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Original Research Article

COMPARATIVE STUDY OF McGRATH VIDEO LARYNGOSCOPE VS McCOY LARYNGOSCOPE EFFICACY IN OROTRACHEAL INTUBATION IN SIMULATED CERVICAL SPINE INJURIES

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ABSTRACT

Background: Cervical spine injury complicates airway management, making safe intubation crucial. McCoy and McGrath's laryngoscopes aid in visualisation. McCoy for direct, stress-reducing access and McGrath for indirect, camera-guided intubation, ideal for restricted neck mobility or emergencies. This study aimed to compare the efficacy of the McGrath video laryngoscope and the McCoy laryngoscope in orotracheal intubation for cervical spine injuries. **Materials and Methods:** This prospective randomised control study included 80 patients at the Mahatma Gandhi Memorial Hospital, Trichy, from November 2022 to November 2023. Standard monitors (NIBP, ECG, SpO_2, and capnography) were connected, and anaesthesia was administered per protocol using IV drugs, including glycopyrrolate, midazolam, fentanyl, propofol, xylocard, and succinylcholine. After orotracheal intubation, dexamethasone was administered, a Philadelphia collar was applied, and anaesthesia was maintained with O_2, N_2O (FiO_2 40%), and sevoflurane (0.2–2%). **Result:** The McGrath group had a significantly shorter mean intubation time (41.75 ± 7.78 s) than the McCoy group (53.98 ± 2.87 s; $p < 0.0001$). The mean POGO score was markedly higher in the McGrath group (78.23 ± 31.78) than in the McCoy (32.18 ± 5.22; $p < 0.0001$). Hemodynamic parameters such as systolic BP (143.25 ± 11.41 vs. 166.5 ± 12.72 mmHg), diastolic BP (85.25 ± 9.6 vs. 100.75 ± 8.88 mmHg), and pulse rate (107.98 ± 13.23 vs. 134.63 ± 16.9 bpm) were all significantly lower in the McGrath group ($p < 0.0001$). Cormack-Lehane Grade 1 glottic view was achieved in 57.5% with McGrath and 0% with McCoy, indicating significantly better visualisation with McGrath ($p < 0.0001$). **Conclusion:** The McGrath video laryngoscope offered better glottic visualisation, with reduced haemodynamic stress in a shorter time compared to the McCoy blade laryngoscope in simulated cervical spinal injuries during intubation.

INTRODUCTION

Cervical spine injuries are frequently associated with blunt trauma in patients. It usually affects 2 to 5% of all blood trauma patients. Cervical pain injury often leads to damage to the spinal cord.[1] Patients with cervical spine injuries clinically present with loss of consciousness, head or facial trauma, and an altered neurological status. In these cases, oxygen supply to the brain is reduced and hypoxia is observed, which results in reduced ventilation and decreased blood pressure due to systemic involvement. To avoid complications of spinal cord injuries, it is necessary to manage these injuries. In such cases, intubation techniques are critical. There are several intubation techniques either using manual or video-guided laryngoscopes. They help in reducing the complications due to cervical spine damage.[2,3] Endotracheal intubation is the most commonly used technique for this purpose. This is done to avoid hypoxia and securely provide a continuous oxygen supply. Medical professionals usually perform this procedure in emergency management, but these procedures are also performed in elective as well as surgical indications.[4] The techniques include manual placement of the laryngoscope and video-guided placement of the laryngoscope. This placement of the scope with the correct approach is

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essential in maintaining the airway, especially in patients with loss of consciousness and altered sensorium. Several procedures were used for visualisation. One such procedure is laryngoscopy, which is useful in identifying the larynx. This is performed during general association or laryngeal surgeries. This is done in other settings that require emergency management.[5,6]

The most significant types are direct and video laryngoscopy. This technique requires several essential pieces of equipment. One such piece of equipment is the laryngoscope. This would be helpful for intubation. The most common types are direct, video, and fiberoptic laryngoscopes. They are used to visualise the larynx during an emergency.[7,8] Another instrument that uses a camera to locate the larynx and is useful for medical professionals is the video laryngoscope. When a patient has limited access, especially with a cervical collar, this technique may be the most helpful. In case the scope used is flexible, then it is termed as a fibre optic.[9]

