https://doi.org/10.52973/rcfcv-e34321 Revista Científica, FCV-LUZ / Vol. XXXIV, rcfcv-e34321

Clinical and Radiological Evaluation of Distal Extremity Lesions in Racehorses

Evaluación clínica y radiológica de lesiones de las extremidades distales en caballos de carreras

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ABSTRACT

Distal extremity lesions are prevalent in racehorses and cause mild-to-severe lameness, adversely affecting the racing life of horses. This study aimed to determine the incidence of distal extremity lesions in racehorses, to clinically and radiologically assess those lesions. The study included 158 limbs from 140 horses with distal extremity lesions among 282 horses of different breeds, age and sex that were presented to Equine Hospital of the Directorate of Diyarbakir, Turkey, Hippodrome with various clinical complaints during a racing season. Following anamnesis, the horses were clinically examined and lameness was localised. In cases where the lameness could not be localised upon physical examination, regional anaesthesia was performed, followed by radiological assessments based on radiographs acquired from different positions. Clinical and radiological examination revealed that 84.17% of the cases occurred in the forelimb and 15.82% in the rear limb, and the lesions in the forelimb were mostly located in the carpal joint (26.58%), metacarpus (25.31%) and metacarpophalangeal joint (23.41%), whereas those in the rear limb were located in the tarsal joint (7.5%). Therefore, the lesions in the forelimbs were more prevalent than those in the rear limbs of the affected racehorses. Radiography remains a satisfactory imaging technique for the diagnostic imaging of distal limb injuries in horses owing to its cost-effectiveness.

Key words: Distal extremity; radiological examination; racehorse

RESUMEN

Las lesiones distales de las extremidades son frecuentes en los caballos de carreras y causan cojera de leve a grave, lo que afecta negativamente la vida de los caballos en las carreras. Este estudio tuvo como objetivo determinar la incidencia de lesiones de las extremidades distales en caballos de carreras, evaluar clínica y radiológicamente esas lesiones. El estudio incluyó 158 miembros de 140 caballos con lesiones en las extremidades distales entre 282 caballos de diferentes razas, edades y sexos que fueron presentados al Hospital Equino de la Dirección del Hipódromo de Diyarbakir, Turquía, con diversos problemas clínicos durante una temporada de carreras. Después de la anamnesis, los caballos fueron examinados clínicamente y se localizó la cojera. En los casos en los que la cojera no pudo localizarse mediante el examen físico, se realizó anestesia regional, seguida de evaluaciones radiológicas basadas en radiografías adquiridas desde diferentes posiciones. El examen clínico y radiológico reveló que el 84,17 % de los casos ocurrieron en el miembro anterior y el 15,82 % en el miembro posterior, y las lesiones en el miembro anterior se localizaron mayoritariamente en la articulación del carpo (26,58 %), metacarpo (25,31 %) y articulación metacarpofalángica (23,41 %), mientras que los del miembro posterior se localizaron en la articulación del tarso (7,5 %). Por lo tanto, las lesiones en las extremidades anteriores fueron más prevalentes que las de las extremidades traseras de los caballos de carreras afectados. La radiografía sigue siendo una técnica de imagen satisfactoria para el diagnóstico por imagen de lesiones de las extremidades distales en caballos debido a su rentabilidad.

Palabras clave: Extremidad distal; examen radiológico; caballo de carreras

Received: 18/09/2023 Accepted: 13/10/2023 Published: 22/01/2024

INTRODUCTION

Distal limb lesions are prevalent in racehorses and cause varying degrees of lameness. Lameness is one of the most important causes of poor performance and is associated with substantial economic losses in horses (*Equus caballus*). Accurate diagnosis is the first step of effective treatment [1]. Clinical examination is crucial in determining the cause of lameness. However, sometimes it proves to be insufficient and thus imaging techniques are required. Radiography is a preferred imaging technique for lameness and limb examination in horses owing to its low cost and the ability to evaluate solid structures, including bones [2]. Radiological examination is a frequently used auxiliary examination method to try to diagnose the cause of lameness, including osteophytic growth or enthesophytes (dorsal metacarpal disease (DMD), osselet, exostosis of metacarpus, form (ringbone), bone spavin among others), osteoarthritis, fractures and dislocations, intraarticular fragment fractures, cartilage and soft tissue calcifications, foot penetration and foreign body penetration [3].

This study aimed to examine the incidence of distal extremity lesions in racehorses with intensive and exhaustive exercises, to clinically and radiologically assess those lesions.

MATERIALS AND METHODS

The study included 158 limbs from 140 horses with distal extremity lesions among 282 horses of different breeds, age and sex that were presented to Equine Hospital of the Directorate of Diyarbakir Hippodrome, Turkey with various clinical complaints during a racing season (2022 race year).

