Scholars Journal of Applied Medical Sciences (SJAMS)
Abbreviated Key Title: Sch. J. App. Med. Sci.
ISSN 2320-6691 (Online)
ISSN 2347-954X (Print)
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A Unit of Scholars Academic and Scientific Society, India
www.saspublisher.com

Medicine

A Comparative Evaluation of the Hemodynamic Response and Ease of Intubation with King Vision Video Laryngoscope and Mccoy Laryngoscope in Patients Posted For Cervical Spine Surgery, Undergoing Tracheal Intubation for General Anaesthesia

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Original Research Article

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Article History
Received: 10.03.2018
Accepted: 21.03.2018
Published: 30.03.2018

DOI:
10.21276/sjams.2018.6.3.89

Abstract: Fiber optic bronchoscope, Airwayscope, Glidescope, C-mac video laryngoscope, Airtraq have been shown effective in intubating patients with cervical spine injury. Though McCoy laryngoscope has been proved useful in these patients for intubation, but the recently added King's Vision video laryngoscope has limited data in such scenario. 60 ASA physical statuses I and I, non obese patients of either sex (18-60 yrs age) of all Mallampati classes, undergoing general anaesthesia for elective cervical spine surgery were included. Cervical immobilisation maintained using manual inline stabilisation with the anterior part of the cervical collar removed. The two laryngoscopes, the King Vision [KV] and McCoy [MC] were compared with each other with respect to the laryngoscopy and intubation time, POGO score, number of attempts taken, incidence of successful intubation, ease of intubation, changes hemodynamics during laryngoscopy and intubation, and incidence of complications like blood staining of laryngoscope blade during laryngoscopy and sore throat. The mean intubation time was significantly faster with the King vision (22.64 ±2.63 s) compared to the McCoy laryngoscope (24.98 ±2.84 s, p=0.0016). King Vision provided a better glottis visualization with a mean POGO score of 95.53± 17% as compared to the 79.9±31.23% with McCoy laryngoscope (p=0.019). First attempt success was noted in 93.3% (28/30) and 70% (21/30) of the patients using King Vision and McCoy laryngoscopes respectively. The ease of intubation was thus significantly better with the King vision as compared to the McCoy laryngoscope (p=0.042). The haemodynamic stress response to laryngoscopy and intubation was found to be less with King vision laryngoscope as compared to the McCoy.
Keywords: laryngoscopy, Cervical immobilization, intubation.

INTRODUCTION

Direct laryngoscopy with the conventional Macintosh laryngoscope involves extension of the head at the atlanto – axial joint and flexion at the lower cervical vertebrae can be a potential risk in patients with an unstable cervical spine, carrying a possible risk of neurological deterioration. Fiber optic bronchoscope, Airwayscope, Glidescope, C-mac video laryngoscope, Airtraq has been shown by many authors to decrease cervical spine movements in patients requiring immobilization of the cervical spine. Fiberoptic bronchoscopy is regarded as the gold standard for intubation in patients with cervical spine injury, however its use is restricted by availability, lack of expertise, and additional time required to perform bronchoscopy.

The commonly used McCoy laryngoscope with a hinged tip facilitates tracheal intubation with the patient's head in a neutral position. The McCoy improves the Cormack and Lahane grade by 1 in comparison to Macintosh in patients with cervical spine instability. The king vision video laryngoscope is a recent addition to the long list of devices that claim to provide the "perfect view" for intubation via use of video and digital technology. The curvature of the blade and the design of the video camera components help in visualization of the glottis without the need for alignment of the three airway axes. However, till date we have been able to access only a limited number of detailed randomized studies comparing King vision video laryngoscope and McCoy laryngoscope. We therefore, had conducted this prospective randomized, single center study to compare and evaluate the efficacy of the McCoy laryngoscope and

the king vision video laryngoscope aided intubation in patients posted for cervical spine surgery, requiring tracheal intubation for general anaesthesia.

MATERIALS AND METHODS

60 ASA I & II patients of either sex, aged 18-60 years posted for elective cervical spine surgery, requiring general anaesthesia were included in the study. Patients were randomly divided into two groups using computer based random number.

