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Study of Comparison of Standard And English Macintosh Laryngoscope Blades in Patients Undergoing Surgery Under General Anaesthesia.

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Abstract: *For securing airway as for anaesthesia or in intensive care unit we use various type of laryngoscopic blade. Each type has different design and mechanism to aid in normal or difficult airway situation. Macintosh is most commonly used among this and it has two types of designed blade, Standard and English typein this study we compared use of this type of blade in 500adult patient of either sex who are undergoing general anaesthesia for surgery. Parameter studied was Number of attempts of laryngoscopy with one blade, Cormack Lehane grading, Time taken for the attempt, Complications, Haemodynamic parameters duration of laryngoscopy and intubation.*

In this prospective randomized clinical study, we observed that.in normal airway situation both types of blade are comparable in terms of number of attempts, duration of layngoscopy, ease of intubation and hemodynamic changes caused during their use,There is advantage of English blade in difficult laryngoscopy situation over Standard one regarding the laryngoscopic view of glottis and number of attempts required. The efficacy of English blade was found to be more in difficult laryngoscopy situation as compared to the Standard blade.

Keyword: *Macintosh, Standard blade, English blade, Cormack Lehane, Intubation*

I. Introduction

The different types of laryngoscopes give more or less similar results. On occasion considerable technical difficulty is encountered when orotracheal intubation is attempted under direct vision by conventional methods. Unusual anatomic configurations may be encountered when the airway is difficult itself. Difficult intubation remains one of the major risks in anesthetic practice. During anesthesia airway catastrophes can occur due to variety of reasons such as respiratory obstruction, difficult intubation or esophageal intubation. So airway assessment is one of the tools to anticipate difficult airway and manage accordingly.

In a difficult airway situation all conditions should be optimized. Best of the available laryngoscope blades should be used. During past five decades several authors have proposed many types of laryngoscopes such as the levering laryngoscope, obstetrical laryngoscope, mirror laryngoscope, left handed laryngoscope, and blades differing in length and shape. Also various accessories such as bougie, prism, angle adaptorand mirrors as well as various methods of laryngoscopy such as modified straight blade laryngoscopes were tried to overcome the problem of difficult intubation. Various methods such as use of angulated laryngoscope with prism, left molar technique of laryngoscopy using infant size blade, paraglossal straight blade laryngoscopy were tried in the past. There are many studies comparing different types of laryngoscopes in general and in a difficult intubation scenario. To the best of our knowledge only one study is done comparing the two types of Macintosh Laryngoscope blades i.e. Standard (Fig 1) and English(Fig 2). There is slight change in design of these two variant of Macintosh blade. Our study is about comparing these two types of Macintosh laryngoscope blades regarding their differences in glottic view, attempts of laryngoscopy, intubation attempts and haemodynamic changes associated with the individual blade.

II. Materials And Methods

A study was randomized prospectively consisting of 500 patients posted for surgical procedure under general anaesthesia. The Ethics Committee approval was taken to conduct the study. During study each patient was subjected to laryngoscopy twice before intubation to assess the laryngoscopic view.

Inclusion criteria:

1. Age 15-75yrs
2. ASA grade I and II
3. MPC grade I, II and III

Undergoing surgery under general anaesthesia.

Exclusion criteria:

1. Patient's refusal for consent for study.
2. Patients less than 15 years and more than 75 years of age.
3. Patients with ASA III & IV.
4. Patients with MPC Grade IV patients with difficult mask ventilation.
5. Patients with pathology in neck, upper respiratory tract and upper alimentary tract.

Detailed pre-anaesthetic evaluation was done prior to surgery.

History of chief complaints, any systemic medical diseases, any previous surgery and anaesthesia, any addiction, history of any drug intake or drug allergy was evaluated**.** Along with routine general and systemic examination, thorough airway assessment was carried out. It included Inter-incisor gap, MPC- grading T.M. joint mobility, Neck extension, Thyromental distance, Mentosternal distance and condition of teeth i.e. loose, missing, and artificial or bucked teeth.Also routine preoperative investigations like complete blood count, Urine (Routine and Microscopic) or renal and liver function test, Chest X-ray and as per necessity Fasting blood sugar and ECG carried out. All patients were explained about the nature of the study and a written informed valid consent on a separate consent form was taken from the patient and his / her relative. Any queries from patient were cleared. Adequate starvation was confirmed.

