



Ultrasonographic Anatomy of the Fetlock in Draught Horses

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Abstract

Objective- To describe the normal sonographic images of the soft tissues of the dorsal and palmar aspects of the fetlock region in the draught horses.

Design- Descriptive study.

Animals- Five clinically and radiographically normal draught male horses were used during this study.

Procedures- Horses were examined both radiographic and ultrasound ante mortem and post mortem. Based on the proximal sesamoid bones the fetlock region was divided into three zones. Zone I (PSB1) located 4 cm above the sesamoid bone. Zone II (PSB II) located at the level of the sesamoid bones. Zone III (PSBIII) located distal to the sesamoid bones. Measurements of tendon and ligament structures for the three zones were determined by means of electronic calipers. Cross transverse sections for the structures of the three zones were identified.

Results and Conclusion- The fetlock joint is surrounded by soft and hard tissue structures. The gross anatomical, radiographic and Ultrasonographic images were studied. The ultrasound images of the palmar and dorsal aspects were identified and reviewed. The echogenic patterns of the three zones were evaluated. This study provides a detailed knowledge on the normal ultrasound anatomy and measurements of the tendon and ligaments in the three zones.

Clinical Relevance- This study is a useful value in the diagnosis of fetlock lameness under clinical conditions.

Key Words- Ultrasonography, Fetlock, Draught Horse.

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Introduction

The fetlock joint of the horse (metacarpo/Metatarsophalangeal joint) is a rotary joint and has the greatest range of motion than any equine joints.¹ The gross anatomical location of the fetlock structures have been described.^{2,3,4}

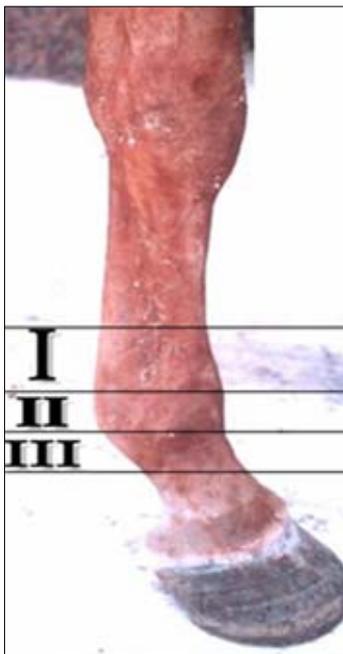
The fetlock is frequently subjected to the largest number of traumatic and degenerative lesions among all joints in the horse.⁵

The equine fetlock joint have biomechanics stressed during Locomotion. The angular design permits a wide range of motion during competition. Hyperextension during weight bearing and extreme flexion during the swing phase lead to tremendous tensile and torque forces on the fetlock soft tissues.³ Studies the descriptive and topographic anatomy of the soft tissue structures in the fetlock is essential before ultrasonographic signs of injury can be recognized.

The aim of this study is to provide detailed anatomical and ultrasonographic images of the soft tissue structures in the fetlock region in the horse. Comparison of Ultrasonographic images with the anatomical dissected specimens will provide precise and accurate diagnosis of fetlock lameness in the horse.

Materials and Methods

During this study the fetlock of the Five clinically and radiographically normal draught male horses were evaluated with ante-mortem sonographic examination and post mortem dissection of bone and soft tissue structures. Radiographs of the fetlock joint were obtained using dorso-palmar, later medial, flexed latero- medial and lateral and medial oblique views. Both fore limbs and hind limbs from each horse were included in this study. These horses were euthanized for reasons other than musculaketal disease. The limbs were isolated proximal to the carpus and tarsal joints. The limbs were frozen for dissections.



◀ **Figure 1.** Palmar aspect of the fetlock joint divided into three zones.
Zone I: PSBI: 4 cm above the proximal sesamoid bones.
Zone II: PSBII, at the level of the sesamoid bones.
Zone III: PSBIII: distal to the base of the sesamoid bone to mid PI.

