Comparison of two techniques for injection of the podotrochlear bursa in horses

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Objective—To compare accuracy of 2 methods for injection of the podotrochlear bursa in horses.

Design—Observational study.

Animals—17 French Standardbreds.

Procedure—In each horse, contrast medium was injected into the podotrochlear bursa of 1 foot by use of a distal palmar approach with the needle inserted parallel to the sole (DPPS) and into the podotrochlear bursa of the other foot by use of a distal palmar approach to the navicular position (DPNP). Podotrochlear bursa injection was evaluated by means of radiographic examination in all horses and postmortem examination in 6.

Results—Contrast medium was successfully injected into the podotrochlear bursa in 6 of 16 feet in which the DPPS method was used and 14 of 17 feet in which the DPNP method was used; these results were significantly different. Failure was attributed to contrast medium invading the distal interphalangeal joint, contrast medium pooling palmar to the deep digital flexor tendon, and an inability to inject contrast medium despite adequate needle placement.

Conclusions and Clinical Relevance—Results suggest that the DPNP technique can be used successfully for injection into the podotrochlear bursa in horses. However, radiographic assessment should be used to confirm that material was injected into the bursa. (J Am Vet Med Assoc 2005;226:1524–1528)

Even given recent advances in diagnostic imaging techniques, diagnostic anesthesia remains one of the most useful tools for determining the underlying cause of lameness in horses, particularly as it can be used not only to identify the site of pain but also to confirm a tentative diagnosis.1 Diagnostic anesthesia of the podotrochlear (navicular) bursa is commonly performed in horses examined because of lameness,2 and multiple techniques for performing diagnostic anesthesia of the podotrochlear bursa have been described. One of the first techniques described involved introducing a needle into the hollow of the heel and directing it parallel to the coronary band or parallel to the bearing surface of the foot.3 A fourth technique involved inserting a needle abaxial to the deep digital flexor tendon at the level of the heel and advancing it alongside the tendon toward the toe.4 Radiography has been used to assess needle location and confirm that material was injected into the bursa,5 and use of these techniques, sometimes with minor modifications, has been described on numerous occasions.2,13 A fifth technique has also been described.12 This technique involves locating the position of the distal sesamoid bone on the basis of topographic landmarks and directing the needle toward this position. The bone was found to lie in the middle of and 1 cm distal to the coronary band,5 and this technique has been identified as the distal palmar approach to the navicular position (DPNP).5

Results obtained with diagnostic anesthesia of the foot in horses have been reviewed.14 The authors showed that anesthesia of the podotrochlear bursa may help to differentiate pain associated with disease of the distal interphalangeal joint from pain arising from the distal sesamoid bone and associated structures. Injections into the podotrochlear bursa have also been used for treatment of horses with navicular syndrome refractory to corrective shoeing and nonsteroidal anti-inflammatory drugs.

None of the techniques described for injection into the podotrochlear bursa has been universally validated, and the procedure is sometimes considered difficult to perform.13 The 5 techniques previously described were compared in an in vitro study,3 and the DPNP yielded the best results with 92% accuracy. However, comparisons between the various techniques in standing horses are lacking.

The purposes of the study reported here were to evaluate accuracy of the DPNP technique in standing horses, compare accuracy of the DPNP technique with accuracy of a distal palmar approach in which the needle is inserted parallel to the sole (DPPS), and assess the necessity for radiographic guidance to confirm the site of injection.

Materials and Methods

Animals—Seventeen adult French Standardbreds (16 geldings and 1 mare) were used in the study. Horses ranged from 5 to 8 years old (mean ± SD, 6 ± 0.3 years) and weighed between 450 and 520 kg (990 and 1,144 lb; mean ± SD, 481.8 ± 5.9 kg [1,060 ± 13.0 lb]). All 17 horses were shod and free from lameness.

Experimental design—For all horses, contrast medium was injected into the podotrochlear bursae of both forefeet. The DPNP technique was used on 1 forefoot, and the DPPS technique was used on the other. For each horse, which forefoot the DPNP technique was used on was randomly
assigned. All injections were carried out by a single individual (CPC) experienced with the 2 techniques. All procedures were approved by the Ethical Committee of the National Veterinary School of Lyon, France.