If patient fit in the inclusion criteria was included in study. The patients were premedicated with Inj. Glycopyrrolate 4 microgram / kg I.M. half an hour before surgery. After shifting patient on the operating table, pulse and blood pressure were checked and monitors such as cardioscope, pulseoximeter were attached and intravenous access established with 18G-veinflow and intravenous fluid started accordingly. Preoxygenation with 100% oxygen was done for 5 minutes and patients sedated with Inj. Midazolam 0.03 mg/kg I.V. and Inj. Fentanyl 2 mcg/kg I.V. Induction was done using Inj. Propofol 2 mg / Kg I.V. After confirming adequate mask ventilation, neuromuscular blocking agent, Inj. Vecuroniurm 0.1 mg /kg I.V. was given. After mask ventilation with N20+02 (60:40) for 3 minutes and oxygen 100% for one minute, position for laryngoscopy was given.

Laryngoscopy was done with Standard and English Macintosh laryngoscope blades one after another; particular blade was used first in every alternate patient. The blade size was used according to choice of the anesthetist but same size was used for both blades. All laryngoscopy done by second year resident who has one year experience in anaesthesia. Glottic view was seen and classified according to Cormack Lehane grading.[1] The first blade removed, patient is again mask ventilated with 100% oxygen for one minute then second blade, according to the order, was introduced through mouth opening, this time glottis was viewed and trachea was intubated with endotracheal tube of appropriate size. During this procedure the pulse rate, ECG, blood pressure, and oxygen saturation was monitored. After successful endotracheal intubation, the tube attached to the circuit, patient ventilated with 100% oxygen. Tube position confirmed with auscultation of chest and end tidal CO_2 by capnography. Endotracheal tube fixed at appropriate mark. The view of oropharynx before general anaesthesia was defined as difficult when the MPC class was 3. Laryngoscopy was defined as difficult when the view of glottis was grade 3 or 4.

Our main interest was to compare the ease of viewing the glottis between the two types of laryngoscope blades. We considered that there would be a clinically important difference if the view of the glottis is 3 or 4 using one blade but grade 1 or 2 using the other blade.

Things to monitor:

1. Number of attempts of laryngoscopy with one blade and Cormack Lehane grading
2. Time taken for the attempt.
3. Complications.
4. Haemodynamic parameters.

The statistical analysis of the study was carried out by SPSS and GraphPadInstat. ANOVA application, Chi square test, wherever applicable.

III. Result

The mean weight of the patients was 58.3 kg ± standard deviation of 9 kg. It can be observed that out of the 500 patients 340 (68%) patients were males while 160 (32%) were females. Out of the 500 patients 468 patients were ASA class I while 32 were in ASA class II.

Out of the 500 patients studied 347 patients belonged to Mallampati Class I while 145 and 8 patients were in Mallampati Class II and III respectively. 476 patients included in the study had normal dentition whereas 19 patients had multiple missing teeth and 5 patients were edentulous. Neck extension was grade I in

473 patients, grade II in 24 patients and grade III in 3 patients. None of the patients had neck swelling or any other neck pathology.

Table1: Demographic Data

		N	%
Gender	**F**	160	32.0%
	M	340	68.0%
	Total	500	100.0%
MPC	**I**	347	69.4%
	II	145	29.0%
	III	8	1.6%
	Total	500	100.0%
Teeth	**Edentulous**	5	1.0%
	multiple missing	19	3.8%
	Normal	476	95.2%
	Total	500	100.0%
NE (Grade)	**I**	473	94.6%
	II	24	4.8%
	III	3	0.6%%
	Total	500	100.0%
ASA Grade	**I**	468	93.6%
	II	32	6.4%
	Total	500	100.0%

Table 2. Comparison of Cormack Lehane Grade with Standard Blade and Cormack Lehane Grade with English Blade

