Dorsolateral approach for arthrocentesis of the centrodistal joint in horses

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Objective—To develop a dorsolateral approach to the centrodistal (distal intertarsal) joint in horses and compare its success rate with that of the traditional medial approach in that joint.

Sample Population—25 cadaveric equine hind limbs, ultrasonographic images, and radiographic views of the tarsal region of 5 and 59 healthy horses, respectively, and 22 horses with a clinical indication for centrodistal joint centesis.

Procedures—The dorsolateral approach was established anatomically (3 cadaveric limbs), ultrasonographically (5 horses), and radiographically (59 horses). Centrodistal joint arthrocentesis was performed in 22 cadaveric hind limbs and 22 horses; the number of needle repositionings required for procedure completion via the medial (in vitro) and the dorsolateral approach (in vivo) was determined.

Results—For the dorsolateral approach to the centrodistal joint, the injection site was 2 to 3 mm lateral to the long digital extensor tendon and 6 to 8 mm proximal to a line drawn perpendicular to the axis of the third metatarsal bone through the proximal end of the fourth metatarsal bone. The needle was directed plantaromedially (angle of approx 70° from the sagittal plane). The number of needle repositionings required to complete centrodistal joint centesis via the dorsolateral and medial approaches was not significantly different.

Conclusion and Clinical Relevance—In a clinical setting, the dorsolateral approach to the centrodistal joint in horses appears to have some advantages over the traditional medial approach. The success rate of arthrocentesis was similar via either approach, and palpation of the anatomic landmarks was easy. (Am J Vet Res 2007;68:946–952)

Osteoarthritis of the centrodistal (distal intertarsal) or TMT joints (bone spavin) is one of the most common causes of hind limb lameness in adult horses.1,3 The centrodistal joint is most commonly affected, followed by the TMT and talocalcaneal-centroquartal (proximal intertarsal) joints.2,4,5 Intra-articular analgesia and medication play an important role for diagnosis and treatment of bone spavin. Although it is not uncommon for osteoarthritides of the distal joints of the tarsus to be localized only or mainly to the centrodistal joint,3,6 clinicians often exclusively inject the TMT joint for diagnosis and management of bone spavin because this procedure is considered easier and safer to perform.1,6,8 With that practice, the assumption is that a medication or analgesic agent will reach the centrodistal joint via anatomic communication between the 2 joints or as a result of diffusion from 1 joint to the other.2,9 However, anatomic communication between the TMT and centrodistal joints is inconsistent among horses; various materials injected into the TMT joint reach the centrodistal joint in only 8.3% to 67% of clinically normal horses.2,10-13a Even forced injection of a large volume of an anesthetic solution or medication into the TMT joint does not lead to an artificial communication with the centrodistal joint, but instead results in extra-articular leakage.2,14 Diffusion of an analgesic agent after intra-articular injection in the TMT joint is associated with a lack of specificity because although the solution may diffuse to the centrodistal joint,2,14 it can also diffuse to the insertions of the tibialis cranialis and pere-neus tertius muscles, to the tarsal sheath including the deep digital flexor tendon, or to the dorsal and plantar metatarsal nerves (resulting in perineural analgesia of these nerves).1,5 Because diffusion is dependent on the volume of solution administered and time after injection,2,4,17 diagnosis of bone spavin may be achieved more effectively via intra-articular injection of the centrodistal joint with a low volume of anesthetic solution and evaluation of lameness after a period of ≤ 5 minutes. Additionally, the concentration of drugs distinctly decreases during diffusion from 1 joint to the other,6 and this may influence the therapeutic effect of medication administered intra-articulary. Consequently, selective arthrocentesis of both the TMT and centrodistal joints for intra-articular analgesia and treatment of distal tarsal osteoarthritis is recommended.1,4,18 Traditionally, arthrocentesis of the centrodistal joint has been performed via a medial approach through the gap between the central, third, and fused first and second tarsal bones at the distal aspect of or through the

