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Cardiology Case Carousel

Lessons from a “Beast Weekend”

David Miranda
Cardiology Fellow

Cases to Review/Objectives

• 49 year old male playing Hockey
  – Peripheral VA ECMO
• 27 year old female, previously healthy – 31 week gravida. Presents with fever and malaise
  – Post-Cardiotomy Shock - Central VA ECMO
  – Review MHI Data on ECMO
• 39 year old female --36 weeks (third child). Presents with chest pain.
  – Can’t believe this all happen the same weekend!!
Case #1

Case 1... Beginning of the week

- 49 year old male no prior cardiac history.
- Very active. Playing Hockey with friends
- Drove himself to St. Francis Regional Medical Center.
• Security staff saw the patient pulling in the emergency parking lot.

• Car hit the curb – wedge in the snowbank

• Found unresponsive with seizure-like activity. Security breaks the window and take him to the ER.
St. Francis ED

- Ativan 1 mg for seizure
- K
- Ca Gluconate
- Amiodarone
- Epi
- Atropine
- Bicarb
- Magnesium
- ASA
- 8 shocks – Initial 200 J and subsequent at 300J
- Immediate transfer to Abbott for VA ECMO.
In the Cath Lab

• On arrival: Lucas in place. BP 90 systolic
  – Intubated, mildly sedated
  – Cool and clammy extremities

• Decision was to proceed with VA ECMO cannulation first
  – A Left femoral artery (17F)
  – V Right femoral vein (25F)
• IABP in Right femoral artery
Successful Thrombectomy

In the Cath Lab

• ASA, Ticagrelor loading dose
• Cangrelor load and infusion given.
• Vascular surgery called in the room.
  – Pt not properly sedated
• Hemodynamics
  – AO 86/60 – 67
  – Wedge: 18
  – CVP: 12
  – CO/CI: 10.55/5.48
  – Pump flow: 3.29 LPM
  – Sweep flow: 2.5 LPM
  – PA Sat: 84.6
Hospital Course

- Meeting with the wife.
- Echo with limited views on ECMO and EF of 10-20%.
- AKI
- Shock liver
- Dobutamine, Dopamine to enhance LV ejection fraction (PP was 15-20)

Follow up

- 48 hours post-event he was successfully decanulated.
- Following commands
- Renal function improving, liver function improving
- Troponin peak at 220
- Telemetry floor in 5 days
Outpatient

• AHF bridge clinic with Dr. Hryniewicz
  – Happens to be my continuity clinic

• EF 45-50%

• Appropriate guideline-directed medical therapy.
### Case Presentation

- 27 year old female, previously healthy – 31 week gravida. Transferred from St. Cloud Hospital with diagnosis of Endocarditis and severe AI.
- Social Hx: PA at the Medicine Clinic with Centra Care.
- FHx: No history of valvular disease, no premature CAD.
- SHx: (-)

### Physical Exam

- BP: 113/49, HR: 116, SpO2: 89%
- Mild distress, very anxious
- Bilateral crackles
- Tachycardic, holodiastolic murmur, no elevated JVP
- Gravid abdomen
- Otherwise unremarkable
Blood Pressure: 113/49

LVEDP: DBP – (4 x End-diastolic Velocity²)
LVEDP: 49 – 2.9² m/s
LVEDP: 18 mmHg

Holodiastolic flow reversal in descending aorta
Decision Making

- Consult MFM – Dr. Fairbanks
  - Could we proceed with maternal valve replacement surgery or should we delay for fetal benefit at this gestational age?
    - Betamethasome 12 mg IM
    - Prepare for C-Section
  - Antibiotics selection – any contraindication?
- Consult ID
Pre-Surgical Plan

- C-section first.
- AVR afterwards – small sternotomy
- Bioprosthetic vs mechanical valve
- Transfer to ICU, surgery early AM
In the OR

• Start with C-section. Immediate post delivery she goes into VF

• Attempt femoral cannulation for 30 min
  – Femoral cut down
  – Wire won’t go up
  – Norepinephrine, Dobutamine, Vasopressin

• Finally on ECMO

• Sternotomy

Surgical Details

• LV severely distented – LV vent placement
  – Right superior pulmonary vein – sucking 1.5 L/min and still distended.
  – Pulmonary artery vent added – additional 1 L/min of decompression.
  – Crossclamp - retrograde cannula into the coronary sinus and then cross clamped her aorta.
  – Immediately the heart shrunk
  – AVR
Surgical Details

- LV vent and crossclamp removed.
- NSR resumed spontaneously
- Wean off CPB – VA ECMO with LV Vent

VA ECMO with LV Vent
Hospital Course

• Decannulated by vascular surgery in 24 hours. Extubated in 48 hours.