			ENGLISH CL GRADE		**Total**
			Normal	**Difficult**	
STANDARD BLADE CL GRADE	**Normal**	**Count**	474	5	479
		% within STD CL GRADE	99.0%	1.0%	100.0%
		% within ENGLISH CL GRADE	96.7%	50.0%	95.8%
	Difficult	**Count**	16	5	21
		% within STD CL GRADE	76.2%	23.8%	100.0%
		% within ENGLISH CL GRADE	3.3%	50.0%	4.2%
Total		**Count**	490	10	500
		% within STD CL GRADE	98.0%	2.0%	100.0%
		% within ENGLISH CL GRADE	100.0%	100.0%	100.0%

*** P Value 0.027 (McnemarTest)**

It can be seen that out of the 500, 479 (95.8%) patients had grade I and II of Cormack Lehane grading whereas 21(4.2 %) patients had Cormack Lehane grade III and IV while doing laryngoscopy with standard blade. The Cormack Lehane grade was I and II for 490 (98%) of patients and grade III and IV for 10 (2%) of patients when English blade was used for laryngoscopy. 16 patients found to have difficult laryngoscopic view with Standard blade which showed a nondifficultlaryngoscopic view with English blade. In 5 patients the laryngoscopic view of English was CL III/IV which was nondifficult with Standard blade. This difference in

views with the two types of laryngoscope blades was clinically significant with English blade giving better laryngoscopic view as compared to that given by Standard blade (p=0.027).

Table 3. Comparison of pulse rate

	Mean	S.D	Range	P Value*
Pre Op	80.8	8.7	64 – 108	< 0.0001
Standard Blade	102.3	15.5	64 – 148	0.0137
English Blade	99.9	15.1	67 – 140	
Pre Op	80.8	8.7	64 – 108	< 0.0001

* Calculated by unpaired t-test

Table 4. Comparison of Systolic Blood Pressure (Mm of Hg)

	Mean	S.D	Range	P Value*
Pre Op	117.8	10.7	86 – 150	< 0.0001
Standard Blade	142.1	13.2	104 – 188	0.225
English Blade	141.1	12.6	100 – 174	
PRE OP	117.8	10.7	86 – 150	< 0.0001

*** Calculated by unpaired t-test**

Table 5. Comparison of Diastolic Blood Pressure (Mm of Hg)

	MEAN	S.D	RANGE	P VALUE*
PRE OP	79.2	6.4	60 – 110	< 0.0001
STANDARD BLADE	88.2	7.8	60 – 110	0.7212
ENGLISH BLADE	88.3	7.4	60 - 104	
PRE OP	79.2	6.4	60 – 110	< 0.0001

*** Calculated by unpaired t-test**

It can be seen that there was a significant rise in pulse rate systolic and diastolic blood pressure ($p < 0.0001$) from that of preoperative value while doing laryngoscopy with either of the blades. The difference in pulse rate while doing laryngoscopies with the two blades was also significant with mean pulse rate 102.3 seen with Standard blade while 99.9 seen with English blade ($p = 0.0137$). No difference in blood pressure was seen at the time of laryngoscopies with the two blades (p=0.225 for systolic BP, p= 0.7212 for diastolic BP)

Table 6. Comparison of Time Taken With Standard Blade and English Blade

		Mean Time (Sec)	N	Std. Deviation	Std. Error Mean
	Standard Blade	9.19	500	1.457	.065
	English Blade	9.29	500	1.178	.053

*** p value = 0.110**

The mean time taken for laryngoscopy was 9.19 sec with standard blade and 9.29 sec with English blade. The difference was not significant (p=0.110 by paired sample test).

Table 7. Comparison Of Laryngoscopy Attempts Taken With Standard Blade And English Blade

			Attempts With English Blade		Total
			1	2	
Attempts With Standard Blade	**1**	**Count**	491	1	492
		% Within Standard attempts	99.8%	.2%	100.0%
		% Within Englishattempts	98.4%	100.0%	98.4%
	2	**Count**	8	0	8
		% Within Standard Attempts	100.0%	.0%	100.0%
		% Within English	1.6%	.0%	1.6%

		Attempts			
TOTAL		**Count**	499	1	500
		% Within Standard Attempts	99.8%	.2%	100.0%
		% Within English Attempts	100.0%	100.0%	100.0%

