



Post-Operative Increased Work of Breathing Following Interscalene Catheter Placement for Reverse Total Shoulder Arthroplasty

Alexandra Rice, DO, Nicole Hollis, DO, Cy Mazingo, MD
Department of Anesthesiology, West Virginia University

Introduction

The interscalene approach to the brachial plexus is a common peripheral nerve block for surgeries of the proximal upper extremity and shoulder. If prolonged analgesia is preferred, a catheter can be placed.

Anatomy:

- Brachial plexus visualized at C6 vertebral level between anterior and middle scalene muscles targeting the C5-C7 roots/trunks¹
- C8-T1 typically spared with this block
- The phrenic nerve runs superficial to the interscalene groove at the level of the cricoid cartilage and runs in a caudad direction on top of the anterior interscalene muscle³

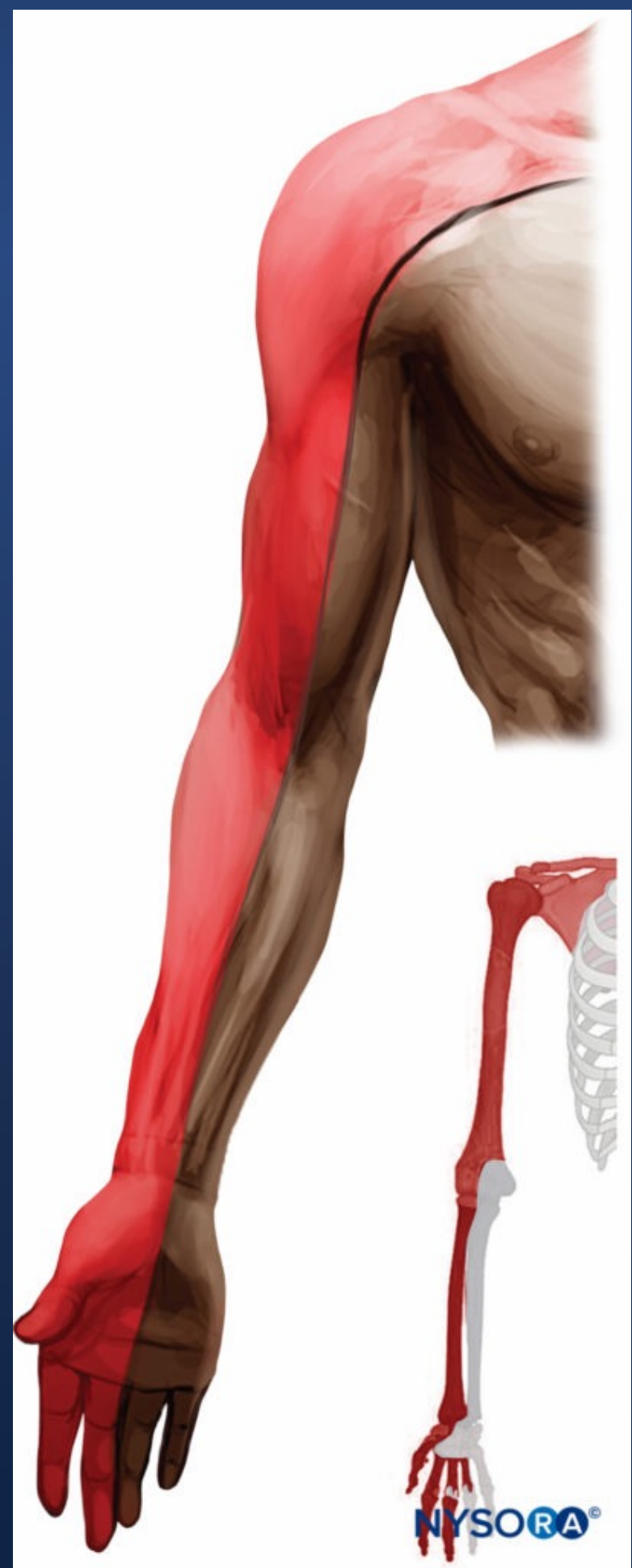


FIGURE 1. Sensory distribution of interscalene brachial plexus nerve block (in red). Image retrieved from Gautier³

