

Keeping Up With Technical Innovations in Organ Transplantation: Perfusion & Preservation Technology - Part I

CLARIFYING TERMINOLOGY

PERFUSION

The passage of a fluid (blood or other) through the vessels of organs or tissues. (*OPTN Glossary*)

PRESERVATION

Method used to keep organs viable between procurement and transplantation. (*OPTN Glossary*)

Ex vivo: "outside of a living body"

In vivo: "inside of a living body"

Allograft: tissue/organ taken from another person

Autograft: tissue re-transplanted in / on oneself, e.g., blood vessels, skin

Advances in organ preservation and perfusion techniques and technologies are demonstrating improved organ transplant outcomes and increased organ utilization from deceased organ donors, especially from those with complex medical history or older ages. A critical phase during the process is the transportation and preservation of an organ from the donor to the recipient. With improved preservation and perfusion, increased preservation time and transportation distances are permitted, and early data is demonstrating improved outcomes.

Presently, organs traveling between the donor and the recipient are maintained mostly in static cold storage (SCS). Chilled preservation solutions that contain ingredients to prevent cellular swelling and help to minimize molecular changes within the cells are utilized along with wet ice to maintain storage temperature between 4-8 °C (Hosgood et al. 2021). There are however side effects to this type of storage, primarily, cell swelling, acidosis and ischemic/reperfusion injury, which can cause early graft dysfunction and can contribute to chronic complications in the recipient.

In recent years, several different preservation advances have emerged in the transplantation field to help limit some of the negative effects of cold storage, extend preservation times for organs, as well as to facilitate the use of medically complex or at-risk organs. Determining which technique and technology to utilize for a particular donor, organ or situation, still requires more experience and outcome data.

Types of Preservation & Perfusion Technologies

Hypothermic machine perfusion (HMP) / Hypothermic oxygenated machine perfusion (HOPE): A dynamic, oxygenated cold preservation method at 4°C which supplies oxygen to the graft (organ) during the ex vivo period.

Normothermic machine perfusion (NMP): An ex vivo preservation of organs at normal body temperatures with the help of a machine that also provides oxygen and nutrients

Normothermic regional perfusion (NRP): An in situ (or in vivo) perfusion of a portion (region) of the donor's body with the help of extracorporeal organ support (ECOS), utilized in donation after circulatory determination of death (DCD) donors immediately following cessation of cardiac function. This supplies the organs with blood and oxygen during the organ-recovery process.

Which Organs Would Benefit and In What Way?

All of these technologies and approaches to organ preservation and perfusion are still being extensively and actively researched to determine best use and outcomes for various organs. New data and identification of outcome benefits are frequently published and thus, information is rapidly increasing. Early results are suggesting an increased use of organs, particularly from DCD donors, as well as a reduction in ischemic reperfusion injury, early allograft dysfunction, ischemic type biliary lesions, delayed graft function, cold ischemic times, as well as potentially restorative possibilities and improved assessment opportunities of the various organs. It is recommended to closely follow publications on this topic to remain current with the developments (*some examples are listed in the reference section*).

Who is Responsible for Storing, Managing and Transporting These Devices and the Needed Supplies?

This is a question that is still being discussed and varies across the country. In some instances, the organ procurement organization (OPO) may assume this role, in some locations the transplant center will, and in other areas a Regional Perfusion Center (a dedicated location with the technologies to providing perfusion and preservation services) may provide this service. Additionally, there are significant costs and resource commitments to provide this service which still need to be evaluated and managed.

Keeping Our Eyes on Stewardship

In the meantime, the mission of organ donation and transplantation is too vital, the stewardship of these gifts too precious, and the time remaining for those waiting for their transplant too unpredictable for the donation and transplantation community not to embrace innovation and advances in preservation and perfusion technology.



Helpful References:

- OPTN Glossary - <https://optn.transplant.hrsa.gov/patients/glossary/>
- Hunt F, et al. 2022. From haphazard to a sustainable normothermic regional perfusion service: a blueprint for the introduction of novel perfusion technologies. *Transplant International*. 2022; 3(35): 10493. doi:10.3389/ti.2022.10493. eCollection 2022



For a more detailed overview and a multidisciplinary perspective, review a recent presentation featured at the 2022 National Critical Issues Forum presented by Kevin Myer, Dr. Victor Pretorius, and Dr. Garrett Roll: "[Navigating Technical Innovation: Access, Product Selection, and Value](#)"

For additional references & resources; or to learn more, please visit:

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