Comparative Study of Stress Response to Intubation between King Vision and Macintosh Laryngoscope in Routine Airway Management

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ABSTRACT

BACKGROUND

Laryngoscopy and intubation are known to cause exaggerated haemodynamic response and may have deleterious respiratory, neurological and cardiovascular effects. Among the various interventions employed to obtund these responses, the role of King Vision Video Laryngoscope (KVVL) was reported in some studies. So, we would like to compare the haemodynamic responses between the conventional Macintosh laryngoscope and KVVL.

METHODS

The study was a prospective, randomized one in which 90 adult patients of either sex, aged 18-60 years undergoing elective surgery under general anaesthesia with endotracheal intubation were enrolled in either group of 45 patients each to be subjected to KVVL (Group K) or Macintosh laryngoscope (Group M) for orotracheal intubation. Haemodynamic parameters such as heart rate and blood pressure were recorded every minute for the first 5 minutes after intubation and thereafter every two minutes till the 15th minutes. The time taken for laryngoscopy and intubation were also recorded and $P<0.05$ was deemed to be significant.

RESULTS

Demographic parameters such as age, sex, ASA and body mass index were comparable in the two groups ($P<0.05$). Intubation time was significantly longer in group K (20.74 ± 8.81 sec) as compared to group M (13.23 ± 7.60 sec). The heart rate and mean arterial blood pressure increased from the baseline value to a maximum at around 7th minute post intubation and thereafter receded to approach its baseline value in 15th minute and the difference became significant from the 5th minute onwards till the 15th minute.

CONCLUSIONS

King Vision Video Laryngoscopy was found to be more effective in reducing haemodynamic responses to laryngoscopy as compared to conventional Macintosh laryngoscopy.

KEYWORDS

Macintosh Laryngoscope, King Vision Video Laryngoscope, Haemodynamic Response

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BACKGROUND

Laryngoscopy and intubation are known to cause exaggerated haemodynamic response and increased intracranial pressure manifesting as tachycardia, hypertension, dysrhythmias, raised catecholamine level in blood and they may have deleterious respiratory, neurological and cardiovascular effects.[1,2] This rise in blood pressure and heart rate is highly variable and transient with peak response occurring approximately 30-45 seconds after laryngoscopy and lasts less than 10 minutes which are generally well tolerated in healthy patients.[3] However, in patients with hypertension, coronary artery disease, cerebrovascular disease, thyrotoxicosis and various other diseases, this response may lead to dangerous complications like left ventricular failure, myocardial infarction, dysrhythmias or cerebral haemorrhage.[4] It is usually due to sympathoadrenal response arising from the stimulation of the supraglottic region by the laryngoscope blade along with the tracheal tube placement and cuff inflation.[5,6]

Pharmacological interventions (both intravenous and topical), modification of instruments and use of other intubating devices have been tried to obtund this haemodynamic response to laryngoscopy and intubation.[7,8] Conventional Macintosh blade is the most durable and most successful blade in the history of anaesthesia till date and is considered as the gold standard.[5] The King Vision Video Laryngoscope is an indirect, optical device that has been designed to provide a view of the glottis without alignment of the oral, pharyngeal and tracheal axes. It is the latest in a long series of devices that provide the "perfect view" for intubation via use of video and digital technology. The channelled blade requires minimum of 18 cm mouth opening while non-channelled blade requires minimum 13 cm mouth opening.[9] Keeping above things in mind present study was undertaken to evaluate the haemodynamic response between direct laryngoscopy using the conventional Macintosh blade with indirect laryngoscopy using the King Vision Video Laryngoscope.

METHODS

The study was a prospective, randomized one conducted in a tertiary care centre at Imphal, Manipur during 2017 to 2019. After getting approval from the Institutional Ethics Committee and written informed consent, 90 adult patients of either sex, aged 18-60 years, ASA grade I and II undergoing elective surgery under general anaesthesia with endotracheal intubation were enrolled for the study. Patient with anticipated difficult airway (Mallampati >3, thyromental distance <6.5 cm), pregnant or lactating mothers, patients with respiratory, cardiac, neurological, renal, liver, psychiatric diseases and with known allergy to the drugs used in the study were excluded. Computer generated randomization chart was prepared and accordingly 45 patients each were subjected to King Vision Video Laryngoscope (Group K) or Macintosh laryngoscope (Group M) for orotracheal intubation.

