RADIOGRAPHIC INTERPRETATION OF PROLIFERATIVE PERIOSTITIS IN DONKEYS

BY

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SUMMARY

Splints and ring bone were the two main forms of proliferative periostitis recorded in donkey's limb. Posterior-metacarpal, intermetacarpal and traumatic splints were the most common forms and mainly recorded at the medial aspect of the metacarpal region. True ring bone was found to affect the PIP joints of both fore and hind limbs, while false ring bone was seen mainly in the fore limbs.

INTRODUCTION

For centuries, donkeys are still the symbol of hard working farm animals that are popular in many Middle Eastern countries. Despite the great economic importance of this animal for many farmers, little attention has been given to research dealing with the radiographic pictures of many diseased conditions, compared to horses. For this reason, this article will summarize the most common forms of periosteal proliferation in donkeys as regard to their radiographic appearance, location, and their effect on the animal's working life.

Splints is a disease of young horses; most often affects the forelimbs as sequel to a sprain or tear of the suspensory ligament between small metacarpal / metatarsal bones and MC III / MT III *(Stashak, 1996 and Thrall 1998). Frank (1964)* said that, the term splints refers to those exostosis that occur along the large and small metacarpal or metatarsal bones and may involve only one or both of the bones. It is usually found more commonly in the middle third of the small metacarpal or metatarsal bones in the form of one well defined enlargement or may be a number of smaller enlargements occurring on the entire length of the splint bones.

The localization of splints on MC II may be due to the greater compression load on the medial side of the limb, together with the anatomical articular pattern of MC II with the carpal joint *(Ronny and Prickett 1966). Misk and Hifny (1981)* added that, the sprain of the tendons of insertion of the extensor carpi obliqus and flexor carpi radialis muscles which are inserted at MC II may be an additional cause for the prevalence of splints in this bone. *Stashak*

Misk and Hifny (1981) detected four types of splints in donkeys, posterior-metacarpal, intermetacarpal, knee, and deep metacarpal splints. They observed that, posterior-metacarpal splints was the most common type encountered in donkeys and may accompanied by intermetacarpal splints. The latter were present between the large and small MC bones at the level of the middle, proximal, or the distal third of the small MC bone. Knee splints involve the head of small MC bone and encroaches over the palmar and dorsal surfaces of MC III and distal row of the carpal bones. Deep metacarpal splints present at the origin of the suspensory ligament. *Stashak, (1996)* described the "Intermetacarpal" splints in horses as a blind splints because the bony exostosis occurred on the axial (inner) side of the splint bone. He added that knee splints is observed as an enlargement of the proximal portion of the splint bone that may reach to the knee joint.

Most types of splints could be diagnosed radiographically using dorsopalmar/plantar, lateral and both oblique radiographs *(Misk and Hifny 1981, Allen and White 1987, and Colahan, Mayhew, Merritt, and Moor 1991). Stashak (1996)* found that, X-.ray revealed that the splint bone is not primarily involved in case of "splints" and the bone growth is almost entirely on the cannon bone. *Misk and Hifny (1981)* found that only the deep metacarpal splints cannot be easily diagnosed by using X-ray.

Ring bone is a term refers to any bony enlargement below the fetlock that is more common in the forelimbs than the hind ones in the horse. It is a chronic aseptic condition, which leads to deformation of the articular cartilage, bone, joint capsule, and ligaments*(O'conner 1960).* High ring bone is a new bony growth occurring on the distal end of P I and the proximal end of PII, and low ring bone is a new bone growth occurring on the distal end of P II and/or proximal end of P III, especially on its extensor process *(Adams 1974).* When the condition is limited to the interphalangeal areas *Pool and Meagher (1990); and MC Neel and Reidesel (1998)* found that it usually results in response to instability of the joints. Moreover, they found that when it occurs at the attachment site of joint capsule or collateral ligaments it indicates ossification of fibro-osseous attachment or focal stimulation of underlying periosteum.

Ring bone has been also described as, articular versus periarticular ring bone. Articular ring bone "true ring bone " usually shows radiographic signs of DJD to varying degrees while, periarticular ring "false ring bone" shows radiographic features of periosteal new bone growth away from the joint margin *(O'conner 1960; Adams 1974; Trotter, Mcilwraith and Norrdin 1982; and Stashak 1996).* In case of "true ring bone " any or all of the following radiographic signs are present: partial or complete joint space narrowing, marginal osteophytes formation, subchondral bone sclerosis, and occasionally subchondral bone lysis and periosteal new bone growth *(O'Brien, Morgan, Wheat, Suter 1971, O'Brien 1977, and Mcilwraith and James 1982, Trotter et. al 1982).* The new bone proliferation in the interphalangeal area "osteophytes" leads to sharply marginated lipping of the periarticular surface, while the other

forms which located at the attachment site of joint capsule or collateral ligaments "entheseophyte" leads to bone spur formation *(Pool and Meagher 1990; and MC Neel and Reidesel 1998).*

MATERIALS AND METHODS

A total number of 132 specimens "89 forelimbs and 43 hindlimbs" were radiographed for diagnosis of periosteal proliferation below the carpus and tarsus. The animals were of both sexes, above three years old, and collected from training surgical rooms of the Faculties of Veterinary Medicine; of Meinofia University; Cairo University, and Assuit University together with Brooke Hospitals Society for Animals.

