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How to Perform and Interpret Navicular Bursography

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The injection of contrast material into the navicular bursa, accompanied by a subsequent radiographic examination, provides new and relevant information about pathologic damage to the navicular flexor fibrocartilage, the deep digital flexor tendon, and adjacent structures. A small percentage of injuries that can be identified by bursography have not been identified on magnetic resonance imaging. Author’s address: Anoka Equine Veterinary Services, 16445 70th Street NE, Elk River, MN 55330; e-mail: turner@anokaequine.com. © 2013 AAEP.

1. Introduction
Palmar foot pain is a common cause of lameness. Many aspects of this lameness syndrome, including the pathogenesis, diagnosis, and treatment, are controversial, in part because there is little agreement as to what characterizes this common disease.1,3 Traditionally, the diagnosis of palmar foot pain is based on history, clinical signs, response to palmar digital analgesia, and the detection of radiographic abnormalities. However, many recent reports suggest difficulties in reliably interpreting radiographic changes within the navicular bone.5 Hence, magnetic resonance imaging (MRI) has become the standard for definitive diagnosis of underlying pathology in this lameness syndrome.3 Lesions that have been diagnosed by MRI include core deep digital flexor injuries, superficial tears of the deep flexor within the navicular bursa, erosions of the navicular flexor fibrocartilage, and desmitis of the distal digital annular ligament.3,4 Unfortunately, not all clients with horses with palmar foot pain choose MRI because of the expense or the inconvenience. In these cases, other methods must be used when radiography fails to define a diagnosis. The objective of this report is to discuss how to perform navicular bursography and discuss interpretation of results.

2. Materials and Methods
Injection into the bursa was made from the palmar surface with the limb flexed at the carpus. Aseptic injection techniques were used to inject a 3-mL mixture of 1:1 contrast material and local anesthetic or medication.5 The landmark for needle insertion was a point just proximal to the central sulcus of the frog, with the needle directed toward the apex of the frog and in a direction parallel to the ground surface of the hoof. Needle insertion is made easier if regional analgesic injection of the medial and lateral palmar nerves is performed first, or, in the instance of “blocking” the bursa for diagnostic purposes, a small bleb of local anesthetic over the site of insertion is very helpful. A 20-gauge, 3.5-inch (9-cm) needle was used. The needle was inserted until resistance was encountered; this was usually at two-thirds the length of the needle (Fig. 1A). If the needle was inserted further before encountering resistance, it usually indicated incorrect placement.
A lateral radiograph of the hoof was taken to confirm the position of the needle before injection. Ideally, the needle tip was positioned midway between the proximal and distal borders (Fig. 1B). Once the needle position was confirmed, the bursa was injected with the contrast mixture and a second lateral hoof radiograph was taken to confirm the filling of the bursa. If the bursa had been successfully injected, then a palmarproximal-palmarodistal (PP-PD) oblique projection of the navicular bone was obtained. The contrast material seen from a lateral view normally had the shape of an apostrophe. The contrast, seen from the PP-PD projection, was a distinct line of contrast material juxtaposed to the deep digital flexor tendon that was normally separated from the navicular cortical bone by a layer of radiolucent fibrocartilage (Fig. 2).

The bursograms were evaluated for several different changes: (1) normal flexor fibrocartilage seen as a uniform radiolucent area 1 to 2 mm in thickness covering the flexor surface of the navicular bone; (2) thinning or erosions of the flexor fibrocartilage, seen as a loss of the thickness of the previously mentioned radiolucent line; (3) fibrillation or splits of the deep flexor tendon within the navicular bursa, which was noted as filling defects along the bursal surface of the deep flexor tendon; (4) presence of flexor subchondral bone cystic defects, which were noted as focal filling of the flexor cortical area with contrast; (5) communication of the navicular bursa with the distal interphalangeal joint, seen as leakage of the contrast from the bursa into distal interphalangeal joint; (6) complete focal loss of the dye column, which was thought to be a result of flexor tendon adhesion to the bone; (7) narrowing or enlargement of the proximal to distal borders of the navicular bone.
bursa (bursa change) thought to represent inflammatory changes of the bursa; (8) leakage of contrast from the bursa, suggesting a tear of the border of bursa; (9) marked widening of the contrast thickness thought to indicate loss of palmar support of the tendon by the distal annular ligament; (10) contrast within the body of the tendon thought to be a focal deep flexor tear; (11) contrast within the impar ligament assumed to be indicative of tearing or damage to the impar ligament; and (12) contrast within or surrounding the proximal suspensory of the navicular bone indicative of ligament injury.

3. Results
The author has performed 344 bursograms. Normal fibrocartilage was seen in 29% of examinations. Thinning or erosion of the flexor fibrocartilage was seen in 62% of the bursograms. Fibrillation of the deep flexor tendon was recognized in 24% of the bursograms. Subchondral defects were seen in only two cases. Communication between the navicular bursa and the distal interphalangeal joint was noted in 11% of the contrast studies. Bursal tears were seen in 18% of the bursograms. Bursa changes were noted in 24%. Proximal suspensory tears were noted on 5%. Four of the changes were only seen in horses with unilateral lameness: (1) adhesions (loss of the dye column) were noted in 8% of the horses; (2) loss of distal annular ligament support was found in 1% of the horses examined; (3) contrast filled areas of the deep flexor in 3% of the horse; and (4) the impar ligament was involved in 1% of horses.