**ABBREVIATIONS**

<table>
<thead>
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<tr>
<td>TMT</td>
<td>Tarsometatarsal</td>
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<tr>
<td>Mt III</td>
<td>Third metatarsal bone</td>
</tr>
<tr>
<td>Mt IV</td>
<td>Fourth metatarsal bone</td>
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cunean tendon (medial tendon of insertion of the tibialis cranialis muscle). This approach to the centrodistal joint is considered technically difficult because the landmarks for orientation are indistinct or their relative positions to the arthrocentesis site are inconsistent. There is also a considerable chance of inadvertent centesis of other synovial structures (eg, the TMT or talocalcaneal-centroquartal joints or the cunean bursa). Another disadvantage of the traditional medial approach to the centrodistal joint is the potential risk for the person performing the injection because that individual must assume a position under the abdomen of a standing horse. A dorsolateral approach to the centrodistal joint was attempted by Bassage and Ross, but in their opinion, the perforating tarsal artery precludes the use of this site in vivo. The objective of the study reported here was to develop a dorsolateral approach to the centrodistal joint in horses and compare the success rate of dorsolateral arthrocentesis with that of the traditional medial approach in that joint.

Materials and Methods

Development of a dorsolateral approach to the centrodistal joint—A suitable location for dorsolateral arthrocentesis of the centrodistal joint was determined via anatomic preparation of the bones and soft tissues in cadaveric right hind limbs from 3 medium-sized horses of unknown breed. The horses were euthanized for reasons unrelated to tarsal joint diseases by IV administration of an overdose of thiopental sodium in combination with a preparation containing mebezonium iodide and embutramide. Only limbs without obvious abnormalities of the tarsal region were used. Additionally, ultrasonographic examination (by use of a linear array transducer with a frequency of 7.5 MHz) of the dorsal and lateral tarsal regions of both hind limbs was performed in vivo in 5 healthy mature horses (4 warmbloods and 1 Standardbred). This group included 4 geldings and 1 mare aged 13 to 28 years (mean ± SD age, 20.40 ± 6.23 years); the horses weighed 475 to 668 kg (mean weight, 561.40 ± 77.8 kg). The ultrasonographic images were used to establish the location and size of blood vessels in the dorsolateral aspect of the tarsal region (ie, dorsal pedal vessels and perforating tarsal vessels) and their position relative to the tendons of the digital extensor muscles. The aim was to find suitable landmarks for lateromedial localization of the dorsolateral arthrocentesis site for the centrodistal joint.

To establish topographic landmarks for proximodistal orientation, an analysis of lateromedial radiographic views of the tarsal region in 59 horses was performed. Only 1 hind limb from each horse was evaluated. The radiographic views were obtained at 1.4 mA and 85 kV with a 90-cm focal film distance. The cassette with the radiographic film was directly adjacent to the tarsus. With these settings, an effect of magnification for distance measures could not be detected in a preliminary radiographic investigation of the equine tarsus; therefore, this effect was considered negligible in the examination. Measurements were made only on radiographic views in which the central x-ray beam was positioned at the level of the centrodistal joint and oriented exactly parallel to the joint space. The joint space of the centrodistal joint had to be clearly visible at the dorsal bony surface. Radiographic views of horses with distinct new bone formation, ankylosis of the central and third tarsal bones, tarsal bone collapse, or other severe bony alterations as well as limbs with obvious soft tissue swelling in the dorsal aspect of the tarsal region were excluded.

To determine the position of the centrodistal joint in relation to palpable bony landmarks, the relative distance to the dorsal part of the joint space of the centrodistal joint (considered suitable as the arthrocentesis site for the dorsolateral approach) was measured in all radiographic views. For these measurements, auxiliary lines were drawn perpendicular to the axis of Mt III through the proximal end of Mt IV and the most distal point of the lateral trochlear ridge of the talus. The distances between these auxiliary lines to the arthrocentesis site of the centrodistal joint were measured in the direction of the axis of Mt III (Figure 1). The distance between the auxiliary line at the level of the proximal end of Mt IV and the centrodistal joint was designated D1. The distance between the centrodistal joint and the most distal point of the lateral trochlear ridge of the talus was designated D2.

