Organ Donation in Canada and Management of the Potential Organ Donor

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Assistant Professor
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University of Toronto
Declarations

I am the Hospital Donation Physician at Toronto General Hospital

Appointed (and funded) by Trillium Gift of Life Network
Dr. Jeff Singh  
Regional Medical Lead – GTA West  
Trillium Gift of Life Network, Ontario  

Medical Director  
Neuro-Medical-Surgical ICU  
Toronto Western Hospital
Objectives – what I want to say

1. Review the current trends in organ donation in Canada and worldwide.
2. Characteristics of the potential donor for donation after cardiac death (DCD)
3. Clinical and ethical challenges of donor management
4. Withdrawal of life sustaining therapy in the ICU, in the context of DCD
INTRODUCTION

Update on organ transplantation
Supply-Demand Problem

Worldwide:
- Approximately **120,000** organ transplants performed each year
- Kidney (70%), Liver (20%), Heart (5%), Lung (3%), and Pancreas (2%) of global activity
- Meets only **10%** of the World’s transplant needs (WHO, 2016)

Canada:
- Over **4,500** people were waiting for organ transplants
- **2,903** organs were transplanted (CIHI, 2016)

Adam Smith’s economic principles do not fully apply – if demand rises > supply:
- **The price rises: 276 people died in Canada** waiting for a transplant
- If we cannot increase production/availability; to lower the price quality may fall
## Ontario: Transplant Waiting List

<table>
<thead>
<tr>
<th>Organ</th>
<th>March 31, 2017</th>
<th>March 31, 2016</th>
<th>March 31, 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney</td>
<td>1, 120</td>
<td>1, 134</td>
<td>1, 146</td>
</tr>
<tr>
<td>Liver</td>
<td>237</td>
<td>221</td>
<td>214</td>
</tr>
<tr>
<td>Heart</td>
<td>45</td>
<td>56</td>
<td>67</td>
</tr>
<tr>
<td>Lung</td>
<td>62</td>
<td>64</td>
<td>81</td>
</tr>
<tr>
<td>Pancreas- Whole</td>
<td>16</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Small Bowel</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kidney/ Pancreas</td>
<td>63</td>
<td>62</td>
<td>64</td>
</tr>
<tr>
<td>Multivisceral*</td>
<td>12</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>1, 556</td>
<td>1, 565</td>
<td>1, 597</td>
</tr>
</tbody>
</table>

140 Died waiting

*Multivisceral i.e. liver/kidney, heart/lung, lung/ kidney, etc.
ORGAN SUPPLY

Update on organ transplantation
Organ donation

Organ donor

- Deceased
  - Beating Heart Donor
  - Neurological Determination of Death
    - NDD
  - Non-beating Heart Donor
  - Cardiocirculatory Determination of Death
    - DCD
- Living
Organ donation

- Organ donor
  - Deceased
    - Beating Heart Donor
    - Neurological Determination of Death
      - NDD
  - Non-beating Heart Donor
    - Cardiocirculatory Determination of Death
      - DCD
- Living

Approach for Consent
  - Somatic Support of Organs
    - Approach for Consent
      - Decision to Withdraw Life Support
        - Unacceptable Prognosis
# Terms and abbreviations

Non-heart beating organ donation (NHBD) – Maastrict 1995
Donation after cardiac death (DCD) – Paris 2013

<table>
<thead>
<tr>
<th>Category I. Uncontrolled</th>
<th>Found dead</th>
<th>Sudden unexpected CA without any attempt of resuscitation.</th>
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<tr>
<td></td>
<td>IA. Out-of-hospital</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IB. In-hospital</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category II. Uncontrolled</th>
<th>Witnessed cardiac arrest</th>
<th>Sudden unexpected irreversible CA with unsuccessful resuscitation</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>IIA. Out-of-hospital</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IIB. In-hospital</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category III. Controlled</th>
<th>Withdrawal of life-sustaining therapy</th>
<th>Planned withdrawal of life-sustaining therapy, expected CA</th>
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<table>
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<tr>
<th>Category IV. Uncontrolled Controlled</th>
<th>Cardiac arrest while brain dead</th>
<th>Sudden CA after brain death diagnosis during donor life-management but prior to planned organ recovery.</th>
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### Donation after cardiac death (DCD) – Paris 2013

