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Hemodynamics and intubating conditions in king vision video laryngoscope versus airtraq optical laryngoscope in adults with normal airway: a comparative study

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Introduction

Endotracheal intubation is a part of clinical anesthesia and resuscitation. Considering the COVID-19 outbreak where increasing the mouth to mouth distance from the patient becomes essential, several modifications of direct laryngoscopes are increasingly being preferred. AirTraq and King Vision are kinds of video laryngoscopes that are recommended in unanticipated difficult airway situations and also during the current COVID pandemic to minimize the aerosol generation and OT contamination by repeated intubations. Present study aims to compare the laryngoscopy and intubating conditions and its effect on hemodynamic stability in two groups of patients using Airtraq Optical Laryngoscope and King Vision Video Laryngoscope.

Aims and Objectives

1. Comparative assessment of laryngoscopy and intubating conditions in two groups of patients using Airtraq Optical Laryngoscope and King Vision Video Laryngoscope.
2. Evaluation of the impact of the two intubating techniques on hemodynamic stability.
3. To analyze desaturation episodes and airway trauma during the intubation attempts.
4. To analyze postoperative complications (laryngospasm, hicupp, sorethroat, nausea).

Materials And Methods

Approval of the institutional ethical and research committee has been obtained

Source of Data: Patients aged between 18-50 years, ASA grade I-II posted for elective surgeries under general anaesthesia in A. J. Institute of medical sciences ,Mangalore between December 2018 to august 2019

Study design: By randomized sampling method.

Inclusion Criteria

1. ASA I and II with normal airway assessment.
2. Age between 18 and 50 years.
3. Undergoing elective surgery.

Exclusion Criteria

1. Patients refusal
2. ASA physical grade III and more.
3. Patients with anticipated difficult airway like- Mouth opening less than 3 finger. Mallampati grade III and more. Mento-hyoid distance <3cm Thyro-mental distance <5cm Sterno-mental distance <10cm Neck circumference >42cm Obese patients (body mass index >30)
4. Pregnant patients.
5. Patients with cervical spine pathology

Study Group

104 patients posted for elective surgeries under general anaesthesia, in A. J. Institute Of Medical Sciences, Mangalore, were divided into two groups (Group A and Group K) of 52 patients each, by random sampling method.

Group A- Airtraq optical laryngoscope group. Group K - King vision video laryngoscope group.

Then after explaining the procedure, written and informed consent was obtained from the patients. Preanaesthetic evaluation was done for all the patients . All patients from both the groups were kept nil per oral according to the departmental protocol. Patients were shifted to the operation room, a standard general anaesthesia technique and monitoring was done according to the departmental protocol like pulse oximetry, 5 lead ECG and NIBP.

Baseline vitals were recorded and i.v line was secured with 18G cannula, i.v fluid ringer lactate was started. All patients were premedicated with i.v glycopyrrolate(10µg/kg) maximum 0.2mg, i.v fentanyl (1µg/kg) and induced with iv propofol(2-4mg/kg) which was titrated to induce anaesthesia in a dose sufficient to produce loss of eye lash reflex. After confirmation of the adequacy of bag mask ventilation, vecuronium i.v (0.1mg/kg) was administered and ventilated with 100% oxygen and 2% sevoflurane. After 3minutes laryngoscopy was performed by an experienced anaesthesiologist who is familiar with both the airway devices.First conventional laryngoscopy was done with machintosh laryngoscope and all parameters were documented. The fourth parameter was however the time taken till the placement of the ET tube near the glottis but not insertion. Then Machintosh laryngoscope was taken out and patient was ventilated with 100% oxygen for one minute. This was taken as control for both the study groups Then patient was intubated with respective indirect laryngoscopes according to randomized selection of the patients. Correct placement of ET tube was confirmed by auscultation and Etco2. After endotracheal intubation subsequent anaesthetic management was continued as per the need of the case.

