrospective record of the outcome of meniscal tears treated by arthroscopic surgery has been maintained at the author’s hospital. A statistical analysis of the published results of 80 cases showed that the odds of returning to full use decreased significantly with increasing severity of injury.

Fig. 6. The same view of the lesion in Fig. 4 shows a partially separated piece of medial meniscal tissue (arrow). The medial aspect of the meniscus is on the left of the picture. MFC, medial femoral condyle.
Outcome was also significantly worsened if there was concurrent articular cartilage disease or an associated radiographic abnormality. Overall, of 89 cases that have been followed up from the 110 horses with meniscal tears that have now been treated at the LEH, 39 (44%) have returned to full use. Schramme and colleagues [13] reported an overall return to full work of 6 (21%) of 29 cases.

Fig. 7. This picture demonstrates the use of a meniscal knife to remove the piece of loose meniscal tissue \((\text{arrow})\) shown in Fig. 6. The medial aspect of the meniscus is on the left of the picture.

(63% of grade I tears, 56% of grade II tears, and 6% of grade III tears).

Fig. 8. Postoperative view of the lesion in Fig. 4 after removal of the loose meniscal tissue and debridement with a motorized synovial resector. Remaining healthy meniscal tissue is indicated \((\text{arrow})\). The medial aspect of the meniscus is on the left of the picture. MFC, medial femoral condyle.
Cruciate injuries

There are two cruciate ligaments, the cranial and caudal, whose role is to maintain dynamic stability of the joint through its range of movement [27]. During flexion and extension of the stifle, the tibia rotates about the longitudinal axis of the limb. As the joint flexes, the smaller lateral femoral condyle moves posteriorly on the tibial plateau, resulting in medial rotation of the tibia; this causes the cruciate ligaments to twist on each other and stabilize the movement [28]. When the limb extends, the CRCL is under tension and prevents cranial displacement and hyperextension of the joint. The caudal cruciate ligament (CACL) is under tension when the joint is in extreme flexion [29], and it also stabilizes the lateral rotation of the tibia as the joint is loaded in extension [30]. The ligaments lie extrasynovially and cross each other in the middle of the stifle. The CRCL originates on the caudal medial surface of the intercondylar region of the femur and inserts cranially and laterally on the intercondylar eminence of the tibia. The CACL originates on the cranial medial part of the intercondylar region of the femur and inserts on the popliteal notch of the tibia [29]. In the author’s experience, injury to the CACL is much less frequently encountered than injury to the CRCL. Only 4 of 75 cruciate injuries diagnosed on arthroscopy at the LEH involved the CACL (J.P. Walmsley, MA, VetMB, CertEO, HonFRCVS and T.J. Phillips, BVetMed, CertEP, CertEO, DESTS, MRCVS, Hampshire, United Kingdom, unpublished data), although other clinicians report a slightly higher incidence in racehorse practice (L.R. Bramlage, DVM, Lexington, Kentucky, personal communication, 2001). CACL injury without CRCL injury does occur in the horse, however [30,31]. Rich and Glisson [27] showed that under experimental conditions, the CRCL is most likely to fail midbody, and clinical experience tends to agree with this. The mechanism of injury in the horse may be similar to that in the dog, where it is caused by hyperextension of the stifle joint or sudden rotation of the joint during partial flexion [28].

Clinical signs

Mild to moderate cruciate injuries show similar clinical signs to many soft tissue stifle injuries. Severe injuries, including rupture of the CRCL, are accompanied initially by severe lameness and distention of the FP and MFT joints and usually have a history of acute trauma. The cruciate draw test is rarely possible at this stage because of intense limb guarding, although it can sometimes be appreciated in the rare chronic case of a ruptured CRCL. Flexion of the limb exacerbated lameness in 40 (69%) of 58 cases diagnosed on arthroscopy at the LEH, and intra-articular analgesia significantly improved lameness in 98% of horses in which it was performed. Confirmation of diagnosis with diagnostic analgesia may be unnecessary in severe injuries, and the severity of the inflammation may render it ineffective.
Radiography