Figure 1—Lateromedial radiographic view of the tarsal region of the right hind limb of a 7-year-old warmblood to illustrate the proximodistal orientation for dorsolateral arthrocentesis of the centrodistal joint. Perpendicular to the long axis of Mt III (dashed line), auxiliary lines are drawn through the most distal point of the lateral trochlear ridge of the talus, through the joint space of the centrodistal joint at the injection site for the dorsolateral arthrocentesis approach, and through the proximal end of Mt IV. D1 = Distance between the centrodistal joint and the proximal end of Mt IV. D2 = Distance between the centrodistal joint and the most distal point of the lateral trochlear ridge of the talus. Bar = 1 cm.
In vitro comparison of arthrocentesis of the centrodistal joint via dorsolateral and medial approaches—

For the comparison of arthrocentesis via the dorsolateral and medial approaches in horses, the right hind limbs of 22 cadavers were used. In all limbs, both centrosis sites were evaluated. The horses were euthanized for reasons unrelated to tarsal joint diseases by use of a lethal dose of thiopental sodium, mebezonium iodide, and embutramide administered IV. After each horse’s death, the right hind limb was disarticulated at the level of the stifle joint and stored at 2° to 4°C for ≤ 5 days until arthrocentesis was performed. Only limbs without visible or palpable musculoskeletal abnormalities of the tarsal region were used.

Medial (standard) arthrocentesis of the centrodistal joint was performed routinely through the gap between the central, third, and the fused first and second tarsal bones directly distal to the cunean tendon by use of a 20-gauge 40-mm-long needle. Before or after medial arthrocentesis, dorsolateral centesis of the centrodistal joint was carried out by use of a 20-gauge 40-mm-long needle. All in vitro arthrocenteses were performed by the same person (EMJ).

The correct needle position was confirmed by aspiration of synovial fluid or by through-and-through-lavage of the centrodistal joint (medial to lateral [n = 13 joints] or lateral to medial [9] direction) with 5 mL of an iopamidol contrast solution. The direction of the joint lavage was chosen depending on the number of times the needle had to be repositioned during the centesis procedures. To reduce the risk of subcutaneous leakage through the eventually perforated joint capsule, the lavage was always performed from the side with the lower number of needle repositionings. In those instances in which the number of needle repositionings for the medial and the dorsolateral approaches was the same, the direction of the joint lavage was randomly chosen. After the joint lavage, 2 radiographic views (dorsoplantar and lateromedial views) were obtained at 1.4 mA and 85 kV with a 90-cm focal film distance to confirm the correct needle placement. For medial and dorsolateral arthrocentesis, the number of times the needle was repositioned after skin penetration to obtain intra-articular access was recorded.

Dorsolateral arthrocentesis of the centrodistal joint in vivo—All horses evaluated at the Clinic of Orthopaedics that required an intra-articular injection of the centrodistal joint for diagnosis or treatment of osteoarthritis of the distal tarsal joints between June 1, 2004, and August 31, 2005, (n = 22) were included in the in vivo investigations. Before performing this portion of the study, the Animal Care and Use Committee of the Vienna University of Veterinary Medicine was informed and the study protocol was reviewed and approved.

In all horses, the dorsolateral tarsal region of the affected hind limb was clipped (with a No. 20 blade) and prepared aseptically. A 20-gauge 40-mm-long needle was inserted via the dorsolateral approach into the joint in the weight-bearing limb (with the exception of 1 horse in which the procedure was conducted during anesthesia) until firm contact was made. The appearance of synovial fluid in the needle hub and ease of injection without creating a subcutaneous swelling were defined as evidence of successful arthrocentesis. The number of needle repositionings required to gain joint access and the macroscopic appearance of the synovial fluid (color, viscosity, and turbidity) were recorded. Additionally, for each horse, the breed, affected hind limb (right or left), and the reason for centesis of the centrodistal joint as well as the person performing the centesis and the requirements for restraint (chemical or physical) to complete the diagnostic or treatment procedures were recorded. If diagnostic procedures were performed, the result of the intra-articular analgesia and the interval before the centesis was repeated for medication of the joint were also recorded.

Statistical analysis—All statistical comparisons were performed by use of a commercial software program. For measurements of anatomic landmarks for the dorsolateral arthrocentesis site of the centrodistal joint, radiographic views of the tarsi were grouped on the basis of horse breed. Normal distribution of the measured distances D1 and D2 was assessed by use of the Kolmogorov-Smirnov test, and occurrence of approximately equal variances was tested by use of the Levene test. The influence of breed on these distances was determined by use of a 1-way ANOVA and a multiple-comparison post hoc test (Bonferroni). The level of significance was set at a value of P < 0.05. Descriptive statistics such as mean values and SDs as well as the 95% confidence intervals were used to summarize the results.

Table 1—Mean ± SD distances (D1 and D2) between specific bony landmarks and the centrodistal joint in radiographic views of the tarsal region in 59 horses of various breeds. Values in parentheses represent the 95% confidence interval.

