Osteochondrosis of the Tarsocrural Joint and Osteochondral Fragments in the Fetlock Joints: Incidence and Influence on Racing Performance in a Selected Group of Standardbred Trotters

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The relationship between tarsocrural osteochondrosis (OCD) and presence of osteochondral fragments in fetlock joints has been previously investigated in racehorses, especially Standardbreds. The increased knowledge of the problem and the introduction and spread of arthroscopy probably reduced the negative effects of these lesions on racing careers. A large group of Standardbred yearlings have been radiographically investigated in this study, and racing results of horses affected by tarsocrural OCD or osteochondral fragments in the metacarpo/tarso-phalangeal joints have been compared with results of non-affected horses. Most of the lesions did not negatively affect the racing performance, and a fair to good prognosis can be anticipated for selected radiographic lesions identified in yearling Standardbreds. Authors’ addresses: Clinica Equina Bagnarola, Via Armiggia, 25, 40050, Bagnarola, Bologna, Italy (Torre); and Dipartimento di Fisica, Università di Bologna, Viale Berti Pichat 6/2, 40127 Bologna, Italy (Motta). © 2000 AAEP.

1. Introduction
Intra-articular bony fragments represent a frequent finding in Standardbred horses. Their incidence and clinical significance have been the subject of several surveys and clinical reports. Several studies and surveys have been published in the past 15 years, in order to focus on different aspects of equine osteochondrosis (OCD) and osteochondral intra-articular fragments including proposed causes and aetiopathogenesis,1–6 epidemiology,7–14 genetic factors,15–17 clinical aspects,18–22 and surgical management.23–28 The sites of predilection of developmental and traumatic lesions in Standardbreds have been identified and today routine pre-sale or pre-purchase radiographic investigations mostly focus on the tarsocrural and fetlock joints. Surveys on yearlings are also useful in order to evaluate the incidence of lesions in a population and for planning preventative surgery, most of the lesions having developed by 1 year of age.29 The purpose of this study was to investigate the incidence of OCD in the tarsocrural joint and osteochondral fragments in the fetlock joints of a large group of Standardbred yearlings, and to compare the racing performance of affected and unaffected horses.

2. Materials and Methods
This study includes three groups of Standardbred yearlings from three different generations (born in 1990, 1991, and 1992) admitted to the selected session of the Standardbred yearling sales in Italy.
Each yearling, before acceptance, had to meet certain standards of pedigree and conformation. Each accepted horse was then submitted to a basic radiographic examination including at least one view (lateromedial) for each fetlock and two views (dorsolateral-plantaromedial oblique and plantarolateraldorsomedial oblique) for each tarsocrural joint. Extra views were obtained when needed, particularly in order to better visualize the displantor aspect of hind fetlocks (dorsolateral-plantaromedial and dorsomedial-plantarolateral oblique views with a 45° proximodistal direction). A radiographic report was prepared for each horse. Because of the radiographs selected, comments concerned only the tarsocrural and metacarpo/tarsol-phalangeal joints. For each joint, the following lesions were recorded:

### Tarsocrural Joint
- Fragments or large defects of the intermediate ridge of the tibia
- Fragmentation of the lateral troclear ridge of the talus
- Fragmentation of the medial malleolus

### Metacarpo/tarso-phalangeal Joint
- Palmar/plantar proximal fragmentation of the proximal phalanx
- Un-united proximoplantar eminence of the proximal phalanx
- Osteochondrosis (Type I, II, and III\(^{18}\)) of the sagittal ridge, lateral or medial condyles\(^{30}\) of the distal metacarpus/tarsus
- Dorsoproximal fragmentation of the proximal phalanx
- Apical fragmentation of the proximal sesamoid bones

The racing career as two- and three-year-old was evaluated for each horse when the last generation of the group (horses born in 1992) completed the third year of life and data were obtained by the Italian Trotting Association (ENCAT). The following parameters were examined for each horse:

