

# Cervical Epidural Steroid Injections

Review & Recommendation Statement

Evidentiary Tables

March 2011



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## Review & Recommendation Statement

### Evidentiary Tables

#### **Review and Recommendation Statement: Evidence Work Group**

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#### Disclaimer

This document should not be construed as including all proper methods of care or excluding other acceptable methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment is to be made by the physician and patient in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution.

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## Does the use of CESIs improve the outcomes of cervical radiculopathy/radiculitis?

Article (Alpha by Author)	Level of evidence	Description of study	Conclusion
Anderberg, L., M. Annertz, et al. (2007). "Transforaminal steroid injections for the treatment of cervical radiculopathy: a prospective and randomised study." Eur Spine J 16(3): 321-8	Level III  Type of evidence therapeutic	<input checked="" type="checkbox"/> Prospective <input type="checkbox"/> Retrospective  Study design: comparative  Stated objective of study: assess the short-term benefit of a single transforaminal epidural steroid injection (TFESI) in patients with cervical radiculopathy  Type of treatment(s): TF ESI  Total number of patients: 40 Number of patients in relevant subgroup(s): 20  Consecutively assigned? Yes  Duration of follow-up: 3 weeks  Validated outcome measures used: VAS referenced, but data not reported  Nonvalidated outcome measures used: 10 questions about symptoms and function  Diagnosis made by: <input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input checked="" type="checkbox"/> MRI <input type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input checked="" type="checkbox"/> Other: positive SNRB  Results/subgroup analysis (relevant to question): No difference in outcome between patients treated with steroid vs saline (with local anesthetic)	<i>Critique of methodology:</i> <input type="checkbox"/> Nonconsecutive patients <input type="checkbox"/> Nonrandomized <input type="checkbox"/> Nonmasked reviewers <input type="checkbox"/> Nonmasked patients <input checked="" type="checkbox"/> No validated outcome measures used <input checked="" type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input checked="" type="checkbox"/> Other: No true control group; improper randomization  <i>Work group conclusions</i> Potential Level: II Downgraded Level: III  <i>Conclusions relative to question</i> This paper provides evidence that:the use of Depo-Medrol + local anesthetic does not provide more pain relief at 3 weeks than local anesthetic + saline.

		Author conclusions (relative to question): No benefit to adding steroid to TF ESI. Further studies required.	
Bush, K. and S. Hillier (1996). "Outcome of cervical radiculopathy treated with periradicular/epidural corticosteroid injections: a prospective study with independent clinical review." Eur Spine J 5(5): 319-25	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input checked="" type="checkbox"/>Prospective <input type="checkbox"/>Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: To monitor the clinical outcome of patients when using serial periradicular/epidural corticosteroid injection techniques in the management of cervical radiculopathy.</p> <p>Type of treatment(s): Cervical plexus block, then if not effective, transforaminal epidural injection, if that not effective, then interlaminar epidural injection.</p> <p>Total number of patients: 68 Number of patients in relevant subgroup(s): 11/68 (16%)</p> <p>Consecutively assigned? Yes</p> <p>Duration of follow-up: 39 months mean (4-112)</p> <p>Validated outcome measures used: VAS</p> <p>Nonvalidated outcome measures used: telephone questions</p> <p>Diagnosis made by:  <input checked="" type="checkbox"/>Clinical exam/history  <input type="checkbox"/>Electromyography  <input type="checkbox"/>Myelogram  <input checked="" type="checkbox"/>MRI  <input checked="" type="checkbox"/>CT  <input type="checkbox"/>CT/Myelogram  <input type="checkbox"/>Other:</p> <p>Results/subgroup analysis (relevant to question): No patients had surgery; 48/63 available for follow up (mean 39 months) had no arm pain</p> <p>Author conclusions (relative to question): patients with cervical radiculopathy make an adequate recovery with periradicular or ESI</p>	<p><i>Critique of methodology:</i>  <input type="checkbox"/>Nonconsecutive patients  <input checked="" type="checkbox"/>Nonrandomized  <input checked="" type="checkbox"/>Nonmasked reviewers  <input type="checkbox"/>Nonmasked patients  <input type="checkbox"/>No validated outcome measures used  <input type="checkbox"/>Small sample size  <input type="checkbox"/>&lt;80% follow-up  <input checked="" type="checkbox"/>Lacked subgroup analysis  <input type="checkbox"/>Diagnostic method not stated  <input type="checkbox"/>Other:</p> <p><i>Work group conclusions</i>  Potential Level: IV  Downgraded Level:</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that:epidural steroid injections may provide long-term relief and avoidance of surgery.</p>

<p>Castagnera L, Maurette P, Pointillart V, Vital JM, Erny P, Senegas J. Long term results of cervical epidural steroid in- jection with and without morphine in chronic cervical radicular pain. Pain 1994; 58:239-243</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input checked="" type="checkbox"/>Prospective <input type="checkbox"/>Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Assess the short, mid and long-term effectiveness of a single CESI performed with or without morphine in patients with chronic cervical radicular pain (CRP) of non-compressive and non-malignant origin whose indications did not require surgery.</p> <p>Type of treatment(s): (1) Dilutional (2) Lysis of adhesions (3) Single C7-T1 ICESI with 0.5% lidocaine and triamcinolone or morphine and triamcinolone.</p> <p>Total number of patients: 24 Number of patients in relevant subgroup(s): Steroid and lidocaine 14 patients</p> <p>Steroid and morphine 10 patients</p> <p>Consecutively assigned? No</p> <p>Duration of follow-up: Minimum 12 months; Average maximum &gt; 40 months.</p> <p>Validated outcome measures used: VAS</p> <p>Nonvalidated outcome measures used: (1)Effectiveness of treatment determined by percent decrease in VAS. (2) Analgesic and anxiolytic drug consumption.</p> <p>Diagnosis made by:  <input checked="" type="checkbox"/>Clinical exam/history  <input checked="" type="checkbox"/>Electromyography  <input checked="" type="checkbox"/>Myelogram  <input type="checkbox"/>MRI  <input checked="" type="checkbox"/>CT  <input type="checkbox"/>CT/Myelogram  <input checked="" type="checkbox"/>Other: X-ray</p> <p>Results/subgroup analysis (relevant to question): Three months after the ICESI, complete and excellent results were observed to the same degree in</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/>Nonconsecutive patients  <input type="checkbox"/>Nonrandomized  <input type="checkbox"/>Nonmasked reviewers  <input type="checkbox"/>Nonmasked patients  <input type="checkbox"/>No validated outcome measures used  <input checked="" type="checkbox"/>Small sample size  <input type="checkbox"/>&lt;80% follow-up  <input type="checkbox"/>Lacked subgroup analysis  <input type="checkbox"/>Diagnostic method not stated  <input type="checkbox"/>Other:</p> <p><i>Work group conclusions</i>  Potential Level: IV  Downgraded Level:</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that:interlaminar epidural steroid injections may provide long-term relief for patients with cervical radicular pain who failed 12 months of medical treatment and did not require surgery.</p>
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		<p>both groups: 71.4% and 70% in the lidocaine and morphine group, respectively. Improvement did not vary 3 months after the ICESI.</p> <p>Three months after the ICESI: 13/24 patients stopped taking analgesics and 11/20 patients stopped taking anxiolytics.</p> <p>Author conclusions (relative to question): In patients suffering from CRP unrelated to a compressive or malignant lesion and not needing surgery, a single ICESI could be helpful when medical treatment fails.</p>	
<p>Cyteval, C., E. Thomas, et al. (2004). "Cervical radiculopathy: open study on percutaneous periradicular foraminal steroid infiltration performed under CT control in 30 patients." AJNR Am J Neuroradiol 25(3): 441-5</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: To evaluate the feasibility, tolerance, and efficacy of cervical transforaminal periganglionic steroid infiltration under CT control in patients with a radiculopathy resistant to conventional medical treatment.</p> <p>Type of treatment(s): Transforaminal epidural steroid injections under CT guidance</p> <p>Total number of patients: 30 Number of patients in relevant subgroup(s): 30</p> <p>Consecutively assigned? No</p> <p>Duration of follow-up: 6 months</p> <p>Validated outcome measures used: VAS</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history  <input type="checkbox"/> Electromyography  <input type="checkbox"/> Myelogram  <input type="checkbox"/> MRI  <input checked="" type="checkbox"/> CT  <input type="checkbox"/> CT/Myelogram  <input type="checkbox"/> Other:</p>	<p><i>Critique of methodology:</i></p> <p><input checked="" type="checkbox"/> Nonconsecutive patients  <input checked="" type="checkbox"/> Nonrandomized  <input checked="" type="checkbox"/> Nonmasked reviewers  <input checked="" type="checkbox"/> Nonmasked patients  <input type="checkbox"/> No validated outcome measures used  <input checked="" type="checkbox"/> Small sample size  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i>  Potential Level: IV  Downgraded Level:</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that:transforaminal epidural steroid injections under CT guidance in patients with cervical radiculopathy may provide significant reduction in pain in about 60% of patients.</p>

		<p>Results/subgroup analysis (relevant to question): Excellent (at least 75% reduction in VAS) in 11/30 (37%) and Good (at least 50% reduction) in 7/30 (23%)</p> <p>Mean VAS decreased from 6.5 to 3.3 at 2 weeks and was maintained at 6 months. 60% of patients received at least a 50% reduction in their pain at 2 weeks (71% if herniated disc, 50% if stenosis)</p> <p>Author conclusions (relative to question): Intraforaminal injection produced substantial and sustained relief of symptoms</p>	
<p>Dreyfuss, P., R. Baker, et al. (2006). "Comparative effectiveness of cervical transforaminal injections with particulate and nonparticulate corticosteroid preparations for cervical radicular pain." Pain Med 7(3): 237-42</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input checked="" type="checkbox"/>Prospective <input type="checkbox"/>Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Compare the efficacy of nonparticulate (dexamethasone) and particulate (triamcinolone) steroids in ESI of patients with cervical radiculopathy</p> <p>Type of treatment(s): TF ESI - single injection</p> <p>Total number of patients: 30 Number of patients in relevant subgroup(s): 30</p> <p>Consecutively assigned? Yes</p> <p>Duration of follow-up: one month</p> <p>Validated outcome measures used: VAS</p> <p>Nonvalidated outcome measures used: patient self functional assessment.</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/>Clinical exam/history  <input type="checkbox"/>Electromyography  <input type="checkbox"/>Myelogram  <input checked="" type="checkbox"/>MRI  <input checked="" type="checkbox"/>CT  <input type="checkbox"/>CT/Myelogram  <input type="checkbox"/>Other:</p> <p>Results/subgroup analysis (relevant to question): Both groups</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/>Nonconsecutive patients  <input type="checkbox"/>Nonrandomized  <input type="checkbox"/>Nonmasked reviewers  <input type="checkbox"/>Nonmasked patients  <input type="checkbox"/>No validated outcome measures used  <input checked="" type="checkbox"/>Small sample size  <input type="checkbox"/>&lt;80% follow-up  <input type="checkbox"/>Lacked subgroup analysis  <input type="checkbox"/>Diagnostic method not stated  <input type="checkbox"/>Other:</p> <p><i>Work group conclusions</i>  Potential Level (select one): IV  Downgraded Level (select one):</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that:TFESI may provide significant short-term symptomatic relief of radicular pain in about one quarter to one-third of patients.</p>

