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Ultrasound diagnosis of meniscal injuries in horses

J. M. Denoix and *V. Lacombe*

Clinique équine – INRA – Laboratoire d'Anatomie, Ecole Nationale Vétérinaire d'Alfort, France

Summary

Although soft tissue injuries of the equine stifle have been reported, only few ultrasonographic studies of this joint have been presented. The purpose of this paper is to present and analyse the ultrasonographic appearence of meniscal injuries in athlet horses.
Sound adult horses without history of lameness were used to obtain normal ultrasonographic images of the medial and lateral menisci.
Abnormal ultrasonographic findings in the menisci were identified in 49 out of 150 femorotibial joints examined. These findings were indicative of tears, fibroplasia, calcification, collapsus and prolapsus; 42 of them involved the medial meniscus, 12 were found in the lateral meniscus. Out of the 49 femorotibial joints considered in this study, meniscal injuries were suspected on radiographs in only 18 of them.
Indications for ultrasonographic examination of the menisci include: local signs (synovial distension), positive manipulative tests, hindlimb lameness with positive intrasynovial block of the femorotibial joint, abnormal radiographic findings to assess associated soft tissue injuries and trauma.

Keywords: horse, meniscus, ultrasonography, stifle

Ultraschall-Diagnose von Meniskusschäden bei Pferden

Obwohl über Weichteilverletzungen des Kniegelenks des Pferdes bereits berichtet wurde, gibt es nur wenige Studien über Ultraschall-Untersuchungen dieses Gelenkes. In dieser Untersuchung wird die ultrasonographische Darstellung von Meniskusschäden bei Sportpferden beschrieben und analysiert. Gesunde erwachsene Pferde, bei denen bis dato keine Lahmheiten aufgetreten waren, wurden benutzt, um normale Ultraschall-Aufnahmen der lateralen und medialen Menisken zu erhalten.
Abnormale ultrasonographische Befunde an den Menisken traten bei 49 der untersuchten 150 Femorotibialgelenke auf. Dies waren Risse, Fibroplasie, Kalzifikation, Kollaps und Prolaps; in 42 Fällen war der mediale Meniskus betroffen, in 12 Fällen der laterale Meniskus. Von den 49 Femorotibialgelenken mit Meniskusschaden, die in dieser Studie vorgestellt werden, bestand nur in 18 Fällen ein Verdacht anhand des Röntgenbildes.
Indikationen für eine Ultraschalluntersuchung der Menisken sind: lokale Anzeichen (synoviale Schwellung), positive manipulative Tests, Lahmheit der Hinterhand mit positiver intrasynovialer Anästhesie des Femorotibialgelenkes, abnormale Röntgenbefunde, um damit einhergehende Weichteilverletzungen und Traumata zu beurteilen.

Schlüsselwörter: Pferd, Meniskus, Ultraschall, Kniegelenk

Introduction

Ultrasonography has become a very useful technique for the diagnosis of tendon and ligament injuries in sport and race horses and appears as a complementary method to radiography for the evaluation of many articular injuries (*Denoix* et al 1994a). Although soft tissue injuries of the equine stifle has been described (*Nickels* and *Sande* 1982, *Prades* et al 1989, *Penninck* et al 1990), only few studies about the ultrasonographic assessment of meniscal injuries have been presented (*Denoix* et al 1993, *Denoix* et al 1994a and 1994b, *Dik* 1995).
The purpose of this study is to present and analyse normal ultrasound images and abnormal findings of the menisci in athletic horses.