Parameters observed were-

A. Airway evaluation

1. Ease of laryngoscopy grading according to likert scale.
2. Likert scale- very difficult(-2),slightly difficulty (-1),not difficult(0), easy(1) Very easy(2).
3. Grading of Cormack-Lehane and Number of attempts.
4. Time taken for intubation
5. Success of intubation
6. Need for any additional manouveres (like cricoid pressure)

B. Impact on hemodynamic variables.

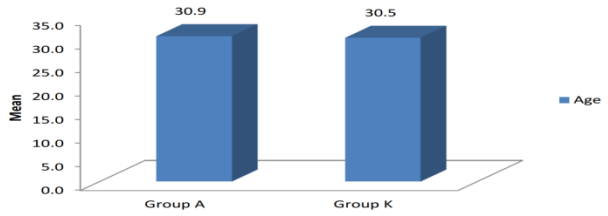
C. Episodes of desaturation and airway trauma during intubation attempts

D. Adverse effect if any

Statistical Analysis: All the obtained data are maintained in an MS excel spreadsheet. All the measured numerical data are summarized by mean, Std Deviation and Confidence Interval. Categorical data are expressed in number and percentage. All the obtained data are compared using Chi- Square test, Fisher Exact test, unpaird t test, Mannwhitney U test, repeated measures of ANOVA and Bonferroni test. A p value of less than 0.05 is considered statistically significant. IBM SPSS Statistics 20 is used for statistical analysis.

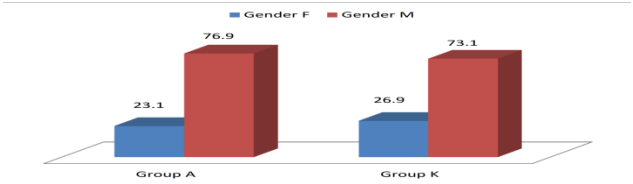
Observations and Results

1. Comparison Of Age Between Two Groups



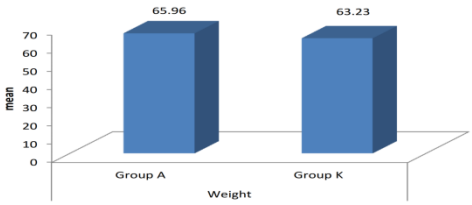
'p' value 0.805 . Hence not significant -unpaired t-test.

2. Gender Distribution Between Two Groups



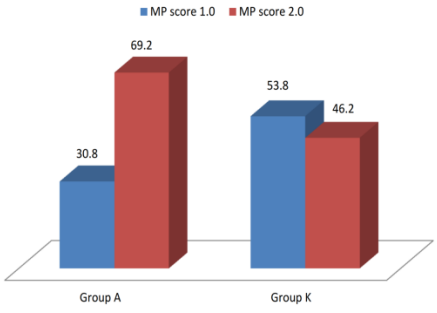
P value of 0.749 hence not significant -chi-square test

3. Comparison Of Weight Between Two Groups



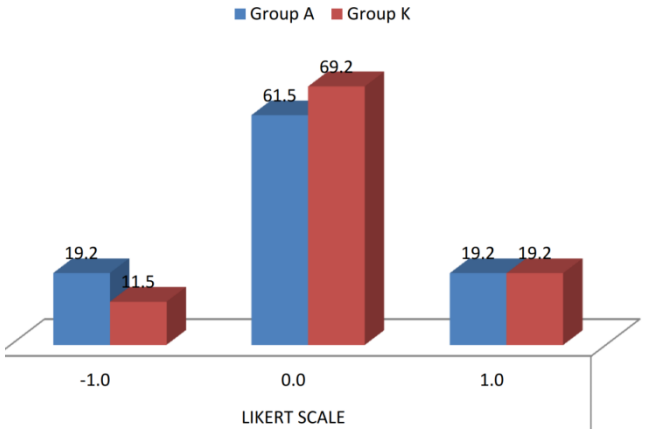
In both groups weight is comparable and there is no statistical difference between the two groups

4. Comparison Mallampati Grading Between Two Groups



In our study, in the group A,8 patients were MP grade 1 and 18 patients were grade 2 and in group K, 14 were MP grade 1 and 12 were MP grade 2, There was no significant association between the two groups(P value=0 .092). - Chi Square test