The palmar/plantar aspects of the metacarpo/metatarsophalngeal region were divided into three anatomic zones in relation to the proximal sesamoid bones (Fig 1).Zone (I), the region extended 4cm.

Above the proximal sesamoid bones (PSBI). Zone (II), the region at the level of the proximal sesamoid bones (PSB II). Zone (III), the region located just distal to the ergot and extended to mid proximal phalanx (PSBIII).Gross transverse cross sections for the three zones were performed. The shape, orientation and the relative relationships of the structures in the three zones were evaluated and identified.

Sonographic examination was performed in full weight bearing horse. Preparation included clipping and shaving the hairs,

followed by Antiseptic washing and rinse with alcohol. Acoustic gel was applied to the fetlock region. A diagnostic ultrasound machine (Toshiba, just vision 200) with a 3 -7 MHz convex transducer was used to image bone and soft tissues both in sagittal and transverse scan. Measurements of tendon and ligament structures for the three zones were determined by means of Electronic calipers on the ultrasound machine. Measurements of the lateral to medial and dorsal to palmar/plantar dimensions in transverse scan were determined. The dorsal surface of the fetlock was examined both transverse and sagittal scans. The examination was done at the level of the sagittal ridge of the distal condyle. Comparison of ultrasound images with gross transverse anatomical dissected specimens in the three zones was evaluated.

Results

The gross anatomical structures in the transverse section in zone PSB I (Fig2a) consisted of SDFT, DDFT, medial and lateral branches of the suspensory ligaments (SL) and the third metacarpal/metatarsal bones (MTIII/MTIII). The Ultrasonographic of zone PSB I revealed the SDFT has a homogenous and echogenic in appearance and is slightly less echogenicity than the DDFT. The SDFT appeared as strap shaped and forming a ring (manica flexoria) around the oval shaped DDFT (Fig 2b).

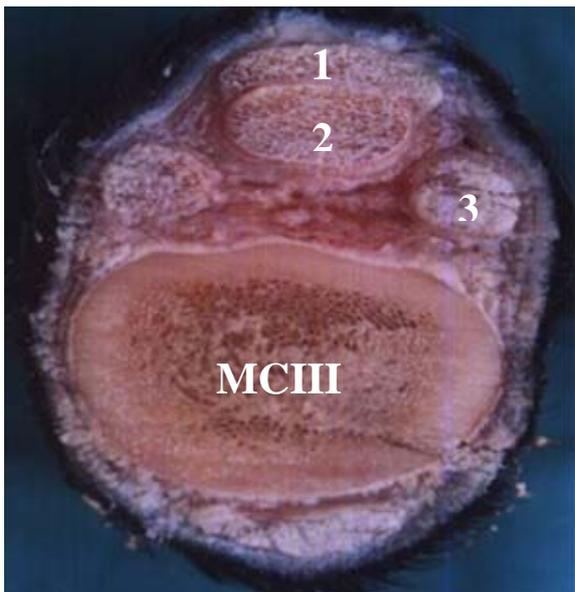
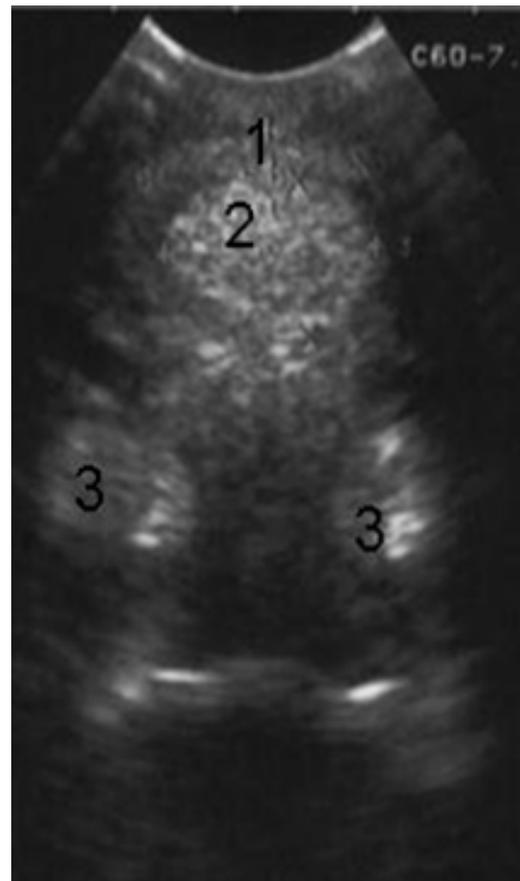