Clinical examination (inspection, direct and indirect palpation, trot examination, examination on a lunge) was performed upon taking detailed anamnesis from the individuals in charge of the horses included in the study. Cases of lameness upon clinical examination were scored according to the American Association Equine Practitioners (AAEP) lameness scoring system [4]. Regional anaesthesia (intraarticular, palmar digital nerve blockade, abaxial nerve blockade and lower four-point nerve blockade) was performed in cases where lameness was determined on clinical examination but it could not be accurately localised. Regional anaesthesia was performed from distal to proximal extremity. In those cases, the region was localised upon decreased or complete recovery of lameness. Standard radiographic views of the specific affected anatomic area were obtained (TABLE I). Detomidine HCl (Domosedan, Zoetis, Turkey) at a dose of 20–40 μg·kg^{-1} was administered intravenously to uncooperative horses, with rough temperament during the X-ray (Gierth, HF 80, Japan) procedure. Data from the horses' clinical and radiological examinations were recorded. Each radiographic image was separately examined, and the lesions were classified based on region and percentage rate evaluated thereafter.

RESULTS AND DISCUSSION

Based on the records, 282 thoroughbred Arabian and British racehorses underwent X-ray imaging for various reasons in a racing season at the Equine Hospital of the Directorate of Diyarbakir Hippodrome. The X-ray procedures were performed for acquisition

TABLE I
Radiographic positions used for radiographic examination

Front Limb	
Carpus	Dorsopalmar (DPa)
	Lateromedial (LM)
	Dorsolateral–palmaromedial 45° oblique (D45L–PaMO)
	Dorsomedial–palmarolateral 30° oblique (D30M–PaLO)
	Flexed lateromedial (Flexed LM)
	Flexed dorsoproximal–dorsodistal 30° oblique (flexed D30Pr–DDiO)
	Flexed dorsoproximal–dorsodistal 80° oblique (flexed D80Pr–DDiO)
Metacarpus	Lateromedial (LM)
	Dorsopalmar (DPa)
	Dorsolateral–palmaromedial oblique 55 ° (D55L–PaMO)
	Dorsomedial–palmarolateral oblique 55 ° (D55M–PaLO)
Metacarpophalangeal joint (Fetlock)	Lateromedial (LM)
	Dorsopalmar
	Dorsoproximal–palmarodistal 30° oblique (D30Pr–PaDi)
	Flexed lateromedial (flexed LM)
	Dorsoproximal–dorsodistal 45–70° oblique (D45–70Pr–DDiO)
	Lateroproximodorsal–mediodistopalmar 20° oblique (L20Pr20D–MDiPaO)
	Dorsolateral–palmaromedial 45° oblique (D45L–PaMO)
	Dorsomedial–palmarolateral 45° oblique (D45M–PaLO)
Hoof	Dorsopalmar (DPA)
	Lateromedial (LM)
	Dorsoproximal–palmarodistal 30° oblique (D30Pr–PaDiO)
	Palmarodistal oblique (PaDiO)
	Dorsoproximal–palmarodistal 60° oblique (D60Pr–PaDiO)
	Palmaroproximal–palmarodistal 45° oblique (Pa45Pr–PaDiO)
Hind Limb	
Tarsus (Hock)	Lateromedial (LM)
	Dorsoplantar (DPl)
	Dorsomedial–plantarolateral 55° oblique (D55M–PlLO)
	Dorsolateral–plantaromedial 35° oblique (D35L–PlMO)
Metatarsus	Lateromedial (LM)
	Dorsoplantar (DPl)
	Dorsolateral–plantaromedial oblique 55 ° (D55L–PlMO)
	Dorsomedial–plantarolateral oblique 55 ° (D55M–PlLO)
Metatarsophalangeal joint (Fetlock)	Lateromedial (LM)
	Dorsoproximal–plantarodistal 30° oblique (D30Pr–PlDi)
	Flexed lateromedial (flexed LM)
	Dorsoproximal–dorsodistal 45–70° oblique (D45–70Pr–DDiO)
	Lateroproximodorsal–mediodistoplantar 20° oblique (L20Pr20D–MDiPlO)
	Dorsolateral–plantaromedial 45° oblique (D45L–PlMO)
	Dorsomedial–plantarolateral 45° oblique (D45M–PlLO)
Hoof	Dorsoplantar (DPl)
	Lateromedial (LM)
	Dorsoproximal–plantarodistal 30° oblique (D30Pr–PlDiO)
	Plantarodistal oblique (PlDiO)
	Dorsoproximal–plantarodistal 60° oblique (D60Pr–PlDiO)
	Plantaroproximal–plantarodistal 45° oblique (Pl45Pr–PlDiO)

purposes, to determine whether or not the growth plate was closed, for differential diagnosis and for visualisation of proximal extremity bones. Distal extremity damage was detected in 140 (49.64%) horses, while no pathology was noted in 142 (50.35%) of the horses that underwent X-ray.

A total of 140 thoroughbred British (n=66) and Arabian (n=74) horses with distal extremity lesions detected upon clinical and radiological examination were included in the study. Of these horses, 53 (25 British and 28 Arabian horses) were female and 87 (42 British and 45 Arabian horses) were male. The age of the horses in the study ranged 2–11 years. Among the horses included in the study, 119 (85%, 56 British and 63 Arabian horses; 45 female and 74 male) had lesions in the forelimbs and 21 (15%, 10 British and 11 Arabian horses; 8 female and 13 male) had lesions in the rear limbs.

