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Literature Review

SYSTEMATIC REVIEW COMPARISON OF ENDOTRACHEAL INTUBATION SUCCESS RATE USING MCGRATH® MAC VIDEOLARYNGOSCOPE WITH DIRECT LARYNGOSCOPE (MACINTOSH): A MANIKIN STUDIES

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ABSTRACT

Introduction: McGrath® MAC *videolaryngoscope* is a single-handed device designed to facilitate intubation in patients both in patients with normal airway conditions (without any complications) or airway conditions with complications such as cervical spine and/or anatomic abnormalities. **Objective:** This study aims to compare McGrath® MAC *videolaryngoscope* and direct laryngoscope using Macintosh blades as learning material or study simulators for medical personnel (including anesthesiologist and paramedics) and novice operator (medical students). **Method**: this study is a systematic review using the PRISMA method which was carried out systematically. Data was collected through Pubmed, direct science, EBSCOHost, and Proquest using the keywords 'airway management ', 'laryngoscopy', and 'manikin'. Journal included based on published publication time between 2008 and 2020, a study using SimMan Laerdal Airway manikin, a journal discussing intubation using McGrath® MAC *videolaryngoscope* and direct laryngoscope with Macintosh blades here, where it is normal airway (without complications) and difficult airway. **Results**: 1556 journals were collected through 4 journal search sites and then carried out a screening process for the publication year approved in 2008 to 2020. Four studies use adult manikin SimMan Laerdal Airway including 247 participants were included in this systematic review. **Conclusion**: Based on journals that have been reviewed, McGrath® MAC *videolaryngoscope* provides better and superior results compared to Macintosh in terms of the success rate and visualization of glottis. Also, the intubation time using McGrath® MAC *videolaryngoscope* is shorten compared to Macintosh both on the normal airway (without complication) and difficult airway. The participants (medical personnel and novice operators) in all studies that reviewed prefer to use McGrath® Mac videolaryngoscope instead of using direct laryngoscope with Macintosh blade for Endotracheal Intubation mainly used for learning or study simulators.

Keywords: Airway Management; Laryngoscopy; Manikin; McGrath

ABSTRAK

Latar belakang : McGrath® MAC *videolaryngoscope* merupakan perangkat genggam yang dirancang untuk memfasilitasi intubasi pada pasien baik pada pasien dengan kondisi jalan napas normal (tanpa ada penyulit) maupun kondisi jalan napas dengan penyulit seperti cedera *cervical spine* dan/atau kelainan anatomi. **Tujuan :** Studi ini bertujuan untuk membandingkan anatar McGrath® MAC *videolaryngoscope* dan *direct laryngoscope* menggunakan bilah Macintosh sebagai bahan pembelajaran atau simulator studi untuk tenaga medis dan mahasiswa kedokteran. **Metode** : Studi ini merupakan *systematic review* dengan menggunakan metode PRISMA yang dilakukan secara sistematis. Data dikumpulkan melalui Pubmed, science direct, EBSCOHost dan Proquest menggunakan kata kunci 'airway management', 'laryngoscopy', dan 'manikin'. Jurnal yang diinklusikan berdasarkan waktu publikasi yang berikasr antara tahun 2008 hingga 2020, studi yang menggunakan manikin dewasa SimMan Laerdal Airway, jurnal yang membahas mengenai perbandingan intubasi menggunakan McGrath® MAC *videolaryngoscope* dan *direct laryngoscope* dengan bilah Macintosh pada situasi jalan napas normal (tanpa penyulit) dan jalan napas sulit. **Hasil** : Didapatkan 1556 jurnal dikumpulkan melalui empat situs pencarian jurnal dan kemudian dilakukan proses *screening* berdasarkan tahun publikasi yang dibatasi pada tahun 2008 hingga 2020. Empat studi menggunakan manikin dewasa SimMan Laerdal Airway manikin termasuk 247 partisipan di inklusikan dalam *systematic review* ini. **Kesimpulan** : Berdasarkan 4 jurnal yang

