

## Original Article

**EFFECTIVENESS COMPARISON OF USING *MACINTOSH BLADE* AND *McCoy BLADE* FOR ENDOTRACHEAL INTUBATION IN ANESTHESIA RESIDENTS**Christya Lorena<sup>1</sup> , Agustina Salinding<sup>1a</sup> , Prananda Surya Airlangga<sup>1</sup> <sup>1</sup> Department of Anesthesiology and Reanimation, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia<sup>a</sup> Corresponding Author: [agustina.salinding@fk.unair.ac.id](mailto:agustina.salinding@fk.unair.ac.id)**ABSTRACT**

**Introduction:** Laryngoscopy is one of the critical points in the intubation process and a mechanical trauma that provides noxious stimulation, affecting cardiovascular, respiratory, and intracranial changes. Practitioner competence is a significant factor that supports laryngoscope intubation procedures. That can influence the intubation duration and amount of mechanical trauma besides caused by laryngoscope type. **Objective:** To analyze the effectiveness of using *Macintosh blade* compared to *McCoy blade* in intubation laryngoscopy by Anesthesia Residents. **Materials and Methods:** This research is an experimental study in adult patients who underwent elective surgery at GBPT Dr. Soetomo Hospital. Intubation did by Anesthesia Residents at levels 5-9 using *Macintosh* or *McCoy* Laryngoscope and chosen randomly. The data of laryngeal visualization (*Cormack Lehane*), hemodynamics (blood pressure, pulse), pain scale (*qNOX*), intubation time length, and pain scale data (*VAS*) after extubation were taken during intubation laryngoscope. **Result and Discussion:** The study was conducted on 28 samples that met the criteria. Anesthesia Resident's competence levels based on the semester in both groups laryngoscopes were not different ( $p$  0.868). Based on laryngeal visualization data laryngoscopy, the *McCoy's blade* had better visualization with CL 1 at 85.7% of the samples and  $p$ -value 0.020. This good visualization makes it possible to speed up the laryngoscope-intubation in the *McCoy blade* group with a significant difference of time compared to the *Macintosh blade* group. Hemodynamic parameters, there were significant differences for hemodynamics increase. In the *Macintosh blade* group, the blood pressure and pulse were significantly increased after laryngoscopy intubation. The pain scale during the intubation procedure, which was rated based on the *qNOx* score, showed a significant increase in the *Macintosh blade* group with a  $p$ -value of 0.003. The postoperative pain scale (*VAS*) was smaller in the *McCoy blade* group compared to the *Macintosh* group ( $p$ -value <0.001). **Conclusion:** The ability to use both laryngoscopes at some levels of Anesthesia residents was equally good, and the use of *McCoy Blade* is more effective than *Macintosh Blade* in the intubation laryngoscopy procedure.

**Keywords:** Anesthesia Residents; Effectiveness; *Macintosh Blade*; *McCoy Blade*; Medicine; Laryngoscopy; Intubation**ABSTRAK**

**Pendahuluan:** Laringoskopi menjadi salah satu titik kritis dalam proses intubasi dan merupakan suatu trauma mekanik yang memberikan stimulus *noksius* dan dapat mempengaruhi perubahan respon kardiovaskuler, respirasi, dan intrakranial. Kompetensi praktisi merupakan faktor terbesar dalam mendukung tindakan laringoskopi intubasi karena mempengaruhi durasi dan besar trauma mekanik tindakan selain akibat jenis laringoskop yang digunakan. **Tujuan:** Penelitian ini menganalisis efektivitas penggunaan *blade Macintosh* dibandingkan *blade McCoy* pada tindakan laringoskopi intubasi yang dilakukan oleh PPDS Anestesi **Bahan dan Metode:** Penelitian eksperimental pada pasien dewasa yang menjalani operasi elektif di GBPT RSUD Dr. Soetomo. Intubasi dilakukan oleh PPDS Anestesi semester 5-9 menggunakan *blade Macintosh* atau *McCoy* yang dipilih acak. Data penelitian yang diambil saat tindakan laringoskopi intubasi, yaitu visualisasi laring (*Cormack Lehane*), hemodinamik (tekanan darah, nadi), skala nyeri (*qNOX*), lama waktu intubasi, dan data skala nyeri (*VAS*) pasca ekstubasi. **Hasil dan Pembahasan:** Penelitian dilakukan pada 28 sampel yang memenuhi kriteria. Level kompetensi PPDS Anestesi berdasarkan semester, tidak didapatkan perbedaan yang bermakna pada kedua kelompok laringoskop ( $p$  0.868). Berdasarkan data visualisasi laring (*Cormack Lehane / CL*) saat laringoskopi, didapatkan bahwa *blade McCoy* memiliki CL yang lebih baik, yaitu CL 1 pada 85.7% sampel dan nilai  $p$



