AJNR

CT Fluoroscopic-Guided Cervical Nerve Root Blocks

Andrew L. Wagner

AJNR Am J Neuroradiol 2005, 26 (1) 43-44
http://www.ajnr.org/content/26/1/43

AJNR Am J Neuroradiol 26:43–44, January 2005

Technical Note

CT Fluoroscopic–Guided Cervical Nerve Root Blocks

Andrew L. Wagner

Summary: While both fluoroscopic and CT-guidance during cervical nerve root blocks have been well documented in the literature, the use of CT fluoroscopy (CTF) has not. CTF is well suited to provide imaging guidance during these procedures due to its combination of excellent anatomic detail, relatively low radiation dose and the ability to perform an initial dynamic contrast injection, and is a viable alternative to fluoroscopic guidance. Details of the technique along with the initial experience at one institution are presented.

Although cervical selective nerve root blocks (CSNRBs) are commonly performed by using fluoroscopy to guide needle placement, they can also be done with CT guidance. CT has the advantage of superior anatomic resolution, allowing precise placement of the needle tip with a minimum of readjustment. However, this approach has been perceived as taking longer and as prohibiting the dynamic injection of contrast material, as can be done by using fluoroscopy. CT fluoroscopy has been used in a variety of interventional procedures, and has shown to be fast, safe, and accurate in guiding spinal injections. This technique is well suited for CSNRB, as it combines the excellent anatomic visualization of CT with the safety of fluoroscopic guidance.

Technique

Before the procedure, informed consent is obtained after the procedure, its benefits, and its risks are discussed with the patient. The risks include the possibility of bleeding, infection, and allergic reaction, as well as an extremely small risk of a severe adverse outcome, such as spinal cord stroke or death.

For the procedure, the patient is placed in the supine position, with his or her head turned slightly to the contralateral side from the injection. Scout images are obtained through the desired cervical neural foramen. It is important not have the patient's head turned too much, as this makes it difficult to accurately identify the correct level on the topogram. An appropriate needle entry point is identified and marked on the skin before its sterilization. The entry site should be chosen to avoid the carotid and jugular vessels and to gain access to the outer foramen. Usually, the needle is parallel to the table or angled slightly downward. An upward angle is not desirable, as it precludes the clearing of air from the needle hub before injection.

Once the site is sterilized and the skin and subcutaneous tissue are anesthetized, a 25-gauge, 3.5-inch, straight spinal needle is partially inserted, and an initial image is obtained by using the minimum exposure the machine can provide. Because of the flexibility of the needle, the gravitational effect on the needle hub can cause the needle tip to be displaced anteriorly when the needle is released; therefore, the it should be supported to keep the optimal angle. The author uses sterile gauze pads to rest the hub on while acquiring an image. After the initial image is obtained, the needle is adjusted and advanced toward the posterior aspect of the neural foramen by using an intermittent CT fluoroscopic technique. The optimal placement of the needle tip is at the outer edge of the posterior foramen (Fig 1). The patient often describes reproduction of his or her pain when the needle is in good position.

After the needle tip is in the desired location, dilute contrast material (the author uses 3 mL of Omnipaque 180 [Amersham Health, Princeton, NJ] diluted with 1 mL of nonbacteriostatic saline) is then slowly injected during a few seconds of continuous CT fluoroscopy. This step includes the acquisition of images after the cessation of the injection to confirm that the needle tip is not within a radicular vessel or a vessel feeding the vertebral artery (Fig 2). One injection at the level of the foramen and another slightly higher ensure that there is no opacification of the anterior spinal artery, vertebral artery, or other vascular structure. The site is then infused with a small volume of steroid or local anesthetic. The needle is withdrawn, pressure is applied, and the patient is observed for an appropriate time before being released.

Using CT fluoroscopic guidance, the author has performed more than 200 CSNRB procedures without serious complications, although there have been occasional vasovagal reactions and one small local hematoma. In five cases, the needle was initially intravascular, and its repositioning was required before steroid and local anesthetic were injected. The CSNRB procedure is fast and safe, with 100% success in blocking the desired nerve root. Patients typically have minimal discomfort, and mild sedation was necessary in only one case.

