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Original Article

Anaesthesia Section

Comparison of King Vision Video Laryngoscope with Macintosh Laryngoscope in Patients Requiring Nasal Intubation for Oromaxillofacial Surgery-A Randomised Controlled Study

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ABSTRACT

Introduction: Anaesthesiologists are at constant risk of contracting Coronavirus Disease-2019 (COVID-19) disease. They are constantly conducting surgical procedures despite being surrounded by pandemic. Patients requiring Nasotracheal Intubation (NTI) for oromaxillofacial surgery expose anaesthesiologists to aerosol-risk. Video laryngoscope simplifies NTI with diminished aerosol exposure, decreased time and difficulty for intubation in patients undergoing oromaxillofacial surgery.

Aim: This study was intended to compare the effectiveness of King Vision Video Laryngoscope (KVVL) and Macintosh laryngoscope in patients requiring NTI for oromaxillofacial procedures.

Materials and Methods: This prospective randomised controlled study was conducted on total of 40 patients undergoing oromaxillofacial surgery under general anaesthesia with NTI in Parul Sevashram Hospital, Vadodara, India, from September 2020 to February 2021. Patients were randomly allocated into group KL and group ML of 20 patients each. Laryngoscopy in group KL was performed with KVVL (non channelled blade), while in group ML patients were intubated using Macintosh laryngoscope. Intubation time, Modified Nasointubation Difficulty Scale (MNIDS), haemodynamic parameters, and complications were noted. Student t-test and Chi-square test were used respectively for continuous and categorical variables.

Results: There was no significant difference in the mean age, weight and gender between the groups KL and ML (p-value >0.05).The mean age of the group KL patients were 32.65 years and group ML was 33.95 years which was not statistically significant. Time required for passing tube from glottic opening to trachea (T3) was significantly less (13.5 seconds) in group KL than (17.4 seconds) in group ML (p-value <0.001). A total of 16 patients (80%) and 12 (60%) patients respectively, in group KL and group ML had MNIDS of 0. Increase in Heart Rate (HR) and Mean Arterial Pressure (MAP) was significantly higher in group ML than group KL. Also, a video laryngoscope increases the distance between the operator and airway and hence reduces aerosol exposure.

Conclusion: Intubation time, assist manoeuvre, and change of head position were less in group KL than group ML. KVVL reduces distance between patient and anaesthesiologist. Video laryngoscopes reduce aerosol transmission better than macintosh laryngoscopes. Thus, the video laryngoscopes were found better than macintosh laryngoscopes.

Keywords: Airway management, Maxillofacial surgery, Nasotracheal intubation

INTRODUCTION

To provide a secure airway and good operation field, Nasotracheal Intubation (NTI) is commonly practised in patients undergoing oromaxillofacial surgery. Direct laryngoscopy has been the benchmark technique for endotracheal intubation for years. However, the last two decades have seen the development of multiple intubation devices [1].

Macintosh laryngoscope, invented by Sir Robert Reynolds Macintosh, is a gold standard for intubation for years. Its curved blade allows visualisation of the larynx by placing the tip anterior to epiglottis, in vallecula. It is designed to ease the passing of an Endotracheal Tube (ETT) [2].

In this century, video laryngoscopy is the most compelling development in the airway management. The KVVL is a novel intubation device primarily developed for handling the normal and difficult airways. The most striking feature of these video laryngoscopes compared with the macintosh laryngoscope is that they assist the visualisation of the vocal cords without the need to align the oral, pharyngeal, and tracheal axes [1]. Although video laryngoscopes have been widely available before the COVID-19 pandemic, their use in many hospitals was limited in the main theatre areas. Evidence supports video laryngoscopes use as a backup device when unexpected difficult intubation is encountered and direct laryngoscopy has been futile [3]. Also, a video laryngoscope increases the distance between the operator and airway and hence reduces aerosol exposure. These benefits become increasingly relevant when dealing with patients especially in the COVID-19 era, where intubation has high risk of spreading to healthcare providers involved in the procedure [4].

The present study was designed to compare intubation time, MNIDS score, vital parameters and complications of KVVL and macintosh laryngoscope in patients requiring NTI for oromaxillofacial surgeries. The null hypothesis of the study was that, there was no significant difference between the outcomes of macintosh and KVVL in patients requiring nasal intubation for oromaxillofacial surgery.

