

Critical Review Form

Meta-analysis

Bedside focused echocardiography as predictor of survival in cardiac arrest patients: a systematic review. *Acad Emerg Med.* Oct 2012;19(10):1119-1126.

Objectives: “to determine if focused transthoracic echocardiography (echo) can be used during resuscitation to predict the outcome of cardiac arrest.” (p. 1119)

Methods: A systematic review of the literature was undertaken utilizing the [Prisma statement](#) (chosen a priori) for reporting. A search was completed on February 23, 2011, and was repeated on January 29, 2012, of four databases: MEDLINE via PubMed, EMBASE, CINAHL, and the Cochrane Library. The references of relevant papers were searched for any additional studies. A search of [gray literature](#) and conference proceedings was also conducted. Duplicate studies that were derived from the same data source were excluded. Only studies in which clinicians performed transthoracic echo on adult patients during cardiopulmonary resuscitation, and in which outcomes were reported, were accepted for further review.

Two reviewers assessed the selected titles and abstracts for full review and compared results. Consensus was reached through discussion as to which articles to include. Two independent reviews graded the selected articles using 8 of the 14 components of the quality assessment in diagnostic accuracy studies ([QUADAS](#)) tool (Table 1).

TABLE 1
QUADAS tool components
1. Representative spectrum?
2. Selection criteria described?
3. Quality reference standard?
4. Blinding of index test?
5. Blinding of reference test
6. Did everyone receive the same reference standard?
7. Uninterpretable results reported?
8. Withdrawals from study explained?

The search strategy yielded 2539 studies, of which 12 were selected for full review. Of these, 8 studies were included in the final analysis. These 8 studies

included a total of 568 patients, of whom 107 (18.8%) achieved return of spontaneous circulation (ROSC).

Guide	Question	Comments									
I	<i>Are the results valid?</i>										
1.	Did the review explicitly address a sensible question?	Yes. Ability to use bedside cardiac echo to determine prognosis in cardiopulmonary resuscitation has the potential to significantly impact practice. If absence of kinetic activity is associated with no chance of ROSC, further efforts could be deemed medically futile. If, however, ROSC occurs in a significant proportion of patients with no kinetic activity seen, further resuscitation efforts would be warranted.									
2.	Was the search for relevant studies details and exhaustive?	Yes. All major databases were searched, as well as non-traditional literature and conference proceedings.									
3.	Were the primary studies of high methodological quality?	Yes. All studies utilized a representative patient spectrum and an acceptable reference standard, and all adequately described their reference standard. Resuscitation efforts were continued in all studies regardless of findings on bedside echo.									
4.	Were the assessments of the included studies reproducible?	Yes. The 8 components of the QUADAS tool were explicitly defined. The authors' assessment of the studies based on each of these criteria was included.									
II.	<i>What are the results?</i>										
1.	What are the overall results of the study?	<p>Of 378 patients with no detectable cardiac contractility on echo, 9 (2.4%; 95% CI 1.3%-4.5%) achieved ROSC.</p> <p>Random-effects pooled results: sensitivity 91.6% (95% CI = 84.6%-96.1%), specificity 80.0% (95% CI = 76.1%-83.6%), positive likelihood ratio 4.26 (95% CI = 2.63-6.92), negative likelihood ratio 0.18 (95% CI = 0.10-0.31).</p> <table border="1"> <thead> <tr> <th></th> <th>ROSC</th> <th>No ROSC</th> </tr> </thead> <tbody> <tr> <td>Cardiac contractility seen on echo</td> <td>98</td> <td>92</td> </tr> <tr> <td>No cardiac contractility seen on echo</td> <td>9</td> <td>369</td> </tr> </tbody> </table>		ROSC	No ROSC	Cardiac contractility seen on echo	98	92	No cardiac contractility seen on echo	9	369
	ROSC	No ROSC									
Cardiac contractility seen on echo	98	92									
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2.	How precise are the results?	See above.									
3.	Were the results similar from study to study?	Yes and no. Heterogeneity was low for the negative LR (I2 = 0.0), but higher for the positive LR (I2 = 82.1%). The number									

		of false negatives (patients with no cardiac activity on echo who achieved ROSC) was much higher in one of the studies (Breitkreutz 2010) with 5 of 37 (13.5%) achieving ROSC compared to 4 of 332 (1.2%) in all of the remaining studies. This could be due to a difference in patient populations (traumatic arrest, younger/healthier population) or sonographer error.
III.	<i>Will the results help me in caring for my patients?</i>	
1.	How can I best interpret the results to apply them to the care of my patients?	This meta-analysis yielded a proportion of patients with no cardiac motion who have ROSC is 2.4%. While this would suggest that we should continue resuscitative efforts on patients with no cardiac activity seen, the study did not assess survival to hospital discharge or neurologically intact survival, which would be of much greater interest. The impact on families and the healthcare system of ROSC in patients who do not survive to hospital discharge, or who survive without significant neurologic function, may in fact be harmful.
2.	Were all patient important outcomes considered?	No. The study assessed ROSC only, and did not affect survival to hospital discharge, neurologically-intact survival, quality of life, healthcare costs, or impact on families.
3.	Are the benefits worth the costs and potential risks?	Uncertain. The benefit of ROSC in patients undergoing resuscitation is dependent on some sort of neurologically-intact survival beyond hospital admission, and this was not assessed in this study. The potential cost (emotional and financial) of hospital admission and inpatient care in patients with ROSC but no functional survival could potentially outweigh any benefits.

Limitations:

- 1) **The outcome for the pooled estimates was ROSC, rather than more [patient-important outcomes](#), such as survival to hospital discharge and neurologically-intact survival.**
- 2) **The pooled false-negative rate was affected by a single outlier ([Breitkreutz 2010](#)), possibly due to differences in study design. Excluding this study, the false-negative rate drops from 2.4% to 1.2%.**
- 3) **While the authors note that “In all studies, resuscitation was continued,**

regardless of the echo findings,” (p. 1122) this is no guarantee that the results did not affect the duration of attempted resuscitation. This could lead to a decreased in the number of patients with no cardiac activity with ROSC.

Bottom Line:

This meta-analysis demonstrates that 9 of 378 patients (2.4%; 95% CI 1.3%-4.5%) with no cardiac activity on bedside US achieved ROSC. It is unclear what survival rate would dictate continuing resuscitation in such patients, though these results do seem to indicate that continued resuscitation is indicated despite bedside US results. However, it would be important to know what percent of these patients survived to hospital discharge with some neurologic function, as this would be a more significant outcome.