Dept. of Anatomy & Histology
Fac. Vet. Med., Assiut University
Head of Dept. Prof. Dr. A. Hifny

RADIOLOGICAL ANATOMICAL STUDY ON THE NAVICULAR BURSA OF DONKEY, CATTLE, BUFFALO AND CAMEL

(With 7 Figures)

By

K.E.H. ABDALL

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دراسة إشعاعيه تشريحيه على الكيس الزلالي الزورقي في الحمير والأبقار والجاموس والجمال

كمال الدين هاشم عبدالله

نظرا للأهميته الأكلينيكيه للكيس الزلالي والجمال فقد تمت دراسة التركيب التشريحي بالتفصيل لهذا الكيس وتحديد اماكن حقنه وكذلك علاقته بالتراكيب الزلاليه المجاوره في الحمير والأبقار والجاموس والجمال. وقد تبين أنه لايوجد إتصال بين الكيس الزلالي الزورقي والمفصل بين الأصبعي القاصي في الأبقار والجاموس بينما لوحظ وجود إتصال بينهما في حالة من الحمير وحالتين من الجمال. كما وجد إتصال بين الكيس الزلالي الزورقي والغمد الزلالي الأصبعي في ثلاث حالات من الجمال بينما لم يوجد هذا الاتصال في باقي الحيوانات تحت الدراسة.

SUMMARY

The navicular bursa does not communicate with the digital Tendon sheath in donkey, cattle and buffalo, but this communication was observed in three cases of camel. Moreover, the communication betweeen this bursa and the distal interphalangeal joint is not found in cattle and buffalo, however it was demonstrated in one case of donkey and two of camel. The navicular bursa extends proximally, distally and laterally beyond the edges of the navicular bone in donkey or scatum distale in camel, while the bursa has a proximal and very small distal extension in cattle and buffalo. The navicular bursa has a proximoaxial pouch in cattle and buffalo, a feature which is not present in donkey and camel. The proximal end of the bursa has distally directed sagittal projection which divides this end into two equal areas in donkey, but in cattle and buffalo the axial area is larger than the abaxial one. This projection was not observed in most cases of camel.

Kaywords: *Radiological anatomical study on the navicular bursa of Donkey, Cattle, Buffalo and Camel.*

INTRODUCTION

The navicular diseases are one of the most important causes of lameness, these diseases begin as bursitis of the navicular bursa (*ADAMS, 1962*). Despite this, the literature about the radiological and anatomical informations of the navicular bursa in donkey, cattle, buffalo and camel are meagre. Therefore it is necessory from the anatomical point 22995of view to make detailed study about this bursa in the previous animals including position, termination, relation, extension, length and breadth of the bursa. In addition the site of injection of the navicular bursa and its relationships with the digital tendon sheath and the distal interphalangeal joint must be studied.

MATERIALS and METHODS

This work was carried out on eleven mani of each of donkey, cattle, buffalo and camel. All specimens were used in fresh state, four of them were dissected for morphological features of the navicular bursa, another four specimens were injected with radioopaque substance; barium sulphate 40% for the radiological examination. The remaining materials were injected with gum milk latex to study the extension of the bursa.

RESULTS

The navicular bursa; Bursa podotrochlearis (Fig. 1-6), begins slightly distal to the termination of the digital tendon sheath (Fig. 1,7). It extends distally till the attachment of the deep digital flexor tendon on the distal phalanx. The bursa and the sheath are separated by connective tissue band which extends from the dorsal aspect of the deep digital flexor tendon to the palmar surface of the middle phalanx. This band is relatively wide and thick in donkey, cattle and buffalo but narrow and thin in camel. Due to the weakness of the connective tissue band in camel the communication could be observed between the navicular bursa and the digital tendon sheath as demonstrated in three cases (Fig. 6). This communication was not observed in donkey, cattle and buffalo.