Lateromedial (LM), dorsopalmar/dorsoplantar (DP) and dorsmedial-palmarolateral or plantrolateral oblique projections were used for radiographic imaging using a Simens X-ray Machine (German industry) at the Teaching Hospital of the Faculty of Vet. Med., Sadat City, Meinofia University. The radiographic parameters used were 52 to 56 KV, 12 to 16 MA/sec and 90 cm FFD. Specimens were prepared for gross pathological confirmation of some radiographic lesions.

RESULTS

The radiographic examination of the suspected specimens revealed proliferative periostitis in 30 forelimbs and 9 hind ones. Bone splints were recoded radiographically in 20 forelimbs and 2 hindlimbs while, ring bone were recorded in 10 forelimbs and 7 hindlimbs.

The radiographic density of splints ranged from opaque increased soft tissue density with irregular margin to a solid radiopaque bone density (Fig1 A,B&D). The splints were classified according to their positions as regard to the metacarpal and the metatarsal bones into the following forms; posterior-metacarpal, intermetacarpal, knee, deep metacarpal and traumatic splints.

Posterior-metacarpal splints was seen in 3 limbs along the posterior border of the second or fourth metacarpal bones (Fig1 A, B &D) Intermetacarpal splints was recorded in 8 limbs in the form of localized areas of increased radiopacity located between the third metacarpal and the second or fourth metacarpal bones (Fig1 A&B). Intermetacarpal and posterior-metacarpal splints were seen together in 11 limbs. The Intermetacarpal splints was in the form of localized areas of increased radiopaicty between the second and fourth metacarpal bones (Fig1; A&B and Fig2; C). Traumatic splints was seen associated with other forms of splints in 6 limbs at different sites on the large metacarpal bones (Fig1; D) and in association with intermetacarpal splints (Fig2; C). Knee splints was seen in 2 limbs at the proximal third of the second and third metacarpal bone associated with radiographic signs of DJD in the carpal joint (Fig2; A). Deep metacarpal splints was not able to be identified radiographically through a dorsopalmar projection but it was seen during preperation of one metacarpal bone sample at the area of attachment of the suspensory ligament (Fig2; D).

Ring bone was seen in 10 forelimbs and 7 hindlimbs. True ring bone at the level of PIP joint was seen in 5 forelimbs and 6 hindlimbs, while false ring bone was seen in 5 forelimbs and one hindlimb. Radiographically; true ring bone was in the form of marginal osteophytes formation appeared in conjunction with other DJD radiographic signs; such as narrowing of joint space and subchondral bone sclerosis (Fig3). In more advanced cases; ankylosis occurred as a result of extensive new bone formation bridging the proximal aspect of P II and the distal aspect of P I (Fig4; B, C & D). False ring bone was seen as a localized area of radioopaque bone density on the diaphysis of the proximal and middle phalanges (Fig 5).

DISCUSSION

Both forms of proliferative periostitis "splints and ring bone" were found to affect the forelimbs more than the hind ones in donkeys. Radiographically; bone splints were recoded mainly on the medial aspect of the forelimb and represent about 91% of the recorded cases, while ring bone were recorded in the forelimbs in 59% of the examined cases. From these results we noticed that periosteal proliferation is more common in the forelimbs as a result seemed to be similar to *Bolbol and Saleh (1987)* for hoof affections, *Abou-El-Ella (1995)* for joint affections and *Stashak (1996)* for splint bone affections in equine. The increased prevalence of the forelimb injuries attributed by *Adams (1974)* to that the animal bears most of his weight on the fore limbs and aid the hindlimbs in propelling the body. The prevalence of splints in the second metacarpal bone was attributed to the greater compression load on the medial side of the limb *(Rooney and Prickett 1966),* the sprain of the tendons of insertion of the extensor carpi obliqus and flexor carpi radialis *muscles (Misk and Hifny 1981)* and the characters of the large articulating surfaces and more muscle and ligamentous attachments than do the metatarsal bones *(Goble 1982 and Stashak 1987).*

