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Case Report / Olgu Sunumu

Postcardiotomy extracorporeal membrane oxygenation for infective endocarditis in a patient with intravenous drug use and COVID-19 infection: An ethical dilemma

İntravenöz ilaç kullanımı ve COVID-19 enfeksiyonu olan bir hastada enfektif endokardit için kardiyotomi sonrası ekstrakorporeal membran oksijenasyonu: Bir etik ikilem

Stephanie Jiang[1], Zachariah Mansour[2], Campbell David[3], Payne Darrin[1], El-Diasty Mohammad[1]

Institution where the research was done:
Kingston Health Sciences Centre, Kingston, Canada

Author Affiliations:
[1]Division of Cardiac Surgery, Kingston Health Sciences Centre, Kingston, Canada
[2]Critical Care Medicine, Kingston Health Sciences Centre, Kingston, Canada
[3]Ethicist, Kingston Health Sciences Centre, Kingston, Canada

ABSTRACT

In this report, we present a case of native valve infective endocarditis due to active intravenous drug use in a 29-year-old female patient that presented during the peak of the coronavirus disease 2019 (COVID-19) pandemic. The patient underwent a complex cardiac surgical intervention with aortic valve replacement and mitral valve repair. Postcardiotomy extracorporeal membrane oxygenation (ECMO) support was required due to severe biventricular dysfunction. In this unprecedented situation, multiple ethical dilemmas arose at different stages in the management of this patient. These dilemmas stemmed from the lack of evidence supporting the use of postcardiotomy ECMO in patients with active intravenous drug use and the scarcity of resources due to the COVID-19 pandemic, resulting in pressure put on our healthcare system. In this case report, we present the decisions made by our team, taking into account both the patient's best interests and the available resources. We hope this decision-making process will serve as a valuable learning experience for other teams and will act as an antecedent for similar situations in the future.

Keywords: COVID19, extracorporeal membrane oxygenation, infectious endocarditis, intravenous drug use, medical ethics.

ÖZ

Bu makalede koronavirüs hastalığı 2019 (COVID-19) pandemisinin zirvesi sırasında başvuran 29 yaşında bir kadın hastada aktif damar içi ilaç kullanımına bağlı doğal kapak enfektif endokardit olgusu sunuldu. Hasta, aort kapak replasmanı ve mitral kapak onarımı ile birlikte karmaşık bir kardiyak cerrahi müdahale geçirdi. Ciddi biventriküler yetmezlik nedeniyle kardiyotomi sonrası ekstrakorporeal membran oksijenasyon (ECMO) desteği gerekti. Bu benzeri görülmemiş durumda, hastanın yönetiminde farklı aşamalarda birçok etik ikilem ortaya çıktı. Bu ikilemler, aktif damar içi ilaç kullanımı olan hastalarda postkardiyotomi ECMO kullanımını destekleyen kanıtların olmamasından ve COVID-19 pandemisi sonucu gelişen kaynak kıtlığı nedeniyle sağlık sistemimiz üzerinde oluşan baskıdan kaynaklandı. Bu olgu sunumunda, hem hastanın çıkarlarını hem de mevcut kaynakları göz önünde bulundurarak ekiplerimiz tarafından alınan kararlar sunuldu. Bu karar sürecinin diğer ekipler için değerli bir öğrenme deneyimi olarak hizmet edeceğini ve gelecekte benzer durumlar için bir örnek olacağını umuyoruz.

Anahtar sözcükler: COVID-2019 ekstrakorporeal membran oksijenasyon, enfektif endokardit, damar içi ilaç kullanımı, tıp etiği.

