Patients with COVID-19 may benefit from lung transplantation

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ABSTRACT

Millions of people have suffered acute lung injury as a result of the COVID-19 epidemic. COVID-related Acute Respiratory Distress Syndrome (CARDS) develops in certain patients, and they are unable to be weaned off of mechanical ventilation. Others may develop post-COVID fibrosis, which can lead to significant impairment and the requirement for long-term oxygen therapy. Treatment teams frequently inquire about lung transplantation in each of these instances. In fact, lung transplantation has been used effectively in a small number of patients globally for both CARDS and post-COVID fibrosis. After a COVID infection, lung transplantation poses a variety of particular issues that transplant teams must consider. The inability to do comprehensive psychosocial evaluation and pre transplantation education in patients with severe CARDS, as well as substantial deconditioning from critical illness and infectious worries about virus reactivation, are major roadblocks. Our inadequate understanding of the natural course of healing following COVID-19 infection is worrisome for patients with post-COVID fibrosis. Increased understanding of the incidence and degree of recovery following COVID-19 acute lung injury is critical for making informed transplantation decisions. In compared to a patient with a known progressive Fibrosing Interstitial Lung Disease, transplant specialists must balance the risks and advantages of lung transplantation differently in a post-COVID fibrosis patient who is anticipated to remain stable or gradually improve. Lung transplantation is clearly a life-saving therapeutic option for some COVID-19-infected individuals with significant lung damage. In this research, we look at how lung transplant providers from a number of reputable facilities approach CARDS or post-COVID fibrosis lung transplantation.

Key Words: *ARDS; COVID-19; Lung transplantation; Pulmonary fibrosis*

MINI REVIEW

Since the beginning of the epidemic, COVID-19 has infected approximately 150 million people globally. Criticilln--ess, which is characterized by respiratory failure, shock, and multi-organ system failure, affects about 5% of infections or about 7.5 million people so far. Patients with serious COVID-19 infections have a significant mortality rate, with more than 30% of patients dying in most studies. A fraction of COVID-19 acute lung injury survivors develop residual lung disease, necessitating the use of supplemental oxygen and impairing mobility. The large influx of critically ill patients has had a significant influence on global health care systems. Lung transplantation, also known as pulmonary transplantation, is a surgical surgery in which one or both lungs are replaced with donor lungs. Donor lungs can be obtained from either a living or a deceased donor. A live donor can only give one lobe of the lung. With some lung disorders, a patient may only require a single lung transplant. Other lung illnesses, such as cystic fibrosis, necessitate the donation of two lungs. While lung transplants have certain dangers, they can potentially increase life expectancy and improve quality of life for those with end-stage pulmonary illness. While the specifics of the surgery will vary depending on the kind of transplant, several processes are shared by all of these operations. The transplant surgeon examines the donor lung(s) for evidence of injury or illness before operating on the recipient. If the lung or lungs are accepted, the recipient is given an IV line and several monitoring devices, including pulse oximetry. The patient will be sedated, and a machine will breathe for him or

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The patient's pre-operative preparation takes around an hour. A single lung transplant takes four to eight hours to complete, whereas a double lung transplant takes six to twelve hours. A history of previous chest surgery may complicate the process and necessitate more time.

The area of Lung Transplantation (LTx) has not been spared and has been impacted in a variety of ways. Because many of the victims of catastrophic COVID-19 lung injury are young and previously healthy people with single-organ failure, LTx is frequently regarded a last-ditch treatment option Ct findings [1].

The number of requests for LTx examination has increased dramatically, often including emotionally and intellectually hard situations in which patients do not fulfil standard criteria for LTx recipients but have no other options for rehabilitation. We discuss two extremely distinct cases of COVID patients that were referred for LTx examination in this study. In October 2020, a 62-year-old man presented to the clinic for an LTx assessment, about 5 months after acquiring COVID-19. Until he was infected with SARS-CoV-2 and required hospitalization, the patient was in good health, with no known lung problems. Remdesivir, steroids, and tocilizumab were used to treat him, but he developed COVID-19 Acute Respiratory Distress Syndrome (CARDS). Despite the fact that intubation was avoided, he was forced to rely on a high-flow nasal cannula and noninvasive breathing, which resulted in significant desaturations that restricted his mobility. The patient had a tracheostomy and a percutaneous gastrostomy tube implanted after a 3-month hospitalization due to dysphagia and marked desaturation, and was discharged to a long-term acute care facility. The patient had been decannulated before returning to clinic, but she was still fairly debilitated, having trouble with daily activities and requiring 4 L of supplementary oxygen at rest and 6 L when ambulating. A CT scan of the lungs taken during the clinic visit indicated diffuse ground-glass opacities, upper lung peripheral consolidation, and traction bronchiectasis that had advanced since the admission CT. A moderately significant restrictive defect was discovered during pulmonary function testing (FVC, 1.82 L [45%); FEV1, 1.55L (50%)). For the carbon monoxide manoeuvre, he was unable to tolerate the lung's diffusion capacity. The patient was referred to pulmonary rehabilitation and told that she will be seen in clinic in a few months to see if she had improved clinically. COVID-19 pneumonia caused progressive respiratory failure in a 37-year-old woman with no major medical history. She was given remdesivir, dexamethasone, diuretics, and empiric antibiotics, but she did not improve significantly. Approximately 20 days after her initial symptoms, she was intubated and placed on venous-venous Extracorporeal Membrane Oxygenation (ECMO). Her hospital stay was made more difficult by ventilator-associated Stenotrophomonas and methicillin-resistant Staphylococcus aureus pneumonia, which she was treated for with the necessary medications. She was gradually weaned off the sedatives until she was alert, interactive, and able to participate in physical therapy. Her lung mechanics, on the other hand, did not improve significantly, and she remained on full ventilator and ECMO support after eight weeks. Her chest CT revealed pulmonary fibrosis with traction bronchiectasis in the upper lobes, as well as ground-glass opacities throughout [2]. The COVID-19 pandemic is likely to have a long-term impact on the management of Fibrotic Interstitial Lung Disease (fILD). For every fILD, COVID-19 acute lung damage will be included to the differential diagnosis or contributory exposure list, and checking for a history of COVID-19 pneumonia will become a mandatory standard during history taking [3]. Indeed, we believe that any COVID-19 infection could become a risk factor for the development of Interstitial Lung Disease (ILD), similar to burn pit and World Trade Center exposures, which were only discovered years later.

