Comparative Evaluation of McGrath MAC, Truview Video Laryngoscopes and Macintosh Laryngoscope for Endotracheal Intubation in Patients Undergoing Surgery under General Anaesthesia

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Abstract

Background: Videolaryngoscopy is a newly developed technique to improve tracheal intubation success. It was made to bypass the need of directly visualising the glottic inlet. These devices are advantageous as there is no need of aligning the laryngeal, pharyngeal and oral axes for a clear view, thus making intubation easier and faster. **Aim and Objectives:** Primary objective of the study was to determine the duration of laryngoscopy and intubation and Cormack - Lehane grading when intubating with McGrath MAC, Truview video laryngoscope and Macintosh laryngoscope. Secondary objectives of the study were to determine the number of attempts and optimization manoeuvres required to intubate. **Materials and Methods:** This study was conducted on total of 120 patients in age 20-70 years, either sex, with American Society of Anaesthesiologists physical status classes I or II scheduled for elective surgery under general anaesthesia. They were randomly assigned equally to group 1, 2 and 3 (n = 40) to be intubated by McGrath MAC video laryngoscope, Truview video laryngoscope and Macintosh laryngoscope respectively. Parameters recorded were duration of laryngoscopy and intubation, Cormack Lahane grading, ease of intubation, number of attempts and optimisation manoeuvres required for intubation. **Statistical Analysis:** Comparison of mean value among the three groups was done using student t test and percentage comparison was done using chi square test. To compare more than two variables ANOVA test was used. The P values of less than 0.05 was considered statistically significant. **Results:** Duration of laryngoscopy was significantly less in McGrath MAC group when compared to Truview group (P = 0.02) and to Macintosh group (P < 0.001) and the duration of intubation was comparable among all three study groups (P > 0.05). The difference in Cormack - Lehane grading was not significant between McGrath MAC and Trueview (P = 0.71) but was significant between McGrath MAC and Macintosh (P = 0.002) and Trueview and Macintosh (P = 0.002). Ease of intubation was better in McGrath MAC and Trueview groups compared to Macintosh group (P < 0.05). Intubation was successful in the first attempt in 39 (97.50%) patients in McGrath MAC group, 40 (100%) patients in Truview group and 35 (87.50%) patients in Macintosh group. McGrath MAC and Truview groups performed better with respect to optimization manoeuvres compared to Macintosh group (P < 0.05). Trauma was observed in 2 (5%) patients in Truview group and 5 (12.50%) patients in Macintosh group. In McGrath MAC group, no patient underwent any trauma. **Conclusion:** Although duration of laryngoscopy was significantly shorter in McGrath as compared to Truview video laryngoscope and Macintosh laryngoscope but the duration of intubation was comparable between the three groups. Both these video laryngoscopes performed significantly better than Macintosh laryngoscope with respect to laryngoscopic view, requirement of optimization manoeuvres and need for second attempt for intubation.

Keywords: Machintosh Laryngoscope, McGrath MAC, truview videolaryngoscope

Introduction

Videolaryngoscopy is a relatively recent development in airway management that attempts to improve the success of tracheal intubation. Videolaryngoscope (VL) contains

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miniature video cameras enabling the operator to visualize the glottis indirectly. VL places an imaging device toward the distal end of laryngoscope blade. This moves the providers point of view past the tongue, avoiding the need for a direct line of sight to the glottis.\textsuperscript{[1,2]} The American Society of Anesthesiologists (ASA) difficult airway taskforce recommends that a VL be available as a first rescue device for all patients being intubated.\textsuperscript{[3]} Various studies have found that VL improves the ability to visualize the larynx and improves the intubation success.\textsuperscript{[4,7]}

Over the last two decades, a number of VL have emerged offering several advantages over direct laryngoscopy. McGrath MAC video laryngoscope has a slim disposable transparent regularly shaped blade similar to the Macintosh blade and a wide LCD screen attached to the handle. It is lighter in weight and has a more compact screen and handle which may make tracheal intubation easier and faster.\textsuperscript{[5]} Trueview video laryngoscope has an integrated optical lens system with unique angulated blade which provides optimal indirect view of the glottis.\textsuperscript{[6]}

This trial was conducted to compare the effectiveness of McGrath MAC video laryngoscope, Trueview video laryngoscope and Macintosh laryngoscope when performing endotracheal intubation in patients undergoing surgery under general anesthesia.

