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Ultrasonographic Findings in the Stifle Joint of Active Jumping and Dressage Horses

Elke Van der Vekens[1*], Erik H J Bergman[2], Arie C Hoogendoorn[3], Els V Raes[1], Bernadette Van Ryssen[1], Katrien Vanderperren[1] and Jimmy H Saunders[1]

[1]*Department of Medical Imaging, Faculty of Veterinary Medicine, Ghent University, Belgium*

[2]*Sporthorse Medical Diagnostic Centre, Hooge Wijststraat 7, 5384 RC Heesch, Netherlands*

[3]*De Watermolen, Watermolenweg 5, 7481 VL Haaksbergen, Netherlands*

***Corresponding author:** Elke Van der Vekens, Department of Medical Imaging, Faculty of Veterinary Medicine, Ghent University, Belgium, Tel: 09 264 76 32; E-mail: elke.vandervekens@UGent.be*

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Abstract

Objective

Ultrasonography (US) is frequently used to evaluate the equine stifle joint. Some soft tissue US findings are known to be clinically relevant, while others are considered incidental. These considerations are not always evidence-based. This study aims to describe the US findings observed in the stifle of clinically sound, active jumping and dressage horses.

Design: Prospective study

Animals: 46 Warmblood horses

Procedures:

To be included in this study, the horses had to fulfil 4 criteria: (1) in competition at least 1 time/month at national or international level, (2) in full work, (3) free of lameness, (4) no complains of the horse's performances. Both stifle joints of each horse were scanned systematically by US and US findings were recorded.

Results:

46 Warmblood horses fulfilled the criteria. US was normal in 21 horses, whereas abnormalities were detected in one or both stifles in 7 and 18 horses, respectively.

Changes were seen in all compartments of the stifle joints: medial femorotibial joint (18 horses): osteophytes, effusion, subchondral cyst in the medial femoral condyle and lesions in the cranial meniscotibial ligament or medial collateral ligament; lateral femorotibial joint (4 horses): mild effusion, subchondral cyst in lateral femoral condyle; femoropatellar joint (16 horses): effusion, lesions in medial or intermediate patellar ligament or osteochondrotic lesions.

Conclusion and Clinical relevance:

Mild changes can be found ultrasonographically in the stifles of sport horses. Periarticular new bone formation was observed in 25% of the horses, apparently clinically not relevant. Lesions in the menisci, the tendinous portions of the popliteus muscle, long digital extensor muscle or peroneus tertius muscle or the lateral collateral ligament were not observed.

Keywords: Ultrasonography-equine; Stifle joint; Show jumping; Dressage; Sports medicine-equine

Introduction

Stifle injuries are increasingly recognized as a major cause of hind limb lameness [1]. Due to its clinical importance, this joint has been studied extensively by radiography and ultrasonography (US) [2-8]. However, radiography can be disappointing and only late changes are visualised. Therefore US improved our ability to confirm or to rule out soft tissue lesions in the stifle joint. However, a good knowledge of the anatomy is required as this is a very complex joint. Soft tissue lesions for example at the level of the menisci affecting the echogenicity of the meniscus such as tears or complete prolapse are known to be clinically relevant [9,10] while others are considered incidental such as hypoechoic areas in a patellar ligament [11]. These interpretations are not always evidence-based, but are often the result of personal experience or are based on individual clinical cases.

The objective of this study was to describe abnormal ultrasonographic features in the stifles of clinically sound, active sport horses used for jumping and dressage.

Materials and Methods

The horses used in this study, all originated from clients belonging to a sport horse hospital in the Netherlands. Horses were included if they fulfilled all the following criteria: (1) in competition at least 1 time per month at national or international level or a career of at least 10 years at an international level; (2) in full work (= training for at least 5 days a week); (3) no signs of lameness at walk and trot at the day of the US examination; (4) no complains of the horses' riders on the performance of the horse. The owners of all horses included in this study agreed to participate in this study.

The breed, age, sex and type of performance of the selected horses were recorded. All horses underwent an ultrasonographic examination of both stifles by an ECVDI Diplomate (EVdV) or an ECVDI Associate member (EHJB). Before ultrasonography, the horses received a low dose sedation using acepromazine (0.05 mg/kg 0.02 mg/lb, IV) to improve cooperation during the examination. The skin was not clipped, but cleaned by a brush. Alcohol (70%) and acoustic coupling gel were applied liberally. For practical reasons two ultrasound machines d,e were used, both using linear-array transducers f, g with frequency ranges of 5 MHz-10 MHz and 6 MHz -13 MHz. The frequency, the gain and the focal points (two focal points were used) were adjusted for optimal visualization of the examined structure.

