

# Comparison of Intubation with Chula Formula Method and Manubrium Sternal Joint (MSJ) Formula against Oxygenation and Sore Throat in General Anaesthesia at Dr. Soetomo General Hospital

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## ABSTRACT

Intubation is a way to free the airway during general anesthesia procedures, but some severe complications can arise from this procedure, such as desaturation up to the cardiac arrest and brain damage. Another complication that can arise from ETT insertion is a sore throat. Optimal Endotracheal Tube (ETT) depth is a significant concern because of complications associated with ETT malposition. By using the right formula, the incidence of sore throat and desaturation can be minimized. This study compared the Chula formula's intubation method and the Manubrium sternal Joint (MSJ) formula against oxygenation and sore throat under general anesthesia. This research is a prospective comparative analytical study carried out on 50 people aged  $\geq 18$ - $\leq 65$  years, with the American Society of Anesthesiology (ASA) I-III, Mallampati score I-II and conducted in Dr. Soetomo General Hospital Surabaya's surgical room from September-October 2020. Subjects were divided into two treatment groups: those with ETT depth measurements

using the formula Chula and groups with Manubrium Sternal Joint (MSJ). Assessment of ETT tip distance to the carina using a Fiberoptic Laryngoscope (FOL), while oxygenation measured by pulse oxymetry and sore throat using a questionnaire. This study showed optimal oxygenation and minimal sore throat incidence in the Chula formula was better than the MSJ technique. Statistical analysis used the Kolmogorov-Smirnov test. The analysis results showed statistically significant differences ( $p < 0.05$ ). This research concludes that the use of the Chula formula results in optimal oxygenation and minimal sore throat.

Keywords: Intubation, Chula formula, MSJ, Sore throat

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## INTRODUCTION

Insertion of an Endotracheal Tube (ETT) is used in airway management to ensure the patient's airway remains clear. This procedure is often performed when the patient is undergoing general anaesthesia, management in the emergency department, and care in an intensive care unit [Rudraraju P et al., 2020]. However, in malposition, some severe complications can arise from this procedure, such as desaturation to heart attack and brain damage [Gomez JC et al., 2016; Varshney M et al., 2011].

Another complication due to the insertion of the ETT is a sore throat. The incidence of sore throat cases ranges from 21% to 71.8%, a hospital in Ethiopia reported 45.6% cases [Fenta E et al., 2020]. Several studies have shown that several factors influence the incidence of sore throat after ETT insertion, such as; women, smoking, difficulty in intubation, use of Suxamethonium, high endotracheal cuff pressure, airway suction, duration of surgery, and prolonged use of a laryngeal mask, mucosal injury due to laryngoscopy, or use of a breath aid device in the pharynx and large endotracheal tube [Fenta E et al., 2020; Mandoe H et al., 1992].

The cause of sore throat after the ETT insertion is unknown for sure but suspected caused by inflammation due to the release of various inflammatory mediators as a local response to cellular damage that affects the sensory nerves tracheal mucosa. However, the anatomical location of a sore throat is still unde-

termined [Fenta E et al., 2020].

To prevent the occurrence of sore throat, ETT positioning plays an important role. ETT is the optimal position when the balloon's proximal end position is located at 2 cm below the vocal cords, and the distal end is located at 2-5 cm from the carina [Pang G et al., 2010]. This position should be maintained to avoid inadvertently extubated and malposition endobronchial [Sharma K et al., 2009; Berry JM et al., 2013].

Definition of desaturation is a state of decreased oxygen saturation  $< 90\%$  of the initial  $SPO_2 > 90\%$  or a decrease from a baseline of less than  $90\%$  [Dunford JV et al., 2003]. Desaturation  $< 70\%$  has the risk of exposing the patient to dysrhythmias, hemodynamic decomposition, hypoxic brain injury, and death [Davis DP et al., 2008]. One of the signs of ETT malposition is the occurrence of desaturation in patients. Regarding management of the airway, intubation failure, difficult or delayed, can potentially create further complications [Cook TM et al., 2012].

Determination of the ideal ETT position can be done in various ways, including the incisor-Manubrium sternal Joint (MSJ) formula. There is a significant linear correlation between the distances of incisor- MSJ with the length of the airway, and therefore this method can be used as a determinant of the accuracy of the depth of ETT. The findings are summarized as a constant length of 21 cm for women and 23 cm for men [Lee BJ et al., 2009; Collins SR et al., 2014].

**MATERIAL AND METHODS**

This study is a prospective comparative analytical study comparing oxygen saturation levels and sore throat after endotracheal intubation in all elective surgery patients using general anesthesia with the Chula formula technique compared to the MSJ technique Integrated Central Surgical Building Dr. Soetomo Surabaya. The study was conducted from September-October 2020.

The inclusion criteria of the subjects of this study were patients aged  $\geq 18$  years  $\leq 65$  years.

Exclusion criteria were signs of a difficult airway (including maxillofacial anatomical abnormalities), congenital disease, and cervical spine injury confirmed positive for COVID-19 or was pregnant.