In this study, more than one lesion was detected in 18 horses upon clinical and radiological examination. Accordingly, 4 and 14 horses had multiple lesions in the rear limbs and forelimbs, respectively. Among the horses with >1 lesion in the forelimb, 2 had exostosis of metacarpus (Mc) and DMD, 1 had Mc IV fracture and DMD, 4 had sesamoiditis and sesamoid fracture, 3 had sesamoiditis and osselet, 1 had sesamoiditis and form (ringbone), 2 had osteoarthritis and intraarticular fracture in the carpal joint, and 1 had sesamoiditis and DMD. Of the 4 horses with rear limb lesions, 2 had bone spavin and osteochondritis dissecans, 1 had sesamoiditis and form (ringbone), and 1 had sesamoiditis and sesamoid fracture together.

The horses included in the study were presented with certain clinical complaints, such as lameness, increase in lameness after strenuous exercise, decrease in lameness after training, stumbling in races and training, frequent foot changes, local swellings, and poor performance. The lesions identified at the front and hind extremities as a result of clinical and radiological examination are listed in TABLES II and III.

Upon clinical examination, regional temperature increase and swelling were evident in all cases presented to the hospital in the acute stage, and temperature and swelling varied by case. In addition, varying degrees of lameness were observed in all cases; however, it was more prevalent in horses with multiple lesions than in those with a single lesion. The lameness scores are given in TABLE IV.

In cases involving the joint region (osteoarthritis, osselet, intraarticular fracture, osteochondritis, and other ones), effusion was found to be remarkable. It was observed that effusion was more prevalent in horses presented after racing and training. With regard to intraarticular fractures of the distal interphalangeal joint, the fracture fragment was located in the processus extensorius of the distal phalanx. Clinical examination of the cases with joint region involvement revealed that pain intensified when the joint was flexed. In these cases, lameness also increased in horses that were trotted up by flexion test. Based on these clinical examination findings, X-ray images of the area with pain were acquired from the positions specified in TABLE I.

The lesions with damage based on X-ray findings are listed in TABLES II and III. Images of certain cases with lesions in the distal extremity upon examinations are shown in FIGS. 1, 2 and 3.

Pain was localised by regional anaesthesia in cases of reactive horses (touch-sensitive horses) and where lameness could not be localised upon clinical examination. Complete disappearance of lameness or decreased lameness was considered positive and pain was localised

TABLE II
Distribution of lesions detected in the front limb

Region	Determined lesion (n)	Breed (A/B)	Sex (F/M)	Age range	% ratio in front limb	% ratio among total lesions
Carpus	Carpal III fissure (8)	3/5	2/6	3–7	6.01	5.06
	Intraarticular fracture (5)	4/1	2/3	3–7	3.75	3.16
	Osteoarthritis (29)	15/14	13/16	4–11	21.80	18.35
Metacarpus	Metacarpus II fracture (4)	2/2	0/4	4–6	3.00	2.53
	Metacarpus IV fracture (2)	1/1	1/1	3–7	1.50	1.26
	Incomplete fracture of metacarpus III (5)	2/3	1/4	4–6	3.75	3.16
	Sore Shine(DMD) (21)	11/10	11/10	2–3	15.78	13.29
	Suros (Splint) (8)	4/4	2/6	2–5	6.01	5.06
Fetlock	Osselet (14)	8/6	6/8	4–8	10.52	8.86
	Sesamoid fracture (7)	3/4	2/5	3–7	5.26	4.43
	Sesamoiditis (12)	7/5	5/7	2–5	9.02	7.59
	Ligament calcification (4)	3/1	1/3	4–8	3.00	2.53
Pastern	Form (Ringbone) (8)	3/5	4/4	4–8	6.01	5.06
Hoof	İntra articular fracture (2)	0/2	0/2	5–8	1.50	1.26
	Distal phalanx fracture (4)	3/1	1/3	4–7	3.00	2.53
Total	133	69/64	51/82	2–11		84.17

A: Arabian horse, B: British horse, F: Female, M: Male

TABLE III
Distribution of lesions detected in the hind limb

Region	Determined lesion (n)	Breed (A/B)	Sex (F/M)	Age range	% ratio in hind limb	% ratio among total lesions
Hock	Bone spavin (4)	2/2	2/2	4–6	16	2.53
	Osteochondritis dissecans (8)	4/4	3/5	2–3	32	5.06
Metatarsus	Suros (Splints) (5)	3/2	2/3	4–7	20	3.16
Fetlock	Osselet (2)	1/1	1/1	4–5	8	1.26
	Sesamoid fracture (1)	1/0	0/1	5	4	0.63
	Sesamoiditis (3)	1/2	1/2	2–3	12	1.89
Pastern	Form (Ringbone) (2)	1/1	1/1	6–7	8	1.26
Total	25	13/12	10/15			15.82

A: Arabian horse, B: British horse, F: Female, M: Male

TABLE IV
Distribution of lameness scores according to cases

Lameness score*	Diagnosis	Number of cases	Total
1	Suros (Splints)	1	1
2	Suros (Splints)	2	8
	Sore–shine	3	
	Sesamoiditis	2	
	Osselet	1	
3	Suros (Splints)	6	50
	Sore–shine	18	
	Metacarpus II fracture	3	
	Metacarpus IV fracture	1	
	Ligament calsification	4	
	Osselet	15	
	Bone spavin	1	
	Form (Ringbone)	2	
4	Osteoarthritis (Carpus)	16	53
	Suros (Splints)	4	
	Sesamoiditis	13	
	Form (Ringbone)	8	
	Bone spavin	3	
	Intraarticular fracture (Carpus)	2	
	Intraarticular fracture (Hoof)	1	
	Osteochondritis dissecans	4	
	Metacarpus II fracture	1	
	Metacarpus IV fracture	1	
5	Osteoarthritis (Carpus)	13	46
	Incomplete fracture of metacarpus III	5	
	Sesamoid fracture	8	
	Intraarticular fracture (Carpus)	3	
	Intraarticular fracture (Hoof)	1	
	Osteochondritis dissecans	4	
	Carpal III fissure	8	
	Distal phalanx fracture	4	
Total		158	158

