

Case Report

 **Severe Scapular Pain Following Unintentional Cervical Epidural Air Injection**

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This is a unique case of severe scapular pain following unintentional epidural space air injection during epidural steroid injection.

A 70-year-old woman presented for a fluoroscopically guided C7-T1 interlaminar epidural steroid injection. Three injection attempts were made using the loss of resistance with air technique. On the first attempt the epidural space was entered, but contrast injection showed that the needle was intravenous. On the second attempt an equivocal loss of resistance with air was perceived and 5 mL of air was lost from the syringe. The needle was withdrawn and redirected, and upon the third needle passage the contrast injection showed appropriate epidural space filling up to the C4-5 level. Injection of betamethasone mixed in lidocaine was initially uneventful.

However, 20 minutes post-injection the patient experienced sudden sharp and continuous pain along the medial edge of the scapula. After failing to respond to multiple intravenous analgesics, the patient was transferred to the emergency room. Her pain subsided completely following an intravenous diazepam injection. Cervical spine computerized tomography showed obvious air in the posterior epidural space from C4-5 to C6-7 as well as outside the spinal canal from (C4-T2). Having recovered fully, she was discharged the following morning.

In reviewing the procedure, the equivocal loss of resistance on the second passage was actually a true loss of resistance to epidural space and air was unintentionally injected. Surprisingly, severe scapular pain resulted in a delayed manner after the steroid solution was injected. The authors theorize that unintentional prefilling of the epidural space with air prior to the injection of the subsequent steroid mixture added sufficient pressure to the epidural space to cause right-sided C4 nerve root stretching/entrapment and ensuing radicular pain to the right scapular border. The subsequent intravenous diazepam provided cervical muscle relaxation and facilitated foramina passage of air out of the spinal canal.

This case demonstrates that under certain conditions entry of air into cervical epidural space can lead to unexpected, albeit temporary, neurological symptoms.

**Key Words:** Pneumorrhachis, cervical, epidural, steroid, complication, pain, radicular, air

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Interlaminar cervical epidural steroid injection (ESI) is frequently employed to treat neck and radicular pain. Both prospective and retrospective studies report infrequent post-procedural symptoms. Reported pain is relatively minor, short in duration, and/or produces localized stiffness or procedure site tenderness. Rarely is hospitalization required unless there have been distinct neurological changes (1-3). However, we present a case where severe temporary radicular pain to the scapula

occurred from unrecognized cervical epidural space air injection.

**CASE REPORT**

Written consent was obtained for all medical information used in this report. A 70-year-old woman with extensive cervical spondylosis and prior C4-C7 anterior cervical discectomy and fusion complained of persistent neck pain, predominantly radiating to the

posterior deltoid region. A full neurologic exam was normal. The patient also had extensive lumbar degenerative disc disease with associated multiple lumbar laminectomies. She had a lower thoracic spinal cord stimulation system, precluding use of magnetic resonance imaging (MRI).

Four months earlier the patient had an uneventful fluoroscopically guided cervical interlaminar ESI at C-7 that provided 50% relief for nearly 3 months. She requested repeat ESI. The patient was positioned prone and a total of 1 mg of midazolam was administered for mild sedation. She remained verbally responsive to questions throughout the procedure. Anterior-posterior (AP) views were taken for real time lipamidol-200 contrast injections. Lateral views were used to assist needle direction/depth placement.

The skin/interspinous ligaments were anesthetized at C7-T1 level with 1% lidocaine. A 20 gauge epidural needle with attached Pulsator Portex (Smiths Medical ASD, Inc, USA) syringe was passed in the midline touching the T-1 lamina with distinct loss of resistance with air (LOR/air) slightly right of midline. Two mL of lopamidol-200 contrast was injected with real-time imaging. Rather than epidural space filling, a rapid disappearance of contrast occurred; a tinge of

