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Original Article

Comparison of Intubating Condition of the McGrath® Video Laryngoscope With and Without Muscle Relaxant

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ABSTRACT

Objective: The objectives of this study were to evaluate the intubating conditions using the McGrath® Series 5 Portable Video Laryngoscope (VL) with and without a muscle relaxant.

Material and Methods: This randomized, prospective study was performed in 34 patients with ASA (American Society of Anesthesiologist) I-II who required oroendotracheal tube intubation. The patients were divided into two groups as the rocuronium group and the placebo (saline) group. McGrath® VL intubation was initiated after 90 seconds when the patient was fully relaxed. The primary outcome was the conditions of tracheal intubation between the two groups. The secondary outcome were the success rate of the first intubation attempt, time to intubation, required propofol dosage for intubation, and the anesthetic events during the intraoperative and recovery room periods were evaluated.

Results: Compared to the placebo group, the intubating conditions in the rocuronium group were more acceptable (excellent or good conditions) (88.2 vs. 41.2%; p-value=0.007). There were no significant differences in the success rates of first attempt intubations (16(94.1), 13(76.5); p-value=0.4). In comparison to the rocuronium group, the placebo group required more propofol (218 mg vs. 186 mg; p-value=0.023). The rates of intraoperative and recovery room events were similar.

Conclusion: Overall the intubating conditions when using the McGrath® VL Series 5 Portable Video Laryngoscope using muscle relaxants were more acceptable than when not using muscle relaxants, but there were no significant differences in the number of attempts, time to intubation, and anesthetic events between the study groups.

Keywords: intubating conditions; McGrath®; Muscle relaxants; video laryngoscope

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INTRODUCTION

In general anesthesia, problematic intubation and mask ventilation are often related. In this situation, the American Society of Anesthesiologists 2022 Practice guidelines for management of the Difficult Airway recommend considering anesthetic techniques without muscle relaxation, which allows for a quick recovery to spontaneous ventilation if ventilation becomes insufficient[1].

The McGrath® Series 5 Portable Video Laryngoscope is a new device for tracheal intubation (Aircraft Medical, Edinburgh, UK), which has been shown to be effective in managing both normal and difficult airways. It is a self-contained videolaryngoscope[2,3] using manual in-line stabilization in 88 anaesthesized patients of ASA physical status 1-2. The primary outcome was laryngoscopic view. Secondary outcomes included rates of successful tracheal intubation and complications. A Cormack and Lehane grade-1 or -2 view was found in all patients when using the McGrath compared with 45 (51%, p<0.0001. It has a tiny camera and a light source at the blade's tip, allowing the operator to see the vocal cords and adjacent airway anatomy on an LCD screen connected to the laryngoscope handle[4].

In a previous study about tracheal intubation with GlideScope® using and not using a muscle relaxant, the success rate of GlideScope® intubation was 100% in both the placebo and rocuronium groups. However, the study did not examine other intubating conditions[5].

This study hypothesized that intubating conditions using the McGrath® video laryngoscope would not differ between with and without a muscle relaxant. We carried out a randomized trial to compare intubating conditions using the McGrath® Video Laryngoscope between using and not using muscle relaxants.

MATERIAL AND METHODS

Following by the Human Research Ethics Committee approval (NCT02575716), we recruited 34 patients aged 18-65 years old with American Society of Anesthesiologists physical status I-II who required general anesthesia with oroendotracheal intubation for elective surgery. The exclusion criteria were suspected or known difficult airway, risk of aspiration requiring rapid sequence induction, planned to remain intubated postoperatively, allergic to any of the drugs used in the study, duration of surgery less than 1.5 hours, and renal or hepatic diseases. The main objective was to compare the conditions of tracheal intubation between the two groups. The secondary outcomes were success rate of the first attempted intubation, time to achieve intubation, and the required propofol dose for intubation. We also observed adverse events such as hoarseness, sore throat, bronchospasm, mucosal and dental trauma, hemodynamic events, esophageal intubation, and peripheral oxygen saturation of less than 90%. After obtaining written informed consent, the patients were randomly allocated to one of the two groups, with or without muscle relaxants, using computer-generated numbers enclosed within sealed opaque envelopes.

