

Thoracic Sympathetic Block and Radiofrequency Ablation

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Equipment and Monitoring

- Standard ASA monitoring
- Fluoroscopy
- Sterile prep, and drape
- Skin local anesthesia prior to any needle larger than 25G (unless sedation is used)
- Coaxial view is always used to advance needle, unless otherwise specified
- CPR equipment and medications available
- 22G, 3.5 inch (90 mm)–5 inch (130 mm) needle for diagnostic block, tip curved to facilitate steering
- 18–21G, 3.5 inch (90 mm)–5 inch (130 mm), 5 or 10 mm curved active tip radiofrequency cannula for radiofrequency ablation
- 2 ml 1% Lidocaine per site for diagnostic block and before radiofrequency ablation (RFA)
- Nonionic contrast

Anatomy

- Sympathetic chain at T2 and T3 thoracic level
- Target the junction of the posterior 1/3 and anterior 2/3 of the vertebral body

Structures to Keep in Mind and Possible Complications

- Intercostal artery, vein, nerve → bleeding/nerve damage
- Lung → pneumothorax
- Exiting nerve roots → nerve injury

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- Intraspinal structures → spinal, epidural injection
- Vena azygos → bleeding
- Thoracic duct → chylothorax (left side)
- Esophagus → discomfort, infection
- Trachea
- Vagus nerve
- Infection
- Bleeding
- Postprocedure pain
- Vasovagal reaction
- Allergic reaction

Fluoroscopy Technique, Target Localization

- Patient in prone position
- Anteroposterior (AP) image (Fig. 11.1a–c)
- Identify T2 level (then T3 for second needle placement)
- Square off vertebra with cephalad tilt (so needle will be eventually parallel to vertebral body endplates) (Fig. 11.2a–c)
- Oblique C-arm until vertebral body visualizes lateral to laminar edge (about 15–20°) (Fig. 11.3a, b)
- Entry point should be about 4 cm off midline, depending on body habitus
- Identify cephalad edge of corresponding rib and transverse process (TP)

Procedure Steps

- The procedure must be performed on the affected side at both T2 and T3 levels
- Needle #1 entry at T2 just cephalad to the 3rd rib and TP, at the junction of rib and vertebral body shadow
- Needle #2 entry at T3 just cephalad to the 4th rib and TP, at the junction of rib and vertebral body shadow