*** p value 0.039 (McNemar Test)**

It can be observed that in 492 (98.4 %) patients laryngoscopy was done in single attempt and 8 (1.6%) patients laryngoscopy required two attempts while using standard blade. On the other hand while using English blade successful laryngoscopy was done in 499 (99.8%) in single attempt whereas only one patient (0.2 %) required second attempt for laryngoscopy. This difference in number of attempts required for successful laryngoscopy was significant with English blade requiring fewer number of attempts as compared to standard blade (p=0.039)

Table 8.Comparison Of Type Of Blade With Number Attempts Taken For Intubation In Difficult Situation (Cormack LehaneGrade Iii And Iv)

			Intubation Blade		**Total**
			English	**Standard**	
Intubation Attempts	**1st**	**Count**	9	10	**19**
		% Within Intubation Attempts	47.4%	52.6%	**100.0%**
		% Within Intubation Blade	75.0%	71.4%	**73.1%**
	2ND	**Count**	3	4	**7**
		% Within Intubation Attempts	42.9%	57.1%	**100.0%**
		% Within Intubation Blade	25.0%	28.6%	**26.9%**
Total		**Count**	**12**	**14**	**26**
		% Within Intubation Attempts	**46.2%**	**53.8%**	**100.0%**
		% Within Intubation Blade	**100.0%**	**100.0%**	**100.0%**

*** p value = 0.596 (Fisher's Exact Test)**

Among26 difficult laryngoscopy patients, 14 patients were intubated with Standard blade and 12 were intubated with English blade. Total numbers of intubations done in patients with difficult grades in first attempt were 19 (73.1%) where as those requiring second attempt were 7 (26.9%). The difference was not significant (p=0.596).

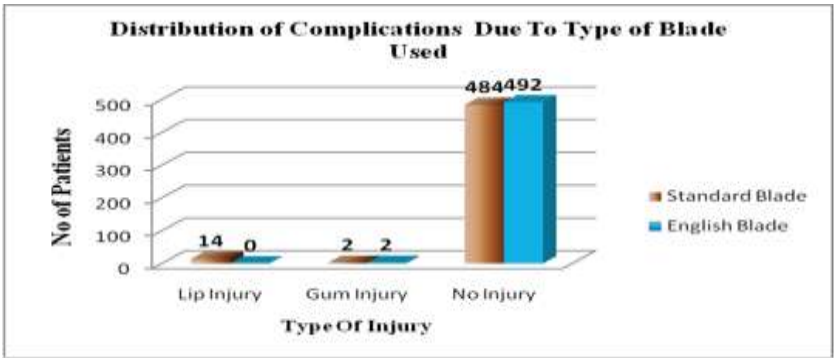
Table 9. Comparison Of Type Of Blade With Number Of Attempts Taken For Intubation

Attempt	**Standard Blade**	**English Blade**
First	245	248
Second	4	3

*** p value 0.723 (Fisher's exact test)**

Table 9 is showing that successful intubation was done in first attempt in 245 (49%) patients while using Standard blade and in 248 (49.6%) patients while using English blade. Second attempt of intubation was required in 4 (0.8%) patients when Standard blade was used and in 3 (0.6%) patients when English blade was used. The difference was not significant (p=0.723).

The number of injuries seen with standard blade was 16 (3.2%) while that with English blade was 6 (1.2%). This difference in the injuries during laryngoscopy with the two blades was not significant (p=1.000, Fisher's exact test).



Graph 1: Complications Due To Type Of Blade

IV. Discussion

It is the primary responsibility of an anesthesiologist to manage the airway under anaesthesia. There are well known disastrous outcomes with failed or difficult tracheal intubation following the induction of general anaesthesia. Macintosh blade is basic tool we use for direct laryngoscopy and studies have shown that we get best glottis view with straight blade but intubation is easy with curved blade.[2] There are currently two major types Macintosh available: the standard and the English type (E type) laryngoscope blades.[3]. The English blade differs from the standard blade in a few aspects (Fig. 1), the English blade is longer, its curve is more continuous across the entire length of the blade, and the height of the blade flange is shorter. The flange of the standard blade ends more abruptly and further away from the tip, whereas the flange of the English blade continues close to the blade tip. In our study we compared the glottic view of both, Standard and English Macintosh laryngoscope blades. Macintosh blade has a curvature which acts as a visual "hill;" interrupting the line of sight, called the "Crest of the Hill" effect. [4]In present study both blades are used in 500 patients one after another for laryngoscopy. There are only two studies to our knowledge comparing these two blades, but a lot of studies have been done comparing glottic view with different types of laryngoscope blades which has different mechanism for visualization of glottis.

