CLINICAL CONCEPTS AND COMMENTARY

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Treatment of Lumbosacral Radiculopathy with Epidural Steroids

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ALTHOUGH it generally is assumed that corticosteroids injected epidurally are effective for the treatment of sciatica because of their antiinflammatory effect, there are other reasons they might affect pain perception in the presence of nerve root pathology: (1) Corticosteroids inhibit ectopic discharge originating from experimentally created neuromas, and this membrane-stabilizing effect may be responsible for symptomatic improvement of patients with nerve root pathology. (2) Persistent noxious stimulation leads to enhanced responsiveness of dorsal horn neurons. This central sensitization is in part mediated by increased production of prostaglandins, and the intrathecal administration of nonsteroidal antiinflammatory drugs has been shown to block the development of this hyperalgesic state. It would, therefore, seem logical that neuraxially administered steroids might also have an antihyperalgesic effect because corticosteroids block prostaglandin production. However, intrathecal steroids were found to have minimal effects in blocking spinal sensitization in the formalin test in rats.[1]

Epidural Steroid Treatment Protocol

There is considerable difference of opinion regarding indications, technique, drug doses, and frequency and timing of treatments. The following treatment recommendations represent a single opinion, but one based on extensive review of the literature and shared by a substantial number of anesthesiologists.

Patient Selection

Pain associated with radiculopathy is the principal indication for epidural steroid injections.[2,3] The procedure generally does not provide lasting benefit for patients with nonradiating back pain. Myofascial pain syndrome and facet and sacroiliac arthropathy often produce pain that radiates into the lower extremity, but they are unlikely to respond to this therapy. Radiculopathy-associated disk herniation is the condition that is most responsive to epidural steroids, especially if there is a dermatomal pattern of sensory loss and positive sciatic stretch signs. Previous back surgery and long duration of symptoms are associated with lower success rates. A fairly low success rate has been reported for patients with spinal stenosis, particularly if neural claudication is the principal symptom.[4]

There has been fairly good correlation between treatment success and clinical signs and symptoms, but a fairly poor correlation between outcomes and imaging study results. Therefore, insistence on magnetic resonance imaging or computed tomography before epidural steroid injection may not be justified, although some physicians believe it is prudent to rule out tumor as a cause of radicular symptoms.

Injection Technique

The two preparations of corticosteroid suspensions used most extensively for epidural injection are triamcinolone diacetate and methylprednisolone acetate. Soluble preparations are not used because they are rapidly cleared from the spinal canal and have produced seizures and segmental hyperalgesia when injected intra-

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thecally in animals. The needle should be placed at a level adjacent to the affected nerve root (fig. 1). It is not unusual for patients to experience exacerbation of symptoms as the needle enters the epidural space or as the drug is injected. Because there is some concern about the possible neurotoxicity of intrathecal steroid injection, it would seem prudent to administer a small test dose of local anesthetic to rule out subarachnoid needle placement. If no motor block occurs within 5 min, 50 mg triamcinolone diacetate or 80 mg methylprednisolone acetate is injected. Reduction in radicular symptoms over a 10- to 15-min period provides evidence that the drug has reached the offending nerve root. After the local anesthetic effect dissipates, patients may experience recurrence or exacerbation of symptoms for a day or two, followed by gradual improvement.

Patients should be reevaluated after one to several weeks (fig. 2). If symptoms are improved dramatically, there is no need to repeat the procedure because many patients will continue to do well without additional injections. If there has been no improvement after the initial injection, it may be reasonable to repeat the procedure, particularly if there was no pain relief immediately after the injection of steroid plus local anesthetic. Lack of response to the initial injection may be a result of failure of the drug to reach the affected root, and it is reasonable to perform a repeat procedure at an adjacent level or, in the case of an S-1 radiculopathy, *via* a caudal approach.

If there is partial improvement after the first injection, the procedure should be repeated, with reassessment of the patient in another 1–3 weeks. A third injection may be performed if there is further, but incomplete improvement. If there is recurrence of symptoms several weeks or months after an initial favorable response, it is reasonable to perform an additional epidural steroid injection. Patients who consistently experience dramatic but transient improvement present a dilemma because frequent treatment may lead to adrenal suppression or cushingoid symptoms, and it is not known whether repeated treatment over prolonged periods is safe.

