

Assessing left ventricular systolic function by emergency physician using point of care echocardiography compared to expert: systematic review and meta-analysis

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Supplemental Digital Content

Appendix 1:

MeSH terms and search terms used for the literature review and supplementary searching recourses.

Query box search:

((2 d echocardiography[MeSH Terms] OR ("echocardiography"[MeSH Terms])) AND ((emergency medicine[MeSH Terms] OR (emergency service, hospital[MeSH Terms] OR (emergency care[MeSH Terms] OR (emergency services, medical[MeSH Terms])))) OR (((emergency*) AND ((echocardiograph*) OR (POCUS) OR (FOCUS) OR (bedside echo) OR (cardiac ultrasound))) AND ((sonograph*) OR (cardiol*) OR (Fellow*) OR (expert)) AND ((LV*) OR (left ventricle) OR (ejection fraction) OR (systolic*)) AND ((agreement) OR (reliability) OR (accuracy) OR (correlation) OR (comparison))) AND ((humans[Filter]) AND (english[Filter]))).

Supplementary searching:

Annals of Emergency Medicine Journal, European Journal of Emergency Medicine EJEM, Emergency Medicine Journal EMJ, European Medicines Agency EMA, Journal of Emergency Medicine JEM, *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* SJTREM, Academic Emergency Medicine AEM and The American Journal of Emergency Medicine AJEM.

Appendix-2:

QUADAS-2 Signalling questions for patient selection, index test, reference standard and flow and timing with details for QUADAS-2 process of rating as low, high, or unclear risk of bias.

Patient Selection: The risk of spectrum bias was tested by the following signalling questions:

- Signalling question 1: Was a consecutive or random sample of patients enrolled?
- signalling question 2: Was a case-control design avoided?
- Signalling question 3: Did the study avoid inappropriate exclusions?
- Signalling question 4: Are there clear patient selection criteria that are rigorously applied?
- Signalling question 5: Do the patients selected for the study reflect patients who will receive POC echocardiography in practice?

Low risk of bias of a study was defined if the patients were consecutively recruited in the study with any selection (e.g., by physiological parameters) defined a priori.

Studies recruiting convenience samples were considered having high risk of bias.

Sonographic studies that excluded patients because of lack of feasibility (for example, body habitus, poor acoustic windows) were also considered to be at high risk for bias.

Index Test: The Risk if bias was tested by the following signalling questions:

- Signalling question 1: Were the POC echocardiography test results interpreted without knowledge of the results of the reference standard?

- Signalling question 2: If a threshold was used, was it pre-specified? Was there a priori specified agreement on windows to use & how-to assess & report cardiac function?
- Signalling question 3: Did all patients receive POC echocardiography?
- Signalling question 4: Were the methods of performing POC echocardiography adequately described?
- Signalling question 5: Are the numbers accurately presented and were the results presented clearly with correct statistical tests?
- Signalling question 6: Was the POC echocardiography performed by practitioners having similar clinical information to 'real life' practice?
- Signalling question 7: Were equivocal or technically impossible scans reported (and how)?

The index test was defined as the POC echocardiography performed by a clinician sonographer. The Index test was considered as low risk of bias if performed blind to the reference standard against a priori defined protocol (machine type, transducer, windows, method of assessment, and the performer). Studies that did not account for all patients who received both index and reference standard were considered high risk. Studies that included a selected group of clinician sonographer to perform the index test (e.g., a subgroup of more highly trained emergency physicians) were considered high risk.

Reference Standard: The Risk of bias was tested by the following signalling questions:

- Signalling question 1: Is the reference standard likely to correctly classify the target condition?
- Signalling question 2: Were the reference standard results interpreted without knowledge of the results of the index test?
- signalling question 3: Were the methods of performing reference echocardiography adequately described?