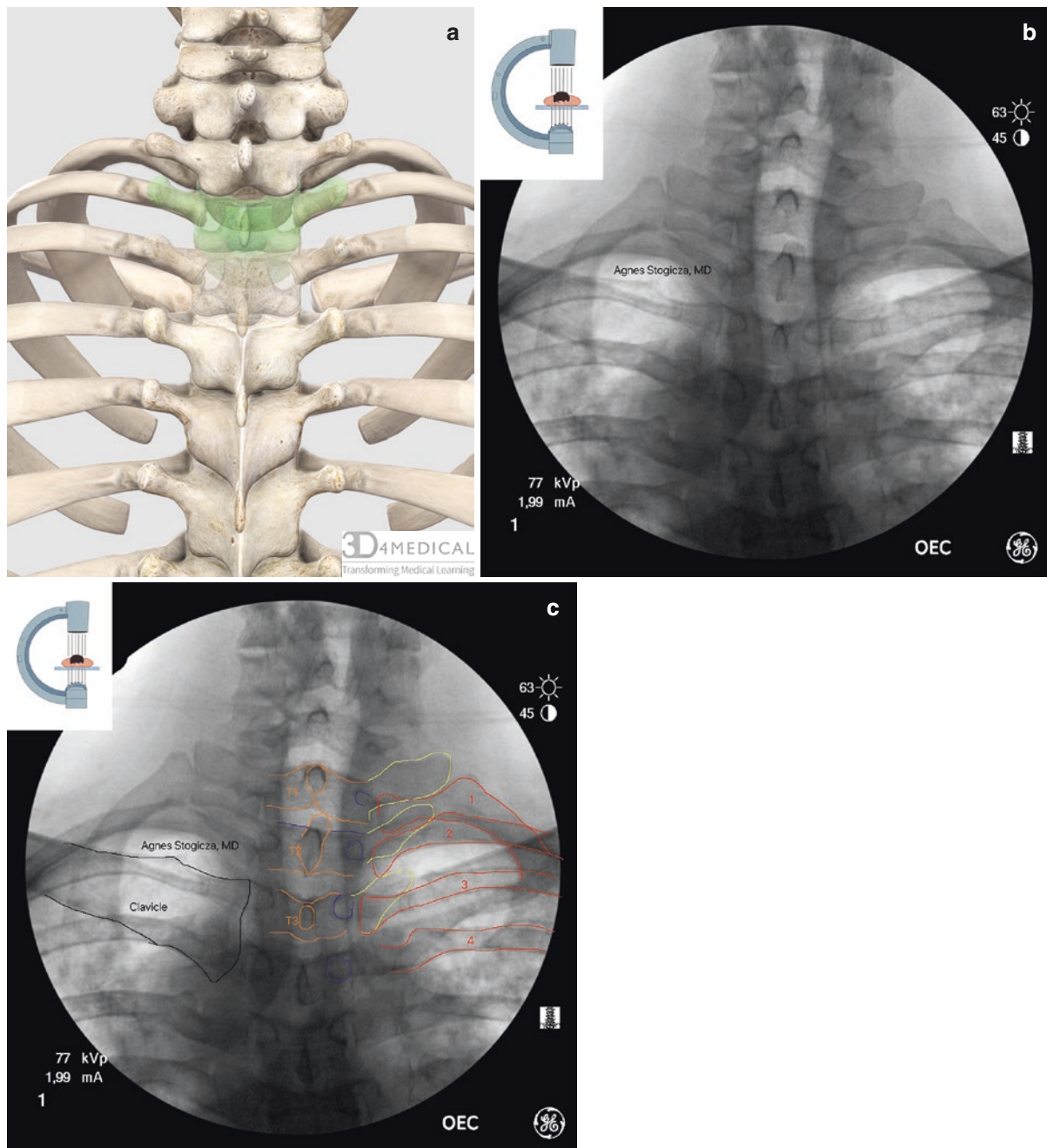


Fig. 11.1 AP view of the thoracic spine. True AP view, spinous processes in the midline. T1 is identified by the first rib. Orange = spinous process and lamina; yellow = transverse process; dark blue = pedicle;

red = ribs; Black = clavicle. Complete Anatomy image, T2 vertebra green highlighted, faded, T3 vertebra faded (a), native (b) and edited fluoroscopy images (c)

