

Research Paper

Pressuring of Acupoints as a Complement to the Diagnosis of Stifle Diseases in Horses

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Available online 2 July 2019

Received: Jul 12, 2018
Accepted: Jun 13, 2019

KEYWORDS

acupuncture;
equine;
horse;
radiography;
ultrasonography

Abstract

Diseases of the stifle joint remain a challenge for veterinarians. The objective of this study was to achieve a valuable acupuncture suggestive diagnosis to be considered for stifle joint diseases in horses. Thirty-nine nonlame horses involved in different activities were assessed. Acupuncture was independently performed by two evaluators. Reactions of the animal when pressurizing the point suggestive of stifle disease (PSSD), Bladder-20 and/or Bladder-21, were considered as the inclusion criteria for inclusion in the stifle group (SG, n = 31), and the animals with no reactions were assigned to the control group (n = 8). Radiographic and ultrasonographic examinations were performed and evaluated by two independent professionals blinded to the group allocation. Thermographic examination of the PSSD and stifles was also performed, after acclimatization. The ultrasound scores and radiographic findings were higher in the SG than in the control group. Thermography evidenced increased temperature in the PSSD and stifles in the SG. The minimum acupuncture diagnostic criteria for stifle joint disease had a sensitivity of 87.5% and a specificity of 57.0%, and the addition of the acupoints Gallbladder–dorsal

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tuber coxae, Gallbladder-27, and Spleen-13 to the minimum diagnostic criteria improved sensitivity and specificity. In conclusion, assessing the reaction at the demonstrated acupoints can facilitate a diagnosis of a potential stifle lesion.

1. Introduction

Diseases of the stifle joint are frequent causes of pain and lameness in horses, as has been documented for more than 50 years. A study revealed that 8% of 835 horses evaluated for hind limb and spinal pain had disorders of the stifle joint [1]. Lesions in the stifle joint of sport horses result in high economic losses [2]. Moreover, the stifle joint was the major location for osteochondritic lesions in young Thoroughbred [3,4] and Warmblood [5] horses.

The use of acupuncture for identifying lesions in the musculoskeletal apparatus of horses has been described [6]. Cain [7] described patterns of sensitive acupoints suggestive of musculoskeletal diseases in horses, including diseases of the stifle joint. Using the diagnostic criteria proposed by Cain [7], our group described 86 suspected cases of stifle joint disease after examining 810 horses. Radiography and/or ultrasonography confirmed the diagnoses of osteochondrosis, degenerative joint disease, collateral and patellar ligaments, and meniscal lesions in 21 of these horses [8].

Investigations testing the proposed acupuncture diagnoses are scarce, and thus, experimental studies are necessary to provide high-quality results, establish the clinical relevance of this approach, and to contribute to the knowledge on acupuncture [9,10]. Here, we hypothesized that a clinical examination using diagnostic acupuncture can identify horses with stifle joint disease based on a pattern of sensitive acupoints. The aim of this study was to achieve a valuable predictive acupuncture diagnosis of stifle joint diseases in horses and to propose a minimum criterion for the diagnosis of stifle joint diseases that can be applied by veterinarians during equine lameness examinations.

2. Materials and methods

2.1. Type of study and ethical aspects

This was a blind, case–control study to investigate whether acupuncture diagnosis could be a suggestive for stifle joint diseases of horses. This study was approved by the Ethical Committee on the Animal Use of the Pontifícia Universidade Católica do Paraná under Number 895. The owners of all the animals that were examined signed a client consent form.

2.2. Animals

During the study period (August 2014 to July 2015), 39 horses from the researcher's clinical routine base were enrolled in the study, which included 13 Warmbloods, six Thoroughbreds, one Appaloosa, one Lusitano, and 18

mixed-breed animals. Seventeen were females, and 22 were males, aged between 2 and 18 years (mean age, 9.7 ± 4.5 years). The animals belonged to equestrian establishments in the city of Curitiba, Paraná, Brazil, and were involved in various activities such as jumping (13/39), racing (6/39), and pleasure riding (2/39) and used by mounted police (18/39).