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telat di review, McGrath® MAC *videolaryngoscope* memberikan hasil yang lebih baik dan unggul dibandingkan dengan Macintosh dalam hal tingkat keberhasilan dan visualisasi glottis. Selain itu, waktu intubasi menggunakan McGrath® MAC *videolaryngoscope* lebih cepat dibandingkan dengan *direct laryngoscope* menggunakan bilah Macintosh baik dalam situasi jalan napas normal (tanpa penyulit) dan jalan napas sulit. Semua partisipan termasuk ahli anestesi, paramedis, dan mahasiswa kedokteran lebih memilih menggunakan McGrath® MAC *videolaryngoscope* dibandingkan dengan *direct laryngoscope* dengan bilah Macintosh terutama apabila digunakan sebagai media pembelajaran.

Kata Kunci : Manajemen Jalan Napas; Laringoskop; Manikin; McGrath

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INTRODUCTION

Airway management is one of the capabilities that paramedics, especially anesthetists must-have. The effectiveness of airway management is needed as a primary aid as well as primary care for critically ill and injured patients. (1) Airway management can be challenging for paramedic especially when there is some condition that causes difficult airways such as infection (mandibular abcess, epiglottitis), trauma (laryngeal fracture, cervical spine trauma), obesity, inadequate cervical extension due to rheumatic arthritis, ankylosing spondylosis, and several anatomical variations including micrognathia, prognathism, large tongue, short neck, and malocclusion teeth. (2) This condition is expected to complicate intubation as an effort to secure airway or airway management. (3) Besides, cervical spine injuries can also complicate access to intubation. According to the American Society of Anesthesiologists, the incidence of difficult and failed intubation in the operating room is 1.2 to 3.8% and 0.13 to 0.30%, respectively with estimates as high as 20% in Intensive Care Units (ICU). (4) This condition can lead to serious complications and increases mortality and morbidity. (5,6)

One of the instruments needed to perform intubation is a laryngoscope and the procedure using a laryngoscope is known as a 'laryngoscopy'. Laryngoscopes have various forms and types including direct laryngoscopes and videolaryngoscope which were introduced in 1990. The direct laryngoscope is operated by using two blades for options, Miller blade for a child patient and Macintosh blade for an adult patient while videolaryngoscope has many types with various models, (7) one of which is McGrath® Mac videolaryngoscope which has been introduced in 2008. (8)

The use of a direct laryngoscope requires a high level of personal training and skills because foresight is required for the alignment of the oral-pharyngeal-tracheal axis and placement of the tracheal tube. The videolaryngoscope was introduced to the clinical to facilitate intubation and very helpful for less experienced operators to perform intubation. Among the various models and brands of videolaryngoscopes, McGrath® Mac is one that has a cable-free shape equipped with a 2.5 inches LCD screen on the handle and uses Macintosh as a blade which has been made from a modified disposable clear plastic so that blade can be locked perfectly on the handle. (9,10) These conditions make McGrath® Mac videolaryngoscope adaptable to the surroundings and can be carried anywhere because of its similar size as direct laryngoscope and almost the same weight is even lighter.

Several studies have been conducted to compare the use of McGrath® Mac videolaryngoscope with a direct laryngoscope in patients with specific cases or only for trials

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using a manikin, but of the many trials conducted there are still pros and cons about the result of these trials. Besides, no studies are comparing McGrath® Mac videolaryngoscope and direct laryngoscope using Macintosh blade in Indonesia either manikin trials or patient trials. This is what makes the authors interested in conducting a comparative study about McGrath® Mac videolaryngoscope and direct laryngoscope using Macintosh blade. Besides that, to provide more definitive clarity on the test results, therefore a systematic review was conducted to analyze the difference in success rates of performing endotracheal intubation using McGrath® Mac videolaryngoscope and direct laryngoscope with Macintosh blade on a manikin with normal and difficult airway scenarios by novice operators. This is useful in providing clarity on endotracheal intubations as a means of learning, trial, and simulation for a paramedic or medical students as well as to determine which one is better between McGrath® Mac videolaryngoscope and direct laryngoscope with Macintosh blade.

METHOD

This research is a systematic review using the PRISMA method which is carried out systematically by following the research protocols. This study began with a participant, intervention, comparator, outcome (PICO), Research Question (RQ), as well as the criteria required to make this script.

