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Journal of Society of Anesthesiologists of Nepal

## Original Article

# Hemodynamic changes during orotracheal intubation using Airtraq video laryngoscope and direct laryngoscope: A randomized comparative study

**Sarobar Upadhyaya, Laxmi Pathak**

***Universal College of Medical Sciences, Bhairahawa, 32900 Rupandehi, Nepal***

**Corresponding Author**
Laxmi Pathak, MBBS, MD
ORCID: https://orcid.org/0000-0002-0489-9290
Professor, Department of Anesthesiology and Critical Care Medicine,
Universal College of Medical Sciences, Bhairahawa, 32900 Rupandehi, Nepal
Email: pathak0laxmi@gmail.com

**Abstract**

**Introduction:** Direct laryngoscopy is associated with sympathetic stimulation and altered hemodynamics. A long intubation time may result in a greater stress response. Alternative techniques using video laryngoscopes have been developed that do not require direct vocal cord visualization and may decrease the hemodynamic response. This study aimed to compare the difference between hemodynamic changes and intubation time with Airtraq video laryngoscope and conventional Macintosh direct laryngoscope.

**Methods:** A prospective randomized comparative study was conducted involving 100 adult patients who underwent elective surgeries under general anesthesia and endotracheal intubation. The patients were randomly assigned to group V (Video laryngoscope) or group D (Direct laryngoscope). In addition to the vitals at baseline various time intervals, intubation time was also recorded. We considered a difference in heart rate and mean arterial pressure of 20% to be clinically significant and statistical significance at p-value <0.05.

**Results:** Statistical difference was found in heart rates immediately after laryngoscopy (110.40 vs. 105.02 beats/minute; p<0.01) and 1 minute after intubation (109.30 vs. 106.20 beats/minute; p<0.01) with attenuation seen in video laryngoscopy group. Blood pressures were similar in both the groups at all times. Time for intubation was prolonged in video laryngoscopy group than that for direct laryngoscopy group (26.54 vs. 22.80 seconds; p<0.05). There were no adverse events associated with either of the techniques.

**Conclusions:** The Airtraq video laryngoscopy resulted in lesser change in heart rate and longer intubation time. However, clinical impact of such a difference seemed to be insignificant.

**Keywords:** Airtraq; endotracheal intubation; hemodynamic changes; intubation time; video laryngoscopy

**Article History**
Received 29th April 2019
Accepted 29th May 2019
Published 31st May 2019



**How to cite this article:** Upadhyaya S, Pathak L. Hemodynamic changes during orotracheal intubation using Airtraq video laryngoscope and direct laryngoscope: A randomized comparative study. Journal of Society of Anesthesiologists of Nepal (JSAN) 2019;6(1):e272. https://doi.org/10.3126/jsan.v6i1.24299

**Introduction**

Macintosh laryngoscope has been the "Gold standard" device for direct laryngoscopy. The sympathetic response and the resulting hemodynamic responses have been extensively studied in patients with or without cardiac illness.[1,2] Intubation procedure may be prolonged and complicated when glottis is poorly visualized.[3] Alternative techniques using video laryngoscopes for tracheal intubation have been developed that do not require direct vocal cord visualization and need comparatively lesser degree of airway manipulation alleviating the stimuli to oropharyngeal structures with the expectation of less hemodynamic stress response during laryngoscopy.[2] Though several studies found that video laryngoscopy provides a better view of the upper airways, thus facilitating intubation when compared to the conventional laryngoscopy method, its hemodynamic effects remain elusive.

This study aimed to compare the differences in hemodynamic changes and intubation time between Airtraq video laryngoscope and Macintosh laryngoscope during orotracheal intubation in patients requiring general anesthesia for various elective surgeries.

**Methods**

This prospective randomized comparative study was conducted in Universal College of Medical Sciences, Bhairahawa, Nepal for duration of one and half years from January 2017 to June 2018, after obtaining ethical clearance from the Institutional Review Committee and after taking informed written consent from all the study population. One hundred adult patients with ASA physical status I &II between 18 to 60 years who were undergoing elective surgery under general anesthesia (GA) with endotracheal intubation were included in the study. Randomization was done by computer generated random number concealed in sealed envelope. Both the performing anesthesiologist and the participants were blinded in this study. A sample of 45 was needed to obtain a power of 90% and confidence level of 95% and to detect significant difference of mean heart rate between the two groups.[4] With addition of 10% possible dropouts, 50 samples were taken in each group in this study. We considered a difference in heart rate and mean arterial pressure of 20% to be clinically significant.

