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Original Research Article

# A Clinical Study on Methods of Anesthesia and its Effects on Peri-Interventional Morbidity Following Rigid Bronchoscopy

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**Abstract**

**Background:** Providing Anesthesia for rigid Bronchoscopy is a challenge to the Anesthetist and ENT surgeon as they both compete for the same Airway. Rigid Bronchoscopy is an interventional procedure requiring General anesthesia of course with different strategies. The range of complications includes both mechanical and systemic types, depending on the technique of anesthesia used.

**Aim of the study:** To assess the Anesthetic strategies used for Rigid Bronchoscopy and their role in peri-interventional morbidity.

Methods: 68 patients of rigid Bronchoscopy were included and divided into two groups. Group A included patients in whom Total Intravenous Anesthetics were used (TIVA group) and group B where patients were administered Gaseous anesthetics (Volatile group). In group A, 46 patients were included and in group B 22 patients were included. In comparison, group A patients (TIVA group) consisted of more Hypertensive patients than the group B. Foreign body removal was performed under inhalation anesthesia in 21/68 (30.88%) patients (TIVA group- 11 and 10 Volatile group), Biopsy of Bronchogenic carcinoma was done in 11/68 (16.17%) patients (TIVA group- 06 and 05 Volatile group) and diagnostic Bronchoscopy was done in 14/68 (20.58%) of the patients (TIVA group- 06 and 08 Volatile group) to investigate the cause of hemoptysis. Both the groups of patients received similar ventilation irrespective of the indication for Bronchoscopy.

**Results:** The hemodynamic showed the pre-operative and post-operative arterial blood gas, pulse oximetry and pulmonary function test data. The baseline values of these parameters were similar in the both groups. Post-operative estimation of arterial blood gas (7.42 ± 0.42 vs. 7.35 ± 0.17, P = 0.021) showed a lower PH in the patients who received volatile anesthesia than the TIVA group. But the volatile group patients were found to have a greater forced vital capacity (Volatile: 2.98 ± 0.60 vs. TIVA: 2.19 ± 0.62, P = 0.034) than the TIVA group after rigid Bronchoscopy. The Volatile group patients showed greater incidence of systemic complications like Hypertension postoperatively, 14.25% in TIVA group than in Volatile group: 15.25%.

**Conclusion:** The present study concluded that the two methods of anesthesia and ventilation used for rigid Bronchoscopy produced similar results and none of the both have shown to be superior over the other. Propofol and remifentanil combination used in TIVA group was better and

appeared to be popular as it had attenuated haemodynamic response during the procedure. Both the groups showed improvement in spirometry mea- surements. The incidence of hypoxia or hypercapnia was also similar.

**Keywords:** Haemodynamic, bronchoscopy, hypercapnia, post operative estimation



## Introduction

Rigid Bronchoscopy is an interventional clinical practice consisting of introduction of rigid bronchoscope per oral route across the laryngeal inlet into the trachea and bronchial to inspect, identify and assess the local luminary changes and to retrieve foreign bodies, mucus plugs or biopsies from the growths arising from the walls of the trachea bronchial walls. It can be done through the tracheostomy opening also. Rigid Bronchoscopes are always aided by light sources, telescopes and accessory instruments [1]. In recent times flexible Bronchoscopy has replaced Rigid Bronchoscopy to some extent but it has not replaced the later. Rigid Bronchoscopy is still the safest and quick method of retrieving foreign bodies from the trachea-bronchial tree especially in children and infants. It also maintains its value for better control of the compromised airway, massive haemoptysis, airway stent placement and removal of large foreign bodies [2]. The indications and contraindications for rigid Bronchoscopy were reviewed in the literature and found these: Management of massive haemoptysis, Treatment of trachea-bronchial stenosis, Foreign body removal, Tumor resection, Deep bronchial wall biopsy, Contraindications for rigid Bronchoscopy, Unstable cervical spine, Severe maxillofacial trauma or deformity [3]. Complications during and after Bronchoscopy include surgical emphysema, bleeding, perforation, pneumothorax and collapse of lung [4]. They could be due to the underlying pathology, faulty technique and anesthetic complications [5]. A certain degree of morbidity is expected in few patients either due to anesthesia or Bronchoscopy itself [6]. Jet ventilation being one of the commonest methods used to ventilate the lungs during Bronchoscopy may at times lead to pulmonary parenchyma damage when the pressures are not maintained appropriately [7]. The present study was conducted to to assess the Anesthetic strategies used for Rigid Bronchoscopy and their role in peri-interventional morbidity.

