

# Driving After an Epidural Steroid Injection Without Sedation

Zachary L. McCormick, MD<sup>1</sup>; Byron Schneider, MD<sup>2</sup>; and Clark Smith, MD, MPH<sup>3</sup> on behalf of the Spine Intervention Society's Patient Safety Committee

<sup>1</sup> University of Utah, Department of Physical Medicine and Rehabilitation, Salt Lake City, Utah, U.S.A.;

<sup>2</sup> Vanderbilt University, Department of Physical Medicine and Rehabilitation, Nashville, Tennessee, U.S.A.;

<sup>3</sup> Columbia University Medical Center, Rehabilitation and Regenerative Medicine, New York, New York, U.S.A.

**Myth:** Driving is safe after an epidural steroid injection (ESI) procedure without the use of sedation.

**Fact:** Driving safety is potentially compromised by the use of local anesthetic included in the epidural injectate even if sedation is not used during the procedure. Further, rare cases of delayed-onset visual and sensorimotor impairments, independent of the effects of local anesthetic, have been associated with ESI. Therefore, clinicians may consider rescheduling an ESI procedure if the patient does not have a driver.

## Key Points:

- Temporary sensorimotor impairment is expected in a subset of patients who undergo ESI with local anesthetic included in the epidural injectate, and delayed-onset sensorimotor block and loss of consciousness may occur following unintentional subdural local anesthetic injection.
- The risk of delayed-onset visual impairment related to retinal hemorrhage may be mitigated by slow, low volume injection.
- The risk of spinal hematoma with subsequent sensorimotor impairment may be mitigated by transforaminal access in accordance with clinical practice guidelines [1,2].

## Background

The question of whether to allow patients to drive immediately following an epidural steroid injection (ESI) is a dilemma that is not directly addressed by clinical practice guidelines [1]. There have been no case reports of adverse consequences of driving post-procedure, but there are a number of theoretical risks of driving after ESI. In general, for a person to drive safely, minimum functional criteria should be met. These criteria include: alert mental status, appropriate cognition and reaction time, as well as unimpaired vision and sensorimotor function [3-5]. Some of these faculties may be compromised by elements of ESI procedures. For example, because sedation compromises mental status, cognition, and reaction time, it is necessary for clinicians to strongly advise against driving after ESI procedures in which such agents are administered. Likewise, driving should be avoided following ESI in which local anesthetic is included in the injectate (regardless of sedation use during the procedure), as temporary sensorimotor impairment may occur in a subset of patients [6,7] and delayed-onset sensorimotor block and loss of consciousness may occur following unintentional subdural local anesthetic injection [8-10]. Further, one small prospective case-control study of lumbar selective nerve root block demonstrated delayed driving reaction time equating to an increase in stopping distance of 3.8 meters if traveling 100 km/hr both immediately and at two week follow-up [11].

Independent of the use of procedural sedation and epidural local anesthetic, delayed or undetected compromise of visual or sensorimotor function is possible, which poses a risk to driving post-procedure. Such cases, related to retinal pathology, transient glaucoma, epidural hematoma, and subdural hematoma have been described in the literature, as detailed below.

## Visual Impairment

Retinal hemorrhage has occurred following both cervical [12](Kim) and lumbar ESI [13-16]. This phenomenon, also known as "Terson Syndrome," results from transmission of pressure from the epidural space (volume expansion) to the subarachnoid space, which displaces cerebrospinal fluid and raises intracranial pressure (ICP). This increase in ICP elevates optic nerve pressure, which causes vascular congestion and rupture of retinal venules and capillaries [13]. Visual impairment results. In the cases described after ESI, visual acuity was reduced to 20/400 in at least one eye and more commonly both eyes when objective measurement was performed. An associated 6<sup>th</sup> nerve palsy was also described in one case [12]. The time to complaint of visual disturbance by each patient was variable from minutes [14] to hours [12,15,16]. While 20-25 mL of volume was injected in these cases, as little as 10 mL of volume injected into the lumbar interlaminar epidural

space can increase intracranial pressure (ICP) [17] and 15 mL of volume injected into the epidural space can increase subarachnoid pressure by over 300% [18]. Volume but also the rate of injection is directly related to the relative increase in ICP [19]. Therefore, while not described in the literature, it is conceivable that Terson Syndrome could result from an ESI of lower volume if administration is rapid.

Retinal detachment [20], retinal necrosis [21] and transient glaucoma [22] have all been reported following lumbar ESI. Each of these adverse events was thought to result from the corticosteroid agent, rather than volume or pressure changes. Unfortunately, the dose of corticosteroid used during ESI was only reported in the case of transient glaucoma (80mg methylprednisolone). The time to complaint of visual disturbance by each patient varied from 2-5 days [20-22] to 3 weeks [20]. However, measurable visual impairment was likely present prior to patient complaint. In the case of retinal detachment, blind spots resulted [20], while decreased visual acuity to 20/200 : 20/50 and "hand motions only" were found in respective cases of retinal necrosis [21]. While "blurred vision" was reported by the patient, objective ophthalmologic assessment was not reported in the case of post-ESI transient glaucoma [22].

