Donation after Cardio-circulatory Death: Canada Update

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CCCF 2014
No conflicts of interest to disclose
Canadian DCD Donors

* Total for Atlantic Provinces
Calendar Year: 2008-2013
Data Source: Canadian OPOs
Canada: 554 deceased donors, 66 DCD(12%) 2013

Pop: 33,476,688
RPM=16.5
## Canadian DCD activity 2006-2013

<table>
<thead>
<tr>
<th>PROVINCE</th>
<th>TOTAL DCD 2006-2013</th>
<th>% of all DCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANADA</td>
<td>376</td>
<td>100</td>
</tr>
<tr>
<td>BC</td>
<td>24</td>
<td>6.4</td>
</tr>
<tr>
<td>ALBERTA</td>
<td>10</td>
<td>2.7</td>
</tr>
<tr>
<td>SASK</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MANITOBA</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ONTARIO</td>
<td>266</td>
<td>71</td>
</tr>
<tr>
<td>QUEBEC</td>
<td>61</td>
<td>16</td>
</tr>
<tr>
<td>NOVA SCOTIA</td>
<td>15</td>
<td>3.9</td>
</tr>
<tr>
<td>NEW BRUNSWICK</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PEI</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NFLD</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
BC: 67 donors, 6 DCD(9%)
Alberta: 48 Donors, 3 DCD (6.3%)

Pop: 3,645,257

RPM = 13.2
Sask: 7 donors, 0 DCD

Pop: 1,033,381
RPM=7
Manitoba: 11 donors, 0 DCD

Pop: 1,208,268
RPM=9
Ontario: 225 Donors, 39 DCD(17%)

Pop: 12,851,821

RPM=17.5
Quebec: 165 Donors, 14 DCD (8.5%)

Pop: 7,903,001
RPM = 20.7
Atlantic: 31 Donors, 4 DCD (13%), NS-19 (4 DCD (21%)), NB-2, NL-10

NS: 921,727 RPM=20.6

NB: 751,171 RPM=2.6

NL: 514,536 RPM=18.5
Ontario 2006-2013
266 DCD Donors

Who died?
Who lived?
## Ontario DCD Donors by Cause of Death

<table>
<thead>
<tr>
<th>Cause Of Death</th>
<th>Donor Count</th>
<th>% Of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anoxia</td>
<td>126</td>
<td>39%</td>
</tr>
<tr>
<td>Cardiac Death</td>
<td>6</td>
<td>2%</td>
</tr>
<tr>
<td>CVA/Stroke</td>
<td>79</td>
<td>25%</td>
</tr>
<tr>
<td>Head Trauma</td>
<td>84</td>
<td>26%</td>
</tr>
<tr>
<td>Other</td>
<td>19</td>
<td>6%</td>
</tr>
<tr>
<td>Blank</td>
<td>7</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>321</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

June 1, 2006 – September 30, 2014

Data Source: TOTAL
Ontario DCD Hospitals

- Barrie
  - Royal Victoria Regional HC
  - Orillia Soldiers Memorial
- Guelph
  - Guelph General Hosp.
- Hamilton
  - Hamilton Health Sciences
  - St. Joseph Healthcare
  - Brantford General Hosp.
- Kingston
  - Kingston General Hosp.
  - Quinte Health Care
- Kitchener
  - Grand River Hosp.
  - St. Mary General Hosp.
- London
  - London Health Sciences
  - Bluewater Health
  - Huron Perth Health
  - St. Thomas Elgin General
- North Bay
  - North Bay Regional HC
- Niagara
  - Niagara Health System
- Ottawa
  - Queensway Carleton
  - The Ottawa Hospital
  - University of Ottawa Heart Institute
- Peterborough
  - Peterborough Regional HC
  - Sault Ste. Marie
  - Sault Area Hospital
- Sudbury
  - Health Sciences North
- Thunder Bay
  - Thunder Bay Regional HC
- Timmins
  - Timmins & District Hosp.
- Toronto/GTA
  - Halton Healthcare Services
  - Humber River Hospital
  - Lakeridge Health
  - Mackenzie Health
  - Markham Stouffville Hosp.
  - North York General Hosp.
  - Rouge Valley Health System
  - The Scarborough Hosp.
  - St. Michael’s Hosp.
  - St. Joseph’s HC
  - The Hospital for Sick Kids
  - Southlake Regional HC
  - Sunnybrook HSC
  - Trillium Health Partners
  - University Health Network
  - William Osler Health Sys.
- Windsor
  - Windsor Regional Hospital
  - Chatham Regional Hosp.

