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LETTER

Six versus eight and twenty-eight scan sites for B-line assessment: differences in examination time and findings

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Dear Editor,

Debate exists on the optimal number of sites scanned during lung ultrasound (LUS) [1, 2]. The number of scan sites used or even recommended ranges from just 4 to 28 sites for identifying congestion [3]. We estimated that the commonly used six-scan site BLUE protocol in critically ill patients [4] is a time-efficient alternative compared to 8 and 28 sites and would not result in clinically relevant different findings. We, therefore, added a sub-study during our ongoing research within the SICS-II cohort [5].

The SICS-II is a single-center, prospective observational study designed to evaluate the prognostic and diagnostic value of clinical examination and Critical Care Ultrasonography (CCUS), in critically ill patients. All acutely admitted patients underwent CCUS according to a predefined protocol for measurements of the heart, lung, vena cava and kidney [5]. For this sub-study, we additionally performed LUS using three different protocols: protocol A: 6 scan sites [4]; B: 8 scan sites; and C: 28 scan sites. LUS was performed using a phased array probe (M3S or M4S) set at a frequency of 3.7 MHz, a depth of 15 cm and maximal image width (Vivid-S6, GE Healthcare, London, UK). Trained researchers performed the LUS under supervision of an expert cardiologist-intensivist. One researcher obtained all images for all three protocols during one session. We measured the time of examination for each protocol and recorded the number of B-lines (0–5) per scan site during two heart

cycles. To compare the relative amount of B-lines, we divided the number of observed B-lines by the maximum possible amount of B-lines per protocol (A: $6 \times 5 = 30$, B: $8 \times 5 = 40$, C: $28 \times 5 = 140$ B-lines). Researchers were not involved in patient care and instructed not to share their findings with the attending physicians.

The SICS-II study ran from May 15, 2018, to July 10, 2019, and included 1010 patients. During the last months, we included a convenience sample of 20 patients in this sub-study, with a median age of 65 years. Eleven patients (55%) were mechanically ventilated, and ten patients (50%) were receiving vasoactive medication during the examination. The median time of the examination was shorter in A versus B and C, the median number of observed B-lines was lower in B versus A and C, and the relative number of B-lines was similar for different protocols (Table 1).

In this pilot study, we show that the time of examination is significantly shorter using the protocol, including six scan sites. Besides, the relative amount of B-lines observed is equal irrespective of the number of scan sites in different protocols. These results question the necessity of more than six LUS scan sites to detect signs of congestion. Since time is valuable in the care of critically ill patients, the principle of less is more comes to mind. The results have to be validated in a larger sample but currently challenge the recommendation of scanning more sites to be able to assess signs of congestion.

SICS Study Group

Nora A. Spraakman, Jildau A. Meinderts, Justin D. Postma, Arlinde J. Roelofs, Leonie Tijms (patient inclusions for this sub-study) Renske Wiersema, Geert Koster, Frederik Keus, Iwan CC van der Horst (project leaders).

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Table 1 Results: time for examination and number of B-lines per protocol used

	A	B	C	p value
Time of examination, minutes [#]	1.39 (1.23, 2.01)	2.26 (2.05, 2.46)	5.43 (5.05, 6.2)	< 0.001
Number of B-lines [#]	3 (2, 5)	2.5 (1, 4.5)	10 (5, 20.5)	< 0.001
Relative number of B-lines ^{**}	0.1 (0.1, 0.2)	0.1 (0, 0.1)	0.1 (0, 0.1)	0.48

[#] Median [IQR]

^{**}The total number of observed B-lines divided by maximum possible amount of B-lines per protocol (A: 30, B: 40, C: 140 B-lines)

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Compliance with ethical standards

Conflicts of interest

The authors declare that they have no conflict of interests.

Ethics approval and consent to participate

In unresponsive patients, informed consent was first obtained from the legal representatives. Consent for use of the study data was asked at a later time if the patient recovered consciousness. If the patient died before consent was obtained, the study data were used, and the legal representatives were informed of the study. The study was approved by the local institutional review board (METc M18.228393).

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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