The dorsal aspect of the navicular bursa in donkey, cattle and buffalo is related mainly to the palmar surface of the navicular bone (Os sesamoideum distale) which has a sagittal eminence separating two concave areas. This eminence is centrally situated in donkey, while in cattle and buffalo the eminence is low and lies slightly abaxially separating two unequal areas; the axial area is larger than the abaxial one. The palmar surface of the navicular bone is coated with cartilage to faciltate the movement of the deep digital flexor tendon over it. Instead of the navicular bone in camel there is a relatively thick cartilage; scatum distale, which has concave smooth palmar surface for the passage of the deep digital flexor tendon.

The navicular bone or the scatum distale separates partially the navicular bursa from the distal interphalangeal joint. But due to the proximal extension of the navicular bursa above the edge of the navicular bone in doneky, cattle and buffalo or above scatum distale in camel,

it was found that the bursa and the preceding joint are in contact at this area. It was observed that at this area the two synovial cavities were communicated in one case of donkey (Fig. 2) and two cases of camel, however this communication was not demonstrated in cattle and buffalo. It was noted that the area of contact between the navicular bursa and the distal interphalangeal joint is relatively larger and thinner in camel and donkey than in cattle and buffalo. Therefore the possibility of communication between the two synovial structures is higher in the camel and donkey than in the cattle and buffalo. The navicular bursa extends also 0.7 cm below the edge of the navicular bone in donkey and 0.5 cm below the scatum distale in camel. While the bursa terminates slightly distal to the edge of the navicular bone in cattle (0.2 cm) and buffalo (0.3 cm).

The palmar aspect of the navicular bursa is related to the dorsal surface of the deep digital flexor tendon. In donkey, cattle and buffalo the tendon presents a sagittal groove adapted to the sagittal eminence of the navicular bone. This feature was not observed in camel. The thickness of the deep digital flexor tendon varies in the different examined animals at the region of the navicular bursa, it is 0.4, 0.5, 0.6, 0.2 cm in donkey, cattle, buffalo and camel respectively. This explains that the deep digital flexor tendon in camel is thinner than the other studied animals.

The proximal end of the navicular bursa (Fig. 3,4) has a distally directed sagittal projection in donkey, cattle and buffalo. This projection corresponds the level of the sagittal eminence lying on the palmar surface of the navicular bone. In donkey this porjection divides the proximal end of the bursa into two equal convex parts. However in cattle and buffalo the two convex parts are unequal; the axial part is larger than the abaxial one. It was observed that in one case of cattle and three cases of buffalo 3-4 projections exend from the proximal end of the bursa, the longest of them is that corresponding to the sagittal eminence of the navicular bone. The proximal end of the navicular bursa in camel is convex and presents no projection except in two cases a small median sagittal projection was observed.

The distal end of the navicular bursa (Fig. 1-6) terminates nearly at the level of the distal interphalangeal joint in cattle and buffalo. In donkey and camel it terminates below the foregoing joint. The distal end of the bursa is slightly serrated in donkey, cattle and buffalo, it is convex in the former animal however in the latter two animals it extends obliquely distally and axially. In camel the distal end is slightly convex.

The parietal layer of the navicular bursa extends from the palmar aspect of the medial and lateral (axial and abaxial) margins of the navicular bone to the corresponding margin of the deep digital flexor tendon. In donkey and camel the parietal layer extends somewhat outwards before attaching the deep digital flexor tendon, this extension is not found in cattle and buffalo. The navicular bursa in donkey and camel extends proximally, distally and laterally beyond the edges of

the navicular bone (donkey) or scatum distale (camel). However the bursa has a proximal and very small distal extension beyond the edges of the navicular bone in cattle and buffalo.

The proximodistal axis of the navicular bursa measures 2.4, 3.1, 3.7, 2.7 cm in donkey, cattle, buffalo and camel, the mediolateral (axioabaxial) axis is 2.8, 2.4, 3.4, 2.6 cm in the previous animals respectively. This indicates that the long axis of the navicular bursa is directed mediolaterally in donkey and proximodistally in cattle as well as buffalo. In camel the dimensions of the two directions are nearly equal, therefore the bursa of this animal is nearly quadrilateral in shape.

