The prognosis for return to athletic function for Thoroughbred racehorses in Hong Kong with injuries to the palmaroproximal aspect of the metacarpus diagnosed using low-field magnetic resonance imaging

Thomas O. C. Ratcliffe, BVM&S1*; Paul Robinson, BVSC, DACVS2; Sarah M. Rosanowski, BSc, PGDip VCS, PhD3,4

1Veterinary Clinical Services, Equine Hospital, Hong Kong Jockey Club, Hong Kong SAR
2Ashby Equine, Bargara, QLD, Australia
3Digital Agriculture, Grasslands Research Center, AgResearch Limited, Palmerston North, New Zealand
4Department of Veterinary Clinical Sciences, Faculty of Veterinary and Agricultural Sciences, University of Melbourne, Werribee, VIC, Australia
*Corresponding author: Dr. Ratcliffe (tor6@cornell.edu)

OBJECTIVE
To evaluate and compare the prognosis for Thoroughbred racehorses to return to galloping and racing with injuries to the palmaroproximal metacarpus diagnosed with MRI.

ANIMALS
29 flat racing Thoroughbreds at the Hong Kong Jockey Club that underwent MRI between 2014 and 2022.

METHODS
Clinical, radiographic, ultrasonographic, and MRI reports were collected from veterinary clinical records, and these were combined with training and racing data. Horses were categorized on the basis of MRI diagnosis: (1) proximal suspensory ligament (PSL) involvement only, (2) PSL and concurrent proximal third metacarpal (MC3) bone involvement, and (3) proximal MC3 bone involvement only. The following were compared for prognosis for return to athletic function: return to galloping or racing, and reinjury.

RESULTS
Overall, the prognosis for return to athletic function was fair, with 92% (22/24; P = .53) and 67% (16/24; P = .73) of horses returning to galloping and racing, respectively. There was a relatively low reinjury rate, with 18% (4/22) of horses reinjuring. Horses with concurrent injury to both the PSL and proximal MC3 bone (Category 2) took longer to return to gallop (median, 116; IQR, 100.5 to 160), when compared with horses having only PSL injury (median, 69; IQR, 43 to 80; P = .04). Of the 4 horses that reinjured, 3 (75%) were horses in Category 2.

CLINICAL RELEVANCE
The findings from this study suggest that injuries involving both PSL and proximal MC3 bone concurrently require a longer rehabilitation period than those with PSL involvement alone.

Keywords: proximal suspensory ligament, avulsion fracture, enthesopathy, desmopathy, palmar cortical fracture

Injuries of the palmaroproximal aspect of the metacarpus are a well-recognized cause of lameness in performance horses of different disciplines.1–3 Injury is thought to be a result of repetitive work-related trauma and excessive strain.4 The pathologic process of injury to the palmaroproximal aspect of the metacarpus in horses can manifest in a variety of clinical forms. These include suspensory ligament (SL) enlargement alone, fiber disruption of the SL,5 or even injury extending into the cortex and medulla of the third metacarpus (MC3) presenting in the form of avulsion fractures,5,6 enthesophyte formation,1 or MC3 palmar cortical endosteal reaction.8 Fracture to the palmar cortex of proximal MC3 is another well-recognized injury and has been described. Examples include incomplete proximal MC3 cortical stress fractures,8,10 incomplete longitudinal fractures, and fatigue injuries of the palmaroproximal aspect of MC3.11 Lameness is variable4,7,11–13 and generally reflects the degree of severity of the injury.