Exclusion criteria were patient's refusal, ASA Physical Status more than II, Anticipated difficult airway, Patients with systemic diseases like uncontrolled Diabetes, Uncontrolled Hypertension, Cerebrovascular disease, Neurological disorders, Cardiovascular diseases and airway diseases like COPD, Asthma, BMI greater than or equal to 26 $kg/m^2$, Pregnancy, More than one attempt of laryngoscopy and intubation.

The pre-anesthetic evaluation of patient was done one day prior to the schedule surgery date with Airway assessment consisting of mouth opening, neck mobility, modified Mallampatti grade, thyromental distance, protruded upper incisors and Upper lip bite test. Patients were advised for Nil Per Oral after midnight and to take Tablet Diazepam 5 mg before sleep. Baseline vitals were recorded in preparation room on the day of surgery. Intravenous access was established and the patients were preloaded with ringer lactate solution, 5ml/kg administered over a period of 10-15 min. Essential equipment for difficult airway and intubation including Fiberoptic Bronchoscope was made available. With continuous monitoring of vitals, induction of anesthesia was done by administering Midazolam 1mg, Fentanyl 2mcg/kg and Propofol 1.5 mg/kg intravenously. After checking ventilation, Vecuronium 0.1 mg/kg was used as a muscle relaxant. After four minutes, laryngoscopy and intubation were performed either by direct laryngoscopy (group D) using Macintosh blade size 3 or 4 in sniffing position or by video laryngoscopy using Airtraq video laryngoscope (group V) in neutral position. In the video laryngoscopy group, the tracheal tube was pre-fitted into the device before insertion. Where necessary, the epiglottis was lifted by elevating the blade into the vallecula. If intubation of trachea failed after the first attempt, then fibreoptic intubation was planned.

Difference in heart rates was our primary outcome measure as changes in heart rate may occur with lesser degree of airway stimulation than that for changes in Blood Pressure as mentioned in the reference article.[4] Our secondary outcome measures were systolic, diastolic and mean arterial pressure and intubation time. Heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressures were recorded immediately after laryngoscopy, then 1, 3, 5 and ten minutes after intubation of trachea. Total intubation time

(in seconds) was also recorded and was defined as the time from insertion of the assigned laryngoscope into the mouth up to the time the tracheal tube positioned between the vocal cords. An anesthetic assistant recorded the vitals at particular time intervals. Surgery was started only after ten minutes of intubation. Maintenance of anesthesia was achieved by delivering oxygen at 2 L/min, Isoflurane 1.5 volume % and Vecuronium 1mg when required. At the end of the surgery, reversal of neuromuscular blockade and awake tracheal extubation was done. Then, the patient was shifted to Post Anesthesia Care Unit.

Data was entered and coded in Microsoft Excel and then transferred to SPSS (Statistical Package for Social Sciences) version 20.0 for further analysis. Continuous variable were compared using Student's t test when the data was normally distributed and Wilcoxon's rank sum test when the data was not distributed normally. Categorical data was compared using chi square test or fisher exact test whichever applicable. A p-value <0.05 was considered statistically significant.

**Results**

All 100 patients were included in the study. Out of 100 participants, 61 were females. 47 patients were ASA I and three were ASA II in Direct Laryngoscopy group whereas in Video Laryngoscopy group, 49 were ASA I and only one patient was ASA II. The mean difference in age, weight, mouth opening, thyromental distance and Mallampatti class between two groups were not statistically significant (Table 1).

Table 1. Showing comparison between age, weight, mouth opening, thyromental distance, Mallampatti class and total intubation time

| Parameters | Group D | | Group V | | | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | t | P value |
| Age (yrs) | 30.80 | 7.55 | 29.62 | 7.62 | 0.778 | 0.439 |
| Weight (kg) | 54.84 | 6.69 | 54.76 | 7.54 | 0.056 | 0.955 |
| Mouth Opening(cm) | 5.02 | 0.33 | 5.08 | 0.37 | -0.852 | 0.396 |
| Thyromental distance(cm) | 6.98 | 0.23 | 7.00 | 0.25 | -0.423 | 0.673 |
| Mallampatti class | 1.10 | 0.30 | 1.12 | 0.33 | -0.352 | 0.726 |
| Intubation time (seconds) | 22.80 | 3.85 | 26.54 | 3.86 | -4.851 | <0.001 |

