How to Perform Synoviocentesis of the Navicular Bursa

Michael C. Schramme, DrMedVet, CertEO, PhD, Diplomate ECVS, ACVS*; John Schumacher, DVM, MS, Diplomate ACVIM; and Ray Wilhite, PhD

Authors’ addresses: Equine Clinic, National Veterinary School of Lyon, 69280 Marcy l’Etoile, France (Schramme), Equine Sports Medicine Program (Schumacher) and Department of Anatomy and Physiology (Wilhite), College of Veterinary Medicine, Auburn University, Auburn, AL 36849; e-mail: michael.schramme@vetagro-sup.fr. *Corresponding and presenting author. © 2012 AAEP.

1. Introduction
Synoviocentesis of the navicular bursa is performed as part of an examination for lameness because it is the most localizing analgesic procedure that can be performed during an investigation to determine the site of pain within the horse’s foot.1,2 Synoviocentesis of the navicular bursa is also often performed to administer corticosteroids, sodium hyaluronate, or autologous conditioned serum (IRAP) as treatment of horses with navicular disease.3–6 Many methods of synoviocentesis of the navicular bursa have been described and have previously been summarized.7 These include a distal palmar approach parallel with the coronary band,8–11 a distal palmar approach parallel with the sole,11–15 a proximal palmar approach4,5,16 through the hollow of the heel at an angle of 10° to 30° to the horizontal, and a lateral approach.10–12,15,17 None of these techniques consider the shape of the foot when describing the direction along which the needle is advanced. Many lame horses have an abnormal foot conformation, so using the slope of the coronary band or the bearing surface as a guide for needle direction during advancement often results in failure. However, it has been shown that the navicular position in the foot can be reliably defined, regardless of the conformation of the foot, as a point on the lateral hoof wall, 0.5 to 1 cm distal to the coronary band, and halfway between the most dorsal and most palmar aspect of the coronary band.3,7 Consequently, Verschooten (1991) described a method of synoviocentesis of the navicular bursa whereby the needle is advanced along the sagittal plane toward the navicular position.3,7

2. Materials and Methods
Restraint
Many horses resent insertion of a needle for synoviocentesis of the navicular bursa. If application of a lip twitch or lip chain does not provide sufficient restraint, xylazine (0.2 mg/kg) can be administered intravenously to most horses without significantly decreasing the degree of lameness.1 Xylazine may be more useful for restraint than detomidine because of its shorter duration of action. The degree to which sedation or tranquilization may interfere with assessment of gait, however, may depend on the severity of lameness and the skill of the clinician...
performing the examination. Because of the uncertainty of the effect of sedation or tranquilization on gait, chemical restraint should be avoided when possible. When sedation is necessary to administer local anesthetic solution, antagonizing the sedative effects of an \( \alpha_2 \)-agonist\(^1\) may make interpretation of diagnostic analgesia more straightforward. One-half to 1 mL of local anesthetic solution is administered subcutaneously at the site of needle insertion just proximal to the hairline on the palmar aspect of the foot between both bulbs of the heel. Local anesthetic solution is difficult to administer at this site because here the skin is tightly adhered to subcutaneous tissue. For the purpose of administering intrabursal medication, horses can first be sedated with detomidine (10 \( \mu \)g/kg) and butorphanol (0.02 mg/kg). In addition, anesthesia of the palmar digital nerves at the level of the ungular cartilages of the foot or the proximal sesamoid bones can be performed instead of subcutaneous infiltration of local anesthetic solution at the site of needle insertion.

Preparation
The hair coat and hoof wall should be cleaned and the foot and the distal limb proximal to the pastern can be covered with clean self-adherent elastic bandaging tape to minimize the potential for contamination during injection. The foot is held in a Hickman block (Fig. 1) by an assistant wearing a radioprotective gown and gloves. Positioning the foot in a block minimizes potential problems of maintaining aseptic technique when working at the level of the bulbs of the heel. It places the foot in flexion, thereby reducing the compression of the deep digital flexor tendon against the palmar surface of the navicular bone and thus facilitating injection. It also positions the foot adequately for an immediate lateromedial radiograph once the needle is inserted.

