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Editorial

What is a Problem – Intubation or High O_2?

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Editorial

Tracheal intubation is one of the familiar procedures to emergency department physician. At the same time, it is one of the imperative procedures for cardiac arrest patients.

It is not clear since when the tracheal intubation became popular for cardiac arrest patients. Considering laryngoscopy is needed for tracheal intubation, it would be same when the laryngoscopy became popular and when the tracheal intubation became popular. The first hand-held laryngoscopy is introduced between 1907 and 1913 by Dr. Chevalier Jackson (1865-1958). Later Dr. Robert Arden Miller (1906-1976) introduced Miller blade at 1941 and Dr. Robert R. Macintosh (1897-1989) introduced Macintosh blade at 1943. Anyway, in the world first guideline for the advanced cardiac life support at 1974, tracheal intubation is recommended for cardiac arrest patients as soon as practical by trained personnel to secure airway and for artificial ventilation. Now, nearly a century was passed after the tracheal intubation became a cornerstone procedure without any supporting data which showed favorable outcome when compared to control group [1].

The idea that tracheal intubation would be beneficial for cardiac arrest patients was started to be challenged at 1990. Tortolani AJ et al. reported that tracheal intubation is more frequent in patients who died during the arrest than those who survived using data of 470 in-hospital cardiac arrest (IHCA) patients. At 2001, in a study using 445 prospectively recorded IHCA resuscitation records, Dumot JA et al. found out that tracheal intubation is associated with poor survival at discharge (adjusted odd ratio (OR) 0.09, 95% confidential interval (CI) 0.04-0.20, adjusted OR 0.13, 95% CI 0.04-0.41) [2]. To date, following studies showed mix results for both IHCA and out-of hospital cardiac arrest (OHCA) [3,4,5].

Recently, Anderson et al evaluated [6] the association between survivals with early tracheal intubation (within 15 minutes) during adult IHCA using big data from the multicenter get with the Guidelines – Resuscitation (GWTG-R) registry. When compared to no intubation patients (n=36,464), early tracheal intubation patients (n=71,615) showed less return of spontaneous circulation (ROSC) (59.2% vs. 69.0%), less survival to hospital discharge (17.0% vs. 33.2%), and less favorable functional outcome (11.2% vs. 25.7%). Propensity analysis showed similar results (ROSC: 57.8% vs. 59.3%, survival to hospital discharge: 16.3% vs. 19.4%, favorable functional outcome: 10.6% vs. 13.6%). Subgroup analysis, sensitivity analysis, and post hoc analysis using non-time-dependent propensity score matching also showed similar results. The authors concluded that these findings do not support early tracheal intubation for adult IHCA.

Several mechanisms were proposed including interruption in chest compression, unrecognized esophageal intubation and dislodgement of the tube. Although a skillful doctor can intubate with no or extremely short interruption in chest compression, those procedural mechanisms should be in consideration.

Hyperventilation [7] was also listed as a potential cause. It is well known that hyperventilation is deleterious in cardiac arrest because increased intrathoracic pressure reduces the inflow of blood to the right heart thus reducing cardiac output and respiratory alkalosis shifts the oxygen-hemoglobin dissociation curve to the left, reducing oxygen delivery to tissue, and causes cerebral vasoconstriction. Therefore the guideline adopted the avoidance of hyperventilation since 2005 [8], and this principle might be followed in practice among enrolled hospitals during study period.

It is likely that high O_2 was supplied to the IHCA patients: 100% O_2 via E-tube for intubated patients and 15L O_2 via bag valve mask for non-intubated patients. However, chest compressions inhibit the sealing of the mask to the face, thus non-intubated patients would receive less O_2 contrary to expectation. Therefore, we suggest that there would be a substantial difference in blood oxygen tension between intubated and non-intubated patients. Hyperoxia is a known factor which was independently associated with increased in-hospital mortality among resuscitated patients [9]. In other words, the tracheal intubation was not the only intervention to tracheal intubation group in Anderson's study. Tracheal intubation and high supplemental O_2 provision were the interventions to the tracheal intubation group in that study.

Currently, a randomized phase 3 trials ongoing to assess the endotracheal intubation for OHCA patients, compared to bag-valve-mask ventilation- Tracheal intubation vs. Bag-valve-mask ventilation in patients with out-of-hospital cardiac arrest CAAM study (CAAM, clinical trials.gov identifiers NCT02327026). However, it also has no specific comment on the use of supplemental O_2 via E-tube or bag-valve mask. And there is no outcome measure related with O_2 tension difference between two groups.

Lastly, what is the point? Is early intubation not supported by big data? Is early intubation harmful, ineffective, or unnecessary? How much does early intubation interrupt CC? Should a next move be a randomized controlled trial (RCT) which evaluates the effect

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of tracheal intubation? No. In our opinion, whether to provide high supplemental O_2 supply or not is the point and should be a theme for the RCT. Like air versus oxygen in ST-segment elevation myocardial infarction (AVOID) did [10].

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