Why we need DCD

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Scripps Center for Organ Transplant
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No Disclosures
Why we need DCD

• History of DCD
• Early hopes
• Clinical outcomes
• Risks of overuse
• Ethical issues
History of Organ Donation in the US

• 1954
  – First successful US transplantation
  – Kidney from identical twin living donor

• 1962
  – First successful deceased donor kidney transplant
  – Early immunosuppressive therapy era

• 1978
  – Discovery of cyclosporine
History of Organ Donation in the US

• Early era:
  – Living donation
  – Donation following declaration of death based on irreversible cessation of circulatory and respiratory function
    *i.e. the options were living donor and DCD*
  – 1960s: Improved ICU care (mechanical ventilation/medical support)
  – Need for better criteria for determining death
Transplantation Legislation

• 1968 Uniform Anatomical Gift Act (UAGA)
  • Uniform legal environment for donation across the US
  • Gave adults the right to donate their bodies/organs upon their death “without subsequent veto by others.”

• 1981 Uniform Determination of Death Act
  • Codified existing common laws for determining death
  • “An individual who has sustained either irreversible cessation of circulatory and respiratory functions, or irreversible cessation of all functions of the brain, including the brain stem is dead.”
Transplantation Legislation

• 1984 National Organ Transplant Act (NOTA)
  • Established the OPTN (data reporting began in 1988)
  • Expanded the OPO system
  • Prohibited commercial transactions in organs

• 1987 Amended UAGA
  • Provided explicit priority to the intention of donors over that of their relatives
  • Prohibited the sale of body organs
  • Included required request provisions
Brain Death

• 1981 Uniform Determination of Death Act
  • “An individual who has sustained either irreversible cessation of circulatory and respiratory functions, or irreversible cessation of all functions of the brain, including the brain stem is dead.”

• Use of neurologic criteria for determination of brain death has gained wide medical legal, ethical and public acceptance in the US.
Pivotal time in organ transplantation

• 1950-70s
  – Limited immunosuppressive therapy options (steroids/azathioprine)
  – “DCD” donors

• 1978-81
  – Cyclosporine
  – UDDA: Brain Death soon becomes foundation for organ donation and benchmark for deceased donor transplant outcomes
Waiting List by Year
1989-2009

Source: United Network for Organ Sharing
WaitList for 2009 as of July 8, 09 and at end of year for other years.
“Narrowing the Gap”

- 2006 Institute of Medicine
  - Committee on Increasing Rates of Donation
  - Multifaceted approach
    - Systems support, consent, facilitating donation decisions, presumed consent, incentives, living donation
  - “Expanding the population of potential deceased donors”
IOM Reports on DCD

• 1997, 2000, 2006

• “emphasized the importance of developing the nation’s capabilities for donation after circulatory determination of death (DCDD*)... as there is an opportunity to significantly expand the number of organ donors”

• “One set of conservative estimates suggests that at least 22,000 of out-of-hospital cardiac arrest deaths annually in the [US] could be potential donors if important ethical and practical matters could be resolved”
Terminology

• DCDD
  – Donation after circulatory determination of death

• NHBD
  – “Non-heart-beating” donor

• DCD
  – Donation after cardiac death
  – Donation after circulatory death

• DNDD / DBD
  – Donation after neurologic determination of death
  – Donation after brain death
Terminology

• Maastricht Classification of DCD donors

  I  Brought in dead
  II  Unsuccessful resuscitation \{ uncontrolled
  III  Awaiting cardiac arrest \{ controlled
  IV  Cardiac arrest after brain-stem death
  V  Cardiac arrest in a hospital inpatient \{ uncontrolled

III - Patients in the ICU with non-survivable conditions who wish to donate after life-sustaining treatment is withdrawn

Increasing uncontrolled (I, II, V) donors has proved to be more challenging
Controlled DCD

• Expected withdrawal of care
• Allows family time to psychologically prepare
• Allows for determination of donation potential
  – Potential organ(s) and potential recipient(s)
  – Appropriate procurement team(s)
• Facilitates procurement process
  – Minimizes ischemic time to organs
Recommendations from IOM

• All OPOs and hospitals should have DCD protocols in place
• DCD should be considered part of the continuum of quality end-of-life care
• Openness and public education regarding DCD to ensure public trust
• Adherence to ethical principles
Ethical Principles of DCD

• Organ donors must be dead at time of organ removal
  – Determination of death after circulation *permanently (irreversibly)* lost
    • 1997/2001: 5 minute wait to ensure no auto-resuscitation
    • 2006: “At least 2 minutes of observation is required, and more than 5 minutes is not recommended.”

