

Clinico-radiographic Studies on The Prevalent Distal Limb Affections in Working Equine at Luxor City

A.A.A. Abdel-Hady¹, M.A. Sadan¹, Asmaa A. Metwally¹, A.S. Soliman²

¹Department of Surgery, Anaesthesiology and Radiology, Faculty of Veterinary Medicine, South Valley University, Qena, Egypt

²Department of Surgery, Anaesthesiology and Radiology, Faculty of Veterinary Medicine, Cairo University, Egypt.

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ABSTRACT

To illustrate the clinical and radiographic findings of some distal limbs affections in Ninety two animals (24 horses and 68 donkeys) which were admitted to Animal Care Hospital in Luxor. Each animal was subjected to thorough clinical and radiographic examination; the grade of lameness was recorded and the best radiographic views were taken. Fifteen types of distal limb affections were evident. The most prevalent affections in donkeys were high and low ring bone (29.35%) and hoof abscess (9.78%) followed by traumatic arthritis of the fetlock (6.52%), suspensory ligament desmitis (5.43%), fracture of first phalanx (5.43%), fracture of PII (4.35%), side bone (3.26%) whereas, fracture of metacarpal bone (1.09%), sesamoditis (1.09%) and flexural deformities (1.09%) represented the lowest prevalent affections. On the other hand, side bone (4.35%), fracture of the metacarpal bone (4.35%) represented the most prevalent affections in horses followed by high and low ring bone (3.26%), fractures of PI (2.17%), PII (2.17%), subluxation of coronopedal joint (2.17%) and punctured wounds in of the hoof (2.17%), traumatic arthritis of the fetlock joint (2.17%). Whereas, navicular disease (1.09%), suspensory ligament desmitis (1.09%) and hoof abscess (1.09%) were the lowest prevalent affections in horses. Treatment was not recommended in certain cases. In conclusion, although the wide stride progress have made in diagnostic imaging in recent decades, the x ray still offers a satisfactory tool for diagnostic imaging in equine limb practice that is useful for equine practitioners.

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Introduction

Radiography remains the main stay of equine musculoskeletal imaging due to its low cost, ready accessibility and global evaluation of bony structures (Kinns and Nelson, 2010). Also, it is the most imaging tool used for diagnosis of the bony disorders of limbs in equine (Vanderperren and Saunders, 2009). Fetlock joint is of a wide physiological peculiarity due to its angular design and the high speed loading if compared with any other equine joints, ranging from 120° of flexion, particularly during athletic events such as racing or jumping, which makes the joint susceptible to injury along with signs of degenerative joint disease (Betron, 2004). In Luxor city, horses and donkeys are usually used in carts and light transportation purposes; therefore this work has been aimed at determining the prevalent distal limb affections among these animals in addition to identification of the clinical and radiographic findings of the distal limb affections with complete diagnosis and evaluation of the treatment trials performed for

such cases.

Materials and methods

The present study was carried out on 92 animals (68 donkeys and 24 horses) of both sexes and different ages. These animals were admitted to Animal care in Luxor, Egypt from May 2015 to May 2016 suffered from different disorders causing the distal limb lameness. Case history was taken concerning onset and duration of the diseases. Physical examinations of the distal limb were done according to Stashak, (2002). Each case was subjected to radiographic examination at the seat of lameness according to Butler *et al.*, (2000). Distal limb was washed to prevent the artifacts and shoe was removed along with trimming of the hoof for removal of the excess horny materials with foot paring or packing, particularly the frog clefts which may lead to air artifacts that could be mistaken for fractures. Radiographic examination was done by using Agfa computed radiography (CR) apparatus, a Konica Minolta Company, in New England in Animal care. The Agfa CR radiographic setting factors were ranged according to (Table1).

The focal film distance (FFD) was 90cm. Different radiographic views of the distal limb included: lateromedial, dor-

*Corresponding author: Asmaa A. Metwally

E-mail address: asmaaabdelsalam104@yahoo.com

sopalmar/dorsoplantar, dorsomedial-palmarolateral oblique (DMPLO), dorsoproximal-palmarodistal oblique skyline (DPr-PaDiO), lateromedial flexed, dorsomedial-palmarolateral, dorsolateral-palmaromedial views; according to (Butler *et al.*, 2000). Adequate radiographic interpretation was dependent on complete and systematic evaluation of all of the information that is found on the film. Complete and accurate tentative diagnosis depended on clinical and radiographic interpretation.

