

## Post-arrest Echo

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Being in the business of saving lives, it is always a difficult decision to elect to terminate resuscitative efforts, particularly when there is PEA or a young patient. The following studies evaluated the use of bedside echo with the hope that the results would help to make this decision easier.

Blaivas, Michael and John Christian Fox. "Outcome in Cardiac Arrest Patients Found to Have Cardiac Standstill on the Bedside Emergency Department Echocardiogram." Academic Emergency Medicine; June 2001, volume 8 number 6.

- Echo done by "senior EM resident" alone 30% of the time but otherwise done in conjunction with or by attending
  - Subxiphoid or parasternal view
- 169 patients
  - excluded <18 yo, traumatic arrest, "obvious non-cardiac causes"
  - standstill = "no myocardial contractions seen for the duration of the pulse check [5-10 sec]"
  - if TOD was called, final echo lasted 20 sec
- 136 with standstill on initial echo despite 71 of them with rhythm on the monitor
  - 65 asystole, 38 PEA, 66 VF
  - 12 PEA survived, 8 VF survived
- 20 patients lived to leave ED, **standstill on echo had 100% PPV of death** and NPV 58%
- also tracked several other factors (listed as survival vs nonsurvival)
  - downtime PTA: 14.3 vs 13.3 min
    - downtime prior to arrival in ED for patients in standstill 14.1 min vs with cardiac motion 13.2 min
  - length of resuscitation in ED: 15.1 vs 17.1 min
  - age: 67.2 vs 72.3
    - standstill on echo: 72.1 vs cardiac motion 68.4 years old
  - time to EMS arrival on scene: 5.6 vs 5.9 min
- this article does not mention any therapies tried (TPA, pericardiocentesis, etc) nor their success or failure rate

Salen, et al. "Can Cardiac Sonography and Capnography be Used Independently and in Combination to Predict Resuscitation Outcomes?" Academic Emergency Medicine; June 2001, volume 8 number 6.

- 102 patients had echo while 53 also had capnography
- echo done by EM residents
  - subxiphoid view unless obese then used apical view
  - <10 sec looks during pulse checks or with any change in cardiac electrical rhythm
  - capnography was initiated after intubation or upon arrival if patient was intubated PTA
  - noted ETCO<sub>2</sub> levels during US exams and only peak levels were reported
- survival was admission to the hospital

- cardiac activity was not defined
- 31% with cardiac activity on the initial echo survived vs 2% without cardiac activity
  - if the heart was contracting every time it was viewed, 100% survived but this rate dropped to 7% if at any time the heart was not contracting when viewed
- 2 patients without cardiac activity survived (1 PEA, 1 asystole)
- 4 patients had pericardial effusions but it does not mention presence of tamponade or if pericardiocentesis was performed
- **no patient with an ETCO<sub>2</sub> of <16 torr survived**
  - this was regardless of cardiac activity on echo
  - if the ETCO<sub>2</sub> was >16 torr but there was no cardiac activity on echo, 1/5 survived
- logistic regression analysis showed that only ETCO<sub>2</sub> >16 torr was a predictor of survival to hospital admission and “for every increase of 1 torr, the odds of surviving increased 16%”
  - authors felt that small sample size might account for the fact that sonography could not predict survival
- this article does not mention any therapies tried (TPA, pericardiocentesis, etc) nor their success or failure rate

Aichinger, et al. “Cardiac Movement Identified on Prehospital Echocardiography Predicts Outcome in Cardiac Arrest Patients.” Prehosp Emerg Care, Apr-Jun 2012.

- Graz, Austria where physicians are part of EMS teams and provide care on scene
  - Physicians had no US experience prior to 2 hours of instruction given on echo using portable handheld US
- 42 patients
  - excluded trauma, <18 yo
- echo was done after initial procedures (intubation, vascular access, defibrillation)
  - performed during rhythm/pulse check
  - mechanical ventilation was held during US
  - cardiac activity = “any detected motion of the myocardium, ranging from visible ventricular fibrillation to coordinated ventricular contractions.”
  - CPR had to resume for at least 15 minutes after initial echo and results were not used to make clinical decisions
- 32 patients had standstill on initial echo, 1 survived. The other 4 survivors had cardiac activity
  - 10 patients had cardiac motion on the initial US
  - 7 patients had motion on every US
  - cardiac standstill had **PPV 96.9% for death at scene**, NPV 40%
- tracked other variables (listed as survival vs nonsurvival)
  - mean time during CPR to echo was 17.4 min
  - age: 66.3 vs 70.9
  - downtime prior to CPR: 9.8 vs 12.1 min
  - mean initial ETCO<sub>2</sub>: 32.2 vs 31.0 mmHg
- interestingly all patients in this study who had bystander CPR at the scene died but the authors note that they excluded any patient that had ROSC prior to echo from the reported results

Blyth, et al. "Bedside Focused Echocardiography as Predictor of Survival in Cardiac Arrest Patients: A systematic Review." Academic Emergency Medicine; October 2012, volume 19 No 10.

- Meta-analysis of 12 studies with 568 patients
- Heterogeneity of results was non-significant
  - While some studies excluded traumatic arrests, others focused on this or did not have this as an exclusion
  - All studies did not use the same definition of cardiac activity and some studies did not even clarify their definition
    - Authors feel this would have a "greater effect on predictive value of echo findings, rather than the validity of cardiac standstill as a predictor of death"
  - Not all studies reported the number of echos performed during the resuscitation
- Pooled sensitivity of predicting ROSC 91.6% and specificity 80.0%
- Positive likelihood ratio 4.26, indicating "echo is a **weak predictor of ROSC**"
- Negative likelihood ratio 0.18, indicating "echo is a **fairly effective (although not definitive) test for predicting death if no cardiac activity is noted during resuscitation**"
- Predict that only 2.4% of patients without ventricular wall motion will go on to achieve ROSC based on the pooled statistics. The likelihood of survival increased to 51.6% if wall motion was noted

All in all, the likelihood that a patient with no cardiac motion on echo will survive to hospital admission is very low, regardless of electrical activity on the monitor. If the ETCO<sub>2</sub> >16 torr, their chances improve regardless of activity. If the patient has motion however, you are less able to predict their chance of survival based on echo results alone. Keep in mind that all of these studies fail to mention the survival rates with respect to who got TPA, pericardiocentesis, or other measures outside of the ACLS drugs. Based on this fact, I think more studies need to be done before I would feel comfortable ending the resuscitation on a patient based upon lack of cardiac activity on initial echo alone. That being said, if the patient repeatedly has no cardiac motion despite resuscitation attempts, I think echo can support the decision to discontinue resuscitation.