Materials and methods

Sport and race horses included in the study were examined clinically because of hindlimb lameness. One hundred and fifty femorotibial joints were evaluated ultrasonographically because of abnormal findings obtained during physical (synovial fluid distension, painful response to passive flexion) and dynamic examination (lack of flexion during the swing phase, positive manipulative tests) and/or positive intraarticular anaesthesia. The patients were also examined radiographically with lateromedial and caudocranial projections.
Nine sound adult horses without history of lameness were used in order to obtain reference transverse and longitudinal (sagittal, parasagittal and frontal) ultrasonographic images of the menisci; these images were compared to transverse and longitudinal anatomical sections of 7 normal frozen injected limbs and to transverse and longitudinal Magnetic Resonance Imaging (M.R.I.) scans performed on 3 normal isolated limbs.
The ultrasonographic images were made with a semiportable machine (SIEMENS LM) or non portable machines (ALOKA 1200 and ALOKA 2000). The routine ultrasonographic examination was performed with 7.5 MHz linear probes and a 10 MHz sector probe. The skin of the area was clipped and a standoff pad was placed between the skin and probe in order to improve contact with the limb and to enhance visualisation of superficial structures. The caudal horn of the menisci was imaged using a 5 MHz sector probe placed on the caudal femoral muscles. All the longitudinal and transverse ultrasound scans were recorded on 3/4 inch U-Matic videotapes to allow complete retrospective analysis. The M.R. Images were performed using T1 and T2 weighted sequences with a 0.5 and a 1.5 Tesla field machines.

Results

Normal ultrasonographic images
Comparison was made between ultrasonographic images of the menisci of sound limbs and anatomical sections as well as M.R.I. scans. It allowed to establish the normal ultrasonographic images of these elements in the horse. The cranial and intermediate parts of the medial meniscus are easy to image between the medial femoral condyle and the medial ti-

bial condyle; their radial ultrasonographic cross-section has a triangular shape and is homogeneously echogenic (Fig.1). The intermediate part is

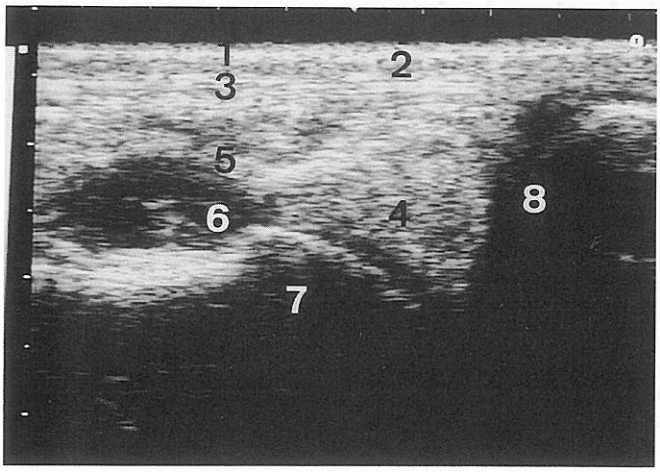

Fig 1: Longitudinal (frontal) ultrasound scan performed at the medial aspect of a normal femorotibial joint of a sound 11 year-old gelding.
The medial meniscus has normal shape, position and echogenicity. The synovial membrane and capsule are attached on its abaxial (medial) surface.
1– Skin; 2– Subcutaneous tissue; 3– Femoral fascia; 4– Medial meniscus; 5– Synovial membrane and articular capsule; 6– Medial recess of the medial femorotibial joint; 7– Medial femoral condyle; 8– Medial tibial condyle.

in close relation with the medial collateral ligament. The lateral meniscus is located deeper and separated from the lateral collateral ligament by the proximal tendon of the popliteus muscle. Its cranial part is in contact with the proximal tendon of the long digital extensor and third peroneus muscles. The cranial insertion of each meniscus can be imaged with a cranial approach on the flexed joint as an echogenic structure attached on the cranial aspect of the tibial spine. The caudal horn is thicker on the lateral meniscus than on the medial one; it is covered by the thick gastrocnemius and caudal femoral muscles.

Abnormal ultrasonographic images

Abnormal ultrasonographic images were obtained on clinical cases and allowed to document meniscal injuries in sport and race horses. Among the 150 femorotibial joints which were examined clinically and ultrasonographically, abnormal findings within the menisci were identified and documented in 49 of them. In 42 clinical cases the medial meniscus was found injured and the lateral meniscus was altered in 12 cases. Anechoic or hypoechoic images were induced by meniscal tears (12 cases) (Fig. 2), fibre disorganisation, edema or fibroplasia (36 cases) (Fig. 3 and 4); hyperechoic images were obtained in 11 cases with bone metaplasia; modification of shape, size and position of the menisci were correlated to collapsus of the femorotibial joint space (6 cases) and/or prolasus of the injured structure (7 cases). Enthesopathy of cranial attachments of the medial meniscus were identified in 3 cases. The most common combination of meniscal abnormalities (collapsus and calcification, tears and fibroplasia) were found in 8 medial menisci.

