*Intensive Care Med*
https://doi.org/10.1007/s00134-022-06888-7

CORRESPONDENCE

# Airway management in cardiac arrest and outcomes. Author's reply

Chiara Robba[1,2*], Denise Battaglini[1,2], Rafael Badenes[3], Niklas Nielsen[4] and Paolo Pelosi[1,2]



We would like to sincerely thank Milne [1] for the appreciation on our work [2] and for highlighting such an important issue in the management of cardiac arrest patients i.e., the airway protection and prehospital factors. Indeed, early airway securing may prevent aspiration of secretions, blood, vomitus thus avoiding aspiration pneumonia, and gastric insufflation may hinder oxygen delivery during and after resuscitation. Optimal airway management in out-of-hospital cardiac arrest (OHCA) is therefore a fundamental part of the Chain of Survival for these patients.

Endotracheal intubation or insertion of supraglottic airways has long been considered the standard criterion for advanced airway management of patients with OHCA. The optimal technique to apply is matter of debate. Some authors [3] reported no difference in the rates of sustained return to spontaneous circulation, (ROSC), survival to hospital discharge and neurological outcome in initial prehospital airway management between patients managed with supraglottic devices or endotracheal tube. However, other studies showed that patients receiving laryngeal tube compared to endotracheal intubation had better 72 h survival, as well as more favorable neurological status at discharge [3]. A meta-analysis [3] including a large sample size of OHCA patients treated by Emergency Medical Service found a higher incidence of ROSC, survival to hospital admission and better favorable neurological outcome in patients who received endotracheal intubation compared to supraglottic devices. More recently, Kohei et al. [4] demonstrated that any type of advanced airway management was independently associated with decreased risk of neurologically favorable survival compared with conventional bag-valve-mask ventilation. A summary of the key randomized controlled trials on airway management during out-of-hospital cardiac arrest in adults including primary outcomes and main results is presented in Table 1. Heterogeneous results are provided by the literature on the use of different strategies for advanced airway management as well as the optimal device to be used. Further insights in the TTM2 trial and other studies are warranted to further explore the association between the type of device used on mortality and neurological outcome at 6 months.

In conclusion, we thank Milne [4] for highlighting the clinical relevance of prehospital airway management in patients with OHCA, although questions remain on the best strategy to optimize patients' outcome.

*Correspondence: kiarobba@gmail.com
[2] Department of Surgical Sciences and Integrated Diagnostics, University of Genoa, Viale Benedetto XV 16, Genoa, Italy
Full author information is available at the end of the article

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**Table 1 Key randomized controlled trials on airways management during out-of-hospital cardiac arrest in adults**

| First author | Trial design | Eligibility criteria | Interventions | Study setting and locations | Sample size | Outcomes | Results |
|---|---|---|---|---|---|---|---|
| Wang et al. [5] | RCT, cluster, cross-over | Inclusion criteria: age ≥ 18 years with nontraumatic OHCA treated by participating EM service agencies and requiring anticipated ventilatory support or advanced airway management. Exclusion criteria: EM services not affiliated with the trial | LT vs. ETI | 27 EM services | 3000 (1505 LT, 1495 ETI) | The primary outcome was 72-h survival. Secondary outcomes were return of spontaneous circulation, survival to hospital discharge, favorable neurological status at hospital discharge | LT group survived more than ETI group at 72-h. Return of spontaneous circulation, hospital survival, and favorable neurological status at discharge were better in the LT group. There were no significant differences in oropharyngeal or hypopharyngeal injury, airway swelling, or pneumonia or pneumonitis |
| Benger et al. [6] | RCT, cluster | Inclusion criteria: age ≥ 18 years with nontraumatic OHCA, treated by a paramedic participating in the trial who was either the first or second paramedic to arrive at the patient's side; and resuscitation was commenced or continued by emergency medical services personnel. Exclusion criteria were: detained in prison, previously recruited to the trial, resuscitation deemed inappropriate, advanced airway already in place when a paramedic arrived at the patient's side; known to be enrolled in another prehospital RCT; and the patient's mouth opened less than 2 cm | SAD vs. ETI | 4 EM services | 9296 (4886 SAD vs. 4410 ETI) | The primary outcome was favorable functional outcome at hospital discharge or after 30 days. Secondary outcomes included ventilation success, regurgitation, and aspiration | Functional outcome did not differ between groups. Regurgitation and aspiration did not differ between groups |
| Lee et al. [7] | RCT, cluster | Inclusion criteria: patients with OHCA who need CPR, adults ≥ 20. Exclusion criteria: traumatic OHCA. resuscitation deemed inappropriate, not suitable for ETI, not suitable for SAD, cardiac arrest during transportation to the hospital, do-not-resuscitate request at the scene, ROSC at the scene and no need for advanced airway support, and airway devices had been established before paramedics arrived | SAD vs. ETI | 4 EM services | 968 (360 SAD, 413 ETI) | Primary outcome was sustained ROSC. Secondary outcomes were survival to hospital discharge and favorable neurological outcome | No difference in the rates of sustained ROSC in initial prehospital airway management between groups. Survival to hospital discharge and neurological outcome did not differ between groups |