The success rate is lower among patients who have persistent or recurrent radicular symptoms after laminectomy. In some patients who underwent operation, epidural fibrosis may prevent the drug from reaching the injured nerve root. Techniques designed to disrupt fibrous tissue have been described. These procedures involve the injection of hyaluronidase, hypertonic saline, and steroids close to the affected root *via* fluoroscopically guided catheters or an epiduroscope. To date, there have been no outcome studies to indicate that such techniques are safe or effective.

Treatment Outcomes

In the English language, reports of more than 7,000 patients attest to the beneficial effects of epidural steroid injections for the treatment of sciatica. However, only 13 controlled, randomized studies of the use of caudal or lumbar epidural steroid injections have been published. Koes *et al.*[5] assessed the methodological quality of 12 of these studies and found that 8 of the 12 had a methodological score of less than 50 on a 100-point scale, indicating significant methodological flaws. Of the four best studies, two reported positive (beneficial) results and two reported negative results. Of the 12 studies evaluated, 6 reported that the epidural steroid group had better outcomes, and 6 reported no difference between the steroid group and the group that received no steroid. Watts and Silagy[6] performed a meta-analysis of nearly the same group of studies (11 randomized studies with 907 patients). In assessing the chance of short-term success (> 75% improvement for up to 60 days), they found the odds ratio for success in the steroid treatment group to be 2.61 (95% confidence interval [CI], 1.90–3.77). For long-term pain relief (up to 12 months), the odds ratio for the steroid treatment group was 1.87 (95% CI, 1.31–2.68). There was no significant difference in outcomes when caudal and lumbar epidural injections were compared. The most recent controlled study, not included in either of the aforementioned reviews, compared epidural methylprednisolone acetate to epidural saline.[7] The steroid-treated group experienced more improvement in sensory function and flexibility at the 3-week assessment, but not at 6 weeks or 3 months after treatment. The steroid treated group had better improvement in leg pain than the control group at 6 weeks, but not at 3 months.

To address the issue of long-term persistence of beneficial response to epidural steroid injections, Abram and Hopwood[8] performed a follow-up study of 212 patients treated with lumbar epidural steroid injections. They found that just more than half of the patients treated were substantially improved 2 weeks after treatment. At 6- and 12-month follow-up intervals, those patients who responded well initially were even further improved. The study identified several variables that were independently predictive of lower treatment response rates, including prolonged duration of symptoms (> 6 months),