All patients were premedicated with oral diazepam (0.1-0.2 $mg.kg^{-1}$) about 90 minutes before induction of anesthesia. The patients were pre-oxygenated with 100% oxygen via a tight-fitting mask for 3 minutes. Anesthesia was induced with 1.5 $mg.kg^{-1}$ lidocaine intravenously to blunt laryngeal reflex, followed by 1.5 $mcg.kg^{-1}$ fentanyl intravenously, then 3 minutes later 3 $mg.kg^{-1}$ propofol was injected within 30 seconds. After loss of eyelash reflex and apnea, the patients were ventilated with 100% oxygen and then received either rocuronium (0.6 $mg.kg^{-1}$) for muscle relaxation or normal saline for placebo by the anesthesiologist who opened the envelope. Ninety seconds later, the operator (staff anesthesiologist or second or third-year resident), blinded to the muscle relaxant use, performed the tracheal intubation. According to the study protocol, if the insertion failed on the first attempt because of patient cough or other patient movements, peripheral oxygen desaturation to less than 90%,

or time to intubation more than 120 seconds, the patient would be ventilated with 100% oxygen and given one or more incremental doses of propofol 0.5 $mg.kg^{-1}$ until apnea, no movement, and peripheral oxygen saturation at 100% before the next attempt. If the second attempt failed, it would be recorded as failed intubation with a McGrath® video laryngoscope, and the intubating device would be changed to a Macintosh laryngoscope.

The grading of the intubating conditions was judged by the intubator using a qualitative scoring system described by Viby-Mogensen et al. [6], which included ease of laryngoscopy, position and movement of vocal cords, coughing, and movement of the limbs. Laryngoscopy was classified as easy (jaw relaxed, no resistance to laryngoscope blade), fair (jaw not fully relaxed, slight resistance to blade), or difficult (poor jaw relaxation, active resistance of the patient to laryngoscopy). Vocal cord position and movement were considered as easy (abducted, no movement), good (intermediate, moving), or poor (both are close). Coughing was defined as cough of more than 10 seconds, which was graded as excellent (no cough), good (diaphragm), and poor (sustained). Movement of patients on intubation was regarded as excellent (no movement), good (slight movement), or poor (good muscle tone). Overall, intubating conditions were considered as excellent (if all variables were excellent), good (if all variables were either excellent or good), or poor (if any single variable was assessed as poor). Excellent or good intubating conditions were considered clinically acceptable; poor intubating conditions were defined as clinically not acceptable. Before intubation, all intubator will be taught the intubating condition and assessment. Furthermore, they will attend a workshop to use this device before practicing in the patient.

An independent observer recorded the number of insertion attempts, time to intubation (TTI), and other events. A failed attempt was defined as the removal of the device from the patient's mouth. Time to intubate was recorded as time elapsed between inserting the tip of the McGrath® video laryngoscope into the mouth and visualization of continuous three waveforms capnography. The maximum time provided for each attempt was 120 seconds, and the final time represents the total time of all attempts. The following events were also recorded during the procedure: cough, patient movements, bronchospasm, mucosal or dental trauma, hemodynamic events, esophageal intubation, and peripheral oxygen saturation less than 90%. Postoperatively, hoarseness, sore throat, and laryngeal stridor were recorded in the recovery room after the patient was fully awake and able to answer questions.

Hemodynamic events were defined as any deviation of heart rate or mean arterial blood pressure of more than 30% from baseline values.

Statistical analyses were performed using the R program version 4.0.2. Data were recorded as mean and standard deviation (S.D.) or number and percent (%). The data were analyzed by descriptive statistical terms, and Wilcoxon rank sum test was used to test differences between median values. Pearson's chi-square test or Fisher's exact test was chosen to assess categorical comparisons between the groups. The level of statistical significance was set at $p\text{-value}<0.05$. The power calculation for two-sample proportions of intubating conditions was 98%, with a sample size of 17 in each group.

RESULTS

Thirty-four patients were enrolled into this study. The patient demographic data were statistically not different between the two groups regarding sex, age, weight, height, BMI, ASA classification, Mallampati grade, intubator, grade of laryngoscopic view, and the intubator (Table 1).