Table 1. Exposure factors for equine distal limb.

Structure	View	KV		MAS	
		Donkey	Horse	Donkey	Horse
P3	LM	56	62	1.2	1.4
P3	DP	56	58	1.4	1.4
Pastern	LM, DP	54	60	1.4	1.4
Fetlock	LM, DP	56	60	1.4	1.6

P3: Third phalanx LM: Lateromedial DP: Dorsopalmar

Results

Third metacarpal bone fracture

It was recorded in 5 animals with a prevalence of 5.43% (4 horses, one donkey). The most obvious clinical signs were lameness of 2/5 degree, swelling and pain during palpation of the cranial aspect of proximal extremity of the large metacarpal bone. In 2 animals there was a wound at the level of fracture. Radiographic examination revealed the presence of a longitudinal radiolucent line which indicates an incomplete fissure fracture of the large metacarpal bone. This line was more obvious on the dorsopalmar view. Treatment was done by application of splint with complete rest given to the animal. All cases were completely recovered after one or two months (Fig.1, a, b) and (Fig. 2, a, b, c).



Fig.1. a) Dorsopalmar view of 9 years old mare, note the fissure fracture at proximal aspect of the left metacarpal bone (arrow). b) The same case after 2 months of splint application showing disappearance of radiolucent line.

Traumatic arthritis of fetlock joint

It was recorded in 8 animals with the prevalence of 8.73% (6 donkeys and 2 horses). The clinical signs differed according to the severity of the disease. In mild cases, joint inflammation occurred without lameness and in severe cases, the lameness is obvious and there was swelling alongwith injury of the surrounding soft tissues with history of trauma. On radiographic examination, only reduction in the joint space was evident (Fig.

3). All cases were completely recovered (Table 2).



Fig. 2. a) A 3 months old foal suffers from swelling at the left carpal joint. b) Latromedial oblique view revealed fracture at the proximal aspect of metacarpus (arrow). c) Lateromedial view of the same joint showed healing of fracture after month and half of splint application.



Fig. 3. Lateromedial view of the right hind limb of 4 years old horse. Note; the reduced joint space of fetlock joint (arrow).

Osteoarthritis of proximal interphalangeal joint (PIP) and distal interphalangeal joint (DIP) (High and Low Ring Bone)

It was recorded in 30 animals in the present study with the prevalence of 32.61% (27 donkeys and 3 horses). In case of high ring bone, the animal has a bony growth around the pastern area with less mobile pastern joint. Pain was evident especially when the pastern joint is moved or rotated. Early cases have lameness scores of 1/5-2/5; with little or no bony swelling seen which can be felt when compared to the oppo-

Table 2. Prevalence of the distal limb affections in equine

Affection	Animal		Donkey		Horse		Total	
	No	%	No	%	No	%	No	%
Fracture of third metacarpal bone	1	1.09	4	4.35	5	5.43		
Traumatic arthritis of fetlock joint	6	6.52	2	2.17	8	8.73		
High and low ring bone	27	29.35	3	3.26	30	32.61		
Sesamoditis of proximal sesamoid bones	1	1.09	-	-	1	1.1		
Navicular Disease	-	-	1	1.09	1	1.1		
Suspensory ligament desmitis	5	5.43	1	1.09	6	6.52		
Flexural Deformity	1	1.09	-	-	1	1.1		
Fracture of proximal phalanx	5	5.43	2	2.17	7	7.60		
Fracture of second phalanx	4	4.35	2	2.17	6	6.52		
Solar margin fracture of third phalanx	2	2.17	-	-	2	2.2		
Side bone	3	3.26	4	4.35	7	7.60		
Subluxation of distal interphalangeal joint	-	-	2	2.17	2	2.2		
Hoof abscess	9	9.78	1	1.09	10	10.83		
Punctured wounds of hoof	4	4.35	2	2.17	6	6.51		
Total	68	73.91	24	26.09	92	100		

site pastern. In case of low ring bone, lameness was evident representing a grade 2/5-3/5. In advanced cases, the bony growth was seen on the coronet. Osteophytes (new bone formation) were seen at the level of pastern and coffin joints as a result of the osteoperiosteal reaction (Fig. 4, a, b, c, d). The treatment was not recommended due to lack of facilities.



