Imaging-guided Injection Techniques with Fluoroscopy and CT for Spinal Pain Management

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Local spinal pain and radiculopathy are common conditions that debilitate millions of Americans annually. Most cases are successfully treated conservatively with rest or physical therapy. Chiropractic manipulation or, in some cases, surgery may also be performed. Percutaneous injection has been used for spinal pain management for many years, but many of these procedures have historically been performed without imaging guidance. Recently, however, newer minimally invasive, imaging-guided percutaneous techniques have been added to the list of available treatment options for spinal pain. Imaging-guided techniques with fluoroscopy or computed tomography increase the precision of these procedures and help confirm needle placement. Cervical, thoracic, lumbosacral, and sacroiliac pain can be evaluated and treated safely and effectively with injections of local anesthetics or long-acting steroids into facet joints, sacroiliac joints, selective nerve roots, spondylolytic areas, and the epidural space. Because imaging-guided techniques appear to provide better results and reduce complication rates, they are becoming more popular despite controversy regarding their effectiveness. Controversy will continue to surround these imaging-guided techniques until large, double-blinded studies become available. In the meantime, there is an increased demand for these procedures from referring physicians, and it is important to be able to safely perform them with a minimum of patient discomfort.
Introduction
Local spinal pain and radiculopathy are very common conditions that debilitate more than half the population of the United States at some time in their lives. The prevalence of these conditions is at least 5% annually (1,2). Most cases are successfully treated conservatively with rest or physical therapy. Chiropractic manipulation is also very common although not frequently recommended to patients by their allopathic physicians. Surgery is reserved for a small percentage of cases. Because imaging abnormalities do not correlate with symptoms in most cases (3–5), many patients do not receive a specific diagnosis and have continued pain.

Percutaneous injection techniques have been used to treat back pain for many years—and have been controversial. Many of these procedures have historically been performed without imaging guidance. Imaging-guided techniques with fluoroscopy or computed tomography (CT) increase the precision of these procedures and help confirm needle placement. Because imaging-guided techniques should lead to better results and reduced complication rates, they are now becoming more popular. These improvements are probably due in part also to better patient selection by experienced spine physicians.

Cervical, thoracic, lumbosacral, and sacroiliac pain can be evaluated and treated with interventional procedures including injections of local anesthetics or long-acting steroids into facet joints, sacroiliac joints, selective nerve roots, spondylolytic areas, and the epidural space.

In this article, we discuss and illustrate techniques for CT- and fluoroscopy-guided percutaneous injections used at our institution for spinal pain management. These include techniques for facet joint injection, selective nerve root injection, epidural injection, sacroiliac joint injection, and injection for spondylolysis.

Technique
All of the procedures discussed in this article are routinely performed on an outpatient basis. The patient is questioned regarding previous steroid use (oral, cutaneous, or injected) to avoid causing iatrogenic Cushing syndrome. We usually wait 2–3 months before administering repeat injections. This is particularly important when multi-level injections (eg, bilateral L3-4, L4-5, and L5-S1 facet joint injections) are performed. Relative contraindications include hemorrhagic diathesis, local skin infection, and pilonidal cyst as well as progressive neurologic disorder, which may be masked by the procedure.

The procedure as well as possible benefits and complications are explained to the patient, and informed consent is obtained. Because it is often difficult to determine the origin of spinal pain, the patient is advised that the procedure may not be effective. Possible complications that are discussed include Cushing syndrome, infection, hemorrhage, pneumothorax, anaphylactic (idiosyncratic) reaction to iodinated contrast material or anesthetic, and nerve damage.

Baseline vital signs are obtained. Physiologic monitoring (pulse oximetry and intermittent automatic blood pressure and pulse rate monitoring) is
used if conscious sedation is administered to the patient. Physiologic monitoring is not necessary in otherwise healthy patients if sedation is not used (6). Intravenous sedation is required in less than 20% of patients and consists of low doses of opioids or anxiolytic drugs. Midazolam hydrogen chloride (initial dose, 1 mg) is used for sedation and anxiolysis. In healthy adults, additional doses of 1 mg are given as needed up to a total of 4 mg with an interval of at least 2 minutes between doses. In patients over 60 years of age and in chronically ill or debilitated patients, additional doses are reduced to 0.5 mg up to a total of 3 mg. Morphine sulfate (initial dose in healthy adults, 1–2 mg) is used for pain relief. Additional doses of 1–2 mg are given as needed up to a total of 10 mg with an interval of at least 2 minutes between doses. Resuscitation equipment should be readily available.

