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Successful Lung Transplantation from a Donor with Previous Severe COVID-19 Pneumonia

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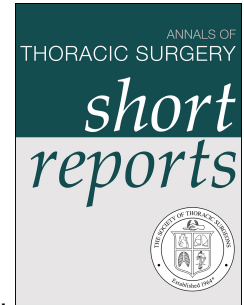
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Successful Lung Transplantation from a Donor with Previous Severe COVID-19

Pneumonia

Running head: Lung donation after severe COVID-19

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ABSTRACT

Lungs from donors with previous COVID-19 could become a precious resource, if proved safe. So far, only three successful lung transplants from donors with previous mild COVID-19 have been reported. We describe a successful bilateral sequential lung transplantation from a donor who, 10 months before, had developed severe COVID-19 acute respiratory distress syndrome (ARDS). No donor-derived viral transmission occurred and, 12 months after transplant, the recipient lung function is normal. In presence of a negative bronchoalveolar lavage and of adequate functional and morphological parameters, even a history of severe COVID-19 ARDS might not be considered a contraindication to lung donation.

The safety of transplanting lungs from donors with previous COVID-19 is currently under investigation. The main concerns are the possible risk of donor-derived viral transmission and the possible impairment of graft quality. Ceulemans et al., who pioneered this approach, encouraged transplant centers to share their experience with this issue¹. So far, to our knowledge, three successful lung transplants from donors with resolved mild COVID-19 have been reported¹⁻⁴. We describe a successful bilateral sequential lung transplantation from a donor with previous severe COVID-19 acute respiratory distress syndrome (ARDS). Approval for reporting was granted by the recipient and by the donor family.

The donor was a 51-year-old nonsmoker. Ten months before the cerebrovascular accident leading to brain death, when COVID-19 vaccines were not available, he had developed severe COVID-19 ARDS (figure 1A). He was admitted to the intensive care unit (ICU), where he was supported with mechanical ventilation for 5 days, and was treated with steroids and remdesivir. He did not develop extra-pulmonary complications. At discharge, after a 7-day ICU stay and a 15-day hospital stay, he was still in need for supplemental oxygen. Subsequently, he gradually returned to his pre-COVID conditions, apparently with no long COVID symptoms, and received two doses of mRNA BNT162b2 (Comirnaty) vaccine. Eight months after discharge, the follow-up spirometry measurement was normal. At the time of donation, the bronchoalveolar lavage (BAL) tested negative for SARS-CoV-2 PCR, the best PaO₂/FiO₂ was 415, and chest X-ray (figure 1B) and bronchoscopy appeared normal. At procurement, macroscopic lung appearance and compliance were normal.

The recipient was a 57-year-old woman with end-stage bronchiolitis obliterans syndrome due to chronic graft-versus-host disease after allogeneic stem cell transplantation, receiving continuous long-term oxygen therapy. She had previously been administered two doses of mRNA-1273 (Moderna) vaccine and, at the time of transplant, the nasopharyngeal swab tested negative for

SARS-CoV-2 PCR. She was informed of the donor history of COVID-19, but no specific consent was required by our national guidelines⁵.

The bilateral sequential lung transplant was uncomplicated. The patient received standard induction therapy with basiliximab, and standard maintenance immunosuppressive therapy with tacrolimus, steroids and azathioprine. She was extubated 12 hours after transplant, and discharged from the ICU 5 days later. The subsequent course was complicated by *Pseudomonas aeruginosa* pneumonia, successfully treated with antibiotics, and by right bronchial stenosis (location “a” and extent “b”, according to the grading system proposed by the International Society for Heart and Lung Transplantation⁶) and malacia (location “a”), requiring endoscopic toilette and dilation. The patient was discharged to home 47 days after transplant, with no need for supplemental oxygen.

Post-transplant surveillance nasopharyngeal swabs tested negative for SARS-CoV-2 PCR until the fifth post-transplant month, when the Omicron variant was detected. The patient remained fully asymptomatic. The endoscopic appearance of the right bronchial anastomosis progressively improved and, at the last check, 10 months after transplant, stenosis or malacia was not detected.