The horses were independently examined by two professionals trained in acupuncture; these examinations were performed on different days of the same week. The results of the examinations were compared to categorize the animals into two groups: animals suspected of stifle joint lesions [stifle group (SG) = 31] and a control group (CG; $n = 8$), which consisted of nonlame animals that did not present signs of stifle/musculoskeletal conditions during the examination. The groups were categorized by contingency, based on the evaluation of 84 horses during the study period (August 2014 to July 2015). The inclusion criteria were established by agreement of clinical suspicion between the two examiners, at the examination, according to the proposed minimum diagnostic criteria. The presence of a different musculoskeletal condition or evidence of a clinically obvious stifle joint condition led to the exclusion of the animal from the study.

The radiographic and ultrasound examinations were performed by two veterinarians trained in their respective areas, who were blinded to the initial clinical diagnosis and to the results of other imaging examinations. Ultrasound findings were scored and described by the examiner. The radiographic images were evaluated, and the findings were described by the same professional who acquired the images.

2.3. Acupuncture examination

A clinical acupuncture examination was performed using a rounded plastic probe to pressurize the sensitive acupoints. The pressure exerted on the acupuncture channels was continuous, consistent, and uninterrupted. The horse's pain reactions were identified on the basis of muscular contraction, flinching, moving away from the examiner, behavioral changes manifested as irritation, or trying to bite or kick. The complete examination was performed according to Cain [7] and Fleming [11].

The minimum inclusion criteria for the SG was sensitivity in the following acupoints: the point suggestive of stifle disease (PSSD) located at the sacral origin of the *biceps femoris* muscle, together with the points Bladder (BL)-20, located at the 17th intercostal space, lateral to the dorsal midline in the ileocostal muscle groove, and/or BL-21, located caudal to the last rib, lateral to the dorsal midline in the ileocostal muscle groove [7,8].

Other acupoints proposed by various authors for the diagnosis of stifle joint disease, such as Gallbladder (GB)-

28, GB-29, Spleen (SP)-13, Stomach (ST)-31, GB-33 [12], BL-50, BL-49, BL-36, BL-37, BL-38 [11], SP-11, SP-12, ST-31, BL-36, BL-37, BL-38, *Dantian, Juliao* [13], and GB-27 [8], were also included in the examination. The other reactive points were appropriately registered at the end of the complete acupuncture examination [7,11]. Their anatomical location has been described elsewhere [7,11,12].

2.4. Radiographic examination

A radiographic examination was performed by an experienced veterinarian, in the same week as the acupuncture evaluation, using an Eklin digital Eklin digital MARK III apparatus (Sound, Carlsbad, CA, USA) associated with a MinXray X-ray emitter (TR 90 model; MinXray, Northbrook, IL, USA). Caudocranial, lateromedial, and caudo 20° lateral-craniomedial oblique projections were used. The radiographic findings were described by the examiner according to Bastos et al [4].

2.5. Ultrasound examination

The ultrasound examination was performed by the same examiner and as per the same protocol for all the cases, using a Siui® CTS 5500 ultrasound apparatus (Shantou Institute of Ultrasonic Instruments Co., Ltd., Guangdong, China), with a 10-mHz real-time linear transducer. The majority of the medial and lateral compartments of the stifle joint were evaluated and included transverse images of the menisci, long-axis images of the cranial meniscotibial ligaments, short- and/or long-axis images of the femoral condyles, femoral trochlea, and short- and/or long-axis images of the patellar ligaments [14], in the same week as the acupuncture evaluation. The horses were not sedated, and the hair was not clipped because all the horses were being used for training and/or competition.

Each finding was scored from 0 to 3 using a scoring system that is summarized in Table 1.

2.6. Thermographic examination

Thermographic examination was performed in seven horses of the SG and in six horses of the CG, after 30 min of acclimatization in a room with temperature maintained at 20°C. The images were obtained at an approximate distance of 1.5 m from the animal, using an infrared camera (ThermaCAM model i40; Flir Systems, São Paulo, Brazil), and capturing the dorsal view (with emphasis on the lumbar region) and the lateral view of both stifle joints. To ensure a consistent evaluation of the temperature, a metal coin was

fixed to the dorsal midline at the level of the PSSD acupoint and 15 cm behind each stifle joint. The images, randomly numbered, were blindly evaluated by two researchers using Flir Tools software (Flir Systems, São Paulo, Brazil). Temperatures of the right and left PSSD and of both stifle regions were obtained in degrees Celsius (°C).