Mean heart rate between two groups immediately after laryngoscopy (110.40±3.88 vs. 105.02±4.35) and 1 minute after intubation (109.30±2.82 vs. 106.20±5.16) was statistically significant with p<0.001 but was not clinically significant. (Figure 1). Mean systolic, diastolic and mean arterial pressure at various time intervals between these two groups were similar. (Figure 2, 3, 4)

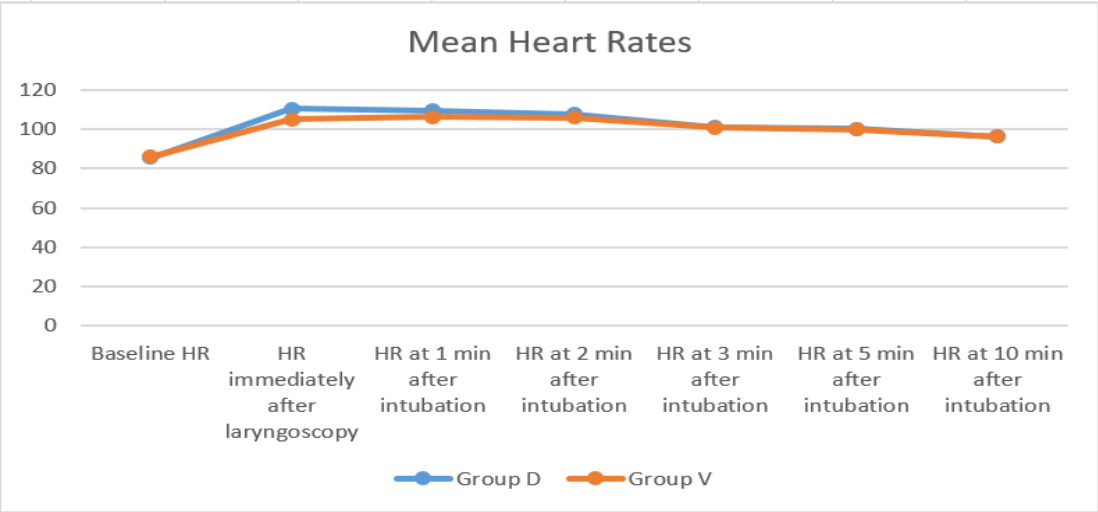


Figure 1. Difference in heart rates between two groups

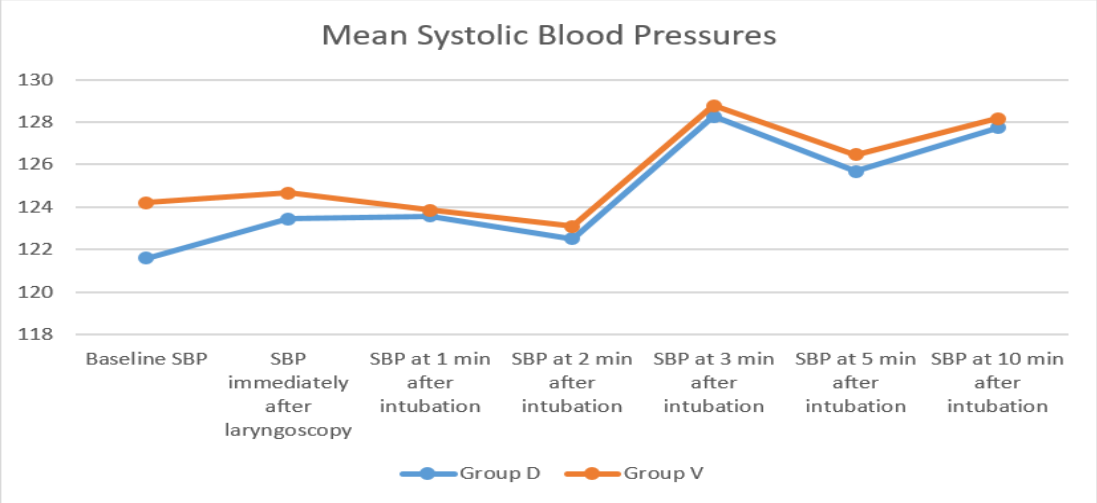


Figure 2. Difference in systolic blood pressure between two groups

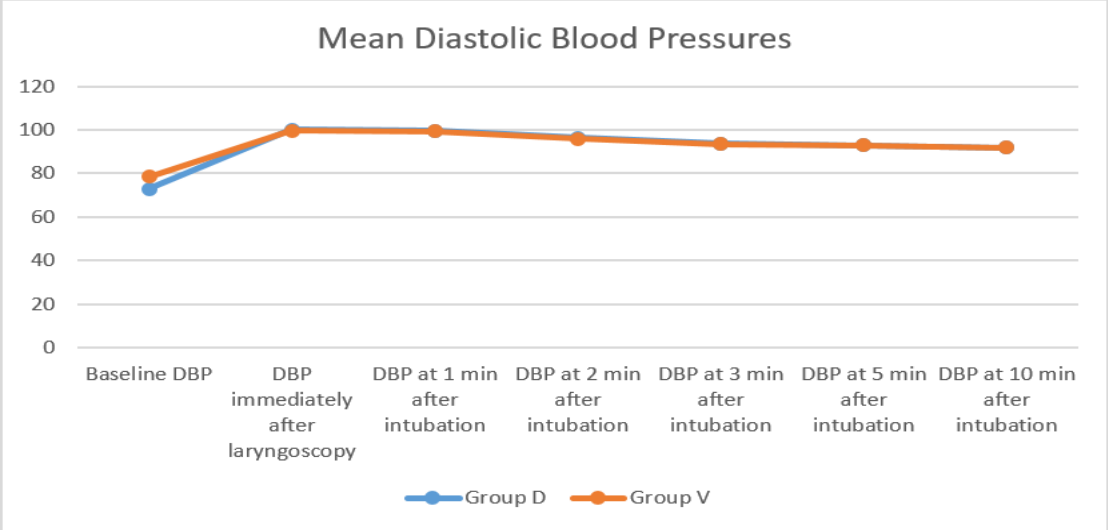


Figure 3. Difference in diastolic Blood Pressures between two groups