Discussion

Selective nerve root blocks are useful in the treatment of radicular symptoms, as they allow the infiltration of a large dose of steroids around a particular nerve root, which is thought to act in a number of ways to ultimately reduce pain. Compared with epidural injections, these blocks are a more selective and elegant procedure, and while often done with fluoroscopic guidance, CT can also be used with good success, allowing precise needle placement because of its excellent anatomic resolution (1–4). The use of CT affords the physician the ability to identify and avoid the jugular, vertebral, and carotid vessels while steering the needle into the outer neural foramen. Criticism of CT guidance has mostly been that it adds time and cost to the procedure while increasing the radiation dose, but these problems can be solved with the use of CT fluoroscopy.

CT fluoroscopy uses low milliampere-second and partial reconstruction algorithms to allow a tableside operator to acquire rapid, lower-resolution images by using

Received May 29, 2004; accepted after revision July 1.

From the Department of Radiology, Rockingham Memorial Hospital, Harrisonburg, VA, and University of Virginia School of Medicine, Charlottesville, VA.

Address reprint requests to Andrew L. Wagner, Department of Radiology, Rockingham Memorial Hospital, 235 Cantrell Ave, Harrisonburg, VA 22801.

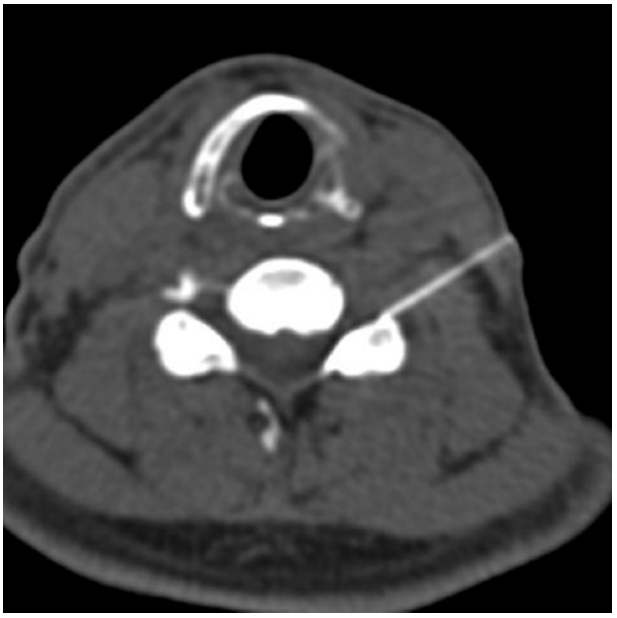

FIG 1. Axial CT fluorscopic image demonstrates the approach used to access the neural foramen. Needle tip is located along the posterior foramen, well away from the vertebral vessels but directly adjacent to the exiting nerve root.

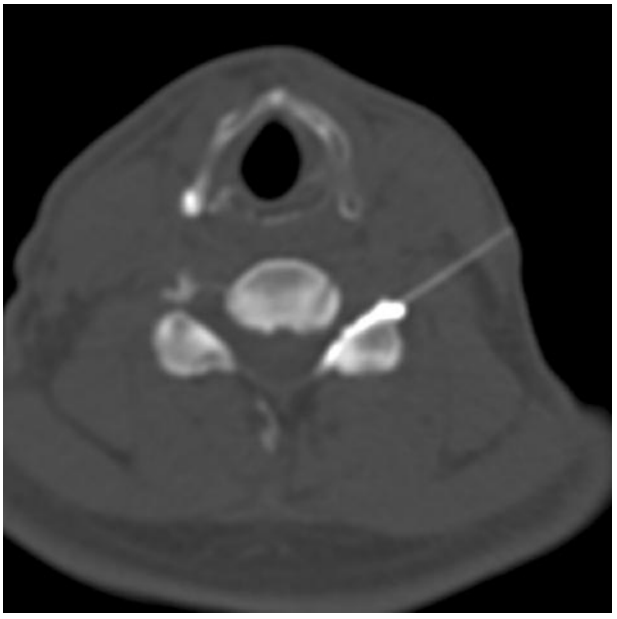

FIG 2. After its injection, the contrast material is noted to travel along the posterior aspect of the nerve root within the neural foramen. In many cases, transforaminal contrast enhancement is not seen, as the material stays around the ganglion and extraforaminal nerve.