Figure 2a. Transverse cross-section of the normal fetlock joint (zone I).

1:The SDFT, 2:The DDFT, 3:The medial and lateral branches of the suspensory ligament, MCIII: The third metacarpal bone.

Figure 2b. Transverse ultra sonogram scans of the PSBI.

1:The SDFT; strap in shape and less echogenic than the DDFT, 2:The DDFT; oval in shape, 3:The medial suspensory ligament branch; trapezoid in shape.



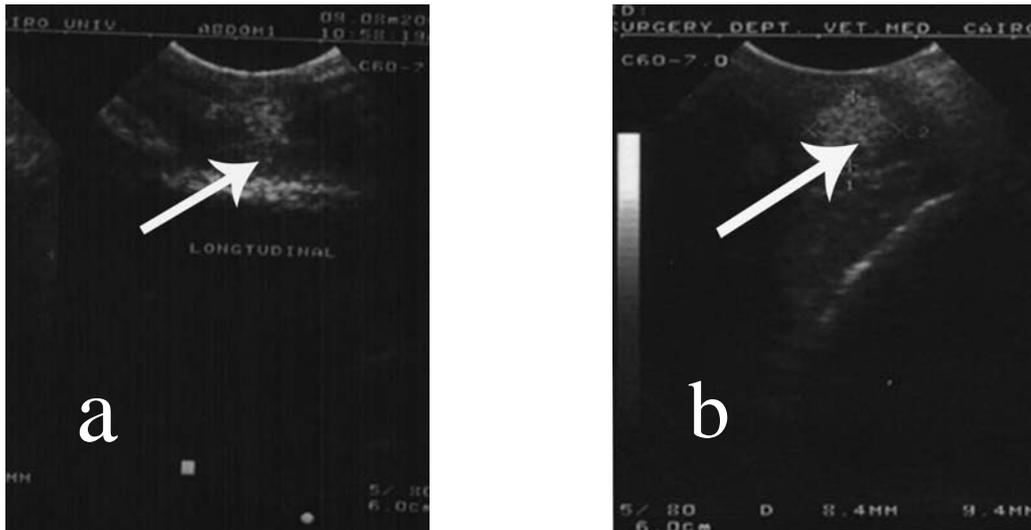


Figure 3. Longitudinal (a) and Transverse (b) ultrasound images of the normal medial suspensory ligament at zone I. The medial SL. Appeared trapezoid in shape.

The digital sheath is not recognized. The suspensory ligament branches appeared oval to trapezoid shape in transverse scan. The SL branches have similar echogenicity and sonographic texture like the flexor tendons (Fig 3).

The transverse cross sectional anatomical structures within the zone PBS II consisted of palmar digital annular ligament, SDFT, DDFT, intersesamoiden ligament, proximal sesamoid bones and distal third of MCIII/MTIII Bones (Fig 4a).