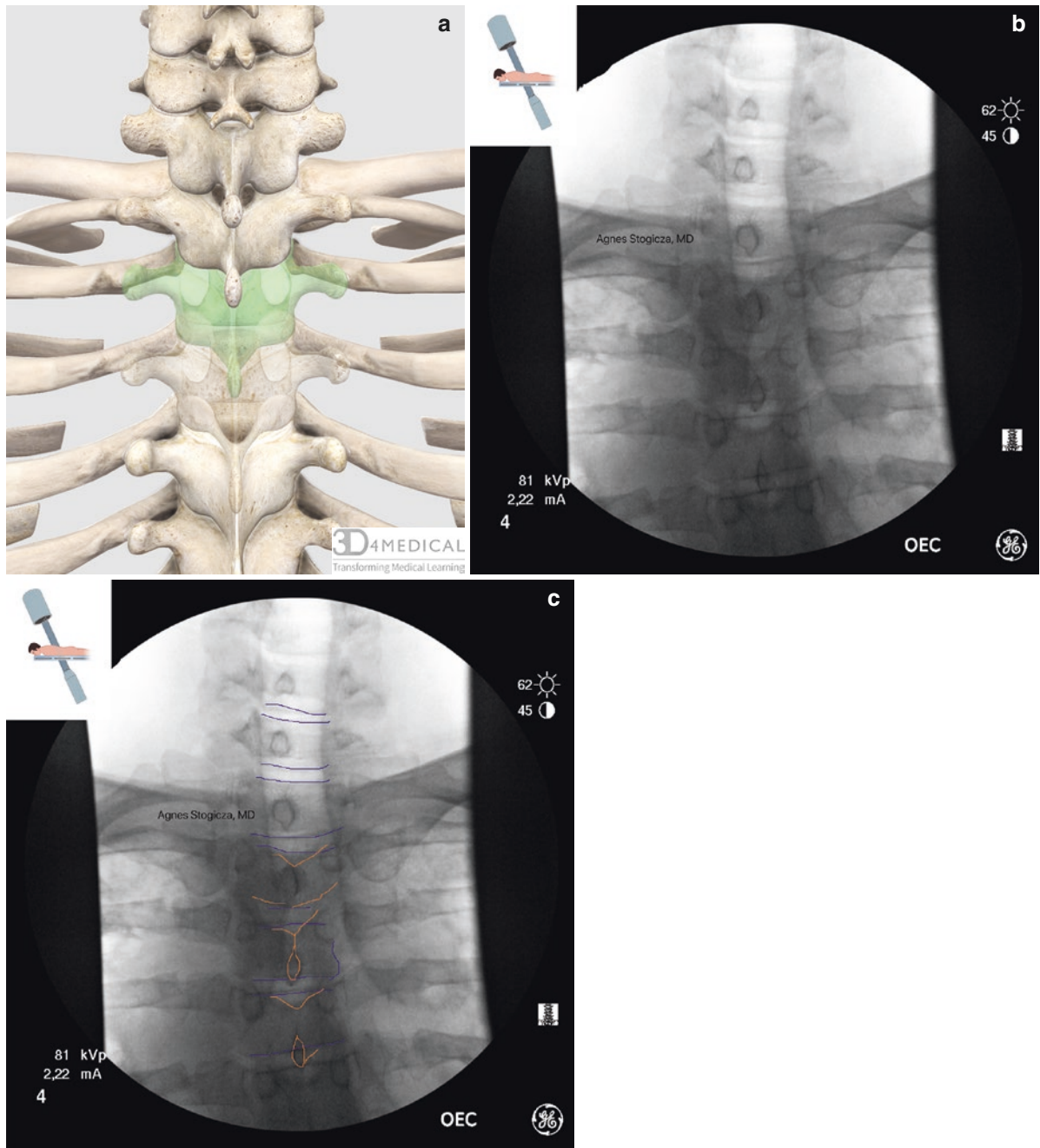


Fig. 11.2 AP view of the thoracic spine with cephalad tilt of the C-arm. Vertebral body endplates are lined up at the area of interest, which will allow the needle to be placed parallel to the endplates.

Orange = spinous process and lamina; purple = vertebral body. Complete Anatomy image, T2 vertebra green highlighted, faded, T3 vertebra faded (a), native (b) and edited fluoroscopy image (c)

