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Commentary: Crossing the Rubicon—pre-emptive recipient bilateral pneumonectomy and delayed lung transplantation

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"Jules-César arrivé au Rubicon," by Gustave Boulanger, 1854, Musée Picardie, Amion, France.

CENTRAL MESSAGE

Ongoing COVID-19 infection is a contraindication for lung transplantation. Bilateral pneumonectomy and extracorporeal support before lung transplant have been performed for such a patient.

Defying the Roman Senate, Julius Caesar declared "alea iacta est" ("the die is cast") and crossed the Rubicon River with his army in 49 BCE. The ensuing civil war led to the end of the Roman Republic. By analogy, performing bilateral pneumonectomy in anticipation of later lung transplantation also represents a point of no return. In this issue, Ghodsizad and colleagues[1] present their experience with this strategy for a young patient with active coronavirus disease 2019 (COVID-19) infection and COVID-19–induced end-stage lung disease (COVID-ESLD). After initial bilateral pneumonectomy, a bridge with venous-arterial extracorporeal membrane oxygenation (ECMO) was used before a staged single-lung transplant. This is only the third reported case of pre-emptive pneumonectomy before transplantation, with each case remarkable for a unique ECMO strategy.[2,3]

Lung transplantation for COVID-ESLD is feasible,[4,5] with favorable short-term outcomes.[6] The suggested criteria for lung transplantation in COVID-ESLD are evolving and include age <65 years, isolated and irreversible lung dysfunction, and a negative severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) polymerase chain reaction (PCR) test.[7,8] Despite the emphasis on clearance of virus at the time of transplantation,[8] the potential for recurrent infection in lungs transplanted into PCR-positive donors remains unclear. For one, specimens obtained from PCR-positive patients more than 1 week after symptom onset and with cycle threshold values >24 (indicating lower viral load) rarely produce culturable virus in vitro.[9] Moreover, there is a report of lung transplantation in a SARS-CoV-2–positive patient (PCR cycle threshold = 33) who avoided recurrent infection.[10] Separately, virologic sterilization via pneumonectomy might be impossible since SARS-CoV-2 does not solely replicate in lung tissue.[11-13] Evidence of viral replication has been found in lungs, central airways, central nervous system, heart, liver, kidney, and pancreas.[13-15] Wong and colleagues[16] found the COVID-19 PCR test was still positive 3 days postpneumonectomy, suggesting that there were potentially other sources of virus. While pneumonectomy is unlikely to lead to immediate clearance of virus, future investigations should examine whether pneumonectomy instead reduces a source of dysregulated immune response to SARS-CoV-2.[16]

Supporting a "lung-less" patient requires judicious planning and meticulous execution, which Ghodsizad and colleagues achieved with a novel venous-arterial ECMO circuit. In addition to draining the right atrium, the authors placed an additional drainage cannula in the pulmonary artery to decompress the right heart, prevent blood stasis, reduce right ventricular afterload, and maintain pulsatility. A patent foramen ovale ensured decompression of the left side of the heart. This current approach appears simpler

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than the other reported solutions for managing the "lungless" patient as it obviates the need for an additional circuit,[3] theoretically reducing thromboembolic risk, or a vascular anastomosis between the pulmonary artery and veins,[2] reducing complexity of pneumonectomy and subsequent implantation. As most patients do not have a preexisting patent foramen ovale, the left heart could be decompressed via atrial septostomy, open surgical placement of left ventricular vent, or a catheter-delivered intracardiac pump.[17,18]

Notwithstanding the clinical and ethical concerns,[7] lung transplantation has been used in a significant number of patients with COVID-ESLD.[6] While remaining SARS-CoV-2 viral load poses a risk of recurrent infection in lung allografts, this could be mitigated by new targeted antiviral therapies.[19] Pneumonectomy is unlikely to achieve complete clearance of infection but could help curtail a dysregulated immune response to infection, thus providing a rationale for staged lung transplant, and requires further study. The extracorporeal support of a patient without lungs requires careful preparation and can involve cannulation strategies suggested here by Ghodsizad and colleagues.

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