



Areas of Research Interest in Airway Management: Direction and Gaps

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Airway management has a central role in safe anesthesia practice. Many guidelines and airway modalities have been introduced but difficult airway remains as one of the most challenging tasks of anesthetists. Most of earlier efforts have focused on the development of new pharmacologic agents and airway devices. However, safe anesthesia practice requires both technical and non-technical skills in crisis management (1-4). Recent guidelines emphasize the role of decision making and communication skills in the anesthesia team to overcome cognitive errors arisen during airway crisis such as CICO scenarios (5, 6). The role of human factors at individual, team, and organizational levels in the management of airway crisis should be evaluated in future studies and practiced regularly considering local circumstances. Some potential topics of research interest with our knowledge gaps are presented in the following.

1. Prediction of Difficult Airway

There are several algorithms for predicting difficult airway. These algorithms include a combination of examinations such as mouth opening, Mallampati classification, thyromental distance, neck movement, and prognathism, as well as the history of earlier difficult intubation. These indices are going more and more developed. However, recent guidelines suggest that the focus should be on the techniques of improving the likelihood of successful intubation even in unanticipated cases rather than attempting to predict difficult airway (7). If the difficult airway is anticipated, awake methods are preferred. If general anesthesia is the plan, evaluating the front of neck access and escape portal for oxygenation (i.e. needle or surgical cricothyroidotomy) should be considered before the induction of anesthesia (5). If in doubt, ultrasonography is currently the most useful modality to identify cricothyroid membrane (8). Finally, it seems reasonable to invest our times in

improving rescue modalities rather than developing more parameters to predict difficult airways.

2. Preoxygenation and Apneic Techniques to Maintain Oxygenation

Apneic oxygenation via facemask or oxygenation via traditional nasal cannula has been used for several decades. However, efficacy and comfort are two issues at the time. For instance, high-flow nasal cannula does not increase the time to desaturation in critically ill patients and they require higher concentrations of inspired oxygen (9). Many of available devices deliver a dry flow of oxygen that is uncomfortable for the patients. The new concept is the introduction of new devices with the capability of delivering higher oxygen concentrations with increased comfort. Some of these techniques include dual-use laryngoscopes (10), buccal RAE (Ring - Adair - Elwyn) tubes (11), and transnasal humidified rapid - insufflation ventilatory exchange (THRIVE) (12). The latter method was found to be effective for pre-oxygenation during rapid sequence induction (13). These techniques have to be developed more in the future.

3. Techniques of the Emergency Front of Neck Access

The CICO scenario is the nightmare of every anesthesiologist. Two techniques, scalpel and cannula cricothyroidotomy, have been suggested for the case. Traditionally, anesthetists are more familiar with the cannula technique. However, both the failure rate and the complications such as pneumothorax following jet ventilation are unacceptably high (14). The 2015 Difficult Airway Society guidelines strongly suggest scalpel techniques over cannula airways, a change from the 2004 guidelines (5). Scalpel techniques

vary in the number and direction of incisions and methods to keep the incision open. Recent guidelines recommend a scalpel - bougie technique for tracheal cannulation and keeping the incision open (5). The research gap in the field is that we cannot definitely translate the result of very small size earlier studies to clinical practice. The learning curve of each method, simulation training, overall success rate, and finally the availability of devices should be considered in future studies.

4. Development of New Devices

Every year, manufacturers introduce new airway devices to the market without strong evidence on their clinical efficacy (15). In contrast to the marketing of new drugs, evidence on the efficacy of instruments has to be provided by the users thereafter (16). Regarding the great size of the market, manufacturers should support early studies to demonstrate the possible superiority of new devices over available ones. Guidelines prepared by academic organizations may direct manufacturers toward paying for airway - related research before marketing. Such a policy has been recently employed by the UK's Difficult Airway Society (DAS) (17). As an outstanding example, early research is required to shed light on introducing new video laryngoscopes (VL) and encouraging their use in various settings other than operating theater, including prehospital, emergency department, and intensive care unit (ICU).

5. The Role of Ultrasonography

Ultrasonography has been increasingly used in airway management. Identification of cricothyroid membrane for the front of neck access before induction of anesthesia is probably the most popular indication (18). Assessment of postoperative vocal fold movement when nerve injury is suspected is another interesting application of ultrasonography (19). This modality can be used to confirm ventilation by observing lung sliding bilaterally, verify endotracheal intubation, detect intraoperative pneumothorax, and aid in percutaneous dilatational tracheostomy (20, 21).

6. Airway Management in Certain Conditions

Little is known about the management of unanticipated difficult airway in specific conditions such as pediatric, obstetric, geriatric, and obese and trauma patients. Lack of manikins that truly simulate the airway of these patients makes the conclusion much more difficult. Specifically, the use of VLs in pediatrics with difficult airway and ultrasonography in obese patients has been the focus of interest in recent years.

7. High-Evidence Versus Low-Evidence Practice

Research makes evidence and we all are interested in more 'evidence' to prepare guidelines. Noteworthy, the function of the guideline is not to generate rigid management protocols, but to offer a rational modifiable plan for both routine and extraordinary medical conditions. Sure, every guideline is modifiable according to the availability of equipment, specific condition of the patient, and the expertise of the clinician. On the other hand, possibly all faculty members heard this sentence from their trainee: 'why do you do it that way?' Today, there is less room for the answer 'my own experience says...' because of its low level of evidence. Thus, we should now challenge and verify our beliefs and habits of airway management by conducting well-designed studies. Leaving behind the dogma for both personal habits and certainty of guidelines will move us forward and brings safety.

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