In the present study, posterior-metacarpal, intermetacarpal, knee and traumatic splints could be diagnosed using lateral, dorsopalmar, and oblique radiographic projections. Deep metacarpal splints could not be diagnosed radiographically but observed only during preparation of one metacarpal bone specimens. This result is in agreement with that given by *Misk and Hifny (1981)* as they found that deep metacarpal splints is difficult to be diagnosed by using X-ray in donkeys. Posterior-metacarpal and traumatic splints together with intermetacarpal splints were the most common types of splints encountered in the present study, while *Misk and Hifny (1981)* found that posterior metacarpal splints is the most common type of splints encountered in donkeys. *Stashak (1996)* described only the intermetacarpal and knee splints in horses. This may be attributed to that the animals of the present study were subjected to frequent traumatic lesions and extensively used and neglected to be treated from their owners. Radiographic signs of knee splints appeared as a new bone formation at the proximal third of the second metacarpal bone associated with radiographic signs of degenerative joint

disease in the carpal joint. The involvement of the carpal joint was attributed to the proliferative osteoperiostitic changes that is usually associated with knee splints formation *(Misk and Hifny 1981 and Stashak 1996)*

True ring bone in donkeys was mainly affecting the proximal interphalangeal joints in both fore and hind limbs, while the false one was recorded in five forelimbs and one hindlimb. True ring bone was a main signs of the degenerative diseased conditions of the interphalsngeal joints while the false one was related to external trauma. *Adams (1974)* used the term ring bone to describe any bony enlargement below the fetlock joint, whether or not the joint was involved. Entheseophytes were used by *Trotter et. al. (1982) and MC Neel and Reidesel (1998)* to describe the false ring bone as it is mainly resulted from localized traumatic periostitis on the diaphysis of the proximal and middle phalanges with clearance of the articular margins. Marginal osteophytes formation was used to describe the true ring bone by *O'Brien et. al. (1971), O'Brien (1977), Haynes (1980), Mcilwraith and James (1982), Trotter et. al. (1982) and Butler et. al. (2000)* as its associated with other signs of interphalangeal degenerative diseased conditions.

In conclusion, these chronic inflammatory forms of the periosteum and underlying bone may be attributed to that working donkeys under local circumstances are used extensively for heavy carriage and draft beside being neglected from their owners. The distal part of the limb is being the most amenable for proliferative periostitis because it is less protected by muscles and more susceptible to different types of traumas that may negatively reflect on animals health and shorten its working life.

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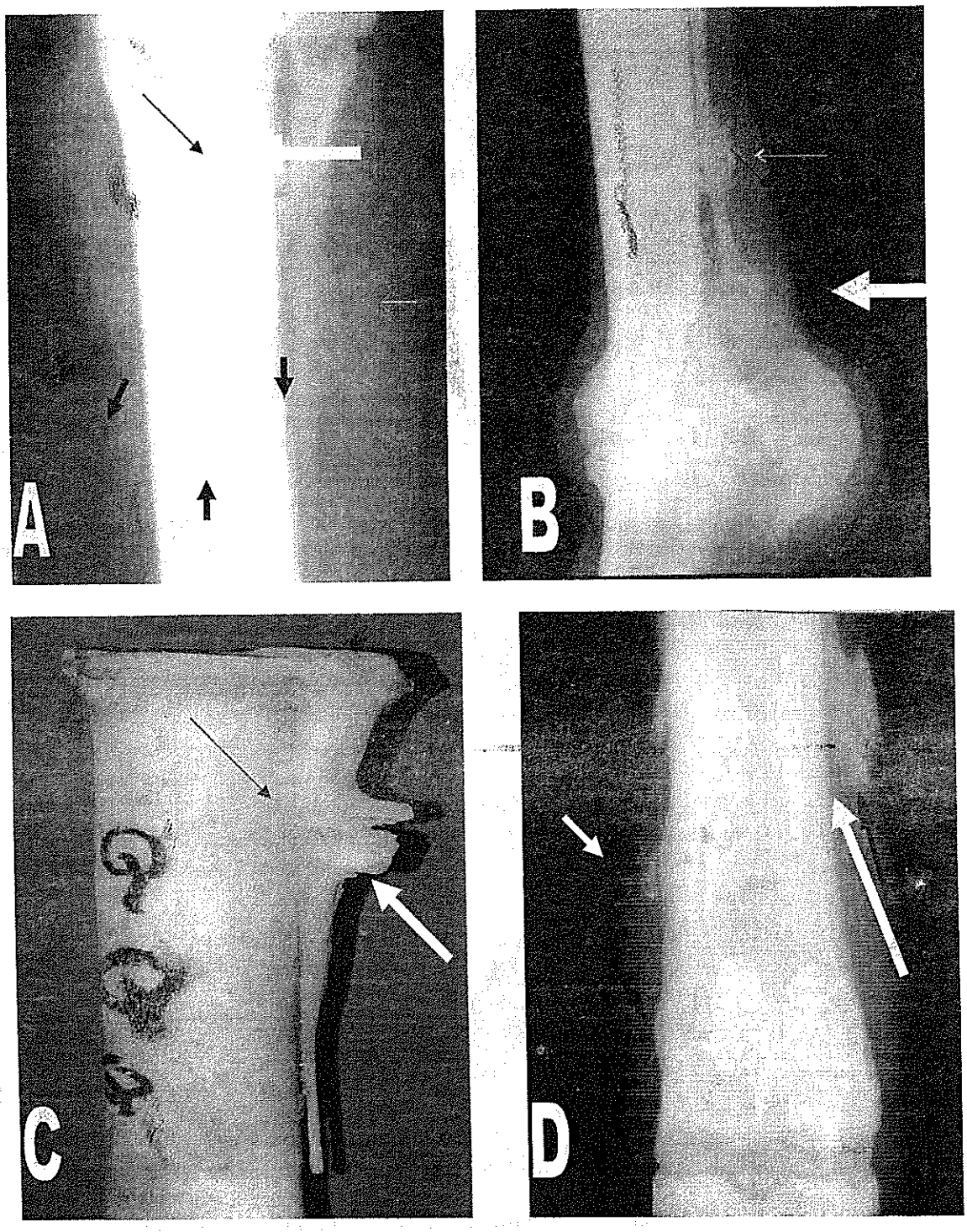

