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Comparative Study of McCoy, Airtraq and King's Vision Videolaryngoscope in Simulated Difficult Laryngoscopy Using Rigid Neck Collar.

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ABSTRACT

Background: Comparative study of McCoy, Airtraq and King's Vision Videolaryngoscope in simulated difficult laryngoscopy using rigid neck collar. **Methods:** It was a prospective study, including 90 ASA grade I/II patients aged between 18 to 60 years of either sex and weight 50 kg - 70 kg, scheduled for elective surgeries under general anesthesia requiring endotracheal intubation. The patients were divided in McCoy, Airtraq and King's Vision Videolaryngosocpe group comprising 30 patients each. The primary outcome measured was time of intubation. The secondary outcomes were number of attempts, overall success rate, Intubation Difficulty Score (IDS), Percentage of Glottic Opening (POGO) score, haemodynamic parameters and complications. **Results:** The time of intubation was significantly lower for King's Vision Video laryngoscope (p=<0.0001). Number of successful first intubation attempt was significantly higher in King's Vision Video laryngoscope group. The mean POGO score was also significantly improved in the King's Vision Video laryngoscope group. The mean IDS was also reduced significantly in King's Vision Video laryngoscope group. Haemodynamic parameters such as pulse rate and mean arterial pressure was significantly lower in King's Vision Videolaryngoscope group immediately after intubation. Incidence of complications like airway trauma was least with King's Vision Video laryngoscope. **Conclusion:** King's Vision Video laryngoscope, as compared to McCoy and Airtraq reduces the mean time of intubation, offers better laryngeal view, has higher success rates at first intubation attempts, reduces the IDS, and has least effect on haemodynamic parameters and least complications like airway trauma.

Keywords: McCoy, Airtraq, King's Vision Video laryngoscope, time of intubation.

INTRODUCTION

Airway management is the major responsibility of an anesthesiologist. Direct laryngoscopy involves proper positioning of the head and neck for optimal laryngeal view, which requires the alignment of the oral, pharyngeal and laryngeal axes. This necessitates a position with a neck flexion of 35°and a head extension of 15°, also known as the sniffing position.[1] Performing tracheal intubation, without leading to cord damage and exacerbation of the neurological injury, in patients with cervical spine fractures or other cervical pathology, in whom the stabilization (MILS) of cervical spine to prevent neck movements;[3] this may result in a poor laryngeal view on conventional laryngoscopy leading to difficulty in intubation.[4] The cervical collar significantly reduces the mouth opening, lifts up the chin, and tips the larynx anteriorly, rendering laryngoscopy difficult. These issues led to the development of alternatives to Macintosh laryngoscopes. Numerous anatomically shaped indirect laryngoscopes are available in the market, such as Truview EVO2, McGrath videolaryngoscope, Glidescope, Airtraq, and King's Vision Videolaryngoscope.

Both the Airtraq and the King's Vision Videolaryngoscope provide an improved Cormack−Lehane (CL) score with enhanced glottis visualization when compared with direct laryngoscopy, a fast learning curve, along with a blade that incorporates a tube channel to hold the endotracheal tube (ETT) and guides it toward the glottis.[5] The visualization of anatomical landmarks and ETT movement and passage is obtained either through direct vision on the device or through a liquid crystal display.[6] The high quality enlarged images obtained through these monitors are useful tools for not only training and teaching but also managing a difficult airway,[7,8] allowing for better co-ordination between the operator and assistant. Multiple studies have reported the improved success

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rate of intubation, with the use of video laryngoscopy in patients with a cervical collar.[9]

The McCoy laryngoscope comprises a blade with an adjustable hinged tip for the elevation of distal structures such as the epiglottis and is associated with significant improvement in glottis opening visualization.

The Airtraq optical laryngoscope is a new single-use laryngoscope designed to facilitate tracheal intubation in patients with both a normal and difficult upper airway anatomy. It does not require the alignment of the oral, pharyngeal, and tracheal axes for a proper view of the glottis due to its exaggerated blade curvature and an internal arrangement of optical components. Airtraq also produces less hemodynamic stimulation, a major advantage in certain clinical situations.

Videolaryngoscopy is an excellent option in difficult intubation because of the angulation and narrow blade used. It is an indirect technique requiring lesser force and smaller mouth opening for a glottic view and ETT placement than most traditional laryngoscopies. Emergency care providers may encounter deteriorating airway conditions in patients with facial trauma, neck or cervical spine injury, and oropharyngeal edema. They are involved in managing the most difficult airways, and patients frequently have concomitant head injury, multiple system trauma, and cervical spine injury. Therefore, the airway should be secured using the safest and most efficient method of videolaryngoscopy.

