Comparison of Intubation Time with GlideScope® and McIntosh Laryngoscope in Obese Patients

Wirat Wasinwong MD*, Vimana Pukdeetanakul MD*,
Orarat Kanchanawanitkul MD*, Bussarin Sriyannaluk BNs*

** Department of Anesthesia, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla, Thailand*

Background: *Difficult intubation is more frequent in obese than in lean patients. The GlideScope® is a videolaryngoscope that provides a laryngoscopic view equal to or better than a direct laryngoscope in non-obese patients.*
Objective: *To compare the intubation time between the GlideScope® and the McIntosh laryngoscope in obese patients.*
Material and Method: *The authors randomly allocated 46 obese patients (BMI >28 kg/m^2) with the American Society of Anesthesiologists physical status I to III, scheduled for elective surgery under general anesthesia with oroendotracheal intubation into either the McIntosh group (Group M) or the GlideScope® group (Group G). The age range was 18 to 65 years old. Intubation was performed by anesthetic residents with experience in the use of the GlideScope® at least 10 times. The intubation time, the laryngoscopic view, the number of intubations and success rate, the number of optimizing maneuvers, vital signs, and complications from intubation were recorded.*
Results: *The intubation time in Group G (31 seconds) was not different from Group M (29 seconds). There was a significant difference in laryngoscopic view between the two groups. The laryngoscopic view was grade 2 in Group M and was grade 1 in Group G (p = 0.007). All patients in Group G were successfully intubated in the first attempt. There were two patients in Group M who needed more than one attempt. One of these needed a second intubation and another one was successful on the third attempt with the GlideScope®. However, there was no statistical significance in the overall success rate. The heart rate, blood pressure and complications were not statistically different.*
Conclusion: *The intubation time and the success rate between the McIntosh blade and GlideScope® in obese patients was not significantly different. Nevertheless, the GlideScope® provided a better laryngoscopic view than the McIntosh blade.*

Keywords: *GlideScope®, Videolaryngoscope, Obese patients, Intubation time*

J Med Assoc Thai 2017; 100 (3): 306-12
Full text. e-Journal: *http://www.jmatonline.com*

Obesity has become one of the most important public health problems. Difficult airway management was reported in 13 to 20% of obese patients with a higher grade of laryngoscopic view[1]. Hypoxia is often observed due to faster desaturation during induction of anesthesia in this group of patients[2]. Difficult tracheal intubation is more frequent in obese than in lean patients[3]. Recently, video-assisted intubation devices have been developed. Videolaryngoscope offers superior view of the glottis compared with a standard direct laryngoscope in non-obese patients[4]. The GlideScope® is a videolaryngoscope with a high-resolution camera and a light source embedded within the blade for illumination. The GlideScope® blade differs from a standard laryngoscope blade in shape which has a 60° midline angle and width of 18 mm at any point. Previous trials demonstrated that the GlideScope® provided a laryngoscopic view equal to or better than a direct laryngoscope in non-obese patients[5,6]. It was shown to have significant higher success rate of intubation with untrained medical personnel[7]. In morbidly obese patients, use of a videolaryngoscope improved the laryngoscopic view in comparison with direct vision[8]. The objective of the present study was to compare the intubation time between the GlideScope® and the standard McIntosh laryngoscope in obese patients.

Correspondence to:
Wasinwong W, Department of Anesthesia, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand.
Phone: +66-74-451651-2, Fax: +66-74-429621
E-mail: wwasinwong@hotmail.com