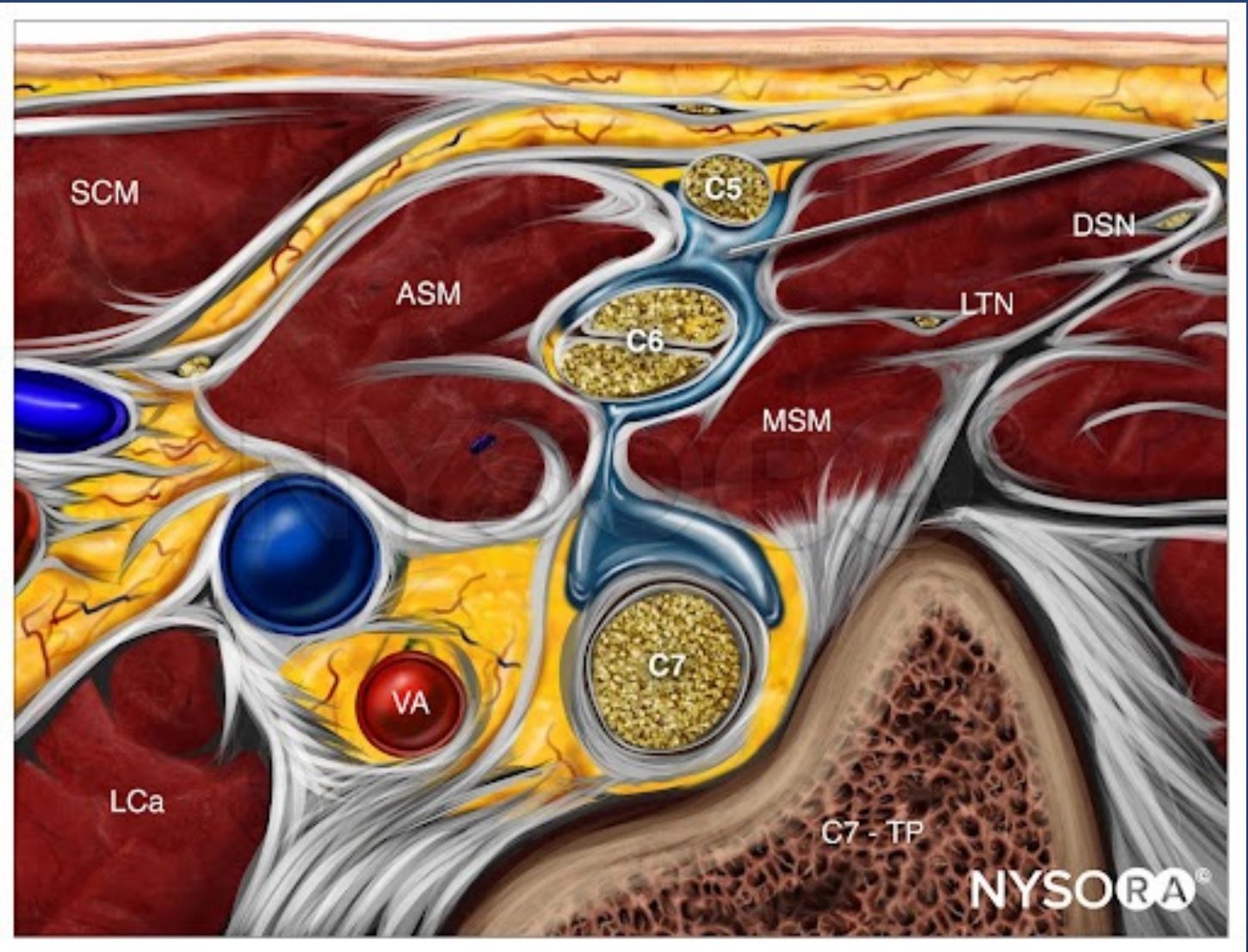


FIGURE 2. Ultrasound anatomy of interscalene brachial plexus nerve block. Image retrieved from Gautier³

Complications:

- Phrenic nerve is anesthetized almost 100% of the time resulting in ipsilateral hemidiaphragm weakness.
- Intervascular injection, seizures, stellate ganglion block (Horner's syndrome), recurrent laryngeal nerve block, pneumothorax⁵

Materials and Methods

Informed consent was obtained from the patient for submission of this case report. As the case report is devoid of patient identifiable information, it is exempt from IRB review requirements as per West Virginia University's policy.

