

**Original Article**

## A Prospective Randomized Study to Compare the Ease of Tracheal Intubation using Truview, Airtraq and Macintosh Laryngoscopic Blades

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**Abstract**

**Introduction:** Anaesthesiologists face several complications during tracheal intubation, inability to intubate being the most devastating. Macintosh has been the gold standard since times immemorial. Newer indirect laryngoscope blades have come into vogue which improve visualization of glottis. In our study we compare the ease of tracheal intubation between direct and indirect laryngoscopes.

**Methods:** Ninety consenting patients were included in this prospective randomized controlled trial to compare the ease of tracheal intubation using Truview(Group 1), Airtraq (Group 2) and MacIntosh (Group 3) laryngoscope blades. The time taken for intubation, intubation difficulty score, hemodynamic changes with intubation and complications were observed and compared.

**Results:** There was no statistically significant difference between the three blades with respect to duration of intubation ( $p = 0.3$ ), intubation difficulty score or complications. Statistically significant difference in pulse, mean arterial pressure at 1,3 and 5 minutes post intubation was found between the groups. Therise in pulse was found to be significantly lesser in Group 1( $p$  value-0.001) and Group 2( $p$  value- 0.040) when compared to Group 3 at 3 minutes and significantly lesser in Group 1 when compared to Group 3( $p$  value-0.041) at 5 minutes. Rise in mean arterial pressure (MAP) was significantly lesser in Group 2 when compared to Group 3 at 1 minute ( $p$  value- 0.038) and 3 minutes ( $p$  value- 0.026) after intubation.

**Conclusion:** Airtraq provides certain advantages over Truview and Macintosh in terms of ease of intubation and hemodynamic stability when used by experienced anesthesiologists in a normal airway.

**Keywords:** Truview; Macintosh; Airtraq; Intubation.

**Introduction**

In the day-to-day practice of anaesthesiology, securing the airway using an endotracheal tube remains an on-going challenge,<sup>[1]</sup> common problems being anticipated or unanticipated difficult intubation. In an effort to improve the

success rate and ease of intubation different designs of laryngoscopes have been developed which provide a wide angle view of the glottis without a need for alignment of oral, pharyngeal and laryngeal axes<sup>[2,3,4]</sup>. The aim of this study is to compare the ease of intubation, intubation

difficulty score (IDS), hemodynamic variations and complications during intubation between Truview, Macintosh and Airtraq.

**Methods**

This study was initiated after institutional ethical committee clearance and it has been registered under clinical trial registry of India. Ninety consenting patients were allotted randomly by computer generated random number table into 3 groups: Group 1- intubated with Truview, Group 2- intubated with Airtraq and Group 3- intubated with Macintosh. Patients aged more than 18 years, belonging to ASA class I and II, undergoing elective surgery, requiring general anesthesia were included in the study. Patient refusal, distorted airway, difficult intubation, ASA class III or IV were the exclusion criteria.

On arrival in the operation theatre, standard ASA monitors - electrocardiogram (lead II), noninvasive blood pressure, pulse oximeter were attached. Baseline parameters – heartrate, blood pressure (BP), oxygen saturation (SpO2) were recorded.

Patients were pre-medicated with injection (Inj) Midazolam 0.03mg/kg intravenous(iv) and Inj. Fentanyl 2µg/kg iv and pre-oxygenated with 100% oxygen for 3 minutes. Anesthesia was induced with Inj. Propofol 2mg/kg iv and after checking feasibility of ventilation with a face mask, neuromuscular blockade was achieved with Inj. Rocuronium 1mg/kg iv. The laryngoscopy and intubation was carried out by an anesthesiologist who had performed at least 20 intubations with the device [5, 6]. Intubation was done with one of the three –Truview, Airtraq or MacIntosh laryngoscope based on the group the patient was randomly allotted to. The following aspects were studied during tracheal intubation: (i) Success rate of intubation. Tracheal intubation attempt was considered to have failed if intubation could not be accomplished within 60 seconds for each attempt or if the saturation fell below 95% (ii) Duration of intubation- The time from insertion of blade between the teeth until the first appearance of capnographic waveform (ii) Intubation Difficulty Score [figure 1]<sup>[7]</sup>

**Figure 1** Intubation Difficulty score<sup>[7]</sup>

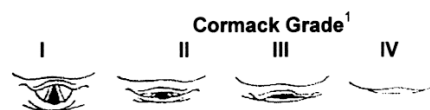
**Intubation Difficulty Scale**

Parameter	Score
Number of Attempts >1	N <sub>1</sub>
Number of Operators >1	N <sub>2</sub>
Number of Alternative Techniques	N <sub>3</sub>
Cormack Grade - 1	N <sub>4</sub>
Lifting Force Required	
Normal	N <sub>5</sub> =0
Increased	N <sub>5</sub> =1
Laryngeal Pressure	
Not applied	N <sub>6</sub> =0
Applied	N <sub>6</sub> =1
Vocal Cord Mobility	
Abduction	N <sub>7</sub> =0
Adduction	N <sub>7</sub> =1
<b>TOTAL: IDS = SUM OF SCORES</b>	<b>N<sub>1</sub>-N<sub>7</sub></b>