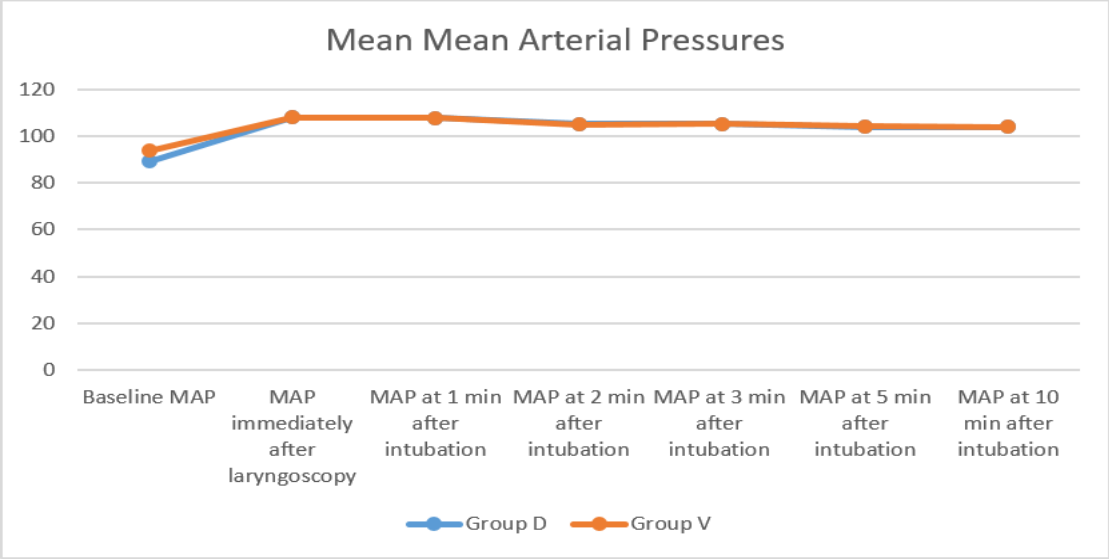


Figure 4. Difference in mean arterial pressures between two groups

The mean intubation time for direct laryngoscopy was 22.80 seconds and for video laryngoscopy was 26.54 seconds which was statistically highly significant ($p<0.001$). (Table 1)

No complications were observed in any of the groups.

**Discussion**

The main finding of our study was that there were differences in heart rate immediately and at one minute after tracheal intubation. Heart rate was higher in the conventional Macintosh laryngoscopy group than the Airtraq group. It took slightly longer time for anesthesiologist to perform endotracheal intubation with Airtraq. However, the differences were clinically insignificant.

