Reviewer's report

Title: Comparison of the Glidescope, CMAC, Storz DCI with the Macintosh Laryngoscope: A Manikin Study

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Reviewer: david turnbull

Reviewer's report:

Major compulsory revisions: The concept of Subjective Confidence of correct endotracheal tube placement should be removed. This is an arbitrary score on a ten point scale, and I do not feel that it is a helpful contribution to the comparison of the performance of the laryngoscopes tested. Videolaryngoscopy enable the user and an observer to see the placement of the endotracheal tube and with correct usage there should be no doubt of the position of the endotracheal tube.

Minor Essential Revisions:

There are many studies that have considered the problem addressed by the authors in some way. A brief review of "pubmed" demonstrates that there are 160 studies where a manikin and intubation were in the title, in addition the Glidescope appears in 280 studies, the Storz videolaryngoscope in 13 studies and the Storz CMAC 8 in studies. 227 studies have compared Macintosh with other blades. The excellent review by Mihai1 considered that manikin studies are not comparable to clinical trials, "We are not aware of any substantial evidence that manikin studies correlate with clinical performance in this area. The use of rigid plastics, the lack of collapsible soft tissues, absence of secretions and the fact many manikins do not have anatomically correct epiglottic and laryngeal structures makes them very unlikely to be useful surrogates for evaluation of either easy or difficult intubation." The comparative performance of laryngoscopes in a manikin study is unlikely to be transferrable to clinical practice. This could be addressed by the authors in the introduction.

The introduction describes that “there is little evidence comparing the performance features of these devices (videolaryngoscopes) against each other in true difficult airways.” However, the “Practice Guidelines for Management of the Difficult Airway” referred to in the first paragraph said that “A standard definition of the difficult airway cannot be identified in the available literature.” The authors need to inform the reader what they consider to be a difficult airway, or what aspect of a difficult airway the study is considering. In this study a difficult airway could be considered to be one that a reasonably skilled anaesthetist is unable to intubate with a standard Macintosh and bougie or stylet. However, in only two cases were the users unable to intubate the manikin with a macintosh laryngoscope. At the conclusion of the introduction the authors state “A Cormack and Lehane
view 3 or 4 implies that the vocal cords are not visualised on laryngoscopy and has been used throughout the available literature to define a difficult view at direct laryngoscopy. This will be termed a “difficult view” for the remainder of this article.

The aim of this study was to investigate the performance features of a selection of video laryngoscopes in a difficult airway scenario reproduced by a high fidelity airway manikin” It may be semantics, but a difficult view is not a difficult airway. A skilled anaesthetist is able to manage a grade 3 view with a Macintosh and stylet or bougie in 90% of cases. The authors should make clear that this is a study in a manikin where the hi fidelity simulator has reproduced a difficult view and this does not relate to a difficult intubation.

Methods. The authors describe the application of a hard collar. What was the impact on the mouth opening or the neck movement of the hard collar? As the scenarios were randomised, was there a standard method used to place the hard collar so that the difficulty it produced was standardised across all subjects.

The authors describe “the subjects reported confidence of correct endotracheal tube placement (assessed on a 10-point verbal scale).” The videolaryngoscopes are intended to provide a good view of the vocal cords and the passage of the ETT through the cords. The Cormack and Lehane score was intended for use with direct laryngoscopy and its application to videolaryngoscopes is unclear. An observer could monitor the laryngoscopic view achieved. Why was it necessary to have a 10 point scale, would a 2 point scale be acceptable?

The statistical analysis of the confidence of successful intubation was described as “To analyze the outcome of subjective confidence of correct endotracheal tube placement the results were divided into unconfident (1–7) and confident (8–10). The results were analyzed using Fishers Exact (2 sided test) a statistical test appropriate for categorical values.” I am unaware of previous studies where subjective confidence was used, and the division into two groups appears arbitrary and the reader could consider that the cut off has been created to favour a particular outcome. I might suggest that the entire concept of subjective confidence has no value and could be removed.

