

A Practical Approach to Intensive Care Imaging

Imaging and intensive care medicine have become inextricably intertwined in recent decades. One of the reasons is that physical examination can be often difficult in the ICU setting. On the other hand, the interpretation of portable ICU chest x-rays may also be difficult, due to common technical limitations, the patient's condition, and the presence of devices inside the thorax or on the patient that commonly overlap and obscure portions of the chest.

There has been controversy regarding the role of routine chest x-ray in the ICU, and for years the practice was based on old data. Studies from the 1980s documented the cost-effectiveness of the ICU radiographs, showing that 40–65% of all exams reveal unexpected or abnormal findings, often affecting the patient management.¹ Over the years, however, the routine daily chest x-ray progressively appeared less useful, especially in the cardiothoracic ICU, and recent large meta-analyses and prospective studies confirmed these findings.²

A few years ago, the American College of Radiology published its appropriateness criteria and established that a daily radiograph is indicated for patients with acute cardiac and/or pulmonary problems, and for patients on assisted mechanical ventilation.³ Only a post-procedure exam is appropriate in patients with central venous lines, feeding tubes, pleural drainage, and pulmonary artery catheters. Patients with stable cardiac function or pure extrathoracic problems usually do not require routine chest x-rays, but only one on admission.

Clinicians should also consider the problem of radiation level, especially in infants, children, and young adults. Because the range of radiation exposure can be great with different radiologic procedures and because of a number of individual factors (for example, region of the body, patient size), the American College of Radiology produced a relative radiation level indication for each examination, based on the effective dose. In the adults, the relative radiation level associated with a chest portable x-ray is considered low (< 0.1 mSv), but repeated exams or additional computed tomography (CT) studies can substantially increase the radiation dose.

Today the increasing availability of multimodal technology is refining the diagnostic strategies for evaluating patients in the ICU with different respiratory disorders. However, clinicians and radiologists cannot disregard the interpretation of the bedside chest radiography, which still

represents the cornerstone of diagnosis and monitoring of ICU patients. Interpreting bedside chest radiography is regarded as one of the most challenging tasks for radiologists, owing to its intrinsic and above cited limitations. It is incumbent upon the radiologist to extract as much useful information as possible from this less-than-ideal image, also because many logistical issues specific to ICU patients (eg, hemodynamically unstable patients, constant requirement of many medical devices, etc.) often hinder use of CT.

The review by Eisenhuber et al⁴ provides several hints that may facilitate clinicians in interpreting both imaging findings and corresponding radiologists' reports. A systematic approach to the interpretation of the bedside chest radiograph is recommended to minimize overlooking important findings such as malpositioned tubes and other complications. Furthermore, the authors emphasize that an integrated clinical-radiological approach is of substantial value for the interpretation of the frequently nonspecific findings. Thus, the radiologist can usually offer a sensible diagnosis or, at worst, a limited list of differential diagnoses.

A review of the radiology, together with the clinical features, may be diagnostic in some instances (eg, bilateral lobar opacification in a patient with pyrexia and a productive cough is most likely to be due to infection instead of pulmonary edema). Such an interactive approach is now particularly important, as the digital techniques and the picture archiving and communication systems might reduce communication between clinicians and radiologists. Further, the review by Eisenhuber et al⁴ deals with the debate on the cost-effectiveness of routine daily chest radiographs in the ICU, which still seems not completely resolved.

Chest ultrasonography is a noninvasive and readily available imaging modality that has important applications in pulmonary medicine either within or outside of the ICU. Gardelli et al⁵ review basic chest ultrasonography signs that both clinicians and radiologists should become familiar with for optimizing ICU patient management. They discuss how chest ultrasonography might prove its worth as a strategic instrument to be used directly after the clinical investigation.

The ability to either diagnose or corroborate the radiographic assessment of common pleuro-parenchymal dis-

eases, such as pneumothorax, pleural effusion, or interstitial syndrome, might decrease useless or redundant radiologic examinations, thus reducing radiation exposure. The review by Sheard et al⁶ discusses the characteristic CT appearances of ARDS from onset to resolution, the complications of CT interest, and the differential diagnosis. Interestingly, the authors clarify how much imaging information may fulfill some of the most common clinical queries for patients with ARDS, such as: Can CT identify etiology? Can CT be used to direct ventilation? Can CT provide relevant prognostic information? Such a practical approach enables readers to easily understand the most critical issues related to ARDS imaging.

These recent reviews in *RESPIRATORY CARE* are a must-read for anyone caring for mechanically ventilated patients in the ICU.

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