* AAEP lameness scale was used [4]. Lameness score 0: No lameness. 1: It is difficult to observe lameness. On a mount, it is not consistently visible on hard surfaces when longitudinal. 2: It is difficult to observe lameness while walking or running in a straight line. However, it can be detected on hard surfaces while riding, longing. Lameness is not always evident. 3: Lameness is evident at a certain speed. 4: The lameness is evident even in walking. 5: Lameness is evident both in motion and at rest.

based on these regions. The test was positive in all horses (n=12) that received regional anaesthesia. Regional anaesthesia was used to localise the pain and radiological examination revealed sesamoiditis, osselet, carpal joint osteoarthritis and distal phalanx fracture.

Clinical and radiological examination revealed that the degree of lameness was higher in cases with intraarticular lesions, bone fractures and multiple lesions. The lameness scores of all cases are given in TABLE IV.

Distal limb lesions cause varying degrees of lameness, ranging from barely visible to severe lameness. Especially in racehorses, lameness or inadequate and deficient performance associated therewith adversely affects the racing life of the horse. Diagnosis of lameness caused by distal extremity lesions requires a comprehensive examination, including a careful inspection and palpation, manipulative tests, careful examination of the shoe nail and regional anaesthesia. However, the diagnosis requires technical imaging modalities to fully assess the specific causative lesions [1, 2]. Radiology is an important diagnostic method for determining the normal postural position, bone–joint relationships and bone lesions in horses [2, 5, 6]. It is also one of the most widely used imaging modalities in the diagnosis of limb bone disorders in horses [2]. Radiological examination plays an important role in both the diagnosis and treatment of degenerative joint and bone damage. Osteophytic formations around the joint, in the joint capsule, and at tendon–ligament–bone junctions, irregularities in the periosteum and bone lysis can be visualised via radiological examination. To examine lower extremity lesions and small volume bone lesions in horses through radiological examination, it is critical to know the radiographic positions during the procedure and to take radiographs in several directions rather than a single radiographic position to ensure accurate diagnosis and treatment [3].

The structure of the forelimb in horses is critical for the horse's overall athletic performance and susceptibility to lameness, as it carries approximately 55–60% of the body weight of a standing horse. During races or strenuous exercise, the front extremities are exposed to more stress than the rear [3, 7, 8]. In this study, 85% of the horses had lesions in various parts of the forelimbs (n=119), whereas 15% had lesions in various parts of the rear limbs (n=21).