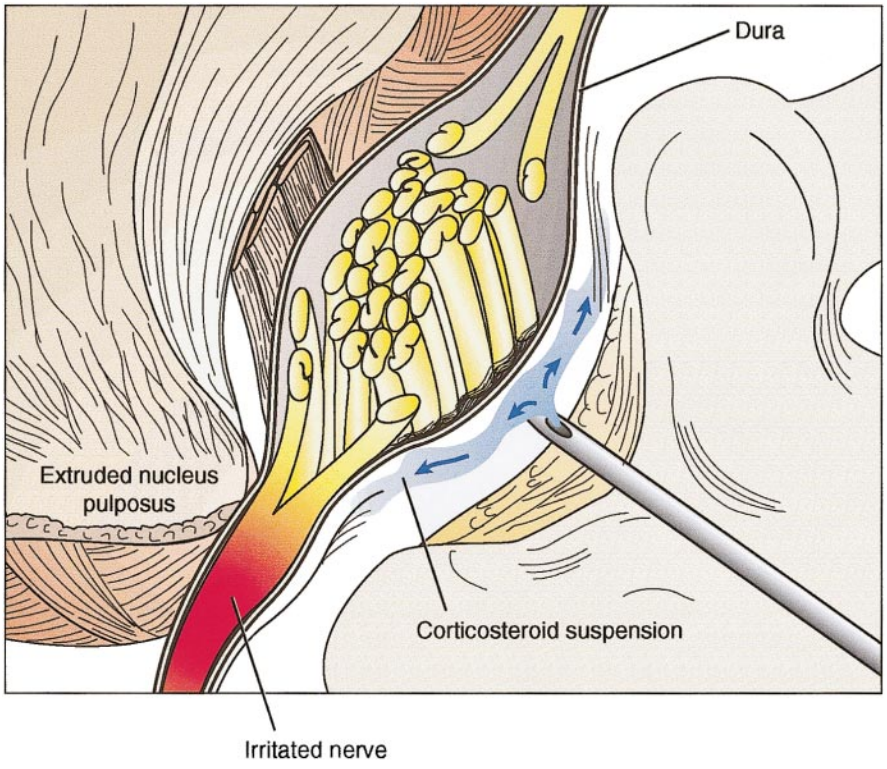

Fig. 1. Lumbar epidural injection with solution distributed to irritated site. Immediately before steroid injection, physical examination should obtain a semiquantitative threshold for pain (*e.g.,* how long sitting, how far walking, how far bending, elevation of straight-leg lift to produce pain) for comparison after the injection. When performing an epidural steroid injection, insertion of an intravenous line usually is not necessary, although resuscitation equipment always must be available. Needle placement is achieved in a manner identical to injection for epidural anesthesia, except the level of insertion should be as close as possible to the level of pathology.

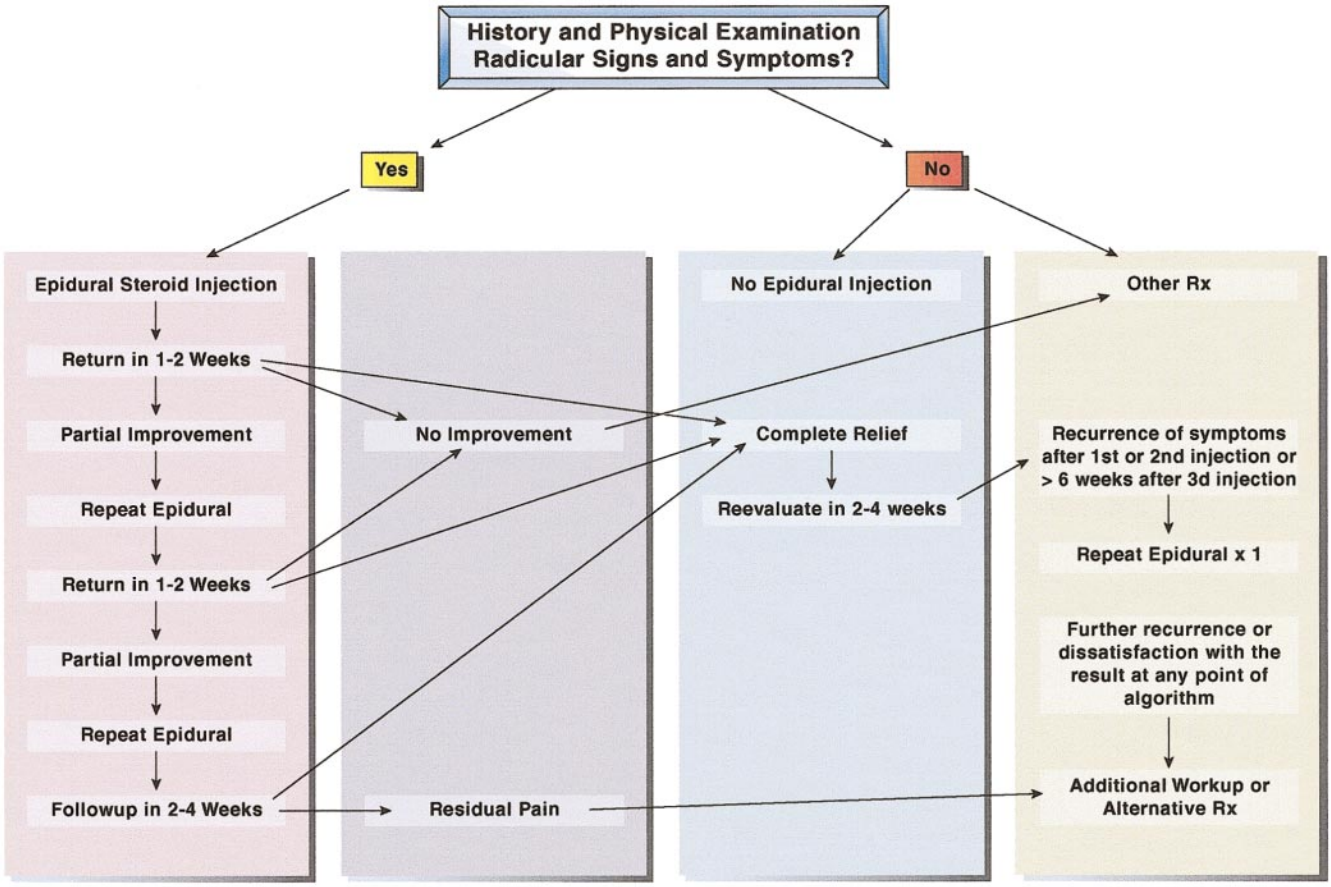

Fig. 2. Algorithm for treatment of sciatica with epidural steroid injections.

