Endotracheal intubation—still the gold standard in out-of-hospital cardiac arrest airway management?

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We read with great interest the article written by Yang *et al.* titled "*Comparing the efficacy of bag-valve mask, endotracheal intubation, and laryngeal mask airway for subjects with out-of-hospital cardiac arrest: an indirect meta-analysis*" (1). The authors of the study must be congratulated for their efforts in performing an indirect meta-analysis of 13 studies to compare the outcomes of bag-valve mask (BVM), laryngeal mask airway (LMA), and endotracheal intubation (ETI). Outcome measures used were return of spontaneous circulation (ROSC) and the survival rate to admission or discharge.

Approximately 300,000 persons in the United States alone experience an out-of-hospital cardiac arrest (OHCA) each year with a mortality of approximately 92% (2). This review is made even more timely by the current unprecedented global health crisis caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). A recent systematic review identified that there has been a 120% increase in the incidence of OHCA since the pandemic, with an increase in mortality and supraglottic airway usage (3). Therefore, this article provides invaluable insights in the current conversation for OHCA management during the pandemic.

Despite the importance of effective airway management in the treatment of patients with OHCA, there is a paucity of available data on the topic, including limited high-quality Randomized Controlled Trial (RCT) data comparing the efficacy of various techniques in airway management. Randomized trials have proven to be the gold standard in analysing causal relationships as the act of randomisation and concealment of allocation eradicates inherent biases that might exist in other study designs (4). Equipoise between the various techniques have led to calls for more and larger RCTs comparing the use of BVM, LMA, and ET in the context of OHCA, to determine the most optimal device for airway management.

Of the 13 studies included by Yang *et al.*, three studies were randomized while the rest were observational in nature. We conducted a sensitivity analysis to compare the findings of the randomized studies against the findings by Yang *et al.*, to identify any incongruity in the findings.

Our analysis found that there were differing results for ROSC and survival to discharge when comparing BMV to LMA as compared to the values that were presented by Yang *et al.* On inspection of the randomized studies by Benger *et al.* and Fiala *et al.*, we found no statistically significant difference when comparing BVM and LMA in the outcome of ROSC (RR =1.00, 95% CI, 0.75–1.33; I^2=0%, P=1.00) (*Figure 1A*) (5,6). Yang *et al.*, however, found that there was a significant difference between LMA and BVM (RR =0.84%, 95% CI, 0.57–1.24; I^2=94.8%, P<0.001) (1).

Further discrepancies were noted in survival to discharge when comparing BVM with LMA for the randomized studies. Our results revealed no significant difference

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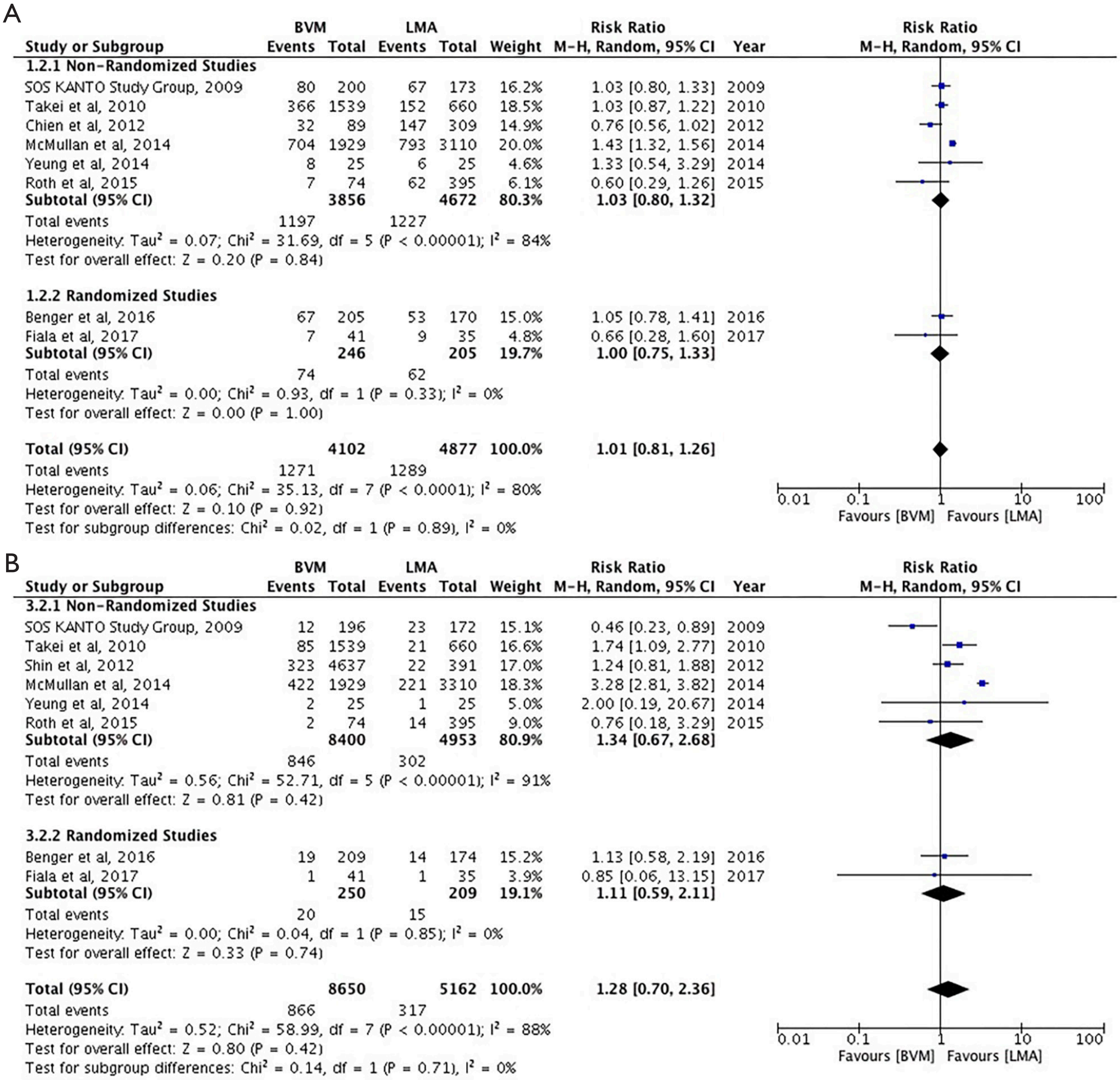