Figure (1); (A&B); Dorsomedial-palmarolateral oblique radiograph of the right MC11 showing posterior splints (white arrows). Notice the intermetacarpal splints (black arrow) and the degenerative changes of the MCP joint in fig. A(short arrows). (C); Bone specimen of the same bone in fig. B showing the posterior (white arrows) and intermetacarpal splints (black arrow). D; Dorso-palmar view of the a right MC1I1 showing posterior splints at the end of the medial splint bone (long arrow) and traumatic splints at the lateral aspect of MC111 bone (short arrow).

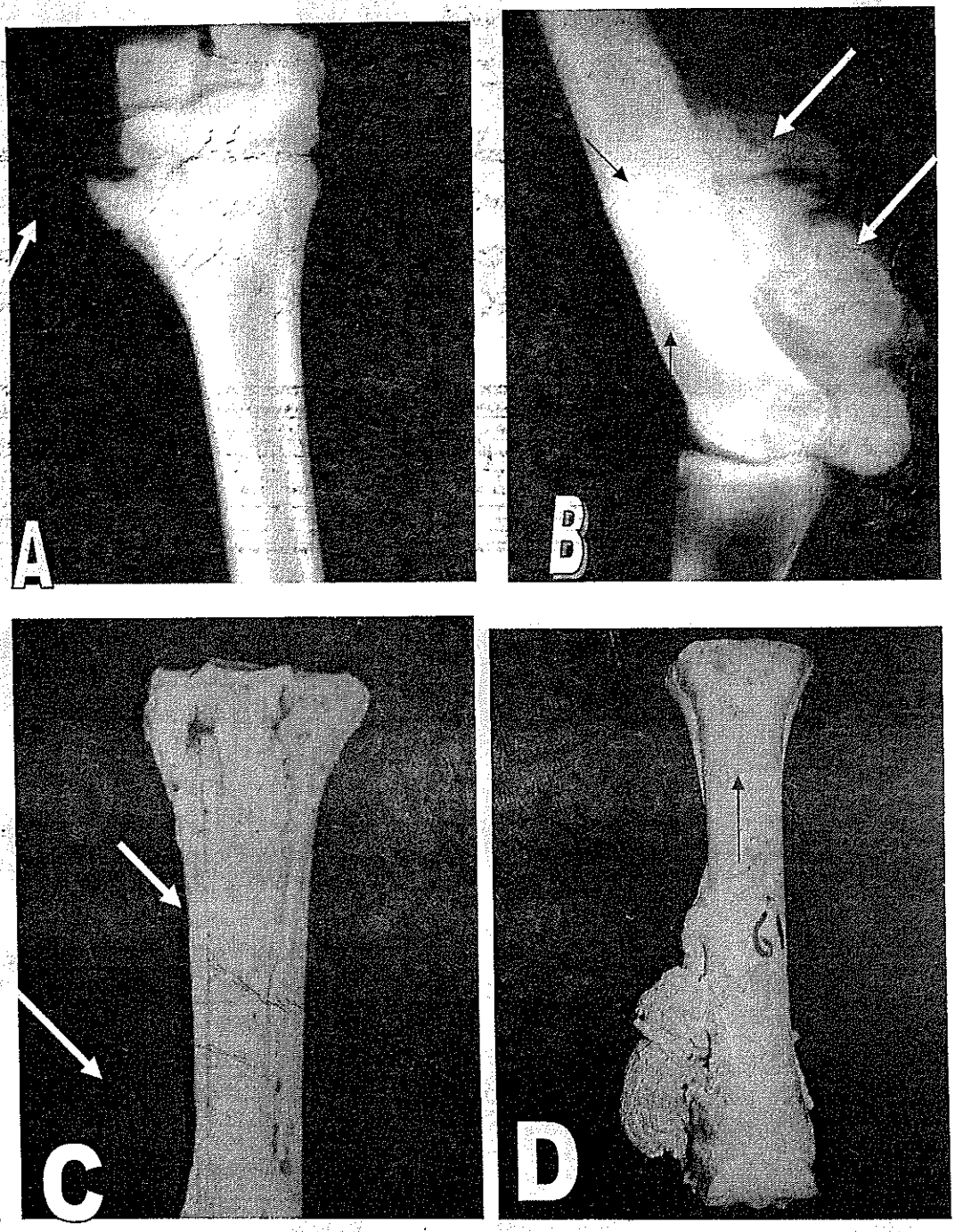

Figure (2): (A); Dorsopalmar radiograph of the right MC111 showing knee splints extending from the proximal extremity of MC III to the level of the first row of the carpal bones (arrow). (B); Lateromedial radiograph of the left MC111 showing extensive traumatic splints (white arrows). Notice the superimposition of the newly formed bone at the distal end of the MC111 bone (black arrows). (C); Anterior view of a bone specimen of the same bone in fig. B showing the