• AVR 23 mm Magna Ease Tissue Valve

• Bicuspid Valve – Streptococcus mitis group
Follow up

• AHF bridge clinic on 2/28
  – Doing well. Finishing course of antibiotics
  – On guideline-directed medical therapy.
  – EF low normal

• Dr. Sun saw her on 3/13
  – Baby out of NICU.
  – Both mom and kid are in good health

Minneapolis Heart Institute Experience on Refractory Cardiogenic Shock (RCS) ECMO.

We performed a retrospective analysis of patients with RCS managed by ECMO at Abbott Northwestern January 2012 and May, 2016
**Demographics**

- Total of 129 patients were analyzed
- VA vs VV ECMO
- Overall death during hospitalization was 62%
- VA ECMO vs VV ECMO 64% vs 56%

### Table: Demographics

<table>
<thead>
<tr>
<th></th>
<th>All Patients (n=129)</th>
<th>VA (n=113)</th>
<th>VV (n=18)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean(SD)</td>
<td>55.8 ± 13.9</td>
<td>56.9 ± 13.4</td>
<td>49.2 ± 15.7</td>
<td>0.030</td>
</tr>
<tr>
<td>Male, (%)</td>
<td>81 (62.8)</td>
<td>71 (64.6)</td>
<td>10 (55.6)</td>
<td>0.49</td>
</tr>
<tr>
<td>White, (%)</td>
<td>115 (92.2)</td>
<td>100 (90.1)</td>
<td>15 (83.3)</td>
<td>0.39</td>
</tr>
<tr>
<td>Hx CAD, (%)</td>
<td>39 (30.1)</td>
<td>38 (34.2)</td>
<td>1 (5.6)</td>
<td>0.014</td>
</tr>
<tr>
<td>Previous MI, (%)</td>
<td>18 (14.0)</td>
<td>17 (15.3)</td>
<td>1 (5.6)</td>
<td>0.27</td>
</tr>
<tr>
<td>Hx CABG, (%)</td>
<td>17 (13.2)</td>
<td>17 (15.3)</td>
<td>0 (0.0)</td>
<td>0.075</td>
</tr>
<tr>
<td>Hx CHF, (%)</td>
<td>34 (26.4)</td>
<td>33 (29.7)</td>
<td>1 (5.6)</td>
<td>0.011</td>
</tr>
<tr>
<td>Hx DLD, (%)</td>
<td>58 (45.0)</td>
<td>54 (48.7)</td>
<td>4 (22.2)</td>
<td>0.037</td>
</tr>
<tr>
<td>Hx DM, (%)</td>
<td>33 (25.6)</td>
<td>29 (26.1)</td>
<td>4 (22.2)</td>
<td>0.73</td>
</tr>
<tr>
<td>Hx HTN, (%)</td>
<td>68 (52.7)</td>
<td>61 (53.6)</td>
<td>7 (38.9)</td>
<td>0.21</td>
</tr>
<tr>
<td>Hx Tobacco, (%)</td>
<td>70 (54.5)</td>
<td>58 (52.3)</td>
<td>12 (66.7)</td>
<td>0.26</td>
</tr>
<tr>
<td>Hx CVD, (%)</td>
<td>18 (14.0)</td>
<td>17 (15.3)</td>
<td>1 (5.6)</td>
<td>0.27</td>
</tr>
<tr>
<td>Hx COPD, (%)</td>
<td>15 (11.6)</td>
<td>11 (9.9)</td>
<td>4 (22.2)</td>
<td>0.13</td>
</tr>
<tr>
<td>Prior CVA, (%)</td>
<td>7 (5.4)</td>
<td>5 (4.5)</td>
<td>2 (11.1)</td>
<td>0.25</td>
</tr>
<tr>
<td>Hx PVD, (%)</td>
<td>7 (5.4)</td>
<td>6 (5.4)</td>
<td>1 (5.6)</td>
<td>0.98</td>
</tr>
<tr>
<td>VHD, (%)</td>
<td>23 (17.8)</td>
<td>21 (18.9)</td>
<td>2 (11.1)</td>
<td>0.42</td>
</tr>
<tr>
<td>Cardiac Arrest, (%)</td>
<td>46 (36.7)</td>
<td>45 (40.5)</td>
<td>1 (5.6)</td>
<td>0.004</td>
</tr>
<tr>
<td>LOS (days), median (25%, 75% percentile)</td>
<td>19 (11.1, 37)</td>
<td>19 (12, 37)</td>
<td>20 (17, 57)</td>
<td>0.43</td>
</tr>
<tr>
<td>Time On ECMO (Days), median (25%, 75% percentile)</td>
<td>6 (4.6)</td>
<td>5 (4.8)</td>
<td>10.5 (9.16)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bridge to LVAD, (%)</td>
<td>15 (11.6)</td>
<td>15 (13.5)</td>
<td>0 (0.0)</td>
<td>0.007</td>
</tr>
<tr>
<td>Death During Hospitalization, (%)</td>
<td>40 (31.0)</td>
<td>41 (36.5)</td>
<td>8 (44.4)</td>
<td>0.54</td>
</tr>
</tbody>
</table>

