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Late living-donor kidney transplantation from the same donor after living-donor lobar lung transplantation

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Chronic kidney disease (CKD) is a common late complication associated with increased mortality after lung transplantation. Given the increased risk of infection in dialysis patients, late living-donor kidney transplantation (LDKT) provides excellent long-term survival in patients on dialysis after lung transplantation. However, recipients of living-donor lobar lung transplantation (LDLLT) might have scarce opportunity to receive LDKT due to the limited availability of living donors (LDs) for the second transplantation. We describe a successful case of late LDKT from the same donor after LDLLT. A 23-year-old woman with lymphangioleiomyomatosis underwent bilateral LDLLT of the right lower lobe from her brother and left lower lobe from her mother. Twelve years after LDLLT, she required hemodialysis for severe CKD. At the age of 37, she underwent LDKT from her mother, who was also an LD for the LDLLT. The postoperative courses of both the recipient and donor were uneventful, and the recipient remains in good physical condition (at the time of writing) despite developing recurrent lymphangioleiomyomatosis 23 years after the LDLLT, that is, 9 years after the LDKT. Her mother, the dual-organ LD, was able to return to her previous lifestyle. Late LDKT even from the same donor might be a viable option for patients developing severe CKD after LDLLT.

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Background

Chronic kidney disease (CKD) is a common late complication associated with increased mortality after lung transplantation (LT), which has been primarily attributed to the prolonged use of calcineurin inhibitors after LT. Approximately 9.9% of recipients of LT require renal replacement therapy, including chronic dialysis or kidney transplantation (KT), within 10 years.[1] Given the fact that dialysis patients, especially immunosuppressed transplant recipients, are susceptible to infection, KT rather than dialysis is recommended for CKD developing after LT.[2] Late living-donor KT (LDKT) after LT from deceased donors has been shown to provide excellent long-term survival.[3,4] However, recipients of bilateral living-donor lobar lung transplantation (LDLLT) from 2 living donors (LDs) might

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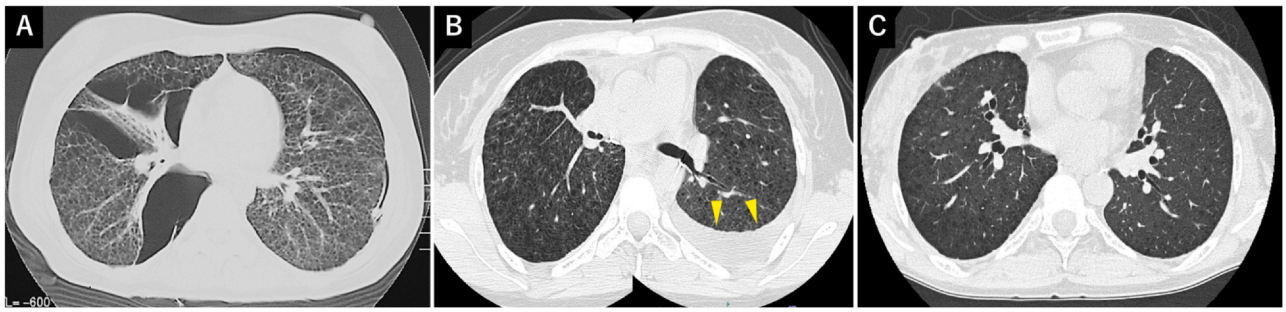

Figure 1 Chest computed tomographic (CT) image of the recipient. (A) Lymphangioleiomyomatosis before bilateral living-donor lobar lung transplantation (LDLLT). (B) CT image showing newly emerging cystic changes in both the transplanted lobar lungs along with left pleural effusion (arrow heads) 5 years after the LDLLT. (C) The recipient had survived without the development of chronic lung allograft dysfunction for 23 years (at the time of writing) after the LDLLT.

have scarce opportunity to undergo late LDKT due to the limited availability of LDs. According to 1 report, 16 patients have undergone LDKT from a different LD after LDLLT, but little information is available about LDKT from the same LD after LDLLT.[5] Herein, we describe the first successful case of late LDKT from the same LD after LDLLT.

Case report

The details of the patient's clinical course are described in our previous report.[6] In brief, a 23-year-old woman with lymphangioleiomyomatosis (LAM) underwent bilateral LDLLT of her brother's right lower lobe and mother's left lower lobe (Figure 1A). Her mother showed normal lung function with the forced vital capacity (FVC) of 2.66 liter (106.8% predicted), the forced expiratory volume in 1 sec (FEV1) of 2.32 liter (111.1% predicted), and the FEV1/FVC ratio of 0.87 before the LD lobectomy. Post-transplant immunosuppression consisted of tacrolimus, mycophenolate mofetil, and a steroid. Five years after the LDLLT, chest computed tomography revealed newly emerging cystic changes in both the transplanted lung lobes, with left pleural effusion (Figure 1B). Since LAM cells were detected in a sample of the chylous effusion, the patient was diagnosed as having recurrent LAM. Sirolimus was added to control the recurrent LAM. With the addition of sirolimus, the lung function remained stable thereafter despite the recurrent LAM. Twelve years after the LDLLT, the patient developed severe diarrhea and subsequently, severe CKD, requiring chronic hemodialysis (Figure 2). Two years after the initiation of hemodialysis, at the age of 37, she received LDKT from her mother, the same LD as for the LDLLT, at a local hospital. Her mother underwent a comprehensive evaluation to assess her medical, psychological, and social suitability for serving as a living organ donor for the second time at the age of 64, and LDKT was performed after obtaining adequate informed consent. The donor had normal kidney function, with the serum creatinine level of 0.44 mg/dl, the blood urea nitrogen level of 12.4 mg/dl, and

