Debate: Is Video Laryngoscopy Making Direct Laryngoscopy Obsolete?
The "Yes" Position

SOCIETY FOR TECHNOLOGY IN ANESTHESIA

Why Video Laryngoscopy Is Winning Over Direct Laryngoscopy

D. John Doyle MD PhD
Professor of Anesthesiology
Cleveland Clinic

No Conflicts of Interest

"Try this—I just bought a hundred shares."

http://www.medrants.com/100shares.gif

Central Arguments

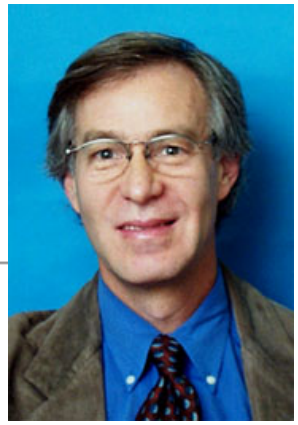
- VL is easier to learn than DL
- VL is easier to perform than DL
- VL is less stimulating than DL
- VL provides better visualization than DL
- VL allows all stakeholders to see the glottis
- VL equipment is getting cheaper and cheaper
- Eventually DL will be only of historical interest - like blind nasal intubation and digital intubation

VL = videolaryngoscopy
DL = direct laryngoscopy

Internet Journal of Airway Management

2007

Homepage
Volume 4 (January 2006 to December 2007)



Is Direct Laryngoscopy Obsolete?

Richard M. Cooper, MD [1]

[1]Professor of Anesthesia, Department of Anesthesia, University of Toronto, Toronto General Hospital, Toronto, Ontario, Canada.

Address correspondence and comments to Richard M. Cooper .

Received from the Department of Anesthesia, University of Toronto, Toronto General Hospital, Toronto, Ontario, Canada.

Statements
The author was consultant to Saturn Biomedical Systems (Burnaby, British Columbia, Canada) and is currently consultant to Verathon Medical (Bothell, Washington, United States), the manufacturers of the GlideScope Video Laryngoscope.

Key Words
Tracheal intubation: direct laryngoscopy.

Published: July 9, 2007.

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Available from URL: http://www.adair.at/ijam/volume04/specialcomment01/default.htm
Date accessed: month day, year.

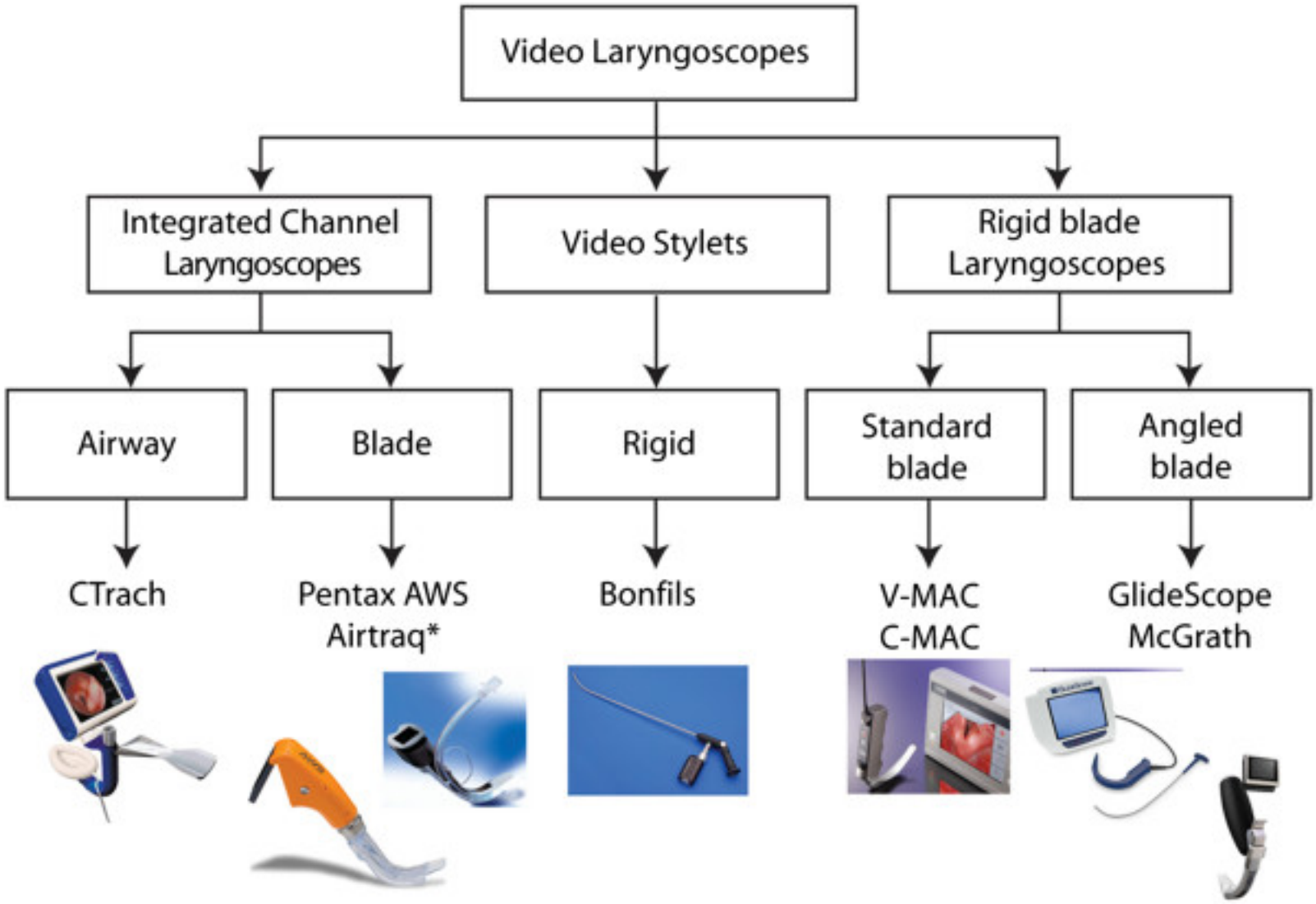
Is Direct Laryngoscopy Obsolete?

Richard M. Cooper, MD

- Many of the newer techniques are easy to learn and can be easily introduced into our practice
- This is more applicable to video laryngoscopy than rigid fiberoptic laryngoscopy
- Ideally, the technique should be suitable in challenging settings (blood, secretions, RSI, poor oxygenation, awake patient) and resistant to fogging
- Old airway management was about getting the TT in. New airway management is about achieving this with minimal discomfort and postoperative laryngeal morbidity.

But first… some introductions

Prototype of the curved laryngoscope blade developed by Sir Robert Macintosh (1897-1989) and his skilled technician, Mr. Richard Salt.



Healy DW, Maties O, Hovord D, Kheterpal S. A systematic review of the role of videolaryngoscopy in successful orotracheal intubation. BMC Anesthesiol. 2012 Dec 14;12:32. doi: 10.1186/1471-2253-12-32. PubMed PMID: 23241277; PubMed Central PMCID: PMC3562270.

Videolaryngoscope Design Issues

- Regular or Channeled Videolaryngoscope
- Angulation of the Videolaryngoscope Blade
- Positioning of Camera on the Videolaryngoscope
- Width of the Videolaryngoscope Blade
- Oral vs Nasal Intubation
- Malleable vs Rigid Stylet
- Angulation of Malleable Styletted ETT
- Available of a “Bougie Port”
- Type of ETT Used (e.g., Pentax AWS)

Regular Videolaryngoscopes

- GlideScope family
- McGrath products
- Storz products
- AP Advance
- CoPilot VL
- Truphatek

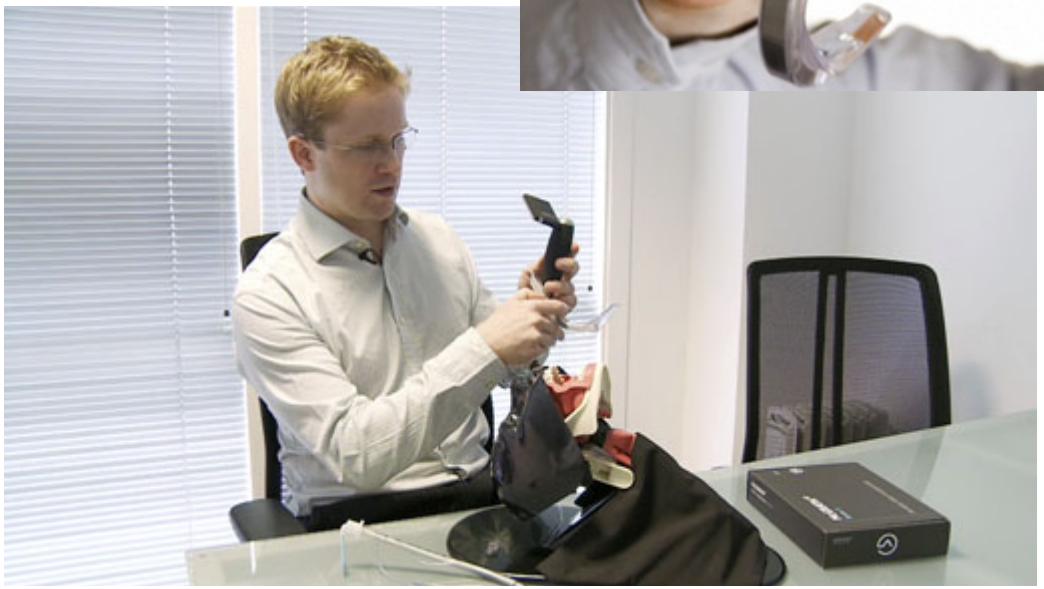
GlideScope ®
Family of Products


Early GlideScope Use (2003)

