The ToxIC NOSE (Novel Opioid and Stimulant Exposure)

Report #11 from ToxIC's Rapid Response Program for Emerging Drugs

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Organ Donation after Overdose Death

Introduction

As younger Americans develop chronic disease with the potential for organ failure, and the aging population of the United States continues to increase, the waitlist for hopeful transplant recipients has also increased each year across all solid organ categories.[1-3] In 2022, 2,397 individuals died while waitlisted for a solid organ transplant, and another 3,398 were removed from the waitlist, deemed too sick to transplant.[4] These statistics underscore the urgent need for donor organs in the United States.

Over the past two decades, there has also been a surge of drug overdose deaths, many of whom were previously healthy and would otherwise be ideal organ donor candidates. The relative contribution of these overdose death donors (ODDs) has risen from 1.1% of all organ donors in

The ToxIC Novel Opioid and Stimulant Exposure (NOSE) Reports

Through the ongoing support of the Opioid Response Network (ORN) since 2020, the American College of Medical Toxicology (ACMT) Toxicology Investigators Consortium (ToxIC) has implemented an enhanced sentinel detector field within the ToxIC Core Registry to identify novel and emerging opioid and stimulant exposures. Once an emerging trend or risk is identified, ToxIC releases a quarterly report.

The goal of this project is to disseminate this novel information to the medical toxicology community as well as the ORN as part of a Rapid Response program.

For more information on the ToxIC Core Registry and data collection, please visit: www.toxicregistry.org

2000 to 13.4% in 2017.[5] Though more granular data on the type of overdose is not available in the Scientific Registry of Transplant Recipients (SRTR) database, this trend coincides with the dramatic increases in opioid-related mortality over the same timeline.[6]

Successful transplant outcomes have been reported for donors with a range of toxicities including carbon monoxide (CO), methanol, tricyclic antidepressants, and cocaine.[7-11] However, controversy exists around the viability of organs after illicit drug overdose. Medical toxicology physicians frequently assess and treat hospitalized patients with illicit drug overdose and can provide guidance for the assessment of ODD organ viability, aiding in decreasing the stigma associated with utilizing these life-saving organs. The ToxIC Core Registry's enhanced NOSE detector field identified two cases in which organ donation occurred to highlight the considerations of organ viability after a substance use related overdose and a CO poisoning death.

Case Presentation

Case 1:
A 35-year-old female was found unresponsive after reportedly using ketamine and gamma butyrolactone (GBL) with her boyfriend. She was initially thought to be asleep but then started having "foaming" at the mouth and became unarousable. Bystander cardiopulmonary resuscitation (CPR) was initiated by her boyfriend. EMS arrived and found her to be pulseless. She regained pulses after naloxone and epinephrine administration by prehospital personnel.

On arrival to the emergency department, she was immediately intubated for airway protection. She had a low blood pressure and low temperature, and was placed on vasopressors to maintain her blood pressure. The patient developed a cardiac dysrhythmia with an intraventricular conduction delay (prolonged QRS) that improved with administration of sodium bicarbonate. This raised concern that cocaine toxicity may have caused her initial cardiac arrest. Cocaine is a stimulant that can increase the heart rate, but also has sodium channel blockade effects that are known to prolong the QRS and cause life threatening cardiac dysrhythmias and seizures.

The patients comprehensive urine drug screen showed cocaine, ketamine, and MDMA. GBL, a gamma hydroxybutyrate (GHB) precursor that also causes profound sedation, was not found on her toxicology testing. However, the urine sample obtained for testing was collected 8 hours after arrival, a time window which may exceed window of detection for GBL or GHB.[12]

The patient did not recover consciousness. She eventually developed cerebral edema and was declared brain dead. She was subsequently taken to the operating room for organ procurement. Due to institutional policies, the specific organs she donated and the ultimate decision regarding their suitability for transplant was not available.

Case 2:

A 14-year-old female was found unconscious in a house fire. After removing her from the burning structure, medics found her to be in cardiac arrest. After 10 minutes of CPR at the scene, she regained pulses and was brought to a nearby ER.

On arrival to the ER, she was found to have dangerously low blood pressure requiring vasopressor medication to sustain an adequate degree of circulation to her vital organs. Because she was found in a house fire, there was a high suspicion for inhalational CO poisoning. Her carboxyhemoglobin level was found to be 60% (normal <5%), signifying severe CO poisoning. She was administered the pharmacologic antidote for CO poisoning, hydroxocobalamin, and transferred to a facility with the ability to provide hyperbaric oxygen in hopes of preventing delayed neurologic dysfunction.

Unfortunately, by the time she arrived at the tertiary hyperbaric-capable hospital, her lungs had filled with fluid and were therefore unable to absorb enough oxygen, a condition known as acute respiratory distress syndrome (ARDS). She was placed on an invasive form of lung bypass called veno-venous extracorporeal membrane oxygenation (VV-ECMO) to temporarily help with the delivery of oxygen to the rest of her body while her lungs recovered.

