

LETTER TO THE EDITORS

# First report of a living liver graft in combined lung and liver transplantation

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Dear Editors,

There is no organ allocation priority for combined organ transplantation in Korea. It is therefore difficult for patients who have both lung and liver failure to be matched to both organs simultaneously, particularly in patients for whom only a single organ is acutely driving the need for transplant, while the failure of the other is not as severe. Combined lung and living donor liver transplantation (CLDLT) is an alternative option for such patients.

A 52-year-old man was diagnosed with idiopathic pulmonary fibrosis and alcoholic liver cirrhosis in 2012 and 2013, respectively. He had subsequently undergone four endoscopic esophageal variceal ligations due to recurrent bleeding. Secondary to progressive dyspnea, the patient was evaluated for lung transplantation in February 2015. He showed severe restrictive respiratory insufficiency by spirometry: forced expiratory volume (FEV1) 29% pred and forced vital capacity (FVC) 31% pred. He could not ambulate without oxygen support. After receiving 2 l of oxygen, the patient underwent an arterial blood gas analysis, revealing pCO<sub>2</sub> of 32.0 mmHg, PaO<sub>2</sub> of 58.1 mmHg, SatO<sub>2</sub> of 90.7%, and pO<sub>2</sub>/FiO<sub>2</sub> ratio of 278.0. His model for end-stage liver disease (MELD) score was 17 at the time of registration and would subsequently rise. Our transplant team

concluded that combined lung and liver transplantation was the best option for this patient. However, considering the low incidence of deceased donors in South Korea, the patient was unlikely to receive a liver due to his low MELD. The patient's spouse volunteered as a living liver donor.

Our transplant team discussed and simulated what would be the best sequential scenario for CLLDLT because the team could not predict the exact time at which a donor lung would become available for transplantation. Table 1 shows the estimated timetable that we established before organ matching.

Deceased donor lungs were available for transplantation on May 31, 2015. The donor was a 48-year-old male with identical blood type who had died from a subarachnoid hemorrhage. As anticipated, while the patient was priority status I for lung transplant, he was not able to receive the deceased donor's liver for combined organ transplantation because his MELD score was only 24 at that time: too low for liver allocation. Therefore, during recovery of the lungs from the deceased donor, the liver transplant team started the patient's dissection for living donor liver transplantation. All hilar structures and the inferior vena cava were isolated, but not clamped. After finishing the liver dissection, the chest wall was opened by the lung transplant team. Double lung transplantation was performed via a clam-shell incision, while the living donor hepatectomy was performed in an adjacent room. The cold ischemic times were 175 min in the right lung and 247 min in the left lung. After reperfusion of the lung graft, central venous-arterial extracorporeal membrane oxygenation (ECMO) was applied due to poor initial graft function. After lung transplantation, a partial liver graft was implanted. Engraftment and reperfusion of the liver graft were performed under heparinization because of ECMO. The total surgical time was 12 h 31 min. During the surgery, 15 units of packed RBCs were transfused during the lung transplantation, but no transfusion was required during the liver

**Table 1.** Estimated timetable and procedure times.

Time point				
Estimated time	Real time	Recipient surgery	Donor surgery	Cooperative tasks
T – 2 h	T – 2 h	The patient entered the operating room.		
T – 0 h	T – 0 h	Anesthesia and surgical preparation	Deceased donor surgery initiation	
T + 1 h	T + 40 m	Abdominal dissection after decision making for the deceased donor organ	Decision making for the donor organ (lung)	Communication with lung procurement team
T + 3 h	T + 2 h 55 m	End of liver dissection	Aorta clamping (lung donor) Living donor admission to operating room	Communication and cooperation with other organ procurement teams
T + 10 h	T + 9 h 14 m	End of lung transplantation	Living donor hepatectomy finishing	Consideration of ECMO
T + 14 h	T + 12 h 53 m	End of liver graft implantation	MHV reconstruction	
T + 16 h	T + 14 h 31 m	Chest wall closure + abdomen closure		

ECMO, extracorporeal machine oxygenation; MHV, middle hepatic vein; T – 0 h, initiation of deceased donor surgery.

transplantation. After transplantation, the lung graft's function improved, and the patient was successfully taken off ECMO on postoperative day 3; ventilator support was discontinued on postoperative day 15. His liver function normalized on postoperative day 3. He was sent to the general ward on postoperative day 16.

To our knowledge, there are no previous reports of simultaneous CLLDLT in the literature. Small case series of combined lung and liver transplantation from deceased donors showed longer wait times for these patients than for patients awaiting single organ trans-

plantation, with reported median wait times of 40–700 days [1–6]. Considering the severe shortage of deceased donors, the combination of living and deceased donor grafts is a feasible treatment option if a successful team approach can be utilized to minimize the risks of this technically and logistically challenging scenario to the recipient and living donor alike.

### Conflict of interests

The authors have declared no conflicts of interest.

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