2.7. Statistical analysis

Initially, we performed a descriptive analysis of the data of the SG and CG. After analysis of data normality using the D'Agostino and Pearson test, the Mann–Whitney test was used to compare the groups for age, number of reactive acupoints, and radiographic and ultrasound findings, and Student ttest was used to compare the mean temperatures determined by the two evaluators in the thermographic examination. The results of quantitative analyses (age and number of reactive acupoints) are presented as mean \pm standard deviation of the mean. The ultrasound score is presented as mean and standard error of the mean. Sensitivity, specificity, and the positive and negative predictive value of the acupuncture diagnosis were calculated. Correlations were analyzed using the Spearman test. All analyses were performed using GraphPad Prism 5.0 software (San Diego, CA, USA), and statistical significance was set at $P < 0.05$.

3. Results

3.1. Animals

The mean age of the horses in the CG was 10.0 ± 4.6 years, whereas that of the horses in the SG was 9.6 ± 4.6 years ($P = 0.807$). There was no sex difference in stifle joint disease suspicion between the CG and SG ($P = 0.317$). Of the 31 animals included in the SG, 29.1% (9/31) presented with a complaint of poor performance, 3.2% (1/31) was suspected of having lameness in one of the front limbs, and 67.7% (21/31) were in regular training without any complaints.

For the 31 horses investigated in the SG, bilateral stifle joint disease was suspected in 17 (54.8%), and the condition was present in the left and in the right limb in 13 (41.9%) horses and 1 (3.2%) horse.

3.2. Acupuncture examination

The number of sensitive acupoints was higher in the SG than that in the CG (6.0 ± 2.80 vs. 0.25 ± 0.45 , $P < 0.0001$). In addition to the minimum inclusion criteria, other

Table 1 Scoring system (0 to 3) used to grade the ultrasound findings in horses previously evaluated clinically with acupuncture.

Score	Classification	Ultrasound findings
0	Absent	Lesions absent
1	Mild	Mild lesions with small irregularities; mild or no loss of the echogenic pattern
2	Moderate	Moderate lesions; evident changes with no calcification, edema, or fiber rupture
3	Severe	Severe lesions with well-defined changes of the echogenic pattern

diagnostic points were also reactive, together with the minimum inclusion diagnostic points, and could be incorporated in the acupuncture diagnosis of stifle joint disease. Among these, the most prevalent (number of horses in the SG/%) were GB-dorsal *tuber coxae* (DTC) (29/85.4), GB-27 (26/75.0), SP-13 (24/75), Local Point 3 (22/66.7), Local Point 2 (20/62.5), Local Point 1 (18/58.3), ST-31 (11/56.3), and ST-10 (16/27.1).

3.3. Radiographic examination

The radiographic findings revealed that a higher number of abnormalities were present in the SG than in the CG. Major findings were the remodeling at the medial tibial border and flattening of the medial femoral condyle (Table 2).

3.4. Ultrasound examination

The animals in the SG had a higher number of abnormal ultrasound findings and score than those in the CG (1.04 ± 0.11 vs. 0.61 ± 0.15 , $P = 0.008$). The conditions observed in the ultrasound examination in the horses of both groups are demonstrated in Table 2.

3.5. Thermographic examination

The temperature was significantly higher in horses in the SG than in those in the CG, for the left PSSD (31.6 ± 2.7 vs. 28.4 ± 2.7 °C, $P = 0.006$), right PSSD (31.7 ± 2.9 vs. 28.4 ± 2.7 °C, $P = 0.007$), left stifle joint (31.6 ± 3.1 vs. 29.0 ± 3.0 °C, $P = 0.043$), and right stifle joint (31.9 ± 2.7 vs. 29.0 ± 2.7 °C, $P = 0.011$).

3.6. Sensitivity and specificity

The sensitivity, specificity, positive predictive value, and negative predictive value for the minimum acupuncture diagnostic criteria, as well as for inclusion of the most prevalent acupoints in the evaluated horses, are demonstrated in Table 3. The latter points were GB-27 (cranio-dorsal to the cranial aspect of the iliac spine), GB-DTC (in the depression immediately medial to the most dorsal aspect of the *tuber coxae*, on a line drawn at a 90° angle to the dorsal midline and extending to the most dorsal aspect of the *tuber coxae*), and SP-13 (cranioventral to the *tuber coxae*). The locations of these acupoints are demonstrated in Fig. 1.

