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

Worksheet author(s)

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Clinical question.

EIT-032 "(P)In adult patients receiving chest compressions I - is there a method to teach chest compressions(C) compared with current teaching (O) to achieve full chest recoil (complete release) after each chest compression? (Interventional WS)".

Is this question addressing an intervention/therapy, prognosis or diagnosis? Teaching an intervention.

State if this is a proposed new topic or revision of existing worksheet: New topic.

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? No. I have performed research and published peer-reviewed articles on this topic. Consultant: Medtronic, JoLife, Take Heart America; President (volunteer position) of the Citizen CPR Foundation; Volunteer, National American Heart Association BLS Subcommittee

Search strategy (including electronic databases searched).

Electronic data bases:
OVID MEDLINE
AMED
BIOSIS
EMBASE
Global Health
NASW Clinical Register
Google

Search terms included: Cardiopulmonary resuscitation, CPR, compression, decompression, chest recoil, chest wall recoil, complete chest recoil, incomplete recoil, incomplete chest recoil, incomplete chest wall recoil

- State inclusion and exclusion criteria

Included years 1997-2009
English language
Animal or human studies
Pediatric and adult

Exclusion criteria: Abstract-only articles were excluded (the corresponding full text article was searched for), as were reviews, guidelines, current opinion articles, non-peer reviewed papers, and manuscripts not addressing complete chest recoil.

- Number of articles/sources meeting criteria for further review: 6

Summary of evidence

Evidence Supporting Clinical Question

Good				**(Niles,2009,553; 4E)** **(Sutton,2009,494;4E)** **(Sutton, 2009, 1259;4E)**	**(Aufderheide, 2006,341; 5E)** **(Aufderheide, 2005,353; 4E, 5E)** **(Wenzel,1997,129; 5E)**
Fair					
Poor					
	1	**2**	**3**	**4**	**5**
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					
	1	**2**	**3**	**4**	**5**
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					
Fair					
Poor					
	1	**2**	**3**	**4**	**5**
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

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

Using electronic recordings of intra-tracheal pressure in humans receiving CPR from professional rescuers following out-of-hospital cardiac arrest, Aufderheide (Aufderheide,2005,353) showed a 46% incidence of incomplete chest recoil with the AHA-recommended CPR technique. Sutton (Sutton, 2009,494) showed a 23.4% incidence of incomplete recoil (excessive residual leaning force (>or=2500 g) in pediatric in-hospital resuscitations. He also demonstrated that incomplete recoil was more likely to occur following pauses for a provider switch (Sutteon,2009,1259). Niles (Niles,2009,553) electronically recorded chest recoil during in-hospital pediatric cardiac arrests, and found that leaning on the chest (>2.5 kg; an adult feedback threshold) occurred in 50% of chest compression/decompressions and that the incidence of incomplete recoil was significantly reduced with real-time automated feedback. Wenzel (Wenzel,1997,129) showed that without specific training in complete chest recoil CPR technique, 22% of medical students leaned on the chest during CPR 6 months following training.

Aufderheide demonstrated significant improvement (in a manikin model) in complete chest recoil using simple techniques to lift the heel of the chest-compressing hand slightly, but completely off the chest following each compression. (Aufderheide, 2006, p341; Aufderheide, 2005, p353) Three alternative CPR techniques (the "Two-Finger Fulcrum", "Five-Finger Fulcrum", and "Hands-Off" Techniques) were found to significantly increase the incidence of complete chest recoil during CPR when performed by both professional as well as layperson rescuers compared with the standard AHA hand position. (Aufderheide, 2006, p341; Aufderheide, 2005, p353). However, duty cycle and compression depth were reduced when both professional and layperson rescuers applied these techniques. Skill in applying these techniques requires psychomotor practice and these techniques have only been applied in a manikin model (making their effects when applied to humans unknown).

Acknowledgements:

Citation List

1. Aufderheide TP, Pirrallo RG, Yannopoulos D, Klein JP, von Briesen C, Sparks CW, Deja KA, Kitscha DJ, Provo TA, Lurie KG. Incomplete chest wall decompression: a clinical evaluation of CPR performed by trained laypersons and an assessment of alternative manual chest compression-decompression techniques. Resuscitation. 2006 Dec;71(3):341-51.

   Good quality, LOE 5, supportive. Manikin studies performed in a prospective randomized manner comparing standard CPR technique to multiple different hand positions to optimize chest compression and chest decompression, performed by trained laypersons.

2. Aufderheide TP, Pirrallo RG, Yannopoulos D, Klein JP, von Briesen C, Sparks CW, Deja KA, Conrad CJ, Kitscha DJ, Provo TA, Lurie KG. Incomplete chest wall decompression: a clinical evaluation of CPR performance by EMS personnel and assessment of alternative manual chest compression-decompression techniques.Resuscitation. 2005 Mar;64(3):353-62.

   Good quality, LOE 4 and LOE 5, supportive. Two parts: a) Clinical case series demonstrating incomplete chest wall recoil in 46% of cases. b) manikin studies performed in a prospective randomized manner comparing multiple different hand positions to optimize chest compression and chest decompression, performed by professional EMS personnel.

3. Niles D, Nysaether J, Sutton R, Nishisaki A, Abella BS, Arbogast K, Maltese MR, Berg RA, Helfaer M, Nadkarni V. Leaning is common during in-hospital pediatric CPR, and decreased with automated corrective feedback. Resuscitation. 2009 May;80(5):553-7.

Good quality, LOE 4, supportive. Demonstrate leaning in 50% of chest compressions performed during in-hospital pediatric cardiac arrests. The incidence of leaning was significantly reduced with real-time automated feedback.

4. Wenzel V, Lehmkuhl P, Kubilis P, Idris A, Pichlmayr I. Poor correlation of mouth-to-mouth ventilation skills after basic life support training and 6 months later. Resuscitation 35: 129-134 (1997)

   Good quality, LOE 5, supportive. Manikin study demonstrating that lack of specific teaching related to leaning on the chest after each compression resulted in poor retention skills as 22% of the subjects leaned on the chest 6 months after being taught CPR. This paper emphasizes the need to teach student specifically about the importance of full chest wall recoil and the correct hand position to accomplish this.

5. Sutton RM, Niles D, Nysaether J, Abella BS, Arbogast KB, Nishisaki A, Maltese MR, Donoghue A, Bishnoi R, Helfaer MA, Myklebust H, Nadkarni V. Quantitative analysis of CPR quality during in-hospital resuscitation of older children and adolescents. Pediatrics. 2009 Aug;124(2):494-9.

   Good quality, LOE 4, supportive. Case series of 18 pediatric in-hospital cardiac arrests evaluating quality of CPR performed. There was excessive residual leaning force (>or=2500 g) in 23.4% of compressions (8611 of 36749 compressions).

6. Sutton RM, Maltese MR, Niles D, French B, Nishisaki A, Arbogast KB, Donoghue A, Berg RA, Helfaer MA, Nadkarni V. Quantitative analysis of chest compression interruptions during in-hospital resuscitation of older children and adolescents. Resuscitation. 2009 Nov;80(11):1259-63.

   Good quality, LOE 4, supportive. Case series analyzing CPR quality in pediatric ICU/ED cardiac arrests with attention to pauses in chest compressions. CPR epochs following pauses due to provider switch were more likely to have measurable residual leaning (OR: 5.52; CI(95): 2.94, 10.32; p<0.001)