Fig.4. The osteoperiosteal reaction in (a) Right forelimb of 7 years old donkey showing periarticular ring bone (arrow). b) Left forelimb of 10 years old horse showing periarticular ring bone (arrow). c) Left hind limb of 9 years old donkey showing periarticular and aricular ring bone (arrow). d) Left hind limb of 5 years old horse showing articular and periarticular ring bone (arrow).

Sesamoditis of proximal sesamoid bones

It was encountered in one donkey at the left hind limb with a prevalence of 1.1% with 2/5 degree lameness. Palpation of the proximal sesamoid bones revealed severe pain especially with extension of fetlock. Lateromedial radiographic examination revealed, a periosteal reaction and beginning of new bone formation was evident along with calcification of the suspensory and distal sesamoidean ligaments (Fig. 5). Treatment was not recommended.



Fig. 5. Lateromedial view of 9 years old donkey shows the inflammatory reaction around the proximal sesamoid bone of the left hind limb (arrow).

Navicular disease

It was recorded in a mare with the prevalence of 1.1%. The clinical signs revealed unilateral chronic right forelimb lameness with short strides. Hoof examination by hoof tester revealed severe pain and the animal was unable to turn. The suitable radiographic view for examination of navicular disease was the dorsopalmar view where the radiographic changes which occurred in the navicular bone was distinct as serrations of the distal margin of navicular bone (Fig. 6). The treatment not recommended.



Fig.6. Dorsopalmar view of 10 years old mare. Note; serration of navicular bone in the right forelimb (arrow).

Suspensory ligament desmitis

It was detected in 6 animals with the prevalence of 6.52% (5 donkeys and one horse). Painful swelling at the level of the ligament on manipulation and lameness of first degree were the most remarkable signs in 2 cases. In the other 4 cases there was undetectable lameness. Radiography on the lateromedial view revealed calcification of the suspensory ligament (Fig. 7). The treatment not recommended.



Fig.7. Lateromedial view of the right hind limb of 7 years old horse. Note; calcification of suspensory ligament (arrow).

Flexural deformities

It was detected in the left forelimb of 6 years old donkey with prevalence of 1.1%.The animal dragging its limb which was knuckled over the pastern and coffin joints on the ground with abnormal motility of the animal and contraction of flexor tendons and suspensory ligament. Lateromedial radiographic view revealed the abnormal flexion of the pastern and coffin joints (Fig. 8). The treatment not recommended.

Fractures of the proximal phalanx

It was recorded in 7 animals (5 donkeys, 2 horses) with the prevalence of 7.60%.

Comminuted fracture of proximal phalanx

It was recorded in one donkey and one mare. The most obvious clinical signs were 4/5 degree of lameness with swelling at the level of fetlock joint with severe pain on palpation of the fetlock, crepitating sound with abducted limb. The dorsolateral-palmaromedial oblique radiography revealed the presence of a complete, oblique fracture with multiple bone

fragments (Fig. 9a). The treatment not recommended.



Fig.8. Lateromedial view of the left forelimb of 6 years old donkey. Note; the abnormal flexion of pastern and coffin joint.

Chip Fracture of the proximal phalanx

It was recorded in 5 animals (4 donkeys and one horse). 2/5 degree lameness with swelling at the level of fetlock joint was noted during examination of the animals. During palpation there was severe pain with flexion of the fetlock. On dorso-palmar/dorsoplantar radiograph, a bone fragment was seen separated from the proximal extremity of the first phalanx (Fig. 9 b, c). The treatment not recommended.