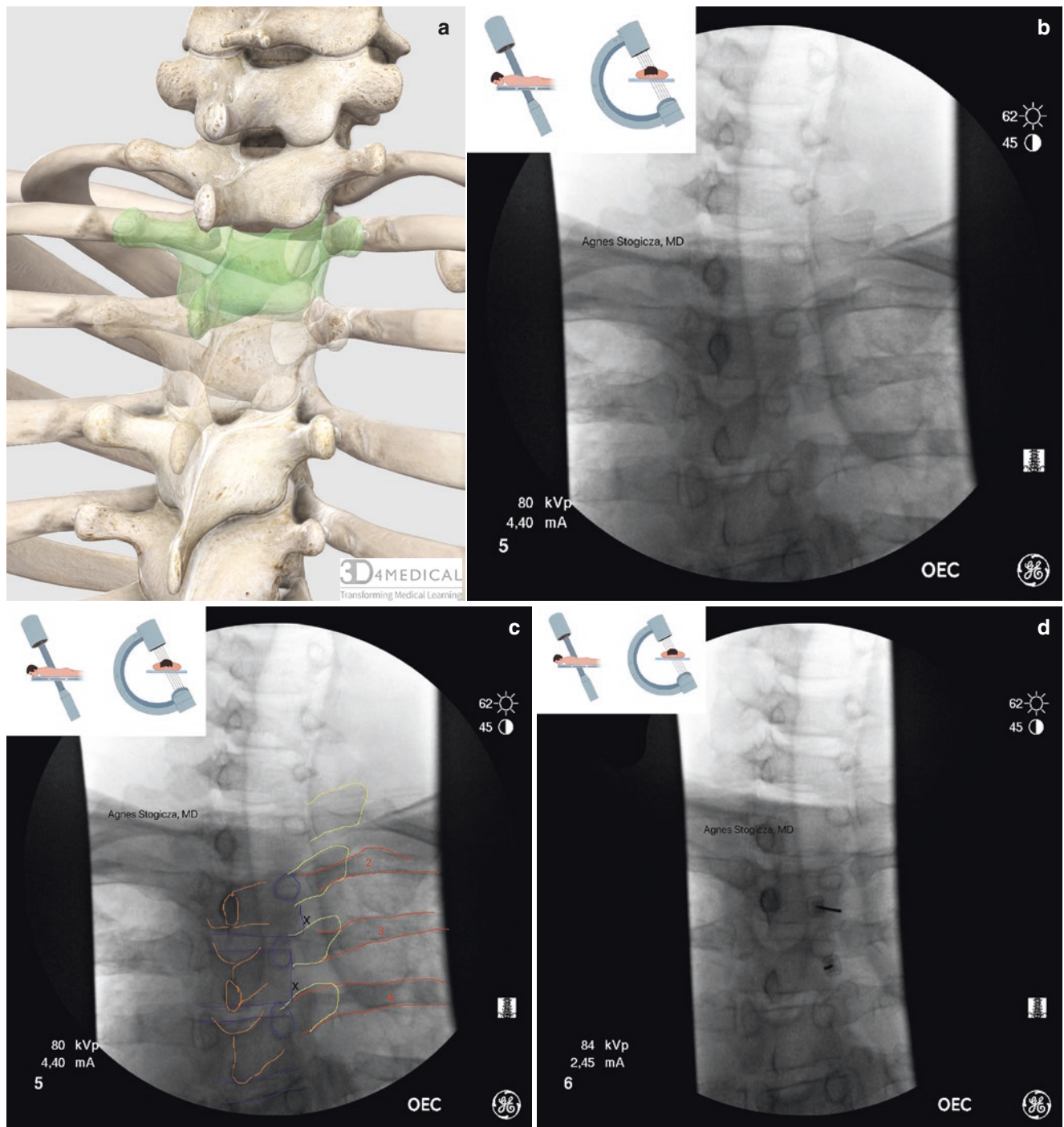


Fig. 11.3 Oblique view of the thoracic spine. C-arm is tilted in the cephalad then ipsilateral direction. Orange = spinous process and lamina; yellow = transverse process; dark blue = pedicle; red = ribs; purple = vertebral body, x marks the needle entry points, just cephalad from the transverse processes. Collimation helps visualization of the

area of interest, and decreases radiation. Complete Anatomy image, T2 vertebra green highlighted, faded, T3 vertebra faded (a), native (b) and edited fluoroscopy image (c). Needles are advanced in coaxial view to touch the vertebral body (d)

- Coaxial approach in order to touch vertebral body (Fig. 11.3c, d)
- Check lateral view to assess depth of needle
- Once the vertebral body is touched, wiggle anteriorly (rotate needle tip to and away from the vertebral body while advancing the needle) in lateral view, constantly keeping the needle contacting bone with fluoroscopy control until target is reached (Fig. 11.4a–c)
- AP view to confirm appropriate needle position (Fig. 11.5)

For diagnostic block:

