ANESTHETIC MANAGEMENT FOR THORACOTOMY IN A GERIATRIC PATIENT WITH BRONCHIECTASIS WHO UNDERWENT LOBECTOMY COMPLICATED BY SEVERE AORTIC STENOSIS: A CASE REPORT

Penanganan Anestesi Untuk Pasien Geriatri dengan Bronkiektasis Pada Tindakan Lobektomi Torakotomi dengan Komplikasi Stenosis Aorta Berat: Laporan Kasus

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Abstract

Bronchiectasis, characterized by the abnormal and permanent dilation of the bronchi and the destruction of the elastic and muscular layers of the bronchial wall, often arises from infections such as tuberculosis and pneumonia. This condition can lead to significant morbidity and potential mortality due to loss of lung function. Surgical intervention could be considered in cases of failed medical therapy or persistent symptoms. Anesthetic management for thoracotomy and lung resection in these patients is crucial, particularly when complicated by severe aortic stenosis (SAS), which poses additional risks for perioperative complications. This condition requires careful anesthetic strategies to optimize outcomes. In this case report, a 77-year-old male with chronic bronchiectasis and severe aortic stenosis was scheduled for elective thoracotomy lobectomy. The patient experienced persistent cough and dyspnea, with preoperative spirometry indicating moderate restriction. Echocardiography revealed critical aortic stenosis and low ejection fraction, indicating high surgical risk. Anesthesia induction involved fentanyl, midazolam, and atracurium, followed by intubation with a left-sided double-lumen tube for one-lung ventilation. Intraoperatively, hemodynamic stability was maintained with dobutamine and nitroglycerin. The patient successfully underwent a thoracotomy lobectomy lasting approximately 4.5 hours with manageable blood loss. He was transferred to the ICU for postoperative care and was extubated on the second postoperative day. He was discharged on the tenth postoperative day without complications. This case highlights the importance of hemodynamic stability in patients with bronchiectasis and severe aortic stenosis undergoing thoracotomy lobectomy. Careful anesthetic management and monitoring are crucial to prevent complications, and dobutamine and nitroglycerin effectively maintain stability during surgery for better outcomes.

Keywords: Thoracotomy; Anesthesia; Lobectomy; Chronic Bronchiectasis with SAS

Abstrak

Bronkiektasis, yang ditandai dengan dilatasi bronkus yang abnormal dan permanen serta kerusakan lapisan elastis dan otot pada dinding bronkial, sering kali disebabkan oleh infeksi seperti tuberkulosis dan pneumonia. Kondisi ini berpotensi menyebabkan morbiditas yang signifikan dan meningkatkan

*mortalitas akibat hilangnya fungsi paru. Intervensi bedah dapat dipertimbangkan pada kasus yang tidak memberikan respons terhadap terapi medis atau mengalami gejala persisten. Manajemen anestesi untuk torakotomi dan reseksi paru pada pasien dengan bronkiektasis menjadi tantangan tersendiri, terutama jika disertai dengan stenosis aorta berat (*severe aortic stenosis*/SAS), yang meningkatkan risiko komplikasi perioperatif. Kondisi ini memerlukan strategi anestesi yang hati-hati untuk mengoptimalkan hasil pembedahan. Laporan kasus ini mendeskripsikan seorang pria berusia 77 tahun dengan bronkiektasis kronis dan stenosis aorta berat yang dijadwalkan menjalani lobektomi torakotomi elektif. Pasien mengalami batuk persisten dan dispnea, dengan hasil spirometri preoperatif menunjukkan restriksi sedang. Ekokardiografi mengungkapkan stenosis aorta kritis dan fraksi ejeksi rendah, yang mengindikasikan risiko bedah yang tinggi. Induksi anestesi dilakukan dengan fentanil, midazolam, dan atrakurium, diikuti dengan intubasi menggunakan* double-lumen tube *sisi kiri untuk ventilasi satu paru. Stabilitas hemodinamik intraoperatif dipertahankan dengan dobutamin dan nitrogliserin. Pasien berhasil menjalani lobektomi torakotomi selama sekitar 4,5 jam dengan kehilangan darah yang dapat dikendalikan. Setelah operasi, pasien dipindahkan ke ICU untuk perawatan pascaoperasi dan berhasil ekstubasi pada hari kedua pascaoperasi. Ia kemudian dipulangkan pada hari kesepuluh tanpa komplikasi. Kasus ini menekankan pentingnya stabilitas hemodinamik pada pasien dengan bronkiektasis dan stenosis aorta berat yang menjalani lobektomi torakotomi. Manajemen anestesi yang cermat dan pemantauan ketat sangat penting untuk mencegah komplikasi, serta penggunaan dobutamin dan nitrogliserin terbukti efektif dalam menjaga stabilitas selama pembedahan guna mencapai hasil yang lebih baik.*
***Kata Kunci**: Torakotomi; Anestesi; Lobektomi; Bronkiektasis Kronis dengan Stenosis Aorta Berat*

