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

Worksheet author(s)

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Clinical question.

In rescuers performing CPR on adult or paediatric patients (P), does compression only CPR (I) when compared with traditional CPR (C) result in an increase in adverse outcomes (e.g. fatigue) (O)?

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

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

Search strategy (including electronic databases searched).

Medline (PubMed, Ovid, SCOPUS)
Embase.
Follow-up of quoted references

Cardiopulmonary resuscitation OR CPR AND fatigue
Cardiopulmonary resuscitation OR CPR AND quality
Chest compression AND fatigue
Chest compression AND quality
Chest compression AND continuous

• State inclusion and exclusion criteria.
Chest compressions given mechanically or using feedback devices excluded.

• Number of articles/sources meeting criteria for further review:
465 papers met the above criteria; 25 papers were reviewed; 7 papers were considered relevant to the question

Updated search 17 August 2009 - Search terms as above – articles since July 2007 (date of initial search)

211additional papers met the above criteria; 4 papers were considered relevant to the question

Summary of evidence

Evidence Supporting Clinical Question

Good					Hightower, 1995 E
Fair					Huseyin, 2002 E Ashton, 2002 E Odegaard, 2007 E Trowbridge, 2009, 6 E
Poor					Ochoa, 1998 E
	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

denotes key article

Evidence Neutral to Clinical question

Good					
Fair				Sugerman, 2009, 981 E	Heidenreich, 2006 E Lucia, 1999 E
Poor					Riera, 2007, 108 E Manders, 2009, 1015 E
	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:

A single in-hospital, human study was found that measured quality of CPR during actual cardiac arrest procedures by healthcare professionals (LOE 4: Sugerman, 2009, 981). A sensing device with feedback to the rescuer was used to measure depth and rate of continuous chest compression for 3min. After 90sec, there was a significant fall in mean depth of compression, although this was not considered clinically significant. A weakness of the study was the presence of the feedback device which may have helped to encourage the rescuers to maintain adequate compression.

A single, manikin, study was found that directly compared the quality of continuous chest compression (CCC) with 30:2 CPR(LOE 5 Odegaard, 2007, 335). Travellers at Oslo Airport were invited to volunteer, then randomised to perform 5 min of 15:2, 30:2, or continuous chest compression. Quality of compression was measured as depth and rate. The mean depth of compression during CCC was reduced significantly with time ($p=0.01$), and the mean depth (30mm ± 8mm) was significantly less than that for 30:2 (45±8; $p=<0.05$). There was no significant difference in rates of compression.

Five manikin studies were found that measured the effect of time (3-18 min) on the quality of CCC without comparison with CPR. Four of these (LOE 5: Ashton, 2002, 151; Hightower, 1995, 300; Huseyin, 2002, 57; Ochoa, 1998, 149) demonstrated a time-related deterioration in quality of chest compression. In each, compression depth was included as part of 'correct/adequate' compressions, but without specific data as to the actual depths of compression achieved. The aim of the fifth study (LOE 5: Lucia, 1999, 158) was to evaluate the effect of physical fitness on performance of CC. No values for compression depth are reported, but 'the mean values fell within standard accepted limits (38 to 51 mm)…'

Two LOE 5 manikin studies (Lucia, 1999, 158; Riera, 2007, 108) were found that demonstrated that performing chest compressions increases heart rate and oxygen consumption in healthcare professionals. Three LOE 5 studies (Odegaard 2007, 335; Trowbridge, 2009, 6; Lucia, 1999, 158) showed that some rescuers are unable to complete 5min (laypeople), 5-6min (laypeople) or 18min (healthcare professionals) continuous chest compression respectively because of physical exhaustion.

One manikin study (LOE 5: Heidenreich, 2006, 1020) compared 9-minutes of CCC with 15:2 CPR. The mean number of 'adequate compressions' were greater for CCC than 15:2 for the first 2 minutes, no longer different by the third minute, and less by the ninth minute.

A single, manikin, healthcare professional, LOE 5 study (Manders, 2009, 1015) compared the number of effective (depth >38mm) compressions over 8 min, changing rescuer every 1 minute with changing every 2 min. Fatigue was reported more frequently with 2-min periods of compression, but total effective compressions were similar.

Acknowledgements:

None

Citation List

Ashton A, McCluskey A, Gwinnutt CL, A.M. Keenan AM. Effect of rescuer fatigue on performance of continuous external chest compressions over 3 min. Resuscitation 2002; 55: 151-155.

Level 5 (manikin). Fair. Supporting.
Continuous chest compressions only. 2 x 3-min periods. Deterioration in depth/quality of compression over each 3-min period.

Heidenreich JW, Berg, RA, Higdon TA, Ewy GA, Kern KB, Sanders AB. Rescuer Fatigue: Standard versus Continuous Chest-Compression Cardiopulmonary Resuscitation. Academic Emerg Med 2006; 13: 1020-1026.

