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Radiographic Studies of Distal Limb Fractures in Working Equine: A Clinical Study.

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ABSTRACT:
Although the development of diagnostic tools, X-ray radiography is still essential for diagnosis of hard tissue problems as well. The present study investigated the different types of fractures in the manus and pes regions in working equine using X-ray radiography. Our study was carried out on 60 working equines admitted to the Veterinary Teaching Hospital, South Valley University, suffering from different degrees of lameness. Various types of fractures were recorded depending upon clinical signs and radiographic examination. At least two radiographic views were performed (lateral and dorsopalmer/dorsoplantar). The most common fractures were noticed: fracture of the 1st phalanx (40%), large metacarpal bone fracture (38.3%), fracture of splint bone (13.3%), fracture of 2nd phalanx (3.3%), fracture of extensor process of 3rd phalanx (3.3%), and fracture of the proximal sesamoid bone (1.6%). Most of the fractures in the distal limb were managed by plaster of paris cast with a good clinical outcome except for the comminuted fracture.

Keywords: Radiography; Fractures; Lameness; Working equine.

INTRODUCTION:

Radiography is the most useful tool for getting information about the bones, but not the soft tissue structures such as tendons and ligaments (Vanderperren and Saunders, 2009). Donkeys play an important role as a cheap transportation way for harvesting crops, traction, and helping the farmers in daily work (Mustefa, 2019) especially in our society. Distal limb is the most common area affected with lameness due to direct exposure for repetitive trauma, accident, and kicking from other animals leading to fracture (Vanderperren et al., 2009). The present study was to focus on radiographic descriptions of different fractures affecting distal limb including manus and pes region of working equine.

MATERIAL AND METHODS:

This study was conducted on 60 working equines (37 horses; 16 male and 21 female and 23 donkeys; 16

male and 7 female) ranging in age from 1 to 5 years which were admitted to Veterinary Teaching Hospital, South Valley University. These animals suffered from different types of fractures, mostly traumatic in origin depending upon case history and variable degrees of lameness as an obvious clinical sign. These animals were exposed to radiographic examinations to detect seats and types of fracture.

Shimadzu radiographic device (Model: MD100P, SHIMADZU Corporation, Kyoto, Japan) was used for radiographic examination of the cases at South Valley University. Exposure factors were displayed in (Table 1). We used two radiographic views mostly lateromedial (LM) and Dorsopalmar/dorsoplantar (DP) views, in addition to oblique views such as Dorsomedial-palmarolateral oblique and Dorsolateral-palmaromedial oblique views for good identification of the fracture (Brokken et al., 2007), where x-ray tube was placed lateral to the foot in case of LM view, while in front of the distal limb in case of DP view. Moreover, focal film distance (FFD) was 90cm.

Table 1: Exposure factors for Equine limbs by Shimadzu radiographic imaging device (Model: MD100P).

Structure	**Views**	**KV**	**MA/0.1S**
P3	LM, DP	75	10
Pastern	LM, DP	75	10
Fetlock	LM	65	10
Fetlock	DP	70	10
Metacarpal & carpal joint	LM, DP	70	10
Metatarsal & tarsal joint	LM, DP	70	10

P3: 3rd phalanx LM: Lateromedial DP: Dorsopalmar/Dorsoplantar

RESULTS:

1. Large metacarpal bone fracture:

It was recorded in 23 animals (38.3%) including 22 horses (9 males and 13 mares) and one male donkey. The most characteristic signs of these cases were grade 5 of lameness, severe pain during palpation, clear crepitation sound, swelling at the site of fracture. Closed transverse diaphyseal fracture (18 cases) was more expressed than open fracture (5 cases) (Figure 1A-D). Most of the affected animals were completely recovered after application of plaster of paris cast.

2. Splint bone fracture:

It was recorded in 8 animals (13.3%) including 4 horses (3 males and 1 mare) and 4 donkeys (3 males and she donkey). The affected animals were suffering from grade 2 of lameness, obvious swelling at the affected part and pain during palpation. The treatment of the fractures was variable according to its location where 2 cases were suffering from fracture near the distal end of splint bone. It is recommended to remove bone spicules surgically. While in cases of the fracture at the middle of splint bone. It is recommended to apply plaster of paris cast with complete rest (Figure 1E&F).