Received August 8, 2023
Accepted November 27, 2023
doi.org/10.2460/javma.23.08.0442
©The authors
As diagnostic imaging becomes more sophisticated and readily available to equine practitioners, there is the potential that the extent of these injuries and subsequent definitive diagnoses are made in a wide variety of breeds and disciplines. Given the spectrum of injuries that can occur within the palmaroproximal metacarpal region in horses, an early and accurate diagnosis of the extent of the condition is valuable to enable clinicians to institute a prompt therapeutic rehabilitation plan. A diagnosis of injury to the palmaroproximal aspect of the metacarpus is often made using conventional modalities such as ultrasonography and radiography. Ultrasonography will detect changes in acoustic properties of the soft tissue structures of the proximal MC3, such as the SL, and it continues to remain a highly valued imaging modality for diagnosis of proximal suspensory lesions by many experienced clinicians. Advanced imaging such as MRI can detect subtle abnormalities, such as changes in ligament morphology. Changes in MR signals can reflect changes in the biochemical composition of tissues that may not necessarily have gross structural changes present; therefore, MRI has the ability to potentially detect changes, of which ultrasonography is not capable. Low-field MRI has been shown to be useful in the detection of osseous abnormalities at the palmaroproximal aspect of MC3. It has been suggested that MRI is best employed for early detection of injury within the proximal metacarpal region. This theory has also been demonstrated by high-field MRI studies of the origin of the PSL, albeit in the hind limb, such as Labens et al, whereby MRI was utilized as the gold standard to highlight the lack of specificity of diagnostic analgesia of this region.

Previous studies have reported the prognosis for return to athletic function in horses of varying disciplines with injuries to specific structures in the palmaroproximal aspect of the metacarpus based predominantly on a diagnosis from conventional imaging modalities. These horses were reportedly treated surgically or conservatively on the basis of the structures involved and extent of the injury. To date, the authors are unaware of any study comparing the prognosis for return to athletic function in Thoroughbred racehorses with different injuries sustained to the palmaroproximal aspect of the metacarpus diagnosed on MRI examination. The aim of this study was to evaluate and compare the prognosis of different injuries to the palmaroproximal aspect of the metacarpus diagnosed using MRI of Thoroughbred racehorses in Hong Kong for return to galloping exercise and subsequent racing.

Methods

Study design, population, and data sources

The study design was a retrospective cohort study conducted between 2014 and 2022. The study assessed the prognosis of return to athletic function of Thoroughbred racehorses in training at the Hong Kong Jockey Club (HKJC) during the study period that had sustained an injury to the palmaroproximal aspect of the metacarpus. Clinical, radiographic, ultrasonographic, and MRI information was collected from veterinary clinical records at the HKJC. Training and racing data were collected from the training and racing records maintained by a dedicated system within the HKJC.

Case definition and identification

All cases were examined by veterinary surgeons working for the Department of Veterinary Clinical Services at the HKJC. At the HKJC, each trainer is allocated 1 veterinarian who provides veterinary care for the horses within that stable. They are responsible for the clinical decisions and diagnostic imaging reports (ultrasonography and radiography) that are made and uploaded to the HKJC’s custom veterinary management information system (VMIS). Cases were defined as horses having the following inclusion criteria: first, a visible forelimb lameness at the trot in a straight line; second, localization of the pain causing lameness using diagnostic analgesia techniques as described by Pezzanite et al; or by obvious resentment upon deep palpation of the palmaroproximal aspect of the metacarpus at the origin of the proximal suspensory ligament (PSL); and third, a confirmed diagnosis of injury to the palmaroproximal aspect of the metacarpus by a veterinary radiologist on low-field MRI. Horses that had a discernible forelimb lameness at the trot and injury to the palmaroproximal aspect of the metacarpus made without the use of low-field MRI were excluded. Cases were identified by performing a systematic search of the MRI database and crossmatched to clinical records of the VMIS for horses that had undergone an MRI of the proximal metacarpal region. Horses with an MRI diagnosis of pathology not associated with the PSL or palmaroproximal MC3 were not included.

