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Original research article

Comparative Randomized Clinical Study of Airtraq and Macintosh Laryngoscope for Airway Management

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Abstract

Background: Airway management is a major responsibility and vital skill of Anesthesiologist's. Laryngoscopes, which range from simple rigid scopes to complex fiberoptic video devices play an important role in administration of general anaesthesia and in securing airway in emergency conditions. Macintosh laryngoscope introduced in 1943 is the most popular and commonly used rigid laryngoscope.

Material and Methods: This is prospective, study randomized trial, 60 ASA I-II patients scheduled for various elective surgeries under general anesthesia with no risk factors of difficult intubation were randomly allocated to two groups with 30 each to undergo intubation with either Macintosh laryngoscope or optical Airtraq laryngoscope. Same general anesthesia protocols were followed in both the groups and all patients were intubated by same anaesthetist experienced in using both the laryngoscopes.

Conclusion: Airtraq laryngoscope resulted in significant improvement in ease of intubation with better glottic view and no marked hemodynamic variations during laryngoscopy.

Keywords: Airway, Laryngoscope, Macintosh.

Introduction

Airway management is a major responsibility and vital skill of anesthesiologist's.Absence of any single factor that reliably predicts the existence of difficult airway makes many difficult intubations not recognised until after induction of anaesthesia. Difficulties with tracheal intubation and failure to successfully secure the airway significantly contribute to the morbidity and mortality in anaesthetic and emergency conditions.[1]Laryngoscopes play an important role in administration of general anaesthesia and in securing airway in emergency conditions. They range from simple rigid scopes to complex fiberoptic video devices. Macintosh laryngoscope introduced in 1943 is still most commonly used rigid direct laryngoscope to facilitate endotracheal intubation and constitute the gold standard despite the recent developments in airway device technologies.[1] Successful direct laryngoscopy depends on aligning the axes of oral cavity, pharynx and larynx which is achieved by 'Sniffing position'. The tip of the blade is placed in valecula and base of tongue is lifted anteriorly to indirectly lift the epiglottis and

hence visualise the glottis. Laryngoscopy is known to have profound cardiovascular effects. The force exerted by laryngoscope blade on base of tongue cause activation of autonomic nervous system with release of stress hormone leading to tachycardia, hypertension, dysrhythmias. Sympathoadrenal response arise from stimulation of supraglottic region along with tracheal tube placement and cuff inflation. These changes are maximum at 1minute after intubation and lasts for 5-10 minutes.[3] Airtraq optical laryngoscope(Prodol Meditec S.A., Vizcaya, Spain) is an intubation device that has been developed to facilitate endotracheal intubations in patients with normal and anticipated difficult airway. As a result of exaggerated curvature of blade and an internal arrangement of optical components, a high quality view of glottis and surrounding structures is provided without sniffing position. The factors that influence the magnitude of hemodynamic changes are duration of laryngoscopy and intubation, type of laryngoscope[4] used, anesthetic agent and the depthof anesthesia. Transient tachycardia and hypertension are of no significant consequences in healthy individuals, but may be hazardous to those with hypertension, myocardial insufficiency or cerebrovascular diseases. Despite advances in medical technology with the advent of many new devices to ease the burden of airway management, tracheal intubation continues to be a challenge even to the most experienced anaesthetist. Laryngoscopes must provide good glottic exposure to ease the process of intubation and should trigger minimal stress response. The utility of Airtraq laryngoscope in clinical practice remains to be determined.

Objectives

To evaluate ease of intubation based on Intubation Difficulty Scale(IDS) score, Glottic view as per Cormack and Lehane grading, To evaluate the impact on hemodynamic variables during laryngoscopy andintubation.