- Aspirate for fluid (blood, cerebrospinal fluid (CSF) or chyle)
- Inject 1–2 ml of nonionic contrast
- Check the optimal dispersion of the contrast media in AP and lateral view. The contrast media must “hug” the vertebral body laterally
- Inject 2–3 ml of local anesthetic

For chemical neurolysis:

- Aspirate for fluid (blood, cerebrospinal fluid (CSF) or chyle)
- Inject 1–2 ml of nonionic contrast
- Check the optimal dispersion of the contrast media in AP and lateral view. The contrast media must “hug” the vertebral body laterally, and not track backwards to the neuroforamen
- Inject 2 ml of phenol 6–10% (not painful)

For radiofrequency (RF):

- Perform sensory and motor stimulation
- At 50 Hz, the sensory stimulation is conducted up to 1 V
- If patient reports stimulation or twitches in the arm or in the chest, the needle needs to be advanced anteriorly
- Inject 2–3 cc of local anesthetic
- Perform the RF lesion (60–90 seconds, 80 °C). Turn the RF needle 180° and perform another lesion

Clinical Pearls

- Notice that the thoracic vertebral bodies are narrower at this level than the lamina, so needle will eventually point medially
- Precise entry point identification is particularly important for ease of procedural performance

- On lateral view, it is often difficult to visualize the anterior borders of the vertebral bodies at T2 and T3 levels because of the shoulder; however, lower levels T4, 5, 6 vertebral bodies show well, allowing “projecting” a line identifying anterior portion of the vertebral bodies at the level of interest
- Collimating the fluoroscopy image helps good visualization of the spine
- Magnifying the image helps visualization, but increases radiation
- If performing radiofrequency ablation procedure, appropriate distance from exiting nerve root and intercostal nerve is crucial (Fig. 11.4c). 0.2 mV in stimulation roughly corresponds to 1 mm distance of nerve. For example, if patient notes intercostal stimulation at 1 mV, needle is about 5 mm distance of nerve
- Affected upper extremity veins will be dilated, and hand will be warm and dry upon successful block, with no sensory or motor block

Unacceptable, Potentially Harmful Needle Placement on Exam

- Rough needle manipulation
- Far lateral entry point, lack of awareness of lung in vicinity
- Not checking lateral view to assess depth of needle
- Compromise of intraspinal space
- Needle too dorsal, compromising exiting nerve root
- Needle advanced too anterior multiple times and not recognized by the candidate
- Any proof of lack of understanding of thoracic anatomy, for example, needle left far posterior behind pedicle line and believing it is in the right place

Unacceptable, But Not Harmful Needle Placement on Exam

- Placing the needle past the anterior third of the vertebral body
- The procedure was abandoned after unsuccessful attempts, but it was clear that the examinee was cognizant of the safety aspects of the procedure, the needle did not compromise vital structures, did not reach the epidural space and there was no cord compromise

