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Ultrasonographic anatomy of the patellar ligaments before and after medial patellar desmotomy in buffaloes (Bos bubalis)

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Abstract: The aims of the present study were to investigate the ultrasonographic appearance of the patellar ligaments in buffaloes before and after desmotomy. The medial, middle (intermediate) and lateral patellar ligaments, with upward fixation of the patella, were examined ultrasonographically in 12 adult buffaloes before and after medial patellar desmotomy. The results reveal that the ligaments were all of uniform echogenicity. The medial patellar ligament was visualized as highly echogenic circular structure, the middle patellar ligament as thick and triangular and the lateral patellar ligament was more echogenic structure and appeared flattened triangular in cross section. After surgery, there was slight increase in the thickness and width of the patellar ligaments especially the medial one. Ultrasonography will be useful as a complementary technique for examining the patellar ligaments of the buffalo.

Key words: Anatomy, buffalo, patellar ligaments, ultrasonography

تشريح بالموجات فوق الصوتية للأربطة الرضفية قبل وبعد عملية قطع الرباط الرضفى الداخلي في الجاموس

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ملخص: إن الهدف من هذه البحث هو دراسة الأربطة الرضفية في الجاموس قبل وبعد عملية قطع الرباط الرضفى الداخلي وذلك باستخدام الموجات فوق الصوتية. استخدمت في هذه الدراسة عدد اثنا عشر من الجاموس المصري. شملت هذه الدراسة على تصوير بالموجات فوق الصوتية للرباط الرضفى الداخلي والوسط والخارجي قبل وبعد عملية قطع الرباط الداخلي في جاموس مصاب بانزلاق الرضفة. أوضحت النتائج ظهور الأربطة الرضفية متجانسة وصدوية حيث ظهر الرباط الرضفى الداخلي دائري الشكل بينما ظهر الرباط الرضفى المتوسط سميك ومثلثي الشكل كما ظهر الرباط الرضفى الخارجي أكثر صدوية ومفلطح. كما أوضحت النتائج زيادة في سمك وعرض هذه الأربطة خاصة الرباط الرضفى الداخلي وذلك بعد إجراء جراحة قطع الرباط الرضفى الداخلي للجاموس المصاب بانزلاق الرضفة. لذلك فان الموجات فوق الصوتية تعتبر من الوسائل القيمة التي من الممكن أن تستخدم لتقييم وفحص الأربطة الرضفية في الجاموس.

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Introduction

The medial, middle (intermediate) and lateral patellar ligaments act as the functional insertions of the quadriceps femoris and biceps femoris muscles by attaching the patella to the tibial tuberosity. Proximal upward fixation of the patella is a common surgical problem in cattle and buffaloes (Tyagi and Singh, 2001; Shivaprakash and Usturge, 2004). Medial patellar desmotomy is the treatment of choice for surgical correction when upward fixation of the patella is unresponsive to conservative management. Associated complications with medial patellar desmotomy are well recognized (Gibson et al., 1989; Mcllwraith, 1990).

The gross anatomy of bovine stifle and patellar ligaments has been well documented (Ashdown and Done, 1984; Nickel et al., 1992; Desrochers et al., 1996). Only few papers reported the sonoanatomy of the stifle region and patellar ligaments in cattle (Kofler, 1999) but there are no reports on the patellar ligaments of the buffalo. Ultrasonography is useful for the diagnosis of many soft tissue lesions but, until recently, its application to the bovine stifle has been limited to a description of normal and abnormal structures. It has been established as a useful method for imaging and diagnosis of soft tissue alterations in human, equine and bovine muscloskeletal disorders (Sattler and Harland, 1988; Pennick et al., 1990; Munore and Cauvib, 1994; Dik, 1995; Kofler, 1999).

The objectives of this study were; first, to describe the ultrasonographic appearance of the patellar ligaments in buffaloes before and after desmotomy to determine the morphological changes associated with their pathogenesis. Second, to establish reference data for ultrasonographic examination of the bovine patellar ligaments.

Materials and Methods

Animals

The patellar ligaments of the hind limbs of 12 adult buffaloes of various ages and sexes were used for this study. Eight buffaloes were admitted to the clinic of Faculty of Veterinary Medicine-Benha University, with upward fixation of the patella (five right and three left), were examined ultrasonographically before surgery and at each postoperative examination. The stifle regions of other four left and right cadaver limbs were dissected and studied macroscopically to describe the patellar ligaments.