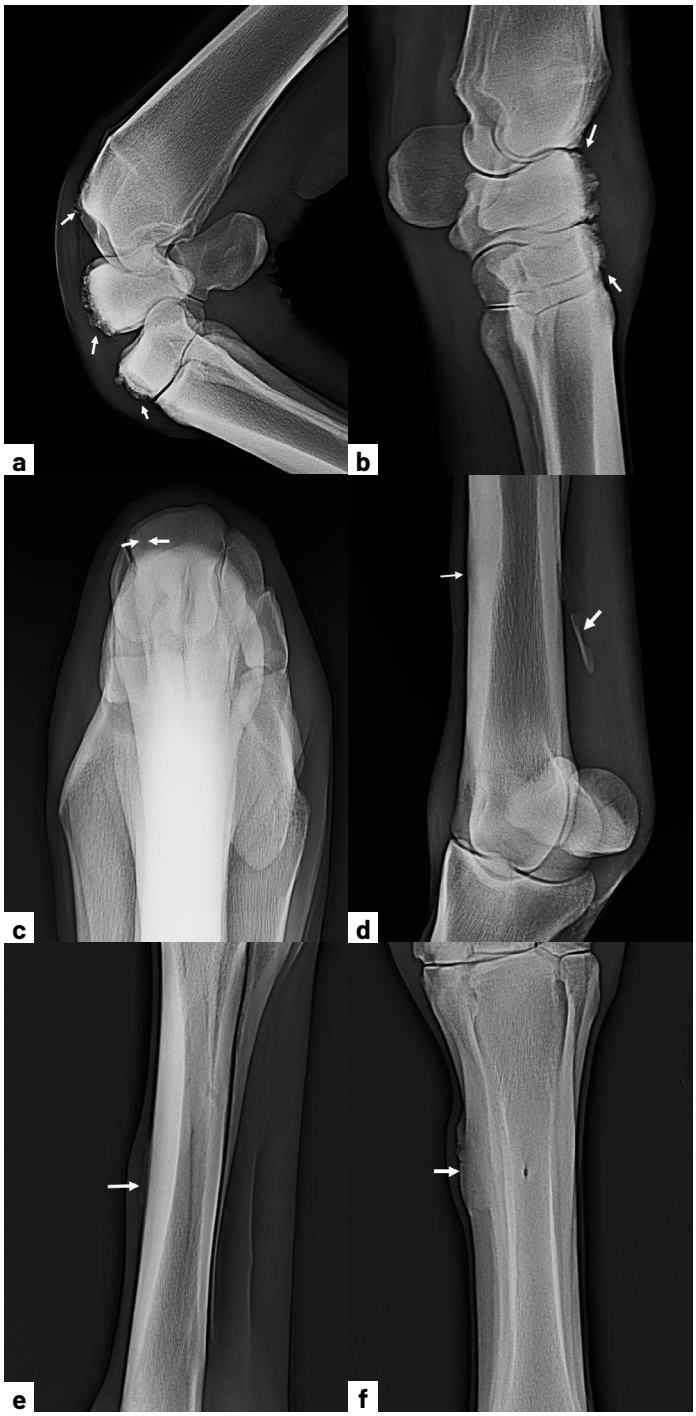

FIGURE 1. a–c. Some cases observed in the carpal joint. a. Flexed LM radiographic view of the carpal joint. b. LM view of the carpal joint. a,b: Osteophytosis and lysis in carpal bones and distal radius due to osteoarthritis are shown. c. In the D30Pr–DDiO radiographic view of the carpal joint, the fissure formed in the carpal III bone is shown between the arrows. d–f. Some cases determined in the metacarpus. d. In the D55L–PaMO radiographic position of the metacarpus, periostitis formed at the level of the middle one–third of the mediolateral of the metacarpal 3 and a broken arrow formed in the distal of the metacarpal 4 are shown. e. In the radiographic position of D55L–PaMO, periostitis due to sore–shine and osteoperiostic osteophytosis in the middle third of the mediolateral aspect of the dorsal surface of the metacarpus are shown by the arrow. f. In the DPa imaging of the metacarpus, osteophytic growths (Suros) formed on the medial side between the middle and upper 1/3 of the Metacarpal 3 are shown

