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Research Article

Incidence, Types and Outcomes of Distal Limb Fractures of Racehorses in Kenya: A Retrospective Study of Radiographs (2005-2014)

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ABSTRACT

This retrospective study aimed to determine the incidence of fractures affecting the distal limbs of racehorses and their outcomes. A total of 387 radiographs each showing at least one significant bone lesion were examined. These radiographs were from racehorses examined in the period starting 1st January 2005 to 31st December 2014 at the Equine Clinic of the Jockey Club in Kenya. Radiographs showing all types of fractures were retrieved from the records archive and evaluated. Fractures accounted for 23.5% (91/387) of the cases studied and out of these, 56.0% (n=51) were of the distal limb. The commonest distal limb fractures occurred in the phalangeal bones (47.1%, n=24), followed by the proximal sesamoid bones (27.4%, n=14), metacarpal bones (19.6%, n=10) involving mainly metacarpus IV (50.0%, n=5) and metacarpus III (40.0%, n=4), navicular bones (3.9%, n=2) and metatarsal bone (2.0%, n=1). Of the phalangeal fractures, 45.8% (n=11) were chip fractures, while 41.7% (n=10) were single line fractures. Overall, horses with fractures involving the distal limb had a higher incidence for retirement (74.5%, n=38) compared to those that returned to racing (25.5%, n=13). Out of these distal limb fractures, those of the proximal sesamoid bones had a higher incidence for retiring from racing at 85.7% (n=12), while cases of navicular bone fractures that were only 2 retired from racing. The study concluded that among the distal limb fractures occurring in racehorses in Kenya, phalangeal fractures are the commonest particularly those affecting the third phalanx. Racehorses with distal limb fractures in Kenya have a high likelihood of retiring from racing owing to the fact that surgical intervention is rare except for removal of chip fractures.

Key words: Radiographs, Lameness, Racehorses, Kenya, Fractures, Outcomes

INTRODUCTION

Flat horse racing in Kenya has been practiced over years since the 1920s and it takes place in the Ngong race course. Racehorse injuries are commonly encountered during racing or exercise. In many parts of the world, racing is done in an anticlockwise direction, in which most injuries tend to occur on the right limbs (Rick *et al*., 1983; Rooney, 1983; Ramzan and Palmer, 2011). About 36% to 67% of the conditions causing lameness in horses involve limb bones and joints (Williams *et al*., 2001; Perkins *et al*., 2005; Cogger *et al*., 2008). The most common lameness problems in horses occur in the foot (Stashak, 2002; Ross and Dyson, 2011).

Distal limb fractures of racehorses occur on racetracks and often result in financial losses to the horse owners because the horses are unable to return to racing, but instead retire from racing (Boden *et al*., 2006; EPMA, 2009). Distal limb fractures refer to those occurring in the bones distal to the carpal and tarsal joints, which mainly involve phalangeal, proximal sesamoid, navicular, metacarpal and metatarsal bones. The documented incidence of limb fractures occurring during racing in horses ranges from 1.8% to 24.0% (Milgrom *et al*., 1994; Verheyen and wood, 2004; Oikawa and Kusunose, 2005; Ramzan and Palmer, 2011). The wide range of incidence may probably be attributed to variations in the conditions of racetracks in different parts of the world in which some are on soft and others on hard grounds, hence transmitting varied concussion forces into the limbs as the horse races.