<table>
<thead>
<tr>
<th>Breed</th>
<th>No. of horses†</th>
<th>D1 (mm)</th>
<th>D2 (mm)</th>
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<tbody>
<tr>
<td>Warmblood</td>
<td>20</td>
<td>7.73 ± 2.72 (6.45–9.00)</td>
<td>21.30 ± 4.03 (19.41–23.19)*</td>
</tr>
<tr>
<td>Thoroughbred</td>
<td>10</td>
<td>6.00 ± 3.67 (3.37–8.63)</td>
<td>19.35 ± 3.57 (16.80–21.90)*</td>
</tr>
<tr>
<td>Standardbred</td>
<td>10</td>
<td>6.00 ± 4.90 (2.50–9.50)</td>
<td>17.25 ± 2.67 (15.34–19.16)</td>
</tr>
<tr>
<td>Icelandic horse</td>
<td>10</td>
<td>7.05 ± 2.65 (5.15–9.95)</td>
<td>12.75 ± 2.15 (11.21–14.29)</td>
</tr>
<tr>
<td>Other</td>
<td>9</td>
<td>7.23 ± 3.35 (4.60–10.06)</td>
<td>19.17 ± 5.80 (14.71–23.62)*</td>
</tr>
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</table>

*For these measurements, auxiliary lines were drawn perpendicular to the axis of Mt III through the most distal point of the lateral trochlear ridge of the talus and through the proximal end of Mt IV. The distances between these auxiliary lines to a line through the joint space of the centrodistal joint at the injection site for the dorsolateral arthrocentesis approach were measured in the direction of the axis of Mt III. The distance between the auxiliary line at the level of the proximal end of Mt IV and the centrodistal joint was designated D1. The distance between the centrodistal joint and the most distal point of the lateral trochlear ridge of the talus was designated D2. †Measurements were made in 1 hind limb/horse.

†Values with the same superscript letter are significantly (P < 0.05) different.
The success rate of arthrocentesis was evaluated by counting the number of needle repositionings (a score of 0 indicated that joint entry was gained without correction of the needle position). Normal distribution was excluded by use of the Kolmogorov-Smirnov test. To compare the number of needle repositionings required for successful dorsolateral arthrocentesis in cadaver joints with that required for successful arthrocentesis via the medial approach in the same limb, a Wilcoxon test was used. For comparison of the number of needle repositionings for dorsolateral arthrocentesis in cadaveric limbs and horses examined at the clinic, a Mann-Whitney test was used (for all clinical cases, only the results of the first arthrocentesis were considered). In horses that underwent dorsolateral arthrocentesis in both hind limbs, the numbers of needle repositionings for dorsolateral arthrocentesis in the right and left hind limb were compared by use of a Wilcoxon test. Significance for results was set at a value of \( P < 0.05 \). Data are expressed as median values and range.

**Results**

Development of the dorsolateral approach to the centrodistal joint—For proximodistal orientation for dorsolateral arthrocentesis of the centrodistal joint, an analysis of radiographic views of the tarsal joints of 20 warmbloods, 10 Standardbreds, 10 Thoroughbreds, 10 Icelandic horses, and 9 horses of other breeds (5 stallions, 25 geldings, and 29 mares) was performed. The horses were 1 to 18 years old (mean ± SD age, 7.69 ± 4.93 years) and weighed 200 to 700 kg. Only 1 hind limb from each horse was evaluated.

Results of the measurements of D1 and D2 were assessed on the basis of breed (Table 1). Among all horses, mean D1 was 6.97 ± 3.41 mm (95% confidence interval, 6.08 to 7.85 mm) and there was no significant breed influence. However, a considerable influence of breed on values of D2 was detectable; in Icelandic horses, D2 was significantly less than that determined in warmbloods (\( P < 0.001 \)), Thoroughbreds (\( P = 0.003 \)), and the group of other breeds (\( P = 0.006 \)).

On the basis of these results, the proximodistal orientation for dorsolateral arthrocentesis of the centrodistal joint in the subsequent in vitro and in vivo investigations was applied wherein the distal end of the lateral trochlear ridge of the talus and the proximal end of Mt IV were used as bony landmarks. The axis of Mt III and an auxiliary line at the level of the proximal end of Mt IV were imagined. Depending on the breed of the horse, skin penetration was performed approximately 13 to 21 mm distal to the lateral trochlear ridge of the talus. For all breeds, the arthrocentesis site was approximately 6 to 8 mm proximal to the auxiliary line at the level of Mt IV (equal to D1).

