Gastrointestinal Bleeding and LVAD: What’s a Few Units Between Friends?

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Disclosures

• Co-PI, MOMENTUM 3 Trial, Abbott Laboratories
GI Bleeding - Case

• 69 yr. old male with advanced heart failure. Undergoes uneventful implantation of an LVAD for Destination Therapy

• Discharged Home

• Presents for Outpatient Follow-up
  • Complains of malaise and that he “weak as a kitten”
  • Hemoglobin returns at 6.1 gm/dl
  • Notes very dark stools
ADVANCES IN QUALITY & OUTCOMES:
A Data Managers Meeting

Patient-related Factors
- Advanced age, renal failure, atrial fibrillation, CAD, diabetes, smoking, stroke
- Fracturing atrial or ventricular thrombus
- Abnormalities of blood flow: low CO, interventricular dysynchrony, dilated cardiac chambers, stasis
- Abnormalities of vessel wall (atherosclerosis, endothelial dysfunction)
- Abnormalities of blood constituents (hypercoagulability)

↑ Risk for arterial thrombosis, stroke and bleeding

Management-related Factors
- Inadequate antithrombotic therapy
- Infection
- Low pump speed
- Fatality
- Gaps in antithrombotic therapy

Pump-related Factors
- Very high shear stress
- Flow characteristics (length, diameter)
- Rotor-housing gaps
- Flow type
- Heat dissipation
- Rotor-exponential/acceleration spikes
- Surface-blood interaction

LVAD Implantation

Hemolysis

Gastrointestinal Bleeding

Thrombosis

Ischemic/Embolic & Hemorrhagic Stroke

Shah et al. Bleeding and Thrombosis in LVADs
The Journal of Heart and Lung Transplantation, Vol 36, No 11, November 2017
Adverse Event Rates (events/100 patient months)

<table>
<thead>
<tr>
<th>Adverse Event</th>
<th>1st 3 months post</th>
<th>3 – 12 months post</th>
<th>1st 3 mths vs 3-12 mnths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>events</td>
<td>rate</td>
<td>events</td>
</tr>
<tr>
<td>Bleeding</td>
<td>7810</td>
<td>16.24</td>
<td>4205</td>
</tr>
<tr>
<td>Cardiac/Vascular</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>54</td>
<td>0.11</td>
<td>31</td>
</tr>
<tr>
<td>Cardiac Arrhythmia</td>
<td>5026</td>
<td>10.45</td>
<td>1359</td>
</tr>
<tr>
<td>Pericardial Drainage</td>
<td>858</td>
<td>1.79</td>
<td>17</td>
</tr>
<tr>
<td>Arterial non-CNS Thrombosis</td>
<td>162</td>
<td>0.34</td>
<td>52</td>
</tr>
<tr>
<td>Venous thrombotic event</td>
<td>663</td>
<td>1.38</td>
<td>80</td>
</tr>
<tr>
<td>Infection</td>
<td>6552</td>
<td>13.63</td>
<td>4692</td>
</tr>
<tr>
<td>Stroke</td>
<td>1162</td>
<td>2.42</td>
<td>1154</td>
</tr>
<tr>
<td>Neurological: Non-Stroke</td>
<td>640</td>
<td>1.33</td>
<td>332</td>
</tr>
<tr>
<td>Renal Dysfunction</td>
<td>1687</td>
<td>3.51</td>
<td>495</td>
</tr>
<tr>
<td>Hepatic Dysfunction</td>
<td>453</td>
<td>0.94</td>
<td>167</td>
</tr>
<tr>
<td>Respiratory Failure</td>
<td>3212</td>
<td>6.68</td>
<td>567</td>
</tr>
<tr>
<td>Wound Dehiscence</td>
<td>194</td>
<td>0.40</td>
<td>58</td>
</tr>
<tr>
<td>Psychiatric Episode</td>
<td>751</td>
<td>1.56</td>
<td>279</td>
</tr>
<tr>
<td>Other SAE</td>
<td>5340</td>
<td>11.11</td>
<td>2170</td>
</tr>
<tr>
<td>Total burden</td>
<td>34564</td>
<td>71.89</td>
<td>15658</td>
</tr>
</tbody>
</table>

CNS, Central nervous System; LVAD, left ventricular assist device; BiVAD, biventricular assist device.