In our study 500 patient which fit into inclusion criteria were undergone laryngoscopy with either of the two types of Macintosh, standard or English blade used one after another and final intubation done with blade which was used second. The laryngoscopy was difficult (Cormack Lehane grade III and IV) with at least one blade in 26 (5.2%) patients. Among these 26 patients the laryngoscopy was difficult with English blade in 5 (19.25%) patients, with Standard blade in 16 (61.5%) patients and in 5 (19.25%) patients the laryngoscopy was found to be difficult with both the blades. There was difference in the grade with the blades in 23 (88.5%) patients out of 26. The grades were similar in 3 (11.5) patients with both blades. Among the 23 patients the English blade was better in 18 (78.3%) patients and Standard blade was better in remaining 5 (21.7%) patients. The p value was 0.027 which is significant ($p<0.05$). The incidence of difficult laryngoscopy with English blade was 2% (10 of 500 patients) and for Standard blade the incidence was 4.2% (21 of 500 patients). (Table 2)

T. M. Cook in their study of 177 patients found that the McCoy blade in the neutral position produced a worse view than the Macintosh blade.[5] In the study done by Cheung R W et al, there was no evidence of any worse view with the Macintosh laryngoscope blade as compared to the Flexiblade without activation of lever in both the groups.[20]. But the laryngoscopic views obtained by the Flexiblade after activation of lever were significantly better than Macintosh blade.

D. Sethuramanstudied Dorges, McCoy and Macintosh laryngoscope blades in a simulated difficult intubation scenario.[6]There was a significant difference in Cormack and Lehane scores between the easy and difficult settings for all three blades ($p < 0.001$), but no significant differences between the blades ($p = 0.223$ and $p = 0.135$ for easy and difficult, respectively).

In the study done by Spyros D. Mentzelopoulos, Maria Tzoufi, et al, there was a median increase of 41% in the laryngeal aperture exposure with balloon laryngoscopy. The grade II laryngoscopic views with conventional blade were improved in the form of improvement in the glottic opening exposure and decrease in intubation difficulty score.[7] In the study done by Asai et al, it was found that among 300 patients in 220 patients there was no difference in the laryngoscopic view of the glottis between the two blades.[8] There was difference in the glottic view in 80 patients. Among these 80 patients the view was better in 63 patients using English blade and in remaining 17 patients it was better with Standard blade. Among 300 patients the laryngoscopy was difficult in 42 (14%) patients Out of these 42 patients the difference in the Cormack Lehane grade between the two blades was in 28 patients, English blade was better in 25 (60%) patients and in only 3 (7%) patients the Standard blade was found better than the English blade. The p value was <0.001. This shows that the laryngoscopic view of English blade was significantly better than the Standard blade in patients with difficult laryngoscopy.

As per the anesthesiologist performing laryngoscopy there was no significant difference in the ease of laryngoscopy and intubation between both blades. There was no difference in 81.6% of patients between the two blades. Among the difficult laryngoscopy situations the performer felt that the English blade was better in 78.3% and worse in 19.2% of patients and 21.7% of patients the Standard blade was better than English blade. No maneuvers were used during laryngoscopy to create a better view. There was no difference in the laryngoscopic view in 5 out 26 (19.2%) patients of difficult laryngoscopy.

In the present study the mean time taken for laryngoscopy with Standard blade was 9.19sec and with the English blade it was 9.29secs. Using the paired samples test the p value is 0.110 which shows there is no significant difference in the time taken for laryngoscopy between the two laryngoscopes.

In the study done by Asai et al in 300 patients no second attempt was required for the laryngoscopy with both the blades.[8] In our studyout of 500 laryngoscopies done with English blade, 499 laryngoscopies were done in first attempt and second attempt was required in only 1 patient. Second attempt for laryngoscopy was required in 8 patients with Standard blade and in same patients the laryngoscopy was done in first attempt with the English blade. (Table 7) .The p value was 0.039 which shows significant difference in the attempts required for laryngoscopies. The 1 patient for whom two attempts of English blade were required was a 60 year patient with multiple missing teeth. Among the 8 patients who required second attempt with Standard blade, 7 were associated with difficult laryngoscopy, 3 with multiple missing teeth making introduction of the blade difficult, 3 with neck extension grade III and 2 patients were with difficult oropharyngeal view.