## Sensorimotor Impairment

Both epidural and subdural hematomas are known possible complications of ESI. Such hematomas can gradually increase in size and cause compression to the neural structures and subsequent onset of weakness and decreased sensation, which can impede driving and increase risk both to the patient and others in close proximity. While the onset of sensorimotor impairment due to a developing epidural hematoma may occur within minutes [23,24] or take more than a day [25-32], there are case reports of onset in the time-frame of discharge after injection in a typical clinic setting (*i.e.* 20-30 minutes) [33,34]. Similarly, case reports of sensorimotor impairment due to subdural hematoma after ESI note onset "while riding as a passenger in a car" on the way home [35] and 2 hours post-injection [36]. It is important to note that all cases of spinal hematomas have been reported after the epidural space was accessed via an interlaminar route or when a transforaminal ESI was performed without adherence to clinical practice guidelines [1,2].

## Implications

Driving safety is potentially compromised by the use of local anesthetic included in the epidural injectate even if sedation is not used during the procedure. Furthermore, driving safety may be potentially affected, independent

of the use of local anesthetic or procedural sedation, by delayed-onset visual or sensorimotor impairment. The risk of delayed-onset visual impairment due to retinal hemorrhage may be mitigated by slow, low volume injection, and the risk of delayed-onset sensorimotor impairment due to spinal hematoma may be mitigated by transforaminal access in accordance with clinical practice guidelines [1,2]. However, these complications cannot be unequivocally prevented; thus, clinicians may consider rescheduling an ESI procedure if the patient does not have a driver.

## References

1. Bogduk N (ed). Practice Guidelines for Spinal Diagnostic and Treatment Procedures, 2nd edn. International Spine Intervention Society, San Francisco, 2013.
2. Smith CC, Schneider B, McCormick ZL, Gill J, Loomba V, Engel AJ, Duszynski B, King W, Standards Division of the Spine Intervention Society. Risks and benefits of ceasing or continuing anticoagulant medication for image-guided procedures for spine pain: A systematic review. *Pain Med* 2018;19:438-448.
3. Occupational Safety and Health Administration. Guidelines for Employers to Reduce Motor Vehicle Crashes. [https://www.osha.gov/Publications/motor\\_vehicle\\_guide.pdf](https://www.osha.gov/Publications/motor_vehicle_guide.pdf)
4. International Council of Ophthalmology. Vision Requirements for Driving Safety with Emphasis on Individual Assessment, 2006. <http://www.icoph.org/downloads/visionfordriving.pdf>
5. American Association of Motor Vehicle Administrators. Driver Fitness Medical Guidelines, September 2009. [https://www.aamva.org/uploadedFiles/MainSite/Content/SolutionsBestPractices/BestPracticesModelLegislation\(1\)/DriverFitnessMedicalGuidelines\\_092009.pdf](https://www.aamva.org/uploadedFiles/MainSite/Content/SolutionsBestPractices/BestPracticesModelLegislation(1)/DriverFitnessMedicalGuidelines_092009.pdf)
6. Plastaras C, McCormick ZL, Garvan C, Macron D, Joshi A, Chimes G, Smeal W, Rittenberg J, Kennedy DJ. Adverse events associated with fluoroscopically guided lumbosacral transforaminal epidural steroid injections. *Spine J* 2015;15:2157-65.
7. McCormick ZL, Nelson A, Kendall MC, McCarthy RJ, Nagpal G, Walega DR. Does cervical interlaminar epidural steroid injection with low-dose lidocaine cause objective upper extremity weakness? A preliminary study. *Pain Med* 2017;18:2296-2305.
8. Bansal S, Turtle MJ. Inadvertent subdural spread complicating cervical epidural steroid injection with local anaesthetic agent. *Anaesth Intensive Care* 2003;31:570-2.
9. Lehmann LJ, Pallares VS. Subdural injection of a local anesthetic with steroids: complication of epidural anesthesia. *South Med J* 1995;88:467-9.
10. Silva Costa-Gomes T, Montes A, Sanchez JC, Bermejo S, Escolano F. [Cardiorespiratory arrest: a rare complication of subdural block]. *Rev Esp Anestesio Reanim* 2002;49:108-111.
11. Al-khayer A, Schueler A, Kruszewski G, Armstrong G, Grevitt MP. Driver reaction time before and after treatment for lumbar radiculopathy. *Spine* 2008;33:1696-1700.