Results: If the authors accept that the data from a manikin study is not transferrable to the clinical area, and that a difficult view is unrelated to a difficult intubation, the authors should be careful to not make too much of the data collected. The time to a successful intubation (TTSI) is analysed to demonstrate a difference between laryngoscopes. However, a statistical difference does not equate to a clinical difference and perhaps the authors could consider what would be an acceptable time to intubate at the outset and then consider if any of the devices breached that.

Similarly, the difference in the grade of view obtained between a Macintosh and a videolaryngoscope may have little clinical significance particularly as previously discussed where the cut off is Cormack and Lehance grade 3 or higher.

I may have misunderstood the results. However, the study used two scenarios,
easy and difficult. The results appear to be homogenised from both scenarios. Could the authors report the results of Cormack and Lehane view from the difficult scenario independently of the easy scenario?

Figure 7 suggests that the grade of view obtained with the macintosh was often a grade 3, but the time to intubate was only 19 seconds. This returns to my original point that a grade 3 view does not equate to a difficult intubation. I think the authors should highlight the excellent performance of the macintosh laryngoscope even in the difficult scenario.

Discussion: The opening sentence is “The results of this study demonstrate that use all of the video laryngoscopes improved the grade view at laryngoscopy in a difficult airway simulation compared with the Macintosh blade.” Again I think that the authors should make it clear that the grade of view obtained does not equate to a difficult airway and this does not demonstrate that the videolaryngoscopes would provide an improvement in a true case of a difficult intubation.

The authors conclude that “The use of an airway manikin instead of patients when investigating airway devices results in limited generalizability...... A high level of caution must be applied if any of the findings are to be extrapolated to a human difficult airway population.” This has been the observation of many other trials and reviews. It is therefore unclear how the results from this study move forward our understanding of the management of the difficult intubation. The practice guidelines referred to in the introduction2, 3 make no mention of videolaryngoscopy. The position of the camera relative to the blade tip altering the laryngoscopic view is an interesting observation, and one that needs to be considered when purchasing particular systems.

Overall, the contribution of this study to the future development of practice guidelines for difficult intubation management is small. The limited value of manikin studies has been highlighted in previous reviews. The results suggest that even where the grade of view was 3 or higher the performance of the Macintosh was at least as good as the other blades and was better than the Storz and Glidescope. However, regular users of videolaryngoscopy frequently attest to the improvement in clinical practice that videolaryngoscopy has bought.


Discretionary Revisions
There are many studies that have considered the problem addressed by the authors in some way. A brief review of “pubmed” demonstrates that there are 160 studies where a manikin and intubation were in the title, the Glidescope appears in 280 studies, the Storz videolaryngoscope in 13 studies and the Storz CMAC 8 in studies. 227 studies have compared Macintosh with other blades. The excellent review by Mihai1 considered that manikin studies are not comparable to clinical trials, “We are not aware of any substantial evidence that manikin studies correlate with clinical performance in this area. The use of rigid plastics, the lack of collapsible soft tissues, absence of secretions and the fact many manikins do not have anatomically correct epiglottic and laryngeal structures makes them very unlikely to be useful surrogates for evaluation of either easy or difficult intubation.” The performance of laryngoscopes measured in diminished in a manikin study and is therefore unlikely to be transferrable to clinical practice. This could be addressed by the authors in the introduction.

The American “Practice Guidelines for Management of the Difficult Airway” state that “A standard definition of the difficult airway cannot be identified in the available literature.” In this study a difficult airway could be considered to be one that a reasonably skilled anaesthetist is unable to intubate with a standard Macintosh and bougie or stylet. However, the number of failures of the macintosh were small (n = 2) demonstrating the excellent performance of the macintosh blade even in “difficult” conditions.

The aim of this study was to investigate the performance features of a selection of video laryngoscopes in a difficult airway scenario reproduced by a high fidelity airway manikin” It may be semantics, but a difficult view is not a difficult airway. A skilled anaesthetist is able to manage a grade 3 view with a Macintosh and stylet or bougie in 90% of cases1. Therefore, this is a study in a manikin where the high fidelity simulator has reproduced a difficult view and this does not relate to difficult intubating conditions in the clinical setting.

**Level of interest:** An article of limited interest

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

I declare that I have no competing interests.