Editorial

Videolaryngoscopy for all intubations: Is direct laryngoscopy obsolete?

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Tracheal intubation is one of the most commonly performed procedures in the operating room (OR), intensive care unit (ICU) and emergency department (ED). The Macintosh laryngoscope developed by Sir Robert Macintosh in 1943 has a curved blade, which provides visualisation of the vocal cords with elevation of the epiglottis. Having facilitated millions of successful tracheal intubations, the Macintosh laryngoscope has inherited the title of being the "gold standard" against which newer laryngoscopes are compared and obliged to better.[1] Dr. John Pacey, a Canadian surgeon, introduced the first videolaryngoscope (VL) in 2001.[2] A VL enables indirect laryngoscopy using a camera attached a few centimetres proximal to the tip of the blade thereby bringing the external view of the airway onto a screen, providing a new way to look around the curve of the tongue. The VL camera allows a more anterior view of the glottis and a wider field of vision, thereby providing an improved visualisation of the larynx.

The VL has emerged as an effective alternative to direct laryngoscope (DL) use. The past two decades have witnessed a number of different VL devices in the market. They are available in both adult and paediatric sizes, as single-use and reusable devices and may be portable if battery-operated. The VL blade may be anatomically curved ("j" shaped or hyper angulated) or non-anatomically curved (Macintosh types). Some VLs have a side channel to load a tracheal tube (channelled VL) to direct the tracheal tube in the axis of the laryngeal view, for ease of intubation. Despite the technological advancements in VL, more than 80 years after its invention, the Macintosh laryngoscope remains the most widely used device for tracheal intubation across the globe. What could be the probable reasons for this and has the time come to abandon the DL and use a VL for all intubations?

ADVANTAGES OF A VIDEOLARYNGOSCOPE OVER A DIRECT LARYNGOSCOPE

A VL has several advantages over a DL. The video camera of the VL obviates the need for alignment of the three airway axes and provides a superior glottic view by requiring less force and cervical spine manipulation, making it especially useful in patients with cervical spine immobilisation.[3-5] Increased first-pass intubation success rates with VL use have been demonstrated in patients with a difficult airway and in obstetric, paediatric and trauma patients.[4-13] The shared airway view provided using a VL has tremendous advantages; it allows more than one person to visualise the airway, which is invaluable in the teaching setting, allowing the trainer to give real-time feedback, facilitating effective supervision during intubation and better team coordination during airway management. The shared visual confirmation of tracheal tube placement dramatically improves the margin of safety in airway management.

Use of a VL helps to reduce the exposure risk from infected patients, by avoiding the need for close proximity to the airway, as witnessed in coronavirus disease 2019 (COVID-19) patients.[14] Nonetheless, many technological innovations to reduce the risk of contracting infection came into existence during the COVID-19 pandemic and many of these served as food for research. The aerosol box and VL were notable among these.[15-17] In a randomised manikin-based study being published in this issue of the *Indian Journal of Anaesthesia* (IJA), the C-MAC VL has been compared with the King Vision VL in terms of ease of intubation and time taken to intubate in an aerosol prevention intubation box for COVID-19 patients. The study concludes that though the time for successful intubation under COVID-19 simulation conditions is comparable with both VLs, the C-MAC VL is more easy to use and handle.[18]

FIRST-PASS INTUBATION SUCCESS

A Cochrane review comparing VL with DL for adult patients requiring tracheal intubation performed in 2015 included 64 studies (61 included elective surgical patients, and three were conducted in an emergency setting) with 7,044 patients. The study concluded that VLs may reduce the number of failed intubations, particularly among patients presenting with a difficult airway. There was no evidence to indicate that use of a VL reduces the number of intubation attempts, incidence of hypoxia or respiratory complications or the time required for intubation.[6]