Meniscal lesions often were accompanied by other injuries of the femorotibial joint including :

- synovial fluid distension of the femorotibial recesses (37 cases) (Fig. 2 and 3),
- degenerative changes with periarticular bony proliferation (24 cases) (Fig. 4),

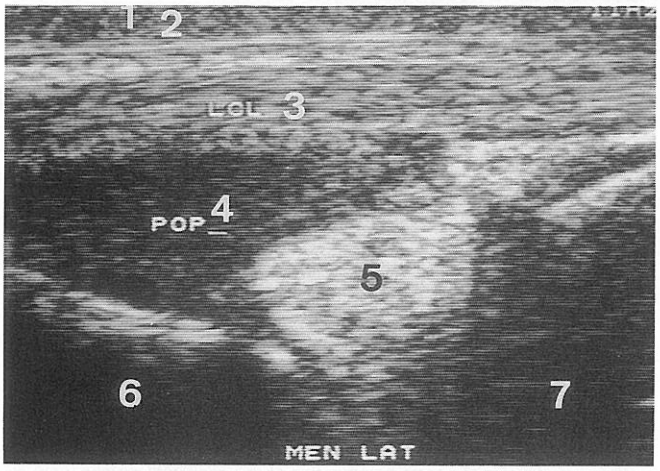

Fig. 2: Longitudinal (frontal) ultrasound scan performed at the lateral aspect of a normal femorotibial joint of a sound 3 year-old thoroughbred filly.
As its fibers runs obliquely to the lateral meniscus, the proximal tendon of the popliteus muscle looks hypoechogenic when the ultrasound beam is orientated to image this meniscus.
1– Skin; 2– Subcutaneous tissue; 3– Lateral collateral ligament; 4– Proximal tendon of the popliteus muscle; 5– Lateral meniscus; 6– Lateral femoral condyle; 7– Lateral tibial condyle.

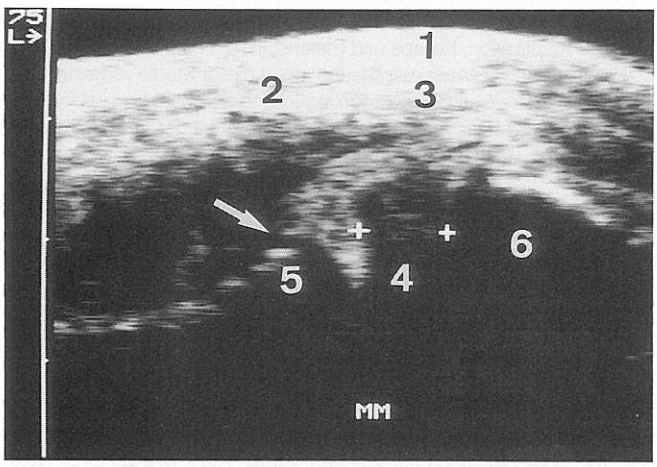

Fig. 3: Longitudinal (frontal) ultrasound scan performed at the medial aspect of the femorotibial joint of a 3 year-old male thoroughbred who sustained a stifle trauma 6 weeks ago.
There is a large and very hypoechogenic area (crosses) in the deep (axial) and distal parts of the medial meniscus close to the medial collateral ligament. This finding is compatible with fiber disorganization, edema and/or increased cellularity. There is also some periarticular bone remodeling of the medial femoral condyle (arrow).
1– Skin; 2– Subcutaneous tissue; 3– Femoral fascia; 4– Medial meniscus; 5– Medial femoral condyle; 6– Medial tibial condyle.

- medial collateral ligament desmopathy (14 cases), and lateral collateral ligament desmopathy (4 cases),
- bone cyst like lesions within the femoral or tibial condyles (12 cases),
- cruciate ligament desmopathies (16 cases).

Among the 49 femorotibial joints considered in this study, meniscal injuries were suspected on radiographs in only 18 of them on lateromedial and caudocranial projections.

In one case (Fig. 4), the gross post mortem examination was performed and confirmed the ultrasonographic diagnosis (bone metaplasia of the medial meniscus).

