Impact of COVID-19 on the number of deceased donors and organ transplantation in Western countries

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The severe acute respiratory syndrome coronavirus 2 disease 2019 (COVID-19) pandemic has an impact on all facets of our health care system, including life-saving procedures. The COVID-19 in 2020 has a substantial impact on the transplant community. This study aimed to assess the impact of COVID-19 on the number of deceased donors and organ transplantation in Western countries by analyzing literature review. In Spain, the COVID-19 pandemic has posed significant challenges to the Spanish donation and transplantation program. The program activities decreased substantially during the most critical weeks of the first COVID-19 wave, but recovered over the next weeks to return to a reasonable level. In France, there was a 28% decrease in the number of organ donations and a 22% decrease in the number of liver transplantation in 2020. In Italy, a 47% reduction in organ donation and a 44% reduction in transplantation during the first 6 weeks of the COVID-19 pandemic compared with one year before. In the United States of America, the overall reduction in deceased donor transplantations since the COVID-19 outbreak was 51.1%, with the highest percentage of reduction in kidney transplantation. The present study revealed that there is a strong association between the increase in COVID-19 infections and a striking reduction in solid organ transplantation procedures. However, further studies are necessary to follow up and validate the results of this study.

Keywords: SARS-CoV-2; COVID-19; Deceased donor; Living donor; Organ transplantation

INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) disease 2019 (COVID-19) pandemic has an impact on all facets of our health care system, including life-saving procedures like organ transplantation. Solid organ transplantation is a life-saving procedure that should

continue even when the other elective surgical procedures are curtailed. Unfortunately, since 2020, concerns for potential exposure to SARS-CoV-2 have profoundly altered the processes of organ donation and recovery which are vital to organ transplantation [1-4]. Increased risk of viral transmission from donor to recipients or to and from health care workers has had a negative impact on organ donation and

transplant procedures.

This study aimed to assess the impact of COVID-19 on the number of deceased donors and organ transplantation in Western countries by analyzing literature review.

IMPACT OF COVID-19 IN SPAIN

The first cases of COVID-19 in Spain were reported at the end of February 2020. By mid-March, the Spanish government declared a state of alarm with a national lockdown, confinement measures, and restricted mobility to control the spread of the virus. These measures were maintained until the end of June 2020. In the intervening weeks, the healthcare system was under pressure and the intensive care unit capacity was overwhelmed. The COVID-19 pandemic has posed significant challenges to the Spanish donation and transplantation program. There was a substantial decrease in the program activities during the most critical weeks of the first COVID-19 wave, but recovered over the next weeks to return to a reasonable level which was maintained even in the second wave of the pandemic (Fig. 1) [4].

IMPACT OF COVID-19 IN FRANCE

A study was conducted to determine whether the COVID-19 outbreak affected organ donation and liver transplantation activity in France [5]. Data on the number of brain-dead donor procurements and adult liver transplantation were compared between two periods of January to May 2019 and January to May 2020. There was a 28%

decrease in the number of organ donations in 2020 (543 in 2020 vs. 752 organ donations in 2019). A 22% decrease in the number of liver transplantation also was observed (435 in 2020 vs. 556 in 2019). Overall, the North East area of France which was the main COVID-19 cluster area, had more than 25% decrease in the multiorgan procurement (–33% compared to 2019), and liver transplantation (–26% compared to 2019) activities in 2020 (Fig. 2) [5]. These findings indicated that there was a significant decrease in the number of organ donation and liver transplantation performed in France during the COVID-19 outbreak.

IMPACT OF COVID-19 IN ITALY

A study was conducted to investigate the effect of COVID-19 on transplantation in the North Italy Transplant program [6]. This cross-sectional study included all consecutive potential deceased donors proposed in the North Italy Transplant program in six weeks after February 21, 2020 (period A), the number of all the potential donors during the same period of the previous years (period B), and all potential donors six weeks before February 20, 2020 (period C). Fifty-eight deceased donors were proposed during period A, 95 were proposed during period B, and 128 were proposed during period C. After the evaluation process, 32 of 58 (55.2%), 60 of 95 (63.2%), and 79 of 128 (61.7%) donors were used for organ donation in the periods A, B, and C, respectively ($p=0.595$). They observed a 47% decrease in donation in period A compared to period B and a 60% decrease compared to period C (Fig. 3). There was a 44% and 59% decrease in transplantation comparing period A with

Fig. 1. Changes in donation and transplantation activities by months in 2020 vs. 2019 in Spain. The number of deceased and living donors (A) and the number of solid organ transplantation (OTx) (B). Between January and September 2020, the number of deceased donation and solid organ transplantation decreased by 26% and 22%, respectively, compared with the corresponding period in 2019.

period B and period C, respectively (Fig. 4) [6]. This study showed that there was a significant reduction in donations and transplantation during the COVID-19 pandemic.

IMPACT OF COVID-19 IN THE UNITED STATES OF AMERICA

A study on the weekly rates of deceased donor organ recovery and LT was conducted using the United Sharing for Organ Donation (UNOS) data in the United States of America (USA) [7]. The decision to proceed with transplantation was judiciously determined by each transplant center. In most cases, living donor transplantation, especially liver donation, was deferred, to allow healthy donors to follow the recommended stay-at-home guidelines. In contrast, deceased donor liver transplantation has been continually

pursued in those with the greatest disease severity according to the model for end-stage liver disease scores. The COVID-19 pandemic has caused a major disruption of the organ donation and recovery processes, resulting in declining rates of overall organ recovery (Fig. 5). The COVID-19 pandemic affected multiple regions in the United States at varying degrees and at different time points, depending on the incidence and prevalence of COVID-19. As organ recovery and living donation have markedly diminished, liver transplantation decreased by more than 25% between February and April 2020, nationwide (Fig. 6) [7].