Case Presentation

- HPI
 - 63-year-old female 5'5", 111kg with BMI of 40.45 presented with right rotator cuff tear arthropathy
 - PMH: Type II diabetes mellitus, obstructive sleep apnea on CPAP, hypertension, hyperlipidemia, hypothyroidism, and morbid obesity
- Surgical Procedure: right reverse total shoulder arthroplasty
- Pre-Operative:
 - Right interscalene peripheral nerve block with catheter placement under ultrasound guidance. Tolerated procedure well.
 - Skin local: 1mL of 1% lidocaine
 - Initial bolus: 20mL of 0.5% ropivacaine
 - Sedation: 1mg IV midazolam, 50mcg IV fentanyl



FIGURE 3: Ultrasound imaging of brachial plexus. Retrieved from EMR



FIGURE 4: Ultrasound imaging showing the needle location during administration of initial bolus dose. Retrieved from EMR

- Intraoperative:
 - General anesthesia with endotracheal intubation in the beach chair position
 - No immediate complications. Extubated to simple face mask
- Postoperative:
 - Patient noted to have an increased work of breathing in PACU, stated she was unable to inspire deeply
 - Interscalene catheter flushed with 10mL of normal saline and subsequently removed
 - CPAP with her home setting of 11 ordered
 - Shortly after flushing the catheter, the patient noted a drastic improvement of her symptoms
 - Admitted overnight by surgical team
 - Post-op day 2- patient reported good control of her pain and no episodes of increased work of breathing overnight

Discussion

- Interscalene peripheral nerve block causes weakness in the ipsilateral hemidiaphragm
 - This can be observed using M-mode on an ultrasound as seen in Figure 5.²
- This often goes unnoticed in healthy patients
- In patients with respiratory comorbidities (asthma, COPD, OSA, pneumonectomy) it can increase work of breathing and result in respiratory compromise