Evaluation of bilateral bursograms revealed two populations: 43% of the horses with bilateral examinations had similar changes on both feet, but 57% of the horses had completely different changes. Secondly, the bursa changes were more numerous on the more lame leg in all cases. Four horses had repeat bursograms. In two of the horses, the changes noted were worse on subsequent bursograms, whereas in the other two, the abnormalities seen in the repeat bursograms were unchanged.

Therapeutic injection of the navicular bursa was an important aspect of managing these cases, and treatment was considered successful in 87% of the horses. Therapy was unsuccessful on horses with adhesions, horses in which the most striking lesion was deep flexor fibrillation, and horses with complete loss of cartilage from the flexor surface of the navicular bone.

Since the original description of navicular bursography in 1998, the author has noted six other changes that have not been previously described on bursograms: (1) tears in the core of the deep flexor tendon extending from the bursa up the pastern (Fig. 3); (2) tears in the bursa seen as leakage from the bursa (Fig. 4); (3) displacement of the deep flexor tendon from its normal position behind the navicular bone (Fig. 5); (4) contrast within the impar ligament (Fig. 6); (5) contrast within and around the proximal navicular ligament (Fig. 7); and (6) changes in the normal shape of the navicular bursa (Fig. 8A,B).

4. Discussion
Navicular bursography was originally devised to confirm an injection of local anesthetic into the bursa. Navicular bursography is used to further evaluate the navicular bursa region when standard radiographs failed to discern the pathology. The most common finding noted is thinning or erosions of the flexor fibrocartilage. This is consistent with pathologic studies that have shown thinning and erosions of the flexor fibrocartilage to be the most
common pathology seen in navicular disease. It follows that the flexor fibrocartilage is the most fragile structure in this area and therefore the most readily damaged. Although this is the most common change seen, it is not more important than any other change. The third most common finding is splits or filling defects along the bursal surface of the deep digital flexor tendon. This is a common MRI finding as well. In these cases, these splits were invariably associated with thinning and erosions of the flexor surface of the navicular bone.

Communication between the bursa and the distal interphalangeal joint is a sign of coffin joint capsule injury and is often associated with collateral ligament desmitis. The bursa and joint are in close proximity, and injury to the palmar capsule could result in this communication. Adhesions of the deep flexor to the navicular bone were seen as gaps in the dye column. A previous study proved these to be adhesions on necropsy.

MRI has detected fibrous scar tissue between the proximal suspensory ligament of the navicular bone and the deep digital flexor tendon. Contrast studies show this finding as a shortening of the length of the bursa. The bursa loses its apostrophe shape and is seen as a small fluid sac only as long as the navicular bone. This illustrates some of the restriction that is thought to occur as a result of this
pathology.3 This was described as bursal change in this study, and it included both the constriction and enlargement of the bursa. Tearing of the abaxial border of the bursa is seen as leakage of the dye from the bursa. This is a lesion that has not been reported by MRI or any other pathologic studies. The reason for this is that the leaks are small and only detectable by a dynamic study such as was performed here. From a pathologic standpoint, it would be expected to cause bursitis.

Dye may fill into the deep flexor tendon. This is one of the most common findings seen with MRI. It would be expected that bursography would underestimate this lesion because to fill the injury, it must communicate with the bursa. However, if identified, this offers another avenue to treat the tendon by injecting the bursa. For example, stem cells or platelet-rich plasma could be injected into the bursa and fill the same defect as the dye. Injury was also noted in this study to the impar ligament and collateral sesamoidean ligament (proximal suspensory of the navicular bone). Both have been seen with MRI. Another injury seen with MRI is distal annular ligament desmitis.4 In these cases, the lesion caused constriction of the deep flexor tendon. In this study, this injury was diagnosed when the contrast filling the bursa delineated a wider area. The only way this can occur is if there is more space between the deep flexor tendon and navicular bone. The PP-PD radiographic projection is performed with the leg positioned so that the tension on the deep flexor tendon and between the deep flexor tendon and navicular bone is at its greatest. Therefore, to allow this greater filling of the bursa, an injury has had to occur to allow the tendon to displace in a more palmar direction. Desmitis of the distal annular ligament would fulfill these criteria. It is hypothesized in the cases reported here that this may be a more acute phase of the same injury. In the cases in which bursography identified this lesion, the horses were kept active to prevent constriction of the annular ligament as it healed.

5. Conclusions

Navicular bursography is a simple technique that can be used to confirm injection into the navicular bursa and can also give valuable new information regarding pathology in the region of the navicular bone. Changes seen by means of contrast navicular bursography represent stages of pathologic damage and allow a more timely therapeutic intervention, more targeted management, and more accurate
prognostication. Bursography offers another imaging modality to study pathology of navicular region. This is a technique that can be performed when MRI is not an option.

References