0.020. Melalui visualisasi yang baik, maka kecepatan waktu laringoskopi intubasi kelompok *blade McCoy* lebih singkat secara signifikan dibandingkan kelompok *blade Macintosh*. Terdapat perbedaan bermakna dalam kenaikan hemodinamik, yaitu peningkatan tekanan darah dan nadi pada kelompok *blade Macintosh* setelah tindakan laringoskopi intubasi. Skala nyeri selama prosedur intubasi, dinilai berdasarkan nilai qNOX, dan menunjukkan peningkatan yang signifikan pada kelompok *blade Macintosh* dengan nilai  $p < 0.003$ . Pada skala nyeri pasca operasi juga menunjukkan perbedaan yang bermakna, dimana angka VAS lebih kecil pada pengguna *blade McCoy* (nilai  $p < 0.001$ ). **Kesimpulan:** Kemampuan penggunaan kedua laringoskop pada beberapa level PPDS Anestesi sama baiknya dan penggunaan *Blade McCoy* lebih efektif dibandingkan *Blade Macintosh* pada tindakan laringoskopi intubasi.

**Kata Kunci:** PPDS Anestesi; Efektivitas; *Blade Macintosh*; *Blade McCoy*; Kedokteran; Laringoskopi; Intubasi

**Article info:** Received February 1<sup>st</sup> 2021, Received in Revised February 3<sup>rd</sup> 2021, Accepted June 8<sup>th</sup> 2021

## INTRODUCTION

Intubation is the gold standard to secure the airway (1). Laryngoscopy for intubation aims to visualize the anatomy of the larynx and provide illumination of the larynx (2).

Practitioner competence is a significant factor that supports laryngoscope intubation procedures. That can influence the intubation duration and amount of mechanical trauma (3,4).

Some research states that the laryngoscope intubation procedure was done by an experienced anesthetist (5). In experienced hands, 82% of laryngoscopy revealed easy viewing, 16% revealed limited viewing, and 2% revealed complex presentation (1).

The laryngoscopy procedure is one of the critical points in the intubation process because there is a non-oxygenation period during the procedure. This action is a mechanical trauma that provides a noxious stimulation to mechanoreceptors and nociceptors. Then, through the pain pathway, it integrates with the sympathetic system in the spinal cord, brain stem, and center of the brain, providing a neuroendocrine response through reflex responses that affect cardiovascular changes. These changes include hemodynamic responses (increasing blood pressure and pulse, to dysrhythmias)

and changes in respiration (laryngospasm and bronchospasm) (6). In addition, this noxious stimulus perceives as pain at the center of the brain (prefrontal cerebral cortex) called sore throat (7).

The author is the anesthesia residents with mid to high competency level, researched to analyze and compare the effectiveness of *Macintosh* and *McCoy blades* in their use for orotracheal intubation. The comparison of effectiveness assessed was based on visualization, hemodynamic response (changes in blood pressure and pulse), laryngoscopic intubation time, pain scale during laryngoscope intubation, and postoperation sore throat complications.

## MATERIALS AND METHODS

### Research Design and Sample

This research is an experimental study with Single-Blind Randomized, in the operating room of GBPT Dr. Soetomo Hospital Surabaya. It was held from October 2020 to November 2020, and has received approval from the Hospital Ethics Committee (number 0085 / KEPK / X / 2020). The sample collection technique based on the study population that met the inclusion and exclusion criteria. Twenty-eight subjects were randomly grouped and received the same treatment.



