

Introduction

- In patients where hemi-diaphragmatic paralysis (HDP) won't be tolerated such as in our case, utilizing motor sparing blocks or costoclavicular block (CCB) seem to serve as a safe alternatives.
- It is important to identify patient at risk to develop clinical manifestation of phrenic nerve paralysis associated with brachial plexus block for shoulder surgeries, and to perform motor sparing block in those at risk.

Case Presentation

- A 76-year-old patient presented preoperatively to our block room to receive a regional block for postoperative pain analgesia. She is undergoing rotator cuff repair for which she has received shoulder joint cortisone injections without relief . Her past medical history is pertinent for COPD, GOLD stage 4 (very severe), on 3-7 liters of oxygen at home with SPO2 ranging 90-95%.
- She has been maintained on Spiriva, albuterol HFA and nebulizer, advair, prednisone 5 mg daily for rheumatoid arthritis, azithromycin, and oxygen 3-7 liters. The most recent pulmonary function test showed severe obstruction with FVC of 84%, FEV1 of 40 % and FEV1/FVC of 47%. Preoperative chest CT scan showed severe upper lobe predominant centrilobular emphysema, diffuse airway inflammation and bilateral lower lobe predominant fibrotic changes with traction bronchiectasis. The patient was assessed by pulmonology preoperatively for optimization, and she was deemed high risk for perioperative respiratory complications and need for postoperative mechanical ventilator.
- In the block room the patient didn't complain of shortness of breath, and her baseline SPO2 was 97% on 4 liters oxygen. Considering her medical history, it was concluded that the patient won't tolerate hemi-diaphragmatic paralysis so a decision was made to place a suprascapular nerve catheter using the anterior sub-omohyoid approach, in addition to an axillary nerve block.
- To perform the blocks, the patient was placed in a semi- recumbent position at 30°. Sonographic examination using a high frequency linear ultrasound probe was performed to identify the brachial plexus adjacent to the subclavian artery at the supraclavicular level, the suprascapular nerve was isolated from the brachial plexus because it branched from the superior trunk. The suprascapular nerve was traced laterally, a 17-gauge Tuohy needle was inserted and advanced medially in-plane until adjacent and just deep to the suprascapular nerve (Figure 1.A), and a 19-gauge catheter (Flex-Tip Plus, Arrow International, Reading, PA) was threaded through the Tuohy needle (Figure 1.B). A single shot axillary nerve block was performed following securing the suprascapular nerve catheter.

