

Advances in laryngoscopy: rigid indirect laryngoscopy

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Abstract

There is a growing body of evidence to support the use of rigid indirect laryngoscopy or 'video' laryngoscopy for tracheal intubation. We summarise some of the key issues, comparing rigid indirect laryngoscopy with direct conventional laryngoscopy.

Introduction and context

Anaesthesia has become a fine art, with modern anaesthetic agents and techniques resulting in improving outcomes. Technological advances are relatively slow, but occasionally a product comes along that revolutionizes the way we practice. The laryngeal mask airway is a prime example. Perhaps rigid indirect laryngoscopy (RIL) is the next such innovation?

Direct conventional laryngoscopy (DCL) has been the 'gold standard' for endotracheal intubation since the 1940s. It has a high success rate and hundreds of laryngoscope blades have been developed. In 2003, the first reports of RIL were published. There have now been hundreds of published papers and reports in one form or another about RIL and the different types of scopes available.

Airway studies historically have been very difficult to perform [1]. A meta-analysis by Mihai *et al.* [2] called for more homogenous research into this comparative field. The authors compared success rates and times of intubation but found that due to the heterogeneity of the patient populations studied, it was difficult to draw conclusions. We chose to look at the recent literature comparing RIL with DCL. We have limited our review to the randomised controlled trials (RCTs) or randomised crossover trials (including manikin studies) of two specific rigid indirect laryngoscopes: the Glidescope® (Verathon Medical UK Ltd, Buckinghamshire, UK) and

the Airtraq videolaryngoscope (Prodol Meditec, Vizcaya, Spain). We chose these types of RIL because they are both handled blades but they involve inherently different techniques. The Glidescope® has a conventional 'feel' requiring bimanual manipulation of the endotracheal tube, a technique aptly described as 'steering'. The AirTraq has the direction of passage of the endotracheal tube predetermined by the scope itself, a technique described as 'tube-guided'.

Recent advances

In regard to all of the papers, what one needs to be aware of is that the Cormack-Lehane grading of direct laryngoscopy is not the ideal endpoint. Rather than glottic view, success and timing of intubation should be the primary assessments measured. The research to date may not be scientifically robust, and many studies suffer from various methodological flaws. Nevertheless, evidence appears to be in support of RIL over DCL in a variety of clinical and simulated settings and among both novices and experts.

Advantages of rigid indirect laryngoscopy over direct conventional laryngoscopy

Faster intubation time

Faster intubation time is given as an advantage in a number of circumstances, including the difficult airway, cases involving cervical spine immobilisation and morbidly obese patients, and when a novice laryngoscopist is performing the procedure.

Predicted difficult airways

For the predicted difficult airway, there were four manikin studies and one clinical RCT in which improved intubation times were shown [3-7]. The clinical RCT, comparing the AirTraq with DCL, included patients with at least three characteristics indicating an increased risk of difficult intubation [3]. The manikin randomised crossover studies, comparing either the AirTraq or the Glidescope® with DCL, simulated the difficult airway with tongue swelling or pharyngeal obstruction.

Cervical immobilisation

The studies used either manual in-line stabilisation or a hard collar to simulate cervical immobilisation in patients with nonpathological cervical spines. The AirTraq performed better than DCL in this category [5,8], but the studies comparing the Glidescope® to DCL came to conflicting conclusions. Experienced laryngoscopists took longer to intubate with the Glidescope® [6,9], whereas among less experienced or novice laryngoscopists, intubation using the Glidescope® was as fast as or faster than intubation with DCL [10,11].

Morbidly obese patients

The speed of intubation is important in morbidly obese patients as they can desaturate rapidly despite adequate preoxygenation. The two referenced trials [12,13] concluded that in morbidly obese patients the AirTraq improved the ease of tracheal intubation, improved arterial oxygenation during airway management, and thus enhanced patient safety.

Novice laryngoscopists

In terms of speed of intubation, for novice or less experienced laryngoscopists, faster intubation time was a consistent finding in the AirTraq versus DCL trials [5,14]. The AirTraq also demonstrated a more favorable learning curve over DCL. The Glidescope® trials show benefit over DCL in the difficult airway scenarios [15] but less or no benefit in the normal airway or in cervical immobilisation scenarios.