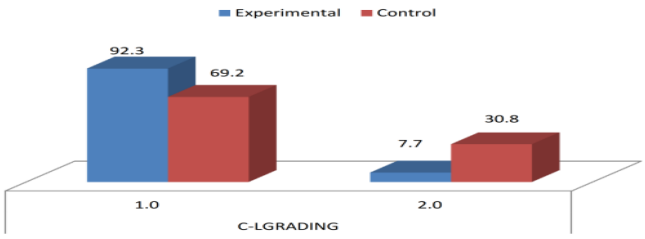
5. Comparison of Likerts Scale

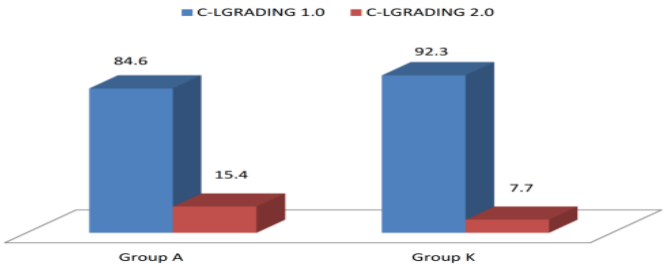


no statistically significant difference in the likert scale between the Group A and control group with a P value of 0.372 and between Group K and Control Group with a p value of 0.755 and Group A and Group K with a p value of 0.734 using Chi Square test.

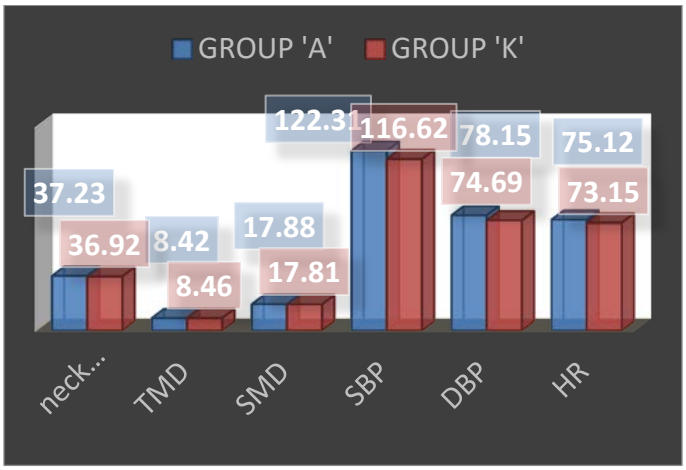
6. Comparison Of C-L Grading

In the present study we found that there was no statistically significant difference in the C-L Grading between the Group A and control group with a P value of 0.188 and between Group A and Group K with a p value of 0.385 -There is significant association in the C-L Grading between Group k and Control Group with a P value of 0.035. -Fisher Exact Test





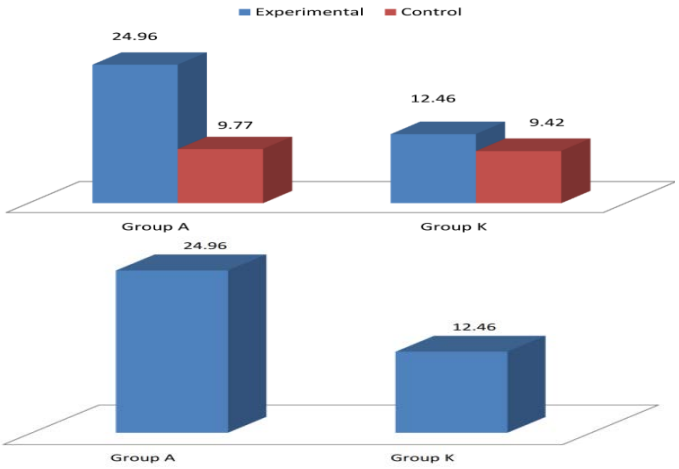
7. Comparison Of Basic Parameters Before Intubation



Comparison of neck circumference, temporomandibular distance, sternomental distance, systolic BP , diastolic BP , heart rate was compared by unpaired t-test in which the 'p' value is non significant