IDS Score	Degree of Difficulty
0	Easy
0 < IDS ≤ 5	Slight Difficulty
5 < IDS	Moderate to Major Difficulty
IDS = ∞	Impossible intubation

**Rules for Calculating IDS Score:**

N <sub>1</sub>	Every additional attempt adds 1 pt.
N <sub>2</sub>	Each additional operator adds 1 pt.
N <sub>3</sub>	Each alternative technique adds 1 point: Repositioning of the patient, change of materials (blade, ET tube, addition of a stylette), change in approach (nasotracheal/orotracheal) or use of another technique (fibroscopy, intubation through a laryngeal mask).
N <sub>4</sub>	Apply Cormack grade for 1st oral attempt. For successful blind intubation N <sub>4</sub> = 0.
N <sub>6</sub>	Sellick's maneuver adds no points.
<b>Impossible intubation:</b> IDS takes the value attained before abandonment of intubation attempts.	



<sup>1</sup> Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. *Anaesthesia* 1984;39:1105-1111.

(iii) Hemodynamic parameters such as Pulse, BP and SpO2 were noted after induction and at 1,3

and 5 minutes post intubation (iv) Complications such as dental and lip trauma, oropharyngeal

bleeding if occurred. A maximum of 2 attempts were allowed for a device. If both the attempts failed, the attempt was terminated and after mask ventilation for 1 min, intubation was attempted with a device as per the discretion of the senior anesthetist. Thereafter difficult airway cart was to be kept ready with Laryngeal mask airway(LMA), Intubating LMA, Frova ventilating bougie, Maccosy. Maintenance of anesthesia was with O<sub>2</sub>:N<sub>2</sub>O 50:50 and Isoflurane and MAC of 1 was maintained.

Comparison of quantitative data like duration of intubation and hemodynamic parameters such as pulse, B.P was done using one way ANOVA test.

**Table 1** Demographics and Airway measurements

	Group 1	Group 2	Group 3	p value
Mean age(years)	34.40±12.92	31.03±14.13	29.83±12.4	0.38
Gender Male	17(56.7%)	16(53.3%)	16(53.3%)	0.9
Female	13(43.3%)	14(46.7%)	14(46.7%)	
Weight(kg)	53.33±11.52	52.4±13.59	56.87±15.39	0.41
ASA I	27(90%)	26(86.7%)	28(93.3%)	0.69
classification II	3(10%)	4(13.3%)	2(6.7%)	
Airway measurements				
MPC I	20(66.7%)	24(80.0%)	25(83.3%)	0.42
II	9(30.0%)	6(20.0%)	5(16.7%)	
III	1(3.3%)	0(0.0%)	0(0.0%)	
Thyromental distance(cm)	6.28±0.28	6.39±0.38	6.45±0.50	0.21
Interincisor distance(cm)	4.73±0.47	4.53±0.61	4.67±0.55	0.31

All 30 patients were successfully intubated in the first attempt in Group 2 while 5 patients required 2<sup>nd</sup> attempt (16.7 %) in Group 1 and one patient required 3 attempts in Group 3(3.3% failure rate), the third attempt being done with Macintosh. First attempt success rate was significantly higher for Group 2 (p value- 0.02), however, the overall success rate was comparable between the groups. In this study the duration of intubation was found to be 22.87±8.143 seconds in Group 1, in Group 2 it was 21.53±10.345 seconds and in Group 3 it was 25.13±11.218 seconds (p value – 0.372) which was statistically insignificant. All patients in Group 2 had Cormack Lehane (CL) grade I, in group 1; 2 patients had CL II and 1 CL III. Group 3 had higher CL grade- CL II in 4 patients, CL III in 1 and IV in 1 patient. The need

Qualitative data - The Intubation difficulty score was analysed using the Kruskal Wallis test. All statistical calculations were done using computer programs Microsoft Excel and SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 16. P-value of ≤0.05 was considered to be statistically significant.