A search process of journals is conducted after all the initial required stages have been met, especially relevant keyword to the research topic to be discussed. This research uses the keywords: 'airway management'; 'laryngoscope'; and 'manikin'. Furthermore, research journals are screened based on publication time (2008 – 2020), and publication type (research journal). a search process of journals is carried out through several sites including PubMed, Science Direct, EBSCOHost, and Proquest.

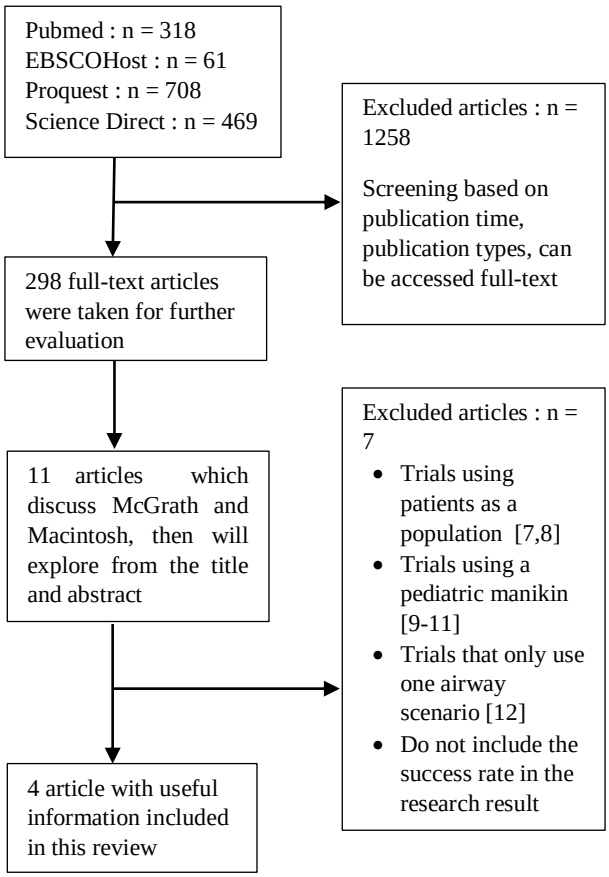

Figure 1. PRISMA Flow Diagram(11)

The journals that were obtained and described the use of manikin or manikin studies to compare the McGrath® Mac videolaryngoscope with the Macintosh laryngoscope were all selected and excluded all randomized controlled trials using patients as well as trials using pediatric manikin by identifying them by title and abstract.

Inclusion of article publication also includes articles that can be viewed full-text and use participant, intervention, comparator, outcome (PICO) to assess eligibility. The Population included: medical students; paramedic; anesthetist; manikin; volunteer studies.

In the next step, the articles were reviewed and then independently determined which journals met the inclusion criteria, journals

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that discussed and compared the success rate of endotracheal intubation using the McGrath® Mac videolaryngoscope and direct laryngoscope using a Macintosh; especially studies using an adult manikin, and; a study using two airway scenarios, then data extraction.

A systematic review in this article, we were discussed about the duration of intubation or intubation time, success rate, and glottic visualization that assessed by the Cormack-Lehane grade which was carried out in two scenarios; they are normal airway and difficult airway scenarios. Data extraction was also carried out regarding the title of the article, year of publication, the instruments used, the number of participants, and the characteristics of the participants. Subgroup analyzes were performed to determine the effect of airway characteristics (normal vs difficult) and operator characteristics (novice vs experienced).

RESULTS AND DISCUSSION

The keywords used are: 'airway management'; 'laryngoscope'; 'manikin' and found out 1556 journals (EBSCOHost 61 journals, Proquest 708 journals, PubMed 318 journals, and Science Direct 469 journals). Furthermore, screening is carried out based on publication time which is limited from 2008 to 2020, with the publication type is research journals, and journals that can be fully accessed. 298 journals are conducted to review according to the inclusion and exclusion criteria, and journals that can't be fully accessed or only available in abstract are automatically excluded.