extensively formed traumatic splints (long arrow) and intermetacarpal splints (short arrow) that was hidden in the lateromedial radiograph. D; Posterior view of a bone specimen of the MC111 showing deep splints at the attachment areas of the suspensory ligament (black arrows).

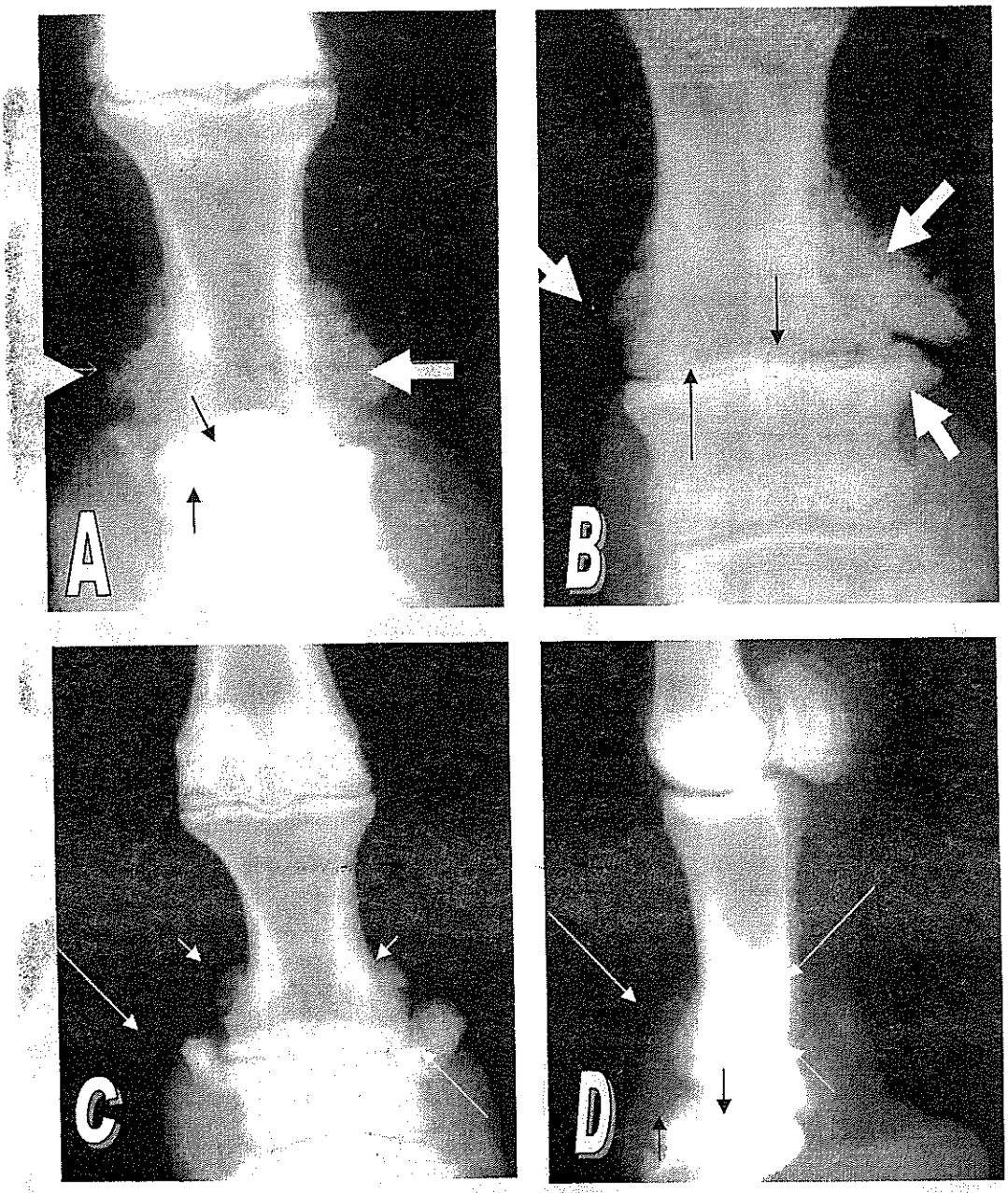

Figure (3): Dorsopalmar radiographs of the phalangeal regions (A) left fore and (B) right hind showing periarticular true ring bone at the level of the PIP joints (white arrows). Notice the obliteration of the joint spaces as a result articular cartilages degeneration and articular ring bone formation (black arrows). (C) left hind phalangeal region is showing periarticular true ring bone at the proximal extremity of P2 (long arrows) and false ring bone at the distal third of P1 (short arrows). (D) Lateromedial radiograph of the left fore phalangeal region showing degeneration of the PIP joint as a result of articular ring bone formation (black arrows) and false ring bone formation along the dorsal and palmar surfaces of P1 (white arrows).