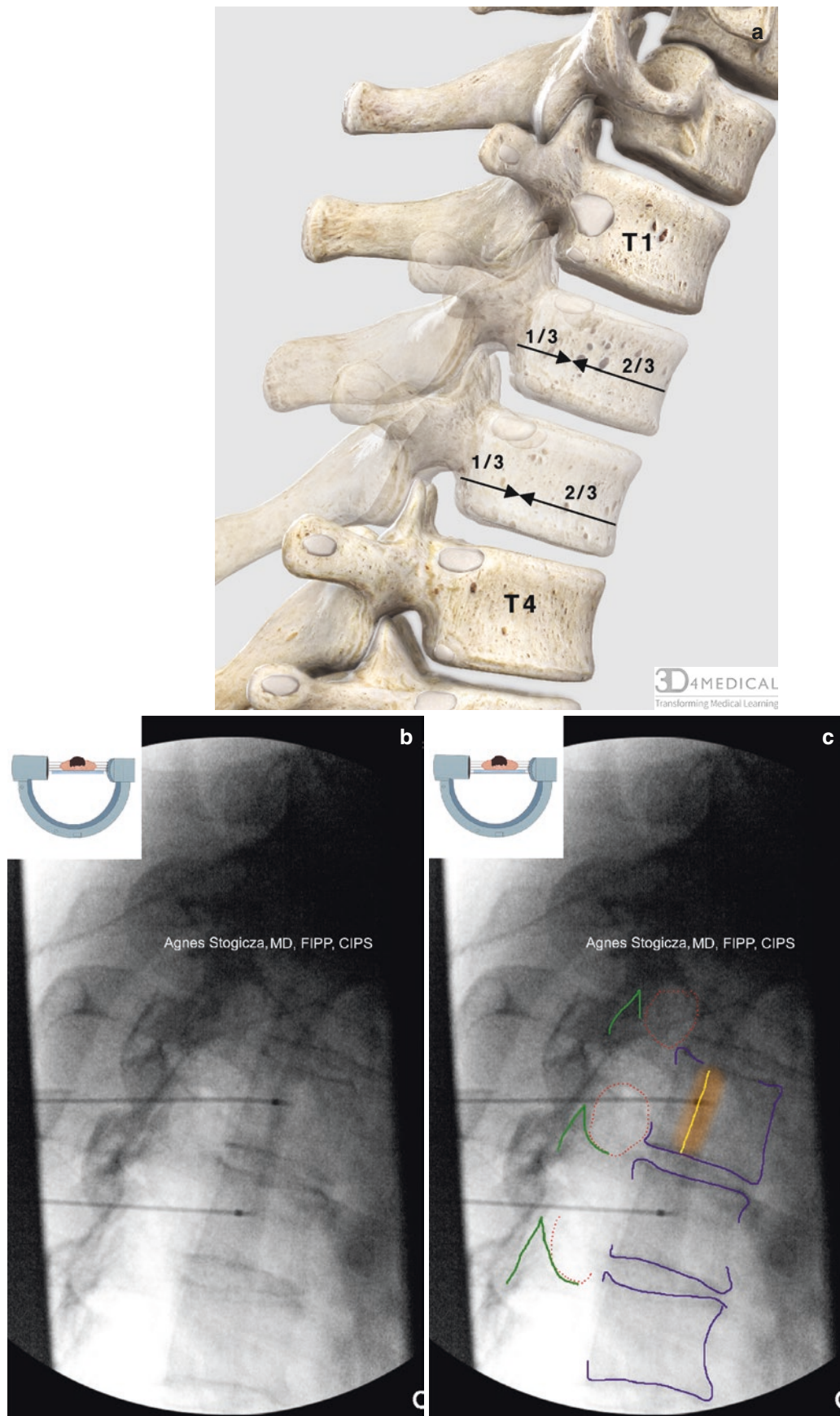


Fig. 11.4 Lateral view of the thoracic spine: Complete Anatomy image (a). Needle is positioned on target, at T2 and T3 level at the junction of the posterior one third and anterior two third junction of the vertebral body (b).

Purple = visible vertebral body contours, green = superior articular process, red dotted = neuroforamen. Yellow line marks the target zone for diagnostic block, orange zone marks the target zone for the active tip for RFA ablation (c)