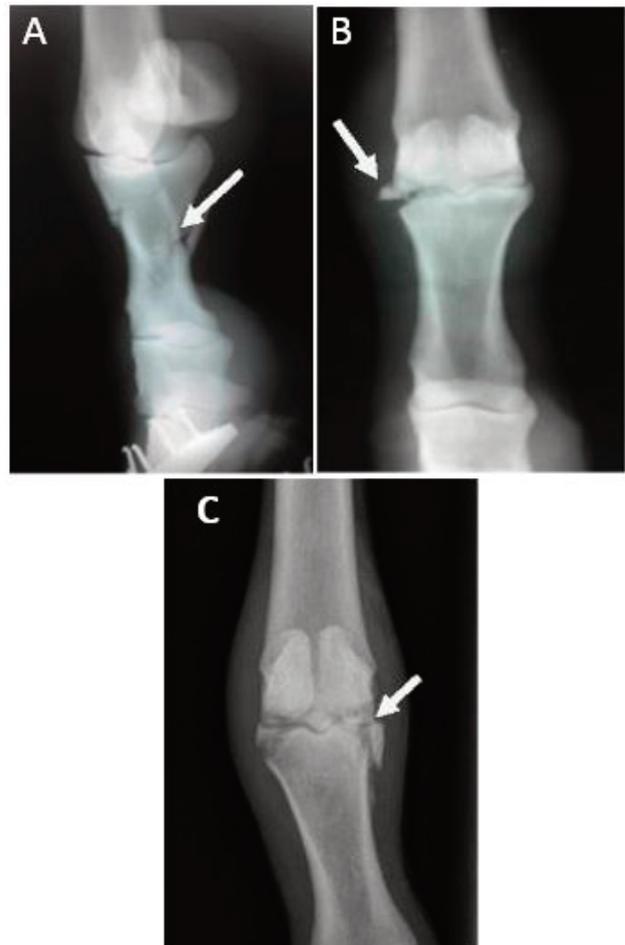


Fig.9. a) Dorsolateral palmaromedial oblique view of 6 years old mare showing a complete and multiple fracture of the proximal phalanx of the right forelimb (arrow). b) Dorsoplantar view of 8 years old horse showing a separate bone fragment from the proximal phalanx of the left forelimb (chip fracture) (arrow). c) Dorsopalmar view of 3 years old donkey showing fracture of both proximal extremities of proximal phalanx of the left hind limb (arrow).

Fractures of the middle phalanx

It was recorded in 6 animals (4 donkeys and 2 horses) with the prevalence of 6.52%.

Comminuted fracture of second phalanx

It was detected in one donkey where the second phalanx of the right fore limb was fractured. Clinically there was moderate swelling at the level of second phalanx with severe pain. The animal was unable to bear weight on the affected limb with lameness of 4/5. The best view for radiographic examination of such case was dorsopalmar view, where the fracture was seen as a multiple bone fragments (Fig. 10a). The treatment not recommended.

Chip fracture of the middle phalanx

It was recorded in 5 animals (3 donkeys and 2 horses). Clinically there was a mild swelling at the level of the second phalanx, severe pain on palpation accompanied with 2/5 degree lameness. Dorsopalmar/dorsoplantar radiographs revealed the presence of bone fragment at the proximal aspect of the second phalanx (Fig. 10b). The treatment not recommended.



Fig.10. a) Dorsopalmar view of 2 years old donkey showing complete fracture of the second phalanx of the right forelimb (arrow). b) Dorsopalmar view of 4 years old horse indicates presence of a separated bone fragment of second phalanx (chip fracture) in the left hind limb (arrow).

Solar margin fracture of third phalanx

Was recorded in 2 donkeys with the prevalence of 2.2%. Clinically there was severe pain associated with severe lameness of 3/5 and the animal can't bear weight on the affected limb. The use of hoof tester revealed pain and the animal snatch the limb during examination. The coronary band showed a pronounced swelling. Palmarodorsal and dorso-proximal-palmarodistal oblique radiographs showed that, there was bone fragments which were separated from the third phalanx as a result of severe trauma (Fig.11 a, b).

Ossification of the collateral cartilages of the distal Phalanx (Side bones)

It was recorded in 7 animals (3 donkeys and 4 horses) with the prevalence of 7.60%. There was no evidence of the lameness in cases with side bone. This condition was encountered in aged animal. Dorsopalmar/dorsoplantar radiography revealed the radiopaque elongated lateral cartilages with ossification. A separate centers of ossification in the proximal half of the cartilages was found especially at the distal aspect of

the cartilages (Fig. 12 a, b).



Fig. 11. a) Palmarodorsal view of left forelimb of 9 years old donkey, note the fragmentation of PIII. b) Dorso-proximal-palmarodistal oblique radiographic view of the distal phalanx of the same donkey.



Fig. 12. a) Dorsopalmar view of 8 years old donkey showing complete ossification of collateral cartilage of the hoof of the left forelimb. b) Plantarodorsal view of 11 years old horse showing complete ossification of collateral cartilage of the hoof of the left forelimb (arrows).

Subluxation of distal interphalangeal joint

It was detected in 2 horses with the prevalence of 2.2%. Severe lameness of 5/5 degree was evident and the animal was unable to bear weight on the affected limb. On the lateromedial radiograph, there was partial luxation of the distal phalanx from the distal interphalangeal joint (Fig. 13).



