Stress Reactions to the Plantarolateral Condyles of MtIII in UK Thoroughbreds: 26 Cases

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Stress reactions to the distal condyles of the cannon are an important and common cause of hindlimb lameness in the galloping horse. Quantifying the degree of uptake is useful in determining the significance and extent of the degree of damage. Authors' address: Rossdale & Partners, Beaufort Cottage Laboratories, High Street, Newmarket, Suffolk CB8 8J S, England. © 1997 AAEP.

1. Introduction

Stress remodeling is a normal physiological response of bone. This is induced by changing forces as a result of increased exercise. A stress reaction represents an extreme of remodeling in which this physiological response becomes pathological. This term describes a bone injury that is detectable scintigraphically but not radiographically. A stress reaction within the plantarolateral condyle of MtIII describes the pathological condition occurring at this anatomical site. In more advanced cases there can be subchondral bone collapse with resultant disruption to the integrity of the overlying cartilage.

Stress reactions to the plantarolateral condyle of MtIII are often bilateral. They are also commonly seen in the McIII. Affected horses may display a poor action as opposed to an overt lameness. This phenomenon appears to be related to the bilateral presentation. Histological studies of normal meta- carpal and metatarsal condyles consistently show an increase in bone density or hypermineralization in the plantarolateral and plantaromedial condyles. This increase in bone density reduces dramatically as the sagittal ridge is approached. It has been proposed that this adjacent variation in bone density and inherent variations in mechanical properties may predispose to parasagittal condylar fractures.

This stress reaction involving the plantarolateral condyle of MtIII appears to show similarities to stress fractures in other regions of the body. The cyclical nature of fast exercise results in the repeated bone damage exceeding the reparative capacity of the bone tissue. A significant difference in this region is the close anatomical relationship between bone and articular cartilage. This appears to affect the course and prognosis when compared with a diaphyseal stress fracture. Previous studies have shown the articular cartilage of the plantar condyle to show gross abnormalities. It is postulated that this cartilage degeneration occurs secondary to subchondral bone pathology. The term traumatic osteochondrosis has been used to describe this observation.

2. Method

The cases in this series came from a population of approximately 1000 Thoroughbred racehorses be-
between July 1995 and December 1996. All the horses were in an active training program to race on the flat. For inclusion in the series, they were required to show a hindlimb lameness that was attributed to a focal increase in technetium uptake associated with the plantarolateral condyle of MtIII. No cases involving a radiographically detectable fracture to the condyle were included. A further confirmation by local anesthetic techniques was performed when necessary.

Data collected included age, sex, history, clinical signs, clinical workup, and scintigraphic and radiographic findings. The management and treatments regimes were recorded. Where available, the outcome of each case was noted. The follow-up period ranged from 3 to 20 months.

Scintigraphy was performed by using a standard protocol with a Technicare Omega 500, rectangular field-of-view camera. Horses were injected with 4.5 GBq of $^{99m}$Tc-MDP and scanned between 2 and 3 h after injection. Both a lateromedial and a plantar–dorsal view of the metatarsophalangeal (MTP) joint were obtained. Region of interest (ROI) counts were obtained from the lateromedial view. In all cases, counts from an equally sized region were taken from the plantar condylar and the middiaphyseal region of MtIII. A ratio between these two figures was calculated by dividing the ROI (condyle) by the ROI (diaphysis). These ratios were also calculated from a group of 26 similarly matched sound but retired for an unassociated problem, three (11%); and lost to follow-up or still resting, two (7%).

The calculated ratio of technetium uptake between the plantar condyle and mid-MtIII of the affected fetlock joints ranged from 1.8 to 8.4. The average ratio for affected fetlocks was 3.39. The scintigraphic ratios of unaffected MtIII’s ranged from 0.9 to 3.0, with an average of 2.13. No normal MtIII had a ratio greater than 3.0. This compares with 54% of affected joints having a ratio greater than 3.0.

All cases were radiographed. There were radiographic changes detectable in 11 of the 26 cases. The remaining 15 cases had no obvious abnormality detectable radiographically. Of the 11 cases classified as having radiographic abnormalities, the changes noted were all very subtle. These included either poorly defined or crescentic shaped lucencies within the plantar subchondral bone of the lateral condyle. These were often associated with varying degrees of irregular sclerosis. The only projection in which a radiographic abnormality was detected in this series was the dorsodistal–plantaroproximal oblique view.

The lateromedial view of the distal MtIII shows a triangular area of sclerosis in the plantar condyle. The extent of this sclerotic region was difficult to determine accurately, and its appearance was greatly affected by exposure values. Differentiation between affected and unaffected fetlock joints by the degree of sclerosis seen in this radiographic projection was not possible. The other more conventional views showed no obvious abnormalities.

The treatment and management regimes varied greatly. In all cases, they involved a variable period of rest with or without systemic or intra-articular medication. The intra-articular medications used were sodium hyaluronate, dexamethasone, triamcinolone acetonide, and methyl prednisolone acetonide. The systemic medications used were polysulfated glycosaminoglycans, isoxsuprine, and aspirin. The degree of variation and the small numbers involved in this series meant that no meaningful conclusion could be reached with respect to the efficacy of treatments.