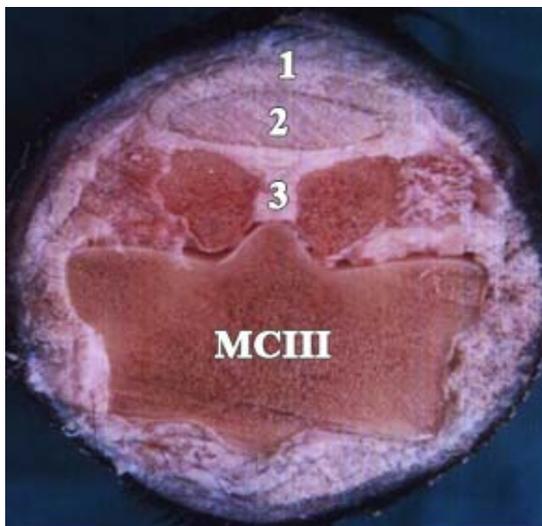


Figure 4a. Transverse cross-section of the normal fetlock joint Zone II.
1:The SDFT, 2:The DDFT, 3:Inter sesamoidean ligament, 4:proximal sesamoid bones, MCIII:the third metacarpal bone.

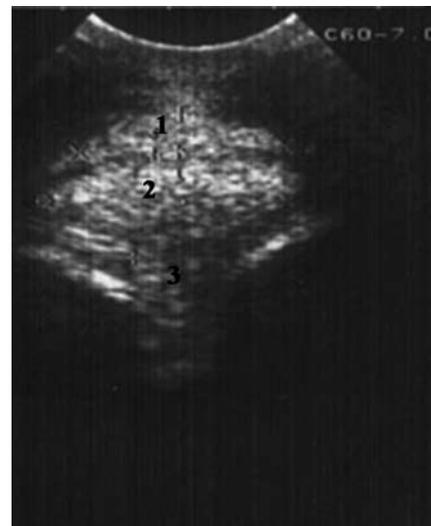
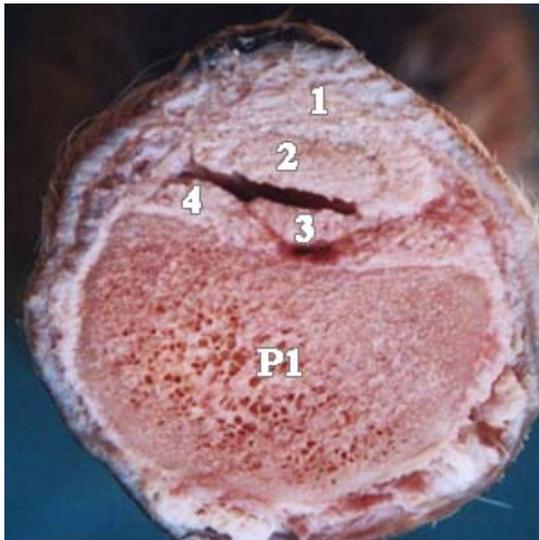


Figure 4b. Transverse ultrasound image of the zone II.
1:The SDFT; flattened in shape and of similar echogenicity with the DDFT, 2:The DDFT; oval in shape, 3:Inter sesamoidean ligament extend between the sesamoid bones.

