

Anesthesia management in geriatric patients which were interventional bronchoscopy due to central airway obstruction; retrospective analysis

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ABSTRACT

Aim: In the endobronchial treatment of tumors that cause obstruction in the tracheobronchial system; Applications such as cryo-recanalization and argon plasma coagulation (APC) are widely used. Patients presenting with central airway obstruction (CAO) require urgent intervention, sharing the airway with the bronchoscopist, severe shortness of breath in patients, and the presence of comorbid diseases make it difficult for anesthetists. This situation becomes more complicated due to pharmacokinetic and pharmacodynamic changes in geriatric patients. In this article, it is aimed to present the anesthesia method in geriatric patients who underwent interventional bronchoscopy due to central airway obstruction.

Material and Method: The files of geriatric patients who underwent interventional procedures for central airway obstruction between January 2021 and September 2021 were reviewed retrospectively. The treatments applied to the patients and the applied anesthetic protocols were recorded.

Results: Forty-five geriatric patients who underwent interventional procedures for CAO were identified. 74% of the patients were male. 95.6% of the patients were in the American Society of Anesthesiologists (ASA) III or ASA IV risk group, which we can refer to as the high risk group. It was observed that rapid and short-acting propofol and remifentanyl were used in induction and maintenance of anesthesia, rocuronium was used as muscle relaxant, and sugammadex was used to eliminate the residual effect of the muscle relaxant.

Conclusion: Airway management is very complex in severe life-threatening airway stenosis. This situation requires a more comprehensive preoperative evaluation, selection of appropriate short-acting anesthetics, and effective anesthetic monitoring, especially in geriatric patients. In addition, the anesthetist and bronchoscopist should be prepared and in constant communication against complications that may develop.

Keywords: Airway obstruction, anesthesia, geriatrics, interventional pulmonology, rigid bronchoscopy

INTRODUCTION

Rigid bronchoscopy, cryorecanalization and argon plasma coagulation (APC) applications are increasingly used to remove or reduce tumors that cause obstruction in the endobronchial system (1). Dilatation, stent placement, laser and electrocautery are other methods used to reduce or eliminate obstruction (2). General anesthesia is usually required during rigid bronchoscopy (3). However, patients with central airway obstruction (CAO) require urgent intervention, sharing the airway with the bronchoscopist, severe shortness of breath in patients and the presence of comorbid diseases complicate the work of anesthesiologists.

In addition, the fact that the patients are in the geriatric age group makes the work even more complicated and difficult. Geriatric patients are known to be more sensitive to anesthetic agents. It is possible to achieve the desired effect with fewer drugs in geriatric patients, and the drug effect is generally prolonged in the elderly population (4). This difference in geriatric patients is mainly due to the difference in kidney and liver metabolism and, accordingly, changes in pharmacokinetic and pharmacodynamic responses (5-7). Therefore, anesthesia management is very important in geriatric patients presenting with CAO. In this study, it was aimed to present our anesthesia management experience in the treatment of severe airway stenosis in geriatric patients.

MATERIAL AND METHOD

The study was initiated with the approval of the Ankara Keçiören Training and Research Hospital Ethics Committee (Date: 28.09.2021, Decision No: 2012-KAEK-15/2357), our study was conducted in the 3rd level chest diseases and chest surgery center (Ankara Atatürk Chest Diseases and Thoracic Surgery Training and Research Hospital). All procedures were performed adhered to the ethical rules and principles of the Helsinki Declaration. The files of patients who underwent interventional procedures due to CAO reviewed retrospectively between January 2021 and September 2021.

Patients aged 65 and over, with ASA score of I-IV and with central airway obstruction were included in the study.

Patients under 65 years of age, patients with ASA score of V and above, and without central airway obstruction were excluded from the study.

Diagnosis, age, body mass index, gender, history of smoking and alcohol use, ASA score, pre-procedural dyspnea, presence of hemoptysis, mallampati score, concomitant diseases, lesion localizations and treatments, applied anesthetic protocols were recorded.

Data were analyzed using IBM SPSS 25.0 (Armonk, NY: IBM Corp.) statistical package software. Frequency, percentage and standard deviation were used for descriptive statistics

Anesthesia Protocol Applied in CAO

The patients were evaluated in the anesthesia outpatient clinic at least one day before the interventional procedure. After the ASA physical scores were determined, the patients who signed the written informed consent form underwent an interventional procedure.

Invasive pressure monitoring was also provided by monitoring the patients after routine preparations and performing radial artery cannulation. A 37 Fr and 39 Fr double lumen endobronchial intubation tube was kept ready in case of endobronchial bleeding. After 3 minutes of preoxygenation with 100% oxygen, 1 mg/kg 2% lidocaine, 50 mg ranitidine, 1 mg/kg methylprednisolone and 2 mg/kg propofol were administered intravenously (iv). Patients were given 40 mcg remifentanyl and 0.9 mg/kg rocuronium iv. After the rigid bronchoscope was inserted into the trachea of the patients by the bronchoscopist, it was connected to the anesthesia circuit and ventilated with balloon ventilation. Anesthesia maintenance was adjusted as propofol 4-6 mg/kg/hour and remifentanyl 2-3 mcg/kg/min as IV infusion. During the procedure, the hemodynamic parameters of the patients were monitored continuously and their arterial blood gases (ABG) values were followed every 10 minutes.