Diagnostic imaging

Radiography of the proximal metacarpal region, if performed, included 4 standard views of the proximal metacarpal region and carpus of the affected limb. The standard radiographic views obtained were the following: dorsopalmar, lateromedial, dorsolateral-palmaromedial oblique, and dorsomedial-palmarolateral oblique. All cases within this study that underwent ultrasonographic examination of the palmaroproximal metacarpal structures with emphasis on the origin of the PSL were done in accordance with the veterinary standard operating procedures at the HKJC using a linear transducer. This included ultrasonographic images of the PSL obtained using the non-weight-bearing technique, in addition to images obtained using the standard weight-bearing technique. Both forelimbs were clipped and prepared with chlorhexidine and alcohol prior to scan. The contralateral limb in all cases was also scanned to allow for comparison. The decision to perform radiography and ultrasonography as initial diagnostic imaging of the palmaroproximal aspect of the metacarpus prior to low-field MRI was made by the primary care veterinarian.
Data collection and variables

At the HKJC, each trainer is allocated 1 veterinarian who provides veterinary care for the horses within that stable. They are responsible for the clinical decisions that are made regarding each case. Over the 29 cases, there was a total of 8 primary clinicians. The VMIS at the HKJC was used to obtain the following data for each case: the signalment of the horse, the grade of lameness observed at the initial clinical examination, and days from initial clinical examination to MRI diagnosis. The lameness grade attributed to the horse was made by the veterinarian in charge of the case and defined in accordance with the 0 to 5 lameness grading system (Table 1).

Table 1—The 0 to 5 lameness grading scale used at the Hong Kong Jockey Club.

<table>
<thead>
<tr>
<th>Lameness grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No lameness is visible.</td>
</tr>
<tr>
<td>0.5</td>
<td>Lameness is difficult to observe or is not consistent or repeatable at the trot.</td>
</tr>
<tr>
<td>1</td>
<td>Lameness involves a discernible head nod at the trot; however, full and symmetrical limb movement is present.</td>
</tr>
<tr>
<td>2</td>
<td>Consistent and moderate head nod and asymmetrical limb placement at the trot.</td>
</tr>
<tr>
<td>3</td>
<td>Consistent and marked head nod at the trot. Lameness is not visible at the walk.</td>
</tr>
<tr>
<td>4</td>
<td>Lameness is visible at the walk.</td>
</tr>
<tr>
<td>5</td>
<td>Lameness produces minimal weight-bearing in motion or at rest or a complete inability to move.</td>
</tr>
</tbody>
</table>

Each study was subsequently interpreted by a board-certified radiologist and the report uploaded to the VMIS. All diagnostic imaging was taken on the basis of requirements set out by the Veterinary Regulation Department at the HKJC.

Statistical analysis

All categorical signalment, clinical, diagnostic imaging, and exercise data were described using numbers and proportions. Continuous data were described using medians, IQR and maximum, or mean and SD (SD) as appropriate. Summary statistics were determined on the basis of data normality, established by visual assessment of histograms.

Associations between the binary and continuous variables for prognosis for return to athletic function...
and the categories for MRI diagnosis were examined using χ² or Fisher exact tests, as appropriate, for binary data or the nonparametric Kruskal-Wallis test for continuous data. All analyses were conducted with Stata analysis software (version 17; StataCorp LLC).

**Results**

In total, 30 horses had low-field MRI of the proximal metacarpal region performed at the HKJC between 2014 and 2022; 29 of these met the case definition and subsequent inclusion criteria. All horses were colts or geldings. Sixteen horses had raced in Hong Kong prior to injury, for a median of 3.5 starts (IQR, 2 to 6 starts; maximum, 26 starts). The median age at time of injury was 4 years old (IQR, 3 to 4 years; maximum, 6 years).

**Clinical findings**

Of the 29 cases, 15 (52%) horses were lame in the right forelimb and the remainder were lame in the left forelimb. Twenty-eight of the 29 (97%) horses were lame in 1 limb only, and 1 horse had a concurrent low-grade right hind limb lameness present. In total, 31% (9/29) of cases had a lameness grade in the forelimb of 1/5, 62% (18/29) of cases were 2/5, and 7% (2/29) of cases 3/5.