The inclusion criteria in this research were adult patients (age 18-65 years), PS ASA 1-2, no sign of difficulty airway, 1-2 mallampati score, and 1-5 hours operation time. The research method was explained to the patient's guardian, and if they were willing to sign the informed consent, the patient would be included as the research subject. The exclusion criteria in this study were patients with anatomical defects in the face, neck, and upper airway; difficult airway signs, limited neck movement, cervical spine abnormalities history and injuries, BMI  $\geq$  30, and surgical procedures in the airway area.

### Data Collecting Methods

The datasheets recorded initial data such as gender, age, BMI, operation time length, PPDS competence. Researched parameters such as laryngeal visualization, duration of intubation, laryngoscopy, blood pressure, pulse, qNOX, and pain scale (VAS) then be recorded in the datasheet for further analysis.

### Statistical Analysis

The research distribution data was carried out by data normality test using the Shapiro-Wilk test. Data with normal distribution were analyzed by independent t-test, and data with abnormal distribution were analyzed using Mann-Whitney test, while categorical data were analyzed using chi-square test. Statistical analysis was performed by using the Statistical Package for Social Sciences (SPSS) v19 software.

## RESULTS AND DISCUSSION

The study involved 28 adult patients with more men than the number of women, which is 18 samples (64.3%) and ten samples (35.7%). The predominant patients age group is 36-45 years (39.3%). Both groups had normal BMI, and the distribution was almost

even in the two groups, namely 21.9 in the *Macintosh* user group and 22.05 in the *McCoy* user group. The distribution of the research population and their demographic characteristics are in table 1.

**Table 1.** Research Subject Demography

Demography Data	<i>Macintosh</i>	<i>McCoy</i>	Percent age	P-Value
<b>Gender</b>				
Male	9	9	64.3 %	1.000*
Female	5	5	35.7 %	
<b>Age (years)</b>				
18-25	1	2	10.7 %	
26-35	4	1	17.9 %	0.170*
36-45	6	5	39.3 %	
46-55	3	2	17.9 %	
56-65	0	4	14.3 %	
<b>BMI</b>	21.9	22	-	0.882**

\* Analyzes by *Chi-Square Test*

\*\* Analyzes by *Independent Sample Test*

Practitioner competence is a factor that supports the procedure, which can influence the intubation duration and amount of mechanical trauma. This research was done by anesthesia residents in mid and high-level competence. There wasn't a significant difference in the ratio of residents' semesters in the two groups (p-value 0.868). These factors are shown in Table 2.

**Table 2.** Factors of Mechanical Trauma in Laryngoscope Intubation

Supporting Factors	<i>Macintosh</i>	<i>McCoy</i>	Percent age	P-Value
<b>Anesthesia Resident Competence (semester)</b>				
5	4	1	17.9	
6	2	4	21.4	
7	1	2	10.7	
8	3	7	35.7	0.868*
9	4	0	14.3	
<b>Length of Operation (second)</b>	232.5	205.00	-	0.158

\* Analyzes by *Man-Whitney Test*

Hemodynamic data (blood pressure and pulse) is the cardiovascular response after mechanical trauma due to laryngoscope intubation. Moreover, The CONOX tool also monitored the changes in consciousness degree (qCON) and pain scale (qNOX) during the procedure. The data presented in table 3.

**Table 3.** Hemodynamic Parameters, qCON, and qNOX After Intubation

Parameters	Group Mean Value		P-value
	McCoy	Macintosh	
SBP (mmHg)	107.86	116.86	0.002**
DBP (mmHg)	63.14 ± 5.112	70.21 ± 7.224	0.006**
▲ N (x/minute)	3.86 ± 4.538	10.36 ± 3.992	< 0.001**
qCON	47.14 ± 3.959	50.07 ± 3.772	0.056*
qNOX	48.57 ± 3.322	53.07 ± 3.970	0.003*
▲ qCON	10.21	18.79	0.006*
▲ qNOX	8.99	20.11	< 0.001*

\* Analyzes by Mann-Whitney Test

\*\* Analyzes by Independent Sample Test

The laryngeal visualization during laryngoscope intubation greatly influences the research process and the data result. In the *McCoy blade* user group, the laryngeal visualization was mostly in CL 1 with 85.7% samples, while in *Macintosh blade* users, the most laryngeal visualization was CL 2 with 64.3% samples. The data presented in table 4.

