

### The Use of Epidural Corticosteroids for Cervical Radiculopathy: An Interlaminar Versus Transforaminal Approach

#### CASE SCENARIO

A 43-year-old right-handed man presents with left shoulder pain and left arm pain and numbness. His symptoms began 6 weeks previously while weightlifting, performing repetitive shoulder abductions with a 10-pound dumbbell in each hand. He noticed a sudden cramp in his neck and left shoulder and immediately stopped his workout. While driving home from the gym, he noticed a temporary jolting pain into his left arm to the hand and fingers. He awoke the following morning with sharply increased pain. His primary care physician initially prescribed ibuprofen, cyclobenzaprine, and hydrocodone, and later gabapentin. Ibuprofen was helpful, and each of the remaining medications ameliorated a portion of his pain but caused either somnolence or vertigo.

Within the first week, the patient developed numbness in left hand and thumb whereas the overall severity of his pain decreased. Cervical magnetic resonance imaging (MRI) was ordered, and physical therapy prescribed including 12 sessions of traction, mobilization, and stretching, resulting in temporary improvement only. He attempted a few home exercises but was limited by increased pain while performing sit-ups and weakness of his left arm while performing push-ups and pull-ups. He denied problems with walking or balance and had no changes in his bladder or bowel function except for some constipation associated with use of hydrocodone.

The patient works for the phone company, installing and repairing phone lines. The job involves phone line work from a bucket as well as ground work for building installations. Aside from his tools, there is no heavy lifting. During installations, he is required to maintain awkward neck and arm positions that significantly aggravate his arm pain and numbness more than neck pain. He has missed 4 of the last 6 weeks of work and has exhausted his paid sick leave and is concerned about losing his job.

He is cooperative and pleasant during the examination. He has a positive Spurling maneuver to the left, a diminished left brachioradialis tendon reflex, subtle weakness of the left biceps, and reduced pin-prick sensation in the left lateral hand and thumb. The remainder of the neurologic examination is normal. His MRI taken 2 weeks previously demonstrates a left paracentral disc herniation at C5–C6 (Figs. 1 and 2). While the physician discusses these findings with the patient, the patient states that he is “willing to have surgery or do whatever it takes to get better quickly.”

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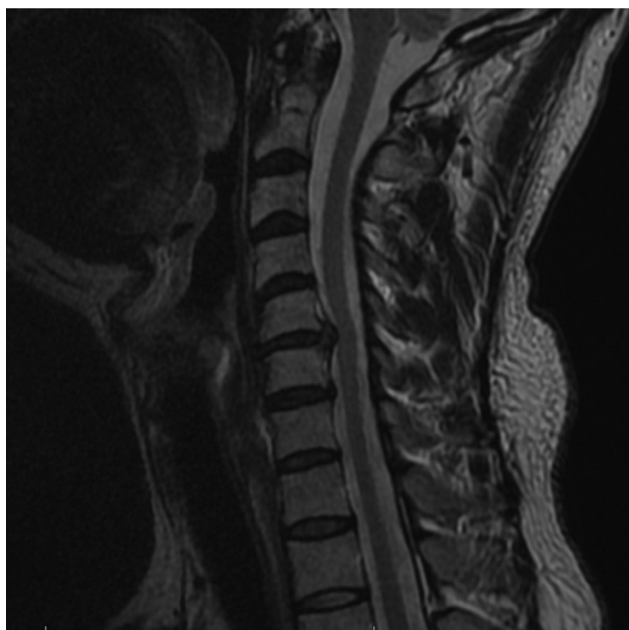
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Disclosure: nothing to disclose

#### Matthew Smuck, MD, Responds

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This case describes the typical early course of acute cervical radiculopathy caused by a cervical disc herniation. Although acute radiculopathies have more evidence-informed care than other spinal disorders, controversy remains regarding best treatments as this discussion will illustrate. The patient described here has a left C6 radiculopathy caused by a C5–C6 disc herniation. His symptoms have been present for 6

weeks. Fortunately, the natural history of acute radiculopathy resulting from intervertebral disc herniation is favorable [1]. The majority of individuals with this condition improve within several weeks or months. Unfortunately in this case, conservative treatments thus far have provided little relief of his radicular symptoms, and his work situation is not well suited to a “watch-and-wait” approach. Several more weeks



**Figure 1.** Sagittal T2-weighted MRI showing a C5–C6 disc herniation.

of significant functional limitations could have a longstanding negative impact on his professional and personal life.