Fig. 13. Lateromedial view of left hind limb of 6 years old horse showing partial luxation of the pedal bone (arrow).

Hoof Abscesses

Hoof abscess were recorded in 10 animals (9 donkeys and

one horse) with the prevalence of 10.83%. The animal showed severe pain with black pus discharge of offensive odor. During motion, lameness of 3rd degree was clearly evident. Latero-medial radiographic view revealed lyses in the horny material of the hoof at the level of abscess (Fig.14). All cases recovered within 3 weeks.



Fig.14. Lateromedial radiograph of 5 years old donkey showing the lyses of the horny material of the hoof of the right forelimb (arrow).

Punctured wounds to the hoof

Penetrating injuries of the hoof were recorded in 6 animals with the prevalence of 6.51% (4 donkeys and 2 horses). The animals suffered from lameness of second degree. These punctured wounds can be detected during examination of the foot using hoof tester which reveal pain. On radiographic examination, the presence of foreign body or nail embedded within the hoof which appeared more radiopaque and considered diagnostic (Fig. 15).



Fig. 15. Lateromedial oblique view of 8 years old horse. Note; the nail penetration to the hoof of the right forelimb (arrow).

Discussion

The results of the present work reflect the importance of the distal limb disorders in equine as they constitute the most prevalent causes of lameness. The results indicated that, out of 92 animals were affected by different distal limb affections. This incidence is higher than that reported by Rhoades (2008) who mentioned that, distal limb affections constitute 50% of cases causing lameness. This may be attributed to number of the animal in the study, type of management and type of work. Also, the results demonstrated that, the prevalence of the third metacarpal bone fracture was 5.43%. Most of animals in this study were hard worker so; they were more susceptible to trauma at the level of metacarpal bone. The same was also

reported by (Veen and Greef, 2005 and Smith and Greet, 2009). Concerning the radiography of the metacarpal bone, the suitable radiographic views of choice were dorsopalmar and lateromedial views as was also mentioned by (Brokken, Schneider, and Sampson, 2007). Fractures of (MCIII) bone were treated by application of splint, which was made from plastic and fixed on all sides of metacarpal bone from the distal radius to the hoof with administration of phenylbutazone for decreasing of pain and all cases recovered well from month to two months. In this respect, (Bianca, Kasia and Zdzislaw, 2012) reported that, the fixation of cannon bone or distal radius fractures was performed with a full limb bandage (Robert Jones bandage) with caudal and lateral splint starting from the hoof up to the elbow joint.

In the present work, the prevalence of traumatic arthritis of the fetlock joint was 7.6% and donkeys were more affected than horses. This may be attributed to the type of work and the management of the animals under our Egyptian relations as was also recorded by Semieka *et al.* (2012b). The lateromedial and dorsopalmar/plantar views were the best views of choice for radiographic examination of traumatic arthritis of fetlock joint. The same result was mentioned by Mostafa *et al.* (2008). Cases suffered from Osteoarthritis of proximal interphalangeal joint (PIP) and distal interphalangeal joint (DIP) were recorded in 30 animals (27 donkeys and 3 horses) with a prevalence of 32.6%. Periarticular ring bone was more common in the pelvic limb (22 animals) than in thoracic limbs (8 animals). This may be due to the fact that, in Egypt most of equine especially in upper Egypt are working animals which usually given hard work in hot weather and on hard ground and usually exposed to trauma with bad managemental style. Nearly similar explanation was given by Semieka *et al.* (2012b), who reported that, hard work in a hard ground leading to severe periostitis and extensive osteophytes affecting phalanges and interphalangeal joints. On radiographic examination ring bone appear clear on the lateromedial and dorsoplantar views. This result agreed with Butler *et al.* (2000); Abd El-Glil (2004). Phenylbutazones were used to decrease inflammation associated with acute ring bone. The same result was recorded by Timothy (2008).