The injection site is aseptically prepared for insertion of a 20-gauge, 3.5-inch spinal needle. Using a radiographically guided technique with the navicular position in the foot as a landmark, it can be helpful to mark the navicular position by applying an adhesive marker to the lateral hoof wall at a point 0.5 to 1 cm distal to the coronary band, midway between the dorsal and palmar limits of the coronary band as viewed from lateral. Before inserting the needle, the X-ray tube and cassette holder are positioned to allow easy radiographic control of needle position without causing potentially frightening movement of equipment around the horse.

Radiographically Guided Injection
A 20-gauge, 8.9-cm (3.5-inch), disposable spinal needle is inserted between the bulbs of the heel just proximal to the coronary band, and the needle is advanced dorsally along a sagittal plane, aiming for a point 0.5 to 1 cm distal to the coronary band, midway between the dorsal and palmar limits of the coronary band (Figs. 3 and 4). The spinal needle is advanced through the deep digital flexor tendon until the tip of the needle contacts the flexor surface of the navicular bone. At this time, a lateromedial radiograph is obtained. Digital radiography allows for instant inspection of the position of the needle tip up against the palmar surface of the navicular bone (Fig. 5). Once accuracy of needle placement is sat-
isfactorily confirmed, 3 to 4 mL of local anesthetic solution or medication is injected. If excessive pressure is encountered, the needle is rotated 90° to 180° or very slightly withdrawn in an attempt to free the bevel of the needle from palmar fibrocartilage of the navicular bone. Further flexing the foot may also increase ease of injection. Care should be taken not to withdraw the needle too far, as the deep digital flexor tendon is very thin on the sagittal midline and this may result in injection palmar to the tendon. The person holding the foot in the block should make an extreme effort to ensure that the horse does not place the foot on the floor while the needle is in position, as this may result in damage to the palmar fibrocartilage of the navicular bone or the deep digital flexor tendon. Another method of determining success of the procedure is to examine the foot radiographically immediately after injecting the bursa, provided that 0.5 to 1.0 mL of radiopaque solution or room air was added to the local anesthetic or medication solution. Radiographic identification of radiopaque solution or air within the bursa is evidence of a successful bursal injection (Figs. 6 and 7). Although radiographic control is always advisable when performing synoviocentesis of the navicular bursa, with some experience using the navicular position as a guide, the

Fig. 3. Graphic representation of the path of advancement of the spinal along a sagittal plane, aiming for a point 0.5 to 1 cm distal to the coronary band, midway between the dorsal and palmar limits of the coronary band.

Fig. 5. Lateromedial radiograph of the foot demonstrating proper positioning of the needle for synoviocentesis of the navicular bursa. The needle tip is up against the palmar surface of the navicular bone.

Fig. 4. The spinal needle is positioned directly palmar to the navicular position.

Fig. 6. Lateromedial radiograph of the foot with radiopaque contrast within the navicular bursa.
procedure can be done without radiographic assistance with a relatively high reliability. Nonradiographic indicators of successful synoviocentesis of the navicular bursa include assessment of the depth of needle penetration from the skin surface when it contacts the flexor surface of the navicular bone. This can be evaluated by holding the stylet alongside the lateral aspect of the foot and parallel with the spinal needle, with the handle of the stylet level with the hub of the needle. The tip of the needle should reach the marker of the navicular position applied to the lateral aspect of the hoof wall. This distance is approximately 4 to 5 cm from the site of needle introduction in most horses. When the tip of the needle is inserted too far proximally, it passes proximal to the navicular bone, enters the palmar pouch of the distal interphalangeal joint, and encounters bone at a greater distance (6 to 7 cm) from the skin surface. The tip of the stylet held parallel with the needle will then overshoot the marker of the navicular position.

Successful centesis of the navicular bursa might also be assumed if the first 2 mL of local anesthetic solution is easily administered and then, as pressure within the bursa increases during administration of additional solution, the syringe barrel refills with solution when pressure on the plunger is released. A much larger volume of fluid (e.g., >7 mL) can be administered before pressure is encountered, if the needle has entered the palmar pouch of the distal interphalangeal joint. Synovial fluid can usually be aspirated from the palmar pouch of the coffin joint but not from the navicular bursa.

