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Reply:

We thank the editor for giving us the opportunity to reply to the comments of Jutzi et al. Firstly, our results cannot be compared with those of Parkinson who injected local anesthetic via a needle and not via a catheter.[1] Secondly, we threaded the catheters up to 12 cm in order to inject local anesthetic more cephalad to obtain a better block of the obturator nerve. Again, our results are difficult to compare with those of Capdevila[2] who threaded the catheters up to 16–20 cm. Furthermore, Ritter studied the spread of solution injected via a needle and not via a catheter.[3] However, there is a question that remains; are the study's conditions similar in cadavers and in patients undergoing surgery. Concerning radiological control of the catheters, the aim of our study was to explore, in clinical conditions, the effect of different doses of local anesthetic injected via a catheter regardless of the exact position of its tip. However, lack of radiological verification of catheters is well mentioned in the discussion.

We agree that testing of the obturator nerve blockade is a complex problem. As have many others authors,[2,4–6] we tested sensory obturator block at the medial aspect of the knee. In one of these studies, sensory and motor obturator blocks were tested and the results show that the sensory block is more consistent than the motor one. Recently, Bouaziz reported the lack of cutaneous innervation of the obturator nerve at the knee level in 57% of the subjects.[7] If these data are confirmed by other investigations, motor rather than the sensory block of the obturator nerve should be tested. Nevertheless, even in the absence of skin fibres, the obturator nerve contributes to sensory inervation of the knee joint. Very low pain scores documented four hours after the block support the finding of a high percentage of obturator block in our patients. Finally, there is perhaps some doubt about the existence of three-in-one block, but this term is currently used in the anesthetic literature.

Anne Weber MD
Roxane Fournier MD
Zdravko Gamulin MD
Hôpitaux Universitaires de Genève, Geneva, Switzerland
E-mail: Anne.Weber@hcuge.ch

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Delayed respiratory depression after interscalene blockade for shoulder surgery in geriatric patients

To the Editor:

In our institution, as in many others, surgery on the proximal part of upper arm is usually performed under interscalene brachial plexus block (ISB) with general anesthesia (GA) upon request of the surgeon. We recently experienced three cases of delayed respiratory distress after complete recovery of uneventful anesthesia in geriatric patients who received ISB and GA for surgeries on the upper arm or shoulder. In all cases ISB was performed using a nerve stimulator at first attempt by the Winnie approach.

In the first case, a 74-yr-old female received ISB with a 30 mL mixture containing ropivacaine 112 mg and lidocaine 150 mg with epinephrine, injected slowly in divided doses. Ten minutes later, GA was administered with sufentanil, propofol, sevoflurane and atracurium to facilitate tracheal intubation. At completion

of surgery performed without supplemental opioids, the patient recovered fully from GA and her trachea was extubated 130 min after ISB. However, within ten minutes, she began to sweat and became dyspneic, breathing at 34 min^{-1}, and paradoxical thoracoabdominal movements on the ipsilateral side of ISB were noted. Documentation of motor and sensory block isolated to the repaired arm excluded any neuraxial extension of anesthesia. The trachea was re-intubated to facilitate ventilation for two hours after which time the block regressed sufficiently to allow spontaneous respiration and full recovery. In the second case, a 90-yr-old female received 20 mL of 0.25% bupivacaine for ISB under similar conditions. Her trachea was extubated 175 min after ISB and 20 min later, she became dyspneic with paradoxical movements. As supplemental oxygen administered via a facial mask was ineffective to maintain adequate saturation, she was mechanically ventilated for an additional 12 hr. In the third case, a 72-yr-old female received 20 mL of 0.2% ropivacaine for ISB. Her trachea was extubated 90 min after regional anesthesia and 15 min later, respiratory insufficiency appeared with paradoxical chest movements. In her case, supplemental oxygen administered via face mask for three hours was effective to maintain $SpO_2 > 95\%$.

As the phrenic nerve is in the vicinity of brachial plexus nerves at the interscalene level, the incidence of phrenic nerve block approaches 100% of cases, whatever technique of nerve location is used.[1] For anatomical reasons, digital pressure is ineffective in reducing the incidence of diaphragm paresis after ISB.[2–4] Healthy patients generally compensate for unilateral diaphragmatic paralysis by recruiting accessory respiratory and abdominal muscles. Therefore, changes in respiratory function after ISB are usually asymptomatic[5] because efficient negative intrathoracic pressure can be generated by only one half of the diaphragm. In the present cases, accessory respiratory muscle function was insufficient to compensate for phrenic nerve block. This may partly be explained by aging, and residual effects of GA despite the low doses of anesthetics used. As all three patients presented delayed paradoxical movements of abdominal muscles related to prolonged diaphragmatic paralysis on the side of the ISB, effects of aging and local anesthetics on the phrenic nerve cannot be ruled out. Others have also reported delayed pulmonary dysfunction after ISB in awake patients[6] as well as in anesthetized patients.[7] In our series, it is likely that controlled ventilation during the surgical procedure protected the patients from respiratory insufficiency, which occurred in the early postoperative period due in part, to the low muscle masses and limited pulmonary reserves of these elderly patients. Finally, these cases highlight the fact that onset of respiratory insufficiency related to ISB may be delayed in the elderly, occurring several hours after performing the block, especially when patients are anesthetized for surgery.

Jérôme Delcourt MD
Jeanne Barré MD
Chantal Lelarge MD
Martine Payen MD
Jean-Marc Malinovsky MD PhD
University Hospital Maison Blanche, Reims, France
E-mail: jmmalinovsky@chu-reims.fr
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