Routine preanaesthetic assessment were done for all the patients on the day before the surgery and overnight fasting of at least 6 hours were maintained. Uniform anaesthetic protocol was advocated for all the enrolled patients. After preoxygenation for 3 minutes with a face mask, all the patients received intravenous butorphanol (10 mcg/Kg) and intravenous propofol (2 mg/Kg, bolus) for induction till loss of eyelash reflex. Intubation was attempted after 60 seconds following intravenous succinylcholine (1.5 mg/Kg) with 1.5% sevoflurane. King Vision Video Laryngoscope was used for intubation in group K while in group M, Macintosh laryngoscope with blade, size 3 or 4 whichever deemed appropriate were employed. Laryngoscopy and intubation were performed in both groups by anaesthetists considered proficient in the said procedure. Correct tube placement was confirmed with end tidal carbon dioxide estimation and auscultation. Anaesthesia was maintained with sevoflurane (1-3%) with a fresh gas flow of 3 l/min comprising of 50% nitrous oxide in oxygen supplemented with intermittent bolus dose of intravenous atracurium for muscle relaxation.

Monitoring was standard for both the groups and consisted of heart rate (beats/min), mean arterial blood pressure (MAP), systolic blood pressure (SBP), diastolic blood pressure (DBP), measured continuously and recorded before induction, before laryngoscopy, immediately after endotracheal intubation and every minute for the first 5 minutes and then every two minutes for the next 15 minutes after intubation. The time taken for laryngoscopy (TL) and intubation were recorded from the start of laryngoscopy till the confirmation of correct tube placement.

Sample size was calculated based on the study conducted by Gotiwale K et al[10] where we need to enrol 45 patients for each group at a power of 84% and level of significance at 0.05. Data collected was checked for completeness and consistency and was entered in IBM SPSS Statistics version 21 for Windows (IBM Corp. 1995, 2012). Appropriate statistical method was used for analysis of data - Independent Students T-test used for continuous variable and Chi square test used for discrete data.

RESULTS

The demographic parameters such as age, sex, body mass index, ASA and Mallampati score in the two groups were comparable and insignificant, as shown in table 1 and did not affect the study outcome.

The time taken for intubation was significantly longer in group K (20.74 ± 8.81 sec) as compared to group M (13.23 ± 7.60 sec) and is shown in table 2.

The heart rate, as shown in table 3, increased from the baseline value to a maximum around the 7th minutes and thereafter receded to approach its baseline value in 15 minutes in both the groups. However, the difference in the two groups assumed significance from 5th minutes onwards

till the 15th minutes. The distribution of mean arterial pressure (MAP) also followed the same trend as that of the heart rate with significant difference being observe from 5th minutes till the 15 minutes (shown in table 4).

Parameters	Group K (N=45)	Group M (N=45)	Statistical Test Value	P Value
Age (years) (Mean ± SD)	38.13 ± 12.78	40.31 ± 14.00	Student 'T' test value of 0.77	0.44
BMI (Mean ± SD)	23.34 ± 3.24	23.30 ± 4.16	Student 'T' test value of 0.05	0.96
ASAI/ ASAII	36/9	40/5	Chi square value of 1.35	0.38
Mallampati Grade (1/2)	34/11	38/7	Chi square value of 1.11	0.43
Sex (Male/Female)	15/30	19/26	Chi square value of 0.76	0.38

Table 1. Comparison and Distribution of Demographic Parameters in the Two Groups

P< 0.05 is significant

	Group K (N=45) (Mean ± SD)	Group M (N=45) (Mean ± SD)	Statistical Test Value (Student T Test Value)	P Value
Intubation time in seconds	20.74 ± 8.81	13.23 ± 7.60	4.32	< .001

Table 2. Comparison of Intubation Time in the Two Groups

P< 0.05 is significant

Time Points	Group K (N=45) (Mean ± SD)	Group M (N=45) (Mean ± SD)	Statistical Test Value (Student T Test Value)	P Value
Baseline	84.75 ± 15.92	88.02 ± 15.39	0.99	0.32
Induction	87.86 ± 15.03	89.13 ± 17.65	0.36	0.71
1 minute	87.80 ± 14.99	89.13 ± 17.65	0.38	0.70
2 minutes	88.86 ± 17.02	89.20 ± 15.30	0.09	0.92
3 minutes	90.22 ± 19.16	87.97 ± 18.29	0.56	0.57
4 minutes	91.02 ± 17.76	88.04 ± 18.47	0.77	0.44
5 minutes	84.02 ± 13.08	96.37 ± 14.23	4.28	<0.01
7 minutes	90.22 ± 19.03	98.97 ± 19.03	2.20	0.03
9 minutes	89.02 ± 15.64	94.06 ± 17.54	2.58	0.01
11 minutes	85.66 ± 11.95	92.42 ± 17.62	2.12	0.03
13 minutes	85.48 ± 16.83	92.48 ± 15.49	2.05	0.04
15 minutes	84.02 ± 14.32	90.00 ± 12.56	2.10	0.03

