Techniques in Regional Anesthesia and Pain Management (2009) 13, 281-287

ELSEVIER

Techniques in
Regional Anesthesia
& Pain Management

Evidence-based practice of lumbar epidural injections

Sukdeb Datta, MD,[a] Ramsin M. Benyamin, MD,[b] Laxmaiah Manchikanti, MD[c]

From the [a]Vanderbilt University Medical Center, Nashville, Tennessee;
[b]Millenium Pain Center, Bloomington, Illinois; and the
[c]Pain Management Center of Paducah, Paducah, Kentucky.

KEYWORDS:
Epidural injections;
Lumbar interlaminar;
Lumbar transforaminal;
Caudal;
Steroids;
Local anesthetic

Epidural administration of corticosteroids is one of the commonly used interventions in managing low back pain with or without radiculopathy. Approaches used to access the lumbar epidural space include the caudal, interlaminar, and transforaminal injections. Reports of effectiveness have varied from 18% to 90%. However, most of the analyses have failed to separate the three approaches, not only mixing the various procedures but also results and outcomes. Recent guidelines by the American Society of Interventional Pain Physicians and others have evaluated effectiveness of caudal epidural steroid injections (ESIs), transforaminal, and interlaminar injections separately. The consensus from these reviews is that caudal ESIs are superior to the interlaminar epidural injections and equal to transforaminal epidural injections. In addition, the response to epidural injections for various pathologic conditions (disc herniation and/or radiculitis, discogenic pain without disc herniation, spinal stenosis, postsurgery syndrome) is variable. The systematic reviews indicated Level I evidence for caudal ESIs in managing disc herniation or radiculitis, and discogenic pain without disc herniation or radiculitis. They also indicated evidence is Level II-1 or II-2 evidence for caudal epidural injections in managing pain of postlumbar surgery syndrome and lumbar spinal stenosis. They also provided strong recommendations of 1B or 1C for caudal ESIs in managing pain secondary to disc herniation and radiculitis, or discogenic pain without disc herniation or radiculitis, postlumbar laminectomy syndrome, and spinal stenosis.
Published by Elsevier Inc.

Advantages of targeted epidural steroid injections (ESIs) encompass high concentration of administered drugs and lack of dependency on local blood flow, which is frequently impaired with compressive lesions.[1] However, target site concentration is variable based on multiple factors, including the route of administration. Caudal or interlaminar epidural injections are affected by the presence or absence of epidural plica or scarring, which may prevent migration of the dorsally injected medication to the ventral epidural space, where the primary pathology is usually located. Other variables, such as volume of the injectate and/or rate or pressure of the injection, may affect outcome. Studies of epidural injections performed "blindly" (without fluoroscopic control) have revealed misplacement of up to 30-40% of the caudal and 30% of interlaminar techniques, even in experienced hands.[2-14]

In fact, the most significant procedural flaw in all studies published before 2000 is that none used fluoroscopic-guided needle placement and contrast injection when performing the ESIs.[15] Thus, negative results may have been due to either incorrect placement (not in the epidural space) or incorrect application to the precise location of pathology.[16-22]

Caudal epidural injection of drugs was introduced in 1901 by Sicard.[23] Other workers who popularized the tech-

Financial support: Dr. Datta receives research support from Sucampo Pharmaceuticals and an honorarium from Smith and Nephew.

Address reprint requests and correspondence: Sukdeb Datta, MD, Vanderbilt University Interventional Pain Center, Vanderbilt University, 719 Thompson Lane, Ste. 22209, Nashville, TN 37204.
E-mail address: sukdeb.datta@vanderbilt.edu.

1084-208X/$ -see front matter Published by Elsevier Inc.
doi:10.1053/j.trap.2009.06.015

nique include Cathelin,[24] Pasqueir and Leri.[25] In 1925, Viner administered epidural procaine, Ringer's solution, and saline.[26] The interlaminar approach to the epidural space was considered a preferable route, as it is directed more closely to the assumed site of pathology than the caudal, thus facilitating delivery of injectate directly to target and requiring less volume. Subsequently, the disadvantages of the interlaminar approach, including extradural placement, were recognized.[9-11,27] Due to the mixed results with the interlaminar approach, transforaminal lumbar epidural injections have been emerging as an alternative.[27-29] However, this procedure is by no means new. The earliest use of epidural steroids by transforaminal route by Robecchi and Capra in 1952 reported relief of lumbar and sciatic pain.[30] This was followed in 1953 by Levre and coworkers reporting on injection into the S1 root.[31] McNab described the diagnostic value of selective nerve root injection for radiculopathy in 1971 in the United States.[32]