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Correspondence: El-Diasty Mohammad, MD, PhD, MRSC (UK), FRCS CTh (UK). Division of Cardiac Surgery - Victory 3, Kingston Health Sciences Centre, 76 Stuart St, Kingston (ON), K7L2V7, Canada.
Tel: (613) 548 2422 e-mail: mohammad.eldiasty@kingstonhsc.ca

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There is much controversy regarding whether or not surgical intervention should be offered to patients with infective endocarditis secondary to ongoing intravenous drug use (IVDU).[1] This is due to increased perioperative mortality, complication rates, and repeat surgical intervention rates.[2] Prosthetic valve endocarditis carries a higher mortality risk of up to 80%, with a high risk of deadly complications, such as sepsis and heart failure.[3,4] Thus, it is difficult for the healthcare team to decide whether or not to operate on this complex patient group. The healthcare team must then balance their responsibilities for stewardship and conservation, particularly in current, unprecedented times of the coronavirus disease 2019 (COVID-19) pandemic.

In this case report, we present a young female patient with active IVDU that was surgically treated for infective endocarditis during the peak of the COVID-19 pandemic. Furthermore, this patient required postcardiotomy extracorporeal membrane oxygenation (ECMO), which has never been reported previously in patients with infective endocarditis due to active IVDU. We share the decision-making process and ethical dilemmas the healthcare team faced in hopes of acting as a precedent for future cases.

CASE REPORT

A 29-year-old female with native mitral and aortic valve endocarditis secondary to active IVDU presented to the Emergency Department. The patient was also the mother of two young children with a poor social support network. In the initial discussion with the patient, she underplayed the severity of her cardiac condition and did not show any willingness to quit IVDU or engage in any rehabilitation programs. The initial decision was to treat the patient conservatively; however, after a few days of antibiotic therapy, the patient developed severe cardiogenic shock due to severe aortic and mitral valve regurgitation. The patient was referred for emergency inpatient cardiac surgery. After obtaining her mother's consent, a complex cardiac surgical procedure was performed with aortic valve replacement and complex mitral valve repair. However, the patient could not be weaned off the cardiopulmonary bypass machine due to severe biventricular dysfunction. Therefore, the application of postcardiotomy venoarterial ECMO was decided. After five days of clinical progress and one failed attempt to wean off ECMO, mechanical circulatory support was successfully discontinued. The patient remained in the intensive care unit (ICU) for the continuation of her recovery. After a total of 75 days, the patient was finally discharged to her local convalescence center for the continuation of rehabilitation.

DISCUSSION

While this case was clinically complex, it was the ethical intricacies that caused the greatest challenge to the healthcare team. One of the major limiting factors was the timing of the patient's admission, which was during the peak of the COVID-19 pandemic. At that point in time, there was a severe limitation on available resources, including a shortage of ICU beds and nurses, cardiac surgical operating rooms, ECMO machine availability, and perfusionist availabilities to run the ECMO service. The ethical challenges we faced in this scenario included: *(i)* offering a high-risk cardiac surgical procedure to a patient who is not willing to quit IVDU with high possibility of developing prosthetic valve endocarditis postoperatively; *(ii)* the lack of evidence to support the use of postcardiotomy ECMO in patients with active infective endocarditis and IVDU; *(iii)* the absence of bail-out strategies should it be impossible to wean off ECMO, given that both long-term mechanical circulatory support and heart transplantation would have been contraindicated due to the patient's complex background; *(iv)* the rationing and scarcity of resources, including personnel and equipment, during the peak of the COVID-19 pandemic, which made it challenging to consider the full spectrum of postoperative care.

The first issue we would like to discuss is the controversy of offering cardiac surgery for infective endocarditis in patients who are unwilling to quit IVDU. Native valve endocarditis is often managed medically. However, certain features, such as valvular abscesses, a large vegetation size, bradyarrhythmias, and severe valve dysfunction, may warrant surgical intervention in both the general population and those with IVDU.[1,2] It is estimated that 20 to 40% of IVDU-related endocarditis cases may require surgical treatment, with more than half requiring repeat surgical intervention.[3] The reported perioperative mortality may be as high as 12%.[4] Furthermore, the risk of prosthetic valve reinfection with ongoing IVDU after discharge from the hospital is extremely high and can occur in up to 32% of patients.[5] Prosthetic valve endocarditis typically requires surgical treatment that carries up to 80% mortality risk and an elevated risk of perioperative complications, such as sepsis, renal failure, and heart failure.[6,7] Therefore, due to the high rates of reinfection and the extremely poor outcomes with repeat surgical interventions, it is highly controversial whether or not the first surgical

intervention should even be offered to patients who continue to inject drugs.[8]

