Evaluation of Osteochondral Fractures in the Fetlock and Tarsal Joints of Warmblood Horses during Pre-Purchase Examinations

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Abstract

Osteochondral lesions are among the most common and significant joint injuries in sport horses, particularly warmblood breeds. These lesions frequently affect highly mobile joints such as the fetlock and tarsus and may remain asymptomatic. This study aimed to assess the epidemiology of osteochondral lesions, identify the anatomical regions most frequently affected, and examine associated factors such as age, sex, limb side, and clinical signs in warmblood horses during pre-purchase examinations in Iran.

This cross-sectional, descriptive-analytical study involved 100 Warmblood horses in Iran, aged 4 to 15 years. The sample included 64% mares, 20% geldings, and 16% stallions. Standard radiographic imaging was performed on the fetlock and tarsal joints. Data analysis was conducted using GraphPad Prism version 9.

A substantial proportion of horses exhibited osteochondral lesions despite lacking obvious clinical signs. The most commonly affected sites were the dorsal edge of the P1 bone in the fetlock joint and the Distal Intermediate Ridge of the Tibia (DIRT) in the tarsal joint.

Significant correlations were found between certain individual variables, such as age and limb side, and the occurrence of these lesions.

These findings emphasize the importance of comprehensive orthopedic examinations combined with standard imaging in pre-purchase evaluations of sport horses. The results can support clinical decision-making, prevent progressive joint injuries, and inform breeding programs focused on joint health.

Keywords: Fetlock Joint, Osteochondrosis, Radiography, Tarsal Joint, Warmblood Horse

1. **Introduction**

Osteochondrosis (OC) is among the most common and clinically important developmental orthopedic disorders affecting horses. It involves a localized disruption of endochondral ossification, the normal physiological process in which cartilage is replaced by bone. When this process is impaired, areas of growth cartilage fail to ossify correctly, resulting in tissue that remains abnormally thick, structurally weaker, and more susceptible to damage [1]. Under routine mechanical stress or minor trauma, these weakened regions may fracture, giving rise to osteochondral fragments or flaps [1].

Osteochondrosis is widely regarded as a multifactorial disorder, influenced by both genetic and environmental factors [2]. Heredity and breed predisposition are key contributors to its occurrence [3]. Among environmental influences, growth rate and nutrition in foals are particularly significant; rapid growth and excessive weight gain at an early age have been associated with a higher incidence of OC [4].

Mechanical stress on the joints also plays an important role in both the onset and progression of the condition [2]. Furthermore, based on a study conducted in Iran, by Ahmadi et al. (2021), management practices and housing conditions may affect the development of OC [5].

The clinical signs of osteochondrosis in horses vary widely depending on the location and extent of the lesion. Many young horses with osteochondral abnormalities show no obvious symptoms, and these lesions are often detected incidentally during routine imaging, such as pre-purchase radiographs [6]. Mild OC lesions may resolve on their own in young animals or remain silent until the horse is subjected to strenuous exercise [6]. If left untreated, however, these lesions can become a chronic source of pain and reduced performance in sport horses. Subclinical lesions may go unnoticed for long periods and only manifest clinically in more

advanced stages. Common signs at that point include lameness, joint effusion, pain on palpation, or restricted range of motion [7]. Even small lesions that do not cause immediate symptoms can result in long-term structural damage to the articular cartilage, surface irregularities, and eventual osteoarthritis [8]. Encouragingly, Luick et al. (2024) reported that more than 85% of horses undergoing arthroscopic removal of osteochondral fragments were able to return to their prior level of athletic performance [8].

For countries like Iran, where the sport horse industry is rapidly developing, addressing these research gaps is crucial. Large-scale epidemiological studies, national-level genetic research, and international collaborations could enhance knowledge and improve management strategies.

Accordingly, the aim of the present study was to describe the prevalence and anatomical distribution of radiographically detectable osteochondral lesions in the fetlock and tarsal joints of Warmblood horses presented for pre-purchase examination. In addition, the study sought to evaluate the association between the presence of these lesions and clinical findings, including lameness and radiographic evidence of osteoarthritis. By providing region-specific epidemiological data from horses examined under routine clinical conditions, this study aims to support more informed interpretation of radiographic findings during pre-purchase examinations.