Successful laryngoscopy and endotracheal intubation are influenced or determined by several key anatomical factors like patient's glossopharyngeal proportions (tongue-pharyngeal volume proportions), upper airway or the space above laryngeal inlet, and the alignment of a visualization vector for the anesthesiologist eye to the vocal cords. Hemodynamic changes during laryngoscopy and intubation is often encountered during General Anesthesia. Anticipation and recognition of these hemodynamic changes is of prime importance in certain patient groups. Various pharmacological and non-pharmacological methods have been employed to attenuate these stress response including optimum intubating position, shortening the time of laryngoscopy and intubation, external laryngeal manipulation etc. Hemodynamic stress responses with the use of various video laryngoscopes were extensively studied in recent years. Kanchi M et al compared hemodynamic response to endotracheal intubation in thirty patients with coronary artery disease scheduled for elective coronary artery bypass grafting were studied using direct conventional laryngoscopy and video laryngoscopy but found no significant hemodynamic changes between the groups.[3] Glidescope and Macintosh laryngoscope was used in snoring patients in one of the study which showed no significant difference in mean arterial pressure and heart rate ($P > 0.05$) when these two groups were compared.[5] Pournajafian AR et al. too compared Glidescope and Macintosh laryngoscope at various time intervals and observed no significant differences in blood pressures and heart rates between two groups at all time points.[6] Lightwand (Trachlight) when compared with conventional direct laryngoscopy also showed similar result.[7,8] Most of these studies did not show differences in hemodynamic parameters with videolaryngoscope and conventional Macintosh laryngoscope.

Nociceptive stimulation during Macintosh laryngoscopy and McGrath Mac video laryngoscopy was studied by Rathvirak Ing et.al and found similar heart rate and systolic arterial pressure in both groups before tracheal intubation but after intubation, heart rate increased in the Macintosh laryngoscope group though variations in systolic arterial pressure were similar.[9] Studies were done using Glidescope, Airtraq and Macintosh laryngoscope in patients during routine airway management to deliver general anesthesia and found higher haemodynamic response values in Macintosh group when compared with Glidescope and Airtraq

group.[10,11,12,13] Maassen et al found relative increase of rate pressure product (RPP = systolic blood pressure times heart rate) from baseline values at intubation which was significantly lower using video laryngoscope (i.e. 27%, P < 0.001) when compared to the classic direct laryngoscopy.[14] Similar finding was observed in the study done on hemodynamic response by Dashti M et al using Glidescope and Macintosh laryngoscope in patients with untreated hypertension.[15] Mean arterial pressure, pulse rate and RPP were lower in Glidescope group after endotracheal intubation (P < 0.05). All these values were returned to pre-intubation values at 3 minutes after intubation in Glidescope group and 4 minutes after intubation in Macintosh group (P < 0.05).

Hemodynamic response was studied even in patients with difficult airway in emergency department using SMT- Ⅱvideo laryngoscope and Macintosh laryngoscope.[16] The mean arterial pressures and heart rates before induction, after induction, after laryngoscopy, 5 and 10 minutes after intubation were recorded and found significant lower values in video laryngoscope group at various time intervals.

However, in contrary to most of the above studies, Parasa M et al observed that Glidescope group exhibited more laryngoscopy response than Macintosh group resulting in more increased in Blood Pressures and heart rates though the difference was not statistically significant.[17]

Despite significant increase in percentage of visible glottic opening with Glidescope (P < 0.05), Choi GS et al did not find any difference in the time required for a successful tracheal intubation when compared with the Macintosh laryngoscope.[18] Similar finding for intubation time was observed in many other studies using KingVision video laryngoscope, Airtraq and Glidescope when all these were compared with Macintosh laryngoscope.[5,12,19] Unlike these studies, Castillo-Monzón CG et al and Dhonneur G et al found shorter intubation time with Airtraq when compared with Macintosh laryngoscope.[10,20] But, many researchers have observed significantly longer time for intubation using video laryngoscope mostly Glidescope when compared with Macintosh laryngoscope.[3,6,13,16,17]

Limitation we realized in our study was a smaller study population and not recording other airway assessment parameters like thick neck, shrunken cheeks, history of snoring etc. which could have reflected more uniform distribution of such population in both the groups.

