

SYMPTOMATIC PNEUMORRHACHIS AFTER CERVICAL EPIDURAL STEROID INJECTION RESULTING IN A TRANSIENT RIGHT-SIDED BRACHIAL PLEXOPATHY: A CASE REPORT

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Background: Cervical epidural steroid injection (CESI) is a commonly performed procedure for both the diagnostic and therapeutic management of various types of cervical spine pathology. Serious complications from this procedure are rare, but include dural puncture, epidural hematoma, and air embolism. Pneumorrhachis, the presence of air in the spinal canal, is hypothesized to be a common radiological finding following epidural anesthesia that is rarely symptomatic.

Case Report: We report the case of a 56-year-old woman who experienced right upper-extremity numbness and paralysis following interlaminar CESI, with subsequent imaging showing an air lesion in the epidural space from C6-T3. The patient's symptoms resolved spontaneously after 12 hours of observation.

Conclusions: This case demonstrates a previously unreported complication of CESI that is important for practitioners of ESI (epidural steroid injection) to be aware of.

Key words: Case report, epidural steroid injection, injections, interlaminar, pneumorrhachis

BACKGROUND

Cervical epidural steroid injections (CESI) are a widely used conservative treatment for patients suffering from cervical pain and radiculopathy related to a wide range of cervical pathologies (1). CESI is performed by the injection of corticosteroids (oftentimes combined with local anesthetic and saline) into the cervical epidural space to inhibit the inflammatory pathways and afferent nociceptive signaling responsible for pain and radiculopathy (2). Two types of CESI are commonly performed: interlaminar CESI (ICESI), where the needle is inserted between the laminae of 2 adjacent vertebrae, and transforaminal CESI (TFCESI), in which the needle is

inserted through the neural foraminal space (3). ICESI is more commonly performed due to its lower rate of complications related to the lack of nearby neural and vascular structures in this approach (4). ICESI has been found to be effective in achieving short- to moderate-term relief of cervical pain and radiculopathy, but various complications have been reported (1). Severe complications of ICESI are rare, but include dural puncture, epidural hematoma, and air embolism (5). One of the least frequently reported complications of CESI is epidural pneumorrhachis, a condition in which there is a buildup of air in the epidural space that can potentially cause neurological symptoms (6). We present the case

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of a patient who experienced temporary right upper-extremity (RUE) paralysis and numbness following ICESI. Subsequent emergent images showed the presence of air in the epidural space.

CASE

The patient is a 56-year-old woman with a history of extensive cervical and lumbar pathologies that had been treated by our practice 15 years prior to injection. She initially presented with severe right neck pain with RUE radiculopathy and was diagnosed with C5-7 spondylosis. She underwent a C5-7 anterior cervical decompression and fusion (ACDF) one year later. This procedure provided significant pain relief, but she experienced residual severe neck pain and RUE radiculopathy.

The patient's residual complaints were successfully treated conservatively following surgery until 6 months before the injection date, when a fall at work resulted in neck pain and RUE radiculopathy so severe that she presented to her local emergency department. A C7 epidural steroid injection (ESI) was attempted by another orthopedic specialist but was aborted after the patient had a syncopal episode, likely vasovagal, and the patient returned to our clinic.

The patient presented to our clinic 3 months prior to injection complaining of cervical pain with RUE radiculopathy. Her physical exam at that time was significant for diminished global cervical range of motion and pain over the right trapezius in the C4-5 dermatome. She had full motor strength, and her reflexes were intact. A computed tomography (CT) scan showed a solid C5-7 fusion with a large bone spur covering the anterior plate as well as an enlarged C4-5 facet joint. A cervical spine CT scan showed no significant canal stenosis. The patient's symptoms were attributed to adjacent segment disease versus a symptomatic nonunion and she was scheduled for a C7-T1 interlaminar epidural steroid injection.