		<p>demonstrated clinically and statistically significant improvement in VAS at 4 weeks. Dexta: 4.8 to 2.9 with 7% complete relief; Triam: 4.9 to 1.7 with 27% complete relief.</p> <p>Author conclusions (relative to question): No statistically significant difference in outcome between particulate and nonparticulate injections</p>	
<p>Fish, D. E., H. W. Kobayashi, et al. (2009). "MRI prediction of therapeutic response to epidural steroid injection in patients with cervical radiculopathy." Am J Phys Med Rehabil 88(3): 239-46</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: assess whether MR findings predict outcome of CESI</p> <p>Type of treatment(s): interlaminar fluoro-guided ESI</p> <p>Total number of patients: 32</p> <p>Number of patients in relevant subgroup(s):</p> <p>Consecutively assigned?</p> <p>Duration of follow-up:</p> <p>Validated outcome measures used: NDI</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): Patients with NFS, disc herniation and root compression did not show statistically significant improvement in outcomes (vs CSS) All patients in all groups showed superior improvement to patients with negative MR findings.</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/> Nonconsecutive patients</p> <p><input type="checkbox"/> Nonrandomized</p> <p><input type="checkbox"/> Nonmasked reviewers</p> <p><input type="checkbox"/> Nonmasked patients</p> <p><input type="checkbox"/> No validated outcome measures used</p> <p><input checked="" type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that: ESI may be more effective in patients with CSS and radicular pain.</p>



		Author conclusions (relative to question): Patients with CSS have significantly better outcome than patients without.	
Kim, H., S. H. Lee, et al. (2007). "Multislice CT fluoroscopy-assisted cervical transforaminal injection of steroids - Technical note." Journal of spinal disorders & techniques 20(6): 456-461	Level IV  Type of evidence therapeutic	<input checked="" type="checkbox"/> Prospective <input type="checkbox"/> Retrospective  Study design: case series  Stated objective of study: To evaluate the feasibility and the outcome of cervical transforaminal epidural steroid injection guided by multislice CT.  Type of treatment(s): CT-guided transforaminal ESI  Total number of patients: 19 Number of patients in relevant subgroup(s):  Consecutively assigned? Yes  Duration of follow-up: 16 weeks  Validated outcome measures used: VAS  Nonvalidated outcome measures used:  Diagnosis made by: <input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input checked="" type="checkbox"/> MRI <input checked="" type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other:  Results/subgroup analysis (relevant to question): Significant reduction in VAS score maintained at 16 weeks  Author conclusions (relative to question): CT guided ESI is safe and effective	<i>Critique of methodology:</i> <input type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input type="checkbox"/> Nonmasked reviewers <input checked="" type="checkbox"/> Nonmasked patients <input type="checkbox"/> No validated outcome measures used <input checked="" type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that:CT-guided ESI may be effective in providing short-term relief of cervical radicular pain.
Kolstad, F., G. Leivseth, et al. (2005).	Level IV  Type of	<input checked="" type="checkbox"/> Prospective <input type="checkbox"/> Retrospective  Study design: case series	<i>Critique of methodology:</i> <input checked="" type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized

<p>"Transforaminal steroid injections in the treatment of cervical radiculopathy. A prospective outcome study." Acta Neurochirurgica 147(10): 1065-1070</p>	<p>evidence therapeutic</p>	<p>Stated objective of study: To assess if transforaminal steroid injections applied to a cohort of patients waiting for cervical disc surgery reduce the pain of cervical radiculopathy and hence reduce the need for surgical intervention.</p> <p>Type of treatment(s): Fluoroscopic-guided transforaminal ESI</p> <p>Total number of patients: 21 Number of patients in relevant subgroup(s): 21</p> <p>Consecutively assigned? No</p> <p>Duration of follow-up: 4 months</p> <p>Validated outcome measures used: VAS</p> <p>Nonvalidated outcome measures used: Odom's criteria</p> <p>Diagnosis made by:  <input checked="" type="checkbox"/> Clinical exam/history  <input type="checkbox"/> Electromyography  <input checked="" type="checkbox"/> Myelogram  <input checked="" type="checkbox"/> MRI  <input type="checkbox"/> CT  <input type="checkbox"/> CT/Myelogram  <input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): 5 patients improved enough to cancel surgery. Statistical improvement in pain relief at 6 weeks</p> <p>Author conclusions (relative to question): Preoperative CESI reduces the number of persons needing surgery</p>	<p> <input checked="" type="checkbox"/> Nonmasked reviewers  <input checked="" type="checkbox"/> Nonmasked patients  <input type="checkbox"/> No validated outcome measures used  <input checked="" type="checkbox"/> Small sample size  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input type="checkbox"/> Other:         </p> <p><i>Work group conclusions</i>            Potential Level: IV            Downgraded Level:         </p> <p><i>Conclusions relative to question</i>            This paper provides evidence that:CESI may be effective in treating cervical radiculopathy.         </p>
<p>Kumar, N. and V. Gowda (2008). "Cervical foraminal selective nerve root block: a 'two-needle technique' with results." Eur Spine J</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p> <input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective         </p> <p>Study design: case series</p> <p>Stated objective of study: evaluate the efficacy of SNRB in treating cervical radiculopathy using a two needle technique</p>	<p><i>Critique of methodology:</i></p> <p> <input type="checkbox"/> Nonconsecutive patients  <input checked="" type="checkbox"/> Nonrandomized  <input checked="" type="checkbox"/> Nonmasked reviewers  <input checked="" type="checkbox"/> Nonmasked patients  <input type="checkbox"/> No validated outcome measures used  <input checked="" type="checkbox"/> Small sample size         </p>

17(4): 576-84		<p>Type of treatment(s): Fluoroscopic-guided TFESI using two needle technique</p> <p>Total number of patients: 33 Number of patients in relevant subgroup(s):</p> <p>Consecutively assigned? Yes</p> <p>Duration of follow-up: 12 months</p> <p>Validated outcome measures used: VAS, NDI</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:  <input checked="" type="checkbox"/> Clinical exam/history  <input type="checkbox"/> Electromyography  <input type="checkbox"/> Myelogram  <input checked="" type="checkbox"/> MRI  <input type="checkbox"/> CT  <input type="checkbox"/> CT/Myelogram  <input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): VAS improved from 7.4 to 2.2 at 6 weeks and 2.0 at 12 months, highly significant as was improvement in NDI(66.9 to 31.7 at 6 weeks and 31.1 at one year)</p> <p>Author conclusions (relative to question): SNRB is an effective treatment for cervical radiculopathy without significant motor deficit.</p>	<p><input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i>  Potential Level: IV  Downgraded Level:</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that:the use of cervical transforaminal epidural steroid injections may provide a reduction in pain for up to 12 months.</p>
Kwon, J. W., J. W. Lee, et al. (2007). "Cervical interlaminar epidural steroid injection for neck pain and cervical radiculopathy: effect and prognostic factors." Skeletal Radiol 36(5): 431-6	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Verify the effectiveness of interlaminar CESI in patients with neck and radicular pain and identify prognostic factors for response to injection</p> <p>Type of treatment(s): fluoroscopic guided interlaminar ESI</p> <p>Total number of patients: 76</p>	<p><i>Critique of methodology:</i>  <input type="checkbox"/> Nonconsecutive patients  <input checked="" type="checkbox"/> Nonrandomized  <input checked="" type="checkbox"/> Nonmasked reviewers  <input checked="" type="checkbox"/> Nonmasked patients  <input type="checkbox"/> No validated outcome measures used  <input type="checkbox"/> Small sample size  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input checked="" type="checkbox"/> Other: mixed patients with neck and</p>

		<p>Number of patients in relevant subgroup(s): 63</p> <p>Consecutively assigned? Yes</p> <p>Duration of follow-up: 2 weeks</p> <p>Validated outcome measures used: VAS</p> <p>Nonvalidated outcome measures used: 5 point scale; treatment graded as effective or ineffective</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input checked="" type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): 26/33 (78.8%) with radiculopathy only and 20/30 (66.7%) with both neck and arm pain improved.</p> <p>Author conclusions (relative to question): Interlaminar ESI is a safe and effective short-term treatment for neck pain and radiculopathy</p>	<p>radicular pain</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that:interlaminar ESI may be an effective short-term treatment for cervical radiculopathy.</p>
<p>Lee, J. W., K. W. Park, et al. (2009). "Cervical transforaminal epidural steroid injection for the management of cervical radiculopathy: a comparative study of particulate versus non-particulate steroids." Skeletal Radiol 38(11): 1077-</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: compare the effectiveness of particulate (triamcinolone) vs nonparticulate (dexamethasone) CESI in cervical radiculopathy</p> <p>Type of treatment(s): Fluoroscopically-guided TFESI</p> <p>Total number of patients: 159</p> <p>Number of patients in relevant subgroup(s): 159</p> <p>Consecutively assigned? No</p>	<p><i>Critique of methodology:</i></p> <p><input checked="" type="checkbox"/> Nonconsecutive patients</p> <p><input checked="" type="checkbox"/> Nonrandomized</p> <p><input checked="" type="checkbox"/> Nonmasked reviewers</p> <p><input type="checkbox"/> Nonmasked patients</p> <p><input checked="" type="checkbox"/> No validated outcome measures used</p> <p><input type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p>