Jack Pacey's Original GlideScope Prototype

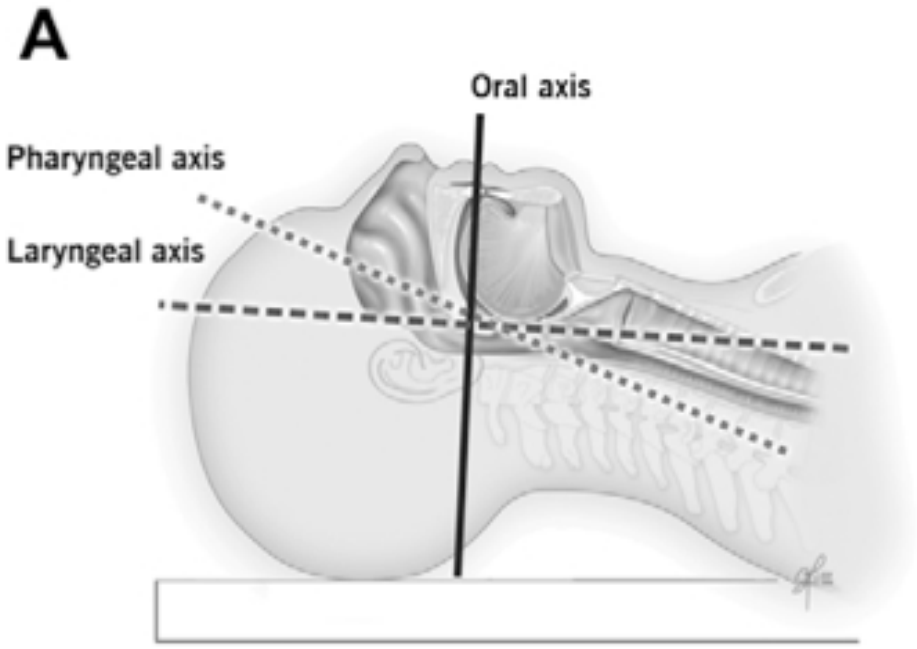
Matt McGrath

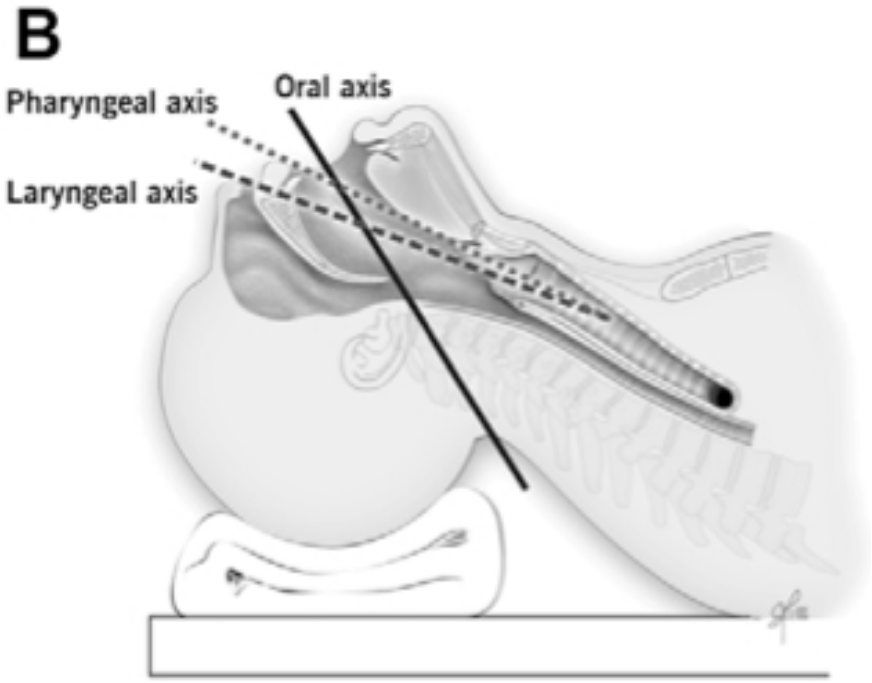
Inventor and CEO



AIRCRAFT MEDICAL

Matt has a 1st class honours degree in Industrial Design. He founded Aircraft Medical in June 2001 with the vision to build a full infrastructure medical devices company. He twice won the coveted Royal Society of Arts design award, an achievement shared with Jonathon Ive (Head of Design at Apple Inc.). He has lived and worked in New York, Lisbon and London as well as working at the UN Centre for Design Research on medical devices. Matt was awarded the title of 'Emerging Entrepreneur of the Year' by Scotland's Entrepreneurial Exchange and was recently named "Young Scot of the Year". Matt is an advisor to the Royal Society of Arts and sits on The Wellcome Trust's Expert Review Group. Matt is the recent winner of the coveted 2010 Gannochy Trust Innovation Award of the Royal Society of Edinburgh.





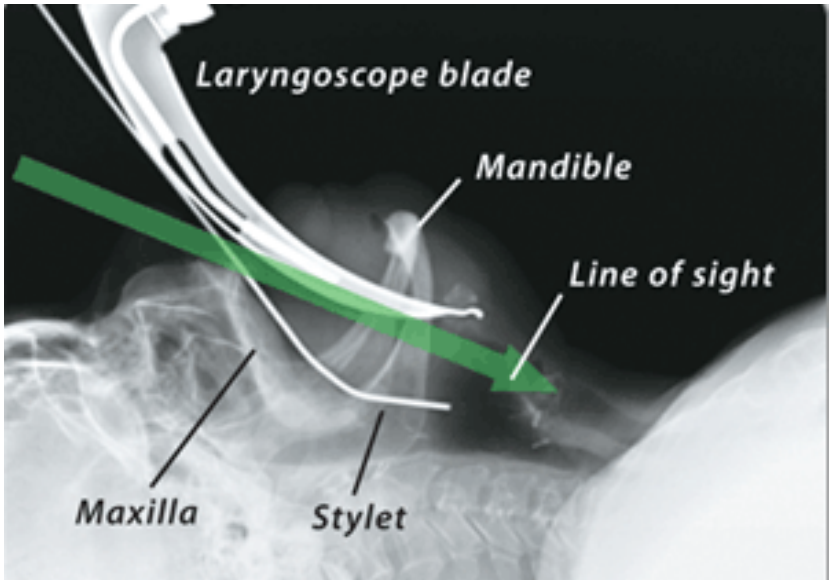
Anesthesiology
1999; 91:1964–5

Frédéric Adnet, M.D., Ph.D.

The Three Axis Alignment Theory and the "Sniffing Position": Perpetuation of an Anatomic Myth?

It would appear to us that, although the sniffing position may provide the best laryngeal view, the explanation of the benefit of the sniffing position based on alignment of the three axes is an error perpetuated since 1944 that deserves reexamination.

Anesthesiology, V 91, No 6, Dec 1999



KEY POINT

Laryngoscope blade angulation is important in determining the resulting laryngeal view.

Canadian Journal of Anaesthesia
March 1993, Volume 40, Issue 3,
pp 262-270

Equipment

An analysis of laryngoscope blade shape and design: new criteria for laryngoscope evaluation

Rex R.D. Marks MB ChB BSc (Hons.),*
Richard Hancock RMIP LBIPP,†
Peter Charters MD MRCP FFARCS BA*

Laryngoscope blade design has tended to be relatively arbitrary and so far scientific analysis has not allowed useful comparisons between blade shapes. A new theoretical method of analysing laryngoscope blades is introduced and uses the depth of insertion profiles of two angular measurements. One represents eyeline displacement and the other the forward space that the blade occupies at the level of the mandible. Photographs of straight and curved blades were studied on Cartesian graphs with the tip T, at the origin and handle fittings parallel to the x-axis of the graph. Then, IT is any line from the origin to the incisor surface and represents a point of contact with the upper incisors for a given depth of blade insertion. Angle EIT (eyeline displacement) is to a tangent from I along the lower lingual surface of the blade. Point M is on the upper lingual surface of the blade, at right angles to IT, 1/3 of the distance from I along IT. Angle MIT (forward space) may be positive or negative depending on whether M is in front of or behind IT. The angles EIT, MIT and their additive combination are used in blade analysis. Negative MIT compensates for eyeline displacement as Macintosh size 3 and 4 blades have better combination scores than Miller size 3. All three are superior to the straight Soper size 3 blade. The Macintosh size 1 and 2 blades are quite different from the larger Macintosh blades. This theoretical basis for blade analysis is consistent with commonly expressed clinical opinions and may influence blade design in the future.

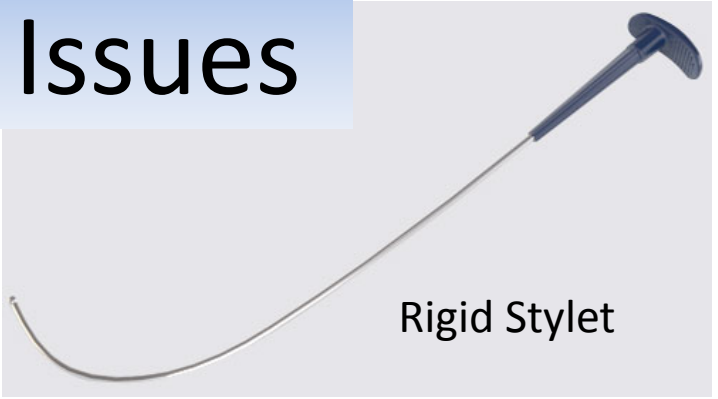
La conception des lames de laryngoscope tient de l'arbitraire et a jusqu'à maintenant a défié toute analyse scientifique comparative. Les auteurs présentent une nouvelle méthode analytique basée sur le profil de la lame vue sous deux angles différents après son insertion. Le premier montre la déviation de la ligne de vision et l'autre l'espace rétromandibulaire que la lame occupe. Des photographies de lames droites et courbes sont transposées sur des coordonnées cartésiennes avec la pointe T à l'origine et le point d'attache du manche parallèle à l'abscisse du graphique. IT devient la ligne qui naît de la surface des incisives et représente le point de contact avec les incisives supérieures pour une profondeur donnée d'insertion. L'angle EIT (déplacement de la ligne de vision) est la tangente de I avec la surface linguale inférieure de la lame. Le point M se situe sur la surface linguale supérieure de la lame, à angle droit avec IT, au tiers de la distance entre I et IT. L'angle MIT (espace antérieur) peut être positif ou négatif selon que M est en avant ou en arrière de IT. Les angles EIT et MIT et leur combinaisons additives sont utilisés pour l'analyse des lames. Un angle MIT négatif compense pour le déplacement de la ligne de vision: les lames Macintosh 3 et 4 ont une meilleur cote que la Miller 3. Les trois sont supérieures à la lame droite Soper 3. Les Macintosh 1 et 2 sont tout à fait différentes des Macintosh plus longues. Cette analyse théorique est consistante avec les impressions cliniques courantes et pourrait dans l'avenir influencer la conception des lames.

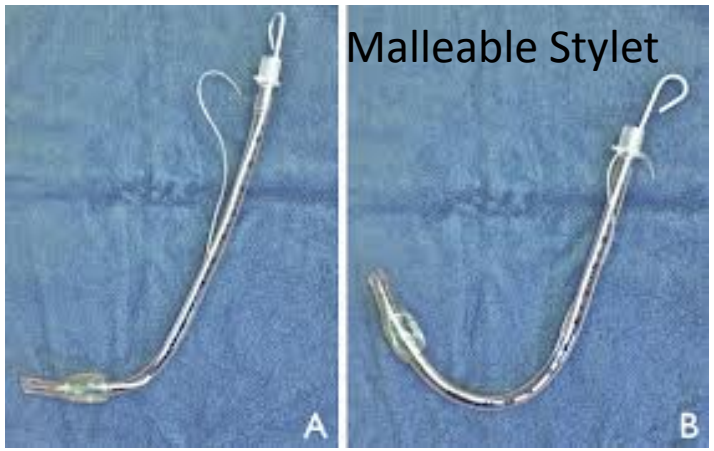
Key words
ANATOMY: airway, larynx;
EQUIPMENT: laryngoscopes;
INTUBATION: tracheal.

From the Department of Anaesthesia*, and the Department of Medical Illustration†, Walton Hospital, Rice Lane, Liverpool L9 1AE, England UK.
Address correspondence to: Dr. P. Charters.
Accepted for publication 9th November, 1992.

