WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care

Worksheet author(s)

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Clinical question.

For infants and children in cardiac arrest (P), does the use of a pulse check (I) vs. assessment for signs of life © improve the accuracy of diagnosis of pediatric CPA (O)?

Is this question addressing an intervention/therapy, prognosis or diagnosis? Diagnosis
State if this is a proposed new topic or revision of existing worksheet: New

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? Yes; Dr. Tibballs is the primary author of one article included in the review

Search strategy (including electronic databases searched).

Cochrane: "Heart rate [MeSH]" or "Pulse [MeSH]" or "pulse check [keyword]" AND "Heart arrest [MeSH]" or "cardiopulmonary resuscitation [MeSH]"

Medline: "Heart Rate"[Mesh] OR "Pulse"[Mesh] AND "Heart Arrest"[Mesh] OR "Cardiopulmonary Resuscitation"[Mesh] AND (sensitiv*[Title/Abstract] OR sensitivity and specificity[MeSH Terms] OR diagnos*[Title/Abstract] OR diagnosis[MeSH:noexp] OR diagnostic *[MeSH:noexp] OR diagnosis, differential[MeSH:noexp] OR diagnosis[Subheading:noexp]) AND (((infant[MeSH] OR child[MeSH] OR adolescent[MeSH])))

EmBase: textwords ("heart arrest" or "resuscitation" or "cardiopulmonary resuscitation" or "cardiopulmonary arrest") AND ("pulse rate" or "heart rate" or "pulse check"); limit 'human', 'infant <to one year> or child <unspecified age> or preschool child <1 to 6 years> or school child <7 to 12 years> or adolescent <13 to 17 years>'

AHA EndNote database: textwords "heart arrest" or "cardiopulmonary resuscitation" AND "pulse" or "heart rate" or "pulse check"

- State inclusion and exclusion criteria

The following studies are excluded: studies not involving patients (e.g. mannequin or animal studies); abstract only studies, stdies not peer reviewed, studies which do not pertain directly to research question

- Number of articles/sources meeting criteria for further review:

16 studies met criteria for further review. Of these, 15 were LOE D5 and one LOE D3.

Summary of evidence

Evidence Supporting Clinical Question

Good					
Fair					
Poor					
	D1	**D2**	**D3**	**D4**	**D5**
Level of evidence					

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Animal studies

Evidence Neutral to Clinical question

Good					
Fair					
Poor					**Lee, 1991 E** **Mather, 1996 E** **Tanner, 2000 E** **Inagawa, 2003 E** **Sarti, 2005 E** **Sarti, 2006 E** **Kamlin, 2006 E**
	D1	**D2**	**D3**	**D4**	**D5**
Level of evidence					

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Animal studies

Evidence Opposing Clinical Question

Good			**Tibballs, 2008 E**		
Fair					**Eberle, 1996 E** **Dick, 2000 E**
Poor					**Cavallaro, 1983 E** **Brearly, 1992 E** **Bahr, 1997 E** **Whitelaw, 1997 E** **Ochoa, 1998 E** **Owen, 2004 E**
	D1	**D2**	**D3**	**D4**	**D5**
Level of evidence					

A = Return of spontaneous circulation
B = Survival of event
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D = Intact neurological survival
E = Other endpoint
Italics = Animal studies

REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

The majority of published studies examine the technique of pulse checking in children and adults who are healthy, and have consistently found that there is significant inaccuracy on checking a pulse within 5 to 10 seconds for both laypeople and health care practitioners[1,2,9,10]. Several studies also compared pulse palpation to chest auscultation, or compared multiple sites of palpation of pulses for speed and accuracy of assessing the pulse, all in healthy children[3,6,7,8,11,12,14,16]. One study evaluated infants with mild hypotension during anesthesia, comparing brachial to femoral pulse palpation[13]. No studies directly compared pulse palpation to assessing for signs of life in diagnosing cardiac arrest.

The only published studies that evaluate the technique in patients with and without puslatile blood flow have been done in either adults undergoing cardiopulmonary bypass with aortic cross clamping in the operating room[4,5], or most recently in children on extracorporeal circulatory support with varying degrees of native cardiac dysfunction.[15] In the adult studies, only 15-16.5% of participants make correct assessments of pulse status within 10 seconds, and only 2% could correctly diagnose pulselessness within 10 seconds (i.e. rapid, correct assessments were made predominantly in patients with a pulse present).

In the most recent and robust pediatric study, children aged 1 week to 13 years supported by either ECMO or a left ventricular assist device (LVAD) with arterial catheters in place were assessed by blinded examiners; the sensitivity of the pulse check was 0.86 and the specificity 0.64; overall accuracy was 78%.[15]

In regard to the safety and efficacy of assessing for signs of life in diagnosing cardiac arrest, we did not find any studies addressing this alternative approach.

Acknowledgements:

N/A

Citation List

1. Bahr J, Klingler H, Panzer W, Rode H, Kettler D. Skills of lay people in checking the carotid pulse. Resuscitation 1997;35(1):23-6.

LOE D5. Poor. Opposing (wrong patient population)
449 lay volunteers asked to perform carotid pulse check on healthy adults. No comment about industry funding.

2. Brearley S, Shearman CP, Simms MH. Peripheral pulse palpation: an unreliable physical sign. Ann R Coll Surg Engl 1992;74(3):169-71.