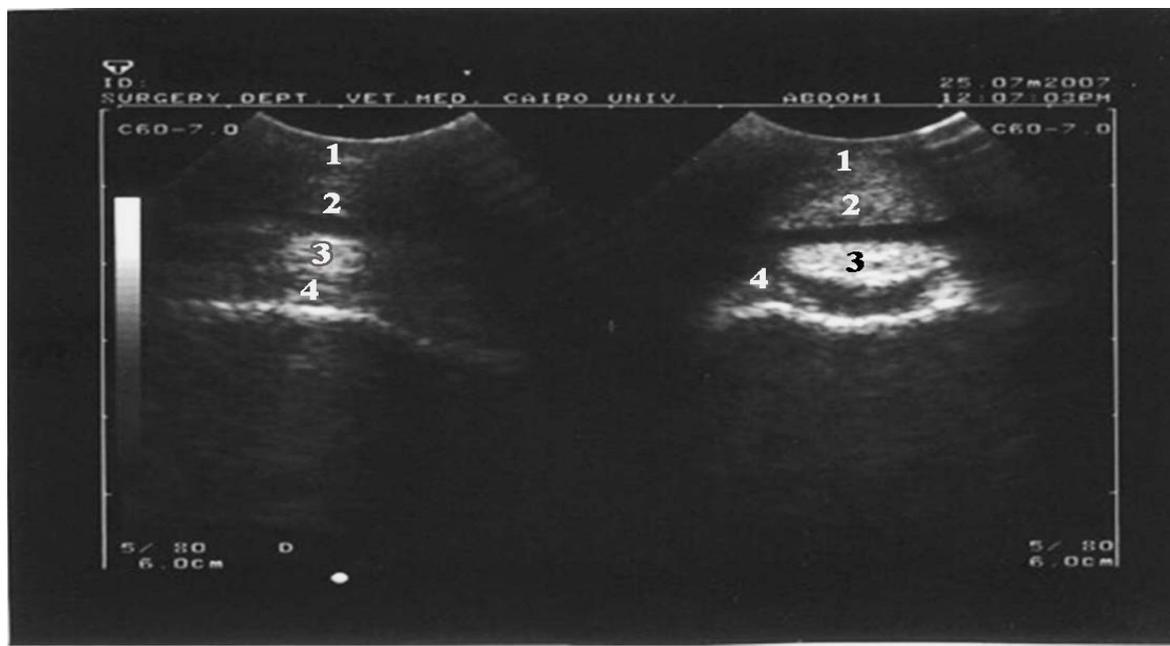
The annular ligament was undistinguished from the digital sheath. The sonographic imaging showed that, the SDFT appeared flattened in shape. The DDFT was visualized as an oval shape. The SDFT has a homogenous echogenic pattern and have similar brightness of DDFT. The intersesamoiden ligaments was appeared moderately echogenic and occupied the space between the echogenicity DDFT and hyperechoic sesamoid bones (Fig 4b).

The zone PSBIII included the SDFT, DDFT, straight (SDSL) and oblique (ODSLs) distal sesamoidean ligaments and the proximal phalanx (Fig 5a).



◀ **Figure 5a.** Transverse cross-section of the normal fetlock Zone III.
1:The SDFT, 2:The DDFT, 3: Straight sesamoiden ligament (SDSL), 4:The oblique distal sesamoidean ligaments (ODSLs), P1:The first phalanx.

Figure 5b. Transverse ultrasonogram scans of the Zone III.
1:The SDFT; half moon in shape, 2:The DDFT; oval in shape, 3:SDSL; Thick echogenic band, 4:ODSLs; oval to round.



The sonographic studies displayed the SDFT was thin and half moon shaped. The DDFT was oval in shape and located immediately dorsal to the SDFT. The straight distal sesamoidean ligament

(SDSL) was visualized as thick echogenic flat band and more echoic than the flexor tendons. The ODSLs were seen as two ovals to rounded bands running on the palmar surface of the proximal phalanx adjacent to the SDSL. The ODSLs were appeared less echogenic than the SDSL (Fig5b). The ultrasonographic images of the dorsal aspect of the fetlock joint (Fig 6) revealed the joint capsule appeared thick and moderate homogenous echoic structure. The dorsal aspect of the subchondral bone of the sagittal ridge and the proximal phalanx were seen regular and well defined lines. The Fetlock joint dorsal and proximal palmar synovial recesses have a small amount of anechoic synovial fluid.

The measurements of the tendons and ligaments structures were determined (Table, 1) in the three zones. The superficial digital flexor tendon measurements lateral to medial were 1.9 ± 0.04 , 1.7 ± 0.06 and 2.1 ± 0.03 cm in zones PSB I, PSB II, and in zone PSBIII respectively.

The measurements of the deep digital flexor tendons were 1.9 ± 0.06 , 2.0 ± 0.4 and 1.3 ± 0.03 cm lateral to medial and palmar to dorsal were 0.9 ± 0.02 , 0.8 ± 0.05 and 0.5 ± 0.03 cm respectively in the three zones.