12. Kim EC, Kim MS. Acute bilateral retinal hemorrhages and unilateral sixth cranial nerve palsy after inadvertent epidural anaesthetic injection and subsequent dural puncture. *Can J Ophthalmol* 2010;45:542-3.
13. Gill JB, Heavner JE. Visual impairment following epidural fluid injections and epiduroscopy: a review. *Pain Med* 2005;6:367-74.
14. Pagani-Estevez GL, Chen JJ, Watson JC, Leavitt JA. Acute vision loss secondary to epidural blood patch: Terson Syndrome. *Reg Anesth Pain Med* 2016;41:164-8.
15. Young WF. Transient blindness after lumbar epidural steroid injection: a case report and literature review. *Spine* 2002;27:E476-7.
16. Purdy EP, Ajimal GS. Vision loss after lumbar epidural steroid injection. *Anesth Analg* 1998;86:119-122.
17. Hilt H, Gramm HJ, Link J. Changes in intracranial pressure associated with extradural anaesthesia. *Br J Anaesth* 1986;58:676-80.
18. Coombs DW, Hooper D. Subarachnoid pressure with epidural blood "patch". *Reg Anesth Pain Med* 1979;4:3-6.
19. Usubiaga JE, Usubiaga LE, Brea LM, Goyena R. Effect of saline injections on epidural and subarachnoid space pressures and relation to postspinal anesthesia headache. *Anesth Analg* 1993;46:293-6.
20. Levy J, Lifshitz T. Bilateral blurred vision after epidural corticosteroid injection. *Intern Med J* 2011;41:360.
21. Browning DJ. Acute retinal necrosis following epidural steroid injections. *Am J Ophthalmol* 2003;136:192-3.
22. Manijani D, Said S, Kaye AD. Transient glaucoma after an epidural steroid injection: a case report. *Ochsner J* 2015;14:79-82.
23. Benyamin RM, Vallejo R, Wang V, Kumar N, Cedeno DL, Tamrazi A. Acute epidural hematoma formation in cervical spine after interlaminar epidural steroid injection despite discontinuation of clopidogrel. *Reg Anesth Pain Med* 2016;41:398-401.
24. Alkhudari AM, Malk CS, Rahman A, Penmetcha T, Torres M. Epidural hematoma after routine epidural steroid injection. *Surg Neurol Int* 2016;7:55.
25. Loomba V, Kaveeshvar H, Dwivedi S. Paraplegia after thoracic epidural steroid injection. *A A Case Rep* 2015;7:118-21.
26. Xu R, Bydon M, Gokaslan ZL, Wolinsky JP, Witham TF, Bydon A. Epidural steroid injection resulting in epidural hematoma in a patient despite strict adherence to anticoagulation guidelines. *J Neurosurg Spine* 2009;11:358-64.
27. Page J, Moisi M, Oskouian RJ. Lumbar epidural hematoma following interlaminar fluoroscopically guided epidural steroid injection. *Reg Anesth Pain Med* 2016;41:402-4.
28. Yoo HS, Park SW, Han JH, Chung JY, Yi JW, Kang JM, Lee BJ, Kim DO. Paraplegia caused by an epidural hematoma in a patient with unrecognized chronic idiopathic thrombocytopenia purpura following an epidural steroid injection. *Spine* 2009;34:E376-9.
29. Ain RJ, Vance MB. Epidural hematoma after epidural steroid injection in a patient withholding enoxaparin per guidelines. *Anesthesiology* 2005;102:701-3.
30. Stoll A, Sanchez M. Epidural hematoma after epidural block: implications for its use in pain management. *Surg Neurol* 2002;57:235-40.
31. Siddiqui MN, Ranasinghe JS, Siddiqui S. Epidural hematoma after epidural steroid injection: a possible association with use of pentosan polysulfate sodium. *Anesthesiology* 2001;95:1307.
32. Lee JY, Nassr A, Ponnappan RK. Epidural hematoma causing paraplegia after a fluoroscopically guided cervical nerve-root injection. A case report. *J Bone Joint Surg Am* 2007;89:2037-9.
33. Shanthanna H, Park J. Acute epidural haematoma following epidural steroid injection in a patient with spinal stenosis. *Anaesthesia* 2011;66:837-9.
34. Ghaly RF. Recovery after high-dose methylprednisolone and delayed evaluation: a case of spinal epidural hematoma. *J Neurosurg Anesthesiol* 2001;13:323-8.
35. Chien GC, McCormick Z, Araujo M, Candido KD. The potential contributing effect of ketorolac and fluoxetine to a spinal epidural hematoma following a cervical interlaminar epidural steroid injection: a case report and narrative review. *Pain Physician* 2014;17:E385-95.
36. Reitman CA, Watters W 3<sup>rd</sup>. Subdural hematoma after cervical epidural steroid injection. *Spine* 2002;27:174-6.