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Research Article

Comparison of Fibreoptic Bronchoscope and C-Mac Video Laryngoscope for Awake Tracheal Intubation with Cervical Spine Immobilization

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Abstract

Background: Awake fiberoptic intubation (AFOI) is a widely accepted technique for managing difficult airways in patients with facial trauma, oropharyngeal masses, and obesity. It preserves the patient's spontaneous respiratory effort. This study was designed to compare the efficacy of the C-MAC video laryngoscope with a fibreoptic bronchoscope (FOB) in simulated cervical spine immobilization.

Methods: This prospective, randomized study included 100 patients aged 18–80 years, with ASA physical status I or II, undergoing elective surgeries requiring cervical spine immobilization. Patients were randomized into two groups: Group I (FOB) and Group II (C-MAC VL). The primary outcome was time to successful intubation and overall success rate. Secondary outcomes included hemodynamic changes and intubation-related complications.

Results: The C-MAC group had significantly shorter intubation times compared to the FOB group ($p<0.05$). No significant difference was observed in the number of attempts between groups ($p>0.05$).

Conclusion: The C-MAC video laryngoscope offers a time advantage over the fibreoptic bronchoscope for awake tracheal intubation in patients with cervical spine immobilization, assuming adequate airway preparation.

Keywords: Awake tracheal intubation, Fibreoptic Bronchoscope, C-MAC Video Laryngoscope, Cervical spine immobilization.

INTRODUCTION

Awake Fibreoptic Intubation (AFOI) is a useful method in managing difficult airway among the patients with facial trauma, oropharyngeal mass, obese patients etc. It is done to preserve the patient's respiratory drive. FOI is often performed in patients with cervical spine injury or instability. Awake FOI techniques in patients with injured cervical spines may have several benefits. First, the head and neck can be maintained in a neutral position during airway management, and neck flexion and extension can be easily limited. A second benefit to awake FOI is that protective reflexes can be maintained, thereby reducing the risk of aspiration. The video laryngoscope technique has become increasingly popular for tracheal intubation in situations where visualization of the glottis structures may be problematic. Early clinical trials including the C-MAC VL indicated that it could offer a more advantageous view as compared to direct laryngoscopy (DL) in patients with limited interincisor distance and cervical spine clearance.[1] Although the use of standard Macintosh blade for direct laryngoscopy has been compared to indirect videolaryngoscopy in patients who require immobilization of the cervical spine.[2] The present study was designed to compare the devices C-M A C video laryngoscope and fibreoptic bronchoscope (FOB) in clinical settings of cervical spine immobilization.

MATERIALS AND METHODS

The study was approved by the Institutional Ethics Committee (CTRI/2023/08/056995), and written informed consent was obtained from all participants.

GROUP I: Patients were intubated using fibreoptic bronchoscope

GROUP II: Patients were intubated using C-MAC video laryngoscope

Patients with cervical spine pathology,any degree of A-V block in ECG,upper airway pathology,ASA III & IV were excluded in this study.

All patients were subjected to the same anaesthetic protocol. Preparation of the patient was done in induction room and procedure was explained to the patient. Intravenous access was established with 20G cannula and 500ml RL was pre-loaded. Patients were asked to gargle 2% viscous lidocaine. In addition,Lignocaine 10% pump spray (each metered dose puff delivers 0.1ml which contains 10mg lignocaine) was used by applying two puffs on tonsillar pillars and back of the throat. Airway reflexes including coughing, gagging, and laryngospasm should be suppressed for successful airway management. Local anaesthetic was directly sprayed onto the nasopharynx and oropharynx via the McKenzie technique.[3]The McKenzie technique utilizes a 10ml syringe, 20 gauge cannula attached to oxygen tubing with a three-way stopcock. The oxygen tubing was attached to an oxygen source, which delivers a flow of 8-10L/min (high flow). 2ml of 4% Lignocaine diluted to 10ml is administered via a syringe, a jetlike spray is created to enable effective topicalization of the nasal and oral mucosa.[3]

The used lignocaine dose did not exceed the maximum dose (3- 4mg/kg of body weight). The sufficiency of the oropharyngeal analgesia was evaluated by the patient's acceptance of Guedel airway being placed in their mouth or introduction of the blade of the laryngoscope after Lidocaine application. Once the patient tolerates the introduction of the blade of the laryngoscope and a good view of the glottis is obtained, two puffs of lignocaine 10% pump spray was administered on the glottic opening to anesthetize the vocal cords.[4][5]

After premedication with intravenous Midazolam 1mg, Fentanyl 1-2mcg/kg and Glycopyrrolate 10mcg/kg,patients were immediately transported to the operating room. Standardized monitoring devices consisted of an automatic blood pressure cuff, 5-lead electrocardiogram, capnography and pulse oximeter were put on the patient.All patients were placed in supine position on the operating table. Manual in line stabilization was performed by one of the assistant.