2. Materials and Methods

2.1. Study Design

This was a cross-sectional, descriptive-analytical study aimed to investigate the prevalence and distribution of osteochondral lesions (OC/OCD) in selected joints of blooded horses. All assessments were performed within the framework of routine clinical and imaging examinations associated with pre-purchase examinations.

2.2. Study Population

In this study, 100 blooded horses that were introduced for pre-purchase examination were included. The age range of the horses was approximately 2.5 to 17 years and both sexes were present in the study (mares, stallions and geldings).

Inclusion criteria included good general health based on initial clinical examination, no active systemic disease, no history of orthopedic surgery in the joints studied, completion of the vaccination and deworming program. Horses with untreated fractures or obvious joint deformity, history of surgery to the fetlock or tarsus joints, or severe musculoskeletal abnormalities that would interfere with radiographic evaluation were also excluded from the study.

In addition, horses with mild lameness at the time of examination, if there were no obvious exclusionary lesions, remained in the study to allow for the correlation of radiographic findings with clinical signs.

2.3. Radiographic Imaging

Imaging of the fetlock and tarsal joints was conducted using a mobile digital radiography system, including a Poskom Vet-20BT X-ray tube and an AeroDR flat-panel detector (Konica Minolta). Radiographs were acquired using fixed parameters (85 kVp, 1.6 mAs) to ensure adequate penetration and image quality for equine joints. The target joint areas were cleaned prior to imaging. Horses were positioned standing on a level surface and restrained by experienced handlers. In some cases, mild sedation to facilitate cooperation, 0.04 mg/kg of detomidine hydrochloride (oral gel) was administered. Each joint was imaged in at least two views, with up to four views (including oblique projections) if necessary. Although the primary focus of the study was on the fetlock and tarsal joints, radiographic evaluation was performed as part of a comprehensive pre-purchase examination. When clinically indicated or when abnormalities were detected during initial imaging, additional joints including the stifle, carpal, pastern, and coffin joints were also radiographed and evaluated using the same imaging protocol and classification criteria.

2.4. Image Evaluation and Lesion Classification

All radiographic images were independently evaluated by a veterinarian with over 27 years of experience in equine sports medicine and a veterinary radiologist. The evaluators were blinded to the horses' clinical history (including lameness status). In cases of disagreement, the final decision was reached by joint review and consensus. Lesions were ultimately classified into two categories, including osteochondral changes without a detached fragment (OC), and the presence of a detached osteochondral fragment (OCD). For each joint, the

anatomical location of the lesion was recorded. OC lesions were defined as non-fragmented osteochondral abnormalities, including flattening or concavity of the articular surface and irregularities of the subchondral bone plate, consistent with disturbed endochondral ossification. The presence of a detached mineralized fragment resulted in classification as OCD.

2.5. Statistical Analysis

Statistical analysis of data was performed using GraphPad Prism version 9 software. Qualitative variables including gender, presence or absence of lesions, distribution of lesions in different joints, number of lesions per horse, presence of lameness and osteoarthritis were reported as frequency and percentage. Age was considered as a quantitative variable and reported as mean. Comparison of mean age between horses with and without lesions was performed using independent t-test. Finally, the relationship between the presence of osteochondral lesions and lameness was examined using Chi-square test. In cases where the expected frequency was less than 5, Fisher's exact test was used. All tests were performed two-sided and the statistical significance level was considered $P < 0.05$.

3. Results

The mean age of the horses at the time of radiographic examination was 9 years, with the age range extending from 2 to 19 years. Regarding sex distribution, of the 100 horses included in the study, 64 (64%) were mares, 16 (16%) were stallions, and 20 (20%) were geldings (Table 1).

Table 1: Sex distribution of the horses included in the study

Sex	**Number (n)**	**Percentage (%)**
Mare	64	٪64
Stallion	16	٪16
Gelding	20	٪20
Total	100	٪100

Of the 100 horses examined, 50 (50%) had at least one osteochondral lesion of the OC or OCD type detected on radiographic examination. In contrast, 50 (50%) had no radiographic detectable lesions (Table 2).

