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Perioperative management of transforaminal lumbar interbody fusion in a post-double lung transplant recipient: A case report

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Abstract

Background: As long-term survival following lung transplantation improves, anesthesiologists increasingly encounter such patients for elective non-transplant surgeries. These patients present unique perioperative challenges due to altered pulmonary physiology, chronic immunosuppression, and multiple comorbidities.

Case Presentation: We report the case of a 56-year-old female with a history of double lung transplantation in 2022, who presented with severe lumbar spinal canal stenosis and underwent elective L4-L5 transforaminal lumbar interbody fusion (TLIF) with L3-L4 decompression. Her comorbidities included well-controlled hypertension, type 2 diabetes mellitus, hypothyroidism post-total thyroidectomy, and she was on maintenance immunosuppressive therapy. Preoperative investigations revealed a restrictive pulmonary pattern, cardiomegaly with a dilated main pulmonary artery, mosaic attenuation in both lungs, and an ejection fraction of 70% with mild left atrial enlargement. She was evaluated and deemed fit for surgery by a multidisciplinary team including a chest physician, cardiologist, and nephrologist. The procedure was successfully performed under general anesthesia with lung-protective ventilation and strict aseptic precautions. Her postoperative course was uneventful, and she was discharged on postoperative day six.

Conclusion: This case underscores the importance of individualized perioperative management, vigilant respiratory and infection control strategies, and multidisciplinary coordination in ensuring favorable outcomes for lung transplant recipients undergoing elective spine surgery.

Keywords: Lung transplantation, perioperative management, spine surgery

Introduction

Lung transplantation has become the definitive treatment for various forms of end-stage pulmonary disease, with survival rates steadily improving ^[1, 2]. As a result, transplant recipients are increasingly presenting for elective surgical procedures unrelated to the graft. These patients represent a high-risk group due to altered pulmonary mechanics, immunosuppression-related complications, and frequent coexisting comorbidities such as diabetes, hypertension, and thyroid dysfunction ^[3, 4].

Spine surgery, particularly in the prone position, further amplifies these risks by potentially compromising respiratory mechanics and increasing infection susceptibility due to prolonged operative time and instrumentation ^[5, 6]. Anesthetic management in this context demands a meticulous approach aimed at preserving graft function, minimizing infection risk, and maintaining hemodynamic and ventilatory stability ^[1, 4].

We report a case of successful anesthetic and perioperative management of a double lung transplant recipient undergoing elective transforaminal lumbar interbody fusion.

Case Report: A 56-year-old female (height: 150 cm, weight: 56 kg, BMI: 24.9 kg/m²) presented with a 6-month history of progressive bilateral lower limb weakness and neurogenic claudication, significantly impairing her mobility. MRI of the lumbar spine revealed severe spinal canal stenosis at L4-L5 with adjacent segment degeneration at L3-L4. She was scheduled for elective L4-L5 transforaminal lumbar interbody fusion (TLIF) with L3-L4 decompression. Her past medical history was significant for double lung transplantation in 2022 for end-stage pulmonary fibrosis, well-controlled hypertension on amlodipine, type 2 diabetes mellitus managed with oral hypoglycemics, and hypothyroidism

secondary to total thyroidectomy in 2018 for multinodular goiter, for which she was on levothyroxine. She was on maintenance immunosuppressive therapy including tacrolimus, mycophenolate mofetil, and low-dose prednisone. A multidisciplinary preoperative evaluation was conducted involving pulmonology, cardiology, nephrology, and endocrinology. Pulmonary function tests revealed a right-sided restrictive ventilatory defect. High-resolution CT of the chest demonstrated cardiomegaly, a dilated main pulmonary artery, and mosaic attenuation in both lungs suggestive of ventilation-perfusion mismatch. A transthoracic echocardiogram revealed preserved left ventricular systolic function with an ejection fraction of 70%, mild left atrial enlargement, and no evidence of pulmonary hypertension. Laboratory investigations including renal and hepatic function were within normal limits, and tacrolimus levels were therapeutic. Airway examination was unremarkable (Mallampati Class II) with adequate mouth opening and neck mobility. After informed consent and thorough risk stratification, she was taken up for surgery. In the operating room, standard ASA monitors including ECG, non-invasive blood pressure, pulse oximetry, end-tidal CO₂, and temperature monitoring were applied. An arterial line was secured in the left radial artery for continuous blood pressure monitoring, and two 18-gauge peripheral intravenous lines were established. General anesthesia was induced with intravenous propofol 100 mg and fentanyl 100 mcg, followed by neuromuscular blockade with rocuronium 40 mg. The trachea was intubated using video laryngoscopy with a 7.0 mm internal diameter cuffed endotracheal tube without difficulty. Mechanical ventilation was initiated in volume-controlled mode using a tidal volume of 6 mL/kg ideal body weight, PEEP of 5 cm H₂O, FiO₂ of 0.5, and respiratory rate titrated to maintain end-tidal CO₂ between 35-40 mmHg. Peak airway pressures were maintained below 25 cm H₂O throughout the procedure. The patient was positioned prone on a spine table with chest and pelvic bolsters to facilitate optimal abdominal excursion and reduce venous congestion. All pressure points were carefully padded, and normothermia was maintained using a forced-air warming device. The surgery lasted approximately four hours, with an estimated blood loss of 300 mL. Intravenous fluid administration was restrictive, limited to 1.5 liters of balanced crystalloids, and urine output remained adequate. Hemodynamics were stable throughout without the need for vasopressors.