The suitable site for injection of the navicular bursa in donkey, cattle and buffalo lies in the middle of the palmar aspect directly above the level of the hoof. The needle is introduced dorsally and distally for about 1.3, 1.5, 1.6 cm in donkey, cattle and buffalo, pierceing the deep digital flexor tendon till touching the navicular bone where it becomes within the navicular bursa. It is important to take in consideration that the needle must be introduced carefully and slowly. Another trial for injection of the navicular bursa in the foregoing animals from the lateral side was also performed. Slightly dorsal to the heel of the hoof the needle is introduced distomedially and slightly dorsally between the middle phalanx and the deep digital flexor tendon till encountering the navicular bone where it becomes in the navicular bursa. In camel due to the deep position of the navicular bursa, it can be injected from the palmar aspect of the hoof pad. Opposite to the caudal end of the nail and about 3.0 cm medial to the lateral boundary of the hoof pad, the needle is introduced vertically for about 2.5 cm through this pad and the overlying tissue, pierceing the deep digital flexor tendon to become in the bursa.

DISCUSSION

The present study reveals that the navicular bursa does not communicate with the distal interphalangeal joint in cattle and buffalo. The same result was given in cattle by *GREENOUGH et al. (1981),* in horse by *CALISLAR/CLAIR (1969)* as well as *JOHNSON (1973)* and in donkey by *TAHA (1987)*. This communication was observed in one case of donkey and two cases of camel. In this respect, *SKERRITT/MCLELLAND (1984)* mentioned that in horse the navicular bursa is often continuous with the distal interphalangeal joint. *De LA-HUNTA/HABEL (1986)* reported that in the latter animal the latex injected into the bursa will not pass through the navicular ligament into the joint, nor it will pass in the reverse direction. It must be noted that the possibility of communication between the navicular bursa and the distal interphalangeal joint depends upon the size and the thickness of the area of contact between the two synovial structures. This area lies above the edge of the navicular bone or scatum distale.

According to the present study the navicular bursa communicated proximally with the digital tendon sheath in three cases of camel. This communication was not observed in donkey, cattle

and buffalo, similar result was recorded in the former animal by *TAHA (1987)* and in the second animal by *GREENOUGH et al. (1981)*. In this connection, *DYCE et al. (1987)* reported that the navicular bursa, digital tendon sheath and the distal interphalangeal joint do not communicate, except for a connection between the sheath and the joint in the foal. despite this, anesthetics injected into the distal interphalangeal joint of the adult horses reaches the navicular bursa by diffusion. *De LA-HUNTA/HABEL (1986)* stated also that in spite of their impermeability to latex, the membranes between the three synovial structures permit the diffusion of anesthetic solutions from one to other.

The dorsal aspect of the navicular bursa is related mainly to the navicular bone in donkey, cattle and buffalo. This finding is confirmed in horse and ruminant by *SISSON (1975); GETTY (1975); FRANDSON/WHITTEN (1981); SEIFERLE/FREWEIN (1983) and DYCE et al. (1987)*. In camel due the absence of the navicular bone the dorsal aspect of the navicular bursa is related mainly to cartilage called scatum distale which is termed as meniscus by *ARNAUTOVIC/ABDALLA (1969)*. According to *KARKORA (1986)* the scatum distale is made up of dense collagenous bundles intermingled with fibrocartilage. But corresponding to the statement of *ARNAUTOVIC/ABDALLA (1969)* the fibrocarilage was not observed in the scatum distale. The absence of the navicular bone in camel was also reported by *LESBRE (1903); MORCOS (1955) and KARKORA (1986)*.

