Emergent Echocardiography During Code Arrests

October’s journal club focused on the topic of emergent echocardiography during codes. This topic was selected because of a recent code arrest during which an echocardiogram of the heart was performed, but a pneumothorax missed. This clinical experience highlighted uncertainty we had about how to optimally use echocardiography during codes.

We reviewed 6 papers (see reference list below). Drs. Chu, Robbins, and Raschke were present for the discussion. Jessica Hurley, Roxanne Garcia-Orr, Emad Wissa and Henry Luedy submitted written synopses of the papers they reviewed. Brief critiques of each article follow, but since our original intent was to synthesize the information into a suggested bedside approach, I compiled our overall conclusions.

Critical appraisal: The articles by Volpicelli (1) Hernandez (2) and Breitzkreutz (3) were excellent reviews, with well-reproduced images of echocardiograms in a variety of PEA etiologies. Table 1 from Breitzkreutz’s article provides a step-by-step approach on how to perform echocardiography without compromising CPR. Salen’s paper was a multi-center prospective cohort in which the aim was to see whether preservation of cardiac wall motion during PEA predicted survival (4). Unfortunately, they made a number of major mistakes in their study design and statistics. They reported the accuracy of echocardiography wall motion to predict survival to discharge was 87%, and concluded echocardiography was useful in code decision-making. However, only one of 70 patients in their study actually survived. Seven of 8 patients with favorable echocardiography findings ended up dying. Therefore the accuracy of merely supposing that everyone would die was 98% - superior to prognostication by echo. Blaivas’s paper was a case series of patients in whom transesophageal echocardiography (TEE) favorably influenced ACLS management decisions (5). In several cases, transthoracic echocardiography (TTE) showed no cardiac wall motion, but TEE did, and further resuscitative efforts resulted in good outcomes. This gave us further reason to distrust the contention that the finding of no wall motion by TTE could be appropriately used to abbreviate ACLS efforts. The most recent study by Breitkreutz was prospective observational cohort study (6). 204 patients with PEA
arrest or shock underwent a standard, focused echocardiography examination. This was successful in imaging the heart in 96% of cases, and altered management in 78%. Interestingly, they found that 13 of 37 patients with electrocardiographic asystole actually had left ventricular wall motion by echo, and nine of these survived to discharge. Their data showed an apparent strong relationship between the presence of wall motion by echocardiography and survival, but inexplicably, they didn’t perform any statistics on the data. Some simple tests were performed on their data: the relative risk for death in the absence of wall motion was 2.1 and a Fisher’s exact test resulted in a p<0.0001. But five of 37 patients (14%) without wall motion survived to discharge.

**In Summary:** Chest ultrasonography could be useful during PEA arrest for 3 reasons:

1) Echocardiography can identify reversible causes for PEA including tamponade, RV failure (indicative of massive pulmonary embolism), LV failure, or LV underfilling/hypovolemia.

2) Echocardiography can possibly help prognosticate code outcome by identifying patients with or without ventricular wall motion.

3) Chest ultrasonography can identify pneumothorax.

However, ultrasonography is associated with certain risks and limitations. The greatest risk is incurred if CPR is interrupted by echocardiography longer than it normally would be for pulse/rhythm checks. We were uncertain about our ability to rapidly get decent images in a code, and questioned how echocardiography compares to physical examination for the diagnosis of pneumothorax - especially given our current state of relative inexperience in this part of the echocardiography exam.

**Recommendations:** We came up with the following recommendations for use of the echocardiography machine on our code service:

• CPR should not be stopped specifically for an echocardiography examination.

• When CPR is stopped for rhythm checks, echocardiography should not delay reinstitution of CPR. A normal ACLS rhythm or pulse check should take less than 5-10 seconds.
• Coordination and preparation are required to perform echocardiography in less than 10 seconds. The echocardiography machine should be turned on, and the probe should be gelled-up and in the subxyphoid position before CPR is interrupted. The subxiphoid position is most likely to give an adequate image in a code.

• The main goal should be to quickly evaluate left and right ventricular function, and assess for tamponade.

• The literature suggests that lack of ventricular wall motion (EMD) is associated with worse outcomes. We would not stop a code early after diagnosing EMD by echo. But the converse finding of persistent left ventricular contractility in a pulseless patient should encourage ongoing ACLS efforts.

• Later in the code, chest ultrasonography for pneumothorax can be considered. But we didn’t think it was reliable enough in our hands to clearly prefer it over standard methods for detecting pneumothorax.

Comment: Our experience with our portable ultrasound machine has been very positive over the past few years. We have basically incorporated echocardiography into the physical examination of any ICU patient with shock. It has revealed the cause of code arrests or shock states many times, and has improved safety of common bedside procedures. Although we haven’t quantitated the cost/benefit, it’s our impression that a portable echocardiography machine is fast becoming a very valuable tool in the ICU.

References:


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