82		<p>Duration of follow-up: 1 month</p> <p>Validated outcome measures used:</p> <p>Nonvalidated outcome measures used: 1-5 scale</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input checked="" type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): 76.1 percent of all patients showed short-term improvement. (80.4% triamcinolone; 69.4% dexamethasone)</p> <p>Author conclusions (relative to question): Cervical epidural steroids are effective in short-term management of cervical radiculopathy</p>	<p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that:TF ESI may provide short-term benefit to patients with cervical radiculopathy.</p>
Lin, E. L., V. Lieu, et al. (2006). "Cervical epidural steroid injections for symptomatic disc herniations." Journal of spinal disorders & techniques 19(3): 183-186	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: examine the efficacy of CESI treatment of symptomatic cervical disc herniations</p> <p>Type of treatment(s): fluoroscopically guided TFESI</p> <p>Total number of patients: 70</p> <p>Number of patients in relevant subgroup(s): 70</p> <p>Consecutively assigned? Yes</p> <p>Duration of follow-up: 13 months mean</p> <p>Validated outcome measures used: Avoidance of surgery</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/> Nonconsecutive patients</p> <p><input checked="" type="checkbox"/> Nonrandomized</p> <p><input checked="" type="checkbox"/> Nonmasked reviewers</p> <p><input checked="" type="checkbox"/> Nonmasked patients</p> <p><input checked="" type="checkbox"/> No validated outcome measures used</p> <p><input type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p>

		<p>Nonvalidated outcome measures used: subjective report of pain (Odom's criteria)</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): 44/70 (63%) avoided surgery</p> <p>Author conclusions (relative to question): Approximately two thirds of patients with cervical disc herniation and radiculopathy obtain short-term relief with CESI.</p>	<p>This paper provides evidence that:TFCESI may provide short-term relief of radicular pain in patients with cervical HNP and possibly avoid surgery.</p>
<p>Pasqualucci, A., G. Varrassi, et al. (2007). "Epidural local anesthetic plus corticosteroid for the treatment of cervical brachial radicular pain: single injection versus continuous infusion." Clin J Pain 23(7): 551-7</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input checked="" type="checkbox"/> Prospective <input type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Compare the outcomes of intermittent ESI vs continuous epidural infusion in patients with cervical radiculopathy</p> <p>Type of treatment(s): continuous epidural steroid infusion vs intermittent ESI Q 5 days</p> <p>Total number of patients: 141</p> <p>Number of patients in relevant subgroup(s): 141</p> <p>Consecutively assigned? No</p> <p>Duration of follow-up: 6 months</p> <p>Validated outcome measures used: VAS</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p>	<p><i>Critique of methodology:</i></p> <p><input checked="" type="checkbox"/> Nonconsecutive patients</p> <p><input type="checkbox"/> Nonrandomized</p> <p><input checked="" type="checkbox"/> Nonmasked reviewers</p> <p><input checked="" type="checkbox"/> Nonmasked patients</p> <p><input type="checkbox"/> No validated outcome measures used</p> <p><input type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input checked="" type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that:both continuous and intermittent ILESi may provide improvement in the pain associated with chronic (&gt;180 day symptom duration)</p>

		<input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input checked="" type="checkbox"/> MRI <input checked="" type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other:  Results/subgroup analysis (relevant to question): Patients with chronic (>180 days) of symptoms had a significantly greater response to continuous infusion compared to intermittent ESI. Other groups of shorter duration, no difference in symptoms between two treatments.  Author conclusions (relative to question): N/A	radiculopathy, though continuous infusion may provide better benefit at 6 months.
Razzaq, A. A., D. O'Brien, et al. (2007). "Efficacy and durability of fluoroscopically guided cervical nerve root block." Br J Neurosurg 21(4): 365-9	Level IV  Type of evidence therapeutic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study design: case series  Stated objective of study: Assess the long-term efficacy of CESI  Type of treatment(s): fluoro guided ESI  Total number of patients: 19 Number of patients in relevant subgroup(s): 19  Consecutively assigned? Yes  Duration of follow-up: 6 months  Validated outcome measures used: VAS  Nonvalidated outcome measures used:  Diagnosis made by: <input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input checked="" type="checkbox"/> MRI <input type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram	<i>Critique of methodology:</i> <input type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input checked="" type="checkbox"/> Nonmasked reviewers <input checked="" type="checkbox"/> Nonmasked patients <input type="checkbox"/> No validated outcome measures used <input checked="" type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that: 43% of patients with symptoms of radiculopathy have moderate relief of symptoms for at least 6 months after TFESI.

		<input type="checkbox"/> Other:  Results/subgroup analysis (relevant to question): 43% of patients (9/19) achieved significant or moderate relief of pain at 6 months.  Author conclusions (relative to question): CESI may benefit some patients with cervical radiculopathy	
Rowlingson, J. C. and L. P. Kirschenbaum (1986). "Epidural analgesic techniques in the management of cervical pain." <i>Anesth Analg</i> 65(9): 938-42	Level IV  Type of evidence therapeutic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study design: case series  Stated objective of study: define clinical indications for and effectiveness of CESI  Type of treatment(s): non fluoro ESI  Total number of patients: 25 Number of patients in relevant subgroup(s): 25  Consecutively assigned? No  Duration of follow-up: 8-9 mos  Validated outcome measures used:  Nonvalidated outcome measures used: rated improvement poor - excellent  Diagnosis made by: <input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input checked="" type="checkbox"/> Myelogram <input type="checkbox"/> MRI <input checked="" type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other:  Results/subgroup analysis (relevant to question): 6/25 (24%) patients had an excellent response; 10/25 (40%) had good response	<i>Critique of methodology:</i> <input checked="" type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input type="checkbox"/> Nonmasked reviewers <input checked="" type="checkbox"/> Nonmasked patients <input type="checkbox"/> No validated outcome measures used <input checked="" type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that:non-fluoroscopically-guided ILCESI produced a good-excellent result in 64% of patients at 8-9 months follow-up.



		Author conclusions (relative to question): CESI produced a good-excellent result in 64% of patients and should be in the armamentarium of pain anesthesiologists.	
Slipman, C. W., J. S. Lipetz, et al. (2000). "Therapeutic selective nerve root block in the nonsurgical treatment of atraumatic cervical spondylotic radicular pain: a retrospective analysis with independent clinical review." Arch Phys Med Rehabil 81(6): 741-6	Level IV  Type of evidence therapeutic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study design: case series  Stated objective of study: Evaluate the outcome of SNRB in cervical spondylitic radicular pain  Type of treatment(s): SNRB, average 2.2 injections per patient  Total number of patients: 20 Number of patients in relevant subgroup(s): 20  Consecutively assigned? No  Duration of follow-up: 21.2 months mean  Validated outcome measures used: VAS  Nonvalidated outcome measures used: patient satisfaction, work status, medication use  Diagnosis made by: <input checked="" type="checkbox"/> Clinical exam/history <input checked="" type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input checked="" type="checkbox"/> MRI <input type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other:  Results/subgroup analysis (relevant to question): Significant improvement in pain score and medication use; no change in work status  Author conclusions (relative to question): SNRB is clinically effective in management of cervical spondylitic radicular pain	<i>Critique of methodology:</i> <input checked="" type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input checked="" type="checkbox"/> Nonmasked reviewers <input checked="" type="checkbox"/> Nonmasked patients <input type="checkbox"/> No validated outcome measures used <input checked="" type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that:TFESI may be effective in reducing pain and medication use in patients with cervical radiculopathy.
Stav, A, Ovadia A, et	Level III	<input checked="" type="checkbox"/> Prospective <input type="checkbox"/> Retrospective	<i>Critique of methodology:</i>

al. (1993). "Cervical epidural steroid injection for cervicobrachialgia." Acta Anaesthesiologica Scandinavica 37(6): 562-66	Type of evidence therapeutic	<p>Study design: comparative</p> <p>Stated objective of study: compare pain relief and ROM in patients with cervical radiculopathy treated with CESI vs tender/trigger point injection</p> <p>Type of treatment(s): CESI, loss of resistance technique</p> <p>Total number of patients: 50 Number of patients in relevant subgroup(s): 25</p> <p>Consecutively assigned? No</p> <p>Duration of follow-up: one year</p> <p>Validated outcome measures used: VAS</p> <p>Nonvalidated outcome measures used: ROM</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history  <input type="checkbox"/> Electromyography  <input type="checkbox"/> Myelogram  <input checked="" type="checkbox"/> MRI  <input checked="" type="checkbox"/> CT  <input type="checkbox"/> CT/Myelogram  <input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): At one week, 76% of patients in ESI group had good/very good improvement (vs 35.5 in TPI group). At one year, 68% of patients in ESI group had good/very good improvement (vs 11.8% in TPI group).</p> <p>Author conclusions (relative to question): CESI is an effective short-term and long-term treatment for cervical radiculopathy</p>	<p><input checked="" type="checkbox"/> Nonconsecutive patients  <input type="checkbox"/> Nonrandomized  <input type="checkbox"/> Nonmasked reviewers  <input type="checkbox"/> Nonmasked patients  <input type="checkbox"/> No validated outcome measures used  <input checked="" type="checkbox"/> Small sample size  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input checked="" type="checkbox"/> Other: large drop out in patients randomized to nonESI (8/25)</p> <p><i>Work group conclusions</i>  Potential Level: II  Downgraded Level: III</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that: ILCESI may provide good/very good short(1 week) and long-term (&gt;1 year) improvement in symptoms of radiculopathy.</p>
Vallee, J. N., A. Feydy, et al. (2001). "Chronic cervical radiculopathy: lateral-approach	Level IV  Type of evidence therapeutic	<p><input checked="" type="checkbox"/> Prospective <input type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Evaluate the efficacy of periradicular</p>	<p><i>Critique of methodology:</i>  <input checked="" type="checkbox"/> Nonconsecutive patients  <input type="checkbox"/> Nonrandomized  <input type="checkbox"/> Nonmasked reviewers  <input checked="" type="checkbox"/> Nonmasked patients</p>

<p>periradicular corticosteroid injection." Radiology 218(3): 886-92</p>		<p>corticosteroid injection in patients with chronic cervical radiculopathy</p> <p>Type of treatment(s): Periradicular corticosteroid injection</p> <p>Total number of patients: 32 Number of patients in relevant subgroup(s): 32</p> <p>Consecutively assigned? No</p> <p>Duration of follow-up: 6 months</p> <p>Validated outcome measures used: VAS</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input checked="" type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): 62% of patients had good - excellent (&gt;50% improvement from baseline pain score) relief of radicular symptoms at 14 days with 53% at 6 months. Patients with shorter duration of pain had higher response rates.</p> <p>Author conclusions (relative to question): In patients with chronic cervical radiculopathy, periradicular injection produced durable improvement in &gt; 50% of patients.</p>	<p><input type="checkbox"/> No validated outcome measures used</p> <p><input checked="" type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that:TFESI may provide short (14 days) in 63% and longer term(6 month) relief in 53% of patients with symptoms of cervical radicular pain.</p>
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## Are there prognostic indicators that predict which patients are likely to benefit from cervical epidural steroid injections?