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<td>Uncontrolled</td>
<td>Controlled</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category V.</th>
<th>Medical Assistance in Dying (Euthanasia)</th>
<th>Expected CA after planned withdrawal of life-sustaining with prior planned organ recovery.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled</td>
<td>VA. Medically assisted cardiocirculatory death in ICU or ward</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Controlled</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VB. Medically assisted cardiocirculatory death in OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Highly controlled</td>
<td></td>
</tr>
</tbody>
</table>
DCD – worldwide potential for donation


- 56.4 million Deaths per year
- 20 million Communicable diseases
- 15 million Cardiovascular diseases
- 3.19 million Respiratory diseases
- 1.34 million Traffic

- 8.76 million ischemic cardiomyopathy
- 6.24 million cerebrovascular accident

uDCD, cDCD, or NDD

DCD – Canadian potential for donation

1:134

Canadian Death Ratio

35,848,600

Canadian Population

Jeff Singh, Trillium Gift of Life Network
**Deceased Donation is a Rare Gift**

- **~267,000 Deaths**
- **~150,000 Hospital Deaths**
- **5,236 Potential Donors**
- **651 Utilized Donors**

1 figure = 650.28 persons

Jeff Singh, Trillium Gift of Life Network
Deceased Donors in Canada 2006-2016

Increase in total deceased donors (2006-2016)

Jeff Singh, Trillium Gift of Life Network
DCD Donors, 2006-2016

2016 results reported are preliminary and may be subject to change pending validation

*Rates for BC - population of Yukon is included;
**Rates for Alberta - populations of NWT & Nunavut are included
### Organ(s) Transplanted

<table>
<thead>
<tr>
<th>Organ(s) Transplanted</th>
<th>2016/17</th>
<th>2015/16</th>
<th>2014/15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney</td>
<td>500</td>
<td>416</td>
<td>383</td>
</tr>
<tr>
<td>Liver</td>
<td>209</td>
<td>189</td>
<td>194</td>
</tr>
<tr>
<td>Heart</td>
<td>89</td>
<td>83</td>
<td>78</td>
</tr>
<tr>
<td>Lung</td>
<td>149</td>
<td>128</td>
<td>125</td>
</tr>
<tr>
<td>Pancreas- Whole</td>
<td>22</td>
<td>22</td>
<td>17</td>
</tr>
<tr>
<td>Other</td>
<td>45</td>
<td>55</td>
<td>54</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,256</strong></td>
<td><strong>1,174</strong></td>
<td><strong>1,129</strong></td>
</tr>
</tbody>
</table>

*Deceased donors include provincial and non-provincial donors*
Organs Transplanted by Donor Type, 2006-2016

* Missing Quebec data

Jeff Singh, Trillium Gift of Life Network
Perceived Barriers to DCD Donation

- Temporal proximity and perceived conflict of interest and duty can be a source of distress
- The need to allow sufficient time to get patient wishes and allow organ procurement organisation (OPO) time to approach re: organ donation
- Discomfort or uncertainty at the clinical interface between end-of-life care and organ donation work up.
- Uncertainties around the time at which death can be confirmed using circulatory criteria, e.g. ROSC after asystole, and lingering responsiveness of the nervous tissue to restoration of cerebral blood flow.
- Concerns about the ethics and lawfulness of both controlled and uncontrolled DCD persist

Ethical considerations

• Utilitarian justification
  • Violations of the dead donor rule, consent process, pre-mortem interventions are justified by the benefits to those awaiting organ transplants

• Abbreviated time to the declaration of death
  • 2-5 minute interval to the time the donor is declared dead, it is quite possible that portions of the brain (responsible for thoughts and emotions) have not yet ceased to function

• Surrogate consent
  • SDM or POA provide consent for a living individual for an intervention without benefit to that person

• Future considerations
  • Imminent death donation
  • MAID
  • Presumed consent (opt out vs. opt in)
APPROACHING THE FAMILY

Update on organ transplantation
We are not good at this!

Do you:

a. Negotiate a time for withdrawal of life support?

b. Make him a no-escalation/no CPR?

c. Ignore physiological goals now?

d. Ask family if he had ever discussed organ donation?

e. Give them time and space and circle back?