Material and Method

Approval was obtained from the Institutional Ethics Committee and all patients provided written informed consent. Forty-six obese patients (BMI >28 kg/m^2), aged 18 to 65 years old with the American Society of Anesthesiologists physical status I to III, undergoing elective surgery under general anesthesia with oroendotracheal intubation were prospectively enrolled in the study from December 2010 to June 2011. Exclusion criteria included: the patients with a history of difficult airway or probable difficult airway

after assessment by trained anesthesiologists, unstable cervical spine, contraindication for succinylcholine, dental problems that may impact intubation, risk of pulmonary aspiration, full stomach, or patients who needed rapid sequence induction. All patients received no premedication and fasted at least 8 hours. Preoperative data included age, gender, weight, height, body mass index (BMI), evidence of snoring or obstructive sleep apnea, airway assessment including interincisor distance, thyromental distance, neck circumference, neck extension and flexion, jaw gliding ability, Mallampati score, and other medical diseases. Preoperative airway assessment was performed by an attending anesthetic resident. The patients were divided in two groups by means of random numbers generated by a computer into the standard McIntosh blade group (Group M) and the GlideScope® group (Group G). Endotracheal tubes with inner diameters of 8.0 mm and 7.5 mm for males and females were prepared. A stylet guide was used in each patient (GlideScope® stylet in the GlideScope® group).

Every patient was routinely monitored with non-invasive blood pressure, electrocardiography, oxygen saturation (SpO_2), and capnography ($EtCO_2$). The patients were supine in the sniffing position. Pre-oxygenation with a tight face mask was given for 5 minutes before administration of intravenous propofol 2 to 2.5 mg/kg based on an estimated 120% ideal body weight. Manual mask ventilation and inflation of the lungs was attempted via face mask and then succinylcholine 1.5 mg/kg was administered intravenously. Intubation was performed by second year anesthesia residents who had experience in the use of the GlideScope® at least 10 times. Intubation may be enhanced by external laryngeal manipulation which was also recorded.

If the laryngeal aperture was not visualized and the endotracheal tube could not pass into the trachea after two attempts, it was considered to be a device failure. In this scenario, another attempt of intubation with another device was then performed. In the event that neither device resulted in a successful intubation, the algorithm for a failed intubation was followed. The intubation time was defined as the time from passing the blade through the patient's lips until the $EtCO_2$ curve was shown on the capnograph. The laryngoscopic view (Cormack and Lehane grade), number of intubations and success rates, number of optimizing maneuvers, blood pressure, heart rate and SpO_2 were recorded. Complications from intubations that occurred intra-operatively and postoperatively were also recorded.

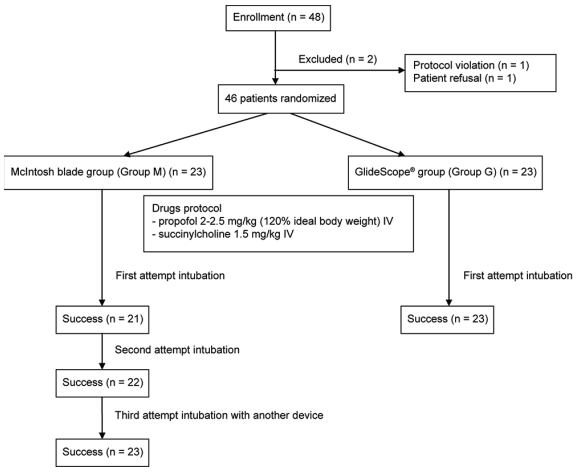

Fig. 1 Flowchart for a prospective, randomized, double-blind comparison of intubation time with GlideScope® and McIntosh laryngoscopes in obese patients.

Statistical analysis

A sample size of 23 in each group was calculated to detect a difference in intubation times between the two devices of more than 20 seconds, which is based on two previous studies[9,10]. The statistical analysis was performed using the R 2.11.1 software. Fisher's exact test was used for categorical data. The independent sample t-test was used for normal distribution data and the Wilcoxon Rank Sum test for data which was non-normal distribution. The hemodynamic parameters (mean arterial pressures and heart rates) were analyzed by the fit Generalized Estimating Equations. All tests were 2-tailed, and $p<0.05$ was set as the threshold for statistical significance.