Article (Alpha by Author)	Level of evidence	Description of study	Conclusion
Cyteval, C., E. Thomas, et al. (2004). "Cervical radiculopathy: open study on percutaneous periradicular foraminal steroid infiltration performed under CT control in 30 patients." AJNR Am J Neuroradiol 25(3): 441-5	Level III  Type of evidence prognostic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study Design: comparative  Stated objective of study: To evaluate the feasibility, tolerance and efficacy of cervical transforaminal periganglionic steroid infiltration under CT control in patients with radiculopathy resistant to conventional medical treatment.  Total number of patients in the study: 30 (16 patients with foraminal degenerative stenosis and 14 patients with foraminal obstruction due to a disc herniation). Number of patients in subgroup of relevance to the question: 30  Duration of follow-up: 6 months  Validated outcome measures used: yes  Nonvalidated outcome measures used:  Diagnosis made or confirmed by (check all that apply): <input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input type="checkbox"/> MRI <input checked="" type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other  Results/subgroup analysis (relevant to question): Cervical epidural was effective in 60% of patients. Type of pathology (disc herniation versus foraminal stenosis) was not predictive of results.  Author conclusions (relative to question): Cervical foraminal epidural steroid injection produced substantial sustained pain relief regardless of the pathology (disc herniation versus foraminal stenosis).	<i>Critique of methodology</i> <input checked="" type="checkbox"/> Patients not enrolled at same point in their disease <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Follow-up not standardized <input type="checkbox"/> No validated outcome measures used <input checked="" type="checkbox"/> Small sample size <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic methods not described. <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: II Downgraded Level: III  <i>Conclusions relative to question</i> This paper provides evidence that: transforaminal cervical epidural steroid injection is an effective treatment for cervical radiculopathy in the majority of cases due to foraminal stenosis or cervical disc herniation.

<p>Ferrante, F. M., S. P. Wilson, et al. (1993). "Clinical classification as a predictor of therapeutic outcome after cervical epidural steroid injection." <i>Spine</i> (Phila Pa 1976) 18(6): 730-6</p>	<p>Level III</p> <p>Type of evidence prognostic</p>	<p><input type="checkbox"/>Prospective <input checked="" type="checkbox"/>Retrospective</p> <p>Study Design: comparative</p> <p>Stated objective of study: To identify prognostic factors that predict effectiveness of interlaminar cervical epidural steroid injections.</p> <p>Total number of patients in the study: 100 Number of patients in subgroup of relevance to the question: 100</p> <p>Duration of follow-up: 6 months (80% of subjects)</p> <p>Validated outcome measures used: NO</p> <p>Nonvalidated outcome measures used: Return to Activities of Daily Living</p> <p>Diagnosis made or confirmed by (check all that apply):</p> <p><input checked="" type="checkbox"/>Clinical exam/history <input type="checkbox"/>Electromyography <input checked="" type="checkbox"/>Myelogram <input checked="" type="checkbox"/>MRI <input checked="" type="checkbox"/>CT <input checked="" type="checkbox"/>CT/Myelogram <input type="checkbox"/>Other</p> <p>Results/subgroup analysis (relevant to question): Multiple regression analysis identified radicular symptoms as a predictor of better outcome after cervical epidural steroid injection.</p> <p>Author conclusions (relative to question): Cervical epidural steroid injection is more likely to be beneficial if a patient has radicular symptoms as opposed to axial neck pain.</p>	<p><i>Critique of methodology</i></p> <p><input checked="" type="checkbox"/>Patients not enrolled at same point in their disease <input type="checkbox"/> &lt;80% follow-up <input type="checkbox"/> Follow-up not standardized <input checked="" type="checkbox"/> No validated outcome measures used <input type="checkbox"/> Small sample size <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic methods not described. <input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i> Potential Level: II Downgraded Level: III</p> <p><i>Conclusions relative to question</i> This paper provides evidence that:patients with a cervical radiculopathy have a 62% probability of obtaining at least 50% pain relief and at least partial return to their activities of daily living.</p>
<p>Fish, D. E., H. W. Kobayashi, et al. (2009). "MRI prediction of therapeutic response to epidural steroid injection in patients with cervical</p>	<p>Level III</p> <p>Type of evidence prognostic</p>	<p><input type="checkbox"/>Prospective <input checked="" type="checkbox"/>Retrospective</p> <p>Study Design: case control</p> <p>Stated objective of study: To identify MRI characteristics in patients with cervical radiculopathy that predict therapeutic response to intralaminar cervical spine epidural injections</p>	<p><i>Critique of methodology</i></p> <p><input checked="" type="checkbox"/>Patients not enrolled at same point in their disease <input type="checkbox"/> &lt;80% follow-up <input checked="" type="checkbox"/> Follow-up not standardized <input type="checkbox"/> No validated outcome measures used <input checked="" type="checkbox"/> Small sample size <input type="checkbox"/> Lacked subgroup analysis</p>

<p>radiculopathy." Am J Phys Med Rehabil 88(3): 239-46</p>		<p>Total number of patients in the study: 32 Number of patients in subgroup of relevance to the question: 14 (central canal stenosis)</p> <p>Duration of follow-up: 20.5 weeks (median)</p> <p>Validated outcome measures used: NDI</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made or confirmed by (check all that apply):</p> <p><input type="checkbox"/> Clinical exam/history  <input type="checkbox"/> Electromyography  <input type="checkbox"/> Myelogram  <input checked="" type="checkbox"/> MRI  <input type="checkbox"/> CT  <input type="checkbox"/> CT/Myelogram  <input type="checkbox"/> Other</p> <p>Results/subgroup analysis (relevant to question): Patients with cervical spine central canal stenosis had the worst NDI functional scores pre-treatment and had a significant response to treatment following cervical epidural steroid injection.</p> <p>Author conclusions (relative to question): Cervical spine MRI has a useful role to play in determining which patients would benefit from cervical spine epidural injection. Central canal stenosis is a predictor of therapeutic response.</p>	<p><input type="checkbox"/> Diagnostic methods not described.  <input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i>  Potential Level: III  Downgraded Level:</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that:central canal stenosis identified on cervical spine MRI predicts a statistically significant improvement in NDI scores from cervical epidural steroid injection.</p>
<p>Kwon, J. W., J. W. Lee, et al. (2007). "Cervical interlaminar epidural steroid injection for neck pain and cervical radiculopathy: effect and prognostic factors." Skeletal Radiol 36(5): 431-6</p>	<p>Level II</p> <p>Type of evidence prognostic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study Design: comparative</p> <p>Stated objective of study: To determine predictors of short-term outcome following interlaminar cervical epidural spine injections</p> <p>Total number of patients in the study: 76 Number of patients in subgroup of relevance to the question: 76</p> <p>Duration of follow-up: 2 weeks</p> <p>Validated outcome measures used: VAS</p>	<p><i>Critique of methodology</i></p> <p><input checked="" type="checkbox"/> Patients not enrolled at same point in their disease  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Follow-up not standardized  <input type="checkbox"/> No validated outcome measures used  <input type="checkbox"/> Small sample size  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic methods not described.  <input checked="" type="checkbox"/> Other: short-term follow-up</p> <p><i>Work group conclusions</i></p>

		<p>Nonvalidated outcome measures used: effective vs ineffective</p> <p>Diagnosis made or confirmed by (check all that apply):</p> <p><input type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input checked="" type="checkbox"/> CT</p> <p><input checked="" type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other</p> <p>Results/subgroup analysis (relevant to question): Patients with herniated disc were more likely to benefit from cervical spine epidural than patients with cervical stenosis.</p> <p>Author conclusions (relative to question): The radiographic cause of pain is a significant predictor of therapeutic response following cervical epidural. A significantly larger number of patients with herniated disc responded compared with those with central canal stenosis.</p>	<p>Potential Level: II</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that:cervical spine epidural is associated with short-term benefit in the majority of patients with herniated cervical disc and radiculopathy symptoms.</p>
<p>Lin, E. L., V. Lieu, et al. (2006). "Cervical epidural steroid injections for symptomatic disc herniations." Journal of spinal disorders &amp; techniques 19(3): 183-186</p>	<p>Level III</p> <p>Type of evidence prognostic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study Design: case control</p> <p>Stated objective of study: To compare patients who requested surgery to those who did not after transforaminal cervical spine injections</p> <p>Total number of patients in the study: 70</p> <p>Number of patients in subgroup of relevance to the question: 70</p> <p>Duration of follow-up: 13 months (average)</p> <p>Validated outcome measures used: avoidance of surgery</p> <p>Nonvalidated outcome measures used: Odom's Criteria</p> <p>Diagnosis made or confirmed by (check all that apply):</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p>	<p><i>Critique of methodology</i></p> <p><input checked="" type="checkbox"/> Patients not enrolled at same point in their disease</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input checked="" type="checkbox"/> Follow-up not standardized</p> <p><input type="checkbox"/> No validated outcome measures used</p> <p><input checked="" type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic methods not described.</p> <p><input checked="" type="checkbox"/> Other: treatment not standardized</p> <p><i>Work group conclusions</i></p> <p>Potential Level: III</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that:two-thirds of patients with cervical radiculopathy from cervical disc herniation might avoid surgery. Patients older than 50 might be more likely to</p>

		<input type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other  Results/subgroup analysis (relevant to question): Patients who failed cervical spine epidural and requested surgery were more likely to be younger (age < 50 years) and had a delay in first epidural from initial diagnosis.  Author conclusions (relative to question): Two-thirds of patients with symptomatic cervical disc herniation may avoid surgery for at least 1 year by having a series of transforaminal epidural steroid injections.	benefit from transforaminal cervical spine epidural.
Strub, W. M., T. A. Brown, et al. (2007). "Translaminar cervical epidural steroid injection: short-term results and factors influencing outcome." J Vasc Interv Radiol 18(9): 1151-5	Level IV  Type of evidence prognostic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study Design: case series  Stated objective of study: To assess prognostic factors that influence outcome following interlaminar cervical spine epidural steroid injection.  Total number of patients in the study: 161 Number of patients in subgroup of relevance to the question: 161  Duration of follow-up: 10 days (median)  Validated outcome measures used:  Nonvalidated outcome measures used: patient subjective assessment of improvement (none, minor, some, substantial)  Diagnosis made or confirmed by (check all that apply): <input type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input checked="" type="checkbox"/> MRI <input type="checkbox"/> CT <input checked="" type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other  Results/subgroup analysis (relevant to question): Patients with multi-level cervical spondylosis, radicular symptoms (to hand or finger), or had injection at the C7-T1 level were more likely to report substantial	<i>Critique of methodology</i> <input checked="" type="checkbox"/> Patients not enrolled at same point in their disease <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Follow-up not standardized <input checked="" type="checkbox"/> No validated outcome measures used <input type="checkbox"/> Small sample size <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic methods not described. <input checked="" type="checkbox"/> Other: treatment not standardized - some received multiple injections  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that:interlaminar cervical spine epidural injection is associated with short-term benefit in patients with cervical radiculopathy.



		improvement.  Author conclusions (relative to question): Interlaminar cervical spine epidural injection is more effective in patients with multi-level cervical spondylosis and patients with radiculopathy.	
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## What are the risks associated with administration of cervical epidural steroid injections?

