Critical Review Form
Cohort Study

PGY-3

Reardon RF, Chinn E, Plummer D, et al. Feasibility, utility, and safety of fully incorporating transesophageal echocardiography into emergency medicine practice. Acad Emerg Med. 2022 Mar;29(3):334-343.

Objectives: **" to report: (1) feasibility, as determined by the acquisition of interpretable images; (2) quality of those images, compared to traditional POC [point-of-care] TTE [transthoracic echocardiography], particularly by non-US faculty; and (3) safety." (p. 335)**

Methods: **This retrospective, observational cohort study included all cases in which a F-TEE [focused transesophageal echocardiography] was performed at Hennepin County Medical Center in Minneapolis, MN between April 26, 2017 and October 1, 2020. During this period, physicians were free to use TEE whenever they felt it might be useful in intubated patients. Prior to this, most (40 of 52) full- and part-time faculty underwent training and credentialing in F-TEE through a 4-h workshop that involved didactics and hands-on experience with a high-fidelity simulator, followed by a brief standardized assessment. All remaining physicians (n = 12) underwent subsequent training for new faculty or recredentialing. All F-TEE studies were reviewed for quality assurance.**

Information was retrieved from Qpath, a program in which nearly all F-TEEs were recorded and stored, and from the medical record. Indications for F-TEE were separated into 3 categories: 1) ongoing cardiac arrest, 2) pre- or post-arrest, and 3) shock. Physicians who performed F-TEE were divided into 2 groups: 1) US faculty, which included those who had completed an US fellowship or had other advanced US training (n = 10), and 2) non-US faculty (n = 42). Recorded US images were graded on image quality by US faculty and labeled as "good" (standard views with important anatomy clearly identified, "fair" (not ideal but sufficient to answer clinical questions), or "poor" (uninterpretable). The primary outcome was whether the provider was able to insert the probe, obtain images, and interpret them in the electronic medical record. This did not require images to be saved or to be interpreted properly. Secondary outcomes were the quality of the images, quality compared to TTE (when performed), and immediate procedural complication (displacement of the ET tube, blood on the probe requiring transfusion or endoscopy, or esophageal perforation).

A total of 557 F-TEEs were attempted during the 42-month study period. All 52 faculty performed at least 1 F-TEE, with a median of 10 (IQR 5-15). Three-fourths of F-TEEs were performed by non-US faculty. The median age of the patients was 58 and 68.2% were male.

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Guide	Comments
Are the results valid?	
Did experimental and control groups being the study with a similar prognosis?	
Did the study address a clearly focused issue?	No. The authors sought to evaluate the feasibility of performing TEE in the ED and the quality if images obtained, but did not ask any specific questions or identify any outcomes of interest. As a result, the study is at high risk of data mining in order to justify the use of TEE in the ED.
Did the authors use an appropriate method to answer their question? - Is a cohort study a good way of answering the question under the circumstances?	Yes. Given the decision to look rather broadly at the feasibility and quality of TEE imaging in the ED, the use of an observational cohort study was a reasonable means of making this assessment. As nearly all TEEs performed were recorded, their review of the imaging database should be sufficient assess study quality.
Was the cohort recruited in an acceptable way? - Was the cohort representative of a defined population? - Was there something special about the cohort? - Was everybody included who should have been included?	Yes. The authors included all patients who underwent a TEE in the ED during a specified time frame, identified by completion of documentation in the medical record and Qpath. While the authors did not pre-specify a particular indication for the TEE, about one third were performed for cardiac arrest, just over half were performed for periarrest evaluation, and 12% were performed for shock.
Was the exposure accurately measured to minimize bias? - Did they use subjective or objective measurements? - Do the measures truly reflect what you want them to (have they been validated)? - Were all the subjects classified into exposure groups using the same procedure?	Yes. The "exposure" in this study was performance of a TEE in the ED, which was easily identified in the medical record.
Was the outcome accurately measured to minimize bias? - Did they use subjective or objective measurements? - Do the measures truly reflect what you want them to (have they been validated)? - Has a reliable system been established for detecting all the cases (for measuring disease occurrence)? - Were the measurement methods similar in the different groups? - Were the subjects and/or the outcome assessor blinded to exposure (does this matter)?	N/A
Have the authors identified all important confounding factors and have they taken account of the confounding factors in the design (i.e. modelling, regression, propensity analysis, or sensitivity analysis to correct, control or adjust for confounding factors)?	N/A
Was the follow up of subjects complete and was the follow up of subjects long enough?	Yes. The authors were looking solely at the feasibility and quality of TEE in the ED. Long-term outcomes were not being assessed and hence care beyond the ED was not included in this study.
What are the results?	