MATERIALS AND METHODS

After approval from the institution ethics committee, 90 American Society of Anesthesiologists grade I/II patients of either sex, aged between 18 and 60 years, with weights between 50 kg and 70 kg, and scheduled for elective surgeries under general anesthesia requiring endotracheal intubation were selected for the prospective study. The patients were divided into three groups using a "closed envelope technique" as follows:

Group A: McCoy laryngoscope was used for visualization and comprised 30 patients

GroupB: Airtraq laryngoscope was used for visualization and comprised 30 patients

Group C: King's Vision Videolaryngoscope was used for visualization and comprised 30 patients

After the preanesthetic evaluation of all patients and obtaining a written informed consent from them, an appropriate-sized rigid cervical collar was placed on each patient as per the manufacturer's instructions. The mouth opening was measured before and after its application.

Standard monitoring including electrocardiogram, noninvasive arterial pressure, SpO2 and end-tidal carbon dioxide measurement was performed. Inj Glycopyrrolate (0.2 mg i.v.), Midazolam (1.5 mg i.v.), and Tramadol (1.5 mg/kg i.v.) were administered as premedication. All patients were preoxygenated with 100% oxygen for 3 min. Anesthesia was induced with propofol injection of 2mg/kg i.v., and succinylcholine (1.5 mg/kg i.v.) was injected for muscle relaxation. An anesthesiologist with an experience of more than 75 intubations with the McCoy laryngoscope and more than 25 intubations with the Airtraq and King's Vision Videolaryngoscope performed the laryngoscopy in all the patients. Intubation was performed with a 7-mm cuffed ETT in females and an 8-mm ETT in males. In case of the McCoy laryngoscope, if the percentage of the glottic opening (POGO) score > 50%, intubation was performed without using the hinge of the laryngoscope. If the POGO score was <50%, the hinge of the McCoy laryngoscope was used to improve laryngeal visualization. If introducing the ETT was not possible in >3 attempts or the time taken for intubation was >120 s, the cervical collar was removed and intubation was performed using the routine method. Failure to intubate (>3 attempts or time taken >120 s) and the episodes of desaturation (SpO2<90%) during intubation were noted. The time taken for intubation was noted for all the three laryngoscopes. An assistant, not involved in the laryngoscopy and intubation, recorded the time taken for intubation with a stopwatch.

Table 1: The Intubation Difficulty Score

Parameter	Score
Number of attempts >1	N1
Number of operators >1	N2
Number of alternative techniques	N3
Cormack- Lehane(CL) grade 1	N4
Lifting force required Normal Increased	 N5=0 N5=1
Laryngeal pressure Not applied Applied	 N6=0 N6=1
Vocal cord mobility Abduction Adduction	 N7=0 N7=1
Total IDS = sum of scores	N1-N7
IDS = 0 Easy IDS = 1-5 Moderately difficult IDS => 5 Very difficult	

The number of insertion attempts with each laryngoscope was noted. A modified Intubation Difficulty Score (IDS) described by Adnet and Colleagues was noted for intubation aided by each type of laryngoscope [Table 1].[10] The Percentage Of Glottic Opening(POGO) score and grading for the laryngeal view were assessed. Hemodynamic parameters such as the pulse rate and mean arterial pressure were recorded before induction, during laryngoscopy, immediately after intubation and at the completion of intubation. Postoperative airway trauma was noted. Continuous data were compared using ANOVA. Statistical analysis was performed using SPSS. A P value of <0.05 was considered significant.

RESULTS

The three groups were compared based on demographic data and airway assessment characteristics [Table 2]. The overall success rate was similar for all the groups [Table 3]. The time taken for intubation was significantly lower for the King's Vision Videolaryngoscope than the McCoy and Airtraq laryngoscopes (P≤0.0001). Number of successful intubations at the first attempt were significantly higher in the King's Vision Videolaryngoscope group (P≤0.0001). The mean POGO score and mean IDS were significantly higher in the King's Vision Videolaryngoscope group (P≤0.0001 for both scores) [Figure 1], whereas hemodynamic parameters such as the pulse rate and mean arterial pressure were significantly lower in the King's Vision Videolaryngoscope group immediately after intubation (P≤0.0001) [Figures 2,3]. The incidence of complications such as airway trauma was the least in the King's Vision Videolaryngoscope group (P=0.02) [Table 3].

