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

**Worksheet author(s)**

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<tr>
<th>Name</th>
<th>Date Submitted for review:</th>
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<tbody>
<tr>
<td>Diana Cave</td>
<td>8/11/2009; 2/1/2010</td>
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**Clinical question.**

BLS 026(B) In adult and pediatric patients in cardiac arrest (pre-hospital [OHCA], in-hospital [IHCA]) (P), does the use of compressions first (30:2) (I) compared with standard care (2:30) (C), improve outcome (eg. ROSC, survival) (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).**

1) OVID Medline/Pubmed was searched using the following strategies:
   A) MeSH headings "heart arrest" OR "CPR" OR "ventricular fibrillation" OR "cardiopulmonary resuscitation"
   B) AND keywords "30:2" OR "2:30"
   C) AND keywords "sequence"
   D) AND keywords "initial rescue breaths" OR "initial compressions"
   E) AND keywords "CPR sequence"
   F) AND "ABC" OR "CAB"

2) Forward search on Google Scholar and PubMed [yielded no additional articles]

3) Cochrane Database of Systematic Reviews searched using defined terms [yielded no additional articles]

4) AHA EndNote Library X [yielded no additional articles]

**State inclusion and exclusion criteria**

**Exclusion criteria –**

1) Abstract only studies are excluded from this review.

**Inclusion criteria –**

1) All peer-reviewed articles comparing CPR with initial compressions to CPR with initial ventilations are included.

**Number of articles/sources meeting criteria for further review:** Four.

- Only one study compares compressions first (30:2) to ventilations first (2:30):
   - LOE 5 study: Kobayashi, 2008, 333
- Two peer-reviewed position articles and one book chapter are included for evidence evaluation as they directly address this research question.
  - Position papers: Nolan 2008; Meursing BTJ, 2005
  - Book Chapter: Handley, 2005

2) A hand search was conducted of the reference lists from the four selected articles and yielded 9 additional articles. These 25 articles do not directly answer the research question and are therefore listed as LOE 5 for the purpose of this worksheet. However, these articles do provide rationale to support compressions first (30:2) as compared to ventilations first (2:30) and are therefore included in this review. Rationale supporting CAB (30:2) includes the following:

   - Airway & Breathing:
     - Studies identifying barriers to a rescuer opening a victim’s airway and giving 2 breaths. Any delay in providing the initial breaths in the ABC (2:30) model will delay compressions.
     - Delays in giving rescue breaths: Odegaard, 2006; Higdon, 2006; Nolan, 2006; Odegaard, 2008
# Summary of Evidence

## Evidence Supporting Clinical Question

Does **CAB CPR** (30:2) as compared with **ABC CPR** (2:30) improve outcome (eg. ROSC, survival)

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- **Meursing, 2005, 279-86**  
  *(position paper supporting CAB)*
- **Handley, 2005, S7-S23**  
  *(ERC Guidelines 2005)*
- **Nolan, 2008, 194-9**  
  *(Review article, rationale for CAB)*

- **Kobayashi, 2008, 333-9**  
  *(observational mannequin study CAB v ABC)*

### Level of evidence

- **A** = Return of spontaneous circulation
- **B** = Survival of event
- **E<sub>a</sub>** = airway/breathing
- **E<sub>c</sub>** = circulation
- **C** = Survival to hospital discharge
- **D** = Intact neurological survival
- **E** = Other endpoint
- **Italics** = Animal studies

## Evidence Neutral to Clinical question

Does **CAB CPR** (30:2) as compared with **ABC CPR** (2:30) improve outcome (eg. ROSC, survival)

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### Evidence Opposing Clinical Question

Does **CAB CPR** (30:2) as compared with **ABC CPR** (2:30) improve outcome (eg. ROSC, survival)

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A = Return of spontaneous circulation  
B = Survival of event  
E<sup>b</sup> = airway/breathing  
C = Survival to hospital discharge  
D = Intact neurological survival  
E<sup>c</sup> = circulation  

*Italics = Animal studies*  
E = Other endpoint
# Summary of evidence

## Evidence Supporting Clinical Question

There are barriers to providing ventilation during CPR

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| Good              |  |  |  |  | Odegaard, 2006, 335-40  
(Compared CPR parameters for 15:2, 30:2, CC) |
| Fair              |  |  |  |  |  
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### Level of evidence