Diagnostic regional analgesia was performed fully in 86% (25/29) of cases using 1 of the 4 recognized techniques for regional analgesia of the equine metacarpus. Of these, lameness was significantly improved or abolished following analgesia of the palmaroproximal metacarpal region in all cases. Not all VMIS records stated the percentage of improvement in lameness observed by the primary care veterinarian. For all cases, the improvement was deemed enough to justify subsequent investigation in the form of imaging of the palmaroproximal aspect of the metacarpus. Diagnostic analgesia of the palmaroproximal metacarpus was not performed in 4 horses, and diagnosis of the source of lameness was based on a marked pain response upon firm palpation of the palmaroproximal aspect of the metacarpus in the affected limb compared to the contralateral forelimb.

The median interval from first clinical examination to definitive diagnosis on MRI was 5 days (IQR, 3 to 11 days; maximum, 28 days).

<table>
<thead>
<tr>
<th>Category</th>
<th>Diagnosis</th>
<th>No. of horses (%)</th>
<th>No. of horses in category (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PSD Only</td>
<td>10 (35)</td>
<td>10 (35)</td>
</tr>
<tr>
<td>2</td>
<td>PSD</td>
<td>Plus palmaroproximal MC3 enthesopathy 9 (31)</td>
<td>14 (48)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plus proximal MC3 fissure fracture 5 (17)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Proximal MC3</td>
<td>Bone stress reaction only 2 (7)</td>
<td>5 (17)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fissure fracture 3 (10)</td>
<td></td>
</tr>
</tbody>
</table>

**Radiographic findings**

In total, 26 out of 29 (90%) horses underwent radiographic examination. Seventeen of these 26 (65%) horses had unremarkable findings and 6 (23%) horses had radiolucency of the proximal aspect of MC3. These radiolucencies varied in appearance from circular to curvilinear and were visible predominantly on the dorsopalmar view in all cases. Three of 26 (12%) horses had increased radiopacity of the proximal aspect of MC3 (Supplementary Table S2). These radiopacities were circular in shape and predominantly located on the medial aspect of proximal MC3.

**Ultrasonographic findings**

Twenty-seven out of the 29 (93%) horses underwent ultrasonographic examination. Of these, 16 of 27 (59%) had unremarkable findings. Nine of 27 (33%) horses had either enlargement of the PSL (3/27 [11%]) or loss of long linear parallel echoes (3/27 [11%]), or both (3/27 [11%]). In 2 of 27 (8%) horses, there was loss of smooth contour of the proximal palmar aspect of MC3.

One horse did not undergo either ultrasonography or radiography. Twelve of 25 (48%) horses had unremarkable findings in both the radiographic and ultrasonographic examination.

**Low-field MRI diagnosis**

Low-field MRI diagnosis of injury to the palmaroproximal aspect of the metacarpus was made and highlighted (Table 2). Ten of 29 (35%) horses were diagnosed with a PSD only and subsequently placed in Category 1 (PSL involvement only). 14 of 29 (48%) horses were placed in Category 2 (PSL and concurrent proximal MC3 bone involvement), and 5 of 29 (17%) horses were placed in Category 3 (proximal MC3 bone involvement only).

Within Category 2, 9 horses had concurrent MC3 involvement in the form of enthesopathy; 3 horses with an avulsion of MC3, and 2 horses with a fissure fracture of proximal MC3, defined as incomplete palmar cortical fractures of the proximal aspect of MC3. Within Category 3, 2 horses had palmaroproximal MC3 bone stress reaction only, defined by marked bone marrow edema–type signal pattern17 and 3 fissure fractures only.

