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Original Research Article

COMPARISON OF CHANNELLED BLADE WITH NON-CHANNELLED BLADE OF KING VISION VIDEO LARYNGOSCOPE FOR OROTRACHEAL INTUBATION

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Abstract
Background: The inability to establish a definitive airway has been identified as a significant factor contributing to morbidity and mortality associated with airway-related complications. To address this issue, the current study aimed to compare the performance of the channelled blade and non-channelled blade of the King Vision™ video laryngoscope in facilitating orotracheal intubation. **Materials and Methods:** The study included a cohort of 60 patients divided into two groups: Group A, which underwent intubation using a channelled blade, and Group B, which underwent intubation using a non-channelled blade. The research compared factors such as intubation time, ease of intubation, and the quality of the laryngeal view achieved. **Results:** The higher mean laryngeal exposure time was observed in Group A (9.36±2.47 s) compared to Group B (5.9±1s). A higher mean intubation time was observed in Group B (27.43 ± 5.26 s) compared to Group A (12.06 ± 3.106 s). The higher mean attempts at intubation were observed in Group B (27±3) compared to Group A (24±6). The ease of insertion for blades was reported to be significantly easy with non-channelled blades, and ETT ease insertion was found to be better with channelled blades. The manoeuvring of the device was not needed after laryngeal exposure in the case of the non-channelled blade. Intubation with a channelled blade requires anticlockwise rotation of the endotracheal tube. **Conclusion:** Based on our findings, we can infer that using the channelled blade of the King Vision video laryngoscope results in a shorter intubation time when compared to the non-channelled blade.

INTRODUCTION

The recognition of the significant impact of the inability to establish a definitive airway on airway-related morbidity and mortality was initially described by Caplan et al. in 1990.[1] One of the major contributors to this problem was the inability to intubate patients, which led to subsequent efforts successfully focused on improving the success rate of intubation. The development of video laryngoscope technology emerged as a crucial advancement in enhancing intubation success rates. Video laryngoscopes revolutionized laryngeal visualization, particularly in patients with challenging airways, due to their ability to achieve better visualization with reduced lifting force.[2-3] These devices offered an expanded field of vision and the capability to visualize previously difficult areas, especially with anatomically-shaped devices. However, the pursuit of improved visualization has also introduced its own set of challenges. Various video laryngoscope devices have been developed, including the Macintosh type (C-MAC), hyper angulated devices like the GlideScope, and devices featuring a dedicated channel, such as the King Vision. Each device type requires its technique for successful intubation, necessitating a learning curve for proficiency.[3]

Video laryngoscopes equipped with a channel offer the benefit of a dedicated pathway for guiding the endotracheal tube, eliminating the requirement for a stylet to direct the tube towards the glottic opening. Nevertheless, certain situations may arise where a channel is not advantageous, and a non-channelled device becomes necessary. It is important to note that video laryngoscopes are typically available in either channelled or non-channelled configurations, with both blades not generally present in a single device. Several studies have been conducted to evaluate and compare the efficacy of various devices with different designs.[4-5]

The King Vision™ video laryngoscope is equipped with both channelled and non-channelled blades. These blades are designed to have similar angles. The channelled blade provides a dedicated pathway for guiding the endotracheal tube, which can result in faster intubation. On the other hand, the non-channelled blade requires a smaller mouth opening and offers more maneuverability for oral and nasotracheal intubation. However, it necessitates using a stylet to direct the endotracheal tube towards the glottic opening. Currently, no existing literature directly compares the performance of channelled and non-channelled blades of the King Vision video laryngoscope for orotracheal intubation.[6]

Our study aimed to compare the channelled and non-channelled blades of the King Vision™ video laryngoscope concerning laryngoscopy, intubation time, and ease of laryngoscopy. The study's primary objectives were to identify any challenges encountered during video laryngoscopy and explore techniques that could be employed to overcome these difficulties.