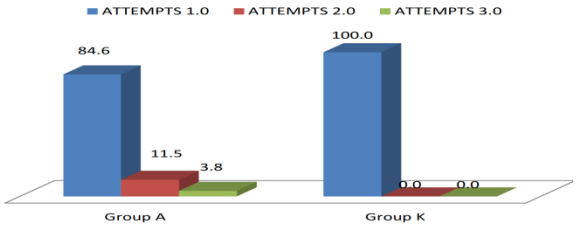
8. Comparison of Intubation Time

There is significant association in the time taken between the Group A and Control Group with a P value less than .0001 using the Mannwhitney U test.There is also significant association in the time taken between the Group k andControl Group with a P value less than .0001 using the Mannwhitney U test. There is significant association in the time taken between the Group k and Group A with a P value of .001

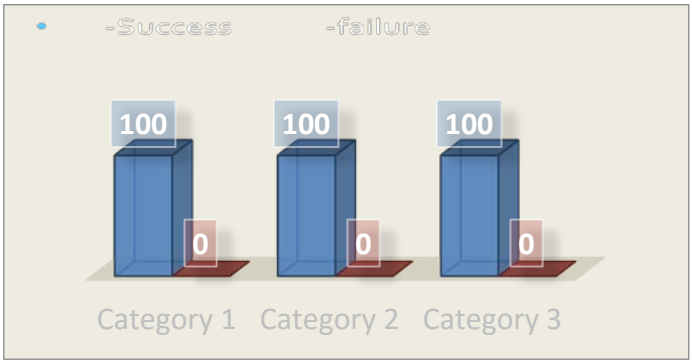


9. Comparison of Number Of Attempts

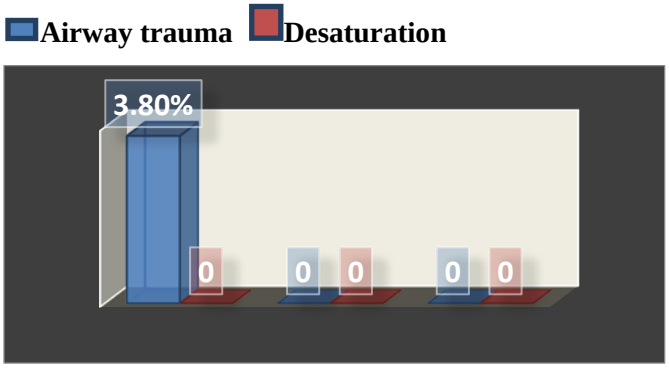
chi- square test - p value appeared non significant (p 0.115)