There was a strong temporal association between the increase in COVID-19 infections and a striking reduction in overall solid organ transplantation procedures (Fig. 7). The overall reduction in deceased donor transplantations since the COVID-19 outbreak was 51.1% in the USA [8]. This re-

Fig. 2. Time variations of the organ procurement (A) and liver transplantation (B) activities by months in early 2020 vs. early 2019 in France.

Fig. 3. Trend of donors during the three evaluated periods in Italy. The figure plotted numbers of the total potential donors (A) and used donors (B) during the considered periods: period A (6 weeks after February 21, 2020); period B (6 weeks after February 21, 2019); and period C (6 weeks before February 20, 2020).

duction was especially high in kidney transplantation, but a substantial effect was also observed in heart, lung, and liver transplantations, all of which provide significant improvement in survival probability.

In recognition of these challenges, the United Network for UNOS/Organ Procurement Transplant Network (OPTN) swiftly approached the COVID-19 pandemic with a multi-faceted strategy to support the patients on the transplant waiting lists, the transplant centers, and the organ procurement organizations with policy changes, guideline developments, and easily accessible resources.

DISCUSSION

COVID-19 has spread rapidly around the world, causing

Fig. 4. Trend of solid organ transplants during the three evaluated periods in Italy. The figure shows the numbers of total solid organ transplantations during the three considered periods: period A (6 weeks after February 21, 2020); period B (6 weeks after February 21, 2019); and period C (6 weeks before February 20, 2020).

the World Health Organization to declare it a global pandemic. Among the numerous pandemic challenges, there have been significant effects on patients with end-stage organ disease that are awaiting transplant surgery [9,10]. As the pandemic worsens globally, procurement of organs from deceased donors has decreased, and living donor organ transplantation has been postponed to preserve medical resources for COVID-19 management and to avoid nosocomial transmission [7,11,12].

The present study revealed that the COVID-19 pandemic has led to a sudden decrease in organ donation and transplantation in many Western countries that have actively performed solid organ donation for a long period [3-7]. This could majorly be attributed to the overwhelming COVID-19 burden on the health-care system.

A short-term analysis on organ transplantation in the

Fig. 5. Weekly rates of the deceased donor organ recovery between January and August 2020, in the United States. Significant decreases in organ recovery rates were noted at the height of the COVID pandemic in March 2020. A 25% reduction in organ recovery was observed between February and April 2020.

Fig. 6. Weekly rates of the deceased donor (A) and living donor (B) liver transplants performed between January and June 2020 in the United States of America. Marked reductions in liver transplantation were observed in March and April 2020. Living donor liver transplantation has continued to be performed seldomly throughout the month of April 2020.

Fig. 7. Trends in COVID-19 spread over time in France and the United States of America (USA) and recovery of organs and solid-organ transplantation procedures from deceased donors. Number of COVID-19-confirmed cases and number of solid organs recovered for transplantation over time in France (A) and the USA (C). Total number of deceased donor transplantations, with separate trend lines for kidney, liver, heart, and lung, over time in France (B) and the USA (D).

USA demonstrated a strong temporal association between the increase in COVID-19 infections and a striking reduction in overall solid organ transplantation procedures [8], an effect that was observed in several European countries [4-8]. The overall reduction in deceased donor transplantations since the COVID-19 outbreak was 90.6% in France and 51.1% in the USA, respectively [8]. In both France and the USA, this reduction was especially high in kidney transplantation, but a substantial effect was also seen in heart, lung, and liver transplantations, all of which provide a meaningful improvement in survival probability.

On the contrary, the impact of COVID-19 on the number of deceased donors and organ transplantation in Korea does not appear to be significantly high. A study from Severance

Hospital revealed that the institutional transplantation activities with living and deceased donors remained stable during the COVID-19 outbreak, compared to the same period in the year 2019, as well as none of their transplant recipients contracted COVID-19 [13]. A study on the number of deceased donor and living donor liver transplantations during a year of 2020 using the Korean Network for Organ Sharing (KONOS) database revealed that the numbers of deceased donors and deceased donor liver transplantations were 450 and 391, respectively, in the year 2019, and 478 and 395 in year 2020, respectively ($p=0.284$). These results suggested that in Korea, the numbers of deceased donor and living donor liver transplantations remained stable in the year 2020, despite the persistence of the COVID-19

pandemic [14].

The difference in the impacts of COVID-19 on organ transplantation between Western countries and Korea is primarily based on the prevalence of COVID-19 in the general population and the incidence of critically ill patients. A Korean epidemiologic study revealed that the national COVID-19 death rate was 2.3 per 100,000 [15], which is significantly lower than that of the Western countries [16,17].

In conclusion, the results of this study revealed that there is a strong association between the increase in COVID-19 infections and a striking reduction in solid organ transplantation procedures. However, further studies are necessary to follow up and validate the results of this study.

FUNDING

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CONFLICT OF INTEREST

All authors have no conflicts of interest to declare.

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AUTHORS' CONTRIBUTIONS

Conceptualization: All. Data curation: All. Formal analysis: All. Investigation: All. Methodology: All. Visualization: All. Writing - original draft: All. Writing - review & editing: All.

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