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REPORT OF A TECHNIQUE

# THORACIC FACET BLOCKS: BENT NEEDLE TECHNIQUE

Joseph D. Fortin, DO, and Mary Jane McKee, PA-C

Thoracic posterior joints are putative pain generators; yet there is a paucity of information to assist the clinician in the diagnosis and treatment of dorsal spine pain. A safe and effective bent needle injection/arthrography technique is described which can assist in the diagnosis of some patients with thoracic zygapophyseal joint dysfunction.

*Keywords:* Thoracic spinal pain, zygapophysial joint, bent needle technique

When considering the existing body of knowledge pertinent to the thoracic joints, the notion that these joints are potential pain sources is an attractive one, yet experimental evidence to ratify or refute this concept has, until recently, been insufficient.

Numerous clinical reports ascribe various dorsal referral pain patterns to the thoracic zygapophyseal joints (1-4). An animal model (i.e. monkey) demonstrated the rich innervation of the thoracic posterior joints (5) and preliminary dissection investigation suggests articular nerve twigs emanate from the medial branch of the dorsal rami above and below each joint (1, 6). Thoracic posterior joints share innervation with interspinous structures, which have, upon experimental provocation, been shown to be sources of referred pain (3, 4). Hence, the existence of dorsal zygapophyseal joint referred pain may be extrapolated from these findings. Moreover, a recent investigation validated pain referral patterns from the thoracic posterior joints (7). The latter investigation paralleled previous ones employing cervical and lumbar intra-articular provocative injection, which demonstrated that the posterior joints can cause neck or back pain, and are provoked in a reproducible manner upon stimulation (8-10).

## Anatomy of the Thoracic Facet Joints

Thoracic facet joints are paired diarthrodial joints. C7-T1 are the most superior thoracic facet joints, while T12-L1 are considered the most inferior. Orientation of the upper and mid thoracic zygapophyseal joints is predominately in the coronal plane. Cervicothoracic (C7-T1) and thoracolumbar (T11-T12 and T12-L1) joints show transitional cervical and lumbar facet joint features, respectively. Cervicothoracic joints assume a more transverse orientation whereas the thoracolumbar joints assume a more sagittally orientation (11).

Thoracic facet joints are synovial joints as are the cervical and lumbar facet joints. Like other synovial joints the thoracic facet joints contain a joint space, a synovial cartilage membrane, hyaline cartilage, and a fibrous capsule. Articulating surfaces of the joints are lined with hyaline cartilage. Their fibrous capsules are thick and consist of glycosaminoglycans and type I, III, and VI collagen. Ligamentum flavum and posterior ligamentous complex reinforce the capsules. Histology of the capsules reveals both mechanoreceptors and nociceptors in humans (11).

Facet joints of the thoracic spine are innervated from the medial branches of the dorsal rami. Each joint receives two innervations, one from the dorsal rami above the joint and one at the level of the joint. Unlike the medial branches that supply the upper and lower thoracic joints by crossing directly over and around the superolateral aspect of the transverse processes before innervating the joints, the mid-thoracic facet joints (T5 though T8) are innervated by medial branches that are displaced somewhat cephalad and suspended in the intertransverse space.

## Materials and Methods

The patient is sterilely prepped and draped, on a standard overhead fluoroscopy table, in prone position. Pre-procedural sedation is rarely required because the discomfort is minimal and the procedure is accomplished swiftly with a 25-gauge 3.5-inch spinal needle.

An image intensifier controlled segmentation count beginning at C1 is performed to insure selection of the proper level(s). The zygapophyseal joints are bounded above and below by the vertebral pedicles on either side. Therefore, the pedicles are used as primary landmarks. The skin entry site is made alongside the medial aspect of the caudal pedicle (e.g. T5 pedicle for a T4-5 injection) at the junction of the mid and the lower third of the pedicle.

Prior to the injection, a standard 25 gauge 3.5 inch spinal needle is gently bent back on itself, approximately one-half inch from the tip: so that the bevel faces away from the bend. Two purposes are served with this slight bend (approximately 15 degrees). First, the bend allows the needle tip to conform to the slope of the joint after engaging the capsule. Second, if the initial attempt is met with bony resistance (since the inferior margins of the joint are often irregular), the apex of the angle serves as a fulcrum to pivot the needle tip around to pierce another portion of the capsule.

The needle should enter perpendicular to the skin with the bevel facing downward. The orientation of the bevel and the subtle needle bend will automatically "steer" the needle at a suitable angle to the skin. Under an intermittent AP fluorosco-

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From Spine Technology and Rehabilitation, Fort Wayne, IN. Address Correspondence: Dr. Joseph D. Fortin, DO, Spine Technology and Rehabilitation, 7230 Engle Road, Suite 210, Fort Wayne, IN-46804. E-mail: Fortin@pol.net.

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py beam, the needle is advanced upward and laterally at a point just superior to the caudal pedicle: which lie at approximately the "12 o'clock" position of the pedicle.

The periosteum of the lamina is struck just inferior to the tip of the inferior articular process. As the needle is further advanced, the substance of the joint capsule is penetrated and the bend/bevel combination work synergistically to conform to the angulation of the joint space. The clinician typically feels the needle tip wedge in the inferior aspect of the point. If the needle tip "slips off" the inferior articular process, it is withdrawn slightly and redirected toward the zygapophysial joint. The facet joint can often be filled simply by penetrating the dorsomedial capsule, medial to the joint space.