This was echocardiography performed or reported by expert sonographer. The reference standard was considered as low risk if the expert sonographer reported video clips and images of echocardiograms performed by clinician sonographer, or the expert sonographer performed echocardiograms using the same equipment or different equipment to clinician sonographer, or expert sonographer reported video clips and images of echocardiogram performed by a sonographer (comprehensive TTE). If expert sonographer was not blinded to POC echocardiography results of clinician sonographer, the studies reference standard was rated high risk.

Flow and Timing: The Risk of bias was tested by the following signalling questions:

- Signalling question 1: Was there any delay between FOCUS ECHO and reference Standard that could impact findings?
- Signalling question 2: Did all patients receive the same reference standard?
- Signalling question 3: Were all patients accounted for and included in the analysis?

Ideally, the index and reference tests should be performed with minimum time separation. Where the expert sonographer reported reference, echocardiogram was performed at a different time to the index test the time interval was recorded. Low

risk was defined as when index and reference tests used the same images/videos or if the reference echocardiogram was performed immediately before or after the index POC echocardiography. We reported high risk of bias if the index and reference tests were performed at different times and /or if the patient received any intervention that may alter left ventricular performance between the studies. The type of ultrasound machine and transducers used by the reference or index test were not assessed for or considered as a risk of bias.

Additional legends for illustrations:

Figure 4: Forest plot of sensitivity and specificity of POC echocardiography by clinician sonographer for the assessment of LVSF as compared to expert sonographer. “Positive” finding defined as abnormal LVSF and “Negative” finding defined as normal LVSF.

Figure 5: Forest plot of positive and negative likelihood ratio of POC echocardiography by clinician sonographer for the assessment of LVSF as compared to expert sonographer.

Table 5: Data extraction for analysis.

Figure 6: Deeks funnel plot for publication bias.