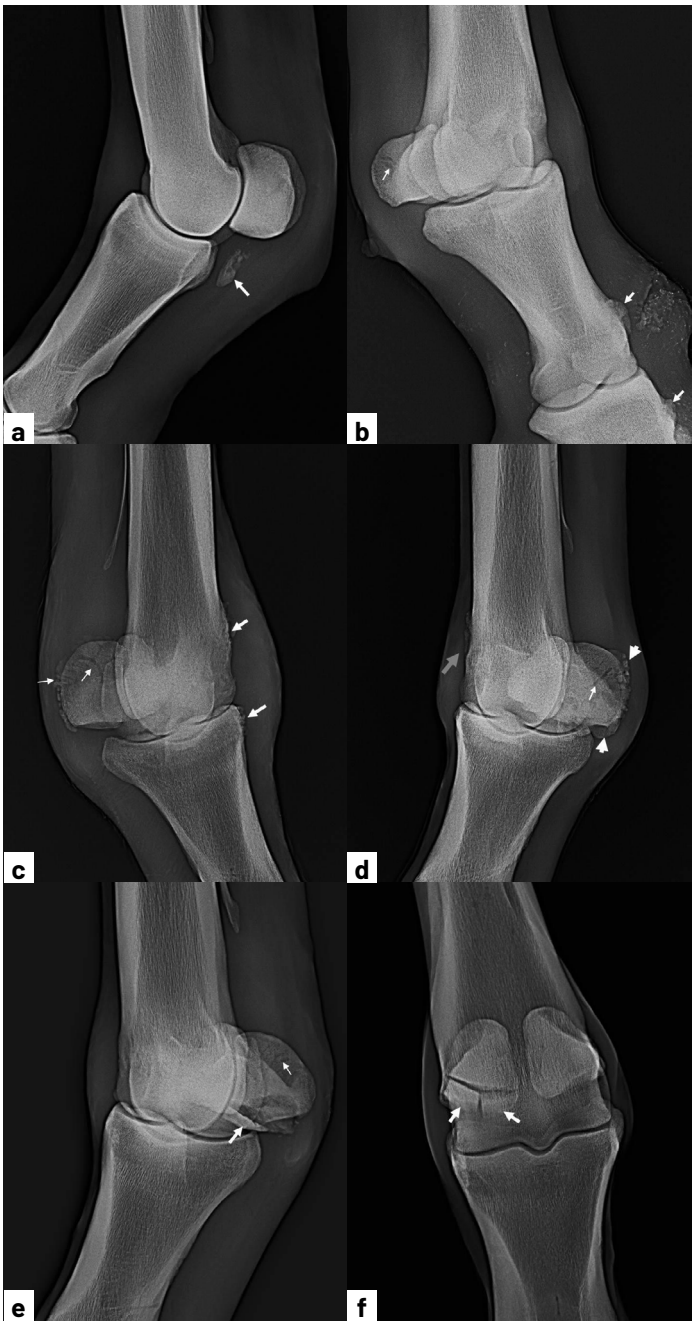

FIGURE 2. Metacarpophalangeal joint (fetlock) and some cases with lesions more distally. a. A case of calcification in the distal sesamoidan ligament identified in the LM radiographic view of the metacarpophalangeal joint (indicated by the arrow). b. D45M–PaLO radiographic view of the pastern region, the case of the form (ringbone) formed in the proximal phalanx and phalanx media and the enlarged vascular channels formed in the lateral sesamoid (indicated by arrows). c. In the D45L–PaMO radiographic view of the fetlock, osselet formed on the dorsolateral surface, enlarged vascular channels due to sesamoiditis formed in the medial sesamoid and entesophyte case formed around the sesamoid (osteophytic growths and enlarged vascular channels are shown with arrows). d–f. Some cases seen in proximal sesamoid bones. d. A case of sesamoiditis and osselet in the D45L–PaMO radiographic view of the fetlock: Enlarged vascular canal in the sesamoid bone (shown by thin white arrow), osteophytic areas formed around the sesamoid bone (shown by thick white arrows), osteophytosis forming dorsolateral to the fetlock (shown by gray arrow). e. A case of sesamoid fracture due to sesamoiditis detected in D45M–PaLO radiographic view of fetlock (enlarged vascular channels are indicated by thin white arrow and sesamoid fracture by thick white arrow). f. Fracture case of proximal medial sesamoid bone detected in D30Pr–PaDi radiographic view of fetlock (indicated by arrows)

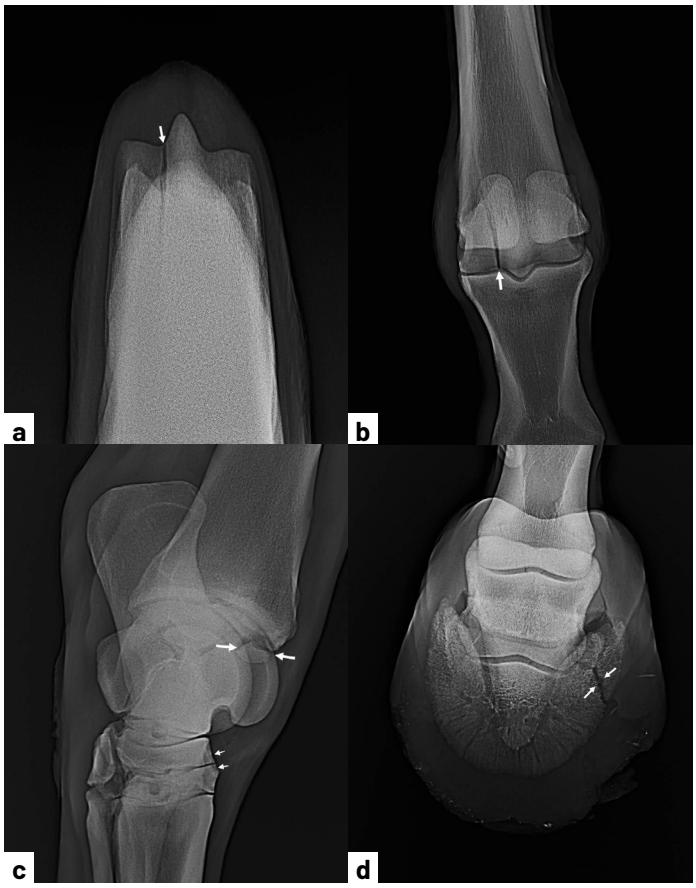

FIGURE 3. Radiographic view of the incomplete fracture formed in Metacarpal III of the same case (a and b) in different positions. In the radiographic view of the region (a. D45–70Pr–DDiO, b. DPa), intraarticular parasagital fracture formed in the dorso–lateral aspect of the distal metacarpus are shown by arrows. c. osteoarthritis and osteochondritis dissecans (OCD) and bone spavin case seen in hock. In the D55M–PlLO radiographic view of the tarsal joint, the bone fragment fractured from the distal end of the tibia is shown with thin small white arrows between the ends of two thick arrows, and periostitis formed in the tarsal bones medial to the tarsal joint. d. Distal phalanx fracture case. D60Pr–RaDiO radiographic position of hoof, the fracture line of the distal phalanx formed in the processus palmaris lateralis is shown with the tips of two arrows