Awake FOI was performed with the patient in the supine position and the operator at the patient's head. The FOB was inserted in the intubating oral airway and its tip tilted ~45 degrees upward and advanced forward until it is beyond the base of the tongue where it was directed to the glottic opening and vocal cords. Once the scope enters the trachea, it was advanced forward till the carina appears on the LED monitor. A previously loaded ETT on the shaft of the FOB was advanced in to the trachea keeping its tip 2-3 cm above the carina, then the scope was withdrawn while holding the tube in place.

Intubation time was measured from insertion of FOB in intubating oral airway till confirmation of ETT (appropriate size) placement by capnography.

Patient was intubated using C-MAC video laryngoscope, with the blade inserted into the mouth in the midline over the centre of the tongue and the tip positioned in the vallecula. The view was seen on the LED monitor until the epiglottis and the vocal cords are seen and then ET tube was advanced until it passes through the vocal cord.

The intubation attempt was considered unsuccessful if the VL is removed from the oral cavity due to coughing,gagging or inability to view the vocal cord.

All intubations were performed by anaesthesiologists proficient in the use of both the devices (more than 50 intubations with each device). Three attempts were permitted for each technique. An attempt was aborted when the patient desaturated below 92%.In between two attempts,the patient's lungs were ventilated.

Intubation time was measured from insertion of C-MAC D-Blade in the mouth till confirmation of ETT placement by capnography.

Difficulty of intubation was graded as follows in all the patients:

no coughing or gagging

mild coughing or gagging

moderate coughing or/and gagging that interfere minimally with intubation

severe coughing or/and gagging that made

intubation difficult

If severe gagging or coughing occurred, two more puffs of lidocaine 10% was administered under direct vision and intubation was reattempted after 60s.

The primary endpoint was time to tracheal intubation (TTI) estimated from the advancement of the fiberscope or the VL in the mouth until the appearance of a capnography curve. It was determined by a stopwatch held by an observer not included in the study.

Intubation success by the first attempt, number of attempts, failure of technique and oesophageal intubations were also documented. The grading of difficulty of intubation and evaluation of the ease of the procedure by visual analogue scale and potential complications were recorded.

HR, SBP, DBP, MAP, SPO2 and ETCO2 were recorded at baseline,pre induction, pre intubation, 1 minute, 3 minutes, 5 minutes &10 minutes post intubation. Any arrhythmia and other complications such as local injuries (to lip, tongue, palate, larynx) bleeding,regurgitation and laryngospasm during laryngoscopy and intubation were noted.

Drug adverse events and post op sore throat were also recorded.

Statistical Analysis

Statistical analysis was performed with International Business Machines Statistical Package for the Social Sciences (IBM SPSS) Statistics for Windows, version22.The categorical variables were presented in the form of absolute numbers and percentages.The continuous variables were presented as mean±standard deviation (SD). Student(t)test, Mann-Whitney (U) test or Chi square were used for comparison between groups. P value <0.05 was set as a cutoff for significance.

RESULTS

The demographic profile (age, weight), gender distribution and ASA physical status between the groups were comparable as shown in table 1.

Both groups were comparable as regard to number of attempts and difficulty of intubation grades. However, there was significant difference in the time taken for intubation of the patients between the groups (P<0.05) with significantly more time needed for fibreoptic intubation as shown in table 2. The VAS score for ease of intubation was significantly lower in VL when compared to FOB groups (3.08±0.83 vs 1.10±0.79)

Table 1: Demographic Data

Parameter	FOB Group (n=50)	C-MAC VL Group (n=50)	p-value
Age(mean±SD)	41.02±11.87	45.66 ±13.04	0.140
Gender (M/F)	9/41	12/38	0.461
Weight(mean±SD)	63.78±9.64	62.26±9.89	0.439
ASA status(I/II)	35/15	27/23	0.099

