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CORRESPONDENCE

In reply: Hemidiaphragmatic paresis associated with interscalene nerve block

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To the Editor,

We thank Dr. Li and colleagues[1] for their insights into our findings on the effects of continuous interscalene block *vs* continuous high-thoracic erector spinae plane (HT-ESP) block on hemidiaphragm function in patients undergoing total shoulder arthroplasty.

The authors suggested that a lower concentration bolus of ropivacaine before measurements would have decreased the rate of hemidiaphragm paralysis. Studies have shown that a lower concentration and a smaller volume of local anesthetic reduce the effect on hemidiaphragm function.[2,3] We agree that a 5 mL bolus of 0.25% ropivacaine may have resulted in lower rates of hemidiaphragm paralysis compared with 5 mL of 0.5% ropivacaine. This choice in volume and concentration of local anesthetic was based on our practice for an initial bolus through an interscalene catheter before surgery. As we could not ensure that measurements could be done before patients went to the operating room, the postanesthesia care unit bolus before measurements was the only way to mimic a preoperative bolus without delaying clinical care. This way, we could still provide information relevant to clinical practice.

The authors also pondered how to clinically interpret our findings of 100% incidence of hemidiaphragm paresis in the interscalene group when our study showed no difference in individual adverse events for our selected low-risk patients. First, it is important to remember that the study was not powered to detect a difference in these adverse events. Hence, the lack of *statistical significance* does not equate to *no difference*. In particular, dyspnea is a potential adverse event associated with hemidiaphragm paresis that is relatively infrequent in healthy patients. We cited references suggesting that the incidence of shortness of breath with interscalene blocks is between 9% and 12% in healthy study populations. To power a study with an anticipated incidence of 10% dyspnea in one group compared with 0% incidence in the other group, 73 participants would be required in each group (80% power, alpha level of 0.05).

Second, we excluded patients with significant pulmonary disease or a body mass index $> 40\ \mathrm{kg \cdot m^{-2}}$ because of safety concerns. This is the population of patients in which we expect a block that causes 100% hemidiaphragm paresis to have the greatest risk of adverse events with *clinical relevance*. Therefore, the lack of adverse outcomes in our low-risk population cannot be applied to high-risk patient populations. We hope that the information generated from our study will help guide us in the challenging clinical decision-making process for these high-risk patients.

Most importantly, the authors questioned whether the statistically significant difference in mean cumulative opioid consumption on postoperative day 0 between the two groups was clinically relevant. They noted that the difference was 9.6 mg *iv* morphine, which is less than the minimal clinically important difference (MCID) of 10 mg

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iv morphine for postoperative opioid consumption (from 0 to 24 hr), as determined by a systematic review.[4] The very existence of a study seeking to define the MCID shows that there is variability regarding what each clinician would consider "clinically meaningful"; and even for the same provider, this cut-off may vary based on the patient and the scenario. We concur with the authors' comment that "the clinical relevance [i.e., of the higher cumulative POD 0 opioid consumption in the HT-ESP block group] is debatable."[1] Nevertheless, we felt obligated to report our *statistically significant* finding, even with minor effects, for the readers' consideration. Indeed, we believe that the HT-ESP block is a reasonable alternative to interscalene block for certain high-risk patients. We encourage future studies to be powered for differences in clinically meaningful functional outcomes rather than focusing on opioid consumption, which is an outcome fraught with questions of *clinical relevance vs statistical significance*.

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