



Original Research Article

A randomized comparison of the performance of Airtraq videolaryngoscope versus Macintosh laryngoscope in simulated rapid sequence induction of anaesthesia

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ARTICLE INFO

Article history:

Received 29-07-2023

Accepted 29-08-2023

Available online 07-09-2023

Keywords:

Cormack- Lehane grade
Airtraq videolaryngoscope
Rapid sequence induction

ABSTRACT

Background and Aim: Application of cricoid pressure during rapid sequence induction (RSI) of anaesthesia leads to difficult airway. No channeled videolaryngoscope (VL) has been compared with the Macintosh laryngoscope for facilitating intubation in RSI. Thus, we compared Airtraq® VL with Macintosh laryngoscope for simulated RSI in patients scheduled for elective surgeries.

Materials and Methods: Following approval from Institutional Ethics Committee-Human Research, this randomized study was conducted. Patients of either sex, aged 18-65yr, ASA grade I/II, scheduled for elective surgeries under GA were included. 'Group DL' underwent direct laryngoscopy (DL) using Macintosh laryngoscope and Group VL with Airtraq® videolaryngoscope. Time taken for intubation, Cormack-Lehane (CL) grade of laryngeal view, number of intubation attempts, and haemodynamic parameters were noted. Student t-test and chi square test were used for statistical analysis.

Results: A total of 140 patients with 70 in each group were included. The mean time taken for intubation was significantly higher in VL group (84.70 ± 28.05 s) than DL group (23.90 ± 6.67 s). The optimal laryngeal view (i.e. CL grade I or II) was significantly improved in VL group than DL group i.e. 97% vs 94%. In group DL, 99% (n=69) were intubated in first attempt; whereas 60% (n=42) in Group VL (p<0.001). Hemodynamics was better in group VL.

Conclusion: Airtraq® VL is better than conventional Macintosh laryngoscope for endotracheal intubation during RSI in terms of optimal glottic view, ease of intubation and haemodynamics. On the contrary, the "time taken to intubation" and the first attempt intubation rate were higher with Airtraq® VL.

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1. Introduction

Airway management is a key element in the anaesthetic management. Rapid sequence induction (RSI) is a standard procedure and is indicated in patients with an increased risk of gastric regurgitation and aspiration.¹ One of the drawbacks of RSI is difficulty in visualisation of laryngeal structure due to the application of cricoid pressure

which impairs the glottic view thus leading to difficult laryngoscopy and intubation.²

Since last one decade, videolaryngoscopes (VLs) have emerged as a promising difficult airway adjunct.^{3,4} It improves the visualization of laryngeal structure and therefore, increases first attempt intubation success rate.^{5,6} Recently few authors have evaluated the efficacy of various VLs i.e. C-MAC,^{6,7} PENTAX,⁸ and CVS (Clarus Videosystem)⁹ for obtaining an optimal laryngeal view in RSI. The use of C-MAC VL in RSI leads to improved

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visualization of the vocal cords⁶ and the use of bougie further leads to higher first intubation success.⁷ Very recently, both CVS-V (Clarus Videosystem as a videostylet) and CVS -L (Clarus Videosystem as a Lightwand) have been evaluated and compared with direct laryngoscopy for facilitating intubation in RSI with cricoid pressure. A faster intubation time and improved vocal cord view was observed with CVS-V.⁹ This is the only study comparing the ease of tracheal intubation using a channeled VL i.e. PENTAX AIRWAY SCOPE in RSI and it concluded that cricoid pressure did not significantly affect the view of the glottis with the use of the device.⁸

However, on literature search, no channeled VL has been compared with the conventional Macintosh laryngoscope for facilitating intubation in RSI. The Airtraq® (ProdolMeditec S.A., Vizcaya, Spain) VL, a new channeled VL was developed in order to facilitate tracheal intubation in patients with normal or difficult airway.¹⁰

Therefore, the present study was undertaken with the aim to evaluate and compare the performance of Airtraq® VL with conventional Macintosh laryngoscope for simulated RSI in terms of time to intubation, Cormack and Lehane (CL) grade, first attempt intubation success, haemodynamic parameters and complications, if any, in patients scheduled for elective surgeries.