Consequently, the decision regarding surgical treatment must be patient-centered and reflect the patient's wishes. The team in charge of the treatment plan should tailor decisions to each patient's clinical goals and values as well as their social situation, with emphasis on the patient's wellbeing. As per the World Medical Association's International Code of Medical Ethics, a fundamental responsibility of the physician is to "be dedicated to providing competent medical service in full professional and moral independence, with compassion and respect for human dignity," while preventing harm to the patient.[9] This is further enforced in the Canada Health Act.[10] The decision for patient care should consider more than just the patient's physical condition.

Offering surgery for patients with IVDU who are unwilling to quit is a challenging ethical dilemma that involves tensions between the ethical principles of respecting patient autonomy, beneficence, and nonmaleficence, and justice, particularly if they are presenting with repeat endocarditis after receiving a prosthetic valve.[11] From a clinical perspective, surgery is the best and likely the only curative treatment option; without surgery, the patient would most likely die. However, these patients will almost certainly develop new prosthetic infections if they continue IVDU and thus be subjected to postoperative complications and high mortality rates, as mentioned previously. Additionally, these procedures require prolonged, postoperative hospital stays and massive consumption of resources at both a financial and personnel level. This is in direct contraindication with the ethical principle of stewardship, which involves the duty to use scarce resources responsibly.

In this case, the patient was unwilling to quit IVDU as she did not think her drug use was a problem, but clinically needed surgery in order to survive infective endocarditis. As the patient continued to deteriorate, the team had many discussions regarding the best mode of action to ensure her survival and wellbeing while also taking into consideration her multi-faceted social situation and two children. A decision was reached to perform surgery with a contingency plan of rehabilitation, close community follow-up, and organization support from Street Health, a local community health center that provides support for individuals with substance use issues.[12] These steps were taken to ensure the patient had proper postoperative support and aid. Further plans were enacted to protect the patient's children while she was recovering.

Second issue is the use of ECMO for patients with active endocarditis and IVDU. Unfortunately, this patient did not tolerate the surgical intervention, and the only option was ECMO support. Extracorporeal membrane oxygenation requires the presence of highly trained staff around the clock. There are no previously published reports of the outcomes of using postcardiotomy ECMO in patients with infective endocarditis due to active IVDU. However, limited experience with the use of percutaneous ECMO in drug-dependent patients has resulted in longer hospital stays and higher rates of complications.[13]

Another dilemma the team faced was whether it was ethically the right decision to put this patient on ECMO, knowing that she may face longer hospital stays and poorer postoperative outcomes. Additionally, ECMO would require the allocation of a perfusionist around the clock, which would inevitably result in reducing nearly half the elective and inpatient cardiac operations in our unit. Furthermore, we could no longer offer ECMO to other patients who may require it, including any potential COVID-19 patients. Due to the pandemic, ECMO use was strictly rationed, and the selection criteria became increasingly stringent to reserve therapy only to patients with the highest chance of survival.

Therefore, the care team experienced significant moral distress in this position as this decision would consume precious resources, such as highly trained personnel and hospital technology, in a situation where the patient was drug dependent and expressed no desire to stop IVDU, particularly during the peak of the COVID-19 pandemic. Although we questioned the patient's ability to truly appreciate how her IVDU had harmed her health to the point of requiring such extensive life-saving interventions, ultimately, the choice was made to pursue ECMO to ensure the patient's survival and future rehabilitation while also lengthening the amount of time available to make the next series of decisions.