## Methods

The present study was an observational cross-sectional study conducted at a tertiary care Hospital in Telangana between Jan 2020 to July 2022. The study was conducted to assess the types of Anesthetic methods used for rigid Bronchoscopy and the role of these methods in the morbidity of patients immediate and after the procedure. 68 patients undergoing Bronchoscopy were included. An Institutional ethics committee clearance was obtained. An ethics committee approved consent letter was used in collecting the data variables.

**Inclusion Criteria:** Patients undergoing Bronchoscopy belonging to all age groups were included. Patients undergoing Bronchoscopy electively on emergency situations were included.

**Exclusion criteria:** Patients undergoing flexible Bronchoscopy were excluded. Patients in ICUs were excluded. Patients with terminal illnesses were excluded. All the procedures were done by the authors who were involved in all the cases analysed in this study. An ethics committee approved data proforma was used for all the patients. Fall in

blood pressure was defined as (Hypotension) reduction of mean arterial pressure (MAP) below 20% of the baseline which was recorded prior to the intervention. It was also defined as when an inotropic drug was used to maintain MAP as and when blood pressure falls below more than 65 mmHg. Hypertension was defined as more than 20% hike in the blood pressure above the basal level. Oxygen saturation levels less than 92% and/ PPO2 (partial pressure of oxygen) less than 60 mmHg was taken as hypoxia.

A change in the basal rhythm of the heart was considered as Dysrhythmia of new onset. An ischemic change in the ECG was considered as acute Myocardial infarction. Elevated cardiac troponins were considered as Acute Myocardial infarction. Deaths were recorded if they occurred after rigid Bronchoscopy. The authors used the above guidelines to identify the complications. All the data was analysed using standard statistical methods. The clinical complications such as pulmonary oedema, pulmonary embolism, pneumothorax, pneumonia and delirium were kept in data sheet for recording purpose.

## Statistics

It was done using SPSS 19 version. Continuous variables were shown as mean and standard deviation (± SD). Categorical variables were shown as percentages. Student's t-test was used for comparison of means of continuous variables between the studied groups. Pearson chi-square test was used for comparison of categorical variables among studied groups. A value of $P < 0.05$ was considered significant.

## Results

Totally 68 patients who underwent Bronchoscopy were included in this study. The patients were attending the ENT department, ICUs and Respiratory medicine department for various complaints related to lower respiratory tract such as hemoptysis, foreign body inhalation, stridor and unilateral wheeze. Based on the type of Anesthesia used the patients were divided into two groups. Group A included patients in whom Total Intravenous Anesthetics were used (TIVA group) and group B where patients were administered Gaseous anesthetics (Volatile group). In group A 46 patients were included and in group B 22 patients were included. The demographic data were tabulated in Table 1. In comparison, group A patients (TIVA group) consisted of more Hypertensive patients than the group B (Table 1).