Article (Alpha by Author)	Level of evidence	Description of study	Conclusion
Beckman WA, Mendez RJ, Paine GF, Mazzilli MA. Cerebellar herniation after cervical transforaminal epidural injection. Reg Anesth Pain Med. May-Jun 2006;31(3):282- 285.	Level IV  Type of evidence therapeutic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study design: case series  Stated objective of study: Inform readers of potential catastrophic complications associated with performing cervical transforaminal epidural steroid injections.  Type of treatment(s): Patient supine. Intravenous conscious sedation with propofol. 25 gauge spinal needle fluoroscopically directed to the right C7-T1 neuroforamen. Omnipaque 1 ml administered with continuous fluoroscopy under an AP projection outlining the right C8 nerve root with epidural spread. Aspiration was negative, and there was no vascular uptake. CTESI injectate comprised of 60 mg of Depomedrol and 7.5 mg of lidocaine. The injectate was not entirely instilled because the patient complained of neck pain and a headache.  Total number of patients: 1 Number of patients in relevant subgroup(s):  Consecutively assigned?  Duration of follow-up: protracted  Validated outcome measures used: CT scan; MRI; Posterior fossa craniectomy.	<i>Critique of methodology:</i> <input checked="" type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input checked="" type="checkbox"/> Nonmasked reviewers <input checked="" type="checkbox"/> Nonmasked patients <input checked="" type="checkbox"/> No validated outcome measures used <input checked="" type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that: cervical epidural injections can have catastrophic complications.

		<p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input checked="" type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input checked="" type="checkbox"/> Other: Posterior fossa craniectomy.</p> <p>Results/subgroup analysis (relevant to question): Cerebellar herniation into the foramen magnum and a right cerebellar infarction. Patient underwent a posterior fossa craniectomy with resection of cerebellar tissue. The postoperative course was complicated by meningitis. Patient survived with residual diplopia, and difficulties with short-term memory loss and concentration.</p> <p>Author conclusions (relative to question): Although transforaminal epidural steroid injections are efficacious treatment of radicular syndromes, there can be catastrophic complications.</p>	
<p>Botwin, K. P., R. Castellanos, et al. (2003). "Complications of fluoroscopically guided interlaminar cervical epidural injections." Archives of Physical Medicine and Rehabilitation 84(5): 627-633</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: To assess complication rate following interlaminar cervical epidural steroid injection</p> <p>Type of treatment(s): interlaminar cervical epidural</p> <p>Total number of patients: 157</p> <p>Number of patients in relevant subgroup(s): 157</p> <p>Consecutively assigned? Yes</p> <p>Duration of follow-up: 3 weeks</p> <p>Validated outcome measures used:</p> <p>Nonvalidated outcome measures used: complication rate assessed by phone</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/> Nonconsecutive patients</p> <p><input checked="" type="checkbox"/> Nonrandomized</p> <p><input checked="" type="checkbox"/> Nonmasked reviewers</p> <p><input checked="" type="checkbox"/> Nonmasked patients</p> <p><input type="checkbox"/> No validated outcome measures used</p> <p><input type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that: there is a</p>

		<p>call 24 hours after injection as well as review of office records 3 weeks after injection.</p> <p>Diagnosis made by:</p> <p><input type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input checked="" type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): The complication rate was 16.8%. All complications were minor and resolved.</p> <p>Author conclusions (relative to question): Interlaminar cervical epidural is safe for patients with cervical radicular pain.</p>	16.8% rate of minor complications following translaminar cervical epidural.
<p>Brouwers PJ, Kottink EJ, Simon MA, Prevo RL. A cervical anterior spinal artery syndrome after diagnostic blockade of the right C6-nerve root. Pain. Apr 2001;91(3):397-399.</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Describe the blood supply of the cervical spinal cord and suggest that this infarction resulted from an impaired perfusion of the major feeding anterior radicular artery of the spinal cord.</p> <p>Type of treatment(s): A 22 gauge spinal needle was fluoroscopically directed to posterior-caudal corner of the right C6-7 neuroforamen. AP projection showed the needle tip just over the lateral part of the facet column, within the intervertebral foramen. Isovist 0.2 ml was instilled, and fluoroscopy showed spread of contrast along the C6 nerve root. Aspiration was negative. CTESI performed with 1 ml injectate comprised of 2.5 mg Marcaine and 10 mg of Triamcinolone.</p> <p>Total number of patients: 1</p> <p>Number of patients in relevant subgroup(s):</p> <p>Consecutively assigned?</p> <p>Duration of follow-up: Weeks</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/> Nonconsecutive patients</p> <p><input type="checkbox"/> Nonrandomized</p> <p><input type="checkbox"/> Nonmasked reviewers</p> <p><input type="checkbox"/> Nonmasked patients</p> <p><input type="checkbox"/> No validated outcome measures used</p> <p><input type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that: cervical epidural injections can have catastrophic complications.</p>

		<p>Validated outcome measures used: MRI</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): Approximately 1 minute after the instillation of the injectate the patient developed flaccid paralysis and breathing difficulties. Thirty minutes later the patient's neurologic exam showed complete paralysis below the C3 level. The initial post-procedure MRI showed increased signal intensity of the spinal cord from C2 to T1. The following day MRI showed extensive infarction of the spinal cord. His hospitalization was complicated by pneumonias, and the following month the patient died from a stomach perforation.</p> <p>Author conclusions (relative to question): In most patients collateral blood supply of the cervical spinal cord is sufficient, but as our case shows, sometimes there is only one major feeding cervical anterior radicular artery. If this specific artery becomes iatrogenically occluded by a presumably spastic reaction or dissection on local injection, a devastating complication may be the result.</p>	
<p>Derby, R., S. H. Lee, et al. (2004). "Complications following cervical epidural steroid injections by expert interventionalists in 2003." Pain Physician 7(4): 445-449</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Retrospective survey to compare complication rates following interlaminar versus transforaminal cervical epidural injection</p> <p>Type of treatment(s): interlaminar or transforaminal cervical epidural</p> <p>Total number of patients: 5968 injections (number of patients not stated)</p> <p>Number of patients in relevant subgroup(s):</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/> Nonconsecutive patients</p> <p><input checked="" type="checkbox"/> Nonrandomized</p> <p><input checked="" type="checkbox"/> Nonmasked reviewers</p> <p><input type="checkbox"/> Nonmasked patients</p> <p><input type="checkbox"/> No validated outcome measures used</p> <p><input type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p>

		<p>Consecutively assigned?</p> <p>Duration of follow-up: unknown</p> <p>Validated outcome measures used:</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input type="checkbox"/> MRI</p> <p><input type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): Complication rate was 0.52% following interlaminar epidural and 0.32% following transforaminal epidural</p> <p>Author conclusions (relative to question): The complication rate following either interlaminar versus transforaminal cervical epidural is very low for both groups.</p>	<p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that: complication rates following interlaminar and transforaminal cervical epidural steroid injection are low and comparable when performed by experts.</p>
<p>Hodges, S. D., R. L. Castleberg, et al. (1998). "Cervical epidural steroid injection with intrinsic spinal cord damage. Two case reports." Spine (Phila Pa 1976) 23(19): 2137-42; discussion 2141-2</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: To draw attention to 2 case reports of serious complication following interlaminar cervical epidural injection</p> <p>Type of treatment(s): interlaminar cervical epidural</p> <p>Total number of patients: 2</p> <p>Number of patients in relevant subgroup(s): 2</p> <p>Consecutively assigned? No</p> <p>Duration of follow-up:</p>	<p><i>Critique of methodology:</i></p> <p><input checked="" type="checkbox"/> Nonconsecutive patients</p> <p><input checked="" type="checkbox"/> Nonrandomized</p> <p><input checked="" type="checkbox"/> Nonmasked reviewers</p> <p><input checked="" type="checkbox"/> Nonmasked patients</p> <p><input type="checkbox"/> No validated outcome measures used</p> <p><input checked="" type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p>

		<p>Validated outcome measures used: MRI imaging of spinal cord injury</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): 2 cases of spinal cord injury are reported. IV sedation was used in both cases.</p> <p>Author conclusions (relative to question): Patients should be awake when cervical spine epidurals are administered.</p>	<p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that: cervical epidural injections can have catastrophic complications.</p>
<p>Huston, C. W., C. W. Slipman, et al. (2005). "Complications and side effects of cervical and lumbosacral selective nerve root injections." Archives of Physical Medicine and Rehabilitation 86(2): 277-283</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input checked="" type="checkbox"/> Prospective <input type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: To determine the complication rate associated with cervical and lumbar selective nerve root block injections</p> <p>Type of treatment(s): transforaminal</p> <p>Total number of patients: 211 (includes 60 controls)</p> <p>Number of patients in relevant subgroup(s): 37</p> <p>Consecutively assigned? Yes</p> <p>Duration of follow-up: 3 months</p> <p>Validated outcome measures used:</p> <p>Nonvalidated outcome measures used: patient - reported complications</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/> Nonconsecutive patients</p> <p><input checked="" type="checkbox"/> Nonrandomized</p> <p><input checked="" type="checkbox"/> Nonmasked reviewers</p> <p><input checked="" type="checkbox"/> Nonmasked patients</p> <p><input checked="" type="checkbox"/> No validated outcome measures used</p> <p><input checked="" type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that: serious complications did not occur in a small prospective series of patients following cervical spine epidural injection.</p>