Third, we struggled to find the correct intervention following ECMO. Postcardiotomy ECMO is a short-term mechanical support device that can be utilized temporarily (a few days to a few weeks) and is generally associated with a high incidence of morbidity and mortality, ranging from 24.8 to 52% of patients.[14] Extracorporeal membrane oxygenation acts as a bridge to either patient recovery or more definitive therapy, namely a long-term ventricular

assist device or cardiac transplantation.[15] For otherwise healthy or minimally comorbid patients, both these latter options can be offered depending on the patients' clinical condition. Upon initiation of ECMO therapy, all these options need to be discussed by the relevant teams.

On the one hand, there is limited evidence to guide patient selection for long-term mechanical cardiac support. The 2019 European Association of Cardiothoracic Surgery Expert Consensus on long-term mechanical circulatory support advises against such therapy in patients with active substance abuse; however, this is based on expert opinion and does not take into account the many intricacies of a patient's clinical and social situation.[16] Similarly, the availability of adequate social support and appropriate ventricular device care programs are essential components of patient eligibility for long-term support therapy. On the other hand, in patients with non-IVDU-related infective endocarditis, heart transplantation is a very high-risk procedure and is often considered a bailout or salvage procedure due to the need for intense immunosuppression.[17,18] Furthermore, candidates for an organ transplant are required to have a satisfactory social support network in the postoperative recovery period.[19]

There are currently no reports of heart transplants performed in patients with infective endocarditis due to active IVDU. This may be due to the potential spread of infection to the new orthotopic heart and the lack of adequate social support, which is often the case in a significant proportion of this vulnerable patient population.

In our patient's case, due to the ongoing infective endocarditis, the continued IVDU, and the limited available social support in her community, her options were slim and balanced precariously on her ability to refrain from IVDU in the future. Should she be able to achieve that feat, potential LVAD or cardiac transplantation could be considered if she remained ECMO-dependent, although this was a route the healthcare team wished to avoid if possible.

Lastly, the allocation of scarce resources amidst the COVID-19 pandemic. In healthcare, the question is "how to allocate scarce life-saving resources has been the main ethical dilemma," which is particularly true during the COVID-19 pandemic.[20] Over one year into the pandemic, there continues to be a rapid rise in cases, further placing unprecedented strains on healthcare systems worldwide. Areas with surges in cases have experienced elevated needs for life support systems, often greater than the available supply. This includes ECMO, with increasingly stringent eligibility criteria as the numbers of COVID-19 patients increase.[21] Additionally, as mentioned previously, ECMO requires great amounts of personnel and precious staff resources.

Although active IVDU is a relative contraindication for ECMO, our patient would have otherwise been eligible, as she had no other co-morbidities. However, the vast limitation in resources caused by the pandemic, compounded with previously discussed factors, made the decision difficult to pursue ECMO.

After much discussion and debate, despite it being the peak of COVID-19 with limited resources, ECMO support was ultimately pursued for the patient. The patient was able to tolerate ECMO and was slowly weaned off. She had a long recovery while in the hospital, providing time for the multidisciplinary team of cardiac surgeons, ICU attendings, nurses, social workers, and psychiatrists to ensure postoperative abstinence from IVDU. Education on the dangers of IVDU and the extremely high risks of repeat operations, paired with intensive counseling from the cardiac and allied health teams, reiterated the critical need for the patient to abstain from IVDU. These efforts and the harrowing near-death experience ultimately changed the patient's mind, and she adamantly promised to never use intravenous drugs again in the future. This was reaffirmed at the one-month follow-up appointment, and she will be followed closely throughout her care by the cardiac surgeon, family physician, and community.

In conclusion, this case revealed several ethical dilemmas, which were addressed through a multidisciplinary team approach that took into account the patient's best interests while dealing with the many challenges created by the COVID-19 pandemic.

Patient Consent for Publication: A written informed consent was obtained from each patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: ZM, DP, MED were involved in patient care. SJ wrote the manuscript with support and edits from ZM, DC, DP, and MED; DC offered medical ethics expertise; DP and MED supervised the project.

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