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Room Hall C2-4

## The Ascending and Deep Cervical Arteries Are Vulnerable to Injury during Cervical Transforaminal Epidural Injections: An Anatomic Study

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**Background:** Corticosteroids are commonly injected in the cervical epidural space as a treatment for radiculitis. Traditionally, epidural corticosteroid has been injected via an interlaminar approach, but the transforaminal approach has become prevalent. Recent case reports (1,2) of anterior spinal cord infarct and death have elicited safety concerns for the transforaminal approach.

**Methods:** In this prospective anatomic study of 10 embalmed cadavers, the relationships of the spinal roots, blood supply from the vertebral, ascending cervical and deep cervical arteries supplying radicular or segmental medullary anastomoses were examined. Specific areas of vulnerability to needle trauma in the posterior (dorsal) foramen were examined. Arterial origin, outer diameter, location and foraminal distribution were documented.

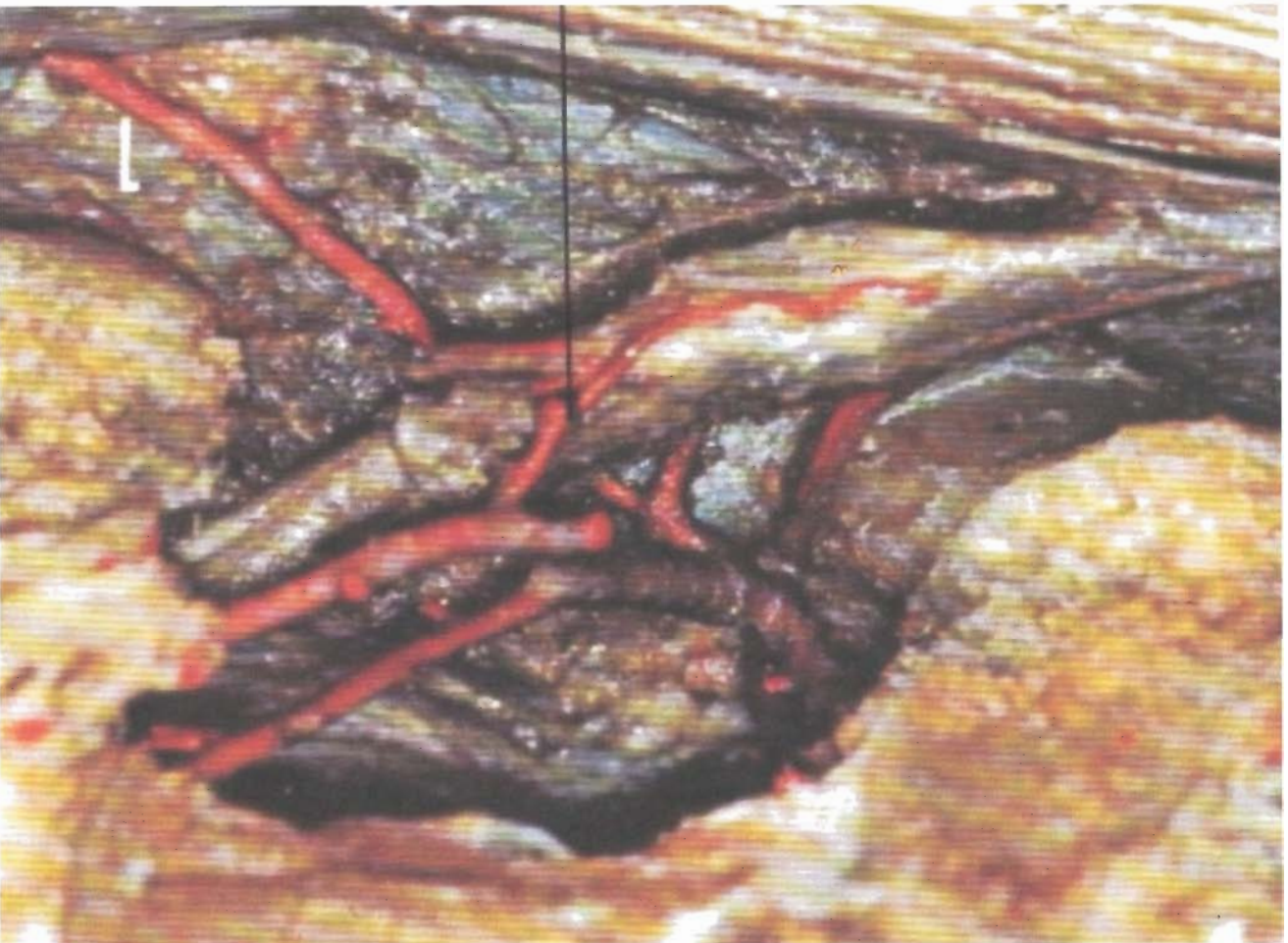
**Results:** In 5 dissected cadavers of 10 planned, 3 of the 5 have arteries that are vulnerable to needle injury during a standard dorsal middle transforaminal injection. In a female cadaver a large branch of the deep cervical artery arising directly from the subclavian arch on the right passes ventral to the C7 nerve root before diving under the C6 root in the dorsal aspect of the intervertebral foramen. This vessel is vulnerable to needle injury from transforaminal placement. The vessel measures 1.6 mm, compared to the 3.0 mm vertebral artery. The deep cervical supplies segmental medullary blood to the anterior spinal artery. In a second (male) cadaver, an ascending cervical branch from the right thyrocervical trunk passes ventral to the C7 root then passes through the dorsal aspect of the C6 foramen, continues ascending to the dorsal aspect of the C5 foramen then trifurcates into a segmental medullary vessel as well as ascending branches. The artery is 1.0 mm compared to the 3.5 mm vertebral artery, and appears to be very vulnerable at C5 and C6. In a third male cadaver, a radicular branch of the deep cervical artery is vulnerable at the dorsal aspect of the C7 root.