SD:standard deviation;ASA:American Society for Anesthesiologists

Table 2: Time to Intubation and Success Rates

Parameter		FOB Group (n=50)	C-MAC VL Group (n=50)	p-value
TTI(mean±SD) (time to tracheal intubation)		3 minutes 4 seconds±1 min 44 seconds	1 minute 19 seconds±55 seconds	0.001
Number of attempts	One	41	44	0.401
	Two	9	6	
	Three	0	0	
Difficulty of intubation grades	1 (no coughing)	37	40	0.522
	2 (mild coughing)	12	10	
	3 (moderate coughing)	1	0	
	4 (severe coughing)	0	0	

VAS (mean±SD) (visual analogue scale)	3.08±0.83	1.10±0.79	<0.001

The post-intubation parameters i.e. HR(Heart Rate), SBP(Systolic Blood Pressure), DBP(Diastolic Blood Pressure), MAP(Mean Arterial Pressur), SPO2(Saturation of Oxygen) and ETCO2(End tidal Carbon dioxide) at 1 minute,3 minutes,5 minutes and
10 minutes were statistically non-significant as the p value was > 0.05. The hemodynamic stability observed in both groups suggests that neither device causes significant cardiovascular stress during the intubation process. However, the faster intubation time with C-MAC VL may contribute to overall better patient outcomes, particularly in emergency settings.

DISCUSSION

The video laryngoscope, as a recent intubating device, has gained so much popularity for managing difficult intubation in the last decade. It can be used as a substitute to flexible fibreoptic bronchoscope (FOB) in intubating challenges.The aim of this study was to compare the utility of video laryngoscopy (VL) and fibreoptic bronchoscopy (FOB) for intubating time,number of attempts, adverse effects and post intubation haemodynamics outcome during awake intubation with cervical spine immobilization.In the presence of cervical immobilization, the use of C-MAC device facilitated a more rapid tracheal intubation compared with FOB.

The mean time taken for intubation in Group I using the fibreoptic bronchoscope was 3 minutes 4 seconds with SD of 1 min 44 seconds and for Group II using C-MAC video laryngoscope was 1 minute 19 seconds with SD of 55 seconds. The difference was statistically significant as the p value was <0.05.

Similar findings were observed in the study conducted by Salama AKet al in 2015 which shows that the intubation time was significantly higher in patients intubated using the fibreoptic laryngoscopy (62.97 ± 37.54 seconds) compared to patients intubated using the C-MAC laryngoscopy (22.13 ±2.83 seconds).[6] Abdelazim A.T. Hegazy et al in 2018 compared fibreoptic bronchoscope versus C- MAC Video-Laryngoscope for awake intubation in obese patients with predicted difficult airway. The study showed longer intubation time in patients intubated with FOB than patients intubated with C-M A C VL.[7]

Our findings was also consistent with the Elvir Lazo et al.[8] who compared tracheal intubation with the C-MAC VL versus FOB among individuals undergoing surgical procedures on the cervical spine and found that time of intubation was longer in the FOB group. The current study showed higher first-attempt success rate using the C-MAC VL than using FOB.However this difference was statistically insignificant. This was in consistent with Abdellatif et al.[9] who compared Glide Scope video- laryngoscope (GVL) with flexible FOB for awake intubation of morbidly obese patients with predicted difficult intubation, and they concluded that intubation success rate on the first attempt was 80.6 and 75% in G V L and FOB, respectively, with no statistical difference between the two groups.

There were 37 patients (74%) who had no cough/gag,12 patients (24%) had mild cough/gag and 1 patient (2%) had moderate cough/gag in group I. Further, group II shows that there were 40 patients (80%) who had no cough/gag and 10 patients (20%) who had mild cough/gag. There was no statistically significant difference in the difficulty of intubation grades between the patients in both groups (P>0.05).

The mean VAS for ease of intubation as assessed by anaesthesiologist in group I was 3.08±0.83 in comparison to group II where the mean VAS was 1.10±0.79. It was statistically significant as the p value was < 0.05. This was also in line with studies conducted by Saud Mohammed Erwi et al in 2019 [10] in which the VAS for fibreoptic intubation was 2.60-1.86 and 1.84-1.57 for Video Laryngoscope. It was statistically significant as the p value was <0.05. Similar findings were observed in a study conducted by Roya Yumul et al in 2014 [1] to compare the C-MAC video laryngoscope to the standard flexible fiberoptic scope (FFS) with an eye piece.

Conclusion: This randomized, prospective study demonstrated that the C-MAC video laryngoscope may offer an advantage over fibreoptic bronchoscope with respect to the time required to obtain a clear glottic view and successful placement of the tracheal tube with manual inline cervical spine immobilization when airway is adequately prepared.

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