The lateral and medial branches of the suspensory ligaments were similar in diameter and lateral to medial was 0.8 ± 0.03 and 0.9 ± 0.04 cm palmar to dorsal directions.

The straight distal sesamoidean ligament (SDSL) and oblique distal sesamoidean ligaments were measured within the zone PSBIII.

The measurements lateral to medial was 0.7 ± 0.03 cm and 0.3 ± 0.01 palmar to dorsal.



Figure 6. Transverse ultrasonographic scans of the normal dorsal aspect of the fetlock joint. Notice thickened joint capsule with small anechoic synovial fluid in the dorsal recess (Arrow).

Table1. The mean electronic measurements of the SDF, DDFT, Suspensory ligaments (SL), straight distal sesamoidean ligaments (SDSL) and oblique distal sesamoidean ligaments (ODSLs) in the three zones of fetlock region in the horse.

		PSB I	PSB II	PSB III
		mean \pm SE (cm)	mean \pm SE (cm)	mean \pm SE (cm)
SDFT*	Palm – Dor	0.3 ± 0.02	0.3 ± 0.01	0.2 ± 0.03
	Lat – Med	1.9 ± 0.04	1.7 ± 0.06	2.1 ± 0.03
DDFT**	Palm – Dor	0.9 ± 0.02	0.8 ± 0.05	0.5 ± 0.03
	Lat – Med	1.9 ± 0.06	2.0 ± 0.04	1.3 ± 0.03
SL	Palm – Dor	0.9 ± 0.04	-	-
	Lat – Med	0.8 ± 0.03	-	-
SDSL	Palm – Dor	-	-	0.7 ± 0.01
	Lat – Med	-	-	1.4 ± 0.03
ODSLS	Palm – Dor	-	-	0.3 ± 0.01
	Lat – med	-	-	0.7 ± 0.02

* SDFT: the superficial digital flexor tendon.

**DDFT: the deep digital flexor tendon.

Discussion

Studies the morphological gross anatomical structures of the three Zones of the fetlock region in the horse showed that the fetlock is surrounded by hard and soft tissue structures. The fetlock joint of the horse is composed of multiple hard and soft tissues and any injury to any of these components usually have some effects on the other.⁴ Therefore, study the shape, size, orientation and relative relationships of the three zones PSBI, PSBII, and PSBIII will provide accurate knowledge for interpretation of ultrasonographic images.

Ultrasound has a wide extensive use in the diagnosis of equine soft tissues and musculoskeletal injuries.⁶ The accessory carpal bone was used in the fore limb and the fourth metatarsal bone for the hind limb a standard fixed points for accurate diagnosis and measurements of tendon and ligaments.⁷ Accordingly, the proximal sesamoid bones were used in the present study a standard fixed point for diagnosis and measurements of the soft tissues of the fetlock region in the horse.

Based on the proximal sesamoid bones, the fetlock region was divided into three zones. Zone PSBI located 4cm above the proximal sesamoid bones. Zone PSBII at the level of the proximal sesamoid bones. Zone PSBIII distal to the level of the proximal sesamoid bones.

As far as we aware, this classification has yet been described.

The comparison between anatomical sections and ultrasonographic images of the fetlock soft tissues at the dorsal and abaxial aspects have been studied⁸ they concluded that a thorough knowledge of the normal ultrasonographic anatomy is critical for an accurate diagnosis of fetlock soft tissues. Therefore in the present study the descriptive and topographic anatomy of the soft tissues in the three zones of the fetlock region is essential before ultrasonographic signs of fetlock pathologies can be recognized.