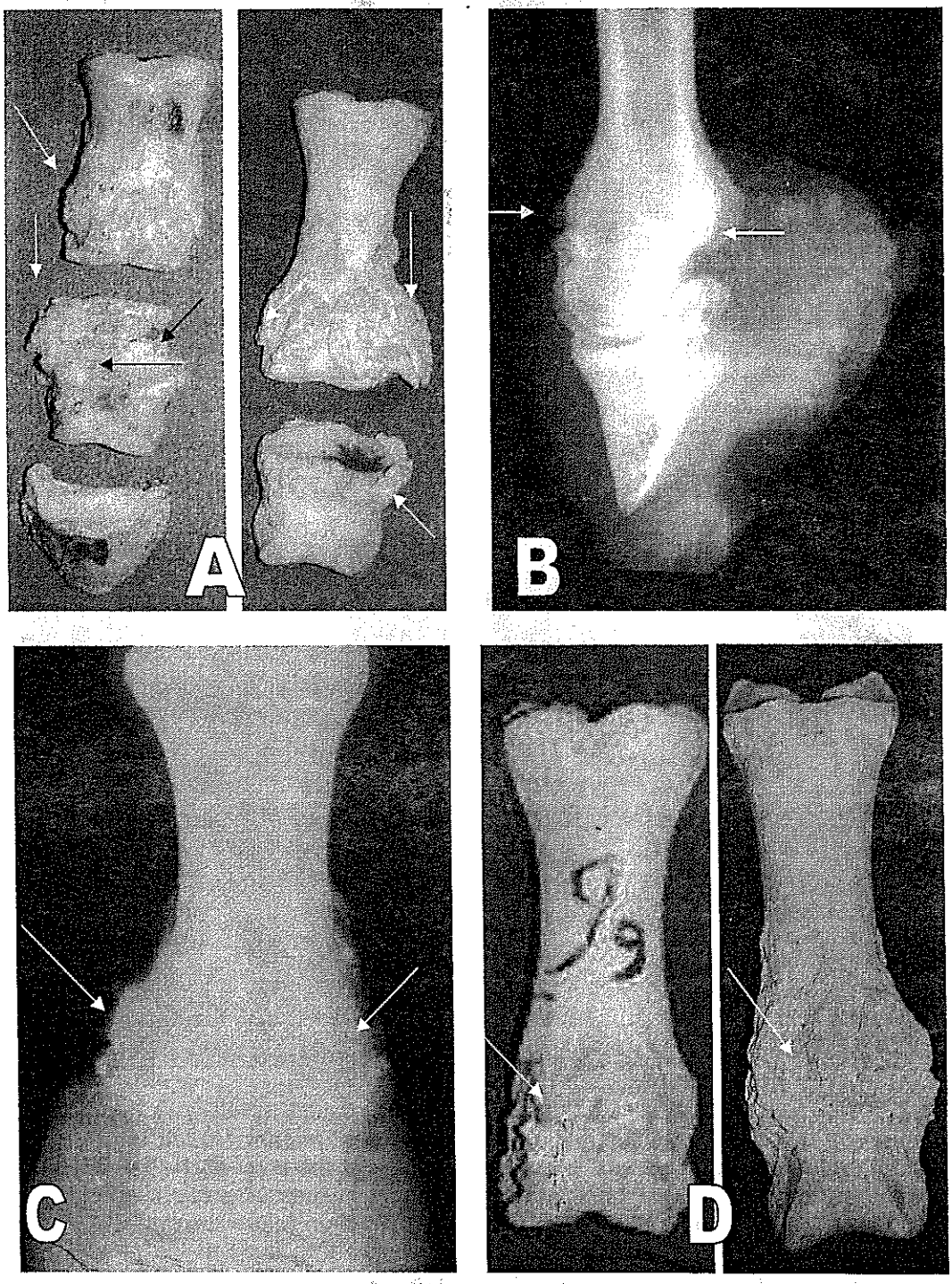

Figure (4): (A) Anterior views of bone specimens of the same radiograph in figure 3, (A) and (B) showing true ring bone of the PIP joints; periarticular (white arrows) and articular (black arrows). (B) lateromedial radiograph (C) dorsopalmar radiograph of left fore phalangeal regions showing an extensive periarticular and articular ring bone that causes ankylosis of the PIP joints (arrows). (D) Anterior views of the bone specimens of the same radiograph in figure B and C showing ankylosis and complete absence of the PIP joints (arrows).

