

Confirmation Of Traumatic Cardiac Arrest In Children: A Review Of Current Evidence Informing The PERUKI PTCA Consensus Study



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CLINICAL SCENARIO

Imagine an 8 year old pedestrian admitted to ED after a RTC with a bus.

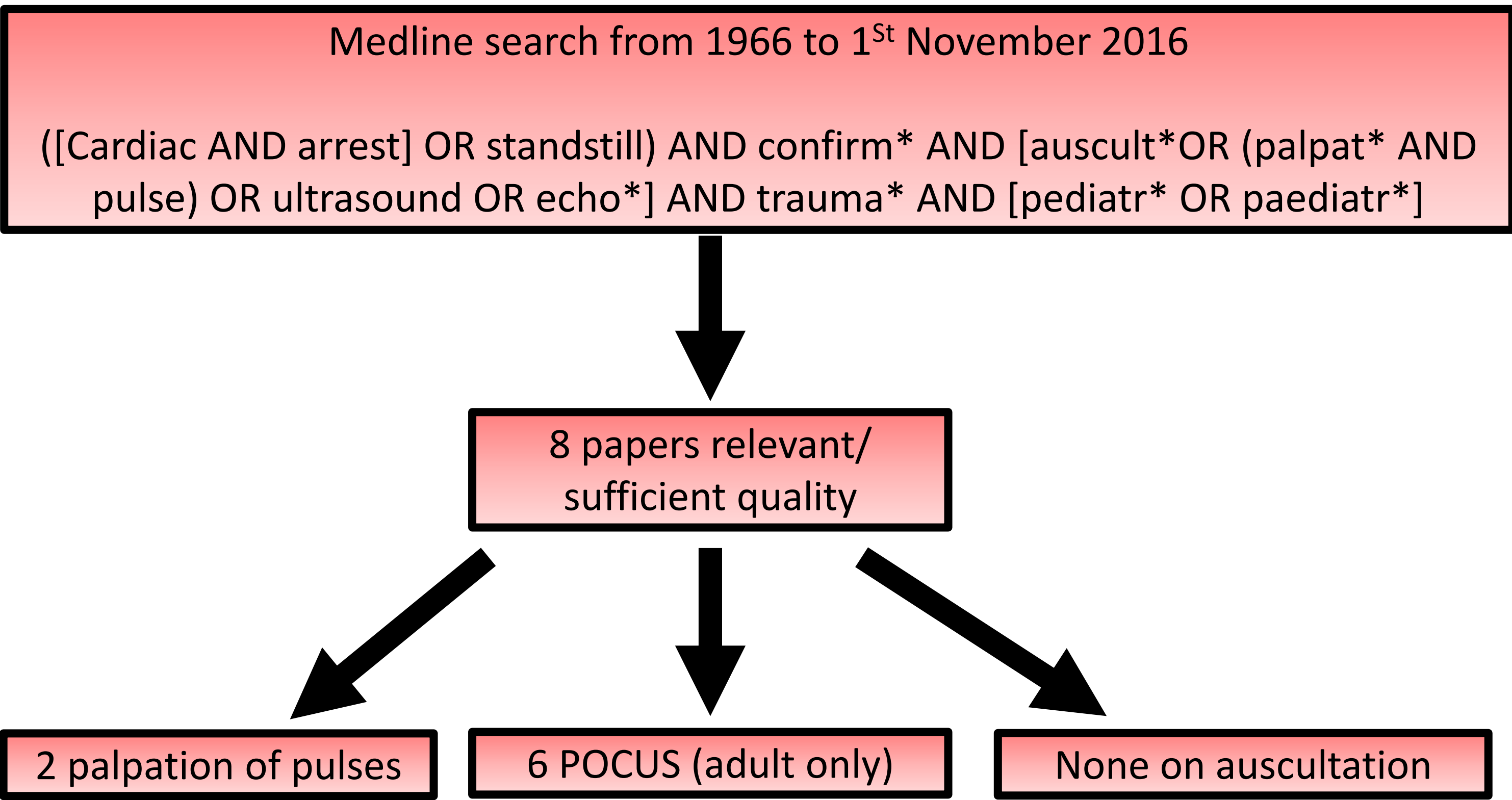
He is displaying signs of hypovolaemia due to suspected ongoing internal bleeding, with tachycardia and hypotension despite fluid resuscitation.

You are concerned that he is at risk of cardiac arrest, but are unsure of the optimal method of identifying cardiac arrest to help you decide when to start your traumatic cardiac arrest protocol.

