

Comparative Performance of Pulmonary Ultrasound, Chest X-ray, and CT Amongst Patients with Acute Respiratory Failure

SUPPLEMENTAL CONTENT 1 – Lung Ultrasound Protocol Comparison

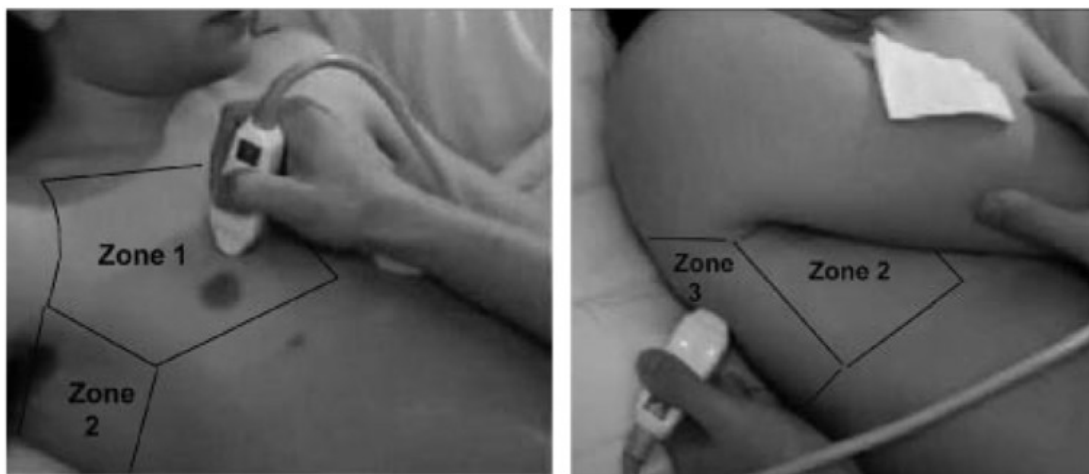
9-Point Pulmonary Ultrasound Protocol Rationale & Comparison

Several previously published lung ultrasound exam protocols vary in their zone locations and quantity (1–3) including the 9-point protocol used by our group in a previous study (4) (see Supplemental Figures 1-4 below). Our 9-point protocol zones most closely resemble those of the 8-zone protocol from Volpicelli et al. (1) (see Supplemental Figure 2 below).

The 9 lung zones included in our protocol reflect a clinical examination in an applied setting. A clinical PU examination sequence often involves conceptual lobar anatomy, and thus the right lateral, caudal area was divided into both an anterior (zone 4) and posterior zone (zone 3) over the right middle and lower lobes respectively. Designation of an “extra” zone in the right lung, in addition to being clinically relevant, can be physiologically rationalized based on the greater total lung capacity of the right lung (5) especially in the setting of lung scoring algorithms quantifying the extent of lung pathology. This zone is included in the 28-zone protocol from Drs. Baldi and Gargani as the right 5th intercostal space on the anterior axillary line (3) (see Supplemental Figure 3 below). Of interest, 3.9% of our patients in the original 250 patient study cohort, all with aspiration or pneumonia diagnoses, had ultrasound findings isolated to the right lateral, caudal zone on the anterior axillary line (zone 4) that would have been missed if that “extra” zone was not included in the examination protocol (4).

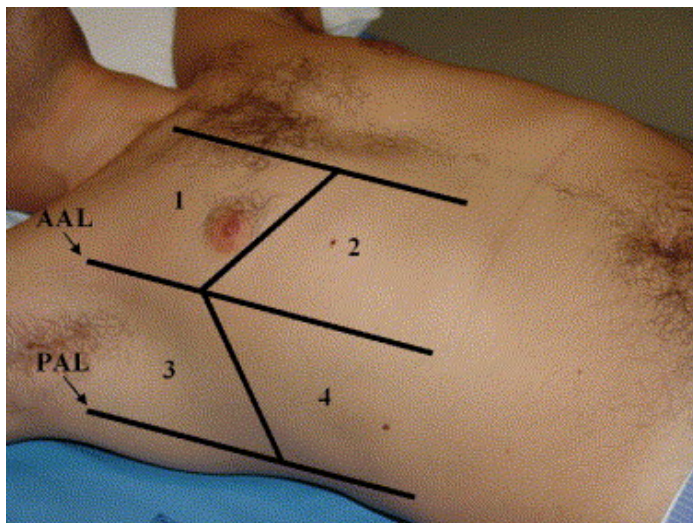
Our 9-point protocol used in this study, restricted ultrasound interrogation of an area no larger than the area of our hospital name badge (7.5 x 5 cm) within the center of each zone. Previous studies using the other 3 protocols referenced below often allow complete interrogation of the chest wall or an entire interspace within the zone.

COMMON LUNG ULTRASOUND PROTOCOL COMPARISON




Supplemental Figure 1. 6-zone scanning protocol from Drs. Lichtenstein and Mezière.

Figure reprinted from *CHEST*, Volume 134, Lichtenstein DA, Mezière GA. Relevance of Lung Ultrasound in the Diagnosis of Acute Respiratory Failure*: The BLUE Protocol. Pages 117-125, Copyright (2008), with permission from Elsevier. <https://www.sciencedirect.com/journal/chest>



Supplemental Figure 2. 8-zone scanning protocol from Volpicelli et al.

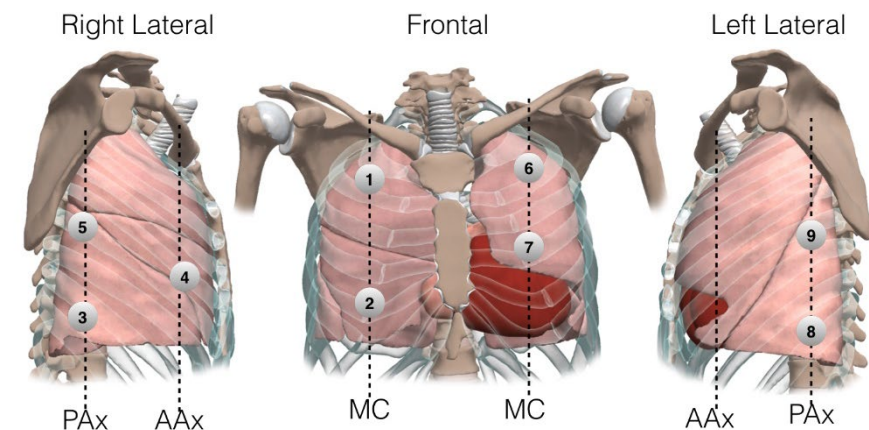
Figure reprinted from *Am J Emerg Med*, Volume 24, Volpicelli G, Mussa A, Garofalo G et al. Comparative Performance of Pulmonary Ultrasound, Chest X-ray, and CT Amongst Patients with Acute Respiratory Failure. Pages 689-696, Copyright (2006), with permission from Elsevier. <https://www.sciencedirect.com/journal/the-american-journal-of-emergency-medicine>



	Mid-axillary	Anterior axillary	Mid-clavicular	Para-sternal	Inter-costal space	Para-sternal	Mid-clavicular	Anterior axillary	Mid-axillary	
					2					
					3					
					4					
					5					

Supplemental Figure 3. 28-zone antero-lateral scanning protocol from Drs. Baldi and Gargani et al.

Figure reprinted by permission from: Springer Nature, *Intensive Care Medicine*; 2013; 39:74-84. Lung water assessment by lung ultrasonography in intensive care: a pilot study. Baldi G, Gargani L, Abramo A et al., Copyright 2013.



Supplemental Figure 4. 9-point scanning protocol used in this study.

REFERENCES

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