The stifle joint was scanned systematically in 4 steps based on a previously described scanning protocol c. Using these steps all recesses of the femoropatellar joint and the medial and lateral compartments of the femorotibial joint were evaluated for distention and signs of synovitis or capsulitis, while signs of osteoarthrosis were appreciated at the articular borders of the femur and tibia. Changes in echogenicity and outline of the cartilage and subchondral bone of the femoral trochlea and condyles were appreciated. The tendinous portions of the popliteus muscle, the long digital extensor muscle and the peroneus tertius muscle, the cruciate ligaments, both menisci, both femorotibial collateral ligaments and both cranial meniscotibial ligaments were evaluated for changes in size, shape or echogenicity. The caudal approach (step 5 in the protocol from Hoegaerts et al.) was not performed meaning that the cruciate ligaments and the caudal parts of the femoral condyles and of the menisci were not fully scanned.

All the US findings were recorded in a spread sheath on computer. In the result section, the findings are described according to the medial, lateral, cranial approach.

Results

Animals

Fourty six horses fulfilled the criteria and were used in the study. All horses were Warmblood horses (35 Dutch Warmblood horses, 2 Danish Warmblood horses, 3 Belgian Warmblood horses, 2 Zangersheide Warmblood horses, 2 Hanoverian and 1 of each Westfaler and Oldenburger). Twenty-eight horses were show jumpers and 18 were dressage horses. The mean age of the horses was 9 years (range 4 years-25 years) and the study included 18 mares, 11 stallions and 17 geldings.

Ultrasonographic findings

In 21 horses, no ultrasonographic abnormalities were detected during ultrasound scanning. In 25 horses one or more US abnormalities were present. Of these latter horses, 7 horses showed abnormalities in one stifle (3 left and 4 right), and in 18 horses abnormalities were present in both stifles. Show jumpers were more affected (n=17) in comparison with the dressage horse (n= 8). In total 43 stifles showed abnormal findings.

The distribution of abnormalities for each joint compartment is illustrated in Table 1.

	Show Jumping		Dressage	
	horses	stifles (L:R)	horses	stifles (L:R)
MFTJ	11	18 (9:9)	7	8 (3:5)
LFTJ	4	5 (2:3)	0	0 (0:0)
FPJ	12	15 (7:8)	5	9 (5:4)

Table 1: The distribution of abnormalities for each joint compartment for both horses used for show jumping and dressage. The number of affected horses, stifles and the distribution between left and right stifle is noted. L: left stifle; R: right stifle; MFTJ: medial compartment of the femorotibial joint and related soft tissue structures; LFTJ: lateral compartment of the femorotibial joint and related soft tissue structures; FPJ: femoropatellar joint and related soft tissue structures.

Medial compartment of the femorotibial joint

Twenty-six stifles (from 18 horses) showed abnormalities involving the medial compartment of the femorotibial joint and associated structures (12 left and 14 right). In 2 stifles of 2 show jumpers, the proximal aspect of the medial collateral ligament of the femorotibial joint had a slightly heterogeneous appearance and showed mild enthesopathy at its proximal attachment on the femur. Mild periarticular new bone formation involving the medial aspect of the femorotibial joint was found in 7 stifles. Both the femur and tibia, or only the femur or the tibia was affected in two, four and one stifles, respectively. In 9 stifles (from 6 horses), mild to moderate effusion of the medial recess was seen, which was accompanied by a mild amount of synovial proliferation in 4 of these stifles.

Although no abnormalities were found in the medial meniscus, changes at the level of its cranial meniscotibial ligament were seen in 13 stifles from 13 horses (left stifle in 5 horses and right stifle in 8 horses). These changes included an irregular outline of the tibia at the level of insertion, accompanied by a heterogeneous aspect of the ligament in 3 right stifles.

A small subchondral cyst-like lesion was seen in the medial condyle of the femur of 4 stifles from 3 horses (2 left, one bilaterally) (Figure 1).