• Active euthanasia is absolutely prohibited

• Complete openness about policies and protocols

• Informed consent

• Respect for donor’s and family’s wishes

• Enhancing rates of organ donation is of value to society

• Safeguards against conflict of interest
Ensuring Success from Donation

**DBD**
- After neurologic determination of death:
  - Artificial cardiopulmonary support continues
  - Maintains normal circulation of oxygenated blood to preserve organ viability
  - Maximizes utilization of organs from the donor

**DCD**
- After circulatory determination of death:
  - Lack of blood flow and oxygenation leads to tissue ischemia / damage
  - Measures to ensure organ viability must be implemented as rapidly as possible
  - Duration of tolerable ischemia varies by organ
    - Kidney / Lung
    - Pancreas
    - Liver
    - Heart
Ensuring Success from Donation

• Every protocol / maneuver to enhance the DCD process and every intervention to the organ after procurement represents an effort to minimize ischemic time and enhance organ viability (and approximate DBD donation success)

• Better definition of when organ ischemia begins

• Better definition of graft function after DCD
Maneuvers to Enhance Outcomes

• Anticoagulants / thrombolytics (heparin / TPA)
• Organ perfusion solutions
• Organ perfusion / surgical techniques
• Re-intubation after death (lungs)
• ECMO
• Pulsatile organ perfusion after recovery
• Minimizing cold ischemic time of organ
• Proper recipient selection
  – Distance, appropriate for risk, anatomy, etc.
Defining Success with DCD

• Increase number of organs transplanted?
  – Should be additive (i.e. “expand the pool”)

• Maintain patient and graft survival rates?
  – Compared to organs from DBD
  – Compared to not getting transplanted
Defining Success with DCD

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  – Compared to not getting transplanted
# DCD Kidney Transplantation

## 2000–2004

<table>
<thead>
<tr>
<th>DCD and pumping type</th>
<th>Percentage of DGF</th>
<th>OR¹</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>NonDCD, not pumped</td>
<td>23.9</td>
<td>1.00</td>
<td>Ref</td>
</tr>
<tr>
<td>NonDCD, pumped</td>
<td>17.0</td>
<td>0.54</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>DCD, not pumped</td>
<td>42.3</td>
<td>2.52</td>
<td>&lt;0.0001</td>
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<tr>
<td>DCD, pumped</td>
<td>40.2</td>
<td>2.04</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

## Table 5: Summary of adjusted kidney graft survival results by donor type and delayed graft function (DGF)

<table>
<thead>
<tr>
<th>Donor type</th>
<th>N</th>
<th>Percentage of DGF</th>
<th>One-year survival %</th>
<th>Three-year survival %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>No DGF (%)</td>
<td>DGF (%)</td>
</tr>
<tr>
<td>SCD</td>
<td>29862</td>
<td>21</td>
<td>93</td>
<td>80</td>
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<tr>
<td>ECD (no DCD)</td>
<td>5424</td>
<td>33</td>
<td>88</td>
<td>72</td>
</tr>
<tr>
<td>DCD (no ECD)</td>
<td>1120</td>
<td>40</td>
<td>93</td>
<td>83</td>
</tr>
<tr>
<td>DCD + ECD</td>
<td>136</td>
<td>55</td>
<td>85</td>
<td>76</td>
</tr>
</tbody>
</table>

SCD = standard criteria donors; ECD = expanded criteria donors; DCD = donation after cardiac death.

Adjusted for recipient age, sex, race, preformed antibodies, end-stage renal disease, years of end-stage renal disease, HLA mismatch, year of transplant, previous transplant, transfusions and donor sex, race, diabetes and cold ischemia time.

Data from Scientific Registry of Transplant Recipients.
DCD Liver Transplantation

- Older recipients
- More HCC
- Lower MELD
- More complicated intraoperative course after reperfusion
- Higher costs
- Longer ICU stay
- Longer hospital stay
- More post-txp renal injury
- “High Risk” grafts

[Graph showing Adjusted Liver Graft Survival from 1/1/2000 to 10/31/2003]
DCD Liver Transplantation

- Seven UK transplant centers
- Recipients of DCD livers have 2x risk of graft loss and death at 3 years
- Results varied across centers
DCD Liver Transplantation

• 14% DCD
• Versus no transplant?
DCD Liver Transplantation

Comparative Effectiveness of Donation After Cardiac Death Versus Donation After Brain Death Liver Transplantation: Recognizing Who Can Benefit

Colleen L. Jay,¹ Anton I. Skaro,¹ Daniela P. Ladner,¹ Edward Wang,¹ Vadim Lyuksemburg,¹ Yaojen Chang,² Hongmei Xu,² Sandhya Talakokla,¹ Neeshar Parikh,¹ Jane L. Holf,²,³ Gordon B. Hazen,⁴ and Michael M. Abecassis¹
¹Comprehensive Transplant Center, ²Institute for Healthcare Studies, and ³Department of Pediatrics, Feinberg School of Medicine, Northwestern University, Chicago, IL; and ⁴McCormick School of Engineering and Applied Science, Northwestern University, Evanston IL

• Modelling study
  – MELD <15 and HCC: greater cost and reduced effectiveness
  – MELD 15-20: improved effectiveness but at increased cost per year of benefit (QALY)
  – MELD >20: improved effectiveness with less cost/QALY
Potential long-term costs of DCD

