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CASE REPORT **CARDIOTHORACIC ANESTHESIA**

Anesthetic challenges during repairing left pulmonary artery sling without cardiopulmonary bypass: a case report

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ABSTRACT

Left pulmonary artery sling (LPAS) is a rare vascular anomaly. The general surgical technique to correct it is through median sternotomy under cardiopulmonary bypass (CPB). In this case, we discuss the anesthetic management of left pulmonary artery (LPA) reimplantation without CPB to improve the understanding and provide an overview for practitioners in managing patients with this rare vascular anomaly. Patient was a 10 months old baby, with main complaints of shortness of breath since he was 4 months old, and diagnosed with LPAS from cardiac multi-slice CT scan (MSCT) examination. Intraoperatively, when the LPA was clamped, the blood pressure decreased due to decreased preload, and the end-tidal CO_2 increased to 70 mmHg due to increased dead space, which was successfully managed. Postoperatively, the patient suffered from ventilator acquired pneumonia (VAP). Evaluating and assessing the potential complications that can occur during the perioperative period will help prepare for management and improve the success of anesthetic management.

Abbreviations: CPB- Cardiopulmonary Bypass; ETT- Endotracheal Tube**;** LPA- Left Pulmonary Artery; LPAS- Left Pulmonary Artery Sling; MSCT- Multi-Slice CT Scan; RPA- Right Pulmonary Artery; VAP- Ventilator Acquired Pneumonia

Key words: Left Pulmonary Artery; Anesthesia Management; Pulmonary Sling; Cardiopulmonary Bypass

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1. INTRODUCTION

Left pulmonary artery sling (LPAS) is a vascular anomaly with the left pulmonary artery (LPA) arising from the right pulmonary artery (RPA) and running posteriorly over the surface of the bronchi between esophagus and trachea to the left lung. This situation suppresses the distal trachea, right main bronchus, and small part of left main bronchus.[1] As a result, the patient will show symptoms of coughing, wheezing, stridor, severe respiratory distress to death. The severity of the symptoms depends on the degree of tracheal obstruction.[2,3]

The common surgical technique for correction of LPAS is median sternotomy approach using cardiopulmonary bypass (CPB). The surgery consists of the releasing of LPA from the trachea, and reimplanting it to the main pulmonary artery (MPA), followed by repair of the narrowed trachea with tracheoplasty.[3] This case report presents the anesthetic management of a 10 months old patient with LPAS who underwent LPA reimplantation without using CPB.

2. CASE REPORT

We present a case report of a 10 months old baby with main complaint of shortness of breath accompanied

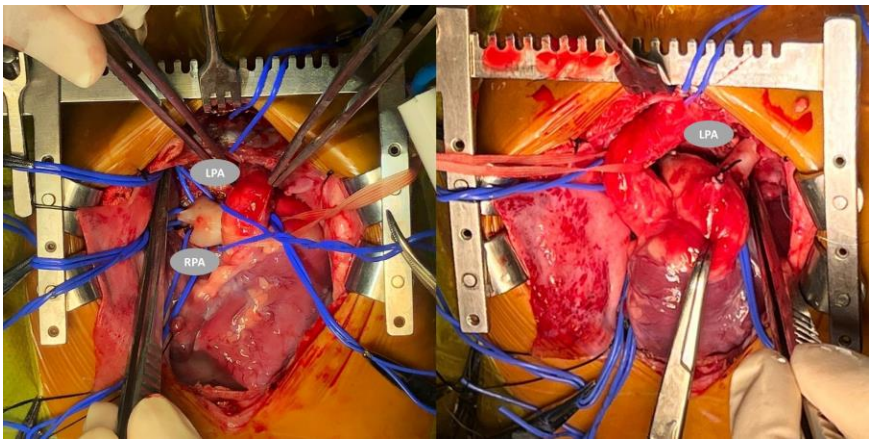

Figure 1: During LPA sling repair surgery; (LPA: Left Pulmonary Artery; RPA: Right Pulmonary Artery)

by wheezing, since he was 4 months old. On physical examination, the respiratory rate was 40 breaths/min with symmetrical vesicular lung sounds accompanied by wheezing during inspiration and expiration, with no stridor. Chest X-ray showed bronchopneumonia. Based on the results of cardiac multi-slice CT scan (MSCT), the patient was diagnosed with LPAS. The patient was planned for LPA sling repair surgery without using CPB (Figure 1).

The patient underwent general anesthesia. During the operation, the patient's hemodynamic parameters remained stable. The surgery was performed without CPB by releasing and reimplanting LPA into the MPA. When the LPA was clamped to be cut and release the sling, the blood pressure decreased and the end-tidal CO_2 increased to 70 mmHg. We injected inotropic drugs along with colloid fluid loading of 10 ml/kg and increased the tidal volume, respiratory rate and FiO_2. After the completion of the reimplantation process, the LPA and RPA showed confluence, and the end-tidal returned to normal. The surgeons decided not to perform tracheoplasty at that stage. The patient was shifted from the operating room to intensive care unit (ICU) to be mechanically ventilated.

In the ICU, on the second day of treatment, the patient developed respiratory distress and was diagnosed to be suffering from ventilator acquired pneumonia (VAP). The sputum culture results showed Klebsiella pneumoniae infection. Appropriate antibiotics were started. On the seventh day of treatment, the patient was extubated and continued to use non-invasive ventilation (NIV). After the extubation, intravenous dexamethasone was given to reduce tracheal edema. On the tenth day of treatment, the patient's clinical condition improved, she was fully conscious and hemodynamically stable without inotropic support. The patient was then transferred to the intermediate ward.