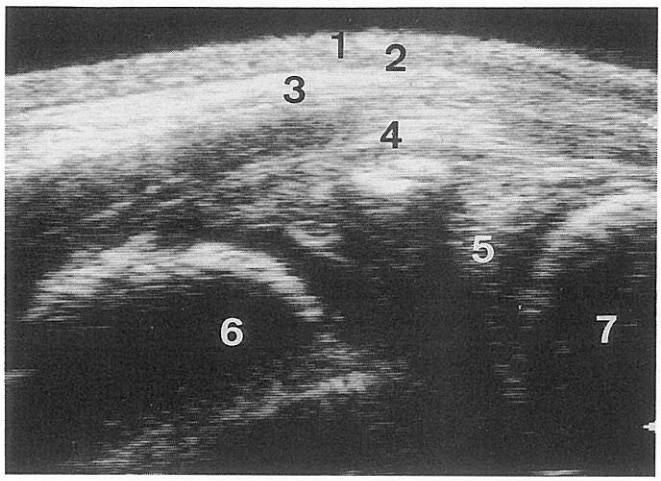

Fig. 4: Longitudinal (frontal) ultrasound scan performed at the medial aspect of the femorotibial joint of a 3 year-old male, selle français.
There is hyperechogenic material at the abaxial border of the medial meniscus casting an acoustic shadow. The proximal border of this meniscus is irregular and the medial femoral condyle presents some periarticular bone remodeling. At post mortem examination, bone metaplasia was present in the abaxial part of the medial meniscus.
1– Skin; 2– Subcutaneous tissue; 3– Femoral fascia; 4– Medial collateral ligament; 5– Medial meniscus; 6– Medial femoral condyle; 7– Medial tibial condyle.

Discussion

Meniscal injuries have rarely been described with the support of ultrasonography in humans (*Selby* et al 1986 and 1987) and horses (*Denoix* et al 1993, 1994a and 1994b, *Dik* 1995). This technique demonstrated that these lesions are not uncommon in sport and race horses. As a non-invasive imaging procedure giving information about architecture of soft tissues, ultrasonography presently appears as the best method for evaluation of the menisci in athletic horses. Its use requires the support of reference images and an adequate technique. Ultrasonographic examination on the menisci requires a deep knowledge of the stifle anatomy and of the pitfalls inherent in this technique. Artefacts can be created with inadequate orientation of the probe or inadequate position of the limb, lack of contact, defective preparation and should not be confused with injuries.

With ultrasonography, a wide variety of meniscal injuries can be diagnosed. They include modifications of shape and position, calcification, fibroplasia, tears and enthesopathies of the cranial attachments.

Comparative imaging of femorotibial joints with meniscal injuries demonstrated that radiography was of little value in the identification of meniscal injuries. With plain radiographs, only calcification and collapsus can be identified.

Simple or double contrast studies are not commonly performed in the horse. They are invasive technique and give only informations about the meniscal silhouette and tears.

Ultrasonography and radiology take both advantage to be performed as associated methods on the same clinical cases as they give complementary informations.

Diagnostic arthroscopy allows a direct, but partial, visualisation and palpation of the menisci. Examination of the cranial part of the menisci (and with advance technique : of the caudal part) allows evaluation of the meniscal attachments and meniscal surface. But the body of each meniscus cannot be imaged with arthroscopy and this technique does not allow evaluation of architectural changes. Moreover, this technique is invasive and requires a dorsal recubency under general anaesthesia. Ultrasonography has advantages over arthroscopy as it is a low cost, non invasive technique and can be done on the standing horse. It allows to evaluate the internal architecture of the menisci.

Indications for ultrasonographic examination of the equine menisci include :

- local signs (synovial fluid distension),
- positive manipulative tests of the stifle,
- hindlimb lameness with positive intrasynovial block of the femorotibial joint,
- abnormal radiographic findings to assess associated soft tissue injuries,
- trauma.

Radiography remains essential for the non-invasive assessment of concomitant femoral or tibial condyle injuries as well as for evaluation of cruciate ligament insertions.

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J. M. Denoix
V. Lacombe

Clinique équine – INRA – Laboratoire d'Anatomie
Ecole Nationale Vétérinaire d'Alfort
7, Avenue du Général de Gaulle
94704 Maisons-Alfort Cedex
France
Tel: (1) 43 96 71 08
Fax: (1) 43 96 31 62