In this setting, failure of conservative care at 6 weeks is a relative indication for aggressive intervention such as injections or surgery. Approximately 10% to 20% of patients with cervical radiculopathy eventually undergo surgery [1,2]. With surgery, it is possible to obtain more rapid relief of symptoms [3]. However, there is also evidence of recurrence rates as high as 30% in patients treated both surgically and nonsurgically [2,4]. Further, the specific surgical procedure will impact long-term results. Anterior cervical decompression and fusion increases the risk of adjacent level degeneration and radiculopathy. In this case, the paracentral location of the disc herniation would likely require an anterior approach rather than a posterior decompression without fusion. Alternatively, an artificial cervical disc implantation may obviate the need for fusion. One will assume that after discussing these options, the patient is not interested in a surgical procedure to treat his radiculopathy at this time.

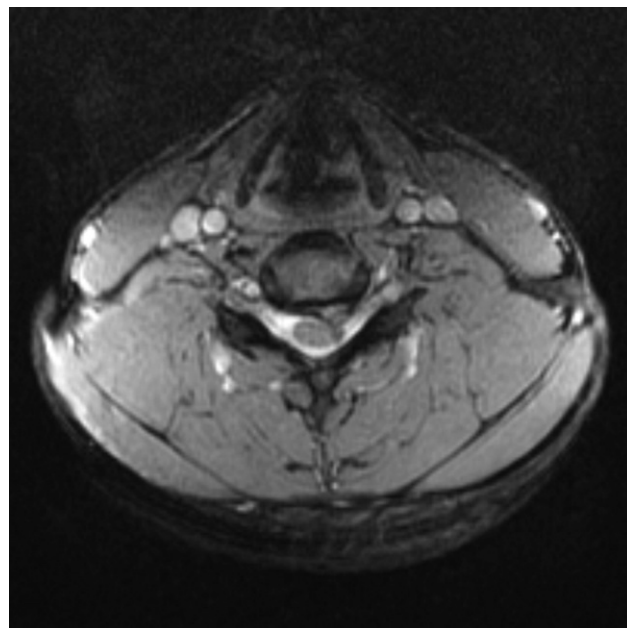
The primary goal of nonoperative treatment of acute radicular pain is to ameliorate the symptoms and maintain/restore function while the favorable natural history runs its course. For this purpose, epidural corticosteroids have proven beneficial [5]. Therefore, an epidural steroid injection is the best treatment option for this patient at this time with potential to reduce his pain and increase his function while avoiding the risks and consequences of surgery. Although commonly prescribed in clinical practice, oral corticosteroids are not superior to placebo in lumbar radiculopathy [6] and have not been extensively studied in cervical radiculopathy.

In the case presented here, the patient's symptoms and the findings on examination correspond with a disc herniation

observed radiographically. Thus, no further diagnostic testing is warranted before recommending an epidural injection. The goal of the injection is to deliver a single dose of a potent corticosteroid to the site of pathology. In this case, a left C5–C6 transforaminal injection is the most direct and selective route. Theoretically, a concentrated deposition of steroid at the site of pathology may produce a more efficacious result than an interlaminar injection, which is thought to deliver medication to the location of pathology from 1 or 2 levels below. A C5–C6 interlaminar epidural injection would be ill advised because the epidural space is quite small at this level [7]. In addition, many surgeons use a transforaminal injection as a diagnostic tool in surgical planning.

Although there have been no randomized controlled studies to determine the efficacy of cervical transforaminal epidural corticosteroid injections, prospective studies have demonstrated their effectiveness in reducing pain and the need for surgeries [8,9]. In fact, in one study, recovery occurred after a single injection in the majority of patients [9].