Results

Forty-eight patients were enrolled in the present study, but two were excluded because one had a protocol violation and another refused to participate. All of the 46 patients were analyzed. The baseline patient's characteristics were shown in Table 1. There was no statistically significant difference between the two groups except for the interincisor distance which was 4.5 cm in Group M and 4 cm in Group G ($p = 0.02$).

The difference in the intubation time between the two groups was not significant. The mean intubation time was 29 seconds in Group M and 31 seconds in Group G, but more variations of data were found in Group M (12 to 143 seconds) than in Group G (18 to 75 seconds). There were two patients in Group M that

required an intubation time more than 60 seconds (107 and 143 seconds) and one patient in Group G (75 seconds).

All patients in Group G were intubated successfully in one attempt. There were 2 patients in Group M who needed more than one attempt. One of these was intubated successfully with the second attempt and the other was considered to be a device failure on the second attempt but then was successfully intubated in the third attempt with the GlideScope®. The intubation time in the patient who had the device failure was analyzed in the original group (intention-to-treat). However, there was no statistical significance in terms of the number of intubations and intubation times. The number of intubations, laryngoscopic view, use of external laryngeal manipulation, and complications were shown in Table 2.

There was a significant difference in laryngoscopic view between the two groups. Laryngoscopic view was grade 2 in Group M and grade 1 in Group G (p = 0.007). The heart rate and mean arterial blood pressure changes were not statistically different between the two groups (Fig. 2, 3). Nevertheless, in both groups, the mean arterial pressure increased at the intubation time and decreased at the induction and at 3 to 5 minutes after intubation significantly compared to the baseline mean arterial pressure (Fig. 2). None of the patients in either group developed hypoxia during the induction and intubation periods.

Discussion

In the present study, the intubation time using the GlideScope® was not significantly different from the standard McIntosh blade (31 vs. 29 seconds). The reason might be that the patients enrolled in our study were within the wide range of obesity (BMI range 28.3 to 55.9 kg/m^2) and only 9 in 46 patients (19.5%)

Table 1. Baseline patient characteristics

	Group M (n = 23)	Group G (n = 23)	p-value
Sex (male/female), n	3/20	3/20	1
Age (year), mean (SD)	49.3 (9.2)	49.2 (10.2)	0.98
Weight (kg), mean (SD)	82.5 (13.7)	81.7 (12.5)	0.86
Body mass index (kg/m^2), mean (SD)	33.4 (5.4)	33.3 (3.8)	0.66
Co-morbidities, n	13	11	0.27
Diabetes mellitus	0	3	
Hypertension	6	5	
Dyslipidemia	1	0	
Others	6	3	
History of snoring, n (%)	19 (82.6)	18 (78.3)	1
History of obstructive sleep apnea, n (%)	2 (8.7)	4 (17.4)	0.66
Mallampati score, median (range)	2 (1 to 3)	3 (1 to 3)	0.14
Interincisor distance (cm), median (range)	4.5 (4 to 6)	4 (3.5 to 5)	0.02
Thyromental distance (cm), median (range)	8 (7 to 10)	8 (6 to 9)	0.45
Neck circumference (cm), median (range)	37 (33 to 46)	37 (33 to 45)	1
Ability of gliding jaw (grade 1 to 3), median (range)	1 (1 to 3)	2 (1 to 3)	0.19

Table 2. Comparison of oroendotracheal intubation and complications between the GlideScope® and the McIntosh laryngoscope groups

	Group M (n = 23)	Group G (n = 23)	p-value
Intubation time (second)	29 (12 to 143)	31 (18 to 75)	0.46
Number of intubations	1 (1 to 3)	1	0.16
Laryngoscopic view	2 (1 to 3)	1 (1 to 2)	0.007
Use of external laryngeal manipulation	4 (17.4)	2 (8.7)	0.66
Complications (sore throat, hoarseness, minimal bleeding)	12 (52.2)	9 (39.1)	0.55

Values are presented with median (range) or number (%)