2. Materials and Methods

Ethical approval for this study (IEC-HR/2019/41/17) was provided by the Institutional ethics committee - Human research, University College of Medical Sciences (UCMS), Delhi, India (Chairman Prof Nalin Mehta) on 16 October 2019. This trial was conducted from November 2019 to October 2021. It was carried out in line with the principles of Declaration of Helsinki. Written informed consent was obtained from each participant in the trial.

Patients of either sex, aged 18-65yr, ASA grade I/II, scheduled for elective surgeries under general anaesthesia (GA) were included. Patients with major maxilla-facial trauma, cervical spine injury and Obstetric patients were excluded. The randomization was done using a computer-generated random number table. The allocation concealment was done by using sequentially-numbered sealed opaque envelopes and was done by the person not involved in the study. Patients were randomized into two groups. Patients in group DL (n=70) underwent conventional direct laryngoscopy using Macintosh laryngoscope; whereas, patients in group VL (n=70) underwent laryngoscopy using Airtraq® VL. (Figure 1)

All patients were placed in supine position on operation theatre table. Patients were informed about the application of cricoid pressure. All routine ASA recommended minimum mandatory monitoring i.e. continuous ECG, heart rate, pulse-oximetry, end tidal CO₂ and intermittent non-

invasive blood pressure (NIBP) were instituted. Baseline hemodynamic parameters were recorded. All patients received normal tidal volume pre-oxygenation with 100% oxygen for 3 minutes. Anaesthesia for RSI was induced with inj. propofol (1.5-2mg/kg), inj. fentanyl (2mcg/kg) and inj. rocuronium (1 mg/kg). Cricoid pressure was started along with the administration of IV propofol, pressure was slowly increased and continued till confirmation of endotracheal intubation by the square wave capnography. Laryngoscopy was attempted using either Macintosh laryngoscope or Airtraq VL depending upon the group allocation. Laryngoscopy by Airtraq VL was attempted by an experienced anaesthetist having experience with its use. The depth of anaesthesia was maintained by using oxygen, nitrous oxide and sevoflurane/isoflurane maintaining the MAC between 1-1.2.

Patients' characteristics like age, gender, ASA grade was noted (Table 1). The time taken for intubation in both the groups was recorded. It was measured from the time-point when the laryngoscope is inserted in the oral cavity till the confirmation of endotracheal intubation by using square wave form capnography. The CL grade was used to grade the laryngeal structures visualized in both the groups and was also recorded (Table 2) [CL grade 1: most of the cords visible; CL grade 2A: posterior cord visible; CL grade 2B: only arytenoids visible; CL grade 3A: epiglottis visible and liftable; CL grade 3B: epiglottis adherent to pharynx; CL grade 4: no laryngeal structures seen].¹¹ The laryngeal view was considered 'Optimal' if it is either CL grade I or grade II; whereas, CL grade III and IV was considered as 'Poor'. In case of poor view, a repeat attempt of laryngoscopy with the use of VL was considered in group DL or by a different laryngoscopist. The number of intubation attempts was also noted which was defined as the number of times the laryngoscope or VL was inserted in oral cavity. Successful first-attempt tracheal intubation was confirmed by continuous square wave capnography. Failure to intubate was defined as failure to intubate with selected technique which was followed by the use of any alternative technique.

The baseline haemodynamic parameters i.e. Mean Arterial Pressure (MAP) and Heart Rate (HR) were recorded before induction of anaesthesia and thereafter at an interval of two minutes till the confirmation of endotracheal tube placement. The ease of intubation (1-veryeasy; 2-easy; 3-somewhat difficult; 4-difficult; 5-impossible) was also recorded. Complications such as dental trauma, injury/bleeding of the larynx / pharynx, aspiration, the need for an alternative airway device for intubation, desaturation spells and technical problem with the device were also recorded.

The primary outcome was "time taken for intubation" and the secondary outcomes were CL grade of laryngeal view, number of intubation attempts, hemodynamic parameters during laryngoscopy and complications, if any.