Diagnosis of orthopaedic conditions in horses can be made through a combination of several methods. These include proper history-taking and thorough clinical examination with or without local nerve blocks and the aid of diagnostic imaging. The most commonly used diagnostic imaging method is radiography (Buchner *et al*., 1996; White and Moore, 1998; Stashak, 2002; Keegan,

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2007; Tranquilli *et al*., 2007; Ross and Dyson, 2011). Radiography is used in assessing limb bones and joints and some changes in the soft tissues may also be discernible. Depending on the treatment employed, a horse may recover fully, progression of the condition may be slowed, a horse may be salvaged for different uses other than racing and in extreme cases it may be euthanized (White and Moore, 1998; Stashak, 2002; Ross and Dyson, 2011). Fractures occurring on the distal limb bones of racehorses are either treated surgically or left to heal conservatively and the prognosis for both methods varies from fair to poor. Generally, navicular bone fractures have poor prognosis, particularly when concurrent with navicular disease (Stashak, 2002; Gore *et al*., 2008; Baxter, 2011; Ross and Dyson, 2011). There is no literature documenting orthopaedic limb conditions with their radiographic characteristics, their management as well as their outcome in racehorses in Kenya. Hence, the purpose of this study was to establish the incidence of fractures affecting the distal parts of the limbs and their outcomes in Kenyan racehorses. The reason of focusing on the distal part of the limb is due to higher frequency of lameness of the foot than the proximal parts of the limb.

MATERIALS AND METHODS

Study design

This was a retrospective study carried out at the Equine Clinic of the Jockey Club of Kenya. It included cases seen during a 10-year period starting from 1st January 2005 to 31st December 2014. The study involved examining radiographs taken from the limbs of racehorses during the 10-year period

Data collection

All the radiographs of orthopaedic limb conditions taken in the 10-year period from cases of racehorses were retrieved from the storage archives in the Equine Clinic of the Jockey Club of Kenya. Among these radiographs with orthopaedic limb conditions, all those with fractures involving bones distal to the carpal joints in the forelimbs and distal to the tarsal joints in the hind limbs were selected for detailed examination. Each of the selected radiograph was closely examined for fracture characteristics which included noting the following: bone involved, site of fracture on the bone, direction of the fracture line, bone fragment displacement, soft tissue changes, limbs involved and radiographic views. All these findings were recorded as observed.

Data management and analysis

The data recorded from the radiographs were given numerical codes, which were entered into Microsoft office and analyzed using Microsoft Office Excel 2013.
The incidence of distal limb fractures was calculated in percentages as follows:

$$\text{Percentage of distal limb fractures} = \frac{\text{Number of cases with distal limb fractures}}{\text{Total number of cases with fractures}} \times 100$$

The incidence of various sites of distal limb fractures was calculated in percentages as follows:

$$\text{Percentage of specific sites of distal limb fractures} = \frac{\text{Number of fractures affecting specific sites of the distal limb}}{\text{Total number of cases with distal limb fractures}} \times 100$$

The incidence of various specific bones of the distal limb fractures were calculated in percentages as follows:

$$\text{Percentage of various bones affected} = \frac{\text{Number of bones of the distal limb with fractures}}{\text{Total number of cases with fractures at the specific site}} \times 100$$

The incidence of various types of fractures on the distal limb was calculated in percentages as follows:

$$\text{Percentage of various types of fractures} = \frac{\text{Number of specific fracture types affecting various bones}}{\text{Total number of cases with fractures on the distal limb}} \times 100$$

RESULTS

Out of a total 543 radiographs retrieved at the Equine Clinic, only 71.3% (n=387) had radiographic changes suggesting orthopaedic limb problems. Among these positive radiographs that showed orthopaedic limb problems, 23.5% (n=91) had radiographic signs of fractures, out of which 56.0% (51/91) were on the distal parts of the limbs. The bones commonest affected on the distal parts of the limbs included the phalanges (47.1%, 24/51), proximal sesamoid bones (27.4%, 14/51) and metacarpus (19.6%, 10/51) as shown in (Table 1).

