

Initial experience with deceased-donor lung transplantation at a newly established lung transplant center: a report of three cases

Taiki Ryo, Heng Huang, Minoru Sugihara, Tatsuya Masuda,
Yasuhisa Ichikawa, Yoshito Imamura, Hirofumi Takenaka, Hiroki Watanabe,
Yuta Kawasumi, Keita Nakanishi, Yuka Kadomatsu, Harushi Ueno,
Taketo Kato, Shota Nakamura, Tetsuya Mizuno and
Toyofumi Fengshi Chen-Yoshikawa

Department of Thoracic Surgery, Nagoya University Graduate School of Medicine, Nagoya, Japan

ABSTRACT

Deceased-donor lung transplantation (DDLT) is an established therapeutic option for patients with end-stage lung disease; however, the number of certified lung transplant centers in Japan remains limited. Our institution was certified as the 11th lung transplant center in Japan in March 2023, and lung transplant registration was subsequently initiated. We report our initial experience with three consecutive DDLTs performed at our institution. The patients included two men with idiopathic pulmonary fibrosis and one man with diffuse panbronchiolitis. Right single-lung, bilateral lung, and left single-lung transplantation were performed, respectively. One patient developed postoperative aspiration pneumonia, which was successfully treated with antibiotics. Another patient required methylprednisolone pulse therapy for suspected acute rejection and transient renal replacement therapy for acute renal dysfunction. All patients showed favorable postoperative recovery, with substantial improvement in functional status. Donor lung procurement, surgery, and postoperative management were conducted through close collaboration with an experienced transplant center and a multidisciplinary team. This experience suggests that DDLT can be safely introduced at a newly established lung transplant center through interinstitutional cooperation and comprehensive multidisciplinary perioperative management.

Keywords: lung transplantation, deceased-donor lung transplantation, low-volume center, initial experience

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INTRODUCTION

Deceased-donor lung transplantation (DDLT) is an established therapeutic option for patients with end-stage lung disease.^{1,2} In Japan, the number of lung transplantations has gradually increased following the enactment and subsequent revision of the Organ Transplant Law^{3,4};

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Corresponding Author: Toyofumi Fengshi Chen-Yoshikawa, MD, PhD

Department of Thoracic Surgery, Nagoya University Graduate School of Medicine,

65 Tsurumai-cho, Showa-ku, Nagoya 466-8550, Japan

Tel: +81-52-741-2111, Fax: +81-52-744-2382, E-mail: yoshikawa.toyofumi.t1@f.mail.nagoya-u.ac.jp

however, the number of certified lung transplant centers remains limited.¹ Our institution was certified as the 11th lung transplant center in Japan in March 2023, after which lung transplant registration was initiated.

As a newly established lung transplant center, not only surgical expertise but also close collaboration with experienced centers and the establishment of a comprehensive multidisciplinary perioperative management system are essential. In this report, we describe our initial experience with three consecutive cases of DDLT at a newly established lung transplant center, focusing on perioperative management and early postoperative outcomes.

CASE PRESENTATIONS

Case 1

A 59-year-old man with idiopathic pulmonary fibrosis (IPF) underwent DDLT at our institution. He was diagnosed with IPF at age 51 years and was listed for DDLT at another hospital at age 57 years. Following relocation, his transplant registration was transferred to our center at age 58 years. During the waiting period, he experienced two episodes of acute exacerbation of IPF.

After a waiting period of 13 months, lung transplantation was performed at age 59 years. At the time of organ allocation, the patient was ranked fourth on the waiting list; however, lungs became available due to the emergence of three simultaneous donors, and transplantation was subsequently allocated to this patient. Preoperatively, he required home oxygen therapy at 3 L/min at rest and 4 L/min during exertion. Although his activities of daily living remained independent, his dyspnea progressed from modified Medical Research Council (mMRC) grade 1 at the time of transplant registration to grade 3 at the time of transplantation.

Preoperative imaging demonstrated predominant reticular opacities with traction bronchiectasis and honeycombing in the right lung (Fig. 1A, B). Lung perfusion scintigraphy revealed an asymmetric blood flow distribution, with 33.4% to the right lung and 66.6% to the left lung. Although the mean pulmonary artery pressure (mPAP) was 15 mmHg at the time of transplant registration, it increased to 43 mmHg following the induction of general anesthesia, indicating pulmonary hypertension. In operation, a right single-lung transplantation was performed under central venoarterial extracorporeal membrane oxygenation (VA-ECMO) support. After implantation of the right donor lung, the ratio of arterial oxygen partial pressure to fraction of inspired oxygen (P/F ratio) improved to 340, allowing successful weaning from ECMO. The mPAP subsequently decreased to 17 mmHg. The operative time was 6 hours 28 minutes, and the total ischemic time was 9 hours 05 minutes.

