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EDITORIAL

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Ultrasound of the lung: just imagine

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Imaging techniques have improved tremendously in recent decades. Digital chest radiography, magnetic resonance, and multislice spiral computed tomography (CT) are only a few examples of improved technology, and improved contrast media have also made contrast imaging much safer. Critically ill patients, however, have not always benefited from these advancements. Indeed, the paradox in intensive care has been that the sicker the patients, the poorer is the imaging. Portable chest radiography is of relatively poor, blurred imaging quality as it lacks a lead grid for scatter reduction, and therefore subtle abnormalities may go undetected on portable chest radiography that might otherwise be visualized. Chest CT appears to yield much information than conventional portable chest radiography both in the clinical evaluation of patients and in research settings for the acute respiratory distress syndrome [1, 2, 3, 4]. Indeed, chest CT has been recommended in cases of severe acute respiratory distress syndrome [5], but, again, the paradox is that those who might benefit most run the highest risks during transport and imaging. Although intrahospital transport is relatively safe [6], these patients poorly tolerate being lifted onto the CT table and then lifted back into bed.

Point-of-care ultrasound examination (US) would conceivably provide the ideal imaging tool, but US of the lungs has traditionally been considered an inappropriate technology as thoracic gas renders the chest inaccessible to US examination. US has become popular in the ICU for abdominal, soft tissue, and pleural evaluation, especially for imaging guidance of bed-side procedures such as abscess drainage and the detection and evaluation of pleural effusions [7]. Evaluation for possible pneumothorax would provide yet another important application of pleural US, but the published experience is limited, as is the evidence provided for its applicability [8]. Us can demonstrate consolidation due to atelectasis of the left lung after selective intubation of the right main bronchus, as recently reported in *Intensive Care Medicine* [9]. Daniel Lichtenstein et al. [10] now report the use of US in the diagnosis of alveolar consolidation in patients admitted to the ICU, with a significant proportion of them being mechanically ventilated. Using standard methods for validation of this new test, with evaluation of interobserver error, they demonstrated good concordance of US evaluation with a satisfactory κ test result (0.89). CT carried out less than 6 h before US was used as gold standard for comparison. The authors provide the first published evidence that US may provide an important tool in the evaluation of patients with various forms of alveolar consolidation.

This first report in the English-language literature to show the potential of this elegant bed-side imaging technique should be interpreted cautiously, however. First, the number of observations is relatively small—only 30 ventilated patients with acute respiratory distress syndrome were evaluated—and the number of examiners was only two. The two examiners are highly dedicated with extensive experience in US, as evidenced by their track record in the literature [8, 9, 10]. More importantly, their measurements in the middle range of abnormalities was less precise than at the extremes of the spectrum compared with CT. Finally, technical failures occurred when the chest wall was covered, for example, by dressings.

US provides an imaging test with very little if any toxicity or adverse effects. However, the history of intensive care medicine should caution one to ask for

validation and clinical evaluation before introducing any new technology in the clinical arena, the debate over the pulmonary artery catheter being a pungent example [11, 12]. There are generally four stages in the development of a new test (or a new therapeutic technology, for that matter) that should be passed before such test should be introduced into research settings or the clinical arena: development, validation, management impact, and patient benefit [13]. The authors have provided only the first two stages of this process, by developing and validating the proposed method for alveolar consolidation (atelectasis, pneumonia, and edema); further validation is thus needed. Reliability should now be tested in an array of pulmonary abnormalities in the setting of the ICU, and preferably in ventilated patients who run risks in CT evaluation. Finally, to justify the wide use of US in ICU patients suspected of having pulmonary alveolar consolidation some benefit should be shown for the patients themselves, for example, early detection of potentially harmful complications that warrant intervention, or substitution of CT by US. Before we can be sure that patients benefit from thoracic US examination, we should consider the test experimental and use it for research purposes—after appropriate consent has been obtained.

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