Sympathetic stimulation during laryngoscopy and intubation can be deleterious in patient especially with cardiorespiratory diseases. It is mentioned that greater sympathetic stimulation is required to increase blood pressure than to increase heart rate.[21] Thus, with the same amount of stimulation, our study showed similar Blood Pressure changes but statistically significant heart rate changes on comparing both groups. (Figure 1,2,3,4). Though intubation time was longer with video laryngoscope in our study, lesser increase in heart rate was observed only at two points of time without much of clinical significance to consider Airtraq as a better alternative to conventional laryngoscope.

**Conclusion**

In conclusion, use of Airtraq video laryngoscope for orotracheal intubation during general anesthesia resulted in lesser hemodynamic changes but longer intubation time, when compared with conventional direct laryngoscopy. Lesser increase in heart rates by Airtraq is statistically significant at only two point of times. However, it is clinically insignificant to affect any cardiovascular outcome. Also, as intubation with video-laryngoscopy was performed in neutral position in this study, it may also benefits patient with cervical spine disorder or trauma. Many studies on this subject are required to come to discrete conclusion.

**Conflict of interests**

All the authors have filled the ICMJE conflict of interest form and declare that they have nothing to disclose.

**Acknowledgment**

Our heart full thanks to Dr Shambhu Acharya (MD, FRCA), Consultant Anaesthetist from Aintree University Hospital, Liverpool, U.K for providing Airtraq as a useful and precious gift, without which this research could not have been possible.

**Sources of funding**

None

**References**


1. Forbes AM, Dally FG. Acute hypertension during induction of anaesthesia and endotracheal intubation in normotensive man. BJA: British Journal of Anaesthesia. 1970 Jul 1;42(7):618-24. https://doi.org/10.1093/bja/42.7.618 PMid:5453244

2. Yoo KY, Lee J, Kim HS, Im WM. Hemodynamic and catecholamine responses to laryngoscopy and tracheal intubation in patients with complete spinal cord injuries. Anesthesiology: The Journal of the American Society of Anesthesiologists. 2001 Sep 1;95(3):647-51. https://doi.org/10.1097/00000542-200109000-00017 PMid:11575537

3. Kanchi M, Nair HC, Banakal S, Murthy K, Murugesan C. Haemodynamic response to endotracheal intubation in coronary artery disease: Direct versus video laryngoscopy. Indian journal of anaesthesia. 2011 May;55(3):260. https://doi.org/10.4103/0019-5049.82673 PMid:21808398 PMCid:PMC3141150

4. Das B, Samal RK, Ghosh A, Kundu R. A randomised comparative study of the effect of Airtraq optical laryngoscope vs. Macintosh laryngoscope on intraocular pressure in non-ophthalmic surgery. Brazilian Journal of Anesthesiology (English Edition). 2016 Jan 1;66(1):19-23. https://doi.org/10.1016/j.bjane.2014.07.004 PMid:26768925

5. Ke J, Xu Q. Comparison the applications of tracheal intubation with GlideScope video laryngoscope and Macintosh direct laryngoscope in snoring patients. Journal of clinical otorhinolaryngology, head, and neck surgery. 2013 May;27(9):468-70.

6. Pournajafian AR, Ghodraty MR, Faiz SH, Rahimzadeh P, Goodarzynejad H, Dogmehchi E. Comparing GlideScope video laryngoscope and Macintosh laryngoscope regarding hemodynamic responses during orotracheal intubation: A randomized controlled trial. Iranian Red Crescent Medical Journal. 2014 Apr;16(4):e12334. https://doi.org/10.5812/ircmj.12334 PMid:24910788 PMCid:PMC4028761

7. Hirabayashi Y, Hiruta M, Kawakami T, Inoue S, Fukuda H, Saitoh K, et al. Effects of lightwand (Trachlight) compared with direct laryngoscopy on circulatory responses to tracheal intubation. British journal of anaesthesia. 1998 Aug 1;81(2):253-5. https://doi.org/10.1093/bja/81.2.253 PMid:9813535

8. Monte FR, Giraldo JC, Betancur LA, Rincón JD, Rincón IE, Vanegas MV, et al. Endotracheal intubation with a lightwand or a laryngoscope results in similar hemodynamic variations in patients with coronary artery disease. Canadian Journal of Anesthesia. 2003 Oct 1;50(8):824. https://doi.org/10.1007/BF03019380