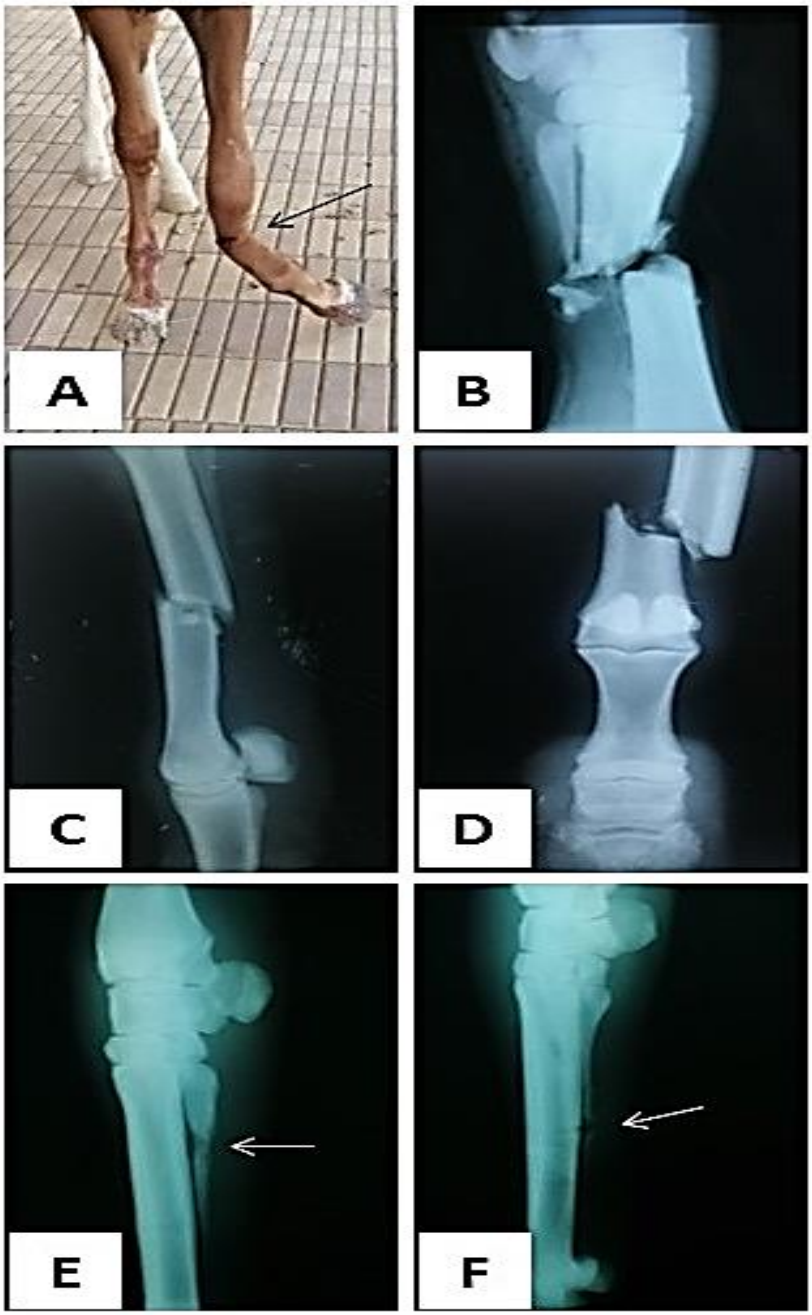

Figure 1: (A) 18 months old mare suffered from complete fracture and swelling at metacarpal bone of the left forelimb (arrow). (B) Lateromedial X-ray view of the same limb showed compound and complete fracture at the diaphysis of metacarpal bone. (C and D) Lateromedial and Dorsopalmer view of 2 years old mare showed complete, simple, single, oblique fracture at the diaphysis of metacarpal bone. (E) Dorsolateral-palmaromedial oblique view of metacarpus showed old fracture of splint bone at the proximal part (4th metacarpal bone) (arrow). (F) Dorsomedial-palmarolateral oblique view of metacarpus showed fracture of the distal third of second metacarpal bone (arrow).