Figure 1 Forest plots of BVM and LMA for the outcome of ROSC and for the outcome of survival to discharge. (A) Forest plot comparing BVM and LMA for the outcome of ROSC; (B) Forest plot comparing BVM and LMA for the outcome of survival to discharge. BVM, bag-valve-mask; LMA, laryngeal mask airway; ROSC, return of spontaneous circulation.

between BVM and LMA (RR =1.11, 95% CI, 0.59–2.11; I^2=0%, P=0.74). (*Figure 1B*) This is contrary to the results in the original study, whereby BVM was shown to be significantly better than LMA (RR =0.61; 95% CI, 0.38–0.98; I^2=79.4%, P<0.001) (1). The study by Ono *et al.* was intentionally excluded from the results in *Figure 1* as the use of the laryngeal tube, an extra glottic airway device, was classified under ETI instead (7,8).

However, these values should be interpreted with caution as the two randomized studies listed had relatively smaller sample sizes as compared to the non-randomized counterparts. This can be attributable either to the nature of the study; as a direct consequence of randomization, or due to limitations such as number of eligible participants that fulfil the inclusion criteria, the amount of time available, and the budget allocated for the trial.

Nonetheless, there are benefits to randomized trials as it allows for the comparison of cause and effect relationships

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between interventions and outcomes (9). Randomisation also prevents any priori knowledge of group assignments and balances participant characteristics between the groups, therefore reducing any selection biases that might skew the results and allowing for any attribution of differences in outcomes to the intervention (10).

Besides the aforementioned limitations with RCTs, it is essential to acknowledge the challenges that exist especially in the context of Emergency Medicine, due to the possible ethical implications and the nature of the trial. This is particularly so with OHCA due to its unpredictable nature, making it impossible to gain the consent of patients prior to enrolment and implementation of intervention. Moreover, due to the urgency and variability in the presentation of eligible patients, randomization by patients might lead to delays in care processes and is not only impractical but potentially unethical.

Finally, there also exists a risk of residual confounding bias as numerous compounding variables such as the ventilation rate, duration of chest compression interruption for the insertion of airway adjunct, as well as other interventions that might have been performed either on-site or in-hospital, might have influences on the outcome which cannot be accounted for.

In conclusion, we acknowledge that airway management is of paramount importance in the treatment of OHCA. Although ETI has long been considered the gold standard of airway management, with the advent of alternative airway devices, there has been a recent paradigm shift regarding the most effective device for airway control. Currently, evidence on this matter remains scarce and there is a pertinent need to conduct further large scale RCTs, in order to gather more data on the efficacy of each device on the outcomes of OHCA.

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Footnote

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