4. Discussion

In the present study, the objective was to achieve a suggestive, complementary, acupuncture diagnosis for stifle joint disease to be used by equine veterinarians. Previously, the diagnosis of stifle joint conditions, using a pattern of painful acupoints described by Cain [7], was demonstrated in a clinical case series [8]. In this study, we used an appropriate experimental design with blinded examination, including a CG, and performed radiography and ultrasound for all the investigated horses, aiming to obtain

a dependable conclusion. Other consistent acupoints, presented in the clinical examination of the investigated horses, were added to the initial diagnostic criteria, and this resulted in a valuable suggestive acupuncture diagnosis for stifle joint diseases in horses, which can now be tested further by other veterinarians.

The use of contingency samples resulted in two homogenous groups, with variation in age, breed, activity, and sex, showing the repeatability of acupuncture diagnosis for stifle joint conditions, not only in nonlame older horses prone to joint diseases owing to long periods of activity but also in young horses.

The conventional diagnosis for equine stifle joint diseases has been thoroughly described [15] but still represents a challenge for the veterinarian [16,17]. The large muscles that support stifle joint movement [18] and the involvement of the joint within the reciprocal apparatus [19] can sometimes make the clinical manifestations of stifle joint conditions less evident [20]. In fact, the investigated animals that were positive for an acupuncture diagnosis during the routine veterinarian examination in the present study were in normal training without complaints about lameness. It is likely that the trainers and riders were not able to identify subtle asymmetries [21] that were evidenced in the thorough clinical examination pressuring acupuncture diagnostic points. The stifle joint has been reported to be the main location for osteochondritic lesions in young Thoroughbred horses [3,4] and Warmblood horses [5]; these conditions mostly manifest after training is initiated.

For the proposed suggestive acupuncture diagnosis, the acupoint PSSD, previously demonstrated to be useful for stifle joint disease diagnosis [7,11,8], was considered as the principal point in our study, with which other acupoints should be associated. The BL-20 and BL-21 acupoints, located on the bladder meridian, were initially proposed for use in this diagnosis as they are the acupoints associated with the spleen and stomach in the five elements theory of Traditional Chinese Veterinary Medicine, respectively; the meridian passes over the stifle joint [6] and is associated with stifle joint diseases [7,12].

However, other acupoints were also involved in the acupuncture diagnosis of the investigated horses, mainly the GB-27, GB-DTC, and SP-13. It is important to specify the anatomical location of these acupoints as they were used in the present study because there are differences in the descriptions. SP-13 is located 0.5 *cun* (Chinese metric) cranioventral to the *tuber coxae* [7,12]. GB-27 is located 0.5 *cun* craniodorsal to the cranial aspect of the iliac spine [7,12]. GB-DTC is in the depression immediately medial to the most dorsal aspect of the *tuber coxae*, on a line drawn at a 90° angle to the dorsal midline and extending to the most dorsal aspect of the *tuber coxae*, behind GB-27.

The association of the acupoints GB-27, SP-13, and GB-DTC with the PSSD resulted in a more complete suggestive diagnosis for stifle joint disease than those initially proposed in the study. Their inclusion yielded higher sensitivity and positive predictive values for diagnosis of a stifle joint condition. Thus, we achieved the main objective of the study, that is, to develop and suggest a complementary diagnostic method that could be easily performed in the field and would help diagnose suspected stifle joint disease.

Table 2 Breed, sex, age (years), and radiographic and ultrasonographic findings of horses suspected of stifle joint disease [stifle group, (SG)] by the pressuring of acupoints during the clinical examination and horses of the control group (CG).