The McCoy laryngoscope, with its hinged tip controlled by a lever, enhances direct laryngeal visualisation, requires less intubation force, and reduces haemodynamic stress, making it suitable for difficult airway management.[10,11] The McGrath is a modern, portable video laryngoscope equipped with a 1.7-inch LCD monitor for indirect visualisation of the larynx. Its portability, low cost (approximately 10 times cheaper than other video laryngoscopes), and single-use plastic blade make it a favoured choice, especially for patients with highly infectious diseases like COVID-19.[12] Its portability and ease of use make it well-suited for emergency intubation. The McGrath Video Laryngoscope provides an indirect view of the larynx, which requires less force and mouth opening. It is ideal for difficult airways, particularly in patients with limited neck mobility or cervical collars, and offers safer intubation in emergency and infectious settings.[13,14]

As multiple methods are available for intubation with a wide variety of laryngoscopes, it is essential to determine the effectiveness of each laryngoscope in patients with cervical spine injury. Hence, this study was conducted to assess the effectiveness of the McGrath video laryngoscope and McCoy laryngoscope blades and compare their efficacy in orotracheal intubation in patients with cervical spine injury in a tertiary care setup.

Aim

This study aimed to compare the efficacy of the McGrath video laryngoscope and the McCoy laryngoscope in orotracheal intubation for cervical spine injuries.

MATERIALS AND METHODS

This prospective randomised control study was conducted on 80 patients at the Anaesthesia Department of Mahatma Gandhi Memorial Hospital, Trichy, from November 2022 to November 2023. Before initiating the study, it was approved by the Institutional Ethics Committee. Written informed consent was obtained before patient enrolment.

Inclusion and exclusion criteria

Patients aged between 18 and 65 years, classified as ASA physical status I to III, with a body mass index (BMI) of < 30 kg/m², and scheduled for elective surgeries under general anaesthesia were included. Patients with cervical myelopathy, known or anticipated difficult airway, or bleeding disorders were excluded.

Methods

A total of 80 simulated patients scheduled for elective surgery under general anaesthesia were randomised and divided into two groups- McGrath and McCoy, with 40 patients in each group.

Standard monitors, including non-invasive blood pressure (NIBP), electrocardiogram (ECG), pulse oximetry (SpO_2), and capnography, were connected. Premedication, preoxygenation, induction, and administration of muscle relaxants were performed according to standard anaesthetic protocols. Intravenous induction drugs included glycopyrrolate 5 mcg/kg, midazolam 0.05 mg/kg, fentanyl 2 mcg/kg, propofol 2 mg/kg, xylocard 1.5 mg/kg, and succinylcholine 2 mg/kg.

Dexamethasone (8 mg) was administered after successful orotracheal intubation. The pillow was removed and a properly sized Philadelphia neck collar was placed based on each patient's neck circumference or height. Anaesthesia was maintained with oxygen and nitrous oxide (FiO_2 40%) along with sevoflurane at a concentration of 0.2–2%. The distance between the edge of the sternum and the lower jaw with the neck in extension was measured to determine the appropriate collar size.

Collar sizes were categorised based on neck circumference. Size S included patients with neck measurements between 3 and 3.5 inches (7.5 to 8.75 cm), size M included those between 3.5 and 4 inches (8.75 to 10.00 cm), and size L included those between 4 and 4.5 inches (10 to 11.25 cm). The HANS scale categorises facemask ventilation as follows: grade 0, no attempt at mask ventilation; grade 1, successful mask ventilation; grade 2, ventilation achieved with a mask or adjunct; grade 3, difficult and unstable ventilation requiring two practitioners; and grade 4, ventilation not possible.

The Percentage of Glottic Opening (POGO) score quantifies glottic visibility during laryngoscopy: 100% indicates full visualisation of the glottic aperture, 33% reflects visibility of only the lower third of the vocal cords and arytenoids, and 0% denotes complete absence of glottic structure visualisation. The Cormack-Lehane grading system classifies laryngeal views as follows: grade 1, full glottic view; grade 2a, partial glottic view; grade 2b, only arytenoids or posterior vocal cords visible; grade 3, only the epiglottis visible; and grade 4, neither the glottis nor the epiglottis visible.