**Ultrasonographically Guided Injection**

Synoviocentesis of the navicular bursa can also be guided ultrasonographically. For an ultrasonographic view of the navicular bone, the frog is trimmed to pliable tissue, and then soaked in warm water for 30 to 120 minutes; the time of soaking depends on the moisture content of the frog. The needle is advanced into the navicular bursa, using Verschooten’s method of centesis, and the position of the needle tip is determined using a 7.5-MHz linear probe placed on the frog in a sagittal orientation. The needle is properly placed when the tip of the needle is observed to contact the flexor surface of the navicular bone. A lateral approach to synoviocentesis can also be guided ultrasonographically. The foot is positioned in a Hickman block, the hair over the palmar aspect of the heel is clipped, and skin is prepared for ultrasonographic examination. An adhesive marker is applied to the lateral hoof wall over the navicular position. The site of needle insertion is at the proximal border of the lateral ungual cartilage, immediately proximal to the navicular position, between the lateropalmar border of the middle phalanx and the lateral border of the deep digital flexor tendon. After aseptic preparation of this site, a 20-gauge, 8.9-cm (3.5-inch), disposable spinal needle is introduced and advanced distally at an angle of 25° to 45° to the horizontal, aiming toward the proximal border of the navicular bone, until significant resistance is encountered.

**Aftercare**

After injection, two sterile gauze sponges soaked with alcohol are applied to the injection site and taped in place over the hoof for a couple of hours. After medication of the bursa, the horse is confined to a stall for 5 days before gradually resuming normal activity. However, a recent report indicated that the duration of remission of lameness after injection and the percentage of horses still sound at follow-up was significantly greater in horses in which intrabursal injection of corticosteroids was combined with a rest and rehabilitation program compared with duration of remission of lameness of

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**Fig. 7.** Lateromedial radiograph of the foot with air in the proximal recess of the navicular bursa (arrow) after injection of intrabursal medication with 0.5 mL of room air.
horses that returned to work immediately after injections.6

3. Results

The radiographically guided technique, using the navicular position as described by Verschooten, resulted in significantly higher success rates when compared with all other techniques. It was between 2.3 and 5.75 times more likely than any of the other techniques to result in successful injection of the navicular bursa in the hands of inexperienced operators.7,20 A radiographically guided lateral approach resulted in successful injection of the navicular bursa in only 40% of limbs, with the most common complication being inadvertent injection of the distal interphalangeal joint or digital sheath.7

Our experiences with the ultrasonographically guided lateral approach suggest that ultrasonographic visualization of the tip of a laterally introduced needle in the proximal recess of the navicular bursa can avoid inadvertent injection of other synovial cavities.

Analgesia of the navicular bursa temporarily ameliorates pain from the bursa, navicular bone, and its suspensory ligaments and the toe region of the sole.21 It also ameliorates pain in approximately 66% of horses with distal tendinopathy of the deep

Fig. 8. Lateral (A) and palmar (B) illustrations of the foot with the needle inserted at the proximal border of the lateral ungular cartilage, immediately proximal to the navicular position (green dot), between the lateropalmar border of the middle phalanx and the lateral border of the deep digital flexor tendon. The needle is advanced distally at an angle of 25° to 45° to the horizontal, aiming toward the proximal border of the navicular bone.

Fig. 9. For an ultrasonographic view of the proximal pouch of the navicular bursa during lateral synoviocentesis, a microconvex transducer is placed transversally on the palmar aspect of the foot between the heel bulbs.

Fig. 10. Ultrasonographic image of the proximal recess of the navicular bursa bordered by the collateral sesamoidean ligaments (CSL) and the deep digital flexor tendon (DDFT). The needle tip can be identified in the lateral aspect of the bursa (arrow). The middle phalanx is visible at the dorsal aspect of the image (P2).
digital flexor tendon but does not affect lameness caused by pain from the distal interphalangeal joint or the collateral ligaments of the distal interphalangeal joint. Results of experimental studies indicate that the effect of intrabursal analgesia of the navicular bursa on lameness should be assessed soon after injection (ie, within 5 to 10 minutes) because after this time, the structures that become desensitized by diffusion of the anesthetic solution become uncertain. In a study using endotoxin-induced synovitis of the distal interphalangeal joint, intrabursal analgesia with 3.5 mL of mepivacaine hydrochloride had no effect on lameness scores at 10 minutes, but lameness was improved 20 minutes after injection.