10. Comparison of Success of Intubation

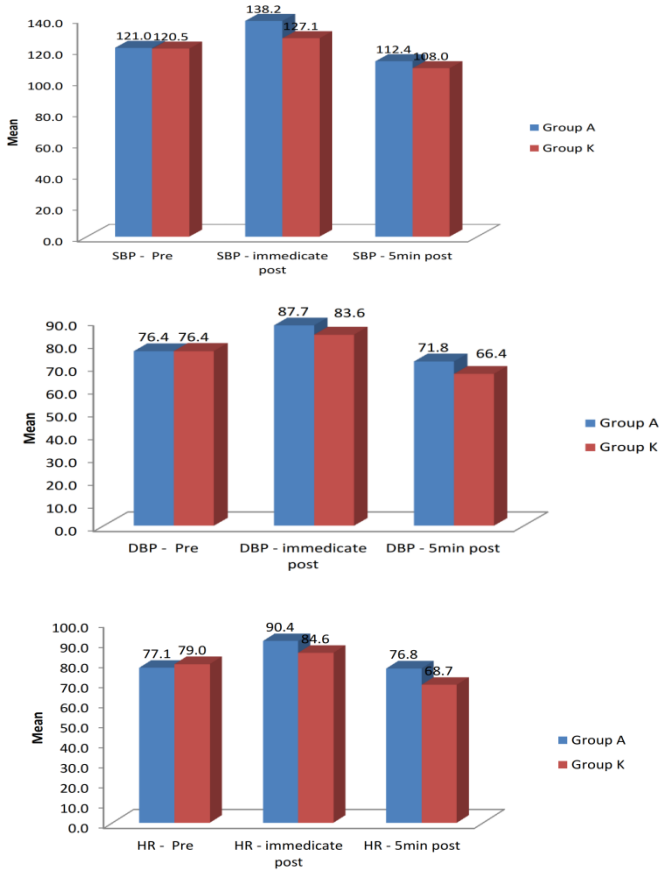


11. Comparison Of Complication During Intubation Chi-Square test with the 'p' value 0.313 appeared non significant .



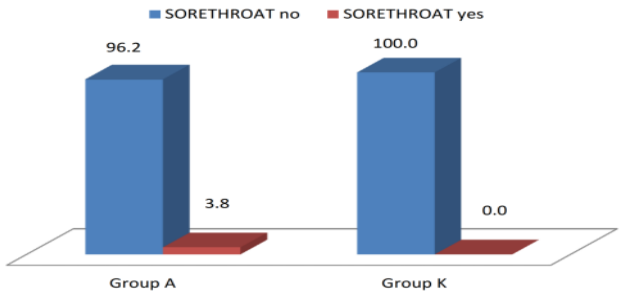
Group 'A' **Group 'K'** **Control**

12. Comparison of Haemodynamic Variability Between Two Groups



Changes in the blood pressure(SBP & DBP) and heart rate were compared by using three intervals i.e. difference in BP and HR pre-induction, immediately post-intubation and 5 minutes after intubation for each of the laryngoscopes which was statistically significant.

13. Comparison Of Post-Op Complications



Chi-Square test - p value 0.313 Appeared Non-Significant.

Discussion

The current study is designed to compare the hemodynamic perturbations and intubation responses between the King vision and Airtraq group. In our study group the patients characteristics were comparable and there was no statistical differences between the groups.

Ease of laryngoscopy grading according to likert scale:

Control group in both Airtraq and King Vision Video Laryngoscopy the ease of laryngoscopy was either easy or not difficult except 7.7% of the cases it was slightly difficult which was much better than respective study groups. Between Group A(Airtraq) and Group K (King Vision) ease of laryngoscopy was easy in Group K though it was statistically non significant. The reason may be technical feasibility with King Vision Video Laryngoscope being similar to Machintosh Laryngoscope(Control Group) and hence the easier insertion. Other reason might be due to the bulky built of the Airtraq Laryngoscope when compared to the King Vision Video Laryngoscope. In favour of this finding we have a study by Padmaja durga et al. "Comparison of tracheal Intubation using the Airtraq and the Machintosh laryngoscope in the presence of rigid cervical collar simulating cervical immobilization for traumatic cervical spine injury" in which the Airtraq appeared to have (38.3%) of Likert scale of (-1) when compared with the Machintosh Laryngoscope (33.3%).[18]

Another study we have in literature is by Qazi Ehsan Ali, Syed Hussain Amir who concluded that the King Vision laryngoscope with curved blade has an specially designed blade curvature and a video system, it needs minimal manipulation or even extension of the head at the atlantooccipital joint, requires less effort for blade introduction into the oral cavity and to push the tube into the trachea through the inbuilt conduit. Airtraq requires more skill and needs a perfect hand-eye co-ordination over the eye piece.[2]

Laryngoscopic view

The laryngoscopic view was better in Group A (Airtraq) and Group K (King Vision) than the respective control group (Macintosh Laryngoscope).[5,6,7,8,9,11]

The Cormack-Lehane grade was I for 84.6% of patients in the Airtraq group and 92.3% of patients in King Vision group making them a very efficient device since they magnify and also channelize view only to the glottis.

Airtraq with its built of prisms and mirrors improves the view even in the presence of edema or any restricted line of sight[1].

Airtraq and King Vision Laryngoscope provides an indirect view of glottis without any need to align oral, pharyngeal and tracheal axes.

When using conventional laryngoscope, intubating person have only a narrow view of the airway structure, whereas video laryngoscopes provide high quality video images, that are enlarged on the video monitor for easier visualization.[2].

Time taken for intubation

In the present study there is significant difference in the time taken between the Group A (Airtraq) and Control Group (Macintosh Laryngoscope). Mean time taken for intubation in Group A is 24.96 secs and in Control Group it is 9.77 secs [10,12,13,17].