Topographic landmarks for mediolateral orientation of dorsolateral arthrocentesis of the centrodistal joint were the tendons of the digital extensor muscles (lateral and long digital extensor muscles). The optimum location for needle placement that was identified ultrasonographically and from examination of anatomic preparations was directly lateral to the tendon of the long digital extensor muscle. In that position, a 6- to 15-mm-wide area without relevant blood vessels (particularly the dorsal pedal and perforating tarsal vessels) was identified in all examined hind limbs (Figures 2 and 3). To avoid penetration of the synovial tendon sheath of the long digital extensor muscle, the best location for needle placement was 2 to 3 mm lateral to this tendon. From this location, the needle was then inserted perpendicular to the axis of Mt III and directed plantaromedially (from dorsolateral to plantaromedial direction) at an angle of approximately 70° from the sagittal plane to a depth of 1.5 to 2 cm until its tip had contact with bone or cartilage. The needle was then minimally withdrawn until the tip was free and aspiration of synovial fluid was attempted. If aspiration was not successful, the position of the needle was slightly corrected in proximal or distal direction prior to repetition of aspiration.

In vitro comparison of the dorsolateral and medial approaches—For the in vitro investigation, the right hind limbs of 12 warmbloods, 2 Standardbreds, 2 Thoroughbreds, 1 Icelandic horse, and 5 horses of other breeds (4 stallions, 8 geldings, and 10 mares) were used. The horses were 2 to 23 years old (mean age, 11.90 ± 6.79 years) and weighed 300 to 650 kg. In all cadaveric hind limbs, arthrocentesis of the centrodistal joint was performed via the dorsolateral and medial approach at the same time. For both approaches, the
median number of needle repositionings was 1 (range, 0 to 6); the number of needle repositionings required to complete each approach was not significantly \( (P = 0.416) \) different.

In 18 of 22 hind limbs, synovial fluid was collected from the centrodistal joint via both approaches; synovial fluid was only obtained via the dorsolateral approach and the medial approach in 1 and 3 hind limbs, respectively. Mediolateral or interomedial through-and-through lavage with contrast solution was possible in 21 of 22 hind limbs. In 1 limb, lavage was not possible, but correct needle placement and joint space entry were confirmed at both sites by the appearance of synovial fluid in the needle hub and evidence of 2 needles placed in the centrodistal joint in the dorsopalmar radiographic view of the tarsal region. In that limb, the contrast solution accumulated at the dorsolateral aspect of the joint following the dorsolateral injection.

Evaluation of the positive contrast arthrograms revealed that in 12 hind limbs, contrast solution was only detectible in the centrodistal joint, particularly in the dorsal pouches that extended proximally and in the plantar pouches that extended proximally as well as distally. In 5 hind limbs, contrast solution was detected in the centrodistal joint as well as in the dorsal and plantar pouches of the TMT joint. In the remaining 5 hind limbs, intra-articular distribution could not be assessed because of extra-articular leakage of the contrast solution (associated with the medial approach in 2 limbs and with the dorsolateral approach in 3 limbs). In these 5 limbs, the number of needle repositionings performed at the leakage site ranged from 0 to 2 (median, 1).

In vivo arthrocentesis of the centrodistal joint via the dorsolateral approach—Dorsolateral arthrocentesis was performed 35 times in 27 centrodistal joints (16 right and 11 left hind limbs) of 22 horses. These horses included 13 warmbloods, 3 Icelandic horses, and 6 horses of other breeds (1 stallion, 10 geldings, and 11 mares). The horses were 1 to 21 years old (mean age, 9.64 ± 5.22 years) and weighed 200 to 700 kg. Intra-articular analgesia of the centrodistal joint was performed in 16 joints with 5 mL of a 2% solution of lidocaine, and in 11 of those joints, the intra-articular analgesia was effective within 5 minutes. For 11 of 35 procedures, the arthrocentesis was performed without any means of restraint, and for 13 procedures, horses were restrained by use of a lip twitch. For 9 intra-articular treatments, horses were sedated via IV administration of detomidine and butorphanol (0.01 mg/kg dose each) and 2 joints of 1 horse were treated while the horse was anesthetized and positioned in dorsal recumbency. In all but 3 procedures, dorsolateral arthrocentesis of the centrodistal joint was performed by the 3 authors (19, 11, and 2 centeses were performed by TFL, BP, and EMJ, respectively). In the remaining 3 procedures, intra-articular centesis was performed by 2 persons, who were instructed by the authors and used the dorsolateral approach the first time. In those instances, entry of the joint space was achieved with the first attempt \( (n = 1) \) or with only 1 correction of the needle position \( (n = 2) \).