INTRODUCTION

Bronchiectasis is characterized by the abnormal and permanent dilatation of the bronchi that often results from infectious pulmonary diseases such as tuberculosis, pneumonia, pertussis, and measles[1,2]. It causes significant loss of lung function thus resulting in morbidity and even early mortality[3]. The incidence of this pathology ranges from approximately 67-362/100,000 adults[4]. Treatment includes both medical and surgical therapies. Surgical treatment may be considered if medical treatment fails, the disease is widespread, or if the patient experiences persistent symptoms like excess sputum production, chronic cough, lung abscess, hemoptysis, or localized bronchiectasis[2,5]. Anesthetic management in patients who underwent thoracotomy lung resection as surgical treatment for bronchiectasis involves several key considerations. These include a thorough presurgery evaluation, managing factors that might affect anesthesia during the operation, and planning for pain management after surgery[6]. General anesthesia, securing the airway using a one-lung ventilation technique, is crucial for ensuring a clear view of the surgical lung. While one-lung ventilation can improve surgical visibility, it may also lead to lung complications. To minimize these risks, protective lung ventilation techniques like adjusting tidal volumes, positive end-expiratory pressure, and oxygen levels can help reduce overall lung damage, even when using one-lung ventilation[6]. As complicated as it is, anesthesia in severe aortic stenosis (SAS) can result in rapid clinical deterioration and patient mortality[7]. Therefore, managing patients with both cases in combination requires more thorough anesthetic consideration and management. Here, we present a case of a patient with bronchiectasis who underwent thoracotomy lobectomy complicated by SAS.

CASE REPORT

A 77-year-old male diagnosed with chronic bronchiectasis, severe restriction of the right lung, and SAS was electively admitted to the Immanuel Hospital for a scheduled thoracotomy lobectomy. The patient presented with persistent cough, shortness of breath, and dyspnea d'effort. His medical history included allergies to dust, sensitivity to low temperatures, and a history of heavy smoking. The bronchiectasis had been managed for the past three months, and SAS was discovered incidentally during preoperative screening. The preoperative posteroanterior (PA) chest X-ray (Figure 1A) reveals extensive bronchiectasis changes with increased opacities in the affected lung, likely due to chronic infection and mucus retention. The mediastinum appeared slightly shifted, and the cardiac silhouette is enlarged, consistent with underlying SAS. Additionally, blunting of the costophrenic angle suggested the presence of pleural effusion or atelectasis.

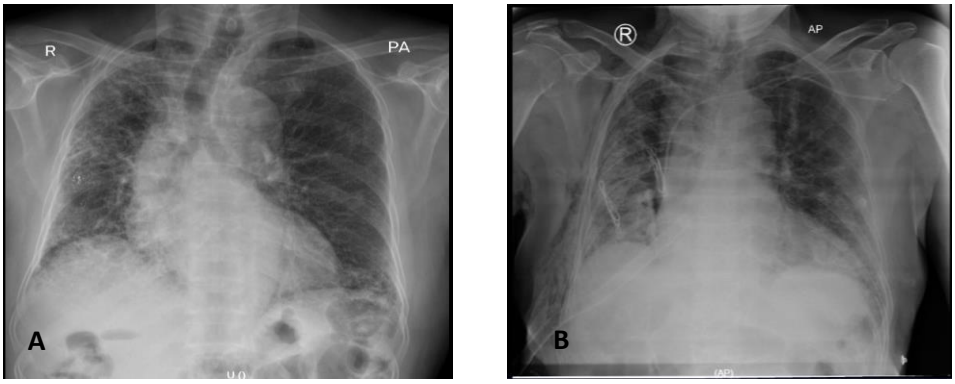


Figure 1. Patient's chest radiograph image (a) Presurgery (July 29th 2024) and (B) Postsurgery (August 2nd 2024)

Spirometry results, as shown in Figure 2 and Table 1, indicated a forced vital capacity (FVC) of 48% and a forced expiratory volume in one second (FEV1/FVC) ratio of 65%, suggesting mild obstruction and moderate restriction.