- Number of starts at 2 years of age
- Number of wins at 2 years of age
- Number of placings at 2 years of age
- Earnings at 2 years of age
- Record time at 2 years of age
- Number of starts at 2 and 3 years of age
- Number of wins at 2 and 3 years of age
- Number of placings at 2 and 3 years of age
- Earnings at 2 and 3 years of age
- Record time at 3 years of age

The horses were divided into two groups, characterized by the absence of lesions (group without radiographic lesions) or by the presence of one or more lesions (group with radiographic lesions). The racing results of the group with radiographic lesions were compared with the results of the group without radiographic lesions. No clinical information was available for the horses and some of the horses with lesions were likely to have been treated surgically. In order to define a possible prognostic score for each lesion, racing results of horses characterized by the presence of the same lesion were evaluated and compared with the results of the total group and the group without radiographic lesions.

### 3. Results
The total group of three generations examined comprised 764 yearlings (410 males, 354 females). In 186 yearlings (24%), one or more joints with radiographic lesions were recorded, whereas 578 yearlings had no radiographic lesions. In 60 yearlings (8%), two joints with radiographic lesions were recorded; in 4 (0.5%), three joints with lesions; and in only one case four joints with lesions were identified. Lesions were found in 117 tarsocrual joints, and in 110 fetlock joints. The total number of joints with lesions was 227. The histogram in Figure 1 summarizes the location of different lesions. Lesions were classified according to their type and location and each lesion was identified with a number (1 to 20, see legend in Fig. 1).

In the tarsocrual joint (Table 1), the lesions had the following locations:

- Intermediate ridge of the tibia: 100 joints (54 on the right, and 46 on the left)
- Lateral troclear ridge of the talus: 9 joints (6 on the left, and 3 on the right)
- Medial malleolus: 7 joints (2 on the left and 5 on the right)
- Miscellaneous lesions: 1 joint

The dimensions and number of fragments of the same lesion were not recorded. More lesions were identified in the left tarsocrural joint than the right, but the difference was not significant.

In the fetlock joint (Table 2), the lesions were distributed as follows:

- Plantar fragmentation of proximal PI: 26 hind limbs (13 on the left and 13 on the right)
- Dorsodistal OCD of the metacarpus: 29 front limbs (14 on the left and 15 on the right)
- Dorsodistal OCD of the metatarsus: 33 hind limbs (18 on the left and 15 on the right)
- Dorsoproximal fragmentation of the proximal phalanx: 24 front limbs (13 on the left and 11 on the right) and 11 hind limbs (7 on the left and 4 on the right)
- Un-united lateral eminence of the proximal phalanx: 2 left hind limbs
- Apical fragmentation of proximal sesamoid bones: 7 cases in 5 horses (in 2 cases the fragmentation involved both sesamoids in the same fetlock)
Miscellaneous lesions (irregular defects of the dorsal contour of the sagittal ridge of the distal metacarpus): 2 cases

Due to different combinations of lesions within the same joint, a total of 134 lesions resulted distributed in 110 fetlock joints.

In Table 3, results referring to the 10 parameters examined are summarized for each group. Average data for each parameter are shown. The graphic representation of the data was characterized by the following patterns:

- Earnings were correlated with the number of wins
- Placings were correlated with the number of starts

### Table 1. Distribution of Lesions in the Tarsocrural Joint

<table>
<thead>
<tr>
<th>Intermediate Ridge Tibia</th>
<th>Lat. Troclear Ridge Tibia</th>
<th>Medial Malleolus</th>
<th>Miscellaneous</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>9</td>
<td>7</td>
<td>1</td>
<td>117</td>
</tr>
</tbody>
</table>

### Table 2. Distribution of Lesions in the Fetlock Joint

<table>
<thead>
<tr>
<th>Plantar Fragmentation PI</th>
<th>OCD Metacarpus</th>
<th>OCD Metatarsus</th>
<th>Dorsoproximal PI fragment</th>
<th>Un-united PI lateral eminence</th>
<th>Apical sesamoid fracture</th>
<th>Miscellaneous</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>29</td>
<td>33</td>
<td>35</td>
<td>2</td>
<td>7</td>
<td>2</td>
<td>134</td>
</tr>
</tbody>
</table>
Record time was an independent observation that did not correlate with other data.