Sesamoditis of proximal sesamoid bones was recorded in a donkey which was accompanied with calcification of suspensory ligament. The same clinical findings were recorded by El-rashidy (2015). Who reported that, dorsopalmar/plantar, lateromedial, dorsomedial, palmaro/plantarolateral oblique and dorsolateral-palmaro/plantaromedial oblique were the suitable views used for radiographic examination of the fetlock joint. In our study, the lateromedial and dorsomedial-planarolateral oblique views were the suitable views for diagnosis of sesamoditis where the osteophytes were clearer around the non-articular surface of sesamoid bone while on the dorso-plantar view; desmitis of suspensory ligament was more easily detected. For treatment of sesamoditis of proximal sesamoid bones (Stashak, 2002) mentioned that, the animal must be rested, cold and hot packs as well as antipahlogistic packs should be used. Convalescence is long (6 to 8 months), and injury often reoccurred when the horse returned to full work. Firing and blistering have been used in chronic stages. This line of treatment was not practiced in the present study because the owners refuse to give their animals the chance of rest for long period of time but they receive only anti-inflammatory drugs such as phenylbutazone just to decrease pain to improve the condition of the animal.

Navicular disease was recorded in a mare. The disease characterized by degenerative changes in the structure, composition, and mechanical function of the cartilage, subchondral bone, and surrounding soft tissues of the navicular apparatus as was also obtained by Rijkenhuizen (2006). There

are two proposed causes of navicular disease: vascular compromise and biomechanical abnormalities which leading to tissue degeneration. Similar observations were given by Bentley *et al.* (2007).

Waguespack and Hanson (2010) mentioned that, horses with navicular syndrome often present with a history of fore-limb lameness of insidious onset often mild at first, with the resolving lameness with work. In the meantime, the lameness may become exacerbated by exercise. The gait is often characterized by short, choppy strides, and the lameness is usually bilateral, with one limb more predominant than the other and the animal showing a pain response to pressure applied with hoof tester over the middle one-third of the frog. Clinical signs of navicular disease were distinct in a mare of 10 years old. The same picture was recorded by Dyson (2003); Sampson *et al.* (2008). They mentioned that, middle-aged to older horses are most commonly affected with the disease. Usually the clinical signs become apparent in most of horses between 7 and 10 years of age, although younger horses can be affected. Lateromedial, dorsoproximal-palmarodistal views were found of choice for the exact radiographic evaluation of navicular bone. The same result was mentioned by Dyson (2008). The treatment applied by administration of NSAIDs as phenylbutazone. The same result was mentioned by Erkert *et al.* (2005), who reported that, NSAIDs as phenylbutazone was a common adjunctive treatment for equine with navicular disease/syndrome. On the other hand, Rijkenhuizen (2006) mentioned that, the treatment of the disease was by corrective trimming and shoeing.

Our results indicated that, hardworking animals were inflicted by suspensory ligament desmitis where there is excessive rotational movement of the limbs which may increase the risk of injuries. The same result was also mentioned by Baxter (2011). The present study showed that, the lateromedial and dorsopalmar/dorsoplantar views were the best for examination of suspensory ligament desmitis. On the other hand, Thrall (2002); Abd El-Glil (2004); Farrow (2006) found that, dorsopalmar/dorsoplantar, lateromedial, flexed lateromedial, dorsolateral, palmaromedial oblique and dorsomedial-palmarolateral oblique views were successfully used for radiography of fetlock joint. Cases with suspensory ligament desmitis during radiographic examination showed dystrophic mineralization (calcification) within the ligament. The same result was mentioned by Stashak (2002). They were treated by application of anti-inflammatory as phenylbutazone and bandaging to reduce any swelling and pain. A result which agreed with Baxter (2011).

Acquired flexural deformity was recorded in a 6 years old donkey. The animal goes on the dorsal hoof wall with 3rd degree lameness. A finding which agreed with Trotter (2016). Williams (2015) said that, acquired flexural deformities of the fetlock can be seen only in older horses as was observed in the present work. The clear clinical sign as knuckling over was diagnostic but the radiography was essential to evaluate the extent and degree of the disease which may occur as osteoarthritis. Similar findings were mentioned by Kidd and Barr (2002) they reported that, radiography was not required for diagnosis of acquired flexural deformities; however it was useful to identify abnormalities which may alter the prognosis for correction of the deformity. The radiographic changes which may occur as a consequence of deformity and in relation to the distal interphalangeal joint, including modeling of the dorsodistal aspect of the third phalanx, rotation of the third phalanx in the hoof capsule and osteoarthritis of the distal interphalangeal joint.