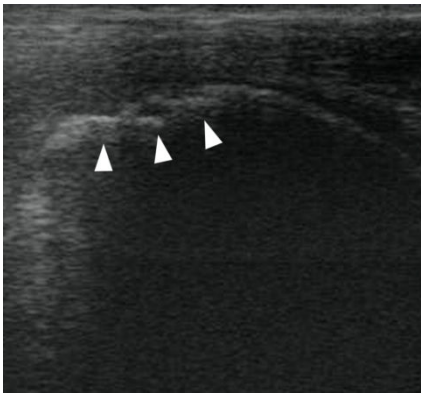

Figure 1: Transverse image of a medial femoral condyle (cranial to the left side). A subchondral cyst-like lesion is visible as a mildly irregularly outlined, semilunar indentation in the subchondral bone of the condyle with a depth of 2,3 mm (arrowheads).

In one left stifle it was visible as an irregularly outlined semilunar indentation in the subchondral bone, while in others they were more smoothly bordered. The overlying cartilage was not visible in 1 left stifle.

Lateral compartment femorotibial joint

Five stifles (from 4 horses) had abnormalities involving the lateral compartment of the femorotibial joint and associated structures.

A mild effusion in the cranial recess of this compartment was found in 3 stifles from 3 horses and bilaterally in the subextensor recess at the level of the proximal tibia in one other horse.

A subchondral cyst-like lesion appearing as a smoothly bordered semilunar indentation in the subchondral bone of the condyle,,was present in the lateral condyle of the right femur in one of the horses with effusion in the cranial recess of the lateral compartment femorotibial joint.

Lesions in this compartment were seen only in horses used for show jumping (Table 1).

Femoropatellar joint

Twenty-four stifles (from 16 horses) showed changes involving the femoropatellar joint and its associated structures. In the 8 horses with unilateral abnormalities 4 were in the right stifle and 4 in the left stifle.

The medial patellar ligament showed a hypoechoic or heterogeneous appearance over its complete length in one stifle and was increased in thickness bilaterally in the stifles of another horse. In 8 stifles (from 6 horses) the intermediate patellar ligament showed a hypoechoic or heterogeneous area visible on a transverse plane in the mid to distal portion of the intermediate patellar ligament corresponding to a loss of fibre alignment in a longitudinal plane (Figure 2).

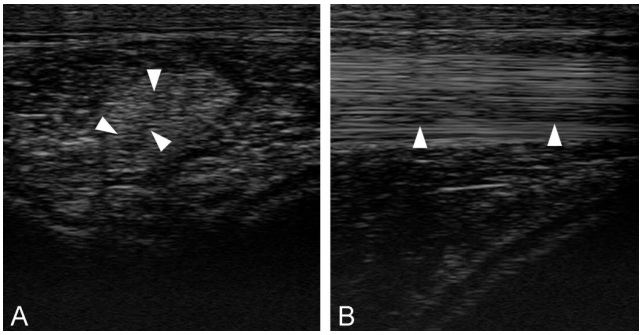

Figure 2: (A) Transverse ultrasound image (lateral on the left side) and corresponding (B) longitudinal (proximal to the left side) ultrasound image of an intermediate patellar ligament. The intermediate patellar ligament shows a hypoechoic lesion (arrowheads), with loss of fiber alignment in the central part of the ligament over its entire length.

Four stifles showed mild anechoic effusion of the lateral recess of the femoropatellar joint. One stifle showed a moderate effusion of the lateral and medial recesses of the joint with in addition thickening of its joint capsule. Osteochondrotic lesions, visible as a thickening of the cartilage layer and/or a mild indentation in the subchondral bone were seen in 10 stifles (from 8 horses). In 6 stifles from 5 horses, it involved the medial trochlea of the femur (2 right, 2 left, 1 bilateral) and in 3 stifles from 2 horses the lateral trochlea was affected (1 left, one bilaterally). Additionally an osteochondrotic lesion was found within the sulcus between both trochlea in the left stifle of 1 horse. The cartilage at the distal aspect of the medial trochlea of the femur had a heterogeneous appearance in one right stifle, showing hyperechoic speckles (Figure 3).