Cervical transforaminal epidural steroid injection is not risk free. In general, these injections are safe with a low incidence (0.32% to 1.6%) of minor complications reported in patients treated by expert hands [10,11]. Still, serious morbidity and death have been reported from cervical epidural injections so their use should be carefully considered (Editor's Note: see rebuttal for detailed discussion). In my opinion, the potential benefits outweigh the potential risks in this case. The patient's desire for rapid improvement and functional recovery warrants consideration of additional intervention. Sustaining the current conservative treatments in anticipation of eventual recovery would cause undue finan-



**Figure 2.** Axial T2-weighted MRI showing the same C5–C6 disc herniation.

cial and personal distress. Also, progressing to surgical treatment is premature without first attempting less invasive alternatives. Therefore, I recommend a left C5-6 transforaminal epidural corticosteroid injection.

## REFERENCES

1. Saal JS, Saal JA, Yurth EF. Nonoperative management of herniated cervical intervertebral disc with radiculopathy. *Spine* 1996;21:1877-1883.
2. Radhakrishnan K, Litchy WJ, O'Fallon WM, Kurland LT. Epidemiology of cervical radiculopathy. A population-based study from Rochester, Minnesota, 1976 through 1990. *Brain* 1994;117:325-335.
3. Bohlman HH, Emery SE, Goodfellow DB, Jones PK, Robinson anterior cervical discectomy and arthrodesis for cervical radiculopathy. Long-term follow-up of one hundred and twenty-two patients. *J Bone Joint Surg Am* 1993;75:1298-1307.
4. Gore DR, Sepic B. Anterior discectomy and fusion for painful cervical disc disease: a report of 50 patients with an average follow-up of 21 years. *Spine* 1998;23:2047-2051.
5. Stav A, Ovadia L, Sternberg A, Kaadan M, Weksler N. Cervical epidural steroid injection for cervicobrachialgia. *Acta Anaesthesiol Scand* 1993; 37:562-566.
6. Haimovic IC, Beresford HR. Dexamethasone is not superior to placebo for treating lumbosacral radicular pain. *Neurology* 1986;36:1593-1594.
7. Goel A, Pollan JJ. Contrast flow characteristics in the cervical epidural space: an analysis of cervical epidurograms. *Spine* 2006;31:1576-1579.
8. Bush K, Hillier S. Outcome of cervical radiculopathy treated with periradicular/epidural corticosteroid injections: a prospective study with independent clinical review. *Eur Spine J* 1996;5:319-325.
9. Vallee JN, Feydy A, Carlier RY, Mutschler C, Mompoin D, Vallee CA. Chronic cervical radiculopathy: lateral approach periradicular corticosteroid injection. *Radiology* 2001;218:886-892.
10. Derby R, Lee SH, Kim BJ, Chen Y, Seo KS. Complications following cervical epidural steroid injections by expert interventionalists in 2003. *Pain Physician* 2004;7:445-449.
11. Ma DJ, Gilula LA, Riew KD. Complications of fluoroscopically guided extraforaminal cervical nerve blocks. An analysis of 1036 injections. *J Bone Joint Surg Am* 2005;87:1025-1030.

## Jack Rosenberg, MD, Responds

In this case, a young patient with symptoms and signs consistent with acute cervical (C6) radiculopathy is desperately searching for relief from his pain. Despite saying that he is willing to do "whatever it takes," it seems that he is not currently willing to continue conservative therapy, even though that approach is supported by the literature [1]. Instead he wishes to find a more rapid, or maybe better stated, convenient way to treat his pain and return to work. Further he wishes to immediately return to a potentially problematic occupation despite existing weakness in his arm. A sensitive question to consider is whether the physician should attempt to treat the patient according to his unrealistic desires. A separate question is whether a nonvalidated and potentially dangerous technique (cervical transforaminal epidural injection) should be used when less dangerous and better documented techniques exist. As clinicians, we often treat patients who desire particular interventions. In response to their requests we determine a diagnosis and suggest a treatment plan supported by evidence and experience. It is natural to attempt to please the patient, but sometimes clinicians are faced with patient requests that we believe are counterproductive or, even worse, harmful.