Figures 2 and 3 respectively show the correlation between number of starts and placings (good) and between number of starts and wins (poor).

The group with radiographic lesions was characterized by better performances when compared to the group with no radiographic lesions. The number of starts as 2- and 3-year-olds in the group with radiographic lesions (5.96 and 17.76, respectively) was higher than the group without radiographic lesions (5.77 and 16.91). The differences increased when the number of wins was examined, especially in 3-year-old horses: in the total group, the average number of wins was 3.87, in the group without radiographic lesions 3.69, but in the group with radiographic lesions the average number of wins at completion of the 3-year-old racing career was 4.37, and this was significant.

As previously noticed, a correlation was observed between the number of wins and earnings. The average earnings of 2-year-olds in the total group were 6.693 million lire; the group without radiographic lesions had a lower value (L. 6.366 million) and the group with radiographic lesions averaged L. 7.708 million. More differences were observed when

<table>
<thead>
<tr>
<th>Group</th>
<th>S2y.o</th>
<th>S2&amp;3y.o</th>
<th>W2y.o</th>
<th>W2&amp;3y.o</th>
<th>P2y.o</th>
<th>P2&amp;3y.o</th>
<th>T2y.o</th>
<th>T2&amp;3y.o</th>
<th>ML2y.o</th>
<th>ML2&amp;3y.o</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total group</td>
<td>5.82</td>
<td>17.13</td>
<td>2.10</td>
<td>3.87</td>
<td>3.06</td>
<td>7.30</td>
<td>0.19</td>
<td>0.18</td>
<td>6.693</td>
<td>30.088</td>
</tr>
<tr>
<td>Without radiographic lesions</td>
<td>5.77</td>
<td>16.91</td>
<td>2.04</td>
<td>3.69</td>
<td>3.04</td>
<td>7.27</td>
<td>0.19</td>
<td>0.18</td>
<td>6.366</td>
<td>27.282</td>
</tr>
<tr>
<td>With radiographic lesions</td>
<td>5.96</td>
<td>17.76</td>
<td>2.29</td>
<td>4.37</td>
<td>3.12</td>
<td>7.38</td>
<td>0.19</td>
<td>0.18</td>
<td>7.708</td>
<td>38.811</td>
</tr>
</tbody>
</table>

*In Italy, we do not use the time referred to the mile, but the average time per kilometer. So 1.18, 1, for example, means that the average speed during the race was 1 minute, 18 seconds and 1 tenth/kilometer.

S2y.o Starts as 2-year old  
S2&3y.o Starts as 2- and 3-year old  
W2y.o Wins as 2-year old  
W2&3y.o Wins as 2- and 3-year old  
P2y.o Placings as 2-year old  
P2&3y.o Placings as 2- and 3-year old  
T2y.o Record time as 2-year old  
T2&3y.o Record time as 2- and 3-year old  
ML2y.o Earnings (million Lires) as 2-year old  
ML2&3y.o Earnings (million Lires) as 2- and 3-year old
earnings as 3-year-old were considered. In the total group, the average was L. 30.088 million; the group without radiographic lesions averaged L. 27.282 million whereas the group with radiographic lesions reached L. 38.811 million. The differences were less when other parameters were considered (number of placings and record times), but with the same trend of the group with radiographic lesions to show better results than the group without radiographic lesions.

The incidence of each type of lesion and its possible influence on the racing career were further evaluated, in order to identify prognostic indicators.

Lesions affecting the tarsocrural joint were considered as a single group, because most cases were OCD of the intermediate ridge of the tibia. The number of wins and earnings as 3-year-old (5.15 and 37.641 million, respectively) of horses affected by tarsocrural OCD were less but similar in comparison with the corresponding values of the full group with radiographic lesions.