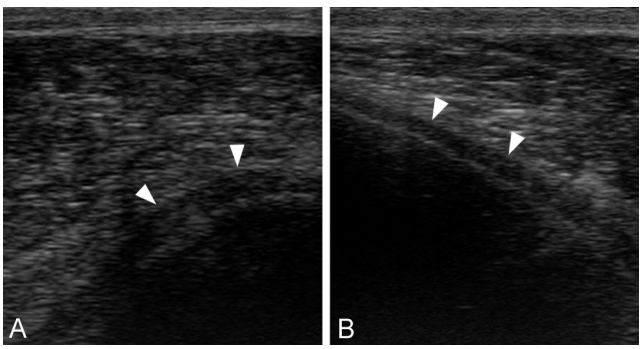

Figure 3: (A) Transverse (lateral on the left side) and corresponding (B) longitudinal (proximal to the left side) ultrasound images of a medial femoral trochlea, showing hyperechoic speckles in the cartilage (arrowheads). This may represent pseudogout.

The medial and lateral meniscus, the tendinous portions of the popliteus muscle, the long digital extensor muscle or the peroneus tertius muscle, the lateral collateral ligament, the lateral patellar ligament and the lateral cranial meniscotibial ligament were normal in all stifles.

Discussion

The US examination of the stifle was normal in 46% of the horses and showed abnormalities in 54% of the horses in the present study. The abnormalities observed were detected in the medial compartment of the femorotibial joint, in the lateral compartment of the femorotibial joint and in the femoropatellar joint in 39%, 9% and 35%, respectively. The more frequent involvement of the medial aspect of the femorotibial joint compared to the lateral aspect is in agreement with previous reports [10,12]. It is hypothesized to be due to higher loading of the medial aspect of the joint during weightbearing, which causes this site to be more susceptible to stress and injuries [13].

In this study two horses showed unilateral mild changes at the proximal attachment of the medial collateral ligament. These lesions were supposed to be older lesions with incomplete healing (absence of perfect parallel fiber alignment). These findings were considered as clinically insignificant at this moment, also because of the absence of effusion of the medial compartment of the femorotibial joint in these stifles.

Mild to moderate anechoic effusion was seen in 17% of the horses, involving the 11 stifles. In 3 stifles of 3 horses, effusion of the medial compartment of the femorotibial joint was associated with periarticular new bone formation or changes at the level of the medial meniscotibial ligament. In 6 stifles from 4 horses, no additional changes in the medial compartment of the femorotibial joint were found. Effusion of the femoropatellar joint was seen in 4 stifles of 4 horses. Two of these had also effusion in the medial compartment of the femorotibial joint. Only one of the stifles showed additional abnormalities in the femoropatellar joint region (desmitis of the intermediate patellar ligament). Distension of the joints is common and may be encountered in sound horses but the synovial membrane should remain very thin [14]. Joint effusion is also a common finding in asymptomatic human athletes where this finding is mainly due to microtrauma [15].

Twenty six percent of our population showed periarticular new bone formation and/or changes at the level of the medial meniscotibial ligament. This was an unexpected finding, as these changes are usually presumed to be clinically significant. Horses with these changes had a slightly higher mean age (9.5 year), but had the same median age as our overall population. It is probably more correct to state that these sport horses were presumably asymptomatic. The horses in this study were fully functional, without any decrease in performances reported by the owners. Whether they were truly asymptomatic cannot be determined in this imaging study and further study with a longer follow-up period may be required.

Subchondral cyst-like lesions were seen in the medial and lateral femoral condyles of 4 horses. All were seen as a semilunar indentation, in the subchondral bone of the condyle, with a maximum depth of 2.3 mm. Some lesions had an irregular outline while others were more smoothly bordered. Subchondral bone cysts are most common in the medial femoral condyle, at the point of load bearing in the joint, but have also been described in the lateral femoral condyle [16]. Ultrasonography is superior to radiography for diagnosis of small subchondral cysts 16 and these lesions can be clinically silent [17,18]. While the presence of subchondral cyst-like lesions are most commonly described in Thoroughbreds, they can seen in many different breeds [19].

Lesions involving the medial collateral ligament and the lateral compartment of the femorotibial joint were seen only in horses used for show jumping. Although this could suggest that the type of performance is associated with changes in these areas, further research, especially on the differences in biomechanics of the stifle between dressage and show jumping, is necessary before any conclusions can be drawn.

As expected, no lesions were seen in the menisci confirming the findings of previous studies regarding the high clinical relevance of any abnormality detected in the meniscus [17,20].

One horse showed a bilaterally thickened medial patellar ligament. This is a common appearance of the medial patellar ligament after previous transection or iodine injections, although the owner could not confirm any therapy for proximal fixation of the patella had been performed [21]. Horses can have a successful career after transection of the medial patellar ligament as treatment of proximal fixation of the patella [22].