Group	Horse	Breed	Sex	Age (years)	Radiographic findings	Ultrasonographic findings
SG	1	BJH	M	13	Flattening and sclerosis of the medial femoral condyle; remodeling of the medial tibial border	Flattening of the medial femoral condyle; desmitis of the medial collateral and medial patellar ligaments; desmitis of the cranial meniscotibial ligament of the medial meniscus
	2	TB	M	4	NPF	Desmitis of the medial collateral ligament; hypoechoic medial meniscus; desmitis of the cranial meniscotibial ligament of the medial meniscus
	3	Mixed	F	12	Flattening of the medial femoral condyle	Hypoechoic medial meniscus
	4	BJH	F	11	Flattening of the medial femoral condyle; remodeling of the medial tibial border	Flattening of the medial femoral condyle; desmitis of the medial collateral ligament
	6	Mixed	M	17	Remodeling of the medial tibial border; reduced medial femorotibial joint space	Hypoechoic, degenerating medial meniscus; osteochondritis dissecans at the lateral trochlear ridge of the femur
	8	BJH	F	9	Remodeling of the medial tibial border	Desmitis of the medial collateral and middle patellar ligaments; osteochondritis dissecans at the lateral and medial trochlear ridges of the femur; hypoechoic, degenerating medial meniscus
	9	BH	F	5	Flattening of the medial femoral condyle; remodeling of the medial tibial border	NPF
	11	Warmblood	M	9	Flattening and sclerosis of the medial femoral condyle; remodeling of the medial tibial border	Flattening of the medial femoral condyle
	12	TB	M	3		Flattening of the medial femoral condyle
	14	Mixed	M	17	Remodeling of the medial tibial border	Desmitis of the medial collateral ligament
	15	BJH	M	9	NPF	NPF
	16	Mixed	M	15	Remodeling of the medial tibial border	Desmitis of the medial collateral and middle patellar ligaments; hypoechoic, degenerating medial meniscus
	17	BJH	F	9	Remodeling of the medial tibial border.	Osteochondritis dissecans at the lateral trochlear ridge of the femur.
	18	Mixed	F	8	Flattening of the medial femoral condyle	Flattening of the medial femoral condyle
	20	Appaloosa	F	10	Flattening of the medial femoral condyle; reduced medial femorotibial joint space	Flattening of the medial femoral condyle; reduced medial femorotibial joint space; osteochondritis dissecans at the lateral trochlear ridge of the femur
	21	Mixed	M	18	Flattening of the medial femoral condyle; remodeling of the medial tibial border; reduced medial femorotibial joint space	Osteochondritis dissecans at the lateral trochlear ridge of the femur
	22	Mixed	M	16	Flattening of the medial femoral condyle; remodeling of the medial tibial border	Flattening of the medial femoral condyle; desmitis of the medial collateral ligament; osteochondritis

(continued on next page)

Table 2 (continued)

Group	Horse	Breed	Sex	Age (years)	Radiographic findings	Ultrasonographic findings
						dissecans at the lateral and medial trochlear ridges of the femur; desmitis of the cranial meniscotibial ligament of the medial meniscus
	23	Mixed	F	14	NPF	NPF
	24	BJH	M	10	Flattening of the medial femoral condyle; remodeling of the medial tibial border	Desmitis of the medial collateral ligament
	26	BJH	M	11	Flattening of the medial femoral condyle; remodeling of the medial tibial border	Desmitis of the medial collateral ligament; osteochondritis dissecans at the medial trochlear ridge of the femur
	27	TB	M	2	Remodeling of the medial tibial border	Remodeling of the medial tibial border
	28	TB	M	3	NPF	Desmitis of the middle patellar ligament; hypoechoic medial meniscus
	29	TB	F	3	Remodeling of the medial tibial border	Remodeling of the medial tibial border; osteochondritis dissecans at the lateral trochlear ridge of the femur
	30	TB	F	12	Flattening of the medial femoral condyle; remodeling of the medial tibial border	Flattening of the medial femoral condyle; remodeling of the medial tibial border
	32	Mixed	F	9	NPF	Desmitis of the middle patellar ligament; osteochondritis dissecans at the medial trochlear ridge of the femur; flattening of the medial femoral condyle
	33	Mixed	M	4	Remodeling of the medial tibial border	NPF
	34	Mixed	M	9	NPF	Desmitis of the lateral collateral ligament
	35	BJH	F	14	Flattening of the medial femoral condyle; remodeling of the medial tibial border	Flattening of the medial femoral condyle; hypoechoic, degenerating medial meniscus
	36	Mixed	M	10	NPF	NPF
	37	Mixed	F	4	Remodeling of the medial tibial border	Desmitis of the medial collateral ligament
	39	BJH	F	9	Remodeling of the medial tibial border	Desmitis of the lateral collateral ligament; hypoechoic medial meniscus
CG	5	BJH	M	4	NPF	Flattening of the medial femoral condyle
	7	Lusitano	M	13	Remodeling of the medial tibial border	Desmitis of the medial collateral ligament
	10	Mixed	M	7	NPF	NPF
	13	Mixed	F	4	NPF	NPF
	19	Mixed	M	15	Remodeling of the medial tibial border	NPF
	25	Mixed	M	14	NPF	NPF
	31	Warmblood	M	15	NPF	Osteochondritis dissecans at the lateral and medial trochlear ridges of the femur
	38	Mixed	F	9	NPF	NPF

BJH = Brazilian Jumping Horse; F = female; M = male; NPF = no positive findings; TB = Thoroughbred.