MATERIALS AND METHODS

The prospective randomised comparative study was conducted on 60 patients undergoing elective surgery in Government Theni Medical College, Theni from April 2021 to September 2022. All 60 patients were randomly divided into Group A (channelled blade) and Group B (non-channelled blade), with 30 patients in each group. Institutional ethical committee approval and written consent were taken before the start of the study.

Inclusion Criteria

All patients willing to participate in the study were aged 18 to 60, and patients undergoing elective surgery with ASA I and II were included.

Exclusion Criteria

Patients with restricted mouth opening and limited neck movements, MPG III and IV, BMI > 30 kg/cm2 and age less than 18 years, and those unwilling to take the test and moribund ill patients were excluded.

Methodology

After a thorough pre-anaesthetic evaluation, patients were assigned to one of the two groups –Group A and Group B. All patients were fasting overnight and given acid aspiration prophylaxis with Tablet Ranitidine 150mg and Tablet Metaclopromide 10mg the night before surgery. The anaesthetic machine was checked before starting the procedure. Ensured the availability of a working laryngoscope, oral airway, and endotracheal tube of various sizes. Made sure that the essential emergency drugs were available and the patient was secured with an 18G I/V cannula.

In the operating room, Patients were connected with standard monitoring, including ECG, NIBP, pulse oximeter and baseline vital parameters were recorded. Premedication was done with Inj. Glycopyrrolate 10 mcg/kg IM 45 minutes before surgery and Inj. Midazolam 0.1mg/kg IV, Inj. Fentanyl 2mcg/kg IV was given before induction. Baseline vitals (T0), heart rate (HR), mean arterial pressure (MAP) and saturation (SpO2) were noted. Preoxygenation was done for 3 min using a face mask connected to a closed circuit primed with 100% oxygen at a fresh gas flow of 6 L/min. The patient was induced with Inj. Propofol 2mg/kg and paralysed with Inj. Succinylcholine 2 mg/kg. Following confirmation of complete muscle paralysis, the patient was positioned supine with the neck in a neutral position. Then video laryngoscopy was performed with a King Vision video laryngoscope (channelled blade for Group A and non-channelled blade for Group B). The technique of intubation followed for both blades was recommended by the company. The ease of insertion of the laryngoscope and Endotracheal tube was judged based on grades by the operator (Table 1). Laryngeal exposure time (time taken from blade entry to glottis exposure) was noted for both groups.

Table 1: Grading of Laryngoscopy

Grades	Laryngoscopy	Endotracheal tube
1	Easy	Non-problematic
2	Moderately	difficult Manageable with adjuncts
3	Failed	Difficult or impossible

The endotracheal tube was gently slid from the side channel into the larynx for the A group. For Group B, a styletted, preshaped, cuffed endotracheal tube of appropriate size (7.0 mm ID for females and 8.0 mm ID for males) was introduced into the oral cavity and advanced into the larynx. Intubation time (time taken from the blade entry till the passage of the cuff through the glottis) was noted for each patient. Tube placement was confirmed by direct visualisation of the passage beyond vocal cords and bilateral air entry. The impingement site (right or left aryepiglottic fold, inter arytenoid region, epiglottis and anterior subglottic area) was noted during the endotracheal tube passage. During intubation, manipulations of scope (left/right rotation, withdrawal, lifting of scope) and manipulations of the endotracheal tube were also noted (withdrawal of tube, 90° and 180° clockwise/anticlockwise rotation and then reversing same rotation, complete withdrawal and reinsertion). Other manipulations during the procedure, such as rotation of the scope for introduction into the oral cavity or change in the head-and-neck position while introducing the endotracheal tube or external laryngeal manipulation, were noted.