As the navicular disease progresses, degenerative and erosive lesions of the fibrocartilage begin on the tendinous surface of the navicular bone, the degenerative fibrocartilage becomes frayed and pitted near the sagittal ridge *(ADAMS, 1962)*. The present work shows that the palmar aspect of the navicular bone is coated with cartilage to faciltate the movement of the deep digital flexor tendon corresponding to that recorded by *GETTY (1975) and STASHAK (1987)*. The palmar aspect of the navicular bone has a central sagittal eminence in donkey similar to that given in horse by *NICKEL et al. (1986)*. A low sagittal eminence is also found on the navicular bone in cattle and buffalo, but this eminence divides the palmar surface into a larger axial part and a small abaxial one. According to the statement of *KARKORA (1986)* the obtained finding indicates that the palmar surface of the scatum distale in camel is smooth and concave on which the deep digital flexor tendon glides. Concerning to the function of the navicular bursa *GREENOUGH et al. (1981)* mentioned that in cattle the synovial fluid of the bursa faciltates movement and reduces friction between the opposing structures. In horse *STASHAK (1987)* stated also that the bursa cushing the movement of the tendon against the bone.

The palmar aspect of the navicular bursa is related to the deep digital flexor tendon which has variable thickness in the different examined species. It was found that the tendon of the camel at the area of the navicular bursa is thinner than the other investigated animals. In

this respect, *EREISHA (1982)* and *KARKORA (1986)* reported that beyond the level of the pastern joint the deep digital flexor tendon in camel has the form of a relatively thin band along the palmar or the plantar aspect of the scatum distale up to its termination on the distal phalanx. The dorsal surface of the deep digital flexor tendon in donkey, cattle and buffalo presents a sagittal groove adapted to the sagittal eminence of the navicular bone. This groove was not observed in camel.

SEIFERLE/FREWEIN (1983) pointed out that the navicular bursa in horse spreads laterally, proximally and distally beyond the gliding surface of the navicular bone. The same result was demonstrated in donkey and camel, while in cattle and buffalo the navicular bursa has a proximal and very small distal extension beyond the edges of the navicular bone. Moreover the proximal end of the navicular bursa in the examined cattle and buffalo forms a proximoaxial pouch. *GREENOUGH et al. (1981)* stated that the navicular bursa in cattle is confined on either side by the strong fibrous structures, but forms a small pouch distal to the navicular bone and larger pouch proximal to it.

Concerning to the sites of injection the navicular bursa in donkey, cattle ar buffalo there are two positions, the fir of them lies on the middle of the palm aspect directly above the level of th hoof. This method is confirmed in do key by *TAHA (1987)* and in horse b *Van KRUININGEN (1963). SKE RITT/MCLELLAND (1984)* describe the same position for injection of th bursa in horse but the needle is directe parallel to or slightly below the proxim border of the hoof. Another trial for in jection of the navicular bursa from th lateral side slightly dorsal to the heel the hoof was also performed in donke cattle and buffalo. This method was de scribed in horse by *Van KRUININGE (1963).* According to the present stud the first method of injection is more suitable and easily to be applied than th second one. But it is necessory durin application of the first method or th palmar injection to introduce the needl carefully and slowly to avoid traumatiz ing the navicular bone and its coverin cartilage with the tip of the needle. I camel the navicular bursa can be in jected from the palmar aspect of the hoof pad.

LEGENDS

Fig.1: Mediolateral radiographs showing the navicular bursa and the digita tendon sheath in donkey.

Fig.2: Mediolateral radiographs showing the communication between th navicular bursa and distal interphalangeal joint in donkey.

Fig. 3: Dorsopalmar radiographs showing the navicular bursa in cattle.

Fig. 4: Dorsopalmar radiographs showing the navicular bursa in buffalo.
Fig. 5: Dorsopalmar radiographs showing the navicular bursa in camel.
Fig.6: Dorsopalmar radiographs showing the communication between the navicular bursa and digital tendon sheath in camel.
Fig.7: Dorsopalmar radiographs showing the digital tendon sheath and the distal interphalangeal joint in camel.

A- Proximal phalanx. **1-** Navicular bursa.
B- Middle phalanx. **2-** Digital tendon sheath.
C- Distal phalanx. **3-** Distal interphalangeal joint.