**Table 4.** Laryngeal Visualization (Cormack Lehane)

Laryngeal Visualization	Group		Total	P-Value
	McCoy (n=14)	Macintosh (n=14)		
CL 1	12 85.7%	5 35.7%	17 60.7%	0.020*
CL2	2 14.3%	9 64.3%	11 39.3%	
<b>Total</b>	14 100%	14 100%	28 100%	

\* Analyzes by Chi-Square Test

This research also assessed the other parameters such as duration of intubation and pain scale after extubation. The group differences significantly in intubation duration between *McCoy blade* users and *Macintosh blades* with a p-value <0.001. In addition, post-extubation pain, which is considered a sore throat, is measured using a scale named VAS (Visual Analogue Scale). The details of the data are shown in table 5.

**Table 5.** Duration of Intubation and VAS

Parameters	Group		P-Value
	McCoy (n=14)	Macintosh (n=14)	
<b>Intubation Duration</b>	8.14 seconds	20.86 seconds	< 0.001
<b>VAS</b>	2	9	< 0.001*

\* Analyzes by Mann-Whitney Test

Intubation is widely used in daily practice (surgery under general anesthesia), emergencies, intensive care, and trauma (1). It is performed at all ages by medical personnel or paramedics who have the skills to perform these procedures.

In this research, the distribution of gender between the two study groups was evenly distributed (p-value > 0.05). There were more men than women in this study because significantly more men underwent surgery. Then, the age characteristics of the two study groups were evenly distributed, with an average age of 41 years old and still in the productive period with high mobility.

The laryngoscope procedure is a critical point because it is a mechanical trauma that becomes a noxious stimulus. That contributes to changes in cardiovascular and respiration, primarily through the reflex response that occurs (6).

Practitioner competence is a significant factor that supports laryngoscope intubation

procedures. The competence can influence the intubation duration and amount of mechanical trauma. Several studies suggest that laryngoscope intubation procedures are performed by experienced anesthesiologists (6).

Hamonangan (8) states that one point of intubation management is the preparation of doctors who have the skill and ability to perform intubation. This intubation management is also necessary because it can affect all parameters in the study related to the noxious stimulation of laryngoscope intubation procedures. Noxious stimuli will produce a neuroendocrine response. This can affect hemodynamic responses, such as blood pressure and pulse increased, to dysrhythmias (6,9). This response can cause fatal conditions in some cases, i.e., patients with the age level of children or the elderly, and patients with the severe comorbid disease, such as heart and blood vessel disorders patients (10).

From the research result, the *Macintosh blade* group has significant hemodynamic changes. This result showed a similar outcome from the previous study by Aggarwal *et al.*, (11). The hemodynamic increases are more significant in the *Macintosh blade* user group than the *McCoy blade* user group.

According to Dorsey *et al.*, (6), the competency of executing the intubation will affect the laryngeal visualization and make it easier for intubation so that the duration of intubation is shorter and side effects from mechanical trauma lesser. Based on the anesthesia resident competency test on performing intubation laryngoscopy, there is no significant difference. We can assume that the trauma that can affect the hemodynamic response in the two-*blade* groups is not different significantly.

There was a significant difference between the two *blade* groups that showed in

laryngeal visualization based on Cormack Lehane (CL), where the *McCoy blade* group had more CL 1 (85.7%) than the *Macintosh blade* group with CL 2 (64.3%). This result was also obtained in Nadkarni *et al.*, (4) where the laryngeal visualization of the *McCoy blade* group was better. The study of Tewari *et al.*, (12) in 2019, showed an increase in epiglottis removal by 70°, making visualization more accessible, and head-neck manipulation not required during laryngoscope intubation.

Furthermore, in the research of Bharti *et al.*, (13), it was found that there was a decrease in visualization based on CL by one degree. Thus, better visualization of the larynx is obtained and can facilitate the laryngoscope intubation procedure in patients with cervical spine abnormalities (limited neck mobilization).