Several horses showed hypoechoic areas within the medial and intermediate patellar ligaments. Similar findings have been described previously in the intermediate patellar ligament of clinically normal horses11. Further research is necessary to determine the cause and nature of these findings.

Osteochondrotic lesions, seen in 8 horses in our study, are a common finding in Warmblood horses [23-25]. When they are small in size, these lesions are most often of no significance for the present and future performances of the horse 3.

Heterogeneities in the cartilage at the femoral trochlea were seen in 1 horse. In human patients hyperechoic speckles are seen in the cartilage at the level of the stifle in association with pseudogout. They are caused by deposition of calcium pyrophosphate crystals within the cartilage, but may also be seen in the joint capsule, the synovial fluid and tendons [26,27]. Further research on this finding is necessary to determine its prevalence and clinical significance in both the general horse population and in sport horses in particular.

One limitation of this study is that the skin was not clipped prior to the US examination, mainly because of reluctance from the owners. However, even if we can expect that the image quality would have been better after clipping, it was possible to obtain images of sufficient quality for adequate evaluation of the studied structures in all horses, with a similar image quality on the medial and lateral aspects of the joint. Another limitation is that the caudal approach was not performed during the US examination. Only a minor sedation was given to the horses and performing the caudal approach includes an increased safety risk because of positioning and because of the increased length of the examination. Only few findings are diagnosed by using a caudal approach, even in horses with known stifle pathology, therefore the authors consider this a reasoned decision.

In conclusion, many abnormalities were seen in the stifles joints of active jumping and dressage horses in this study. However, most of these changes were small in nature and were not surprisingly clinically insignificant. The presence of periarticular new bone formation in one fourth of the horses was an unexpected finding from which the true clinical relevance has still to be determined.

Footnotes:

a. Dyson SJ (2002) Lameness associated with the stifle and pelvic regions, in Proc. Annu Meet Am Assoc Equine Pract 48: 387-411.

b. Bergman EHJ, Puchalski SM, van der Veen H, et al. Computed tomography and computed tomography arthrography of the equine stifle: technique and preliminary results in 16 clinical cases. Proc Annu Meet Am Assoc Equine Pract 2007 53: 46-55.

c. Hoegaerts M and Saunders JH. How to perform a standardized ultrasonographic exmination of the equine stifle, in Proc Annu Meet Am Assoc Equine Pract 2004 50: 212-218.

d. Prosound SSD-3500SV, Aloka, Biomedic Nederland BV, Almere, The Netherlands.

e. Prosound 2, Aloka, Biomedic Nederland BV, Almere, The Netherlands.

f. UST 5413 (5-10 MHz), Aloka, Biomedic Nederland BV, Almere, The Netherlands.

g. UST 5551 (6-13 MHz), Aloka, Biomedic Nederland BV, Almere, The Netherlands.

References:

