Hybrid Coronary Revascularization

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May 28, 2015
What do patients want?

- Least invasive option
- No sternotomy
- Quick return to normal activity
- Less risk of reintervention
- Lowest risk of stroke
The LIMA graft is the most durable treatment for the LAD
(long term survival advantage)

**LIMA to LAD Patency Rates**
- 95% at 5 years
- 93% at 10 years
- 92% at 15 years
DES versus SVG

- With HCR, DES replace SVG for lesions suitable for PCI

- Failure rate of SVG makes PCI with DES of non-LAD vessels viable alternative
Hybrid Coronary Revascularization (HCR)

PCI of Non-LAD targets

LIMA to LAD

Combines positive features of CABG and PCI
(minimally-invasive LIMA-LAD with DES to non-LAD vessels)
Hybrid Coronary Revascularization (HCR)

- FDA clearance in July 2004
- Based on multi-center trial data, single vessel LIMA-LAD procedure.
- daVinci may be employed to perform coronary anastomosis in cardiac revascularization with adjunctive mediastinotomy.
Hybrid Coronary Revascularization (HCR)

• 1. PLANNED use of PCI and CABG techniques for revasc.

• 2. Both stages of HCR procedures being performed within 60 days of each other, either during the same or different hospitalization, regardless of each procedure’s location.

• 3. Neither the CABG nor PCI portion of the procedure being performed for complications of either procedure.

• 4. Regardless of surgical approach (choice of incision).

• 5. Exclusion of cases in which patients present with AMI and undergo balloon angioplasty or PCI of the infarct related artery followed by multivessel CABG.
Combining Positive Features From Both

- FREEDOM FROM PROCEDURAL RISK AND INVASION
- DURABILITY (Freedom from re-intervention) AND SURVIVAL

**PCI**
- Less Invasion

**HYBRID**

**CABG**
- Higher Durability
Goals of HCR

- Treat proximal LAD with best treatment option available
- Minimize morbidity of CABG
  - Stroke
  - Sternal complications
  - Less ICU and ventilator times
  - Blood transfusion
- Provide comparable treatment for non-LAD vessels: **PCI with DES vs SVGs?**
- Meet demands of patient preferences for less invasive treatment options
Caveats of HCR - Essentials

- Sternal-sparing LIMA-LAD
- Cost-effective
- Comparable LIMA-LAD patency rate
- Comparable clinical outcomes
- ‘reasonable’ # of stents for non-LAD lesions
- ‘Heart team’ approach by cardiologists and surgeon
- Cardiologists and surgeons alike must be trained to think differently
Contraindications for HCR

- Non-graftable LAD
- Hemodynamically unstable patient
- Previous sternotomy or left thoracotomy
- BMI greater than 40
- Non-LAD disease not felt to be successfully treated with PCI
- Severe pulmonary disease with inability to tolerate single-lung ventilation
Sequence of HCR

- **General rule:** treat culprit lesion first
- **Two-stage procedures** (aka staged)
  - LIMA-LAD first
    - PCI during same or different hospitalization
  - PCI first
    - Usually non-LAD lesion critical
- **One-stage procedures** (aka simultaneous, concomitant)
  - Both done under same setting
DaVinci Robot
Surgical Technique
Port Placement
LIMA Takedown
Pericardiotomy and Target Identification
Distal LIMA division
Conduit and Target Vessel Preparation
LAD stabilizer
LAD preparation
Anastomosis
Postoperative Care

- No standard “sternotomy” restrictions
- Return to work per patient discretion
- No limitations
- Very satisfied patient and cardiologist
Postoperative Care
Clinical and Angiographic Results After Hybrid Coronary Revascularization

Michael E. Halkos, MD, MSc, Patrick F. Walker, BS, Thomas A. Vassiliades, MD, MBA, John S. Douglas, MD, Chandan Devireddy, MD, Robert A. Guyton, MD, Aloeke V. Finn, MD, S. Tanveer Rab, MD, John D. Puskas, MD, MS, and Henry A. Liberman, MD

Divisions of Cardiothoracic Surgery and Cardiology, Clinical Research Unit, Emory University School of Medicine, Atlanta, Georgia
Methods

- 300 consecutive HCR procedures from 2003-2012 (1/2 in last 3 years) on intent to treat basis

- All planned thoracoscopic or robotic-assisted LIMA-LAD grafting

- All LIMA-LAD grafting done via 3-4cm off-pump, sternal-sparing, non-rib-spreading thoracotomy
Results

- Incomplete revascularization
  - **24/300 (8.0%)** did not undergo PCI
- Stent type
  - DES used in **232/300 (77.3%)**
- Sequence of HCR
  - LIMA-LAD first in **192/300 (64%)**
  - PCI first in **56 (18.7%)**
  - Concomitant in **21 (7.0%)**
- Timing of HCR
  - **203/248 (81.8%)** had both procedures done during same hospitalization
# Clinical Outcomes