Radiographic changes were seen in 33 (44%) of 75 horses in the LEH case series, and these were mostly observed in chronic or severe cases. Fracture of the MICET was reported in 6 of 10 horses by Prades and coworkers [32] and in 5 of 5 horses by Sanders-Shamis and colleagues [31]. These were described as avulsion fractures, but in the author’s experience, many of these are concurrent injuries and not avulsions, because the CRCL insertion lies cranial on the MICET and does not always involve the fracture fragment. Of eight MICET fractures seen at the LEH, cruciate injury was diagnosed on arthroscopy in only 2 cases; it could be that these fractures are caused by lateral pressure from the medial femoral condyle. Avulsion of the femoral insertion of the CRCL and CACL has been reported [30,33,34], and fracture fragmentation as a result of concurrent injury to the femoral condyles also occurs; mineralization of the ligament can develop in chronic cases. Cranial translocation of the proximal tibia after rupture of the CRCL and caudal displacement of the proximal tibia after rupture of the CACL can occur [31]. In the LEH series of 71 cases of CRCL injury, osteoarthritic changes were seen in 14 (20%), mineralization of soft tissues in 7 (Fig. 9), new bone formation on the MICET in 5, and fracture fragmentation in 5.

Ultrasonography

Ultrasonographic imaging of the cruciate ligaments is more difficult than imaging the menisci or collateral or patellar ligaments and is more likely to be a reliable diagnostic tool in the hands of experienced ultrasonographers.

Fig. 9. An LM radiograph of the left stifle of a 7-year-old Thoroughbred-cross gelding shows mineralization of the left CRCL (arrow). This horse sustained a grade III CRCL injury 12 months previously.
Imaging from the cranial aspect of the stifle is performed with the stifle flexed. Changes in the echogenicity, fiber alignment, cross-sectional area, and outline of the tibial insertion may be diagnosed [8,14].

**Arthroscopy**

The criteria for performing an arthroscopic examination of the joint are the same as for meniscal injuries. Because the cruciate ligaments are extrasynovial, minor changes can be difficult to identify. Using the cranial arthroscopic approach [10,18,24], the cranial and middle parts of the CRCL can be viewed beneath the median septum in the MFT and the LFT. Removing the fascia over the ligament electrosurgically or with a motorized synovial resector allows a more detailed examination of the ligament (Fig. 10). The femoral insertion of the ligament is inaccessible arthroscopically [33]. The proximal CACL is seen medially in the intercondylar fossa of the femur in the cranial MFT. The distal CACL is visible in most horses beneath the median septum in the caudal MFT. The author has graded CRCL damage as follows: grade I is mild (hemorrhage on the surface of the ligament and mild superficial disruption of the fiber pattern; see Fig. 10), grade II is moderate (obvious superficial separation of the fibers of the ligament; Fig. 11), and grade III is severe (rupture of the fibers of the CRCL). Of 71 CRCL injuries diagnosed on arthroscopy at the LEH as being the main cause of lameness, 42 (59%) were grade I, 22 (31%) were grade II, and 7 (10%) were grade III. Concurrent damage to the menisci was present in three cases. Another report noted that two of six horses with CRCL injury had concurrent meniscal damage [10]. The triad of cruciate, meniscal, and collateral ligament injury seen in people seems to be uncommon in

![Fig. 10. A view of the right LFT joint shows the CRCL of a 6-year-old Thoroughbred-cross gelding during removal of the median septum (MS) with a motorized synovial resector. There is a grade I CRCL injury. LFC, lateral femoral condyle.](image)
the horse, but this may reflect that horses with ruptured CRCLs are so severely traumatized that they are frequently euthanized and do not undergo arthroscopy. Secondary articular cartilage disease was seen in 43 (61%) horses at the LEH and was evenly distributed among the grades of injury.

**Treatment**

The forces on an equine CRCL are quite large [27], and this, combined with the problems of anesthetic recovery, has discouraged attempts at repair. Medial and lateral imbrication and cranial cruciate replacements using the gluteobiceps tendon have been performed in cattle experimentally and therapeutically, with good results [35–38]. Currently, treatment consists of debridement of damaged loose tissue by removal with a motorized synovial resector, an arthroscopic punch, or arthroscopic scissors. Bone fragments should be removed (see Fig. 11). Concurrent injury must also be assessed and treated appropriately. Postoperative management is the same as for meniscal injuries.

**Outcome**

Severe injuries to the cruciate ligament in horses carry a poor prognosis. All 10 affected horses reported by Prades and coworkers [32] and all 6 reported by Sanders-Shamis and colleagues [31] failed to return to use. Four of 6 horses treated arthroscopically for CRCL injury in another study returned to use [10]. The recovery rate of cases treated and followed up at the LEH was 2 (33%) of 6 of the grade III injuries, 10 (59%) of 17 of the grade II injuries (Fig. 12), and 18 (46%) of 39 of the grade I injuries. To
the author’s knowledge, no comparisons of surgical with conservative treatment have been made and the treatment of these injuries remains empirical.

