Study Highlights

**Hypothesis:** Biodebris in LVAD bend relief → external outflow graft compression

**Design:**
- Retrospective, single center
- Inc: LVAD + chest CTA (09-17)
- Measured degree of biodebris
- Different imaging criteria for HM2, HM3, HVAD

**Results: n = 110**
- Significant biodebris + graft narrowing
  - 15/93 HeartMate devices
  - 0/17 HVAD
- Outflow graft kinking
  - 4/93 HeartMate device
  - 0/17 HVAD

Central Figure

**Bend Relief Analysis**
- Biodebris at borders of outflow graft
- Luminal border within outflow graft defined by contrast edge
- HeartMate II:
  - Bend relief diameter 21 mm
  - Aggregate biodebris diameter >7 mm was further analyzed
- HeartMate 3:
  - Bend relief diameter 18 mm
  - Aggregate biodebris diameter >4 mm was further analyzed

**Free Cannula Analysis**
- Biodebris at borders of outflow graft
- Luminal border within outflow graft defined by contrast edge
- HeartMate models:
  - Aggregate biodebris diameter >10 mm or any outflow graft luminal narrowing to ≤14 mm was further analyzed
- HeartWare model:
  - Strain relief (no bend relief)
  - Aggregate biodebris diameter >4 mm or any outflow graft luminal narrowing to ≤10 mm was further analyzed

Reviewer’s Comments

Biodebris build up = under-recognized. ?? implications for HeartMate devices (HVAD: no fully encasing bend relief)

**Limitations:**
- Mostly HM2 (n=89)
- 5 CTAs excluded for poor quality → unclear criteria
- Selection bias; why did patients have CTAs?
- Different LVAD device designs → difficult to compare LVAD types
**Objective:** Validate echo-based HVAD protocol for estimating hemodynamic status

**Methods:**
- 35 HVAD patients (2014–2017)
- Correlated echo estimates with RHC

**Results:**
- Strong correlations between estimated and invasive pressures
  - RA ($r = 0.839$); LA ($r = 0.889$)
- Accurate for finding high pressures
  - RA (AUC = 0.94); LA (AUC = 0.91)
- High RAP correlated with:
  - High LAP
  - Death/hospitalization at 180d
- Hemodynamic profiles correlate with clinical risk

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**CENTRAL FIGURE: HVAD protocol**

**A**

<table>
<thead>
<tr>
<th>eRAP&lt;sub&gt;IVC&lt;/sub&gt;</th>
<th>eRAP&lt;sub&gt;HVFF&lt;/sub&gt;</th>
<th>eRAP&lt;sub&gt;Right E/e'&lt;/sub&gt;</th>
<th>eRAP&lt;sub&gt;Right E/e'&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm Hg IVC &gt; 21 mm without collapse</td>
<td>$V_s &lt; V_o$ and HVFF &lt; 45% or $V_s$ reverse</td>
<td>&gt; 8</td>
<td></td>
</tr>
<tr>
<td>15 mm Hg IVC &gt; 21 mm with &lt; 50% collapse</td>
<td>$V_s &lt; V_o$ and HVFF &lt; 55%</td>
<td>&gt; 6</td>
<td></td>
</tr>
<tr>
<td>10 mm Hg IVC &gt; 21 mm with &gt; 50% collapse OR IVC ≤ 21 mm with &lt; 50% collapse</td>
<td>$V_s &lt; V_o$ and HVFF &lt; 55%</td>
<td>&gt; 4</td>
<td></td>
</tr>
<tr>
<td>5 mm Hg IVC ≤ 21 mm with ≥ 50% collapse</td>
<td>$V_s &gt; V_o$</td>
<td>≤ 4</td>
<td></td>
</tr>
</tbody>
</table>

**B**

| eLAP<sub>E/A</sub> | eLAP<sub>MDI</sub> | eLAP<sub>septal E/e'</sub> | eLAP<sub>MR</sub> | eLAP<sub>MR</sub> |
|-------------------|-------------------|----------------------|----------------------|
| 20 mm Hg Restrictive (DT < 125 ms) | < 1.5 | ≥ 20 | 4/+4/+ | |
| 15 mm Hg Restrictive (DT 125-160 ms) | < 2 | ≥ 15 | 3+/4/+ | |
| 10 mm Hg Pseudonormal | > 2 | ≥ 8 | 2+/4/+ | |
| 5 mm Hg Impaired relaxation | > 3 | < 8 | 1+/4/+ | |