Of the 27 procedures performed first for diagnostic or treatment purposes, there was 1 horse in which dorsolateral arthrocentesis was successful but for which it was not possible to define exactly the first time of joint space entry because of initial lack of cooperation of the horse. Therefore, only 26 centeses in 21 horses could be used for the statistical evaluation. For all clinical patients that underwent dorsolateral arthrocentesis (considering only the first injected hind limb for each of 21 horses), the number of needle repositionings (median, 1; range, 0 to 5) required to complete the procedure was not significantly \( (P = 0.251) \) different from that required to complete dorsolateral arthrocentesis in vitro. In those horses in which dorsolateral arthrocentesis was performed in both hind limbs \( (n = 5) \), the number of needle repositionings in right and left hind limbs was not significantly \( (P = 0.564) \) different. Considering only the first arthrocentesis for all joints \( (n = 26) \), the degree of contamination of the synovial fluid with hemorrhage was relatively low; in most instances, the fluid was clear \( (n = 9) \) or contained only trace of blood \( (n = 9) \).

With regard to breed, the number of needle repositionings ranged from 0 to 5 (median, 1) among the Warmbloods \( (n = 15 \) joints) and from 0 to 3 (median, 0) among the horses of other breeds (8 joints). Entry to the joint space in the 3 Icelandic horses was achieved without correction of the needle position.

For intra-articular medication, arthrocentesis of 7 centrodistal joints was repeated in 6 horses (in 1 horse, arthrocentesis was repeated twice). In 1 horse, arthrocentesis via the dorsolateral approach was impaired because of a subcutaneous hematoma that developed after undergoing dorsolateral centesis of the centrodistal joint previously. In another horse, repeated dorsolateral centesis of the centrodistal joint was successful, but the uncooperative nature of the patient did not allow definition of the first time of joint space entry. For the remaining 6 repeated centeses, the number of times the needle was repositioned ranged from 0 to 1 (median, 0)

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Figure 3—Photograph of a transverse section of the right hind limb of a horse at the level of the centrodistal joint with the needle positioned for arthrocentesis of the centrodistal joint via the dorsolateral approach. The needle is directed perpendicular to the long axis of Mt III. T1+2 = Fused first and second tarsal bones. T3 = Third tarsal bone. T4 = Fourth tarsal bone. c = Perforating tarsal vein. Bar = 1 cm. See Figure 2 for remainder of key.
Inadvertent puncture of blood vessels in the dorsolateral approach for arthrocentesis was not significantly different. Nevertheless, arthrocentesis was repeated after an interval of >20 days and the success rate of the second intra-articular centesis was similar to that of the first arthrocenteses. In all 4 repeated centeses, joint space access was achieved after only 1 needle repositioning and the synovial fluid was clear or contained only traces of blood.

**Discussion**

To assess synovial joint cavities and their relationship to periarticular structures in horses, examination of anatomic preparations and application of imaging techniques such as ultrasonographic and radiographic examinations are useful. The landmarks for the dorsolateral approach for arthrocentesis of the centrodiscal joint established by use of those methods are easily palpated.

For dorsolateral arthrocentesis of the centrodiscal joint, the relative position of the injection site to the bony landmarks (especially the lateral trochlear ridge of the talus) depends on the size of the tarsal bones and therefore on the size of the horse. Hence, D2 was smaller in Icelandic horses than in horses such as warmbloods and Thoroughbreds in the present study. However, the proximal end of Mt IV was a consistent landmark because D1 was similar for all radiographic views of the tarsal regions with low variation and without significant differences among horse breeds.