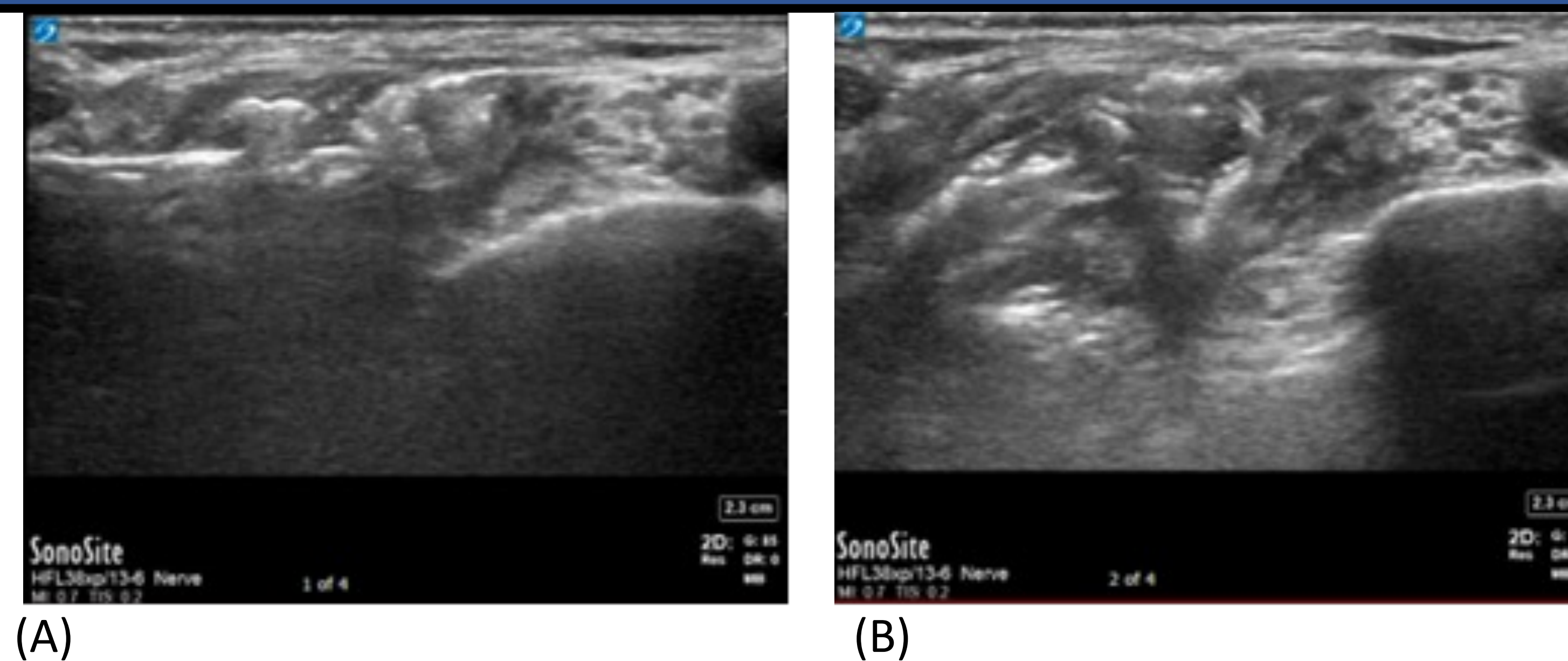


Figure 1. (A) ultrasound image showing brachial plexus lateral to the subclavian artery and the Tuohy needle visualized under the suprascapular nerve. (B) ultrasound image showing the placement of the nerve catheter around the suprascapular nerve.

- Intraoperative course was uneventful. Decision was made to dispose the patient to the ICU on mechanical ventilation for close monitoring and further management. Ropivacaine 0.1% solution was used for the peripheral nerve catheter pump, which was programmed to run at 4/0/0/0. In the ICU, the patient got extubated on the same night without any complication.

Discussion

- The shoulder receives its sensory innervation via 4 peripheral nerves originating from the upper trunk (suprascapular nerve), the lateral cord (lateral pectoral nerve), and the posterior cord (axillary nerve and subscapular nerves) of the brachial plexus (1). In patients where hemi-diaphragmatic paralysis (HDP) won't be tolerated such as in our case, utilizing motor sparing blocks or costoclavicular block (CCB) seem to serve as a safe alternatives. In an RCT that compared respiratory (FVC and FEV1) and analgesic effects of interscalene (ISB) versus anterior and posterior suprascapular blocks (SSB), found that anterior and posterior suprascapular block preserve lung function, however only anterior SSB had a comparable analgesic effect to that of ISB (2). This can be explained by a cadaveric study that targeted the anterior suprascapular nerve with 5 mL of dye, and found that the latter spread not only to the suprascapular nerve, but also to the upper and middle trunks (3). However, it also found that even with only 5 mL of injectate, the phrenic nerve was mildly stained in 20% of specimens, therefore risk of HDP cannot be ruled out using this technique and caution with the volume of injected local anesthetic should take place (3).

