Orthogonal oblique fluoroscopy for interventional spine: Technical report.

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INTRODUCTION: Painful spine disorders are among the most common and costly medical complaints, and spine injections under fluoroscopic guidance are some of the most frequently performed medical procedures. There are not universally accepted methods of fluoroscopy use, and most common techniques have significant disadvantages: For example, patient positioning for traditional approaches of certain injections is awkward and painful, and lateral view is often blocked due to shoulders, ribs, or body habitus, and so accurate assessment of needle tip is often not possible. Knowing the needle depth and position is crucial for proper performance of the procedure, for accurate medication placement, and to prevent potential injury, such as trauma to the spinal cord. Furthermore, ligamentum flavum is often not reliable as a sole landmark for the common loss of resistance or hanging drop techniques.

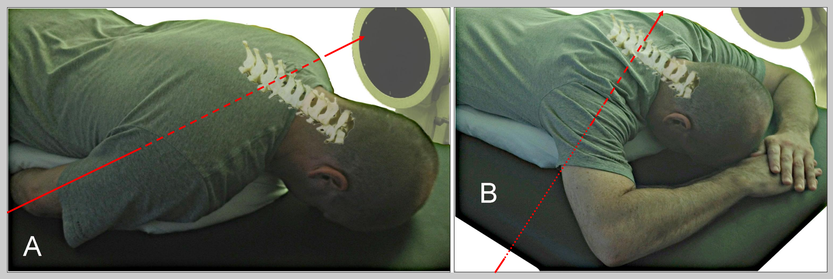

Figure 1. (A) is the standard patient position for CESI using lateral views. The position places traction on the brachial plexus and spinal nerves in an attempt to clear the shoulders from the cervicothoracic junction, and is poorly tolerated. Position (B) is well-tolerated, and oblique views clear the shoulders. The beam (red line) is passing through C7 in each position.

OBJECTIVE: In this technical report, we describe the use of orthogonal oblique views, also known as “contralateral oblique;” a method that aids in viewing a distinct, robust landmark, the spinolaminar line. We further describe a completely novel technique of transforaminal injections using oblique orthogonal views.

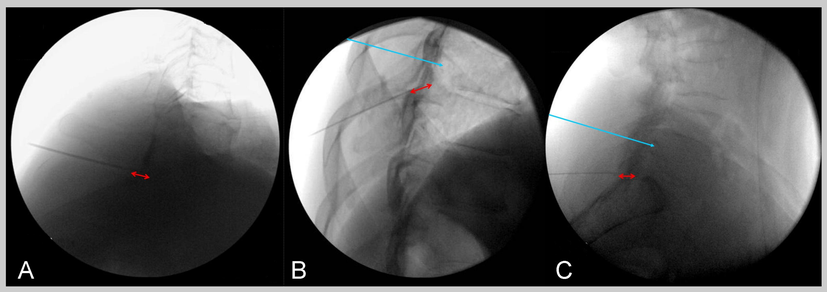

Figure 2. (A), (B), and (C) are lateral views of cervical, thoracic, and lumbar, respectively. For interlaminar approaches, landmarks for epidural injection are obscured, including (A) by shoulders, (B) by ribs and (C) by degeneration, iliac crest and habitus. The interlaminar landmark falls within a zone of uncertainty (marked by the red bar). Transforaminal approaches are further obscured by overlapping foraminal boundary projections (marked in blue).

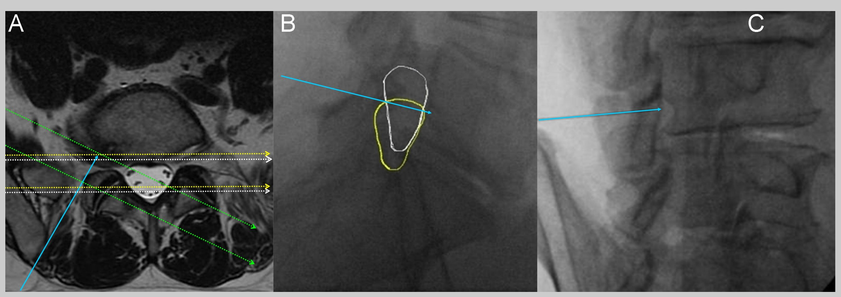

Figure 3. (A) White and yellow lines are lateral beams producing overlapping foraminal projections in (B). Needle tip (blue) is further obscured by any roundness to the vertebral body. (A) Green lines are oblique beams, orthogonal to needle, tangential to curvature of target, with a single foramen shadow clearly projected in (C). (Disregard R/L/level for purpose of illustration.)