Since the advent of tracheal intubation in anaesthesia, at least 50 descriptions of laryngoscope blade designs have been published, and many more designs exist unpublished. Despite this, only a small number of blades has passed beyond the prototype stage to enjoy widespread clinical use. In a recent review, McIntyre classified different designs in terms of addressing specific problems of difficult intubation; however, he concluded that "detailed evaluations of the performance of any particular

ETT Stylet Issues





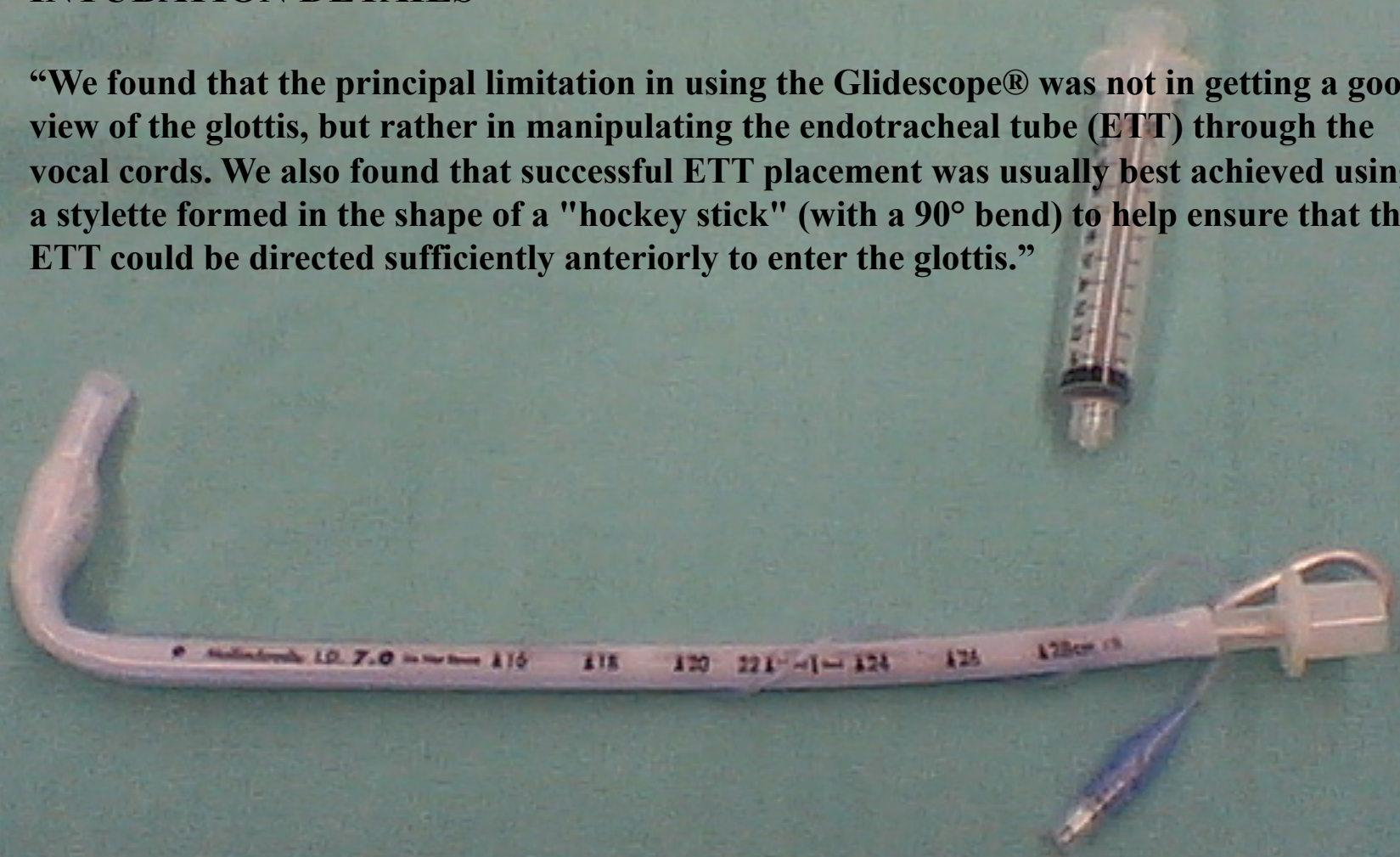
Turkstra TP, Harle CC, Armstrong KP, Armstrong PM, Cherry RA, Hoogstra J, Jones PM. The GlideScope-specific rigid stylet and standard malleable stylet are equally effective for GlideScope use. Can J Anaesth. 2007 Nov;54(11):891-6.

Turkstra TP, Jones PM, Ower KM, Gros ML. The Flex-It stylet is less effective than a malleable stylet for orotracheal intubation using the GlideScope. Anesth Analg. 2009 Dec;109(6):1856-9.

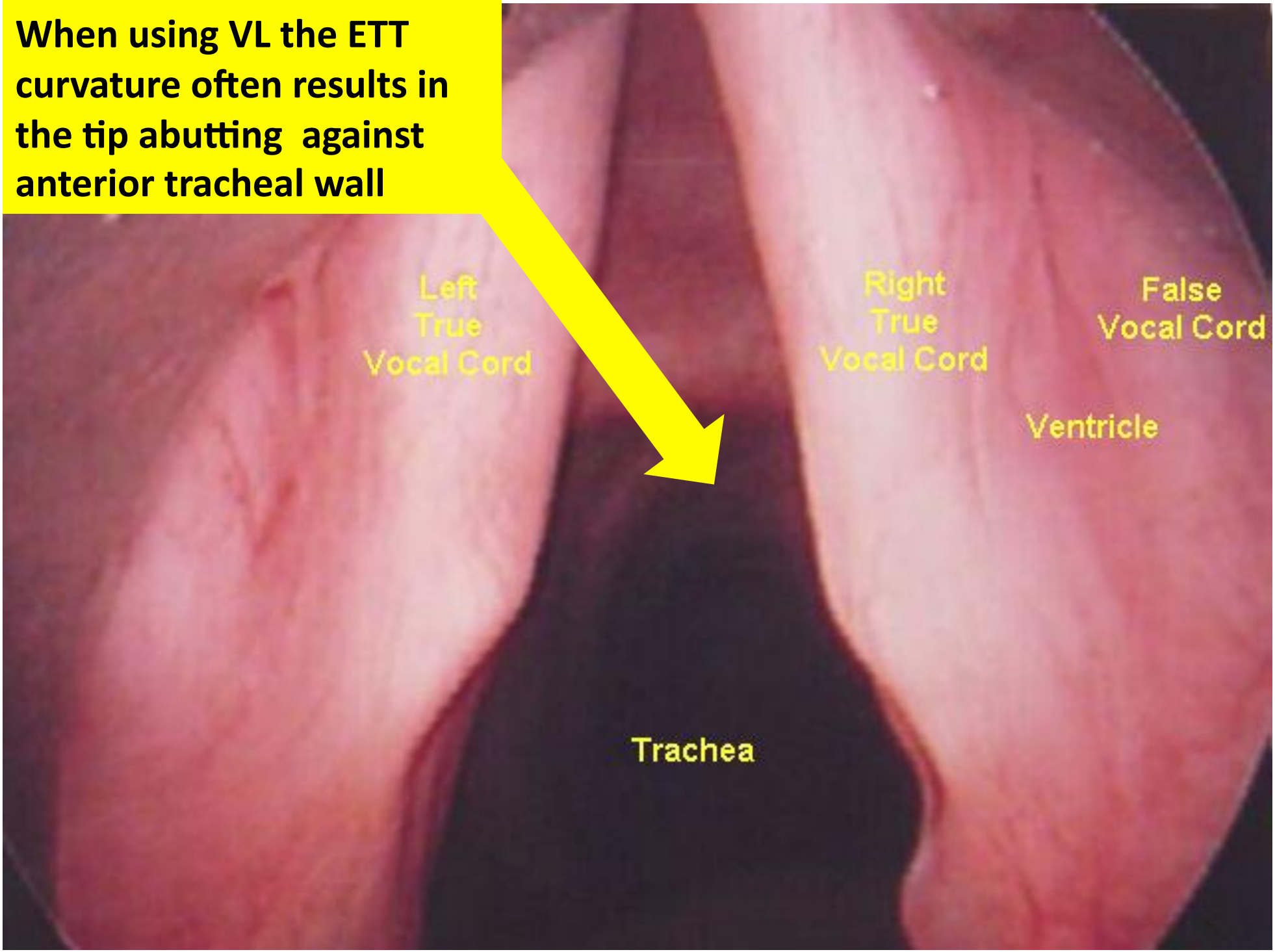
Walls RM, Samuels-Kalow M, Perkins A. A new maneuver for endotracheal tube insertion during difficult GlideScope intubation. J Emerg Med. 2010 Jul;39(1):86-8.

INTUBATION DETAILS

“We found that the principal limitation in using the Glidescope® was not in getting a good view of the glottis, but rather in manipulating the endotracheal tube (ETT) through the vocal cords. We also found that successful ETT placement was usually best achieved using a stylette formed in the shape of a "hockey stick" (with a 90° bend) to help ensure that the ETT could be directed sufficiently anteriorly to enter the glottis.”

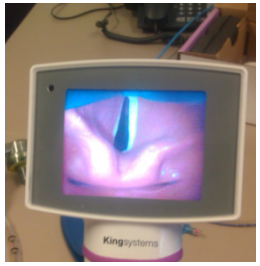


D. John Doyle, MD PhD, Andrew Zura, MD and Mangalakaraipudur Ramachandran, MD. Videolaryngoscopy in the Management of the Difficult Airway. Canadian Journal of Anesthesia 51:95 (2004)

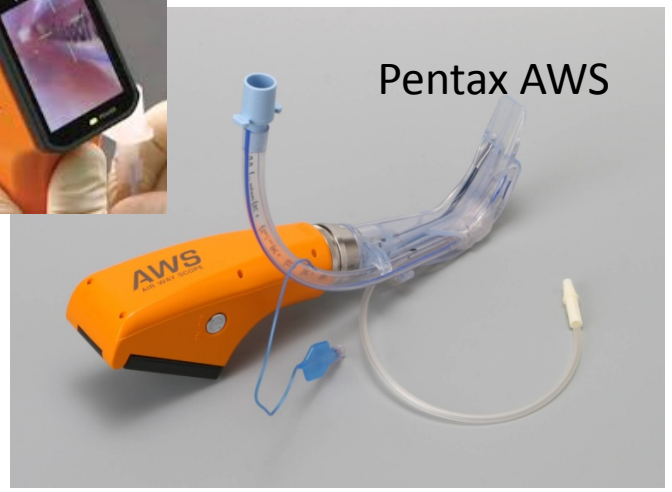

When using VL the ETT curvature often results in the tip abutting against anterior tracheal wall
Left True Vocal Cord
Right True Vocal Cord
False Vocal Cord
Ventricle
Trachea

Channeled Videolaryngoscopes

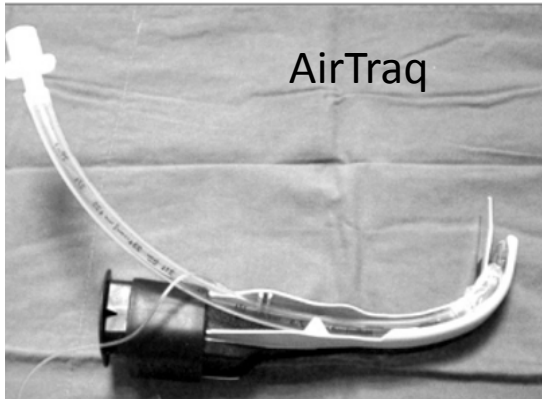
- Pentax AWS
- AirTraq
- King Vision
- CoPilot VL (sort of)



King Vision



Pentax AWS



AirTraq

bougie port

CoPilot VL

Robot-Assisted Intubation

British Journal of Anaesthesia **108** (6): 1011-16 (2012)
Advance Access publication 28 March 2012 · doi:10.1093/bja/aes034