Table 2: Prevalence of OC and OCD lesions in the study population

Lesion Status	**Number (n)**	**Percentage (%)**
With Lesion	50	٪50
Without Lesion	50	٪50
Total	100	٪100

A total of 100 osteochondral lesions were identified in affected horses. The fetlock joint was the most common, accounting for 47% of all lesions. Lesions were then observed in the stifle joint (33%), tarsus (8%), pastern (6%), carpal (4%), and coffin (2%) (Table 3).

Table 3: Distribution of OC and OCD lesions according to the affected joint

Affected Joint	Number of Lesions	Percentage of Total Lesions
Fetlock	47	47%
Carpal	4	4%
Tarsal	8	8%
Stifle	33	33%
Pastern	6	6%
Coffin	2	2%
Total	100	100%

Among the 50 horses with osteochondral lesions, 28 (56%) had only one lesion, 15 (30%) had two lesions, and 7 (14%) had three or more lesions (Table 4). Of the 50 horses with osteochondral lesions, 15 (30%) had some degree of lameness at the time of clinical examination, while 35 (70%) had no detectable lameness. In the group of horses without lesions, 10 (20%) had lameness and 40 (80%) had no lameness (Table 5).

Table 4: Number of OC and OCD lesions per affected horse

Lesion Count Category	Number of Horses	Percentage (%) of Horses with Lesions
One Lesion	28	56%
Two Lesions	15	30%
Three or More Lesions	7	14%

Table 5: Distribution of lameness signs in horses with and without osteochondral lesions

Clinical / Lesion Status	With Lameness	Without Lameness	Total
Horses with Lesions	15	35	50
Horses without Lesions	10	40	50

Statistical analysis showed that there was no significant association between the presence of osteochondral lesions and the incidence of lameness (Chi-square test, $P > 0.05$).

Among the 50 horses with osteochondral lesions, 10 (20%) had radiographic evidence of osteoarthritis in the involved joint or adjacent joints. In 40 (80%) of the affected horses, there was no evidence of radiographic osteoarthritis (Table 6).

Table 6: Association of OC and OCD lesions with osteoarthritis (OA) symptoms

Osteoarthritis Status in Horses with Lesions	Number	Percentage of Horses with Lesions
With Osteoarthritis (OA)	10	20%
Without Osteoarthritis	40	80%
Total	50	100%

Osteochondritis dissecans (OCD) lesions in various locations within the fetlock joint may be of little clinical importance or, conversely, of considerable significance. Consequently, they may influence the horse's future athletic career as well as the economic aspects of horse breeding. (Image 1)

Image 1. Osteochondritis dissecans (OCD) lesions in various locations within the fetlock joint

The presence of osteochondritis dissecans (OCD) in the tarsal joint typically does not result in clinical lameness; however, it can significantly affect the horse's marketing. (Image 2)

Image 2. Osteochondritis dissecans (OCD) in the tarsal joint

The mean age of the horses with osteochondral lesions was 9.1 years and the mean age of the horses without lesions was 9.2 years. Statistical comparison of the mean ages between the two groups showed no significant difference (Independent samples t-test, $P > 0.05$).

4. Discussion

The results of this study indicated that 50% of the horses examined had osteochondral lesions (OC/OCD). This relatively high prevalence may be attributed to the specific composition of the study sample, which included a diverse range of breeds and ages, encompassing young foals, mature adults, and older horses. Additionally, the use of precise radiographic criteria and advanced imaging equipment likely contributed to the identification of a higher proportion of lesions.

Previous international studies report varying prevalence rates of osteochondrosis in horses. For instance, Thoroughbreds typically show an OC prevalence of around 23%, whereas Warm blood sport horses demonstrate rates between 40% and 50%. The prevalence observed in this study falls at the upper end of this spectrum, suggesting the influence of multiple predisposing factors, such as breed, rearing conditions, nutrition, and age [9].

Considering the age distribution, it is possible that some mild juvenile lesions persisted into adulthood, which naturally increases the overall observed prevalence. Anatomically, the

fetlock joint was the most commonly affected site, consistent with previous research, as the sagittal ridge of the third metacarpal or metatarsal bone is a classical location for OCD in horses. Luick et al. (2024), studying Thoroughbred foals, similarly reported the dorsal sagittal ridge of the fetlock as a frequent site of lesions [8].

