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Optimizing Chest Imaging Reports in Critical Care

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Chest, Optimizing, Report, Ultrasound, X-Ray.

Introduction

Thoracic ultrasound is increasingly used in critical care, offering portability, no ionizing radiation, and diagnostic capabilities. Despite high acoustic impedance, clinicians exploit ultrasound artifacts as diagnostic landmarks. Performed by clinicians, it complements other imaging. Here, we highlight ultrasound's advantages over chest X-ray (CXR) and suggest augmenting the radiological report with ultrasound findings which add to the accuracy and the diagnostic value of the report.

Limitations of Chest X-Ray

Chest X-ray remains a mainstay in critical care but has inherent limitations:

1. **Reduced Sensitivity**: Small pneumothoraxes and subtle pleural abnormalities may go unnoticed.
2. **Limited Fluid Detection:** Mild or moderate fluid accumulations are often underappreciated.
3. **Diagnostic Delays**: Even a portable X-ray requires processing time, which can stall urgent interventions.

Advantages of Thoracic Ultrasound

Ultrasound offers significant advantages over CXR in several scenarios:

1. **Pneumothorax:** M-mode findings, including the seashore sign, allow rapid diagnosis at the bedside; the "lung point" can definitively confirm a pneumothorax.
2. **Pleural Effusions:** Ultrasound is the gold standard for detecting and quantifying fluid in the pleural space, enabling precise guidance for procedures like thoracentesis. Its sensitivity surpasses CXR.
3. **Pulmonary Edema:** Identification of B-lines (comet tail artifacts) provides a sensitive assessment of alveolar-interstitial fluid accumulation.
4. **Atelectasis:** When correlated with CT, ultrasound demonstrates higher sensitivity and specificity for detecting atelectasis compared to standard CXR.

Table 1: Attenuation and Imaging Characteristics of Different Tissue Types.

Type of Tissue	Half Power Distance (cm)	Degree of Attenuation	Degree of Tissue Penetration	Image Color
Water	380	Minimal	Very High	Anechoic (Black)
Blood	15	Low	High	Anechoic
Soft Tissue	1–5	Intermediate	Intermediate	Hypoechoic (Gray)
Muscle	0.6–1.0	High	Low	Hypoechoic (Gray)
Bone	0.2–0.7	Very High	Very Low	Hyperechoic (White)
Air	0.08	Maximal	Impermeable	Hyperechoic

Though imaging air-filled structures can be challenging, characteristic artifacts and dynamic signs often offset this limitation.

Proposal: Considering the Chest Ultrasound Findings in CXR Reporting

In many institutions, radiologists handle all CXR interpretations, though their workload can be immense. Meanwhile, critical care physicians often perform bedside ultrasound and interpret images in real time [1,2]. By integrating their expertise into the formal

reporting process, several benefits could follow:

1) **Enhanced Diagnostic Accuracy:** Correlating real-time ultrasound data with CXR improves detection of pneumothorax, effusions, and other acute issues.
2) **Streamlined Care**: Rapid bedside assessments expedite clinical decisions, such as chest tube placement or thoracentesis.
3) **Collaboration:** Bringing radiologists, critical care physicians, and other specialists together fosters a team-based approach to patient care.

Conclusion

Chest X-ray remains indispensable in critical care practice, yet ultrasound excels in identifying pneumothorax, pleural effusions, pulmonary edema, and atelectasis. Given the constraints and urgency of intensive care, involving critical care physicians with ultrasound expertise can yield more comprehensive, timely imaging reports. Such collaboration does not replace radiologists but complements their broader diagnostic role, ultimately improving patient outcomes and efficiency in high-pressure environments.

References

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