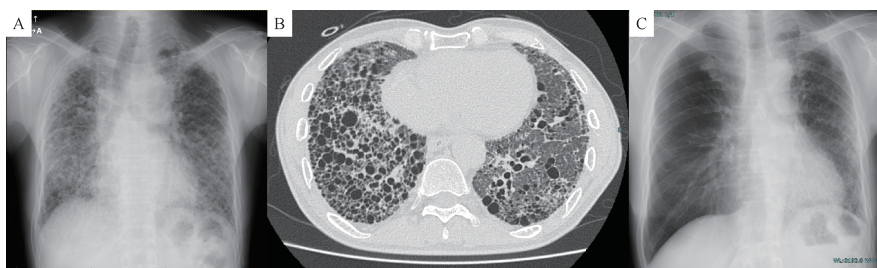


Fig. 1 Imaging findings in Case 1

Fig. 1A: Preoperative chest radiograph showing reticular opacities in both lung fields.

Fig. 1B: Preoperative chest computed tomography demonstrating traction bronchiectasis and honeycombing.

Fig. 1C: Chest radiograph at discharge showing good radiolucency of the right lung field.

The patient was extubated on postoperative day 2 and discharged from the intensive care unit on postoperative day 10. No episodes of acute rejection or postoperative infection were observed. Given that this was the first case at our institution, postoperative medication adjustment and rehabilitation were conducted cautiously. The patient was discharged approximately 2.5 months after transplantation (Fig. 1C). At discharge, his functional status had markedly improved, and he was able to walk up to 10,000 steps per day.

Case 2

A 56-year-old man with diffuse panbronchiolitis (DPB) underwent deceased-donor bilateral lung transplantation at our institution. He was diagnosed with DPB at age 48 years, and his respiratory condition progressively deteriorated thereafter. Home oxygen therapy was initiated at age 51 years. Despite ongoing treatment, he experienced recurrent hospitalizations due to respiratory infections and was referred to our institution for lung transplantation at age 54 years. He was listed for DDLT in the same year.

After listing, the patient continued to have repeated hospitalizations for infectious exacerbations and developed recurrent right-sided pneumothorax. Lung transplantation was allocated 23 months after listing. At that time, he was hospitalized because of a right pneumothorax and infection, and subsequently developed a left-sided pneumothorax (Fig. 2A, B). As a result, his activities of daily living markedly declined, and he was close to being bedridden. He required high-flow oxygen therapy using an oxygen-conserving nasal cannula at 5–6 L/min both at rest and during exertion, as well as nocturnal nasal high-flow therapy at 30 L/min. Preoperative arterial blood gas analysis revealed hypercapnia, with a partial pressure of arterial carbon dioxide of 55.7 mmHg.

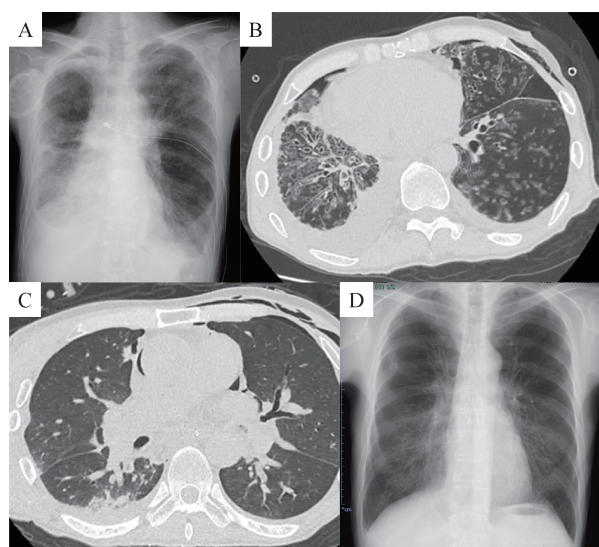


Fig. 2 Imaging findings and postoperative course in Case 2

Fig. 2A: Preoperative chest radiograph showing diffuse reticulonodular opacities predominantly in the bilateral middle to lower lung fields.

