



PRO: Liver Transplantation in the Times of COVID-19: Patients with COVID-19 Infection Should Undergo Liver Transplantation

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KEY POINTS

- A COVID PCR can remain positive for weeks after infection and does not represent active infection.
- Personal protective equipment is effective and should be triaged to use in emergent situations, such as liver transplantation for acute liver failure.
- Mortality is not increased in liver transplant recipients with COVID-19.
- Immunosuppression is not associated with mortality in liver transplant patients and may actually be protective against severe COVID-19 infection.

Liver transplantation is a lifesaving intervention that should be considered in all patients with acute liver failure. The patient in this case has no absolute contraindication to liver transplantation despite a coronavirus disease 2019

(COVID-19) infection. Her candidacy for liver transplantation is supported by multiple factors.

We should not compound the negative impact of the pandemic by risking the lives of patients in need of emergent transplantation. As health care providers, we pledge to uphold the principles of medicine, including beneficence, nonmaleficence, and justice, when considering the care of patients.¹ Although the COVID-19 pandemic has resulted in fear and exhaustion in the medical community, it remains our moral obligation to evaluate this patient for a lifesaving transplantation.

A positive COVID-19 polymerase chain reaction (PCR) can remain detectable for months even after the patient has recovered from the infection. Although this patient does have a positive COVID-19 PCR, it is unclear when she

Abbreviations: COVID-19, coronavirus disease 2019; PCR, polymerase chain reaction; SARS-CoV-2, severe acute respiratory syndrome coronavirus-2.

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contracted COVID-19. At the time of presentation and for the weeks prior to her admission, she did not exhibit common symptoms related to COVID-19. She may have contracted COVID-19 in the weeks prior to presentation and has a persistently positive COVID-19 PCR. The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) virus peaks in respiratory cultures in 7 to 10 days after exposure and can no longer be isolated from the respiratory tract after 14 days; however, the COVID-19 PCR can remain positive for up to 5 to 6 weeks because of shedding of inactivated virus.² It would be unfair to judge her liver transplant candidacy without confirmation of an active COVID-19 infection.

Patients with an asymptomatic COVID-19 infection typically remain asymptomatic. Even if this patient does have an active COVID-19 infection at the time of presentation, she is currently asymptomatic. Previous studies on patients with asymptomatic COVID-19 determined that only 10% will experience symptoms when monitored for 2 weeks after exposure. The risk for development of symptoms increased with age.³ Even if the presented patient has an active infection, it is unlikely this asymptomatic, young female will experience severe pulmonary symptoms related to COVID-19. Given minimal risk for development of symptoms, a potential asymptomatic COVID-19 infection should not affect her liver transplant candidacy for acute liver failure.

Personal protective equipment is effective and should be prioritized to use in emergent situations. The appropriate use of personal protective equipment is highly effective at minimizing the risk for exposure to COVID-19 in health care employees. SARS-CoV-2 particles measure 5 to 10 μm , and N95 masks filter greater than 95% of particles $\geq 0.3 \mu\text{m}$. Appropriately fitted N95 masks and gloves are an efficacious defense mechanism for all health care employees involved in potentially lengthy and complex surgical procedures.⁴ Initially during the COVID-19 pandemic, health care workers experienced a severe shortage of personal protective equipment resulting in an increased risk for exposure while treating patients. Due to increased production and development of effective reesterilization technique, shortages of equipment are less common.⁴ Even at time of extreme shortage of personal protective equipment, emergent interventions should still be performed, such as liver transplantation for acute liver failure as in this clinical situation. Personal protective equipment should be adequately triaged and used for these emergent interventions and reduced for routine clinical encounters.

Mortality is not increased in liver transplant recipients with COVID-19. Multiple studies have highlighted that liver transplant recipients with COVID-19 are not at an increased risk for mortality compared with the general population (19% versus 27%, $P = 0.04$, and 18% versus 28%, $P = 0.03$).^{5,6} Factors that were associated with death among liver transplant recipients included advanced age, elevated serum creatinine, and nonliver cancer. The time from transplant and use of immunosuppression was not associated with death.⁵ Less than 3% of the transplant recipients experienced graft dysfunction during COVID-19 infection.⁶ Even if our patient does have an active COVID-19 infection at the time of transplant, she is not at an increased risk for mortality or graft dysfunction. She also does not have risk factors associated with increased mortality; therefore, a COVID-19 infection should not be an absolute contraindication for transplant in this patient.

Immunosuppression is not associated with severe COVID-19 infection and may even be protective. Transplant recipients receiving calcineurin inhibitors had fewer intensive care admissions and intubations compared with the general population ($P = 0.07$).⁵ Immunosuppressed patients had milder COVID-19, decreased incidence of COVID-19-related pneumonia, and an overall better outcome as compared with patients with other comorbidities.⁷ Immunosuppression, specifically calcineurin inhibitors, may actually be protective by blocking COVID-19 viral replications and dampening the amplified immune response to COVID-19, which could lead to a less severe disease course.^{7,8}

Patients with severe COVID-19 have undergone successful transplantation. Since the start of the COVID-19 pandemic, multiple patients with severe COVID-19 have successfully undergone organ transplantation during an active infection. Some of these patients were critically ill as a result of a COVID-19 infection requiring plasma exchange, extracorporeal membrane oxygenation, and other lifesaving intervention with good outcomes posttransplant.⁹ Therefore, even if the patient at the center of our debate has an active COVID-19 infection at the time of transplant, she will likely also fare well afterward.

Liver transplantation should be offered to this patient with acute liver failure despite her potential COVID-19 infection. As a transplant community, we previously believed that liver transplantation should not be performed in patients with viral hepatitis or hepatocellular carcinoma.^{10,11} However, with increased data validating

the safety of transplant in these situations, patients with these diagnoses now safely undergo transplantation on a routine basis. Evidence supporting the safety of liver transplantation in this patient with a potential COVID-19 infection justifies performing this lifesaving intervention and will hopefully allow this to be uncontested in the future as COVID-19 will likely remain a management concern for years to come.

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