**Table 1: Showing the demographic data of the two groups of Bronchoscopy in the study (n-68).**

| Patient Observations | Total (N = 68) | TIVA (N = 46) | Volatile (N = 22) | P value |
|---|---|---|---|---|
| Mean age | 23.42± 05.30 | 21.95±04.85 | 23.78±07.15 | 0.214 |
| BMI | 21.64 ± 2.22 | 22.95 ± 3.05 | 21.85 ± 2.08 | 0.415 |
| Gender | | | | |
| Male | 44- 64.70% | 32- 47.05% | 12-17.64% | 0.154 |
| Female | 24- 35.29% | 14-20.58% | 10-14.70% | |
| ASA grade<br>I<br>II<br>III | <br>35-51.47%<br>21-30.88%<br>12-17.64% | <br>29-42.64%<br>11-16.17%<br>06-08.82% | <br>06-08.82%<br>10-14.70%<br>06-08.82% | <br><br>0.048 |
| Medical history | | | | |
| Diabetes | 13.0% | 7.2% | 18.6% | 0.243 |
| Hypertension | 23.3% | 28.8% | 16.2% | 0.012* |
| IHD | 18.1% | 13.7% | 05.22% | 0.106 |

| | | | | |
|---|---|---|---|---|
| CVA | 4.3% | 3.1% | 0% | 0.395 |
| AF | 1.1% | 1.4% | 0% | 0.627 |
| Bronchiectasis | 41.2% | 33.8% | 25.3% | 0.521 |
| COPD | 14.1% | 09.6% | 16.6% | 0.341 |
| Asthma | 04.4% | 05.5% | 0% | 0.323 |
| Tuberculosis | 21.7% | 18.3% | 33.2% | 0.133 |
| Lung Abscess | 06.3% | 4.1% | 0% | 0.395 |
| Cirrhosis | 5.3% | 1.4% | 11.8% | 0.032* |
| Cancer | 48.8% | 51.3% | 28.1% | 0.320 |
| Metastasis | 18.0% | 20.9% | 14.8% | 0.424 |

In table 2 the intervention techniques of Bronchoscopy undertaken were depicted. It also showed the types of anesthesia given and methods of ventilation and the pharmacological agents used were shown. Foreign body removal was performed under inhalation anesthesia in 21/68 (30.88%) patients (TIVA group- 11 and 10 Volatile group), Biopsy of Bronchogenic carcinoma was done in 11/68 (16.17%) patients (TIVA group- 06 and 05 Volatile group) and diagnostic Bronchoscopy was done in 14/68 (20.58%) of the patients (TIVA group- 06 and 08 Volatile group) to investigate the cause of hemoptysis. Both the groups of patients received similar ventilation irrespective of the indication for Bronchoscopy (Table 2).

**Table 2: Showing the indications of Bronchoscopy in the study (n-68)**

| Bronchoscopy Indications | TIVA group | Volatile group | P value |
|---|---|---|---|
| Foreign body removal- 21 (30.88%) | 11 | 10 | |
| Biopsy of Bronchogenic carcinoma- 11 (16.17%) | 06 | 05 | |
| Diagnostic Bronchoscopy- 14 (20.58%) | 06 | 08 | |
| Bronchial toilet- 13 (19.11%) | 07 | 06 | |
| Diagnostic for Hemoptysis-02 (02.94%) | 01 | 01 | |

The hemodynamic parameters recorded during the interventional Bronchoscopy were tabulated in Table 3 showing the pre-operative and post-operative arterial blood gas, pulse oximetry and pulmonary function test data. The baseline values of these parameters were similar in the both groups. Post-operative estimation of arterial blood gas (7.42 ± 0.42 vs. 7.35 ± 0.17, P = 0.021) showed a lower PH in the patients who received volatile anesthesia than the TIVA group. But the volatile group patients were found to have a greater forced vital capacity (Volatile: 2.98 ± 0.60 vs. TIVA: 2.19 ± 0.62, P = 0.034) than the TIVA group after rigid Bronchoscopy. The Volatile group patients showed greater incidence of systemic complications like Hypertension postoperatively, 14.25% in TIVA group than in Volatile group: 15.25%. (Table 3)

**Table 3: Showing the hemodynamic parameters in the study (n-68).**

| Hemodynamic parameters | TIVA group | Volatile group | P value |
|---|---|---|---|
| Arterial blood gas concentration | 7.42 ± 0.42 | 7.01 ± 0.17 | 0.021 |
| PH | 2.19 ± 0.62 | 2.98 ± 0.60 | 0.034 |
| Raised mean SBP in mmHg | 158.25±12.50 | 172.38±09.54 | 0.011 |

The mechanical complications in both the groups were similar and there was no significant difference statistically. The complications encountered were laryngospasm, stent dislodgement, bleeding, tooth dislodgement, and failure to locate the

tumour. The Volatile group patients showed greater incidence of systemic complications like Hypertension postoperatively, 14.25% in TIVA group than in Volatile group: 15.25%. Myocardial infarction was recorded in 05.28% of TIVA group and 01.50% in Volatile group and pneumothorax in 08.90% vs. 1.50%) as compared to patients who received TIVA.