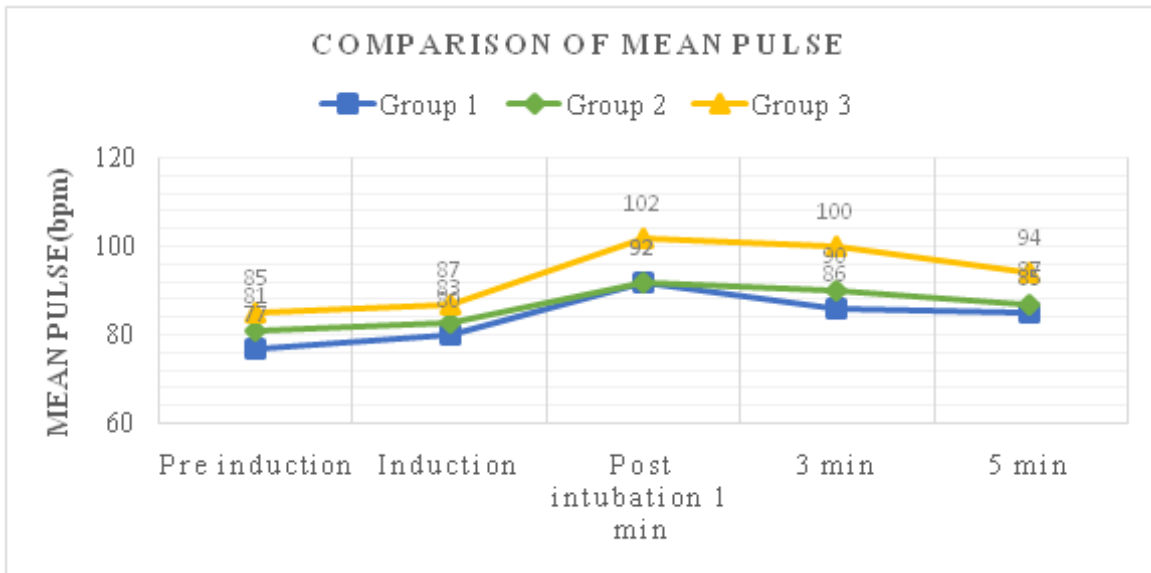
### Results

The age, gender, weight, ASA grade and airway measurements including MPC grade, thyromental distance and inter-incisor distance was comparable in the three groups (Table 1)

for bougie, increased force during laryngoscopy and external manipulation was greater in group 3 than group 1 and least with group 2. The median of IDS of all three groups was found to be 0 which showed that the ease of intubation was similar with all three blades. However, the mean rank of IDS score was found to be significantly lower with Airtraq (p value- 0.014).

There was a rise from baseline heart rate post intubation with all three blades, it being significant at 1 and 3 minutes in all three groups and at 5 minutes in Groups 1 and 3. Macintosh caused the most variations in heart rate. The rise in heart rate post intubation was significantly greater in Group 3 than the other two groups at 3 minutes(p -0.001)and greater than Group 1 at 5 minutes (p- 0.03). (Table 2, figure 2)

**Figure 2.** Comparison of change in heart rate



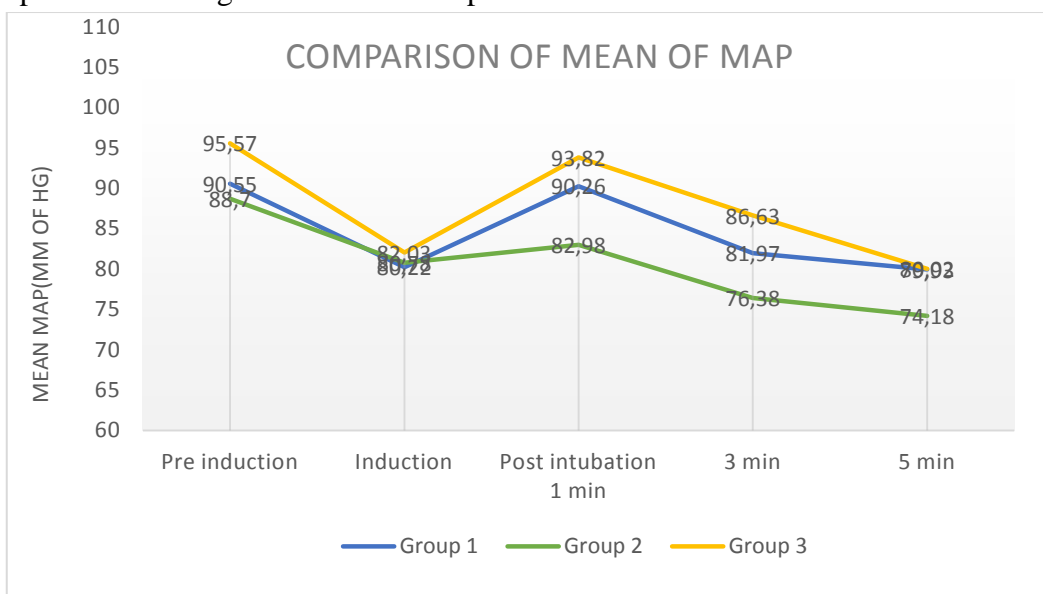
**Table 2** Comparison of change in heart rate (bpm)