3. Fracture of the proximal sesamoid bone:

It was recorded in male horse (1.6%) which suffered from grade 2 lameness, pain during palpation at the level of fetlock region, severe pain response during passive flexion of fetlock joint (Figure 2).

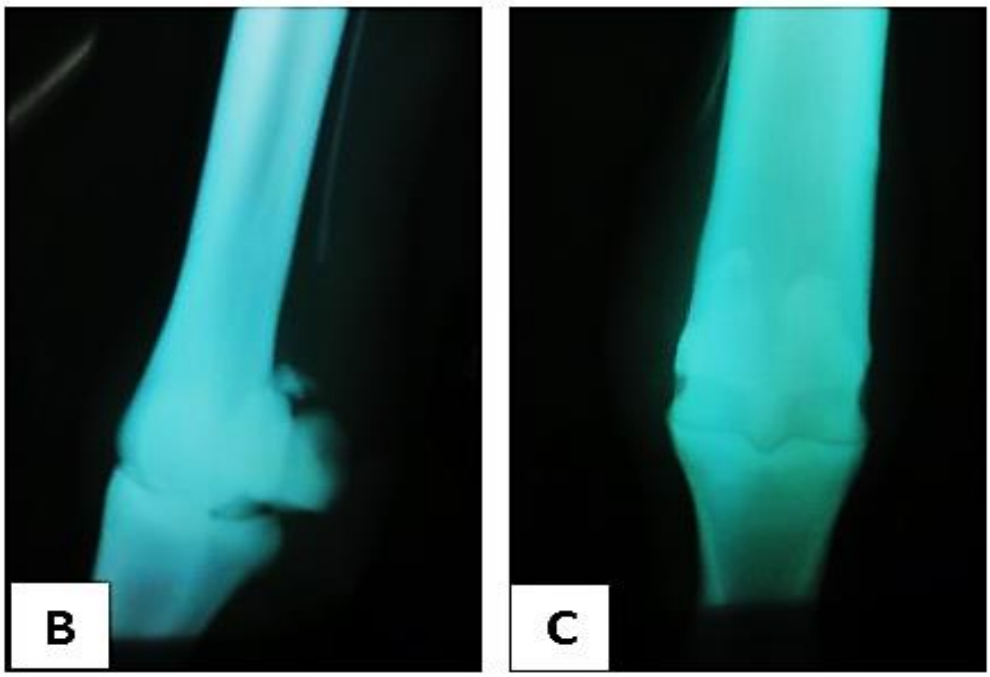

Figure 2: Oblique and dorsopalmar radiographic views showed the presence of apical fracture at lateral proximal sesamoid bone.

4. Fracture of the 1st phalanx:

It is the most common fracture in the present study. It was recorded in 24 animals (40%) including 10 horses (3 males and 7 mares) and 14 donkeys (8 males and 6 she donkeys). Different types of fracture were observed in the first phalanx such as chip fracture, single transverse fracture, and comminuted fracture.

A. Chip fracture was recorded in 7 cases which suffered from clear lameness during trotting, severe pain with fetlock flexion, and swelling at the fracture site. These cases were successfully treated by surgical removal of the bone spicules.

B. Single transverse fracture was recorded in 9 cases. 6 of them were closed type and suffered from lameness of grade 5, severe pain during palpation, clear crepitation sound, swelling at the site of fracture, but the remaining cases were opened fracture. All cases of single fracture were recovered completely after 3 months using plaster of paris cast (Figure 3A).

C. Comminuted fracture was recorded in 8 cases. In this type of fracture, animals were unable to weight bearing with grade 5 lameness, severe pain, crepitation sound, and swelling at the site of fracture. Treatment was not recommended especially in the open fracture (Figure 3B).

5. Comminuted fracture of the 2nd phalanx: was recorded in 2 male donkeys (3.3%) suffering from lameness grade 5, severe pain during palpation, clear crepitation sound and swelling. It was easily diagnosed by radiography using dorsopalmer view (Figure 3C).