**Medial collateral ligament injuries**

MCL injuries are an uncommon but well-recognized cause of lameness [1]. The MCL attaches proximally to the medial epicondyle of the femur and distally to the margin of the medial condyle of the tibia [29]. The lateral collateral ligament is thicker and arises on the lateral epicondyle of the femur and inserts distally on the head of the fibula. It overlies the popliteal tendon, from which it is separated by a bursa [29]. Injuries to the lateral ligament seem to be rare but have been reported to be associated with lateral meniscal injury [14].

**Clinical signs**

Lameness is likely to be acute in onset and severe at first, and there is often a history of a traumatic episode with MCL injuries. Lameness from milder injuries is moderate, but horses with more severe tears or ruptures usually remain quite lame. Pain, heat, and swelling are palpable over the ligament. Ruptured ligaments are extremely painful; despite limb guarding, instability can usually be appreciated using the MCL manipulation test [3]. Flexion or abduction of the limb exacerbates the lameness. Concurrent cruciate ligament injury can occur with severe injuries [31,32]. Desmitis of the MCL leads to chronic thickening. Mild tears may not be obvious on clinical examination, and in the author’s experience, lameness is not always alleviated by intra-articular analgesia. Ultrasonography can assist in the diagnosis of these cases, and scintigraphy can be valuable if there is an insertional
desmopathy. Radiography is most useful for diagnosing changes associated with chronic injury or concurrent acute bone damage.

**Ultrasonography**

Ultrasonography is a sensitive and essential tool for the assessment of MCL injuries and can be used to evaluate the condition of the ligament and other damage in the joint [39]. Diffuse fiber damage is more likely to be seen than discrete core lesions [14]. Separation of the ligament from the meniscus and changes at the insertion can be imaged [15]; instability of the joint may be appreciated ultrasonographically [39].

**Radiography**

Unless the ligament is ruptured or there is an avulsion fracture, there may be no radiographic changes in the acute case. With time, enthesophytes may form on the tibial insertion of the ligament just distal to the medial condyle of the tibia and on the femoral insertion in the roughened area on the medial epicondyle of the femur (Fig. 13). Osteoarthritic changes develop in chronic cases (see Fig. 13). Mineralization of the ligament may be seen in severe chronic cases. Rupture of the MCL can be demonstrated with a caudocranial stressed radiograph (Fig. 14) [31,40]. This can be a painful procedure, and heavy sedation is often required. Fracture fragmentation off the tibia or femur is not uncommon (see Fig. 14).

**Treatment**

Initially, anti-inflammatory treatment and stall rest are indicated for all MCL injuries. Horses with mild sprains should be confined to a stall for

![Fig. 13. Caudocranial radiograph of the left stifle of a 16-year-old Thoroughbred-cross gelding that suffered a severe MCL injury 2 years previously. There is new bone formation at the femoral and tibial insertions of the MCL (arrows), collapse of the MFT joint, and lytic and sclerotic changes in the subchondral bone of the medial femoral and tibial condyles.](image)
4 to 6 weeks and can start hand walking during this time, depending on progress. They should be confined to a small pen to complete a convalescence of 3 to 6 months. More serious desmitis cases require 9 to 12 months of convalescence, and a follow-up ultrasonographic and radiographic examination can assist with the assessment of progress. If there is any possibility of concurrent joint injury, an arthroscopic investigation for evaluation and treatment is indicated once the initial inflammation has settled (Fig. 15).

Because rupture of the MCL in the horse is a devastating injury, frequently accompanied by significant soft tissue or bone damage in the joint, euthanasia is often recommended. Repair in a mare with complete rupture using braided polyester suture anchored to 6.5-mm cancellous screws in the tibial and femoral insertions of the MCL has been reported [40]. The horse was

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**Fig. 14.** Stressed caudocranial radiograph of the right stifle of a 7-year-old Quarter Horse mare with a ruptured MCL shows widening of the MFT joint and a fracture fragment axial to the medial femoral condyle (arrow).