No significant difference in the rate of successful first-pass intubation was found between VL and DL in critically ill patients.[19] A meta-analysis comparing direct laryngoscopy with videolaryngoscopy for emergency tracheal intubation outside the operating room showed higher first-pass tracheal intubation success rates with a VL and fewer oesophageal intubations in the subgroup of ICU patients, though not the overall success rates. The use of VL was associated with more life-threatening complications including arterial hypotension.[20] In a recent meta-analysis comparing VL with DL including nine randomised controlled trials with over 2,000 critically ill patients, the use of a VL did not improve first-pass intubation success rate.[21] Few studies included in this meta-analysis showed a higher incidence of severe life-threatening complications with VL use. Failure to abort attempts at tracheal intubation attempts when there is a clear laryngeal view using VL leading to prolonged apnoea time and complications, was an explanation given for these findings. There was heterogeneity in the studies included and some were of low quality. Nevertheless, though recent evidence does not support the routine use of a VL for all tracheal intubations in the ICU, the VL improves glottic visualisation as compared with a DL, making it an important tool for difficult airway management in the ICU.[22] A study comparing VL with DL during cardiopulmonary resuscitation did not find any difference in the overall and first-pass success in tracheal intubation.[23]

A limitation of the VL is that the demonstration of a Cormack Lehane grade 1 view does not always guarantee successful tracheal tube placement.[24] The laryngeal view is provided by a camera located beyond the curve of the blade; therefore, a pre-shaped stylet is often required to negotiate the oropharyngeal angle to facilitate tracheal tube passage. In a prospective study comparing the use of VL with DL in 709 emergent tracheal intubations in trauma patients, 40% of the VL failures were due to inability to pass the tracheal tube despite having a good glottic view (21% with DL).[4] In a randomised study comparing DL with VL in 300 patients with predicted difficult airway, 54% of the VL failure was due to inability to pass the tracheal tube despite good glottic visualisation (35% with DL).[5] These studies clearly demonstrate that a good glottic visualisation does not guarantee intubation success with a VL.

A randomised trial comparing the DL with different VLs for tracheal intubation between novices and experienced anaesthesiologists showed that expertise with DL does not translate to expertise with VL.[25] These studies highlight the importance of separate training and experience with the use of VL to improve first-pass intubation success rates. It is important to note that experience with one type of VL does not equate to skill with all VLs.[26] This may be a challenge when moving to a different hospital or location within the hospital, having different VL devices.

FAILED VIDEOLARYNGOSCOPY RESCUED BY DIRECT LARYNGOSCOPY

In a study of 2004 intubations assessing the effectiveness of the Glidescope™ for difficult airway management, it is interesting to note that 47% of the VL failures were rescued using a DL.[27] Sakles *et al*.[28] demonstrated a higher success rate with DL compared with VL when more than one attempt at intubation

was required. These studies demonstrate that VL still requires a backup plan, which may be a DL or another device or technique for successful tracheal tube delivery. Thus, while VL is associated with a high first-attempt success rate, failure of VL does require expertise with DL.

Patient factors associated with VL failure include airway pathology, previous airway surgery, neck radiation, presence of a cervical collar and reduced cervical range of movement.[5] There may be some technical limitations, which may obscure the image on the video screen, these include monitor failure, low battery power or a glare on the screen due to sunlight. In addition, secretions, blood, vomitus and fogging may blur the visibility on the screen making tracheal tube delivery challenging or sometimes impossible.

VIDEOLARYNGOSCOPY AND PHARYNGEAL WALL INJURIES

Reports of airway injuries associated with VL are rising. Data from a single centre study suggested a higher risk for injury with VL compared with DL. Sixty-eight percent of the injuries were noted at extubation or re-evaluation of the airway and not during the initial tracheal intubation. The right tonsillar pillars and soft palate were the most frequently injured.[29] There is an inherent blind spot during intubation using a VL. The airway operator tends to focus on the video screen and inserts the VL or tracheal tube blindly, which may cause these injuries. The rigid stylets used with some VLs may also cause trauma if not used appropriately. Tracheal intubation using a VL requires more procedural training. The airway manager should insert the VL and the ETT under direct vision until the palatopharyngeal fold has been passed, and only thereafter look at the video screen to guide the tube into the trachea. The VL improves the glottic view and therefore may reduce the incidence of laryngeal trauma.[6]

