How to Inject the Synovial Cavities of the Digit

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1. Introduction
Arthrocentesis of the equine interphalangeal joints and synoviocentesis of the digital synovial sheath is commonly performed for diagnostic analgesia as part of a lameness examination and to medicate these structures. The techniques for arthrocentesis are the same for the forelimb and the hind limb. Restraint is achieved by applying a lip twitch to the horse. Tranquilization or sedation is rarely used for restraint when centesis of these structures is part of a lameness examination, but in some cases tranquilizing or sedating the horse may be necessary to increase the safety of the procedure. Administration of a low dose of xylazine, detomidine, or acepromazine is unlikely to interfere with gait evaluation1-4 and in some cases may even accentuate lameness. If centesis is performed with the foot bearing weight, the contralateral limb can be held by an assistant. Some horses, however, may buckle at the carpus when the needle is inserted, causing injury if the carpus strikes the ground.

2. Materials and Methods
Arthrocentesis of the Distal Interphalangeal Joint
At least 6 approaches to the distal interphalangeal (DIP) joint have been described: the dorsal perpendicular, the dorsal parallel, the dorsal inclined, the dorsolateral, the lateral, and the palmar ap-
Dorsal Parallel Approach to the DIP Joint

For a dorsal parallel approach, the needle is inserted parallel to the bearing surface of the foot through or immediately proximal to the coronary band (Fig. 4). In the primary author's experience, firm digital pressure at the site of arthrocentesis immediately before insertion of the needle may lessen the horse's reaction to the procedure. The needle can be inserted on the middle sagittal plane or slightly medial or lateral to this plane. The needle passes through the digital extensor tendon to enter the dorsal pouch of the DIP joint, which covers most of the dorsal aspect of the middle phalanx. Inserting the needle too far proximal to the coronary band for a parallel approach may result in arthrocentesis of a distodorsal pouch of the proximal interphalangeal joint (Fig. 5). We are unaware of any reports of complication caused by needle puncture of the digital extensor tendon other than a report of mineralization in the tendon at the site of injection. Gandini speculated that administration of corticosteroid (with subsequent leakage at the injection site) may be the cause of this complication. If mineralization of the digital extensor tendon is a potential complication of arthrocentesis of the DIP joint, its occurrence probably is insignificant. Using a variation of the dorsal parallel approach, the dorsal inclined approach, a needle is inserted perpendicular to the skin surface immediately proximal to the coronary band (Fig. 6). This approach, reported by Kaneps, was found to be more accurate and easier to perform than was the dorsal perpendicular or dorsolateral approaches for accessing the DIP joint.

Lateral Approach to the DIP Joint

The DIP joint also can be entered using a lateral approach. A 1-inch (2.54-cm), 20- to 22-gauge needle is inserted through the skin, just above the palpable depression in the proximal edge of the lateral collateral cartilage. The needle is directed medially at a 45° angle distally and 20° palmar to penetrate the palmar pouch of the DIP joint. The needle is directed distally, perpendicular to the bearing surface of the hoof.
ommended site of insertion, particularly if a needle longer than 1 inch (2.54 cm) is used, or if the procedure is performed with the limb held in a flexed position.13,14 The lateral approach appears to be accurate for arthrocentesis of the DIP joint only when a needle no longer than 1 inch is inserted with the horse standing squarely.14

Palmar Approach to the DIP Joint
A palmar approach to the DIP joint was described by McIlwraith and Goodman,15 who cited a report of the procedure described in a German publication.10 In the German publication, complication of periosteal reaction at the site of capsular attachment on to the distal phalanx and hemorrhage associated with a dorsal perpendicular approach to the DIP joint prompted investigation of a palmar approach to the DIP joint.10 The site for injection is a point on the palmar midline slightly proximal to the deepest indentation of the fossa proximal to the bulbs of the heel. A 3.5-inch (9-cm) spinal needle is directed dorsally aiming for a point halfway between the coronet and the bearing surface of the hoof at the toe (Fig. 9). The advantages cited for using this technique are less vascularity of periarticular structures and the large size of the palmar pouch of the DIP joint. Obvious disadvantages of a palmar approach are that the deep digital flexor tendon must be penetrated to access the joint and the close prox-
imity of the navicular bursa. We are unaware of any studies that have examined the accuracy of this approach.