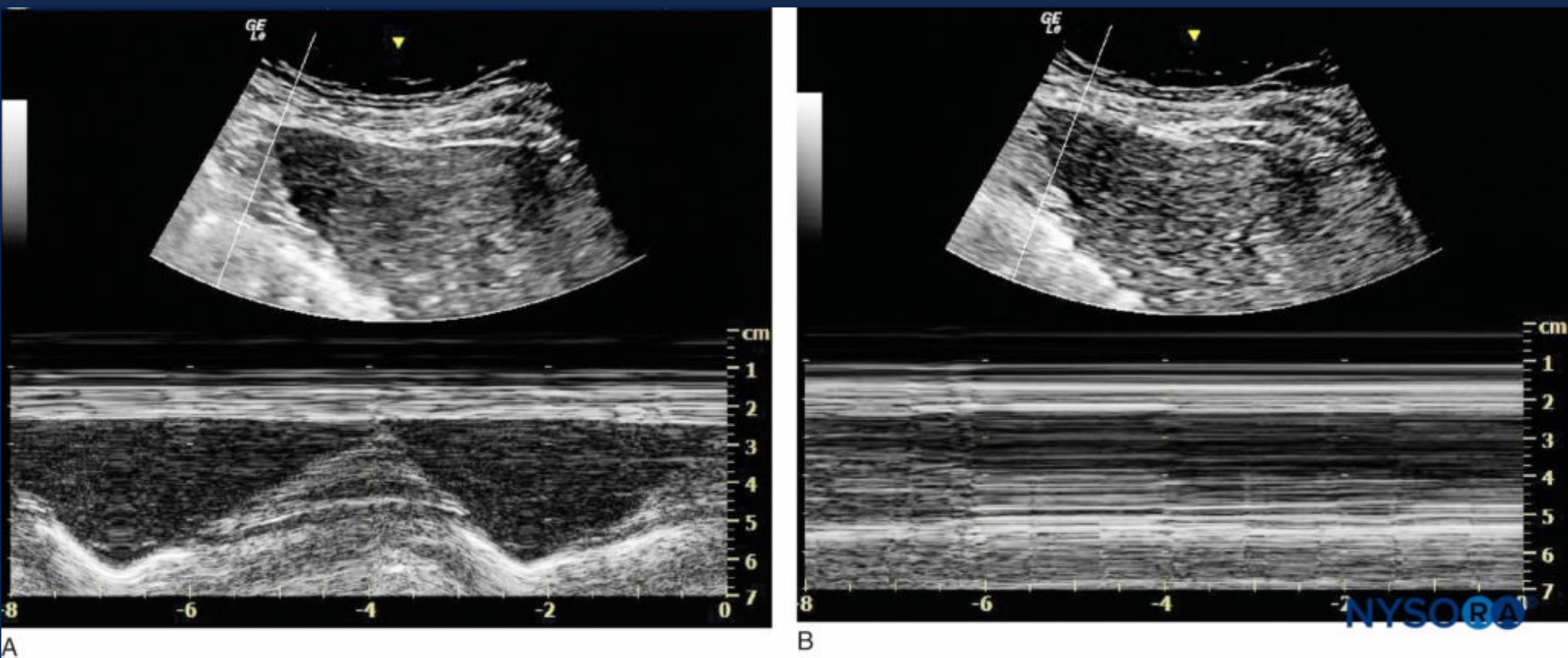


FIGURE 5: Imaging of the right hemidiaphragm under the ribcage on the anterior line. (A) Before interscalene nerve block. (B) After interscalene nerve block with phrenic nerve block. Image retrieved from Gautier³