	Group 1	Group 2	Group 3	P value
Baseline	77.16±14.107	81.20±15.641	85.97±16.327	0.088
After induction	80.90±12.550	83.23±12.533	87.33±12.271	0.131
1 min after intubation	92.71±16.509	92.73±14.505	102.07±17.029	0.058
3 min after intubation	86.39±14.059	90.67±13.296	100.10±15.955	0.001
5 min after intubation	85.55±14.403	87.23±12.637	94.80±15.884	0.033

The mean MAP at 1 and 3 minutes after intubation was found to be significantly greater in Group 3 when compared to Group 2. In all three groups the mean MAP decreased post induction and increased after intubation such that the MAP 1

min after intubation was comparable with baseline in Groups 1 and 3. In Group 2, however, the MAP remained significantly low at 1,3 and 5 minutes post intubation. (Table 3, figure 3)

**Figure 3** Comparison of change in Mean arterial pressure



**Table 3.** Comparison of change in Mean arterial pressure (mm of Hg)

	Group 1	Group 2	Group 3	P value
Baseline	90.55±9.67	88.7±9.83	95.57±11.50	0.192
After induction	80.22±11.84	80.78±10.91	82.03±16.50	0.864
1 min after intubation	90.26±21.98	82.98±11.06	93.82±14.32	0.039
3 min after intubation	81.97±18.17	76.38±12.28	86.63±12.94	0.031
5 min after intubation	79.93±16.48	74.18±10.80	80.02±12.20	0.151
P value calculated using One way Anova test				

The overall complication rate was comparable in the three groups (p value- 0.061)

## Discussion

Endotracheal intubation is an essential maneuver during general anesthesia. Direct laryngoscopy with Macintosh laryngoscope has been a gold standard since times immemorial. Efforts are being made to find methods to circumvent problems such as unanticipated difficulty in intubation and to improve success of laryngoscopy. Hence many new devices like video-laryngoscope have come into vogue<sup>[6,8]</sup>. This study is a prospective randomized controlled trial to compare success rate, duration and ease of intubation between direct (Macintosh) and indirect laryngoscopes (Truview and Airtraq).

Our results, first attempt success rate being higher in Airtraq and Macintosh groups despite the success of intubation being comparable between Truview, Airtraq and Macintosh, were similar to that of Dwivedi et al<sup>[9]</sup>. This could be attributed to the considerable difficulty in advancing the endotracheal tube towards the glottis<sup>[9]</sup> and also that the oropharyngeal and laryngeal axes are not aligned although Truview improves the glottic view.<sup>[10]</sup> A study by Hirabayashi et al.<sup>[11]</sup> concluded that Airtraq laryngoscope provided a significant advantage over the Macintosh laryngoscope in difficult intubation. Two studies found no significant difference between Airtraq and Macintosh- a meta-analysis by Lu et al<sup>[12]</sup> and a study by McElwain et al<sup>[13]</sup>. Saxena et al<sup>[10]</sup> found that Macintosh and Truview provided comparable intubating conditions.

In our study Airtraq provided better CL grade and ease of intubation which was similar to findings by Dwivedi et al<sup>[9]</sup>, McElwain et al<sup>[13]</sup> and Maharaj et al<sup>[5]</sup>. Saxena et al found that Truview was better than Macintosh in terms of ease of intubation.<sup>[10]</sup>

There was no statistically significant difference between the three groups with respect to duration of intubation. McElwain et al<sup>[13]</sup> and Erturk et al<sup>[14]</sup> compared Airtraq and Macintosh and got similar results, however, Lu et al<sup>[12]</sup> found duration of intubation was significantly improved by Airtraq in comparison to Macintosh while Dwivedi et al<sup>[9]</sup> found that intubation was significantly longer with Truview compared to Airtraq and Macintosh.

In our study Truview and Airtraq provided lesser variations in heart rate than Macintosh and the rise in MAP post intubation was significantly lower with Airtraq than Truview and Macintosh, Macintosh showing greatest variations. Timayankar et al<sup>[15]</sup> found that hemodynamic parameters were comparable between Truview and Macintosh. Bag et al<sup>[1]</sup> compared Truview with Macintosh laryngoscope and found lesser hemodynamic response to intubation with Truview.

The number of complications were greater with Macintosh but the difference was not significant. Similar results have been found by other studies.<sup>[9, 10, 14, 16]</sup>

## Conclusion

Airtraq provides certain advantages over Truview and Macintosh in terms of ease of intubation and hemodynamic stability when used by experienced anesthesiologists in a normal airway. Further studies are required to validate its advantages if used by novices and in the setting of an anticipated difficult intubation.



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**Clinical Trial Registry of India number:**

CTRI/2018/02/012067

**Conflict of Interest:** None

**Source of Support:** None

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