Fig. 2B: Preoperative chest computed tomography demonstrating bronchiectasis with mucus retention and bilateral pneumothoraces.

Fig. 2C: Chest computed tomography on postoperative day 5 showing an infiltrative opacity in the right lower lobe, suggestive of aspiration pneumonia.

Fig. 2D: Chest radiograph at discharge showing good radiolucency of both lung fields.

Given the presence of bilateral pneumothorax and hypercapnia, peripheral VA-ECMO standby was established before the induction of general anesthesia by securing right-sided inguinal arteriovenous access. General anesthesia was induced without respiratory or hemodynamic collapse, and intraoperatively, support was converted to central VA-ECMO. Deceased-donor bilateral lung transplantation was performed sequentially, with implantation of the right lung followed by the left lung. After completion of transplantation, the P/F ratio improved to 340, allowing successful weaning from ECMO. The operative time was 9 hours 41 minutes, and the total ischemic time was 9 hours 39 minutes.

The patient was extubated on postoperative day 3. However, we observed swallowing dysfunction because of generalized muscle weakness associated with prolonged preoperative immobilization. On postoperative day 5, he developed aspiration pneumonia caused by postnasal drip from chronic sinusitis that had been present during the pretransplant waiting period (Fig. 2C). This complication was successfully treated with antibiotic therapy. No episodes of acute rejection were observed. The patient was discharged from the intensive care unit on postoperative day 15, and his swallowing function gradually improved with rehabilitation.

Although his preoperative functional status had been nearly bedridden, his activities of daily living markedly improved after transplantation. By the time of discharge, he was able to walk up to 10,000 steps per day. He was discharged on postoperative day 68 (Fig. 2D).

Case 3

A 45-year-old man with idiopathic interstitial pneumonia of the fibrotic nonspecific interstitial pneumonia type (fibrotic NSIP) underwent DDLT at our institution as the third case. He first developed exertional dyspnea at age 26 years, and a thoracoscopic lung biopsy led to the diagnosis of fibrotic NSIP. Between the ages of 32 and 35 years, he experienced four episodes of acute exacerbation, each treated with steroid pulse therapy. Thereafter, he remained on oral prednisolone until lung transplantation and developed steroid-induced diabetes mellitus.

At age 40 years, antifibrotic therapy with nintedanib was initiated, and home oxygen therapy was introduced at age 42 years. Despite these treatments, his respiratory function progressively deteriorated, and he was listed for DDLT at age 43 years. At age 44 years, he was hospitalized for an acute exacerbation and survived after receiving two courses of steroid pulse therapy. Immediately before transplantation, his functional status was severely impaired, and he was able to ambulate only very short distances within his home.

Lung transplantation was allocated 20 months after listing, when the patient was at age 45 years. At that time, he was ranked eighth on the waiting list, and the left lung was accepted as the first lung, resulting in the allocation to this patient. Preoperative imaging demonstrated predominant reticular opacities in the bilateral lower lung fields with diffuse granular shadows and a marked reduction in lung volume (Fig. 3A, B). A deceased-donor left single-lung transplantation was performed.

The operation was initially attempted via a hemi-clamshell incision; however, exposure was limited because of a small thoracic cavity and upward displacement of the diaphragm. Consequently, the procedure was converted to a full clamshell incision with transverse sternotomy to secure an adequate surgical field. Intraoperatively, VA-ECMO was used, with cannulation via right-sided inguinal arteriovenous access. After reperfusion of the transplanted lung, the arterial oxygen partial pressure to fractional inspired oxygen ratio improved to 340, allowing successful weaning from ECMO. The operative time was 6 hours 41 minutes, and the total ischemic time was 6 hours 47 minutes.

The postoperative course was more complicated than in the previous two cases. A tracheostomy was performed on postoperative day 3. On postoperative day 10, acute rejection was