Data referring to yearlings affected by fetlock lesions (with the exclusion of apical fragmentation of the proximal sesamoid bone) showed higher earnings as 2-year-olds (L. 10.239 million) and as 3-year-olds (L. 42.348 million) when compared with the total group, with the group without radiographic lesions, and with the group with radiographic lesions. The group of horses with osteochondrosis of the sagittal ridge or condyles of the metacarpus/tarsus had poorer racing results in comparison with the average results of the group without radiographic lesions. Despite higher number of starts (18.45 as 3-year-olds), with corresponding increase in placings, wins were 2.11 as 2-year-olds and 3.41 as 3-year-olds and earnings were L. 4.801 million as 2-year-olds and 24.049 as 3-year-olds. In the case of plantar fragments from proximal PI, there was slight increase in wins (4.42) in comparison with other groups, and the significant rise in earnings as 3-year-olds: L. 58.121 million. The latter result suggests the possible presence of one or more excellent performers in this relatively small group.

In horses with dorsoproximal fragmentation of PI, average earnings of 16.463 as 2-year-olds and 65.209 as 3-year-olds were recorded, suggesting minimal influence of this lesion on the athletic future. Finally, although rare, the presence of apical fragmentation of the proximal sesamoid bones was associated with the poorest results. The 5 cases in which the lesion was observed (2 involving both sesamoids in the same fetlock), had average 2.5 wins at 3 years of age and earnings of L. 3,968 and 9,450 million at 2 and 3 years of age, respectively.

4. Discussion

The group of yearlings examined in the present study can be considered representative of the Italian Standardbred population due to the large number of horses: each generation was represented by nearly 8% of the Standardbreds born in the corresponding year.

Standardbred trotters are the most widely investigated breed for OCD. Hoppe examined a large group of Standardbreds and Swedish Warmblood horses affected by tarsocrural OCD and lesions were found in 166 out of 212 joints of Standardbreds. Alvarado et al. examined a mixed group of stallions, mares, and two generations of yearlings on the same Standardbred farm. Several radiographic features were considered significant in that study and this produced a large percentage of radiographic findings considered pathologic: 25% of horses were affected. Yearlings affected by OCD accounted for 31.5%. During the following twelve years since Hoppe's study, several surveys on equine OCD have been published. The introduction of arthroscopy has improved knowledge of the incidence of OCD. Improved prognosis after surgical treatment of selected lesions has possibly influenced long term results in terms of athletic performance in this study.

The methods employed to evaluate the racing career referred to 10 performance parameters, this allowed identification of the most significant and well-correlated data. Earnings and wins were well correlated, whereas number of starts (which is been frequently considered the main parameter in similar studies) mostly correlated with number of placings, and the latter is a poor indicator of the racing career. Record times had independent variations. An easy conclusion from those data was that by increasing the number of races one can influence the number of placings, but not the number of wins nor earnings. The latter two parameters presumably represent a figure of the intrinsic quality of the race horse.

The incidence of tarsocrural and fetlock lesions was similar to that reported in previous literature. When results of horses affected by different types of lesions were evaluated, differences for previous reports became evident overall. The group with radiographic lesions had better results when compared with the total group and with the group without radiographic lesions. This trend was confirmed by all 10 parameters, especially wins and earnings. It is not easy to explain these results. Horses had not been clinically evaluated, and subsequent medical or surgical treatment were not known. It can be speculated that improvements in both diagnostic and surgical techniques allowed trainers and veterinarians to identify and treat lesions, mostly by arthroscopic surgery. It can also be hypothesized that the presence of (or predisposition to develop) some lesions is genetically linked to a good athletic genetic capacity. Alternatively, stallions and mares could transmit inferior genetic quality but not OCD or predisposition to develop lesions. A similar hypothesis was proposed by Storgaard Jorgensen et al., in order to explain results similar to ours obtained by horses affected and non-affected by OCD.
No clinical signs were recorded in the latter study, similar to our study.

