Clinical question.

In pediatric patients in cardiac arrest (prehospital [OHCA], in-hospital [IHCA]) (P) does the use of one hand chest compression (I) compared with two hand chest compressions (C) improve outcomes (eg. ROSC, rescuer performance)

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: Revision

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 (ISI web of knowledge)
“Heart arrest” or “cardiopulmonary resuscitation” as MeSH AND “chest compression” as Topic (textword) AND “one hand*” or “two hand*” as Topic (49 hits)
“Heart arrest” or “cardiopulmonary resuscitation” as MeSH AND “chest compression” as Topic (textword) AND “child*” or “pediatric* or paediatric*” as Topic (50 hits)
CINAHL “Heart arrest” or “cardiopulmonary resuscitation” as MeSH AND “chest compression” as textword (52 hits)
EMBASE “Heart arrest” or “resuscitation” as MeSH AND “chest compression” as textword AND “child*” or “pediatric* or paediatric*” as text words (132 hits)
AHAEndnote Master Library, Cochrane database, review of references from articles and forward search using SCOPUS revealed no new articles

“Heart arrest” or “cardiopulmonary resuscitation” as MeSH AND “decompression” as Topic yielded no relevant articles

State inclusion and exclusion criteria

Inclusion: human, manikin, animal studies in children and adults
Exclusion: review articles

Number of articles/sources meeting criteria for further review:
4 articles met criteria for review. All were LOE 5 (manikin studies)
## Summary of evidence

### Evidence Supporting Clinical Question

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**Level of evidence**

- A = Return of spontaneous circulation
- B = Survival of event
- C = Survival to hospital discharge
- D = Intact neurological survival
- E = Other endpoint
- * = Animal studies
### Evidence Neutral to Clinical question

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### Evidence Opposing Clinical Question

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

There remain no outcome studies of children that compare one-handed versus two-handed chest compressions and there are only four small studies that have investigated rescuer performance using a manikin model. A limitation of each of the studies was the lack of a power calculation to determine sample size. All of the studies examined health care professionals performing chest compressions on a child size manikin that is designed to represent a six-year old child. The majority of health care professionals were female medical and nursing staff.

One study showed that the quality of chest compression improved with the two-handed technique as measured by mean and peak chest compressions (Stevenson et al., 2005). Extrapolation of these data to a child in cardiac arrest is difficult as the clinical significance of the data is unclear. The depth of compressions was not measured. Another study reported no difference in compression rates for both techniques, but demonstrated less rescuer fatigue with the two-handed compression technique as measured by a decrease in compression rate between the first and last compression cycle over a one minute period (Peska et al., 2006). Again, it is unclear if the decrease in compression rate was clinically important.

Haque et al., (2008) did not specifically focus on the topic, but when comparing 30:2 and 15:2 chest compression ventilation ratios, measures of the quality of the chest compressions and rescuer fatigue for one-handed versus two-handed chest compressions were reported. The results suggested improvements in compression depth, compression peak and mean pressure, compression rate and number of compression cycles and less rescuer fatigue for two-handed chest compressions. There was no statistical analysis of these data, therefore, this study was regarded as neutral evidence. However, a subsequent analysis of the one-handed and two-handed chest compressions for the 30:2 ratio was later reported (Udassi et al., 2009) and there was found to be no significant differences in the quality of compressions or rescuer fatigue between the two groups.

The height of the trolley was standardized to the iliac crests of the rescuers for three of the studies (Haque et al., 2008; Stevenson et al., 2005; Udassi et al., 2009). There was no attempt to evaluate the decompression phase of CPR in any of the studies.

Two studies reported that the majority of rescuers preferred the two-handed technique (Peska et al, 2006; Stevenson et al., 2005).

In summary, there is weak evidence that supports the use of a two-handed chest compression technique on a manikin model. It is unclear if the findings would apply to a smaller child (eg. two year old). It has not been determined whether compressions may be too forceful with the two-handed technique and nor has the size of the rescuers been considered. It is also possible that the findings are less applicable to male rescuers. Furthermore the studies have not investigated the quality of chest compressions provided by lay rescuers. Despite these limitations, it would seem that the potential benefits, including simplifying teaching of CPR, outweigh the risks and it is reasonable that either the one-handed or two-handed technique can be used for chest compressions in children.

Acknowledgements: Nil

Citation List


LOE 5 (manikin study) fair, neutral evidence (raw data suggested improved quality of chest compressions and less rescuer fatigue with two handed technique for both 30:2 and 15:2 ratios, however, the study was not designed to directly answer the ILCOR question, therefore there was no statistical analysis of these variables. As such, the study has been assessed as neutral).

- 32 of 80 subjects (79% female) mostly experienced paediatric medical & nursing staff
- Manikins placed on hospital stretcher and height adjusted to iliac crest of rescuer
- Raw data suggested improvements in, compression depth, compression peak pressure, compression mean pressure, compression rate & number of compression cycles for two handed chest compression performed on child size manikin for 5 minute periods.
- Increases in rescuer mean pulse and mean respiratory rate were also noted for those performing one handed chest compressions versus two handed chest compressions

LOE 5 (manikin study) fair, opposing evidence (fatigability) to neutral evidence (compression rates).
- Investigators analysing outcomes not blinded to comparison groups (video-taped data)
- 62 medical & nursing staff from ED, 59% female
- 1 size manikin representing 6 year old child
- Chest compressions (2 rescuers with Bag-mask ventilation) performed over relatively short period of time (1 minute)
- Unclear where manikin was located (eg. floor, bed) & whether adjusted for height of rescuer
- Fatigability measured by decrease in compression rate between first and last compression cycle. Although the compression rate decreased more quickly with one handed compressions, given that the median compression rate was higher than recommended guidelines (133.6), it is unclear what the impact on rescuer fatigue would be if performing compressions at the slower rate of 100/minute.
- 66% reported preference for 2 handed technique


LOE 5 (manikin study) fair, opposing evidence (mean & peak compression pressures)
Small study, unclear if investigators blinded to technique when analysing data
- 30 health professionals from ED, 70% female
- 1 size manikin representing 6 year old child
- Chest compressions performed over relatively short period of time (1 minute)
- Manikins placed on hospital stretcher and height adjusted to iliac crest of rescuer
- Unclear of clinical significance, that is, how these mean & peak pressures relate to optimal haemodynamics measurements in children, or the depth of compression required
- 97% reported 2 handed technique easier to perform


LOE 5 (manikin study) fair, neutral evidence for compression depth, compression pressures(mean & peak), compression rate and fatigability
- Study is a subsequent analysis of data arising from Haque (2008) study
- 32 subjects, mostly female (84%) experienced pediatric health care providers, performed chest compressions as lone rescuer (30:2 ratio with simulated rescue breathing) for a 5 minute period
- 1 size manikin representing 6 year old child
- Manikins placed on hospital stretcher and height adjusted to iliac crest of rescuer