BJA

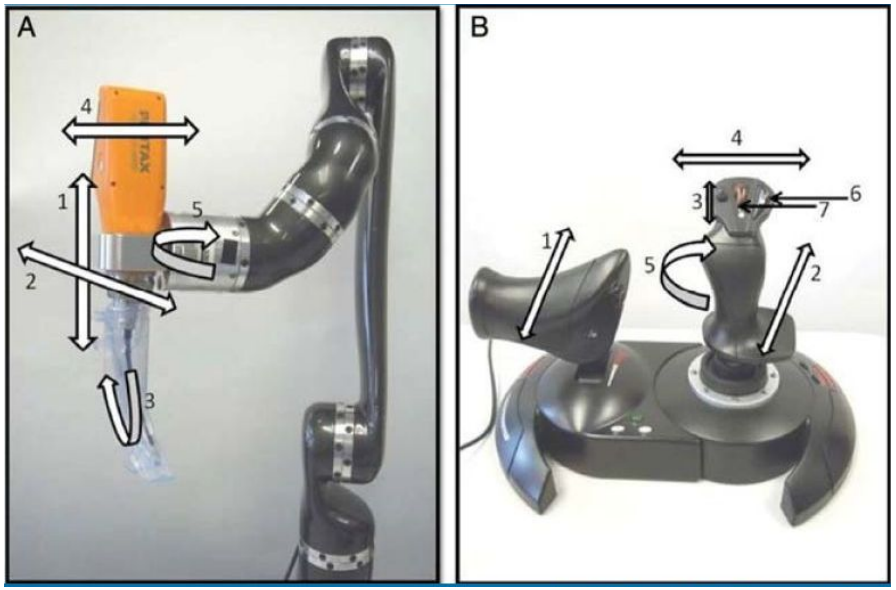
RESPIRATION AND THE AIRWAY

First robotic tracheal intubations in humans using the Kepler intubation system

T. M. Hemmerling*, R. Taddei, M. Wehbe, C. Zaouter, S. Cyr and J. Morse

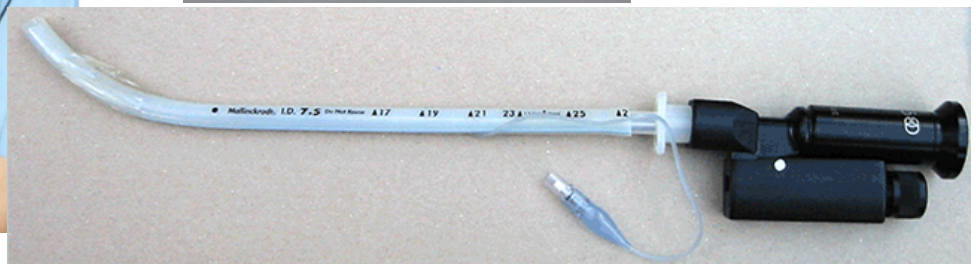
Department of Anesthesia, McGill University, Montreal General Hospital, 1650 Cedar Avenue, Montreal, Canada H3G 1A4

* Corresponding author. E-mail: thomas.hemmerling@mcgill.ca



Stylet Videolaryngoscopes

- Bonfils
- VuStik
- Rigid and flexible laryngoscope (RIFL)
- SensaScope
- Dispososcope



Bir P. The SensaScope® - A new hybrid video intubation stylet. Saudi J Anaesthes. 2011;5:415–417.

“Knock-Off” Videolaryngoscopes

www.alibaba.com

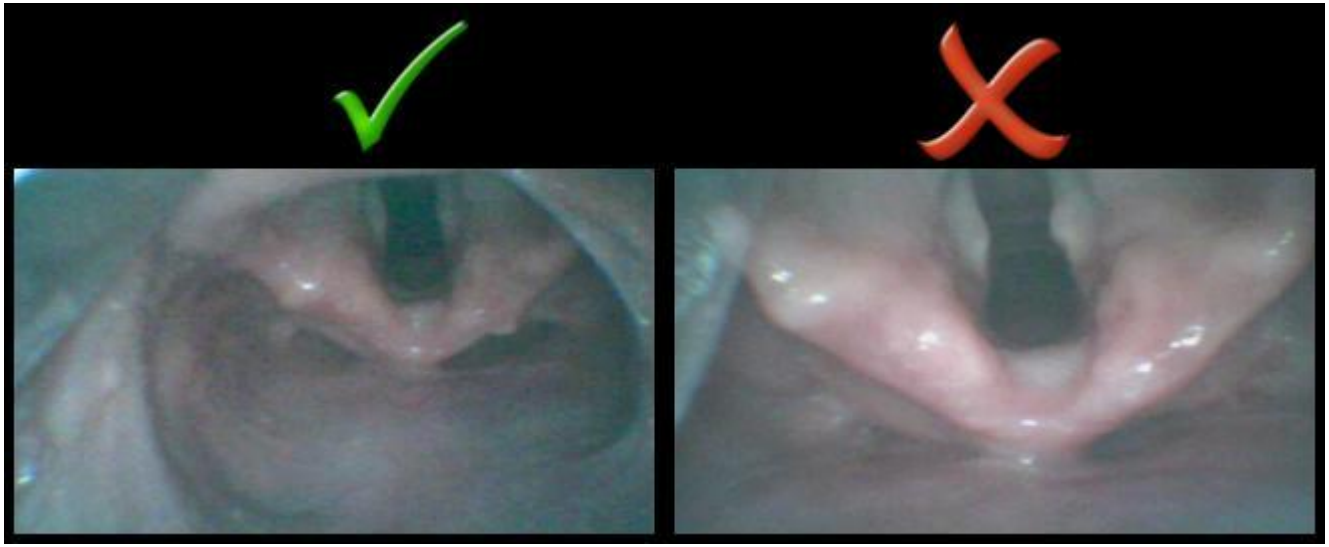
www.alibaba.com

www.made-in-china.com

What do the experts say?

"A common mistake many new VL users will make is placing the end of the scope too close to the glottis. When this happens, the end of the scope will actually get in the way of the tip of the ETT as you try to navigate it into the glottis. Instead, back the scope away from the glottis. With VL, it can be preferential to have a grade 2 view over a grade 1 view. This allows a wider field of view and more room to maneuver the tip of the ETT."

http://copilotvl.com/VL101



"A few other things to keep in mind when learning VL:

"Keep your eyes on the patient as you introduce the scope into the mouth until it reaches the oropharynx."

"A midline introduction is usually recommended, but if your patient has a small mouth, try introducing the sheath further left. Once you have a good laryngeal view, watch the patient as you insert the endotracheal tube into the patient's mouth, or a bougie into the bougie port."

http://copilotvl.com/VL101

Difficulty passing the tube?

"If you're having difficulty passing the tube, reduce your upward lifting force while maintaining good laryngeal view. If you are using a stylet instead of a bougie, slide the stylet back a few centimeters which can straighten the end of the ETT. Also, you may try withdrawing the sheath a centimeter or two. These techniques can bring the axis of the ETT into better alignment with the axis of the trachea."

"Remember, it takes a long time and countless intubations to become an expert at direct laryngoscopy. Give yourself some time to pick up and master the subtle differences with VL. And as always, don't wait until you're in an emergency situation to hone your skills. "

http://copilotvl.com/VL101

VIDEO LARYNGOSCOPY
Advantages

- Improved laryngeal visualization because eye and airway need not be lined up as in direct laryngoscopy
- Less force used than during direct laryngoscopy
- Less cervical spine movement
- Possibly less hemodynamic stress response to laryngoscopy and intubation
- Short learning curve
- Improved portability and cost compared to flexible fiber optic laryngoscopes
- Useful teaching tools
- Generally higher success rate, especially in difficult situations

From Saudi J Anaesth. 2011 Oct-Dec; 5(4): 357–359.

VIDEO LARYNGOSCOPY
Disdvantages

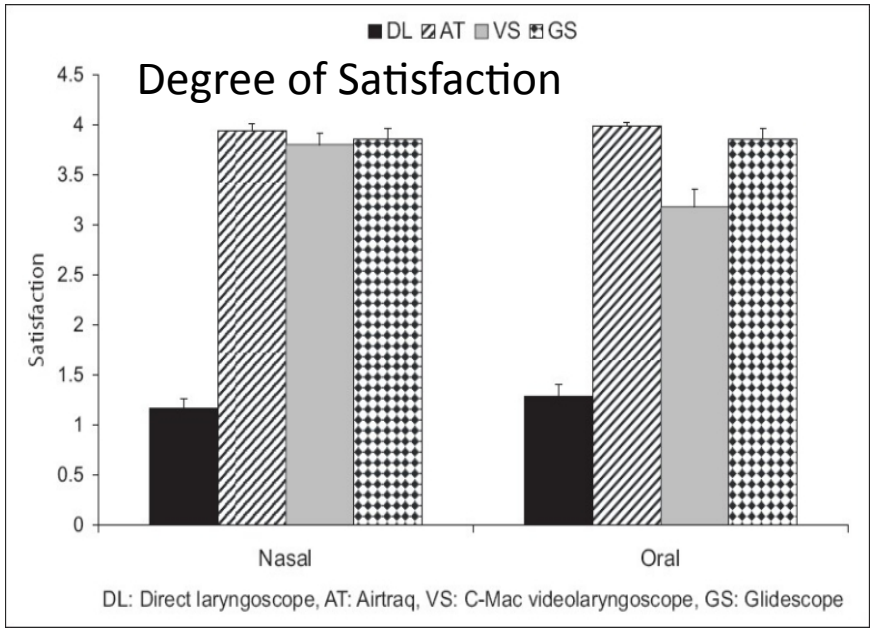
- Passage of the ETT may be difficult despite good view or higher POGO score; often stylet is needed
- Fogging and secretion may obscure the view
- Loss of depth perception
- Economic issues over stock acquisition and maintenance
- No single videoscope is ideal
- Greater processing time
- Different techniques of laryngoscopy and intubation with different makes and models

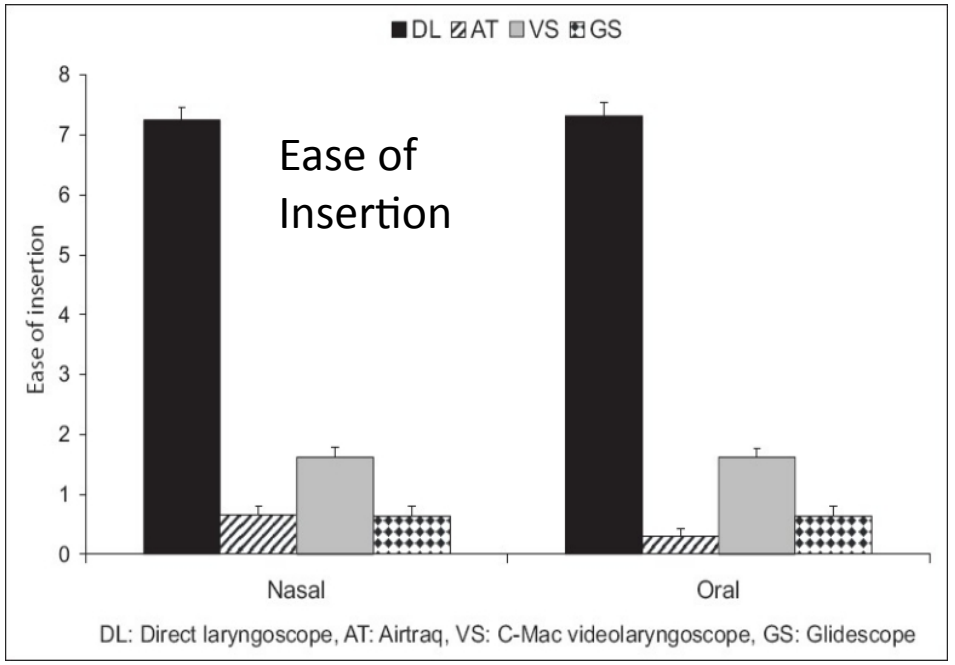
From Saudi J Anaesth. 2011 Oct-Dec; 5(4): 357–359.