Sterile procedure is followed. For cutaneous and tract local anesthesia, we use 1% lidocaine. We use triamcinolone acetonide suspension (Kenalog 10 or 40 [Apothecon, Princeton, NJ]) as a long-acting steroid and bupivacaine hydrochloride (Sensocaine 0.25% [Astra USA, Westborough, Mass]) as a long-acting local anesthetic. After the procedure, the patient is observed in the recovery room or short stay unit for 1–2 hours depending on his or her condition.

Most of these procedures can be performed with either CT guidance or fluoroscopic guidance. The imaging technique used is largely a matter of personal preference. Different steroids and anesthetics may also be used.

Facet Joint Injection
Facet joint pain is attributed to segmental instability, inflammatory synovitis, or degenerative arthritis (1,7,8). Cavanaugh et al (9) conducted a study using New Zealand white rabbits and demonstrated that the facet joints are heavily innervated, that sensitization and excitation of nerves occurs in the facet joints when the joint is inflamed or exposed to certain chemicals that are released during injury and inflammation, and that injection of hydrocortisone and lidocaine results in a marked reduction in this nerve activity. The signs of facet joint syndrome are local paraspinal tenderness; pain on hyperextension, rotation, and lateral bending; absence of neurologic deficit; absence of root tension sign; and hip, buttoc k, or back pain with straight leg raising (8).

Symptoms include hip and buttoc k pain, cramping leg pain involving the thigh but not radiating below the knee, low back stiffness, and absence of paresthesias (8). The back stiffness is typically most marked in the morning.

According to a study by Schwarzer et al (10), the degree of degenerative change identified on CT scans is a poor indicator of the presence or degree of facet joint syndrome. However, Lewinnek and Warfield (11) found radiographic evidence of facet joint disease to correlate with the initial success of facet joint injections. Helbig and Casey (12) described four clinical criteria that led to a high long-term success rate, including back pain associated with groin or thigh pain, well-localized paraspinal tenderness, reproduction of pain with extension-rotation toward the symptomatic side, and significant facet joint arthrosis seen at radiography. Large-volume injections may cause joint rupture and extravasation into the epidural space, which may account for part of their therapeutic effect (13).

There is disagreement as to whether intraarticular injection is preferable to periarticular injection (14,15). The true success of facet joint injections is uncertain despite numerous studies because of questions regarding patient selection, uncertainty as to whether the injections were intraarticular or periarticular, and use of different medications. Facet joint injection may be considered either diagnostic or therapeutic (1,16). CT guidance (7,16) or fluoroscopic guidance (8,10,11,13,14) may be used for facet joint injections. Levels for injection are selected on the basis of local pain or tenderness and imaging evidence of disease. It is often difficult to localize the pain to one level, so that generally two and occasionally three levels are injected. If the pain is bilateral, injections are performed bilaterally. There are reports of long-term (3–6 months) success and failure (14–17). Denervation of the facet joint may also be performed with CT guidance or fluoroscopic guidance. This procedure has been performed with 95% ethanol or with radiofrequency techniques (7,18). Gangi et al (7) denervate facet joints using CT guidance with 95% ethanol. Twenty-two-gauge spinal needles are advanced into the internal superior borders of the transverse processes above and below the target facet joint. One mL of nonionic contrast material is injected to predict ethanol diffusion, and 1.5 mL of 95% ethanol is injected at each level. Van Kleef et al (18) denervated facet joints using C-arm fluoroscopic guidance and 60-second 80° C treatment with a radiofrequency generator. Bogduk and Long (19) studied the anatomy of facet joint innervation and found that the most commonly used techniques usually result in injury to the medial branch of the dorsal ramus rather than to the small nerves of the facet joints. A facet joint is supplied by the nerve exiting at the level of the facet joint as well as at the next higher level (Fig 1). Denervating a facet joint requires that two rhizotomies be performed. For example, denervation of the right L3–4 facet joint requires rhizotomy of right L2 and L3.
We routinely use fluoroscopic guidance for the injection of cervical facet joints. The patient is placed in the supine oblique position at an approximately 45° angle with the side to be injected facing up. The head is turned away from the side to be injected. The frontal tube is angled to open the facet joint, and a 22-gauge needle is advanced into the joint (Fig 2a). The patient is then placed flat, and true lateral and anteroposterior views are obtained to confirm the needle position (Fig 2b). A posterior approach is usually used to avoid the vertebral arteries. If the shoulders are large, an anterior approach may be required. A 25-gauge needle is usually used for this approach. For therapeutic injection, 0.5 mL of triamcinolone acetonide suspension (Kenalog 40) and 1–2 mL of 0.25% bupivacaine hydrochloride are used. For diagnostic purposes, only the latter is injected. If more than four joints are being injected, the dose of triamcinolone acetonide is reduced to keep the total dose below 80 mg.

