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INTRODUCTION

Familiarity, convenience and cost mean that radiography has remained an important tool in the investigation of foot pain in horses despite the increased accessibility of advanced imaging modalities, such as nuclear scintigraphy and magnetic resonance imaging. Comparison with the other imaging modalities has increased recognition of the limitations of radiography in the diagnosis of foot pain (Dyson 2002; Dyson et al. 2006) but these may be minimised by evaluating radiological findings together with the results of physical examination, gait assessment and diagnostic local anaesthesia.

Radiology can play a role in the diagnosis of a number of conditions that are commonly associated with palmar foot pain, including dorsopalmar foot imbalance, navicular disease and fracture of the palmar portion of the distal phalanx. Given the lack specificity of local anaesthetic techniques used to localise pain to the foot, radiography may also contribute to diagnosis by helping to ruling out some of the causes of foot pain that are not restricted to palmar structures, for example, osteoarthritids of the distal interphalangeal joint.

RADIOGRAPHY

The foot should be carefully prepared to remove any dirt or loose horn that might result in radiographic artefacts. Packing of the frog sulci with Playdoh, or similar material, is recommended to avoid problems with interpretation caused by gas densities overlying the palmar foot in dorsoproximal-palmarodistal oblique projections. Leaving the shoe on for lateromedial projections can be helpful to the assessment of foot balance; if retained for the other projections, the shoe frequently obscures areas of interest. The projections required will vary according to the suspected diagnosis but include lateromedial, dorsoproximal-palmarodistal oblique centred and exposed for the distal phalanx, dorsoproximal-palmarodistal oblique centred and exposed for the navicular bone (and tightly collimated to reduce the scatter generated by the high exposures that are used), palmaroproximal-palmarodistal oblique, dorsopalmar, and oblique projections of the palmar processes of the distal phalanx.

CAUSES OF PALMAR FOOT PAIN

Dorsopalmar foot balance

The association between dorsopalmar foot imbalance and foot pain (particularly foot pain caused by navicular disease) is supported by circumstantial evidence and the findings of studies investigating the biomechanical consequences of alterations in foot conformation (Eliashar et al. 2002, 2004). Making measurements from lateromedial radiographic projections of the foot is a well substantiated method for assessing foot conformation objectively; important measurements are moment arm of the distal interphalangeal joint (Eliashar et al. 2002) and heel height relative to toe height (Eliashar et al. 2004).

Navicular disease

Lateromedial, dorsoproximal-palmarodistal oblique, palmaroproximal-palmarodistal oblique and dorsopalmar projections are commonly used in the radiographic assessment of the navicular bone. There is some debate over whether a perfectly aligned lateromedial projection or the palmaroproximal-palmarodistal oblique projection is of greatest diagnostic value (Dyson and Kidd 1993; De Clercq et al. 2000) but it is clear that errors in radiographic technique can hinder interpretation by creating artefacts or obscuring abnormalities.

A complicating factor in radiology of the navicular bone is that not all radiological changes are invariably associated with navicular disease (Kaser-Hotz and Ueltschi 1992). Additionally, navicular disease may occur in the absence of radiological abnormalities of the navicular bone (Dyson 2002). In general terms, however, the greater the number of changes and the greater the severity of those changes, the more likely the diagnosis of navicular disease. A grading system has been developed that provides a useful framework for the assessment of multiple concurrent radiological abnormalities and their severity (Dik and van den Broeck 1995).

In cases in which irregularity of the flexor surface (representing erosion or new bone formation), a cystic lesion within the spongiosa or fracture is identified, the diagnosis of navicular disease can be made by radiology alone (Kaser-Hotz and Ueltschi 1992; Dyson 2008).
Palmar distal phalanx fractures
The majority of distal phalanx fractures are readily visualised by radiography but oblique projections may be required to identify a proportion of palmar process fractures (Robson et al. 2008). Occasionally difficulties are encountered in differentiating vascular canals from incomplete distal phalanx fractures; obtaining further radiographs 7–10 days later when lysis of the bone margins will have resulted in widening of the fracture gap may aid fracture identification. Nuclear scintigraphy, MRI and computed radiography are alternative approaches to establishing the diagnosis. Small fragments at the solar margin or at the extremity of the palmar processes may be incidental findings and thus judgements about their clinical significance must take the entire clinical picture into account.

Ossification of the collateral cartilages (‘side bone’)
Breeds of horses with a high body mass to height ratio are predisposed to ossification of the collateral cartilages of the foot (Down et al. 2007). Although infrequently associated with lameness, very large ossified cartilages or marked asymmetry in the size of cartilages between or within feet may be suggestive of a clinical disease (Down et al. 2007). Fractures of ossified cartilages are a potential cause of lameness but may be difficult to differentiate from a linear radiolucency resulting from a separate centre of ossification of the cartilage.

CONCLUSIONS
Radiology based on good quality radiographs can play a significant role in the diagnosis of palmar foot pain. In those cases in which the radiological abnormalities do not correlate with the clinical signs however, further diagnostic imaging (MRI in particular) is justified.

REFERENCES

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