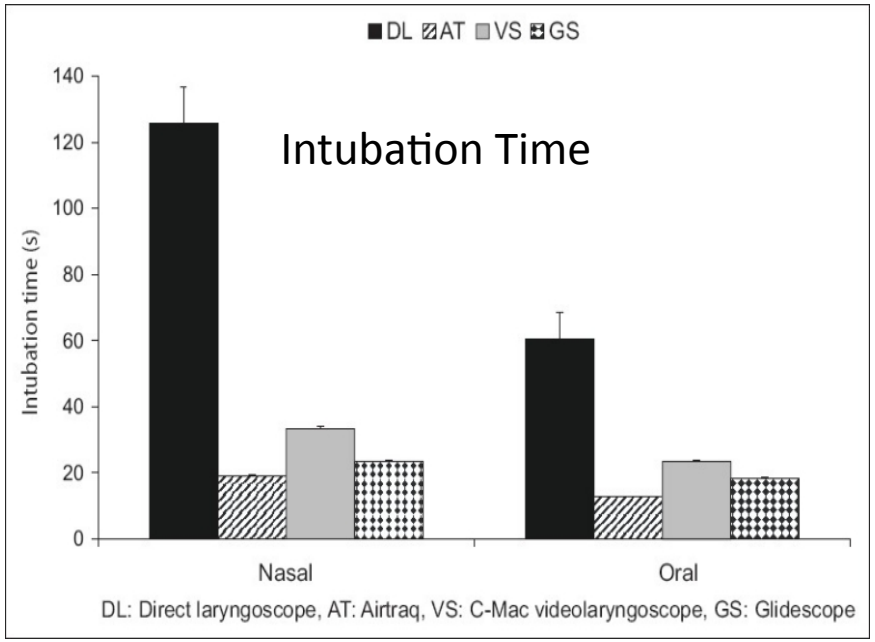
Is VL really easier to learn and perform than DL?

Does VL really provide a better view than DL?

Novice Intubators







Kaki AM, AlMarkabi WA, Fawzi HM, Boker AM. Use of Airtraq, C-Mac, and Glidescope laryngoscope is better than Macintosh in novice medical students' hands: A manikin study. Saudi J Anaesthesia. 2011;5:576–381.

Non-anesthesia residents performed tracheal intubation using either the GlideScope (n = 100) or Macintosh laryngoscope (n = 100).

There were no significant differences in the time needed to secure the airway.

Fewer attempts until successful intubation were made with the GlideScope than with the Macintosh.

Esophageal intubation with the GlideScope was less frequent than with the Macintosh.

"An esophageal intubation is no sin, but there is great sin in not recognizing such a placement."

J Anesth (2010) 24:303–305
DOI 10.1007/s00540-010-0872-y

SHORT COMMUNICATION

GlideScope videolaryngoscope reduces the incidence of erroneous esophageal intubation by novice laryngoscopists

Yoshihiro Hirabayashi · Yoji Otsuka · Norimasa Seo

Received: 1 September 2009 / Accepted: 13 November 2009 / Published online: 28 January 2010

Abstract The purpose of this study was to evaluate the performance of the GlideScope videolaryngoscope for tracheal intubation by novice laryngoscopists compared with that of the Macintosh laryngoscope. Under supervision by staff anesthetists, non-anesthesia residents performed tracheal intubation using either the GlideScope videolaryngoscope ($n = 100$) or Macintosh laryngoscope ($n = 100$). The time required for airway instrumentation, the number of attempts required until successful intubation, and erroneous esophageal intubation were investigated. There were no significant differences in the time needed to secure the airway between the GlideScope videolaryngoscope and the Macintosh laryngoscope. Fewer attempts until successful intubation were made with the GlideScope videolaryngoscope than with the Macintosh laryngoscope ($p < 0.05$). Erroneous esophageal intubation with the GlideScope videolaryngoscope was less frequent than with the Macintosh laryngoscope ($p < 0.05$). Compared to the Macintosh laryngoscope, the GlideScope videolaryngoscope reduces the incidence of erroneous esophageal intubation by less experienced laryngoscopists.

Keywords Tracheal intubation · GlideScope videolaryngoscope · Macintosh laryngoscope

The GlideScope videolaryngoscope (Verathon Medical Inc., Bothell, WA, USA) provides a high-grade, indirect close-proximity view of the glottis on a monitor screen without aligning the oral, pharyngeal, and laryngeal axes [1]. Better glottic exposure may be advantageous, especially to non-anesthesia physicians who only perform tracheal intubation occasionally [2–5]. We conducted a randomized study to compare the performance of the GlideScope videolaryngoscope with that of the conventional Macintosh laryngoscope when used by novice laryngoscopists.

After approval of the study by the local ethics committee, written informed consent was obtained from surgical patients. Patients with a history of previously difficult intubation and those with cervical spine fracture or cervical spine instability were excluded. In all, 29 non-anesthesia residents performed tracheal intubation during their anesthesia training (median period, 6 weeks; range 1–18 weeks) using the first-generation GlideScope videolaryngoscope ($n = 100$) or Macintosh laryngoscope ($n = 100$). The trainees received a short demonstration of the GlideScope videolaryngoscope device and were allowed 5–6 practice intubations using a manikin before using the device clinically. Allocation to the two groups was assigned randomly using numbers drawn from a random numbers table. Patients were comparable with respect to age (GlideScope, 50 ± 16 years vs. Macintosh, 53 ± 17, mean ± SD), weight (60 ± 13 kg vs. 61 ± 12), height (158 ± 8 cm vs. 159 ± 11) and body mass index (24 ± 4 kg/m^2 vs. 24 ± 4). A staff anesthetist supervised each laryngoscopy and an independent observer recorded the duration of tracheal intubation attempts using a stopwatch. When the novice personnel encountered difficulty in visualizing vocal cords and also placing the tube into the trachea, airway operators were allowed to ask a supervisor to help solve the problem, and the supervising staff gave suggestions or instructions. The supervising anesthesiologist obtained only verbal information from the resident

Y. Hirabayashi (✉) · Y. Otsuka · N. Seo
Department of Anesthesiology and Critical Care Medicine, Jichi Medical University, 3311-1 Yakushiji, Shimotsuke, Tochigi 329-0498, Japan
e-mail: yhira@jichi.ac.jp

Aziz MF, Dillman D, Fu R, Brambrink AM. Comparative effectiveness of the C-MAC video laryngoscope versus direct laryngoscopy in the setting of the predicted difficult airway. Anesthesiology. 2012 Mar;116(3):629-36.

Two arm, single-blinded randomized controlled trial involving 300 patients. Inclusion required at least one of four predictors of difficult intubation. The primary outcome was successful tracheal intubation on first attempt.

*"The use of video laryngoscopy resulted in **more successful intubations on first attempt** (138/149; 93%) as compared with direct laryngoscopy (124/147; 84%), P = 0.026. Cormack-Lehane laryngeal view was graded I or II in 139/149 of C-MAC attempts versus 119/147 in direct laryngoscopy attempts (P < 0.01). Laryngoscopy time averaged 46 s (95% CI, 40-51) for the C-MAC group and was shorter in the direct laryngoscopy group, 33 s (95% CI, 29-36), P < 0.001. **The use of a gum-elastic bougie and/or external laryngeal manipulation were required less often in the C-MAC intubations** (24%, 33/138) compared with direct laryngoscopy (37%, 46/124, P = 0.020)."*

Niforopoulou P, Pantazopoulos I, Demestiha T, Koudouna E, Xanthos T. Video-laryngoscopes in the adult airway management: a topical review of the literature. Acta Anaesthesiol Scand. 2010 Oct; 54(9):1050-61.

"Video-laryngoscopes are new intubation devices, which provide an indirect view of the upper airway. In difficult airway management, ***they improve Cormack-Lehane grade*** *and achieve the same or a higher intubation success rate in less time, compared with direct laryngoscopes."*

Russo SG, Weiss M, Eich C. [Video laryngoscopy olé! Time to say good bye to direct and flexible intubation?]. Anaesthesist. 2012 Dec;61(12):1017-26.

"A number of video laryngoscopy systems have been introduced into anesthetic practice in recent years. Due to the technical concepts of these systems ***exposure of the laryngeal structures is usually better than with direct laryngoscopy****, both in normal airways as well as in those that are difficult to manage. With the increasing use of video laryngoscopy it seems as if direct laryngoscopy and flexible fibrescopic intubation are at risk of becoming redundant."*

Journal of Obstetric Anaesthesia and Critical Care
Official Publication of the Association of Obstetric Anaesthesiologists

VL in Obstetrics

Shonfeld A, Gray K, Lucas N, Robinson N, Loughnan B, Morris H, Rao K, Vaughan D. Video laryngoscopy in obstetric anesthesia. J Obstet Anaesth Crit Care 2012;2:53

"Following rapid sequence induction, traditional direct laryngoscopy was performed using a video laryngoscope (Storz C-MAC); intubation was then performed using the image on the screen of the video laryngoscope. The Storz C-MAC laryngoscope blade is the same shape as a standard Macintosh laryngoscope blade and comparable direct laryngoscopy view will be achieved with both. The anesthetists were asked to record the direct Cormack and Lehane grade, the view on the video laryngoscope (given a Cormack and Lehane grade as if it were seen directly) and any aids used for intubation"

	Cormack and Lehane Grade 1 (%)	Cormack and Lehane Grade 2 (%)	Cormack and Lehane Grade 3 or 4 (%)
Standard View	14 (52)	12 (44)	1 (4)
Video Laryngoscope View	27 (100)	0 (0)	0 (0)

Absolute numbers shown with percentages in brackets

Can J Anesth/J Can Anesth
DOI 10.1007/s12630-012-9859-5

REVIEW ARTICLE/BRIEF REVIEW

Review article: Video-laryngoscopy: another tool for difficult intubation or a new paradigm in airway management?

Article de synthèse: La vidéo-laryngoscopie: un autre outil pour les intubations difficiles ou un nouveau paradigme pour la prise en charge des voies aériennes?

Jean-Baptiste Paolini, MD · François Donati, MD, PhD · Pierre Drolet, MD

Received: 24 May 2012 / Accepted: 27 November 2012

Abstract

Background *An adequate airway management plan is essential for patient safety. Recently, new tools have been developed as alternatives to direct laryngoscopy and intubation. Among these, video-laryngoscopy has enjoyed a rapid increase in popularity and is now considered by many as the first-line technique in airway management. This paradigm shift may have an impact on patient safety.*

Principal findings *Studies show that video-laryngoscopes are associated with better glottic visualization, a higher success rate for difficult airways, and a faster learning curve, resulting in a higher success rate for intubations by novice physicians. Thus, unanticipated difficult intubations may be less frequent if video-laryngoscopy is used as the first-line approach. In addition, on-screen viewing by the operator creates a new dynamic interaction during airway management. The entire operating room team can assess progress in real time, which enhances communication and improves teaching. However, if video-laryngoscopes become standard tools for tracheal intubation, these more costly devices will need to be widely available in all locations where airway management is conducted. Furthermore, algorithms for difficult intubation will require modification, and the question of selecting alternate devices will arise. If the incidence of difficult intubation decreases, the lack of motivation to teach and learn the use of alternative devices might adversely impact patient safety.*

Conclusion *The greater effectiveness of video-laryngoscopes associated with multi-person visualization could enhance overall patient safety during airway management. However, the routine use of video-laryngoscopy also introduces some issues that need to be addressed to avoid potentially dangerous pitfalls.*

Résumé

Contexte *Une prise en charge adaptée des voies aériennes est essentielle à la sécurité des patients. De nouvelles alternatives à la laryngoscopie directe et à l'intubation ont été récemment développées. Parmi elles, la vidéo-laryngoscopie est devenue rapidement populaire et beaucoup la considèrent maintenant comme la technique de première intention pour la prise en charge des voies aériennes. Ce changement de paradigme pourrait avoir un impact sur la sécurité des patients.*

Constatations principales *Les études montrent que les vidéo-laryngoscopes sont associés à une meilleure visualisation de la glotte, un taux de réussite supérieur en cas de voies aériennes difficiles et une courbe d'apprentissage plus rapide, aboutissant à des taux de réussite plus élevés pour les intubations réalisées par des médecins novices. En conséquence, les intubations difficiles inattendues pourraient être moins fréquentes si la vidéo-laryngoscopie était utilisée comme approche de première intention. De plus, le suivi sur écran par l'opérateur crée une nouvelle dynamique interactive au cours de la prise en charge des voies aériennes. Toute l'équipe de la salle d'opération peut évaluer l'évolution en temps réel, ce qui encourage la communication et améliore l'enseignement. Cependant, si les vidéo-laryngoscopes deviennent des outils standard pour l'intubation trachéale, ces dispositifs plus coûteux doivent devenir largement disponibles dans tous les endroits où*

J.-B. Paolini, MD (✉) · F. Donati, MD, PhD · P. Drolet, MD
Département d'anesthésiologie, Université de Montréal, Montréal, QC, Canada
e-mail: jbpaolini@yahoo.fr

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Paolini JB, Donati F, Drolet P. Review article: video-laryngoscopy: another tool for difficult intubation or a new paradigm in airway management? Can J Anaesth. 2013 Feb; 60(2):184-91.