**METHODS**

After obtaining approval from the institutional ethical committee and registration under the clinical trial registry of India (CTRI/2018/05/014150) this prospective randomized study was conducted over a period of 1 year. A total of 120 patients in the age 20–70 years of either sex, with ASA physical status Classes I or II scheduled for undergoing elective surgery requiring tracheal intubation were randomly assigned to McGrath MAC, Truview or Macintosh laryngoscope, to compose equal groups of 40 each. All intubations were performed by senior anesthesiologist who had experience of at least 40 intubations in patients using video laryngoscope.

Patients were divided into three groups:

- **Group 1** \((n = 40)\) – patients in this group were intubated using McGrath MAC video laryngoscope
- **Group 2** \((n = 40)\) – patients in this group were intubated using Truview video laryngoscope
- **Group 3** \((n = 40)\) – patients in this group were intubated using Macintosh laryngoscope.

Preanesthetic checkup of all the patients was done 1 day prior to surgery which included detailed history, thorough physical examination (general and systemic), and basic relevant investigations. After obtaining consent from patients, tablet pantoprazole 40 mg and tablet alprazolam 0.25 mg were given to patients night before the surgery and on the morning of the surgery. Patients were kept fasting for 8 h before the surgery.

After arrival in the preoperative room, an intravenous catheter of 18G or 20G was secured and intravenous ringer lactate started at 60 ml/h. The patients were then shifted to the operation theater. In the operation theater, standard monitoring was done using: Continuous electrocardiograph (lead II), \(\text{SpO}_2\), noninvasive blood pressure and \(\text{ETCO}_2\). After preoxygenation, standard general anesthetic technique was followed in all the three groups using injection fentanyl 1.5 µg/kg intravenously, injection propofol 2 mg.kg\(^{-1}\) intravenously and neuromuscular blockade achieved with injection succinylcholine 1 mg.kg\(^{-1}\) intravenously and intubation was attempted after 60 s of injection succinylcholine.

All the intubations were done by the same experienced anesthesiologist and the head was kept in “neutral position.” Stylet was used for intubation in all the three groups. Size 3 of Macintosh blade and McGrath MAC blade and medium sized Truview blade for patients having weight up to 50 kg and size 4 of Macintosh blade and McGrath MAC blade and large-sized Truview blade for patients having >50 kg weight was used. After successful intubation, anesthesia was maintained using 66% nitrous oxide, 33% oxygen, and varying concentrations of isoflurane (1%–1.5%). Neuromuscular blockade was maintained with rocuronium 0.15 mg/kg. About half an hour before the end of surgery injection ondanseteron 0.1 mg.kg\(^{-1}\) intravenously was given to the patient. At the end of surgery, neuromuscular blocks were reversed with– injection neostigmine 0.05 mg.kg\(^{-1}\) and injection glycopyrolate 0.01 mg/kg. Various parameters were recorded:

I. **Duration of laryngoscopy** was defined as oral placement of the laryngoscope blade to obtaining the best glottic view

II. **Evaluation of glottic view using Cormack and Lehane grading**

- Grade I visualization of entire vocal cords
- Grade II visualization of posterior part of the laryngeal aperture
- Grade III visualization of epiglottis only
- Grade IV no glottic structures seen.

III. **Duration of intubation** was defined as time interval between placements of endotracheal tube (ETT) between the dental arches to the first deflection on capnograph

IV. **Ease of intubation**: was graded as

- Grade 1: intubation easy
- Grade 2: intubation requiring an increased anterior lifting force and assistance to pull the right corner of the mouth upwards to increase space
- Grade 3: intubation requiring multiple attempts
- Grade 4: failure to intubate with the assigned laryngoscope.

An attempt was defined as the time from introduction of laryngoscope into the oral cavity until its removal. Three attempts at intubation were allowed for all groups. Failure to intubate was defined as the inability to intubate after three attempts. Alternative technique was used in case of failure as per the discretion of anesthesiologist.
Number of optimization maneuvers required like use of bougie, cricoid pressure, and second assistant were recorded. After intubation blade of laryngoscope was checked for blood staining and inspection of teeth and soft tissue was done to rule out trauma.

**RESULTS**

Data from 120 patients were analyzed. Patients in the three groups were comparable with respect to the baseline demographic characteristics as depicted in Table 1.

Figure 1 shows the duration of laryngoscopy which was significantly less in McGrath MAC group when compared to Truview group (3.92 vs. 4.62 s; \( P = 0.02 \)) and to Macintosh group (3.92 vs. 5.75 s; \( P = 0.001 \), respectively. Duration of laryngoscopy was also significantly less in Truview group when compared to Macintosh group (4.62 vs. 5.75 s; \( P = 0.001 \)).