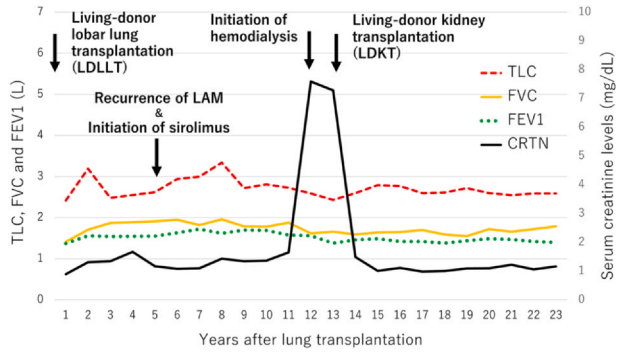

Figure 2 Postoperative changes in the forced total lung capacity (TLC), forced vital capacity (FVC), forced expiratory volume in 1 sec (FEV1), and serum creatinine (CRTN) levels after bilateral living-donor lobar lung transplantation (LDLLT). The TLC, FVC, and FEV1 were maintained throughout the clinical course despite the recurrent lymphangioleiomyomatosis (LAM) after the initiation of sirolimus. Her serum CRTN levels decreased and remained stable after living-donor kidney transplantation (LDKT) from the same donor.

the 24-hour creatinine clearance of 137.8 ml/min, as well as normal lung function with the FVC of 2.11 liter (93.4% predicted), the FEV1 of 1.49 liter (89.2% predicted), and the FEV1/FVC ratio of 0.79, even after the LD lobectomy. We collaborated with the renal transplant physicians at the local hospital, and the same combination of immunosuppressive agents as that after the LDLLT was used after the LDKT. The patient's postoperative course was uneventful, and her lung function remained stable without the development of chronic lung allograft dysfunction (Figures 1C and 2). Notably, anti-human leukocyte antigen antibodies were negative for both class 1 and class 2 molecules after LDKT. The patient returned to her normal social life and has survived without the development of CKD for 9 years (at the time of writing) after the LDKT, that is, 23 years after the initial LDLLT. Her mother returned to her previous lifestyle without any restrictions and remains in good health without the development of CKD or any lung disease. The serum creatinine level of the dual-LD was 0.79 mg/dl 9 years after the LD nephrectomy.

Discussion

Living organ transplantation has been a viable option in countries that suffer from severe deceased donor shortage, such as in Japan.[7] In fact, the average waiting time for KT from deceased donors is more than 14 years, and approximately 90% of KTs are LDKTs in Japan.[8] Moreover, only blood relatives within the sixth degree of consanguinity or relatives by marriage within the third degree in Japan are considered to fulfill the eligibility criteria for LDs in Japan.[9] Consequently, the availability of LDs is limited in Japan as compared with that in the United States. The limited availability of LDs might lead to increased opportunity for multiple organ donations from the same LD in Japan. To date, sequential, but not simultaneous, 2-organ transplants from the same LD, such as kidney after liver and kidney after pancreas, have been reported[5]; however, kidney after LT from the same LD has never been reported until now. To the best of our knowledge, this is a report of LDKT from the same LD after LDLLT.

Satisfactory pulmonary and renal function were achieved after LDLLT and LDKT from the same LD despite the recurrent LAM in our case, contributing to her long-term survival. With regard to dual-organ transplantation from the same donor, simultaneous liver-KT from a single donor has been shown to yield higher kidney graft survival as compared with sequential liver-KT from different donors, or KT alone.[10] In addition, sequential liver-KT from the same LD may have a positive effect on the graft survival.[11] These findings could be attributable to the immunoprotective effect of liver grafts, including through the secretion of soluble class I human leukocyte antigen molecules to neutralize antibodies by the phagocytic Kupffer cells from the liver and the absorption of circulating antibodies by the large sinusoidal endothelial surface of the liver.[12] Immunoprotective effects of allografts were observed only in combined organ transplantation with the liver. Further study is required to investigate the immunoprotective effects of the lung allograft(s) in patients undergoing KT after LT.

One of the major concerns is the health status of the LD for dual-organ donation. Although no mortality has been reported after LD lobectomy for LDLLT, LDs must accept the potential risks of surgical complications and lung function decline after LD lobectomy.[13,14] In our case, even though normal lung function was maintained in the LD for 23 years after LD lobectomy, there was the inevitable risk of LD nephrectomy as well as the potential risk of CKD in the long term in the LD after LD nephrectomy.[15] To avoid the future risk of CKD in the young LD,[16] the old mother not the brother of the LDs in LDLLT was selected as dual-LD for LDKT. Recently, LDs have been shown to have a better health-related quality of life than the general population in the long term after LDLLT (median follow-up period of 12 years)[14]; however, some younger LDs (< 40 years) showed poorer mental health, and also some LDs who experienced recipient death showed poorer social health than the general population.[14] Therefore, dual-living organ donation after LT must be limited to LDs who maintain good overall health after the LD lobectomy. Candidates of dual-LD should have their medical, psychological, and social suitability for organ donation double-checked.[5] Thus, in selected recipients of LDLLT, late LDKT even from the same LD could be a viable therapeutic option for severe CKD.

Disclosure statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Patient consent

The authors confirm that appropriate patient consent to publish this case report was received.

Author contributions

Tsuyoshi Ryuko: Investigation, Resources, Writing - Original Draft. Seiichiro Sugimoto: Conceptualization, Resources, Writing - Review and Editing. Shin Tanaka: Resources. Kentaroh Miyoshi: Resources. Megumi Ishihara: Resources. Yuichi Shibuya: Resources. Shinichi Toyooka: Resources, Supervision.

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