Alvarado et al.\(^9\) reported similar groups to ours. In the population of Standardbreds they examined, 32.7\% of lesions were classified as OCD of the fetlock, 43.7\% of lesions involving the dorsodistal metacarpus/tarsus, 43.7\% the palmaro/plantaroproximal PI, and 12.5\% dorsoproximal PI. Yearlings affected by OCD and subchondral bone cysts had a number of starts slightly lower when compared to the normal group, but a significant rise in average earnings ($4.78 US versus $2.99 US). Another study\(^2\) investigated three groups of horses affected by different types of fetlock lesions in comparison with a normal group. Horses affected by fetlock lesions had a significantly lower number of starts when compared with the group of unaffected horses, but little differences in earnings. More recently, Storgaard Jorgensen et al.\(^3\) compared radiographic findings of a large group of Standardbreds with subsequent racing performance and longevity. These authors found no significant association between radiographic abnormalities and performance. No statistical significance was found in differences between starts and earnings of normal and affected horses. Horses with multiple lesions had lower earnings, but this was not statistically significant. This study did not provide information about treatment of horses affected by OCD, and it was hypothesized that 15\% of horses may have been surgically treated. Similarly, a radiographic survey performed on German Standardbreds\(^3\) showed a 12.4\% prevalence of tarsocrural OCD. No significant differences were found in number of starts, wins, placings, or earnings between affected and non-affected horses.\(^3\) The latter study referred to a group of horses examined between 1970 and 1985, mostly before the advent and spread of equine arthroscopy. A lower morbidity of equine tarsocrural OCD has to be expected after preventative and curative arthroscopy has become routine practice.

Lesions affecting the tarsocrural joint were not differentiated between different locations when the racing career was evaluated. As anticipated, OCD of the intermediate ridge of the tibia was widely prevalent. A more detailed study will be useful in the future, because lesions affecting the lateral trochlear ridge of the talus as well as the medial malleolus have been observed to carry a poorer prognosis for resolution of joint effusion and poor correlation has been demonstrated between radiographic and arthroscopic findings on the medial malleolus.\(^3\) In a previous survey,\(^1\) tarsocrural OCD was observed in 11.5\% of a group of Standardbred yearlings, with 95\% of lesions located in the intermediate ridge of the tibia.

Horses with radiographic lesions in the tarsocrural joint performed well in terms of wins and earnings as 2- and 3-year-olds. Unlike the fetlock, the tarsocrural joint frequently shows effusion and, more rarely, lameness in early stages of training; because of that it is the most frequent joint subject to preventative arthroscopic surgery. This may explain the good results of affected horses as 2-year-olds in the present report. In a retrospective study,\(^2\) racing performance of 114 Standardbreds treated for osteochondrosis of the intermediate ridge of the tibia was compared with racing performance of 456 healthy control horses. Fifty-eight of the 114 horses had been treated surgically and 56 had conservative treatment. Horses affected by bilateral OCD were twice as likely to have arthroscopic surgery. The 114 affected horses had significantly fewer starts than control horses, but earnings of the two groups of horses were similar. Based on previous considerations, one can argue that earnings tend to change independently of the presence of tibiotarsal OCD in Standardbred racehorses.

A recent study investigated morbidity of osteochondrosis of the tarsocrural joint in Standardbreds, and the incidence was 14.3\%.\(^6\) Early studies on horses receiving conservative treatment for OCD of the tarsocrural joint suggested that a poor prognosis should be given for racing soundness,\(^6\) and negative influence of OCD on performance of trotters was confirmed by Hoppe and Philipsson.\(^3\) A more recent study showed acceptable results with conservative treatment of tarsocrural OCD in Warmbloods but not in Standardbreds.\(^6\) The advent of arthroscopy was associated with significant improvement of prognosis after surgical treatment of selected OCD lesions. A study performed on a large group of horses operated for OCD of the tarsocrural joint showed excellent results, with 76.5\% of horses able to race successfully.\(^7\) The latter study showed different prognosis for selected lesions, with poorer results associated with OCD of the lateral trochlear ridge of the talus.