Osteoarthritis is one of the causes of poor performance, pain, disability and economic loss in racehorses [9, 10, 11, 12], occurs mostly at the carpal and metacarpophalangeal joints in racehorses and accounts for approximately 60% of lameness in horses [10, 12]. In racehorses, it may occur both at early and advanced ages [10]. Carpal osteoarthritis is a condition characterised by degeneration of the joint bones, thickening of the joint capsule and associated restricted joint motion and pain in flexion [12, 13]. Osteoarthritis increases the severity of synovial membrane inflammation by affecting the integrity of the articular cartilage and is important because it causes fibrosis of the joint capsule and periarticular muscle weakness [9, 13, 14]. Early diagnosis is important to prevent and treat severe joint damage [9, 13]. Radiology is an important diagnostic method for joint and bone lesions. Although osteochondral damage, fractures, subchondral bone lesions, osteoarthritis and osteochondritis dissecans (OCD) are prevalent in horses, these conditions are generally detected via radiological examination. Radiographic changes in osteoarthritis develop slowly, and when diagnosed, the damage to the bone has already been significant [9, 11]. Unidirectional radiographic position is insufficient for the radiological examination of the distal extremities and more than one radiographic view are necessary for a proper radiographic assessment (Table I). In a study on 114 horses with lameness complaints, Steel *et al.* [15] reported that 28% of the horses had forelimb lameness and that carpal osteoarthritis accounted for 56% of these cases. Himani *et al.* [1] reported that carpal region lesions constituted 7.26% of the lesions they identified in a study involving 78 horses with lameness and that the age of the horses ranged 4–15 years. They reported that carpal osteoarthritis accounted for 66.6% of the carpal region lesions. In the present study, carpal joint lesions (n=42 lesions, 40 horses, 28.57%) included osteoarthritis (n=29), intraarticular fracture (n=5) and fissure in carpal III (n=8). The horses with carpal joint lesions were aged 4–11 years. The most prevalent carpal joint lesion was osteoarthritis (n=29, 69.04%). Two horses had carpal osteoarthritis and intraarticular fracture. Upon clinical examination of horses with carpal osteoarthritis, lameness and pain varied according to the degree of damage to the joint. Lameness and pain on flexion were more prevalent in horses with both osteoarthritis and intraarticular fractures. Cases with fissures in the carpal joint bones (carpal III) and three other cases of intraarticular fractures could be cases where osteoarthritis was not fully detected on radiography but the bone structure had already begun to deteriorate.

DMD is one of the most important causes of poor performance in racing and exercise in young racehorses. DMD, popularly known as sore shin, occurs more frequently in the early stages of beginning strenuous exercises [16]. It was reported to affect 70% of thoroughbred racehorses in training [17]. Initial clinical signs include mild swelling of the dorsal and sometimes dorsomedial aspect of the metacarpus III (Mc III) and pain on palpation. Exposure to cyclic sustained fatigue can involve various pathological changes on the dorsal or dorsomedial surface of the Mc III, including periostitis, new bone formation, lysis of the cortex, and stress fractures [16, 17]. In this study, DMD was diagnosed in 21 cases (13.29%). Most of these cases (n=17) had higher sensitivity on palpation at the middle 1/3 level of the metacarpus. In the other 4 cases, higher sensitivity was determined in the distal 1/3. Periostitis was noted in 15 and osteophytosis in 6 cases with DMD. All horses with DMD were young (2–4 years). The young age of the horses with DMD included in the study suggested that strenuous exercise might have started at a time when bone maturity was not fully formed or that strenuous exercise was started rapidly rather than gradually.

Mineralisation (ossification or calcification) of the tendons and ligaments is one of several possible histological features of desmopathy and tendinopathy, and its incidence in horses is rare. Inflammation in the tendons and ligaments causes degeneration and swelling of collagen bundles. Treatment interruption or failure and continuous traumas cause the inflammation to progress and character followed by dystrophic calcification [18]. Radiography is frequently used for the diagnosis of dystrophic calcification [19]. In this study, distal sesamoid ligament calcification was observed in 4 cases (2.53%). This may be associated with chronic desmitis.

In thoroughbred racehorses, stress fractures, carpal and metacarpophalangeal / metatarsophalangeal (MCP/MTP) joint injuries are important causes of morbidity [12]. Hyperextension in strenuous exercises such as galop or racing in sports arenas may lead to significant stress on the MCP joint. This may increase the sensitivity of

the MCP joint [20]. In racehorses, conditions such as osselet, aseptic and septic joint inflammations, sesamoiditis, fractures in the bones of the region, soft tissue damages [21] and mineralisation or calcification in soft tissues occur in MCP/MTP regions [18]. Osselet can also be described as traumatic osteoarthritis of the MCP/MTP joint; it involves an aggregation of pathological and clinical manifestations that occur in and around the joint as a result of single or repeated trauma to the MCP/MTP joints [21] and is characterised by hypertrophic proliferation of the dorsal capsule of the joints in question [22]. Conditions such as synovitis, capsulitis, joint inflammations, suspensory ligament damages, intraarticular fractures and subchondral bone fractures in the region may cause osselet formation [21]. It may occur in the front and hind extremities. However, it is usually more prevalent in the forelimbs. In this study, osselet was observed more frequently in the anterior extremity; the anterior extremity and the posterior extremity were involved in 14 cases (8.56%) and 2 cases (1.26%), respectively.

Sesamoiditis is a condition characterised by enlargement of the vascular canals of the proximal sesamoids, local osteolysis, osteophytic growth and enthesophyte formation. Sesamoiditis leads to a decrease in exercise performance, especially in racehorses [2, 22]. More than one sesamoid and therefore more than one limb can be concurrently involved. Although the aetiology of this condition has not yet been completely understood [20], it has been reported that the vascular structure of the proximal sesamoid bones could be easily affected by trauma [2]. There are suggestions that rupture or damage of the suspensor ligament, sesamoid ligament and intersesamoid ligaments affect the formation of sesamoiditis [22]. The distal sesamoid ligament extends from the base of the sesamoid bone to the first phalanx. Inflammation of this ligament may result in evident lameness in horses. Calcification in the ligament may also be observed in certain chronic inflammatory conditions [20]. A study by Seghrouchni *et al.* [22] reported that sesamoiditis and ligament calcification occurred a rate of 44.09 and 8.06%, respectively. Furthermore, exposure to excessive hyperextension of the ligaments and tendons in the MCP/MTP joint region, trauma to the sesamoid bones, or any inflammation in the sesamoid bone may cause sesamoid bone fractures [22]. In this study, there were 9.49% of sesamoiditis (9.02% forelimb, 1.89% rear limb), 5.06% of sesamoid bone fracture (4.53% forelimb, 0.63% rear limb) and 2.53% of ligament calcification (forelimb) cases as revealed via radiological examination. The higher load and stress on the forelimb may explain why most of the lesions occurred in the forelimb.