**Discussion:** A recent case described a near -miss during a C7 transforaminal injection in which a segmental medullary pattern of contrast spread caused the authors to abort the procedure. These authors are aware of 6 more cases of spinal cord injury that are sub judice and not yet reported. (3) Previously, Brouwers et.al. had described a fatal transforaminal injection at C6. (1) More recently, Ludwig et. al. reported an anterior cord ischemic event associated with a C6 root injection (2). A prospective study of 504 transforaminal cervical injections documents a 19.4% incidence of contrast confirmed intravascular injection. (4) It is known that the inferior cervical segmental medullary blood supply may come from branches of the ascending and deep cervical arteries, and that some variability exists. (5) Our study demonstrates that the C5, C6 and C7 areas may be most vulnerable to needle injury, with ascending and deep cervical arteries in the presumed safe area of injection, dorsal to the nerve root and vertebral artery. As blood supply is variable, transforaminal injections in these cervical foramina may be inevitably high risk.

### References:

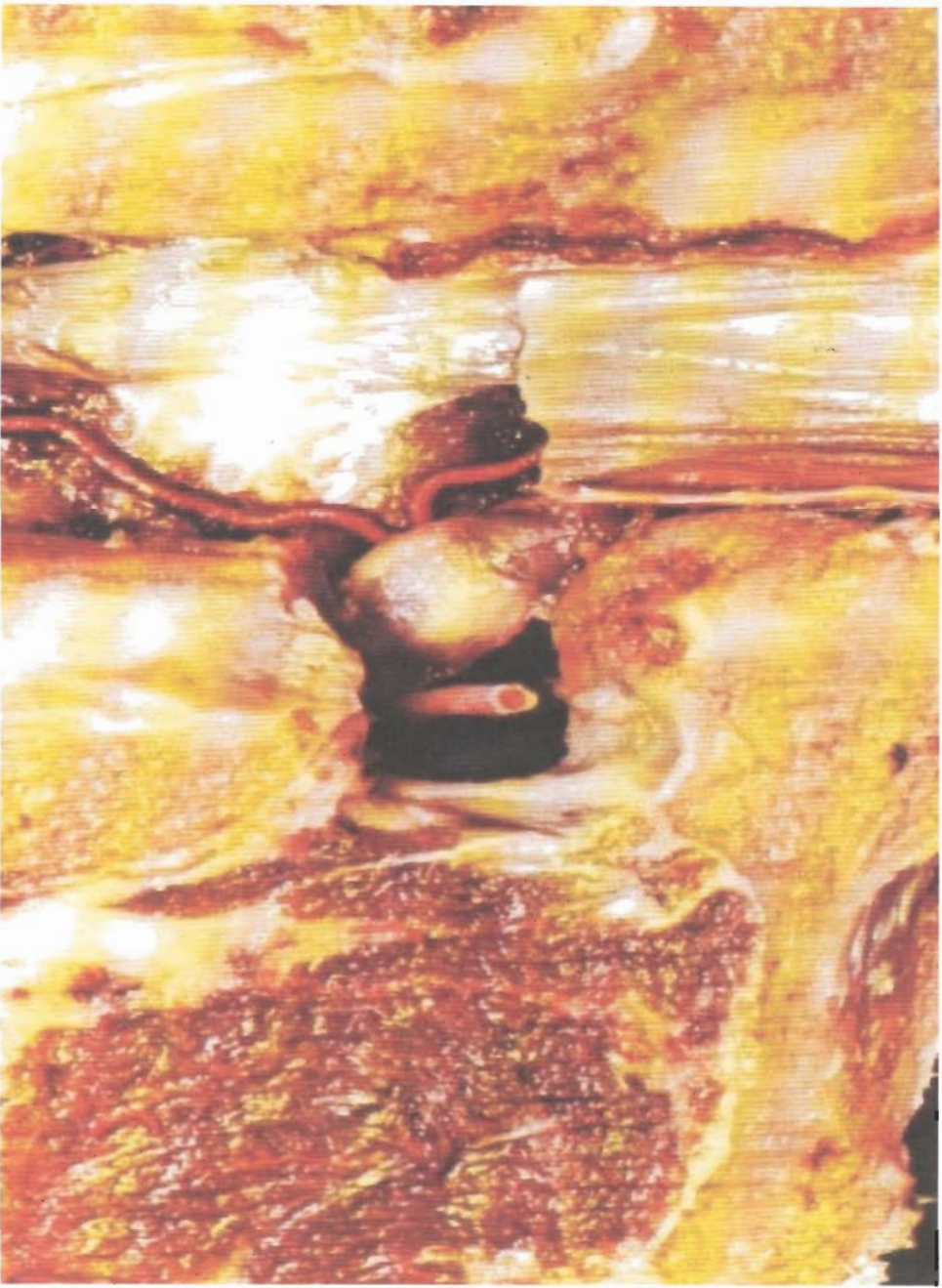
1. Brouwers, et.al. Pain 2001; 91:397
2. Ludwig, et.al. Arch Phys Med Rehab 2003; 84:E37
3. Baker, et.al. Pain 2003;103:211
4. Furman et.al. Spine 2003;28:21
5. Gillilan. J Comp Neurol 1958;110:75

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A detailed photograph to show the anterior spinal canal branches lying anterior to the emerging lumbar nerve root at the intervertebral foramen, together with the ascending anterior and posterior nerve root branches (neural branches) of the lumbar artery, from a female aged 18 years.

**Krock & Yoshizawa 1977 Pg. 17 Fig. 1.14**



A detailed photograph to show the usual relationships between the main stem of the posterior branch of the lumbar artery to the nerve root at the intervertebral foramen and the nerve root relation to the anterior spinal canal branches. The dura mater has been removed from the lower half of the specimen.

**Krock & Yoshizawa 1977 Pg. 16 Fig. 1.13**



A detailed photograph of the distribution of latex-filled arteries at the level of L2 on the left side from the spine of a female aged 18 years. The bifurcation of the anterior spinal canal branches of the lumbar artery can be seen on the right of the specimen. A little further posteriorly, arising from the upper border of the main stem of the lumbar artery as it courses backward, the anterior and posterior radicular arteries can be seen.

They run upward along the nerve root before penetrating the dural sleeve, just medial to the vertebral pedicle.

**Krock & Yoshizawa 1977 Pg. 37 Fig. 2.11**