In this case, the patient apparently has expectations of returning to work immediately because his sick time is running out and losing his job could leave him without insurance. It is my opinion that these considerations should not alter what medical care is provided. First, my proposed treatment plan may take time to be effective, and his current insurance may become exhausted midtreatment. Second, I do not support this patient's desire to immediately return to work even if he had an immediate decrease in his symptoms. The underlying disease process in this case is not corrected, only palliated. His symptoms could return in hazardous situations before the natural process of disc resorption occurs. Another concern is that there is an implication that he has tried to do hazardous work while taking sedating medi-

cations. The patient's disregard or misunderstanding for impairment due to his disease and sedative medication strongly suggests education of the patient is needed. If prompt return to hazardous duty is required, an operation to remove the offending disc material may be a consideration, but even then, recovery varies depending on the surgical procedure.

The second question is which intervention should be selected to provide symptomatic relief for this patient. My preference is for an interlaminar epidural injection placed at the C6-C7 or C7-T1 level. A randomized controlled trial has shown positive results in the treatment of cervical herniated discs [2]. Cervical transforaminal epidural injections have the small-but-catastrophic risk of cervical cord infarction and accompanying paralysis, and even death [3]. These risks have been addressed by performing digital subtraction angiography [4], using blunt tip needles, minimizing sedation, using test doses, and using small-particulate corticosteroid mixtures. These measures make sense but cannot be validated because of the low incidence of the complication. If multiple transforaminal levels are injected, the risk further increases. Additional factors that cannot be so easily controlled such as inadvertent patient movements and the need for multiple injections interfering with digital subtraction angiography further increase my preference for an interlaminar approach.

## REFERENCES

1. Olivero WC, Dulebohn SC. Results of halter traction for treatment of cervical radiculopathy: Retrospective review of 81 patients. *Neurosurg Focus* 2002;12:1-4.
2. Stav A, Ovadia L, Sternberg A, Kaadan M, Weksler N. Cervical epidural steroid injection for cervicobrachialgia. *Acta Anaesthesiol Scand* 1993; 37:562-566.
3. Scanlon GC, Moeller-Bertram T, Romanowsky SM, Wallace MS. Cervical transforaminal epidural steroid injections: more dangerous than we think? *Spine* 2007;32:1249-1256.
4. Jasper JF. Role of digital subtraction fluoroscopic imaging in detecting intravascular injections. *Pain Physician* 2003;6:369-372.

## Dr. Smuck's Rebuttal

It is clear that Dr. Rosenberg and I agree that an epidural injection is indicated in this case. However, we differ in the recommended epidural approach. In addition, questions involving patient expectations and activity instructions have been raised and deserve further discussion.

The topic of patient (and, for that matter, physician) expectations is of critical importance. Physicians treating patients with spine disorders encounter this issue on a regular basis. A patient with chronic low back pain who is depressed, opioid-dependent, and involved in worker's compensation litigation is not likely to find the simple, definitive cure he is seeking. In the same way that unrealistic expectations by patients predispose them to treatment failure, unrealistic expectations by physicians promote undue risks to patients. Arguably, the greater the risks involved in treatment the more important this becomes.

Assessment of patient expectations is one of the fundamental elements of psychiatry. At times this requires challenging unrealistically low expectations, whereas other times limitations must be acknowledged to effectively advance functional recovery. Although this patient is clearly influenced by external forces that are fueling his desire for rapid improvement, I am not convinced that his expectations are unrealistic. Although there are no guarantees, there is a high likelihood of significant improvements in pain and function in the coming weeks either with more aggressive conservative care including epidural injections or potentially with surgical treatment. Rapid improvement is not only a reasonable goal; it is achievable for the vast majority of patients in this situation [1,2]. Therefore, it is good medical advice to suggest an epidural corticosteroid injection and to highlight the potential benefits as long as there is appropriate informed consent.