Group A(KV)->Patients intubated with King Vision Video Laryngoscope.
Group B(MC) ->Patients intubated with McCoy Laryngoscope

Learning curve was achieved by intubating 20 times on manikin and 10 times on patients, using each of the devices prior to start of study.

Inclusion Criteria

- Patients posted for elective cervical spine surgery
- BMI less than 30
- MMP score- all (1 to 4)

Exclusion Criteria

- Patients with thoracic injuries
- Decreased inter incisor distance (< 3 cm)
- Any facial anomaly

All the patients were placed on cervical immobilisation/ rigid cervical collar. They were administered general anaesthesia with Inj. nalbuphine, Inj. Propofol (2.5mg/kg) and neuromuscular blockade with Inj Rocuronium 1mg/kg. After adequate muscle relaxation, the anterior part of the cervical collar was removed & neck immobilisation using manual inline stabilisation (MIS) applied by an experienced anaesthetist. The patients were then intubated with King Vision Video laryngoscope with channeled blade (Group A) or McCoy laryngoscope (Group B), according to the allocated group.

An attempt was defined as the laryngoscope being removed from the mouth before reinsertion. When the first intubation attempt failed, the second attempt was made by applying optimal external laryngeal manipulation (OELM) after mask ventilation for 1 minute. In each group, a tracheal intubation attempt was considered to have failed if the patient could not be intubated. The observer recorded the total number of intubation attempts and the intubation time, which was defined as the time from introduction of the device until the first appearance of the capnographic wave form on the monitor. Any events that occured during intubation, such as lip or dental injury, was also recorded. After obtaining the best glottic view for each device, the percentage of glottic opening (POGO) score was determined. The ease of intubation was also recorded. A failed intubation was defined as the trachea could not be intubated even after 2 attempts, and a supraglottic airway device (SAD) was used as a rescue device. Changes in the heart rate (HR), blood pressure (BP) and SpO2 were recorded in the pre and post intubation period.

POGO SCORING (Percentage of Glottic Opening)

POGO	Glottic Visualisation
0%	No glottic structures, not even arytenoids visible
33%	Only lower 3rd of the vocal cords and arytenoids seen
100%	Entire glottic aperture visualised.

GRADING EASE OF TRACHEAL INTUBATION

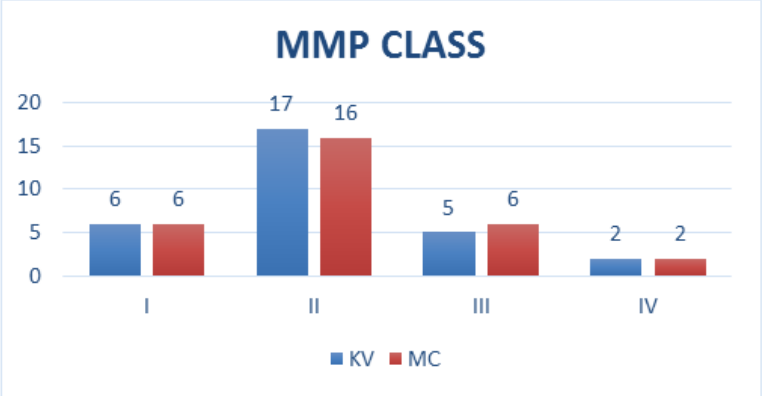
Grade I	No external manipulation of larynx was required to intubate.
Grade II	External manipulation of the larynx was required to intubate.
Grade III	Failed intubation.

