

Comparison of oral intubation using flexible fiberoptic bronchoscope with or without rigid cervical collar: A clinical study

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Abstract

Background: Device like fiberoptic bronchoscope is gold standard for difficult intubation situations. It can be performed by both orotracheal and nasotracheal route. But, through nasal route there are more chances of nasal bleeding and pressure necrosis while through oral route there is only one problem, which is clearing of upper airway for bronchoscope. Manoeuvres like jaw thrust and chin lift are very useful in clearing upper airway for bronchoscope. The aim of this study was to compare ease of oral intubation using flexible fiberoptic bronchoscope with or without rigid cervical collar, in terms of need of manoeuvres: Jaw thrust and Chin lift. **Materials and Methods:** 25 patients in age range 20-50 years, of ASA I - II, and of either sex undergoing elective surgery under general anaesthesia were randomly allocated into each group. There were two groups: Group A (Rigid Cervical Collar) and group B (Without Collar). Intubating condition was assessed in between these groups with need of manoeuvres like jaw thrust and chin lift. Quantitative data i.e. age, weight, thyromental distance and sternomental distance were presented as mean value and standard deviation. Intergroup comparison of quantitative data was done by *t*-test and probability was considered to be significant if less than <0.05 . Categorical data i.e. sex, ASA grade, Mallampati grade and need of manoeuvres were presented as number and were compared among groups using Chi-square test. $P < 0.05$ was considered statistically significant. **Results:** There was significant ($P < 0.05$) difference between group A and group B in terms of use of manoeuvres for ease of intubation and clearing upper airway. In group B, need of jaw thrust and chin lift for clearing airway is significantly ($P < 0.05$) higher than collar group. **Conclusion:** We concluded that as far as the oral intubation with flexible fiberoptic bronchoscope is concerned, rigid cervical collar is very useful tool for making intubation easier.

Key words: Airway, fiberoptic bronchoscope, intubation, jaw thrust, rigid cervical collar

INTRODUCTION

Airway problems are the most common cause of morbidity and mortality due to anaesthesia. With the possibility of difficult intubation (5.8%), "cannot intubate" ($\leq 0.35\%$), or "cannot intubate - cannot ventilate" ($\leq 0.02\%$) situations,

every anaesthesiologist must be prepared to deal with these airway abnormalities.^[1-3] Difficult airway problem can be due to any of the following reasons- limited oropharyngeal space, decreased atlanto-occipital extension, decreased submandibular compliance and decreased pharyngeal space.^[4-7] Flexible fiberoptic bronchoscope is the most viable option available for the anaesthesiologist to manage such difficult airway problems.^[8]

With flexible fiberoptic bronchoscope, intubation can be performed either by orotracheal route or by nasotracheal route. Through nasal route, there are more chances of various complications like epistaxis (most common with an incidence of 18-66%),^[9,10] turbinectomy or

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retropharyngeal dissection.^[11,12] Blood in the airways can produce a dramatic deterioration in conditions by obscuring the view during fibrescopy and by aspiration of blood into lungs.^[13] Though these problems can be reduced with local application of vasoconstrictive drugs, or softening of the tube, or use of a nasopharyngeal airway as a pathfinder,^[14] but are not entirely avoidable. While through oral route there is only one problem which is clearing of upper airway for bronchoscope.

During general anaesthesia, approximation of soft palate, tongue and epiglottis to the posterior pharyngeal wall occurs after administration of induction anaesthetic agents (with or without muscle relaxants).^[15] Due to little space left in oropharynx for manoeuvring distal flexi-tip of fibreoptic bronchoscope, there is difficulty in locating glottic opening.^[16] To solve this problem, several manoeuvres (jaw thrust,^[17-19] lingual traction,^[20,21] etc.) and aid of airway intubators^[22-24] (such as Ovassapian, Berman and Williams) have been tried. Sole use of intubating airways does not clear pathway for fibreoptic and required multiple manipulation.^[21,25-27]

There have been no controlled trials assessing the relative effectiveness of rigid cervical collar as an aid in opening up the oropharyngeal space in anaesthetised patients. It would be useful to know the additional role of cervical collar, as this information might enable anaesthesiologists to perform fibreoptic orotracheal intubation more swiftly and reliably. Therefore, this study was aimed to compare ease of oral intubation using flexible fibreoptic bronchoscope with or without rigid cervical collar, in terms of need of manoeuvres: Jaw thrust and Chin lift.