The clinician should be aware that administration of 5 or 6 mL of local anesthetic solution into the DIP joint desensitizes not only the DIP joint but also the toe region of the sole and the navicular bone and its supporting structures.16–18 When a large volume (ie, 10 mL) of local anesthetic solution is administered into the DIP joint, the palmar portion of the sole is also desensitized.19

Arthrocentesis of the Proximal Interphalangeal Joint

At least four approaches to the proximal interphalangeal (PIP) (pastern) joint have been described. These include a dorsal approach,6,7,20 a dorsolateral approach,5,8,20 a palmaroproximal approach,21 and a lateral approach.22 Synovial fluid is frequently observed with the palmaroproximal and lateral approaches21,22 but is observed rarely using the other approaches. Three of these four methods for arthrocentesis of the PIP joint were evaluated for accuracy by Poore et al, who found that students inexperienced in arthrocentesis of the PIP joint were only 32%, 48%, and 36% successful when performing the dorsal, dorsolateral, and palmaroproximal ap-
approaches, respectively. A 20-gauge, 1.5-inch (3.8-cm) needle is used for the dorsal and dorsolateral approaches, but a 1-inch (2.5-cm) needle is sufficient for the lateral and palmarproximal approaches. The palmarproximal approach is performed with the limb held, and the lateral approach is performed with the limb bearing weight. The dorsal and dorsolateral approaches to the PIP joint can be performed with the limb held or bearing weight.

Dorsal Approach to the PIP Joint

To perform the dorsal approach to the PIP joint as described by Wheat, the needle is inserted on the dorsal midline about 1 cm distal to an imaginary line drawn between the medial and lateral eminences for attachment of the collateral ligaments on the distal end of the proximal phalanx and is directed obliquely distally and medially. To perform the dorsal approach to the PIP joint as described by Stashak (needle B), the needle is inserted on the dorsal midline one-half inch (1.3 cm) proximal to the imaginary line between eminences and directed slightly distally and slightly medially.

Dorsolateral Approach to the PIP Joint

To perform the dorsolateral approach as described by Gabel, the PIP joint is entered by placing a needle at the lateral edge of the common digital extensor tendon, about one-half inch (1.3 cm) off the middle sagittal plane of the limb on an imaginary line drawn between the medial and lateral eminences for attachment of the collateral ligaments on the distal end of the proximal phalanx, one-half inch (1.3 cm) from the middle sagittal plane of the limb and to direct the needle medially, parallel to the ground (Fig. 11).

Lateral Approach to the PIP Joint

To perform the lateral approach as described by Canonici, the PIP joint is entered by inserting the needle directly through the lateral collateral ligament midway between the eminences for the attachment of the collateral ligament on the proximal and middle phalanges. The needle is directed in a slightly proximal to distal direction (Fig. 12). Synovial fluid usually flows from the needle to indicate that the needle has entered the joint. We are unaware of studies comparing the efficacy of this approach to the PIP joint with other approaches to the
joint or reports of complications associated with placing a needle directly through the collateral ligament of the joint.

Dorsolateral Approach to the PIP Joint
To perform the palmaroproximal approach to the PIP joint as described by Miller et al., the needle is inserted into a “V”-shaped depression formed by the palmar aspect of the proximal phalanx dorsally and the lateral branch of the superficial flexor tendon as it inserts on the middle phalanx palmarodistally (Fig. 13). The needle is directed distomedially at an angle of 30° from the transverse plane. The palmaroproximal approach was found to be often inaccurate, with inadvertent injection of the digital synovial sheath when attempted by veterinary students without prior experience.