After the procedure was completed, 4 mg/kg sugammadex was given iv and the rigid bronchoscope was removed. After recovery, the patients were taken to the intensive care unit. Patients who were followed up with nasal O₂ and had no complications and had an SpO₂ value above 90% in room air were sent to the service 2 hours after the procedure.

RESULTS

Between January 2021 and September 2021, a total of 111 patients underwent interventional procedures for CAO. 47 of them were in the geriatric age group. 2 patients were excluded from the study due to missing data (**Figure**).

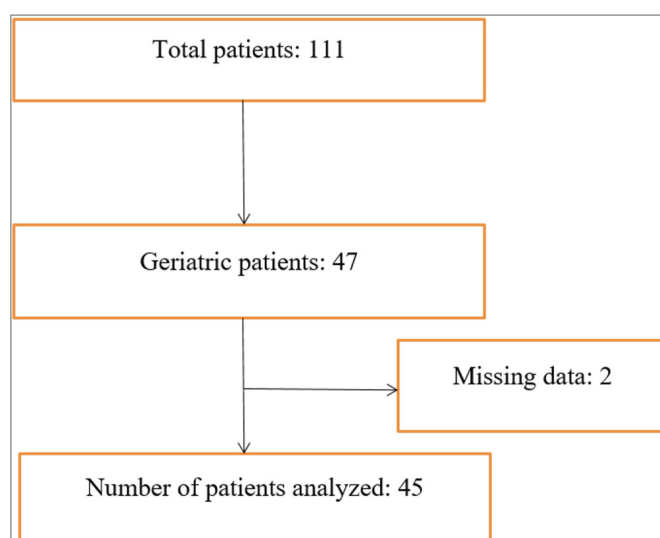


Figure. Flow chart of the patients

Demographic characteristics of patients in the geriatric age group are given in **Table 1**. 74% of the patients were male. 95.6% of the patients were in the ASA III or ASA IV risk group, which we can refer to as the high risk group. In one patient, an interventional procedure was performed under emergency conditions. While 62.2% of the patients had a history of smoking, 93.4% did not have a history of alcohol use (**Table 1**).

Table 2 shows whether the patients had dyspnea and hemoptysis before the procedure, whether they needed nasal oxygen or ventilator, their tracheostomy status and mallampati scores. While 44.4% of the patients were dependent on nasal oxygen, only 2.2% were using a home ventilator. Mallampati score was 2 or 3 in 91.1% of the patients (**Table 2**).

Additional diseases of the patients are listed in **Table 3**. **Table 4** shows the localization of the pathology causing CAO, the diagnosis of the patients and the procedures for the patients.

Table 1. Demographic characteristics of the patients	
	n (%)
Gender	
Female	12 (26%)
Male	33 (74%)
Age (± SD)	71.2±5.29
BMI (± SD)	25.81±4.67
ASA	
II	2 (4.4%)
III	26 (57.8%)
IV	16 (35.6%)
IV-E	1 (2.2%)
Smoking	
Yes	11 (24.4%)
No	17 (37.8%)
left	17 (37.8%)
Alcohol use	
Yes	2 (4.4%)
No	42 (93.4%)
Left	1 (2.2%)

SD: Standart deviation; BMI: Body mass index; ASA: Amerikan Anestezistler Birliği; E: Emergency

Table 3. Additional Diseases of the Patients	
	n (%)
Lung cancer	15 (33.3%)
Chronic obstructive pulmonary disease	14 (31.1%)
Past Covid-19 Infection	6 (13.3%)
Hypertension	17 (37.8%)
Coronary Artery Disease	14 (31.1%)
Arrhythmia	2 (4.4%)
Diabetes Mellitus	10 (22.2%)
Hypothyroidism	1 (2.2%)
Previous Cerebrovascular Event	3 (6.7%)
Chronic renal failure	1 (2.2%)
Extrapulmonary Cancer	9 (20%)

Table 2. Clinical characteristics of the patients	
	n (%)
Dyspnea	33 (73.3%)
Nasal oxygen	20 (44.4%)
Hemoptysis	5 (11.1%)
Home ventilator	1 (2.2%)
Tracheostomy	3 (6.7%)
Mallampati	
I	3 (6.7%)
II	26 (57.8%)
III	15 (33.3%)
IV	1 (2.2%)

Table 4. Diagnosis of the patients, localization of pathology, procedure performed	
	n (%)
DIAGNOSIS	
EBL	35 (77.7%)
Tracheal Stenosis	6 (13.3%)
Tracheal Fistula	2 (4.4%)
Foreign Body	2 (4.4%)
LOCALIZATION	
Trachea	14 (31.1%)
Right Main Bronchus	12 (26.6%)
Left Main Bronchus	17 (37.7%)
Bilateral	2 (4.4%)
APPLIED TREATMENT	
APC	3 (6.6%)
MTR	1 (2.2%)
APC+MTR	24 (53.3%)
Dilation	3 (6.6%)
Cryoextraction	4 (8.8%)
Cryoextraction + APC	2 (4.4%)
Cryoextraction + APC + MTR	2 (4.4%)
Biopsy	4 (8.8%)
Foreign Body removal	2 (4.4%)