6. Fracture in extensor process of third phalanx: was recorded in 2 donkeys (3.3%). This type of fracture is clinically characterized by knuckling over and diagnosed by radiography using lateral view (Figure 3D).

Figure 3: (A) Lateromedial view of 5 years old male horse showed single oblique complete fracture at diaphysis of 1st phalanx. (B) Dorsopalmer view of 3 years old male horse suffered from comminuted fracture at 1st phalanx. (C) Dorsopalmer view of 16 months old male donkey suffered from comminuted fracture at 2nd phalanx. (D) Lateromedial view of the equine fore limb showed knuckling over with fracture and fragmentation in extensor process of third phalanx.

DISCUSSION:

In the present study, several types of fractures were recorded and diagnosed radiologically in the distal limb of the working equine. This may be due to repetitive trauma, heavy loading on unpaved roads, and absence of animal welfare. Misk and Nigam (1985) recorded that most of the fractures were in the first phalanx, and then the large metacarpal bone due to increased chance of exposure to trauma. On the contrary, another study revealed that the most prevalent fracture involved large metacarpal bone followed by

fracture of the 1st phalanx (Semieka et al., 2012). Our results demonstrated that fracture of 1st phalanx was the most prevalent type affecting working equine and represent 40% due to more susceptible to repetitive trauma. In between fractures of the 1st phalanx, we detected the single transverse (9 cases), comminuted (8 cases), and chip fractures (7 cases). Although Semieka et al. (2012) mentioned that single and comminuted fractures were recorded in case of the 1st phalanx. While comminuted fractures were more pronounced than single ones (Kraus et al., 2004). Abdel-Hady et al. (2017) noticed that detection of chip and comminuted fractures in the 1st phalanx with no treatment recommendation for both types of fractures. In the present study, all cases of the 1st phalanx fractures were treated with good impact except comminuted fracture type which was matching with Richardson and Elce (2004) who revealed that chip fracture of the 1st phalanx in horses was treated by arthroscopic removal.

Third metacarpal fracture was recorded in 23 cases (one donkey and 22 horses) as the second prevalent type in our study. This agreed with previous study by Semieka et al. (2012) who mentioned that the common type of fracture was large metacarpal bone. Most of the large metacarpal bone fractures were closed diaphyseal and prognosis of this type of fracture was good depending upon an external fixation of plaster paris cast. Although another study recorded a high percentage (71.4%) of open fracture in the large metacarpal bone in horses (Bischofberger et al., 2009), due to weak support of the soft tissues with skin and tendons which facilitates open fracture occurrence (Schneider and Sampson, 2020). In our study, we did not record any type of fracture in the large metatarsal bone due to stronger construct than large metacarpal bone especially in the dorsal and plantar aspects (Ozyigit and Ozcan, 2010).

The prevalence of splint bone fractures was 13.3% (8 out 60 cases) and its prognosis depends upon particularly on location. Fractures involving distal part have good prognosis with surgical removal of bone in addition to conservative treatment (Jackson et al., 2007). While another study revealed that it is not important to perform surgery in case of distal fracture limiting to conservative treatment (Stashak, 2002).

Rose et al. (2005) reported that fracture of the 2nd phalanx is common especially in horses. While in the present study, comminuted fracture of 2nd phalanx was diagnosed in 2 cases of male donkeys (3.3%) which were constituent with another study by Baxter (2011) who reported that the most common fracture involving the 2nd phalanx is comminuted fracture. Due to limited facilities and owner hesitation regarding treatment, plaster of paris cast was applied with limited outcome. Several studies recorded different types of 2nd phalanx fractures such as chips and comminuted ones (Abdel-Hady et al., 2017) and single and comminuted ones (Semieka et al., 2012), but treatment was not recommended. Regarding radiographic follow-up, absence of x-rays for the recovered cases was potentially limited due to refuse the owner to return to the hospital. Thus, our evaluation was based on owners' feedback by telephone.

CONCLUSION:

X-ray radiography is still a useful diagnostic tool for hard tissue disorders such as fractures although progression of diagnostic tools such as computed tomography (CT) and magnetic resonance imaging (MRI).

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