MATERIALS AND METHODS

This prospective randomised controlled study was conducted on a total of 40 patients admitted in Parul Sevashram Hospital, Vadodara, India from September 2020 to February 2021 for oromaxillofacial surgery requiring nasal intubation. After obtaining Ethical Clearance (Ref. No: PUIECHR/PIMSR/00/081734/3103), patients were divided randomly into two groups of 20 patients each.

Inclusion criteria: All patients requiring nasal intubation belonging to American Society of Anesthesiology (ASA) grade I and II posted for elective oromaxillofacial surgeries were included in the study.

Exclusion criteria: Patients with mouth opening <1.8 cm, history of nasal deformities, bleeding tendencies, history of cervical spine injury/deformity, upper respiratory tract infections, patient having any cardiac disease/Chronic Obstructive Pulmonary Disease (COPD) were excluded from the study.

Sample size calculation: Hospital records of Parul Sevashram Hospital were sought for the past 3 years. The data related to the total number of cases requiring general anaesthesia for nasal intubation was computed from the total number of patients requiring general anaesthesia. This proportion after averaging for 3 years came out to be 5.21%. This was used as a prevalence in the formulae for sample size calculation with a 5% absolute precision to get the sample size of 78. This was rounded off to 80. As it was difficult to carry out the study for such large sample, proportionately 50% of the same i.e., 40 patients were studied which were further divided into two groups to compare results of both groups.

Procedure

Before induction of general anaesthesia, numbers were allotted to all 40 patients. Using Microsoft Excel for the generation of random numbers, the patients were randomly allotted to the two groups of interventions.

After preoperative assessment and routine investigations, written informed consent was obtained and the procedure was elucidated to all the patients. Patients were kept nil per oral, night before surgery. Airway preparation was done in all patients with nasal wicks (with 2% xylocaine with adrenaline) 15 minutes before surgery in the preoperative room. In the operation theatre, an intravenous line was secured and monitors like Electrocardiography (ECG), Oxygen Saturation (SpO_2), Mean Arterial Pressure (MAP) were recorded. Baseline pulse, blood pressure, and respiratory rate were recorded. Premedication was given with intravenous (i.v.) inj. glycopyrrolate 4μg/kg, inj. fentanyl 2 μg/kg, inj. ondansetron 0.1 mg/kg to all the patients.

- Patients in group KL were intubated nasally using KVVL, non-channelled blade (manufactured by Ambu).
- Patients in group ML were intubated nasally using macintosh laryngoscope (manufactured by Anaesthetics India Pvt. Ltd.).

With proper personal protective kit, general anaesthesia was induced with intravenous inj. propofol 2-3 mg/kg and inj. suxamethonium 2mg/kg. Nasal intubation was done according to the groups, with appropriately sized portex endotracheal cuffed tube (7mm for males, 6.5mm for females). Bilateral air-entry was confirmed and the Endotracheal Tube (ETT) was fixed. Oral packing (if required) was done.

The following parameters were assessed:

1. Time taken for intubation was assessed as:

a) From nostril to oropharynx (T1)

b) From oropharynx to glottic opening (T2)

c) From glottic opening to the trachea (T3)

2. Assessment of difficulty of intubation with Modified Nasal Intubation Difficulty Scale (MNIDS Scale) as shown below [Table/Fig-1] [5,6]: The MNIDS score is the sum of N1 through N7. A score of 0 indicated intubation under ideal conditions. An MNIDS score from 1 to 5 indicated zminor difficulty, and an MNIDS score > 5 indicated major difficulty [5-6].

3. Vital parameters like Heart Rate (HR), MAP, SpO_2 were assessed at the following intervals:

a) Pre intubation

b) At the cuff inflation

c) Five minutes postcuff inflation

The study was concluded 5 minutes after cuff inflation. The final reading of HR and BP were noted.

4. Complications if any, were noted.

Maintenance of anaesthesia was done with O_2, air, sevoflurane and inj. atracurium i.v. After completion of the surgery, laryngoscopy and gentle suctioning was done. Patients were observed for any bleeding. The oral pack was removed and neuromuscular blockade was reversed with intravenous inj. glycopyrrolate 8 μg/kg and inj. neostigmine 0.05 mg/kg. Patients were extubated after adequate reflexes and recovery. Patients were then shifted to the recovery room.