In regard to activity restrictions, concern was raised about returning to work soon after palliation of symptoms after an epidural injection because the underlying disc herniation may not have resolved. Although I agree that there is no evidence to suggest that an epidural injection will speed, or slow, the spontaneous resolution of a disc herniation, I think the advice to avoid work in this case is overly cautious. The majority of nonsurgically treated patients with cervical radiculopathy resulting from a disc herniation experience clinical recovery within several weeks although morphologic improvement of disc herniations occurs more slowly [3,4]. In fact, some patients improve clinically despite the persistence of a herniation in long-term imaging follow-up [3]. Also, it is known that a large subset of individuals without a history of neck pain or radiculopathy will have cervical disc herniations on MRI [5]. Certainly, there is no reason to restrict the activities of any of these asymptomatic individuals with disc herniations. In my opinion, substantial restrictions on this patient's activities are not only unnecessary, they are potentially detrimental to his overall recovery.

According to the current best evidence, restricting activity has little or no effect on pain and functional status in patients

with lumbar radicular pain when compared to advice to remain active [6]. Furthermore, supporting continued disability in face of improved symptoms may actually be more harmful in the long term. Prolonged absence from normal activity and social roles, including work, can lead to deterioration of physical and mental health [7]. Further, suggesting that such activities are dangerous may cause unnecessary distress and stimulate fear avoidance behaviors that are associated with prolonged work disability [8,9]. Therefore, I support this patient's goal of a rapid return to work, despite the likely persistence of his C5–C6 disc herniation and mild biceps weakness during the coming months. Another advantage of the epidural injection is that it may allow him to avoid the use of potentially cognition-altering medications that clearly must be avoided in his occupation.

I agree that adequate patient education is essential before proceeding with an epidural injection. It must focus on more than just the risks and benefits of an injection. For instance, it is the physician's responsibility to determine why this gentleman has missed so much work in the previous weeks. Is it because the pain he experiences with his job tasks renders him ineffective? Or, is he restricting his work activities because he is afraid that every brief and small aggravation is an indication that he is making his condition worse? If the latter is true, the best treatment course may be to simply educate him about the known lack of risk in continuing activities, forego the epidural injection, and pursue a more aggressive rehabilitation program to rapidly restore his work abilities, expecting a gradual resolution of his symptoms over time.

Conversely, if pain is the limiting factor, then current evidence suggests that an epidural injection has a high likelihood of improving his condition. As I stated earlier, I think a transforaminal injection is the most direct and selective route in this situation. When the standard for injection accuracy is the delivery of medications to the site of pathology, interlaminar epidural injections have been shown to achieve this in as few as 26% of patients [10]. Most likely, this concentrated placement of medication around the site of nociception is the reason that transforaminal epidural injections have proven superior to interlaminar injections in direct comparisons [11,12]. Of course this evidence is restricted to evaluation of treatment of lumbar radiculopathy and the same evidence does not exist for treatment in the cervical spine.

Opponents of cervical transforaminal epidural injections cite the known serious risks and the lack of randomized trials demonstrating efficacy, leading some to advocate abandoning cervical injections altogether whereas others to suggest performing all cervical epidural injections via the interlaminar route. Certainly, better evidence is greatly needed. Not only do cervical transforaminal epidural injections lack proof of level 1 efficacy, cervical interlaminar epidural injections do as well. The only published randomized trial on the topic,

cited previously, compared cervical interlaminar epidural corticosteroid injections to intramuscular corticosteroid injections [13]. Thus, this study demonstrates the superior effectiveness of interlaminar injections over systemic corticosteroids, but it does not prove efficacy. That proof awaits a well designed placebo-controlled trial. Therefore, currently we have a choice between 2 epidural techniques, both of which have demonstrated good clinical effectiveness in multiple prospective trials, but neither has proven efficacy.

That being said, it is reasonable to compare the relative risks of the 2 techniques to inform this choice. A direct comparison of complications between 4389 cervical interlaminar and 1579 cervical transforaminal injections found no significant difference in minor complications and no major complications in either group [14]. Recently, multiple reports of serious complications from cervical transforaminal epidural injections understandably raised concerns about safety [14]. It does not, however, suggest that the alternative epidural route is safer. In fact, similar serious complications have been reported from cervical interlaminar injections, including epidural hematoma [15], epidural abscess [16], cervical myelopathy [17], and death [18].

