**Clinical question.**

"In adult cardiac arrest (pre-hospital or in-hospital) (P), does an alternate timing for advanced airway insertion (eg. early or delayed) (I) as opposed to standard care (standard position in algorithm) (C), improve outcome (O) (eg. ROSC, survival)?"

**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

**Conflict of interest specific to this question**

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet?

No conflict of interests to declare

**Search strategy (including electronic databases searched).**

**#1 National Center for Biotechnology (NCBI) at the US National Library of Medicine (PubMed) search reveals no MeSH for “airway insertion” as (I). As advanced airway management is part of “advanced cardiac life support (ACLS)”, this MeSH term has been used as the first criteria. ACLS and “airway management” or “airway insertion” reveal a number of more than thousands citations. “Tracheal intubation” however shows 61 potentially relevant publications, incl. extraglottic airway devices as well as manikin studies. The limitation for “adult +19years” revealed a total 25 studies and 3 review articles. Relevant and actual studies will be further starting points for literature search.**

Search: Cardiac Arrest AND Adults AND (advanced airway insertion or Endotracheal intubation) (Time Factors or ROSC)

Search: Cardiac Arrest AND (Clinical Trials OR Meta-Analysis OR Practice Guidelines OR Randomized Controlled Trials or Review or Systemic Reviews)

**#2 Cochrane Database search revealed with the broad MeSH term “Resuscitation” in combination with “tracheal intubation” only five citations of which only one was considered to be useful. At this stage the Cochrane Database does not seems to be an appropriate source for this worksheet topic.**

Search: Cardiac Arrest AND Airway

Cardiac Arrest AND Intubation

**#3 Google Scholar**

Search: Cardiac Arrest AND Airway

Cardiac Arrest AND Intubation

**#4 Existing guidelines**

**#5 EMBASE**

Search: Cardiac Arrest AND Airway AND Survival

**State inclusion and exclusion criteria**

**#1 Inclusion Criteria:** Humans, English Language

**#2 Exclusion Criteria:** We excluded all studies that compared outcome of ALS-CPR with or without advanced airway management as this is not the topic of this worksheet. All studies evaluating influencing factors of survival after CA that did not include advanced airway management were excluded. Furthermore, we excluded all trauma related studies that evaluated whether prehospital intubation per se influences outcome or not and that did not evaluate outcome parameters based on the timing of intubation. Studies, no matter whether manikin or patient studies, trauma or cardio-vascular entities, which addressed the influence of airway management on outcome and/or no-flow-times during CPR (know to be crucial for survival after CA) were included.

Case reports and abstract only publications were also excluded.

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

> 200

9 pertinent to Clinical Question (including one Cochrane review and one general review article)
**Summary of evidence**

**COMMENT BY THE AUTHORS:**
The actual guidelines and algorithms do not recommend a specific timing for advance airway management in cases of cardiac arrest. Based on the clinical question addressed in this worksheet a classification regarding “supporting”, “neutral” or “opposing” does not seem feasible. Therefore, we based our classification of the literature on the following assumption: Minimal interruption of the delivery of external chest compressions during CPR improves outcome after cardiac arrest.

**Evidence Supporting Clinical Question**

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<td>Gausche 2000 C/D</td>
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<td>Hillis 1993 C</td>
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<td>Jennings 2006 E</td>
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<td>Wiese 2009 E</td>
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<td>(Dumot, Burval et al. 2001) ABE</td>
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<td>(Niemann, Stratton et al. 2002) E</td>
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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  
*Italics = Animal studies*
## Evidence Neutral to 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  

*Italicics = Animal studies*

## Evidence Opposing 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  

*Italicics = Animal studies*
In adult cardiac arrest (prehospital or in-hospital) (P), does an alternative timing for advanced airway insertion (e.g. early or delayed) (I) as opposed to standard care (standard position in algorithm) (C), improve outcome (O) (e.g. ROSC, survival)

There are no published RCTs directly addressing the clinical question of this worksheet in adult human cardiac arrests.