blood visible in the needle hub suggested epidural venous placement. The epidural needle was withdrawn to skin, redirected in the midline, and advanced until an equivocal loss of resistance was perceived. Five mL was lost from the syringe. The operator (RWH) assumed that the air had entered the tissue space immediately lateral to the ligamentum nuchae on the right side. The needle was withdrawn 2 – 3 cm, redirected in the midline, and passed into the epidural space. Correct position was verified by injecting 2 mL of contrast, which spread bilaterally up to the C4-5 level. The operator viewed a normal filling pattern at the C-7 level. Six mL of a mixture containing 9 mg of generic betamethasone (American Regent, Inc., Shirley, New York) in 0.5% lidocaine was slowly injected, without paresthesia. However, 20 minutes after the procedure, while in the post anesthetic care unit, the patient became distressed by right scapular pain and exhibited diaphoresis. Her neurologic exam was unchanged, her vital signs remained in the normal ranges, and her neck was supple. She preferred to sit and lean forward and leftward. Multiple intravenous injections of opioids and ketorolac provided no relief. There was no pain on palpation apart from focal tenderness on the right scapular border. A single bupivacaine injection (4 mL/0.25%) into the right rhomboid muscle trigger point also proved unhelpful. The pain presentation was so unusual that the patient was transferred to the emergency department (ED) for further evaluation and pain control. Upon ED arrival, rapid relief of pain was achieved through a 5 mg intravenous injection of diazepam. Computerized tomography (CT) of the cervical spine showed multiple air bubbles filling the posterolateral middle and lower cervical epidural space (Figs. 2 & 3). When analyzed in retrospect, we determined that the final fluoroscopy film did show air bubbles at the C4-5 level (Fig. 1). The spinal CT also showed additional air immediately outside of the spinal canal and adjacent to the right-sided spinous processes from C4-T2 (Fig. 3). The pain never returned after the diazepam injection; laboratory evidence was negative for cardiac ischemia, however, she was admitted overnight for observation as a precaution. The patient's post-discharge exam at one month indicated improvement in chronic neck and arm pain.

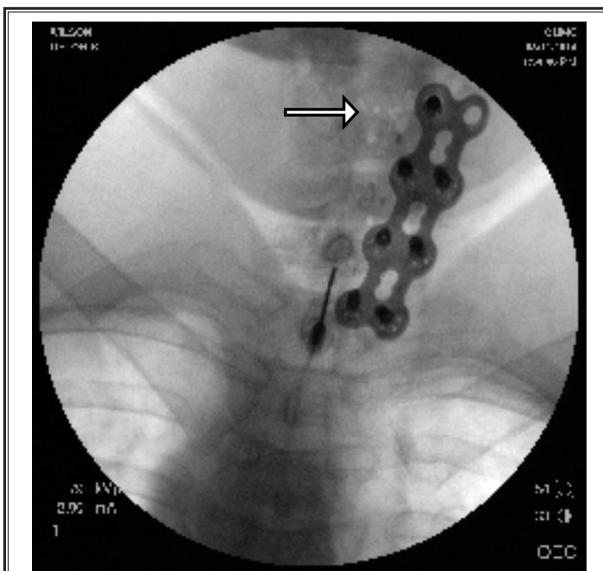


Fig. 1. Fluoroscopy, anterior-posterior view after contrast injection. Epidural needle is at C-7 level. The black arrow points to multiple irregular air bubbles in the epidural space at C4-5 level.

## DISCUSSION

This may be the only report of unintentional air injection produced during cervical ESI. In retrospect, air must have entered the epidural space on the second

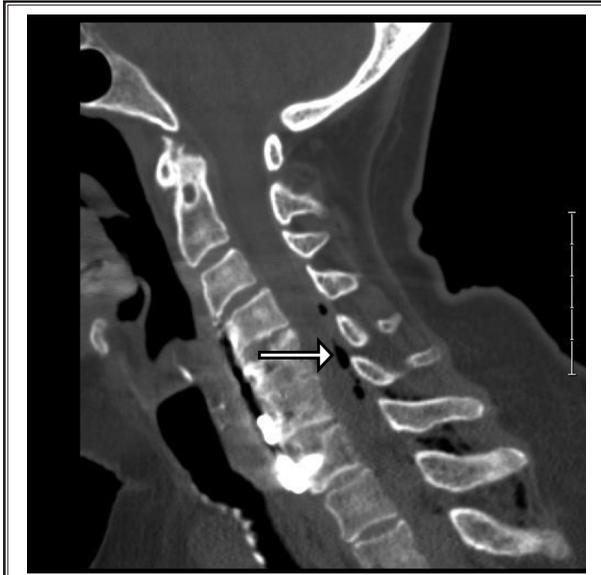


Fig. 2. CT of the cervical spine, sagittal view. Arrow points toward epidural space air bubbles from C4-5 to C6-7. Multiple air bubbles outside of the spinal canal immediately adjacent to the right side of spine extend from C6-7 and T-2.