3. DISCUSSION

LPAS is one of the rare congenital heart defects caused by abnormalities in the LPA. This condition obstructs the trachea and main bronchi due to compression of the LPA (Figure 2)[3], and can be accompanied by tracheal stenosis and other congenital heart defects. In our patient, no other congenital heart defects were found. Diagnosis of LPAS can be established by MSCT scan.[2] In this patient, the cardiac MSCT examination showed that the LPA grew from RPA and ran posteriorly between trachea and esophagus towards the left lung. The MSCT examination showed narrowing of the trachea, which was the main focus for the anesthesiologist, as there was a risk of airway narrowing leading to difficult intubation process.

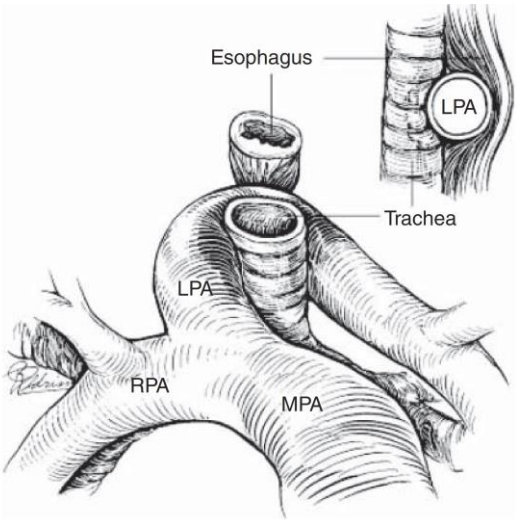

Figure 2: Left Pulmonary Artery Sling (LPAS). Shows lateral view of anterior compression of the esophagus and compression of the posterior trachea; (LPA: Left Pulmonary Artery; RPA: Right Pulmonary Artery; MPA: Main Pulmonary Artery)[3]

Preoperative bronchoscopy examination can estimate the degree of tracheal stenosis, the length and width of stenosis, and the distance from the carina,.[4] In this patient, preoperative bronchoscopy was not performed because the patient's clinical status did not show signs of severe respiratory distress or inspiratory stridor. However, the possibility of tracheal stenosis cannot be completely

ruled out, and the anesthesiologist must consider the possibility of airway complications.

The preparation for anesthesia includes preparing for the possibility of difficulty in maintaining the airway due to tracheal narrowing. Inhalation bronchodilators can help dilate the airway. Intravenous dexamethasone can reduce airway edema caused by intubation.[4,5] Fibreoptic bronchoscopy (FOB) can be useful for patients with potential intubation difficulties.[3] In this patient, the tracheal narrowing was located at the distal carina so that intubation can be performed without complications. A non-cuffed endotracheal tube (ETT) was selected, which has the advantage of reducing the risk of airway edema. The cuff size is adjusted to the patient's age and weight. Large ETT size carries the risk of airway trauma and edema, while small ETT size increasees leakage and peak airway pressure, and decrease CO_2 clearance.[6]

Generally, surgery for correction of LPAS is performed using a median sternotomy approach with CPB. The process consists of releasing LPA sling and reimplanting it into the MPA. Furthermore, tracheoplasty is performed on the trachea to correct the stenosis.[1] In this patient, corrective surgery was performed through median sternotomy without CPB. The surgeon's consideration for not using CPB was because the correction only needed to release and reimplant the LPA to MPA, and the use of CPB can affect postoperative outcomes. There was no correction procedure of associated congenital heart defects.

Tracheoplasty was not performed because the degree of stenosis was not severe, and the stenosis that occurred was a secondary effect due to compression of the slinged LPA. Patients who undergo corrective procedures without tracheoplasty show better prognostic outcomes.[1] Another consideration for performing the corrective procedure without using CPB is the risk of postoperative inflammation with CPB, especially in infants with preoperative infection.[7]

During the clamping of the LPA to cut and release the sling, the blood pressure decreased and the end-tidal CO_2 increased to 70 mmHg. The decrease in blood pressure may be caused by the decrease in pulmonary circulation due to a small part of the MPA being clamped during this period and the blood only circulating through the RPA, resulting in a relative decrease in preload in the left heart, which leads to a decrease in cardiac output. In addition, the decrease in blood pressure may also be caused by bleeding during the reimplantation of the LPA into the MPA.[5,8]

Fluids and inotropics were given to maintain blood pressure. The increase of end-tidal CO_2 may have been caused by the pulmonary circulation that only occurred through the RPA; there was no perfusion in the left lung. As a result, the left lung experienced dead space, with alveolar ventilation only occurring in the right lung. This condition, combined with the narrowing of the trachea compressed by LPA, resulted in impaired CO_2 clearance.[9] During this period, we increased alveolar ventilation by increasing tidal volume and respiratory rate to reduce CO_2. When the LPA was successfully reimplanted, hemodynamic and end-tidal CO_2 returned to normal.

Postoperative complications can occur due to LPA reimplantation and tracheoplasty. During the LPA correction, complications such as narrowing, kinking, and obstruction of the LPA can occur, that can cause decrease in pulmonary circulation and cardiac output, manifesting as a decrease in blood pressure and desaturation.[5,10] The only complication found in this patient was VAP on the second day of treatment, managed by antibiotics. After the extubation, we gave intravenous dexamethasone to reduce tracheal edema and used NIV CPAP for 24 h to ensure that tracheal edema had resolved.[4]

4. CONCLUSION

Left pulmonary artery sling is a rare congenital anomaly. The surgery to release and reimplant the left pulmonary artery was performed without using CPB. Evaluating and assessing the potential complications that can occur during the perioperative period will help prepare for adequate management and improve the success of anesthetic management.

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6. Conflicts of interest

The authors have no conflicts of interest to declare

7. Authors' contributions

AA: study concept and design; literature search; manuscript preparation

AP: manuscript review, revising, and editing

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