Successful sequential transplantation of 2 single lungs from the same donor into 2 different recipients—use of standard cold preservation and 10 °C preservation

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We report a case involving the use of 2 different preservation methods to allow for the successful sequential transplantation of 2 single lungs from the same donor into 2 different recipients.

CASE REPORT

The donor was 26-year-old male who had a neurologic determination of death following a hemorrhagic stroke. Two recipients were chosen, with plans for each to receive a single-lung transplant. Institutional review board approval was not required for this report. The first recipient was a 67-year-old male with idiopathic pulmonary fibrosis (IPF). His medical history was notable for previous coronary artery bypass grafting (CABG); his operation was predicted to be longer, so he was selected as the first recipient. He was listed for a right single-lung transplant to avoid entering a redo chest. The second recipient was a 76-year-old man with IPF and moderate pulmonary hypertension. He was listed for bilateral or single-lung transplant on either side.

At the donor hospital, assessment of the lungs revealed healthy lungs. The arterial oxygen tension/inspired oxygen fraction (P/F) ratio was 545 mm Hg at a positive end-expiratory pressure (PEEP) of 5 cmH2O. The lungs were procured using our standard methods. After lung explantation, the lung bloc was split on the back table (Figure 1) and packaged separately into sterile organ bags containing 3 L of PERFADEX. The lungs were subsequently placed in a cooler containing ice for transfer.

Following assessment of the lungs at the donor hospital, the first recipient was called to the operating room (OR). Due to the previous CABG and moderate pulmonary hypertension, femoral–femoral cannulation was achieved for venoarterial extracorporeal membrane oxygenation (ECMO). A right anterolateral thoracotomy was performed and the lung was implanted in our standard fashion. Total ischaemic time of the right lung was 3 hours and 27 minutes (Figure 2). The patient came off ECMO readily at the end of the implantation. Upon arrival in the intensive care unit (ICU), the first arterial blood gas showed a P/F ratio of 532 mm Hg on a PEEP 5 cmH2O. The patient was extubated 27 hours after arrival on ICU and was discharged home on postoperative day 9.

The second patient was called to the operating room 10 hours after the crossclamp in the donor with the left lung being preserved at 10 °C in a temperature-controlled fridge (MYTEMP 65HC, Benchmark Scientific). A left hemi-clamshell was performed by a second surgeon and central venoarterial ECMO was established, given the patient’s existing pulmonary hypertension. The left lung was implanted in the standard manner with a total ischaemic time of 15 hours and 20 minutes. The patient came off ECMO readily at the end of the implantation. Upon arrival
in the ICU, the first arterial blood gas showed a P/F ratio of 385 mm Hg on a PEEP 5cmH2O. He was extubated after 21 hours following arrival on ICU and had an uneventful recovery. The patient was discharged home on postoperative day 9.

CONCLUSIONS
Our report highlights an innovative and easily applicable approach to dealing with the timings for 2 single-lung transplants. Single-lung transplantation is a reasonable option for patients with IPF. Studies have shown similar survival between older IPF recipients treated with single and bilateral lung transplantation.2,3 Our approach was tailored to the patient’s comorbidities in the first case, due to the previous CABG it avoided the potential challenge of a redo chest. For the second patient, it allowed us to treat an older patient with a faster operation, and he made an excellent recovery.

Interim clinical trial data from our institution have shown promising results with lung preservation at 10 °C (ClinicalTrials.gov identifier: NCT04616365). The main advantage of cold static storage at 10 °C in comparison with the conventional 4 °C approach on ice is that it preserves cellular membrane function and limits mitochondrial...
Injury. In a pilot study of 5 patients, our group has shown that by using 10 °C lung storage, safe preservation times exceeding 16 hours can be achieved without grade three primary graft dysfunction at 72 hours posttransplantation.

Bilateral lung transplantation is the most common approach used clinically. However, some patients are best treated with a single-lung transplant (approximately 15% of our program). Performing 2 single-lung transplants simultaneously from one donor; however, can present logistical challenges—requiring 2 simultaneous ORs and surgical teams or sequential ORs with an acceptance of a longer preservation time for the second lung to be implanted. Our approach of cold preservation at 10 °C for the second lung appears promising and may make splitting the lung bloc for 2 single-lung transplants more attractive, allowing more patients to benefit from transplantation and subsequently shortening waiting times. Further work is ongoing into the use of preservation at 10 °C preservation at our institution to improve transplant logistics and decrease nighttime operations. These 2 cases highlight the benefits of this approach, which resulted in excellent outcomes for both recipients.

References
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