**Treatment and rehabilitation**

The treatment and rehabilitation program were at the discretion of the primary care veterinarian and
training teams associated with the horse and based on the confirmed diagnosis made by the boarded radiologist on MRI. In total, 24 of the 29 (83%) horses started treatment and rehabilitation. Two (8%) horses received a short course of anti-inflammatory therapy. A 2.2-mg/kg dose of phenylbutazone twice daily, PO, at 12-hour intervals for 6 and 9 days was administered. The duration of treatment was at the discretion of the primary care veterinarian. Eighteen of the 24 (75%) horses underwent RPWT of the palmaroproximal aspect of the metacarpus. All 18 horses that underwent RPWT were from Categories 1 and 2. No horse from Category 3 underwent RPWT. One horse had missing information on the length and frequency of radial pressure wave treatment, the remaining horses received 1 session a week for a median of 6 weeks (IQR, 4 to 8 weeks; maximum, 18 weeks). Category 1 horses were given a median of 6 weeks (IQR, 2 to 8 weeks; maximum, 12 weeks; n = 8) and Category 2 horses a median of 8 weeks (IQR, 4 to 8 weeks; maximum, 18 weeks; 9). The period of RPWT prescribed depended on the clinician in charge of the case. The specific RPWT technique used for each case was not available and therefore cannot be assumed to have been standardized.

Clinical notes on postinjury rehabilitation were available for 24 horses. One horse sustained a humeral stress fracture within 1 month of MRI diagnosis after resuming trotting work, but it was unclear how long the rest period was prior to the humeral stress fracture diagnosis. Seventeen horses had rehabilitation length specified, with horses box rested, hand walked, and/or swum for a median of 8 weeks (IQR, 8 to 12 weeks; maximum, 16 weeks). Category 1 horses (n = 3) had 6 weeks (IQR, 2 to 8 weeks; maximum, 8 weeks), Category 2 horses (10) had 9 weeks (IQR, 8 to 10 weeks; maximum, 16 weeks), and Category 3 horses (4) had a median of 8 weeks (IQR, 8 to 10 weeks; maximum, 12 weeks) of rest following injury diagnosis. The duration of box rest and hand walking was determined by the primary care veterinarian in charge of each case, depending on the confirmed diagnosis on MRI. This was followed by a gradual return to full exercise, again, at the discretion of the primary care veterinarian.

Prognosis for return to athletic function
In total, 5 of 29 (17%) horses were retired from racing on the basis of the injury to the palmaroproximal aspect of the metacarpus diagnosed on MRI and subsequently never galloped or raced again (Table 3).

Return to gallop
Of the remaining 24 cases, 22 (92%) horses returned to gallop; 7 of the 10 (70%) horses from Category 1, 12 of the 14 (85%) horses from Category 2, and 3 of the 5 (60%) horses from Category 3 returned to gallop (P = .53; Table 3). Horses returned to gallop in a median of 100.5 days (IQR, 69 to 119 days; maximum, 352 days) and there was a significant difference in time to return to gallop (P = .04). Horses within Category 1 (PSL injury only) returned to gallop in a median of 69 days (IQR, 43 to 80 days), Category 2 horses (PSL and proximal MC3 bone) returned to gallop in a median of 116 days (IQR, 100.5 to 160 days), and Category 3 horses (proximal MC3 bone only) returned to gallop in a median of 91 days (IQR, 55 to 115 days). The 2 horses that did not return to gallop and had not been retired on the basis of the diagnosed injury to the palmaroproximal aspect of the metacarpus were retired during the rehabilitation period due to unrelated injuries including a fractured scapula and humeral stress fracture.

Return to racing
Of the 24 horses that started rehabilitation and conservative treatment, 16 (67%) returned to racing in a median of 170.5 days (IQR, 146.5 to 247.5 days; maximum, 551 days; P = .67; Table 3). Horses that returned to racing had a median of 10 starts (IQR, 3.5 to 20.5 starts; maximum, 42 starts; P = .67), with 6 of 16 (38%) horses currently still racing. There was no significant difference between MRI category and the time to return to racing (P = .67) or the number of races following return to racing (P = .67). In total, 6 of 10 (60%) horses from Category 1, 8 of 14 (57%) horses from Category 2, and 2 of 5 (40%) horses from Category 3 returned to racing (P = .78).