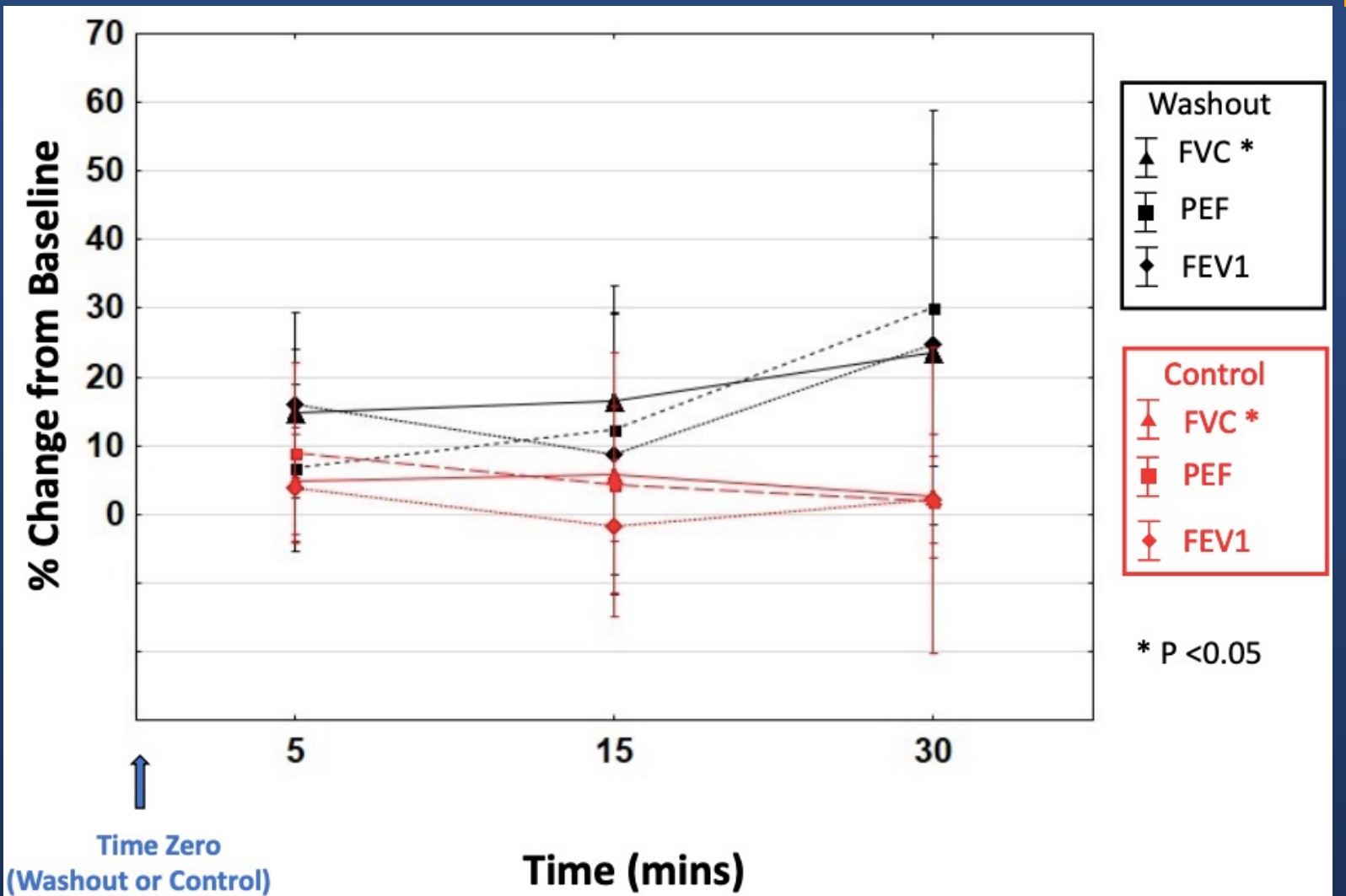


FIGURE 6: Change in pulmonary assessments over the course of the study. Image retrieved from Sarwary²

- A clinical trial was conducted across multiple medical facilities that investigated effects of saline washout on hemidiaphragm paralysis
 - They found no significant difference in reversal of paralysis, but there were more patients in the intervention group that only progressed to partial paralysis
 - Secondary outcomes showed no difference in pain scores, PACU opioid requirement, and sensory/motor exam between the two groups⁴

Relevant Research:

- A randomized, double blinded study was conducted at Stanford University to investigate the effectiveness of saline washout on improving FVC
- Results: significant improvement in the FVC 30 minutes after the saline washout, suggesting a reversal of the phrenic nerve paralysis.²

