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## Unconsciousness and Apnea Complicating Parascalene Brachial Plexus Block: Possible Subarachnoid Block

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The occurrence of subarachnoid block following brachial plexus block performed above the clavicle is a rare complication.<sup>1</sup> Only two cases of total spinal anesthesia following interscalene block have been reported in the literature.<sup>2,3</sup> The following describes a patient who developed signs and symptoms suggestive of inadvertent subarachnoid block as a complication of parascalene brachial plexus block. The complication was attributed to intraneural injection of the local anesthetic, with a subsequent centripetal spread to the subarachnoid space.

### CASE REPORT

A 19-yr-old woman, weighing 52 kg, was scheduled for excision of a ganglion at the right wrist. The patient received no premedication. In the operating room, a right brachial plexus block was done using the parascalene approach.<sup>4,5</sup> The patient was placed in the dorsal recumbent position, with the head turned to the left side. A parascalene block was done using a 22-G needle attached by an extension tubing to a syringe filled with 15 ml 2% lidocaine. The site of puncture was the junction of the lower third and upper two-thirds of a line drawn from the midpoint of the clavicle to the C6 transverse process. The needle was inserted at 90° to the skin and was advanced in the anteroposterior plane until the patient felt paresthesia spreading to the

arm and hand. Aspiration did not show any blood or cerebrospinal fluid. Using the "immobile needle" technique of Winnie,<sup>6</sup> the needle was fixed in position and the local anesthetic injected. During the injection of the first 5 ml, marked resistance was encountered and agonizing pain was felt by the patient. Further injection was stopped, and the needle was withdrawn about 2 mm. When the resistance and pain decreased, an additional 10 ml lidocaine was injected.

Immediately following injection of lidocaine, the patient could not move the right arm but could move her left arm. Five minutes later, it was noted that the patient became unconscious, stopped breathing, and the arterial blood pressure decreased from 120/80 mmHg to 80/50 mmHg. The lungs were ventilated via a face mask using 100% oxygen. Also, 100 µg phenylephrine and 1 L lactated Ringer's solution was infused to increase the blood pressure. Laryngoscopy showed completely relaxed masseter muscles and immobile vocal cords. The trachea was readily intubated with no reflex bucking or coughing, and the lungs were ventilated with 100% oxygen. After 10 min, spontaneous breathing resumed. By the end of surgery, which lasted 45 min, the patient was awake, breathing adequately, and the trachea was extubated. Pinprick sensation was blunted bilaterally from C7 to T5. Complete recovery of pinprick sensations and motor activity was observed after about 1 h, with no neurologic sequelae.

### DISCUSSION

Hypoventilation following supraclavicular brachial plexus block may result from phrenic nerve block or the occurrence of pneumothorax. However, the appearance of the objective signs of pneumothorax is almost always delayed for 2-6 h. Also, unilateral phrenic nerve block is usually inconsequential in the healthy patient with little or no respiratory disease.<sup>1</sup>

Our patient rapidly lost consciousness and developed apnea. The complication may be secondary to inadvertent intravascular injection of the local anesthetic or to an overdose. An overdose usually results in initial central nervous system stimulation manifesting as facial twitches

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or even overt generalized clonic and tonic convulsions, to be followed by central nervous system depression. Occasionally, the rapid and sudden achievement of an extremely high anesthetic blood level may produce respiratory depression and cardiovascular collapse without the initial signs of excitation. However, the rapid development of unconsciousness, apnea, and hypotension following brachial plexus block, without initial central nervous system stimulation should be assumed to result from subarachnoid injection.<sup>1</sup>

In our patient, the apnea also was associated by complete relaxation of the masseters, vocal cords, and respiratory muscles, and a high sensory level could be demonstrated. The possibility of inadvertent segmental cervical epidural block must be considered, since the sensory block observed following recovery of consciousness was segmental between C7 and T5 rather than total from C7 downward. However, recovering subarachnoid block may manifest a segmental nature. Also, the onset of epidural block is usually more gradual than that of subarachnoid block, and the patient usually remains conscious unless circulatory collapse occurs.<sup>1</sup> Our patient rapidly developed loss of consciousness, apnea, and complete muscular relaxation, suggesting inadvertent subarachnoid block rather than epidural block.

There are three ways that local anesthetic agents can enter the subarachnoid space during or after the performance of a brachial plexus block performed above the clavicle.<sup>1</sup> First, the needle may be advanced through an intervertebral foramen and the anesthetic injected directly intrathecally. This may be possible only with the interscalene technique. If the misplaced needle enters an intervertebral foramen but does not penetrate dura, the injection of local anesthetic will most likely result in high epidural block rather than spinal block. Second, a dural cuff occasionally accompanies a nerve some distance distal to the intervertebral foramen through which it passes.<sup>1</sup> In such cases, a direct intrathecal injection is possible, though rare, with any of the brachial plexus techniques carried out above the clavicle. The peridural tissues also may continue toward the periphery with the segmental nerves; solutions injected into perineural tissues during the performance of a brachial block may diffuse centrally into the epidural space, resulting in an epidural block.<sup>1</sup> Third, local anesthetics injected intraneurally can spread centripetally to the subarachnoid space.<sup>7</sup>

In our patient, the inadvertent subarachnoid block is probably due to an intraneural injection of the local anesthetic, as suggested by the marked resistance to injection, by the agonizing pain experienced by the patient, and by the immediate onset of complete block. It has been shown that the perineurium is a direct peripheral extension of the pia mater, while the epineurium is an extension of the dura.<sup>8</sup> Thus, there is a continuous potential space under the perineurium of the peripheral nerves that extends centrally and becomes the potential subpial space. Therefore, local anesthetics, whenever injected subperineurally into a peripheral nerve, can travel centripetally and rapidly reach the subarachnoid space.<sup>1</sup>

In conclusion, the rapid development of apnea, hypotension, and loss of consciousness following parascapular brachial plexus block may be due to subarachnoid block, despite the negative aspiration of cerebrospinal fluid. Subarachnoid block may result from intraneural injection of the local anesthetic with a subsequent centripetal spread. Intraneural injection should be suspected whenever injection of the local anesthetic is faced by marked resistance and is accompanied by a complaint of agonizing pain. The injection should be discontinued immediately, and the possibility of subarachnoid block must be anticipated.

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