Expanding the Donor Pool: Non-Perfused Organ Donation

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NPOD

Protocol

Initial Transplant Experience
Feb 2016 - May 2019

Next Steps
Protocols for uncontrolled donation after circulatory death: a systematic review of international guidelines, practices and transplant outcomes

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Abstract

Introduction: A chronic shortage of organs remains the main factor limiting organ transplantation. Many countries have explored the option of uncontrolled donation after circulatory death (uDCD) in order to expand the donor pool. Little is known regarding the variability of practices and outcomes between existing protocols. This systematic review addresses this knowledge gap informing policy makers, researchers, and clinicians for future protocol implementation.

Methods: We searched MPDL INF. EMRASF. and Google Scholar electronic databases from 2005 to March 2015 as
<table>
<thead>
<tr>
<th>Maastricht classification</th>
<th>Description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Dead on arrival</td>
<td>uncontrolled</td>
</tr>
<tr>
<td>II</td>
<td><strong>Unsuccessful resuscitation</strong></td>
<td>uncontrolled</td>
</tr>
<tr>
<td>III</td>
<td>Awaiting cardiac arrest after WLSM</td>
<td>controlled</td>
</tr>
<tr>
<td>IV</td>
<td>Cardiac arrest after death by neurological criteria</td>
<td>uncontrolled</td>
</tr>
<tr>
<td>V</td>
<td>Cardiac arrest in a hospital inpatient</td>
<td>uncontrolled</td>
</tr>
</tbody>
</table>
NPOD vs. uDCD

• NPOD = No measures to restore circulation are performed after death declaration.

• European uDCD = restore circulation by NRP or cardiac message even before family consent.
Can the Lung Tolerate Periods of No Perfusion (warm ischemia)

• YES - if maintained inflated with oxygen
• Old studies by T. Egan: “The lung does not die when you die”
• Tolerability up to 3h for ventilated/inflated lungs.

A. Changes during agonal phase

- Propofol (mg/kg/h)
- Remifentanil (μg/kg/h)

Minutes after withdrawal:
- 0
- 10
- 13
- 16
- 19
- 22
- 25

B. Delta PO2/FIO2 during EVLP

- Hours of EVLP:
  - Control (n = 4)
  - 2h WIT (n = 4)
  - 3h WIT (n = 5)

C. Static Compliance during EVLP (ml/m of H2O)

- Hours of EVLP:
  - Control (n = 4)
  - 2h WIT (n = 4)
  - 3h WIT (n = 5)

D. Lung viability during EVLP (%)

- Hours of EVLP:
  - Control (4 / 4)
  - 2h WIT (4 / 4)
  - 3h WIT (2 / 5)

E. Images of lungs:
- Pre EVLP
- Post EVLP

Watanabe/Cypel American J. Transplant. March 2019
Failed resuscitation after cardiocirculatory arrest

Determination of death

Rapid referral & limited assessment

Opportunity of organ donation & consent

Organ procurement
**Non-Perfused Organ Donation (NPOD) Screening Tool**

**Unit:**

**Date:** ____________________  |  **Current Time:** ____________

**Time of Arrest (if known):** __________

**Estimated Last Time Seen Alive:** __________

**Pronounced Time of Death:** __________

<table>
<thead>
<tr>
<th>Answer all of the following questions (If unknown, check YES):</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is this patient between the ages of 16 and 65?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Was the cardiac arrest witnessed or, if unwitnessed, was the patient last seen alive less than 1 hour prior to the cardiac arrest?</td>
<td></td>
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<tr>
<td>3. Have both asthma and COPD been ruled out as the cause of death?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Has this patient been cancer free for the past 5 years? (Exception: Basal cell carcinoma of the skin)</td>
<td></td>
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</tr>
</tbody>
</table>

**If all answers are marked as ‘YES’:**

- RN to call Trillium Gift of Life **STAT** and **within 30 minutes** of time of death
- Begin the call by stating “I am calling with a STAT NPOD referral”.
William Osler – TGLN NPOD Recovery Procedure

Unsuccessful resuscitation of a patient

MRP pronounces & documents time of death.

Initiate NPOD Screening Tool

Patient screens as a potential NPOD donor

Ideally, if intubated, RT places patient on NPOD device with medical air (CPAP 20 cm H2O)

Resource Nurse/RN calls TGLN (1-877-363-8456)
“I am calling with a stat NPOD referral.”

TGLN indicates there is interest and a plan to approach the family.
A second physician must complete the "Pronouncement of Death: Non-Perfused Organ Donation" Form prior to the OR.

Consent obtained by TGLN (< 90 mins from death)

Resource Nurse/RN notifies both RT and MRP of consent, both are required to return to implement NPPOD Clinical Protocol (located in NPPOD Box).