Our results indicated that, the distal phalanx was radiographed by lateromedial and dorsopalmar/dorsoplantar views as was also mentioned by Butler *et al.* (2000). Concern-

ing the treatment of acquired flexural deformity, it is well known that, medical or conservative treatment is helpful only as initial treatment but surgery is usually recommended in severely affected cases Kidd and Barr (2002). Treatment in our presented cases was not recommended due to the lack of facilities and the costs of treatment.

Chip fracture of proximal phalanx was encountered in a hardworking mature donkey that exposed to severe trauma at the level of the fetlock joint. Similar result was also recorded by Semieka *et al.* (2012c) they mentioned that, the radiographic examination revealed the presence of chip fracture on the dorsomedial aspect of the first phalanx. In this study, only 2 cases of PII fracture were recorded in the hind limb and 4 cases were recorded in the fore limb. On the other hand, Stashak (2002) mentioned that, fractures of PII occur most commonly in the hind limbs. While, Baxter (2011) reported that, comminuted fractures are the most common fracture involving PII. They nearly always involve the PIP joint (uniarticular) but often extend distally into the DIP joint (biarticular).

The result indicated that, lateromedial; dorsopalmar/dorsoplantar views were of choice where the bone fragment and fractured part were clearly distinct. Meanwhile, Butler *et al.* (2000) reported that, survey radiographs of the proximal and middle phalanges with lateromedial, dorsopalmar/dorsoplantar and two oblique views.

Richardson and Elce (2004) recorded that, arthroscopic removal is the surgical treatment of choice for horses with chip fractures of the dorsoproximal aspect of the proximal phalanx. Baxter (2011) mentioned that, horses with comminuted PII fractures should be repaired with some type of internal fixation (bone plating) if possible. Cases with chip or comminuted fracture of PI in the present study were left without treatment because their owners refused to subject their animals to any surgical interventions.

Solar margin fractures of third phalanx were recorded in 2 donkeys subjected to trauma. Distal phalanx fractures were declared through both dorsoproximal-palmarodistal oblique and palmarodorsal views. On the other hand, Thrall (2002) said that, four views of the distal phalanx were recommended when a fracture is suspected: (1) lateromedial; (2) dorsal 65-degree proximal-palmarodistal oblique; (3) dorsal 65-degree proximal, 45-degree lateral-palmarodistal oblique; and (4) dorsal 65-degree proximal, 45-degree medial palmarodistal oblique. Dorsal 65-degree proximal-palmarodistal oblique through dorsal 65-degree proximal views. Moreover, Butler *et al.* (2000) mentioned that, solar margin fracture was clearly visualized on the dorsoproximal-palmarodistal oblique view. In the present work, PIII fracture was managed by application of bar shoe and the fracture was completely healed after a month. While, Baxter (2011) mentioned that, treatment of PIII fractures include confinement alone, confinement with corrective shoeing which aimed at immobilizing the fracture and preventing expansion of the hoof wall or foot casts, lag screw fixation and surgical removal of the fracture fragment.

The ossification of the lateral cartilage started at the base of cartilage in 6 cases (85.7%) and observed as a separate center of ossification in one case (14.3%) with no evidence of lameness as was also noticed by Stashak (2002). In this direction, Ricarodo *et al.* (2002) mentioned that, ossification starting at the base of the cartilage (86.4%) was more common than that observed as a separate center of ossification (6.6%). Dyson (2010) reported that, the etiology of lateral cartilage ossification still unknown and may be related to hereditary factors and the ossification occurred in old aged animals as was also observed in our study.

In the present study, ossification of collateral cartilage was examined on dorsopalmar/plantar and dorsoproximal palmarodistal oblique (DPr-PaDiO) views. While Dyson (2002) men-

tioned that, radiographic examination of the cartilage included DPa, lateromedial (LM), dorsoproximal palmarodistal oblique (DPr-PaDiO) and flexed dorsolateral-palmaromedial oblique (DL-PaMO), and dorsomedial-palmarolateral oblique (DM-PaLO) views. In this respect, Dakin *et al.* (2006) reported that, radiographic examination reveals the extent of ossification of the affected cartilage(s). About the treatment of cases with lateral cartilage ossification, only rest of the animal with administration of NSAIDs as phenylbutazone was helpful as was also mentioned by Stashak (2002); Furst and Lischer (2006).