Postoperative Course

The patient was extubated uneventfully on table after confirming adequate neuromuscular reversal and spontaneous respiratory effort. She was transferred to the surgical ICU for close observation. Immunosuppressive therapy was continued without interruption. Prophylactic broad-spectrum antibiotics were administered, and stress-dose corticosteroids were provided intraoperatively and tapered postoperatively.

Postoperative pain was managed with IV paracetamol and low-dose fentanyl via PCA. Pulmonary care included incentive spirometry, chest physiotherapy, and early mobilization. Glycemic control was maintained with insulin as needed.

The postoperative period was uneventful. There were no signs of graft dysfunction, infection, or pulmonary complications. The patient was discharged on postoperative

day six and demonstrated significant neurological improvement at follow-up.

Discussion

Lung transplant recipients present a unique perioperative challenge due to their altered pulmonary physiology, immunosuppressive therapy, and high susceptibility to infection and hemodynamic instability^[1, 3]. The transplanted lung lacks normal lymphatic drainage and cough reflex, increasing the risk of atelectasis and pneumonia, especially under general anesthesia and in the prone position^[4, 6].

Pulmonary Protection

The presence of a restrictive defect and mosaic attenuation on imaging suggested areas of ventilation-perfusion mismatch. A lung-protective ventilation strategy with low tidal volume, modest PEEP, and close monitoring of peak airway pressures was crucial^[4, 5]. Prone positioning, while beneficial for spinal access, can further impair lung mechanics; therefore, careful positioning to facilitate chest wall expansion was essential^[6].

Infection Control

Chronic immunosuppression increases the risk of opportunistic and nosocomial infections. Aseptic techniques, continuation of baseline immunosuppressants, and timely prophylactic antibiotic coverage were imperative. Steroid stress dosing was administered to mitigate adrenal insufficiency due to chronic prednisone use^[3, 7].

Cardiovascular and Fluid Management

The patient had mild left atrial enlargement and a dilated pulmonary artery, potentially reflecting elevated pulmonary vascular resistance. Judicious fluid administration and avoidance of volume overload helped preserve both cardiac and graft function^[1].

Multidisciplinary Optimization

Preoperative assessment and optimization by a team comprising pulmonology, cardiology, nephrology, and endocrinology ensured the patient was in optimal condition before surgery. This team-based approach significantly contributes to improved outcomes in such high-risk patients^[2, 6].

Pharmacologic Considerations

Drug interactions with tacrolimus and other immunosuppressants can alter anesthetic drug metabolism and increase the risk of nephrotoxicity. Therefore, intraoperative drug choices were made carefully, and nephrotoxic agents were avoided^[3, 7].

This case highlights that with meticulous planning, thorough risk stratification, and close postoperative monitoring, even high-risk elective procedures such as TLIF can be safely performed in lung transplant recipients. While literature on anesthesia for non-thoracic surgery in lung transplant patients remains limited, this case contributes to the growing evidence supporting individualized perioperative care in this population^[1, 2].

Conclusion

Elective spine surgery in lung transplant recipients is feasible with favorable outcomes when approached with

thorough multidisciplinary preoperative assessment, careful intraoperative anesthetic management, and vigilant postoperative monitoring. A lung-protective strategy, infection control, immunosuppression continuity, and hemodynamic stability form the cornerstone of successful management in such complex cases.

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