Table 3. Distribution and Comparison of Heart Rate at Different Time Points in the Two Groups

P< 0.05 is significant

Time Points	Group K (N=45) (Mean ± SD)	Group M (N=45) (Mean ± SD)	P Value
Baseline	90.75 ± 12.09	94.82 ± 14.51	0.15
Induction	90.42 ± 11.77	92.53 ± 16.11	0.48
1 minute	90.42 ± 11.09	92.06 ± 15.87	0.53
2 minutes	90.80 ± 13.70	90.97 ± 16.62	0.95
3 minutes	90.42 ± 19.01	92.73 ± 26.40	0.63
4 minutes	88.88 ± 17.78	94.11 ± 22.80	0.23
5 minutes	87.15 ± 16.88	99.53 ± 25.34	<0.01
7 minutes	94.93 ± 18.15	105.97 ± 21.17	<0.01
9 minutes	96.73 ± 15.95	106.00 ± 24.15	0.03
11 minutes	95.91 ± 15.90	105.15 ± 15.52	0.006
13 minutes	92.86 ± 15.46	101.62 ± 18.94	0.01
15 minutes	91.60 ± 14.25	99.57 ± 2121	0.03

Table 4. Distribution and Comparison of Mean Arterial Blood Pressure at Different Time Points in the Two Groups

P<0.05 is Significant

DISCUSSION

Laryngoscopy and intubation are major stimuli which evoke a transient but significant sympathetic response leading to increase in heart rate and blood pressure. The demographic parameters were comparable in the two groups as it was found to be statistically insignificant and similar findings were observed in a study done by Ahmad S, et al[11] and Ali QE et al.[10]

Our observations in the present study showed that King Vision Video Laryngoscope provided a better haemodynamic response, as compared to Macintosh Laryngoscope, with a significantly lesser pulse rate at 5 minutes (Group K=84.02 ± 13.08, Group M=96.37 ± 14.23, p value<0.01) and subsequent period of time. There is also significant decline in mean arterial pressure from 5th minutes onwards in the group K as compared to group M. These study findings correspond to the one done by Elhadi SM et al[12] where the heart rate values and mean arterial pressure (MAP) were significantly lower in group K as compared with group M. Intubation time was significantly faster for Group M (13.23 ± 7.60) as compared to Group K (20.74 ± 8.81) in our study (P value <0.001). Akihisa Y et al[13] found similar findings and argued that, though KVVL manufacturer's instruction show that the blades allow either a Macintosh blade-like technique or a Miller blade-like technique to be used successfully, they recommended starting with the blade tip in the vallecula (Macintosh approach) to avoid going too deep. However, most of their participants clung to the Miller approach with the KVC (channelled) or KVNC (non channelled) resulting in difficult manipulation when directing the tracheal tube toward the glottis. This might have caused the longer elapsed times for intubation with the KVC or KVNC. Ali QE et al,[10] also in their study argued that it may not be convincing that King Vision performs better, as limited studies were available to support superiority of KVL, especially in terms of time taken to intubate. However, in three studies it is observed that there was no significant difference between the time needed to achieve laryngeal view and successful intubation between video laryngoscope group and the direct laryngoscope group.[12,14,15]

Limitations

Limitation of the study was the potential of observer bias, as it was not possible to blind the anaesthesiologist to the device being used. Also, we did not study the Cormack-Lehane (C & L) grading, percentage of glottis opening (POGO scores) and post-operative pharyngeal morbidity.

CONCLUSIONS

King Vision Video Laryngoscopy was found to be more effective in reducing haemodynamic responses to laryngoscopy as compared to conventional Macintosh laryngoscopy. Thus, it can be used either as primary airway device, after acquiring required expertise, or in patients with predicted difficult intubation.

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