Fortunately, these serious complications are rare, although their actual incidence remains unknown. In the 2 large published case series of cervical transforaminal epidural injections, no serious complications occurred in more than 2500 injections combined [14,19]. Scanlon et al. [20] delivered a survey to 1340 physician members of the American Pain Society asking them to document personal knowledge of neurologic complications resulting from cervical transforaminal epidural injections. Of the 287 responders, there were only 30 cases of serious neurologic injury reported, including 13 deaths. Given conversations around the water cooler at specialty meetings, one might have expected a larger percentage of positive responses, especially because this type of survey is subject to a selection bias toward those with knowledge of a complication. Unfortunately, this study does not provide any information on the incidence or prevalence of these injuries. A survey asking these same physicians to report only their own complications could have provided more useful data.

By means of a completely informal analysis, I will attempt to estimate the incidence of serious complications in the county where I work. In this county there are 6 group practices with a total of 18 physicians performing epidural steroid injections. During the past 5 years I know of one local fatality after a cervical transforaminal epidural injection. Word of this complication spread quickly throughout the small circle of providers who perform these injections. To estimate the number of injections by each physician, I calculated the average number of cervical transforaminal epidural injections performed annually by the interventional physiatrists at the local university spine clinic. Each of these physicians maintains a less than a full-time clinical practice, so their average of 70 cervical transforaminal injections per year is likely a conservative estimate for physicians in this area. Multiply the 18 local physicians by 70 injections/year, and

that number by 5 years to arrive at a total of 6300 injections. One serious complication from this total equals an incidence of 0.016%. Of course, this is just a raw estimate with many variables. Hopefully future research will help to determine the exact incidence of serious injury from both cervical transforaminal and interlaminar epidural injections. Further, health economics studies measuring the cost savings from avoiding surgery as a result of these injections versus costs of surgery and potential complications may be of value.

Although the exact risk from cervical epidural steroid injections is unknown, the fact remains that serious complications do occur. Therefore, prevention is the next logical area of focus. A discussion of prevention requires an understanding of the mechanisms behind the reported serious complications. In brief, a serious injury can result from inaccurate needle placement and injection into the spinal cord, needle induced arterial spasm or dissection, or inadvertent arterial cannulation followed by injection and embolization of particulate corticosteroids [17,21].

Although procedural competency is difficult to measure objectively, practitioners must ensure that they have adequate training and experience to perform these potentially dangerous injections. Still, serious complications do occur even in experienced hands. Proponents of cervical transforaminal epidural injections have suggested several methods to reduce the incidence of these complications. Because of rare occurrence of serious complications, these safety measures are not likely to be validated by a demonstrable reduction in the incidence of injuries; however the same is not true of testing their utility.

Digital subtraction angiography is often advocated but is not 1 of the 3 methods of reducing risk that has been subject to critical investigation. Therefore, what 3 methods have been studied? First, aspiration for blood with a syringe has been shown to have good specificity but low sensitivity (45%) [22]. Therefore, it is more useful if positive but not if negative. Second, using live fluoroscopy during contrast injections allowed a greater than 50% increase on observing inadvertent vascular injection as compared to intermittent static fluoroscopy [23]. Third, using small particulate corticosteroids (eg, dexamethasone) may prevent neurologic injuries even with inadvertent intra-arterial injections [24]. Because dexamethasone is not approved by the Food and Drug Administration for epidural use, its use in epidural injections is off-label. Further support for using dexamethasone in cervical transforaminal epidural injections comes from a small prospective randomized trial comparing it to a commonly used large-particulate corticosteroid with no significant differences in outcomes between the two treatment groups [25]. In addition to these 3 "proven" risk-reducing practices, several other methods have been suggested to maximize safety, including the use of digital subtraction angiography, the use of blunt-tip needles, screening patients for dissection risk factors, minimizing sedation, avoiding needle manipulation after contrast confirmation by injection through extension tubing, and injecting an anesthetic test dose before the corticosteroids [20,21].