Ultrasonography

Ultrasonographic examination was performed using a real-time ultrasound scanner equipped with 7.5 - MHz linear transducer. The stifle region was finely clipped and washed, prior to liberal application of ultrasound coupling gel. The medial, middle and lateral patellar ligaments were examined from proximally to distally in transverse and longitudinal planes. The thickness of each patellar ligament was measured at three sites in the longitudinal planes: immediately distal to the patella (proximal), midway between the patella and tibia (midbody) and at its insertion (distal). Cross sectional area measurements of the transverse images of the patellar ligaments were made midway between the distal aspect of the patella and the proximal extremity of the tibia.

Medial patellar desmotomy was carried out in the left hind limb of each buffalo. The medial patellar ligament was anesthetized by the infiltration of 10 to 15 ml of 2% lidocaine hydrochloride. A 3-cm skin incision was made in a proximal to distal manner on the medial aspect of the femorotibiopatellar joint. After the medial patellar ligament had been dissected, it was severed with a bistouri, to ensure that all fibers had been severed. The buffaloes were examined ultrasonographically post operative every week for 6 weeks (until day 42^{th}).

Statistical analysis

The statistical data analysis of the measurement values obtained from the twelve adult buffaloes was made using a computer program (SPSS program for windows 6.0, SPSS Inc., 1994). The Nomenclature used in this study was according to Nomina Anatomica Veterinaria together with Nomina Veterinaria Histologica (1994).

Results

The patellar ligaments (Ligamentum patellae)

The patellar ligaments were observed macroscopically and ultrasonographically in all buffaloes throughout their course in the stifle region. These ligaments appeared cranially, laterally and medially in the stifle region of the buffalo. A subcutaneous soft tissue was variably visualized as a moderate echogenic area overlying the patellar ligaments. The thickness values of the patellar ligaments are summarized in Table 1.

Ligament	Width (latero-medial diameter)		Thickness (cranio-caudal diameter)	
	Preop	Postop	Preop	Postop
Medial patellar ligament	16.3±2.5	17.5±2.8	4.1±0.4	6.8±0.7
Middle patellar ligament	26.2 ±2.8	27.1 ±1.9	7.1 ±1.3	8.1 ±1.5
Lateral patellar ligament	18.5 ±1.7	19.6 ±2.1	7.9 ±0.9	8.8 ±1.1

Mean dimension ± standard deviation

The patellar ligaments of the buffalo appeared grossly as thick fibrous bands which arose from the patella and attached to the tibial tuberosity (Figure 1).

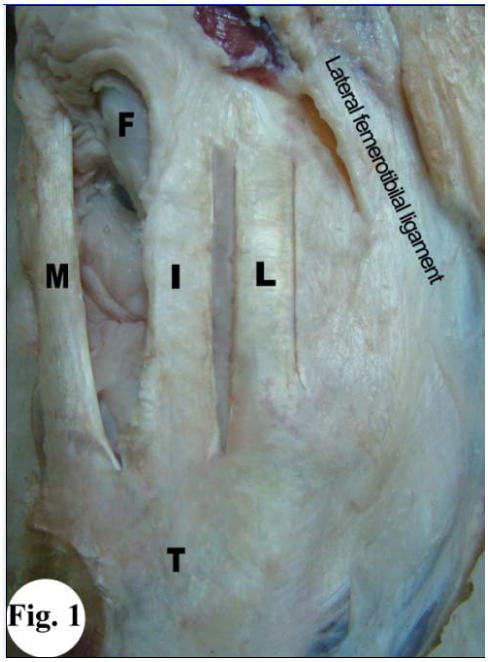

Figure 1. Cranial anatomical view of the buffalo patellar ligaments.

M: medial patellar ligament; I: middle (intermediate) patellar ligament; L: lateral patellar ligament; F: Trochlea of the femur and T: tibial tuberosity.

The convex surface of the patella and the trochlea of the femur and the tibial tuberosity were the anatomic landmarks to orientate the transducer position. These bone surfaces of the patella and tibia were appeared hyperechoic.