During dorsolateral arthrocentesis of the centrodiscal joint, inadvertent centesis of adjacent synovial structures (TMT or talocalcaneal-centroquartal joint or the tendon sheath of the long digital extensor muscle) is a potential risk, but this problem can also occur via the medial approach. Performing dorsolateral arthrocentesis approximately 2 to 3 mm lateral to the tendon of the long digital extensor muscle reduces the risk of an inadvertent centesis of the tendon sheath. If the tendon sheath is palpably distended, ultrasonographic examination of the arthrocentesis site to identify the position of the dorsal pedal and perforating tarsal vessels relative to the distended tendon sheath is probably advisable. In our study, inadvertent centesis of other synovial structures did not occur in any of the 22 cadaveric hind limbs in which the correct needle placement in the centrodiscal joint was confirmed radiographically after through-and-through lavage with contrast solution. Evaluation of such positive contrast arthrograms is a suitable method with which the successful centesis of synovial structures can be verified.

In the present study, comparison of the success rate of dorsolateral arthrocentesis of the centrodiscal joint in vitro with that of medial centesis in vitro or dorsolateral arthrocentesis in vivo revealed that the numbers of needle repositionings required to complete those procedures were not significantly different. Nevertheless, inadvertent puncture of blood vessels in the dorsolateral tarsal region (dorsal pedal and perforating tarsal vessels) in vivo may cause difficulties with the dorsolateral approach to the centrodiscal joint. Because of the oblique course of the dorsal pedal and perforating tarsal vessels, this risk is increased if arthrocentesis of the centrodiscal joint is performed at a site that is more lateral (close to the tendon of the long digital extensor muscle) or more proximal, respectively, than the optimal site. Consequently, the needle should be positioned no more than 2 to 3 mm lateral to the tendon of the long digital extensor muscle. Furthermore, needle placement proximal to the level of the centrodiscal joint space should be avoided (even if arthrocentesis from that position may be successful because of the location of the dorsal pouches of the joint capsule). Despite the blood vessels in the dorsolateral aspect of the tarsal region and the risk of bleeding associated with the dorsolateral approach to the centrodiscal joint, contamination of synovial fluid with hemorrhage was only evident in 17 of 26 (65%) centrodiscal joints in the present study. This result is similar to the frequency of blood contamination of joint spaces reported after centesis of other joints (57% to 60%).

In horses with bone remodeling at the dorsolateral tarsal region attributable to osteoarthritis of the distal tarsal joints (eg, Icelandic horses), dorsolateral arthrocentesis of the centrodiscal joint may be difficult. However, the clinical use of the dorsolateral approach was not limited by dorsolateral bone remodeling in any of the horses in the present study, although osteoarthritis of the distal tarsal joints was suspected or proven in all of those equine patients.

One of the main advantages of the dorsolateral approach for centesis of the centrodiscal joint was improved safety of the person performing the arthrocentesis; standing by the side of the horse (as for arthrocentesis of the TMT joint) is considered to be less risky than the position required to perform centesis of the centrodiscal joint via the medial approach. In the present study, arthrocentesis of the centrodiscal joint via the dorsolateral approach was feasible without sedation or any means of restraint in many horses. The palpable landmarks also contribute to the ease of the dorsolateral approach to the centrodiscal joint. Even the 2 individuals without experience with the dorsolateral approach had no difficulties in achieving centrodiscal joint access in the present study, which appears to indicate that the procedure was easy to perform although the authors recognize that this was a small number of persons tested. Another advantage of the dorsolateral approach is that other therapeutic opportunities arise if this procedure is combined with medial arthrocentesis, including through-and-through lavage of the centrodiscal joint (eg, for flushing a septic joint). The option of an alternative site of arthrocentesis is also advantageous if a superficial wound or dermatitis is present at the site of the medial approach to the centrodiscal joint because in such instances, arthrocentesis should not be performed in the affected area.

The results of the present study have indicated that dorsolateral approach for arthrocentesis of the centrodiscal joint offers some advantages over the traditional medial approach, although the success rate of the me-
dial and dorsolateral approaches in vitro was not significantly different. Arthrocentesis of the centrodistal joint of the tarsus in horses via the dorsolateral approach is technically easy to perform because of the palpable landmarks and in clinical settings, the position for the clinician performing the procedure is less exposed and safer, compared with that required for the medial approach. The dorsolateral approach to the centrodistal joint has been used clinically for several years by 1 of the authors (TFL), and on the basis of the results of the present study, this approach has been adopted as a routine procedure by all clinicians at our clinic. We recommend that arthrocentesis of the centrodistal joint in horses is performed via the dorsolateral approach, thereby increasing the frequency of selective intra-articular anesthesia and treatment of this joint in routine equine practice.

References