Table 2: Comparison between Demographic Data and Airway Parameters [Values are represented as mean (SD)]

Parameters	McCOY Laryngoscope	Airtraq Laryngoscope	King's vision Videolaryngoscope	P-value
AGE (Years)	35.08(10.69)	35.57(10.88)	37.52(10.54)	0.67
Sex(M:F)	4:26	6:24	8:22	0.24
WEIGHT (Kilograms)	57.38(6.45)	57.86(5.2)	58(6.07)	0.92
HEIGHT(Centimeters)	160.54(7.31)	161.86(6.32)	161.76(7.04)	0.74
BMI (Kg/M2)	22.16(1.07)	22.02(0.87)	22.13(0.97)	0.85
Mallampati Score (MPS)	1.60(0.5)	1.46(0.49)	1.41(0.48)	0.30
Thyromental Distance (TMD) (Centimeters)	6.18(0.41)	6.25(0.41)	6.31(0.41)	0.50

Table 3: Comparison Of Intubation Attempts, Time Takenfor Intubation, Ids, Pogo, Airway Trauma, And Success Rate [Values are represented as mean (SD)]

Parameters	McCOY Laryngoscope	Airtraq Laryngoscope	King's vision Videolaryngoscope	P-value
Number Of Attempts	1.81(0.63)	1.35(0.42)	1.21(0.41)	<0.0001
TIME TAKEN FOR INTUATION (Seconds)	41.35(1.96)	37.68(2.76)	26.83(5.34)	<0.0001
Ids	3.96(1)	3(1.02)	1.28(0.8)	<0.0001
Pogo	49.46(18.64)	61.64(1.39)	78.24(4.63)	<0.0001
Airway Trauma	16	12	7	0.02
Success Rate (%)	87	93	97	

Table 4: Comparison of the Pulse Rate [Values are represented as mean (SD)]

Pulse Rate (beats per minute)	McCOY Laryngoscope	Airtraq laryngoscope	King's vision Videolaryngoscope	P-value
Preinduction	77.15±6.99	80.11±9.93	80.28(9.85)	0.367
At laryngoscopy	93.88±7.24	92.46±9.95	87.48(9.76)	0.022
Immediately after intubation	100.62±7.31	98.25±9.83	91.03(9.84)	<0.0001
After the completion of intubation	78.85±6.55	81.86(9.49)	84.21(9.74)	0.084

Table 5: Comparison of the Mean Arterial Pressure [Values are represented as mean (SD)]

MAP(Mean Arterial Pressure) (mmhg)	McCOY Laryngoscope	Airtraq laryngoscope	King's Vision Videolaryngoscope	P-value
Preinduction	83.73(11.54)	86.36(11.91)	85.14(11.59)	0.71
At laryngoscopy	98.38(11.34)	98.54(12.39)	92.52(11.26)	0.09
Immediately after intubation	105.69(11.14)	103.89(11.86)	96.69(11.19)	0.01
At the completion of intubation	86.42(11.13)	88.75(11.54)	88(10.84)	0.74