Updated September 2014
Ontario Transplants from 266 DCD donors
June 2006- Dec 2013

<table>
<thead>
<tr>
<th>TRANSPLANTED ORGAN</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney-Both</td>
<td>11</td>
</tr>
<tr>
<td>Kidney-Left</td>
<td>229</td>
</tr>
<tr>
<td>Kidney-Right</td>
<td>217</td>
</tr>
<tr>
<td>Liver</td>
<td>95</td>
</tr>
<tr>
<td>Lung Both</td>
<td>49</td>
</tr>
<tr>
<td>Lung-Left</td>
<td>10</td>
</tr>
<tr>
<td>Lung-Right</td>
<td>6</td>
</tr>
<tr>
<td>Pancreas-Islets</td>
<td>1</td>
</tr>
<tr>
<td>Pancreas-Whole</td>
<td>13</td>
</tr>
<tr>
<td>Grand Total</td>
<td>631</td>
</tr>
</tbody>
</table>
Two FAQs

1. When is the patient actually dead?

2. Does a DCD program change WLST practice?
When does death occur?
When has death occurred?

One concept of death:

Death occurs when there has been the permanent loss of capacity for consciousness and loss of all brainstem functions.
Alive vs Dead

An emergent phenomenon

Retention of the ability to gestate, grow, respond to infection, heal wounds etc

Three distinct pathways to the descent of emergence (death)
Three avenues to death

Permanent loss of the capacity for consciousness and brain stem function that follows:

1. isolated cessation of CBF in the face of ‘normal’ systemic physiology (ICP=CPP; 4 vessel occlusion)

2. an abrupt loss of systemic circulation

3. progressive hypoxia (hypoxemic or cytotoxic hypoxia)
In each case we use outward available physiologic features to infer that the permanent loss of the capacity for consciousness and brainstem function has occurred (using our experience (counting white sheep)) with:

1. NDD criteria
2. Abrupt loss of circulation (CA/SCD, termination of CPR, ECLS)
3. Progressive or severe hypoxia – apnea and loss of circulation
Inferences

We infer the timing of when indeed there has been the permanent loss of the capacity for consciousness and brainstem function - based on whether - and if so when - it were possible to reverse:

1. Isolated cessation of blood flow
2. Systemic circulation
3. Hypoxia
Inferences

1. Isolated cessation of blood flow
   Time dependence of the availability and effectiveness of craniotomy/ectomy

2. Systemic circulation
   Auto-resuscitation or time dependence of the availability and effectiveness of resuscitation

3. Hypoxia
   Time dependence of the availability and effectiveness of the reversal of hypoxia
Time dependence and effectiveness of the reversal of hypoxia

Conclusions:
By the time progressive hypoxia is accompanied by apnea followed by progressive failure of circulatory function to the point of absent flow, there is permanent loss of the ability to reinstate the electrical activity of the brain stem and core brain centres (e.g. hippocampus) through the reinstatement of oxygenated blood flow.

