



## A case of phrenic nerve palsy

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### ARTICLE INFO

#### Keywords:

Phrenic nerve  
Interscalene block  
Shoulder  
Diaphragm  
Respiratory

### Case report

A 68-year-old male with a history of coronary artery disease with past surgical history of four-vessel coronary artery bypass grafting and aortic valve replacement presented to the Emergency Department with complaint of shortness of breath. The patient arrived in profound respiratory distress with an initial respiratory rate of 32 breaths/minute. He had been placed on 100% oxygen by nonrebreather mask by EMS without relief, however was noted to have SpO<sub>2</sub> of 97% prior to application and 100% following. The patient reported that he had undergone rotator cuff surgery earlier that day, and had developed progressively worsening shortness of breath.

Evaluation in the ED was notable for decreased lung sounds on the right. Bedside ultrasound demonstrated normal cardiac function as well as normal lung sliding bilaterally, though the right diaphragm had minimal movement. An EKG was obtained and was normal. Portable chest x-ray was obtained (Fig. 1).

### Diagnosis/Discussion

Phrenic nerve palsy may be caused by a wide variety of etiologies including blunt neck trauma, neck surgery, cardiac surgery, cervical compressive tumors, pneumonia, herpes zoster, or iatrogenic causes.<sup>1</sup> Phrenic nerve palsy is so common after interscalene nerve block that at least partial palsy is considered an inevitability in patients receiving traditional large volume, landmark-guided regional anesthesia by this method.<sup>2</sup> Patients may develop dyspnea or, infrequently, mild-to-moderate hypoxia but these complications are usually self-limiting. Despite the ubiquitous nature of phrenic nerve palsy after interscalene block, the majority of patients in clinical trials usually experience no

significant adverse outcomes from this palsy and require no additional intervention; however, these studies are limited in that they exclude certain populations which would be particularly sensitive to a diaphragmatic palsy including those with underlying pulmonary disease, obesity, or obstructive sleep apnea. Ropivacaine is a commonly used anesthetic for nerve blocks. It generally has an onset of action within 3 to 15 min with a half-life of approximately 6–9 h.

Each side of the diaphragm is innervated by the ipsilateral phrenic nerve. Injury to either one or both phrenic nerves can subsequently cause unilateral or bilateral paralysis of the diaphragm, resulting in dyspnea and/or respiratory distress. Diagnosis may be suspected by clinical presentation, and is often confirmed with chest X-ray, which will classically demonstrate a markedly elevated hemi-diaphragm. Alternatively, the Sniff test is the most specific test for diagnosis of phrenic nerve palsy. Performed under fluoroscopy or using bedside ultrasound, patients are asked to forcefully sniff and are observed for paradoxical movement of the paralyzed diaphragm during inspiration.<sup>3</sup>

The patient's surgical team was contacted and confirmed that interscalene block with ropivacaine had been utilized for regional anesthesia. The patient was placed on non-invasive ventilation for respiratory support, however he was unable to tolerate this and was transitioned to nasal cannula and administered benzodiazepines for anxiolysis. The patient's respiratory status was monitored for 12 h and steadily improved. He was discharged home following complete resolution of his symptoms. One week after discharge the patient had a repeat chest x-ray performed as an outpatient demonstrating complete resolution of his phrenic nerve palsy (Fig. 2).

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<https://doi.org/10.1016/j.visj.2019.100662>

Received 5 April 2019; Accepted 13 September 2019

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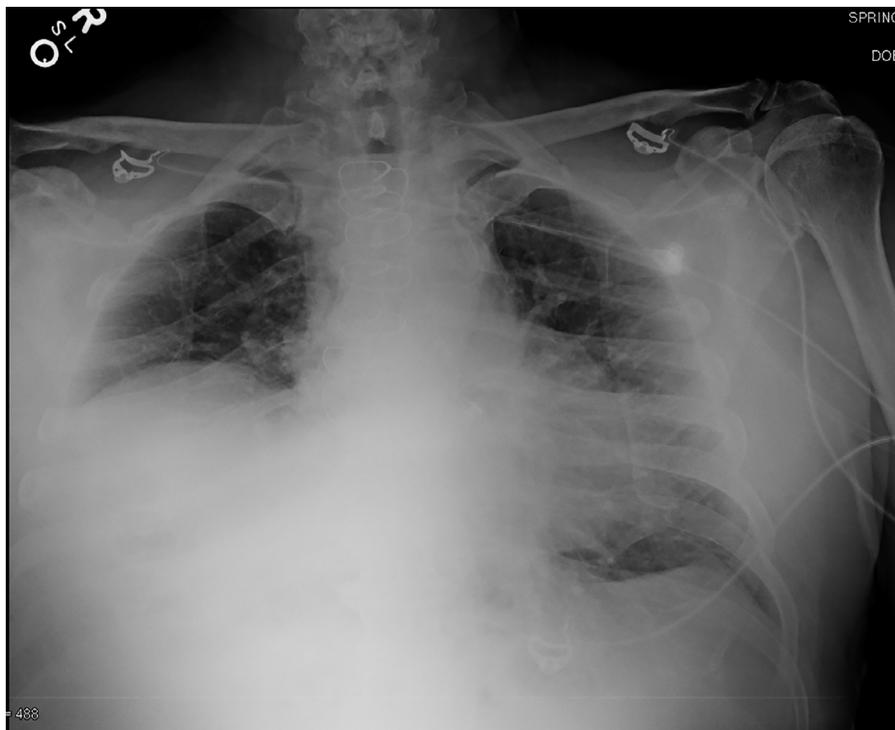


Fig. 1. Portable chest X-ray demonstrating marked elevation of the right hemi-diaphragm, consistent with phrenic nerve palsy.



Fig. 2. Upright chest X-ray demonstrating resolution of right phrenic nerve palsy.

**Questions**

- 1) **True** /False: Phrenic nerve palsy is common following interscalene nerve block.
- 2) What is the most specific test for the diagnosis of phrenic nerve palsy?
  - A) **Sniff Test**
  - B) Chest X-Ray
  - C) Neer's Test
  - D) PFTs

**Answers**

- 1 Answer: True: Phrenic nerve palsy occurs in up to 100% of cases of patients undergoing interscalene nerve block.
- 2 Answer: A) **Sniff Test**: The Sniff test is the most specific test for diagnosis of phrenic nerve palsy.

Performed under fluoroscopy or using bedside ultrasound, patients are asked to forcefully sniff and are observed for paradoxical movement of the paralyzed diaphragm during inspiration.

### Declaration of Competing Interest

All authors have participated in (a) conception and design, or analysis and interpretation of the data; (b) drafting the article or revising it critically for important intellectual content; and (c) approval of the final version.

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The authors have no affiliation with any organization with a direct or indirect financial interest in the subject matter discussed in the manuscript.

### Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.visj.2019.100662](https://doi.org/10.1016/j.visj.2019.100662).

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