LOE 5. Poor. Opposing (wrong patient population)
Funded by Lipha Pharmaceuticals.

3. Cavallaro DL, Melker RJ. Comparison of two techniques for detecting cardiac activity in infants. Crit Care Med 1983;11(3):189-90.

LOE D5. Poor. Opposing (wrong patient population)
25 parents of infants were trained to palpate the cardiac apex and the brachial pulse in healthy infans and given 10 seconds to assess the pulse correctly. No comment about industry funding.

4. Dick WF, Eberle B, Wisser G, Schneider T. The carotid pulse check revisited: what if there is no pulse? Crit Care Med 2000; 18(11):183-5.

LOE D5. Fair. Opposing (wrong patient population)

206 health care professionals (blinded) were asked to assess carotid pulse status of an adult undergoing coronary artery bypass surgery during either pulsatile (spontaneous) or nonpusatile (extracorporeal) circulation. No comment about industry funding.

5. Eberle B, Dick WF, Schneider T, Wisser G, Doetsch S, Tzanova I. Checking the carotid pulse check: diagnostic accuracy of first responders in patients with and without a pulse. Resuscitation 1996;33:107-16.

LOE D5. Fair. Opposing (wrong patient population)
104 EMTs and paramedics (blinded) were asked to assess carotid pulse status of an adult undergoing coronary artery bypass surgery during either pulsatile (spontaneous) or nonpusatile (extracorporeal) circulation. No comment about industry funding.

6. Inagawa G, Morimura N, Miwa T, Okuda K, Hirata M, Hiroki K. A comparison of five techniques for detecting cardiac activity in infants. Paediatr Anaesth 2003;13(2):141-146.

LOE D5. Poor. Neutral.
28 nurses assessed pulse status in anesthetized infants by five separate methods (auscultation, apical impulse, carotid, brachial, and femoral). No comment about industry funding.

7. Kamlin CO, O'Donnell CP, Everest NJ, Davis PG, Morley CJ. Accuracy of clinical assessment of infant heart rate in the delivery room. Resuscitation 2006;71(3):319-21.

LOE D5. Poor. Neutral.
Health care professionals (n=26) assessed the heart rate by one of two randomly assigned methods (auscultation or palpation of umbilical stump) in vigorous newborn infants. No comment on industry funding.

8. Lee CJ, Bullock LJ. Determining the pulse for infant CPR: time for a change? Mil Med 1991;156(4):190-3.

LOE 5. Poor. Neutral.
Comparison of apical impulse auscultation with ear to brachial pulse palpation in healthy infants. No comment on industry funding.

9. Mather C, O'Kelly S. The palpation of pulses. Anaesthesia 1996;51(2):189-191.

LOE D5. Poor (wrong patient population). Neutral.
Physicians assesed the pulse in four locations in 554 anesthetized patients. No comment on industry funding.

10. Ochoa FJ, Ramalle-Gómara E, Carpintero JM, García A, Saralegui I. Competence of health professionals to check the carotid pulse. Resuscitation 1998; 37:173-5.

LOE 5. Poor. Opposing. (Wrong patient population)
Volunteers checking carotid pulse within 5 seconds (outcome of interest according to ERC guidelines) in healthy adult. No comment on industry funding.

11. Owen CJ, Wyllie JP. Determination of heart rate in the baby at birth. Resuscitation 2004; 60:213-7.

LOE 5. Poor. Opposing.
Compared multiple pulse points with auscultation of chest with stethoscope in healthy newborns. No comment on industry funding.

12. Sarti A, Savron F, Casotto V, Cuttini M. Heartbeat assessment in infants: a comparison of four clinical methods. Pediatr Crit Care Med 2005;6(2):212-5.

LOE 5. Poor. Neutral.
Health care professionals assessing pulses in children recovering from anesthesia. No comment on industry funding.

13. Sarti A, Savron F, Ronfani L, Pelizzo G, Barbi E. Comparison of three sites to check the pulse and count heart rate in hypotensive infants. Paediatr Anaesth 2006;16(4):394-8.

LOE 5. Poor. Neutral.
Compared there pulse points (brachial, femoral, and carotid) in infants with hypotension during anesthesia induction. No comment on industry funding.

14. Tanner M, Nagy S, Peat JK. Detection of infant's heart beat/pulse by caregivers: a comparison of 4 methods. J Pediatr 2000;137(3):429-30.

LOE 5. Poor. Neutral.
Parents were given instructions on how to palpate pulses and listen at cardiac apex; they performed a comparison of these assessments on healthy infants.No comment on industry funding.

15. Tibballs J, Russell P. Reliability of pulse palpation by healthcare personnel to diagnose paediatric cardiac arrest. Resuscitation2009; 80(1): 61-4.

LOE 3. Good. Opposing.
Only published study examining healthcare providers performing pulse checks in pediatric patients in a pulseless state. No comment on industry funding.

16. Whitelaw CC, Goldsmith LJ. Comparison of two techniques for determining the presence of a pulse in an infant. Acad Emerg Med 1997;4(2):153-4.

LOE 5. Poor. Opposing.
Health care providers assessed brachial and femoral pulses in a healthy infant (one child used as subject throughout entire study). Brachial pulses were successfully palpated within 10 seconds by 18% of subjects; femoral pulses were successfully palpated within 10 seconds by 21% of subjects. No comment on industry funding.