We prefer CT guidance for the injection of lumbar facet joints and use a technique that is described in the next section; however, fluoroscopic guidance may also be used. The patient is
placed in the prone oblique position with the side to be injected facing up slightly. The patient is then rotated until the facet joint is best visualized (Fig 3). A 22-gauge needle is advanced vertically into the joint, and its position is confirmed with true lateral and anteroposterior views. Our therapeutic and diagnostic injections are identical to those used for cervical facet joints. Gangi et al (7) use 3.75 mg (1.5 mL) of cortivazol mixed with 1.5 mL of 0.25% bupivicaine hydrochloride for every two facet joints. Sarazin et al (20) have described a fluoroscopically guided technique for injecting the inferior articular recess of the facet joint that does not require profiling the joint.

**CT Guidance**

CT guidance is our preferred technique for lumbar facet joint injection. The patient is placed in the prone position, and several images are obtained at the level of interest to determine entry site and angle of approach. The entry site is marked on the skin, and a 22-gauge needle is advanced into the skin (Fig 4). A coaxial system may be used to approach a horizontally oriented joint. Injections are identical to those performed with fluoroscopic guidance. We also prefer CT guidance for thoracic facet joint injections. In the thoracic region, the horizontal orientation of the facet joints and overlying ribs usually limits access. Access may be limited in other areas by bridging spurs. In such cases, periarticular injection is performed (Fig 5). The steroid and anesthetic doses are the same as for other facet joint injections. Cervical facet joint injections may also be performed with CT guidance (Fig 6).

**Figures 4–6.** (4) CT scans demonstrate a bilateral L4-5 facet joint injection with the vertical approach (a) and an L5-S1 facet joint injection with the angled approach (b). (5) CT scan shows a T6-7 facet joint injection. (6) CT scan shows a C5-6 facet joint injection.
Selective Nerve Root Injection

Nerve root injection is indicated in patients with radicular symptoms in the cervical, thoracic, lumbar, or sacral region; acute diskogenic symptoms without nerve paralysis that is resistant to conventional medical therapy; and post-diskectomy syndrome (1). Inflammation of the nerve root is presumed to be the cause of the pain. In a study by Zennaro et al (21), selective nerve root injection provided pain relief in 70% of all patients and in 95% of patients with foraminal stenosis secondary to degenerative stenosis rather than disk herniation. These authors used CT guidance and injected 0.8 mL of 1% lidocaine with 75 mg of hydrocortisone. Selective nerve root injections often result in a degree of epidural injection, which may play a role in pain relief. Typically, injection is performed at a single level that correlates with the radiculopathy.

Fluoroscopic Guidance

Cervical nerve root injections may be performed with CT guidance or fluoroscopic guidance. For a fluoroscopically guided selective cervical nerve root injection, the patient is placed in the supine oblique position with the side to be injected facing up. The head is turned slightly to the opposite side. Obliquity is adjusted until the foramina are well seen (Fig 7a). A 22-gauge spinal needle is advanced toward the foramen. The patient is placed flat, and anteroposterior and lateral views are obtained to confirm the needle position (Fig 7b). The needle should not project medial to the medial margin of the pedicle on the frontal view. The patient often reports reproduction of symptomatic pain along the nerve distribution as the needle nears the appropriate location. For C1 and C2 nerve root injections, the patient is placed in the prone position and the needle is advanced under frontal and lateral fluoroscopic guidance (Fig 8). The stylet is then removed, and absence of cerebro-
spinal fluid flow is verified with aspiration. Two mL of Kenalog 10 and 2 mL of Sensorcaine 0.25% are injected. If the dura mater is perforated, the procedure is terminated and subsequently rescheduled. Similarly, for fluoroscopically guided selective thoracic nerve root injections, the patient is placed in the prone position and the needle is advanced under frontal and lateral fluoroscopic guidance (Fig 9). Care is taken to keep the needle posterior and medial to avoid the pleural space. Although we have used this technique in many patients without causing a pneumothorax, this is a serious concern, and CT guidance may be safer, particularly in thin patients. Injections are the same as for cervical nerve roots.