Observations

Table-1: Comparison of demographic parameters between two groups

Parameter	Group		P	Test of Significance
	KV	MC		
Sex (M:F)	23/7	24/6	0.75	X^2 test
Age (yrs mean ± SD)	38.6± 10.8	42.33 ± 9.05	0.15	T test
BMI (mean ± SD)	24.47± 2.11	24.54 ± 1.95	0.89	T test
ASA Grade (I/II)	23/7	24/6	0.75	X^2 test

Demographic parameters were comparable between the groups



Graph-1: showing mallampati class of patients in both the groups

Table-2: Pogo score on laryngoscopy in both group

POGO SCORE	Group				Test of significance
	KV		MC		
	No of patients	%	No of patients	%	
100%	28	93.3%	24	80%	t-test p=0.019
33%	2	6.7%	6	20%	
0%	0	0%	0	0%	
Total	30	100%	30	100%	
Mean ± SD	95.53±17 %		79.9± 31.23 %		

There was no statistical difference in MP grading of patients in both the groups (p=0.975) (Graph-1).

Group KV had 93.3% of patients with 100% POGO while Group MC had 80% patients with POGO score 100%. 6.7% of patients in Group KV had POGO score 33% compared to 20% in Group MC. There were no patients with 0% POGO in both the groups. The p value of 0.019 signifies there is a statistically significant difference in POGO scoring between the two groups.

Table-3: Number of attempts taken to intubation in both groups

Number of Attempts	Group				Test of Significance
	KV		MC		
	No of Patients	%	No of Patients	%	
1	28	93.3%	21	70%	Fischer's exact test p=0.042
2	2	6.7%	9	30%	
3	0	0.00%	0	0.00%	
Total	30	100%	30	100%	

28 patients in group KV and 21 patients in Group MC were intubated in the first attempt whereas 2 patients in Group KV and 9 patients in Group MC required a second attempt with optimal external laryngeal manipulation. There was no intubation failure in both the groups. The difference was statistically not significant with a p value of 0.042.

Graph-2: Showing incidence of successful intubation in two groups

Table-4: Incidence of ease of tracheal intubation in both groups

Ease of Intubation	Group				Test of Significance
	KV		MC		
	No of Patients	%	No of Patients	%	
Grade 1	28	93.3%	21	70%	Fischer's exact test p=0.042
Grade 2	2	6.7%	9	30%	
Grade 3	0	0.00%	0	0.00%	
Total	30	100%	30	100%	

In Group KV 93.3% patients were intubated without any external manipulation while in Group MC only 70% patients were intubated without any external aid. There was no incidence of failed intubation in both the groups. There was a statistically significant difference between the groups with a p value of 0.042.

Table-5: Correlation between mallampati class and pogo score in kv group

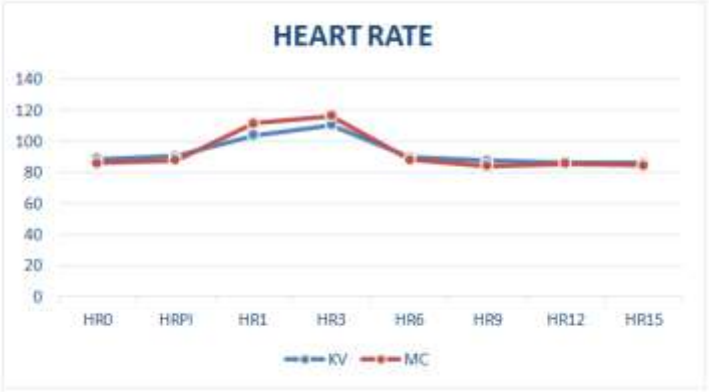
MMP CLASS	Group KV				Test of significance
	POGO 100%		POGO 33%		
	No of patients	%	No of patients	%	
I	6	100%	0	0%	Pearson correlation R= -0.135
II	16	94.12%	1	5.88%	
III	4	80%	1	20%	
IV	2	100%	0	0%	

Pearson correlation was used to determine if any correlation was present between the MMP class and POGO score. It gave an R value of -0.135 which reveals only a weak negative correlation.