Return to gallop but not subsequent racing
Of the 6 horses that returned to gallop but did not return to racing, 3 were as a result of reinjury to

Table 3—Return to athletic function postinjury to the palmaroproximal aspect of the metacarpus diagnosed according to low-field MRI diagnosis category for 29 horses at the Hong Kong Jockey Club.

<table>
<thead>
<tr>
<th>Performance variable</th>
<th>MRI diagnosis category**</th>
<th>Number (total horses)</th>
<th>Median days to return (IQR; maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retired on diagnosis of injury (n = 5)</td>
<td>1</td>
<td>2 (10)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2 (14)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1 (5)</td>
<td>—</td>
</tr>
<tr>
<td>Returned to gallop (n = 22)</td>
<td>1</td>
<td>7 (9)</td>
<td>69 (43-80; 268)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>12 (12)</td>
<td>116 (100.5-160; 352)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3 (4)</td>
<td>91 (55-115; 115)</td>
</tr>
<tr>
<td>Returned to racing (n = 16)*</td>
<td>1</td>
<td>6 (9)</td>
<td>170.5 (148-246; 249)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>8 (12)</td>
<td>181.5 (150.5-246.5; 551)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2 (4)</td>
<td>323.5 (135-512; 512)</td>
</tr>
</tbody>
</table>

*At the time of publication, 2 horses were still in training but had not yet raced.
**Category 1 = Proximal suspensory ligament involvement only. Category 2 = Proximal suspensory ligament and concurrent proximal third metacarpal bone involvement. Category 3 = Proximal third metacarpal bone involvement only.
the palmaroproximal aspect of the metacarpus, 2 were retired or euthanized due to unrelated injuries, and 1 was still in full race training but was yet to race at the end of the study period.

**Reinjury**

Of the 22 horses that returned to training and subsequent gallop, 4 (18%) sustained a reinjury to the palmaroproximal aspect of the metacarpus. Of the 4 horses that reinjured, 3 (75%) were from Category 2, and the other (1/4 [25%]) from Category 1 of the MRI diagnosis categorization. No horse from Category 3 reinjured.

**Discussion**

The current study demonstrated a fair prognosis for flat racing Thoroughbreds to return to athletic function in Hong Kong with confirmed injury to the palmaroproximal aspect of the metacarpus and treated conservatively. To the best of the authors’ knowledge no study has been conducted comparing the prognosis of different injuries to the palmaroproximal aspect of the metacarpus on low-field MRI. The majority of cases identified in the current study returned to in-training gallop work within 4 months of injury. Of these horses, two-thirds subsequently returned to racing.

The majority of cases that started rehabilitation and conservative treatment returned to gallop in a median of 100.5 days. The 2 cases that did not return to gallop were due to unrelated injuries. Horses with concurrent MC3 bone and PSL involvement took longer to return to gallop, with a median of 116 days in comparison with 69 days for Category 1, PSL involvement only, horses. Three-quarters of reinjuries were in horses with concurrent PSL and proximal MC3 bone involvement; however, the number of horses with reinjury was low. Clinically, the current study supported previously reported observations that palmaroproximal metacarpal bone lesions associated with ligament damage carry a poorer prognosis than injuries to the PSL in isolation.\(^7,17,21\) Avulsion fractures of the palmaroproximal metacarpus and an associated PSD typically require a longer convalescence period than lesions such as proximal suspensory desmitis in isolation with no MC3 bone involvement,\(^4\) a finding that was supported in this study. A previous study\(^21\) identified that 90% of sports horses with acute injuries of the PSL in the forelimb return to full athletic function with conservative treatment. Differences in case definitions between the previous and current study likely account for the lower percentage of horses returning to racing demonstrated in this study. Additionally, it is feasible that the physiological stresses of racing, when compared to those of sports horses, may account for some of the differences in return to full athletic function in the current study.