BAKGROUND

- Traumatic cardiac arrest (TCA) is associated with a high positive predictive value of death and poor neurological outcomes in survivors.
- Several methods of confirming cardiac arrest are utilised including auscultation of heart sounds, palpation of pulses and echocardiography.
- Our aim was to review current literature on the best method of confirmation of traumatic cardiac arrest in paediatric patients.
- The review was part of a Delphi consensus study on management of paediatric traumatic cardiac arrest carried out through the PERUKI network (Paediatric Emergency Research in the UK and Ireland).

METHODOLOGY



RESULTS

- Diagnosis of cardiac arrest by palpation alone unreliable.
- Accuracy in confirmation of presence of a pulse was related to clinical experience.
- Use of Paediatric Point of Care Ultrasound (POCUS) can help predict outcomes in patients and reduce both time in resus and unnecessary procedures.
- Cardiac arrest on USS had a positive predictive value of 100% for death in one study
- POCUS can increase confidence of the decision maker.
- No papers discussed sensitivity or specificity of POCUS to confirm arrest, possibly due to the lack of a superior method for demonstrating arrest.

Author, date and country	Patient group	Outcomes/ Key results	Study Weaknesses
Tibballs and Russell 2009, Australia	16 children on ECMO or LVAD; age range 1 week-13 years 209 (Dr&Nurses) asked to decide pulses present/absent within 10 seconds	Pulse palpation is unreliable to diagnose paediatric cardiac arrest. Rescuer pulse palpation accuracy was 78% (95% CI 70–82)	Variety of anatomical sites for pulse check Similarity of cardiac arrest patient and patient on ECMO
Tibballs and Weeranatnac 2010, Australia	Blinded Drs/nurses palpated brachial pulse in 17 children with non-pulsatile extracorporeal circulation for cardiac arrest. Times compared with non-blinded decisions	Diagnosis of cardiac arrest by pulse palpation alone unreliable. At least 30s optimum but accuracy/speed related to clinical experience.	Effect of test environment on speed of decision? Experienced vs inexperienced broad definitions
Blaiva et al. USA, 2001	169 Patients in ED ongoing CPR > 18yo. USS on arrival and at each pulse check. Excluding trauma and non-cardiac arrest	Patients presenting to ED in cardiac standstill on USS do not survive. Cardiac standstill on USS- positive predictive value 100% for death , negative predictive value of 58%	Adult, non-trauma only. Patients enrolled on convenience basis & Small study size
Cureton et al. USA, 2012	318 adult trauma patients in ED without pulses. Results of cardiac USS vs ECG rhythm and survival	Absence of cardiac motion on USS and electrical activity highly predictive of death. Sensitivity of absence of cardiac motion on USS to predict survival to hospital admission 86% (100% penetrating trauma, 75% blunt trauma)	Adult only, lack of standardisation of how cardiac motion quantified Difficult categorisation of patients with/without cardiac activity
Ferrada et al. USA, 2014	Chart review of 37 non-surviving TCA patients at trauma centre. Transthoracic echocardiography (TTE) vs without TTE	TTE decreased time in trauma bay and avoided thoracotomy.	Adult only ; Small study size Only looked at non-survivors
Shoenberger et al. USA, 2007	116 returned surveys from graduated ED physicians trained in USS use	53% of population with USS available use in cardiac arrest and feels shortens time to confirmation of standstill.Rreassure and confirm the presence of cardiac standstill for the physician (88%)	Opinion of those responding to survey only.
Chardoli et al. China, 2012	100 adult patients in PEA randomised into receiving ACLS protocol or ACLS + echo	No significant difference between the two groups in outcome of resuscitation.	Small study size
Bhat et al. USA, 2015	57 prehospital providers given 1 hr training on USS to identify pericardial effusion, pneumothorax and cardiac standstill.	Potential feasibility of training pre-hospital providers to identify cardiac standstill. Pre-test scores vs post-test scores after training	Adult pre-hospital medicine trainees only Small, convenience sample Ability to transpose knowledge.

CLINICAL BOTTOM LINE

- There is little evidence available to guide the optimal method of confirming paediatric cardiac arrest, and no evidence specific to the population of children experiencing cardiac arrest secondary to traumatic causes.
- Palpation is currently the best method as it is available in all centres, but there maybe a role for POCU as it becomes more available.
- Further work is needed to determine the optimal combination of methods for assessing cardiac standstill. Due to the nature of the patient population and setting this work will likely be observational.