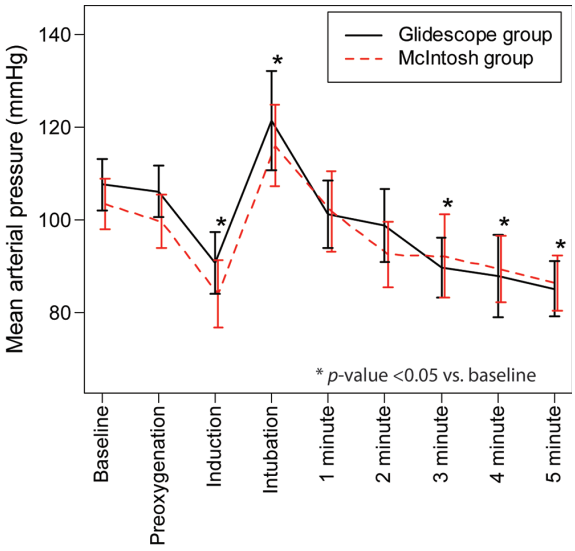

Fig. 2 Comparison of mean arterial pressure changes during intubation period between the GlideScope® and McIntosh laryngoscope groups.

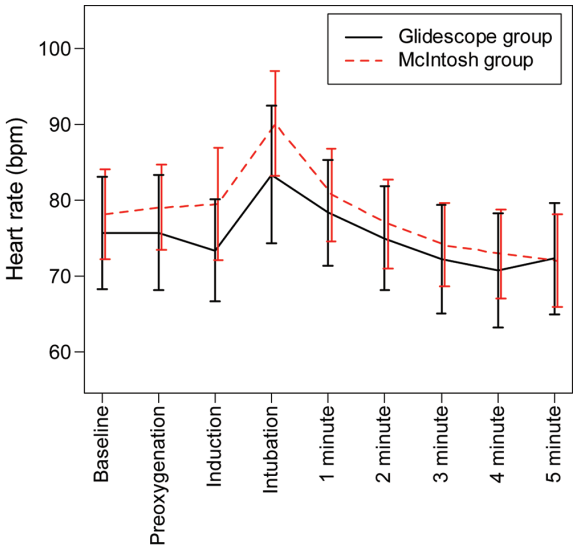

Fig. 3 Comparison of heart rates during intubation period between the GlideScope® and McIntosh laryngoscope groups.

had BMI more than 35 kg/m^2. The mean value of the BMI in both groups was 33 kg/m^2 which was not morbidly obese. A previous study demonstrated that in the simulated easy laryngoscopic scenarios, the anesthetists took longer to intubate using the GlideScope® than the McIntosh laryngoscope but they took less time and found intubation easier with the GlideScope® in the simulated difficult laryngoscopy[11].

For our patients, even though the interincisor distance was statistically different between the groups (4.5 cm in Group M and 4.0 cm in Group G), it was considered to be non-significant in clinical difference. Normally, an interincisor gap greater than 3 cm is adequate and less likely to impact intubation. Wilson et al also reported that the mean interincisor gap was less than 3.8 cm in the patients with difficult intubation[12]. Other baseline patient airway evaluations were also not statistically different. However, patients in the GlideScope® group were more likely to have a difficult airway than the McIntosh group because they had a higher Mallampati score (grade 3 and 2) and a higher grade of gliding jaw (grade 2 and 1).

We also found that the GlideScope® provided better laryngoscopic view than the standard McIntosh blade in obese patients. This finding was compatible with the previous studies[6,7,11,13]. All patients in the GlideScope® group had a laryngoscopic view grade 1 to 2. Three patients in the McIntosh group had a laryngoscopic view grade 3 but were successfully intubated by passing the endotracheal tube under the epiglottis. One patient in the McIntosh group was considered to be a device failure due to an anterior/high vocal cord with laryngoscopic grade 3 even using external laryngeal manipulation in the first and second attempts. His BMI was 30.2 kg/m^2 with unremarkable airway assessment preoperatively except Mallampati class 3. He was then intubated successfully by the GlideScope® with a laryngoscopic view grade 2 in the third attempt. In the situation of a difficult intubation including, but not limited to, anterior/high vocal cord, it was found that the GlideScope® provided a better laryngoscopic view than the standard McIntosh blade in a difficult laryngoscopy[11,13].