The injection was performed at the C7-T1 interspace with a midline injection site, under intravenous conscious sedation using 200 mL of propofol, 50 mL of lidocaine, and 2 mL of midazolam. The patient was placed in the prone position; anteroposterior (AP), oblique, and lateral C-arm fluoroscopy were used during the procedure. Once the patient was prepped and draped, the skin was anesthetized using a 25-gauge needle which was entered under fluoroscopic guidance. A 20-gauge 3.5-inch Tuohy needle was guided using intermittent C-arm imagery into the C7-T1 interspace. Loss-of-resistance technique was used with 1 mL of air.

Iohexol 200 mg/mL was injected to confirm the correct epidural placement of the needle. A 2-mL mixture of 10 mg of dexamethasone and saline was then injected into the epidural space. The needle was removed, and the patient was taken to the recovery room.

Shortly after entering the recovery room, the patient began to complain of RUE monoplegia and numbness in all RUE dermatomes. She didn't note any numbness in this location during the procedure. Due to high suspicion for an epidural hematoma, a rare but known complication of ICESI, immediate images were ordered and a decompressive laminectomy was considered. A cervical CT scan post myelogram was obtained 2 hours post injection, as magnetic resonance imaging was contraindicated due to the patient's pacemaker. While there was no evidence of acute hematoma, the CT showed air in the epidural space C6-T3 (Fig. 1).

In addition to diffuse air from C6-T3, the cervical spine CT scan post myelogram demonstrated a small trail of air traveling to the right side of the patient's body originating near the right T1 neural foramen (Fig. 2).

During the myelogram, the patient had a syncopal vasovagal syndrome episode consistent with past injections and regained consciousness in 10 to 20 seconds. At roughly 10 hours post CESI, the patient's motor function hadn't improved on physical examination, but sensation began to return. The patient was near full recovery in motor ability and sensation after 12 hours and was back to baseline functioning 24 hours post injection.

At follow-up 2 weeks after the injection the patient didn't report any residual numbness or paralysis related to the injection. The patient's right neck pain and RUE radiculopathy were unchanged when compared to severity preinjection. Informed consent was obtained by the patient prior to publication of this case report.

DISCUSSION

We report the case of a woman who experienced RUE paralysis and numbness following an ICESI at the C7-T1 level. The cervical spine CT scan post myelogram showed diffuse air in the spinal canal from the C6-T3 levels predominantly collected on the right and ventral aspects of the epidural space, in addition to a small passage of air moving from the T1 foramen. We suspect that the air was incidentally introduced into the epidural space through the 20-gauge 3.5-inch Tuohy needle prior to injection of contrast medium and steroids. Motor and

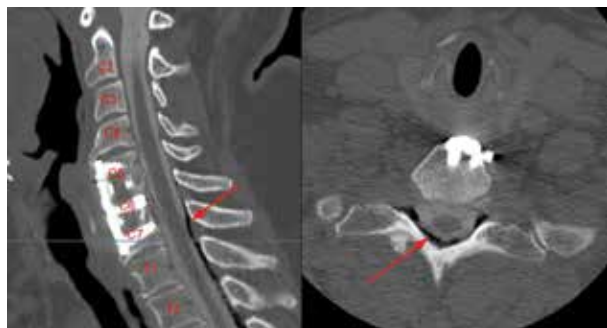


Fig. 1. CT cervical scan post myelogram sagittal view (left) and axial view (right) showing air in the epidural space. No effacement of the cerebrospinal fluid is noted. The blue line (left) represents the location of the axial slice viewed.