For a fluoroscopically guided selective lumbar nerve root injection, the patient is placed in the prone oblique position with the side to be injected facing up. A 22-gauge needle is advanced under the pedicle with the patient in this position (Fig 10a). The patient is then placed flat, and needle position is confirmed with frontal and lateral views (Fig 10b). L5 nerve root injections require marked angulation of the needle to avoid the iliac crest (Fig 11). Injections are the same as for cervical nerve roots. Selective sacral nerve root injections may be performed with a dorsal approach using the same technique used for a sacral foraminal epidural injection.
CT Guidance
For selective lumbar and thoracic nerve root injections, the area of interest is scanned with the patient in the prone position. For selective cervical nerve root injections, the procedure can be performed with the patient in the supine, prone, or lateral decubitus position. The skin entry site and the angle of approach are determined, and a 22-gauge needle is advanced adjacent to the exiting nerve root. Patients usually report reproduction of pain along the distribution of the nerve. Cervical (Figs 12, 13), thoracic (Fig 14), lumbar (Figs 15, 16), and sacral (Fig 17) nerve roots may be injected under CT guidance.

Epidural Injection
Patient selection for epidural injections is poorly described in the literature. We have used epidural injections for treatment of local pain or radiculopathy in the settings of documented disk herniation, central or foraminal stenosis, and absent imaging findings. The technique is usually used if

Figures 12–17.  (12) CT scan (posterior angled approach) obtained with the patient in the prone position demonstrates needles positioned at both exiting C2 nerve roots. (13) On a CT scan (anterior angled approach), a needle is seen posterior to the carotid and vertebral (cursor) arteries for a C7 nerve root injection. (14) CT scan obtained with the patient in the prone position shows a T12 nerve root injection. (15) CT scan obtained with the patient in the prone position shows an L4 nerve root injection. (16) CT scan obtained with the patient in the prone position shows an L5 nerve root injection. (17) CT scan (posterior sacral foramen approach) shows an S1 nerve root injection.
rest has failed to relieve the symptoms or if the patient is considered a surgical candidate but does not desire to undergo surgery. The technique is infrequently used in acute situations.

Various combinations of saline solution, local anesthetics, and steroids have been injected (22–25). Theories for explaining the method of relief include lysis of adhesions, change in relationship between the disk and the nerve root, anesthetic breaking the pain cycle, and reduction of inflammation and swelling (23,24). Epidural injection has been performed mostly by anesthesiologists. White (22), using both sacral hiatus and lumbar interlaminar approaches, documented that even in experienced hands, the needle was not in the epidural space 25% of the time when the procedure was performed without imaging guidance. The needle may be inadvertently placed intradurally or intravascularly or may not even be in the canal. Fluoroscopic guidance is recommended for all epidural injections. Injection of nonionic contrast material to confirm the needle position is also recommended.

The choice of steroid is controversial. Methylprednisolone acetate (Pharmacia & Upjohn, Kalamazoo, Mich) was used extensively prior to the early 1980s (23,26,27). This steroid mixture contains polyethylene glycol, which is neurotoxic. The most common complications associated with methylprednisolone acetate injection include aseptic meningitis and arachnoiditis (26). These complications are probably related to intrathecal injection; however, there may also be toxicity from epidural injection. In a comprehensive literature review, Abram and O’Connor (27) concluded that epidural injection of steroid preparations containing polyethylene glycol is safe. Because of the slight risk of intrathecal injection, even with fluoroscopic guidance, we do not inject methylprednisolone for spinal procedures. El-Khoury and Renfrew (1) inject 3 mL (18 mg) of betamethasone (Celestone Soluspan; Schering, Kenilworth, NJ) followed by 5–10 mL of sterile saline solution or diluted 0.25% bupivacaine hydrochloride via the sacral hiatus. Bush and Hillier (24) inject 80 mg of triamcinolone acetonide with 0.5% procaine hydrochloride in saline solution via the sacral hiatus. Gangi et al (7) use 3.75 mg of cortivazol with or without 2 mL of 0.5% lidocaine.