Excellent intubating conditions were assessed in 70.6% and 5.9% of the procedures in the rocuronium and placebo groups, respectively ($p\text{-value}<0.001$). Overall intubating conditions were considered acceptable (excellent or good conditions) in 88.2% and 41.2% of the procedures in the

rocuronium and placebo groups, respectively. This difference was statistically significant (p-value=0.007) (Table 2).

Of the 34 patients, only five patients had failed intubation on the first attempt, four in the placebo group by the second-year resident and one in the rocuronium group by the staff (Table 3). The difference in time to intubation [54 (45,65) vs. 66(46,102) seconds; p-value=0.87] for the rocuronium and placebo groups, respectively, was not significantly different. The placebo group received a significantly higher dose of propofol than the rocuronium group (218±44 mg vs. 186±32 mg, (p-value=0.023)).

Hemodynamic responses before and after the McGrath® video laryngoscope insertion are shown in Figures 1 and 2. Pre-insertion heart rates (HR) and mean arterial pressures (MAP) were compared, with no statistically significant differences in between the groups. Post-insertion, there was a statistically differences in HR change for both groups but not for MAP.

No episodes of laryngospasm or oxygen desaturation occurred in either group during the procedures, There was one esophageal intubation in the rocuronium group, but without desaturation, and then the endotracheal tube

Table 1 Patient demographic data

Parameter	Rocuronium (n =17)	Placebo (n=17)	p-value
Sex			1.0
Male	7 (41.2)	7 (41.2)	
Female	10 (58.8)	10 (58.8)	
Age (years)	41.6 ± 12.3	39.8 ± 13.1	0.67
BMI ($kg.m^{-2}$)	24.9 ± 3.1	23.5 ± 3.8	0.25
ASA classification			1.0
I	6 (35.3)	6 (35.3)	
II	11 (64.7)	11 (64.7)	
Mallampati class			0.73
I	9 (52.9)	9 (52.9)	
II	8 (47.1)	8 (47.1)	
Laryngoscopic view grade			0.18
I	14 (82.4)	9 (52.9)	
II	2 (11.8)	6 (35.3)	
III	1 (5.9)	2 (11.8)	
Intubator			1.0
Resident II	7 (41.2)	7 (41.2)	
Resident III	2 (11.8)	3 (17.6)	
Staff	8 (47.1)	7 (41.2)	

Data are presented as number (%); mean±S.D.
IQR=interquartile range; S.D.=standard deviation; BMI=body mass index; ASA=American Society of Anesthesiology

was withdrawn and reinserted successfully on the second attempt. Bronchospasm occurred in one patient in the rocuronium group. However, there were no significant differences in overall intraoperative complications (Table 4).

DISCUSSION

This study examined the intubating conditions of the McGrath® video laryngoscope in patients with and without muscle relaxants. The conditions with muscle relaxants were more acceptable. Although the McGrath® video laryngoscope seemed to stimulate airway reflexes less than the Macintosh blade, the number of intubation attempts and time to intubation were not significantly different between the groups, similar to a previous study[5]. One patient in the rocuronium group was mistakenly intubated into the esophagus during the first attempt despite

Table 2 Comparison of Intubating condition between the rocuronium and the placebo groups

Parameter	Rocuronium (n=17)	Placebo (n=17)	p-value
Intubating condition			<0.001
Excellent	12 (70.6)	1 (5.9)	
Good	3 (17.6)	6 (35.3)	
Poor	2 (11.8)	10 (58.8)	
Clinically acceptance			0.012
Acceptable	15 (88.2)	7 (41.2)	
Not acceptable	2 (11.8)	10 (58.8)	

Data are presented as number (%)

Table 3 Comparison of the groups in terms of number of intubation attempts, time to intubation and total dose of propofol

Parameter	Rocuronium (n=17)	Placebo (n=17)	p-value
Number of attempts			0.4
1	16 (94.1)	13 (76.5)	
2	1 (5.9)	2 (11.8)	
>2	0	2 (11.8)	
Time to intubation (seconds), median (IQR)	54 (45,65)	66 (46, 102)	0.448
Dose of propofol, mg, mean (S.D.)	186.8 (32.3)	217.5 (44.2)	0.023

Data are presented as number (%); IQR=interquartile range; S.D.=standard deviation

