Safety of Multi-level or Bilateral Fluoroscopically-Guided Cervical Transforaminal Epidural Steroid Injections

Aditya Raghunandan, MD1; Adam Michalik, DO2; Minh Nguyen, MD3; Mathew Saffarian, DO4; Byron Schneider, MD5,6; and Jaymin Patel, MD7 on behalf of the Spine Intervention Society’s Patient Safety Committee

1UT Health San Antonio, San Antonio, Texas, USA;
2Twin Cities Orthopedics, Interventional Spine and Musculoskeletal Medicine, Saint Paul, Minnesota, USA;
3University of Texas Southwestern, Department of Physical Medicine and Rehabilitation, Dallas, Texas, USA;
4Michigan State University, Department of Physical Medicine and Rehabilitation, East Lansing, Michigan, USA;
5Vanderbilt University Medical Center, Department of Physical Medicine & Rehabilitation, Nashville, Tennessee, USA;
6Vanderbilt University Medical Center, Center for Musculoskeletal Research, Nashville, Tennessee, USA;
7Emory University, Department of Orthopaedics, Atlanta, Georgia, USA

CTFESIs are commonly performed to treat cervical radicular pain [1-3] yet have unique complications and safety considerations [4]. The most serious complications of CTFESI are central nervous system (CNS) infarct and death. Numerous case reports of vertebrobasilar and spinal cord infarcts occurring after CTFESI have been published [5-14]. All report only a single-level injection being performed with particulate steroid. This implies that the incidence of the complication is rare, or the performance of multiple CTFESI in the same session is rare, or both.

Myth: There is no additional risk to performing a second-level or second-side cervical transforaminal epidural steroid injection (CTFESI).

Fact: Safe performance of a CTFESI procedure requires the ability to detect inadvertent arterial injection. Contrast medium placed into the epidural space and/or along the exiting spinal nerves during an initial CTFESI may obscure the detection of inadvertent cannulation of a radiculomedullary artery by a subsequent CTFESI. While no available literature directly addresses the potential risk that exists with a multi-level or bilateral CTFESI, caution is still warranted.

Another serious complication of CTFESI is seizure due to inadvertent arterial injection of anesthetic medication [19]. The use of an anesthetic injection before the injection of steroid may be used as a physiologic test to identify intra-arterial injectate deposition prior to administering corticosteroid, referred to as an anesthetic test dose [4,20]. An anesthetic injection is also requisite for a diagnostic spinal nerve injection [7,8]. Furthermore, a local anesthetic could inadvertently anesthetize surrounding structures, including the phrenic nerves traversing over the anterior scalene muscles on either side. This is a theoretical concern, particularly with a bilateral transforaminal approach, although no cases of phrenic nerve palsy have been reported in this setting.
Recommendations on the safe performance of CTFESI largely focus on avoiding inadvertent intra-arterial injection of potentially hazardous medication [4,20]. Specifically, the following recommendations were made in 2015 by the Multidisciplinary Working Group: all CTFESI should be performed by injecting contrast medium under real-time fluoroscopy and/or digital subtraction imaging (using an AP view) before injecting any substance that may be hazardous to the patient; particulate steroids should not be used in CTFESIs; and extension tubing should be used [4]. Placing the needle in the posterior foraminal space is also recommended to avoid the vertebral artery [20].

What is unknown is whether the performance of a multi-level or bilateral CTFESI increases the risk of this type of complication. During a CTFESI, contrast medium is introduced from the neural foramen into the epidural space, which may also spread in a cephalad or caudal direction. Thus, the presence of contrast medium within the epidural space could obscure the detection of a radiculomedullary artery coursing through the same area. This should not limit the ability to detect flow within the vertebral artery, as it lies outside the epidural space. Based on previously published images, radiculomedullary arteries can be challenging to detect [21]. Detection of inadvertent intra-arterial injection is critical for safely performing CTFESI. Therefore, any technical aspect of the CTFESI procedure which (theoretically) impairs the maximal likelihood of detecting an inadvertent arterial injection should be avoided. CNS infarcts or other major complications following CTFESI are rare, and as a result, the magnitude of additional risk with a multi-level CTFESI is unknown.

There are other considerations. Firstly, the improved safety profile of CTFESI with the use of non-particulate steroid may mitigate the theoretical risk of a two-level or bilateral CTFESI as it pertains to embolic infarcts. However, the use of non-particulate steroid does not mitigate the risk of seizure due to arterial injection of anesthetic if an anesthetic is injected intra-arterially. Even if the detection of an artery is not significantly diminished by a two-level or bilateral CTFESI, there is still an inherently increased risk of arterial injection simply by placing two needles. Live digital subtraction imaging (DSI) increases the rate of vascular detection compared to live fluoroscopy and may be less impacted in its ability to do so by previously administered contrast medium [22].

Conclusion And Recommendations
There is no available literature directly addressing the potential risk, if any, with a multi-level or bilateral CTFESI. Catastrophic complications may occur when CTFESI is performed with improper technique even at a single level. Injection at an additional level increases the risk of complications; therefore, conducting CTFESI in accordance with SIS’s best practices is critical for patient safety. Beyond the use of non-particulate steroids in CTFESI, which is of paramount importance, safety recommendations are centered around detecting inadvertent arterial injection. In theory, injecting a second level after a technically successful first-level CTFESI may reduce the physician’s ability to visualize a cannulated radiculo-medullary artery on live fluoroscopy due to the presence of contrast media in the epidural space. DSI can be used to improve visualization of any inadvertent vascular uptake; however, the DSI should be performed in a technically successful manner, capture high-quality images and avoid common pitfalls of DSI [23,24].

1) All CTFESIs should be performed in accordance with current safety guidelines, including the use of a non-particulate steroid.
2) There is an inherently cumulative risk when two injections via a multi-level or bilateral CTFESI are performed compared with a single injection.
3) Caution is warranted if a multi-level CTFESI is being considered because of the potential risk of previously administered contrast medium obfuscating the ability to detect intra-arterial flow. If performed, consider the use of live digital subtraction imaging in addition to live fluoroscopy to identify radiculomedullary arterial flow.
4) If symptomatic pathology exists bilaterally or at multiple cervical levels and a cervical epidural steroid injection is offered as a treatment, the treating physician might consider using an interlaminar approach at C6-7 or below if anatomically feasible. It should be noted, however, that the relative risk of major complications when comparing multi-level or bilateral CTFESI to ILESI remains unknown.
5) The treating physician should make the ultimate choice of approach or technique (i.e., interlaminar vs. transforaminal, multi-level, bilateral) by balancing potential risks and benefits with each technique for each patient.
References