Ultrasonographic Appearance and Distribution of Deep Digital Flexor Injuries in the Pastern Region

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1. Introduction
Recent studies have shown the deep digital flexor tendon (DDFT) to be the most commonly injured structure in horses presenting for distal extremity magnetic resonance imaging (MRI). The location, shape, and distribution of DDFT injuries have been described, including core lesions, sagittal splits, and dorsal abrasions. Injury from the navicular bone to the DDFT insertion is found with similar frequency as injuries at the second phalanx (P2). The latter region is visible with ultrasound, but in some MRI reports, ultrasound was not performed or was negative for injury. Description of ultrasonographic technique was often not included, and it is unclear if P2 evaluation was attempted in all cases.

In contrast, the ultrasonographic distribution of pastern injuries has been infrequently reported despite its long-term use. Two studies describe DDFT injuries in 3/31 and 4/107 pastern exams, respectively. A more recent study found a higher number of DDFT injuries in 122/630 exams. P2 imaging was routinely performed in this study, but technological advances affecting image quality and differing patient populations may also be accountable. Distal metacarpal(tarsal) DDFT injuries have been described, but the appearance and distribution of pastern DDFT injuries has not been specifically reported. Although MRI has recently dominated the literature, ultrasound remains an option for horses with distal extremity lameness and can provide substantial information in situations where advanced imaging is unavailable or in horses where MRI is ultimately desired.

2. Materials and Methods
Records were reviewed of all patients that underwent pastern ultrasound by the Large Animal Ultrasound Service at the University of California Davis, Veterinary Medical Teaching Hospital, from January 2005 through December 2006. Pastern ultrasound included evaluation of the palmar/plantar structures of P1 and P2, with a 10–14-MHz or 5–10-MHz linear transducer and a 4- to 8-MHz “microconvex” curvilinear transducer. The hair of the pastern and heel bulbs was clipped with #50 blades, the midline cowlick and oblique distal sesamoidean ligament origins were razor shaved, the skin was washed and ultrasound gel was applied in all cases.

3. Results
Three hundred eight pastern exams were performed during the study period. Ninety-five DDFT inju-
ries were diagnosed in 86 horses; nine were bilaterally affected. There were 62 geldings and 24 mares, (age 1–25 yr; mean, 11.3 yr). Multiple breeds/uses were represented; similar to the hospital population. All but one horse was lame (range, 1–5; mean, 3.01; AAEP grading scale). Lameness was localized in 90.6% of horses with a palmar digital, abaxial sesamoid, or low four-point nerve block, digital sheath intrathecal, and/or distal interphalangeal joint intra-articular anesthesia. Other horses presented with wounds, swelling, digital sheath effusion, or behavior not conducive to blocking.

Injuries occurred in the forelimb (72) and hindlimb (23). A total of 60 limbs had injury at P1, and 63 had injury at P2. Injury extended into both regions in 28 limbs. Thirty-five injuries were only visible at P2. P1 injuries were identified using traditional pastern ultrasonographic technique with a linear transducer. Most P2 injuries were found with the microconvex transducer, although some proximal P2 injuries were visible with a linear transducer with the standoff removed. Injuries were graded as mild, (58) moderate (25), and severe (12) based on proximal to distal extent and percent damage.

P1 injuries were found throughout P1A, P1B, and P1C. Injuries were isolated to one zone in 30 limbs and involved all zones in 12. Except for one horse, remaining injuries spanned two adjacent zones. Ultrasonographic appearance was variable and included core lesions and small scattered hypoechoic areas. Eleven horses showed substantial dorsolateral or dorsomedial surface tearing at P1A and often had severe digital sheath effusion. Large, irregularly shaped hypoechoic areas with tendon enlargement were seen in horses with more severe injury. Complete rupture was apparent in three limbs. Distal metacarpal(tarsal) injury was found in 16 limbs.

P2 injuries were identified on the dorsal surface of the DDFT in 76% (48/63) of limbs, often as hypoechoic areas with dorsal bulging that distorted the tendon’s normal medial to lateral symmetry. Large hyperechoic areas were seen in some horses with long-term lameness. Pinpoint hyperechoic areas of dystrophic mineralization were found in 13 limbs. Core lesions (5) and parasagittal splits (4) were occasionally seen. Both lobes were affected in 38% (24/63) of limbs. Injuries otherwise involved either the medial or lateral lobe except for one horse with a midline penetrating injury.

Recheck ultrasound was performed in 34 horses. Thirteen horses underwent two to five recheck exams. Only five injuries showed slight sonographic improvement. Ultrasound otherwise showed a stable appearance, except for 13 limbs with enlarging lesions.

4. Discussion

Our results showed that ultrasound can provide sufficient information to explain the source of distal extremity lameness in many horses, especially because DDFT injury is generally believed to be significant regardless of the imaging modality used. This is important when advanced imaging procedures are not an option, and knowledge of injury at any level is adequate to satisfy owners and formulate a treatment plan. In some cases, ultrasound findings may prompt initially hesitant clients to pursue advanced imaging to elucidate the full extent of injury.

Despite suggestion to the contrary, ultrasonographic evaluation of P2 structures has yielded excellent results at our hospital. P2 evaluation has been included in all pastern exams since 1999; however, only longitudinal views were initially obtained. The addition of transverse imaging in 2002 resulted in improved injury detection because of superior visualization of lobe symmetry, dorsal changes, and alteration in echogenicity compared with longitudinal views. Finally, all exams are performed by experienced clinicians specifically trained and dedicated to equine ultrasonography in a hospital with a large musculoskeletal and performance horse caseload.

In summary, pastern ultrasonography (P1 and P2) remains a valuable and cost-effective option, either as a screening procedure or when advanced imaging is not possible because of availability or financial constraints. Further correlative imaging studies will be helpful to predict the value of advanced imaging procedures in horses with ultrasonographic evidence of injury proximal to the hoof capsule.

References and Footnote


*Universal Ultrasound, Bedford Hills, NY 10507.