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Accidental Subdural Injection of a Lidocaine With Epinephrine Test Dose Leading to Respiratory Arrest in a Parturient Patient: Case Report

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Background: A subdural injection is a rare complication of neuraxial anesthesia where medication is accidentally injected into the potential space between the dura mater and arachnoid mater of the spinal cord. Subdural blocks are typically underdiagnosed due to their variable presentation; failed early detection can lead to significant long-term consequences.

Case Report: This is a unique case of a 33-year-old parturient who presented for epidural placement during which a 3 mL subdural injection of preservative-free 1.5% lidocaine with 1:200,000 epinephrine test dose led to rapid clinical deterioration resulting in respiratory arrest.

Conclusions: The objective of this case is to highlight atypical clinical features of an accidental subdural injection, detail the successful anesthetic management of a subdural injection, and emphasize the need for a high index of suspicion for subdural placement in patients receiving neuraxial anesthesia who develop an unexpected sensory or motor response following medication administration.

Key words: Subdural injection, respiratory arrest, test dose, obstetric anesthesia, epidural anesthesia

BACKGROUND

A subdural injection is a rare, unintended complication of neuraxial procedures where local anesthetics or other medications are accidentally injected into the potential space between the dura mater and arachnoid mater of the spinal cord (1). While its reported incidence ranges from 0.02% to 0.82%, many clinicians suspect the occurrence is underdiagnosed because subdural blocks can mimic failed epidural anesthesia, unexpectedly high or total spinal anesthesia, or intravascular injection (1,2). The subdural space contains a small amount of serous fluid and spans cranially toward the vault and laterally over the dural cuffs, allowing even small volumes of local anesthetic to cause disproportionate cephalad spread (2,3).

Clinically, a subdural block can present with a delayed onset as compared to standard epidural or spinal blocks (2). Patients often display extensive sensory blockade that can extend to cervical levels and potentially result in respiratory compromise, with only mild or patchy motor involvement (1,3). Hypotension can occur if the local anesthetic ascends enough to involve substantial sympathetic fibers; there have been documented cases of loss of consciousness or cranial nerve involvement when spread extends intracranially (3,4). Recognizing such inconsistent or abnormally extensive sensory block, and stopping any additional boluses, is crucial to prevent severe cardiorespiratory complications (1). In obstetric anesthesia, early subtle manifestations (numbness in upper extremities or abnormal facial sensation) are

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sometimes mistaken for patchy epidural; additional bolus dosing may then precipitate more significant cardiorespiratory compromise (5). Among the cases of subdural block reported in the literature, it was found that despite there being a wide range of dermatomal segments involved in subdural blocks, there was no correlation between the total volume of local anesthetic injected and extent of sensory-motor blockade or cardiovascular depression. This contrasts with epidural blockades, which have a predictable relationship between local anesthetic dose and dermatomal spread (1). Although many cases resolve without permanent sequelae once supportive measures and careful observation are in place, vigilance is essential given the potential for high spinal or brainstem involvement (2,5).

Ultimately, the varied and sometimes subtle clinical presentations of a subdural block require a high index of suspicion whenever atypical block characteristics arise. By understanding its key features of delayed onset, disproportionate spread, and minimal motor involvement, clinicians can promptly recognize a subdural injection and minimize potential life-threatening complications (4,5). Informed consent was obtained prior to case write-up. This is a unique case of a 3 mL subdural injection of a preservative-free 1.5% lidocaine with 1:200,000 epinephrine test dose leading to a respiratory arrest in a parturient patient.

CASE REPORT

A 33-year-old Arabic-speaking primigravida presented for epidural placement during an elective term induction of labor. Her medical history was significant for diet-controlled gestational diabetes, chronic hypertension on labetalol, and a body mass index of 35.51 (94.7 kg, 167 cm). She was classified as an American Society of Anesthesiologists Physical Status Class III. Airway assessment revealed Mallampati class II, thyromental distance >3 finger breadths, full range of neck motion, and normal dentition. Prior to epidural placement, obstetric examination demonstrated cervical dilation of 5 cm, 80% effacement and -1 station. She reported no prior surgical or anesthetic exposure and no family history of anesthetic complications. Blood work was unremarkable, with a hemoglobin of 12.3 g/dL and platelet count of 289,000.