EBL: Endobrochial lesion; APC: Argon plasma coagulation; MTR: Mechanical tumor resection

DISCUSSION

In geriatric patients who will undergo rigid bronchoscopy due to severe CAO, general anesthesia is often required to prevent the patient from moving. For this purpose, rapid and short-acting propofol and remifentanyl are appropriate choices for induction and maintenance of anesthesia, considering the physiological, pharmacokinetic and pharmacodynamic changes in geriatric patients. It may be preferable to use fast-acting rocuronium to accelerate the passage of the bronchoscope through the vocal cords. We think that sugammadex will be a good choice for rapid recovery and elimination of the residual effect of the muscle relaxant.

The fact that both physicians use a common airway and there are air leaks during ventilation requires continuity of communication between the anesthetist and bronchoscopist during the procedure.

Interventional pulmonology has made significant advances in the diagnosis and treatment of pulmonary pathologies in recent years (8). Along with these developments, the anesthesia method to be applied is also important. In the literature, performing rigid bronchoscopy under deep sedation where spontaneous breathing is preserved is reported as an alternative to general anesthesia. However, the possibility of hypoventilation in deep sedation, laryngospasm, insufficient relaxation of the laryngeal muscles, coughing or movement of the patient complicates the insertion of the rigid bronchoscope into the trachea and the work of the team (9). However, geriatric patients presenting with CAO usually have a high rate of comorbidities. Therefore, the possibility of complications related to anesthesia is high (10,11).

A safe and controlled airway should be established before the interventional procedure. Alternative airway

equipment such as small-diameter intubation tube, double-lumen intubation tube (DLT) and high-frequency jet ventilator should be ready for acute complications such as bleeding, pneumothorax, and airway obstruction (9). Massive bleeding, especially during the procedure, is a serious life-threatening complication. In this case, DLT, which is frequently applied in our clinic, can be life-saving.

Especially in cases with severe stenosis with limited reserves, hypoxia and cardiopulmonary arrest may develop after the compensation mechanisms are depressed (12). In addition, it should be kept in mind that masses located in the anterior mediastinum may cause tracheal obstruction and sudden cardiovascular collapse during induction due to compression in the supine position (13). For these reasons, the anesthesia method to be preferred should create a rapid and sufficient level of anesthesia, and at the same time, short-acting anesthetic drugs that will provide rapid recovery should be selected (14).

Total intravenous anesthesia (TIVA) should be considered as the first option in the maintenance of anesthesia instead of inhalation anesthesia for reasons such as air leaks in ventilation with a rigid bronchoscope and the need for apnea periods during the procedure (9). Propofol and remifentanyl infusion are frequently used together in TIVA due to the short half-life and rapid recovery of patients.

The adequacy of ventilation should be checked with SpO₂ and end-tidal CO₂ monitoring. The presence of hypercapnia is a strong indicator for inadequate ventilation (14). However, the presence of air leaks requires the end-tidal CO₂ value to be measured with an accurate technique. Transcutaneous CO₂ has been used for hypercapnia monitoring in recent years. However, in cases where this technique cannot be applied, it is very important to monitor acid-base balance, pCO₂ and pO₂ with ABG analysis at regular intervals. Invasive arterial monitoring will be useful for close ABG monitoring and instant hemodynamic evaluation.

Bispectral index monitoring can be used as an appropriate method for the evaluation of depth of anesthesia (15,16). In addition, TOF (train of four) monitoring may be useful in these patients for the evaluation of neuromuscular blockade efficiency (17). It was seen that these techniques were not used in our study, but we think that the use of these two techniques would be beneficial in terms of increasing anesthesia safety.

Reversing the effect of post-procedure muscle relaxants with neostigmine is a frequently used method. Sugammadex, on the other hand, reverses the effect of muscle relaxation faster than neostigmine. In addition, cholinergic side effects are not observed and residual muscle relaxant effects are less common (18,19).

CONCLUSION

As a result, anesthesia management in airway stenosis becomes complicated because the anesthetist and bronchoscopist use the airway together and the procedure is high-risk. Addition of physiological, pharmacokinetic and pharmacodynamic changes and comorbidities in geriatric patients to this situation can put a strain on the anesthetist. Therefore, a comprehensive preoperative evaluation, selection of appropriate short-acting anesthetics, effective anesthetic monitoring, and good perioperative communication with the operating team are very important in preventing complications in geriatric patients.

ETHICAL DECLARATION

Ethics Committee Approval: The study was initiated with the approval of the Ankara Keçiören Training and Research Hospital Ethics Committee (Date: 28.09.2021, Decision No: 2012-KAEK-15/2357).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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