Resource Nurse/RN to call ICU Resource Nurse to bring NPPOD Box to Bedside

Initiate recruitment maneuver and prone
*Early inflation and proning directly correlate with outcome*

When OR staff ready, transport patient prone to OR by RN & RT

RT connects to ventilator
PCV 10 RR 10 PEEP 10 FiO2 0.21

Lung Recovery (under 3 hours from pronouncement of death)
Recovery Team

Travel Time

55 min - 1 h 50 min
48.9 km
TORONTO EVLP

Gas for Deoxygenation
86% N₂, 8% CO₂, 6% O₂

Red: Venous (Oxygenated) perfusate
Blue: Arterial (Deoxygenated) perfusate
Perfusate: Acellular Steen Solution

Perfusion: 40% CO, LAP 5mmHg, PAP 10-12mmHg
Ventilation: 7cc/kg, 7BPM, PEEP 5, FiO₂ = 21%
EVLP & Lung Transplant Activity / Year 1983 - 2018

2012-2018
100% increase
EVLP era
**Primary outcome**
Incidence of ISHLT Primary graft Dysfunction Grade 3 @ 72 h (expected rate less than 20%)

**Secondary outcomes**
Number of consented donors
Utilization of donor lungs
Recipient time on ventilation
In-hospital mortality
1 year survival
Lung function at 1 year
Referrals (N=147)

Ruled out prior to approach (N=66)
- Medically unsuitable as per TGLN (n=42)
- No interest from transplant program (n=24)

Not Approached (N=37)
- Lack of TGLN resources (n=11)
- Other reasons (n=26)

Approaches (N=44)

Consents (N=30)
[Consent rate = 68%]

Declines (N=14)
Consents (N=30) [Consent rate = 68%]

Consented Not Recovered (N=14)
- Medically unsuitable (n=4)
- Medically unsuitable in donor OR (n=6)
- Lack of recovery team resources (n=1)
- Rescinded consent (n=3)

Recovered (N=16)

Recovered Not Transplanted (N=11)
- Medically unsuitable in donor OR (n=2)
- Medically unsuitable post-EVLP (n=9)

Actual Donors & Transplants (N=5)
Recipient Data

Mean warm ischemic time = 165 mins (106-199)
Median age 50.8 +/- 6.3 yrs (41-56)

Median 5 d (2-78)
Median 17 d (8-100)
Median non-NPOD=23 days
Recipient Data

No PGD Grade 3 seen at 24, 48, 72 h

4/5 alive at median 291 d (143-1246) post transplant
Good performance status & lung function

One patient bridged to transplant on ECMO, weaned after 5 days, died at d100 of ischemic gut
Case example

Lungs before EVLP

X-ray during EVLP

CXR just after LTx

Extubated to room air in 12hs
Utilization is still low. What to do?

• Pre-approach inflation

• Add donor prone positioning

• Strategies to decrease organ temperature (i.e. cold air ventilation – under investigation)

• Screening bronchoscopy? Good information?
Donor prone positioning protects lungs from injury during warm ischemia

Yui Watanabe, Marcos Galasso, Tatsuaki Watanabe, Aadil Ali, Robert Qaqish, Daisuke Nakajima, Yohei Taniguchi, Mauricio Pipkin, Lindsay Caldarone, Manyin Chen, Takashi Kanou, Cara Summers, Khaled Ramadan, Yu Zhang, Harley Chan, Thomas K. Waddell, Mingyao Liu, Shaf Keshavjee, Lorenzo del Sorbo, Marcelo Cypel ...

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Main Message

• NPOD/uDCD is possible for lung donation. It works and leads to excellent patient outcomes.

• This is the first lung transplant experience in uDCD in North America.
Assessment of Lungs for Transplant Recovered from Uncontrolled Donation after Circulatory Determination of Death Donors.

Egan T\(^1\), Blackwell J\(^1\), Birchard K\(^1\), Haithcock B\(^1\), Long J\(^1\), Gazda S\(^1\), Casey N\(^2\), Thys C\(^2\).

Author information
1 1 University of North Carolina at Chapel Hill, Chapel Hill, North Carolina; and.
2 2 Carolina Donor Services, Durham, North Carolina.

- 502 referrals
- Lungs recovered from 31 donors
- 13 declined after retrieval and 18 put on EVLP
- 16 failed
- 2 considered suitable — but not transplanted: 1 surgeon not available, 1 no B ABO recipient.
- Zero Transplants
What have we learned?

• Consent rate is high.
• Utilization is still low. We can improve.

• ED/death investigation/OR engagement/culture
• “Emergency donation” is challenging.
• Significant implications post-DCD/timing declines.
Next Steps

**DCD, failed to progress**
Palliative patients who do not die within 2-3 hrs for DCD

**DCD Decline**
“Family decline for timing”
Case Report

• DCD donor
• No cardiac arrest in 2 hours
• Donor team left the hospital
• Donor arrested 15 min later
• Donor team return to hospital
• 2h later (Total of 4h 15min after WLST; 2h no circulation warm ischemia) lungs are recovered
• 5h EVLP: stable function
• Bilateral Lung Tx
• Good lung function after transplantation
Collaborators... and more...

Andrew Healey#  
Yui Watanabe#  
Caitlin Mills  
Michele Stoncius  
Susan Lavery  
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Robert Sanderson  
Atul Humar  

Jonathan Yeung  
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Thomas K. Waddell  
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TGLN & UHN & WOHS staff, death investigators, patients and families
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