Table 1. Main Characteristic of the included studies

	Instrument	Participants	Participants description
Gomez-Rios, M.A., *et* al (2015)	Direct *laryngoscope*, McGRATH® video laryngoscope, AirTraq video laryngoscope	63	Anesthetists (resident, consultant, expert consultant)
Shin, M., *et al* (2016)	Direct laryngoscope, McGRATH® video laryngoscope, C-MAC video laryngoscope	39	Medical students
Korkut, S., *et al*(2019)	Direct laryngoscope, McGRATH® video laryngoscope	52	Paramedics
Ruetzler, K., *et al* (2020)	Direct laryngoscope, McGRATH® video laryngoscope, Trueview video laryngoscope	93	paramedics (have more than 5 years of work experience, have an experience using a direct laryngoscope, dan do not have experience using laryngoscope)

Journals discussing the comparison of McGrath® Mac videolaryngoscope with direct laryngoscope (Macintosh) have been included after reviewed through the titles and abstracts and the remaining 11 journals. (12,13,22,14–21) Then, 2 studies using patients, (12,13) 3 studies using a pediatric manikin, (14–16) one studies used manikin but the required data were incomplete because trials were conducted on normal airways, (17) and the other one studies did not include success rate in the results. (18) Figure 1 shows the PRISMA diagram. Finally, 4 studies using adult manikin with a total of 247 participants

were included in this systematic review. (19–22)

Endotracheal intubation trials that perform in manikin were carried out in 4 journals with 3 journals carried out by paramedics (which have more than 5 years of work experience, have experience using laryngoscopes, and no experience) including anesthesiologist (residents, consultants, and expert consultants), (19,20,22) as well as one other article conducted by medical students. (21) Three of four studies that will be reviewed compared 3 instruments in their articles and both of the instrument is McGrath® Mac videolaryngoscope and Macintosh laryngoscope. (19,21,22) Based on the studies, we focused on the data to compared McGrath® Mac videolaryngoscope with Macintosh laryngoscope on a manikin with normal and difficult airway scenarios with three of them using only two scenarios (normal airway and difficult airway in the condition of tongue edema), (20–22) whereas one article used 5 situations, (19) and focused on assessing two data, it is normal airway and difficult airway scenarios. So, the articles which used three instruments in their trials are only taken data about McGrath® Mac videolaryngoscope and Macintosh laryngoscope to be reviewed. It's because the articles that only use two instruments there are McGrath® Mac videolaryngoscope and Macintosh laryngoscope especially in manikin studies is limited.

Two studies measured the ease of use of a laryngoscope, (19,20) and one studies measured difficulties intubation using the VAS scale. (21) The glottis visualization's time was discussed in only one study. (22) Two studies were performed 3 times (20,21) and only one study mentioned glottis opening presentation (POGO Score). (19) The four studies were included in this systematic review reported the success rate, intubation time, and glottis visualization rate assessed by the Cormack-Lehane grade

Table 2. The Outcome in Normal Airway using Macintosh Laryngoscope

	Macintosh						
	Success rate	**Intubation time**	**CL GRADE**				**Ease of Use**
			1	**2**	**3**	**4**	
Gomez-Rios, M.A., *et al* (2015)	63 (100%)	31.3±14.2*	68.3	31.7	0	0	46
Shin, M., *et al* (2016)	38 (97%)	26.6 (IQR 24.2 – 29.1)	16	16	2	5	-
Korkut, S., *et al*(2019)	52 (100%)	19 (IQR 14 – 21.5)	46	6	0	0	25
Ruetzler, K., *et al* (2020)	92 (99%)	17 (IQR 16 – 21)	87	6	0	0	24

* median ± SD

All studies consisting of 247 participants who performed the endotracheal intubation using laryngoscope reported the results of intubation success rate, intubation time, and also the glottis visualization rate assessed by the Cormack-Lehane grade.