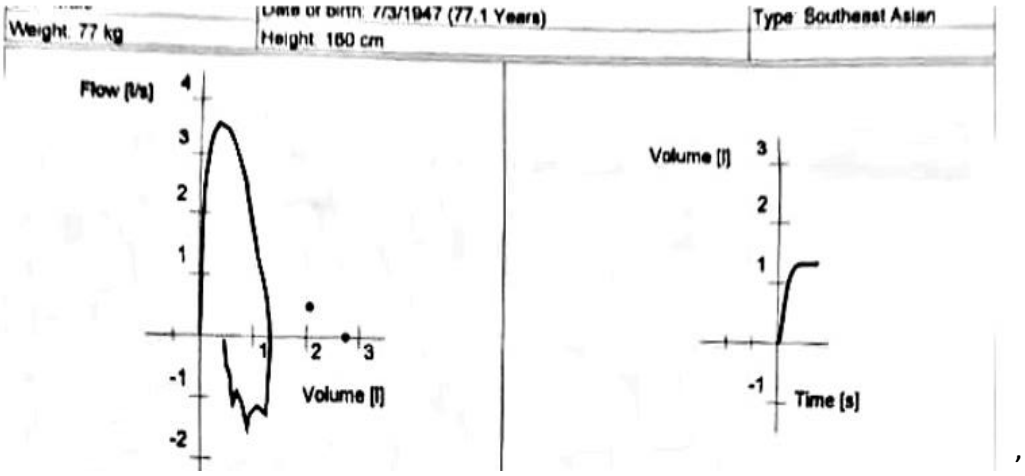
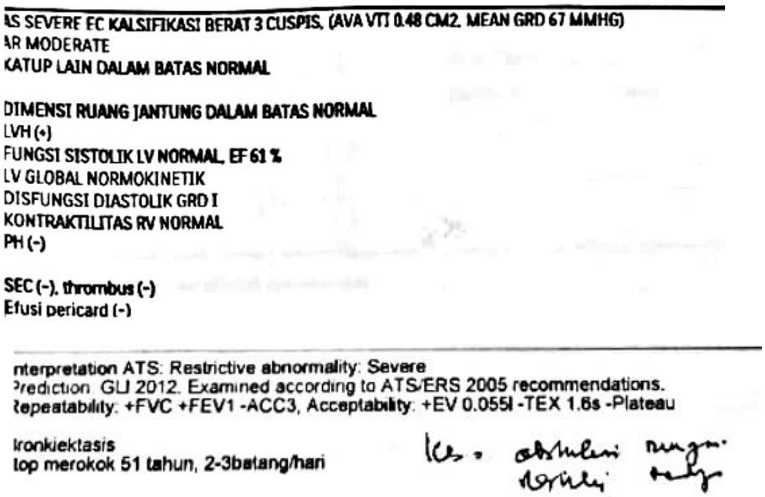


Figure 2. Patient's spirometry graph result

Table 1. Patient's spirometry test result

Parameter	Unit	Pred	LLN	Meas	% Pred
FVC					
FVC	L	2.75	1.96	1.32	48
FEV1	L	2.15	1.49	1.32	61
PEF	L/s	-	-	3.61	-
FEV1/FVC	%	78.46	65.54	100.00	127
MMEF	L/s	1.77	0.78	2.94	166
MEF75	L/s	-	-	3.53	-
MEF50	L/s	-	-	3.17	-
MEF25	L/s	0.50	0.20	1.84	366
TVC	L	-	-	0.87	-
Vext	t^2_A	-	-	3.22	-

Echocardiography revealed critical SAS (aortic valve area (AVA) VTI 0.48 cm² (Figure 3), mean gradient 67 mmHg, and low ejection fraction (EF) of 44%), indicating high-risk mortality. His preoperative examination was otherwise unremarkable, with normal renal and liver function. The patient was administered preoperative medications, including Velutin Plus and Budesma three times daily, Nitrokaf (2 × 2.5 mg), N-acetylcysteine (3 × 1 capsule), Pantoprazole (2 × 1 vial), and Meropenem (3 × 1 g).