		<input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input type="checkbox"/> MRI <input type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other:	
		<p>Results/subgroup analysis (relevant to question): No serious complications occurred</p> <p>Author conclusions (relative to question): Minor and transient side-effects occur following cervical spine epidural injection. Serious complications are rare.</p>	
Lee, J. H., J. K. Lee, et al. (2008). "Spinal cord injury produced by direct damage during cervical transforaminal epidural injection." <i>Regional Anesthesia and Pain Medicine</i> 33(4): 377-379	Level IV  Type of evidence therapeutic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study design: case series  Stated objective of study:  Type of treatment(s): Attempted TCESI. Fluoroscopically-guided placement of spinal needle into the cervical paraforaminal space associated with intense paresthesia. The precise location of the tip of the needle could not be confirmed by fluoroscopy due to the patient's position. To locate the tip of the needle, the patient was given an injection of 0.5 ml of iohexol. During the injection of contrast the patient reported pain in the left hand and the procedure was terminated.  Total number of patients: 1 Number of patients in relevant subgroup(s): 1  Consecutively assigned?  Duration of follow-up: 1 year  Validated outcome measures used: American Spinal Injury Association Impairment Scale  Nonvalidated outcome measures used:  Diagnosis made by:	<p><i>Critique of methodology:</i></p> <input type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input checked="" type="checkbox"/> Nonmasked reviewers <input checked="" type="checkbox"/> Nonmasked patients <input checked="" type="checkbox"/> No validated outcome measures used <input type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:
			<p><i>Work group conclusions</i>          Potential Level: IV          Downgraded Level:</p> <p><i>Conclusions relative to question</i>          This paper provides evidence that:CESI can have catastrophic complications.</p>

		<input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input checked="" type="checkbox"/> MRI <input checked="" type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other:	
		<p>Results/subgroup analysis (relevant to question): Within 2-3 minutes of terminating the procedure the patient developed tetraplegia. At 1 year follow-up, the patient had weakness of the left arm with the development of a claw hand and refractory pain.</p> <p>Author conclusions (relative to question): Blind injection of contrast medium without fluoroscopic confirmation can be hazardous, resulting in spinal cord injury.</p>	
<p>Ludwig MA, Burns SP. Spinal cord infarction following cervical transforaminal epidural injection: a case report. Spine (Phila Pa 1976). May 15 2005;30(10): E266-268.</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Review the literature about spinal cord infarction with epidural steroid injections and report one case.</p> <p>Type of treatment(s): Intravenous conscious sedation for fluoroscopically-guided left C5-6 TCESI with a 25 gauge spinal needle. Confirmation of the needle tip location, the left C6 nerve root, and absence of vascular uptake were obtained using real time fluoroscopic visualization of the injection of Omnipaque in the AP and lateral projections. Aspiration was negative for blood. The TCESI injectate was a 1.5 ml solution of triamcinolone and bupivacaine.</p> <p>Total number of patients: 1 Number of patients in relevant subgroup(s): 1</p> <p>Consecutively assigned?</p> <p>Duration of follow-up: 24 hours</p> <p>Validated outcome measures used: MRI; American Spinal Injury Association Impairment Scale (ASIA)</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/> Nonconsecutive patients  <input checked="" type="checkbox"/> Nonrandomized  <input checked="" type="checkbox"/> Nonmasked reviewers  <input checked="" type="checkbox"/> Nonmasked patients  <input checked="" type="checkbox"/> No validated outcome measures used  <input checked="" type="checkbox"/> Small sample size  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i>          Potential Level: IV          Downgraded Level:</p> <p><i>Conclusions relative to question</i>          This paper provides evidence that: cervical epidural injections can have catastrophic complications.</p>



		<p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): Approximately 10 minutes postprocedure the patient complained of weakness in left arm and bilateral lower extremities. An initial MRI did not show spinal cord signal changes. A subsequent MRI 24 hours later showed evidence of spinal cord infarction from the odontoid to C4-5 level. The patient had incomplete tetraplegia and was classified as American Spinal Injury Association Impairment Scale score C, with loss of pain and temperature sensation and preservation of proprioception.</p> <p>Author conclusions (relative to question): Cervical epidural injections, despite careful fluoroscopic localization, carry a remote but devastating risk of vascular infarction to the spinal cord. The exact mechanism by which these infarctions occur remains unknown.</p>	
McMillan MR, Crumpton C. Cortical blindness and neurologic injury complicating cervical transforaminal injection for cervical radiculopathy. Anesthesiology. Aug 2003;99(2):509-511.	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Present a case of acute cortical blindness and prolonged neurologic compromise complicating cervical transforaminal injection with acute disruption of the the blood brain-barrier demonstrated by magnetic resonance imaging.</p> <p>Type of treatment(s): Patient supine. A 22 gauge spinal needle was fluoroscopically advanced via the anterior/oblique approach to the superior dorsal quadrant of the left C5-6 neuroforamen. On the first pass bright red blood was aspirated through the needle, near the opening of the neuroforamen suggesting a vertebral artery puncture. The spinal needle was withdrawn and reportedly repositioned in the cervical epidural space. Confirmation of the tip of the needle was attempted by the loss of resistance to</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/> Nonconsecutive patients</p> <p><input checked="" type="checkbox"/> Nonrandomized</p> <p><input checked="" type="checkbox"/> Nonmasked reviewers</p> <p><input checked="" type="checkbox"/> Nonmasked patients</p> <p><input checked="" type="checkbox"/> No validated outcome measures used</p> <p><input type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p>

		<p>1 ml of air followed by the instillation of 2 ml of nonionic contrast. The attempted epidurogram was technically unsatisfactory and within seconds the patient developed lateral nystagmus. A final attempt to cannulate the C4-5 foramen was aborted because the patient became restless and agitated.</p> <p>Total number of patients: 1 Number of patients in relevant subgroup(s):</p> <p>Consecutively assigned?</p> <p>Duration of follow-up: 30 days</p> <p>Validated outcome measures used: MRI</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input checked="" type="checkbox"/> MRI</p> <p><input type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): Approximately 45 minutes after the injection of air and contrast, the patient was totally blind in both eyes. The initial MRI, 2 hours after the attempted procedure showed bilateral parenchymal gadolinium enhancement in the occipital lobes and throughout the posterior intracranial circulation, indicating breakdown of the blood-brain barrier. Over the ensuing 24 hours he manifested obtundation, confusion, aphasia, swallowing dysfunction, and bilateral blindness. The patient made gradual improvements over 3 weeks. He was discharged from the hospital at day 30 with mild short-term memory deficit and a persistent partial right homonymous hemianopia.</p> <p>Author conclusions (relative to question): The neurologic deficits at 4 weeks may have been related to the persistent effects of air or other cerebral embolism, direct toxic effects of the contrast, or both.</p>	<p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that: cervical epidural injections can have catastrophic complications.</p>
Muro K,	Level IV	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective	<i>Critique of methodology:</i>

<p>O'Shaughnessy B, Ganju A. Infarction of the cervical spinal cord following multilevel transforaminal epidural steroid injection: case report and review of the literature. J Spinal Cord Med. 2007;30(4):385-388.</p>	<p>Type of evidence therapeutic</p>	<p>Study design: case series</p> <p>Stated objective of study: Report the case of a patient with an acute infarction of the cervical spinal cord after a multilevel transforaminal epidural steroid injection.</p> <p>Type of treatment(s): Intravenous sedation with midazolam, fentanyl and propofol. A 25 gauge spinal needle was fluoroscopically-guided to the left C5-6 and C6-7 levels. Under live fluoroscopy, contrast was noted around the nerve root sleeves and epidural space, and the absence of vascular uptake. Each level was injected with methylprednisolone and bupivacaine.</p> <p>Total number of patients: 1 Number of patients in relevant subgroup(s):</p> <p>Consecutively assigned?</p> <p>Duration of follow-up: 8 weeks</p> <p>Validated outcome measures used: ASIA; MRI</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:  <input checked="" type="checkbox"/> Clinical exam/history  <input type="checkbox"/> Electromyography  <input type="checkbox"/> Myelogram  <input checked="" type="checkbox"/> MRI  <input type="checkbox"/> CT  <input type="checkbox"/> CT/Myelogram  <input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): Thirty minutes postprocedure, the patient had paresis in the upper extremities (left&gt;right) and weakness in the lower extremities with some preservation of sensory function. Initial MRI did not show any significant lesions. Follow-up MRIs showed cervical spinal cord infarction extending to the cervicomedullary junction. At 8 weeks she had gained strength in both upper extremities and in her right lower extremity and was ambulating independently with a walker.</p>	<p> <input type="checkbox"/> Nonconsecutive patients  <input checked="" type="checkbox"/> Nonrandomized  <input checked="" type="checkbox"/> Nonmasked reviewers  <input checked="" type="checkbox"/> Nonmasked patients  <input checked="" type="checkbox"/> No validated outcome measures used  <input type="checkbox"/> Small sample size  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input type="checkbox"/> Other:         </p> <p><i>Work group conclusions</i>          Potential Level: IV          Downgraded Level:</p> <p><i>Conclusions relative to question</i>          This paper provides evidence that: cervical epidural injections can have catastrophic complications.</p>
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		Author conclusions (relative to question): Although the incidence of neurologic dysfunction due to this procedure is low, the consequence can be devastating.	
Pobiel, R. S., K. P. Schellhas, et al. (2009). "Selective cervical nerve root blockade: prospective study of immediate and longer term complications." AJNR Am J Neuroradiol 30(3): 507-11	Level IV  Type of evidence therapeutic	<input checked="" type="checkbox"/> Prospective <input type="checkbox"/> Retrospective  Study design: case series  Stated objective of study: To evaluate immediate and 30 day complications following selective transforaminal cervical nerve root blockade  Type of treatment(s): transforaminal cervical nerve root block  Total number of patients: 659 Number of patients in relevant subgroup(s): 659  Consecutively assigned? Yes  Duration of follow-up: 30 minutes (659 patients); 30 days (345 patients)  Validated outcome measures used:  Nonvalidated outcome measures used: patient-reported complications  Diagnosis made by: <input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input type="checkbox"/> MRI <input type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other:  Results/subgroup analysis (relevant to question): No serious complications; 5% minor complications  Author conclusions (relative to question): Fluoroscopically-guided selective nerve root blockade is a safe outpatient procedure with a low delayed and immediate complication rate.	<i>Critique of methodology:</i> <input type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input checked="" type="checkbox"/> Nonmasked reviewers <input checked="" type="checkbox"/> Nonmasked patients <input checked="" type="checkbox"/> No validated outcome measures used <input type="checkbox"/> Small sample size <input checked="" type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that:fluoroscopically-guided transforaminal selective nerve root block is a low-risk procedure.
Reitman, C. A. and W. Watters, 3rd	Level IV	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective	<i>Critique of methodology:</i> <input type="checkbox"/> Nonconsecutive patients