Table-6: Correlation between mallampati class and pogo score in mc group

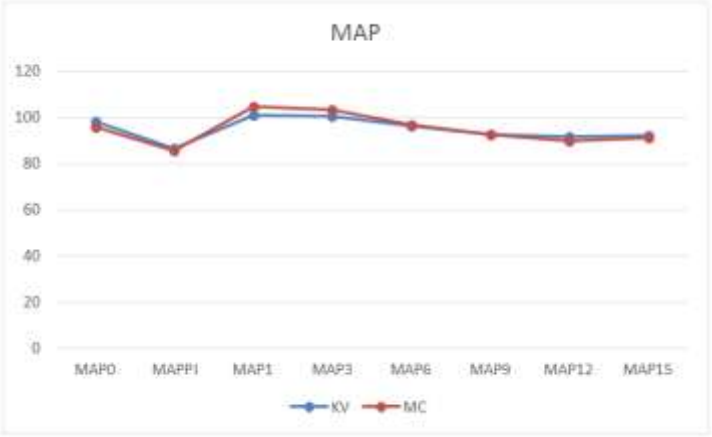
	Group MC				Test of significance
	POGO 100%		POGO 33%		Pearson correlation R= -0.343
	No of patients	%	No of patients	%	
I	5	83.3%	1	16.7%	
II	13	81.25%	3	18.75%	
III	2	33.33%	4	66.67%	
IV	1	50%	1	50%	

Pearson correlation was used to determine if any correlation was present between the MMP class and POGO score. It gave an R value of -0.343 which reveals only a weak negative correlation.



Graph-3: Showing distribution of heart rate at various intervals in two group

The base lines and post induction values were comparable in both the groups. There was a significant rise in the heart rate from the baseline, 1 minute and 3 minutes after intubation in both the groups and returned to baseline by 6 minutes after intubation and remained so at 9,12 and 15 minutes after intubation.



Graph-4: Showing distribution of mean arterial pressure at various intervals in two groups

The base lines and post induction values were comparable in both the groups. There was a significant rise in the mean arterial pressure from the baseline one minute and 3 minutes after intubation in both the groups. The rise was also significantly higher in Group MC in comparison to Group KV. However, in both the groups the mean arterial pressure returned to the baseline by 6 minutes after intubation and remained so at 9,12 and 15 minutes after intubation.

Table-7: Comparing the various intubation parameters between two groups

Parameters	Group		P	Test of Significance
	KV	MC		
Time taken (Mean & SD)	22.64± 2.63	24.98±2.84	0.0016	T test
Number of Attempts (1/2/3)	28/2/0	21/9/0	0.0419	Fischer's Exact test
Ease ofIntubation (1/2/3)	28/2/0	21/9/0	0.0419	Fischer's Exact test
POGO (Mean & SD)	95.53± 17	79.9± 31.23	0.0192	T test
Blood Staining (NO/YES)	28/2	27/3	1	Fischer's Exact test
Sore Throat (NO/YES)	28/2	23/7	0.1455	Fischer's Exact test

DISCUSSION

In patients with cervical spine injury with cervical immobilization, direct laryngoscopic endotracheal intubation is difficult. Though the McCoy laryngoscope has been widely used in simulated difficult airway scenarios, literature regarding the use of King Vision Video Laryngoscope in these circumstances is sparse. In our study, we included only patients with proven cervical spine disease with cervical spine immobilization. Presence of hard collar makes

laryngoscopy difficult by restricted mouth opening. We used hard collar for bag and mask ventilation and manual in line axial stabilization maneuver, with anterior part of hard cervical collar removed for laryngoscopy and intubation.

The demographic profile like the gender, age, BMI, Mallampati class and ASA grade were comparable in both groups. Any prolongation of the apnea time and delay in intubation can lead to hypoxemia and desaturation in patients. The time from insertion of the laryngoscope blade to the appearance of first $ETCO_2$ tracing on the monitor was noted. The mean intubation time was significantly faster with the King vision (22.64 ±2.63 s) compared to the McCoy laryngoscope (24.98 ±2.84 s, p=0.0016). The timings we obtained were similar to the results obtained by Ahmed S *et al*. [1] and Shravanalakshmi *et al*. [2], but the study reported by Ali *et al*. [3] showed that there is no statistical difference in the intubation timings. The prolonged time of intubation with the Mc Coy laryngoscope was because the field of vision was narrower and smaller, requiring more time to identify the pharyngeal and laryngeal anatomy. Also the presence of channel in king vision makes guiding the ETT through the glottis faster and easier.