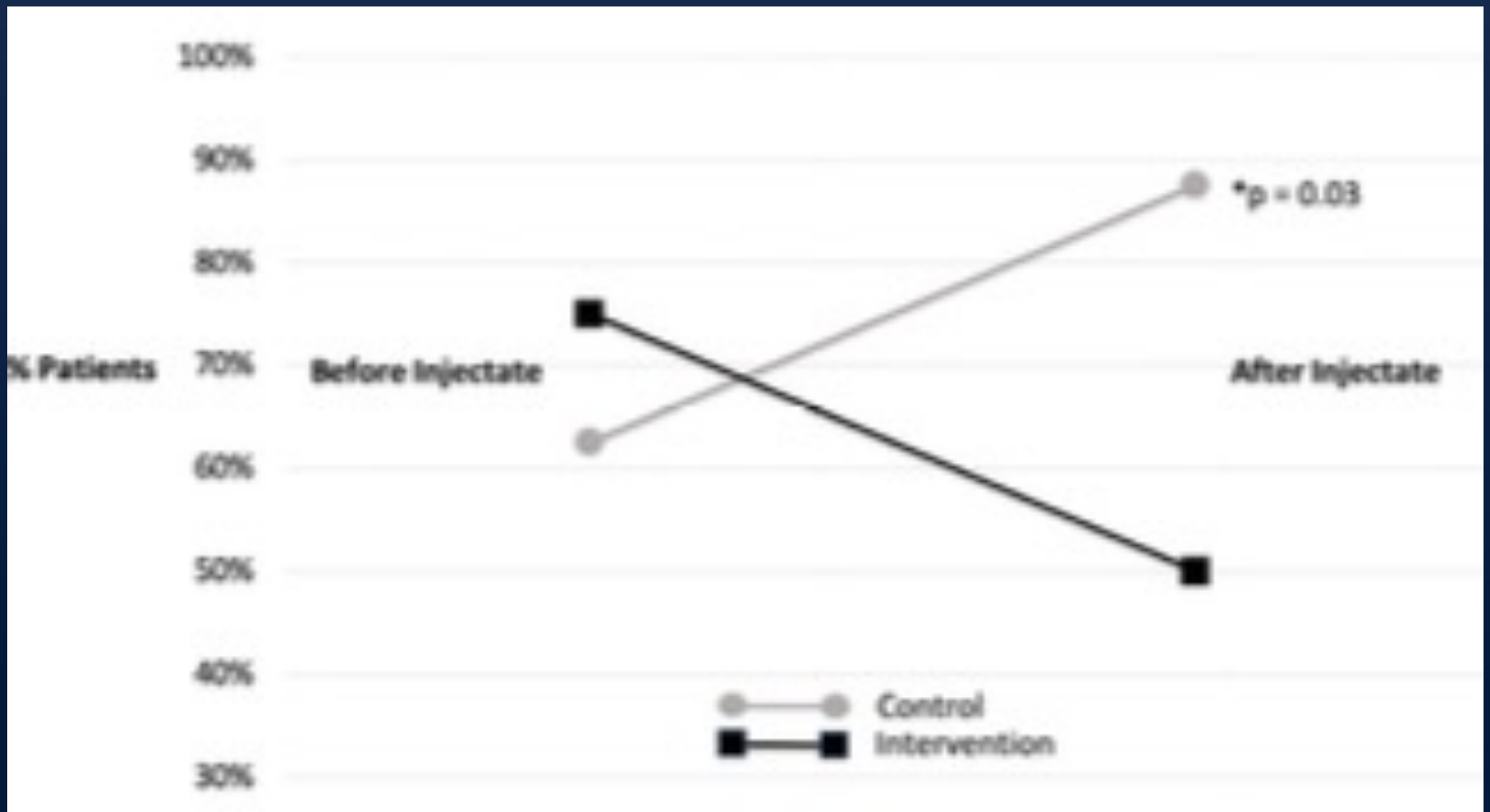


FIGURE 7: Full hemidiaphragmatic paralysis before and after injectate administration. Image retrieved from Gerber⁴

Conclusion

- Saline wash-out following placement of an interscalene catheter is a fast, safe, and reliable way to decrease respiratory symptoms caused by phrenic nerve paralysis
- The analgesia from the interscalene nerve block appears to be preserved following saline washout, further increasing the usefulness of this treatment
- If encountered again, we will consider leaving the catheter in place for continued pain relief

References

1. Manuel C. Pardo, Jr. and Miller, Ronald D. *Basics of Anesthesia*. Philadelphia, PA : Elsevier, Inc., 2018.
2. Sarwary, M., Horn, J. L. E., Boublik, J., & Tsui, B. Improvement of Forced Vital Capacity after Saline Washout in the Setting of Post-Interscalene Catheter Phrenic Nerve Palsy.
3. Gautier, Philippe E., et al. "Ultrasound-Guided Interscalene Brachial Plexus Nerve Block." NYSORA, www.nysora.com/ultrasound-guided-interscalene-brachial-plexus-block/#toc_PHRENIC-NERVE-block.
4. Gerber, Lynn Ngai, et al. "Clinical effect of normal saline injectate into interscalene nerve block catheters given within one hour of local anesthetic bolus on analgesia and hemidiaphragmatic paralysis." *Regional Anesthesia & Pain Medicine*, vol. 46, no. 2, 12 Nov. 2020, pp. 124-129, <https://doi.org/10.1136/rapm-2020-101922>.
5. Freeman, Brian S., and Jeffrey S. Berger. "Chapter 116. Postoperative Pain Relief: Alternative Techniques." *Anesthesiology Core Review, Part One: BASIC Exam*, Second ed., McGraw Hill, 2023, p. 364.