

Renes SH, Rettig HC, et al. Ultrasound-Guided Low-Dose Interscalene Brachial Plexus Block Reduces the Incidence of Hemidiaphragmatic Paresis. Reg Anesth Pain Med 2009;34:498-502.

Design: randomized clinical trial

Study question: In the setting of elective shoulder surgery, does ultrasound-guided (US) interscalene brachial plexus block (ISB) result in lower incidence of hemidiaphragmatic paresis than ISB using nerve stimulation (NS) guidance?

Population/sample size/setting:

- 30 patients (14 men, 16 women, mean age 51) undergoing elective shoulder surgery in Rotterdam, the Netherlands
- Eligible if they were between 18 and 75 and ASA grades I-III (no life-threatening disease)
- Exclusion criteria were refusal of ISB, inability to give informed consent, hemidiaphragmatic dysfunction, coagulation disorders, neuropathy, pulmonary or cardiac disorders/conditions, BMI over 35, pregnancy, and allergy to local anesthetics

Main outcome measures:

- All patients had ISB with either US or NS guidance
 - o NS ISB was done with patient supine by advancing a 22G needle until contractions of the biceps (nerve roots C5/C6) or triceps (C6, C7, C8) were obtained; 10 ml of 0.75% ropivacaine was slowly injected
 - o US ISB was done with patient semisitting with a broadband linear array US probe to identify the transverse process of C7 and the brachial plexus; a 22G needle was advanced to a position just lateral to the C7 nerve root, and 10 ml of 0.75% ropivacaine was slowly injected as its spread was observed
- All patients had induction of general anesthesia 45 minutes after ISB with propofol and remifentanyl
- Primary outcome was diaphragmatic motion with real-time M-mode ultrasonography in an upright sitting position, using a subcostal approach with the liver or spleen as an acoustic window, using both the sigh test and the sniff test
 - o Diaphragmatic complete paresis was defined as (1) a reduction of more than 75% of movement or (2) paradoxical movement of the diaphragm
 - o Partial paresis was defined as movement reduction between 25% and 75%

- Measurements were done before ISB, then repeated 5, 10, 15, 30, 180, and 360 minutes after ISB
- The primary endpoint for diaphragmatic movement was taken at 30 minutes after ISB (15 minutes before general anesthesia)
- There were large differences in diaphragmatic paresis between the two groups
 - For the US group, 13 had no paresis and 2 had complete paresis
 - For the NS group, only 1 had no paresis; 2 had partial paresis and 12 had complete paresis
 - For the sigh test, the US group had 6.4 cm of movement at baseline and 5.7 cm at 30 minutes; the NS group had 6.4 cm of movement at baseline and 0.3 cm at 30 minutes
 - Results appear to be similar for the sniff test, but Table 2 may have a misprint, since the 30 minute movements for the sniff and sigh tests have identical means and standard deviations
- Some secondary outcomes were also measured, without significant differences between US and NS (e.g. , Horner syndrome, morphine use in recovery room, and block success rate)
 - Spirometry measurements (FEV1, FVC, PEF) were also decreased in the NS group from baseline, but for the US group, these did not decrease at 30 minutes from baseline
- No patient in either group experienced respiratory distress during the period of observation

Authors' conclusions:

- When ISB is being used in the setting of elective shoulder surgery, US guidance for needle placement significantly reduces the incidence of diaphragmatic paresis compared with the use of NS for needle placement
- Although no patient had respiratory distress, the use of ISB is relatively contraindicated in patients with severe pulmonary disorders
- The difference between diaphragmatic movement between US and NS may be due to differences in ventral spread toward the phrenic nerve or may be due to differences in rostral spread toward the C4 nerve root
- The use of the transverse process of C7 as a landmark could create some technical difficulties and an increased risk of complications due to the proximity of the vertebral artery, the epidural space, and the cervical nerve root

Comments:

- Table 3 has a misprint: the mean and standard deviation for the M-mode sniff test at 30 minutes are identical to those for the sigh test at the same time; because the

- baseline excursion for the sniff test appears to be less than for the sigh test, the measurements for the sniff test were probably smaller than reported at 30 minutes
- Presumably, the general anesthesia had worn off by the time that the measurements were repeated at 180 minutes; the length of the operation is not reported
 - Although the diaphragmatic measurements were not blinded, it is not likely that this would create sufficient bias to explain all of the substantial group differences which were reported
 - There was only one patient in ASA group III, which includes patients with intermittent bronchospastic symptoms but excludes symptomatic COPD (ASA group IV)
 - o The authors appear to imply that ISB should not be done in patients with chronic pulmonary disorders, whether by US or NS guidance, but this is not explicitly stated
 - The patients were supine for NS but semisitting for US placement of ISB; if rostral spread toward the C4 nerve root is part of the explanation for the observed differences in diaphragmatic motion, it is possible that this could be part of the reason
 - The “sigh test” is not described, but presumably involves respiratory excursions through an open mouth, where the sniff test is through the nostrils

Assessment: adequate for some evidence that in the setting of elective shoulder surgery when interscalene brachial plexus block is being used for anesthesia, and in the absence of chronic pulmonary or cardiac disease, needle guidance with ultrasound reduces the risk of diaphragmatic paresis in comparison to nerve stimulation guidance