The medial, middle and lateral patellar ligaments were imaged through their course in the stifle region. They were readily identified in transverse and longitudinal images as a homogenously echogenic structure (Figures 2-7). The patellar fat pad was interposed between the ligament and skin (Figure 7).

The medial patellar ligament of the buffalo appeared grossly as thin, flattened ribbon like and its width is the smaller than the middle and lateral patellar ligaments (Figure 1). The medial patellar ligament was visualized as a highly echogenic circular structure (Figure 3).

The middle patellar ligament originated from the cranial part of the apex of the patella and attached to the tuberosity of the tibia. Ultrasonographically, it appeared as thick and triangular echogenic ligament (Figure 2).

The lateral patellar ligament extended from the lateral part of the cranial surface of the patella to the lateral part of the tuberosity of the tibia. The ligament was flattened triangular in cross section (Figure 4). It was visualized as more echogenic structure.

After surgery, there was slight increase in the thickness and width of the patellar ligaments especially the medial one (Table 1). Middle Patellar ligament desmitis was reported and considered a common postoperative sequel to desmotomy.

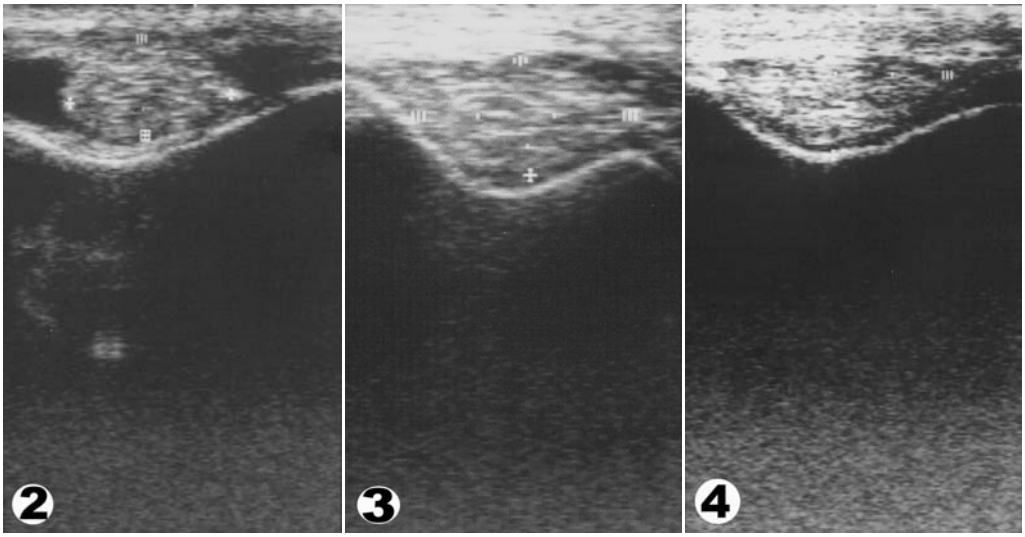

Figure 2. Transverse ultrasonographic image of the midbody of the of the medial patellar ligament of a normal buffalo; Figure 3. Transverse ultrasonographic image of the midbody of the of the middle (intermediate) patellar ligament of a normal buffalo; Figure 4. Transverse ultrasonographic image of the midbody of the of the lateral patellar ligament of a normal buffalo.

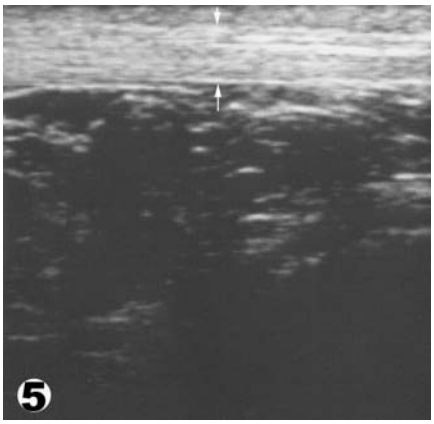

Figure 5. Longitudinal ultrasonographic image of the midbody of the medial patellar ligament of a normal buffalo. Note the uniform echogenicity of the ligament and the smooth bony contour.

The statistical analysis of the patellar ligaments revealed that there is no significant differences between the right and left patellar ligaments in buffalo (medial patellar ligament P= 0.42, middle patellar ligament P= 0.36, lateral patellar ligament P= 0.19).