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## Evidence Neutral to Clinical question

There are barriers to providing ventilations during CPR

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| Good              |  |  |  |  | Nolan, 2006, 112-4  
(E, v, c  
(observation mannequin study, ventilation time)  
Odegaard, 2008, 57-62  
(observation, HCP BVM ventilation during CA) |
| Fair              |  |  |  |  |  
| Poor              |  |  |  |  |  
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Evidence Opposing Clinical Question

There are barriers to providing ventilations during CPR

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In adult and pediatric patients in cardiac arrest (pre-hospital [OHCA], in-hospital [IHCA]) (P), does the use of compressions first (30:2) (I) compared with standard care (2:30) (C), improve outcome (eg. ROSC, survival) (O)?

- There are no published studies comparing patient outcomes (e.g. ROSC, survival to discharge) of compressions first 30:2 (CAB CPR) to ventilation first (2:30) CPR. There are no LOE 1,2,3,4 studies examining this research question. Despite the dearth of sound data on this specific topic, rationale conjecture from several other good quality, LOE 1-4 studies, lends credence towards support of compression first or CAB CPR.

- Only one study LOE 5 study (Kobayashi, 2008, 333) to date, addresses this research question but due to several methodological issues, it is difficult to draw conclusions from the results. Researchers used data recording mannequins and direct observation to measure and evaluate the differences in CPR performance between 33 teams consisting of two MDs, two RNs and two paramedics. Teams were asked to do either ABC 2:30 CPR, or CAB 30:2 CPR. Researchers noted a 30 second delay in initiating compressions with the participants doing ABC CPR. The median time to initiate compressions for teams doing ABC CPR was 42 seconds while the median time for CAB CPR was 16 seconds (p>0.001). Unfortunately, this study has several methodological issues including no randomization of teams, no attempt to cross over groups; assumption of researchers that all teams had the same base level of training and initial skill set.

- There are two peer-reviewed position articles and one book chapter section that provide supporting evidence to this research question, [Nolan 2008,194; Meursing BTJ, 2005, Handley, 2005, 67S1]. The European Resuscitation Council revised their cardiac arrest algorithm in 2005 in support of compressions first. Handley, et al in, “European Resuscitation Council Guidelines for Resuscitation 2005: Section 2. Adult basic life support and use of automated external defibrillators” describes the algorithm and provides the rationale for each step. Both ventilation and circulation issues contribute to poor quality CPR that inevitably lead to poor patient outcomes. Handley (2005) states “It is also recognized
that rescuers are frequently unwilling to carry out mouth-to-mouth ventilation for a variety of reasons, including fear of infection and distaste for the procedure”.[Ornato, 1990, 151; Brenner, 1997, 203; 48; Hew, 1997, 279].

- It is well recognised that skill acquisition and retention is aided by simplification of the BLS sequence of actions”. [Handley, 1998] Handley, (1998) conducted a comparative study using a simplified version of the BLS algorithm to assess learning and retention of BLS skills. Those in the 4-step group were significantly better than those in the 8-step group at remembering the sequence of skills immediately after training (P=0.04), 1 week later (P<0.001) and at 6 weeks (P<0.001).

- Delays in ventilation, related to either fear or lack of skill set, are well documented in the literature. Odegaard S, (2006) conducted a good quality LOE 3 study that compared 15:2, 30:2 and continuous compression CPR. Approximately 75% of the 68 subjects had previous CPR training, but it was 8-12 years previously. Compressions per minute were substantially lower in both ventilation groups at about 40/minute than for the compression only group. Of note, it took an average of 13 seconds for both the 30:2 and 15:2 groups to give 2 rescue breaths and number of effective breaths was only 3 per minute. Higdon TA, (2006) conducted a fair LOE 5, and found trained professionals following AHA guidelines cannot deliver two breaths in less than 10 seconds. Prior studies have shown lay persons pause 16±1 second for 2 ventilations; medical students 14±1 second and now paramedics 10±1 sec.

- Nolan JP, Soar J, Baskett P, J. F (2006) LOE 5 observational manikin study: quality good, neutral. observational manikin study. Twenty participants were asked to complete one cycle of 30:2 CPR. Participants were primarily physicians and all participants had prior training in CPR. This study was completed in the UK in 2006 using 2005 ILCOR & ERC Guidelines. This study does not specify if participants demonstrated ABC CPR or CAB CPR. The median time for participants to complete the initial breaths was 7.3s (IQR 9.6s).