nonradicular pain, pain-related unemployment, and a history of smoking.[8]

Side Effects and Complications

Systemic Corticosteroid Effects

The "depo" steroid preparations used for epidural injections may produce adrenocorticotropic hormone (ACTH) suppression and cushingoid symptoms that can last up to a few weeks. Diabetic patients commonly experience increased insulin requirements for several days after injection. There has been a single report of a true allergic reaction to triamcinolone diacetate.

Technical Complications

Transient exacerbation of symptoms, generally lasting 48 h or less, is fairly common, but a long-term increase in symptoms is rare. Accidental dural puncture with consequent postdural puncture headache is a potential complication, particularly among patients who underwent previous operations. Epidural blood patch is a reasonable treatment option for a patient whose headache persists, but radicular symptoms may be aggravated by this procedure in some cases. Introduction of air into the subarachnoid or subdural space can occur if air is used to detect loss of resistance, resulting in severe headaches that may last for several hours. Epidural hematoma is very uncommon after epidural steroid injections. There has been one report of a case that occurred after cervical epidural steroid injection.

Infectious Complications

A single case of bacterial meningitis has been reported after epidural steroid injection, but dural puncture could not be ruled out in that case. Several cases of epidural abscess after epidural steroid injections have been documented, most of which occurred in diabetic patients.

Neurologic Complications

Clinical Data. Most of the cautionary statements regarding the possibility of neurologic sequelae after epidural steroid injections have been based on extrapolation of the perceived risks of intrathecal injections. Arachnoiditis has been reported after multiple intrathecal injections of methylprednisolone acetate, principally among patients treated for advanced symptoms of multiple sclerosis. The problem has been attributed to a component of the vehicle, polyethylene glycol. However, a study of the effect of this substance on nerve conduction revealed alterations only at concentrations much higher than clinically relevant, and, even at high concentrations, conduction defects were reversible.[9] It is important to point out that arachnoiditis has not been reported after epidural injection of steroids.[10]

Aseptic meningitis also has been attributed to intrathecal administration of deposteroids.[10] Symptoms consist of burning pain in the lower extremities, nausea, headache, and fever. Examination of the cerebrospinal fluid reveals pleocytosis, lowered glucose, and elevated protein levels. Although some authors have warned that this condition may be a precursor to more serious complications, no permanent sequelae to the reported cases of aseptic meningitis have occurred. Only one case has been reported after epidural steroid injection. This occurred after injection of steroid without local anesthetic; therefore, accidental intrathecal placement can not be ruled out.

Animal Data. The few animal studies that have assessed the neurotoxic potential of deposteroids have failed to show cause for concern. One study in cats showed no inflammatory changes in meninges or nerve roots at 4 or 10 days after injection, whereas another study, also in cats, showed mild inflammatory changes 30 days after injection, but no abnormalities 120 days post-treatment.[10] Rats administered four intrathecal steroid injections during a 3-week period failed to show any more histologic abnormalities than saline-injected animals, and exhibited no neurologic dysfunction during the course of the study.[1]

Suggestions for Epidural Steroid Use

The following suggestions for the use of epidural steroid injections do not necessarily represent a consensus of opinion, but seem logical based on current literature. For any individual patient, the risks and potential benefits should be considered before deciding on the use of this or any other course of treatment.

1. Reserve treatment for patients with symptoms of radiculopathy.
2. Avoid the procedure if there is concern about localized infection in the region or systemic infection, or if there is concern about clotting function.
3. Consider the added risk of infection in diabetic patients.
4. Be aware of the reduced chances of success if symptoms are prolonged, if there has been previous back surgery, if there is preoccupation with vocational or

litigation issues, or if there are substance abuse problems or a history of heavy smoking.
5. Avoid intrathecal injection. Use a local anesthetic test dose and postpone the procedure if there is evidence of having punctured the dura.
6. Use moderate steroid doses (50 mg triamcinolone diacetate or 80 mg methylprednisolone acetate) and minimize the number of injections. Repeat injections on the basis of patient response, not a preconceived treatment plan, *e.g.*, a series of three injections.
7. New or modified techniques should be assessed using institutional research protocols rather than empirically.

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