The AirTraq and Glidescope® invariably were scored as easier to use than DCL by both experienced and novice laryngoscopists [3,8,12,16-18]. This was measured using either the Intubation Difficulty Scale score described by Adnet *et al.* [19] or an operator ease-of-use score (visual analog score).

Oesophageal intubation

A statistically significant decrease in the incidence of erroneous oesophageal intubation was demonstrated in a prospective single-blind RCT comparing the use of the AirTraq and DCL by novice laryngoscopists in

patients with no predicted intubation difficulties [14]. In an earlier manikin study using a model of difficult intubation, both student paramedics and experienced prehospital laryngoscopists achieved significantly higher first-time intubation success rates and fewer failed or oesophageal intubations with the AirTraq versus DCL [17].

Airway trauma

The research shows a lower incidence of oral trauma in the difficult airway or when laryngoscopy is performed by novice laryngoscopists. The evidence for this is largely from manikin studies in which the severity of dental trauma was based either on the number of audible teeth clicks (zero, one, or two or more) with the Laerdal® airway trainer or on a grading of pressure on the teeth (none = 0, mild = 1, moderate/severe ≥ 2) with the SimMan® manikin [4,5,17]. These findings have been replicated in an RCT involving patients with predicted difficult airways, in which there were significantly fewer oral lacerations in the AirTraq group than in the DCL group (there was no incidence of dental trauma in either group) [3]. Another prospective RCT involving intubation of morbidly obese patients found no statistically significant difference in oral trauma (blood spots on laryngoscope blade) between the two groups but did find evidence of trauma in both groups [12].

Cervical spine movement

Although some research points to less cervical spine extension or anterior deviation of the cervical vertebral bodies in the AirTraq studies [20,21], these findings were not replicated in the Glidescope® studies [9,22].

Haemodynamic response

Finally, in some cases, the literature points to a lower haemodynamic response to the intubation attempt. Increases in heart rate and blood pressure during and after intubation were significantly greater in the DCL group than in the AirTraq group. This finding was observed in a variety of intubation scenarios, including the normal airway [16], cervical spine immobilisation [8], the predicted difficult airway [3], and the morbidly obese patient [12]. No statistically significant advantage was observed in the Glidescope® studies [18,23,24].

Disadvantages of rigid indirect laryngoscopy over direct conventional laryngoscopy

Currently, the cost of the rigid indirect scopes is a disadvantage, although one would expect the cost of RIL to drop as usage increases. Repairs to such scopes are also expensive. The scopes are also large in size and for patients with a poor mouth opening, such as those with trismus, oropharyngeal abscesses, and tumors, it may be

difficult to insert the blades. One may also get obscured views by blood or secretions on the front end of the scopes, although in reality this is seldom a cause of failure. Of course, the technique of RIL has a learning curve, particularly when one is looking at a monitor or eyepiece and trying to manipulate an endotracheal tube 'around the corner' into view.

Implications for clinical practice

RIL appears to be superior to DCL in many of the areas analysed, including glottic view, overall success rate and time to intubation, ease of insertion, trauma, cervical spine movement, and haemodynamic response. These advantages are more apparent in the studies investigating the difficult airway or novice laryngoscopists. Traditionally, it has been taught that in a known (or unknown) difficult intubation, flexible fibre-optic laryngoscopy (FOL) should be considered early on in the airway plan. To date, there has been little research comparing RIL with flexible FOL. It may be, however, that RIL supersedes flexible FOL in certain difficult airway scenario management plans.

In summary, the papers point to many advantages of RIL over DCL. A consistent finding in the literature reviewed is a superior glottic view. This does not always translate into a higher intubation success rate or faster intubation time, especially in the normal airway or in the hands of those experienced in the art of DCL. An improved overall intubation success rate is seen predominantly in the difficult airway scenarios and when intubation is performed by novice or less experienced laryngoscopists. Whether the rigid indirect laryngoscopes take over from the robust Macintosh laryngoscopes remains to be seen, although the former should probably be made available in situations in which both regular and emergency intubations are performed.

Abbreviations

DCL, direct conventional laryngoscopy; FOL, fibre-optic laryngoscopy; RCT, randomised controlled trial; RIL, rigid indirect laryngoscopy.

Competing interests

The authors declare that they have no competing interests.

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