Discussion

Anatomy textbooks and previous studies (Getty, 1975; De Lahunta and Habel, 1986; Tnibar, 2002; Kofler, 2000) described the patellar ligaments and their cross-sectional dimensions in cattle and horses, but the present study provides a complete description and measurements of the patellar ligaments in the stifle region.

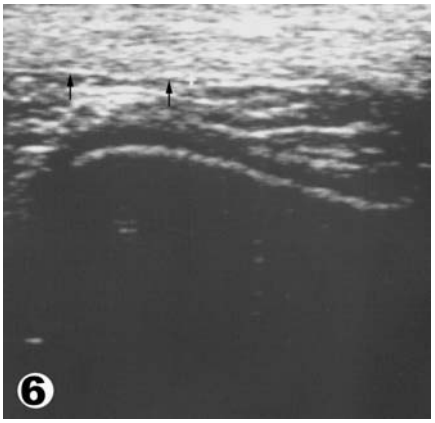

Figure 6. Longitudinal ultrasonographic image of the midbody of the of the middle (intermediate) patellar ligament of a normal buffalo.
Note the uniform echogenicity of the ligament and the smooth bony contour.

Although the physical examination combined with radiography and arthrography is currently the most common diagnostic techniques for evaluation of lameness in animals including buffaloes, ultrasonography

has been widely used in dogs, horses and cattle (Pharr, 1985; Dik, 1995; Kofler, 1999).

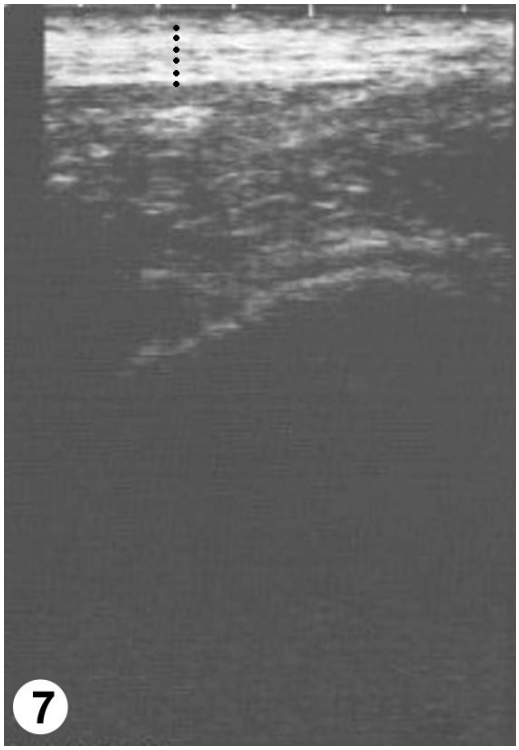

Figure 7. Longitudinal ultrasonographic image of the midbody of the medial patellar ligament of a normal buffalo. Note the uniform echogenicity of the ligament and the smooth bony contour.

Ultrasound examination has the advantages of being non-invasive; enables good visualization of the soft tissue structures of the joints (as ligaments and tendons) and is relatively inexpensive (as most veterinary clinics have an ultrasound machine) and complements radiography. Ultrasonography of the patellar ligaments would be desirable for diagnosis and evaluation of femoropatellar joint disease.

The patellar ligaments in buffalo have a homogenous texture and echogenic appearance, similar to that reported in cattle (Kofler and Edeinberg, 1995; Flurry, 1996).

In the present study, a 7.5-MHZ transducer allowed better resolution of all examined anatomic structures, similar to that in cattle (Kofler, 2000), horses (Tnibar, 2002) and sheep (Macrae and Scott, 1999).

Findings from the frozen anatomical sections and cadaver specimen were in agreement with the ultrasonography. These results serve as reference values for ultrasonographic evaluation of the patellar ligaments in buffaloes.

Blind splitting of the medial patellar ligament in buffaloes may affect the underlying structures, particularly the cartilage of the medial ridge of the femoral trochlea and the femoropatellar synovial membrane, as mentioned in horses by Tinbar (2002).

Overall, results obtained from this study strongly indicates that Ultrasonography will be useful as a complementary technique for examination of patellar ligaments in buffaloes.

In conclusion, if lameness occurs as a sequel to medial patellar desmotomy, consideration should be given to both radiography of the patella and ultrasonography of the middle patellar ligament.

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