MATERIALS AND METHODS

After obtaining approval by Institution's Research Ethical Committee and written informed consent, 50 patients scheduled for various elective surgical procedures requiring orotracheal intubation for general anaesthesia were enrolled. Patients in age range 20-50 years, of ASA (American Society of Anaesthesiologist) I - II, and of either sex were included in study. Patients with ASA physical status III, IV, V, or with anticipated intubation difficulty (Mallampati grade 4, thyromental distance <6 cm, sternomental distance <12 cm), or with a history reactive airway disease, gastro-oesophageal reflux, cervical spine pathology, airway distortion or trauma and major organ dysfunction were excluded from study. It was a hospital-based, randomised, single-blind, comparative, interventional type of clinical trial, conducted between 1 Jan 2013 to 31 Dec 2013.

The allocation sequence was generated using a randomisation technique (chit and box method). Patients were randomised in two groups of 25 each- group A (with rigid cervical collar) and group B

(without rigid cervical collar). Before induction of anaesthesia, patient's fasting status (8 h fasting) was confirmed. All patients received standardised general anaesthesia. Standard monitoring included ECG, non-invasive arterial pressure, SpO₂, EtCO₂ (end tidal carbon dioxide) and measurement of volatile anaesthetic levels. Bispectral index (BIS) (Aspect Medical Systems, Norwood, MA, USA) monitoring was utilised in all patients when available. Patients were premedicated with glycopyrrolate (0.005 mg/kg I.V.) and fentanyl citrate (2 µg/kg I.V.). Induction was done with propofol 2 mg/kg infused I.V. slowly and was titrated to induce anaesthesia in a dose sufficient to produce loss of verbal response. After induction of anaesthesia, all patients were manually ventilated with face mask with 1% isoflurane in oxygen. Neuromuscular blocking agent (rocuronium 1 mg/kg I.V.) was administered after checking adequacy of mask ventilation. If any difficulty was encountered in mask ventilation, the patient was excluded from study. Tracheal intubation was not performed until the BIS score had decreased below 60, and additional dose of propofol were administered to increase the depth of anaesthesia if required.

After the onset of neuromuscular block, tracheal intubation was performed with endotracheal tube (Male -8.0 mm ID, Female -7.5 mm ID) by flexible fibreoptic bronchoscope. For oral intubation with fibreoptic bronchoscope, modified Berman's airway was used as an aid in all patients. An appropriate sized rigid cervical collar (Ambulance Collar, MGRM Medicare Limited, Hyderabad, India) was placed as per manufacturer's instructions in group A. To perform manoeuvres (jaw thrust and chin lift) for fibreoptic intubation, we required a second assistant to place both hands behind the angle of the mandible bilaterally, with thumbs beneath chin, and gently pull forward with visible displacement of the chin forward and upward. Tube position was confirmed by auscultation and confirmed by EtCO₂ tracings. After successful intubation, the endotracheal tube was connected to the circle breathing system of the anaesthesia machine for intermittent positive pressure ventilation. Anaesthesia was maintained with isoflurane/N₂O: O₂ (60%:40%). Subsequent management was left to the discretion of the anaesthesiologist providing care to the patient. Data were collected in form of need of manoeuvres (Jaw thrust and Chin lift)- Yes/No. All the intubations were performed by a single anaesthesiologist who was familiar and trained with intubation using fibreoptic bronchoscope. Any patient who required more than one attempt to achieve successful intubation was excluded from study.

Statistical analysis

The sample size was calculated to be 25 subjects in each group with alpha error 0.05 and power 80%. Sample size calculation was based on pilot study on 12 patients, with need of manoeuvres as the primary

outcome. Sample size calculation and analysis of the statistical data obtained from study was carried out by statistical programming software Statistical Package for the Social Sciences - SPSS Statistics Version 17.0.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data i.e. age, weight, thyromental distance and sternomental distance were presented as mean value and standard deviation. Intergroup comparison of quantitative data was done by student's *t*-test and statistical significance was considered at $P < 0.05$. Categorical data (or qualitative data) i.e. sex, ASA grade, Mallampati grade and need of manoeuvres (jaw thrust and chin lift) were presented as number and were compared among groups using Chi square test. $P < 0.05$ was considered statistically significant.