Subluxation of distal interphalangeal joint was recorded in 2 horses with a history of severe trauma with partial or complete disruption of DDFT. In this direction, Farrow (2006) mentioned that, distal phalangeal subluxation in the equine resulting from a variety of causes, including: congenital rupture of common digital extensor tendons, coffin joint infection leading to vascular thrombosis and necrosis of the joint capsule, torn joint capsule, and nonspecific sprain. Lateromedial radiographic view was found efficient for examination of cases with subluxation of distal interphalangeal joint. The same result was reported by Butler *et al.* (2000) due to the widening of the joint space with displacement of the middle phalanx in a palmar direction. Stashak (2002) mentioned that, surgery should be performed soon after injury, because fibrosis of the palmar support structures hinders joint reduction. But in the present study, no treatment was recommended due to the afore-mentioned reasons.

Hoof abscesses were recorded in 10 animals (9 donkeys and one horse). Donkeys were found more affected than horses due to bad management and bad care of their owners. Clinical signs of hoof abscesses depend on the severity of the infection; therefore, lameness varies from mild lameness progressing to moderate or severe lameness. Other clinical signs might include: swelling, heat, draining tracts (pus, often gray or black in color, from the sole or coronary band), increased digital pulse, and evidence of hoof injuries (that infection may set in the inner hoof structures, leading to abscess formation). Similar signs were also mentioned by West (2015). Lateromedial radiographic view was the best for examination of the hoof abscesses. On other hand, Butler *et al.* (2000) found that, lateromedial, 60° dorsoproximal-palmarodistal oblique, and palmaroproximal-palmarodistal oblique, 60° dorsoproximal-palmarodistal oblique and dorsopalmar views were required for radiography of the foot. By radiographic examination, there was lysis in the horny materials of the hoof. The same result was recorded by Furst, and Lischer (2006). Treatment of hoof abscesses by cleaning with paring and thinning of overlying horn at the site of abscess followed by application of hoof powder composed of tannic acid, copper sulphate and streptomycin followed application of hoof pressure bandage plus I/M injection of penicillin as was also mentioned by West (2015).

Punctured hoof wounds were recorded in 6 animals. Only one case of them was with deep penetrating hoof wound while the others five animals were with superficial hoof wounds. In this direction, Dabareiner *et al.* (2003) they mentioned that, puncture wounds of the foot were classified according to their depth, direction and location. Superficial wounds penetrate only the cornified tissue and do not invade the corium; while deep wounds penetrate the hoof corium and make damage to the deeper structures of the foot such as navicular bursa, digital cushion, digital flexor tendon sheath (DFTS), distal phalanx, or distal interphalangeal joint. The degree of lameness may vary considerably depending on the depth, location, and duration of the wound. The case with deep penetrating hoof wound showed severe lameness with 4th degree while the others of superficial hoof wound showed un-

observable lameness as was also mentioned by Rich (2010). Lateromedial and dorsopalmar/plantar views were the radiographic views of choice for examination of hooves with foreign body for identification of its site, direction and depth as was mentioned by Butler *et al.* (2000). The treatment applied by removal of nails, curetting and removal of all necrotic tissues with application of antibiotics, antitetanic serum and bandages as was also mentioned by Stashak (2002).

Baxter (2011) said that, for accurate radiographic interpretation, there are three requirements; 1) knowledge about the radiographic anatomy of the area of interest, 2) knowledge about common variations in the normal anatomy, and 3) reducing the cause for any radiographic abnormalities. For good resolution of the radiographic films, the choice of accurate radiographic views is considered essential plus the correct radiographic potentials as was mentioned by Butler *et al.* (2000); Ahmed (2014). Moreover, Ahmed (2014) added that, Good quality radiograph (excellent details, correct density and the proper scale of contrast) are essential for making accurate diagnosis. To achieve the ideal images with high quality and lowest possible radiation dose to the patient, one should take care during each stage of image formation.

Conclusion

The radiographic examinations for all cases were helpful and crucial for a definite diagnosis as well as in the follow up in treated cases. The choice of radiographic views was tried to obtain the best radiograph in each case. Treatment was not recommended in certain cases and euthanasia was done according to the policies followed by Animal Care Hospitals. Medicinal and surgical treatments were performed in curable cases along with radiographic follow up of some cases of fractures. In conclusion, although the wide stride progress have made in diagnostic imaging in recent decades, the x ray still offers a satisfactory tool for diagnostic imaging in equine limb practice that is useful for equine practitioners especially in our country.

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