There is also significant difference in the time taken between the Group K(King Vision) and Control Group(Macintosh Laryngoscope). Mean time taken for intubation in Group K is 12.46 secs and in Control Group it is 9.42 secs. [6,10]

There is significant difference in the time taken between the Group A and Group K. Mean time taken for intubation in Group K is 12.46 secs and in Group A it is 24.96 sec [2,10] .The reason for shorter intubation time with King Vision Laryngoscope may be technically insertion of King Vision Video Laryngoscope is similar to Machintosh Laryngoscope (Control Group) and all of us are very familiar with Machintosh Laryngoscope. Other reasons for delay in intubation using Airtraq compared to King Vision Video Laryngoscope may be attributed to the following facts:

(1) Our Airtraq Optical Laryngoscope is not mounted with videoscope which also makes the difference. While inserting the Airtraq laryngoscope intubating person had to focus on the parts of airway looking through eye piece, same time without compromising much in his position intubating person needed to have the skill to dislodge the ET tube from the mount. In this manouvre if the intubating person doesn't have good hand eye coordination it further delays the time of intubation.

(2) In our study while using King Vision Laryngoscope for intubation , since the parts of airway is clearly displayed on mounted display such difficulty is not encountered.

King Vision laryngoscope with curved blade has a specially designed blade curvature and a video system, it needs minimal manipulation or even extension of the head at the atlantooccipital joint, requires less effort for blade introduction into the oral cavity and to push the

tube into the trachea through the inbuilt conduit. Airtraq, as assessed by us, requires more skill.

(1) It needs a perfect hand-eye co-ordination over the eye piece, which gives an indirect view of the larynx

(2) In Airtraq optical laryngoscope there was difficulty with perception of depth leading to either too much advancement of laryngoscope into the valleculla or insufficient advancement of laryngoscope with the fear of causing local trauma.

In contrast to my study, the study by Maharaj C.H et al, in their study "Evaluation of intubation with Airtraq and Macintosh laryngoscope by anaesthesiologists is easy and simulated difficult laryngoscopy- a manikin study" had a mean intubation time for Macintosh 14.2 sec and for Airtraq 9.5 secs, with the anaesthesiologists experiencing a faster learning curve and ease of intubation in this scenario.(13)

In contrast to our study, one more study done by Murphy Id et al, Compared the king vision laryngoscopes (KVVL) to Macintosh Direct laryngoscopes (DL) in simulated normal and difficult airways. Using manikins and clinical-grade cadavers, difficult airway scenarios were simulated using head movement restriction or a cervical spine collar. Four scenarios were studied using the KVVL and DL in normal manikin airway, difficult manikin airway, normal cadaver airway, and difficult cadaver airway. They concluded that in the normal manikin airway scenario, time to intubation was 3.4secs faster with the KVVL compared with DL. Time of intubation was 11.3secs faster with KVVL in the difficult cadaver airway scenario[(8)].

In contrast to our study, the study done by Abdullah M. Et al, among novice 6th year medical students to assess their ability to intubate the trachea in normal airway in manikin using four airway tools, Airtraq, king vision, Glidescope and Macintosh laryngoscope concluded that Airtraq , Glidescope and king vision were better than regular Macintosh laryngoscope for both oral as well as nasotracheal intubation[(5)].

Number of Attempts

Even though the result were non significant, the Airtraq group appeared to need more number of attempts when compared to the control group and king vision group which might be due to inadequate familiarity with the Airtraq Laryngoscope or because of problems with tube advancement despite a good view of glottic opening

In Airtraq optical laryngoscope since optical lens has been used for the purpose of getting clear magnified image of intubating area there was difficulty with perception of depth[(4)]. This has lead to too much advancement of laryngoscope into the valleculla.

Study done by Marc Kriege1 et al and they also reported that it can sometimes be challenging to place an endotracheal tube (ETT) in front of the glottis and advance it despite good visualization on the monitor, especially when a video laryngoscope (VL) with a hyper-angulated blade is used This phenomena (great view but unable to intubate) is linked to VL blades that are, unlike the traditional Macintosh blade, hyper-angulated[(44)].

In contrast to my study, Waleed Riad et al, conducted a study "Airtraq versus Macintosh laryngoscope in intubation performance in the paediatric population in which the Airtraq was associated with less median number of intubation attempts than Macintosh Laryngoscope[(20)].

In contrast to this study, C Fernando in his study "comparison of laryngeal view during tracheal intubation using the Airtraq and the Macintosh laryngoscopes by unskillful anesthesiology residents": a clinical study. In

his study all patients of Airtraq group were intubated in the first attempt[16].