46 yr old male
GCS 4
Large supratentorial ICH
ICH Volume > 30 cc
Intraventricular hemorrhage

ICH Score predicted mortality = 97%

Neyricnk A. Curr Opin Anaesthesiol. 2013; 26: 382-390
Family override

• UK data suggests that family (SDM) override of first person consent occurs in approximately 11.7% of cases

• Factors associated with override:
  • Failure to involve organ donation specialist physician or nurse (OR 3.0)
  • Donation after cardiac death (DCD) (OR 2.7)
  • Black, Asian, or minority ethnicity family (OR 2.7)

• Stated reasons:
  • Length of time of donation process was too long (28%)
  • Didn’t want further surgery (9.1%)
  • Patient had suffered enough (8.4%)
  • Family members divided over the decision (7.6%)

Families Need Time to Consent

When WLST time has been set <6 hours from referral:

- Fewer families are approached about organ donation
- Fewer families consent to organ donation
- Fewer families uphold registered consent decisions

<table>
<thead>
<tr>
<th></th>
<th>WLST Not Discussed</th>
<th>WLST Time Set for Less Than 6 Hours</th>
<th>WLST Time Set for Greater Than 6 hours</th>
<th>WLST Time Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notifications</td>
<td>3399</td>
<td>1042</td>
<td>405</td>
<td>1201</td>
</tr>
<tr>
<td>Approaches</td>
<td>762</td>
<td>126</td>
<td>80</td>
<td>225</td>
</tr>
<tr>
<td>Consent</td>
<td>497</td>
<td>47</td>
<td>54</td>
<td>145</td>
</tr>
<tr>
<td>Consent Rate</td>
<td>65%</td>
<td>37%</td>
<td>68%</td>
<td>64%</td>
</tr>
<tr>
<td>Overturn Rate</td>
<td>13%</td>
<td>43%</td>
<td>3%</td>
<td>12%</td>
</tr>
</tbody>
</table>
SUPPORTING DCD DONORS
Update on organ transplantation
Support of the Consented DCD Donor

• Observational studies suggest that after consent for organ donation, up to 20% of organs may lose transplant potential due to suboptimal medical management.

• In 2015, the Society of Critical Care Medicine set out to develop evidence-based guidelines in donor management, but published, instead, consensus-based guidelines.

• Most guidelines and protocols worldwide centres on NDD donor management.

Within the context of patient-centered End of Life Care
1. Engage the organ donation organisation earlier
2. Don’t write “no-escalation” orders
3. Allow for reasonable escalation of care / patient resuscitation for:
   • Hypotension
   • Ventilation parameters
   • Medications and fluids
Ante mortem ‘management’ of the donor

• In June 2008, nine donor management goals were prospectively implemented as a checklist and every donor after neurologic determination of death was managed to meet them.

• The donor management goals represented normal cardiovascular, pulmonary, renal, and endocrine end points.

• If you met 7 of 9 Goals: OR 1.9 – of having 3+ organs transplanted.
Antemortem lung protection

- Compare conventional strategy and lung protective ventilation settings:
  - VT 6-8 ml/Kg PBW
  - PEEP 8-10 cm H2O
  - CPAP for apnea
  - Closed circuit

- Protective ventilation increases the number of lungs eligible and procured for transplant.
- No difference survival of recipients
- Data does not support extubation during WLST (and nor do our surgeons)

Mascia et al. JAMA. 2010
Antemortem kidney protection

Donor risk factors:

• Hypernatremia (Na > 155 mmol/L) – considered to be independently associated with hepatic and renal dysfunction or graft loss after transplantation.

Excessive sodium administration during resuscitation, or DI, may lead to accumulation of idiogenic osmoles in donor organs. Once transplanted, significant intracellular fluid shifts may occur into the graft.

• Donor age (>60 years)
• Warm ischemic time
• Cold ischemic time
Antemortem liver protection

- Review of 961 organ donors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio for Liver Transplantation</th>
</tr>
</thead>
<tbody>
<tr>
<td>donor BMI</td>
<td>0.94</td>
</tr>
<tr>
<td>male sex</td>
<td>1.89</td>
</tr>
<tr>
<td>glucose &lt;150 mg/dL</td>
<td>1.97</td>
</tr>
<tr>
<td>Sodium at 12-18 hrs</td>
<td>0.95</td>
</tr>
<tr>
<td>lower dopamine dose</td>
<td>0.95</td>
</tr>
<tr>
<td>vasopressin use</td>
<td>1.95</td>
</tr>
<tr>
<td>ejection fraction &gt;50%</td>
<td>1.77</td>
</tr>
</tbody>
</table>

- Increased graft survival was associated with **lower BMI and lower sodium levels**.
- tPA flushed liver grafts to reduce ischemic cholangiopathy
Antemortem heart protection

- Until recently, it has not been possible to assess either the severity or the reversibility of the ischemic injury which inevitably affects the heart in the DCD setting.

- The term “donation after cardiac death” has created a false impression that the heart “dies” during WLST, and that this is critical to the determination of death.

- The heart has stopped functioning but remains viable for a short period of time after death of the donor.