1. Stashak TS (1987) Lameness. In: Adams' lameness in horses. 4th ed. Philadelphia: Lea & Febiger 737-741.
2. Jeffcott LB (1984) Interpreting radiographs 3: Radiology of the stifle joint of the horse. Equine Vet J 16: 81-88.
3. Butler JA, Colles CM, Dyson SJ (2008) The stifle and tibia. In: Clinical radiology of the horse. 3rd ed. Oxford, United Kingdom: Wiley-Blackwell Publishing 363-412.
4. Maulet BE, Mayhew IG, Jones E, Booth TM (2005) Radiographic anatomy of the soft tissue attachments of the equine stifle. Equine Vet J 37: 530-535.
5. Penninck DG, Nyland TG, O'Brien TR, , Wheat JD, Berry CR (1990) Ultrasonography of the equine stifle. Vet Radiol 31: 293-298.
6. Cauvin ER, Munroe GA, Boyd JS, Paterson C (1996) Ultrasonographic examination of the femorotibial articulation in horses: imaging of the cranial and caudal aspects. Equine Vet J 28: 285-296.
7. Reef VB (1998) Musculoskeletal ultrasonography. In: Equine diagnostic ultrasound. London, United Kingdom: WB Saunders Co 54-55.
8. Hoegaerts M, Nicaise M, van Bree H, Saunders JH (2005) Cross-sectional anatomy and comparative ultrasonography of the equine medial femorotibial joint and its related structures. Equine Vet J 37: 520-529.
9. Peroni JF, Stick JA (2002) Evaluation of a cranial arthroscopic approach to the stifle joint for the treatment of femorotibial joint disease in horses: 23 cases (1998-1999). J Am Vet Med Assoc 220: 1046-1052.
10. Walmsley JP (2005) Diagnosis and treatment of ligamentous and meniscal injuries in the equine stifle. Vet Clin North Am Equine Pract 21: 651-672, vii.
11. Dyson SJ (2002) Normal ultrasonographic anatomy and injury of the patellar ligaments in the horse. Equine Vet J 34: 258-264.
12. Walmsley JR, Phillips TJ, Townsend HG (2003) Meniscal tears in horses: an evaluation of clinical signs and arthroscopic treatment of 80 cases. Equine Vet J 35: 402-406.
13. Fowlie JG, Arnoczky SP, Stick JA, Pease AP (2011) Meniscal translocation and deformation throughout the range of motion of the equine stifle joint: an in vitro cadaveric study. Equine Vet J 43: 259-264.
14. Cauvin ERJ (2014) Ultrasonography of the stifle. In: Atlas of equine ultrasonography. 1st ed. Oxford, United Kingdom: Wiley-Blackwell Publishing 160-181.
15. Major NM, Helms CA (2002) MR imaging of the knee: findings in asymptomatic collegiate basketball players. AJR Am J Roentgenol 179: 641-644.
16. Jacquet S, Audigie F, Denoix JM (2007) Ultrasonographic diagnosis of subcondral bone cysts in the medial femoral condyle. Equine Vet Educ 19: 47-50.
17. Scott GSP, Crawford WH, Colahan PT (2004) Arthroscopic findings in horses with subtle radiographic evidence of osteochondral lesions of the medial femoral condyle:15 cases (1995-2002). J Am Vet Med Assoc 224: 1821-1826.
18. McIlwraith CW, Wright I, Nixon AJ (2005) Diagnostic and surgical arthroscopy of the femoropatellar and femorotibial joints. In: Diagnostic and surgical arthroscopy in the horse. London, United Kingdom: Elsevier Health Sciences 197-268.
19. Verschooten F, De Moor A (1982) Subchondral cystic and related lesions affecting the equine pedal bone and stifle. Equine Vet J 14: 47-54.
20. Smith MA, Walmsley JP, Phillips TJ, Pinchbeck GL, Booth TM, et al. (2005) Effect of age at presentation on outcome following arthroscopic debridement of subchondral cystic lesions of the medial femoral condyle: 85 horses (1993-2003). Equine Vet J 37: 175-180.
21. Labens R, Busoni V, Peters F, Serteyn D (2005) Ultrasonographic and radiographic diagnosis of patellar fragmentation secondary to bilateral medial patellar ligament desmotomy in a Warmblood gelding. Equine Vet. Educ 17: 201-206.
22. Dumoulin M, Pille F, Desmet P, Dewulf J, Steenhaut M, et al. (2007) Upward fixation of the patella in the horse. A retrospective study. Vet Comp Orthop Traumatol 20: 119-125.
23. Lepeule J, Bareille N, Robert C, Ezanno P, Valette JP, et al. (2009) Association of growth, feeding practices and exercise conditions with the prevalence of Developmental Orthopaedic Disease in limbs of French foals at weaning. Prev Vet Med 89: 167-177.
24. van Weeren PR, Barneveld A (1999) The effect of exercise on the distribution and manifestation of osteochondrotic lesions in the Warmblood foal. Equine Vet J Suppl : 16-25.
25. Dik KJ, Enzerink E, van Weeren PR (1999) Radiographic development of osteochondral abnormalities, in the hock and stifle of Dutch Warmblood foals, from age 1 to 11 months. Equine Vet J Suppl : 9-15.
26. Grassi W, Meenagh G, Pascual E, Filippucci E (2006) "Crystal clear"-sonographic assessment of gout and calcium pyrophosphate deposition disease. Semin Arthritis Rheum 36: 197-202.
27. Filippucci E, Scirè CA, Delle Sedie A, Iagnocco A, Riente L, et al. (2010) Ultrasound imaging for the rheumatologist. XXV. Sonographic assessment of the knee in patients with gout and calcium pyrophosphate deposition disease. Clin Exp Rheumatol 28: 2-5.