**Fig. 15.** Arthroscopic view of the lateral meniscus of a 3-year-old Thoroughbred-cross mare showing the axial border of the meniscus (arrow) revealed by instability of the joint after rupture of the MCL. This cannot be seen arthroscopically in the normal horse.
reasonably comfortable at 9 months after surgery but was euthanized after falling and becoming severely lame. The author has also performed a similar repair at the LEH, which, again, was disrupted during convalescence. These experiences suggest that current techniques do not provide a strong enough repair to withstand the forces sustained by the equine MCL.

**Outcome**

The prognosis for rupture of the MCL is poor. Persistent instability of the joint and severe osteoarthritis are likely sequelae. To the author’s knowledge, there are no long-term studies on the outcome of a significant number of cases of desmitis of the MCL, but, subjectively, it seems that return to athletic use in all but the mildest injuries is unlikely.

**Patellar ligament injury**

There are three patellar ligaments that attach the patella to the tibia and act as tendons of insertion of the quadriceps femoris and biceps femoris muscles. The lateral patellar ligament (LPL) attaches to the craniolateral aspect of the patella and the craniolateral margin of the tibial tuberosity and receives tendons from the biceps femoris and the tensor fascia lata. The MidPL extends from the cranial aspect of the apex of the patella to the cranial aspect of the tibia at the distal end of the groove on the tibial tuberosity, and it is separated from the patellar apex and tibial tuberosity by small bursae. The MedPL is the weakest and extends from the parapatellar fibrocartilage on the medial patella to the medial side of the groove on the tibial tuberosity [29]; it functions as part of the stay apparatus. Injuries to these ligaments may be associated with direct trauma [1], may develop with no known history of trauma [41], or may be associated with intermittent upward fixation of the patella or medial patellar desmotomy [42]. Although usually caused by direct trauma, medial sagittal patellar fractures are occasionally the result of avulsion of the insertion of the MedPL [6,43,44]. Patellar ligament injuries are uncommon [1,34,41].

**Clinical signs**

Desmitis of the patellar ligaments can be difficult to diagnose, because specific clinical signs are often subtle or absent [41]. The MidPL seems to be the most frequently injured patellar ligament [14], and Dyson [41] reported that six of nine cases involved the MidPL. Two of these cases occurred after desmotomy of the MedPL. Local swelling and pain on palpation, particularly with the limb semiflexed, are sometimes present. Many affected horses have a history of low-grade lameness or loss of performance. Lameness is usually mild to moderate and is partially worsened by flexion of the proximal limb. Slight improvement in lameness after intra-articular analgesia was noted in five of nine cases [41], and no response in
one severe MidPL injury has also been documented [45]. Ultrasonography is the most useful diagnostic aid, and radiographic changes may be seen in chronic cases. Scintigraphy can show increased uptake of radioisotope at patellar and tibial insertions of the ligaments, but this has also been seen in horses without ultrasonographic changes in the ligaments [41]. Arthroscopically, the MedPL and LPL can usually be seen extrasynovially; thus, in some cases, arthroscopy may be useful diagnostically. A severe tear in the MidPL has also been detected arthroscopically [45].

Radiography

The most frequent radiographic changes are seen in chronic cases; they include periosteal roughening, remodeling at the patellar and tibial insertions of the affected ligament [34,42], and mineralization of the affected ligament [34]. If fracture of the patella is suspected, a cranioproximal-craniodistal oblique view is essential.

Ultrasonography

All three ligaments and their attachments can be imaged in longitudinal and transverse planes. Their size varies between horses [41]. The MedPL is triangular in cross-section; the LPL is more oval or flattened; and the MidPL is oval or triangular proximally, more circular at the midligament level, and triangular distally [41]. Lesions include hypoechoic areas within the ligaments, periligamentous echodensities, and irregularities of the parenchyma at the ligament insertions [41].

Treatment

These injuries are poorly documented, so there is little evidence to support treatment regimens. Rest and anti-inflammatory treatment, followed by controlled exercise, depending on the severity of the injury and the progress of the case is a sensible approach, however. Arthroscopy may be useful for further assessment and debridement of any intra-articular damage [45]. Avulsed fragments off the medial patella can be removed arthroscopically by dissection off their attachments to the MedPL [43,44].

Outcome

From the evidence of the scientific literature, this condition seems to carry a poor prognosis. All nine affected horses reported by Dyson [41] and one reported by Wright [45] remained lame. These were all referrals, and most had a duration of lameness of more than 2 months; thus, it may be that horses with acute less severe injury diagnosed and treated immediately could be more responsive to treatment. The prognosis for medial sagittal fractures of the patella, some of which may be avulsion fractures, is good [43,44].
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References