AS SEVERE EC KALSIFIKASI BERAT 3 CUSPIS. (AVA VTI 0.48 CM2. MEAN GRD 67 MMHG)
AR MODERATE
KATUP LAIN DALAM BATAS NORMAL

DIMENSI RUANG JANTUNG DALAM BATAS NORMAL
LVH (+)
FUNGSI SISTOLIK LV NORMAL. EF 61 %
LV GLOBAL NORMOKINETIK
DISFUNGSI DIASTOLIK GRD I
KONTRAKTILITAS RV NORMAL
PH (-)

SEC (-), thrombus (-)
Efusi pericard (-)

nterpretation ATS: Restrictive abnormality: Severe
Prediction GLI 2012. Examined according to ATS/ERS 2005 recommendations.
Repeatability: +FVC +FEV1 -ACC3, Acceptability: +EV 0.055l -TEX 1.6s -Plateau

Ironkiektasis
top merokok 51 tahun, 2-3batang/hari

Figure 3. Patient's echocardiography test result

In the preparation room, one peripheral vein was accessed using an angiocath (no. 16), and a five-lead ECG was placed. A left radial artery arterial line was inserted for invasive blood pressure monitoring. On arrival in the operating room, the patient's vital signs were: blood pressure 140/90 mmHg, heart rate 62 bpm, respiratory rate 22 breaths per minute, and oxygen saturation 99%. The patient's weight was 60 kg. Anesthesia induction commenced with 4 mcg/kg fentanyl, 0.05 mg/kg midazolam, 50 mg atracurium, and 1.5 mg/kg lidocaine. Following the achievement of adequate muscle relaxation, the patient was intubated with a left-sided double-lumen endotracheal tube (size 35) and positioned in the left lateral decubitus position. A central venous catheter (CVC) was placed via the left subclavian vein. Anesthesia was maintained with an oxygen-air mixture and 0.5% sevoflurane, along with a continuous infusion of propofol (2 cc/kg/h), fentanyl (25 mcg/h), and atracurium (20 mg/h). Prior to the surgical incision, additional doses of fentanyl (50 mcg) and atracurium (20 mg) were administered. To regulate heart rate, systemic vascular resistance (SVR), contractility, and blood pressure, dobutamine (3 mcg/kg/min) and nitroglycerin (NTG) (0.05 mcg/kg/min) were infused through the central venous catheter. The patient underwent a thoracotomy

lobectomy of the right bottom lung, with a total surgical duration of approximately 4 hours and 30 minutes, total blood loss of 250 ml, and urine output of 800 ml. He was subsequently moved to the ICU with a continuous infusion of dobutamine (3 mcg/kg/min) and nitroglycerin (NTG) (0.05 mcg/kg/min). Ventilator support was gradually reduced, and he was extubated on the second postoperative day. The postoperative anteroposterior (AP) chest X-ray (Figure 1B) demonstrates changes following the lobectomy. The affected lung region appeared surgically altered, with surgical clips visible on the right side, confirming resection. There was improved lung aeration, but residual postsurgical changes, such as mild opacity and possible pleural fluid, were observed. The cardiac silhouette remained prominent, consistent with pre-existing severe aortic stenosis. He was transferred to the ward on the second postoperative day and discharged on the tenth postoperative day.

DISCUSSION

Careful anesthetic planning and execution are vital to ensure patient safety during bronchiectasis surgery[5]. Due to the dense vascular adhesions commonly found in bronchiectasis surgery, precise lung isolation using one-lung ventilation (OLV) is crucial to ensure optimal surgical exposure of the affected lung while maintaining adequate oxygenation of the healthy lung[5,8]. OLV, commonly induced with a double-lumen tube (DLT) or a bronchial blocker (BB), can result in significant physiological shunting, compromising gas exchange. In the lateral decubitus position, gravity predominantly directs blood flow to the dependent lung, while ventilation initially favors the non-dependent lung due to its decreased compliance. For our patient, we employed a left-sided DLT and specific ventilator settings (tidal volume 5-7 mL/kg, positive end-expiratory pressure 5-7 cmH_2O, plateau pressure <30 cmH_2O) with recruitment maneuvers as necessary. Minimizing both surgical and OLV duration were essential to mitigate the risk of perioperative pulmonary complications.