After the procedure, the blade of the King Vision video laryngoscope was inspected for blood staining to evaluate oropharyngeal trauma during the procedure. Anaesthesia was maintained with nitrous oxide and oxygen (50:50) with sevoflurane 1-2% and Inj. Atracurium 0.5mg/kg bolus followed by 0.1mg/kg in aliquots. Heart rate(HR), Mean arterial pressure(MAP), saturation(SpO2) was recorded 5 minutes(T5), 15 minutes(T15) and 30 minutes(T30) after intubation. At the end of surgery, after adequate spontaneous respiratory efforts, patient was reversed with Inj neostigmine 0.04mg/kg and Inj glycopyrrolate 0.01 mg/kg IV. After adequate reversal and oral suctioning, the patient was extubated. Following extubation, the endotracheal tube was inspected for blood staining to evaluate trauma that could have occurred during intubation. After extubation, the patient was shifted to the postoperative ward and monitored.

Statistical Analysis

The collected data was entered in Microsoft Excel (windows 10), and analysis was done using the statistical package for social sciences (SPSS-19). To find an association between two categorical variables Pearson chi-square test was used. The value of P<0.05 is considered statically significant.

RESULTS

A total of 60 Patients of either sex, aged between 18 to 60 years, were enrolled for the study and divided into groups, namely Group A and Group B, each with 30 subjects. The male and female ratio was the same in both groups. The patient's mean age group, ASA class, Mean heart rate (MHR), mean arterial pressure (MAP) and mean SpO2 were found to be comparable in both groups of patients [Table 1].

The higher mean laryngeal exposure time was observed in Group A (9.36±2.47 seconds) compared to Group B (5.9±1 seconds). A higher mean intubation time was observed in Group B (27.43 ± 5.26 seconds) compared to Group A (12.06 ± 3.106 seconds). The effects were found to be statistically significant (p<0.05).

Table 1: Observation of demographic parameters of both group patients

Parameters		Group A (n=30)	Group B (n=30)	P-value
Gender	Male	15 (50%)	15 (50%)	0.42
	Female	15 (50%)	15 (50%)	
Age group (years)	<20	2 (6.66%)	1 (3.33%)	0.5
	21-30	6 (20%)	7 (23.33%)	
	31-40	11 (36.67%)	8 (26.66%)	
	41-50	7 (23.33%)	9 (30%)	
	>50	4 (13.33%)	5 (16.67%)	
Mean age (years ± SD)		37.66±10.56	39.8±9.96	0.212
ASA classification	I	16 (53.33%)	15 (50%)	0.284
	II	14 (46.66%)	15 (50%)	
Mean heart rate (beats/min)	T0	84.86	84.94	0.326
	T5	89.33	90.46	
	T15	86.1	87.7	
	T30	84.56	84.93	
Mean MAP (mmHg)	T0	79.26	82.53	0.412
	T5	82	84.13	
	T15	82.06	70.36	
	T30	79.26	82.53	
Mean SpO2 (%)	T0	100	100	0.621
	T5	100	100	
	T15	100	100	
	T30	100	100	

The higher mean attempts at intubation were observed in Group B (27±3) compared to Group A (24±6). The ease of insertion for blades was compared in both groups of patients. Grade 1 insertion was observed in 25 patients in group A and 28 in group B. Grade 2 insertions were observed in 5 patients in group A and only 2 in group B. In comparing the ease of insertion of ETT, it was found that more patients with Grade I were reported in Group A (27) and more patients were seen in Group B (7) with Grade II. The above effects were found to be statistically significant (p<0.05) [Table 2, Figure 1].