POSITIVES

"Studies show that video-laryngoscopes are associated with better glottic visualization, a higher success rate for difficult airways, and a faster learning curve, resulting in a higher success rate for intubations by novice physicians."

Can J Anesth/J Can Anesth
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J.-B. Paolini, MD (✉) · F. Donati, MD, PhD · P. Drolet, MD
Département d'anesthésiologie, Université de Montréal, Montréal, QC, Canada
e-mail: jbpaolini@yahoo.fr

Published online: 12 December 2012

Paolini JB, Donati F, Drolet P. Review article: video-laryngoscopy: another tool for difficult intubation or a new paradigm in airway management? Can J Anaesth. 2013 Feb; 60(2):184-91.

NEGATIVES

"… if video-laryngoscopes become standard tools … these more costly devices will need to be widely available … algorithms for difficult intubation will require modification … the question of selecting alternate devices will arise ….(and) if the incidence of difficult intubation decreases, the lack of motivation to teach and learn the use of alternative devices might adversely impact patient safety.

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DOI 10.1007/s12630-011-9620-5

REPORTS OF ORIGINAL INVESTIGATIONS

Glidescope® video-laryngoscopy versus direct laryngoscopy for endotracheal intubation: a systematic review and meta-analysis

Donald E. G. Griesdale, MD · David Liu, MD · James McKinney, MD · Peter T. Choi, MD

Received: 31 August 2011 / Accepted: 19 October 2011

Abstract

Introduction *The Glidescope® video-laryngoscopy appears to provide better glottic visualization than direct laryngoscopy. However, it remains unclear if it translates into increased success with intubation.*

Methods *We systematically searched electronic databases, conference abstracts, and article references. We included trials in humans comparing Glidescope® video-laryngoscopy to direct laryngoscopy regarding the glottic view, successful first-attempt intubation, and time to intubation. We generated pooled risk ratios or weighted mean differences across studies. Meta-regression was used to explore heterogeneity based on operator expertise and intubation difficulty.*

Results *We included 17 trials with a total of 1,998 patients. The pooled relative risk (RR) of grade 1 laryngoscopy (vs ≥ grade 2) for the Glidescope® was 2.0 [95% confidence interval (CI) 1.5 to 2.5]. Significant heterogeneity was partially explained by intubation difficulty using meta-regression analysis (P = 0.003). The pooled RR for nondifficult intubations of grade 1 laryngoscopy (vs ≥ grade 2) was 1.5 (95% CI 1.2 to 1.9), and for difficult intubations it was 3.5 (95% CI 2.3 to 5.5). There was no difference between the Glidescope® and the direct laryngoscope regarding successful first-attempt intubation or time to intubation, although there was significant heterogeneity in both of these outcomes. In the two studies examining nonexperts, successful first-attempt intubation (RR 1.8, 95% CI 1.4 to 2.4) and time to intubation (weighted mean difference −43 sec, 95% CI −72 to −14 sec) were improved using the Glidescope®. These benefits were not seen with experts.*

Conclusion *Compared to direct laryngoscopy, Glidescope® video-laryngoscopy is associated with improved*

Author contributions *Donald E.G. Griesdale* was the principle investigator and responsible for the concept and design of the study. He had access to all of the data and takes full responsibility for the integrity of the data and the accuracy of the data analysis. He was also involved in interpretation of the data and drafting of the manuscript. He has no conflicts of interest and approves of the final submitted version of the manuscript. *David Liu* was involved in the design of the study. He was also involved in acquisition, abstraction, and interpretation of the data. He also helped draft and critically revised the manuscript. He has no conflicts of interest and approves of the final submitted version of the manuscript. *James McKinney* was involved in the design of the study. He was also involved in acquisition, abstraction, and interpretation of the data. He helped critically revise the manuscript. He has no conflicts of interest and approves of the final submitted version of the manuscript. *Peter Choi* was involved in the design of the study. He was involved in interpretation of the data and helped draft the manuscript. He also revised the manuscript prior to submission. He has no conflicts of interest and approves of the final submitted version of the manuscript.

D. E. G. Griesdale, MD · D. Liu, MD · J. McKinney, MD
Division of Critical Care Medicine, Department of Medicine, University of British Columbia, Vancouver, BC, Canada

D. E. G. Griesdale, MD · P. T. Choi, MD
Department of Anesthesiology, Pharmacology and Therapeutics, University of British Columbia, Vancouver, BC, Canada

D. E. G. Griesdale, MD · P. T. Choi, MD
Centre for Clinical Epidemiology and Evaluation, Vancouver Coastal Health Research Institute, Vancouver, BC, Canada

D. E. G. Griesdale, MD (✉)
Program of Critical Care Medicine, Vancouver General Hospital, Room 2438, Jim Pattison Pavilion, 2nd Floor, 855 West 12th Avenue, Vancouver, BC V5Z 1M9, Canada
e-mail: donald.griesdale@vch.ca

D. E. G. Griesdale, MD · P. T. Choi, MD
Department of Anesthesia, Vancouver General Hospital, Vancouver, BC, Canada

Griesdale DE, Liu D, McKinney J, Choi PT. Glidescope® video-laryngoscopy versus direct laryngoscopy for endotracheal intubation: a systematic review and meta-analysis. Can J Anaesth. 2012 Jan;59(1):41-52.

KEY POINTS

- Reviewed 17 trials, 1,998 patients
- Pooled relative risk (RR) of grade 1 laryngoscopy (vs ≥ grade 2) for the Glidescope ® was 2.0
- In the two studies examining nonexperts, successful first-attempt intubation (RR 1.8) and time to intubation (weighted mean difference -43 sec) were improved using the GlideScope

CONCLUSION

Compared to direct laryngoscopy, GlideScope video-laryngoscopy is associated with improved glottic visualization, particularly in patients with potential or simulated difficult airways.

VL in the ICU

Journal of Intensive Care Medicine
00(0) 1-5

DOI: 10.1177/0885066613492641
jicm.sagepub.com
SAGE

Video Laryngoscopy is Associated With Increased First Pass Success and Decreased Rate of Esophageal Intubations During Urgent Endotracheal Intubation in a Medical Intensive Care Unit When Compared to Direct Laryngoscopy

Viera Lakticova, MD[1], Seth J. Koenig, MD[1], Mangala Narasimhan, DO[1], and Paul H. Mayo, DO[1]

Abstract

Background: To compare the complication rates of urgent endotracheal intubation (UEI) performed by pulmonary critical care medicine (PCCM) fellows and attending intensivists using a direct laryngoscope (DL) versus a video laryngoscope (VL) in a medical intensive care unit (MICU). **Methods:** We studied all UEIs performed from November 2008 through July 2012 in an 18-bed MICU in a university-affiliated hospital. All UEIs were performed by 15 PCCM fellows or attending intensivists using only the DL from November 2008 through February 2010 and the VL from March 2010 to July 2012. Throughout the entire study period, the UEI team leader recorded complications of the procedure using a standard data collection form immediately following the completion of the procedure. This permitted a comparison of complication rates between the DL and the VL. **Results:** A total of 140 UEIs were performed using the DL and 252 using the VL. Using the DL, the esophageal intubation rate was 19% and the difficult intubation rate was 22%; using the VL, the esophageal intubation rate was 0.4% and the difficult intubation rate was 7%. There was no significant difference in the rate of severe hypotension, severe desaturation, aspiration, dental injury, airway injury, or death between the 2 groups. **Conclusion:** The use of the VL for UEI performed by PCCM fellows is associated with a reduction in the rate of esophageal intubation and difficult endotracheal intubation when compared to the use of the DL.

Can J Anesth/J Can Anesth
DOI 10.1007/s12630-012-9775-8

REPORTS OF ORIGINAL INVESTIGATIONS

Video-laryngoscopy *versus* direct laryngoscopy in critically ill patients: a pilot randomized trial

Étude pilote randomisée comparant la vidéo-laryngoscopie et la laryngoscopie directe chez les patients gravement malades

Donald E. G. Griesdale, MD · Anthony Chau, MD · George Isac, MD · Najib Ayas, MD · Denise Foster, RN · Corrie Irwin, RRT · Peter Choi, MD · for the Canadian Critical Care Trials Group

Received: 10 April 2012 / Accepted: 16 August 2012

Abstract

Purpose *Endotracheal intubation in critically ill patients is associated with a high risk of complications that tend to increase with multiple attempts at laryngoscopy. In this pilot study, we compared direct laryngoscopy (DL) with video-laryngoscopy (VL) with regard to the number of attempts and other clinical parameters during endotracheal intubation of critically ill patients performed by novice providers.*

Methods *Patients were randomized to either VL or DL for endotracheal intubation. Exclusion criteria for the study included: requirement for immediate endotracheal intubation, cervical spine precautions, anticipated difficult intubation, oxygen saturation < 90%, or systolic blood pressure < 80 mmHg despite resuscitation. The providers, predominantly non-anesthesiology residents in their first three years of postgraduate training, received a one-hour teaching and mannequin session prior to performing the procedures.*

Results *Forty patients, mean age 65 (standard deviation, 16) yr were randomized to VL (n = 20) or DL (n = 20). Sixty percent of the patients received endotracheal intubation for respiratory failure, and all patients received a neuromuscular blocker. Multiple attempts were required in 25/40 (63%) patients, and this did not differ with technique (P = 1.0) Video-laryngoscopy resulted in improved glottic visualization with 85% of patients having a Cormack-Lehane grade 1 view compared with 30% of patients in the DL group (P < 0.001). Total time-to-intubation for VL was 221 sec*

Donald Griesdale was the principle investigator and responsible for the concept and design of the study. He had access to all of the data and takes full responsibility for the integrity of the data and the accuracy of the data analysis. *Anton Chau, George Isac, Denise Foster, Corrie Irwin,* and *Peter Choi* were involved in the design of the study. *Denise Foster* was involved in data acquisition, and *Anton Chau, George Isac, Najib Ayas, Denise Foster,* and *Peter Choi* were involved in interpretation of the data. *Donald Griesdale, Anton Chau, George Isac, Najib Ayas, Denise Foster, Corrie Irwin,* and *Peter Choi* helped draft the manuscript. *Anton Chau, George Isac, Najib Ayas, Denise Foster,* and *Corrie Irwin* critically revised the manuscript. *Peter Choi* was involved in interpretation of the data, and he also revised the manuscript prior to submission.