Optimal visualization of the glottis is important for successful intubation with restricted spine mobility. We used POGO score as the measure of glottis visualization as the Cormac-Lehane grading system has numerous problems like the grades being ambiguous between grade 1 and grade 2.[4-6] In our study we observed that a POGO score 100% was obtained in 28/30 (93.3%) and 24/30 (80%) patients with the King vision video laryngoscope and McCoy laryngoscope respectively. None of the patients in both the groups had a 0% POGO scored. The King Vision provided a better glottis visualization with a mean POGO score of 95.53± 17% as compared to the 79.9±31.23% with McCoy laryngoscope (p=0.019). Similar results were obtained by Ali *et al*. [3], Ahmed S *et al*.[1] and Shravanalakshmi *et al*. [3]. All (6/6) the patients with Mallampati class 1 in King Vision group had a 100% glottic visualisation compared to the McCoy group (5/6).

An attempt was defined as the laryngoscope blade being removed from the mouth before re insertion. A second attempt was made by applying optimal external laryngeal manipulation. Intubation was considered failed if the second attempt fails, and a supra-glottic airway device (SAD) was used as a rescue device. First attempt success was noted in 93.3% (28/30) and 70% (21/30) of the patients using King Vision and McCoy laryngoscopes respectively. External manipulation of larynx was more frequently required for intubation with Mc Coy laryngoscope (9/30) as compared to King Vision video laryngoscope (2/30). The difference is mainly due to the clear and bright image of glottis with wider field of vision on the monitor of king vision together with the angulation of the blade which makes hand and eye co-ordination during intubation. Presence of the channel makes it effortless to guide the ETT to easily pass through the vocal cord once the optimal view is obtained. Also multiple viewers can clearly observe the passage of ETT inside the vocal cord. Our results were similar to the results of Ali *et al*. [3] , Shravanalakshmi *et al*. [2] and Ahmed S *et al*. [1]. But Keline-Brueggeney M *et al*. [7] obtained only an 87% first attempt intubation success with the king vision, contradicting our results.

In our study, intubation success was 100% with both the laryngoscopes. (TABLE 6). This could be because we had gained an adequate learning curve with both the devices prior to the study. Similar results were obtained by Ali *et al*. [3], Shravanalakshmi *et al*. [2] and Ahmed S *et al*. [1].

The ease of intubation assumes a greater significance in patients with cervical immobilization. Intubation difficulty was assessed with numbers of attempts needed and the need for external manipulation of the larynx for successful intubation. We graded the ease of intubation as 1 when no external manipulation was required and 2 when it was required,3 indicated a failed intubation. 28/30 and 21/30 patients in the King vision group and McCoy group respectively could be intubated without any external laryngeal manipulation. The ease of intubation was thus significantly better with the King vision as compared to the McCoy laryngoscope (p=0.042). Our results were supported by the results of Ali *et al.* [3] and Ahmed S *et al*.[1].

Though there was a good correlation between Mallampati class I and POGO 100% in both the groups, but over all there was only a weak negative correlation between Mallampatti classes and POGO score in both the groups.

The haemodynamic stress response to laryngoscopy and intubation was found to be less with King vision laryngoscope as compared to the McCoy. There was a transient increase in the heart rate and mean arterial pressure 1 minute and 3 minute after intubation in both the devices, but the rise was more with McCoy than the King vision laryngoscope. Similar results were obtained by Ali *et al*. [3] and Ahmed S *et al*. [1]. Both the parameters returned to the baseline by the sixth post intubation minute.

The incidence of blood staining on the blade (2 and 3 patients in KV and MC group respectively) and post-operative sore throat (2 patients in the KV group and 7 patients in the MC group) and were fewer in number with King vision video laryngoscope, though statistically insignificant. This could be because of the peculiar design of the king vision blade and due to less manipulation of soft tissue of airway structures during

laryngoscopy and intubation with King Vision as compared to McCoy laryngoscope. Similar results were obtained by Ali *et al*. [3] and Ahmed S *et al*. [1].

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