Table 3 The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for the diagnosis of stifle joint diseases using the pressuring of acupoints in horses suspected of stifle diseases [stifle group (SG)] and controls (CG), using the association of the point suggestive of stifle disease (PSSD) with the acupoints Bladder (BL)-20 and/or BL-21, Gall-bladder (GB)-27, GB-dorsal tuber coxae (DTC), and Spleen (SP)-13.

Acupoint PSSD plus	SG		CG		Sensitivity	Specificity	PPV	NPV
	Present	Absent	Present	Absent				
BL-20 and/or BL-21	31	0	0	8	0.80	0.25	0.90	0.13
GB-27	25	6	0	8	1.00	0.62	0.84	1.00
GB-DTC	29	2	1	7	1.00	0.80	0.94	1.00
SP-13	31	0	3	5	0.91	1.00	1.00	0.63

CG = control group.

Other acupoints that were also prevalent in the investigated horses and that should be further studied are ST-10, ST-31, and the local points described by Cain [7] that are located in the muscular groove between the *biceps femoris* and *semitendinosus* muscles.

In the previous description of acupuncture suggestive diagnosis of stifle joint diseases by our group, some of the horses that were suspected of having the condition during the clinical examination were investigated using

radiography and/or ultrasound, providing evidence for different clinical situations. Digital radiography [22] and ultrasonography [23] are the diagnostic imaging tools most readily available for the equine clinician and are easily performed. Although more accurate imaging modalities have been reported for stifle joint disease diagnoses, such as arthroscopy [24], magnetic resonance imaging [25], and computed tomography arthrography (CTA) [26], they are more expensive and are not widely available for the