Table 3. The Outcome in normal airway using McGrath® Mac videolaryngoscope

	McGRATH® video laryngoscope						
	Success Rate	**Intubation Time**	**CL Grade**				**Ease of Use**
			1	**2**	**3**	**4**	
Gomez-Rios, M.A., *et al* (2015)	63 (100%)	25.4±14.4 *	93.7	6.3	0	0	22
Shin, M., *et al* (2016)	39 (100%)	21.8 (IQR 19.4 – 24.2)	37	2	0	0	-
Korkut, S., *et al*(2019)	52 (100%)	16 (IQR 12.5 – 20)	52	0	0	0	18
Ruetzler, K., *et al* (2020)	93 (100%)	18 (IQR 16 – 21)	93	0	0	0	20

* median ± SD

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The success rate of intubation is defined as the successful intubation that is performed by the operator by looking at several indicators including ventilation of the lungs, after testing with a self-inflating balloon connected to the endotracheal tube and intubation that does not exceed 120 seconds. (20) Shin, M., et al (2016) explained that failed trials were assessed if the time required for intubation is more than 120 seconds or the endotracheal tube was not entered the esophagus and intubation performed more than 3 attempts. (21) Overall, there was no significant difference in the success rate of intubation using the McGrath® Mac videolaryngoscope or using direct laryngoscope with Macintosh blade with a success rate of almost 100% in a normal airway scenario. Meanwhile, in a difficult airway situation, there was an increased success rate using McGrath® Mac videolaryngoscope. (19,21,22) Korkut, S., et al (2019) through their study showed that there was no difference in the success rate in difficult airway scenarios using McGrath® Mac videolaryngoscope or direct laryngoscope with Macintosh blade. (20)

The intubation time was started from the first insertion of the blade between teeth until the first effective ventilation of the lungs which was calculated or recorded using a stopwatch. The four studies also explained that intubation has the possibility of failure especially if the intubation is carried out for more than 120 seconds or when the first effective ventilation is not present. One study estimated that the time required for intubation in manikin would be 12 until 70 seconds, depending on the experience of the operator and the level of difficulty of the situation. (21) Three studies explained that there was a decrease in intubation time using the McGrath® Mac videolaryngoscope in normal airway scenario whereas another study reported that the intubation time did not differ significantly (17 seconds for Macintosh and 18 seconds for McGrath® Mac videolaryngoscope). (20–22) In difficult airway scenario, all studies included in this systematic review reported the same result that there was a significant difference in the intubation time which is the intubation time using McGrath® Mac videolaryngoscope shorter than using direct laryngoscope with Macintosh blade.

Table 4. The Outcome in Difficult Airway using Macintosh Laryngoscope

	Macintosh						
	Success rate	**Intubation time**	**CL GRADE**				**Ease of Use**
			1	**2**	**3**	**4**	
Gomez-Rios, M.A., *et al* (2015)	58 (92%)	51.7±17.2 *	0	19.4	77.4	3.2	78
Shin, M., *et al* (2016)	27 (69%)	34.3 (IQR 29.3 – 39.3)	2	17	5	15	-
Korkut, S., *et al* (2019)	52 (100%)	25 (IQR 24 – 39)	0	2	48	2	49
Ruetzler, K., *et al* (2020)	57 (61%)	44 (IQR 24 -46)	0	3	86	4	74

* median ± SD

The glottic visualization was assessed using the Cormack-Lehane grade which is divided into 4 grades, which grade 1 has a wide field of the glottic view to grade 4 with the smallest or narrowest field of glottic view. The glottic visualization will be assessed by asking the operator after performing the intubation or by asking the operator to directly mention the Cormack-Lehane grade at the time of viewing the laryngoscopy. (19) In a normal airway scenario, the McGrath® Mac videolaryngoscope showed better results in glottis visualization because almost all participant were able to see the glottic at

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grades 1 and 2, (19–22) whereas using a macintosh, one study reported the glottic visualization at grades 3 and 4, (21) as well as 3 other studies reported the glottic visualization at grades 1 and 2. (19–21)

Table 5. The Outcome in Difficult Airway using McGrath® Mac videolaryngoscope

	McGRATH® video laryngoscope						
	Success Rate	Intubation Time	CL Grade				Ease of Use
			1	2	3	4	
Gomez-Rios, M.A., *et al* (2015)	62 (98.4%)	37.4±21.8*	87.1	11.3	1.6	0	45
Shin, M., *et al* (2016)	38 (97%)	31.7 (IQR 27.1 – 36.3)	9	29	1	0	-
Korkut, S., *et al* (2019)	52 (100%)	19 (IQR 14 – 27.5)	50	2	0	0	25
Ruetzler, K., *et al* (2020)	90 (97%)	22 (IQR 20 – 27)	77	16	0	0	34