Statistical Analysis

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Data were analysed using IBM SPSS Statistics version 21.0. Continuous variables are expressed as mean ± standard deviation and were compared using the independent samples t-test. Categorical variables are presented as frequencies and percentages and were analysed using the chi-square test or Fisher's exact test, as appropriate. Statistical significance was set at $p < 0.05$.

RESULTS

The most frequently represented age groups were 31–40 and 41–50 years, each comprising 22.5% of the study population, with a 95% confidence interval (CI) of 13.91–33.21. This was followed by the 51–60 years age group, which accounted for 18.75% (CI: 10.89–29.03), and the >60 years group at 17.5% (CI: 9.91–27.62). The 19–30 years group contributed 13.75% (CI: 7.07–23.27), while the least represented were those under 19 years of age, accounting for just 5% of the participants (CI: 1.38–12.31) (Table 1).

The mean age was comparable between the two groups (McGrath: 43.3 ± 14.86 years; McCoy: 44.95 ± 15.38 years; $p = 0.627$), indicating no significant age difference. However, the total intubation time was significantly shorter in the McGrath group (41.75 ± 7.78 s) than in the McCoy group (53.98 ± 2.87 s) ($p < 0.0001$).

Visualisation of the glottis, as assessed by the POGO score, was markedly better with McGrath (78.23 ± 31.78) than with McCoy (32.18 ± 5.22), which was also significant ($p < 0.0001$). Hemodynamic responses were lower in the McGrath group, with lower systolic BP (143.25 ± 11.41 vs. 166.5 ± 12.72 mmHg), diastolic BP (85.25 ± 9.6 vs. 100.75 ± 8.88 mmHg), and pulse rate (107.98 ± 13.23 vs. 134.63 ± 16.9 bpm), all with p-values < 0.0001, indicating a significantly attenuated stress response with McGrath laryngoscopy (Table 2).

In the McGrath group, 57.5% of patients had a grade 1 view (full view of the glottis), whereas no grade 1 views were recorded with the McCoy laryngoscope. A Grade 2a view was achieved in 37.5% of McGrath cases compared to only 2.5% with McCoy. The McCoy group had a significantly higher proportion of grade 2b (42.5%) and grade 3 (55%) views, indicating limited glottic visibility ($p < 0.0001$) (Table 3).

Table 1: Age distribution of study participants

Age group (years)	Frequency (%)	95% CI	
< 19	4 (5%)	1.38	12.31
19-30	11 (13.75%)	7.07	23.27
31-40	18 (22.5%)	13.91	33.21
41-50	18 (22.5%)	13.91	33.21
51-60	15 (18.75%)	10.89	29.03
> 60	14 (17.5%)	9.91	27.62

Table 2: Comparison of intubation time, POGO score, and hemodynamic parameters between McGrath and McCoy groups

	McGrath	McCoy	P value
Age	43.3±14.86	44.95±15.38	0.627
Total intubation time	41.75±7.78	53.98±2.87	<0.0001
POGO score	78.23±31.78	32.18±5.22	<0.0001
Systolic BP	143.25±11.41	166.5±12.72	<0.0001
Diastolic BP	85.25±9.6	100.75±8.88	<0.0001
Pulse rate	107.98±13.23	134.63±16.9	<0.0001

Table 3: Cormack-Lehane Grading distribution between McGrath and McCoy groups

Cormack-Lehane Grading	McGrath	McCoy	P value
1	23 (57.5%)	0	<0.0001
2a	15 (37.5%)	1 (2.5%)	
2b	2 (5%)	17 (42.5%)	
3	0	22 (55%)	

DISCUSSION

In our study, the age distribution between the McGrath and McCoy groups did not differ significantly; however, this sex difference did not directly correlate with laryngoscope performance. Similarly, Jain et al. found that age was an insignificant predictor of the time needed for successful intubation with video laryngoscopes.[15]

The McGrath video laryngoscope had a significantly shorter intubation time (41.75 minutes) than the McCoy (53.98 minutes) ($p < 0.0001$). This finding aligns with studies by Bhola et al., who observed that McGrath required less time for successful intubation in patients with cervical spine immobilisation.[16] Similarly, Taylor et al. found that McGrath improved glottic views in 75% of patients compared to Macintosh, further reducing intubation time.[17] These studies highlight McGrath's ability to reduce the duration of the procedure, which can decrease the risk of hypoxia and other complications.