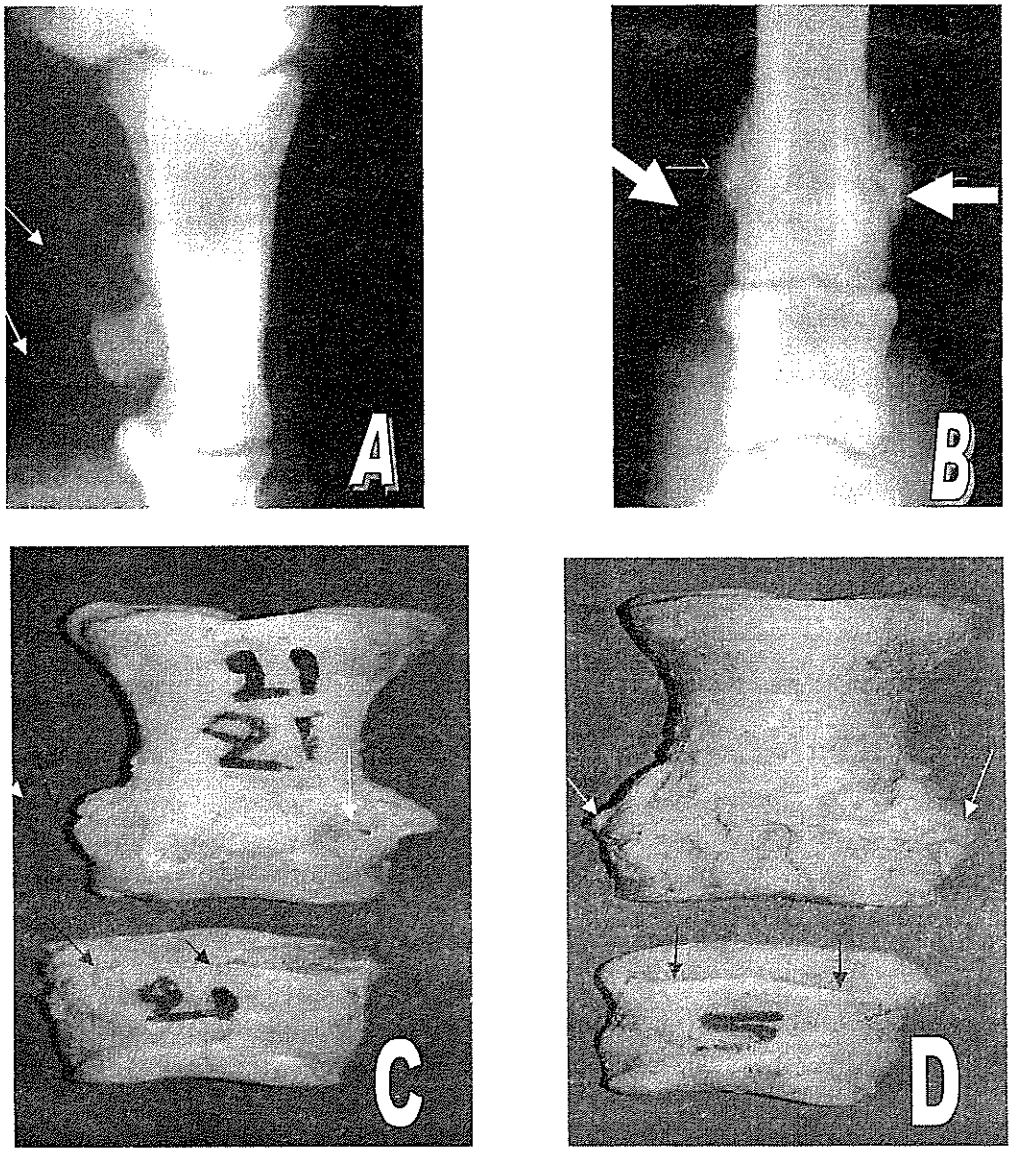

Figure (5): (A) lateromedial (B) dorsopalmar radiographs of the left fore phalangeal regions showing a false ring bone formation palmar (long arrows) and collateral (short arrows) surfaces of P1. (C) and (D)Anterior views of bone specimens of the same radiograph in figures A and B showing the false ring bones PI (white arrows). Notice that the articular surfaces are apparently free from bone exstoses (black arrows).

الملخص العربي

التقييم بالأشعة السينية لالتهاب السمحاق التشعبي في الحمير

نبيل احمد علي مسك*, أمل جلال احمد ابو العل**ا, بهاء الدين علي عبدالآه**

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تمت دراسة حالات التهابات السمحاق التشعبية في قوائم الحمير لمعرفة أماكن حدوثها وأشكالها المختلفة باستخدام الأشعة السينية ومعرفة تأثيرها بالنسبة لمقدرة الحيوان علي الاستمرار في العمل.