* median ± SD

Ease of use assessed by using a visual analog scale or VAS (1-100) reported in several studies including Ruetzler, K., et al., showed that McGrath® Mac videolaryngoscope is easier than Macintosh (24 for Macintosh and 20 McGrath® Mac videolaryngoscope in normal airway scenario; 74 for Macintosh and 34 for McGrath® Mac videolaryngoscope in difficult airway scenario) (19) and Korkut, S., et al reported the same (25 for macintosh and 18 for McGrath® MAC videolaryngoscope in the normal airway; 49 for Macintosh and 25 for McGrath® MAC videolaryngoscope in the difficult airway). (20) Whereas Shin, M., et al rated the subjective difficulty as measured by VAS (1-10) expressed the same thing as the other two studies (4.6 for Macintosh and 2.2 for McGrath® MAC videolaryngoscope on normal airway; 7, 8 for Macintosh and 4.5 for McGrath® MAC videolaryngoscope in difficult airways. (21) One other study did not assess the ease of use of the McGrath® MAC videolaryngoscope and Macintosh. (22)

This systematic review uses two groups, they are direct laryngoscope and video laryngoscope. in there two groups, McGrath® Mac videolaryngoscope was selected to represent the video laryngoscope and the direct laryngoscope was represented by macintosh blade. McGrath® Mac videolaryngoscope was chosen because physically McGrath® Mac videolaryngoscope has a cable-free form and also similar to direct laryngoscope with an additional 2.5 inches screen on the handle and the image will be transmitted to an external screen. The similarity of McGrath® Mac videolaryngoscope and direct laryngoscope with macintosh allows the operator to become more familiar with its use. The blade used in the McGrath® Mac videolaryngoscope are also angled blades that have extra curves that allow visualization only through the camera. Besides, positioning the screen directly in front of the operator's eyes allows easy visualization, which results in a better rate of success in intubation and ease of intubation.

The main results obtained after reviewing 4 studies was the use of the McGrath® Mac videolaryngoscope as a simulation or trial in endotracheal intubation which gave a better success rate compared to the Macintosh both performed by paramedics and novice, including medical students both in normal airway scenario as well as difficult airway scenario. Besides, McGrath® Mac videolaryngoscope is easier to use than the macintosh.

From the literature, Altun (2016) found that the McGrath® Mac videolaryngoscope shortens the endotracheal intubation time so that intubation is performed faster with a better success rate than macintosh especially

in difficult airway's scenario whether performed by paramedics as well as by novice users including medical students. Different results were obtained in other studies which stated that the McGrath® Mac videolaryngoscope provides a longer intubation time in difficult airway scenario. (23) Meanwhile, in normal airway situations, the McGrath® Mac videolaryngoscope did not significantly shorten the intubation time. This is because one study reported an intubation time of 18 seconds for McGrath® Mac videolaryngoscope and 17 seconds for the macintosh.

Overall, the success rate for endotracheal intubation is 100% in the normal airway in both laryngoscope (McGrath® Mac videolaryngoscope and direct laryngoscope using Macintosh blade). In a difficult airway scenario, McGrath® Mac videolaryngoscope has a better success rate which ranged from 97% to 100% than direct laryngoscope with macintosh blade while intubation using Macintosh had variable results with 2 of them ranging from 61% to 69% while the other two reached 100%. The analysis focused on the overall results of the success rate for each study. McGrath® Mac videolaryngoscope provides evident results for success rates in both scenarios normal airway and difficult airway performed by both. Trials conducted by medical students gave a significant improvement in difficult airway scenarios where the success rate of using Macintosh was 69% and using McGrath® Mac videolaryngoscope was 97%. This shows that McGrath® Mac videolaryngoscope is easy to learn and use. This can be due to the special shape of the optical component and the guiding channel that facilitates the placement of the endotracheal tube compared to the Macintosh which requires an accurate eye on the alignment of the oral-pharyngeal-tracheal axis and placement of the tracheal tube, and it is a difficult skill for beginners. This is also proven by a study conducted by Kaki, A. M. et al (2011) indicating that the video laryngoscope is better than the Macintosh when it is used by medical students as beginners for intubation in manikin, (24) and a similar study also stated the same thing. (25) A recent manikin study found that the McGrath® Mac videolaryngoscope can be good alternative for endotracheal intubation in difficult airway scenario, (26) and another study stated that there are no advantages using McGrath® Mac videolaryngoscope for uncomplicated tracheal intubation, but it needs to be mentioning that anesthesiologists in their study performed. (27)

