DECISION MAKING IN HEART TRANSPLANTATION

Between a rock and a hard place.
Disclosures

• Heart transplant cardiologist

• Will do anything to increase donation

• Work for Transplant-Québec
What do you expect from your heart transplant?
Adult and Pediatric Heart Transplants

Kaplan-Meier Survival by Age Group
(Transplants: January 1982 – June 2013)

- Adult (N=100,806)
- Pediatric (N=11,384)

p < 0.0001

Median survival (years):
- Adult = 10.3; Conditional = 13.0
- Pediatric = 15.3; Conditional = 20.0
Adult Heart Transplants
Kaplan-Meier Survival Within 1 Year by Diagnosis
(Transplants: January 1982 – June 2013)

All pair-wise comparisons were significant at p < 0.01 except congenital vs. valvular.

For some retransplants, a diagnosis other than retransplant is reported, so the total number of retransplants may be greater.
Listing Criteria

- Status 4
  - Emergent, ECMO, Intubated, IABP, VAD complication
- Status 3.5
  - Very urgent, VAD not an option
- Status 3
  - Urgent, Patient on VAD
- Status 2
  - Hospitalized, on inotropes
- Status 1
  - Home
One Year Survival by era

- 1982-1991 (N=18,844) - 86%
- 1992-2001 (N=34,987) - 82%
- 2002-6/2005 (N=9,459) - 79%

Years
Survival of Canadian Status 4 Patients 2005-2007

- Number of Status 4 transplants
  - 43

- 30 day survival
  - 65% (93%)

- 1 year survival
  - 56% (86%)
Basically you expect

• A significant mortality
• Especially in the higher status patients
• 15 year survival, if you made it through the first year
• Now let’s hear that offer
Executive decision in the middle of the night

The ICU guy says this heart will recover
He is probably right, but....

- Time is not on our side
  - Donor stability
  - Families
- Planes, trains, automobiles
- Cardiologists
- Surgeons
If you think delayed graft function is bad in kidneys....
Imagine in hearts...

Adult Heart Transplants
Relative Incidence of Leading Causes of Death
(Deaths: January 1994 – June 2014)

Since only leading causes of death are shown, the sum of percentages for each time period is less than 100%.
Long distance dedication

“Keep your feet on the ground and keep reaching for the stars.”

- Casey Kasem

April 27, 1932 – June 15, 2014
Adult Heart Transplants (2008-6/2013)
Risk Factors For 1 Year Mortality with 95% Confidence Limits

Ischemia time

$p = 0.0007$

(N = 10,904)
Reducing ischemic times
Coronary disease
Adult Heart Transplants
Freedom from Cardiac Allograft Vasculopathy by Era
(Transplants: April 1994 – June 2013)

% Freedom from CAV

- Freedom from CAV 2004-6/2013 (N=15,370)

p < 0.0001

Years

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Adult Heart Transplants
Survival After Report of CAV Within 3 Years of Transplant and Survival In Patients Without CAV*
(Transplants: April 1994 – June 2013)

Survival (%)

Time after Report of CAV* (Years)

No CAV (N=21,977)  CAV (N=5,165)

p < 0.0001

* Patient survival for those without CAV within 3 years after transplant was conditioned on survival to median time of CAV development (518 days). Median time to CAV development is based on patients who developed CAV within 3 years of transplant.
Donor Age
Adult Heart Transplants (2008-6/2013)
Risk Factors For 1 Year Mortality with 95% Confidence Limits

Donor Age

\[ p < 0.0001 \]

(N = 10,904)
Adult Heart Transplants
Cumulative Incidence of EGF by Donor Age Group
(Transplants: January 2005 – December 2013)

All pair-wise comparisons were significant at p < 0.001.
Adult Heart Transplants
Kaplan-Meier Survival by Donor Age Group
(Transplants: January 1982 – June 2013)

Median survival (years):
0-10=10.6; 11-39=11.2; 40-59=9.4; 60+=6.4

All pair-wise comparisons were significant at p < 0.05 except 0-10 vs. 11-39 and 0-10 vs. 40-59.
Woman vs Man?
Adult Heart Transplants
Cumulative Incidence of EGF by Donor Gender
(Primary Transplants: January 2005 – December 2013)

- Female (N=9,447)
- Male (N=21,458)

p < 0.0001

Days

Incidence of EGF (%)
Adult Heart Transplants
Kaplan-Meier Survival by Donor/Recipient Gender
(Transplants: January 1982 – June 2013)

All pair-wise comparisons with Female/Male were significant at p < 0.0001. No other pair-wise comparisons were significant at p < 0.05.