<p>(2002). "Subdural hematoma after cervical epidural steroid injection." Spine (Phila Pa 1976) 27(6): E174-6</p>	<p>Type of evidence therapeutic</p>	<p>Study design: case series</p> <p>Stated objective of study: Demonstrate a previously unreported complication of cervical epidural steroid injection.</p> <p>Type of treatment(s): Fluoroscopically-guided ICESI</p> <p>Total number of patients: 1 Number of patients in relevant subgroup(s): 1</p> <p>Consecutively assigned?</p> <p>Duration of follow-up: 6 days</p> <p>Validated outcome measures used: Deceased</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:  <input checked="" type="checkbox"/> Clinical exam/history  <input type="checkbox"/> Electromyography  <input type="checkbox"/> Myelogram  <input type="checkbox"/> MRI  <input checked="" type="checkbox"/> CT  <input type="checkbox"/> CT/Myelogram  <input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): Uncomplicated fluoroscopically-guided ICESI related to acute subdural cervical hematoma and quadraplegia. Patient underwent emergency decompressive surgery 11 hours after the injection. The patient succumbed to complications related to the subdural hematoma 14 days after the ICESI.</p> <p>Author conclusions (relative to question): Spinal subdural hematomas can occur after cervical epidural steroid injection. The sequelae of cervical subdural hematoma after cervical epidural steroid injection are potentially devastating.</p>	<p> <input checked="" type="checkbox"/> Nonrandomized  <input checked="" type="checkbox"/> Nonmasked reviewers  <input checked="" type="checkbox"/> Nonmasked patients  <input checked="" type="checkbox"/> No validated outcome measures used  <input type="checkbox"/> Small sample size  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input type="checkbox"/> Other:         </p> <p><i>Work group conclusions</i>          Potential Level: IV          Downgraded Level:       </p> <p><i>Conclusions relative to question</i>          This paper provides evidence that:spinal subdural hematoma may occur after cervical epidural steroid injection. Cervical epidural injections can have catastrophic complications.       </p>
<p>Rozin L, Rozin R, Koehler SA, et al. Death during</p>	<p>Level IV  Type of</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design: case series</p>	<p><i>Critique of methodology:</i>  <input type="checkbox"/> Nonconsecutive patients  <input type="checkbox"/> Nonrandomized       </p>

<p>transforaminal epidural steroid nerve root block (C7) due to perforation of the left vertebral artery. Am J Forensic Med Pathol. Dec 2003;24(4):351-355</p>	<p>evidence therapeutic</p>	<p>Stated objective of study: Examine the death associated with a C7 nerve root block (TCESI).</p> <p>Type of treatment(s): A 25 gauge spinal needle was fluoroscopically advanced into the left C6-7 neuroforamen. On the initial attempt, blood was aspirated from the spinal needle. The spinal needle was repositioned until it was negative for blood. Omnipaque was injected outling the C7 nerve proximally and distally. This was followed by the instillation of a 3 ml solution of methylprednisolone and bupivacaine. During the injection the patient became noncommunicative.</p> <p>Total number of patients: 1 Number of patients in relevant subgroup(s):</p> <p>Consecutively assigned?</p> <p>Duration of follow-up: 1 day</p> <p>Validated outcome measures used: CT scan; Autopsy</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:  <input checked="" type="checkbox"/> Clinical exam/history  <input type="checkbox"/> Electromyography  <input type="checkbox"/> Myelogram  <input type="checkbox"/> MRI  <input checked="" type="checkbox"/> CT  <input type="checkbox"/> CT/Myelogram  <input type="checkbox"/> Other:</p> <p>Results/subgroup analysis (relevant to question): CT scan showed a large hemorrhage around the brainstem, with obstructive hydrocephalus and extensive bleeding throughout the midbrain and pons into the lateral ventricles and basilar cisterns.</p> <p>Autopsy revealed dissection of the vertebral artery and focal petechial hemorrhage in the adventitia on the left side. A recent thrombosis was noted in the vertebral lumen.</p>	<p> <input type="checkbox"/> Nonmasked reviewers  <input type="checkbox"/> Nonmasked patients  <input type="checkbox"/> No validated outcome measures used  <input type="checkbox"/> Small sample size  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input type="checkbox"/> Other:         </p> <p><i>Work group conclusions</i>          Potential Level: IV          Downgraded Level:</p> <p><i>Conclusions relative to question</i>          This paper provides evidence that:vertebral artery dissection is a potential complication of transforaminal epidural steroid injection. Cervical epidural injections can have catastrophic complications.</p>
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		Author conclusions (relative to question): It is up to the treating physician to take the the appropriate course of action to evaluate for the possibility of a ruptured artery.	
Schellhas, K. P., S. R. Pollei, et al. (2007). "Selective cervical nerve root blockade: Experience with a safe and reliable technique using an anterolateral approach for needle placement." American Journal of Neuroradiology 28(10): 1909-1914	Level IV  Type of evidence therapeutic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study design: case series  Stated objective of study: To evalate the safety and clinical utility of antero-lateral cervical nerve root blockade  Type of treatment(s): Antero-lateral fluoroscopically-guided cervical epidural injection  Total number of patients: 4,612 Number of patients in relevant subgroup(s): 4,612  Consecutively assigned? Yes  Duration of follow-up: immediate  Validated outcome measures used:  Nonvalidated outcome measures used: immediate complications or patient calls within a week  Diagnosis made by: <input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input type="checkbox"/> MRI <input type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other:  Results/subgroup analysis (relevant to question): There was a 5% rate of a temporary exacerbation of pain. There were no permanent neurological injuries  Author conclusions (relative to question): Fluoroscopically-guided cervical epidural injection is safe when performed by experienced personnel.	<i>Critique of methodology:</i> <input type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input type="checkbox"/> Nonmasked reviewers <input type="checkbox"/> Nonmasked patients <input checked="" type="checkbox"/> No validated outcome measures used <input type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that:fluoroscopically-guided transforaminal epidural steroid injection is a low risk procedure.

<p>Suresh, S., J. Berman, et al. (2007). "Cerebellar and brainstem infarction as a complication of CT-guided transforaminal cervical nerve root block." <i>Skeletal Radiology</i> 36(5): 449-452</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/>Prospective <input checked="" type="checkbox"/>Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Present this case report and the literature review of the potential complications of this procedure.</p> <p>Type of treatment(s): CT-guided transforaminal left C5 nerve root block with triamcinolone via a lateral approach.</p> <p>Total number of patients: 1 Number of patients in relevant subgroup(s): 1</p> <p>Consecutively assigned?</p> <p>Duration of follow-up: 1 month</p> <p>Validated outcome measures used: Glasgow Coma Scale</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:  <input checked="" type="checkbox"/>Clinical exam/history  <input type="checkbox"/>Electromyography  <input type="checkbox"/>Myelogram  <input checked="" type="checkbox"/>MRI  <input type="checkbox"/>CT  <input type="checkbox"/>CT/Myelogram  <input type="checkbox"/>Other:</p> <p>Results/subgroup analysis (relevant to question): Immediately, post-procedure the patient was disoriented with loss of normal speech and hypertensive. Eight hours later the patient's condition deteriorated. The patient's Glasgow Coma Scale (GCS) went from 14/15 to 6/15. A brain MRI revealed extensive high signal changes on T2 weighted images in the left cerebellum and left side of the brain stem, in the territory of the left vertebral artery. Forty-eight hours later, the condition improved and the GCS was 15/15. One month after the event the patient made a "progressive recovery."</p> <p>Author conclusions (relative to question): The patient had an infarct. The</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/>Nonconsecutive patients  <input checked="" type="checkbox"/>Nonrandomized  <input checked="" type="checkbox"/>Nonmasked reviewers  <input checked="" type="checkbox"/>Nonmasked patients  <input checked="" type="checkbox"/>No validated outcome measures used  <input type="checkbox"/>Small sample size  <input type="checkbox"/>&lt;80% follow-up  <input type="checkbox"/>Lacked subgroup analysis  <input type="checkbox"/>Diagnostic method not stated  <input type="checkbox"/>Other:</p> <p><i>Work group conclusions</i>  Potential Level: IV  Downgraded Level:</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that: cerebellar/brainstem infarction, presumably due to vertebral artery spasm, is a potential complication of CT-guided transforaminal epidural steroid injection. Cervical epidural injections can have catastrophic complications.</p>
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		infarct was likely due to vasospasm because no dissection of the vertebral artery was evident on imaging.	
Tiso, R. L., T. Cutler, et al. (2004). "Adverse central nervous system sequelae after selective transforaminal block: the role of corticosteroids." Spine J 4(4): 468-74	Level IV  Type of evidence therapeutic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study design: case series  Stated objective of study: Present a case of massive cerebellar infarction after uneventful selective cervical transforaminal block.  Type of treatment(s): Fluoroscopically-guided right C5-6 transforaminal block with local anesthetic and triamcinolone.  Total number of patients: One Number of patients in relevant subgroup(s): One  Consecutively assigned?  Duration of follow-up: One day  Validated outcome measures used: Deceased  Nonvalidated outcome measures used:  Diagnosis made by: <input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input type="checkbox"/> MRI <input type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input checked="" type="checkbox"/> Other: operative findings  Results/subgroup analysis (relevant to question): Upon self-transfer from the C-arm table to the stretch, the patient became unresponsive and hypoxic. Quadraparesis was evident one hour after injection. Patient underwent brainstem decompressive surgery. The patient expired the following day. Pathology findings included bilateral cerebellar and left occipital cortex infarction.  Author conclusions (relative to question): The authors presented a case of	<i>Critique of methodology:</i> <input type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input checked="" type="checkbox"/> Nonmasked reviewers <input checked="" type="checkbox"/> Nonmasked patients <input checked="" type="checkbox"/> No validated outcome measures used <input type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that: cerebellar/brainstem infarction is a potential complication of fluoroscopically-guided transforaminal epidural steroid injection. Cervical epidural injections can have catastrophic complications.