**Outcomes**

- VA ECMO vs VV ECMO 64% vs 56%

* Denotes significant difference between VA and VV ECMO
### Patient Outcomes by Etiology of Shock

<table>
<thead>
<tr>
<th>Etiology</th>
<th># of Patients</th>
<th>Age (mean ± SD)</th>
<th>Length of Stay</th>
<th>Time on ECMO</th>
<th>Death During Hospitalization</th>
<th>Bridged to LVAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMI</td>
<td>32</td>
<td>60.8 ± 8.4</td>
<td>16 (12.5, 31)</td>
<td>5 (4.6, 5)</td>
<td>8 (25.0)</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>Post-cardiomy peripheral ECMO</td>
<td>23</td>
<td>58.9 ± 14.7</td>
<td>23 (11, 44)</td>
<td>6 (4.8)</td>
<td>10 (43.5)</td>
<td>4 (17.4)</td>
</tr>
<tr>
<td>VV</td>
<td>19</td>
<td>49.5 ± 15.4</td>
<td>21 (17, 37)</td>
<td>10 (9, 16)*</td>
<td>8 (42.1)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Septic Shock</td>
<td>19</td>
<td>51.2 ± 12.9</td>
<td>25 (17, 37)</td>
<td>5 (4.7)</td>
<td>6 (31.6)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
<td>53.6 ± 13.1</td>
<td>12 (2, 20)</td>
<td>4 (0.8, 8)</td>
<td>7 (46.7)</td>
<td>1 (6.7)</td>
</tr>
<tr>
<td>Post-cardiomy central ECMO</td>
<td>7</td>
<td>67.4 ± 8.9</td>
<td>22 (10, 40)</td>
<td>7 (5, 15)</td>
<td>3 (42.6)</td>
<td>1 (14.3)</td>
</tr>
<tr>
<td>End-stage Ischemic Cardiomyopathy</td>
<td>6</td>
<td>54.7 ± 14.4</td>
<td>40 (35, 44)</td>
<td>7 (5, 11)</td>
<td>4 (66.7)</td>
<td>4 (66.7)</td>
</tr>
<tr>
<td>New Non-Ischemic Cardiomyopathy</td>
<td>5</td>
<td>47.0 ± 26.7</td>
<td>21 (15, 32)</td>
<td>7 (6, 7)</td>
<td>2 (40.0)</td>
<td>2 (40.0)</td>
</tr>
<tr>
<td>Pulmonary Embolism</td>
<td>3</td>
<td>47.8 ± 7.9</td>
<td>16 (0.26)</td>
<td>5 (4.6, 5)</td>
<td>1 (33.3)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

- Highest survival to discharge of 75% and one of the lowest median time on ECMO support of 5 days.
- Lowest survival to discharge of 33.3%.

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### Table 1: All VA ECMO Data