Level 5 (manikin). Fair. Neutral.
Compared 9-minutes of continuous compressions with 15:2 CPR, not 30:2 The mean number of 'adequate compressions' were greater for continuous than 15:2 for the first 2 minutes, no longer different by the third minute, and less by the ninth minute. Although not compared with 30:2, showed initial good compression quality, deteriorating with time.

Hightower D, Thomas SH, Stone CK, Dunn K, March JA. Decay in quality of closed-chest compressions over time. Ann Emerg Med 1995; 26: 300-303.

Level 5 (manikin). Good. Supporting.
Continuous compression only, but clear deterioration in quality over 5 minutes.

Huseyin TS, Matthews AJ, Wills P, O'Neill VM. Improving the effectiveness of continuous closed chest compressions: an exploratory study. Resuscitation 2002; 54: 57-62.

Level 5 (manikin). Fair. Supporting.
Multiple comparisons of quality continuous chest compression, using teams of 2-3 rescuers. Clear deterioration in quality of compression seen, but value limited because of the team effect.

Lucía A, de las Heras JF, Pérez M, Elvira JC, Carvajal A, Álvarez AJ, Chicharro JL. The Importance of Physical Fitness In the Performance of Adequate Cardiopulmonary resuscitation. Chest 1999; 115: 158-164.

Level 5 (manikin). Fair. Neutral.
The aim of the study was to evaluate the effect of physical fitness on performance of continuous chest compression. No values for compression depth are reported, but 'the mean values fell within standard accepted limits (38 to 51 mm).

Manders S, Geijsel FEC. Alternating providers during continuous chest compressions for cardiac arrest: Every minute or every two minutes? Resuscitation 2009; 80: 1015–1018.

Level 5 (manikin). Poor. Neutral.
Thirty-six nurses in teams of 2 randomized (toss of coin) to deliver 1- or 2-min continuous chest compression on a manikin then changing over with partner to give a total of 8 min compressions. Ten sec delay allowed at each changeover to mimic checks. Subjective fatigue recorded sooner with 2-min changeover, but number of effective (depth >38mm) compressions in 8 min no different for 1- or 2-min changeover. .

Ochoa FJ, Ramalle-Gomara E, Lisa V, Saralegui I. The effect of rescuer fatigue on the quality of chest compressions. Resuscitation 1998; 37: 149-152.

Level 5 (manikin). Poor. Supporting.
No randomisation or control, and no comparison with CPR. However, clear deterioration in quality in second of 5 minute of continuous compressions.

Odegaard S, Saether E, Steen PA, Wik L. Quality of lay person CPR performance with compression:ventilation ratios 15:2, 30:2 or continuous chest compressions without ventilations on manikins. Resuscitation 2006; 71: 335-340.

Leve l 5 (manikin) Fair. Supporting.
Travellers at Oslo Airport were invited to volunteer, then randomised to perform 5 min of 15:2, 30:2, or continuous chest compression. Quality of compression was measured as depth and rate. The mean depth of compression during CCC was reduced significantly with time (p=0.01), and the mean depth (30mm ± 8mm) was significantly less than that for 30:2 (45±8; p=<0.05). There was no significant difference in rates of compression

Riera SQ, González BS, Alvarez JT, Fernández M del M, Saura JM. The physiological effect on rescuers of doing 2min of uninterrupted chest compressions. Resuscitation 2007; 74: 108-112.

Level 5 (manikin) Poor. Neutral.
Twenty-three healthy healthcare volunteers performed chest compression for 2min. Heart rate rose after 1 and 2min performance with no significant fall in SpO_2. All volunteers completed 2min without undue fatigue.

Sugerman NT, Edelson DP, Leary M, Weidman EK, Herzberg DL, Vanden Hoek TL, Becker LB, Abella BS. Rescuer fatigue during actual in-hospital cardiopulmonary resuscitation with audiovisual feedback: A prospective multicenter study. Resuscitation 2009; 80: 981–984.

Level 4. Fair. Neutral.
135 episodes of continuous chest compression by healthcare professionals during in-hospital cardiac arrest procedures were monitored. A sensing device with feedback to the rescuer was used to record depth and rate of compression for 3 min. After 90 sec, there was a significant fall in mean depth of compression, although this was not considered clinically significant. A weakness of the study was the presence of the feedback device which may have helped to encourage the rescuers to maintain adequate compression.

Trowbridge C, Parekh JN, Ricard MD, Potts J, Patrickson WC, Cason CL. A randomized cross-over study of the quality of cardiopulmonary resuscitation among females performing 30:2 and hands-only cardiopulmonary resuscitation. BMC Nursing 2009; 8: 6-18.

Level 5. Fair. Supporting.
Twenty lay female volunteers randomized (cross-over) to 30:2 or continuous compression on a manikin. Rate and depth of compression recorded over 10 min with biometric measurements and lactate levels used to assess fatigue. Three subjects unable to complete the 10 min of continuous compressions. Significant reduction in depth of compression during continuous compressions, but no significant change in compression rate.