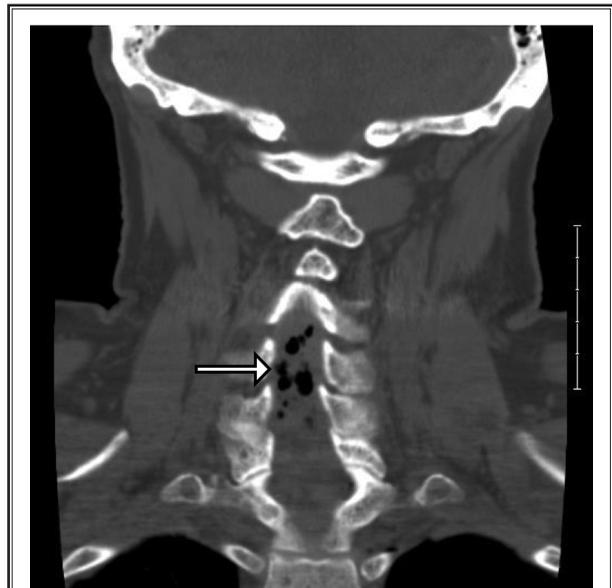


Fig. 3. CT of the cervical spine, coronal view spinal canal. The arrow points to multiple air bubbles spanning the middle-lower of cervical epidural space.

passage at the point of equivocal loss of resistance and at least 5 mL of air entered the cervical epidural space. Had either an AP or lateral contrast study been done at that time of the second needle attempt, the air may have been detected in the epidural space. We hypothesize that adding the volume of the steroid solution with the previously injected air, produced excessive pressure leading to right C4 root irritation and scapular pain. The diazepam injection facilitated release of pressure and relief of pain for the patient, presumably via muscle relaxation and air passing out the spinal canal.

Pneumorrhachis (spinal air) is broadly classified as either intradural or epidural in location. Subdural air is usually the result of cranial injury and frequently associated with serious neurological injury. Epidural pneumorrhachis, on the other hand, is generally considered asymptomatic and most frequently arises from pulmonary alveolar injury/air leakage and is associated with a pneumomediastinum. Air passes from a pressure gradient along contiguous fascia planes through multiple spinal canal foramina to enter the epidural space. This epidural air resolves by vascular absorption in concert with the healing of the thoracic air-leak injury (4). Surprisingly, there are cases reported of spontaneous cervicothoracolumbar pneumorrhachis with full epidural fill-

ing along with substantial subcutaneous emphysema and only minor spine pain (5). Thus, it seems having epidural air presence alone will not necessarily produce severe radiating nerve root(s) symptoms.

There are reports, however, that radicular pain can arise from relative rapid air entry as in the case of Park et al (6) in which a patient had a spontaneous pneumothorax treated with chest tube placement, complicated by developed bilateral radiating upper extremity pain and numbness. A cervical spine CT showed prominent lower cervical/upper thoracic air entrapment. These symptoms promptly resolved with a replacement chest tube and improved decompression of the pneumothorax.

Most recently, Krishna and Gupta (7) reported a case of cervical radiculopathy following an epidural blood patch for post lumbar puncture headache (PLPH) 3 days after an epidural block for vaginal delivery. The patient reported several attempts at establishing epidural anesthesia. She was treated with an epidural blood patch. The anesthesiologist used LOR/air with 10 mL to find the L2-3 epidural space and 20 mL of blood was injected. The PLPH resolved, but the patient developed posterior neck and right shoulder pain. A spinal CT showed prominent filling with air in epidural space from C1-T2. This patient was treated with IV analgesics

resulting in prompt resolution of the shoulder pain and at discharge and at the 5-month follow-up exam the patient showed no signs of neurological dysfunction. In our case, as in Krishna's and Gupta's, sufficient air entered the cervical epidural space and with the additional pressure from fluid or blood volume injected, the nerves were irritated to produce radicular pain.

Many cases have been reported of symptomatic pneumorrhachis associated with LOR/air technique in the thoracic/lumbar spine (8). However, this case is unique because it involves unintentional air injection during a cervical ESI procedure.

### CONCLUSION

Air injection into the cervical epidural space can

produce unexpected severe pain and neurological symptoms depending on volume and compliance of the epidural space. The patient did have multiple level disc disease, prior cervical spine fusion, and therefore reduced epidural space compliance. The combined injected volumes of air (5 mL) and epidural steroid solution (6 mL) may have been excessive and led to nerve pain.

Our recommendation is to use correctly aligned AP and lateral views to guide epidural needle placements and confirm epidural space entry by viewing real time contrast in it. Avoid injection of excessive volumes of air while using LOR technique. Review and practice of newly published safeguards for epidural steroid injections is recommended (9).

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