The drop-out criteria were patients with airway anatomical abnormalities that were not found during the preoperative examination, and the patients were difficult to intubate.

The sample size is determined based on statistical calculations by setting the confidence level of 95% and the power test (power test) 90%. The sample size is determined by the formula for unpaired numerical categorical analytical research. Screening of study subjects was carried out by consecutive sampling adjusted to the inclusion and exclusion criteria. The research subjects consisted of 50 patients, and the choice of using Chula and MSJ formulas was made randomly.

The research operator will receive a verbal explanation and demonstration of endotracheal intubation. The patient's height was obtained from the patient's medical records, and the optimal depth of the ETT was calculated using the formula in the Chula formula group.

The study subjects consisted of 50 patients who were divided into two groups. The first group was MSJ, the second group performed endotracheal intubation with Chula formula, and FOL measured the two groups' ETT depth. Oxygen levels were measured using blood gas analysis, while the scale sore throat was measured by VAS scores in both groups.

**RESULTS AND DISCUSSION**

The determination of the optimal depth of ETT after endotracheal intubation using the MSJ technique was found in all samples, while the success using Chula was 23 out of 25. This shows that the difference was not statistically significant ( $p > 0.05$ ; Table 1). The Chula formula technique to determine the optimal depth of ETT has been widely used in previous studies [Geisser W et al., 2009; Ramsingh D et al., 2016]. The accuracy of the depth of intubation requires practice and relies on the experience of the operator [Ramsingh D et al.,]. The previous study's drawback was a change in head position after endotracheal intubation, which caused a shift in the ETT. In this study, we compared the Chula formula technique with the MSJ technique to determine the optimal depth of the ETT, with additional monitoring of oxygenation and the incidence of sore throat after endotracheal intubation. The ETT tip depth assessment of the carina was carried out using FOL.

**Table 1: Comparison between ETT Depth (cm) and Carina Distance (cm) in MSJ Group and Chula Formula Technique**

Comparison between ETT Depth (cm) and Carina Distance (cm) in Chula Group and MSJ Formula			
Variable	Chula N=25	MSJ N=25	p-value
Distance tip of ETT to the carina			0.490
Shallow (<3cm)	2	0	
Accurate (3-5 cm)	23	25	

The mean oxygen saturation level in the Chula group tended to be higher (98.60%) than the MSJ group (97.00%). This indicates a statistically significant difference ( $p < 0.05$ ; Table 2). This shows that the two formulas can ensure patients receive adequate oxygenation, as we know desaturation below 70% of patients at risk for developing conduct dysrhythmias, hemodynamic decompensation, brain damage due to hypoxia, and death [Weingart SD et al., 2012; Baillard C et al., 2014].

**Table 2: Comparison between Oxygen Saturation in MSJ Group and Chula Formula Technique**

Comparison between Oxygen Saturation in Chula Group and MSJ Formula Technique			
Variable		SpO <sub>2</sub>	p value
	Mean	Std. Deviation	
Chula n=25	98.60	1.041	0.008
MSJ n=25	97.00	1.155	0.006

From the VAS 1 measurement, the lowest sore throat rate was from the MSJ group (12), while the highest score was the same in the two groups (31). At VAS 2, the two groups' lowest pain levels were the same (5), but the pain levels were higher in the MSJ group (16). This suggests that the difference was not statistically significant ( $p > 0.05$ ; Table 3). Sore throat is a common postoperative complaint. After tracheal intubation, the incidence of sore throat varies from 14.4% to 50% [Christensen AM et al., 1994; Harding CJ et al., 1987].

**Table 3: Comparison between VAS (sore throat) in MSJ Group and Chula Formula Technique**

Comparison between VAS (sore throat) in Chula Group and MSJ Formula Technique				
Variable	VAS Score			p-Value
	VAS 1	VAS 2	VAS level changes	
Chula n=25				0.166
Min	14	5	7	
Max	31	15	15	
Mean	19.08	8.72	10.36	
MSJ n=25				0.338
Min	12	5	6	
Max	31	16	15	
Mean	20.52	9.44	11.08	

**CONCLUSION**

The use of the Chula formula technique in oxygenation provides convenience and success compared to the MSJ technique. However, the MSJ technique provides a more successful rate in the optimal depth of ETT. Further research is needed with a larger number of samples and more diverse sample characteristics to assess the optimal depth of ETT, oxygenation, and sore throat in the Indonesian population. Researchers believe that the Chula formula and MSJ can be used side-by-side in daily practice to determine the optimal depth of ETT, oxygenation, and comfort to patients (less pain) in patients about to undergo endotracheal intubation.

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There are several limitations to this study. First, there are only a few samples in this research; therefore, the samples' characteristics are less

diverse. Second, this study relies heavily on the operator's expertise and experience so that it can generate bias.

### CONFLICT OF INTEREST

This study is an independent study without a conflict of interest and has received permission from the Health Research Ethics Committee of Dr. Soetomo Surabaya.

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