

CASE REPORTS

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Unilateral Pulmonary Edema with Interscalene Block

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COMBINED regional and general anesthetic techniques for various surgical procedures are enjoying increased popularity among practicing anesthesiologists. In particular, use of an interscalene brachial plexus block with general anesthesia for shoulder surgery provides excellent postoperative pain relief and reduces the amount of general anesthetic necessary for the procedure.¹ This combined technique, however, can invite unusual presentations of complications resulting from the interactions of the two. We present a case report of a young man who developed unilateral negative pressure pulmonary edema (NPPE) from laryngospasm on emergence from general anesthesia, in the presence of an interscalene block.

Case Report

The patient was an 18-yr-old athletic male (height, 180 cm; weight, 73 kg) who presented for a Bankhart procedure to correct a chronically dislocating left shoulder. The patient had no allergies, took no medications, was in excellent general health, and a non-smoker. He was taken to the operating room, where a left interscalene block was performed using a 22-gauge insulated needle and a nerve stimulator. Twenty-five milliliters of bupivacaine, 0.5%, with 1:200,000 epinephrine was injected in divided doses, without evidence of intravascular or intrathecal injection. General anesthesia was induced with propofol, and the trachea was easily intubated. Anesthesia was maintained with isoflurane, 1%, and 50% nitrous oxide. After completion of the surgery, the patient was allowed to emerge, the pharynx was thoroughly suctioned, and the trachea was extubated in the operating room. Subsequently, the patient developed acute laryngospasm, which was managed with 100% oxygen and positive pressure by mask. The laryngospasm resolved quickly (< 30 s) without further

intervention, and the patient was transported to the post-anesthesia care unit (PACU).

After less than 10 min in the recovery area, the patient became relatively hypoxemic, with SpO₂s of 90-95% on 15 l oxygen by mask. He was awake complaining of shortness of breath, with a respiratory rate of 40, and developed a cough productive of pink frothy sputum. On auscultation, he exhibited rales in his right base; the left lung field was clear. He denied any shoulder or incisional pain, indicative of a well-functioning interscalene block.

A chest radiograph was obtained. Curiously, the chest film revealed an infiltrate confined to only the right lower lobe, associated with a pleural effusion. The left lung field appeared to be uninvolved and demonstrated only an elevated left hemidiaphragm. Initially, this was inferred to be consistent with an aspiration; however, there was no evidence of gastric contents in the airway at the time of extubation, and the patient exhibited classical signs of pulmonary edema (pink frothy sputum). The diagnosis of aspiration remained foremost, until the mechanism that could give rise to this unusual presentation of unilateral pulmonary edema was deduced.

The patient was admitted overnight during which he was treated conservatively with supplemental oxygen and a single dose of furosemide. His symptoms rapidly improved, and his saturation on room air was 95% by the next morning. A repeat chest radiograph revealed marked improvement in the right lower lobe infiltrate and effusion, and clinically the patient did not exhibit signs of pulmonary aspiration or pneumonia. He was discharged the first postoperative day in satisfactory condition.

Discussion

The chest film obtained in the PACU demonstrated a confusing unilateral infiltrate involving the right lower lobe, suggestive of an aspiration; however, an acute aspiration often does not initially demonstrate an infiltrate. Additionally, this patient had undergone elective surgery, was *non per os* more than 8 h, had no associated risk factors for aspiration, and exhibited a cough productive of pink frothy sputum—all inconsistent with the diagnosis of aspiration.

The clinical picture of pulmonary edema with a unilateral infiltrate initially remained unexplained until it was realized that the left lung, which was spared, correlated with the side of surgery and the interscalene block. Phrenic nerve paralysis is a well-described associated effect of interscalene block because of the proximity of the phrenic nerve to the brachial plexus in the area the block is performed, and occurs virtually 100% of

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the time (as evidenced on the chest film by an elevated left hemi-diaphragm).^{2,3} This effect results in decreased forced vital capacity, FEV₁, and peak expiratory flow rates, which are generally well tolerated in most patients without preexisting pulmonary dysfunction.⁴

Post-extubation laryngospasm is a familiar clinical entity, which may result in negative pressure pulmonary edema as a result of forceful diaphragmatic contraction against a closed glottis. High subatmospheric transpulmonary pressure results in disruption of the pulmonary vasculature leading to transudation of fluid into the alveoli.^{5,6} Bronchoscopy performed acutely in the setting of NPPE reveals diffuse punctate hemorrhages throughout the tracheobronchial tree.⁷ Young athletic men tend to be at greater risk of this complication; presumably, their greater respiratory muscle strength is capable of generating more negative intrapulmonary pressures.⁸ In this case, however, only the right hemi-diaphragm was functioning (the left being paralyzed by the interscalene block), such that only the right lung was significantly exposed to the high negative pressure. The precise mechanism whereby the paralyzed left hemi-diaphragm protected the ipsilateral lung from injury is unclear, but it may be related to the non-homogeneous bronchial pressure changes observed experimentally after differential right and left phrenic nerve stimulation.⁹

It is likely that this clinical entity has previously occurred, only gone unreported because it was mistaken as a common aspiration. Given the popularity of combined general anesthetic and interscalene block, cases of unilateral NPPE will no doubt occur again; thus it is important to differentiate this entity from a masquerading aspiration pneumonitis. The clinical course of these two conditions is different: NPPE generally resolves

quickly with conservative management, whereas aspiration frequently produces a chemical pneumonitis from gastric acid contact and may likely lead to pneumonia.

Additionally, any patient with a hemi-diaphragmatic palsy, from whatever cause, may potentially develop NPPE with similar unilateral presentation. Any history of diaphragmatic or pulmonary dysfunction should be carefully considered when blocks affecting diaphragmatic function are planned to avoid possible respiratory embarrassment.

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