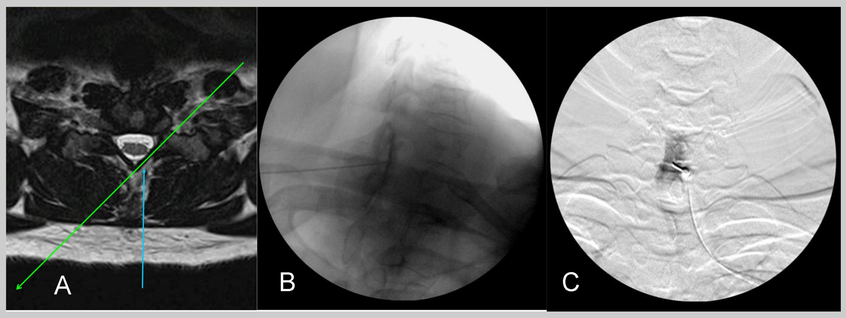

Figure 4. Cervical ESI left paramedian C7-T1. (A) Axial MRI illustrates beam path (green line) and needle (blue line). Contrast outlines the spinolaminar line in (B). Leftward contrast flow is seen with DSA in (C).

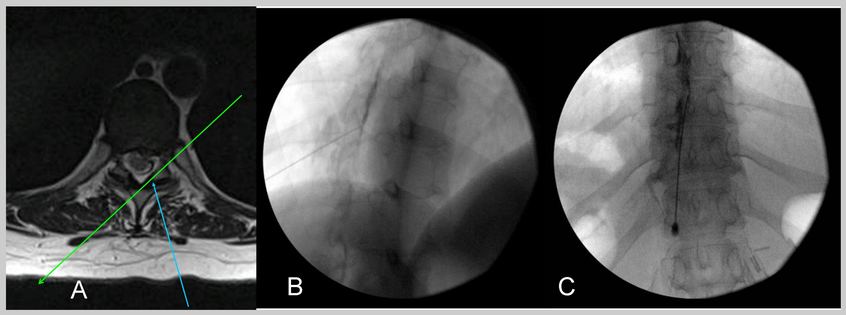

Figure 5. Thoracic interlaminar ESI left T8-9 paramedian. (A) Axial MRI illustrates beam path (green line) near-orthogonal to needle (blue line). Contrast outlines the spinolaminar line in (B).

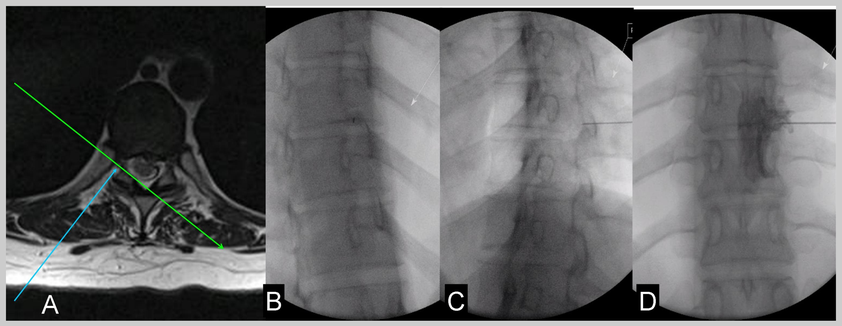

Figure 6. Thoracic TFESI right T8 nerve level. (B) Initial approach with beam parallel to needle. (A) Axial MRI illustrates beam path (green line) orthogonal to needle (blue line), as seen under fluoro in (C), where the tip is just deep to the spinolaminar line. This is a novel technique. This can also be done as a retrodiscal TFESI.