<table>
<thead>
<tr>
<th>Age (years), mean(SD)</th>
<th>ECMO Bridge to LVAD (n=15)</th>
<th>ECMO No Bridge to LVAD (n=66)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All VA ECMO (n=111)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male, (%)</td>
<td>71 (64.0)</td>
<td>11 (73.3)</td>
<td>0.42</td>
</tr>
<tr>
<td>White, (%)</td>
<td>100 (90.1)</td>
<td>13 (86.7)</td>
<td>0.63</td>
</tr>
<tr>
<td>Hx CAD, (%)</td>
<td>38 (34.2)</td>
<td>4 (26.7)</td>
<td>0.51</td>
</tr>
<tr>
<td>Previous MI, (%)</td>
<td>17 (15.3)</td>
<td>2 (13.3)</td>
<td>0.82</td>
</tr>
<tr>
<td>Hx CABG, (%)</td>
<td>17 (15.3)</td>
<td>1 (6.7)</td>
<td>0.32</td>
</tr>
<tr>
<td>Hx CHF, (%)</td>
<td>33 (29.7)</td>
<td>8 (53.3)</td>
<td>0.032</td>
</tr>
<tr>
<td>Hx DLD, (%)</td>
<td>54 (48.7)</td>
<td>6 (40.0)</td>
<td>0.47</td>
</tr>
<tr>
<td>Hx DM, (%)</td>
<td>29 (26.1)</td>
<td>3 (20.0)</td>
<td>0.56</td>
</tr>
<tr>
<td>Hx HTN, (%)</td>
<td>61 (55.0)</td>
<td>7 (46.7)</td>
<td>0.49</td>
</tr>
<tr>
<td>Hx Tobacco, (%)</td>
<td>58 (52.3)</td>
<td>9 (60.0)</td>
<td>0.52</td>
</tr>
<tr>
<td>Hx CKD, (%)</td>
<td>17 (15.3)</td>
<td>3 (20.0)</td>
<td>0.59</td>
</tr>
<tr>
<td>VHD, (%)</td>
<td>21 (18.9)</td>
<td>1 (6.7)</td>
<td>0.19</td>
</tr>
<tr>
<td>Chest Pain, (%)</td>
<td>44 (39.6)</td>
<td>7 (46.7)</td>
<td>0.55</td>
</tr>
<tr>
<td>SOB, (%)</td>
<td>58 (52.3)</td>
<td>8 (53.3)</td>
<td>0.98</td>
</tr>
<tr>
<td>Cardiac Arrest, (%)</td>
<td>45 (40.5)</td>
<td>5 (33.3)</td>
<td>0.54</td>
</tr>
<tr>
<td>Cannulation Central, (%)</td>
<td>8 (8.3)</td>
<td>1 (6.7)</td>
<td>0.80</td>
</tr>
<tr>
<td>Cannulation Peripheral, (%)</td>
<td>88 (91.7)</td>
<td>14 (93.3)</td>
<td></td>
</tr>
<tr>
<td>ECMO support time (Days), median (25th, 75th percentile)</td>
<td>5 (4.8)</td>
<td>7 (5.11)</td>
<td>5 (3.7)</td>
</tr>
<tr>
<td>LOS (days), median (25th, 75th percentile)</td>
<td>19 (12, 37)</td>
<td>42 (38, 63)</td>
<td>17 (12, 31)</td>
</tr>
</tbody>
</table>

Miranda DF, Hryniewicz K. ISHLT 2017

Abbott Northwestern Hospital

Abbott Northwestern Hospital
Case #3...Same Weekend

- 39 year old F. Currently a gestation of 36 weeks (third child). Presents with chest pain. “Something sitting on her chest”.
- Best stress test as outpatient?
- EF 45% - apical hypokinesis, anterior and anterolateral. No valve disease.
History

- PMHx: Hypothyroidism and obesity

- Family Hx: Father had his first MI at age 39 and died at 45 years of age from CV complications.

- Social Hx: No tobacco, no drugs. Husband in the room.

Physical Exam and Ancillary Data

- BP: 119/72, HR: 80s and regular. SpO2: 96%

- She is resting comfortable with mild chest pain.

- Normal JVP, RRR, no murmurs

- Troponin: 0.452
ECG on arrival

ECG 2 hours post arrival
Next Step?

- Extensive discussion with ED staff, patient, OB/GYN, MFM and Interventional cardiology decision was to take her to the cath lab

- Is radiation safe for the child?