Parameters	Score
N1: Intubation attempts	Each additional intubation attempt after the first one adds one point
N2: Operators to attempt intubation	Each additional operator required to attempt intubation adds one point
N3: Alternative intubation techniques or change head position	Each alternative intubation technique or change head position adds one point
N4: Glottic exposure	0=good visualisation of vocal cords with little manipulation 1=tools manipulated in all directions to identify the vocal cords 2=tools extensively manipulated in all directions to identify the vocal cords
N5: The lifting force required to expose the vocal cords	0=lifting without assistance 1=lifting required by the assistant to improve the view of the vocal cords
N6: Optimise glottis exposure with BURP (Backward, Upward and Rightward Pressure)	0=none 1=BURP applied
N7: Techniques to aid intubation	0=none 1=cuff inflation or Magill forceps

[Table/Fig-1]: Modified Nasal Intubation-Difficulty Scale (MNIDS) [5,6].

STATISTICAL ANALYSIS

Statistical analysis was performed using Microsoft (MS) Excel spreadsheet. Gender and complications of patients were presented as numbers and were compared among groups using Chi-square test. MNIDS score was calculated using Mann-Whitney test. Age, weight, Intubation time, mean heart rate, mean arterial pressure, were summarised in form of mean±SD. Student t-test was used to analyse the difference in mean. A p-value <0.05 was considered as statistically significant.

RESULTS

[Table/Fig-2] shows the demographic data like (age, weight, gender). The time taken for passing the tube from nostril to oropharynx (T1) was comparable in both groups. However, there was a significant delay in the group ML as compared to the group KL during the passage of the tube from the oropharynx to glottic opening (T2) and glottic opening to trachea (T3). The reduced intubation time (T) in the group KL mainly resulted from reduced time interval to advance the tube tip from the oropharynx into the trachea (T3).There statistically significant difference (p-value <0.001) was found [Table/Fig-3].

Demographic parameters	Group KL (n=20)	Group ML (n=20)	p-value
Mean age (years)	32.65	33.95	0.46*
Weight (kg)	69.15	68.25	0.82*
Male: female ratio	10:10	11:9	0.75#

[Table/Fig-2]: Demographic data of the study subjects.
*Student t-test; #chi-square test

Groups	Time T1 (Seconds)	Time T2 (Seconds)	Time T3 (Seconds)	Total Time T (Seconds)
Group KL	9.9	17.7	13.5	41.1
Group ML	10.15	20.4	17.4	47.95
p-value	0.57	0.012	<0.001	<0.001

[Table/Fig-3]: Intubation Time.
p-value=student t-test, p-value<0.05 considered significant

The median score of MNIDS was reduced in the group KL as compared to the group ML. Mann-Whitney test was used for calculations and showed that the difference in the MNIDS Score 1-5 was significant (p-value <0.05) [Table/Fig-4].

MNIDS	Group KL (n=20)	Group ML (n = 20)	p-value
MNIDS score 0	16	12	0.6
MNIDS score 1-5	4	8	0.031

[Table/Fig-4]: Modified Nasal Intubation-Difficulty Scale (MNIDS) score.
p-value <0.05 considered significant

Heart rate was significantly higher in group ML as compared to group KL at cuff inflation (p<0.05) [Table/Fig-5]. This is mainly attributed to more manipulation of oropharyngeal structures and more need for assist manoeuvre in patients of group ML than group KL.

Timing	Group KL	Group ML	p-value
Pre intubation	81.05	81.95	0.68
At cuff inflation	88.4	96.45	0.002
5 min post cuff inflation	82.65	84.64	0.37

[Table/Fig-5]: Mean Heart Rate (per minute)
Student's t-test was used to calculate p-value, p-value <0.05 considered significant

Mean Arterial Pressure (MAP) was significantly higher in group ML as compared to group KL at cuff inflation and 5 minutes postcuff inflation (p<0.05) [Table/Fig-6]. This is mainly attributed to more manipulation of oropharyngeal structures and more need for assist manoeuvre in patients of group ML than group KL.

Mean oxygen saturation was comparable in both the groups (p>0.05). Drop in SpO_2 levels was not experienced in any patient [Table/Fig-7].

