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# COVID-19 Pandemic Impact on Liver Donation in the Largest Brazilian Transplantation Center

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## ABSTRACT

**Background.** COVID-19 has spread worldwide and has become a public health emergency and a pandemic of international concern. The solid organ donation system was no different. This study aimed to investigate the effect of COVID-19 on the liver transplant (LT) system in Brazilian territory.

**Methods.** We retrospectively reviewed all liver donor records allocated in São Paulo State, Brazil, 1 year before and 1 year during the COVID-19 pandemic. We defined the pre-COVID-19 (PRE) period as between April 2019 and April 2020 and the post-COVID-19 (POST) period as between April 2020 and April 2021. Moreover, we compared LT performed in our institution during these periods. To evaluate outcomes, we compared 30-day survival after LT.

**Results.** In the PRE period, 1452 livers were offered for donation in São Paulo State and other Brazilian territories. Of these, 592 were used in LT. In the POST period, 1314 livers were offered for donation, but only 477 were used in LT. Organ refusal was higher in the POST period ( $P < .05$ ). Our center performed 127 and 156 LTs in these periods, respectively, and an increase above 20% was significant ( $P = .039$ ). There was no difference in 30-day survival between the periods (87.2% vs 87.9%,  $P > .5$ , respectively).

**Conclusions.** The COVID-19 pandemic harmed potential and allocated donors and LTs performed. However, it is possible to maintain the LT volume of a transplant center without compromising survival outcomes through preventive strategies against COVID-19 propagation.

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COVID-19 is caused by a novel coronavirus termed severe acute respiratory syndrome [1,2]. The disease has spread worldwide and has become a public health emergency pandemic of international concern [3]. Transplant programs worldwide were jeopardized by COVID-19, with dwindling numbers of solid organ transplants. The transplant society’s recommendations and guidelines during the COVID-19 pandemic consider liver transplant (LT) a safe procedure. However, there is a lack of data about the impact of comorbidities, elapsed time since the organ transplant, immunosuppressive regimen, and vaccination on COVID-19 in LT patients. Therefore, the impact of the pandemic in liver recipients remains largely unknown because most data are derived from case reports and small retrospective series [4–6].

São Paulo is Brazil’s most populous state and was the epicenter of the disease in the country. Our institution is one of the largest transplantation centers in Latin America, having performed more than 3000 LTs, with an average of 160 per year [7]. This study aimed to investigate the effect of COVID-19 on the LT system in this Brazilian territory.

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**MATERIALS AND METHODS**

We retrospectively reviewed all liver donor records allocated in São Paulo State, Brazil, 1 year before and 1 year during the COVID-19 pandemic. These records were made available by the Organ Procurement Organization (OPO). We defined the pre-COVID-19 period (PRE) between April 2019 and April 2020 and the post-COVID-19 period (POST) between April 2020 and April 2021. We enrolled potential donors and allocated donors compared with LTs performed.

Moreover, we compared LT performed in our institution (Hospital das Clinicas da Universidade de São Paulo) during these periods. To evaluate outcomes, we compared 30-day survival after LT.

**Statistical Analysis**

Qualitative data are presented as absolute frequency and percentage. Categorical variables were analyzed using the  $\chi^2$  or exact Fisher tests. Groups of quantitative data were first analyzed about normality and homogeneity assumptions and then compared using *t* tests, one-way analysis of variance, or nonparametric Kruskal-Wallis test accordingly. All tests were performed using Graph Prism version 9 (GraphPad Software, Inc, San Diego, Calif, United States), with  $\alpha = 0.05$  and a 95% confidence interval.

**RESULTS**

In the PRE period, 1452 livers were offered for donation in São Paulo State. There were 685 procurement organs, and 592 were used in LTs. In the POST period, 1314 livers were offered for donation for São Paulo State. There were 569 procurement organs, and of these 477 were used in LTs, as demonstrated in Fig 1A. Organ refusal was significantly higher in the POST period ( $P < .05$ ).

Our center performed 127 and 156 LTs in these periods, respectively, an increase above 20% was comparatively