D. E. G. Griesdale, MD · G. Isac, MD · N. Ayas, MD
Division of Critical Care Medicine, Department of Medicine, University of British Columbia, Vancouver, BC, Canada

D. E. G. Griesdale, MD · A. Chau, MD · G. Isac, MD · P. Choi, MD
Department of Anesthesiology, Pharmacology and Therapeutics, University of British Columbia, Vancouver, BC, Canada

D. E. G. Griesdale, MD · P. Choi, MD
Centre for Clinical Epidemiology and Evaluation, Vancouver Coastal Health Research Institute, Vancouver, BC, Canada

D. E. G. Griesdale, MD · G. Isac, MD · D. Foster, RN · C. Irwin, RRT
Program of Critical Care Medicine, Vancouver General Hospital, Vancouver, BC, Canada

D. E. G. Griesdale, MD · G. Isac, MD · P. Choi, MD
Department of Anesthesia, Vancouver General Hospital, Vancouver, BC, Canada

N. Ayas, MD
Division of Critical Care Medicine, St. Paul's Hospital, Vancouver, BC, Canada

D. E. G. Griesdale, MD (✉)
Vancouver General Hospital, Room 2438, Jim Pattison Pavilion, 2nd Floor 855 West 12th Avenue, Vancouver, BC V5Z 1M9, Canada
e-mail: donald.griesdale@vch.ca

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Griesdale DE, Chau A, Isac G, Ayas N, Foster D, Irwin C, Choi P; Canadian Critical Care Trials Group. Video-laryngoscopy versus direct laryngoscopy in critically ill patients: a pilot randomized trial. Can J Anaesth. 2012 Nov;59(11):1032-9.

Video-laryngoscopy resulted in **improved glottic visualization** with 85% of patients having a Cormack-Lehane grade 1 view compared with 30% of patients in the DL group. Total **time-to-intubation for VL was longer** (221 sec vs 156 sec). Video-laryngoscopy resulted in a **lower median SaO_2** (86%) during endotracheal intubation compared with a median SaO_2 of 95% in the DL group.

Intubators received a one-hour teaching and mannequin session prior to the real intubations.

Noppens *et al. Critical Care* 2012, **16**:R103
http://ccforum.com/content/16/3/R103

CRITICAL CARE

RESEARCH Open Access

Endotracheal intubation using the C-MAC® video laryngoscope or the Macintosh laryngoscope: A prospective, comparative study in the ICU

Ruediger R Noppens[†], Stephanie Geimer, Nicole Eisel, Matthias David and Tim Piepho[*†]

Abstract

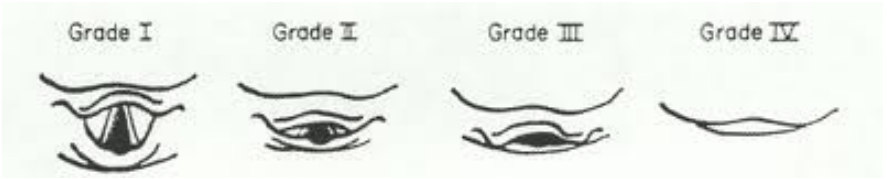
Introduction: Endotracheal intubation in the ICU is a challenging procedure and is frequently associated with life-threatening complications. The aim of this study was to investigate the effect of the C-MAC® video laryngoscope on laryngeal view and intubation success compared with direct laryngoscopy.

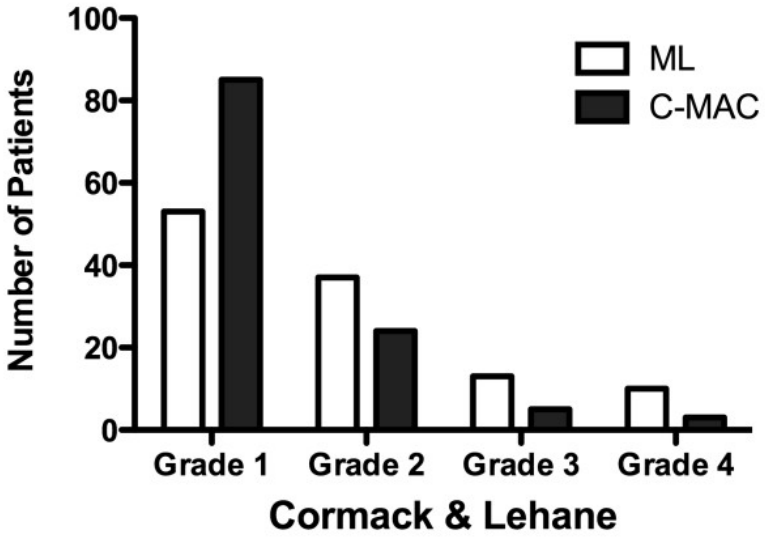
Methods: In a single-center, prospective, comparative before-after study in an anesthetist-lead surgical ICU of a tertiary university hospital, predictors of potentially difficult tracheal intubation, number of intubation attempts, success rate and glottic view were evaluated during a 2-year study period (first year, Macintosh laryngoscopy (ML); second year, C-MAC®).

Results: A total of 274 critically ill patients requiring endotracheal intubation were included; 113 intubations using ML and 117 intubations using the C-MAC® were assessed. In patients with at least one predictor for difficult intubation, the C-MAC® resulted in more successful intubations on first attempt compared with ML (34/43, 79% vs. 21/38, 55%; $P = 0.03$). The visualization of the glottis with ML using Cormack and Lehane (C&L) grading was more frequently rated as difficult (20%, C&L grade 3 and 4) compared with the C-MAC® (7%, C&L grade 3 and 4) ($P < 0.0001$).

Conclusion: Use of the C-MAC® video laryngoscope improved laryngeal imaging and improved the intubating success rate on the first attempt in patients with predictors for difficult intubation in the ICU setting. Video laryngoscopy seems to be a useful tool in the ICU where potentially difficult endotracheal intubations regularly occur.

"Use of the C-MAC® video laryngoscope improved laryngeal imaging and improved the intubating success rate on the first attempt in patients with predictors for difficult intubation in the ICU setting. Video laryngoscopy seems to be a useful tool in the ICU where potentially difficult endotracheal intubations regularly occur."





What about intubation trauma?

Acta Anaesthesiologica Taiwanica 49 (2011) 12–15

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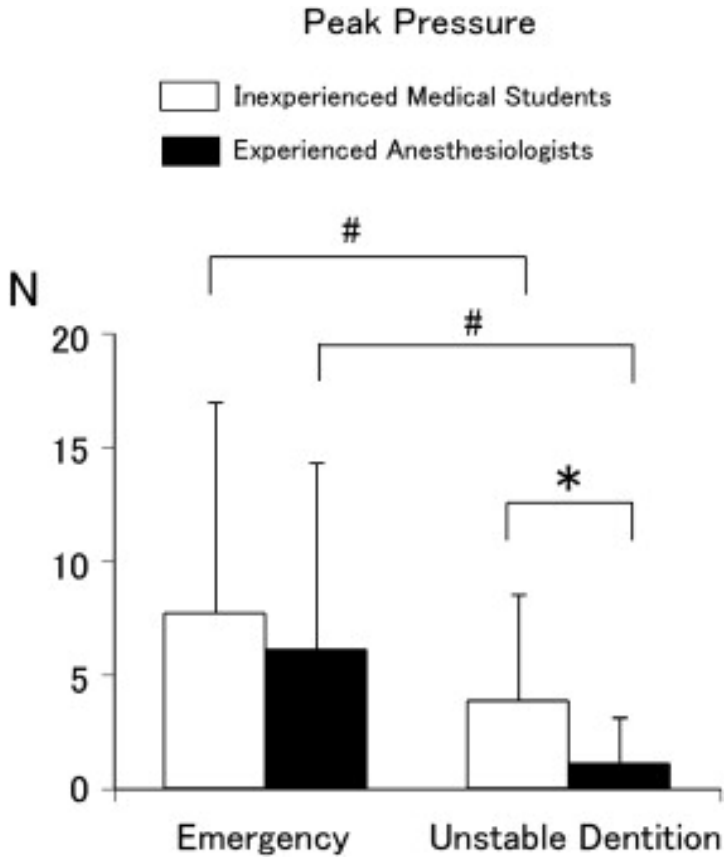
journal homepage: www.e-aat.com

Original Article

Forces applied to the maxillary incisors during tracheal intubation and dental injury risks of intubation by beginners: A manikin study

Taeko Fukuda [1]*, Yuri Sugimoto [1], Soichiro Yamashita [1], Hidenori Toyooka [2], Makoto Tanaka [1]



Lee, R., Van Zundert, A., Maassen, R., Willems, R., Beeke, L., Schaaper, J., Van Dobbelstein, J., Wieringa, P. (2009). Anesthesia & Analgesia, 108(1), 187-191.

What about intubation trauma?

Editor's key points

- The GlideScope laryngoscope blade was compared with the Macintosh for the force required to achieve successful intubation.
- The force, and pressure on the soft tissues, was significantly less with the GlideScope.
- Importantly, the success rate for intubations in difficult scenarios was also higher with the use of the GlideScope.
- This manikin study favours the use of the GlideScope to minimize soft tissue trauma and improve intubation success rate.

British Journal of Anaesthesia Page 1 of 6
doi:10.1093/bja/aer304

BJA

Force and pressure distribution using Macintosh and GlideScope laryngoscopes in normal and difficult airways: a manikin study

M. Carassiti[1*], R. Zanzonico[1], S. Cecchini[2], S. Silvestri[2], R. Cataldo[1] and F. E. Agrò[1]

[1] Department of Anaesthesia and [2] Research Laboratory of Measurement and Biomedical Instrumentation, University Campus Bio-Medico, Via Álvaro del Portillo, 200, 00128 Rome, Italy

* Corresponding author. E-mail: m.carassiti@unicampus.it

Background. The forces applied to the soft tissues of the upper airway may have a deleterious effect. This study was designed to evaluate the performance of the GlideScope compared with the Macintosh laryngoscope.

Methods. Twenty anaesthetists and 20 trainees attempted tracheal intubation of a Laerdal SimMan manikin. Forces and pressure distribution applied by both laryngoscope blades onto the soft upper airway tissues were measured using film pressure transducers. The minimal force needed to achieve a successful intubation, in the same simulated scenario, was measured; additionally, we considered the visualization score achieved by using the Cormack–Lehane grades.

Results. All participants applied, on average, lower force with the GlideScope than with the Macintosh in each simulated scenario. Forces [mean (SD)] applied in the normal airway scenario [anaesthetists: Macintosh 39 (22) N and GlideScope 27 (15) N; trainees: Macintosh 45 (24) N and GlideScope 21 (15) N] were lower than forces applied in the difficult airway scenario [anaesthetists: Macintosh 95 (22) N and GlideScope 66 (20) N; trainees: Macintosh 100 (38) N and GlideScope 48 (16) N]. All the intubations using the GlideScope were successful, regardless of the scenario and previous intubation experience. The average pressure on the blades was 0.13 MPa for the Macintosh and 0.07 MPa for the GlideScope, showing a higher uniformity for the latter.

Conclusions. The GlideScope allowed the participants to obtain a successful intubation applying a lower force. A flatter and more uniform pressure distribution, a higher successful rate, and a better glottic view were observed with the GlideScope.

Keywords: forces and pressure distribution; GlideScope laryngoscope; laryngoscopy; Macintosh laryngoscope; manikin

Accepted for publication: 11 August 2011

What about intubation trauma?

Maassen R, Lee R, van Zundert A, Cooper R. The videolaryngoscope is less traumatic than the classic laryngoscope for a difficult airway in an obese patient. J Anesth. 2009;23(3):445-8.

A 49-year-old woman (BMI = 36), was scheduled to undergo an elective laparoscopic cholecystectomy. Based upon the obesity of the patient and preoperative metrics (Mallampati grade IV; interdental distance of 2.9 cm; thyromental distance, 5.5 cm) a difficult airway was anticipated. Classic direct laryngoscopy using a Macintosh blade size IV failed, despite three intubation attempts-each resulting in a Cormack-Lehane grade IV view.

Intubation using a video-assisted Macintosh laryngoscope (V-Mac; Karl Storz, Tuttlingen, Germany) was successful upon the first attempt. **The maximum force exerted on the patient's maxillary incisors was 61 N by direct laryngoscopy and 7.6 N using the indirect videolaryngoscope,** both using a Macintosh blade.