Table 1: Patients' characteristics

Parameter		Group DL (n=70)	Group VL (n=70)	p-Value
Age (years) (Mean ± SD)		37.77 ± 11.05	36.51 ± 11.84	0.517
Gender	Male	20 (29%)	17 (24%)	0.565
	Female	50 (71%)	53 (76%)	
ASA Grade	ASA I	53 (77%)	53 (76%)	0.842
	ASA II	16 (23%)	17 (24%)	
Weight (kg) (Mean ± SD)		64.29 ± 8.15	62.10 ± 9.50	0.148

Table 2: Cormack lehane (CL) grade

CL Grade	Group DL (n=70)	Group VL (n=70)	Total	p-Value
I	22 (31%)	45 (65%)	67	0.001*
IIa	31 (44%)	17 (25%)	48	
IIb	13 (19%)	5 (7%)	18	
IIIa	4 (6%)	1 (1%)	5	
IIIb	0	1 (1%)	1	
IV	0	0	0	
Total	70	70	140	

*p<0.05-Significant

Table 3: Number of intubation attempts

Number of intubation attempt	Group DL (n=70)	Group VL (n=70)	Total	p-Value
1\$	69 (99%)	42 (60%)	111	<0.001*
2\$	1 (1%)	26 (37%)	27	
3\$	0	2 (3%)	2	
Total	70	70	140	

*p<0.05- significant. ; \$1, 2 and 3 are intubation in first, second or third attempts, respectively

Based on the previous study by Sulsar et al,⁶ the time to intubation using DL was found to be (31+₉ s) during RSI. Considering a difference of 20% decline in time to intubation by 6 secs with the use of VL to be statistically significant with an alpha error of 0.05 and 80% power of study, 65 patients are required in each group. To consider a 10% drop out, a sample size of 140 patients with 70 in each group was considered.

Data was analyzed using SPSS-20 statistical software (IBM corp., Armonk, NY, USA). Data was expressed as SD, median, proportion. Independent student-t test was used to find the significant±mean difference between the two groups for various demographic characteristics and intraoperative parameters such as SBP, DBP, MAP, HR, ease of intubation, age, time to intubation. Chi Square test was used for non-parametric data e.g. A p-value of less than 0.005 was considered as statistically significant.

3. Results

A total of 198 patients were enrolled, forty-two patients didn't meet inclusion criteria, sixteen declined to participate. Finally, a total of 140 patients were included with 70 in each group. The consort diagram is shown as Figure 1.

Both the groups were comparable with respect to the age, gender distribution, ASA physical status and mean weight. There was no significant difference in the Mallampati grading between the two groups. Equal proportion of patients i.e. 64% each in group DL and group VL had MPG score ≥ 2. Maximum number of participants belonged to MP grade-2 i.e. 43%. (Table 1)

The mean time taken to intubate the trachea in DL Group was lesser than VL group i.e. 23.9 sec (± 6.67) vs 84.7 sec (± 28.05). The difference between the groups was statistically significant (p<0.001).

Table 2 shows the difference between the two groups based on the laryngeal view obtained. In the DL Group, 31% of the participants (n=22) had a CL grade I, 44% (n=31) had CL gradeIIa, while 19% of the participants had a CL grade IIB and 6% had CL grade IIIA. None of the patients had grade III B or IV. In the VL group, 45 participants had a CL Grade I (65%), 17 patients had a CL grade IIA (25%), five had grade IIB (7%), one participant had Grade IIIA (1%) and one participant had grade IIIB (1%). On intergroup analysis, the difference was found to be statistically significant (p=0.001).

In Group DL, 99% of the patients (n=69) were intubated in the first attempt whereas only 60% of the patients