Table 2: Different evaluation parameters of patients in both groups

Parameters	Observation N (%)		P-value
	Group A (n=30)	Group B (n=30)	
Laryngeal exposure time (mean ± SD)	9.36 ±2.47	5.9±1.49	0.0007
Intubation time (mean ± SD)	12.06± 3.10	27.43± 5.26	0.0003
Attempts at intubation			
1	24 (80%)	27(90%)	0.563
2	6(20%)	3 (10%)	
Ease of insertion of blades			
1	25 (83.33%)	28(93.33%)	0.0001
2	5 (16.66%)	2 (6.66%)	
Ease of insertion of an endotracheal tube			
1	27 (90%)	23(76.66%)	0.0001
2	3 (10%)	7 (23.33%)	

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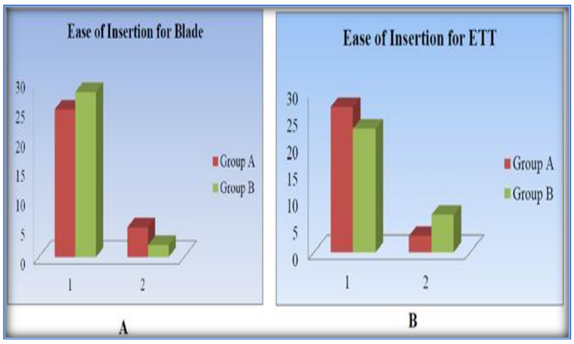

Figure 1: Observation of (A) Ease of insertion of blades (B) Ease of insertion of ETT

On analysing the type of impingement and manipulations needed for successful intubation, the frequency of manipulations required to intubate was almost similar (50% for the channelled vs 46.66% for the non-channelled blade). A higher number of patients was observed in the right AE fold in group A (7), whereas a higher number was observed in the epiglottis fold in group B (4).

In scope manipulations, more patients were observed towards the right in Group A patients compared to Group B patients. The effect was reported as statistically significant, p<0.05. Manipulation of the endotracheal tube was required with equal frequency in both blade types (93.33% for the channelled vs 92.85% for the non-channelled blade). The type of manipulation needed was different with individual blades. Anticlockwise rotation of the endotracheal tube was the most common type of manoeuvre (36.66%) in the case of the channelled blade while withdrawing and redirecting it medially was the most common type of manoeuvre (36.66%) in the case of a non-channelled blade [Table 3].

Table 3: Observations of impingements and manipulations of patients in both groups

Parameters	Observation N (%)		P-value
	Group A (n=30)	Group B (n=30)	
Total impingements %	15 (50%) *	14 (46.66%) *	
Right AE fold	7	3	0.0001
Left AE fold	1	0	
Interaryetenoid membrane	1	1	
Epiglottis	2	4	
Anterior subglottic area	2	3	
multiple impingements	2	3	
Scope manipulations needed for intubations (%)	12 (80%) #	3 (21.42) #	
Towards left	2	0	0.0001
Towards right	7	0	
Withdrawal	2	3	
Lifting	1	0	
ETT manipulations	14 (93.33%) #	13 (92.85%) #	0.0001
Anticlockwise rotation	11	0	
withdrawal and readjustment	0	11	
external manipulation	3	2	

*Percentage incidence of total patients in each group, #Percentage incidence of total impingement.

DISCUSSION

Video laryngoscopes have significantly enhanced the visualization of the glottic region and have proven beneficial in reducing intubation failure, particularly in cases of anticipated difficult airways.[3] The initial true video laryngoscope, GlideScope™, was developed with a hyper-angulated blade to address challenges encountered with anteriorly positioned larynges. Subsequently, angulated channelled video laryngoscopes were introduced to simplify the process of endotracheal tube insertion. Additionally, cameras were integrated into Macintosh-type blades to create video laryngoscopes that resemble conventional Macintosh-type devices. Most video laryngoscopes report improved laryngeal views compared to traditional direct laryngoscopy. However, the techniques employed for intubation vary among devices and necessitate distinct sets of movements and skill sets to achieve successful intubation.[4]

Initially, the design of video laryngoscopes predominantly fell into three categories: hyper-angulated, non-channelled, angulated, channelled, or Macintosh-type blades. Only a few devices incorporated both channelled and non-channelled blade options. Previous studies have compared video laryngoscope devices with channelled and non-channelled blades. These studies found that channelled blades generally resulted in shorter intubation times.[5-7] However, there is a lack of research specifically comparing the performance of different blade types within the same device, particularly when the blades have similar curvature and angles.