Upon completion of informed consent with the assistance of a certified Arabic translator, the patient was placed in a sitting position for the epidural. She was draped and prepped utilizing sterile technique. 3 mL of 1% lidocaine was injected subcutaneously at the L3–L4 intervertebral space for local anesthesia. Due to significant discomfort from contractions, epidural placement was initiated 5 minutes after lidocaine administration, once the patient was able to cooperate with positioning. A single midline attempt was performed at the L3–L4 interspace using a loss of resistance to air technique. Engagement of ligamentum flavum was appreciated, followed by loss of resistance at a depth of 6 cm. The epidural space was dilated with 1 mL of preservative-free saline, catheter was threaded without difficulty and then secured at 12 cm at the skin. A 3 mL test dose of preservative-free lidocaine 1.5% with 1:200,000 epinephrine was administered through the catheter after confirming negative aspiration for cerebrospinal fluid and blood. The test dose was negative after 1 minute, with no significant changes in heart rate or paresthesias after medication injection. The patient was then placed supine with left uterine displacement after the catheter was fully secured on her back. 5 minutes after the test dose, she reported difficulty breathing via the translator, dizziness, and was moving her arms and legs in distress. The head of the bed was elevated, and the patient was instructed to take slow deep breaths via translator services. Her oxygen saturation remained at 100%, heart rate 100 beats per minute, and blood pressure 114/66 mm Hg with a mean arterial pressure of 82, consistent with pre-procedure values. Despite normal oxygen saturation, supplemental oxygen was provided due to worsening subjective dyspnea, rapid response initiated, and decision made to proceed with emergent cesarean delivery.

However, 7 minutes later, 14 minutes after test dose administration, the patient became apneic and lost all spontaneous movement in her extremities. Cardiopulmonary resuscitation (CPR) was initiated for respiratory and pulseless electrical activity cardiac arrest. She received one round of chest compressions and 1 mg epinephrine with ventilation provided via bag and mask initially; subsequently airway was secured with a 7.0 mm endotracheal tube using video laryngoscopy. An emergency bedside perimortem cesarean delivery was performed for both fetal and maternal benefit, resulting in delivery of a healthy neonate 2 minutes after CPR commencement. Maternal return of spontaneous circulation occurred 3 minutes after delivery. Post-arrest vitals included a blood pressure 157/47 mm Hg (mean arterial pressure, 84), heart rate 79 beats per minute, and oxygen saturation 100%. She was transported

emergently to the operating room for uterine closure completion. During closure, the patient was on spontaneous-assisted pressure support mechanical ventilation. General anesthesia was provided with sevoflurane and intravenous fentanyl. Her vitals remained stable during the procedure.

Upon completion of uterine closure, 2 hours after epidural placement, the patient was spontaneously breathing. She intermittently moved her upper extremities but was not following commands or demonstrating purposeful movement. The epidural catheter was removed, and she was transferred to the intensive care unit for observation. Postoperative head computed tomography scan demonstrated mild pneumocephalus in the right lateral ventricle and suprasellar region. Neurology consultation determined that the degree of pneumocephalus was too mild to provoke a cardiac arrest. The following day, the patient was awake, following commands, and purposefully moving both upper and lower extremities, allowing for safe extubation. The remainder of her hospital stay was uneventful, and she was discharged home 6 days later with no long-term neurologic deficits.

DISCUSSION

Clinically distinguishing an inadvertent subdural injection from a failed epidural or a massive subarachnoid block can be difficult due to its variable presentation. The unintentional injection of local anesthetic into the subdural space can result in a wide dermatomal spread, leading to an out-of-proportion sensory block with motor sparing (4). Though the subdural space is thin, it is continuous cranially and laterally, enabling small volumes to ascend unpredictably and produce extensive sensory blockade with minimal or no motor involvement (1,2). The delayed onset and negative test-dose findings commonly associated with subdural injections make them among the most frequently overlooked neuraxial complications (4).

Subdural injections can be radiographically confirmed when contrast media injected into the subdural space is seen as a dense, cephalad-spreading collection confined to the posterior spinal canal. These findings are typically seen on lateral lumbar spine x-rays, computed tomography or magnetic resonance imaging scans, as shown in previous studies (4,6,7). One illustrative case by Drummond and Lee (8) showed that a 3 mL contrast injection through a lumbar catheter resulted in radiographic spread from the lumbar to the cervical region via the subdural space, emphasizing the disproportionate dermatomal spread that can occur with small-volume injections. Despite the availability of imaging, its clinical use is limited. Studies indicate that radiologic confirmation does not improve outcomes and may introduce risk, so diagnosis is typically based on clinical criteria only (9).