Palmarolateral Approach to the PIP Joint
A palmarolateral approach to the PIP joint was reported by Moyer and Carter, who described the site of needle insertion to be immediately proximal to the transverse bony prominence on the proximopalmar border of the middle phalanx. The needle is inserted perpendicular to the sagittal plane close to the palmar border of the proximal phalanx (Fig. 14). To our knowledge, accuracy of the palmarolateral approach has not been investigated.

Synoviocentesis of the Digital Synovial Sheath
The digital synovial sheath can be entered at any of the lateral pouches evident along its length, which is from the distal portion of the third metacarpus/metatarsus to the palmar aspect of the proximal half of the middle phalanx. When the sheath is effused, these pouches are visible in places where the sheath is not encased by annular ligaments (Fig. 15). Even when the sheath is not effused, it often can be entered on the palmar aspect of the pastern between the proximal and distal digital annular ligaments, where the deep digital flexor tendon lies close to the skin (Fig. 16). To access the pouch at this location, the point of the needle must remain superficial to the deep digital flexor tendon. The appearance of synovial fluid in the needle hub indicates successful synoviocentesis.

A primary indication for synoviocentesis of the digital synovial sheath is diagnosis of and treatment for various traumatic, infectious, and inflammatory disorders of the sheath. In these cases, the sheath is usually effused, thereby simplifying synoviocentesis. An additional indication for synoviocentesis is diagnostic analgesia, in which case, the sheath is often not effused, thus hampering synoviocentesis. The palmar axial sesamoidean approach to the digital synovial sheath described by Hassel et al was 100% accurate in accessing the sheath when the sheath was not distended with synovial fluid.
To perform the palmar axial sesamoidean approach to the digital synovial sheath, a 20-gauge, 1-inch (2.5-cm) needle is placed at the level of the midbody of the lateral proximal sesamoid bone, 3 mm axial to its palpable palmar border and immediately palmar to the palmar digital neurovascular bundle (Fig. 17). The needle is directed disto-medially at an angle of 30° from the transverse plane.

To perform the palmaroproximal approach to the PIP joint, the needle is inserted into a “V”-shaped depression formed by the palmar aspect of the proximal phalanx dorsally and the lateral branch of the superficial flexor tendon as it inserts on the middle phalanx palmarodistally. The needle is directed disto-medially at an angle of 45° to the sagittal plane, aiming toward the central intersesamoidean region.

When the digital synovial sheath is effused, pouches are visible in places where the sheath is not encased by annular ligaments.

Fig. 13. To perform the palmarproximal approach to the PIP joint, the needle is inserted into a “V”-shaped depression formed by the palmar aspect of the proximal phalanx dorsally and the lateral branch of the superficial flexor tendon as it inserts on the middle phalanx palmarodistally. The needle is directed disto-medially at an angle of 30° from the transverse plane.

Fig. 14. To perform the palmarolateral approach to the PIP joint, the needle is inserted perpendicular to the sagittal plane close to the palmar border of the first phalanx proximal to the transverse boney prominence on the proximopalmar border of the middle phalanx.

Fig. 15. When the digital synovial sheath is effused, pouches are visible in places where the sheath is not encased by annular ligaments.

Fig. 16. The digital synovial sheath can be entered at any of the pouches evident along its length. Even when the digital synovial sheath is not effused, it often can be entered on the palmar aspect of the pastern between the proximal and distal digital annular ligaments, where the deep digital flexor tendon lies close to the skin (needle A).
A possible disadvantage of this approach is that the needle is likely to penetrate the flexor tendons. It is unlikely, in our experience, that penetration of the flexor tendons by the needle has any clinical significance.

Figures 4, 7, 10, 13, 15, and 16 are adapted from Moyer W, Schumacher J, Schumacher J. A Guide to Equine Joint Injections and Regional Anesthesia, courtesy of Dr. Amy Benz, Academic Veterinary Solutions LLC.

References