- Heparin IV, ASA?
Immediate Questions we had

- PCI
- If PCI, BMS vs DES
- Clopidogrel, Ticagrelor or Prasugrel
- ASA OK?
- Is this SCAD?
- Statins, ACE Inhibitors
- Steroids?
• Schedule for C-Section in 4 weeks.
• BMS – minimum 2 weeks of DAPT, optimal 4 weeks.
• Restenosis rate
• Tentative plan:
  – 2 weeks of Clopidogrel
  – 1 week off
  – Then planned C/S
  – If early labor midline vertical skin incision (less bleeding)
Acute Myocardial Infarction Associated With Pregnancy

Arie Roth, MD,* Uri Elkayam, MD†
Tel Aviv, Israel; and Los Angeles, California

Acute myocardial infarction (AMI) during pregnancy or the early post-partum period is rare but has been shown to be associated with poor maternal as well as fetal outcome. Major changes in both diagnosis and treatment of AMI in the nonpregnant patient have led to improved outcome which may also affect pregnant patients. The purpose of this paper is to review available information related to the pathophysiology and clinical profile and provide recommendations for the diagnosis and management of AMI occurring during pregnancy and the early post-partum period. (J Am Coll Cardiol 2008;52:171-80) © 2008 by the American College of Cardiology Foundation

Table 1
Select Data in 103 Pregnancies Complicated by MIs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Antepartum Group (n = 46)</th>
<th>Peripartum Group (n = 22)</th>
<th>Post-Partum Group (n = 35)</th>
<th>All Groups (n = 103)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age ± SD, yrs</td>
<td>33 ± 6</td>
<td>32 ± 5</td>
<td>34 ± 5</td>
<td>33 ± 5</td>
</tr>
<tr>
<td>Age range, yrs</td>
<td>19-45</td>
<td>24-44</td>
<td>22-43</td>
<td>19-44</td>
</tr>
<tr>
<td>Anterior MI location, n/n (%)</td>
<td>28/43 (73)</td>
<td>16/22 (73)</td>
<td>27/35 (77)</td>
<td>73/94 (78)</td>
</tr>
<tr>
<td>Multifocal, n/n (%)</td>
<td>27/37 (73)</td>
<td>6/13 (46)</td>
<td>19/29 (66)</td>
<td>53/80 (66)</td>
</tr>
<tr>
<td>Hypertension, %</td>
<td>18</td>
<td>15</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Diabetes mellitus, %</td>
<td>13</td>
<td>10</td>
<td>11</td>
<td>11</td>
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<tr>
<td>Smoking, %</td>
<td>62</td>
<td>15</td>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>Family history of MI, %</td>
<td>33</td>
<td>6</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Hypertension, %</td>
<td>23</td>
<td>15</td>
<td>32</td>
<td>24</td>
</tr>
<tr>
<td>Pre-eclampsia, %</td>
<td>2</td>
<td>7</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Congestive heart failure or cardiogenic shock after MI, n (%)</td>
<td>2 (4)</td>
<td>3 (14)</td>
<td>4 (12)</td>
<td>9 (9)</td>
</tr>
<tr>
<td>Coronary anatomy available, n (%)</td>
<td>41 (98)</td>
<td>21 (96)</td>
<td>34 (97)</td>
<td>96 (96)</td>
</tr>
<tr>
<td>Stenosis</td>
<td>26 (54)</td>
<td>6 (27)</td>
<td>10 (29)</td>
<td>41 (41)</td>
</tr>
<tr>
<td>Dissection</td>
<td>8 (15)</td>
<td>11 (50)</td>
<td>12 (34)</td>
<td>28 (27)</td>
</tr>
<tr>
<td>Thrombus</td>
<td>2 (4)</td>
<td>1 (5)</td>
<td>5 (14)</td>
<td>8 (8)</td>
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<tr>
<td>Spasm</td>
<td>1 (2)</td>
<td>0</td>
<td>1 (3)</td>
<td>2 (2)</td>
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<tr>
<td>Embolus</td>
<td>2 (4)</td>
<td>0</td>
<td>0</td>
<td>2 (2)</td>
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<tr>
<td>Normal</td>
<td>6 (13)</td>
<td>3 (14)</td>
<td>4 (13)</td>
<td>13 (13)</td>
</tr>
<tr>
<td>Death, n (%)</td>
<td>4 (9)</td>
<td>4 (18)</td>
<td>3 (9)</td>
<td>11 (11)</td>
</tr>
<tr>
<td>Infant</td>
<td>5 (11)</td>
<td>1 (5)</td>
<td>—</td>
<td>6 (8)</td>
</tr>
</tbody>
</table>

**Manager of ACS during pregnancy**

Exceptions:
- ACE Inhibitors
- ARBs
- Statins
Due to adverse fetal effects.

Follow up

- Hospital course was unremarkable.
- No statin or ACEi per MFM.
  - LDL 190
- EF Normalized.
C-Section

• Schedule C-section 4 weeks later as planned.

• Hypotension in the 50s during spinal anesthesia and ECG changes.

• Cardiology consult

Thank you!

@dmiranda_md