Success of endotracheal intubation

The success of intubation in my study was 100% in both Group A (Airtraq) and Group K (King Vision)[2,5,7,10,16]. We selected only MP I and II patients which might be the reason we could do intubation in all patients.

In contrast to our study, the study conducted by Padmaja durga et al "comparison of tracheal intubation using the Airtraq and McCoy laryngoscope in the presence of rigid cervical collar simulating cervical immobilisation for traumatic cervical spine injury" had two failed intubation with Airtraq which was due to an inability to advance the tracheal tube within 120 sec[18].

In contrast to our study, the study conducted by H Trimmel et al in their study "Use of the Airtraq laryngoscope for emergency intubation in the prehospital setting: a randomized control trial". When the Airtraq was used as first-line airway device vs. direct laryngoscopy, the success rate was 47% vs. 99% respectively (p<.001). The reasons for failed Airtraq intubation were related to the fiber-optic characteristic of this device (i.e.impaired sight due to blood and vomitus) or to assumed handling problems (i.e., cuff damage, tube misplacement, or inappropriate visualization of the glottis). In 54 of the 56 patients, where Airtraq intubation failed, direct laryngoscopy was successful on the first attempt. The conclusion was that the use of the Airtraq laryngoscope as a primary airway device could not be recommended in the prehospital setting without and the clinical learning process of the Airtraq laryngoscope.[14] In contrast to my study, the study conducted by Murphy Id et al Compared the king vision laryngoscopes (KVVL) to Macintosh Direct laryngoscopes (DL) in simulated normal and difficult airways. Using manikins and clinical-grade cadavers, difficult airway scenarios were simulated using head movement restriction or a cervical spine collar. Four scenarios were studied using the KVVL and DL in normal manikin airway, difficult manikin airway, normal cadaver airway, and difficult cadaver airway. In the difficult cadaver airway, 10 of 32 participants failed to successfully intubate the trachea using DL, whereas all KVVL intubations were successful. They concluded that the KVVL had higher success rate in difficult cadaver airway scenario than DL[8].

Complication during intubation

Even though it was non-significant, the Airtraq appeared to cause airway trauma (3.8%) which might be due to airway manipulation done while using Airtraq laryngoscopy[15.17].

The reason for less airway trauma when using King Vision laryngoscope may be related to the absence of laryngoscopy like maneuver and has softer blade material.

Hemodynamic changes

Impact on haemodynamic stability was compared between Airtraq Optical Laryngoscope and King Vision Laryngoscope. The Blood Pressure(SBP & DBP) and Heart Rate were compared by using three intervals i.e. difference in BP and HR pre- induction, immediately post-intubation and 5 minutes after intubation for each of the laryngoscopes.

The effect of laryngoscopy on heart rate and blood pressure was transient. The heart rate and blood pressure increased after intubation in both groups but returned to baseline within 5 minutes after intubation in each groups. But the increase in heart rate and blood pressure was less with King Vision Video Laryngoscope as compared to Airtraq Optical Laryngoscope.

Blunted haemodynamic response with the King Vision Video Laryngoscope shows less manipulation and force required during intubation, thereby reducing the potential for haemodynamic stimulation.

There are few limitations in our study such as

1. Small sample size.
2. Only MP I and MP II was taken.
3. More familiarity in usage of King Vision Laryngoscope than Airtraq Laryngoscope.

Conclusion

1. Using King Vision laryngoscopes ease of laryngoscopy and visualization of glottis is better when compared to the Airtraq optical laryngoscope in unanticipated difficult airway.
2. Intubation is quicker in King Vision laryngoscopes when compared to the Airtraq optical laryngoscope. But there are no episodes of desaturation in both groups
3. Complication during intubation like airway trauma and post operative complications were present with Airtraq optical laryngoscope and it might be due to increased manipulation or due to difficulty in insertion
4. The hemodynamic responses are seen in both laryngoscopes but fluctuations are less with King Vision Video Laryngoscope

King Vision Laryngoscope seems to be easier to use and it also permits shorter delays to intubate and lower number of attempts in comparision to Airtraq Optical Laryngoscope thus reducing the aerosol generation and hence more preferred in the COVID era.

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