RESULTS

Patient's morphometric characteristics and airway assessment parameters are shown in Table 1. There was no statistically significant difference in intergroup comparison of demographic variables. Comparative observation of difficult intubation predictors (Mallampati grade, thyromental distance and sternomental distance) among the study population in both groups also showed statistically insignificant difference ($P > 0.05$).

Intergroup comparison of need of manoeuvres is shown in Figure 1 and Table 2. There was statistically significant ($P = 0.0018$) difference between group A and group B in terms of use of manoeuvres (jaw thrust and chin lift) for ease of intubation and clearing upper airway. In group B need of jaw thrust and chin lift for clearing airway was 76%, while in collar group, it was only 32%.

Episodes of desaturation ($SpO_2 < 90\%$), failure to intubate and airway trauma were not seen in any of the study subject.

Table 1: Intergroup comparison of morphometric characteristics and airway parameters

	Group A (with collar)	Group B (without collar)	Significance (<i>P</i> value)
Age (years)	38.32±8.20	36.12±9.51	NS (0.385378)
Sex (male/female)	17/8	16/9	NS (0.765291)
Weight (Kg)	67.68±8.97	63.32±8.14	NS (0.078171)
ASA grade (1/2)	13/12	12/13	NS (0.777297)
Mallampati grade (1/2/3)	14/9/2	17/7/1	NS (0.646083)
Thyromental distance (cm)	8.21±1.03	8.57±1.13	NS (0.244608)
Sternomental distance (cm)	15.7±2.18	17±2.43	NS (0.066949)

*Qualitative data (i.e. sex, ASA grade, Mallampati grade) are presented as numbers and quantitative data (i.e. age, weight, thyromental distance, sternomental distance) are presented as mean ±SD. NS: Not significant, S: Significant, $P < 0.05$ –Significant

Table 2: Intergroup comparison of need of manoeuvres (jaw thrust and chin lift)

	N=25		Total	Significance (<i>P</i> value)
	Group A (with collar)	Group B (without collar)		
Need of manoeuvres (jaw thrust and chin lift)	8	19	27	Significant (0.001801)
No need of manoeuvres (jaw thrust and chin lift)	17	6	23	
Total	25	25	50	

*Qualitative data (i.e. need of manoeuvres) are presented as numbers. *P* is calculated by Chi square test. $P < 0.05$ –Significant

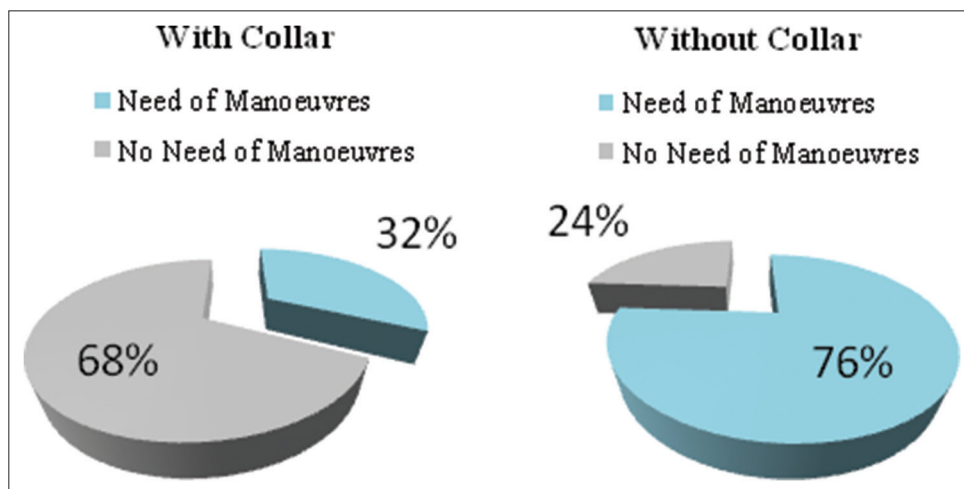


Figure 1: Percentage need of manoeuvres in Group A (with cervical collar) and in Group B (without cervical collar)