Review of Literature

The first use of tracheal intubation as a dedicated airway in anaesthesia was by William Macewen(Glasgow) in 1878, on a patient with cancer of base of tongue. The standard airway management at that time was tracheostomy with a cuffed tube. In 1895, Alfred Kirstein, a Berlin physician, performed the first direct visual examination of the human larynx.[8] This idea came to Kirstein after he learned from a colleague that a scope intended for the oesophagus of a patient had surprisingly slipped into the trachea. The "Autoscope" as Kirstein called his new invention, was in the beginning simply a shortened version of the rigid, tube-shaped oesophagoscope attached to an electric hand lamp. The entire configuration was an L-shaped instrument, shaped much like today‟s versions except that the "Blade" portion was a tube; it was attached to apower source by electrical wires. Using his subjects upper teeth as a fulcrum, Kirstein showed that he was indeed able to consistently depress the tongue and pass his autoscope just beyond the epiglottis, thus exposing the larynx. Concerned about trauma to the upper teeth and lip as well as the extreme extension of the neck necessary for the procedure, Kirstein later modified his original autoscope. In 1913, Chevalier Jackson described a new technique of direct laryngoscopy for the insertion of intratracheal tubes using his own laryngoscope design and reported a highsuccess rate. Jackson‟s laryngoscope was U- shaped allowing an extra handle for manipula Henry H Janeway improved the overall design of both Kirstein and Jackson by developing an L-shaped laryngoscope with a light source powered by batteriesin the handle.[11] Janeway‟s blade, like Kirstein‟s standard blade, had a blunt and slightly curved distal tip.tion. In 1941, Robert Miller described a modified straight laryngoscope blade that has gained widespread acceptance in the United States. He made several changes that were specifically designed to increase the simplicity and ease of direct laryngoscopy and endotracheal intubation. In 1943, Macintosh developed the first curved laryngoscope blade. Macintosh gotthe idea for this curved blade after seeing the Boyle Davis

mouth gag used for tonsillectomies. Since its inception, the Macintosh blade design has become perhaps the most popular throughout the world. videoscopy and optic intubation have been gaining popularity, particularly in patients with difficult airways or as rescue devices in failed intubation attempts

The pharynx is a musculofibrous tube which connects the nasal cavity with larynx and oral cavity with oesophagus. It is composed of a outer fascial layer which is thin.
The nasopharynx is situated directly behind the nasal cavity. Its inferior boundary is a line drawn transversely at the level of the soft palate. The two nasal choanae, the orifices of the two Eustachian tubes, and the inferior outlet to the oropharynx are the five passages which communicate with the nasopharynx. The sphenoid and occipital bones of the skull base form the roof of the nasophyarynx.

The oropharynx lies directly posterior to the oral cavity and extends from the soft palate superiorly to the tip of the epiglottis inferiorly. The posterior wall consists of the prevertebral fascia and the bodies of the second and third cervical vertebrae. The lateral walls of the oropharynx contain the paired tonsillar fossae. The laryngopharynx (hypopharynx) extends inferiorly from the upper edge of the epiglottis to the inferior edge of the cricoid cartilage and communicates with the oropharynx, the laryngeal inlet and the oesophagus. On each side of the larynx are the funnel-shaped piriform recesses. Authors observed that in simulated easy laryngoscopy scenarios, there was no difference between Airtraq and Macintosh in success of tracheal intubation. The time taken to intubate at the end of the protocol was significantly lower using Airtraq, demonstrating a rapid acquisition of skills. Carlos Ferrando and colleagues in 2011 conducted a prospective, randomized cross- over trial with 60 patients with the aim to evaluate if, in unskillful anaesthesiologyresidents during laryngoscopy, the Airtraq compared with Macintosh laryngoscope improves the laryngeal view, decreasing the Cormach -Lehane score. In a study conducted by C.H Maharaj[1] et al., in 2006 compared the Airtraq with the Macintosh laryngoscope in patients deemed at low risk for difficult intubation. Sixty ASA I and II patients presenting for surgery requiring tracheal intubation were randomly allocated to undergo intubation using Macintosh(n=30) or Airtraq(n=30) by anaesthetists experienced in the use of both the laryngoscopes. Marwa A Tolon[2] et al., in their comparitive study between the use of Macintosh laryngoscope and Airtraq in 40 adult ASA I and II patients with cervical spine immobilization observed that there was significantly increase in both heart rate and mean arterial blood pressure values following intubation in Macintosh laryngoscope group(n=20) than in Airtraq group(n=20). J. McElwain and J. G. Laffey in 2011 conducted a study comparing C-MAC, Airtraq and Macintosh laryngoscope in patients undergoing tracheal intubation with cervicalspine immobilization using manual inline axial stabilization of cervical spine. Laryngoscopy and tracheal intubation are noxious stimuli that provoke a transient but marked sympathetic response, manifesting as tachycardia and hypertension. King et al.