The success rate of intubation in our study was not statistically different between the groups (100% in Group G and 91% in Group M). Most of our obese patients in the McIntosh group did not have difficult airway, therefore they were not difficult to intubate. The patients' characteristics of airway assessment in the GlideScope® group were more prone to be a difficult airway but the intubation did not take more time than in the McIntosh group. Additionally, the maximum duration of intubation time in McIntosh group (143 seconds) was twice as long as the GlideScope® group (75 seconds). The usage of external laryngeal manipulation was likely to be lower in the GlideScope® group even though there was no statistical difference. This also supported the benefits of a GlideScope® laryngoscopy. Juvin et al studied the rate of difficult intubation in 129 obese (BMI ≥35 kg/m^2) and 134 lean

(BMI <30 kg/m^2) patients[3]. The patients in the obese group were morbidly obese (BMI = 45.9±7.1 kg/m^2) and had a higher rate of difficult intubation (15.5%) than the lean patients (2.2%). However, some studies reported that obesity was not an independent risk factor for difficult intubations[14,15]. The duration of intubation time with the GlideScope® in our patients (31 seconds) was similar to two previous studies (33±9 and 33±18 seconds)[9,16].

The mean arterial blood pressure changes significantly at the time of induction, intubation and then returned to baseline in both groups. The hemodynamic changes of the patients in both groups did not have statistical difference during the endotracheal intubation. The stimulation of the airway by laryngoscopy with both devices within a non-significant difference in the duration of intubation time may be the reason for the similarity in hemodynamic changes. There was neither hypoxia nor other serious complications in the present study except sore throat (43%), hoarseness (33%) and minimal airway bleeding (9%).

The present study had some limitations. The first one is the low severity of obesity in our patients which may have a low incidence of difficult airway. Secondly, we also could not control the intubating position due to the wide range of degrees of obesity. Finally, the anesthesiologists who performed the endotracheal intubation could not be blinded because the GlideScope® and McIntosh laryngoscopes differ in structure. But since our primary outcome was a clearly defined intubation time this may reduce this bias.

Conclusion

The intubation time and the success rate between the standard McIntosh blade and the GlideScope® in obese patients was not statistically different. Neverthelesss, the GlideScope® provides a better laryngoscopic view than the standard McIntosh blade.

What is already known on this topic?

Cardiac arrest from hypoxia is the most serious catastrophe of the endotracheal intubation. Videolaryngocope is a useful equipment in the difficult airway situation because it provides a better laryngocopic view than standard McIntosh laryngoscopy in difficult airway patients such as morbid obesity. However, incidences of difficult intubation in obese patients are varies among reports and the obesity may not the only independent factor of difficult airway.

What this study adds?

GlideScope® videolaryngoscopy does not reduce intubation time. This was supported by many studies but it still provides the higher success rate of endotracheal intubation in obese patients. In the clinical practice, when the clinicians encounter the patients at risk of difficult airway, difficult airway management must be concerned and well prepared. In the "Practice Guideline for the management of difficult airway: an updated report by the Task Force on Difficult Airway Management 2013" also recommended to prepare video-assisted laryngoscopy as an alternative technique or initial approach for intubation in difficult airway algorithm.

Funding disclosure

This study was supported by Songklanagarind Hospital, Department of Anesthesia, Faculty of Medicine, Prince of Songkla University, Thailand.

Potential conflicts of interest

None.