The clinical outcomes of individual cases are grouped as follows: back in training with no recurrence of lameness, 14 (54%); back in training with recurrent problems or a decreased level of performance attributable to the diagnosis, seven (28%); sound but retired for an unassociated problem, three (11%); and lost to follow-up or still resting, two (7%).
Diagnostic analgesia was performed in seven cases. In all cases the lameness was associated with the MTP joint region. When an intra-articular anesthesia was used, there was a variable response.

4. Discussion
A stress reaction of the plantarolateral region of MtIII is a condition that has only recently been described.\(^7\)\(^,\)\(^8\) The use of scintigraphy has greatly increased the ease of diagnosis, and in the majority of cases it is the only imaging modality capable of contributing to a definitive diagnosis. The condition has also been termed traumatic osteochondrosis, which is a term arising from a postmortem study and which represents a more advanced situation with grossly visible cartilage damage.\(^4\) The pathogenesis of traumatic osteochondrosis is postulated to be associated with repeated loading, subsequent sclerosis, and ischemic necrosis of subchondral bone. Cartilage damage is thought to be a later development, occurring secondarily to subchondral bone damage.\(^4\)

There is a normal physiological response to stress within the condyles of MtIII and McII. This is manifested as an increase in bone deposition, resulting in a sclerotic region within the plantar and palmar aspect of the condyle.\(^5\) Presumably this physiological process becomes pathological when the loading and damage cycle exceeds the reparative and adaptive capacity of the bone.

Only the lateral condyle of MtIII was seen to be affected in this series. Possible reasons for this observation are that the lateral condyle has a smaller weight-bearing surface when compared with the medial condyle. This may result in an increased concentration of force to this area. Also, the lateral condyle is not perpendicular to the long axis of the bone, which may increase the shear stress to this region.\(^9\) This prevalence of lateral condylar location was also observed in a series of Standardbred racehorses, in which it was proposed that this location may have been attributable to training and racing on an oval track.\(^7\) This would not hold true for the horses in this series, as the majority of their training and racing programs occur in a relatively straight line.

It has been postulated that the reason for the plantar cortex being affected and not the dorsal cortex may in part be associated with the resultant force of the proximal sesamoid bones during full dorsiflexion. Calculations have shown this force to be two times greater than the force acting on the dorsal cortex of the distal MtIII.\(^10\) The observation of the condition occurring at faster paces is consistent with the observation in a series of racing Standardbreds who displayed this clinical condition.\(^7\)

Although similar cases of stress reactions involving McII were not included in this series, their prevalence within the same time period was less than those affecting the MtIII. This is likely to be associated with the common practice of exercising up gentle grades in Newmarket, thus shifting the weight distribution toward the hindlimbs.

Calculating a ratio of technetium uptake between the condyle and middiaphysis appears useful in determining the significance of the scintigraphic findings. The ratios from the group of normal horses did not exceed 3:1. It can therefore be postulated that a ratio above this figure is abnormal for the group of horses studied and may represent a pathological process. There are a number of clinical cases that have a ratio that falls in an uncertain level. These cases require further confirmation by diagnostic anesthesia and radiography. The use of this ratio will also allow a quantitative assessment to be made by using a point probe gamma-counting system.

Radiography does not appear to be a very useful imaging modality to assist in the diagnosis. This may in part be due to the minimal degree of bone changes visible, associated with the difficulty in highlighting the plantarolateral condyle of MtIII. A recently described\(^7\) radiographic projection that separates the plantarolateral condyle from the plantar aspect of P1 and the lateral sesamoid bone should increase the sensitivity of radiography. This is a downward-angled dorsolateral-plantaromedial oblique view.

The follow-up data suggest a moderate prognosis. A proportion of the cases have not yet had sufficient time following a period of rest to reach a higher level of exercise; this may influence the apparent prognosis at time of writing. There does not appear to have been any initial clinical findings or treatment regimes that have influenced the outcome of these cases. More cases and further follow-up is required. The variable response to intra-articular anesthesia is presumably affected by the presence or absence of cartilage damage. With significant cartilage degeneration, an adequate desensitization of the painful subchondral bone may be achieved. Conversely, an intact cartilage surface may well prevent adequate penetration of the local anesthetic.

An interesting clinical observation in the majority of the cases was the lack of localizing clinical signs in the face of often severe lameness. This may in part be due to the pathological process being largely confined to the subchondral bone. Postmortem studies suggest that a large proportion of the cases would have a significant degree of damage to the articular surface of the plantar condyle.\(^5\) The reason for the lack of synovial distension in these cases remains unclear.

The seasonal distribution of stress reactions did not appear to follow the pattern for fractures displayed in this same population. A peak incidence was noted in the midseason period between May and June. Fractures show a peak prevalence in the early part of the season, with a secondary but smaller peak in the late season period.\(^11\) In this study there was no objective assessment of conformation or foot flight. It is possible that these factors...
may influence the stress applied through the fetlock joint and hence the etiology of this condition. This may provide a practical approach to prevention and treatment of the condition.

5. Conclusions

In summary, the condition of a stress reaction to the plantar condyles of the distal MtIII appears to be a significant cause of lameness in the racing Thoroughbred in the UK. The use of scintigraphic ratios provides a useful and objective means of assessing the degree of active bone pathology in this region.

References