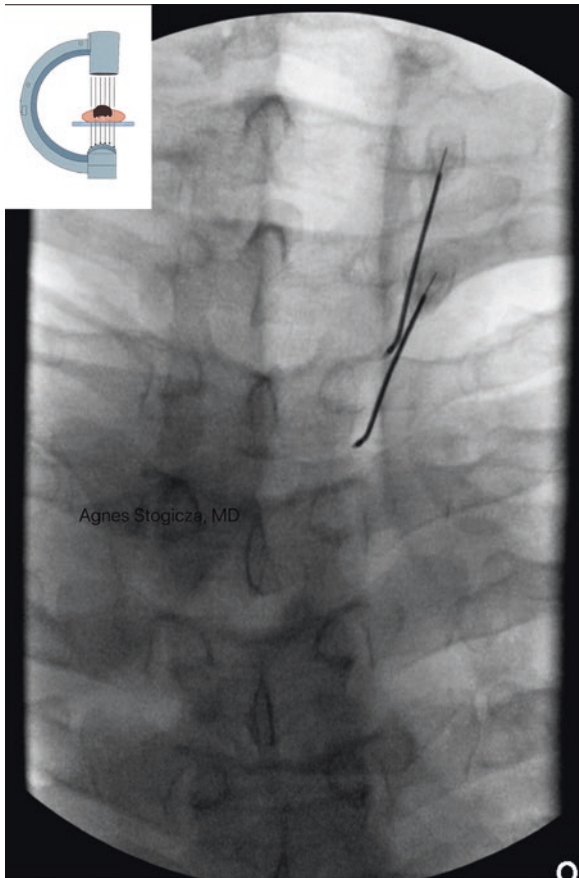


Fig. 11.5 Thoracic sympathetic block (radiofrequency ablation) AP view. Needles are positioned at T2 and T3 levels. Needles are pointing medially, “hugging” the vertebral body

Table 11.2 Level of evidence based on the American Society of Interventional Pain Physicians (ASIPP) review of the literature

Thoracic sympathetic blocks ¹	Evidence
Thoracic sympathetic block for CRPS	Level III

¹Vydyanathan A, Bryan G, Gritsenko K, Hansen H, Manhikanti L. Cervical and thoracic sympathetic blocks. In: Manchikanti L, Kaye AD, Falco FJE, Hirsch JA, editors. *Essentials of interventional techniques in managing chronic pain*. Springer International Publishing; 2018. p. 531–50.

Suggested Reading

- Kim WH, Lee CJ, Kim TH, Shin BS, Sim WS. The optimal oblique angle of fluoroscope for thoracic sympathetic ganglion block. *Clin Auton Res*. 2011;21(2):89–96.
- Skaebuland C, Racz GB. Indications and technique of thoracic(2) and thoracic(3) neurolysis. *Curr Rev Pain*. 1999;3:400–5.
- Skaebuland C, Racz GB. Thoracic (T2-3) ganglion block. In: Diwan S, Staats PS, editors. *Atlas of pain medicine procedures*. New York: McGraw-Hill Education/Medical; 2014. p. 349–56.

The Thoracic Sympathetic Block and Radiofrequency Ablation chapter was reviewed by Sandra van den Huevel; Miles Day; Pierluigi Manchiaro; Sudhir Diwan; Andrea M. Trescot; Milan Stojanovic; Peter S. Staats; Andre M. Mansano.

Evidence

Table 11.1 Level of evidence and recommendations by the Benelux section of the World Institute of Pain

These recommendations are based on both a review of the literature in 2015 by an independent third party (Kleijnen Systematic Reviews LTD) and the previous published guidelines published in Pain Practice. The recent literature, the potential risk for complications, and the grade of invasiveness were considered when deciding to upgrade or downgrade the recommendation.

Indication	Procedure	Recommendation 2009 ¹	Grade 2015 ²	Recommendation 2018 ^{3,4}
Complex regional pain syndrome	Thoracic sympathetic block (Th2-Th3) with ropivacaine and triamcinolone		Low	Weak

¹van Eijls F, Stanton-Hicks M, Van Zundert J, Faber CG, Lubenow TR, Mekhail N, et al. Evidence-based interventional pain medicine according to clinical diagnoses. 16. Complex regional pain syndrome. *Pain Pract*. 2011;11:70–87

²Kleijnen Systematic Reviews Ltd.: Search and evaluation of the literature. 2015

³Huygen F, Kallewaard JW, van Tulder M, Van Boxem K, Vissers K, van Kleef M, et al. “Evidence-based interventional pain medicine according to clinical diagnoses”: update 2018. *Pain Pract*. 2019;19:664–75

⁴<https://www.anesthesiologie.nl/publicaties/praktische-richtlijnen-anesthesiologische-pijnbestrijding>