Towards evidence based emergency medicine: PRIVATE Best BETs from the Manchester Royal Infirmary

Edited by Craig Ferguson

BET 1: BEDSIDE ECHOCARDIOGRAPHY FOR PROGNOSIS OF EMERGENCY DEPARTMENT CARDIAC ARREST

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ABSTRACT

A short cut review was performed to assess the utility of emergency physician echocardiography in patients with cardiac arrest. Six studies with a total of 434 patients were found. The authors, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses are tabulated. The clinical bottom line is that cardiac standstill witnessed in emergency physician echocardiography is predictive of a poor outcome in cardiac arrest.

Best Evidence Topic reports (BETs) summarise the evidence pertaining to particular clinical questions. They are not systematic reviews, but rather contain the best (highest level) evidence that can be practically obtained by busy practicing clinicians. The search strategies used to find the best evidence are reported in detail in order to allow clinicians to update searches whenever necessary. Each BET is based on a clinical scenario and ends with a clinical bottom line which indicates, in the light of the evidence found, what the reporting clinician would do if faced with the same scenario again.

The BETs published below were first reported at the Critical Appraisal Journal Club at the Manchester Royal Infirmary[1] or placed on the BestBETs website. Each BET has been constructed in the four stages that have been described elsewhere.[2] The BETs shown here together with those published previously and those currently under construction can be seen at http://www.bestbets.org.[3] Four BETs are included in this issue of the journal.

1. **Carley SD,** Mackway-Jones K, Jones A, *et al*. Moving towards evidence based emergency medicine: use of a structured critical appraisal journal club. *J Accid Emerg Med* 1998;**15**:220—2.
2. **Mackway-Jones K,** Carley SD, Morton RJ, *et al*. The best evidence topic report: a modified CAT for summarising the available evidence in emergency medicine. *J Accid Emerg Med* 1998;**15**:222—6.
3. **Mackway-Jones K,** Carley SD. bestbets.org: odds on favourite for evidence in emergency medicine reaches the world wide web. *J Accid Emerg Med* 2000;**17**:235—6.

CLINICAL SCENARIO

A 62-year-old male emergency patient arrives in cardiac arrest. During resuscitation he is found to have pulseless electrical activity. Several rounds of ACLS are performed with no improvement in the patient's condition. You wonder if a rapid bedside cardiac ultrasound (echocardiography) would be of any prognostic or diagnostic utility.

THREE-PART QUESTION

In (adults in cardiac arrest) does (emergency physician performed bedside transthoracic echocardiography) have (accurate prognostic accuracy)?

Table 1 Diagnostic value of echocardiogram in cardiac arrest

Author, country, date	Patient group	Study type	Outcomes	Key results	Study weaknesses
Niendorff *et al*, 2005, USA	17 Consecutive patients with 18 PEA arrests over a 6-month period at a major academic hospital. Bedside echocardiography attempted in seven patients and completed in five	Prospective feasibility study	Evaluate performance and reliability of US assessment as an integrated part of the ACLS PEA arrest protocol	In 4/5 cases, the non-expert interpretation was confirmed	Extremely small sample size. Low compliance with study protocol. No follow-up on cause of PEA. Non-emergency physicians with limited ultrasound training
Blaivas and Fox, 2001, USA	Convenience sample of 169 adult non-traumatic patients arriving to a single ED over a 20-month period receiving ongoing CPR. Rapid bedside echocardiogram was performed during pulse check pauses. No patients with cardiac standstill on arrival (136) survived to leave the ED. 100% of patients presenting with asystole (65) had cardiac standstill on initial ECHO	Prospective observational study	Survival of patients with cardiac motion on arrival at the ED	20 Patients (12, 67% with PEA, 8, 53% with VF) survived to leave the ED. 13 Patients (6, 33% with PEA, 7, 47% with VF) died despite cardiac activity on arrival	Small convenience sample (800 eligible patients during study). No follow-up of survivors. 'Survival' included only to hospital admission
			Survival of patients in asystole on arrival at the ED	No patients (65) in asystole on arrival survived. 100% had cardiac standstill on ultrasound	
			Survival of patients arriving at the ED with cardiac standstill	No patients (n=136) with cardiac standstill on ultrasound survived to leave the ED	
Salen *et al*, 2001, USA	102 Non-consecutive patients presenting to two community EDs over a 12-month period. All received a subxiphoid cardiac ultrasound during CPR pause. 53 Patients also had capnography levels recorded	Prospective clinical observational study	Survival to hospital admission	27% (11/41) Patients with cardiac motion survived to admission vs 3% (2/61) patients with cardiac standstill	Convenience sample. No quantification of cardiac contractility. Only measured survival to admission. Small sample size. Resuscitation team not blinded to US results
			Usefulness of US in management of cardiac arrest	96% of EPs felt US was helpful	
			Presence of pericardial effusion	4% (4/102) of patients had a pericardial effusion	