From the 24 cases of phalangeal fractures, 54.2% (n=13) were on phalanx 3, 25.0% (n=6) on phalanx 1 and 20.8% (n=5) on phalanx 2. The types of fractures that affected the phalanges included chip fractures, single line fractures, comminuted fractures and saucer fractures in proportions shown in Table 2 some of which were displaced and others non-displaced as shown in Figure 1. In the 14 fractures of the proximal sesamoid bones, the lateral proximal sesamoid bone fractures constituted 64.3% (9/14) of the cases, medial proximal sesamoid bone fractures constituted 14.3% (2/14) and fractures involving both lateral and medial proximal sesamoid bones were 21.4% (3/14). The types of fractures that occurred on the proximal sesamoid bones included apical fractures, basilar fractures, mid-body and full-body fractures in the percentages shown in Table 3. Other characteristics of proximal sesamoid bone fractures included single line fractures, comminuted fractures, chip fractures (Table 4), displaced and non-displaced (Figure 2).

Out of the 51 cases of distal limb fractures, 10 (19.6%) were on the metacarpal bones and only one (2.0%) on the metatarsal bone. The frequencies of fractures on metacarpal II, III and IV are presented in Table 5. The types of metacarpal fractures seen on the radiographs were single line fractures, comminuted fractures, some of which were displaced and others non-displaced as shown in Figure 3. The only case of metatarsal fracture occurred on the metatarsal IV and was a single line fracture that was displaced. There were only 2 (3.9%) cases of navicular bone fractures both of which were single line fractures and displaced.

Table 1: Percentage occurrences of distal limb fractures in racehorses as shown by radiographs examined at the Equine Clinic of the Jockey Club of Kenya.

The fractured bones	Proportions out of radiographs showing distal limb fractures (n=51)	
	%	Number
Phalanges	47.1	24
Proximal sesamoids	27.4	14
Metacarpus	19.6	10
Navicular bones	3.9	2
Metatarsus	2.0	1
Total	100	51

Table 2: Percentage occurrences of various types of phalangeal fractures in racehorses as shown by radiographs examined at the Equine Clinic of the Jockey Club of Kenya.

Type of phalangeal fractures	Proportions out of radiographs showing phalangeal fractures (n=24)	
	%	Number
Chip	45.8	11
Single line	41.7	10
Comminuted	8.3	2
Saucer	4.2	1
Total	100	24

Table 3: Percentage occurrences of types of proximal sesamoid bone fractures on the limbs of racehorses whose radiographs were examined at the Equine Clinic of the Jockey Club of Kenya

Type of fractures on the proximal sesamoid bones	Proportions out of radiographs showing proximal sesamoid bone fractures (n=14)	
	%	Number
Apical	71.4	10
Basilar	14.3	2
Mid-body	7.1	1
Full-body	7.1	1
Total	100	14

Table 4: Percentage occurrences of various characteristics of proximal sesamoid bone fractures in racehorses as evidenced by radiographs examined at the Equine Clinic of the Jockey Club of Kenya.

Sesamoid bone fracture characteristics	Proportions out of radiographs showing proximal sesamoid bone fractures (n=14)	
	%	Number
Single line	57.1	8
Comminuted	28.6	4
Chip	14.3	2
Total	100	14

Table 5: Percentages of different metacarpal bone involvement with fractures in racehorses whose radiographs were examined at the Equine Clinic of the Jockey Club of Kenya

Metacarpal bone	Proportions out of radiographs showing metacarpal fractures (n=10)	
	%	Number
Metacarpus IV	50.0	5
Metacarpus III	40.0	4
Metacarpus II	10.0	1
Total	100	10

Most (74.5%) of the racehorses with fractures of the distal parts of the limbs, retired from racing especially those with fractures of the phalanges and the proximal sesamoid bones. Both racehorses with the navicular bone fractures retired from racing. The percentages of those that retired from racing versus those that returned to racing after fractures of the different bones of the distal parts of the limbs are presented in Table 6.