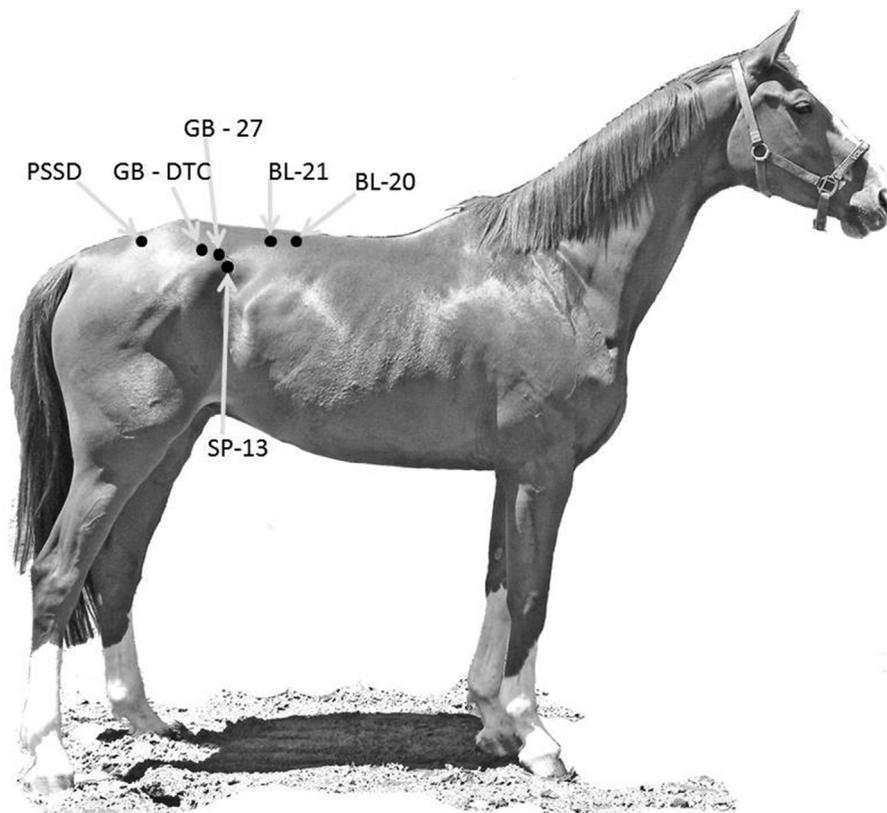


Figure 1 Localization of the acupoints that, when reactive in the acupuncture diagnosis examination, resulted in a pattern suggestive of stifle joint disease in the investigated horses. Point suggestive of stifle disease (PSSD), located at the sacral origin of the *biceps femoris* muscle; Bladder (BL)-20, located at the 17th intercostal space lateral to the dorsal midline in the ileocostal muscle groove; BL-21, located caudal to the last rib lateral to the dorsal midline in the ileocostal muscle groove; Spleen (SP)-13, cranioventral to the *tuber coxae*; Gall-bladder (GB)-27, craniodorsal to the cranial aspect of the iliac spine; GB-dorsal tuber coxae (DTC), in the depression just medial to the most dorsal aspect of the *tuber coxae*, on a line drawn at a ninety-degree angle to the dorsal midline and extending to the most dorsal aspect of the *tuber coxae*.

clinician. The combination of digital radiography with ultrasonography could efficiently demonstrate stifle joint structural lesions of the stifle joint in our study, as in the study by Beccati et al [27]. More accurate imaging diagnosis, such as arthroscopy [28] and arthroscopy plus CTA [29], would probably have improved the sensitivity of the proposed diagnosis, identifying joint pathologies that could have been missed in the investigated horses.

The limitations of the present study could include missed diagnosis because of the lack of use of another diagnostic method (arthroscopy, magnetic resonance imaging, and CTA). In addition, a method of radiographic interpretation was used for young horses bought in yearling sales, not considering joint modifications owing to the years of use or to old lesions that are no longer active, which influenced the negative predictive value of the proposed diagnosis. Imaging findings are usually interpreted in the light of the clinical examination, which was not the case in the present study as we followed an established protocol.

The active condition of the SG horses was demonstrated by a thermographic examination, which was performed only in the horses that could enter the protocol of a controlled environment. The temperature was increased in the location of the diagnostic point (PSSD), as well as at both stifle joints, in comparison with controls, denoting increased blood flow. The PSSD is an *Ashi* point, a painful acupoint not necessarily on a traditional meridian, but could be used for diagnostic purposes. Here, we hypothesized that stifle joint conditions evidenced in the investigated horses cause joint dysfunction and involvement of the autonomic nervous system, resulting in changes that could be noted on thermographic examination [30]. Moreover, stifle joint inflammation might also be present to different extents in the investigated horses, resulting in stifle joint temperature increases.

The acupuncture diagnosis in this study was related to different stifle joint conditions, such as ligament lesions, osteoarthritis, and osteochondritis, as previously pointed out [12,8]. Moreover, the proposed diagnostic approach was shown to be important for evaluation of sport horses with decreased performance, or during routine examination, and in conditions that are considered subclinical.

Finally, it is assumed that the affected limb is the one on the same side as that of the sensitive diagnostic acupoints. However, in evaluated animals suspected of unilateral stifle disease, the contralateral side also evidenced an increased number of reactive acupoints, as well as abnormal ultrasound and radiographic findings, although the complete diagnosis criteria were not met (data not shown). Thermographic examination showed that the temperature was equally increased on both sides in the SG horses. Thus, we suggest that, even if a horse has an indication of unilateral stifle joint disease, both stifle joints should be investigated.

5. Conclusion

The acupuncture diagnosis, based on assessing the reaction at acupoints PSSD, BL-20 and/or BL-21, SP-13, and GB-27 and GB-DTC, was suggestive for stifle joint disease in

horses of different sexes, ages, and activities, as confirmed by the combined use of radiography and ultrasonography. The pattern of acupoints identified in this study should be further verified by other veterinarians.

Disclosure statement

None of the authors have any conflict of interest to declare.

Acknowledgments

The authors are grateful for the scholarship from the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Capes for supporting their research. In addition, the authors thank the staff of the Polícia Militar do Estado do Paraná and Haras Belmont for helping with the study. The authors also thank the veterinarians Vanessa Grendel, Marina Rodacki, Brunna Fonseca, and Fabiane Cassou for the help in analyzing some data of the study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jams.2019.06.001>.

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