Both DLTs and endobronchial blockers have their own advantages and disadvantages. DLTs offer superior lung isolation, particularly in cases where one lung is contaminated with blood or pus. Pulmonary suctioning is more easily accomplished since each lung can be suctioned throughout the procedure, whereas an endobronchial blocker would need to be deflated in order to suction the operative lung.

In comparison to single-lumen endotracheal tubes (SLTs), DLTs are more technically demanding to insert and are associated with a heightened risk of airway injury, including vocal cord and tracheal damage[9,10]. Laryngeal edema may ensue after DLTs, potentially hindering subsequent SLT replacement.

The patient's aortic stenosis constitutes a significant anesthetic risk, as it can precipitate rapid clinical deterioration and mortality[7]. A preoperative echocardiographic evaluation of stenosis severity and left ventricular function is strongly recommended[11]. In line with current ACC/AHA guidelines, echocardiography was performed on our patient with suspected valvular heart disease to assess the severity of aortic stenosis, evaluate left ventricular systolic function, and estimate right heart pressures.

The patient’s echocardiogram in Figure 3 showed SAS with heavy calcification (Aortic Valve Area-Velocity Time Integral 0.48 cm^2, mean gradient 67 mmHg), moderate aortic regurgitation and left ventricular hypertrophy (LVH), suggesting a high risk of mortality.

In the Original Cardiac Risk Index, SAS was linked to a 13% perioperative mortality rate. The occurrence of major adverse cardiac events (MACE) in patients with AS is likely driven by anesthetic agents and surgical stress, leading to hemodynamic instability[12]. Hypotension and tachycardia can lead to a decrease in coronary perfusion pressure, potentially causing arrhythmias, ischemia, myocardial injury, heart failure, and even death. For patients with SAS who have not undergone aortic valve

replacement, meticulous cardiovascular monitoring throughout the perioperative period is essential. Ensuring sufficient preload and systemic vascular resistance is crucial, as aortic stenosis typically leads to diminished contractile reserve and inadequate compensatory mechanisms. Additionally, it is important to prevent prolonged tachycardia and sustain sinus rhythm, since reductions in diastolic filling time can decrease preload and worsen hemodynamics when a fixed outflow obstruction is present. With reduced cardiac reserve, sudden decreases in coronary blood flow due to systemic hypotension can result in myocardial ischemia. As a result, patients with aortic stenosis are at a higher risk of developing type 2 myocardial infarction (supply-demand mismatch) during the perioperative period[13]. Fentanyl, midazolam, atracurium, and lidocaine are administered as induction agents and fentanyl, atracurium, dobutamine, and NTG to maintain hemodynamic stability.

CONCLUSION

This case underscores the critical importance of hemodynamic stability in patients with concurrent bronchiectasis and SAS undergoing thoracotomy lobectomy. The interplay between respiratory and cardiovascular conditions requires meticulous anesthetic management to mitigate the risk of perioperative complications. In this patient, the use of OLV for surgical access was essential but introduced potential challenges, including significant shunting and compromised gas exchange.

Moreover, the management of SAS posed additional risks, including the possibility of rapid clinical deterioration due to anesthetic agents and surgical stress. The necessity of maintaining adequate preload, systemic vascular resistance, and contractility was paramount to prevent adverse cardiac events. In this context, the strategic use of dobutamine and nitroglycerin during surgery proved effective in sustaining hemodynamic stability.

Ultimately, this case illustrates that a comprehensive understanding of the patient's underlying conditions and vigilant intraoperative monitoring is vital for achieving favorable surgical outcomes. Enhanced perioperative care strategies focused on hemodynamic management can significantly improve survival and recovery in patients with complex medical histories.

CONFLICT OF INTEREST

Authors declared that there is no conflict of interest.

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