Median survival (years):
Male/Male=10.8; Male/Female=11.0;
Female/Male=9.6; Female/Female=11.4
Pre-transplant mechanical support
Adult Heart Transplants

% of Patients Bridged with Mechanical Circulatory Support* by Year and Device Type

[Bar chart showing the percentage of patients bridged with different types of mechanical circulatory support (ECMO, VAD+ECMO, TAH, LVAD+RVAD, RVAD, LVAD) by year from 2005 to 2013.]

* LVAD, RVAD, TAH, ECMO

ISHLT 2015

JHLT. 2015 Oct; 34(10): 1244-1254
Adult Heart Transplants
Kaplan-Meier Survival by VAD usage
(Transplants: January 2009 – June 2013)

All pair-wise comparisons with ECMO were significant at p < 0.05.
No other pair-wise comparisons were significant at p < 0.05.

- LVAD Pulsatile (N=145)
- LVAD+RVAD Pulsatile (N=164)
- No LVAD, No Inotropes (N=2,998)
- LVAD Continuous (N=2,952)
- ECMO (N=72)
- No LVAD, Inotropes (N=3,335)
Adult Heart Transplants
Kaplan-Meier Survival by VAD usage Conditional on Survival to 6 Months (Transplants: January 1999 – June 2013)

No pair-wise comparisons were significant at p < 0.05.

- Pulsatile flow (N=3,041)
- ECMO (N=82)
- Continuous flow (N=3,327)
- No LVAD / No Inotropes (N=9,579)
- No LVAD / Inotropes (N=10,275)
VADs are useful, but...

HeartWare Recalls Ventricular Assist Device Pumps Due to Contamination Causing Electrical Issues

The FDA has identified this as a Class I recall, the most serious type of recall. Use of these devices may cause serious injuries or death.

Recalled Product:

- HeartWare Ventricular Assist Device (HVAD)
- Serial Numbers: All HVADs with serial numbers lower than HW25838
- Product Codes: 1103, 1104
- Manufacturing Dates: March 17, 2006 to June 27, 2016
- Devices Recalled in the U.S.: 105 units distributed nationwide
Recrutement cardiaque
Cardiac optimization in Québec 2007-2012

- 75 donors
- 27 transplants
- 4 deaths among recipients
Definitions

- Improved
  - EF Increase $> 10\%$
- Neutral
  - $-10\% \leq EF \leq +10\%$
- Deteriorated
  - EF Decrease $< 10\%$
Improved

- n = 27
- Δ EF: +17%
- Initial EF: 35% (25%-47.5%)
- Final EF: 52% (40%-65%)
- Transplants: 21
Neutral

- \( n = 40 \)
- \( \Delta \text{EF}: 0.2\% \)
- Initial EF: 34\% (12.5\% - 47.5\%)
- Final EF: 35\% (12.5\% - 56\%)
- Transplants: 8
# Comparaison

<table>
<thead>
<tr>
<th></th>
<th>Improved</th>
<th>Neutral</th>
<th>Deteriorated</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4 (h)</td>
<td>16.5</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Management (h)</td>
<td>33</td>
<td>31</td>
<td>30</td>
</tr>
<tr>
<td>Coeurs Greffés (%)</td>
<td>78</td>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>
## Impact on heart transplant

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donors</td>
<td>139</td>
<td>135</td>
<td>144</td>
<td>133</td>
<td>112</td>
<td>124</td>
<td>78</td>
</tr>
<tr>
<td># Hearts</td>
<td>38</td>
<td>36</td>
<td>47</td>
<td>51</td>
<td>39</td>
<td>38</td>
<td>29</td>
</tr>
<tr>
<td>% optimized</td>
<td>4%</td>
<td>8%</td>
<td>10%</td>
<td>14%</td>
<td>18%</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>% transplant from optimized</td>
<td>5%</td>
<td>10%</td>
<td>10%</td>
<td>16%</td>
<td>20%</td>
<td>13%</td>
<td></td>
</tr>
</tbody>
</table>
Survie

6 mois: 23/27  85%
One Year Survival by era

- 86%
- 82%
- 79%

Lines represent different eras:
- 1982-1991 (N=18,844)
- 1992-2001 (N=34,987)
- 2002-6/2005 (N=9,459)
## Influence on wait time

<table>
<thead>
<tr>
<th>Status</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>2</td>
<td>4</td>
<td>11</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Group O (%)</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>44</td>
<td>66</td>
</tr>
<tr>
<td>Wait time (days)</td>
<td>254</td>
<td>111</td>
<td>106</td>
<td>30</td>
<td>9</td>
</tr>
</tbody>
</table>
Cardiac optimization

- Has become an important source of hearts
- Is used safely in patients with advanced listing status