either intermittent fluoroscopy (to capture a single image at a time) or continuous-beam fluoroscopy (to allow essentially real-time visualization) (5, 6). Initially described as a tool for rapidly guiding biopsy needles, CT fluoroscopy has been used for a number of interventional procedures, including epidural injections and lumbar selective nerve root blocks (7). CT fluoroscopy uses 10–60 mAs, and the author has rarely found the need to increase this setting above 20 mAs during interventional spinal procedures. Measured radiation doses to the operator vary with the procedure, but they have been as low as 0.1 mrem per procedure during CT-guided epidural injections, a level well below that of fluoroscopy (7). The expected radiation dose to the operator during CSNRB may be somewhat higher than that encountered during epidural injections because of the continuous-beam technique used during the injection of contrast material. CT fluoroscopy also markedly decreases the procedure time, as the physician can be next to the patient throughout the procedure and use rapidly acquired images to guide the needle.

The initial article describing CT-guided nerve root blocks reported the advantage that no injection of contrast agent was necessary during these procedures (1), as CT did not have the uncertainty of fluoroscopy regarding the exact location of the nerve root and vascular structures. The use of contrast material in these procedures has varied, even within the same report (5). However, with data showing the unreliability of a negative aspiration result to predict extravascular placement of a needle tip (8), the use of contrast material can potentially avoid some devastating complications of CSNRB. Unlike traditional CT guidance, CT fluoroscopy offers the distinct advantage of real-time visualization of the injection, reducing the chance of an inadvertent intravascular infusion of steroid. However, the injection of contrast material does not ensure safety, as serious adverse events have occurred even with an appropriately appearing injection (9).

Conclusion

CT fluoroscopy is a safe and effective alternative for needle guidance during CSNRBs. The technique allows precise needle placement because of its excellent anatomic resolution, and the radiation dose can be lower than that experienced with fluoroscopic guidance. The use of continuous-beam fluoroscopy during injections of contrast material allows evaluation of the intravascular placement of the needle, adding an additional layer of safety to the procedure.

References

1. Quinn SF, Murtagh R. **CT-guided nerve root sleeve block and ablation.** *AJR Am J Roentgenol* 1988;151:1213–1216
2. Zennaro H, Dousset V, Viaund B, et al. **Periganglionic foraminal steroid injections performed under CT control.** *AJNR Am J Neuroradiol* 1998;19:349–352
3. Murtagh R. **The art and science of nerve root and facet blocks.** *Neuroimaging Clin N Am* 2000;10:465–477
4. Wagner AL, Murtagh FR. **Selective nerve root blocks.** *Tech Vasc Interv Radiol* 2002;5:194–200
5. Katada K, Anno H, Ogura Y, et al. **Early clinical experience with real-time CT fluoroscopy.** *Nippon Acta Radiol* 1994;54:1172–1174
6. Paulson EK, Sheafor DH, Enterline DS, McAdams HP, Yoshizumi TT. **CT fluoroscopy-guided interventional procedures: techniques and radiation dose to radiologists.** *Radiology* 2001;220:161–167
7. Wagner AL. **CT-fluoroscopic guided lumbar epidural injection: technique and results.** *AJNR Am J Neuroradiol* 2004;25:1821–1823
8. Furman MB, Giovanniello MT, O'Brien EM. **Incidence of intravascular penetration in transforaminal cervical epidural steroid injections.** *Spine* 2003;28:21–25
9. Houten JK, Errico TJ. **Paraplegia after lumbosacral nerve root block: report of three cases.** *Spine J* 2002;2:70–75