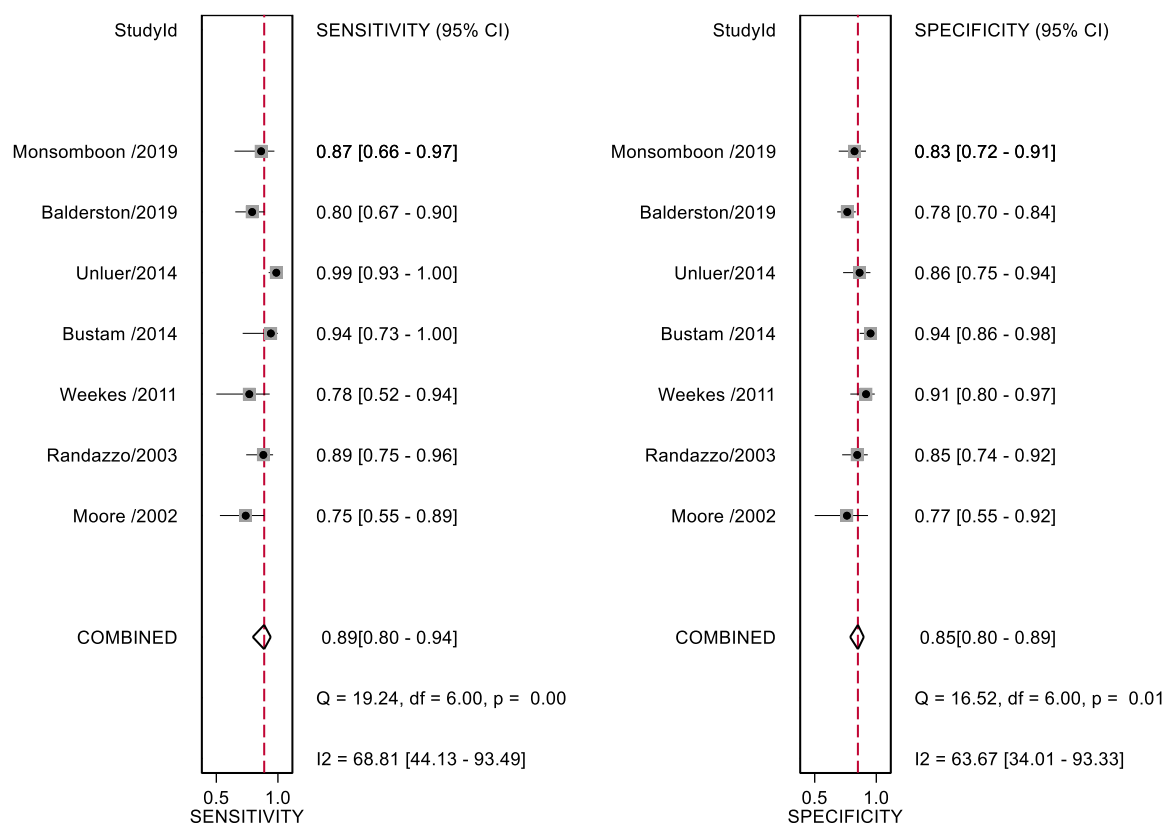


Figure 4: Forest plot of sensitivity and specificity of POC echocardiography by clinician sonographer for the assessment of LVSF as compared to expert sonographer. “Positive” finding defined as abnormal LVSF and “Negative” finding defined as normal LVSF.

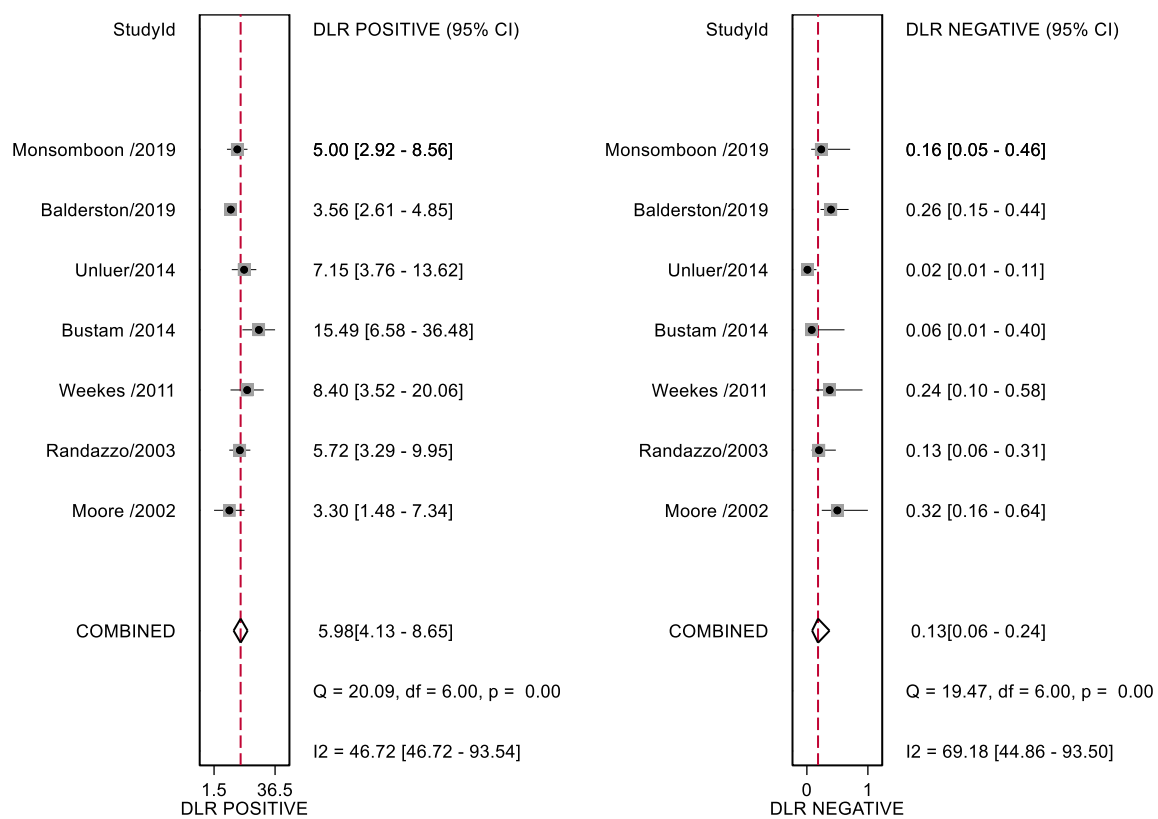


Figure 5: Forest plot of positive and negative likelihood ratio of POC echocardiography by clinician sonographer for the assessment of LVSF as compared to expert sonographer