Acknowledgements:

Citation List


LOE 5: Math model developed to determine oxygen delivery for various compression:ventilation ratios. Researchers concluded current guidelines overestimate the need for ventilation during standard CPR by two to four-fold. Decreasing interruptions, such as unnecessary ventilations, during CPR will improve blood flow and oxygen delivery to the periphery.


LOE 5: Quality good; survey. Surveys were sent to 280 emergency and internal medicine house officers. The survey assessed willingness to participate in resuscitation activities for five hypothetical patients. Residents expressed less willingness to participate in mouth-to-mouth resuscitation as they became more experienced in their medical practice, applicants as compared to residents (56 versus 34%, P<0.00001); senior as compared to junior residents (29 versus 40%, P=0.01). The researchers concluded that there is a prevalence for many physicians and future doctors to become reluctant to perform mouth-to-mouth resuscitation on arrest victims in the community, as they more experience in training.


European Resuscitation Guidelines 2005 advocates 30 compressions prior to ventilation. The technique and rationale supporting the "CAB" method of resuscitation are described in this chapter.
LOE 5: Quality Good; supportive


This study is an attempt to see if simplifying the teaching of basic life support leads to better skill acquisition and retention. Forty-eight lay volunteers received instruction in CPR; 24 were taught the standard 8-step sequence whereas 24 were taught a simplified 4-step sequence. Tests of performance were carried out on a manikin before and after training. Those in the 4-step group were significantly better than those in the 8-step group at remembering the sequence of skills immediately after training (P=0.04), 1 week later (P<0.001) and at 6 weeks (P<0.001). Twenty-three out of the 24 volunteers in the 4-step group got the sequence completely correct each time they were tested, in contrast to only 2 out of the 24 in the 8-step group. There was no difference, however, in the quality of performance of the skills between the two groups. In addition, it was shown that use of the 4-step sequence should result in a useful reduction in the time taken before a rescuer calls for the emergency services and commences CPR. Whether such a radical change in teaching should be introduced is a matter for further discussion and research.


LOE 5 (observational mannequin study): Quality poor; supportive. Researchers used a data recording mannequins and observation to measure and evaluate the differences in CPR performance between 33 teams of participants. Teams consisted of two MDs, two RNs and two paramedics. Teams were asked to do either ABC 2:30 CPR, or CAB 30:2 CPR. Researchers noted a 30 second delay in initiating compressions with the participants doing ABC 30:2 CPR. The median time to initiate compressions for teams doing ABC CPR was 42 seconds while the median time for CAB CPR was 16 seconds (p>0.001). Unfortunately, this study has several methodological issues: no randomization of teams; no attempt to cross over groups; assumption that all teams had the same base level of training; unable to assess data as reported in results.


LOE 5: Review article; Historical perspective. This article is sited as a reference for the ERC BLS algorithm.

**Nolan J.** Basic life support.


LOE 5: Review Article. Review of changes in ERC BLS guidelines for 2005. This article includes a discussion of rationale supporting CAB CPR (30:2) versus ABC CPR (2:30).


LOE 5: observational mannequin study. Twenty participants were asked to complete one cycle of 30:2 CPR. Participants were primarily physicians and all participants had prior training in CPR. This study was completed in the UK in 2006 using 2005 ILCOR & ERC Guidelines. This study does not specify if participants demonstrated ABC CPR or CAB CPR. The median time for participants to complete the initial breaths was 7.3s (IQR 9.6s).


LOE 5 (manikin study). Convenience sample of 68 participants, randomized into one of three treatment groups and asked to do CPR (15:2, 30:2, or continuous compression) for 5 mins. No flow time was 49 +/- 13%(15:2); 38 ±20% (30:2) and 1 ±2%(CC) p < 0.05.


LOE5 (case series (LOE4): Quality good; neutral. Researchers hypothesised that the time used for two ventilations with a bag-valve-mask device before tracheal intubation is longer than recommended and that the extended time contributes to the high no flow time. This study analyzed data from 628 OOHCA cardiac arrest and concluded while pauses occur related to ventilation, they occur less than predicted (27% of total no flow time). The median time for 2 ventilations was 5.5s(iQR; 4.5, 7)