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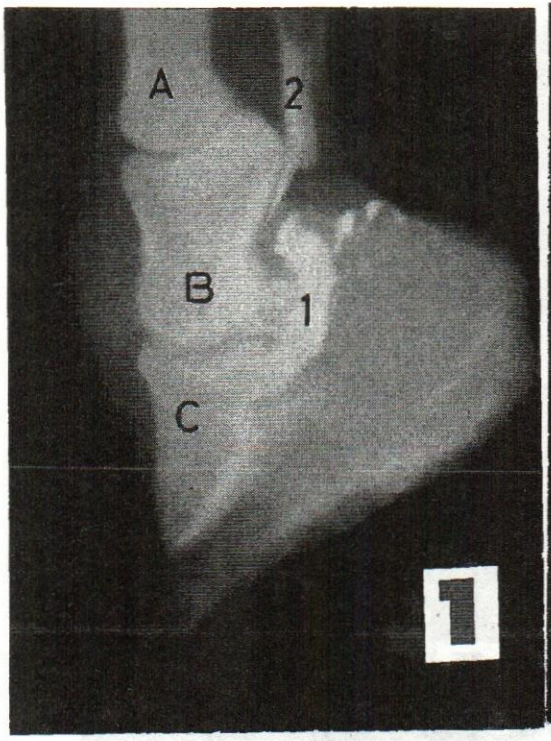
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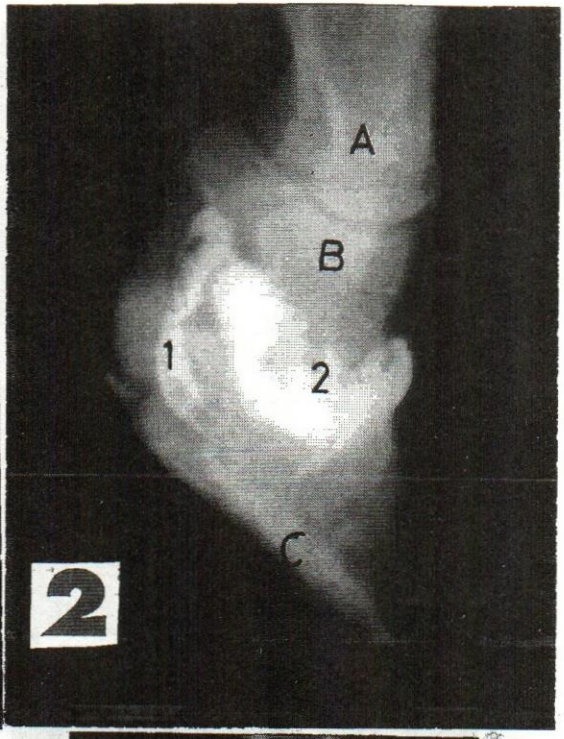
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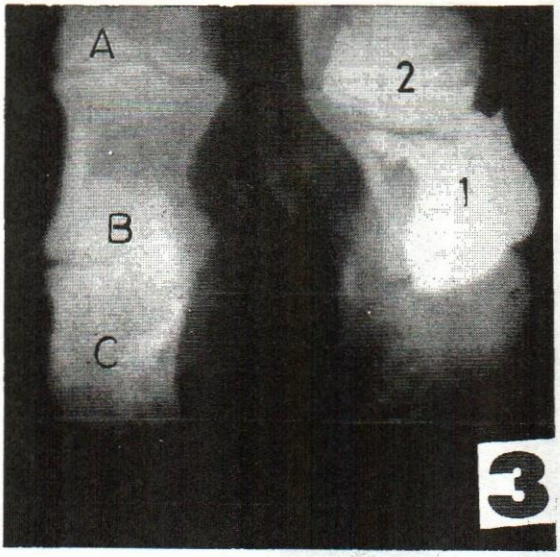
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RADIOLOGICAL, ANATOMICAL, NAVICULAR BURSA