Continued

Table 1 Continued

Author, country, date	Patient group	Study type	Outcomes	Key results	Study weaknesses
Salen *et al*, 2005, USA	Convenience sample of 70 adult non-traumatic patients arriving to four EDs over a 12-month period in either PEA or asystole. Rapid bedside echocardiography was performed during pulse check pauses by emergency physicians	Prospective observational study	Survival of patients arriving with cardiac standstill	No patients with cardiac standstill on arrival (n=59) survived to leave the hospital	Convenience sample. Small sample size. Resuscitation teams were not blinded to US results. Most patients arrived with cardiac standstill. 17/70 Subjects did not get sequential US examinations.
			Return of spontaneous circulation	No patients (n=59) with cardiac standstill had ROSC. 8/11 Patients in PEA with cardiac motion had ROSC	
			Survival to hospital discharge	Only one patient survived to hospital discharge	
Tayal and Kline, 2003, USA	20 Adult patients arriving at the ED in non-traumatic haemodynamic collapse over an 18-month period at a level 1 trauma centre	Prospective observational study	Cardiac standstill	8/20 (40%) Patients were in cardiac standstill	Not randomised. Selection bias, (higher pre-test probability of pericardial effusion). Resuscitation team not blinded to US results. Patients not necessarily in cardiac arrest, inclusion criteria included patients with hypotension
			Survival	None of the 8 patients in cardiac standstill survived	
			Pericardial effusion	8/12 (67%) Patients with cardiac activity had pericardial effusions. Bedside echo diagnosed tamponade in three cases	
Hayhurst *et al*, 2011, UK	Convenience sample of 56 patients in cardiac arrest recruited over a 29-month period from two hospitals. Six patients excluded because scans were performed outside the cardiac arrest period	Prospective feasibility study	Return of spontaneous circulation	Ventricular wall movement present in 20 cases, 11 had ROSC. 1 Patients without VWM had ROSC	Small study
			Survival to ED discharge	Four patients with VWM and one patient without VWM survived to ED discharge	

ACLS, advanced cardiac life support; CPR, cardiopulmonary resuscitation; ED, emergency department; EP, emergency physician; PEA, pulseless electrical activity; ROSC, return of spontaneous circulation; US, ultrasound; VWM, ventricular wall movement.

SEARCH STRATEGY

The following databases were searched:

Ovid Medline(R) 1950 to August 2011 using ((exp ultrasonography OR exp echocardiography) AND (exp cardiopulmonary resuscitation OR exp heart arrest OR cardiac arrest)). Limited to English and human.

457 papers were found of which six were considered relevant to the three-part question.

COMMENTS

Cardiac standstill on bedside echocardiography performed during cardiac arrest is an extremely poor prognostic indicator. Only 0.9% of patients with cardiac standstill across all six studies (3/320) survived to hospital admission. One study, Niendorff DF *et al*, demonstrated that non-emergency physicians with minimal ultrasound experience might carry out inadequate examinations and/or misinterpret the results. However, in the other four studies where this was examined, for all studying emergency physicians in EDs with formal ultrasound training programmes, there was excellent correlation between EP and radiologist interpretations and quick and reliable assessments of cardiac activity were obtained. Several cases of tamponade were identified at the bedside and emergent drainage permitted survival to hospital admission. Few physicians felt that the sonography interfered with, or delayed, resuscitation. All the studies had small sample sizes and the resuscitation teams were not blinded to the ultrasound results. However, the results were highly consistent between studies and cardiac standstill was almost universally associated with failed resuscitations.

Clinical bottom line

Cardiac standstill seen on physician-performed bedside echocardiography during cardiac arrest virtually predicts unsuccessful resuscitation. Even physicians with minimal training can reliably differentiate cardiac standstill from contractile myocardium. Experienced EP sonographers can also use bedside echocardiography to accurately diagnose reversible causes of cardiac arrest (ie, pericardial effusion, hypovolaemia, right heart strain, etc) and therefore potentially improve their patient's prognosis by treating the underlying process.

- **Niendorff DF**, Rassias AJ, Palac R, *et al*. Rapid cardiac ultrasound of inpatients suffering PEA arrest performed by nonexpert sonographers. *Resuscitation* 2005;**67**:81–7.
- **Blaivas M**, Fox JC. Outcome in cardiac arrest patients found to have cardiac standstill on the bedside emergency department echocardiogram. *Acad Emerg Med* 2001;**8**:616–21.
- **Salen P**, Melniker L, Chooljian C, *et al*. Does the presence or absence of sonographically identified cardiac activity predict resuscitation outcomes of cardiac arrest patients? *Am J Emerg Med* 2005;**23**:459–62.
- **Salen P**, O'Connor R, Sierzenski P, *et al*. Can cardiac sonography and capnography be used independently and in combination to predict resuscitation outcomes? *Acad Emerg Med* 2001;**8**:610–15.
- **Tayal VS**, Kline JA. Emergency echocardiography to detect pericardial effusion in patients in PEA and near-PEA states. *Resuscitation* 2003;**59**:315–18.
- **Hayhurst C**, Lebus C, Atkinson PR, *et al*. An evaluation of echo in life support (ELS): is it feasible? What does it add? *Emerg Med J* 2011;**28**:119–21.

Provenance and peer review Commissioned; internally peer reviewed.

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BET 2: INTRALIPID/LIPID EMULSION IN BETA-BLOCKER OVERDOSE

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ABSTRACT

A short cut review was performed to seek the evidence for use of intravenous lipid emulsion in the treatment of overdose with β-receptor antagonists. Eight case reports and one case series with a total of 10 patients were found.

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Notes