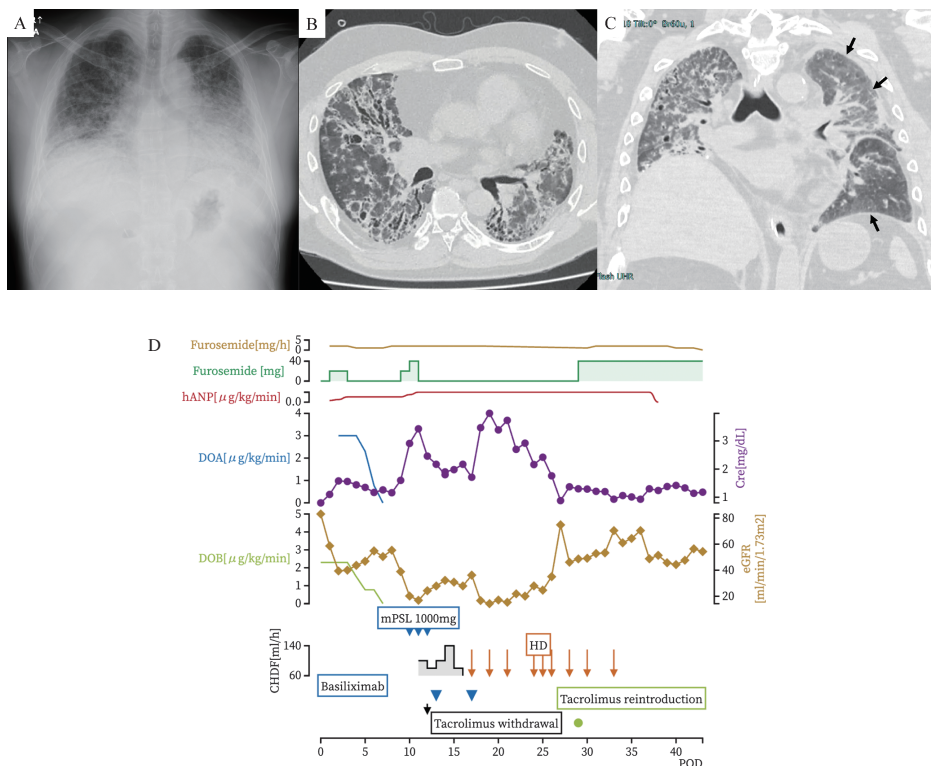


Fig. 3 Imaging findings and postoperative clinical course in Case 3

Fig. 3A: Preoperative chest radiograph showing reticular opacities predominantly in the bilateral lower lung fields.

Fig. 3B: Preoperative chest computed tomography showing diffuse centrilobular nodules, ground-glass opacities, and traction bronchiectasis, with reduced lung volumes.

Fig. 3C: Chest computed tomography on postoperative day 10 showing heterogeneous ground-glass opacities predominantly in the left upper lung field (arrows).

Fig. 3D: Clinical course in the intensive care unit. Severe renal dysfunction due to acute tubular injury was observed, and CHDF was initiated on postoperative day 11. Tacrolimus was discontinued, and basiliximab was introduced. Renal replacement therapy was discontinued on postoperative day 33, and the patient was discharged from the intensive care unit on postoperative day 43.

CHDF: continuous hemodiafiltration

HD: hemodialysis

POD: postoperative day

Cre: serum creatinine

eGFR: estimated glomerular filtration rate

DOA: dopamine

DOB: dobutamine

hANP: human atrial natriuretic peptide

mPSL: methylprednisolone

suspected, and methylprednisolone pulse therapy was administered (Fig. 3C). In addition, severe renal dysfunction due to acute tubular injury associated with a marked inflammatory response was observed, and continuous hemodiafiltration (CHDF) was initiated on postoperative day 11. Tacrolimus was temporarily discontinued, and basiliximab was introduced. Renal function gradually improved, and CHDF was discontinued on postoperative day 33. The patient was discharged from the intensive care unit on postoperative day 43 (Fig. 3D).

Because of long-standing muscle weakness and the complicated postoperative course, rehabilitation was initiated at a very low functional level, with manual muscle testing scores of approximately 1–2 in the upper and lower extremities. With careful adjustment of immunosuppressive therapy and ongoing rehabilitation, the patient gradually improved and was able to ambulate in the general ward on postoperative day 43.

DISCUSSION

In this report, we describe the initial experience with three consecutive cases of DDLT at a newly established lung transplant center. Although the number of cases is limited, several important considerations regarding the implementation and early operation of lung transplantation programs at new centers can be identified.

A key component of our program was the early establishment of a structured multidisciplinary perioperative management system. Close collaboration was maintained among thoracic surgeons, anesthesiologists, intensivists, nurses, clinical engineers, rehabilitation therapists, pharmacists, and dietitians. Preoperative multidisciplinary conferences were held to share patient information and surgical strategies, whereas postoperative management was primarily led by intensivists with daily multidisciplinary rounds involving the thoracic surgery team. In addition, comprehensive conferences were held before discharge from the intensive care unit to review the perioperative course and to identify potential issues during subsequent ward management. Such systematic, repeated information sharing facilitated coordinated decision-making and contributed to stable perioperative management during the initial phase of the program.