Once the needle has penetrated the joint capsule, contrast medium is injected under image intensifier control to verify the needle position. The joint capsule is then fully distended with a radiopaque contrast agent (usual capacity is less than 0.8 mL) to determine if a provocation response is present, and graded accordingly. If the characteristic, circular, AP arthrography pattern (Fig. 1) is not immediately identified, then the needle is repositioned to repeat the above process.

After confirming correct needle placement, 0.5 to 0.75 mL of 0.75% Bupivacaine is then instilled into the facet joint. The patient is then reexamined in 15 minutes to determine if symptoms have abated after the injection. A favorable anesthetic response should be substantiated with a confirmatory block and at least one control level. Pain elicitation by mechanical stimulation upon attempted distention of the thoracic zygapophyseal joint may be suboptimal if the inferior recess extravasation (which is common) occurs. Hence, the analgesic response (versus provocation) is standard diagnostic measure. The patient is then instructed to maintain a pain journal to determine if the duration of the symptoms is congruent with the anesthetic action.

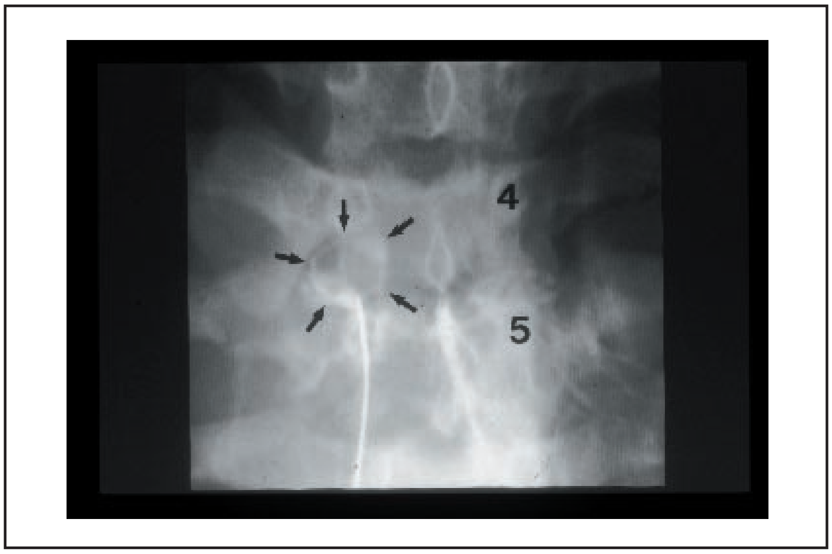

*Fig. 1: AP arthrography of the T4-T5 facet joint.*

## RESULTS

Twenty-five individuals with a history of chronic mid to upper dorsal pain (pain for more than 6 months) were selected for this study. Following informed consent, injections were performed on all subjects employing the aforementioned technique. Injection sites at a single level were selected by matching the pain diagrams and physical examination with standard referral zones (7). There were no complications during the procedures and no subsequent side effects. The thoracic facet joints were identified as the pain generator in twenty of the twenty-five subjects (80%) upon review of the pain journals. These participants obtained at least 70% relief (on a 0 - 10 VAS) of dorsal back pain for the duration of the anesthetic.

## DISCUSSION

In the past, interest in resolving the differential diagnosis of patients with dorsal pain has been diluted with reservation surrounding the lack of data, which unequivocally documents thoracic structures as putative pain sources. Recently, thoracic posterior joint pain patterns were described in asymptomatic volunteers, shedding light on this dilemma (7).

The mid and upper thoracic zygapophyseal joints are predominately oriented in the coronal plane in contrast to the sagittally directed lower thoracic and thoracolumbar joints. The cervicothoracic zygapophysial joints are oriented in a transverse plane. These differences in anatomic orientation make it difficult to enter the transitional thoracic facet joints using the direct posterior approach commonly used for the thoracolumbar and upper lumbar joints. Since there is variation of the orientation of the mid-thoracic facet joints compared to the transitional thoracic joints, as well as individual differences and anomalies, the clinician must be able to adapt this technique to the variability. Because this technique allows for a more direct approach to the intended facet joint space (cutaneous insertion site is a half a motion segment below the intended joint) compared to a previously described technique (12) (cutaneous insertion site is one and half motion segments below the intended joint), there is less likelihood for misadventure. This technique also gives the clinician "steering power" to simply redirect the position of the needle if it does stray. The injection technique described herein allows the diagnostician to safely and effectively enter the mid and upper thoracic facet joints despite their apparent inaccessibility.

This thoracic zygapophyseal joint injection/arthrography procedure has been used to specifically identify the pain generator site in a subset of patients with dorsal pain. This technique is not recommended for the novice spinal diagnostician. Its application should be limited to those patients who have failed to respond to sound conservative management (13, 14) and have and otherwise non-diagnostic workup (e.g. negative imaging studies).

## CONCLUSION

This study demonstrates that the "bent needle" technique can be used safely and effectively to identify whether a mid or upper thoracic zygapophyseal joint is the pain generator site for chronic dorsal back pain. The primary role of this procedure is diagnostic, although anesthetizing a painful dorsal zygapophyseal joint may also facilitate the rehabilitation process.

**Author Affiliation**

**Dr. Joseph D. Fortin, DO**
Spine Technology and Rehabilitation
7230 Engle Road, Suite 210
Fort Wayne, IN-46804
E-mail: Fortin@pol.net

**May Jane McKee, PA-C**
Spine Technology and Rehabilitation
7230 Engle Road, Suite 210
Fort Wayne, IN-46804

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