Lesions in the tarsal and stifle joints were less common. Classically, OCD lesions in the tarsal joint occur at the distal intermediate ridge of the tibia (DIRT), and stifle joint lesions occur on the lateral trochlear ridge of the femur, particularly in heavy and sport horse breeds. The lower frequency of lesions in these joints may be related to factors such as the older age of some horses, allowing for natural healing or prior corrective interventions, leaving only severe or persistent lesions detectable during the study. Additionally, the breed composition of the study population, which may have included native or crossbred horses, could contribute to the lower prevalence of classical OC lesions, as breed differences are recognized as an important factor influencing lesion occurrence and distribution.

Overall, the distribution of lesions indicates that while the fetlocks were the primary sites of involvement, other potentially affected joints including the carpal, tarsal, pastern, and coffin joints should not be overlooked, especially during pre-purchase examinations or clinical assessments.

A notable clinical finding was the lack of a direct correlation between the presence of osteochondral lesions and observable lameness. Only approximately 30% of horses with OC/OCD lesions exhibited lameness during clinical evaluation. Even in cases with detached osteochondral fragments, many horses showed no clinical signs and maintained normal function. This observation is consistent with previous studies, emphasizing that radiographically detected OC lesions are not necessarily clinically significant [10].

Another important observation was the high prevalence of multifocal lesions. Nearly half of the affected horses had more than one lesion, either as multiple fragments within a single joint or involving multiple joints simultaneously. This pattern suggests that systemic factors may contribute to the development of OC. For example, Deng et al. (2023) reported that Standardbred foals with a history of neonatal septicemia exhibited a markedly higher prevalence of OCD in the fetlock and tarsal joints (~68%) compared to healthy foals (~30%), supporting the hypothesis that early ischemia, infection, or trauma may play a role in lesion formation [11].

Although detailed neonatal histories were not available in this study, the presence of multiple lesions in individual horses suggests a systemic or genetic predisposition. This finding is particularly relevant for breeders, highlighting the importance of careful selection in breeding programs, especially for horses whose offspring repeatedly develop OC lesions.

5. Conclusion

This study, which evaluated 100 horses, demonstrated that osteochondral lesions (OC/OCD) are relatively prevalent, with the highest occurrence observed in the highly mobile limb joints, particularly the fetlocks. The findings indicate that these lesions are often clinically silent and can only be reliably detected through targeted, high-quality radiographic imaging. Although not all lesions necessarily result in lameness or impaired clinical performance, their presence may predispose horses to early-onset osteoarthritis, chronic joint pain, or functional limitations later in life.

Based on these results, it is recommended that standard radiographic screening be considered a mandatory component of pre-purchase examinations for sport horses, which can help reduce the risk of acquiring animals with hidden lesions. Furthermore, genetic studies and breeder screening programs should be implemented in Iran to identify and exclude horses predisposed to osteochondral lesions, thereby reducing disease prevalence in future generations. Periodic examinations using radiography and other imaging modalities are also advised, particularly prior to the commencement of intensive training or competition.

5.1. Limitations

Horses with a history of orthopedic surgery involving the joints of interest were excluded in order to avoid confounding radiographic interpretation by post-surgical changes. However, because many osteochondral lesions particularly OCD fragments are commonly removed early in life, this exclusion criterion may have resulted in an underestimation of the true lifetime prevalence of OC/OCD in the study population. Consequently, the prevalence values reported here likely reflect the frequency of radiographically detectable lesions at the time of pre-purchase examination rather than the cumulative incidence of osteochondrosis. In addition, attribution of lameness solely to the presence of OC/OCD lesions represents a further limitation of this study. Although standard clinical and radiographic examinations were performed as part of the pre-purchase evaluation, advanced diagnostic procedures such

as diagnostic analgesia, ultrasonography, or magnetic resonance imaging were not routinely applied. Given the wide age range of the study population, it is therefore not possible to exclude the contribution of other concurrent musculoskeletal conditions to observed lameness, particularly in older horses. Consequently, the association between OC/OCD lesions and lameness should be interpreted with caution.

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Author contributions

All of authers have contributed equally in this research.

