

Prehospital Intubation: The Right Tools in the Right Hands at the Right Time

Holger Herff, MD*

Volker Wenzel, MD, MSc*

David Lockey, FRCA, FIMC, RCS (Ed)†

In this issue of the journal, Cobas et al.¹ report that paramedics in the metropolitan area of Miami, Florida, had problems in 31% of all intubation attempts on trauma patients. It is highly likely that there are similar results in other emergency medical service (EMS) systems, but many may be reluctant to publish negative results. These clinicians in Miami, Florida, are therefore to be congratulated for placing these serious problems into the public spotlight. The observations from Miami, Florida, are in strong contrast to a previous prehospital study in Bordeaux, France, where senior emergency physicians had intubation problems in only 3% of the cases.² This suggests that a significant factor in successful out-of-hospital advanced airway management may be the experience and training of the individual providers.² The helicopter EMS paramedics in the study by Cobas et al.¹ had greater success in airway management than their paramedic colleagues working in ground EMS units. This is not surprising because helicopter EMS personnel usually respond to more major trauma cases than their ground EMS colleagues and perform advanced airway management more often.³ Accordingly, they may also have more experience with alternative airway devices. For example, in Bordeaux, France, experienced emergency physicians used the intubating laryngeal mask airway device in 3% of patients with intubation difficulties (45 of 2082); of these, 96% could be ventilated with the rescue device (43 of 45).² Thus, combining tracheal intubation with one single alternative airway device resulted in nearly 100% success rate in advanced airway management (2080 of 2082).² In contrast, the patients in Miami, Florida, were managed in a rescue strategy with a laryngeal tube as an alternative airway device; interestingly, this group had the worst outcome.¹ It may well be that, rather than demonstrating the different success rates of alternative airway devices, these results may simply be the surrogate marker for an extremely difficult airway situation, with a corresponding poor outcome. In general, the less experienced a rescuer is in advanced airway management, the more likely he or she is to need to use alternative airway devices. However, he or she is less likely to be successful using these devices. The question of which specific airway device should be used at which time has not been answered. Hypoxia in the field may develop rapidly, and the use of airway rescue techniques may again merely be a surrogate marker for bad outcome in patients with difficult airways, decreased physiological reserve, and more severe injury. There is reason to believe that hypoxia may develop more quickly in the field than during the administration of routine anesthesia in the operating room. This is due to hypoventilation, shock, and increased oxygen consumption.⁴ For example, although 4 min of oxygen administration increased Pao₂ from 80 to 400 mm Hg during scheduled anesthesia, the corresponding increase in unstable emergency patients was only from 67 to 104 mm Hg Pao₂.⁴ Patients who are treated by EMS personnel who take even short periods of time to intubate and ventilate may experience rapid desaturation and hypoxia. Observations from an animal model of severe hemorrhagic shock indicate that the combination of inadequate administration of oxygen (which often occurs in the field) and major blood loss can lead to an oxygen

From the *Department of Anesthesiology and Critical Care Medicine, Innsbruck Medical University, Innsbruck, Austria; and †Department of Anaesthesia and Intensive Care, Frenchay Hospital, Bristol, UK.

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Address correspondence and reprint requests to Dr. Holger Herff, Department of Anesthesiology and Critical Care Medicine, Innsbruck Medical University, Anichstrasse 35, 6020 Innsbruck, Austria. Address e-mail to holger.herff@uki.at.

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saturation of 70% within about 30 s of apnea (unpublished observation). Therefore, a short time to definite airway control may be a key factor in the prevention of hypoxemia and secondary brain injury. Whether this is the mechanism of doubled mortality when tracheal intubation is performed in the field rather than in the emergency department is unknown.⁵

There is a further key difference between the helicopter EMS and ground EMS patient group which is mentioned,¹ but not emphasized. The helicopter EMS providers used a muscle relaxant to assist intubation, whereas the ground EMS providers did not. There are two important points here. First, it is perhaps unfair to expect high intubation success rates in trauma patients who may have intact airway reflexes (despite severe injury) without the use of muscle relaxants. Conversely, when EMS providers are trained in the use of potentially lethal muscle relaxants, intubation success rates should approach 100%. A failed intubation rate of 18% after administration of muscle relaxants is unacceptable in any EMS system. The major differences in airway management techniques and EMS provider skills within a study illustrate a common problem of prehospital publications: that a mixture of patients, providers, and techniques are confounding variables that may make accurate extrapolation of results to other systems difficult.

The Association of Anesthetists of Great Britain and Ireland believes that a high level of training and well-practiced simple techniques are the key to successful airway management. Recent safety guidelines recommend that health care personnel providing prehospital anesthesia "should have the same level of training and competence that would enable them to provide unsupervised rapid sequence induction in the emergency department."⁶ The experience recommended is a minimum of 2 yr of training in emergency specialties and at least 1 yr of anesthesia. Furthermore, EMS providers should have a continuous clinical experience of at least one monthly rapid sequence induction to maintain currency. Unfortunately, this level of training may be unrealistic, especially in ground EMS systems that do not frequently manage major trauma patients.³ This insufficient skill level became evident when an experienced emergency physician was added to paramedic-based EMS systems, which resulted in decreased mortality in San Diego, California, and in an international study, respectively.^{7,8} In Germany, the average ground EMS physician's clinical experience in critical interventions when managing major trauma patients has also been found to be insufficient.³ Thus, it is not surprising that in another German study, 8 of 149 patients (5.4%) being intubated in the field died because of esophageal intubation,⁹ or that in 26% of intubation cases in a French study, more than two intubation attempts were necessary.¹⁰ In these systems, it may be that only experienced hospital practitioners have the skills to provide safe prehospital anesthesia. A study

using this level of skills in a German helicopter EMS systems demonstrated 100% success rate while managing very difficult airways.¹¹ This level of training is unlikely to be available in many EMS systems worldwide. If we do not want to accept higher complication rates outside the hospital in these EMS systems, we have to identify alternative first-line airway management techniques for less-skilled EMS personnel, including physicians and nonphysicians lacking daily clinical experience in advanced airway management.

The burning question is that are complication rates lower if alternative airway devices are used as a first-line option instead of tracheal intubation? We have previously proposed a bronze, silver, and gold strategy of airway management depending on the individual rescuer's clinical experience in airway management. Rescuers with daily clinical experience in airway management may provide out-of-hospital tracheal intubation as the "gold standard."¹² Less experienced rescuers (representing a silver standard) should be trained in using alternative supraglottic devices as their first choice airway device. Lastly, rescuers with only occasional experience (representing a bronze standard) should avoid prehospital advanced airway management and concentrate on bag-valve-mask ventilation with the aid of simple airway adjuncts.^{12,13}

It is still quite unclear which airway device is optimal for a particular level of clinical experience, and only carefully designed studies will provide answers. In a recent Cochrane review, Lecky et al.¹⁴ analyzed 452 studies assessing tracheal intubation in the field. Although the case mix, providers, and techniques were very diverse, the authors concluded: "The efficacy of emergency intubation as currently practiced has not been rigorously studied. The skill level of the operator may be key in determining efficacy . . . It would be ethical and pertinent to initiate a large, high quality randomized trial comparing the efficacy of competently practiced emergency intubation with basic bag-valve-mask maneuvers in urban adult out-of-hospital nontraumatic cardiac arrest."¹⁴ The study from Miami, Florida, is additional evidence that it is time to find definitive answers to these critical safety questions.

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