EVMS JC: Critical Appraisal Worksheet: Systematic Review/Meta-analysis

Resident: Spyratos **Date: 3/22/23**

Citation: McGivery K et al., Emergency department ultrasound for the detection of B-lines in the early diagnosis of acute decompensated heart failure: a systematic review and meta-analysis. CJEM. 2018 May;20(3):343-352.

Guide	
1. Did the review explicitly address a sensible question?	Yes – Does the finding of B-lines on bedside US lead to more appropriate and timely diagnosis of patient's w/ undifferentiated ADHF specifically in the Emergency Department
2. Was the search for relevant studies details and exhaustive?	Yes – Systematic search of EMBASE, Med-Line (PubMED), Cochrane Library, Grey literature looking for prospective studies reporting on sensitivity and specificity of B-lines from early lung ultrasound in dyspneic patients.
3. Were the primary studies of high methodological quality?	Yes. Authors followed PRISMA Guidelines for developing a systematic review. 1. Strict inclusion and Exclusion criteria: prospective studies needed to report on the sensitivity and specificity of B-Lines in dyspneic ED patients with a **reference standard** chart review for ADHF as the final diagnosis found by all assessments/diagnostic results EXCLUDING lung US. 2. Two reviewers independently based on the title and abstract review of the search results and then were individually reviewed – any uncertainty about the relevance of the study was automatically included for full-text scoring and disagreements were resolved by consensus. 3. All studies meeting the inclusion criteria also met the requirements for methodological quality using a validated CASP questionnaire domains that include:

Deleted: 3/27/2023

	blinding of the results, use of an appropriate reference standard, and reporting of the specificity and sensitivity of the B-lines.
4. Were the criteria for study inclusion pre-determined and clearly stated?	Yes – See above.
5. Did the authors adequately assess the quality of the included studies?	Yes – All studies meeting inclusion criteria also met requirements for methodological quality using CASP questionnaire including blinding of results, use of appropriate reference standard, reporting of specificity and sensitivity of B-lines. Studies were included if data was available from the author or through extrapolation of presented data. No studies were excluded based on the quality assessment.
CLINICAL IMPORTANCE	
6. What were the overall results of the review? *(Are the results of all included studies clearly displayed? Are the results similar from study to study? Is there a clinical bottom line? If the study results combined, was it appropriate to do so?)*	Pooled sensitivity and specificity were 82.5% (95% CI 66.4%–91.8%) and 83.6% (95% CI 72.4%–90.8%), respectively. The positive likelihood ratio was 4.840 (95% CI 2.57–9.09), and the negative likelihood ratio was 0.189 (95%CI 0.09–0.39) Heterogeneity I^2 92% A second meta-analysis including physician-only sonographer studies (excluded studies involving medical students and residents) was conducted (5 studies). sensitivity and specificity estimates of 88.6% (95% CI 79.6%–94.0%) and 83.2% (95% CI 63.2%–93.5%), respectively. I^2 77.2 For comparison, previously reported sensitivity and specificity of CXR alone being 57% and 78% respectively. There was high inter-rater reliability when comparing novice sonographers and excerpts likely 2/2 to simplicity of Lung U/S.
8. Were the results similar from study to study?	There was significant heterogeneity between the studies that were selected. Subgroup analysis showed this to be from sample sizes and studies that included learners contributed to this however

Deleted: 3/27/2023

	likely additional factors such as protocol, patient population, timing of U/S. The studies that included learners represented outliers in the data and after a second meta-analysis reduced the level of heterogeneity and modestly improved diagnostic accuracy. It is important to note that this made the diagnostic accuracy more reliable however the sample size for physician only analysis was small.
APPLICABILITY	
9. How can I best interpret the results to apply them to the care of my patients?	Early bedside lung US can be an excellent clinical tool to use rapidly at the bedside for undifferentiated dyspnea patients that you have a high clinical suspicion for Heart Failure
10. Were all patient important outcomes considered?	Only one outcome was studied, Use of US in the ED and a final diagnosis of ADHF. Outcomes such as time to make diagnosis, avoidance of harms from diuresis of non-ADHF patients, cost analyses were not considered
11. Are the benefits worth the costs and potential risks?	Yes – Fast, low cost bedside test that can quickly lead to an accurate diagnosis when taken into the clinical picture of patients. Seems to retain acceptable sensitive and specificity in the novice clinician.

Limitations:

Heterogeneity – sample sizes, four different countries w/ varied hospital sizes, Variable timing of scans, treatment initiation prior to scan, No gold standard for diagnostic test of ADHF so retrospective data reviewed by human interpretation, and possible misinterpretation as B-lines can be found in ARDS, Multi-lobar pneumonia, TB, etc. Level of training differed in each study even though each study had formal training.

Clinical Bottom Line:

POCUS, in the right clinical context, can be a great adjunct to help diagnose and initiate treatment for ADHF.

Deleted: 3/27/2023