Time	Group KL	Group ML	p-value
Pre Intubation	94.4	95.4	0.58
At Cuff Inflation	101.4	111	0.01
5 min Post cuff Inflation	94.3	98.9	0.03

[Table/Fig-6]: Mean arterial pressure (mmHg).
Student's t-test was used to calculate p-value, p-value <0.05 considered significant

Time	Group KL	Group ML	p-value
Pre intubation	99	99	0.20
At cuff inflation	98	100	0.31
5 min post cuff inflation	99	98	0.21

[Table/Fig-7]: Mean Oxygen saturation (SpO_2)%.
Student's t-test was used to calculate p-value

In group KL, one patient presented with bleeding and three patients had sore throat, whereas in group ML three patients had bleeding and five patients had sore throat [Table/Fig-8]. Further, three out of four patients who had MNIDS score of 1-5 in Group KL needed an additional intubation attempt due to fogging of the lens with saliva or due to obstruction by the tongue. One patient however needed inflation of the cuff for angulation of the tube. While in Group ML, six patients needed an additional intubation attempt, five patients needed manipulation of tools and change of head position or BURP manoeuvre.

Parameter	Group KL (n=20)	Group ML (n=20)
Intubation attempt(s)		
1st attempt	17	14
2nd attempt	3	6
Assist manouvres (inflation of cuff, change of head position, use of Magill's forceps or BURP.	1	5
Complications		
Bleeding	1	3
Sore throat	3	5

[Table/Fig-8]: Complications in the study subjects.

DISCUSSION

The present study compared KL and ML with respect to the time taken for intubation in 40 patients and their MNIDS scores. It was observed that the time taken for intubation with KL was significantly shorter than that with ML. The time for intubation was divided into three parts for accuracy to determine the main point of delay while intubation with both KL and group ML. The time taken for passing the tube from nostril to oropharynx (T1) was comparable in both groups. However, there was a significant delay in the group ML as compared to the group KL during the passage of the tube from the oropharynx to glottic opening (T2) and glottic opening to trachea (T3). This could be because the visualisation of the vocal cord was much easier with Kings' vision video laryngoscope. Tseng K-Y et al., have compared different types of video laryngoscopes with ML for NTI and suggested that using video laryngoscope virtually needed no additional manoeuvres to view the glottis clearly as compared to ML. They also found that the reduced intubation time with VL mainly results from reduced time interval to advance the tube from the oropharynx to the trachea [6]. Serocki G et al., observed that glidescope when compared to macintosh laryngoscopy resulted in improved view of glottic opening with successful tracheal intubation [7].

Zhu H et al., also found that the time for successful intubation was significantly lower with both VL than with ML. Authors concluded that non channeled KVL and Mc Grath MAC VL significantly reduced the time for laryngoscopy in predicted difficult airway patients [8]. Further, laryngoscopy with kings vision VL caused decreased anterior elevation of the larynx than macintosh direct laryngoscopy because alignment of airway axis was not needed which provided the more direct route from the nasopharynx to the glottis.This helped in advancement of the tube into the trachea [8].

In present study, the ease of intubation in both the groups was assessed using the MNIDS so that both groups could be compared regarding intubation attempts, alternative techniques glottic exposure or other aids required for NTI. Comparing the overall MNIDS score authors found that (16/20) 80% of patients in Group KL had a score of 0 while that was (12/20) 60% in Group ML. Also, 20% of patients in Group KL and 40% patients in Group ML had a score between 1-5 and none of the patients in either group had a score higher than 5. Elhadi S et al., used the Cormack-Lehane grading for visualisation of the larynx to compare KVVL and ML. They found a significant difference in the Cormack-Lehane view to view glottic exposure between KVVL and ML. They found 30 patients in KVVL group with CL view grade 1, 15 with grade 2a, 4 with grade 2b and 1 with grade 3a while the Group ML showed 50 patients with CL view grade 1, 18 had grade 2a, 10 with grade 2b and 5 with grade 3a. Also, they found 10 patients needed more than 1 attempt in ML as compared to 4 in KVVL group. They also found that KVVL reduced the need for optimisation manoeuvre, laryngeal pressure manipulation BURP and hence it offered easier intubating conditions [1]. Black JJM also demonstrated that comparing Airtraq with ML showed that all the patients intubated with AL did not require any optimisation manoeuvre [9].