Verschooten et al (1990) evaluated in 161 horses the effect of navicular bursa treatment with 40 mg methylprednisolone or triamcinolone acetonide that blocked to the foot with a palmar digital nerve block and had no, or mild, radiological abnormalities of the navicular bone. After navicular bursa injection, 80% of horses were sound at 2 weeks, 66% were sound at 1 month, 60% were sound at 2 months, 30% were still sound at 6 months, and 12% were still sound at 12 months after injections. Dabareiner et al (2003) described similar results in a group of 25 horses, with 80% returning to use with a mean duration of soundness of 4.6 months. Therapeutic injection of the navicular bursa results in more horses becoming sound for longer periods of time than similar treatment of the distal interphalangeal joint. In a review of 253 horses with navicular syndrome treated with either intrabursal or intra-articular corticosteroids, 60% of horses in the intrabursally treated group were sound for 2 months or more compared with only 34% of the horses in the intra-articularly treated group. Twelve months after intrabursal injection, 11.5% of horses were still sound and in full work. Multiple intrabursals injections were applied in 21 horses. If the first injection was effective, the second tended to be effective as well, but lameness tended to recur after a shorter period of time than after the first injection. Eventually horses became nonresponsive to follow-up injections.

Complications are rarely encountered after synoviocentesis of the navicular bursa if proper aseptic technique is used and the horse is adequately restrained. Immediate postinjection pain is occasionally seen, especially if the horse inadvertently places the foot on the ground while the needle is inserted in the bursa. Acute postinjection lameness can usually be managed with phenylbutazone (2.2 mg/kg once daily for 5 days). Some horses experience transient lameness at 3 to 4 days after injection, possibly because of tearing of adhesions in the bursa after improvement of the gait. In other horses, temporary resolution of lameness after injection may be followed by recurrence of more severe lameness at a later time. Dabareiner (2003) reported 4 horses that became severely lame 6 to 8 weeks after injection of the bursa due to developing severe tendinopathy of the deep digital flexor tendon in the pastern region. All 4 horses had been injected at least 3 times at 3-monthly intervals and were likely to have exacerbated existing tendon pathology due to increased weight-bearing after resolution of lameness. Alternatively, the needle penetration through the deep digital flexor tendon could have contributed to existing tendon damage that was exacerbated with exercise. The navicular bursa should probably not be injected more frequently than once every 6 months to minimize the incidence of this complication. Injection techniques that avoid penetration of the deep digital flexor tendon may help to reduce this complication further.

4. Discussion

The radiographically guided injection using the navicular position in the foot as a landmark is the authors’ preferred technique because it has the highest success rate and requires the least number of attempts at needle insertion. However, the needle penetrates the deep digital flexor tendon with every bursocentesis. Despite the paucity of reports documenting its incidence and severity, bursocentesis is still thought to pose a risk for iatrogenic tendon damage associated with repeated needle penetration, especially if there is any preexisting tendon pathology. We consider the ultrasonographically guided lateral approach to be a promising alternative because it avoids both penetration of the deep digital flexor tendon as well as inadvertent injection of other synovial cavities.

In a recent study of horses with foot lameness diagnosed with the aid of MR imaging, the efficacy of injection of the navicular bursa with corticosteroids, and particularly the duration of remission of lameness, were highly dependent on the disease present and the duration of lameness before injection. Additionally, the duration of remission of lameness after injection and the percentage of horses still sound at follow-up was significantly greater in horses in which intrabursal injection of corticosteroids was combined with a rest and rehabilitation program compared with duration of remission of lameness in horses that returned to work immediately after injections. It was also reported that remission of lameness was significantly longer in horses with an MR imaging diagnosis of navicular bursitis when compared with disease of the navicular apparatus. Horses with erosive lesions of the flexor surface of the navicular bone were reported to have a poor outcome after intrabursal medication. Improved case selection and modification of postinjection convalescence based on results of MR imaging is likely to increase the efficacy of intrabursal medication.

Even so, the effect of corticosteroids in the presence of tendinopathy remains somewhat controversial. It has been proposed that corticosteroid
injection in or around a tendon induces collagen necrosis that can influence the elasticity and strength of the tendon. Tendon rupture after locally administered corticosteroid has been reported in both equine and human patients, and repeated injection at short time intervals should be avoided.

References