The form is characterised by osteophytic growths as a result of periostitis on the dorsal, medial and lateral sides of the phalanges distal to the MCP/MTP joint [2, 23]. Upon examination, the pain is more intense, especially when the area is moved and rotated. It may lead to varying degrees of lameness [2]. It was reported that periostitis caused by inflammation and stress of the ligament joints in the region was effective in the occurrence of the form. Osteophytic proliferations that occur due to periostitis may cause osteoarthritis and ankylosis in the buccal joints [23]. In a study conducted by Semieka and Ali [23] on donkeys (*Equus asinus*), it was reported that the same were more prevalent in the anterior extremities (16 cases in the anterior extremities and 4 cases in the posterior extremities). Similarly, Himani *et al.* [1] reported that the same were more prevalent in the forelimb (66.67%). In the present study, the rates were 5.06% (n=8) in the forelimb and 1.26% (n=2) in the rear limb.

Distal phalanx fractures are frequently encountered in horses during racing or due to impact with a hard surface. The fracture may be caused by a shock and stress inside the nail. In such cases, a sudden lameness may occur. Lameness is severe in intraarticular fractures but may be less severe in fractures of the lateral wall not connected to the joint. Distal phalanx fractures are more prevalent in the forefoot but are also prevalent in the rearfoot [22, 24]. Intraarticular fractures are easily diagnosed and the resultant lameness is usually associated with joint effusion. The lameness could be localised by pain identified during examination of the nail with an examination forceps in extra-articular fractures. Lameness is aggravated when on lunge or when turning the horse on the affected leg. Clinical symptoms may suggest the possibility of fracture. However, the definitive diagnosis is confirmed by palmar digital nerve block and radiographic imaging. It can be difficult to diagnose based on a radiograph taken immediately after the injury. This is because the fracture is merely similar to the size of a hairline at this stage or the x-ray beam is not tangential to the fracture line [24]. Therefore, it may be necessary to repeat the radiographic study including varying angles a few days or a week later [20, 24, 25]. In this study, distal phalanx fracture was detected in 6 cases (3.79%), of which 2 were intraarticular fractures (1.26%) and 4 were extra-articular fractures (52.53%). All cases with distal phalanx fractures were observed in the forelimb, and intraarticular fractures were found in the processus extensorius region of the distal phalanx. This may be due to hyperextension and overstretching of the musculus extensor digitorum communis tendon during racing and exercise.

Bone spavin is a degenerative osteoarthritis condition characterised by periostitis and osteitis in the os tarsale tertium and centrale bones of the tarsal joint. It is common in older horses and ponies and is a prevalent cause of rear leg lameness [1, 2]. The lameness may vary from mild to severe with dragging the nail tip and has a cold intermittent character. One or both rear limbs may be affected. X-ray images from the affected joints can show a wide range of bone degeneration and damage that does not always correspond directly to the degree of lameness in question. The diagnosis of bone spavin is based on physical and radiological examinations [1, 2, 20]. In this study, bone spavin (2.53%) was found in 4 cases with varying degrees of lameness.

OCD is a developmental orthopaedic disease of the equine joints. It is one of the leading causes of lameness and reduced performance in young athletic horses. Articular cartilage does not normally occur in these horses. This results in lesions in the cartilage and bone and leads to the development of free-floating bone fragments or cartilage fragments within the joint. Rapid growth and high-calorie diets are prevalent causes of OCD. Unbalanced diets that fail to provide sufficient minerals may also increase the risk of OCD. Clinically, effusion is seen in the joint area. Lameness can be of varying degrees. The definitive diagnosis is determined via radiological examination [26]. In this study, there were 8 (5.06%) cases of OCD. Radiographs of all of these cases revealed that the fragments identified in the tibiotarsal joint were separated from the distal part of the tibia.

CONCLUSION

In conclusion, lesions of the forelimbs are more prevalent in racehorses than those of the rear limbs, and this may be attributed to higher load and stress intensity on the forelimbs. Radiological

examination is a highly useful and important diagnostic method in the definitive diagnosis and treatment of bone lesions and in the follow-up of treated cases. Although there has been extensive progress in diagnostic imaging in recent years, radiography still remains a satisfactory imaging technique for diagnostic imaging of the distal extremity in horses owing to its cost-effectiveness.

Funding support

The study was supported by Dicle University Scientific Research Projects Coordination Office with the infrastructure project titled "Equine Medicine and Creation of Hippotherapy Infrastructure of Dicle University Faculty of Veterinary Medicine" with the project code VETERINER.18.008.

Conflict of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

ACKNOWLEDGEMENTS

We would like to thank the staff of Dicle University Scientific Research Projects Coordinator, Diyarbakir Hippodrome Directorate and Horse Hospital.

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