Many other authors have emphasised that VL when used in patients with challenging airway has shown benefits including improved laryngeal view, improved first-pass success rate and lower incidence of external laryngeal manipulation [4]. This has been especially helpful in the COVID-19 scenario as it also increases mouth to mouth distance, the ability to use drapes over the patient, decreases the incidence of requiring assistance in intubation, and reducing staff exposure to infection [10]. This was further reiterated by Tseng KY et al., [6]. In their study, the median MNIDS score was 0 using KVL as compared to the score of 2 in the group ML which is in accordance with the present study. However, concerning 1st attempt success rate, they found no difference between VL and ML which is contrary to the present study results. Zhu H et al., also confirmed that it was easier to advance the tube through the glottis in NTT with VL with less frequency of assist manoeuvre which also saved time. They also suggested that KV improved the Cormack-lehane grade significantly which was its main superiority over ML and their success rate of the first attempt NTI was 100% [8]. St Mont G et al., demonstrated a 1st attempt success rate of 94% in predicted difficult airway which was similar to our study. They noticed that the size and shape of the non channeled king vision blade had little effect on the tube advanced in the oral cavity and the space allowed for nasotracheal tube adjustment is big enough so that KL is a better choice for NTI. They concluded that all failed macintosh assisted NTI were due to poor glottic view, even with the help of assist manoeuvre. These patients were finally intubated on the first attempt with either non channelled KL or Macgrath MAC. This study concluded that VL can act as a backup device for failed NTI using ML [11]. Lewis SR et al., in their systematic review observed that video laryngoscopes reduce the number of failed intubations in patients with a difficult airway [12].

With regards to haemodynamic response comparison between the two groups showed that there was a significant difference in heart rate during the passage of the tube from the glottic opening to the trachea and immediately after intubation. The value was significantly less in group KL as compared to group ML. The MAP also showed similar trends between the two groups. However, SpO_2 levels remained stable throughout the study in all the patients. Similar results were documented by Elhadi S et al., where they found a significant decrease in MAP and HR in the KVL group as compared to the group ML immediately after intubation and at 10 minutes after intubation [1].

With NTI, the haemodynamic changes mainly occur during stimulation of nasopharyngeal structures,oropharyngeal structures and trachea induced by laryngoscopy or ETT advancement. To enhance glottic visualisation in difficult airway patients, improved upward lifting of the Macintosh blade was needed. The laryngeal prominence was compressed and the oropharyngeal structures were distorted. Further, assist manoeuvre was frequently used to aid in passing the ETT through the glottis in the macintosh group [8]. All these procedures at T3 may be responsible for the altered haemodynamics between the two groups in the present study. However, studies also suggest that the VL allowed viewing glottis from the monitor with the use of fewer manoeuvres and less force which minimise the stimulation of the oropharyngeal structures during intubation. Their data strongly affirmed that non channelled KV might provide a clinical edge in reducing haemodynamic changes to potential difficult NTI patients [13].

No major side-effects were noted in either of the groups in our study. However, the incidence of sore throat was higher in the Group ML than Group KL . It is suggested that kings vision video laryngoscope reduce the usage of assist manoeuvre, decreased demand of physical workload and lesser anterior pressure on the soft structures.This could be linked to lesser sore throat and hoarseness in VL patients [8]. Furthermore, kings vision's non channel blade's length and the angle made it better at visualising the glottis than the Macintosh blade.

Limitation(s)

The main limitation of the study was no blinding was possible. MNIDS was the only scale compared in this study, not the percentage of glottic opening score or Cormack Lehane scale. There was bias due to the variability and experience of the anaesthesiologist (performance bias). Novice would not obtain the same result. In the present study, the patient had reduced mouth opening due to pain and injury which could be relieved by adequate anaesthesia and analgesia. Kings vision's video laryngoscope was a newer intubation device in our institute, thus it was difficult to use it in difficult airway patients. Also, the sample size of the study was small. Further studies with a larger sample size are recommended.

CONCLUSION(S)

In the COVID-19 era, where intubation poses a high risk of transmission to the healthcare provider and where time to securing the airway is critical to save the life of a patient, video laryngoscope is better in comparison to Macintosh laryngoscope. A video laryngoscope is a better device that requires less intubation time, less intubation difficulty, fewer complications as compared to the conventional Macintosh laryngoscope for NTI in patients undergoing oromaxillofacial surgery.

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