When horses affected by fetlock lesions were considered as one group (with the exception of cases with apical fragmentation of proximal sesamoid bones), earnings and wins were the highest observed in the study. It must be observed that the clinical significance of some lesions of the fetlock in Standardbreds has been questioned.\(^3\) Because of different aetiopathogenesis of fetlock lesions, a detailed analysis of results of horses affected by each type of radiographic pattern was performed.

Osteochondrosis of the sagittal ridge and condyles of the distal metacarpus/tarsus is characterized by the presence of one or more fragments or defects on the dorsodistal metacarpus/tarsus and can be associated with joint effusion, pain elicited by flexion and lameness under race training.\(^1,8,10\) Osteochondrosis of the sagittal ridge or condyles of the distal metacarpus/tarsus has been reported to mostly affect the hind limb (10\% versus 4.3\% in the fore limb),\(^1\) with tendency of affected horses to have lesions in multiple limbs. In the present study, horses affected by OCD of the sagittal ridge or condyles of the metacarpus/metatarsus had poorer racing results in comparison with control groups (total
group, group without radiographic lesions, and group with radiographic lesions). Interestingly, this group of horses was able to race more frequently than others and this possibly means that dorsodistal OCD of the metacarpus/metatarsus allows some acceptable level of race training, but prevents good results. The prognosis after surgical treatment of OCD of distal metacarpus/metatarsus has been reported as fair to good.41

Plantar fragmentation of proximal PI had lower incidence compared to that reported in previous studies,8,10,13 probably because the appropriate radiographic views (dorsoproximal lateral-plantar distal medial oblique and dorsoproximal medial-plantar distal lateral oblique) were not routinely performed. Sandgren et al.13 examined a group of Standardbred yearlings similar to the group reported here, and found a 22.4% incidence of palmar/plantar fragmentation of proximal PI. In the present study, all fragments from proximal plantar PI were found in hind limbs and mostly medially, according to previous reports.8,13 Proximoplantar fragments from PI have been described as developmental lesions by some authors,11,15,42 but previous43,44 and recent9 studies confirmed the traumatic origin, probably by early avulsion of tissue with osteogenic properties.5 Yearlings affected by plantar fragmentation of proximal PI in the present study had high earnings and number of wins. Prognosis after surgical treatment of this lesion has been reported as good20,45 and arthroscopy led to further improvement during the past 10 years.

Dorsoproximal fragmentation of PI was characterized by the best results in terms of wins and earnings as 2- and 3-year-olds of affected horses when compared with results of horses affected by other lesions. A study performed on a large group of horses submitted to arthroscopic surgery for dorsoproximal fragmentation of PI resulted in 73% of patients (mostly race horses) able to return to the previous use and 73.6% of these returned to the same level of performance.46

Un-united lateral eminence of proximal PI in the hind limb had incidence similar to that reported by Grondahl12 and no specific investigation was performed on racing performance, owing to the small number of horses involved.

Apical fragmentation of proximal sesamoid bones involved 5 horses (2 with fractures of both lateral and medial sesamoid bones of the same fetlock) and was associated with poor racing results. Apical fracture of proximal sesamoid bones selectively affect young horses in training and racing47 and surgical treatment is associated with good to fair prognosis.48 The chronic condition may have negatively influenced the athletic future of affected horses, especially when fractures involved both sesamoids of the same joint.

In conclusion, this study confirms the incidence of tarsocrural OCD and intra-articular bony fragments in metacarpo/tarso-phalangeal joints similar to previous radiographic surveys on Standardbreds. The analysis of the juvenile (2- and 3-year-old) racing career suggests no significant influence of most of the lesions affecting the tarsocrural joint on the athletic performance. Selected lesions of the meta-carpotarso-phalangeal joint may negatively affect the athletic performance. Further studies are needed in order to better assess the clinical relevance of each lesion and the possible genetic links between conformation, presence of OCD, and athletic attitude.

References