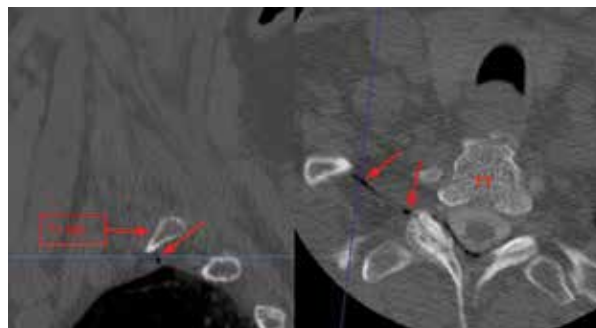


Fig. 2. CT cervical scan post myelogram sagittal view (left) and axial view (right) showing a trail of air from the right T1 neuroforamen. The purple line represents the location of the sagittal slice.

sensory innervation of the upper extremities is provided by the brachial plexus, a bundle of nerves originating in nerve roots from C5-T1 (7). The correlation between the location of the air lesion and the nerve roots providing innervation to the affected dermatome, as well as imaging that failed to demonstrate an emergent cause, suggests that the air was responsible for inhibiting nerve function. The differential diagnosis for this patient initially included epidural hematoma related to the injection. This was unlikely, however, due to the unilateral and focal nature of the patient's symptoms. A cervical spine CT scan post myelogram later confirmed the absence of a hematoma and demonstrated the presence of air in the epidural space.

We believe that this epidural air was responsible for the patient's transient paralysis and numbness before diffusing, corresponding with a resolution of symptoms. The presence of air in the epidural or subarachnoid space is a rare condition known as epidural pneumorrhachis and can be traumatic, spontaneous, or iatrogenic (6). Thus, we present a case of a symptomatic pneumorrhachis resulting in a transient right-sided brachial plexopathy. There are many reports of iatrogenic pneumorrhachis following epidural anesthesia in the literature (8). While these cases are oftentimes due to excessive amounts of air being injected during the "loss-of-resistance" technique, the spontaneous entry of air into the epidural space has also been reported (9-10). This entry of air has been attributed to negative epidural pressure following penetration of the ligamentum flavum (11). Notably, a 20-gauge spinal needle was used in this case. While this falls within a normal range used for ICESI (12), we typically perform the procedure with a 22-gauge needle and believe it is possible the

larger needle allowed for greater air infiltration prior to injection of contrast medium.

Pneumorrhachis is typically asymptomatic, but the rare reported neurological symptoms associated with pneumorrhachis include pain and neurological deficits related to acute nerve root or spinal cord compression (10,13). While case reports exist that demonstrate the ability of nerve root compression by herniated intradiscal gas, Figures 1 and 2 clearly demonstrate that the air lesions do not cause any cerebrospinal fluid effacement or significant canal/foraminal compression. One similar case of spontaneously alleviating unilateral numbness related to pneumorrhachis following lumbar ESI has been reported (14), but a mechanism was not determined in this case.

While a vascular explanation seems theoretically plausible, the interlaminar approach used avoids spinal arterial vasculature (15). One additional possibility is that the air was injected into the epidural venous plexus, which resulted in a venous backflow and prevented the nerve roots from being perfused until the oxygen was reabsorbed. This could help explain the trail of air seen emerging to the right side of the patient's body from the T1 foramen in Fig. 2. To our knowledge, there are no other reports of this in the literature.

Our case demonstrates a form of potential management and prognosis for patients who develop transient brachial plexopathy following ICESI. It is important for those who practice ICESI to be aware of the potential for incidental symptomatic epidural air injection during all epidural injections. In addition to the possibility of nervous complications, it has also been reported that air bubbles can result in incomplete analgesia following epidural anesthesia (16,17). It is possible that the widely

distributed air lesion could have been a contributing factor to the inefficacy of the ICESI in this patient.

CONCLUSION

We report the case of a patient who experienced RUE numbness and paralysis following ICESI with radiological findings of air in the epidural space of spinal levels C6-T3. To our knowledge, this is the first case of transient

brachial plexopathy following CESI related to pneumorrhachis. Although iatrogenic pneumorrhachis is thought to be relatively common in epidural anesthesia, the condition is underreported as it is often asymptomatic. This is an important complication for practitioners of CESI to be aware of due to the possibility of neurological symptoms and hypothesized impact on the efficacy of the injection.

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