COST AND AVAILABILITY OF VIDEOLARYNGOSCOPES

The huge difference in cost between the VL and DL is a major limiting factor for universal use and availability of VLs. This is a concern in low-income countries and resource-limited settings. Though the availability of generic models is increasing the availability and reducing the cost of VLs in these regions, the quality of some devices may be a concern. In hospitals with budget constraints, replacing all the DLs in the ORs, ICUs and other hospital locations with VLs may be a challenge, considering the significant price differential between these devices. These practical considerations make it difficult to completely abandon the DL.

TIME TAKEN FOR VIDEOLARYNGOSCOPY

Few studies have reported a longer time to intubation with the use of VL as compared with DL.[5,30] Though the difference may just be a few seconds, this time becomes relevant in critically ill patients, who have limited physiological reserves and may rapidly desaturate during tracheal intubation. This may explain why studies in the critically ill patients have shown increased risk of complications with VL use.[21] This highlights the importance of proper training with the use of VL to reduce the time to intubation and avoid complications. However, the Cochrane review that included 64 studies did not show any evidence indicating that use of a VL affects the time required for tracheal intubation.[6]

UNANSWERED QUESTIONS WITH VIDEOLARYNGOSCOPY

Though VLs have been recommended for use at first attempt of intubation by most international airway guidelines,[31-33] the universal use of VLs is still facing hurdles because of limited training opportunities, availability and high cost. There is no good data available to clearly identify the learning curve for effective use of a VL and the specific training criteria required to become proficient with its use. Direct laryngoscopy requires a single Macintosh blade, whereas VLs are a heterogeneous group of devices with different blades that includes a Macintosh-type blade, angulated blade, hyper-angulated blade, channelled or non-channelled blades, with different screen sizes and resolutions, different degree of rotations of the screen, location of screen (either on top of the device or on the table), different types of fogging mechanism and camera features (types, resolution and viewing angle), each of which have different advantages and applications in different airway situations. Therefore, the VL chosen must be selected according to indication.[26] In addition, the heterogeneity in the devices included in the various studies and the varied levels of experience of the airway operators, make it difficult to make a fair comparison between different VL devices and the DL. Nevertheless, newer versions of VLs keep coming into the market and studies

comparing different types of VLs have always been a favourite of researchers. In a single-blind randomised prospective study being published in this issue of the IJA, a recently introduced VL with channelled blade, the Split-Type Postman VL has been compared with the conventional Macintosh laryngoscope in a simulated difficult airway with a rigid cervical collar around the neck. The Split-Type Postman VL was found to be superior with respect to intubation characteristics such as time taken for tracheal intubation and the number of attempts required.[34]

Till date we do not have clear guidance on how to proceed with a failed videolarygoscopy; whether we should use a DL, another type of VL or another device is not known. In addition, there is lack of data to help predict a difficult videolaryngoscopy. Though it is well known that a VL provides superior glottic visualisation compared with a DL, we have yet to identify the ideal view required to facilitate optimal tracheal tube delivery. These unanswered questions make it difficult to abandon the DL altogether and use VL as a universal device for all intubations.

Given that a VL provides an improved visualisation of the larynx, increases intubation success and has a significant role in teaching, it should be considered for performing all laryngoscopies, if feasible. However, neither the use of VL nor achievement of a good laryngeal view guarantees a 100% intubation success. Training and experience with VL use is therefore paramount to improve intubation success and reduce complications.

A DL has been used as a successful rescue technique after VL failure and hence airway managers must remain proficient with its use. Several unanswered questions remain with the use of VL. Airway managers should be proficient in using a wide range of intubation tools and techniques to avoid complications. Despite the effectiveness of the VL, and even when available, we must never become complacent and always have more than one way to safely manage the airway. At least in the present times, the DL should remain in our armamentarium and direct laryngoscopy should continue to be taught and performed.

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