<table>
<thead>
<tr>
<th>30-Day Clinical Outcomes (MACE)</th>
<th>N = 300</th>
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</thead>
<tbody>
<tr>
<td>30-day mortality</td>
<td>4 (1.3%)</td>
</tr>
<tr>
<td>Stroke</td>
<td>3 (1.0%)</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>4 (1.3%)</td>
</tr>
<tr>
<td>Repeat revascularization</td>
<td>13 (4.3%)</td>
</tr>
<tr>
<td>Stent thrombosis</td>
<td>2 (0.7%)</td>
</tr>
</tbody>
</table>
Clinical Outcomes

- Postoperative atrial fibrillation: 62 (20.7%)
- Renal Failure: 7 (2.3%)
- Reexploration for bleeding: 6 (2.0%)
- Number of patients receiving blood products: 95 (31.7%)
- Superficial wound infections: 6 (2.0%)
- Mediastinitis: 0 (0%)
- Extubated in OR: 135 (45%)
- Chest tube drainage (24 hours, mL): 836 +/- 545
- Median ventilation time (hours, range): 1.9 (0 – 140)
- Prolonged ventilation (> 24 hrs): 16 (5.3%)
- Median ICU stay (days, range): 1 (0 – 11)
- Median hospital stay (days, range): 5 (2 – 76)

(N = 300)
Hybrid Coronary Revascularization Versus Off-Pump Coronary Artery Bypass Grafting for the Treatment of Multivessel Coronary Artery Disease

Michael E. Halkos, MD, Thomas A. Vassiliades, MD, MBA, John S. Douglas, MD, Douglas C. Morris, MD, S. Tanveer Rab, MD, Henry A. Liberman, MD, Habib Samady, MD, Patrick D. Kilgo, MS, Robert A. Guyton, MD, and John D. Puskas, MD

Division of Cardiothoracic Surgery and the Division of Cardiology, Emory University School of Medicine, Atlanta, Georgia
Methods

- 147 consecutive HCR procedures from 2003-2010 matched to contemporaneous patients with 8 preop variables (age, gender, EF, presence of diabetes, AMI, number of diseased vessels, left main disease, STS predicted risk of mortality).

- All planned thoracoscopic or robotic-assisted LIMA-LAD grafting.

- In-hospital major adverse events (MACCE) and need for repeat revascularization during followup were compared between groups.
Results

• Primary Endpoints:
  • Incidence of MACCE similar between groups (2.0%).

• Secondary Endpoint:
  • Midterm survival was similar between groups with estimated 5 year survival of 84.3% for OPCAB and 86.8% for HCR group.
### Clinical Outcomes

#### Table 4. Hospital Outcomes

<table>
<thead>
<tr>
<th>Hospital Outcomes</th>
<th>OPCAB (N = 588)</th>
<th>HCR (N = 147)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death (%)</td>
<td>5 (0.9)</td>
<td>1 (0.7)</td>
<td>0.84</td>
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<tr>
<td>Stroke (%)</td>
<td>4 (0.7)</td>
<td>1 (0.7)</td>
<td>1</td>
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<td>MI (%)</td>
<td>3 (0.5)</td>
<td>1 (0.7)</td>
<td>0.8</td>
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<tr>
<td>MACCE (death stroke, MI) (%)</td>
<td>12 (2.0)</td>
<td>3 (2.0)</td>
<td>1</td>
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<tr>
<td>Blood transfusion (%)</td>
<td>329 (56.0)</td>
<td>52 (35.4)</td>
<td>&lt;0.001</td>
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<tr>
<td>Renal failure (%)</td>
<td>15 (2.6)</td>
<td>4 (2.7)</td>
<td>0.91</td>
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<tr>
<td>Hospital length of stay</td>
<td>6.1 ± 4.7</td>
<td>6.6 ± 6.7</td>
<td>0.48</td>
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<tr>
<td>(mean ± SD)</td>
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<tr>
<td>Atrial fibrillation (%)</td>
<td>109 (18.5)</td>
<td>29 (20.1)</td>
<td>0.63</td>
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<td>Hours on ventilator</td>
<td>22.7 ± 89.5</td>
<td>17.0 ± 30.8</td>
<td>0.28</td>
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<tr>
<td>(mean ± SD)</td>
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<tr>
<td>Intensive care unit length</td>
<td>52.7 ± 87.8</td>
<td>57.4 ± 145</td>
<td>0.70</td>
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<tr>
<td>of stay (mean ± SD)</td>
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Clinical Outcomes

Fig 1. Kaplan-Meier 5-year survival estimates according to hybrid coronary revascularization (HCR) or off-pump coronary artery bypass grafting (OPCAB) (p = 0.61).
Trends in Coronary Surgery at Emory

Primary Isolated CAB via Sternotomy

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<tr>
<th>Year</th>
<th>Number</th>
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<td>2005</td>
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<td>2007</td>
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<td>2009</td>
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<td>2010</td>
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<tr>
<td>2011</td>
<td>529</td>
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<td>2012</td>
<td>479</td>
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Trends in Coronary Surgery at Emory

Minimally-invasive CAB

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<tbody>
<tr>
<td>Cases</td>
<td>30</td>
<td>61</td>
<td>75</td>
<td>60</td>
<td>51</td>
<td>110</td>
<td>113</td>
<td>111</td>
<td>120</td>
</tr>
</tbody>
</table>
Thank You

Questions?