Table 6: Percentages of outcomes of various distal limb fractures in racehorse cases whose radiographs were examined from the records at the Equine Clinic of the Jockey Club of Kenya

	Outcomes	
Type of fractures	Returned to racing	Retired from racing
Phalangeal %	16.7	83.3
(n=24) *number*	4	20
Sesamoid bone %	14.3	85.7
(n=14) *number*	2	12
Metacarpal %	60	40.0
(n=10) *number*	6	4
Navicular bone %	0	100
(n=2) *number*	0	2
Metatarsal bone %	100	0
(n=1) *number*	1	0

DISCUSSION

This study revealed that phalangeal fractures, sesamoid fractures and metacarpal fractures were the most common fractures of the distal limb. Occurrence of fractures located on these three groups of bones of the distal parts of the limbs can be attributed to repeated trauma, compressive or rotational forces as well as proximal interphalangeal joint hyperextension during the loading phase of race treading. This exerts stress on the suspensory ligaments and distal sesamodean ligaments. When this stress surpasses the threshold, it results in fractures of these bones (Stashak, 2002; Gore *et al*., 2008; Baxter, 2011; Ross and Dyson, 2011). Fractures of the phalanges were more common than metacarpal fractures in the current study probably due to the fact that in Kenya, racehorses perform flat racing. This is unlike previous study by Ely et al. (2009) in which metacarpal fractures were more common than phalangeal fractures probably due to hurdles and steeplechase sports in National hunt racing performed by racehorses in this previous study. Thus posing high chances of injuries to the metacarupus, hence high incidence of metarcarpal fractures in the previous study (Ely *et al*., 2009). The study also revealed that a higher percentage of orthopaedic limb problems were attributed to non-fracture bone and joint changes observable through radiography. The focus of the current paper is fractures affecting bones of the distal parts of the limbs.

The higher incidence of fractures of third phalanx than first and second phalanges can probably be attributed to its position close to the treading surface of the foot. This makes it prone to repeated trauma during racing caused by knocking, high speed and constant treading on hard surfaces, which result in excessive tension on the common digital extensor tendon and pathological changes that weaken the bone, making it prone to occurrence of fractures (Stashak, 2002; Gore *et al*., 2008; Baxter, 2011; Ross and Dyson, 2011). The occurrence of fractures on the extensor side as the commonest site on the third phalanx could in addition to repeated trauma be partly attributed to the extensor process of the bone constantly rubbing against the distal aspects of the second phalanx after hyperextension of the joint, which predisposed to bone cracking as the horse races. This also explains the reason why chip fractures were mainly located at the extensor process as the commonest site (Gore *et al*., 2008; Ramzan and Powell, 2010; Baxter, 2011).

Fig. 1: Radiographs of the foot with phalangeal fractures in racehorses that were examined. A- Dorsopalmer view showing an oblique single line fracture of the first phalanx (Bold arrow); B- Lateral view showing a displaced bone fragment after a single line fracture of the distal phalanx extensor process (Dotted arrow); C- Lateral view showing a saucer fracture of the middle phalanx (P2) (Dashed arrow); D- Lateral view showing a chip fracture of the distal phalanx extensor process (Dash-dot arrow).

Fig. 2: Radiographs of the fetlock in racehorses examined showing sesamoid bone fractures. A- Lateral view showing a basilar sesamoid bone fracture (Bold arrow); B- Lateral view showing a mid-body sesamoid bone fracture (Dotted arrow); C- Lateral view showing a comminuted sesamoid bone fractures (Dash arrow); D- Lateral view showing an apical sesamoid bone fracture (Dash arrow).