We acknowledge the fact that there are skilled airway managers who are able to perform fast and successful endotracheal intubation during continuous external chest compressions. However, there is broad evidence, that out of hospital emergency airway management, including bag valve mask ventilation (BVM) and endotracheal intubation (ETI), is challenging even for experienced anesthesiologists when compared to elective conditions in the operation room (Timmermann, Eich et al. 2006, 179-85). Furthermore, the number of misplaced tubes in the out of hospital setting by clinicians skilled in airway management is alarmingly high. In addition the number of unknown deaths and/or worse outcome due to misplaced tracheal tubes or prolonged and multiple intubating attempts is presumably higher than known (Timmermann, Russo et al. 2007, 619-23) The 2005 guidelines consider the endotracheal tube as the “gold standard” for advanced airway, if the tube is placed by a skilled health care provider. But who is considered as a skilled airway manager? This question seems to be of particular importance, if the main target audience of universal guidelines is kept in mind.

Based on manikin studies (Wiese 2008, 217-23; Wiese 2008, 4) there is good evidence that airway clearance using EGA is accomplished at an earlier stage compared to tracheal intubation. Thus, resulting in a significant decrease in no-flow times (NFT). However, a major limitation of these studies is the fact that they are based on simulated scenarios. Indeed, either insertion or ventilation via EGAs seems to be associated with a higher success rate in manikins than in patients. Therefore, an extrapolation of the results to clinical situations remains difficult.

Regarding the worksheet’s clinical question, the only prospectively RCT took place in a pediatric population (Gausche 2000, 783-90). Pediatric patients in prehospital respiratory arrest were assigned to receive either endotracheal intubation (ETI) or bag valve mask (BVM). The outcome measures were survival to hospital and neurological status at discharge. The results showed no statistical difference between the two groups for either outcome measure. However, it is worth to mention, that tracheal intubation was performed by paramedics and - more importantly – the intubation success rate was an unacceptably low 56-67% (age dependent).

To our knowledge there is only one patient study explicitly addressing the rate of survival correlating to the timing of intubation (Shy 2004, 394-99). This working group looked at survival from cardiac arrest in relation to endotracheal intubation time. It was a retrospective cohort study of patients with Prehospital cardiac arrest receiving endotracheal intubation. They divided the 693 patients into two groups (quick ETI vs. slow ETI). “Quick ETI” was defined as 12 minutes or less after starting resuscitation and “slow ETI” was defined as 13 minutes or longer after the beginning of resuscitation. The “quick ETI group” demonstrated improved survival rates. Based on that data early ETI during the first three to four minutes seems to be favorable. However, a study protocol by Bobrow et al. (Bobrow 2008, 1158-65) focusing on minimal interruption of external chest compressions, did not permit endotracheal intubation until 3 cycles of shock were completed. The authors found a better out-come for the study group when compared to the standard of care in that given EMS area. However, the authors compared the study group (after MICR training) with a control group (before MICR training), which followed the guidelines of 2000. Jennings et al were able to show that ETI during resuscitation is more beneficial than no ETI or BVM only (Jennings 2006, 135-9). One observational study (Wiese 2009, 194-98) showed an easy handling of the LT during cardiac arrest situations when used by paramedics. Unfortunately, in this investigation no outcome parameters defined were defined.

In conclusion, an EGA rather than the usage of BVM seems to be helpful to reduce NFT during resuscitation, presumably resulting in an improved outcome after cardiac arrest. However, several models address a delayed onset of ventilation during CPR as beneficial not only because of a minimized interruption of ECC (Bobrow 2008, 1158-65) but also because positive pressure ventilation may be harmful as intrathoracic pressure increases, thereby decreasing venous return and myocardial blood flow.

Given the recent focus on airway management by lay people, the SOS Kanto study was able to show that advanced airway management during the first minutes of resuscitation is not as useful as it was thought to be (SOS Kanto 2009, 490-6). Otherwise, given the recent focus on “no-flow-time” (NFT), in cardiac arrest, there are several investigations which have shown that NFT is reduced when an alternative airway device other than the tracheal tube was used. (Kurola 2004, 149-53; Wiese 2008, 217-23; Wiese 2008, 4).
Acknowledgements:

Citation List

Abstract