The McGrath group had a significantly higher percentage of patients with CL Grade 1 (57.5%), indicating easier laryngeal visualisation. None of the patients in the McCoy group showed grade 1 CL grading. Reutzer et al. demonstrated similar results,

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where the McGrath video laryngoscope provided an improved glottic view with CL grading 1(72%) in both routine and difficult airway scenarios.[18] Bhola et al. also found that the McGrath laryngoscope showed improved glottic view with cervical spine immobilisation.[16] This indicates that McGrath is better at reducing the difficulty of intubation across various patient groups.

In our study, the McGrath group demonstrated a significantly higher POGO score (78.23) than the McCoy group (32.18), indicating superior glottic visualisation (P-value < 0.0001). Seo et al. found that the C-MAC D-Blade, another video laryngoscope, also provided higher POGO scores and faster intubation in patients with simulated cervical spinal injuries.[19] These findings confirm that video laryngoscopes, particularly McGrath, offer enhanced visualisation during intubation, leading to better outcomes.

The McGrath group exhibited lower systolic blood pressure changes and lower diastolic blood pressure changes than the McCoy group, suggesting that McGrath causes less haemodynamic stress during intubation. The mean systolic BP values in McGrath and McCoy were 143 and 166 mmHg, respectively. Adamu et al. similarly found that the McGrath video laryngoscope induced fewer cardiovascular stress responses in patients with difficult airways undergoing elective surgery.[20] Minimising hemodynamic fluctuations during intubation is crucial, particularly in patients with cardiovascular comorbidities, making the McGrath video laryngoscope a better choice in these scenarios.

Haemodynamic changes were observed in 15% of patients with McGrath and 70% of patients with McCoy. This aligns with Laurent et al., who found that video laryngoscopes, including the McGrath, were associated with fewer hemodynamic changes compared to direct laryngoscopes like the Macintosh.[21] Choosing a video laryngoscope like McGrath reduces cardiovascular stimulation during intubation is essential for patient safety, especially in high-risk populations

The pulse rate was significantly lower in the McGrath group (107.98 bpm) than in the McCoy group (134.63 bpm) (P-value < 0.0001). This suggests that McGrath had reduced physiological stress during intubation compared with McCoy's intubation. Similar findings were reported by Adamu et al., where McGrath was linked to lower heart rate changes during difficult airway management.[20] Minimising cardiovascular strain is critical, particularly in patients with pre-existing cardiac conditions, making McGrath a better choice in terms of minimising adverse responses during intubation.

Sato et al. found that the McGrath significantly shortened intubation time and improved Cormack-Lehane grading compared to both the Macintosh and Airway scopes.[12] Seo et al. also demonstrated that video laryngoscopes like the McGrath reduce intubation duration and improve glottic visualisation in simulated difficult airway scenarios.[19] Moreover, Prekker et al. found that video laryngoscopy led to higher first-attempt success rates in critically ill patients compared to direct laryngoscopy, reinforcing the advantages of video-assisted devices like the McGrath.[9]

Yadav et al. compared the Macintosh, Miller, and McCoy laryngoscope blades in paediatric patients. The study wasn't directly relevant to adult patients, but its findings on ease of intubation and glottic visualisation could provide insights into McCoy's performance across different age groups.[22] Lee et al. compared the McCoy with the McGrath in obese patients, noting a significantly lower IDS (Intubation Difficulty Scale) score in the McGrath group.[23] Though not directly related to McGrath, it could be used to further emphasise the limitations of McCoy compared to modern video laryngoscopes. These findings support the preferential use of the McGrath video laryngoscope in emergency and trauma scenarios, particularly in patients with limited cervical mobility, in whom rapid and safe intubation is critical.

Limitations

This study simulated cervical spine injury conditions using a Philadelphia collar; however, haemodynamic variables were assessed only in healthy individuals without comorbidities or multiple injuries. Although cervical spine immobilisation was performed in real-time, the haemodynamic responses observed may not accurately reflect those in patients with actual cervical spine injuries.

CONCLUSION

The McGrath video laryngoscope demonstrated superior glottic visualisation, reduced intubation time, and attenuated haemodynamic response compared to the McCoy laryngoscope in simulated cervical spinal injuries. Further studies on patients with cervical spine injury are warranted to validate these findings in clinical trauma settings.

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