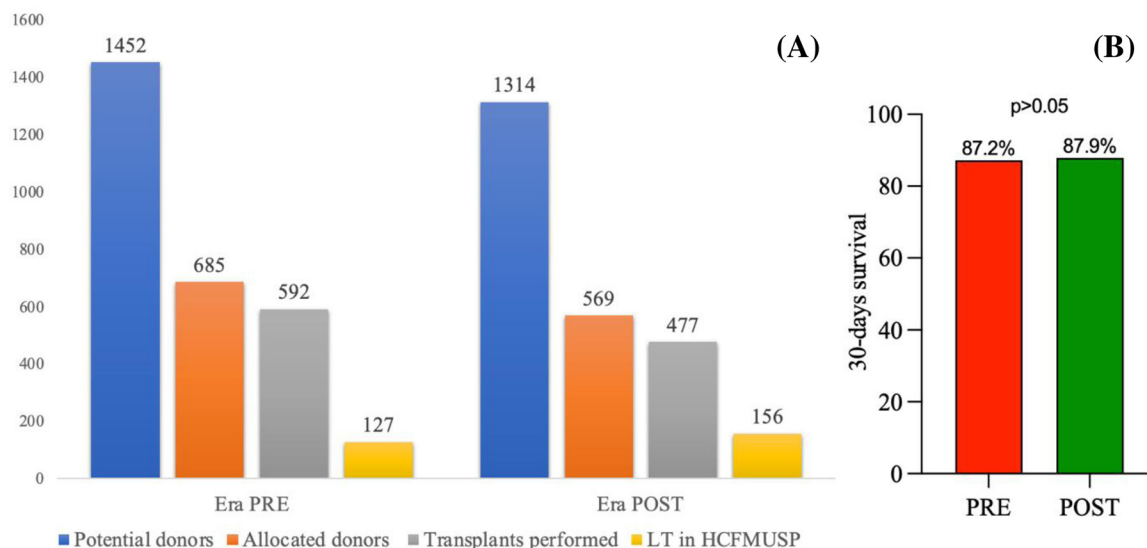
significantly higher than the potential donor’s liver ( $P = .039$ ). There was no difference in 30-day survival between the periods (87.2% vs 87.9%,  $P > .5$ , respectively), as demonstrated in Fig 1B.

**DISCUSSION**

The COVID-19 pandemic has strongly affected many lives worldwide and the transplant community, including transplant recipients who urgently need transplants. Since the pandemic started, intensive care unit beds have been scarce, thus reducing the odds of procuring transplantable solid organs from suitable donors. Our study shows that during the 1 year of the COVID-19 outbreak, there was an important reduction of potential liver donors compared to the same period in 2019 in some Brazilian territories.

Transplant is the standard therapy for several end-stage diseases. Still, during the COVID-19 spread, the lower number of potential donors and intensive care unit’s bed availability limited access to this treatment. Our study observed a more severe reduction in organ donations than in the previous period [8].

Despite the reduction in the number of donors made available by the OPOs, our center increased the number of LTs during the pandemic compared to the same period before the pandemic. Possible explanations may be related to strategies adopted to keep the program running, avoiding the impact on mortality in the list [9]. Another factor associated with the increase in the number of LTs may be related to a possible reduction in the number of transplants from other transplant centers. Our experience shows the utility and importance of continuing the donation and transplant process if procurement and transplant procedures follow a COVID-19-accessible pathway for both donors and recipients.



**Fig 1.** The proportion between potential and allocated donors, liver transplants (LTs) performed, and LTs in the Clinics Hospital of the University of São Paulo Medical School (HCFMUSP) (A) and 30-day survival in our center (B) in pre-COVID-19 (PRE) and post-COVID-19 (POST) periods.

Our institution, the Clinics Hospital of the University of São Paulo Medical School, is a Brazilian public quaternary hospital, and it became the main referral center for severe COVID-19 cases when a city-wide quarantine was declared in March 2020. To maintain LT activity, a building was specifically designated to patients without COVID-19. Moreover, we developed rapid screening protocols for donors and recipients, including clinical evaluation, chest computed tomography scans and real-time polymerase chain reaction for SARS-CoV-2 from respiratory secretions [9]. Additionally, patients on the waiting list were fully informed about the risks of transplant during the pandemic and we emphasized the importance of self-isolation afterward.

Aside from the limited donor numbers, potential donor-related COVID-19 transmission could have been a risk for transplanted patients; thus, extensive COVID-19 testing of donors has been considered mandatory from the beginning [9]. We surveyed patients who underwent transplant between March 24 and July 1, 2020, [10] and found that 7 patients developed COVID-19 in the early posttransplant period (ranging from 9-39 days). All of these patients were transplanted from different donors, and no other recipients transplanted with an organ from these 7 donors developed the infection. Furthermore, we found a significantly lower incidence of COVID-19-related diseases in transplanted recipients previously and/or when waitlist patients were included [4]. In line with a previous paper [11], those data may support the hypothesis that the COVID-19 transmission should not be considered donor-related, and the extensive testing procedure guarantees safe transplant.

## CONCLUSION

The COVID-19 pandemic decreased available donors, but our institution increased the number of LTs without compromising survival outcomes by following a strict protocol of preventive strategies against COVID-19 propagation.

## DATA AVAILABILITY

The authors do not have permission to share data.

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