**Table 1 (continued)**

| First author | Trial design | Eligibility criteria | Interventions | Study setting and locations | Sample size | Outcomes | Results |
|---|---|---|---|---|---|---|---|
| Szarpak et al. [8] | RCT, parallel | Inclusion criteria: patients with COVID-19 with OHCA who need CPR, adults ≥ 18. Exclusion criteria: < 18 years old, predicted difficult intubation | Vie-Scope vs. Macintosh laryngoscope | 3 EM services | 90 (45 Vie-Scope, 45 Macintosh) | The primary outcome was ETI success rate during first laryngoscopy attempt. Secondary outcomes included the duration of the interruption of chest compression during ETI, Laryngeal view during intubation using Cormack-Lehane grade system, and self-reported percentage of glottis opening score | Macintosh required longer time for ETI than Vie-Scope, and less first attempt success rate |
| Cereceda-Sánchez et al. [9] | RCT, pilot | Inclusion criteria: adults ≥ 18, years or older with OHCA who received resuscitation performed by clinicians from participating centers. Exclusion criteria: advanced airways, weight > 50 kg, oral cavity < 2 cm | BMV vs. i-Gel | 4 EM services | 23 (9 BMV, 14 i-Gel) | Comparison between BMV and i-Gel on capnometry and survival | i-Gel group survived more than BMV group |
| Chan et al. [10] | RCT, cluster, cross-over | Inclusion criteria: all patients with OHCAs aged over 13 years, both medical and traumatic. Exclusion criteria: patients who did not meet the criteria for resuscitation by paramedics | LMA vs. LT | 1 EM service | 905 (502 LT, 403 LMA) | The primary outcome was placement success, and the secondary outcomes were complication rates and the presence of prehospital ROSC | Placement success rate for LT was lower than for LMA. Complications were more likely when using LT. ROSC was similar between groups. The outcomes were similar between the two groups |
| Jabre et al. [11] | RCT, non-inferiority, parallel-group | Inclusion criteria: adults ≥ 18 years or older with OHCA who received resuscitation performed by clinicians from participating centers. Exclusion criteria: suspected massive aspiration before resuscitation, presence of a do-not-resuscitate order, known pregnancy, and imprisonment | ETI vs. BMV | 2 EM services | 2043 (1023 ETI, 1020 BMV) | The primary outcome was favorable neurological outcome at 28 days. Secondary outcome included rate of survival to hospital admission, at day 28, rate of return of spontaneous circulation, and ETI and BMV difficulty or failure | Neurological function at 28-day was similar between ETI and BMV. Airway management was more difficult and regurgitation of gastric content in BMV than ETI, while failed more in ETI group. No other differences were found |
| Fiala et al. [12] | RCT, intention to treat | Inclusion criteria: Patients with OHCA ≥ 18 years old. Exclusion criteria were: lack of consent, emergency physician starting airway management prior to arrival of the EM technician, presumed airway obstruction, death of the patient before EMS arrival | LT vs. BMV | 6 EM services | 78 (35 LT, 41 BMV) | Ease of handling and efficacy of ventilation administered by EM technicians using LT and BVM during cardiopulmonary resuscitation of patients with OHCA | The same efficacy in ventilation was found between the two groups. No difference in complications were found between the groups |

The table includes only randomized controlled trials (RCTs) with specific focus on airway management of patients with out-of-hospital cardiac arrest (OHCA). Secondary analysis of RCTs have been excluded

*LT* laryngeal tube, *ETI* endotracheal intubation, *OHCA* out-of-hospital cardiac arrest, *RCT* randomized controlled trial, *ROSC* return to spontaneous circulation, *EM* emergency medical, *BVM* bag-valve-mask, *SAD* supraglottic airway device, *LMA* laryngeal mask airways, CPR cardiopulmonary resuscitation, *COVID-19* coronavirus disease 2019

**Author details**
[1] Anesthesia and Critical Care, San Martino Policlinico Hospital, IRCCS for Oncology and Neuroscience, Genoa, Italy. [2] Department of Surgical Sciences and Integrated Diagnostics, University of Genoa, Viale Benedetto XV 16, Genoa, Italy. [3] Department of Anesthesiology and Surgical-Trauma Intensive Care, Hospital Clínic Universitari de Valencia, Valencia, Spain. [4] Department of Clinical Sciences Lund, Anaesthesia and Intensive Care and Clinical Sciences Helsingborg, Helsingborg Hospital, Lund University, Lund, Sweden.

**Funding**
None.

**Declarations**

**Conflicts of interest**
None.

## Publisher's Note



Received: 2 September 2022 Accepted: 5 September 2022
Published online: 29 September 2022

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