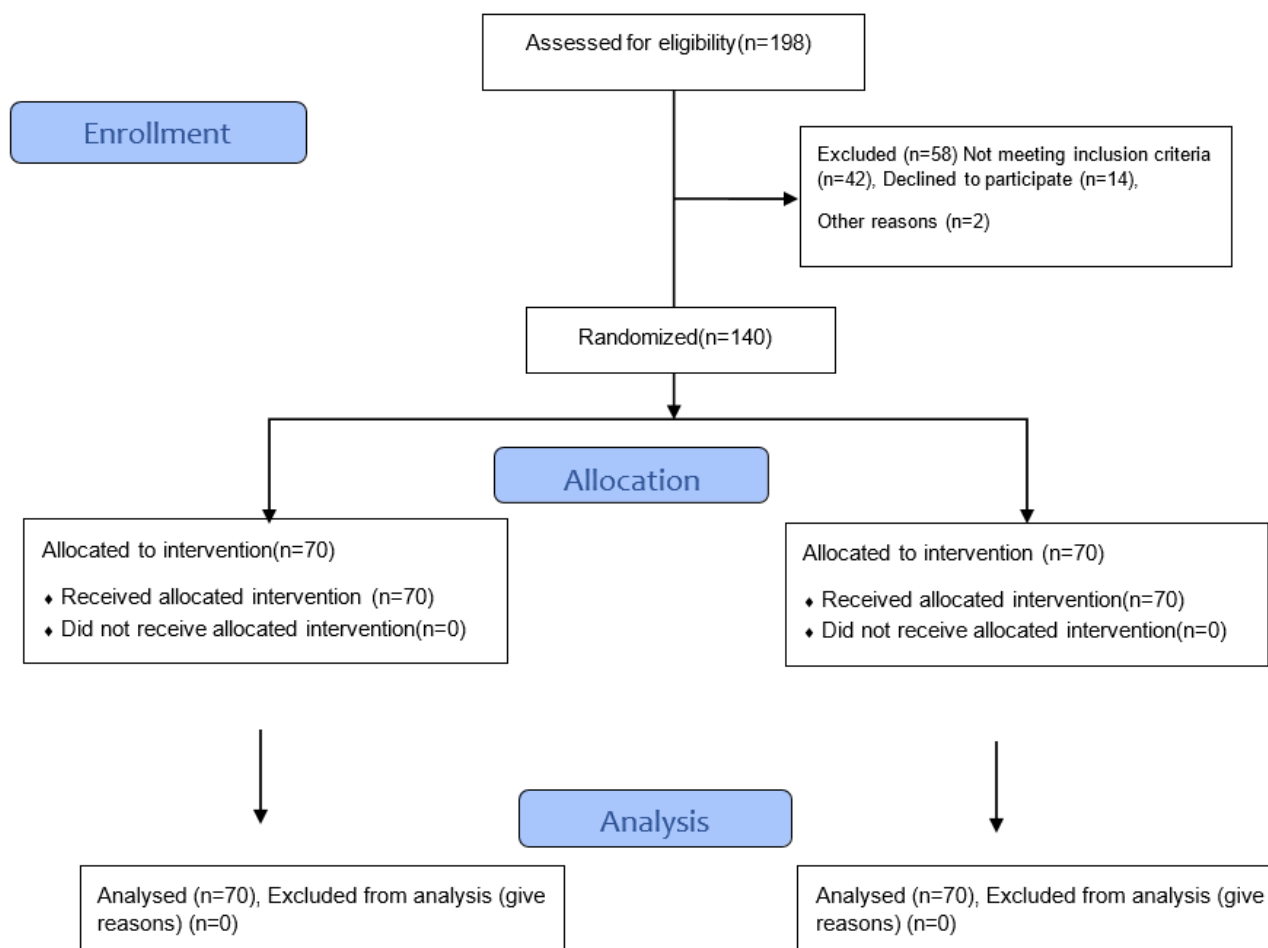


Fig. 1: Consort flow diagram

(n=42) were intubated in the first attempt in the Group VL (Table 3). This difference in the number of intubation attempts was found to be statistically significant ($p < 0.001$). Out of all patients, only four patients in VL group had failed intubation. Two of these 4 patients were successfully intubated with Macintosh laryngoscope, in one patient King vision VL was successfully used and in one patient Proseal laryngeal mask airway (PLMA) was used.

As far as ease of intubation is concerned, In DL group, 34% of the participants (n=24) had very easy intubation, 43% of the participants (n=30) had easy intubation and only 1% had difficult intubation. In Group VL, none of the patient had very easy intubation and 10% (n=7) had easy intubation, 61% (n=43) had somewhat difficult intubation and 6% (n=4) had impossible intubation. This difference was found to be statistically significant ($p < 0.001$).

The MAP was significantly lower in VL group when compared to DL group at all time points till 10mins i.e. 2 min, 4 min, 6 min and 10 mins (Figure 2). The difference in HR between the two groups at 2 min was found to be

significant (Figure 3). The difference in oxygen Saturation was not statistically significant at any point of time. In the VL group, the mean MBP is significantly reduced at all time points till 10th minutes; whereas, the mean HR was significantly reduced only in first two minutes; thereafter, no significant change was observed.