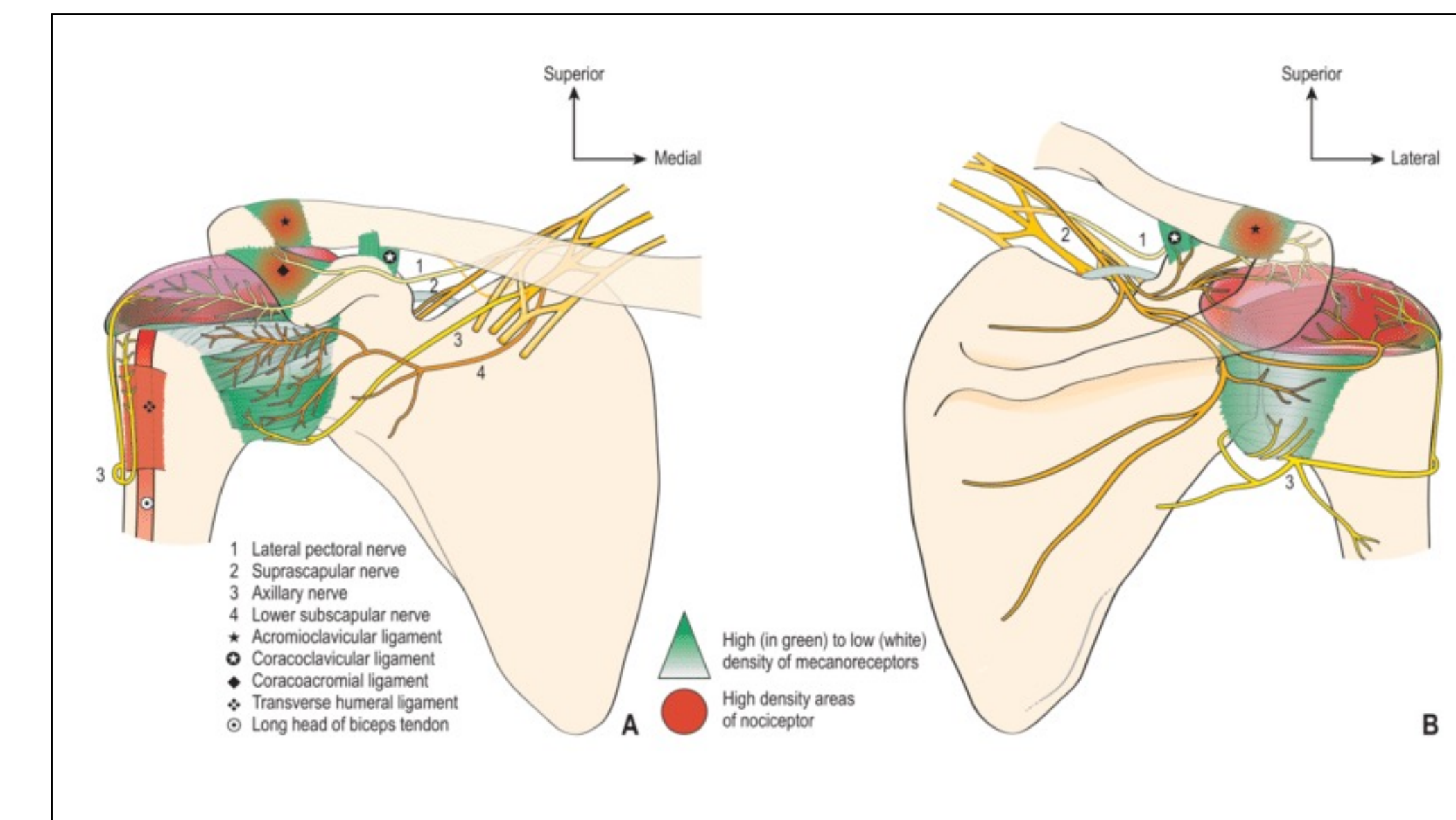


Figure 2. Shoulder joint innervation.

- In an RCT that measured the suprascapular nerve involvement while performing a CCB and compared the incidence of HDP between ISB and CCB (4). This trial demonstrated comparable analgesic effect between ISB and CCB for shoulder surgery, comparable motor block of SSN at 30 mins but not at 20 mins, and significantly less brachial plexus block complications such as HDP (7.55% vs. 92.45%), Horner's syndrome, and dyspnea (4). A drawback of CCB for shoulder surgeries would be the location of indwelling nerve catheter given its proximity to the surgical field.
- Patients who were ASA Physical Status III, had lower preoperative SpO2, higher BMI, advanced age, asthma, or CHF had increased odds of having a respiratory complication in the postoperative period in patients who had interscalene block for shoulder surgery, as concluded in a recent retrospective cohort study that was conducted to determine factors associated with increased risk of clinical respiratory complications in this population.⁵

Conclusion

- It is important to identify patient at risk to develop clinical manifestation of phrenic nerve paralysis associated with brachial plexus block for shoulder surgeries, and to perform motor sparing block in those at risk.

References

- Sebastián Layera, MD, Mohammed Saadawi, MD, De Q. Tran, MD, FRCP, Francis V. Salinas, MD. Motor-Sparing Peripheral Nerve Blocks for Shoulder, Knee, and Hip Surgery. *Adv Anesth*. 2020 Dec;38:189-207.
- Yean Chin Lim, Zhao Kun Koo, Vivian. W. Ho, See Seong Chang, Shivani Manohara, Qian Jun Tong. Randomized, controlled trial comparing respiratory and analgesic effects of interscalene, anterior suprascapular, and posterior suprascapular nerve blocks for arthroscopic shoulder surgery. *Korean J Anesthesiol*. 2020 Oct;73(5):408-416.
- Herman Sehmbi, Marjorie Johnson, Shalini Dhir. Ultrasound-guided subomohyoid suprascapular nerve block and phrenic nerve involvement: a cadaveric dye study. *Reg Anesth Pain Med*. 2019 May;44(5):561-564
- Quehua Luo, Junyi Zheng, Caiqi Yang, Wei Wei, Kejia Wang, Xiaobing Xiang, Weifeng Yao. Effects of the costoclavicular block versus interscalene block in patients undergoing arthroscopic shoulder surgery under monitored anesthesia care: a randomized, prospective, non-inferiority study. *Korean J Anesthesiol*. 2023 Oct;76(5):413-423.
- Rate of occurrence of respiratory complications in patients who undergo shoulder arthroplasty with a continuous interscalene brachial plexus block and associated risk factors. *Reg Anesth Pain Med*. 2023 Nov;48(11):540-546.doi: 10.1136/rapm-2022-104264. Epub 2023 May 12