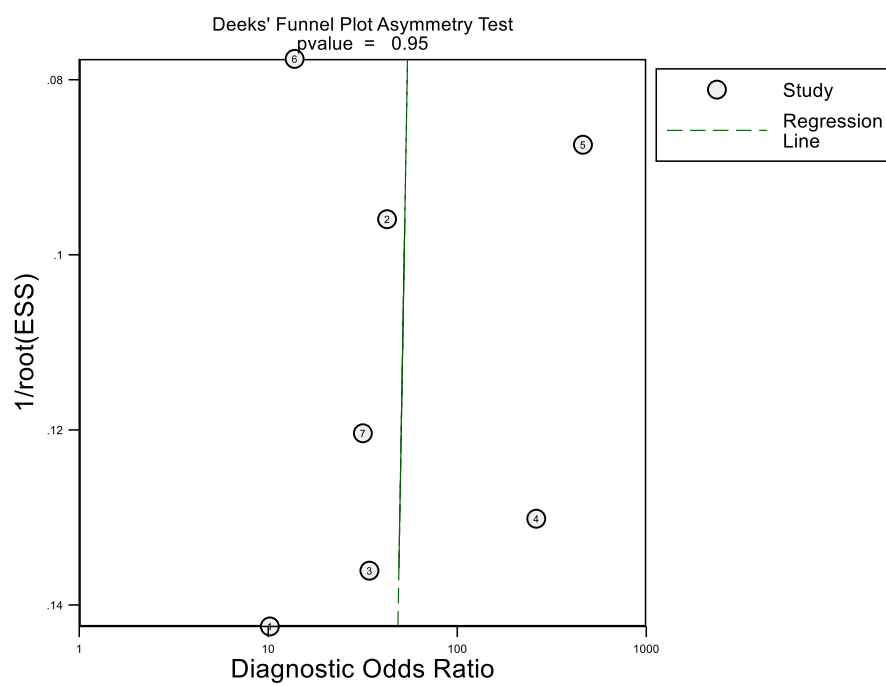


Figure 6: Deeks funnel plot for publication bias

Table 5: Data extraction for meta-analysis.

POC echocardiography method for LVSF assessment by clinician sonographer: Visual estimation	Analysis sample (number of scans)	Number of scans rated by expert sonographer						Number of scans rated by clinician sonographer						Number of Agreements between clinician sonographer and expert sonographer				Total Number of Agreement
		Normal			Abnormal			Normal			Abnormal							
		Hyperdynamic	Normal	SUM	reduced	Severely reduced	SUM	Hyperdynamic	Normal	SUM	reduced	Severely reduced	SUM	Hyperdynamic	Normal	reduced	Severely reduced	
Moore et al. [25]	50	NA	22	22	18	10	28	NA	24	24	16	10	26	NA	17	9	8	34
Randazzo et al. [29]	115	NA	71	71	23	21	44	NA	65	65	23	27	50	NA	60	11	19	90
Weekes et al. [31]	72	21	32	53	16	3	19	14	40	54	15	3	18	10	25	10	2	47
Bustam et al. [33]	100	NA	82	82	1	17	18	NA	78	78	6	16	22	NA	77	0	16	93
Ünlüer et al. [35]	133	NA	58	58	NA	NA	75	NA	51	51	NA	NA	82	NA	50	NA	NA	124
Balderston et al. [26]	224	NA	169	169	NA	NA	55	NA	142	142	NA	NA	82	NA	131	NA	NA	175
Monsomboon et al. [27]	92	NA	69	69	12	11	23	NA	60	60	24	8	32	NA	57	9	7	73

POC; Point-Of-Care, LVSF; left ventricular systolic function.