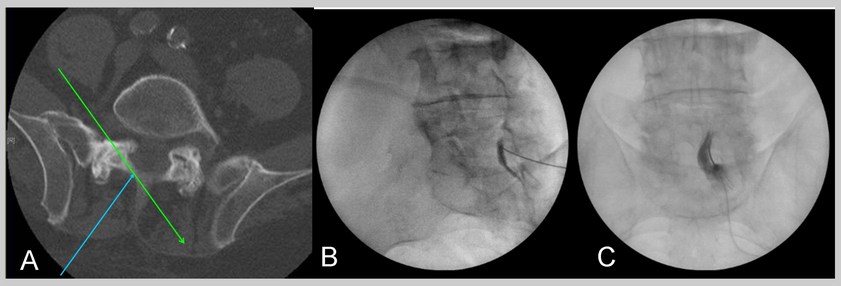

Figure 7. Lumbar interlaminar ESI right L5-S1 paramedian. (A) Axial CT illustrates beam path (green line) near-orthogonal to needle (blue line). Contrast outlines the spinolaminar line in (B).

METHODS: This technical report uses selected cross-sectional spine images (MRI and CT) and intra-procedure fluoroscopic images of spine injections to describe the method of orthogonal oblique fluoroscopy for spine injections. Anatomy and rationale for use of this novel approach are described.

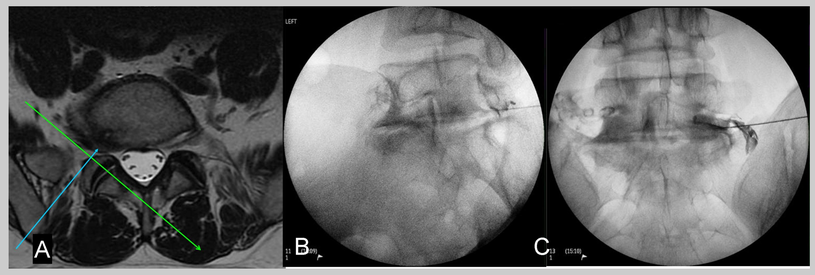

Figure 8. Retrodiscal TFESI right L5/S1 disc level. (A) Axial MRI illustrates beam path (green line) orthogonal to needle (blue line). Contrast outlines the gap between the disc and the spinolaminar line in (B). This is a novel technique. The approach can be used to target Kambin’s triangle, as here, or the safe triangle of Bogduk.

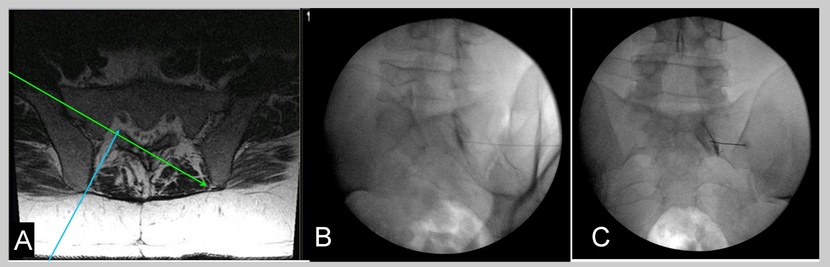

Figure 9. Sacral TFESI right S1 nerve level. (A) Axial MRI illustrates beam path (green line) orthogonal to needle (blue line). Contrast outlines the spinolaminar line in (B). This is a novel technique.

RESULTS/ CONCLUSION: This technical report describes and illustrates in detail the use of orthogonal oblique fluoroscopy views in the performance of spine injections. Innovative methods are described for identifying the spinolaminar line and for identifying the target foramen in transforaminal injections. This approach is applicable for all levels of spine injections, including cervical, thoracic and lumbosacral. Orthogonal oblique fluoroscopy may increase accuracy and safety of spine injections by facilitating more precise medication placement, increased patient comfort, shortened procedure times, and reduced radiation exposure.

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