A landmark retrospective study by Lubenow et al. (2) proposed a diagnostic framework based on 2 major criteria: negative catheter aspiration test and unexplained wide sensory block, and three minor criteria: delayed onset, variable motor block, and extensive sympatholysis. The presence of both major and at least one minor criterion is considered highly diagnostic of subdural injection. Building on this, Hoftman and Ferrante (1) developed a four-step diagnostic algorithm that considers whether the initial neuraxial block was presumed epidural or subarachnoid, the nature of the dermatomal distribution (excessive, restricted, or neither), and the presence of at least one minor criterion relevant to the presumed route.

Our patient met these established criteria for a subdural injection. She had a negative aspiration test, experienced an excessive unexplained sensory blockade after only 3 mL of local anesthetic with motor sparing, respiratory failure, and cardiopulmonary arrest, all while remaining hemodynamically stable prior to the event. Furthermore, our patient did not meet the criteria for other potential diagnoses such as epidural misplacement, intrathecal injection, or intravascular injection (10). Epidural spread generally requires ≥10 mL of anesthetic to reach thoracic dermatomes and follows a predictable dose–response pattern (2,5,6). Our patient received 3 mL, an insufficient amount to cause widespread effects if confined to the epidural space. Intrathecal injection typically presents within 1–3 minutes with a dense, bilateral motor block and positive cerebrospinal fluid aspiration (1,3,10). Our patient exhibited delayed symptom onset (14 minutes), had motor sparing, and a negative aspiration test—inconsistent with intrathecal spread. Intravascular injections trigger rapid epinephrine-induced tachycardia or symptoms of systemic toxicity (4,11), which were absent in our case. As Crosby and Halpern (11) noted, negative epinephrine test results are characteristic of subdural rather than intravascular catheter placement.

Multiple reports in the literature document subdural injections resulting in cardiopulmonary arrest, though most involve large or repeated doses (5,12,13). A case

published by Adachi et al (3) described a radiographically confirmed accidental subdural block following the administration of a 3 mL lidocaine epidural test dose. The patient was subsequently taken for a cesarean section under general anesthesia before onset of any catastrophic symptoms. This decision was prompted by the unusual presentation following the presumed epidural test dose: profound sensory blockade without motor involvement or associated hemodynamic changes (3). Fahel et al. (14) documented a parturient who developed respiratory distress and lost consciousness after receiving 2 mL of 2% lidocaine into the subdural space. Though one minor criterion is delayed onset, case reports confirm that symptoms can appear within 5 minutes (15), underscoring the variable presentation of subdural blocks.

Our case stands out due to the severity of complications: respiratory arrest and need for maternal CPR after administration of a 3 mL test dose. To our knowledge, such severe consequences have only been reported in cases where ≥6 mL of anesthetic medication is administered (5,7). This demonstrates the potential for rapid cranial spread of even small volumes via the subdural space to the brainstem leading to serious complications. Moreover, this case highlights the limitations of current test-dose protocols. Agarwal et al. (4) emphasized that epinephrine tests fail to detect subdural placements, requiring clinicians to rely on clinical signs. Similarly, Crosby and Halpern (11) reported a case where a lidocaine–epinephrine test dose failed to identify a subdural catheter, and a high block developed unexpectedly.

CONCLUSIONS

This case demonstrates a distinct case of rapid clinical deterioration leading to respiratory arrest resulting from subdural injection of a 3 mL test dose of preservative-free lidocaine 1.5% with 1:200,000 epinephrine in a parturient patient. This highlights the importance of early detection of an inadvertent subdural injection by the clinician and prompt supportive management to prevent long-term complications. The objective of this case report is to highlight this atypical clinical feature of an accidental subdural injection and detail its successful anesthetic management without long-term complications. We also aim to emphasize the need for a high index of suspicion for subdural placement in patients receiving neuraxial anesthesia who develop unexpected sensory or motor response following medication administration.

Author Contributions

AH: literature review, research, writing, and editing manuscript
RJ: literature review, research, writing, and editing manuscript
DG: writing and editing manuscript
SL: writing and editing manuscript

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