References

1. Voyagis GS, Kyriakis KP, Dimitriou V, Vrettou I. Value of oropharyngeal Mallampati classification in predicting difficult laryngoscopy among obese patients. Eur J Anaesthesiol 1998; 15: 330-4.
2. Schröder T, Nolte M, Kox WJ, Spies C. Anesthesia in extreme obesity. Herz 2001; 26: 222-8.
3. Juvin P, Lavaut E, Dupont H, Lefevre P, Demetriou M, Dumoulin JL, et al. Difficult tracheal intubation is more common in obese than in lean patients. Anesth Analg 2003; 97: 595-600.
4. Kaplan MB, Hagberg CA, Ward DS, Brambrink A, Chhibber AK, Heidegger T, et al. Comparison of direct and video-assisted views of the larynx during routine intubation. J Clin Anesth 2006; 18: 357-62.
5. Li JB, Wang XL, Xiong YC, Fan XH, Liu Y, Xu H, et al. A comparison of GlideScope videolaryngoscope with Macintosh laryngoscope for laryngeal views. Journal of Medical Colleges of PLA 2007; 22: 54-8.
6. Sun DA, Warriner CB, Parsons DG, Klein R, Umedaly HS, Moult M. The GlideScope Video Laryngoscope: randomized clinical trial in 200 patients. Br J Anaesth 2005; 94: 381-4.

7. Nouruzi-Sedeh P, Schumann M, Groeben H. Laryngoscopy via Macintosh blade versus GlideScope: success rate and time for endotracheal intubation in untrained medical personnel. Anesthesiology 2009; 110: 32-7.
8. Marrel J, Blanc C, Frascarolo P, Magnusson L. Videolaryngoscopy improves intubation condition in morbidly obese patients. Eur J Anaesthesiol 2007; 24: 1045-9.
9. Maassen R, Lee R, Hermans B, Marcus M, van Zundert A. A comparison of three video-laryngoscopes: the Macintosh laryngoscope blade reduces, but does not replace, routine stylet use for intubation in morbidly obese patients. Anesth Analg 2009; 109: 1560-5.
10. Ndoko SK, Amathieu R, Tual L, Polliand C, Kamoun W, El Housseini L, et al. Tracheal intubation of morbidly obese patients: a randomized trial comparing performance of Macintosh and Airtraq laryngoscopes. Br J Anaesth 2008; 100: 263-8.
11. Lim TJ, Lim Y, Liu EH. Evaluation of ease of intubation with the GlideScope or Macintosh laryngoscope by anaesthetists in simulated easy and difficult laryngoscopy. Anaesthesia 2005; 60: 180-3.
12. Wilson ME, Spiegelhalter D, Robertson JA, Lesser P. Predicting difficult intubation. Br J Anaesth 1988; 61: 211-6.
13. Xue F, Zhang G, Liu J, Li X, Sun H, Wang X, et al. A clinical assessment of the Glidescope videolaryngoscope in nasotracheal intubation with general anesthesia. J Clin Anesth 2006; 18: 611-5.
14. Brodsky JB, Lemmens HJ, Brock-Utne JG, Vierra M, Saidman LJ. Morbid obesity and tracheal intubation. Anesth Analg 2002; 94: 732-6.
15. Sifri ZC, Kim H, Lavery R, Mohr A, Livingston DH. The impact of obesity on the outcome of emergency intubation in trauma patients. J Trauma 2008; 65: 396-400.
16. Huang WT, Huang CY, Chung YT. Clinical comparisons between GlideScope video laryngoscope and Trachlight in simulated cervical spine instability. J Clin Anesth 2007; 19: 110-4.