We use fluoroscopic guidance for epidural injections. Gangi et al (7) describe CT guidance for lumbar epidural injections. Dorsal interlaminar, sacral hiatus, and foraminal approaches may be used for lumbosacral epidural injection. Epidurography with nonionic myelography-approved iodinated contrast material (iopamidol [Isovue 200; Bristol-Myers Squibb, Wallingford, Conn]) is performed to document epidural position and evaluate the distribution pattern. If the area of clinical concern is not opacified, the needle position is changed. The plica medians is a midline dural reflection that may be complete or incomplete. If complete, it may confine the contrast material and steroid to one side. If the patient has bilateral symptoms, one-half of the dose is injected followed by repositioning of the needle to opacify the contralateral epidural space and injection of the other half of the dose. If the pain is unilateral, we attempt to inject all the medication on the ipsilateral side in the presence of a complete plica medians.

For a dorsal interlaminar approach, the patient is placed in the prone position. A 22-gauge spinal needle is advanced to the posterior margin of the spinal canal. Positioning in the epidural space is detected with a loss-of-resistance technique. Gentle intermittent pressure is applied on a syringe while advancing the needle. A sudden loss of resistance occurs on entering the epidural space. Standard plastic syringes are usually not adequate; instead, glass syringes or special low-resistance plastic syringes (Pulsator Loss of Resistance Syringe; Sims Portex, Keene, NH) may be used. Absence of cerebrospinal fluid flow is verified with aspiration. Epidurography is performed with 2–3 mL of nonionic myelography-approved iodinated contrast material.

The sacral hiatus approach described by El-Khoury et al (25) is the one most frequently used at our institution. The patient is placed in the prone position. The sacral cornua (ie, the border of the sacral hiatus) and median sacral crest are palpated and localized fluoroscopically. Gauze pads are placed between the buttocks to prevent povidone-iodine (Betadine; Purdue Frederick, Norwalk, Conn) from irritating the perineum and genitals. A 5-inch-long, 22-gauge spinal needle is advanced via the sacral hiatus into the sacral canal until its tip reaches the S3 level (Fig 18). Keeping the needle below the S2-3 disk space minimizes
Figures 18, 19. (18) Frontal (a) and lateral (b) radiographs obtained with fluoroscopic guidance show a needle inserted into the sacral canal via the sacral hiatus. (19) Frontal epidurogram shows an epidural injection via the sacral hiatus.

Figures 20, 21. (20) Frontal epidurogram demonstrates an epidural injection with the S1 foraminal approach. This approach is also used for selective sacral nerve root injections. (21a) Frontal radiograph obtained with fluoroscopic guidance (dorsal interlaminar approach) shows a needle in the posterior epidural space at C7-T1. (21b) Subsequent frontal radiograph obtained with fluoroscopic guidance demonstrates contrast material dispersion. (21c) Drawing shows the needle directed medially over the T1 lamina.
the risk of dural puncture. It is helpful to keep the needle as horizontal as possible. The needle is usually advanced primarily under lateral fluoroscopic guidance with intermittent frontal guidance. On a frontal projection, the needle should lie between the pedicles of the sacral segments. The stylet is removed, and absence of cerebrospinal fluid flow is confirmed with aspiration. Epidurography is performed with injection of 3 mL of nonionic myelography-approved iodinated contrast material (Fig 19). The lumbosacral epidural space is usually opacified to the L4 level and occasionally higher.

The needle bevel is directed to the symptomatic side, and 5–7 mL of Kenalog 10 is injected. We do not usually inject local anesthetic into the epidural space because of the possibility of postural hypotension, particularly in older patients. Many authors use local anesthetic in lower thoracic and lumbosacral epidural injections (1,6,7). If the dura mater is accidentally punctured, we do not perform the injection, and the procedure is rescheduled.

For a lumbar foraminal approach, the patient is placed in the prone position and a 22-gauge needle is advanced under the pedicle of the appropriate segment, similar to the approach used for lumbar nerve root injection (Figs 10, 11). Sacral foraminal injection is performed with a direct dorsal approach, a technique that can also be used for selective sacral nerve root injection (Fig 20).