Table S3
Back to The Case

• Admitted to the Hospital
• Undergoes GI Evaluation
  • Upper Endoscopy: No ulcers or gastritis
  • Lower Endoscopy: Nothing seen
  • Capsule Endoscopy
Shah et al. Bleeding and Thrombosis in LVADs

The Journal of Heart and Lung Transplantation, Vol 36, No 11, November 2017
Heartmate 3 LVAD - Hemocompatibility
A Fully Magnetically Levitated Left Ventricular Assist Device — Final Report


ABSTRACT

BACKGROUND
In two interim analyses of this trial, patients with advanced heart failure who were treated with a fully magnetically levitated centrifugal-flow left ventricular assist device were less likely to have pump thrombosis or nondisabling stroke than were patients treated with a mechanical-bearing axial-flow left ventricular assist device.
### Figure 2. Principal Safety Outcomes in the Per-Protocol Population.

Relative risks of key adverse events, calculated on the basis of the number of events per patient-year in the centrifugal-flow pump group as compared with the axial-flow pump group, are shown. The per-protocol population included all patients who underwent randomization and received the assigned device. The relative risk of an adverse event favors the centrifugal-flow pump when the upper boundary of the 95% confidence interval is less than 1.0. Neither pump is favored when the 95% confidence interval spans the line of unity. The 95% confidence intervals have not been adjusted for multiplicity, and therefore inferences drawn from these intervals may not be reproducible. Narratives for suspected pump-thrombosis events in the centrifugal-flow pump group are provided in the Supplementary Appendix. P values for relative risk are derived from Poisson regression. Other neurologic events included transient ischemic attack, seizure, encephalopathy, and neurologic events other than stroke.
Back to Our Case

- Transfused 3 units of PRBCs – Hb now 11
- Aspirin is withdrawn and he is discharged
- 3 months later – He has a near syncopal event while out with family
- Arrives in the ED
- Hb is again 6.5 and he reports feeling not as good and dark stools again
Resource utilization and hospital readmission associated with gastrointestinal bleeding in patients with continuous-flow left ventricular assist devices

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Fig. 1 Diagnostic imaging studies performed during hospitalization for GIB. CT computed tomography, RBC red blood cell.
Table 3  Discharge and readmission characteristics

<table>
<thead>
<tr>
<th>Discharge/readmission characteristic</th>
<th>n (%) or median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease in INR target</td>
<td>16 (28.1)</td>
</tr>
<tr>
<td>Decrease in antiplatelet therapy</td>
<td></td>
</tr>
<tr>
<td>Discontinued</td>
<td>9 (15.8)</td>
</tr>
<tr>
<td>Dose reduced</td>
<td>9 (15.8)</td>
</tr>
<tr>
<td>Readmission for GIB</td>
<td></td>
</tr>
<tr>
<td>30 days</td>
<td>18 (32.7)</td>
</tr>
<tr>
<td>90 days</td>
<td>27 (52.9)</td>
</tr>
<tr>
<td>180 days</td>
<td>24 (52.2)</td>
</tr>
<tr>
<td>Time to readmission for GIB (days)</td>
<td>41 (14–90)</td>
</tr>
<tr>
<td>Readmission for any cause</td>
<td></td>
</tr>
<tr>
<td>30 days</td>
<td>21 (38.2)</td>
</tr>
<tr>
<td>90 days</td>
<td>32 (61.5)</td>
</tr>
<tr>
<td>180 days</td>
<td>33 (68.6)</td>
</tr>
</tbody>
</table>

GIB gastrointestinal bleeding, INR international normalized ratio. Readmission data calculated with censoring after death or heart transplantation but without censoring after first readmission.

https://doi.org/10.1007/s11239-018-1781-4
Patient Management/Anticoagulation

• Perhaps HM 3 and other future devices will allow for less intense anticoagulation

• Pharmacological Approaches
  • Octreotide
  • Thalidomide
  • High Dose Fish Oil (4 gm./day)
  • Angiopoietin -2 Blockers
How to Code These Patients

• In my opinion, although a chronic problem, this represents a new AE.
Adverse Events and QOL

• Adverse events, bleeding, lead to repeat hospitalizations
• Days in the hospital significantly detract from benefit from LVAD Therapy
• Interventions – Endoscopy, Angiography, etc. do not result in altering the pattern of recurrent GI bleeding
• INTERMACS needs to track these patients
Summary

• Adverse events – in particular bleeding – following LVAD are significant

• Strategies to reduce adverse events will include new technology (HM3, e.g.), perhaps less intense anticoagulation, and other pharmacology

• Understanding who are the recurrent GI bleed patients is important

• Reducing adverse events will prove key to offering LVADs to less sick populations