One patient in VL group had desaturation at the time of insertion of VL, in the same patient we had difficulty in visualization of laryngeal structures and failed intubation attempt. This patient had MPG-III and on attempt with direct laryngoscopy, the CL grade was III B. The airway in this patient was later secured using proseal LMA. No other patient in either of the group had any other significant adverse event such as haemodynamic instability, coughing, bucking, airway trauma etc.

4. Discussion

In the present randomized control study, the time to intubation and number of intubation attempts were found to be significantly higher with Airtraq® VL when compared

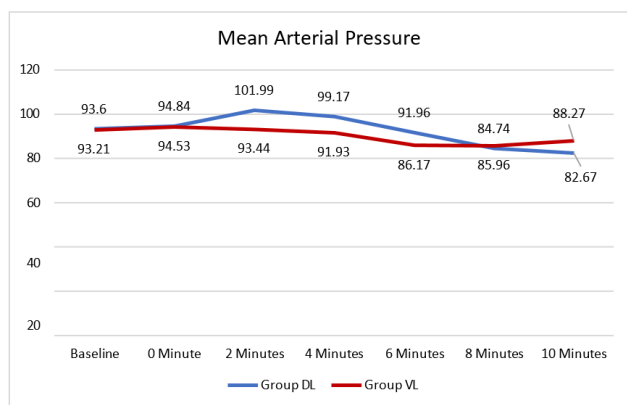


Fig. 2: Mean arterial pressure between the two groups

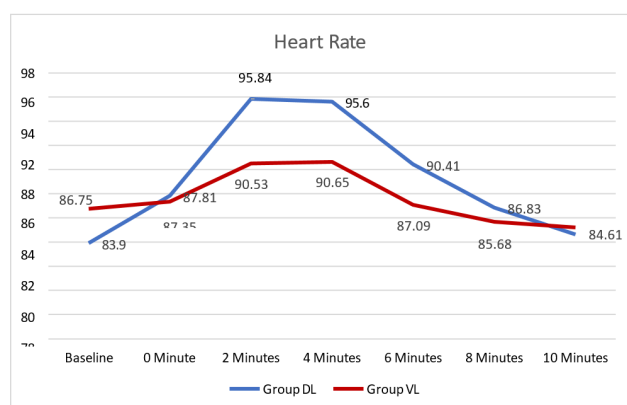


Fig. 3: Heart rate between the two groups

to Macintosh laryngoscope; however, the grade of laryngeal view was found to be significantly better with Airtraq® VL. Also, the haemodynamic parameters during the procedure and the mean ease of intubation were significantly better in VL group.

Difficulty in visualization of laryngeal structure due to the application of cricoid pressure is one of the concern with RSI.² Video laryngoscopes have emerged as a promising difficult airway adjunct from last many years.^{3,4,12} It improves the visualization of laryngeal structure and thus known to increase first attempt intubation rate.⁶ Recently few authors have evaluated the efficacy of various VLs i.e. C-MAC,^{6,7} PENTAX⁸ and CVS,⁹ to facilitate endotracheal intubation in RSI. The Airtraq® (Prodol Meditec S.A., Vizcaya, Spain) VL, a channeled VL is a new intubation device which was developed in order to facilitate tracheal intubation in patients with normal or difficult airway;¹⁰ however, not studied in facilitating intubation with cricoid pressure.

Sulsar et al,⁶ evaluated and compared C-MAC VL with conventional laryngoscope for RSI at the emergency department and concluded that visualization of the vocal

cord was improved but it didn't improve the first attempt success rate. In another study Angerman et al,⁷ combined C-MAC VL with bougie in RSI and concluded that the use of bougie led to higher first intubation success. Very recently, Yenchulin et al⁹ (2019), in a randomized controlled trial evaluated the CVS-V and CVS -L in endotracheal intubation in RSI with cricoid pressure and compared it with direct laryngoscope and observed faster intubation time and improved CL grade with CVS-V.