การศึกษาเปรียบเทียบเวลาที่ใช้ในการใส่ท่อช่วยหายใจโดยใช้อุปกรณ์แบบมีกล้อง (GlideScope®) กับแบบมาตรฐาน (McIntosh laryngoscope) ในผู้ป่วยอ้วน

วิรัตน์ วศินวงศ์, วิมานะ ภักดีธนากุล, อรรัตน์ กาญจนวนิชกุล, บุศรินทร์ ศรีญาณลักษณ์

ภูมิหลัง: *ภาวะใส่ท่อช่วยหายใจยากพบในผู้ป่วยอ้วนได้บ่อยกว่าผู้ป่วยน้ำหนักปกติ ปัจจุบัน GlideScope® เป็นอุปกรณ์ใส่ท่อช่วยหายใจแบบมีกล้องซึ่งช่วยให้มองเห็นกล่องเสียงได้ดีกว่า McIntosh laryngoscope ในคนน้ำหนักตัวปกติ*

วัตถุประสงค์: *เพื่อเปรียบเทียบเวลาที่ใช้ในการใส่ท่อช่วยหายใจระหว่าง McIntosh laryngoscope กับGlidescope® ในผู้ป่วยอ้วน*

วัสดุและวิธีการ: *ผู้ป่วยอ้วน (ดัชนีมวลกายมากกว่า 28 kg/m^2) ที่ผ่านการสุ่มจำนวน 46 ราย และมี American Society of Anesthesiologists physical ในระดับ 1-2 ที่เข้ารับการผ่าตัดโดยใช้การระงับความรู้สึกแบบทั้งตัวและต้องใส่ท่อช่วยหายใจ ถูกแบ่งเป็นกลุ่มใส่ท่อช่วยหายใจโดยใช้ McIntosh laryngoscope และกลุ่มใช้ GlideScope® ผู้ป่วยมีอายุ 18-65 ปี ใส่ท่อช่วยหายใจโดยแพทย์ประจำบ้านวิสัญญีวิทยาปีสองที่มีประสบการณ์การใช้ GlideScope® มากกว่า 10 ครั้ง เก็บข้อมูลเวลาที่ใช้ใส่ท่อช่วยหายใจ การมองเห็นกล่องเสียง (laryngoscopic view, Cormack และ Lehane grade) จำนวนครั้งของการใส่ท่อช่วยหายใจ อัตราความสำเร็จ วิธีการอื่นที่ใช้ช่วยในการใส่ท่อช่วยหายใจ ความดันโลหิต อัตราการเต้นของหัวใจ ความอิ่มตัวของออกซิเจนในเลือด และภาวะแทรกซ้อนต่าง ๆ ที่เกิดขึ้น*

ผลการศึกษา: *เวลาที่ใช้ใส่ท่อช่วยหายใจในกลุ่ม GlideScope® (31 วินาที) ไม่แตกต่างกับกลุ่มที่ใช้ McIntosh laryngoscope (29 วินาที) การใช้ GlideScope® ช่วยให้มองเห็นกล่องเสียงได้ดีกว่าอย่างมีนัยสำคัญทางสถิติ (p = 0.007) โดยค่ากลางของกลุ่ม McIntosh laryngoscope คือ larygoscopic view grade 2 และค่ากลางของกลุ่ม GlideScope® คือ grade 1 (p = 0.07) ผู้ป่วยทุกรายในกลุ่ม G ได้รับการใส่ท่อช่วยหายใจสำเร็จในครั้งแรก แต่มีผู้ป่วย 2 ราย ในกลุ่ม M ต้องใส่ท่อช่วยหายใจมากกว่าหนึ่งครั้ง โดยที่ 1 ราย ใส่สำเร็จในครั้งที่สอง ส่วนอีกหนึ่งรายใส่สำเร็จในครั้งที่สามด้วย GlideScope® อย่างไรก็ตามพบว่าอัตราการใส่ท่อช่วยหายใจสำเร็จ อัตราการเต้นของหัวใจ ความดันโลหิต และภาวะแทรกซ้อนไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติ*

สรุป: *เวลาที่ใช้ใส่ท่อช่วยหายใจและอัตราความสำเร็จระหว่างการใช้ McIntosh laryngoscope กับ GlideScope® ในผู้ป่วยอ้วนไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ แต่พบว่า GlideScope® ช่วยให้มองเห็นกล่องเสียง (larygoscopic view) ได้ดีกว่า McIntosh blade*