Ultrasonographic scanning of the SDFT and DDFT in the three zones showed that the SDFT appeared flattened and less echogenicity than the oval shaped DDFT. Meanwhile The SDFT in the zone III appeared half moon or half ring shaped. The medial and lateral branches of the suspensory ligament in the zone PSBI appeared oval and have similar echogenicity of the digital tendons. These findings have been reported by other investigators in the distal metacarpal areas.^{8,9}

Ultrasound measurements of the normal size of tendons and ligaments promote in reconization of abnormality.¹⁰ During this study the tendon and ligament structures in zone PSBI, PSBII and PSBIII have been measured either medial to lateral or palmar to dorsal directions.

There have been several reports on measuring tendons and ligaments in the metacarpal areas.^{11,12} Compiled the measurements of the SDFT in palmar to dorsal thickness were found slightly less than that previously reported. They reported that the SDFT palmar to dorsal thickness was 0.6 cm and medial to lateral directions was 2.5 cm. However, some studies¹² found that the SDFT and DDFT in the distal metacarpus were 0.4 cm and 0.9 cm palmar to dorsal directions and 1.8 cm to 1.5 cm medial to lateral directions respectively. These findings are in general agreed with our results in zones PSBI; PSBII and PSBIII.

The echogenicity of the medial and lateral branches of the suspensory ligament were bilaterally symmetrically and there was no significant difference in size.¹³ Accordingly, these findings in the present study were agreed with the others.^{9,12}

The measured straight and oblique distal sesamoidean ligaments in zone PSBIII were 0.7 cm and 0.3 cm palmar to dorsal directions and 1.4 cm and 0.7 cm lateral to medial consequently. The same observations were reported^{8,14} in the proximal pastern region. Contrary, the medial to lateral

directions showed slightly less than other findings. In conclusion, this study provides a detailed knowledge on the normal ultrasound anatomy and measurements of the tendon and ligaments in the three described zones. Moreover, it may have value in diagnosis of fetlock soft tissue injury.

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آناتومی اولتراسونوگرافیک ناحیه فتلاک در اسبهای بارکش

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هدف- توصیف تصاویر سونوگرافیک طبیعی بافت های نرم سطح قدامی و خلفی ناحیه فتلاک در اسب های بارکش.
طرح مطالعه- مطالعه توصیفی.

حیوانات- پنج اسب نر بارکش که از نظر بالینی و رادیوگرافی طبیعی بودند.

روش کار- اسب های از نظر رادیوگرافی و اولتراسوند قبل و پس از مرگ مورد بررسی قرار گرفتند. بر اساس استخوان های کنجی فوقانی، ناحیه فتلاک به سه منطقه تقسیم گردید. منطقه ۱ در فاصله ۴ سانتی متری بالای استخوان کنجی قرار داشت. منطقه ۲ در سطح استخوان های کنجی و منطقه ۳ در موقعیت تحتانی استخوان های کنجی قرار داشتند. اندازه گیری های مربوط به وتر ها و لیگامان ها در هر منطقه با استفاده از کالیپر الکترونیک انجام گرفت. مقاطع عرضی ساختارهای هر سه منطقه مورد بررسی قرار گرفتند.

نتایج و نتیجه گیری- مفصل فتلاک بوسیله ساختارهای بافت نرم و سخت احاطه شده است. ساختمان های طبیعی آناتومیک و تصاویر رادیوگرافیک و اولتراسونوگرافیک مورد ارزیابی قرار گرفتند. تصاویر اولتراسوند سطوح قدامی و خلفی ناحیه مورد مطالعه قرار داده شدند. الگوی اکوژنیک هر ناحیه ارزیابی گردید. این مطالعه اطلاعات دقیقی در خصوص ساختمان اولتراسونوگرافیک طبیعی و اندازه گیری وتر ها و لیگامان ها در مناطق سه گانه فوق را به دست می دهد.

کاربرد بالینی- یافته های این مطالعه در تشخیص لنگش های ناشی از فتلاک در شرایط بالینی می تواند مفید باشد.

کلید واژگان- اولتراسونوگرافی، فتلاک، اسب های بارکش.