Though her lungs recovered enough to be removed from the VV-ECMO machine several days later, her neurologic function steadily deteriorated. A computed tomography (CT) scan of her head showed severe swelling of her brain. Brain death testing was delayed due to the development of central diabetes insipidus (DI), a condition that can sometimes arise in cases of neurologic damage where excess water is lost through the urine due to deranged signaling from the solute-sensing regulatory centers in the brain, causing the blood's sodium content to rise. Brain death cannot be declared when there is a concomitant metabolic derangement—in this case, excess sodium in the serum—so her sodium level was corrected prior to the initiation of brain death testing. After correcting her sodium, the patient underwent sequential brain death exams that showed the complete absence of respiratory drive and the complete absence of reflexes. She was subsequently taken to the operating room for organ donation. Again, due to institutional policies, information about the specific organs donated and the decisions for transplant viability was not available.

Discussion

In the two cases presented, one had a confirmative exposure to illicit drugs, including the stimulant cocaine, and the other succumbed to a CO poisoning. Despite the lower rates of medical comorbidities in decedents with a toxicologic cause of death and the medical viability of organs, the transplant community has been less willing to consider transplants from ODDs, especially those associated with illicit substance use. This bias remains a significant barrier to utilization of ODD organs for transplantation. For example, one study found that transplant surgeons were less likely to consider cocaine poisoned hearts compared to other poisonings, despite good outcome data for cocaine ODD procurement and use.[13] Unfortunately, in our two cases, information about the specific organs donated, the decisions for transplant viability, and the outcome of the organ were not available within the electronic medical record.

In the current era of increasing opioid overdose deaths, ODDs are a life-saving option to address the deficit of available transplant organs for those with chronic disease and/or failing organs. However, organ donation after fatal opioid overdose is surrounded by controversy regarding the safety of using organs from ODDs. Concerns arise from the risk of transmission of infectious diseases in this presumed high-risk population with IV drug use and the risk of transplanting a poisoned organ. While ODDs may have higher rates of transmissible diseases like Hepatitis C relative to the general population, proper screening practices should mitigate this risk.[14] One study on ODDs with a history of IV drug use cultured organs for bacteria and candida yeast, and found that this risk factor does increase the odds of positive cultures, but the organ recipient outcomes were not affected during 12 month follow up.[15] In those awaiting a life-saving transplant, the risk of death without a transplant may exceed the risk of ODD disease transmission, and should be considered.[16] Additionally, studies have shown that donor and recipient age are more important predictors of outcome than high risk behaviors.[17-19] Overall, the data regarding this "high-risk" ODD demographic have shown that ODD transplant outcomes are at least equivalent to those in non-ODD transplants. This trend holds true even when compared to donors after traumatic death, a group considered to be the optimal donor demographic.[13,20]

A prime concern from the medical toxicology physician's standpoint in ODDs is the declaration of brain death. Specific overdoses, such as the prescription drug baclofen and the illicit drugs GBL and GHB, can mimic brain death. EEG testing may suggest brain death due to profound sedation, making it a particularly challenging diagnosis.[21,22] Evoked potential (EP) testing is considered a superior diagnostic modality for ODD brain death declaration in these cases.

When analyzing the data supporting the viability of ODD transplantations, it is important to remember that these data do not always clearly differentiate between drug overdose as a cause of death versus a history of drug use or positive urine drug screens. A heart from a patient who used cocaine intermittently, for example, may not be the same as a heart that failed directly related to cocaine intoxication. Despite this, modern techniques to assess organ viability would be expected to screen for impaired organ function in these cases similar to standard organ donations.

Despite these hurdles, ODDs remain an underused source of donor organs with comparable safety and functional outcome profiles to non-ODD donors. Medical toxicology physicians are uniquely poised to assist throughout the timeline of organ donation, from guiding the appropriateness and nature of brain death testing in ODDs, to risk-stratifying the organs most likely affected by specific poisonings, to addressing the stigma associated with ODD organ use that prevents the maximal utilization of this donor pool on a public health level.

Conclusion

Donor organs can be used from individuals who die of either overdose or non-overdose-related poisoning, though there is more stigma surrounding the former. Based on current epidemiologic overdose trends and existing transplant outcome data, increased utilization of ODDs for organ transplantation, including from donors with a history of IV drug use associated with stimulants or opioids, may fit a growing need and are life-saving. Continued education on favorable outcomes after ODD transplantation, as well as specific limitations, is needed.

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About the *Opioid Response Network (ORN)*:

ORN provides free, localized training and education for states, communities, organizations and individuals in the prevention, treatment and recovery of opioid use disorders and stimulant use. Learn more and submit a request at www.OpioidResponseNetwork.org.

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