In study done by Asai et al all patients were intubated in one attempt.[8] In the study done by Spyros D. Mentzelopoulos, Maria Tzoufi the range of attempts required in difficult situation with the Macintosh blade was 1 – 3, with Dorges blade 1 – 4 and with McCoy blade it was 1-2. The p value was 0.02 which showed that there was a statistically significant difference in the attempts with the three blades in difficult situation.[7]in our study there was no difference in the attempts of intubation between both the blades with p value 0.723(table 9). Among the 26 difficult laryngoscopy patients 12 were intubated with English blade and 14 with Standard blade. BURP maneuver was used in 5 out of 14 patients intubated with Standard blade; bougie was used in 5 patients to aid intubation. In remaining 4 patients no aid was required but smaller number of endotracheal tube was used to intubate the trachea. Among the12 patients intubated with English blade, 4 patients were intubated using bougie, 4 with BURP maneuver and 4 with a smaller size endotracheal tube.

While using Macintosh blade, the hyoid and vallecula are pushed anteriorly and caudally as compared with the Miller blade which is also studied by Cinefluroscopy[9][10]This also explains why the movement of cervical vertebrae is less with the Miller blade.Thisepiglottis lifting movement is most painful during laryngoscopy and caused marked pressure re4sponce. In the present study in comparison of hemodynamic parameter, there was significant increase in all parameter as compare to baseline values during intubation with both types of blade($p < 0.0001$). The difference in the change in blood pressure with Standard and English laryngoscope blades was not found to be significant with the p value of 0.225 for SBP and 0.7212 for DBP.as we have used weight basis standard dose of induction drug and no specific attempt is made to reduce hemodynamic response it shows that both types of blade gives almost same type of stress response.

Among the patients with laryngoscopy by Standard blade, 14 had lip injury and 2 had gum injury. Evidence of lip injury was in 4 and gum injury in 2 patients with English blade. Thus in 22 patients there was evidence of complication with the laryngoscope blades. ($p=1$; figure 1).

Thus most of our results are in accordance to the previous studies regarding the efficacy of both the blades in non-difficult and in difficult laryngoscopy situations, attempts for laryngoscopy and intubation, time taken for laryngoscopy, changes in the haemodynamic parameters during laryngoscopy with both the blades.

V. Conclusion

Thus there is advantage of English blade in difficult laryngoscopy situation over Standard one regarding the laryngoscopic view of glottis and number of attempts required. The efficacy of English blade was found to be more in difficult laryngoscopy situation as compared to the Standard blade.

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Figure 1: Standard Macintosh blade

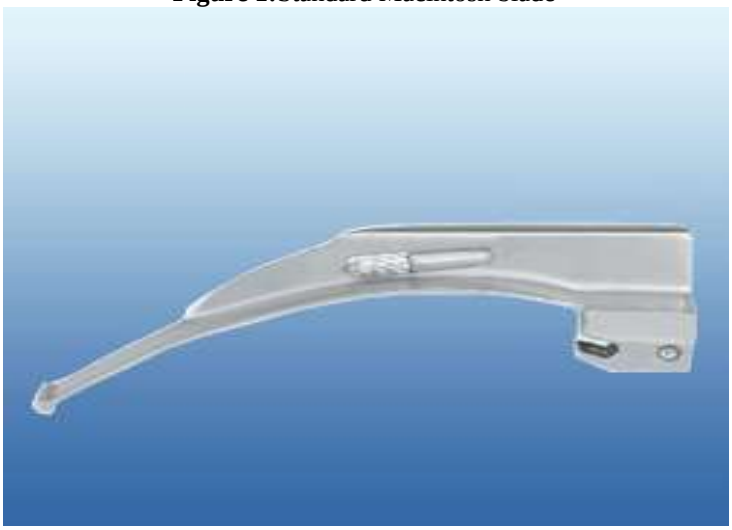

Figure 2: English type Macintosh blade