9. Ing R, Liu N, Chazot T, Fessler J, Dreyfus JF, Fischler M, et al. Nociceptive stimulation during Macintosh direct laryngoscopy compared with McGrath Mac videolaryngoscopy: A randomized trial using indirect evaluation using an automated administration of propofol and remifentanil. Medicine (Baltimore). 2017 Sep;96(38):e8087. https://doi.org/10.1097/MD.0000000000008087 PMid:28930848 PMCid:PMC5617715

10. Castillo-Monzon CG, Marroquin-Valz HA, Fernandez-Villacanas-Marin M, Moreno-Cascales M, Garcia-Rojo B, Candia-Arana CA. Comparison of the macintosh and Airtraq laryngoscopes in morbidly obese patients: a randomized and prospective study. Journal of clinical anesthesia. 2017 Feb 1;36:136-41. https://doi.org/10.1016/j.jclinane.2016.10.023 PMid:28183552

11. Misirlioglu G, Sen O. Comparison of GlideScope video laryngoscopy and Macintosh laryngoscope in ear–nose and throat surgery. Irish Journal of Medical Science. 2016 Aug 1;185(3):729-33. https://doi.org/10.1007/s11845-015-1393-3 PMid:26732694

12. Maharaj CH, O'croinin D, Curley G, Harte BH, Laffey JG. A comparison of tracheal intubation using the Airtraq or the Macintosh laryngoscope in routine airway management: a randomised, controlled clinical trial. Anaesthesia. 2006 Nov;61(11):1093-9. https://doi.org/10.1111/j.1365-2044.2006.04819.x PMid:17042849

13. Jafra A, Gombar S, Kapoor D, Sandhu HS, Kumari K. A prospective randomized controlled study to evaluate and compare GlideScope with Macintosh laryngoscope for ease of endotracheal intubation in adult patients undergoing elective surgery under general anesthesia. Saudi journal of anaesthesia. 2018 Apr;12(2):272. https://doi.org/10.4103/sja.SJA_543_17 PMid:29628839 PMCid:PMC5875217

14. 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 Jan 1;63(4):181-6.
15. Dashti M, Amini S, Azarfarin R, Totonchi Z, Hatami M. Hemodynamic changes following endotracheal intubation with glidescope® video-laryngoscope in patients with untreated hypertension. Research in cardiovascular medicine. 2014 May;3(2):e17598. https://doi.org/10.5812/cardiovascmed.17598 PMid:25478537 PMCid:PMC4253794
16. Yu JH, Wang Y. Clinical study of SMT-Ⅱvideo laryngoscope with difficult airway intubation in emergency department. Zhonghua wai ke za zhi [Chinese journal of surgery]. 2017 Jul;55(7):549-53.
17. Parasa M, Yallapragada SV, Vemuri NN, Shaik MS. Comparison of GlideScope video laryngoscope with Macintosh laryngoscope in adult patients undergoing elective surgical procedures. Anesthesia, essays and researches. 2016 May;10(2):245. https://doi.org/10.4103/0259-1162.167840 PMid:27212755 PMCid:PMC4864696
18. Choi GS, Lee EH, Lim CS, Yoon SH. A comparative study on the usefulness of the Glidescope or Macintosh laryngoscope when intubating normal airways. Korean journal of anesthesiology. 2011 May;60(5):339. https://doi.org/10.4097/kjae.2011.60.5.339 PMid:21716906 PMCid:PMC3110292
19. Erdivanli B, Sen A, Batcik S, Koyuncu T, Kazdal H. Comparison of King Vision video laryngoscope and Macintosh laryngoscope: a prospective randomized controlled clinical trial. Brazilian Journal of Anesthesiology (English Edition). 2018 Sep 1;68(5):499-506. https://doi.org/10.1016/j.bjane.2018.04.008
20. Dhonneur G, Abdi W, Ndoko SK, Amathieu R, Risk N, El Housseini L, Polliand C, et al. Video-assisted versus conventional tracheal intubation in morbidly obese patients. Obesity surgery. 2009 Aug 1;19(8):1096-101. https://doi.org/10.1007/s11695-008-9719-0 PMid:18836785
21. Bajwa SJ, Kaur J, Singh A, Parmar SS, Singh G, Kulshrestha A, Gupta S, Sharma V, Panda A. Attenuation of pressor response and dose sparing of opioids and anaesthetics with pre-operative dexmedetomidine. Indian journal of anaesthesia. 2012 Mar;56(2):123-8. https://doi.org/10.4103/0019-5049.96303 PMid:22701201 PMCid:PMC3371485