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# Severe Ipsilateral Subcostal Pain Associated with Transient Hemidiaphragmatic Paresis after Interscalene Brachial Plexus Block: A Case Report

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**Abstract** **Case Report**

Hemidiaphragmatic paresis caused by phrenic nerve blockade is a well-recognized consequence of interscalene brachial plexus block and is usually recognized by dyspnea, chest tightness, or reduced respiratory tolerance. We report an unusual case in which severe ipsilateral subcostal pain was the predominant symptom. A 70-year-old woman with a right rotator cuff tear scheduled for arthroscopic rotator cuff repair underwent an ultrasound-guided right interscalene brachial plexus block using 27 mL of a 1:1 mixture of 0.75% ropivacaine and 2% lidocaine, resulting in final concentrations of 0.375% ropivacaine and 1% lidocaine. Immediately after the block, she developed severe localized pain beneath the right costal margin, rated 7–8 on a numerical rating scale, despite having no previous pain or discomfort in that area. She repeatedly denied dyspnea, chest tightness, or difficulty breathing, and spontaneous ventilation and oxygen saturation remained stable. The pain decreased to an NRS score of 5–6 before propofol target-controlled infusion was initiated, and surgery proceeded with spontaneous ventilation and continuous respiratory monitoring. After surgery, the pain had decreased to an NRS score of 3–4, although persistent discomfort remained in the same subcostal region. A portable supine chest radiograph showed elevation of the right hemidiaphragm without definite pneumothorax. The patient remained clinically stable, and the discomfort resolved completely approximately 11 hours after the block. Chest computed tomography performed the following day showed no pneumothorax or other structural thoracic abnormality. The clinical course was most consistent with transient phrenic nerve blockade-associated hemidiaphragmatic paresis. This case suggests that focal ipsilateral subcostal pain may rarely be a predominant manifestation of hemidiaphragmatic paresis, even without dyspnea or oxygen desaturation. Clinicians should consider phrenic nerve involvement while appropriately excluding pneumothorax and other thoracic complications.

**Keywords:** Interscalene brachial plexus block, Phrenic nerve blockade, Hemidiaphragmatic paresis, Subcostal pain, Pneumothorax.



## INTRODUCTION

Interscalene brachial plexus block is widely used to provide anesthesia and analgesia for shoulder surgery. Because of the close anatomical relationship between the brachial plexus and the phrenic nerve, ipsilateral phrenic nerve blockade and hemidiaphragmatic paresis are well-recognized complications of this technique (Urmey *et al.,* 1991). The incidence and severity of diaphragmatic impairment are influenced by the volume of local anesthetic, with conventional-volume interscalene blocks producing more frequent respiratory effects than low-volume techniques (Riazi *et al.,* 2008).

Hemidiaphragmatic paresis typically presents with respiratory symptoms such as dyspnea, chest tightness, or reduced respiratory tolerance. However, patients with adequate cardiopulmonary reserve may maintain spontaneous ventilation and normal oxygen saturation despite impaired ipsilateral diaphragmatic movement. Severe focal subcostal pain is not generally recognized as a typical manifestation of phrenic nerve blockade.

When sudden ipsilateral chest or subcostal pain develops after an interscalene block, pneumothorax and other thoracic complications must be considered. Although ultrasound guidance improves visualization of the needle and surrounding structures, pneumothorax after an ultrasound-guided interscalene block has been reported (Mandim *et al.,* 2012).

We report a case of transient hemidiaphragmatic paresis after an ultrasound-guided

interscalene brachial plexus block in which severe ipsilateral subcostal pain, followed by persistent localized discomfort, was the predominant symptom despite the absence of dyspnea, oxygen desaturation, or apparent respiratory deterioration. This case highlights that localized subcostal pain may rarely be an atypical manifestation of phrenic nerve blockade and underscores the need to exclude potentially serious thoracic complications before attributing the symptom to hemidiaphragmatic paresis.