The duration of intubation can also be related to good visualization of the larynx that is present. In a study conducted by Yildirim *et al.*, (14) in three patient group models, the first group is patients with the normal airway. The second is patients with manual cervical stabilization. The third is patients with a normal airway that uses a neck collar. From these experiments, the study gave significantly different results. These results indicate that the *McCoy blade* user group had a shorter incubation time.

However, this result is different from the research Akbarzadeh *et al.*, (15) that found that the intubation time was shorter in the *Macintosh blade* group,  $11.18 \pm 28.44$  compared to the *McCoy blade* group, namely  $14.3 \pm 34.47$ . Then, the research of Aggarwal *et al.*, (11) also obtained a shorter intubation duration in the *Macintosh blade* user group which was influenced by the tool's user experience.

Hemodynamic changes are also influenced by the laryngoscope intubation



length due to the mechanical trauma duration. Yildirim *et al.*, (14) and Altun *et al.*, (16) research also explained that the intervention period of laryngoscope intubation could affect the changes in hemodynamic response. Therefore, a shorter intubation time is expected to minimize the risk of desaturation. This research also found that the intubation duration of the *McCoy blade* group was faster, with the fastest was 12 seconds and the longest was 20 seconds (mean time 16.43 seconds). Meanwhile, Haidry *et al.*, (17) and Buhari *et al.*, (18) stated that there is no evidence of hemodynamic changes in patients using *Macintosh blades* and *McCoy blades* due to short-lived procedures.

The duration of the procedure is also influences the patient's pain scale because it is related to mechanical trauma duration exposure / noxious stimulus. Dorsey *et al.*, (6) further explained that ischemia in the tissue attached to the ETT could happen due to the cuff pressure in the area. The longer the pressure occurs, the broader / heavier the ischemic degree. Based post mortem studies conducted on laryngeal and tracheal specimens, there were pathological cell changes after intubation, including epithelial damage, glottic hematoma, glottic edema, submucosal damage, and granuloma ulcers at the contact site (19).

Moreover, ischemia, cell damage, and stimulation by mechanical trauma can cause the release of inflammatory mediators. The inflammatory mediator will then become a noxious stimulus which is transmitted to the central nerve to the brain and is perceived as pain by Thalamus (7,20).

Significant differences also showed in pain scale data (qNOX) during the laryngoscope intubation. The *McCoy blade* has a hinged tip that is useful to lift the glossoepiglottic higher to make a better

laryngeal visualization and ease the intubation procedure. As such, less mechanical trauma and noxious stimulation are generated. This will reduce the effect of the hemodynamic response and minimize the pain scale (21).

Another pain scale is VAS, which estimated sore throat in this research. The research data obtained showed that the VAS of the *McCoy blade* group was lower (8.75 mm) than the *Macintosh blade* group (20.25 mm). Similar to the research by Altun *et al.*, (16), where the VAS value of the *Macintosh blade* group was higher than the *McCoy blade* group. However, the patient's throat discomforts did not last long. The pain only occurs for few hours to < 24 hours and is usually limited to mild-moderate pain, which disappears without any specific therapy.

In this research, the length of operation was evenly distributed with a value of  $p = 0.158$ . The mean of the surgery in both groups was about 218 minutes. So it is hard to assume that the length of operation influenced the postoperative sore throat differences within two *blade* groups.

Another factor that also affects the duration of intubation is BMI (obesity degree). BMI is related to the changes in airway visualization due to the flab (fat deposit) on the face and neck. It can also affect study parameters changes, such as hemodynamics, length of intubation time, visualization, and pain scale (12).

From this study, there was no significant difference in BMI score between the two *blade* groups with a  $p\text{-value} > 0.05 = 0.882$ . Obesity can affect the length of intubation time because it is associated with manipulation during laryngoscopy.

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## CONCLUSION

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The competence of mid and high-level anesthesia residents in intubation using *McCoy*

*blade and Macintosh blade* is equal. The other result of this research is that the use of the *McCoy blade* is more effective than the *Macintosh blade*. *McCoy blades* can provide better laryngeal visualization, less hemodynamic fluctuation (blood pressure and pulse), pain scale (qNOx) during laryngoscope intubation, and minimize sore throat pain postoperative.

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