On the contrary to the aforementioned studies, Komasa and colleagues⁸ compared the ease of tracheal intubation using PENTAX AIRWAY SCOPE with and without application of cricoid pressure. They concluded that cricoid pressure did not significantly affect the view of the glottis with the use of the device.

The present study is by far the first study evaluating and comparing the performance of Airtraq® VL with conventional Macintosh laryngoscope for simulated rapid sequence induction in terms of time to intubation, Cormack and Lehane (CL) grade and intubation attempts in patients scheduled for elective surgeries.

The mean time taken for intubation in our study was significantly higher in VL group when compared to DL group i.e. (84.7 sec ± 28.05 vs 23.90 ± 6.67s). Al-Ghamdi et al¹³ observed that King Vision™ and Airtraq® require longer intubation times than Macintosh and GlideScope®. This is in concordance to the higher intubation time with Airtraq VL in the present study. However, on the contrary, a meta-analysis by Lu Y et al¹⁴ observed that Airtraq® reduced intubation time significantly as compared to Macintosh laryngoscope; this could be attributed to the application of RSI in present study. Sulsar et al.⁶ observed that time to intubation was similar in both groups with the use of C-MAC when compared with Macintosh laryngoscope when used for RSI. Savoldelli et al¹⁵ also compared channeled with unchanneled VL and has reported that compared to GlideScope®, the Airtraq® was associated with a faster time to intubation. That study, however, was done on manikins with simulated normal airways without cricoid pressure and was not powered to test this difference.

Various factors can be attributed to the significantly longer intubation time in VL group in our study. With the Airtraq® VL which is a channeled device, ET tube insertion is away from the device i.e. via the channel may impair the laryngeal view and can lead to difficult intubation. This technical issue we faced with the use of Airtraq® VL is in concordance with Tomasz Gaszyński.¹⁶ This article suggested that if manoeuvres are necessary, they must be done with the device itself, not the ET.

Out of four studies evaluating various VLs in RSI,⁶⁻⁹ only two have assessed CL grade. Sulsar et al demonstrated that CL score was significantly better using the C-MAC VL.⁶ On the contrary, Komasa et al did not observe any significant difference in CL grade with the use of Pentax

VL when used in RSI.⁸ But it is still controversial, whether improved CL views with the use of VLs result in increased success of intubation.^{17–20} The results of our study clearly demonstrate that visualization was significantly improved with the VL; however, it was not translated into lesser intubation time or higher first attempt intubation.

The present study showed improved hemodynamics with the use of Airtraq® VL. The mean MBP was significantly reduced at all time points till 10th minutes; whereas, the mean HR was significantly reduced only till first two minutes. Thereafter, no significant change was observed. Since, the Macintosh laryngoscope does not have tracheal tube guidance which might increase mechanical stimulation and injury to the oropharyngeal tissue during manipulation.²¹ Similarly to our study, meta-analysis by Hoshijima et al²² noted that Airtraq® VL reduces hemodynamic response to tracheal intubation when compared with Macintosh laryngoscope. Moreover, lesser haemodynamic response was noted with Glidescope VL as compared to Macintosh laryngoscope in controlled hypertensive patients in another study.²³ In the present study, we observed that the use of Airtraq® VL is associated with improved hemodynamics despite the application of cricoid pressure.

The study was dealt with limitation i.e. in case of difficult intubation with the use of Airtraq VL, the use of bougie would have been considered.

5. Conclusion

We conclude that Airtraq® VL, a channeled VL is useful to facilitate endotracheal intubation during RSI in terms of improved visualization of laryngeal structures, ease of intubation and haemodynamic stabilization in comparison to the conventional Macintosh laryngoscope. However, both the “time taken to intubation” and the first attempt success rate have been found to be higher with Airtraq® VL when used with RSI. We recommend further studies comparing a channeled VL like Airtraq® VL with other unchanneled VL to facilitate endotracheal intubation under RSI.

6. Sources) of Support

None

7. Conflict of Interest

None.


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Cite this article: Jain S, Chilkoti GT, Gupta V, Saxena AK, Seth V, Maurya P. A randomized comparison of the performance of Airtraq videolaryngoscope versus Macintosh laryngoscope in simulated rapid sequence induction of anaesthesia. *Indian J Clin Anaesth* 2023;10(3):283-289.