Review of outcomes: Systematic reviews and meta-analysis

Several systematic reviews have evaluated the effectiveness of epidural steroids.[16-20] However, they failed to separate caudal, interlaminar, or transforaminal techniques arriving at erroneous conclusions. Staal and coworkers,[18] Koes and coworkers,[17] and Armon and coworkers[19] all included essentially similar criteria as well as the same studies, uniformly arriving at inaccurate conclusions. Airaksinen and coworkers,[20] in the *European Guidelines for the Management of Chronic Non-Specific Low Back Pain* published in 2006, concluded that epidural corticosteroid injections would only be considered for radicular pain if it contained disc prolapse as the cause of pain and if the corticosteroid is injected close to the target or the nerve root. In addition, they also stated that the injection should be fluoroscopically guided and should aim at the ventral part of the epidural space, near the spinal nerve root through a transforaminal approach. They also concluded that there is conflicting evidence that conventional epidural steroids using a blind approach without fluoroscopic guidance are effective in radicular pain. In contrast, Abdi and coworkers,[22,27] Bogduk and coworkers,[21] and Conn and coworkers[16] evaluated caudal ESIs as separate procedures, reaching opposite conclusions, and concluded that caudal epidural injection in managing lumbar radiculopathy was moderate.

Staal and coworkers[18] concluded that there was limited evidence that epidural corticosteroid injections were not significantly different from placebo injections in the short term and that the effect of epidural corticosteroid injections is not significantly different from nonsteroidal anti-inflammatory agents, benzodiazepines, and morphine combined with corticosteroids. Armon and coworkers,[19] in a Report of the Therapeutic and Technology Assessment Subcommittee of the American Academy of Neurology, assessed the use of ESIs to treat radicular lumbosacral pain. Only four articles were included.[33-36] Although they claimed strict assessment criteria, they failed to separate various types of epidural injections, combining lumbar and caudal procedures. None of the trials used fluoroscopic placement. This systematic review faced substantial criticism.[37] They failed to include transforaminal epidural injections as they failed to meet their inclusion criteria,[38,39] even though they were graded as high-quality studies by others.

Recently, published guidelines by the American Pain Society by a panel of experts and later published in *Spine*,[40] while using similar criteria, such as United States Preventive Task Force (USPTF) and the Agency for Healthcare Research and Quality (AHRQ) guidelines, arrived at dissimilar results, thus pointing to the question of "subjectivity" bias in a so-called objective measure of review. Criteria for selecting studies for inclusion seemed arbitrary, as the Manchikanti and coworkers[41] study was not included, while several low-quality trials were included, such as those by Mathews and coworkers[42] and Zahar and coworkers.[43] Furthermore, although transforaminal injections were looked at separately than caudal injections and interlaminar injection, the evidence reached concluded that there is insufficient evidence on clinical outcomes to recommend a specific approach for performing ESIs or on the use of fluoroscopic guidance. Articles advocated in reaching this conclusion included the studies by Ackerman,[44] McGregor,[45] and Thomas and coworkers.[46] All of these 3 studies had significant deficiencies, which led to exclusion in the ASIPP systematic review. Chou and coworkers[40] also conclude that there is no reduction in rates of surgery using the Arden,[47] Wilson-McDonald,[48] Carette,[35] and the Riew and coworkers[38] studies. The first 3 studies are blind epidural injections, and the Riew study[38] showed that, of the 28 patients receiving the combination of betamethasone and bupivacaine, only 8 had undergone surgery. The difference was highly significant. Furthermore, the follow-up Riew study[49] was even more dramatic; they concluded that most patients with lumbar radicular pain who avoid an operation for at least 1 year after a nerve root block with either bupivacaine or betamethasone will continue to avoid surgery at 5 years.

Caudal epidural steroid injections

Ten randomized trials were used in evidence synthesis in the recent review by Conn and coworkers,[16] with 6 studies evaluating disc herniation or radiculitis.[38,41,42,50-52] Only the studies by Manchikanti and coworkers[41] and Dashfield and coworkers[50] used fluoroscopy. Dashfield and coworkers[50] compared effectiveness of caudal epidural steroid with targeted steroid placement during spinal endoscopy in a prospective, randomized, double blind trial. Patients in the caudal group underwent caudal ESI with a total of 10 mL of lidocaine 1% with 40 mg of triamcinolone 40 mg; the