Material and Methods

This is Prospective study, 60 ASA grade I and II patients in the age group of 18- 60 years, Department of Anaesthesiology, at Darbhanga medical college and Hospital Laheriasarai, Darbhanga, Bihar. requiring general anaesthesia with endotracheal intubation were enrolled in this prospective study. All patients were explained regarding the study and objectives and written informed consent was taken, Ease of tracheal intubation, Visualisation of pharyngeal structures and larynx as per Cormack and Lehane grading and hemodynamic response to endotracheal intubation with Airtraq optical laryngoscope, and Macintosh laryngoscope was analysed.

Inclusion criteria
*ASA grade I and II
*Age group 18-60 years
*Mallampati class I and II

Exclusion criteria
*Interincisor distance <3cm
*Body mass index(BMI)>30kg/m2 ,pregnant women.
*Uncontrolled hypertension, cardiac disease, hepatic or renal impairment.
*Patients recognised as difficult laryngoscopy and intubation during pre anaestheticevaluation.

In this study 60 patients were divided randomly into two groups.Allocation into two groups was be done by computer generated randomization , Sixty(60) patients scheduled for different elective surgeries under general anaesthesiawere randomly allocated to one of the two groups of 30 patients each group. Group A Patients intubated with Macintosh laryngoscope (n=30) Group B-Patients intubated with Airtraq optical laryngoscope (n=30).

All patients were examined a day prior to surgery. A detailed history and systemic examination was done to rule out any of the above mentioned exclusion criteria. The hemodynamic variables- heart rate, systolic blood pressure and diastolic blood pressure and height and weight were recorded. All patients were premedicated with Inj. Glycopyrrolate 0.01 mg/kg IV, Inj. Midazolam 0.03mg/kg IV, Inj Fentanyl 2ug / kg IV. Then patients were preoxygenated with mask for 3 minutes with 100% oxygen.

Results
The comparing two laryngoscopes - the conventional Macintosh laryngoscope and novel Airtraq laryngoscope for endotracheal intubation, Sixty consenting patients belonging to ASA physical status I and II were randomly divided into 2 groups, 30 each based on computer generated randomization table.Baseline patient characteristics and demographic profile were comparable between the groups. All patients were successfully intubated in both the groups. There were no significant adverse events observed in both the groups.

Table 1:

	Group A	Group B	p value
Age(mean±SD) kg	37.37±11.32	33.37±12.07	0.19(NS)
Sex(M/F)	11/19	13/17	0.29(NS)
ASA(I/II)	16/14	18/12	0.27(NS)
MPC(I/II)	8/22	9/21	0.08(NS)
TMD(mean±SD) cm	6.82±0.28	6.96±0.32	0.08(NS)
IID(mean±SD) cm	3.64±0.27	3.7±0.42	0.52(NS)
BMI(mean±SD) kg/m2	23.17±2.07	22.74±2.17	0.43(NS)

There was no significant differences in baseline patient characteristics and airwayparameters between the two groups.

Table 2:

Age in years	Group A		Group B	
	No. of patients	%	No. of patients	%
<20	2	6	2	6
21-30	11	36.66	13	43.33
31-40	8	26.66	6	20
41-50	4	13.33	2	6
51-60	5	16.66	7	23.33
Total	30		30	
Mean ± SD	37.37±11.32		33.37±12.07	
t-value	1.32			
p-value	0.19			

Age distribution between the two groups were comparable. Most of the patient‟s age inboth the groups ranged between 21-40yrs. The minimum age was 18yrs and maximum age was 60yrs.

Lehane grade distribution in two groups

Table 3:

Grade	Group A		Group B	
	No. of patients	%	No. of patients	%
1	13	43	23	77
2	14	47	7	23
3	3	10	0	0

p value-0.0007

In Airtraq laryngoscope group 77% patients had Cormach and Lehane grade 1 view of glottis with no patients with grade 3 or 4 view as compared to Macintosh laryngoscope group with 43% having grade 1 Cormach and Lehane view and 10 % with grade 3 view of glottis. Airtraq decreased the Cormach- Lehane grade of glottic view which was statistically highly significant with p value 0.0007.