## Case Report

A 70-year-old woman, 151.7 cm in height and 61.7 kg in weight, was scheduled to undergo arthroscopic rotator cuff repair of the right shoulder for a rotator cuff tear. Her medical history included hypertension, mild coronary artery disease, and hypothyroidism following bilateral total thyroidectomy for thyroid cancer in 2014. She had no known respiratory disease or smoking history and reported no preoperative dyspnea, chest discomfort, or pain in the right subcostal region. Her preoperative vital signs were a blood pressure of 120/77 mmHg, heart rate of 63 beats/min, respiratory rate of 18 breaths/min, and body temperature of 36.7°C. She was classified as American Society of Anesthesiologists physical status II.

After standard monitoring, including noninvasive blood pressure measurement, electrocardiography, and pulse oximetry, was established, an ultrasound-guided right interscalene brachial plexus block was performed using a 22-gauge, 2-inch needle before sedation. A total of 27 mL of a 1:1 mixture of 0.75% ropivacaine and 2% lidocaine was administered, resulting in final concentrations of 0.375% ropivacaine and 1% lidocaine. The needle tip and spread of the local anesthetic were visualized under ultrasound guidance, and no technical difficulty was noted during the procedure.

Immediately after completion of the block, the patient developed severe localized pain beneath the right costal margin. She repeatedly pointed to the same focal area and rated the pain as 7–8 on an 11-point numerical rating scale. At symptom onset, her blood pressure was 150/65 mmHg, heart rate was 52 beats/min, and peripheral oxygen saturation was 100%. Despite repeated questioning, she denied dyspnea, chest tightness, or difficulty breathing. Bilateral breath sounds were audible without an apparent difference, and spontaneous ventilation appeared adequate.

Before sedation, the pain decreased to an NRS score of 5–6. Because there was no evidence of respiratory deterioration and the patient continued to deny respiratory symptoms, propofol target-controlled infusion was initiated. The planned arthroscopic rotator cuff repair proceeded with spontaneous ventilation. Oxygen was administered through a face mask at 6 L/min, and peripheral oxygen saturation remained at 100% throughout the operation. No intraoperative respiratory event occurred.

After emergence from sedation, the patient reported that the right subcostal pain had decreased to an NRS score of 3–4 and was more tolerable than at onset. However, discomfort persisted in the same right subcostal region after transfer to the ward. Because the pain had developed abruptly immediately after the interscalene block, pneumothorax, pleural injury, and other thoracic complications were considered despite the absence of respiratory deterioration.

Approximately 3 hours after the block, a portable supine anteroposterior chest radiograph was obtained because the patient could not comfortably maintain an upright position after surgery. The radiograph showed elevation of the right hemidiaphragm without definite pneumothorax or significant atelectatic change. These findings raised suspicion of transient right hemidiaphragmatic paresis associated with phrenic nerve blockade. However, because a small pneumothorax could not be completely excluded on a supine anteroposterior radiograph, continued clinical observation was undertaken.

The patient was monitored for respiratory symptoms, changes in oxygen saturation, and clinical signs of pneumothorax. She remained hemodynamically and respiratorily stable. The residual right subcostal discomfort gradually diminished and resolved completely approximately 11 hours after the interscalene block.

Chest computed tomography performed the following afternoon showed no pneumothorax or other significant thoracic lesion. Considering the immediate onset of symptoms after the interscalene block, elevation of the ipsilateral hemidiaphragm on chest radiography, gradual and complete resolution of symptoms, and absence of another structural thoracic abnormality on computed tomography, transient phrenic nerve blockade-associated hemidiaphragmatic paresis was considered the most likely diagnosis.

Written informed consent for publication of this case and the accompanying clinical information was obtained from the patient. Institutional review board approval was obtained (approval number: PMC 2026-08-010).

## Discussion

Ipsilateral phrenic nerve blockade and hemidiaphragmatic paresis are well-recognized complications of interscalene brachial plexus block. In a classic ultrasonographic study, hemidiaphragmatic paresis occurred consistently after routine interscalene brachial plexus anesthesia (Urmey *et al.,* 1991). Subsequent research demonstrated that the incidence and

respiratory consequences of phrenic nerve involvement are influenced by the volume of local anesthetic (Riazi *et al.,* 2008). In the present case, a total of 27 mL of a 1:1 mixture of 0.75% ropivacaine and 2% lidocaine was administered, resulting in final concentrations of 0.375% ropivacaine and 1% lidocaine. The use of this conventional volume made transient involvement of the ipsilateral phrenic nerve clinically plausible.

