Diaphragm and lung ultrasound for weaning prediction

Deciding the optimal timing for extubation in mechanically ventilated patients can be challenging, and traditional weaning predictor tools are not very accurate. A new systematic review indicates that diaphragm ultrasound can help predict weaning outcome, although its accuracy may vary depending on the patient subpopulation. The findings will be published in the journal CHEST; the study is already available online as an accepted manuscript.

Current guidelines for weaning recommend the implementation of a spontaneous breathing trial (SBT) as a tool to predict weaning outcome. However, 13% to 26% of patients who are extubated following a successful SBT need to be reintubated within 48 hours. In recent years, multiple indices and parameters have been proposed as predictors of weaning outcome, but none have shown more than modest prognostic accuracy.

There are two proposed diaphragm sonographic predictors: the diaphragmatic excursion (DE), which measures the distance that the diaphragm is able to move during the respiratory cycle, and the diaphragm thickening fraction (DTF), which reflects variation in the thickness of the diaphragm during respiratory effort and is calculated as (thickness at end-inspiration – thickness at the end-expiration)/thickness at the end of the expiration. Ultrasound can detect the decrease of the aeration of the lung parenchyma due to cardiac, respiratory, or diaphragmatic origin. This can be quantified through the so-called lung ultrasound (LUS) score, a validated scale whose values range from 0 to 36 points, obtained from the sum of the grades assigned to different ventilation patterns observed in every area of the lung scan.

This systematic review and meta-analysis aimed to assess the accuracy of the lung and diaphragm ultrasound, in particular the DE, DTF and LUS score, for predicting mechanical ventilation (MV) weaning outcomes in critically ill adults. The review team carried out a literature search online to identify potentially relevant studies. Two researchers independently selected studies that met the inclusion criteria and assessed study quality in accordance with the Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool. The summary receiver operating characteristics (SROC) curve and pooled diagnostic odds ratio (DOR) were estimated using a bivariate random-effects analysis. The team explored sources of heterogeneity using predefined subgroup analyses and bivariate meta-regression.

The analysis included 19 studies involving 1,071 people. For DTF, the area under the SROC curve (AUSROC) was 0.87, and DOR was 21 (95% confidence interval (CI): 11, 40). Regarding DE, pooled sensitivity was 75% (95% CI: 65, 85); pooled specificity, 75% (95% CI: 60, 85); and DOR, 10 (95% CI: 4, 24). For lung ultrasound, AUSROC was 0.77 and DOR 38 (95% CI: 7, 198). Based on bivariate meta-regression analysis, the team detected a significantly higher specificity for DTF and higher sensitivity for DE in studies with applicability concerns.

The findings suggest that DTF, LUS score and to a lesser extent DE can provide valuable information for predicting weaning outcome, but taken alone, they may not perform as well as individual studies suggest, the review team said.

The team highlighted that all the reviewed studies implemented ultrasound only in patients previously classified as "ready to wean" by traditional assessment; however, it is unknown how many patients would meet this criterion according to ultrasound alone, while failing to fulfil traditional parameters.

"More high-quality studies that rigorously assess the ultimate role of diaphragm and lung ultrasound in critically ill patients – not only its accuracy and applicability – are needed," the authors wrote.

Source: CHEST
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