- Ischemic cholangiopathy in recipients
- “Lesser graft function” but with low MELD
- Poor quality of life
- No avenue for expedited re-transplantation
- Consequences of regulatory oversight
Defining Success with DCD

• Increase number of organs transplanted?
  – Should be additive

• Maintain patient and graft survival rates?
  – Compared to organs from DBD
    – Inferior to equal results
  – Compared to not getting transplanted
    – Better than no transplant in selected populations
Defining Success with DCD

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    – Inferior to equal
  – Compared to not getting transplanted
    – Better than no transplant in selected populations
The Netherlands experienced over 5 years
• a 21% decrease in DBD (159 to 126; -33)
• a 129% increase in DCD (41 to 94; +53)
• Not experienced across the US as a whole, but perhaps within certain OPOs—initiating DCD protocols, local/regional healthcare biases
• Number of donors v. Number of organs recovered v. Number of organs/donor
# National DSA Dashboard

### January - September 2014

<table>
<thead>
<tr>
<th>Category</th>
<th>Total US</th>
<th>National Statistics (Across 58 DSAs)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Number of Donors Recovered</td>
<td>6,383</td>
<td>110</td>
</tr>
<tr>
<td>SCD Donors</td>
<td>4,109</td>
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<tr>
<td>DCD Donors</td>
<td>961</td>
<td>17</td>
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<tr>
<td>ECD Donors</td>
<td>1,313</td>
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<tr>
<td>Percent of Donors Recovered</td>
<td>100%</td>
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<tr>
<td>SCD Donors</td>
<td>64.4%</td>
<td>65.2%</td>
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<tr>
<td>DCD Donors</td>
<td>15.1%</td>
<td>15.1%</td>
</tr>
<tr>
<td>ECD Donors</td>
<td>20.6%</td>
<td>19.7%</td>
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<tr>
<td>Organs Transplanted</td>
<td>19,382</td>
<td>334</td>
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<tr>
<td>Organs Transplanted Per Donor</td>
<td>3.04</td>
<td>2.93</td>
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<tr>
<td>Eligible Deaths Reported</td>
<td>6,888</td>
<td>118</td>
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<tr>
<td>Eligible Deaths - Consent Rate</td>
<td>75.8%</td>
<td>77.7%</td>
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<tr>
<td>Eligible Deaths - Conversion Rate</td>
<td>73.6%</td>
<td>75.3%</td>
</tr>
<tr>
<td>Collaborative - Conversion Rate</td>
<td>77.9%</td>
<td>79.3%</td>
</tr>
</tbody>
</table>

OPTN data as of 12/5/2014

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**Organ Txed Per Donor**

- National Goal: 3.75
- National Average: 3.04

**% DCD Donors**

- National Goal: 10%
- National Average: 15.1%

**Collaborative Conversion Rate**

- National Goal: 75%
- National Average: 77.90%
<table>
<thead>
<tr>
<th>January - September 2014</th>
<th>Selected DSA</th>
<th>National Statistics (Across 58 DSAs)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
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<tr>
<td>Number of Donors Recovered</td>
<td>71</td>
<td>110</td>
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<td>71</td>
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<tr>
<td>DCD Donors</td>
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<td>17</td>
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<tr>
<td>ECD Donors</td>
<td>14</td>
<td>23</td>
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<td>Percent of Donors Recovered</td>
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<td>3.04</td>
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<td>Eligible Deaths Reported</td>
<td>48</td>
<td>118</td>
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<tr>
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<td>77.7%</td>
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<td>75.3%</td>
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<tr>
<td>Collaborative - Conversion Rate</td>
<td>87.7%</td>
<td>79.3%</td>
</tr>
</tbody>
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OPTN data as of 12/5/2014
Number of Organs Recovered/Donor

*Lifesharing

- SCD
- EDC
- DCD
Pressures to Utilize DCD

• Need for more organs

• Mandated benchmark of 10% DCD donors

• Healthcare economics
Medscape Medical News

Futile Treatment Delays Care for Others Waiting for ICU Beds

Critical Care Medicine:

doi: 10.1097/CCM.0000000000000402
Feature Articles

The Opportunity Cost of Futile Treatment in the ICU*

Huynh, Thanh N. MD, MSHS¹; Kleerup, Eric C. MD¹; Raj, Prince P. MHA²; Wenger, Neil S. MD, MPH³,⁴,⁵
Case 1

• 27 year old male, GSW to the head 1 hour ago
  – Non-survivable injury per Neurosurgery
  – Hemodynamically stable in ED
  – Does not currently meet brain death criteria
  – ICU near capacity

• What do you do?
  – Recommend early withdrawal of care 2° futility
  – Transfer to ICU to see if progresses to brain death
Conclusions
(from the perspective of a transplant surgeon)

• Both DCD and DBD should be viewed as part of the continuum of end-of-life care
• The DCD organ supply is critical to addressing the ever-growing organ need
• DCD organs may bring added challenges compared to organs from DBD
• DCD should be an alternate pathway for donors who will not reach brain death, not an expedited means of getting to donation
Thank you

Questions?