These individuals are already being referred to ILD and LTx programmes, especially those who are more severely impacted. However, the best method for assessing and treating these people has yet to be found. AWeighing the danger of transplantation vs. the risk of the patient's underlying lung condition is an important part of the decision to list a patient for LTx. Only when listing for LTx is likely to improve the patient's lifespan and quality of life do transplant pulmonologists and surgeons consider their knowledge of the natural history of the patient's lung illness. In a consensus guideline published in 2014, the International Society of Heart and Lung Transplantation established criteria for both referral and listing for LTx. because they are designed to apply to progressive fILD, many of the ILD criteria might be used to COVID-19 fibrosis. However, little is known about the rate of progression and the possibilities for improvement in COVID-19 fibrosis. Decisions on the appropriateness of LTx for COVID-19 in the outpatient setting are based on knowledge and awareness of the disorder's natural history, therefore a better understanding of the likelihood of COVID-19 fibrosis progression or improvement is critical. Unfortunately, there is a scarcity of information on this subject. The Swiss Covid-19 lung research looked at Pulmonary Function Testing (PFT) and radiographic features four months following the onset of symptoms in 113 individuals with COVID-19 disease, including patients with mild, moderate, and severe disease. Patients with prior severe or critical disease showed lower lung volumes, abnormally reduced diffusion capacity, reduced functional capacity, and exertional oxygen desaturation than patients with mild after severe or critical disease, more than half of the patients displayed mosaic attenuation, reticulations, or architectural distortion on CT image. In a prospective cohort of 114 patients who survived severe COVID-19 pneumonia, 35% had fibrotic alterations on chest CT, another 27% had interstitial thickening or ground-glass opacification, and 38% had complete radiographic recovery. Another study published 3-month follow-up data on 62 patients who needed ICU treatment for CARDS. Among these post-CARDS patients, 49% had signs of reticular lesions, and another 21% had more identifiable fibrotic patterns. Advanced age, a more severe illness and a longer stay in the ICU, the requirement for mechanical ventilation, and a history of COVID fibrosis have all been recognized as risk factors for the development of post-COVID fibrosis. The pathophysiology of COVID-induced pulmonary fibrosis is still unknown. The virus is thought to stimulate profibrotic pathways by disrupting the equilibrium of the renin-angiotensin system and activating growth factors such as fibroblast growth factor, epithelial growth factor, and transforming growth factor beta. Furthermore, direct cellular injury to alveolar epithelial, endothelial, and macrophage cells, as well as inflammation and mechanical force damage, can cause fibroblast/myofibroblast activation and fibrosis. Some patients, like the alleged mechanisms in other fILD, may have a hereditary predisposition to fibrosis formation after COVID-19. According to available evidence and extrapolation from other causes of ARDS, the vast majority of patients with COVID-19 fibrosis will likely improve or stabilize. The length of time that continuing recovery can be expected is unknown. Anecdotally, the writers have noticed a steady improvement over several months. However, patients should be continuously monitored because a small percentage of patients may develop progressive fibrosis, either as a result of post-COVID fibrosis or as a result of an undiagnosed fibrotic lung condition. Most patients with critical COVID-19 have been hospitalized and immobilized for an extended period of time, have a compromised nutritional status due to critical illness, and have been treated with corticosteroids and neuromuscular blockade, all of which predispose to critical illness polyneuropathy/myopathy and significant deconditioning. Prior to transplantation, patients should make every effort to improve their nutritional status and achieve a wakeful, interactive state in which they may engage meaningfully in the transplantation and rehabilitation process.

To achieve these objectives, ECMO help may be required. A patient with a normal baseline functional state and good post-LTx recovery potential whose pulmonary status precludes rehabilitation before transplantation could be considered in extraordinary circumstances. Whether or not a patient's rehabilitative potential and frailty are contraindications to LTx must be assessed in the context of the patient's overall clinical picture and must rely on the multidisciplinary transplant team's clinical judgement. Their mental resilience is just as vital as their physical functional abilities in surviving the immediate psychological trauma of transplantation, as well as the long-term commitment to a stringent medical regimen. This is especially tough for patients who were healthy prior to their COVID-19 infection and have not had time to accept or adjust to their new reality psychologically.

CONCLUSION

COVID-19 can cause serious, irreparable lung damage. LTx may be the only effective therapeutic option in certain circumstances, but only for a limited, highly select set of individuals. For physicians, this patient population has a variety of specific issues that must be carefully considered. COVID-19-associated lung illness is likely to have a long-term impact on the fields of ILD and LTx.

The natural history of COVID-19-related lung illness will require more research. Future research will look at which individuals are likely to totally recover, who will be left with residual lung injury, and who will develop persistent or progressive fibrosis, necessitating transplant consideration. More research is needed to see if the outcomes of COVID LTx are comparable to other indications, and if these patients are at risk for distinct post-LTx problems such VTE and neurocognitive difficulties. An International Registry of COVID-related lung transplants could serve as a starting point for finding answers to these and other growing problems in this field.

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