Despite careful preparation, including the development of perioperative management protocols before the first case, several unanticipated challenges were encountered. These experiences highlighted the importance of continuous refinement of institutional systems to ensure the sustainability of lung transplantation programs. For example, based on the experience in Case 3, off-label use approval was obtained for basiliximab, which was used as an alternative to tacrolimus, in preparation for future patients who may develop postoperative renal dysfunction. In addition, therapeutic drug monitoring for itraconazole, used for postoperative antifungal prophylaxis, was established in collaboration with the pharmacy department. These experiences indicate that logistical and administrative preparedness, including medication availability and monitoring systems, is as critical as surgical expertise when initiating a lung transplantation program.

Another challenge identified during the early phase was coordinating resources when lung transplantation overlapped with other solid-organ transplant procedures. At present, the capacity to perform lung transplantation concurrently with heart, liver, or kidney transplantation remains limited at many institutions, including newly established centers. This limitation may lead to missed transplantation opportunities and underscores the need for further institutional planning and resource allocation to accommodate multiple transplant programs.

Allocation-related issues also deserve consideration. In Japan, the waiting time for lung transplantation is prolonged, with a median duration of approximately 900 days.³ At newly established transplant centers, registered candidates often have relatively low waiting list priority and are therefore less likely to be included in early allocation with advance notification. As a result, transplant opportunities at new centers may arise abruptly only after higher-priority centers or candidates decline the offered donor lungs. Such late-stage allocation requires immediate mobilization of surgical teams and hospital resources, posing a substantial logistical challenge during the early phase of program development.

In addition, previous studies have suggested that outcomes after lung transplantation may vary

across centers, particularly in low-volume settings, and that institutional experience can influence early postoperative outcomes. Large registry-based analyses have demonstrated substantial between-center variability in survival after lung transplantation.⁵ More recent studies have reported an association between increasing center volume and improved short-term survival, while also noting wide performance variation among low-volume centers.⁶ In Japan, analyses have suggested that short-term outcomes can be acceptable even in lower-volume centers operating under an accreditation system, although variability in longer-term outcomes among low-volume centers has been observed.⁷ These findings underscore the importance of structured collaboration, careful case selection, and continuous system refinement during the early phase of lung transplantation program development.

In addition to establishing a lung transplantation program, newly certified centers are also required to maintain existing thoracic surgical services, particularly lung cancer treatment. Lung transplantation demands substantial medical resources and specialized personnel; therefore, developing a sustainable system that enables lung transplantation while preserving the quality and continuity of lung cancer care is a substantial challenge. The ability to balance lung transplantation with ongoing oncologic thoracic surgery will be a critical factor in the long-term viability of lung transplant programs at new centers.

Finally, close cooperation with experienced transplant centers was indispensable in all three cases. Support from established centers extended beyond intraoperative technical assistance to include postoperative management, donor evaluation, and decision-making related to allocation. Participation in national mutual support systems for donor lung procurement provided valuable opportunities to learn perioperative management strategies and donor acceptance criteria used by high-volume centers. Such collaborative frameworks are essential for ensuring safety and improving outcomes during the early phase of lung transplantation programs.

In conclusion, our initial experience suggests that DDLT can be safely implemented at a newly established lung transplant center through structured multidisciplinary collaboration, continuous system refinement, and close cooperation with experienced institutions. In parallel, establishing a sustainable system that balances lung transplantation with routine thoracic surgical care, including lung cancer treatment, will be essential for the long-term success of newly established lung transplant centers.

ETHICAL STATEMENT

This case report was approved by Nagoya University Certified Review Board (approval number, 2025-0549; approval date, March 11, 2026). Informed consent for publication was obtained from all patients.

AUTHOR CONTRIBUTIONS

TR, who served as the attending physician and was primarily responsible for patient care, contributed to case identification, clinical data collection, analysis and interpretation of the data, and drafting of the manuscript. HH, MS, TM, YI, YI, HT, HW, YK, KN, YK, HU, TK, SN, and TM contributed to perioperative patient management, multidisciplinary coordination, and data acquisition. TFC-Y supervised the clinical management and critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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