In conclusion, the decision to prescribe a cervical epidural corticosteroid injection is based on limited data, regardless of which technique is used. Although efficacy in comparison with placebo remains unknown, prospective cohort studies have consistently demonstrated the effectiveness of these injections. On the basis of this effectiveness, I believe that it is prudent to recommend cervical epidural injections to patients with cervical radiculopathy who have failed more conservative treatments as in this case. The decision to proceed requires a frank discussion of the risks involved. Also, both patient and physician expectations must be analyzed since they will influence treatment decisions and outcomes. Finally, it is necessary for the physician performing the injection to have sufficient training, experience and knowledge of every method available to reduce the risks of the procedure.

## REFERENCES

1. Saal JS, Saal JA, Yurth EF. Nonoperative management of herniated cervical intervertebral disc with radiculopathy. *Spine* 1996;21:1877-1883.
2. Bush K, Hillier S. Outcome of cervical radiculopathy treated with periradicular/epidural corticosteroid injections: A prospective study with independent clinical review. *Eur Spine J* 1996;5:319-325.
3. Bush K, Chaudhuri R, Hillier S, Penny J. The pathomorphologic changes that accompany the resolution of cervical radiculopathy. A prospective study with repeat magnetic resonance imaging. *Spine* 1997;22:183-186.
4. Maigne JY, Deligne L. Computed tomographic follow-up study of 21 cases of nonoperatively treated cervical intervertebral soft disc herniation. *Spine* 1994;19:189-191.
5. Matsumoto M, Fujimura Y, Suzuki N, Nishi Y, Nakamura M, Yabe Y, Shiga H. MRI of cervical intervertebral discs in asymptomatic subjects. *J Bone Joint Surg Br* 1998;80:19-24.
6. Hagen KB, Jamtvedt G, Hilde G, Winnem MF. The updated cochrane review of bed rest for low back pain and sciatica. *Spine* 2005;30:542-546.
7. Rainville J, Pransky G, Indahl A, Mayer EK. The physician as disability advisor for patients with musculoskeletal complaints. *Spine* 2005;30:2579-2584.
8. Landers MR, Creger RV, Baker CV, Stutelberg KS. The use of fear-avoidance beliefs and nonorganic signs in predicting prolonged disability in patients with neck pain. *Man Ther* 2008;13:239-248.
9. Swinkels-Meewisse IE, Roelofs J, Schouten EG, Verbeek AL, Oostendorp RA, Vlaeyen JW. Fear of movement/(re)injury predicting chronic disabling low back pain: A prospective inception cohort study. *Spine* 2006;31:658-664.
10. Fredman B, Nun MB, Zohar E, et al. Epidural corticosteroids for treating "failed back surgery syndrome": Is fluoroscopy really necessary? *Anesth Analg* 1999;88:367-372.
11. Schaufele MK, Hatch L, Jones W. Interlaminar versus transforaminal epidural injections for the treatment of symptomatic lumbar intervertebral disc herniations. *Pain Physician* 2006;9:361-366.
12. Thomas E, Cyteval C, Abiad L, Picot MC, Taorel P, Blotman F. Efficacy of transforaminal versus interspinous corticosteroids injection in discal radiculargia—a prospective, randomized, double-blind study. *Clin Rheumatol* 2003;22:299-304.
13. Stav A, Ovadia L, Sternberg A, Kaadan M, Weksler N. Cervical epidural steroid injection for cervicobrachialgia. *Acta Anaesthesiol Scand* 1993;37:562-566.
14. Derby R, Lee SH, Kim BJ, Chen Y, Seo KS. Complications following cervical epidural steroid injections by expert interventionalists in 2003. *Pain Physician* 2004;7:445-449.
15. Williams KN, Jackowski A, Evans PJ. Epidural haematoma requiring surgical decompression following repeated cervical epidural steroid injections for chronic pain. *Pain* 1990;42:197-199.
16. Huang RC, Shapiro GS, Lim M, Sandhu HS, Lutz GE, Herzog RJ. Cervical epidural abscess after epidural steroid injection. *Spine* 2004;29:E7-E9.
17. Bose B. Quadriplegia following cervical epidural steroid injections: Case report and review of the literature. *Spine J* 2005;5:558-563.
18. Reitman CA, Watters W, 3rd. Subdural hematoma after cervical epidural steroid injection. *Spine* 2002;27:E174-E176.
19. Ma DJ, Gilula LA, Riew KD. Complications of fluoroscopically guided extraforaminal cervical nerve blocks. An analysis of 1036 injections. *J Bone Joint Surg Am* 2005;87:1025-1030.
20. Scanlon GC, Moeller-Bertram T, Romanowsky SM, Wallace MS. Cervical transforaminal epidural steroid injections: more dangerous than we think? *Spine* 2007;32:1249-1256.
21. Tiso RL, Cutler T, Catania JA, Whalen K. Adverse central nervous system sequelae after selective transforaminal block: The role of corticosteroids. *Spine J* 2004;4:468-474.
22. Furman MB, Giovannello MT, O'Brien EM. Incidence of intravascular penetration in transforaminal cervical epidural steroid injections. *Spine* 2003;28:21-25.
23. Smuck M, Fuller B, Chiodo A, et al. Accuracy of intermittent fluoroscopy to detect intravascular injection during transforaminal epidural injections. *Spine* 2008;33:E205-E210.
24. Okubadejo GO, Talcott MR, Schmidt RE, Sharma A, Patel AA, Mackey RB, Guarino AH, Moran CJ, Riew KD. Perils of intravascular methylprednisolone injection into the vertebral artery. An animal study. *J Bone Joint Surg Am* 2008;90:1932-1938.
25. Dreyfuss P, Baker R, Bogduk N. Comparative effectiveness of cervical transforaminal injections with particulate and nonparticulate corticosteroid preparations for cervical radicular pain. *Pain Med* 2006;7:237-242.

