Development of an organ procurement team in South Australia in response to COVID-19

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Key words
COVID-19, organ donation, organ transplant, procurement.

Abstract

Background: Due to the nature of border closures and quarantine requirements in Australia during the COVID-19 pandemic, the feasibility of interstate travel for organ retrieval created complex logistics. An organ procurement service in South Australia, to procure heart and lungs of local donors, was commenced to mitigate the impact of the travel restrictions imposed due to COVID-19. The purpose of this review was to examine the initial data and feasibility of the service.

Methods: A single unit, multi-site retrospective review from April 2020–August 2021 of all organ retrievals undertaken by the Flinders Medical Centre cardiothoracic service across Adelaide metropolitan area. Data was prospectively collected and analysed from the DonateLife South Australian centralized database. All data was de identified.

Results: A total of 25 organ procurements had been undertaken across 17 months since commencing the program. Total of 9 hearts and 16 bilateral lungs were procured with median age of donor of hearts 49 years (IQR 35.5–51.5) and 60 years (IQR 44–72) for lung donation. Six organs were donated after determination of circulatory death and 19 after neurological determination of death. Median ischaemic time for heart donation was 4.4 h (IQR 3.0–5.8) and lung donation 4.4 h (IQR 3.4–6.1). All organs procured by the local South Australian team were successfully transplanted at the recipient site. Recipient sites included 8 in Victoria, 10 in New South Wales, 4 in Western Australia and 3 in Queensland.

Conclusions: The necessity of flexibility within the field of cardiothoracic surgery is evident during the COVID-19 pandemic. The implementation of an organ retrieval service in South Australia has been successful with no apparent increased risk to successful transplant outcomes.

Introduction

The global pandemic of COVID-19 (SARS-CoV-2) has had a significant impact worldwide, with 435 882 971 cases of COVID-19 worldwide including 5 974 364 deaths reported to March 2022.1 Major Australian cities including Melbourne and Sydney, faced arduous lockdowns, with Melbourne experiencing in excess of 263 days in total. This had a clear impact upon the ability to provide critical medical and surgical services.

The COVID-19 pandemic and its effect on restricting interstate travel in Australia resulted in an unforeseen effect on the movement of interstate organ retrieval teams in Australia, posing significant logistical issues as well as safety issues for those involved.2 The initial stages of the pandemic were a time of uncertainty and apprehension as Australia faced interstate border closures with ever changing and dynamic border rules. Border closures and the resultant need for exemptions, testing requirements, awaiting results and the potential requirement to quarantine on return from interstate travel caused significant issues for procurement team members. The pandemic also saw a significant reduction of interstate flights which impacted the mobilization of transplant recipients.2 At the beginning of the pandemic there was no heart and lung transplant tertiary hospital in South Australia and there was no plan for a service in South Australia prior to COVID-19. Prior to the COVID-19 pandemic, the procurement of cardiothoracic organs in South Australia had been solely reliant on travel from interstate procurement teams.
travelling from the intended transplant site. The purpose of this review is to quantify the safety and effectiveness of the initiation and implementation of an organ procurement program service in South Australia in response to the COVID pandemic for the procurement of heart and lungs for transplantation at interstate recipient sites. The primary aim was to quantify the rate of successful transplantation of the procured organs at the recipient hospital site. The outcomes post transplant for the recipient will have numerous variables beyond the procurement including but not limited to urgency of transplant, clinical state of the recipient, and technical or clinical structures at the receiving site that are outside the scope of this manuscript.

Methods
A single unit, multi-site retrospective review from April 2020 to August 2021 of all organ retrievals undertaken by the Flinders Medical Centre Cardiac Thoracic Service across Adelaide Metro. There were four procurement sites including Flinders Medical Centre, Calvary Adelaide Hospital, The Royal Adelaide Hospital and Lyell McEwin Hospital. Data was prospectively collected and analysed from the DonateLife South Australian centralized database. All data was deidentified. This project was registered as a quality improvement project with Southern Adelaide Local Health Network with the quality register ID: 2267.

Results
A total of 25 organ procurements were undertaken across 16 months since commencing the program from April 2020 to August 2021. A total of 9 hearts and 16 bilateral lungs were procured, resulting in 9 heart transplants, 12 bilateral lung transplants and 5 single lung transplants (Fig. 1). The donors for solid heart organ had a median age of 49 (IQR 35.5–51.5) years and 60 (IQR 44–72) years for lung donation (Table 1). There were 6 organs donated after circulatory determination of death and 19 after neurological determination of death. All heart procurements were undertaken after neurological determination of death. Median ischaemic time for heart donation was 4.4 h (IQR 3.0–5.8) and lung donation 4.4 hours (IQR 3.4–6.1). All organs dispatched for transplantation by the South Australian team were successfully transplanted as recorded by DonateLife at the recipient site with nil surgical issues from the procurement as stated by the recipient hospital. Recipient sites included 8 organs to Victoria, 10 organs to New South Wales, 4 organs to Western Australia and 3 organs to Queensland (Fig. 2). There were two lung procurements undertaken that upon explant the organs were noted to have pulmonary infarcts in the left lower lobe and the recipient hospital chose not to accept the organ. Follow up 30-day death data was obtained from the DonateLife database. Of the 9 heart transplant recipients, one passed away in the perioperative period due to ischaemic bowel. The recipient hospital stated to DonateLife that there were no issues with the procured heart. Of the 17 lung transplant recipients, two patients passed away in the perioperative period due to an intracranial haemorrhage in one patient and sepsis in the second patient. Both recipient hospitals stated to DonateLife that there were no concerns with the procured lungs.