For a cervical epidural injection, a dorsal interlaminar (Fig 21) or transforaminal (Fig 22) approach can be used. The patient is placed in the prone position for the dorsal interlaminar approach. This procedure is performed only at the C7-T1 disk space, where the dorsal epidural space is larger (1–2 mm thick) than at the higher cervical levels (6). A 22- or 25-gauge Whitacre needle with a blunt tip and side hole is advanced through an 18-gauge needle using a paramedian approach. The needle is directed to the top of the T1 lamina in the midline. The needle contacts the bone and is then slowly advanced into the epidural space with the loss-of-resistance technique. Test injections of contrast material may also be performed while advancing the needle. An epidurogram is obtained to document needle position and evaluate the extent of opacification. We inject 5–6 mL of Kenalog 10. Local anesthetic is not used in upper thoracic or cervical epidural injections because of the risk of spinal anesthesia and respiratory suppression. A similar approach may be used for thoracic epidural injections (6). In the transforaminal approach, a 25-gauge spinal needle is advanced into the inferior neural foramen with the patient in an oblique position to open the foramen. The needle is positioned in the anterolateral epidural space with the loss-of-resistance technique. This approach carries the risk of nerve root or vertebral artery injury. It is used primarily when the dorsal interlaminar approach does not result in opacification of the area of interest.

**Figure 22.** (a) Supine oblique radiograph obtained with fluoroscopic guidance (transforaminal approach) demonstrates an open foramen. (b) Lateral radiograph obtained with fluoroscopic guidance demonstrates opacification of the anterior epidural space. (c) Frontal radiograph obtained with fluoroscopic guidance shows the needle tip just medial to the pedicle.
Sacroiliac Joint Injection

The indications for sacroiliac joint injection are acute or chronic sacroiliac joint pain that is not adequately controlled with nonsteroidal anti-inflammatory agents. The procedure is frequently performed in patients with seronegative inflammatory sacroiliitis. Maugars et al (28) inject 1.5 mL of cortivazol, the equivalent of 62.5 mg of prednisone, without local anesthetic. Fluoroscopy or CT may be used for guidance. With fluoroscopic guidance, the patient is placed in the prone oblique position with the side to be injected facing down to create a vertical pathway to the inferior synovial joint (Fig 23). The patient is then turned to the prone position, and 22-gauge spinal needle placement is confirmed with lateral fluoroscopy. Five mL of Kenalog 10 and 1–2 mL of Sensorcaine 0.25% are injected. With CT guidance, the middle third of the joint is usually most accessible and is accessed with a dorsal angulated approach (Fig 24).

Injection for Spondylolysis

Injection for spondylolysis is used for otherwise unexplained local pain at the affected level. We perform injections directly into the spondylolytic area. El-Khoury and Renfew (1) have demonstrated that injection of adjacent facet joints opacifies the affected area and can be used for therapeutic injections. CT guidance is used because pars defects are easily identified at CT. The procedure is similar to a CT-guided facet joint injection (Fig 25). A 22-gauge spinal needle is used, and 0.5 mL of Kenalog 40 and 1 mL of Sensorcaine 0.25% are injected on each side.

Conclusions

Our preference for a given technique is largely due to our training and experience and does not necessarily mean that we consider the alternatives to be inferior or more dangerous. Further experience with fluoroscopically guided CT may show it to be superior to fluoroscopy for many of the procedures for which we now routinely use the latter modality.

We recommend using the smallest needle that can be effectively directed to the target site (usually 22-gauge or smaller). For cervical procedures, a 25-gauge needle is preferred if a sharp tip is used. Occasionally, a 20-gauge needle will be used in the lumbar region in a very large patient in whom it is difficult to maneuver the needle. Contrast material should be injected to confirm needle placement for epidural injections unless the patient has a history of contrast material sensitivity. Contrast material injection is also useful for this purpose in the other procedures, although it is not as critical. We usually do not inject contrast material for the other procedures unless we are unsure of the needle position. Studies similar to that of White (22) on needle placement for epidural injections may be useful in evaluating whether contrast material should be routinely injected for these procedures. We have safely used Kenalog as our choice of steroid and Sensorcaine as a local anesthetic. Celestone Soluspan appears to be a good alternative steroid.

Controversy will continue to surround these imaging-guided techniques until large, double-blinded studies become available.
tory results of the existing small studies are likely caused by differing patient selection methods, questions about accurate needle placement, and varying definitions of success. Despite the controversy, there is an increased demand for these procedures from referring physicians, and it is important to be able to safely perform them with a minimum of patient discomfort.

References