The mean heart rate in the two groups prior to intubation was comparable with p value 0.58 indicating no statistical significance. At 1, 3 and 5 minutes following intubation the rise in mean heart rate was significantly higher in Macintosh group as compared to Airtraq laryngoscope group with respect to pre-intubation baseline values.

Comparison of mean Diastolic blood pressure changes(mmHg) in response to laryngoscopy and intubation

Table 4:

Time	Group A	Group B	p-value	t-value
Baseline	67.90±7.12	67.27±7.75	0.74(NS)	0.32
1min after intubation	75.83±8.79	70.17±8.22	0.01(S)	2.57
3min after intubation	73.83±7.50	68.17±7.79	0.006(S)	2.86
5min after intubation	72.83±6.75	68.23±7.50	0.015(S)	2.49

The pre-intubation baseline values were comparable between the two groups. Airtraq laryngoscope group had no marked rise in DBP at 1,3 and 5 minutes following intubation as compared to Macintosh laryngoscope group with significant rise in DBP following intubation.

Discussion

Airway management is the most important skill for anaesthesiologists. Laryngoscopes play an important role in securing airway. The current study was aimed at comparing the two laryngoscopes one the conventional Macintosh direct laryngoscope and the other Airtraq video laryngoscope and to note the efficacy of these in terms of ease of intubation, glottic view obtained and the effect of laryngoscopy on the hemodynamic parameters. randomized study conducted at darbhanga medical college and Hospital Laheriasarai, Darbhanga. 60 ASA grade I and II patients undergoing various elective surgeries under general anaesthesia were enrolled and divided randomly into two groups of 30 each, standard anaesthetic protocols were applied to both groups and intubation with appropriate size endotracheal Airtraq laryngoscope over the conventional Macintosh laryngoscope for endotracheal intubation in patients deemed low risk of difficult airway. Airtraq laryngoscope provided better ease of intubation with lesser mean IDS score of 0.43 as compared to 2.23 with Macintosh laryngoscope which was statistically highly significant($p<0.0001$). The data of the study is comparable to the study conducted by Maharaj CH[1] et al comparing Airtraq and Macintosh laryngoscope in routine airway management. Sixty ASA grade I and II patients were intubated with either Airtraq or Macintosh laryngoscope, the mean IDS score was 0.2 in Airtraq group as compared to 1.4 in Macintosh group which was statistically significant. In Airtraq group 77% patients had Cormach- Lehane grade I view of glottis and no patients had grade 3 or 4 view of glottis as compared to 43% with grade 1 view and 10% with grade 3 view in Macintosh group .Thus Airtraq laryngoscope significantly reduced the Cormach- Lehane grade of glottic view with p value 0.0007. Airtraq laryngoscope has been designed to facilitate intubation in both normal and difficult airways. The internal arrangements of the high definition optical components including a series of lenes, prisms and mirrors with antifogging system transfer the image from low temperature illuminated tip to the proximal view finder, giving a high quality and wide angle view of glottis , surrounding structures and the tip of the endotracheal tube. laryngoscopy and tracheal intubation is considered most critical events as they trigger transient but marked sympathoadrenal response which can be detrimental in patients particularly with underlying cardiac diseases. In our study Airtraq laryngoscope resulted in less alterations in hemodynamic parameters with reference to baseline values. This could be due to exaggerated anatomical curvature of the blade of Airtraq laryngoscope which does not require alignment of oral, pharyngeal and laryngeal axes, less lifting force needed during laryngoscopy and less trauma caused during intubation. The hemodynamic findings in ourstudy was comparable to those described by C H Maharaj et al in patients with normal airway[1], anticipated difficult airway. in the primary intubation plan. Airtraq laryngoscope has been reported to increase the success rate of intubation in the first attempt.

With the advances in technology, acquisition of skills over novel intubation aids helps in reducing airway management related morbidity and mortality. A manikin study conducted by Maharaj C H et al evaluating Airtraq and Macintosh laryngoscopes in easy and simulated difficult airway scenarios concluded that, Airtraq laryngoscope had rapid acquisition of skills with less time required for intubation and increase in success rate of tracheal intubation.

Conclusion

The novel optical Airtraq laryngoscope provide a better intubation condition with lower Intubation Difficulty Scale(IDS) score, increased ease of intubation, better glottic view and no

marked hemodynamic alterations to laryngoscopy as compared to Macintosh laryngoscope.

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