Glottic visualization was assessed using the Cormack-Lehane grade which was assessed by the operator. In a difficult airway scenario, the McGrath® Mac videolaryngoscope provides better glottic visualization compared to Macintosh ranging between grades 1 and 2. These results are supported by another study that stated that the McGrath® Mac videolaryngoscope was superior to the macintosh in terms of glottic visualization. (28) Besides that, there are studies indicating that the use of McGrath® Mac videolaryngoscope may improve the visibility of glottis compared with Macintosh laryngoscope. (29) In normal airway scenario, both laryngoscopes provide good visualization, however, the McGrath® Mac videolaryngoscope is still better than the Macintosh because most glottic visualization is grade 1.

In this study, ease of use was assessed using the VAS (visual analog score) with a score of 1 (very easy) to 100 (very difficult). Based on the four studies included in this study, it was found that the McGrath® Mac videolaryngoscope made it easier for the operator to intubate compared to the

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Macintosh in both normal and difficult airway scenarios.

This study uses manikin as a trial to be a study simulator. Manikins are used in many studies in many areas of anesthesia and the easiest and most acceptable way to train novices especially medical students to perform intubation. (30) This study was conducted to provide an overview of the use of the McGrath® Mac videolaryngoscope and Macintosh in which simulated conditions were more effective, better, and easier to use for manikin as an evaluation for use by medical students as a learning session. Although in the future medical students are required to have the ability to perform intubations using a basic laryngoscope or direct laryngoscope, the ability to use a modern laryngoscope such as McGrath® Mac videolaryngoscope is also needed to face the increasingly modern world especially modern instrument that will be used in the medical world. One study stated the rationale for using manikins and medical simulation as a method that allows for randomized cross-over studies without the potential to harm the health and life of the patients or subjects. (28) Besides, Abelson A. said that the fact is done in simulated medical condition and not in a real clinical condition, however, it is a deliberate medical action because the medical simulation allows standardization. (31) The airway simulator does not result in clinically correct intubation conditions and there is no evidence that the outcome on manikin correlates with clinical performance. (32,33) Thus, use in clinical conditions needs to be re-evaluated.

Every study has limitations, especially in this systematic review. The limitation of this systematic review is that there are still not many sources of studies, especially trials using the McGrath® Mac videolaryngoscope as an instrument. With the existing limitations, there are fewer journals that are reviewed, but it shows that further research can be carried out. Besides that, the most limitation in this systematic review is limited source or articles that discussed about McGrath® Mac videolaryngoscope and Macintosh Laryngoscope specifically in manikin studies, so the data that reviewed in this systematical review is taken from the articles which use many instruments in their trials. The generalization of the results is also limited by other factors inherent to the study methodology and the number of journals that discuss this topic specifically.

CONCLUSION

Overall, McGrath® Mac videolaryngoscope gives better results in terms of success rate and glottis visualization. Besides, the intubation time using McGrath® Mac videolaryngoscope is shorter than using a direct laryngoscope, especially in difficult airway scenarios. From the four journals that have been reviewed, it was also found that almost all participants choose to use McGrath® Mac videolaryngoscope for intubation because it helps in visualizing the glotting and is also easy to use for learning and study simulators. Besides that, from all journals that have been reviewed, there are different participants which are medical personnel including anesthesiologist and paramedics and novice operators or medical students. The heterogeneity of the results from individual trials is a limitation for the generalizability of our overall results. We found that publication could potentially be biased because it was impossible to blind operators to the devices they used and the study included in this review was a manikin study and thus cannot be applied in the clinical condition.

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Conflict Of Interest

There is no conflict of interest

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