## Dr. Rosenberg's Rebuttal

In the setting of a nonprogressive neurologic deficit the goals of conservative treatment are to educate the patient, relieve his or her pain, minimize any adverse treatment effects, improve function, prevent chronicity, and avoid surgery. This cascade of endeavors begins with thorough education of the patient. Once accomplished, and with mutual agreement on treatment expectations, then I agree that it is time to proceed to a discussion of epidural corticosteroid injection. After the injection, a prompt clinical reassessment and follow-up physical therapy are both indicated and are especially important given this patient's desire for a timely recovery.

Although patient education is required to develop common goals, there is no evidence that education has any impact on the course of this particular disease or that it can impact the long-term outcome. Furthermore, in the short-term it is not expected to have any impact on his primary symptom—pain. Current research shows that patient education does not improve pain in patients with neck pain with or without radiculopathy [1].

Acknowledging this patient's frustration with the typical course of acute radiculopathy does not convince me to accept greater risk for him, especially without convincing evidence

of improved efficacy of cervical transforaminal epidural steroid injections relative to an available alternative [2]. Cervical interlaminar epidural injections were used for decades before transforaminal injections. As such they have a time-honored track record. Still, the practice of medicine is constantly evolving. Although the efforts to maximize the safety of epidural injections are commendable, I am not convinced that these methods allow the selection of a cervical transforaminal injection over the more established interlaminar technique given the type of complications associated with the procedures.

Hence, I continue to diverge with my colleague and prefer an interlaminar approach until better data exists in the form

of randomized trials. If this patient failed to respond to an interlaminar injection, only then would I discuss the innovative transforaminal approach with him. I would compare this intervention to potential surgical options as well as continued conservative management and proceed based on that discussion.

## REFERENCES

1. Haines T, Gross A, Goldsmith CH, Perry L. Patient education for neck pain with or without radiculopathy. *Cochrane Database of Systematic Reviews* 2008, Issue 4. Art. No.: CD005106. DOI: [10.1002/14651858.CD005106.pub2](https://doi.org/10.1002/14651858.CD005106.pub2).
2. Gillett GR. Innovative treatments: ethical requirements for evaluation. *J Clin Neurosci* 1998;5:378-381.