There was no significant difference between injury category and time taken from injury to first race, with horses taking a median of 6 months to return to racing. However, this outcome variable may not be an accurate assessment for return to athletic function, as deciding whether the horse was fit enough to race was trainer dependent and therefore subjective. In addition, there is a 6- to 8-week “off season” implemented by the HKJC at the end of each racing season during which there are no race meetings scheduled, potentially resulting in a situation whereby a horse was deemed to be “race fit” by the trainer but there were no scheduled race meetings available. It is likely that the break from racing may have resulted in longer times from injury until the first race postinjury. These factors may have contributed to the variation in time from injury to first race and the lack of statistical significance in this outcome measure. Another key finding of this study was the inability of standard imaging modalities, such as radiography and ultrasound, to detect pathology within the palmaroproximal aspect of the metacarpus. Nearly two-thirds of horses that had a confirmed injury to the palmaroproximal aspect of the metacarpus on MRI and underwent radiography had unremarkable findings. If radiographic changes were seen, these included increased radiopacity and/or focal radiolucencies within the proximal MC3 region, both commonly documented radiographic changes associated with injury to the palmaroproximal aspect of the metacarpus.\(^1,12,21\) However, it should be noted that many athletic horses will have radiographic evidence of adaptive or degenerative changes of the palmaroproximal aspect of the metacarpus that may be long standing or of nonprimary clinical significance, and subsequent interpretation of clinical significance should be made with caution.\(^13\) This further supports the need for diagnostic analgesia to localize lameness and aid in subsequent imaging interpretation. Previous studies have demonstrated the increased likelihood of a false negative when using radiography to diagnose injury to the palmaroproximal aspect of the metacarpus, particularly in detecting PSD with the absence of osseous lesions.\(^13,15,21,24\) This study also supported the notion that radiography alone cannot rule out PSL disease or subtle associated bone injury of the MC3.\(^18,30\)

The ultrasonographic findings identified in this study are well documented in previous literature in cases with pathology within this anatomic region.\(^12,16\) However, nearly two-thirds of cases in this study had unremarkable findings. Ultrasonography is a validated technique and used extensively in clinical practice in the diagnosis of PSL lesions in forelimbs and hind limbs.\(^17,31\) However, the current study suggested that it has limitations when trying to obtain an accurate diagnosis of injuries to the palmaroproximal aspect of the metacarpus, particularly injuries with subtle osseous abnormalities, a finding that is becoming increasingly recognized, and highlighted the superiority of advanced imaging such as low-field MRI for making an accurate diagnosis.\(^13,15,21,27\) It should be noted that although in the majority of cases ultrasonography and radiography were performed prior to low-field MRI, in some cases they were not. Decisions regarding imaging to be undertaken were made by the primary care veterinarian in conjunction with the trainer, and the reason for imaging modality selection was not recorded. At the HKJC,
all veterinary care is available on-site in a dedicated equine veterinary hospital within the racing precinct and subsidized. Trainers can be presented with all 3 options for diagnostic imaging, and in the current study 3 trainers chose low-field MRI only. These decisions were at the discretion of owners and trainers. The horse’s own ability and other concurrent veterinary conditions, such as lower respiratory or historical lameness issues, may play a role in how far an owner wishes to investigate the horse’s severity of injury to the palmaroproximal aspect of the metacarpus.

This study further highlighted the benefit of obtaining an accurate diagnosis to provide trainers with a more informed prognosis and subsequent time scale for return to full athletic function and potential likelihood of reinjury, which subsequently can aid in managing trainer expectations and guide rehabilitation. This study provided evidence that, to obtain an accurate diagnosis of injury to the palmaroproximal aspect of the metacarpus, advanced imaging in the form of MRI is twice as likely as conventional imaging modalities such as radiography and ultrasonography to identify subtle pathology within this region in lame horses. The authors acknowledge that the availability of MRI and cost have the potential to be major limitations in the ability to undertake MRI. They also acknowledge that other advanced imaging modalities such as CT increasingly have the ability to accurately identify both osseous and soft tissue subtle abnormalities, and therefore as technology improves these imaging modalities could potentially replace MRI as the preferred choice. The authors also acknowledge that in the current study, the case definition included a diagnosis of confirmed injury to the palmaroproximal aspect of the metacarpus on low-field MRI. As such, it is highly likely that during the study period there were other cases of injury to the palmaroproximal aspect of the metacarpus whereby a diagnosis was made satisfactorily using standard imaging modalities alone, without the use of MRI.