J Anesth (2009) 23:445–448
DOI 10.1007/s00540-009-0780-1

Journal of Anesthesia

The videolaryngoscope is less traumatic than the classic laryngoscope for a difficult airway in an obese patient

Ralph Maassen[1,2], Ruben Lee[3], André van Zundert[3,4], and Richard Cooper[5]

[1]Department of Anesthesiology, Intensive Care and Pain Therapy, Catharina Hospital—Brabant Medical School, Eindhoven, The Netherlands
[2]University of Maastricht, Maastricht, The Netherlands
[3]Department of Biomechanical Engineering, 3ME, Delft University of Technology, Delft, The Netherlands
[4]University of Ghent, Ghent, Belgium
[5]Department of Anesthesiology, Toronto General Hospital, University of Toronto, Toronto, Canada

Abstract
This report describes the anesthetic management of an obese patient with a difficult airway and the merits of videolaryngoscopy, specifically in terms of the reduced risk of dental damage during intubation. A 49-year-old woman (body mass index; BMI, 36 kg·m^{-2}), was scheduled to undergo an elective laparoscopic cholecystectomy because of cholelithiasis. Based upon the obesity of the patient and preoperative metrics (Mallampati grade IV; interdental distance of 2.9 cm; thyromental distance, 5.5 cm) a difficult airway was anticipated. Classic direct laryngoscopy using a Macintosh blade size IV failed, despite three intubation attempts—each resulting in a Cormack-Lehane grade IV view. Intubation using a video-assisted Macintosh laryngoscope (V-Mac; Karl Storz, Tuttlingen, Germany) was successful upon the first attempt. The maximum force exerted on the patient's maxillary incisors was 61 N by direct laryngoscopy and 7.6 N using the indirect videolaryngoscope, both using a Macintosh blade.

Key words General anesthesia · Intubation · Videolaryngoscopy · Difficult airway · Force measurement

Introduction

The recent introduction of laryngoscopes incorporating optics into the blade has improved glottic visualization [1–5]. However, it is not yet clear that this reduces airway trauma or reduces intubation times. Common tests, designed to predict difficult laryngoscopy, are of uncertain relevance when videolaryngoscopy is employed [6–8].

In this report, we review a case that demonstrates the value of a videolaryngoscope for the management of a difficult airway in an obese patient, using the V-Mac Storz videolaryngoscope (Karl Storz, Tuttlingen, Germany). We measured forces applied to the maxillary incisors during direct laryngoscopy using a Macintosh blade size IV and the videolaryngoscope. This challenging case was an extraordinary inclusion in a recent study [9] measuring forces on the maxillary incisors during intubation, in which the attending anesthesiologist was blinded to the applied forces. Institutional Medical Ethics Committee approval and the patient's written informed consent were obtained.

Address correspondence to: A. van Zundert, Department of Anesthesiology, Catharina Hospital, Michelangelolaan 2, NL-5623 EJ Eindhoven, The Netherlands
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Case report

A 49-year-old woman (height, 1.69 m; weight, 104 kg; body mass index [BMI], 36.4 kg·m^{-2}) presented for elective laparoscopic cholecystectomy. She was classified as American Society of Anesthesiologists (ASA) II. Airway characteristics included a reduced interdental distance (2.9 cm), full dentition, reduced oropharyngeal view (Mallampati grade IV), reduced thyromental distance (5.5 cm), and normal neck movement. Both a poor glottic view and difficult intubation were anticipated.

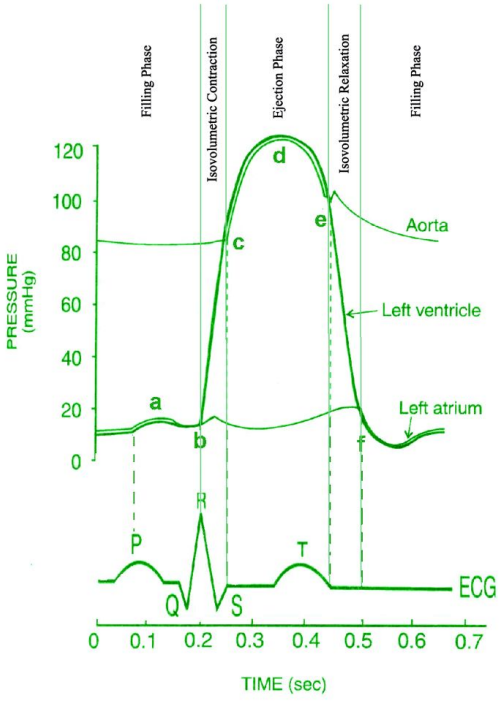
Patient positioning was duly adjusted carefully into the ramped position prior to the induction of anesthesia, using pillows and blankets to bring the patient's sternal notch and the external auditory meatus into an imaginary horizontal line [10,11]. Direct laryngoscopy using a Macintosh blade size IV was initially selected for use with this patient. According to the study protocol, if intubation by direct laryngoscopy could not be achieved within 90 s, a backward, upward and right-sided pressure on the thyroid and cricoid cartilages (BURP) maneuver [12,13] was to be employed. If the BURP maneuver failed to produce laryngeal exposure, the protocol called for the use of a videolaryngoscope.

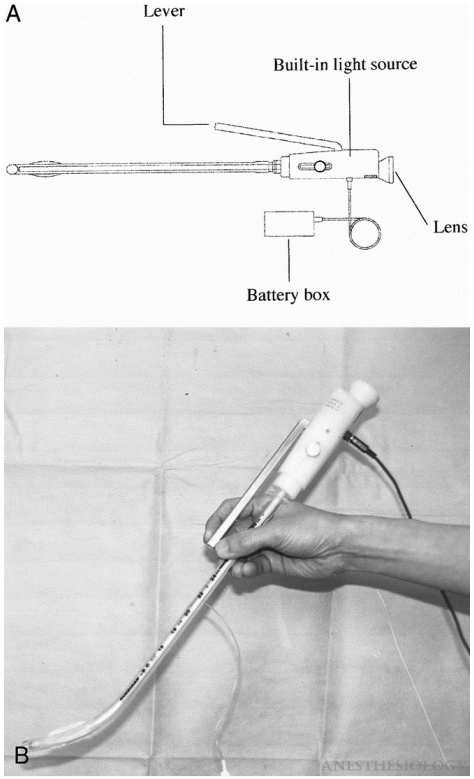
We measured the forces on the laryngoscope blades with Flexiforce sensors (A201-25; Tekscan, South

What about hemodynamics?

Kitamura T, Yamada Y, Chinzei M, Du HL, Hanaoka K. Attenuation of haemodynamic responses to tracheal intubation by the styletscope. Br J Anaesth. 2001 Feb; 86(2):275-7.

Tracheal intubation often causes a haemodynamic response probably generated by direct laryngoscopy. The StyletScope is a new intubation device that does not require direct laryngoscopy. We prospectively measured haemodynamic changes after tracheal intubation using the StyletScope. **The increase of heart rate was less during tracheal intubation with the StyletScope when compared with the Macintosh laryngoscope.**





What about hemodynamics?

Maassen RL, Pieters BM, Maathuis B, Serroyen J, Marcus MA, Wouters P, van Zundert AA. Endotracheal intubation using videolaryngoscopy causes less cardiovascular response compared to classic direct laryngoscopy, in cardiac patients according a standard hospital protocol. Acta Anaesthesiol Belg. 2012;63(4):181-6.

In a randomized cross-over study in eighty adults cardiovascular responses to intubation were recorded as a relative change in rate pressure product (RPP = systolic blood pressure times heart rate) from baseline values.

The relative increase of the RPP at intubation was smaller (i.e. 27%, $P < 0.001$) using VL (GlideScope) compared to DL.

RRP is heart rate multiplied by the systolic blood pressure and serves as a crude indicator of myocardial oxygen demand.

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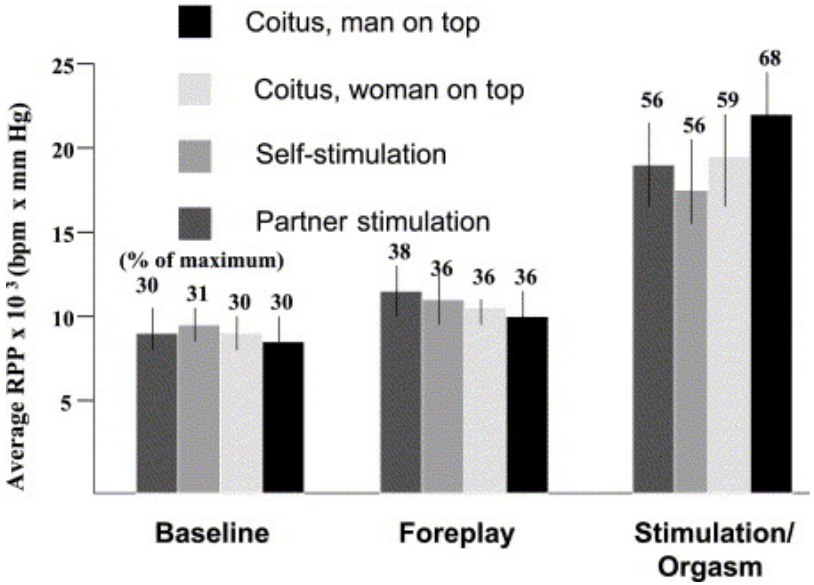

What about cervical spine movement?

Rudolph C, Schneider JP, Wallenborn J, Schaffranietz L. Movement of the upper cervical spine during laryngoscopy: a comparison of the Bonfils intubation fibrescope and the Macintosh laryngoscope. Anaesthesia. 2005 Jul;60(7):668-72.

The movements of the upper cervical spine were measured by fluoroscopy in 20 patients during laryngoscopy with the Bonfils intubation fibrescope and the Macintosh laryngoscope. Laryngoscopy with both the Bonfils intubation fibrescope and the Macintosh laryngoscope resulted in significant extension of the cervical spine as compared to the neutral position but this extension was significantly less with the Bonfils intubation fibrescope than with the Macintosh ($p = 0.001$). However, the atlanto-occipital distance was significantly greater during laryngoscopy with the Bonfils intubation fibrescope ($p = 0.002$), and the angle between the occiput and C1 differed significantly between the two techniques ($p = 0.001$). With the Bonfils intubation fibrescope, significantly less extension was also found at the C1/C2 and C3/C4 levels ($p = 0.001$ and $p = 0.049$, respectively). **There is therefore significantly less movement of the upper cervical spine during laryngoscopy with the Bonfils fibrescope compared with the Macintosh laryngoscope.**

What about the costs of VL?

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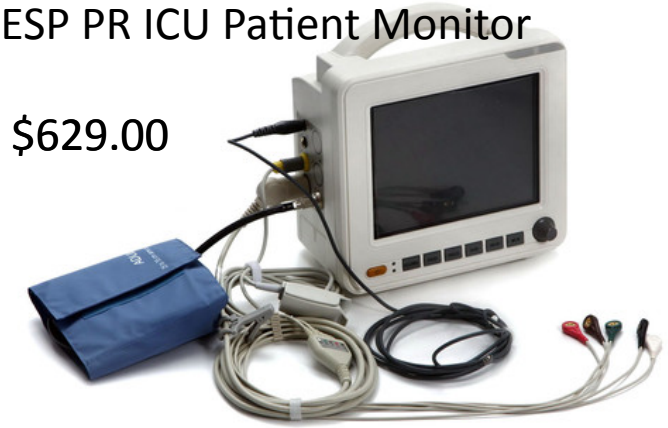

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Conclusion

New Use for DL

THANKS FOR LISTENING