وقد وجد أن حالات التهابات السمحاق التشعبية تصيب كل من السمحاق المبطن للعظام السمسمانية خاصة بالقوائم الأمامية وكذلك السمحاق المبطن للعظام الحلقية في كل من القوائم الخلفية والأمامية وتميزت جميعها بوجود بروزات عظمية واضحة في صور الأشعة السينية. وقد لوحظ أن معظم البروزات العظمية لسمحاق العظام السمسمانية توجد علي الوجه الخلفي لها يلي ذلك منطقة ما بين عظام المشط ثم تليها البروزات الرضية التي توجد علي عظمة المشط الثالثة وقد لوحظ انه غالبا ما توجد معظم هذه البروزات علي الجانب الإنسي لعظام المشط خاصة تلك التي بالقوائم الأمامية.

أما البروزات العظمية الحقيقية لسمحاق العظام الحلقية فقد سجلت في المفاصل السلامية العلوية للقوائم الأمامية والخلفية بينما البروزات العظمية الزائفة لسمحاق العظام الحلقية وجد انه غالبا ما يصيب عظام سلاميات القوائم الأمامية.

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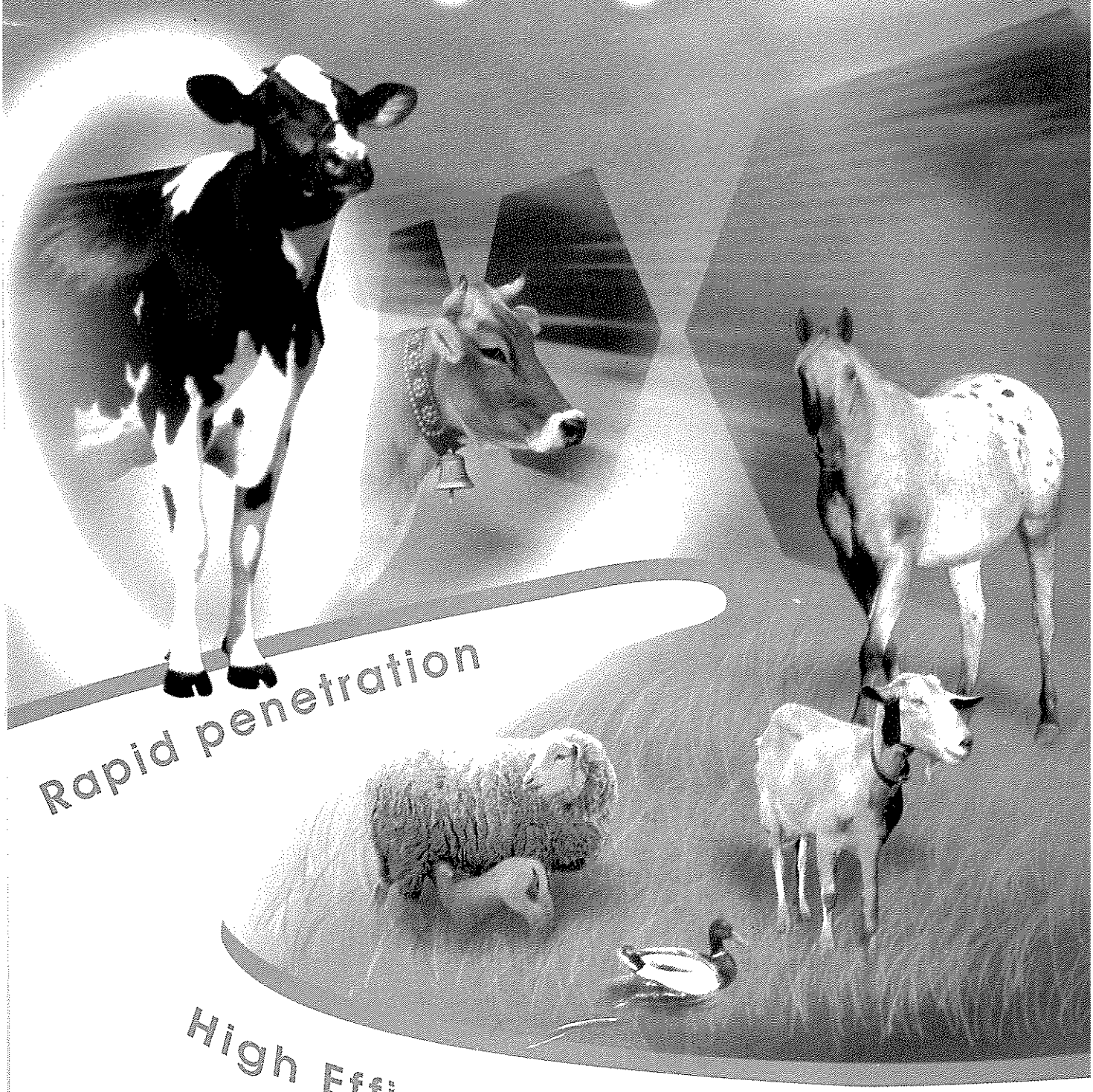

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