Duration of intubation was comparable between McGrath MAC and Truview (6.55 vs. 6.67 s; \( P = 0.73 \)) group, between McGrath MAC and Macintosh (6.55 vs. 7.15 s; \( P = 0.15 \)) groups and between Truview and Macintosh (6.67 vs. 7.15 s; \( P = 0.22 \)) groups [Figure 2].

Table 2 shows Cormack Lehane Grade I was observed in 37 (92.50%) patients of McGrath MAC group, 35 (87.50%) in Truview group and 24 (60%) in Macintosh group. Grade II was observed in 3 (7.50%) patients in McGrath MAC group, 5 (12.50%) patients in Truview group and 7 (17.50%) in Macintosh group, whereas Grade III and IV were observed in 6 (15%) and 3 (7.50%) patients, respectively, in Macintosh group. Statistically, the difference was not significant between McGrath MAC and Truview groups (\( P = 0.71 \)). However, between McGrath MAC and Macintosh and Truview and Macintosh groups, the difference was highly significant (\( P = 0.002 \) for each).

Intubation was easy in 36 (90%) patients in McGrath MAC group, 35 (87.50%) patients in Truview group and 26 (65%) patients in Macintosh group. Statistically, the difference in ease of intubation was better in McGrath MAC and Truview groups compared to Macintosh group (\( P < 0.05 \)). Intubation was successful in the first attempt in 39 (97.50%) patients in McGrath MAC group, 40 (100%) patients in Truview group, and 35 (87.50%) patients in Macintosh group. Statistically, the difference of number of attempts at intubation was comparable among the three groups (\( P > 0.05 \)).

The use of optimization manoeuvres such as bougie, cricoid pressure, and second assistant was required in 4 (10%) patients in McGrath MAC group, 5 (12.50%) patients in Truview group and 14 (35%) patients in Macintosh group. Trauma was observed in 2 (5%) patients in Truview group and 5 (12.50%) patients in Macintosh group. In McGrath MAC group, no patient underwent any trauma. Statistically, the difference among the three groups was not significant (\( P > 0.05 \)).

**DISCUSSION**

In the present study, duration of laryngoscopy was significantly less in McGrath MAC group as compared to Truview (\( P = 0.02 \)) and Macintosh (\( P < 0.0001 \)) groups. Similarly, duration of laryngoscopy was also significantly less in Truview group when

![Figure 1: Histogram showing mean duration of laryngoscopy](image1)

![Figure 2: Histogram showing mean duration of intubation](image2)
compared to Macintosh group ($P < 0.001$). This was possible as Cormack and Lehane Grade I was achieved in maximum number of patients with both the video laryngoscopes compared to the conventional laryngoscope. Truvue video laryngoscope gives a smaller field of vision, where the image of the vocal cords has to be focused on the prism to get the correct view which takes a few seconds, whereas McGrath video laryngoscope has an LCD screen which gives a clear image of the vocal cords and the surrounding anatomy with a larger field of vision.$^{[10]}$ Hence, McGrath video laryngoscope took a lesser time compared to Truvue video laryngoscope. Furthermore with a direct laryngoscope it is necessary to obtain a line of sight from the maxillary teeth to the glottis whereas with the use of video laryngoscope the image of glottis is captured near the tip of the blade, only a few centimeters of line of sight is required and the need to align the oral, pharyngeal, and laryngeal axes is not there.$^{[10-12]}$

