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Washington University Emergency Medicine Journal Club
Airway Management Techniques in Out-of-Hospital Cardiac Arrest

Vignette

You are on your favorite rotation of residency, EMS! You are having a dinner discussion with some of your favorite attendings...EMS ones of course. You ask the group "what do you think is the best way for EMS to manage the airway of cardiac arrest patients?"
Dr. Levine responds: "I still have my medics intubate. Endotracheal tubes are cheap and I also don't want my medics to lose their intubation skills by using alternate methods such as alternate airways or bag-valve-mask (BVM) ventilation."
The very intelligent and well-respected Dr. Svancarek gracefully responds: "But Dr. Levine, we now know that chest compressions are emphasized more than ever and intubation attempts in the field are difficult and timely and cause a significant number of chest compression interruptions. I say the best way is an alternate airway or 2-rescuer BVM."
Dr. Tan then states:"I agree with Dr. Svancarek. My medics go to the King first, although they have the option to intubate first if they feel it is a potentially easy airway."
Dr. Keeperman sighs and rolls his eyes.
Dr. Rathert: "What did I get myself into?"
Dr. Gilmore then pulls his ipad out: "You guys have clearly not been keeping up on the research. Let's pull some of the latest articles up and that should clear things up."

Or will it?

PICO Question
Population:Patient suffering out-of-hospital cardiac arrest (OOHCA).
Intervention: Endotracheal intubation (ETI).
Comparison:Supraglottic airway (SGA) insertion, BVM ventilation, or passive oxygen insufflation.
Outcome: Survival to hospital discharge and neurologic outcomes.

Search Strategy

You search pubmed using the airway "(out of hospital cardiac arrest) AND airway management" which yields 164 articles. After reviewing the titles, you select the four articles you feel best address the question at hand.

Article 1: Bobrow BJ, Ewy GA, Clark L, Chikani V, Berg RA, Sanders AB, et al. Passive oxygen insufflation is superior to bag-valve-mask ventilation for witnessed ventricular fibrillation out-of-hospital cardiac arrest. Ann Emerg Med. 2009 Nov; 54(5):656-662. Answer Key.

Article 2: Wang HE, Simeone SJ, Weaver MD, Callaway CW. Interruptions in cardiopulmonary resuscitation from paramedic endotracheal intubation. Ann Emerg Med. 2009 Nov;54(5):645-652. Answer Key.

Article 3: Studnek JR, Thestrup L, Vandeventer S, Ward SR, Staley K, Garvey L, et al. The association between prehospital endotracheal intubation attempts and survival to hospital discharge among out-of-hospital cardiac arrest patients. Acad Emerg Med. 2010 Sep;17(9):918-25. Answer Key.

Article 4: Wang HE, Szydlo D, Stouffer JA, Lin S, Carlson JN, Vaillancourt C, et al. Endotracheal intubation versus supraglottic airway insertion in out-of-hospital cardiac arrest. Resuscitation. 2012 Sep;83(9):1061-1066. Answer Key.

Bottom Line

Each year in the United States, Emergency Medical Services (EMS) treat approximately 300,000 cases of OOHCA (Lloyd-Jones 2009), with less than 10% of these patients surviving to hospital discharge (McNally 2011). Several studies have suggested that EMS protocols which focus on minimizing interruptions in chest compressions, such as minimally interrupted cardiac resuscitation and cardiocerebral resuscitation protocols, improve rates of neurologically intact survival in OOHCA, as discussed at a previous Journal Club. This has led to the American Heart Association placing more emphasis on chest compressions in CPR, deemphasizing the importance of definitive airway management (Field 2010).

ETI is often considered the standard method of definitive airway management. Safety concerns with prehospital ETI, including unrecognized esophageal intubation (Bair 2005) and interruptions in chest compressions during CPR (Wang 2009), have led many to propose alternative techniques such as BVM ventilation, SGA insertion, and passive ventilation (Guyette 2007, Hayes 2007, Jensen 2010, Deakin 2010). Even with alternate airways, the risk for hyperventilation remains, which has been shown to increase thoracic pressure and decrease coronary perfusion pressure in a pig model (Aufderheide 2004), and decreases cerebral blood flow (Raichle 1972).

Much debate still exists as to the proper management of oxygenation and ventilation in OOHCA. The majority of the literature on the subject is composed of observational studies, many based on pre-existing datasets (Bobrow 2009, Studnek 2010, Wang 2012). Dr. Henry Wang, one of the leading researchers in the area, has himself questioned the utility of such observational data (Wang 2010). However, many barriers exist to performing prospective or randomized trials in the prehospital arena, including lack of funding and issues of obtaining consent in this setting, as previously documented by the Resuscitation Outcomes Consortium. The FDA has made several recommendations regarding approval for Exception from Informed Consent (EFIC) (Table 1) which help illustrate this difficult process. While a large prospective, randomized trial to assess optimal airway management in OOHCA would be most helpful, we must utilize the current body of literature to develop EMS protocols.

Unfortunately, the current literature does not provide a clear answer to our clinical question. While ETI leads to interruptions in chest compression during CPR (Wang 2009), the impact of such interruptions is not immediately apparent. When passive ventilation was compared to BVM ventilation, improved neurologically intact survival was seen in patients with shockable rhythms; however, no significant difference was seen in the primary outcome, overall neurologically intact survival (Bobrow 2009). One study showed a negative association between prehospital ETI and survival (Studnek 2010), while another study showed an association between successful ETI and survival (Wang 2012). Such conflicting results leave a consensus far out of reach. Additionally, EMS training has often focused on the development of technical skills, ETI among them. Emphasis on continued use of ETI has persisted in part due to the association between clinical exposure and the likelihood of success on subsequent ETI attempts(Warner 2010, Wang 2005). The pride that many paramedics feel towards mastery of ETI complicates the implementation of strategies that place less emphasis on definitive airway management when definitive evidence to support such strategies is lacking.

Table 1 **FDA Criteria for EFIC** Guidance for Institutional Review Boards, Clinical Investigators, and Sponsors. Exception from Informed Consent Requirements for Emergency Research. Draft Guidance, 2006. Fed. Reg. 2006.
a) What are the costs, benefits, and feasibility of community consultation as currently required under 50.24?
b) What aspects of community consultation as currently practiced are effective mechanisms for human subject protection?
c) Are there additional practices that could enhance human subjects' protection?
d) Are there elements of community consultation both procedural and substantive that should, at a minimum, be required?
e) Would opt-out mechanisms to identify individuals who do not wish to be included as subjects in particular emergency research studies provide a necessary protection for human subjects? If so, are they feasible?
f) Who should use the information obtained from the community consultation process and how should they use it? Should the regulation be more specific on this point, and if so, what should it provide?
g) Are there others beside the IRB who should play a role in determining the adequacy of the plan for community consultation and the material to be publicly disclosed?
h) Should the regulation require documentation of meeting activities and discussions in sufficient detail to show the information that was disclosed and the community reaction to the clinical investigation? If so, who should be responsible for such documentation?
i) Should the regulation also require that documentation of community consultation activities be submitted to FDA, for example by being placed in the public docket? If so, who should be responsible for doing this?
j) Should this information also be available elsewhere such as on clinicaltrials.gov?