CORRESPONDENCE

Proper use and interpretation of diaphragmatic ultrasonography

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To the Editor,

We read with interest the technical description by El-Boghdadly *et al.*¹ regarding the utility of ultrasound scanning as part of the assessment of diaphragmatic function after brachial plexus blockade. We are appreciative of their admission regarding the novelty of our previously described ABCDE plus sniff technique² and their decision to emulate it as part of their attempt “to further simplify diaphragm ultrasonography” by “using simple surface marking”. Unfortunately, their description neglects the importance of the systematic “step by step” approach we outlined. They also incorrectly claim that gross caudal movement of the pleural line can reliably be used to detect diaphragmatic paralysis. To appreciate the pros and cons of each approach more fully, however, it is important to show clearly where one technique ends and the other begins.

Although not cited in their article, the basis for our use of the sniff test and El-Boghdadly *et al.*'s use of surface markings primarily stem from the original concept of the “ABCDE” approach,³ a mnemonic aid for locating ideal scanning sites to evaluate the diaphragm via intercostal windows rather than hepatic or splenic windows. It involves placing the ultrasound probe at the (A)nterior

axillary line just below the level of the nipple, identifying pleural/lung sliding during (B)reathing, and moving the probe in a (C)audal direction along the axillary line until the (D)iaphragm can be identified and (E)valuated. This mnemonic method utilizes step-by-step landmarking of readily recognizable features, such as lung sliding or movement of the pleural line, to locate the diaphragmatic muscle, which is the primary area of interest. It seems that El-Boghdadly *et al.* intended to describe a new technique of their own by eliminating these systematic steps from the ABC approach - advocating only probe placement at ribs 7-8 (right) or ribs 8-9 (left). By following this course, however, they may have unknowingly reported a technique with a starting location similar to that described by Sarwal *et al.*⁴

More importantly, we question their claim that assessment of diaphragmatic function can be based on the indirect evidence of pleural movement. This approach - based on an indirect inference made from pleural movement, rather than direct visualization of changes in diaphragmatic muscle thickness - is not only susceptible to physiological artefacts, it is subject to the variability of the patient's respiratory effort. Generation of tidal volume and associated pleural movement seen on ultrasonography is the net result of the actions of all inspiratory muscle groups, abdominal muscle groups, and rib cage movement. It does not measure the individual contribution of any single muscle group.⁵ Hence, the caudal extent of the pleural line does not necessarily correlate with diaphragmatic function in the setting of either acute (Figure) or chronic paralysis.⁶ Thus, measurement of muscular thickness has been considered to be sensitive and specific for assessing diaphragmatic function.^{4,6}

We recently performed a pilot study⁷ that showed that the newly described ABCDE approach provided easy

This letter is accompanied by a reply. Please see Can J Anesth 2017; 64: this issue.

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Figure Lung sliding in a patient with a paralyzed diaphragm during deep inspiration. The pleural line was clearly moving caudally although there was no appreciative diaphragmatic muscle thickening (D to D*). (Courtesy of Dr. Christopher Prabhakar, University of British Columbia)

visualization of lung sliding and the diaphragmatic muscle itself. Furthermore, we showed that there was no relation between changes in diaphragmatic thickness and the distance of lung sliding by surface marking. The implication of this observation is that lung sliding or pleural line movement distance recorded by surface marking cannot reliably predict diaphragm thickness changes or vice versa. Thus, cephalad or caudal displacement of the pleural reflection should serve only as an aid for locating the diaphragm, not for assessing its function.

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Conflicts of interest None declared.

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