Table 4 Intraoperative and recovery room events

Events	Rocuronium (n =17)	Placebo (n=17)	p-value
Bronchospasm	1 (5.9)	0 (0)	1.0
Mucosal or dental trauma	2 (11.8)	3 (17.6)	1.0
Esophageal intubation	1 (5.9)	0 (0)	1.0
Hoarseness	6 (35.3)	9 (52.9)	0.49
Sore throat	9 (52.9)	10 (58.8)	1.0
Laryngeal stridor	1 (5.9)	0 (0)	1.0

Data are presented as number (%)

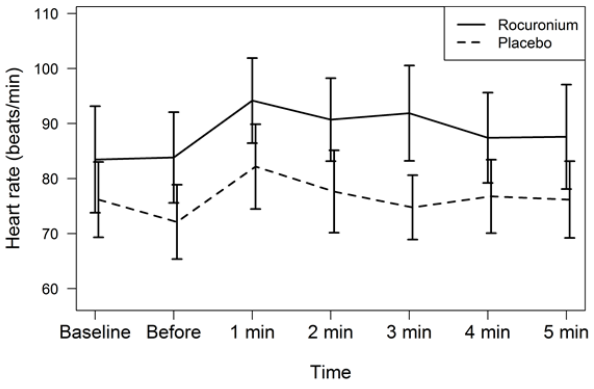

Figure 1 Heart rate responses before and after insertion of a McGrath® video laryngoscope (mean and 95% confidence interval). There were significant diferences only after 1, 2, 3, 4 and 5 minutes of insertion (p-value<0.05).

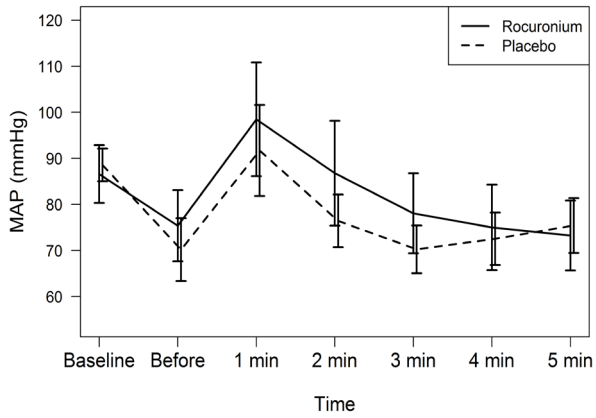

Figure 2 Responses in mean arterial pressure before and after insertion of McGrath® video laryngo scope (mean and 95% confidence interval). No significant differences were seen (p-value >0.05).

appropriate intubating conditions. This was thought to be from a lack of a dequate experience with the device although all intubators had some experience to use this device because all intubators had attended a workshop to use this device before intubation with the patient. A study by Walker et al. Found that inexperienced anesthetists performing intubation with the McGrath® video laryngo-scope took a longer time for successful intubation, but there were no differences in success rates[7].

A propofol dose of 3 mg/kg was chosen to achieve an adequate depth of anesthesia for tracheal intubation and reduce hemodynamic instability. The study found that patients without a muscle relaxant required a significantly higher dose of propofol. This higher dose of propofol may help deepen the patient's level of anesthesia and enhance the appropriate conditions for intubation, resulting in an equal number of intubation attempts and time to intuba-tion for both groups. This finding was similar to previous studies that found higher propofol doses associated with improved intubation conditions[5,8].

Using a stylet with a relatively pronounced curve (the best angle is reported to be 90°)[9,10] at the distal end was most helpful in advancing the tip of the ETT into the glottic opening with a GlideScope®. In the study, we used the stylet of the GlideScope® to help in ETT insertion because the blades of the GlideScope® and McGrath® video laryngoscope have been claimed to have the same curve. Nevertheless, two patients in the placebo group had two occurrences of failed intubation. The alignment of the curve was not favorable for one patient and the anesthetist was unable to pass the ETT past the vocal cords (laryngoscopic view grade 2 by McGrath® video laryngoscope), while the second patient had been difficult intubation by a McGrath® video laryngoscope and was successfully managed by a conventional laryngoscope with a Macintosh blade No 3. For some patients with a normal airway using a McGrath® video laryngoscope may be dif-ficult this is a reason why the Macintosh blade is better than the Macintosh blade. Furthermore, the experience of intubator is important for intubation skill for the new device. However, McGrath® video laryngoscope is a portable device and easy to move when used in the outside operating room compared to GlideScope®, so we think that it is useful for patients with a normal or difficult airway.