Discussion
Since the development of COVID-19, multiple transplant services in Europe have noted a decrease in the ability to provide organs and a transplant service particularly lung transplantation.

| Organ procured          | N  | Age (Yr) | Ischaemic Time (Hr) | Organ donation after neurological determination of death | Organ transplanted at recipient site and no surgical concerns from recipient site |
|-------------------------|----|----------|--------------------|--------------------------------------------------------|-------------------------------------------------------------------|
| Heart                   | 9  | 49       | 4.4 (IQR 3–5.8)    | 9                                                      | 9 (100%)                                                          |
| Lungs                   | 16 | 60       | 4.4 (IQR 3.4–6.1)  | 10                                                     | 10 (100%)                                                         |
| Ischaemic Time (Hr)     |    |          |                    |                                                        |                                                                   |
| Organ donation after neurological determination of death |    |          |                    |                                                        |                                                                   |
| Organ transplanted at recipient site and no surgical concerns from recipient site |    |          |                    |                                                        |                                                                   |

Fig. 1. Distribution of organ retrieval type.

Table 1 Characteristics of organ retrieval cases

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patients dying whilst awaiting lung transplant.\textsuperscript{6} Similarly, a worldwide survey, which included 78 lung transplant centres from 15 countries, not including Australia or New Zealand, demonstrated that 81\% of units reported a significant reduction in lung transplantation due to COVID-19.\textsuperscript{7} The reasons for this significant reduction are not clear and likely include intensive care capacity, limitation of elective surgery, access to donor organs, staff shortages, COVID-19 infections in recipients and transport and logistical issues.

A review of transplant during the era of COVID-19 pandemic in Italy reported that the development of local organ procurement teams was vital to continue transplant services and decrease the risk of staff contracting or spreading COVID-19 during organ procurement.\textsuperscript{8} This is particularly relevant in Australia with the changing border control measures resulting in the real threat that a procurement team, sent interstate may inadvertently spread COVID-19 or be subject to quarantine for 2 weeks upon return if an outbreak of COVID-19 occurred whilst the procurement team was visiting. This risk posed a significant threat to the staffing of a transplant service or in fact a cardiothoracic surgical department if procurement teams were forced to isolate for 2 weeks upon return. A local South Australian cardiothoracic procurement team was developed in April 2020 in the early phases of the pandemic in Australia during a period of strict border closure between South Australia and New South Wales in order to facilitate organ donation and has continued to evolve since.

The organ retrieval team in South Australia consists of two cardiothoracic surgeons with prior transplant training, perfusionists for management and delivery of organ procurement solution and surgical staff members to provide assistance. Once organs are procured, they are delivered by the South Australian Ambulance Service to an awaiting private jet with a solo pilot sent from the recipient hospitals state. Procurement sites included Flinders Medical Centre, Royal Adelaide Hospital, Lyell McEwin Hospital and the Calvary Adelaide Hospital. The ability to create a local cardiothoracic organ retrieval service in South Australia has been noted by one of the largest heart and lung transplant services in Australia, St Vincent’s Hospital Sydney, to decrease the issue of staffing resource on their service as well as the ever dynamic logistical challenges with border control and quarantine requirements in Australia.\textsuperscript{2} An unexpected benefit was engagement with local SA transplant teams procuring other solid organs. This created ability to improve timing and flexibility as required by donor hospitals without the procedure times being constrained by travel arrangements from interstate teams.

In the USA, Balsara \textit{et al.} reported their experience as a transplant centre from Tennessee, who were able to increase their transplant services during the COVID-19 pandemic by creating local donor procurement teams, similar to the team created at Flinders Medical Centre, demonstrating a paradigm shift in the process of organ procurement.\textsuperscript{9} Eliminating the need to travel in the time of the COVID-19 pandemic both decreases the risk of inadvertent exposure to COVID-19 to procurement staff visiting interstate hospitals and the risk to staff at the procurement hospital.

The issue of screening of potential organ donors for COVID-19 has not been problematic during the period reported as there had been an extremely low incidence of COVID-19 in South Australia. Guidelines developed in other countries such as Italy have stated that if nasopharyngeal swabs or bronchoalveolar lavage are SARS-CoV-2 positive then the potential donors are not investigated for procurement.\textsuperscript{10} In a perspective article by DeFilippis \textit{et al.}, the topic of consent is raised and with the authors suggest potential recipients should be consented for the risk of potential donor COVID-19 infections despite steps put in place to mitigate this risk.\textsuperscript{11} They also highlighted that proper screening of potential

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Organ_Distribution_by_Recipient_State.png}
\caption{Distribution of heart and lung organ procurement by recipient state.}
\end{figure}
The development of cardiothoracic surgery during the COVID-19 pandemic is evident. The implementation of a cardiothoracic organ retrieval service in South Australia has been successful with no apparent increased risk to successful transplant outcomes as reported by DonateLife. It has been stated by the Society of Thoracic Surgeons that during the pandemic of COVID-19, the ability to collaborate, prioritize and revaluate are key to the continual delivery of cardiothoracic services. The development of local organ procurement teams and the relationship between interstate tertiary hospitals clearly demonstrates the collaboration between the cardiothoracic surgical communities for the benefit of our patients.

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Author contributions
Damian Joseph Gimpel: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; writing – original draft; writing – review and editing. Gareth Crouch: Conceptualization; supervision; writing – review and editing. Malgorzata Szpytma: Conceptualization; writing – review and editing. Annette Mazzone: Conceptualization; supervision; writing – review and editing. Robert A. Baker: Formal analysis; writing – review and editing. Jayme S. Bennetts: Supervision; writing – review and editing.

Conflict of interest
None declared.

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