- Where it differs from other organs is in its greater susceptibility to the unavoidable warm ischemic injury that occurs during withdrawal of life support and during the interval between circulatory arrest and delivery of myocardial preservation solution.
Antemortem heparin

- **Liver Transplant**: Pre-mortem administration of heparin before WLST reduced incidence of primary non-function of the allograft from 11% to 3.4%.

- **Lung transplant**: Antemortem heparin in DCD, combined with retrograde and anterograde flushing, effectively removes thrombi that form during donation process.

- **Pancreatic transplant**: DCD versus DBD pancreatic transplants, showed equivalent graft survival at 10 years; but the odds ratio of graft thrombosis was 1.67 times higher in the DCD cohort. This difference disappeared in patients whose donor had received heparin prior to withdrawal of life sustaining therapies.

- **Kidney transplant**: It is recommended by the majority of organ procurement organizations, and has been shown to improve machine perfusion operation and its use may obviate the need for subsequent TPA or streptokinase for glomerular thrombi.

- **Ethical Aspects**: In the context of DCD there is no evidence that administering 20000 units of heparin (300mg/kg), at the time of withdrawal of life-sustaining therapy, hastens the patient’s death”(16).

Cao Y et al. *Transplantation* 2016; 100: 1513-1524
Optimisation of the DCD process

• Ante-mortem interventions (e.g. administration of heparin, steroids, and vasodilators)
• Consistent application of published schedules for the prompt identification of death
• Reducing the time interval between the diagnosis of death and organ retrieval (e.g. by withdrawing treatment in the operating theatre)
• Early tissue typing allowing prompt identification and mobilization of suitable recipients
• Post-mortem reperfusion of particularly vulnerable organs such as the liver
Postmortem reperfusion
PREDICTING TIME TO DEATH

Update on organ transplantation
The biggest enemy – warm ischemic time

- Functional warm ischemia starts when:
  - systolic blood pressure <50 mm Hg
  - oxygen saturation <70%.
- Stand-down times from the onset of functional warm ischemia vary by organ:
  - Liver: 30 minutes
  - Pancreas: 30 minutes
  - Lungs: 60 minutes (onset of functional warm ischemia to mechanical re-inflation of lungs)
  - Kidney: 120 minutes - then reassess with regard to logistics
Warm ischemic time terminology

- Total warm ischaemic period
- Functional warm ischaemic period
- Withdrawal (agonal) period
- Asystolic warm ischaemic period

- Withdrawal of life-supporting treatment
- Inadequate organ perfusion
- Circulatory arrest
- Confirmation of death
- In-situ cold perfusion
Predicting time to death after withdrawal

• Approximately 20–30% of consented donors do not die within the time limits required to permit DCD, resulting in false expectations for families and consumption of hospital resources.

• Currently existing prediction tools are not highly sensitive.

• Consistent predictors of time to death that are recognised:
  • controlled ventilation
  • oxygenation
  • vasopressor use
  • Glasgow Coma Scale Score
  • brainstem reflexes.
Length of time for donation

DCD Case Duration - All Referred Cases

Rival Year

2014/15
36:37
38:30
81:56
2015/16
36:31
30:02
73:17
2016/17
40:08
32:36
79:56
2017/18
48:44
47:37
104:26

HH:MM

0:00
12:00
24:00
36:00
48:00
60:00
72:00
84:00
96:00
108:00
120:00

Referral to Approach
Approach to WLS
WLS to Organ Retrieval (Incision/Skin Cut)
Organ Retrieval (Incision/Skin Cut) to Exit OR
Exit OR to First Organ Transplanted

Please note that the image contains a graph illustrating the length of time for donation, specifically focusing on DCD Case Duration for all referred cases over different fiscal years. The graph shows the duration in hours and minutes for each stage of the process, from referral to approach, approach to WLS, WLS to organ retrieval, and organ retrieval to exit OR. The data is presented for fiscal years 2014/15, 2015/16, 2016/17, and 2017/18.
SUPPORTING YOURSELF

Update on organ transplantation
Importantly

Edge walking
Summary – what I wanted to say

1. Universally, early identification is critical.
2. Separate the discussion of WLST and Donation; separate team, separate time.
3. Allow for escalation of therapy until the approach is made.
4. Commence antemortem interventions only for the consented donor.
5. Withdrawal as per the standard of care, (with exception of geography).
6. Including DCD in End of Life Care is patient-centered and good practice.
Your continued partnership in organ and tissue donation gives comfort to those grieving and hope to those still waiting.

Thank you

andrew.steel@uhn.ca