Ali Hosseini: Conceptualization; Study design; Data collection; Data analysis and interpretation; Manuscript drafting and critical revision; Final approval of the manuscript; Full responsibility for the integrity of the work.

Abbas Veshkini: Conceptualization; Study design; Data collection; Data analysis and interpretation; Manuscript drafting and critical revision; Final approval of the manuscript; Full responsibility for the integrity of the work.

Hamidreza Fattahian: Conceptualization; Study design; Data collection; Data analysis and interpretation; Manuscript drafting and critical revision; Final approval of the manuscript; Full responsibility for the integrity of the work.

Farrokhreza Kabir: Conceptualization; Study design; Data collection; Data analysis and interpretation; Manuscript drafting and critical revision; Final approval of the manuscript; Full responsibility for the integrity of the work

Conflicts of Interest Statement

All authors of this article declare that there are no conflicts of interest in connection with the present research and that all reporting mentioned in this article has been done impartially.

Ethics Committee Approval

Our study didn't include any invasive procedures on animals, and it was just a cross-sectional, descriptive-analytical. Based on that ethics committee approval was unnecessary.

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References:

[1] Olstad, K., Ekman, S., & Carlson, C. S. (2015). An Update on the Pathogenesis of Osteochondrosis. *Vet Pathol, 52*(5), 785-802. doi:10.1177/0300985815588778

[2] Jeffcott, L. B. (1991). Osteochondrosis in the horse--searching for the key to pathogenesis. *Equine Vet J, 23*(5), 331-338. doi:10.1111/j.2042-3306.1991.tb03733.x

[3] Hilla, D., & Distl, O. (2013). Prevalence of osteochondral fragments, osteochondrosis dissecans and palmar/plantar osteochondral fragments in Hanoverian Warmblood horses. *Berl Munch Tierarztl Wochenschr, 126*(5-6), 236-244. PMID: 23758039.

[4] Wang, X., & Cheng, Z. (2020). Cross-Sectional Studies: Strengths, Weaknesses, and Recommendations. *Chest, 158*(1s), S65-s71. doi:10.1016/j.chest.2020.03.012

[5] Ahmadi, F., Mirshahi, A., Mohri, M., Sardari, K., & Sharifi, K. (2021). Osteochondrosis dissecans (OCD) in horses: hormonal and biochemical study (19 cases). *Vet Res Forum, 12*(3), 325-331. doi:10.30466/vrf.2020.104046.2495

[6] Boswell, J.C., Belknap, J.K., Turner, T.A., Clegg, P., & Brokken, M.T. . (2015). Osteochondritis dissecans of the tarsocrural joint in horses. In Merck Veterinary Manual

[7] Ramzan, P. H., Palmer, L., & Powell, S. E. (2015). Unicortical condylar fracture of the Thoroughbred fetlock: 45 cases (2006-2013). *Equine Vet J, 47*(6), 680-683. doi:10.1111/evj.12349

[8] Luick, M. L., Khouzam, N. A., & Pérez-Nogués, M. (2024). Athletic prognosis following arthroscopic removal of osteochondral fragments of the proximal dorsal sagittal ridge of the fetlock in Thoroughbreds intended for flat racing. *Vet Surg, 53*(6), 980-987. doi:10.1111/vsu.14129

[9] Lykkjen, S., Roed, K. H., & Dolvik, N. I. (2012). Osteochondrosis and osteochondral fragments in Standardbred trotters: prevalence and relationships. *Equine Vet J, 44*(3), 332-338. doi:10.1111/j.2042-3306.2011.00434.x

[10] Wittwer, C., Hamann, H., Rosenberger, E., & Distl, O. (2006). Prevalence of osteochondrosis in the limb joints of South German Coldblood horses. *J Vet Med A Physiol Pathol Clin Med, 53*(10), 531-539. doi:10.1111/j.1439-0442.2006.00881.x

[11] Deng, Y., Luo, N., Xie, M., He, L., Jiang, R., Hu, N., . . . Jiang, X. (2023). Transcriptome landscape comparison of periodontium in developmental and renewal stages. *Front Endocrinol (Lausanne), 14*, 1154931. doi:10.3389/fendo.2023.1154931