The method of restraint varied depending on the horse’s temperament but typically included use of a nose twitch or sedation with detomidine (10 μg/kg [4.5 μg/lb], IV). The skin between the bulbs of the heel immediately proximal to the coronary band was desensitized with an SC injection of 1 mL of 2% lidocaine through a 23-gauge, 5/8-inch needle. The distal palmar area of the foot was then aseptically prepared, and a 20-gauge, 3.5-inch spinal needle with a stylet was introduced into the podotrochlear bursa.

In 6 horses, a mixture of 3.5 mL of 1% methylene blue dye and 0.5 mL of meglumine ioxithalamate was used. A lateromedial radiographic projection of the foot was obtained while the needle was still in place by use of a portable radiographic machine, a screen, and high-contrast film (70 kVp, 5 mAs, and 40-inch film-focal distance). Horses were then euthanatized, and the feet were cut sagittally to determine localization of the blue dye.

In the 11 remaining horses, a mixture of 0.5 mL of meglumine ioxithalamate and 3.5 mL of 2% lidocaine was used and a lateromedial radiographic projection of the foot was obtained while the needle was still in place. Following injections in both forefeet, horses were turned out in a small paddock. A lameness examination was performed daily for at least 1 week before horses were discharged from the study.

Injection techniques—For the DPPS technique, the needle was inserted midway between the heel bulbs, immediately (4 mm) proximal to the coronary band, and advanced dorsally in the sagittal plane of the limb, parallel with the solar surface of the foot, until substantial resistance was encountered. During the procedure, the foot was placed on a flat wooden block and the contralateral forefoot was held by an assistant.

For the DPNP technique, the navicular position was defined as a point on the lateral hoof wall halfway between the most dorsal and most palmar aspects of the coronary band and 1 cm distal to the coronary band. The needle was inserted midway between the heel bulbs (immediately 4 mm) proximal to the coronary band, and advanced in the sagittal plane toward the point representing the intersection of the sagittal plane and long axis of the navicular bone, until substantial resistance was encountered. The long axis of the navicular bone was assumed to correspond to a line drawn between the navicular position points on the lateral and medial aspects of the hoof wall (Figure 1). During the procedure, the foot was held in a flexed position on a standard 60° inclined radiographic wooden block by an assistant.

Assessment of injection techniques—For each injection technique, the number of attempts at inserting the needle was recorded. Anytime the needle was removed and reintroduced for more than half its length, a new attempt was recorded.

Lateromedial radiographic projections were examined to determine whether injection was successful. The procedure was considered to be successful when contrast medium was seen to only fill the podotrochlear bursa on the radiograph. In the 6 horses in which methylene blue was used, accuracy of the technique was also determined through post-mortem macroscopic examination of the sagittal sections of the feet for localization of the blue dye.

Statistical analyses—Injection success rates were compared between techniques by means of the Fisher exact test. The Wilcoxon test was used to compare the number of attempts at inserting the needle between techniques. Values of P < 0.05 were considered significant.

Results

Mean number of attempts at inserting the needle for the DPPS technique (1.88; range, 1 to 3) was not significantly (P = 0.19) different from mean number for the DPNP technique (1.65; range, 1 to 4).

The podotrochlear bursa was successfully injected in 6 of 16 feet with the DPPS technique (Figure 2) and in 14 of 17 feet with the DPNP technique (Figure 3); these results were significantly different. In 1 horse, the DPNP technique was used on the first foot, but the DPPS technique could not be performed on the contralateral foot because of the horse’s violent behavior. Adequate positioning of the needle, with the desired angulation and the tip toward the palmar surface of the distal sesamoid bone, was visible on radiographs.

For feet in which the DPPS technique was used, failure was attributed to contrast medium invading the distal interphalangeal joint (3 feet; Figure 4), contrast medium pooling palmar to the deep digital flexor tendon (3; Figure 5), contrast medium located in both the podotrochlear bursa and the area palmar to the deep digital flexor tendon (1), contrast medium located in both the podotrochlear bursa and the distal interphalangeal joint (1), and an inability to inject contrast medium despite adequate needle placement (2). In the latter 2 feet, the needle tip was found to be engaged in the tendon core on radiographs.

For feet in which the DPNP technique was used, failure was attributed to contrast medium invading the
distal interphalangeal joint (1 foot), contrast medium pooling palmar to the deep digital flexor tendon (1), and contrast medium located in both the podotrochlear bursa and the area palmar to the deep digital flexor tendon (1).

Postmortem examination in 6 horses confirmed the radiographic observations, except that in 1 foot, dye was observed not only in the podotrochlear bursa but also in the distal interphalangeal joint.