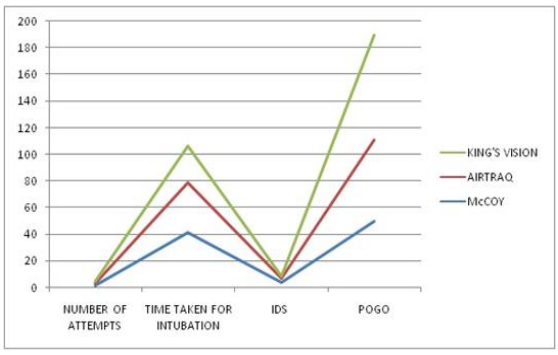

Figure 1: Comparison of Attempts, Time of Intubation, Pogo and IDS

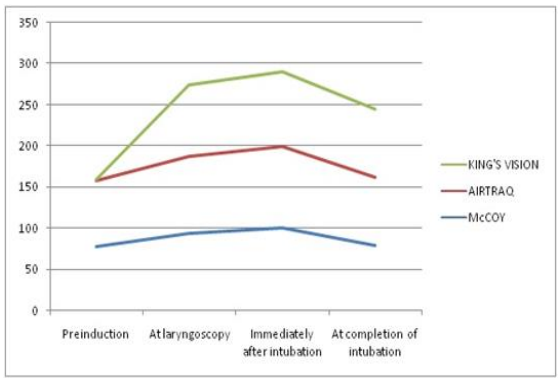

Figure 2: Comaprison of the Pulse Rate

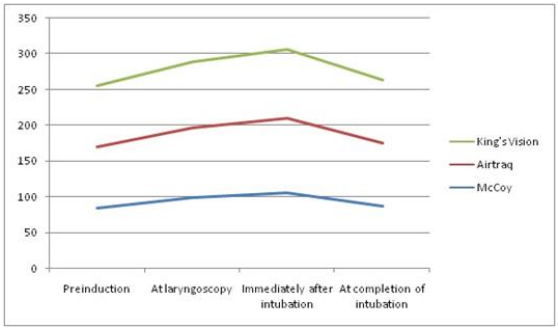

Figure 3: Comaprison of the Mean Arterial Pressure

DISCUSSION

Maneuvers to stabilize the neck in patients at a risk of cervical spinal injury may result in failure to secure the airway, resulting in morbidity and mortality in these patients. Cervical collars reduce cervical spine movements; however, they complicate intubation by reducing the mouth opening and the strap under the chin lifts the larynx up anteriorly. MILS further impairs glottic visualization.

In the present study, the primary outcome measured was time taken for intubation. We found that intubation was easier and required less time with the King's Vision Videolaryngoscope compared with the other laryngoscopes. These results are consistent with that of a study by Ali et al,[11] who found that time required to intubate patients was significantly lesser with the King's Vision Videolaryngoscope than with the Airtraq.($p<0.05$).

A study was conducted by Geeta Bhandari et al,[12] to compare Macintosh, McCoy and Airtraq laryngoscopes in simulated difficult laryngoscopy using rigid neck collar, in which it was concluded that time of intubation was significantly lesser with Airtraq (27.80 sec) as compared to other laryngoscopes($p = 0.04$). The number of successful first intubation attempts was significantly higher in Airtraq group as compared to other groups. ($p<0.0001$).

In our study, the lesser time taken for intubation with the King's Vision Videolaryngoscope may be due to two reasons. First, more patients were intubated in the first attempt in the King's Vision Videolaryngoscope group compared with the other groups, reducing the total time taken for intubation in this group. Second, the improved glottic viewing with the King's Vision Videolaryngoscope helped to pass the ETT in a shorter period compared with the other laryngoscopes. This finding is consistent with that of a study by Ahmad and Kamal who found that more patients were intubated in the first attempt with the King's Vision Videolaryngoscope and time taken for intubation was lesser (13.9±3.16 s) with the King's Vision Videolaryngoscope than with the McCoy laryngoscope (16.33± 4.57s).[13] Improper visualization of the glottic opening, and suboptimal space in the oral cavity to negotiate the tube were the probable causes for the higher number of subsequent attempts in the McCoy laryngoscope group.

In our study, the King's Vision Videolaryngoscope was associated with significantly less difficulty in intubation and better visualization of the glottic opening. This observation is consistent with that of a study by Ali et al,[11] in which the IDS was significantly less in the King's Vision Videolaryngoscope group than with Airtraq . In a study conducted by Geeta Bhandari et al,[12] to compare Macintosh, McCoy and Airtraq laryngoscopes in simulated difficult laryngoscopy using rigid neck collar, it was concluded that the mean IDS was lesser with Airtraq (1.22) as compared to McCoy (3.00).

Another study was conducted by Rendeki et al,[14] which concluded that the King's Vision Videolaryngoscope exhibits significantly improved POGO scores compared with Macintosh and Airtraq laryngoscopes.

Another study by Avula et al,[15] stated that the King's Vision Videolaryngoscope provides a superior view of the glottis without the need to align the oral, pharyngeal, and laryngeal axes, but it is associated with longer intubation time. The majority of the patients in King'sVision Videolaryngoscope showed improvement in Cormack Lehane grade ($p<0.01$). In this study, King's Vision Videolaryngoscope was associated with longer intubation times (42.77s) as compared to Macintosh (29.97).

In our study, hemodynamic parameters such as the pulse rate and mean arterial pressure remained significantly lower with the King's Vision Videolaryngoscope during laryngoscopy and intubation. These results are consistent with that of a study by Ahmad and Kamal,[13] which concluded that the group of patients intubated with the King's Vision Videolaryngoscope were more hemodynamically stable as compared to McCoy. Less airway trauma was noted with King's vision Videolaryngoscope.

However, this study had certain limitations. The anesthetist was not blinded to the randomization of the laryngoscope, which could have resulted in a bias if the anesthetist already had a preference for the device. Second, the POGO score was used to assess the visualization of the vocal cords. It can distinguish patients with large and small degrees of partial glottic visibility and might provide a better outcome for assessing the difference between various intubation techniques.

CONCLUSION

The present study concluded that the King's Vision Videolaryngoscope reduces the mean time taken for intubation, offers superior laryngeal view, has higher success rates at first intubation attempts, reduces the IDS, has the least effect on hemodynamic

parameters, and leads to the least number of complications such as airway trauma compared with Airtraq and the McCoy laryngoscopes.

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