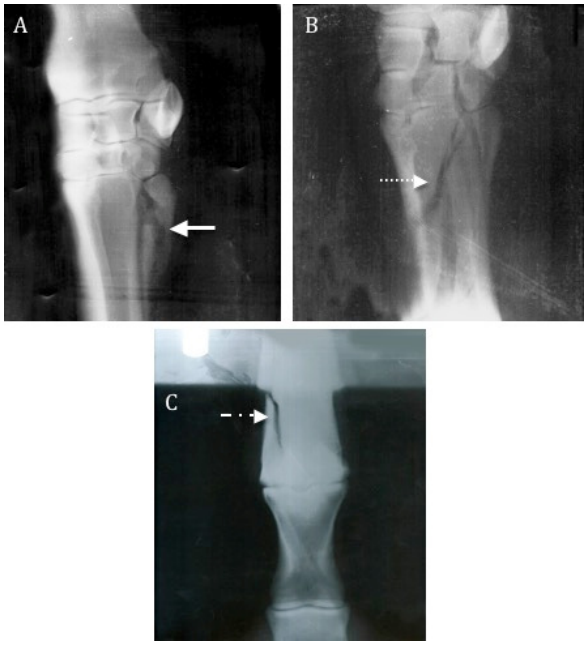

Fig. 3: Radiographs of the metacarpal bones with fractures in racehorses that were examined. A- Dorsolateral-Palmermedial view showing a single line fracture of metacarpal IV (Bold arrow); B- Dorsolateral-Palmermedial view showing a comminuted fracture of metacarpal III (Dotted arrow); C- Dorsopalmer view showing a single line fracture of metacarpal III (Dash-dot arrow).

Fractures involving the proximal sesamoid bones in racehorses tend to be mainly predisposed by hyperextension of the distal limb joints, which results in excess stress to the suspensory ligaments and sesamoidean ligaments (Fretz *et al*., 1984; Woodie *et al*., 1999), followed by the stress surpassing the threshold, hence leading to fractures (Stashak, 2002; Gore *et al*., 2008; Baxter, 2011; Ross and Dyson, 2011). This also explains the common occurrence of apical fractures on the proximal sesamoid bones observed in this study. The higher incidence of fractures on the lateral than the medial proximal sesamoid bones observed in this study is similar to previous reports (Fretz *et al*., 1984; Woodie *et al*., 1999). However, it differs with other studies carried out in which fractures had no predisposition for occurrence in either medial or lateral sesamoid bones (Schnabel *et al*., 2006). Although surgical methods seem to be beneficial in the treatment of sesamoid fractures (Schnabel *et al.,* 2006), the current study indicates that these methods are not commonly employed for management of fractures in the Kenyan racehorses. The reason for this non-practice of surgical methods is speculated as possible limited surgical facilities, general reluctance by the veterinarians to perform surgeries and reluctance by horse owners to enter into costs of surgical management. This may also partly explain the reason for a high percentage of the Kenyan racehorses with fractures of the distal limb bones, retiring from racing and only a small percentage recovering through conservative treatment and returning to racing. The cases that returned to racing were resolved through minimally invasive surgical interventions or non-surgical treatments such as resting coupled with non-steroidal anti-

inflammatory drugs (NSAIDs). The usefulness of rest and administration of NSAID therapy as an alternative management option to proximal sesamoid bone fractures was recommended and used over some years previously (Fretz *et al*., 1984; Bukowiecki *et al*., 1985).

REFERENCES

Baxter GM, 2011. Manual of Equine Lameness. 1st Edition. Wiley-Blackwell.

Boden LA, GA Anderson, JA Charles, KL Morgan, JM Morton, TDH Parkin, AF Clarke and RF Slocombe, 2006. Risk factors for Thoroughbred racehorse fatality in flat starts in Victoria, Australia (1989-2004). Equine Vet J, 39: 430-437.

Buchner HM, HH Savelberg, HC Schamhardt and A Barneveld, 1996. Head and trunk movement adaptations in horses with experimentally induced fore-or hindlimb lameness. Equine Vet J, 28: 71-76.

Bukowiecki CF, LR Bramlage and AA Gabel, 1985. Proximal sesamoid bone fractures in horses: Current treatments and prognoses. Compendium on Continuing Education for the Practicing Veterinarian, 7: 684-698.

Cogger N, DL Evans, DR Hodgson, SW Reid and N Perkins, 2008. Incidence rate of musculoskeletal injuries and determinants of time to recovery in young Australian Thoroughbred racehorses. Australian Vet J, 86: 473-480.