## Discussion

The present study analysed the intra operatively and post operatively the effects of different types of anesthesia used while performing rigid Bronchoscopy for various indications. The analysis included the demographic data, hemodynamic changes, interventions performed, intraoperative medications used, ventilation strategies, complications and types of anesthesia used. General anesthesia was used but in two variants in the study. One used only Intravenous anesthetic drugs and the other used volatile gases. Hemodynamic response of the body to interventional rigid Bronchoscopy created a unique challenge to the anesthetist and the surgeon alike. There was attenuation of hemodynamic parameters due to increased sympathetic nervous system activity and adreno-medullary catecholamine activity [3]. There was hypertension, tachycardia and dysrhythmias in patients which resulted in the peri-operative risk for the subgroup of patients with coronary artery disease, existing hypertension, preeclampsia and intra- cranial pathologies such as aneurysms [4]. To reduce the hemodynamic turbulence during the procedure certain pharmacological agents were used like intravenous or topical lignocaine, esmolol, nifidipine, remifentanil, clonidine, gabapentine, and magnesium sulphate successfully [5-11]. Few authors have used local anaesthetics, calcium channel block-ers, beta blockers and narcotics to reduce the incidence of Dysrrhythmias [12]. Remifentanil was used by Bouillon TW, Bruhn J and He L, Wan X et al an ultra-short acting opioid which worked synergistically with propofol and volatile agents like sevoflurane in reducing the response to laryngoscopy [13,14]. In the present study remifentanil was used in the TIVA group when compared to volatile group (63% vs. 11.8% P = 0.001). Instead, the incidence of intra-operative hypertension was significantly higher in the group B and the incidence of MI was also high.

It was observed in this study that volatile group patients had a higher incidence of raised SBP than in the TIVA group patients. The hemodynamic changes observed supporting this was raised heart rate and mean arterial blood pressure when compared to propofol-remifentanil anaesthesia in the paediatric population, in spite of a faster induction and recovery time [15-17]. However, the Hypotension observed between the two groups did not differ much and significant statistically. The pressor response to rigid bronchoscopy was proven inferior by fentanyl when compared to remifentanil as the later provided greater haemodynamic stability and more effective attenuation of tachycardia [16,18]. The methods of ventilation used in the present study was: (1) Apnoeic oxygenation; (2) Spontaneous assisted ventilation; (3) Controlled ventilation; (4) Manuel jet ventilation; and (5) High frequency jet ventilation (HFOV). Spontaneous assisted ventilation was described as a TIVA technique whereby a close titration of anaesthetic is required to maintain spontaneous ventilation by the patient [19-22]. There are several limitations to our study. The case load of rigid bronchoscope in adults is low in our tertiary centre and practices differ amongst anaesthetists over the years. This skews the perspective of the anaesthetic practice over period of study. Secondly, majority of the data were not on electronic system. Missing or incomplete data which are excluded may contributed to bias in the study. Thirdly, we did not capture

data on the use of bispectral index (BIS) and the complication of awareness. As this is a retrospective review, these data were not available.

## Conclusion

The present study concluded that the two methods of anesthesia and ventilation used for rigid Bronchoscopy produced similar results and none of the both have shown to be superior over the other. Propofol and remifentanil combination used in TIVA group was better and appeared to be popular as it had attenuated haemodynamic response during the procedure. Both the groups showed improvement in spirometry measurements. The incidence of hypoxia or hypercapnia was also similar.

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