Time taken to successfully intubate was less in McGrath MAC laryngoscope (6.55s) compared to Truvue (6.67 s) and Macintosh (7.15 s) laryngoscopes. However, difference in time to intubate was statistically not significant between the three groups ($P > 0.05$). Although the duration of laryngoscopy was shorter in McGrath group as compared to other groups, the duration of intubation was comparable because while using the McGrath video laryngoscope, laryngeal axes are not aligned, and the tip of the tracheal tube must therefore pass around a relatively acute angle to enter the larynx. Second less space is created for tube insertion when using the McGrath, as the pharyngeal tissues are not displaced as far anteriorly as during direct laryngoscopy.$^{[13]}$ In a study Kim et al. found that the mean intubation times with McGrath MAC VL was less and did not differ significantly from those obtained with the GlideScope Ranger or the Macintosh in easy as well as difficult airway scenario, while Arora et al. reported that duration of intubation was less in Truvue laryngoscope than Macintosh laryngoscope, though the difference was not statistically significant.$^{[14,15]}$ Few studies found that intubation time using McGrath video laryngoscope was more as compared with Macintosh laryngoscope.$^{[10,11,16]}$ The reason cited was that although video laryngoscopes offer superior visualization of the glottis, a good laryngeal view does not guarantee easy or successful tracheal tube insertion. All video laryngoscopes without an integrated guide channel for the ETT could face the challenge of advancing the tube into the trachea as the tip of the tracheal tube must pass through an acute angle to enter the larynx and has significant potential of coming in contact with the anterior tracheal wall.$^{[5]}$ Furthermore, contrary to our observation, Barak et al. and Nasim et al. found that Truvue EVO2 laryngoscope took longer time for intubation than Macintosh laryngoscope.$^{[17,18]}$ This may be due to the greater experience of anesthesiologists with the Macintosh blade. Although the anesthesiologists who participated in these studies had practiced with the Truvue blade several times prior to starting the study, their experience with the new device was less than that with the Macintosh blade.

In the present study, Cormack Lehane grading was statistically significant in McGrath and Truvue as compared to Macintosh ($P = 0.002$), whereas it was comparable between McGrath and Truvue groups. Video laryngoscopes provide better glottis exposure compared to direct laryngoscope and thus leading to a better Cormack and Lehane grading. This is attributed to the availability of camera on the blade tip of video laryngoscope that eliminates the need to align the oral, pharyngeal and laryngeal axes which is not the case with direct laryngoscope.$^{[10-12]}$

In the present study, ease of intubation was significantly better in McGrath MAC group and Truvue group as compared to Macintosh group ($P < 0.05$). For optimal visualization of the glottis with direct laryngoscope, the anterior structures of the larynx are elevated while the video laryngoscopes are designed to enable indirect laryngoscopic view and do not require much manipulation by the anesthesiologist to visualize the glottis and thus makes the job easier. This result is also similar to previous reported by other studies who also found that there was higher percentage of glottis opening in McGrath video laryngoscope group compared to Macintosh group ($P = 0.002$).$^{[19,20]}$

Intubation was successful in the first attempt in 39 (97.50%) patients in McGrath MAC group, 40 (100%) patients in Truvue group and 35 (87.50%) patients in Macintosh group in the present study. Statistically, the difference of number of attempts at intubation was comparable among the three groups ($P > 0.05$). In a study conducted by Bhola et al., no second attempt was required in McGrath group, but in Truvue group, two patients needed a second attempt.$^{[21]}$ The results of their study were not statistically significant. Barak et al. reported 100% success rate with Truvue and 90% with Macintosh group, which is almost similar to this study.$^{[17]}$

Regarding the use of optimization maneuvers, McGrath MAC and Truvue groups performed better as compared to Macintosh group ($P < 0.05$). With direct laryngoscopy to visualize the glottis oral, pharyngeal and laryngeal axes need to be in straight line and thus much manipulation is required to achieve this. Furthermore, it is difficult to continuously maintain the glottis view till the intubation is done and thus more number of patients requiring the specific maneuvers.

In the present study, trauma was observed in 2 (5%) patients in Truvue group and 5 (12.50%) patients in Macintosh group. In McGrath MAC group, no patient underwent any trauma. Statistically, the difference among the three groups was not significant ($P > 0.05$). Direct laryngoscopy might require the anesthesiologist to put undue pressure on gums, teeth, and periglottic structures for maximal exposure of vocal cords, thus leading to trauma. Bhola et al. (2014) also found that none of the patients in McGrath group experienced trauma, whereas in Truvue group, two patients had gingival bleed as a complication of laryngoscopy.

The main limitation of our study is that anesthesiologist performing the laryngoscopy and intubation could not be
blinded to the devices used in the study. Furthermore, there is a learning curve for VLs as all the anesthesiologists are mainly trained to use Macintosh laryngoscope.

**Conclusion**

Inspite of duration of laryngoscopy being significantly shorter in McGrath as compared to Truview video laryngoscope and Macintosh laryngoscope, the duration of intubation was comparable between the three groups as it took longer to negotiate the ETT into the trachea. Laryngoscopic view as assessed by the Cormack and Lehane grading was improved in both the video laryngoscope groups. Both these video laryngoscopes performed significantly better than Macintosh laryngoscope with respect to the ease of intubation, requirement of optimization maneuver and need for second attempt for intubation.

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Nil.

**Conflicts of interest**

There are no conflicts of interest.

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