Ely ER, Avella CS, JS Price, RKW Smith, JLN Wood and KLP Verheyen, 2009. Descriptive epidemiology of fracture, tendon and suspensory ligament injuries in National Hunt racehorses in training. Equine Vet J, 41: 372-378.

EPMA, 2009. The economic and social contribution of horseracing in Europe. European Pari Mutuel Association www.parimutuel-europe.org [last visited 05th June 2016].

Fretz PB, SM Barber, JV Bailey and NT McKenzie, 1984. Management of proximal sesamoid bone fractures in the horse. J Amer Vet Med Assoc, 185: 282-284.

Gore T, Gore P and JM Giffin, 2008. Horse Owner's Veterinary Handbook. 3rd Edition. Howell Book House.

Keegan KG, 2007. Evidence-based lameness detection and quantification. Veterinary Clinics of North America: Equine Prac, 23: 403-423.

Milgrom C, A Finestone, N Shlamkovitch, N Rand, B Lev, A Simkin and M Weiner, 1994. Youth is a Risk Factor for Stress Fractures. J Bone Joint Surg, 76: 2022.

Oikawa M and R Kusunose, 2005. Fractures sustained by racehorses in Japan during flat racing with special reference to track condition and racing time. Vet J, 170: 369-374.

Perkins NR, SWJ Reid and RS Morris, 2005. Risk factors for musculoskeletal injuries of the lower limbs in Thoroughbred racehorses in New Zealand. New Zealand Vet J, 53: 171-183.

Ramzan PHL and L Palmer, 2011. Musculoskeletal injuries in Thoroughbred racehorses: A study of three large training yards in Newmarket, UK (2005-2007). Vet J, 187: 325-329.

Ramzan PHL and SE Powell, 2010. Clinical and imaging features of suspected prodromal fracture of the proximal phalanx in three Thoroughbred racehorses. Equine Vet J, 42: 164-169.

Rick MC, TR O'Brien, RR Pool and D Meagher, 1983. Condylar fractures of the third metacarpal bone and third metatarsal bone in 75 horses: radiographic features, treatments and outcome. J Amer Vet Med Assoc, 183: 287-296.

Ross MW and SJ Dyson, 2011. Diagnosis and Management of Lameness in the Horse, 2nd Edition. Elsevier Saunders.

Rooney JR, 1983. Impulse and breakdown on straights and turns in racehorses. J Equine Vet Sci, 3: 137-139.

Schnabel LV, LR Bramlage, HO Mohammed, RM Embertson, AJ Ruggles and SA Hopper, 2006. Racing performance after arthroscopic removal of apical sesamoid fracture fragments in Thoroughbred horses age ≥ 2 years: 84 cases (1989–2002). Equine Vet J, 38: 446-451.

Stashak TS, 2002. Adams' Lameness in Horses, 5th Edition. Lippincott Williams and Wilkins, Philadelphia.

Tranquilli WJ, JC Thurmon and KA Grimm, 2007. Lumb and Jones Veterinary Anaesthesia and Analgesia, 4th Edition. Blackwell Publishing, Iowa, USA.

Verheyen KL and JL Wood, 2004. Descriptive epidemiology of fractures occurring in British Thoroughbred racehorses in training. Equine Vet J, 36: 167-173.

White NA and JN Moore, 1998. Current Techniques in Equine Surgery and Lameness, 2nd Edition. WB Saunders, Philadelphia.

Williams RB, LS Harkins, CJ Hammond and JLN Wood, 2001. Racecourse injuries, clinical problems and fatalities recorded on British racecourses from flat racing and National Hunt racing during 1996, 1997 and 1998. Equine Vet J, 33: 478-486.

Woodie JB, AJ Ruggles, AL Bertone, J Hardy and RK Schneider, 1999: Apical fracture of the proximal sesamoid bone in standardbred horses: 43 cases (1990-1996). J Amer Vet Med Assoc, 214: 1653-1656.