There was one case of bronchospasm and one esophageal intubation in the rocuronium group, while the placebo group had no problems. The lack of statistical significance was due to an inadequate number of patients in the study for these complications to occur and their clinical significance. There were no differences in other intraoperative and recovery room events such as laryn-gospasm, mucosal or dental trauma, peripheral oxygen saturation less than 90%, hoarseness, sore throat, or laryngeal stridor. There were no differences in the number of cardiovascular side effects such as hypotension despite the differences in the dose of propofol. The average post-insertion heart rate in the rocuronium group was significantly higher than in the placebo group, whichcould bedue to less propofol being used to blunt laryngeal reflex. However,

pre-insertion heart rate, pre-insertion MAP, and post-insertion MAP were not significantly different between the groups.

There were some limitations to this study. Inexperience in using the McGrath® video laryngoscope may have worsened the intubating conditions or made the intubations more complex, resulting in a longer time to intubation and a poor success rate.

CONCLUSION

The intubating conditions when using the McGrath® video laryngoscope with muscle relaxants were more acceptable than when not using muscle relaxants in terms of the number of attempts required, time to intubation. However the McGrath® video laryngoscope can be an option for difficult intubation because when muscle relaxants may be harmful. The procedure requires an experienced anesthesiologist to achieve better results.

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CONFLICT OF INTEREST

There are no conflicts of interest that should be declared.

REFERENCES

1. Apfelbaum JL, Hagberg CA, Connis RT, Abdelmalak BB, Agarkar M, Dutton RP, et al. 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. Anesthesiology 2022;136:31–81.
2. Taylor AM, Peck M, Launcelott S, Hung OR, Law JA, Mac Quarrie K, et al. The McGrath® Series 5 videolaryngoscope vs the Macintosh laryngoscope: a randomised, controlled trial in patients with a simulated difficult airway. Anaesthesia 2013;68:142–7.
3. Sargin M, Uluer MS. Comparison of McGrath(®) Series 5 video laryngoscope with Macintosh laryngoscope: A prospective, randomised trial in patients with normal airways. Pak J Med Sci 2016;32:869–74.
4. Jeon WJ, Kim KH, Yeom JH, Bang MR, Hong JB, Cho SY. A comparison of the Glidescope® to the McGrath® videolaryngoscope in patients. Korean J Anesthesiol 2011;61:19–23.
5. Leissner KB, Beutler S, Bigatello L, Srinivasa V. GlideScope® Tracheal Intubation with and without Muscle Relaxation: A Prospective, Randomized Clinical Trial. Open Anesth J [serial on the Internet]. 2013 [cited 2022 Jun 13];7:5-11. Available from:https://openanesthesiajournal.com/VOLUME/7/PAGE/5/
6. Viby-Mogensen J, Engbaek J, Eriksson LI, Gramstad L, Jensen E, Jensen FS, et al. Good clinical research practice (GCRP) in pharmacodynamic studies of neuromuscular blocking agents. Acta Anaesthesiol Scand 1996;40:59–74.
7. Walker L, Brampton W, Halai M, Hoy C, Lee E, Scott I, et al. Randomized controlled trial of intubation with the McGrath Series 5 videolaryngoscope by inexperienced anaesthetists. Br J Anaesth 2009;103:440–5.
8. Bouvet L, Stoian A, Jacquot-Laperrière S, Allaouchiche B, Chassard D, Boselli E. Laryngeal injuries and intubating con ditions with or without muscular relaxation: an equivalence study. Can J Anaesth 2008;55:674–84.
9. Jones PM, Turkstra TP, Armstrong KP, Armstrong PM, Cherry RA, Hoogstra J, et al. Effect of stylet angulation and endotra cheal tube camber on time to intubation with the GlideScope. Can J Anaesth 2007;54:21–7.
10. Turkstra TP, Harle CC, Armstrong KP, Armstrong PM, Cherry RA, Hoogstra J, et al. The GlideScope-specific rigid stylet and standard malleable stylet are equally effective for Glide Scope use. Can J Anaesth 2007;54:891–6.