The unusual feature of this case was the predominance of severe right subcostal pain rather than conventional respiratory symptoms. Immediately after the block, the patient rated the localized pain as 7–8 on the numerical rating scale but repeatedly denied dyspnea, chest tightness, or difficulty breathing. Spontaneous ventilation and oxygen saturation remained stable throughout the perioperative period. Nevertheless, postoperative chest radiography showed elevation of the right hemidiaphragm. The pain gradually decreased, persisted as localized discomfort after surgery, and resolved completely approximately 11 hours after the block. Chest computed tomography performed the following afternoon showed no pneumothorax or other structural thoracic abnormality. Collectively, the temporal relationship, ipsilateral hemidiaphragm elevation, spontaneous symptom resolution, and absence of another structural lesion were most consistent with transient phrenic nerve blockade-associated hemidiaphragmatic paresis.

The sudden onset of severe pain immediately after the block raised concern for pneumothorax or pleural injury. Pneumothorax was considered less likely because the procedure had been performed under ultrasound guidance at the interscalene level without an apparent technical complication. However, ultrasound guidance cannot completely eliminate this risk, and pneumothorax following an ultrasound-guided interscalene block has previously been reported (Mandim *et al.,* 2012). Therefore, the abrupt onset and persistence of focal subcostal pain could not safely be attributed to phrenic nerve blockade without considering and excluding potentially serious thoracic complications. In this patient, the persistent postoperative discomfort warranted chest radiography, continued clinical observation, and subsequent computed tomography.

The mechanism by which hemidiaphragmatic paresis may be associated with focal subcostal pain remains uncertain. Unilateral diaphragmatic paralysis can alter the normal pattern of respiratory muscle use and result in compensatory recruitment of the intercostal and accessory inspiratory muscles (Lisboa *et al.,* 1986). Acute impairment of right diaphragmatic excursion may therefore have prompted increased inspiratory effort and greater chest-wall muscle recruitment. Such altered respiratory mechanics may have been perceived predominantly as localized pain beneath the right costal margin rather than as dyspnea. This explanation remains speculative because diaphragmatic excursion and respiratory muscle activity were not assessed at symptom onset.

This case has several limitations. Hemidiaphragmatic paresis was suspected on the basis of right hemidiaphragm elevation on a portable supine chest radiograph but was not confirmed by diaphragmatic ultrasonography, fluoroscopic sniff testing, or pulmonary function testing. In addition, respiratory muscle activity was not objectively assessed. Right hemidiaphragm elevation on a single postoperative radiograph is not specific for diaphragmatic paresis, and a direct causal relationship between hemidiaphragmatic impairment and subcostal pain therefore cannot be conclusively established.

Nevertheless, the immediate onset of symptoms after the block, ipsilateral hemidiaphragm elevation, gradual resolution of the localized discomfort, and absence of another structural thoracic abnormality suggest that severe ipsilateral subcostal pain may rarely be an atypical predominant manifestation of transient phrenic nerve blockade. Clinicians should consider hemidiaphragmatic paresis when unexplained ipsilateral subcostal pain develops after an interscalene block, even when the patient denies dyspnea and maintains normal oxygen saturation. At the same time, pneumothorax and other potentially serious thoracic causes should be appropriately excluded before the symptom is attributed to phrenic nerve involvement.

## CONCLUSION

Severe ipsilateral subcostal pain may rarely be a predominant clinical manifestation of transient phrenic nerve blockade-associated hemidiaphragmatic paresis after interscalene brachial plexus block, even in the absence of dyspnea, oxygen desaturation, or apparent respiratory deterioration. When unexplained subcostal pain develops immediately after an interscalene block, phrenic nerve involvement should be considered. However, because this symptom is nonspecific, pneumothorax and other potentially serious thoracic complications should be appropriately excluded before the pain is attributed to hemidiaphragmatic paresis.

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