Although the number of cases within this study was low and the resultant statistical power was low, data provided by this study are from a homogenous population of flat racing Thoroughbred racehorses in a single, unique jurisdiction. The number of cases may have made the identification of statistical differences challenging; however, given the unique racehorse training environment in this study, clinically relevant diagnoses and trends for return to athletic function were found and should be considered by clinicians when faced with similar injuries in their own caseload. Additionally, the low case number resulted in 3 categories of MRI diagnosis, resulting in different injuries to the palmaroproximal aspect of the metacarpus being categorized together. Categorization was based on the similarity in anatomic pathology present. Increased number of cases would allow for more homogenous categorization of MRI diagnosis and allow for more accurate comparison of prognosis for return to athletic function.

In the current retrospective study, the treatment and rehabilitation for each case were not standardized. The controlled exercise regimen for each case was determined by the attending veterinarian and therefore varied. Similarly, in three-quarters of cases, RPWT was used, and RPWT treatment regimens were not standardized across cases, with variations in treatment duration and frequency. Subsequently, the interpretation of RPWT impact on prognosis for this study should be made with caution. Extracorporeal shockwave therapy and RPWT have been suggested to improve the prognosis for horses with chronic PSD undergoing conservative treatment in the form of controlled exercise. However, there is little evidence to suggest that extracorporeal shockwave therapy or RPWT improves prognosis for return to athletic function over conservative treatment. Therefore, it remains difficult to say whether the prognosis in this study may have been further improved if a standardized approach had been followed.

In conclusion, this study demonstrated fair prognosis for return to athletic function of Thoroughbred racehorses that sustain an injury to the palmaroproximal aspect of the metacarpus and are treated conservatively in the form of predominantly controlled exercise. Within the spectrum of injuries that can be sustained within this anatomic region, those that involve MC3 bone and PSL concurrently appear to require a longer period of rehabilitation to return to full athletic function in comparison with injuries involving just the PSL in isolation. To accurately diagnose the full extent of injuries to this region, advanced imaging in the form of MRI is recommended. Advanced imaging has the ability to provide more information regarding the extent of injury to the palmaroproximal aspect of the metacarpus and therefore better guide prognosis for owners and trainers, which in turn will aid in management of expectations and subsequent rehabilitation. Further studies will need to be performed to further differentiate the injuries sustained to the palmaroproximal metacarpus in Thoroughbred racehorses and compare the prognoses for return to athletic function.

Acknowledgments

The authors gratefully acknowledge the support of Tige Yip and Ryon Cheong for assisting in retrospective data collection from the veterinary management information system, and Dr. Frederik Pauwels, DVM, CVA, DACVS, DECVDI (LA), for contributing to the interpretation of MRI images acquired.

Disclosures

The authors have nothing to disclose. No AI-assisted technologies were used in the generation of this manuscript.

Funding

The authors have nothing to disclose.

References

2. Bathe A. Neurectomy and fasciotomy for the surgical treatment of hindlimb proximal suspensory desmitis.

In: 40th British Equine Veterinary Association Congress. Equine Veterinary Journal Ltd; 2001:118.


34. Osborne C. Does extracorporeal shockwave therapy or radial pressure wave therapy improve return to function over conservative and/or surgical management in horses with proximal suspensory desmitis? Equine Vet Educ. 2020;33(3):278–280. doi:10.1111/eve.13352

**Supplementary Materials**

Supplementary materials are posted online at the journal website: avmjournals.avma.org