		quadraparesis and brainstem herniation after a selective cervical transforaminal block, and propose a potential role for corticosteroid particulate embolus during unintended intra-arterial injection as a potential mechanism.	
Trentman, T. L., D. M. Rosenfeld, et al. (2009). "Vasovagal reactions and other complications of cervical vs. lumbar translaminar epidural steroid injections." Pain Practice 9(1): 59-64	Level IV  Type of evidence therapeutic	<input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective  Study design: case series  Stated objective of study: To retrospectively compare the rate of vasovagal complication in translaminar cervical epidural versus lumbar epidural injection  Type of treatment(s): translaminar cervical or lumbar epidural injection  Total number of patients: 249 Number of patients in relevant subgroup(s): not stated  Consecutively assigned?  Duration of follow-up: retrospective chart review of clinic visit  Validated outcome measures used:  Nonvalidated outcome measures used:  Diagnosis made by: <input checked="" type="checkbox"/> Clinical exam/history <input type="checkbox"/> Electromyography <input type="checkbox"/> Myelogram <input type="checkbox"/> MRI <input type="checkbox"/> CT <input type="checkbox"/> CT/Myelogram <input type="checkbox"/> Other:  Results/subgroup analysis (relevant to question): The risk of vasovagal complication following cervical epidural was 8% compared to a 1% risk of complication following lumbar epidural injection.  Author conclusions (relative to question): The risk of vasovagal complications following cervical epidural injection is substantially higher than the rate observed following lumbar injections.	<i>Critique of methodology:</i> <input type="checkbox"/> Nonconsecutive patients <input checked="" type="checkbox"/> Nonrandomized <input checked="" type="checkbox"/> Nonmasked reviewers <input checked="" type="checkbox"/> Nonmasked patients <input checked="" type="checkbox"/> No validated outcome measures used <input type="checkbox"/> Small sample size <input type="checkbox"/> <80% follow-up <input type="checkbox"/> Lacked subgroup analysis <input type="checkbox"/> Diagnostic method not stated <input type="checkbox"/> Other:  <i>Work group conclusions</i> Potential Level: IV Downgraded Level:  <i>Conclusions relative to question</i> This paper provides evidence that: cervical epidural injection is more likely to result in a vasovagal complication than a lumbar epidural injection.

<p>Waldman, S. D. (1989). "Complications of cervical epidural nerve blocks with steroids: A prospective study of 790 consecutive blocks." Regional Anesthesia 14(3): 149-151</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input checked="" type="checkbox"/>Prospective <input type="checkbox"/>Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: To prospectively assess the complication rate following cervical epidural injection</p> <p>Type of treatment(s): cervical epidural</p> <p>Total number of patients: 215 patients - 790 consecutive blocks Number of patients in relevant subgroup(s):</p> <p>Consecutively assigned? Yes</p> <p>Duration of follow-up: 6 weeks</p> <p>Validated outcome measures used:</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/>Clinical exam/history  <input type="checkbox"/>Electromyography  <input type="checkbox"/>Myelogram  <input type="checkbox"/>MRI  <input type="checkbox"/>CT  <input type="checkbox"/>CT/Myelogram  <input type="checkbox"/>Other:</p> <p>Results/subgroup analysis (relevant to question): The complication rate following cervical epidural injection is low.</p> <p>Author conclusions (relative to question): Cervical epidural injection is a safe modality.</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/>Nonconsecutive patients  <input checked="" type="checkbox"/>Nonrandomized  <input type="checkbox"/>Nonmasked reviewers  <input type="checkbox"/>Nonmasked patients  <input checked="" type="checkbox"/>No validated outcome measures used  <input type="checkbox"/>Small sample size  <input type="checkbox"/>&lt;80% follow-up  <input type="checkbox"/>Lacked subgroup analysis  <input type="checkbox"/>Diagnostic method not stated  <input type="checkbox"/>Other:</p> <p><i>Work group conclusions</i>  Potential Level: IV  Downgraded Level:</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that:cervical epidural injection appears to be relatively safe.</p>
<p>Wallace, M. A., M. B. Fukui, et al. (2007). "Complications of cervical selective nerve root blocks</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/>Prospective <input checked="" type="checkbox"/>Retrospective</p> <p>Study design: case series</p> <p>Stated objective of study: Present two cases that show potentially devastating outcomes when a cervical SNRB is performed using fluoroscopic guidance.</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/>Nonconsecutive patients  <input type="checkbox"/>Nonrandomized  <input type="checkbox"/>Nonmasked reviewers  <input type="checkbox"/>Nonmasked patients  <input type="checkbox"/>No validated outcome measures used</p>

<p>performed with fluoroscopic guidance." American Journal of Roentgenology 188(5): 1218-1221</p>		<p>Type of treatment(s): Fluoroscopically-guided cervical SNRB</p> <p>Total number of patients: 2 Number of patients in relevant subgroup(s): 2</p> <p>Consecutively assigned?</p> <p>Duration of follow-up: 24 hours and 1 month</p> <p>Validated outcome measures used: Death</p> <p>Nonvalidated outcome measures used: Clinical</p> <p>Diagnosis made by:</p> <p><input checked="" type="checkbox"/> Clinical exam/history</p> <p><input type="checkbox"/> Electromyography</p> <p><input type="checkbox"/> Myelogram</p> <p><input type="checkbox"/> MRI</p> <p><input checked="" type="checkbox"/> CT</p> <p><input type="checkbox"/> CT/Myelogram</p> <p><input checked="" type="checkbox"/> Other: vertebral arteriogram</p> <p>Results/subgroup analysis (relevant to question):</p> <p>Case 1: Head CT showed marked edema of the pons and mid brain; a large hemorrhagic infarction within the pons, mid brain, cerebellum and thalami with intraventricular extension, subarachnoid hemorrhage and hydrocephalus. Postmortem findings included massive cerebral edema with perforation of the vertebral artery and dissection that extended into the basilar artery. Also, an intraluminal thrombus was noted within the dissected vertebral artery.</p> <p>Case 2: Dissection of left vertebral artery. Presenting symptoms were confusion, visual deficits, upper extremity paresis, and facial weakness. The patient was heparinized and the symptom resolved within 24 hours. CT of the head showed normal findings. Follow-up head CT 1 month after discharge was normal.</p> <p>Author conclusions (relative to question):</p> <p>The technical complexity and potential complications of performing cervical nerve root blocks are underappreciated. The combination of not recognizing the potential of lethal complications with a belief that a procedure is simple can</p>	<p><input type="checkbox"/> Small sample size</p> <p><input type="checkbox"/> &lt;80% follow-up</p> <p><input type="checkbox"/> Lacked subgroup analysis</p> <p><input type="checkbox"/> Diagnostic method not stated</p> <p><input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i></p> <p>Potential Level: IV</p> <p>Downgraded Level:</p> <p><i>Conclusions relative to question</i></p> <p>This paper provides evidence that: vertebral artery puncture and dissection with subsequent cerebellar and brainstem stroke is a potential complication of fluoroscopically-guided cervical selective nerve root block. Cervical epidural injections can have catastrophic complications.</p>
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		easily lead to the precipice of failure and disaster.	
<p>Ziai WC, Ardel AA, Llinas RH. Brainstem stroke following uncomplicated cervical epidural steroid injection. Arch Neurol. Nov 2006;63(11):1643-1646</p>	<p>Level IV</p> <p>Type of evidence therapeutic</p>	<p><input type="checkbox"/> Prospective <input checked="" type="checkbox"/> Retrospective</p> <p>Study design (select one): case series</p> <p>Stated objective of study: To describe the clinical, radiological, and autopsy findings of a 41 year old patient treated with a methylprednisolone cervical epidural steroid injection, who developed a fatal hemorrhagic brainstem infarction, and to discuss the possible mechanisms involved.</p> <p>Type of treatment(s): No sedation administered. Fluoroscopically-guided, nonionic contrast confirmed, placement of a needle into the posterior C5-6 epidural space. There was no evidence of blood return. This was followed by the injection of methylprednisolone in preservative-free saline. Within minutes the patient developed nausea , vomiting, and headache. He was observed for two hours and then discharged.</p> <p>Total number of patients: 1 Number of patients in relevant subgroup(s):</p> <p>Consecutively assigned?</p> <p>Duration of follow-up: 7 days</p> <p>Validated outcome measures used: MRI, MRA, death, autopsy</p> <p>Nonvalidated outcome measures used:</p> <p>Diagnosis made by:  <input checked="" type="checkbox"/> Clinical exam/history  <input type="checkbox"/> Electromyography  <input type="checkbox"/> Myelogram  <input checked="" type="checkbox"/> MRI  <input type="checkbox"/> CT  <input type="checkbox"/> CT/Myelogram  <input checked="" type="checkbox"/> Other: MRA</p> <p>Results/subgroup analysis (relevant to question): Seven and one-half hours after the procedure the patient's condition had deteriorated. His speech was slurred and he had progressive weakness in all four extremities. He became</p>	<p><i>Critique of methodology:</i></p> <p><input type="checkbox"/> Nonconsecutive patients  <input type="checkbox"/> Nonrandomized  <input type="checkbox"/> Nonmasked reviewers  <input type="checkbox"/> Nonmasked patients  <input type="checkbox"/> No validated outcome measures used  <input type="checkbox"/> Small sample size  <input type="checkbox"/> &lt;80% follow-up  <input type="checkbox"/> Lacked subgroup analysis  <input type="checkbox"/> Diagnostic method not stated  <input type="checkbox"/> Other:</p> <p><i>Work group conclusions</i>  Potential Level: IV  Downgraded Level:</p> <p><i>Conclusions relative to question</i>  This paper provides evidence that:vertebral artery injury with subsequent brainstem infarction is a potential complication of cervical epidural steroid injection. Cervical epidural injections can have catastrophic complications.</p>

		<p>unresponsive with nonreactive pupils. MRI showed ischemic infarction of the midbrain, pons and medulla, and left thalamus. MRI and MRA 24 hours later showed progression of the ischemia. Patient's condition did not improve and comfort care was instituted 7 days postprocedure.</p> <p>Autopsy showed small area of hemorrhage within the adventitia of the left vertebral artery around the C5-6 level. Hemorrhagic necrosis of basal thalamus, hypothalamus, midbrain, pons and medulla.</p> <p>Author conclusions (relative to question): Serious intracranial pathology from a cervical epidural steroid injection may occur despite the use of fluoroscopic guidance.</p>	
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