Death has preceded cessation of blood flow.
Experimental Setup
mEEG
Spontaneous brain activity
Baseline
10% oxygen
Arterial pulse pressure
0.5 mV
Basel 10% oxygen
7% oxygen
6% oxygen
mEEG
Spontaneous brain activity
Arterial pulse pressure
Time of apnea coincides with loss of spontaneous mEEG activity.
Evoked potential response to hypoxia

Baseline 10% oxygen 7% oxygen

6% oxygen Post-apnea resuscitation
### Resuscitation after apnea

<table>
<thead>
<tr>
<th>Minutes after apnea</th>
<th>CVS resuscitation</th>
<th>Evoked Recording</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:30 n=6</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>3-3:30 7</td>
<td>YES</td>
<td>Abnormal</td>
</tr>
<tr>
<td>4:00 6</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>
Cardiac resuscitation in the absence of brain activity can occur.
Apnea followed by pulseless trace
4:30-5:00

Progressive Hypoxia

Apnea

Flat EEG

No Evoked EEG

Pulseless

No Evoked EEG
With O2 and resusc
Ethical Questions

Does DCD adversely affect the patient/family experience?

Does the possibility of DCD adversely affect the nature of the provider patient relationship?

Does it change the likelihood/frequency of WLST? Does it adversely affect the decision-making?

Does it change the quality of the WLST process?
Errors

Errors of commission versus errors of omission

Is it difficult or impossible to have an ethical DCD program?
The incremental donor

The Deceased donor

- Prevents incremental premature deaths (3+)
- Replaces and prevents a living donation – at risk of morbidity and mortality

An error of omission or commission?
What type of disclosure is necessary?
A call for government accountability to achieve national self-sufficiency in organ donation and transplantation

Prof Francis L Delmonico MD, Beatriz Domínguez-Gil MD ε, Rafael Matesanz MD ε, Luc Noel MD d

Summary

Roughly 100 000 patients worldwide undergo organ transplantation annually, but many other patients remain on waiting lists. Transplantation rates vary substantially across countries. Affluent patients in nations with long waiting lists do not always wait for donations from within their own countries. Commercially driven transplantation, however, does not always ensure proper medical care of recipients or donors, and might lengthen waiting times for resident patients or increase the illegal and unethical purchase of organs from living donors. Governments should systematically address the needs of their countries according to a legal framework. Medical strategies to prevent end-stage organ failure must also be implemented. In view of the Madrid Resolution, the Declaration of Istanbul, and the 63rd World Health Assembly Resolution, a new paradigm of national self-sufficiency is needed. Each country or region should strive to provide a sufficient number of organs from within its own population, guided by WHO ethics principles.
Transplant tourism continues to take advantage of vulnerable people around the world.

Organs for Sale: Impoverished Bangladeshis Try to Sell Kidneys on Black Market, End Up Poor and Ill.
Meeting Support

International Advisory Committee
James Bernat, Alex Capron, Luc Noel, Frank Delmonico

Planning Committee
Sam Shemie (Meeting Chair), Andrew Baker, Jeanne Teitelbaum, Kimberly Young, Laura Hornby, Sylvia Torrance, Dorothy Strachan, Debra Cadelli

Expert Speakers
Sam Shemie, Eelco Wijdicks, Alex Capron, James Bernat, Charles Sprung, Luc Noel
Participation: 32 subject matter experts and delegates from Critical Care, Neurocritical care, Neurosurgery, Neurology and Emergency Medicine
International guideline development for the determination of death

Abstract  Introduction and Methods:  This report summarizes the results of the first phase in the development of international guidelines for death determination, focusing on the biology of death and the dying process, developed by an invitational forum of international content experts and representatives of a number of professional societies. Results and Conclusions: Precise terminology was developed in order to improve clarity in death discussion and debate. Critical events in the physiological sequences leading to definition of human death was developed: ‘the permanent loss of capacity for consciousness and all brainstem functions, as a consequence of permanent cessation of circulation or catastrophic brain injury’. In order to complete the project, in the next phase, a broader group of international stakeholders will develop clinical practice guidelines, based on comprehensive reviews and grading of the existing evidence.

Keywords  Death · Brain death · Circulatory death · Cardiac death ·
Thank You.