Twelve months after transplant, the patient is breathing ambient air, and blood gases are normal. Forced expiratory volume in 1 second and forced vital capacity are normal (92% and 97% of predicted, respectively), and chest X-ray is clear (figure 1C).

COMMENT

To our knowledge, this is the first report of a successful lung transplantation from a donor with previous severe COVID-19 ARDS.

Considering the donor negative BAL and the long interval since the donor infection with SARS-CoV-2, there was virtually no risk of donor-derived viral transmission⁵. In the recipient, the infection with the Omicron variant was most likely de-novo. As a matter of fact, the Omicron

variant was detected in the recipient nasopharyngeal swab 4 months after transplant, after several consecutive negative tests. Besides that, the Omicron variant was first reported to the World Health Organization 12 months after the donor infection.

It is hard to predict the respiratory consequences of COVID-19, and the possible development of lung fibrosis is a reasonable concern. However, the rate of long-term, irreversible fibrotic scarring seems to be low, and the rate of progressive fibrosis seems to be even lower, also in ARDS patients⁷. In Italy, the mandatory testing for deceased lung donors does not include CT scan, which may be performed, or not, at the discretion of the donor hospital. In the case reported, the transplant center was informed of the donor history of COVID-19 only at the very time of procurement. A CT scan had not previously been obtained and, unfortunately, could not be performed at that moment. Nevertheless, given the encouraging available data, its unavailability was not deemed a limitation to a proper evaluation. A careful intra-operative assessment of lung morphology, compliance, and function, as recommended⁵, allowed to reasonably confirm the good quality of the graft. Furthermore, the prognostic value of CT scan in the follow-up of subjects with previous COVID-19 is still unknown⁷. Basically, in the face of organ shortage, we do not consider the unavailability of a CT scan a contraindication to the evaluation of an otherwise potentially suitable donor.

A possible contribute of the donor infection with SARS-CoV-2 to the pathogenesis of the airway complication in the recipient cannot be excluded. However, donor bronchoscopy at the time of donation was normal. Moreover, post-transplant airway complication rates were reported to be up to 18%, and multiple risk factors were identified⁶.

Twenty-two months after severe COVID-19 ARDS, and 12 months after transplant, these lungs perform satisfactorily. Due to the broad diffusion of COVID-19, selected lung donors with previous SARS-CoV-2 infection may reasonably become a precious resource. In the presence of adequate functional and morphological parameters, even a history of severe COVID-19 ARDS might not be considered a contraindication to lung donation.

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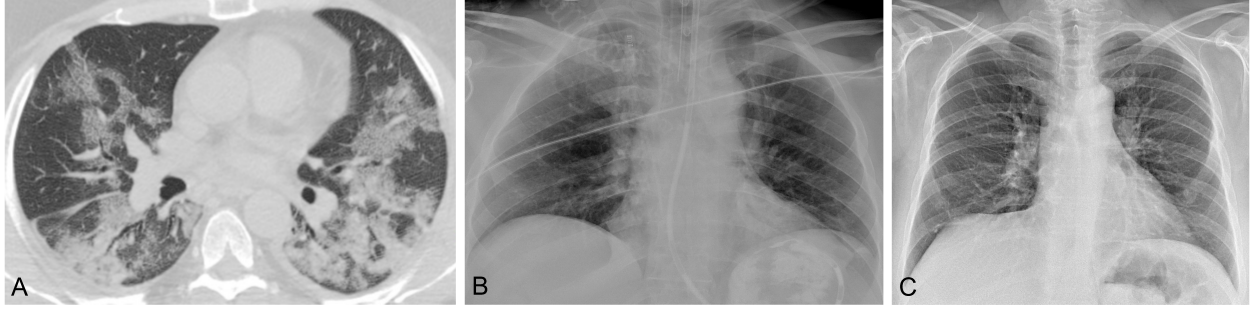
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Figure Legend

Figure 1. A) Chest CT scan of the donor at the time of severe COVID-19 pneumonia. B) Chest X-ray of the donor at the time of donation. C) Chest X-ray of the recipient 12 months after transplant.

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