In our study, we compared channelled (Group A) and non-channelled (Group B) blades of the King Vision video laryngoscope for orotracheal intubation. A significantly higher (p<0.05) laryngeal

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exposure time and decreased intubation time with greater ease of passing the endotracheal tube using the channelled blade were reported. Shah et al. also reported similar findings in their investigations.[8] Biro et al. reported shorter laryngeal exposure time and higher intubation time in their study with the channelled blade.[9] In a study conducted by Savoldelli et al., several video laryngoscope devices, including GlideScope, McGrath, Airtraq, and Macintosh laryngoscopes, were compared.[10] The study found that the Airtraq, a channelled video laryngoscope device, demonstrated the highest procedural ease. The ease of passing the endotracheal tube is likely improved with a channelled video laryngoscope due to a dedicated passage. In contrast, a non-channelled blade typically requires a hyper-angulated stylet, independent of the video laryngoscope, to guide the endotracheal tube.

Ease of insertion of the blade was found significantly ($p<0.05$) better with non-channelled blades than in our study. Lim et al. also reported ease of insertion better with non-channelled blades in their research.[11] In the present study, several intubation attempts were comparable in both groups of patients. Similar findings were also reported in earlier reported studies.[10]

Various manipulations may be necessary to align the trajectory of the tube with the laryngeal opening to facilitate the easy passage of the endotracheal tube (ETT). Teoh et al. identified specific maneuvers that were required during the intubation procedure.[7] The present study found that the frequency of manipulations required for intubation was similar between the channelled blade (50%) and the non-channelled blade (46.66%). With the channelled blade, approximately 50% of impingement occurred over the right aryepiglottic (AE) fold. On the other hand, with the non-channelled blade, impingement occurred at different locations, such as the epiglottis and the anterior subglottic area, including the right aryepiglottic fold. The impingement at the right aryepiglottic fold with the channelled blade could be attributed to the central insertion of the device and the introduction of the endotracheal tube from the right side of the device. The impingement on the anterior glottic structures, particularly with the non-channelled blade, could be due to the use of a hyper-angulated stylet required to position the endotracheal tube in front of the glottic opening.[12]

Among patients who underwent intubation using the channelled video laryngoscope, approximately 80% required manipulation of the device when impingement occurred. In contrast, only 21.42% of patients intubated using the non-channelled blade required repositioning or manipulation after achieving a satisfactory laryngeal view.

Since the video laryngoscope provides a view beyond the curvature of the tongue, it does not offer a complete visual of the entire path taken by the endotracheal tube. Therefore, some form of manipulation is often required to align the trajectory of the endotracheal tube with the glottic opening in both channelled and non-channelled video laryngoscopes.[5-6] With the channelled blade, when impingement on the right aryepiglottic fold occurs, an anticlockwise rotation of the endotracheal tube is typically performed as it slides off the dedicated slot. This maneuver redirects the tube towards the left, effectively overcoming the impingement. This rotation was necessary in approximately 93.33% of cases where impingement occurred. In the case of the non-channelled blade, the styletted endotracheal tube is often withdrawn and redirected towards the centre to facilitate its passage towards the glottic opening. This maneuver was performed in most cases (approximately 92.85%) to ensure proper tube placement.

Limitation of the study

The ease of insertion can be influenced by the limited sample size used in our study. Based on the findings, it is recommended that a larger-scale study be conducted to identify the different impingement sites and determine the potential maneuvers required to overcome the challenges associated with these impingements. A larger study would provide more comprehensive and reliable insights into these aspects.

CONCLUSION

Our study aimed to compare the channelled and non-channelled blades of King Vision video laryngoscope for laryngoscopy, intubation time and ease of laryngoscopy. We conclude that the King Vision video laryngoscope's channelled blade provides shorter intubation time than the non-channelled blade. It is easier to perform intubation with a channelled video laryngoscope.

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