During the 1-week follow-up period in the remaining 11 horses, no lameness was detected during daily examinations.
Discussion

Several recent studies have been published regarding the specificity of various techniques for diagnostic anesthesia of the digit in horses. Diagnostic anesthesia of the podotrochlear bursa has been thought to be a highly specific test. However, pain arising from the solar toe area and from the distal interphalangeal joint can be abolished by anesthesia of the podotrochlear bursa. In addition, the podotrochlear bursa may be anesthetized through injection of local anesthetic into the distal interphalangeal joint. On the other hand, diagnostic anesthesia of the podotrochlear bursa is the only technique that does not desensitize the solar heel area. It therefore remains an accurate diagnostic aid in the diagnosis of solar heel pain.

Guidelines for optimal insertion point and angle of the needle used for podotrochlear bursa injections have been established. Because results have been inconsistent, radiographic confirmation of needle positioning has been suggested and is commonly used in practice. Ultrasonography is intended to detect positioning to confirm placement in the podotrochlear bursa has also been described.

Contrary to other described techniques for podotrochlear bursa injection, the DPNP technique uses a fixed reference target point corresponding to the position of the distal sesamoid bone, rather than a given angle. A previous in vitro study that involved use of isolated limbs found that this technique was more accurate than other techniques, regardless of foot conformation. In the present study, we wanted to determine whether this was also true in vivo. We used the DPPS technique for comparison because it is widely used in practice and it allows the contralateral foot to be held.

The volume of the podotrochlear bursa is believed to be approximately 3 mL, but up to 5 mL of local anesthetic solution has been injected into the bursa, and a recent study on podotrochlear bursa injection used a volume of 3.5 mL of local anesthetic solution mixed with 0.5 mL of contrast medium. No controlled experiments describing the optimal volume that should be administered into the podotrochlear bursa have been reported. Therefore, we used a total volume of 4 mL, as this was similar to the volume used in other studies.

The difference between radiographic and post-mortem findings in 1 horse in the present study may be explained by inadvertent penetration of the palmar recess of the distal interphalangeal joint at the time of needle removal. The absence of a natural communication between these structures has been confirmed by means of latex injections and arthrography.

The DPNP technique was significantly more successful than the DPPS technique in the present study. In addition, it is the only technique described to date that can be performed when the horse is unwilling to bear weight on the affected limb, in that the foot is placed on an inclined block. In our opinion, placement of the foot on an inclined block offers 3 advantages. First, this position is thought to relax the deep digital flexor tendon, which contributes to opening the podotrochlear space, thus facilitating injection. Second, it provides a more vertical position of the flexor surface of the distal sesamoid bone, making it easier to contact the bone when introducing the needle. Third, it increases the distance between the injection site and the ground, so that needle insertion is easier and cleaner.

The main disadvantage of the DPNP technique is associated with restraint. Because the foot is held on an inclined block, it is impossible to hold the contralateral limb to avoid movement and stabilize the horse’s position. This is a serious limitation of the DPNP technique in horses that do not tolerate a nose twitch. Conversely, with the DPPS approach, tension in the deep digital flexor tendon can produce a resistance similar to that of the bone, and fluid may then be injected palmar to the tendon. On the other hand, holding the contralateral limb allows a more secure restraint and facilitates manipulation during the DPPS technique.

Podotrochlear bursa injection may be too risky and too difficult without sedation to be used routinely during lameness examinations. However, the need for sedation when performing diagnostic anesthesia may make results questionable, as the analgesic properties of α2-adrenoceptor agonists, such as detomidine, have been recognized. Xylazine has been used clinically, and its effects on the severity of lameness have been assessed in a limited number of horses, in which it produced no alteration in the lameness. A kinematic study performed to establish the locomotion pattern of horses sedated with detomidine revealed that sedation did not change the degree of lameness, despite some alteration in the general locomotion pattern. In the present study, use of a nose twitch was the most common restraint method, and in our opinion, it was an efficient method when it was well tolerated by the horse. Horses fighting against the nose twitch were sedated, but we found subjectively that the feet were less easy to maintain on the wooden block while introducing the needle.

Radiographic confirmation of adequate needle placement is generally advised when performing podotrochlear bursa injections. One objective of the present study was to determine whether radiography was still required when the DPNP technique was used. The accuracy of the technique (14/17) was fairly high, but in practice, the failure rate may still be unsatisfactory. The authors would therefore recommend that needle placement be confirmed radiographically.

References


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