How to Radiographically Localize the Entheses of the Equine Stifle Joint

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1. Introduction
Radiography of the equine stifle is an important diagnostic tool for visualization of bony changes. Unfortunately, there is limited information describing the precise radiographic location of the soft tissue attachments (entheses) within the joint.1–3 We describe the anatomical location of most entheses of the equine stifle using four radiographic projections: caudocranial, lateromedial, caudolateral-craniomedial, and caudomedial-craniolateral.

2. Materials and Methods
The entheses corresponding to the cranial and caudal cruciate, meniscal, and collateral ligaments and the popliteal, common digital extensor, and peroneus tertius tendons were consistently localized on dissection of six equine stifle joints. A bone specimen of the equine stifle was assembled, using harvested menisci from a different horse for adequate positioning of the femoral condyles in relation with the tibial condyles. The patella was fixed, mimicking the normal weight-bearing location, using Play-Doh.
This bone specimen was then radiographed using four projections (caudocranial, lateromedial, caudolateral-craniomedial oblique, and caudomedial-craniolateral oblique) with barium paste on the precise location of every enthesis or pair of entheses (origin and insertion) corresponding to each structure mentioned above. Each structure was marked and radiographed individually. The radiographic projections were evaluated, and key osseous landmarks for the entheses were determined on the basis of radiographic localization and comparison with a dissected plastinated specimen.

3. Results
A total of 40 radiographic projections of the stifle specimen were obtained. Each enthesis was successfully localized, based on the barium marking on the bone specimen. Distinct radiographic landmarks were identified for all entheses. Figures 1 through 7 are representative radiographs that demonstrate the location of different entheses.
Fig. 1. Caudocranial (a) and lateromedial (b) radiographic projections demonstrating the entheses for the cranial cruciate ligament (arrows). The lateral surface of the femoral intercondylar fossa where the cranial cruciate ligament originates can be better evaluated on the caudomedial-craniolateral oblique projection (c).

Fig. 2. Caudocranial (a) and lateromedial (b) radiographic projections demonstrating the entheses for the caudal cruciate ligament (arrows). The most proximal aspect of the femoral intercondylar fossa can be seen as a slightly irregular radiopaque line (arrowheads) on the lateromedial projection. The origin of the caudal cruciate ligament is located just distal to the subtle convexity of the line.

Fig. 3. Caudocranial radiographic projection demonstrating the entheses for the cranial (arrow) and caudal (arrowhead) ligaments of the medial meniscus (a). Caudocranial radiographic projection of a live horse in which the entheses described in Fig. 3A can be identified by following the visible cranial (arrowheads) and caudal (arrows) periarticular margins of the medial tibial condyle (b).

Fig. 4. Caudocranial (a) and lateromedial (b) radiographic projections demonstrating the entheses for the cranial ligament of the lateral meniscus (arrows). The surface of attachment of this ligament is located on the lateral and most cranial aspect of the tibial intercondylar eminence and in a live horse (c) can be found following a radiopaque line that continues with the tibial tuberosity on the caudocranial projection (arrows).
Fig. 5. Caudocranial (a) and caudomedial-craniolateral (b) oblique radiographic projections demonstrating the entheses for the femoral and caudal tibial ligaments of the lateral meniscus (arrows). The enthesis of the caudal tibial ligament of the lateral meniscus can be found on the caudocranial projection by following a faint radiopaque line that forms the caudal lateral margin of the proximal tibia and is continuous with the caudal periarticular margin of the lateral tibial condyle and the lateral tubercle of the tibial intercondylar eminence (c).

Fig. 6. Caudocranial (a), lateromedial (b), and caudomedial-craniolateral (c) oblique radiographic projections demonstrating the enthesis for the origin of the lateral collateral ligament (arrows). Compare Figs. 6b and 6c with Figs. 2b and 1c, respectively. The entheses of these different structures are superimposed on each other in these particular projections.

Fig. 7. Caudocranial (a), lateromedial (b), and caudolateral-craniomedial (c) oblique radiographic projections demonstrating the entheses for the medial collateral ligament. Note the insertion length of the ligament on the tibia (arrowheads). Compare Fig. 7b with Fig. 6b; the enthesis for the origin of the medial collateral ligament is slightly more caudal than the one for the lateral collateral ligament on a straight lateromedial projection.
4. Conclusions

The results of this study provide a detailed radiographic guide of the anatomical location of several entheses in the equine stifle joint and the associated bony anatomical landmarks for their identification in a live patient. It also demonstrates the potential superimposition of some of these structures on different projections; hence, a complete radiographic examination should be obtained for visualization of a potential lesion in more than one projection.

Knowing the correct location of these entheses in the different radiographic projections will help the veterinarian in completing a thorough radiographic evaluation of the equine stifle joint.

References