What are the results of this study?	• Physicians were able to obtain a viewable image in 99% of cases (95% CI 97.7% to 99.6%).
	  o There was no difference in rate of obtaining a viewable imaging between non-US and US faculty ($p > 0.9$).
	• The quality of recorded images was "good" in 85.9% of cases (95% CI 82.5% to 88.7%).
	  o Image quality was considered to be fair in 9.7% of cases (95% CI 7.3% to 12.6%) and poor in 4.5% of cases (95% CI 2.8% to 6.6%).
	  o US faculty recorded a higher percent of "good" images compared to non-US faculty (92% vs. 84%, $p = 0.036$).
	• In cases where a TTE was also recorded ($n = 408$), TEE was significantly more likely to yield superior images when compared with TTE.
	• The most common indication was periarrest in 55.7% of cases, followed by cardiac arrest in 32.1% and shock in 12.2%.
	• Three potential safety issues were identified, one of which was a pre-existing condition identified on TEE placement:
	  o In one case the ET tube was dislodged during TEE placement; in this case the ET tube was replaced prior to desaturation.
	  o In a second case, a patient intubated prior to arrival was found to have the ET tube cuff above the vocal cords when videolaryngoscopy was performed for TEE placement.
	  o In the third case, pneumomediastinum was noted after an unsuccessful attempt at TEE probe placement. After review, it was felt that the pneumomediastinum was due to blunt trauma rather than TEE probe placement.

How precise are the results? (i.e. what 95% CIs were associated with the results?)	See above.
Do you believe the results?	Yes.
Will the Results Help Me Locally?	
Were the study patients similar to my patient?	Yes, somewhat. This study was conducted was conducted in a large, US academic emergency departments associated with an emergency medicine residency program. I would suspect that the patient population and the clinicians involved would be similar to those seen in our institution. It should be noted that emergency physicians underwent a 4-hour training session involving didactics and simulation, and replication of these results in our institution would require similar training endeavors.
Do the results of this study fit with other available evidence?	Yes. This was a fairly descriptive study without clear-cut outcomes with similar results to other studies being reviewed for this journal club. The authors did attempt to assess the impact of TEE on changes in management and did not make any attempt to discern whether these changes impacted outcomes. Further research to assess the impact in terms of patient-centered outcomes will be necessary to change practice.

Limitations:

1. **This was a retrospective chart review and hence at high risk of missing data and subjective interpretation of the effects of TEE on management.**

2. **The authors provide limited information on the methods used to obtain from the medical records (Gilbert 1996, Worster 2004).**

3. **Image quality was assessed using a non-validated scale (good, fair, poor) with no assessment of interobserver agreement.**

4. **Despite the authors reporting that physicians were able to obtain a "viewable image" in 99% of cases, 4.5% of images obtained were rated as poor (i.e. uninterpretable).**

5. **While this descriptive analysis of the effect of TEE on management of ED patients, the authors did not attempt to evaluate any patient-important outcomes.**

Bottom Line:

This retrospective, observational study found that the use of TEE in ED was feasible following a 4-hour training session. The images obtained were rated as "good" in the vast majority of cases (85.9%) and were found to be superior to TTE images when these were also obtained. There were 3 potential safety events, two of which were not caused by the TEE; the third event did not result in any patient harm.