DISCUSSION

In recent advances, flexible fiberoptic intubation is an essential expertise for an airway management specialist, as found useful in several situations like difficult airway, cervical spine risk, one-lung isolation, endotracheal tube (ETT) exchange and tracheo-bronchoscopy. After determination of fiberoptic intubation as the appropriate choice, we must decide whether to use a nasal or oral approach. In general, the angle of curvature of the ETT (channel) naturally approximates that of the patient's upper airway therefore the nasal route is easier for fiberoptic intubation. But oral fiberoptic intubation has its advantages as it can be performed in patients who have contraindication for nasal application of vasoconstrictors (i.e. parturient, some heart disease patients) or having any bleeding tendency or coagulation disorders.^[28]

This clinical trial was aimed to identify obstacles that might occur during oral fiberoptic intubation and also attempted to alleviate these obstacles with help of manoeuvres or cervical collar. In anaesthetised patient, muscle tone is reduced after induction which leads to posterior displacement of the soft palate, base of tongue and epiglottis and causes approximation to posterior pharyngeal wall,^[15,29] ultimately occluding pathway for fibroscope. Roberts *et al.*^[17], Hartley *et al.*,^[18] and Lucas *et al.*^[19] found in their studies that jaw thrusting was very helpful manoeuvre for clearing airway to perform fibroscopy. While Benumof *et al.*,^[30] found triple airway manoeuvre (chin lift, extension at atlanto-occipital joint and anterior displacement of the mandible) as an effective approach to clear the path. Durga *et al.*,^[31] reported that both lingual traction and jaw thrust were effective manoeuvres for clearance of airway, and jaw thrust was more effective at epiglottic level.

In our study, we demonstrated that application of rigid cervical collar act as an aid for oral fiberoptic intubation with significantly less need of manoeuvres like jaw thrust and chin lift for clearing of upper airway. At soft palate level, apposition of the tongue to uvula base and soft palate was avoided with help of intubating airway, as a result of this, fibroscope was passed to one side of uvula base without any difficulty. At epiglottic level, when the epiglottis was apposed to the posterior pharyngeal wall, passage of the fiberoptic beneath the tip of epiglottis became possible with application of cervical collar (particularly in group A patients) or with help of manoeuvres- jaw thrusting and chin lifting (mainly in group B patients).

Forward movement of jaw during thrusting leads to widening of the oropharyngeal cavity and opens the laryngeal aperture, thus easing insertion of a fiberoptic

bronchoscope into the trachea.^[32,33] But jaw thrusting also causes significant movement of cervical spine.^[34] While our study demonstrated that rigid cervical collar, which is commonly used to provide adequate cervical immobilisation to avoid further devastating neurological outcomes,^[35] markedly reduced the requirement of manoeuvres for oral fibroscopy without cervical spine movement which can be useful particular in patients with cervical spine injury. The study showed that jaw thrust with chin lift was very effective way of clearing of airway both at soft palate and epiglottic levels. We did experience difficulty during railroading of endotracheal tube over fiberoptic bronchoscope in some patients of both groups and this difficulty was sorted out by 90° anticlockwise rotation of the tube over cord as this solution was reported by several studies.^[36,37]

In this study, we didn't include patients with difficult intubation possibility. So at present, it is not known whether application of manoeuvres with airway intubators or use of cervical collar with airway intubators is the more reliable way of airway clearance required to perform oral fiberoptic intubation of patients known to be an intubation difficulty. Further clinical work would be required to review this possibility.

When oral fiberoptic intubation is chosen, satisfactory airway clearance can be secured with use of intubating airway and cervical collar, as a better alternative to various manoeuvres. Performing oral fibroscopy with manoeuvres required a second assistant and significant movement of cervical spine too; both can be avoided with help of cervical collar. With the use of rigid cervical collar, we can fulfil two aims. First is stabilisation of neck (which is very important in a case cervical trauma to avoid further deterioration) during intubation and second is easy fiberoptic oral intubation without chin lift and jaw thrust.

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