**Selected terms:** eRAP, estimated right atrial pressure; HVFF, hepatic venous systolic filling fraction; eLAP, estimated left atrial pressure; MDI, mitral deceleration index

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**REVIEWER’S COMMENTS**

First prospective study of non-invasive hemodynamic evaluation in HVADs

LVAD echo imaging quality often limited → use of Doppler techniques may be of value

Normal RA and LA filling pressures linked with better outcomes

**Limitations:**
- Single center
- Small derivation cohort, n=5
- Small validation cohort, n=35
- Generalizability limited (experience in image acquisition variable)

**STUDY HIGHLIGHTS**

**Background:**
- ↑ # of BTT-LVAD to OHT
- BTT-LVAD may assoc. w/ ↓post-OHT outcomes (small studies)
- No difference in listing status between BTT-LVAD vs. Med-Rx patients

**Design:**
- UNOS database query
- Compare outcomes of BTT-LVAD vs. Med-Rx patients
- Propensity-matching analysis

**CENTRAL FIGURE**

Risk factors: age>60, GFR<40, BMI>30
Low: 0 risk factor. Medium: 1. High: ≥2

Survival: high risk BTT << high risk Med-Rx pts

**OUTCOME:** BTT-LVAD ≈ ↑↑1-yr post-OHT mortality (90.5% vs. 92.8%, log-rank p<0.0001). Most deaths ≈ CV cause (PGD)

**REVIEWER’S COMMENTS**

**Values of study:**
- Large database
- Propensity matching
- Raised question: should BTT-LVAD pts be listed differently vs. Med-Rx pts

**Main limitations:**
- Retrospective
- Registry based -> Inconsistent data collection (PGD not universally defined)
- No validation cohort

**ESC Heart Failure.**

**STUDY HIGHLIGHTS**

**Purpose:** BP measured by Doppler vs. A-line (gold standard).

**Why:** BP control ≈ ↓CVA risk. Measure BP ≈ challenging in CF-LVAD.

**Design:** N=154; HM2=994 vs. HVAD=939, combined=1933 observations)

**Results:** A-line MAP vs. simultaneously measured Doppler opening pressure
- $r = 0.741$, $p<0.0001$
- Mean Error = 2.4 [7.5]
- Median error = 1 [-2,5]

Correlation: HM2 better than HVAD

**CENTRAL FIGURE**

**Doppler BP correlates better w/ A-line MAP** (87% between ±10mmHg) than A-line systolic BP (64% between ±10mmHg)

Though **Doppler BP** may _overestimate MAP_ as pulse pressure ↑, this is _not a significant clinical concern_, as overestimation is < 5 mmHg over a _wide range_ of pulse pressure (0-30 mmHg)

**EXTRAPOLATION LIMITED DUE TO:**
- Single center design
- Selection bias
- No HM3 included.

**REVIEWER’S COMMENTS**

Largest study on this subject to date.

Doppler opening pressure may be the _most accurate method_ for non-invasive BP measurement in CF-LVAD.

Future studies needed to show _consistency in clinical practice_.

Extrapolation limited due to:
- Single center design
- Selection bias
- No HM3 included.
Purpose: compare outcomes of patients with & without ICD or CRT-D (CIED-D).

Why: prior studies conflicting, some suggested no mortality benefits w/ ICD in CF-LVAD patients.

Design: Time-varying analysis using data from multicenter PCHF-VAD registry: N=448 (CIED-D=208 vs. NO-CIED-D=240).

Results: Risk reduction of all-cause mortality w/ CIED-D: 39% (Propensity score adjusted).

Other risk factors for all-cause death: ↑age, LVAD implant as redo surgery, ↑burden of ventricular arrhythmias (VA), pre-VAD vasopressor use.

HR for CV death: 0.65 (p=0.09)
HR for VA post VAD: 1.57 (p=0.06)

Extensive adjustments for potential confounders showing mortality benefit of CIED-D post LVAD.

Prospective randomized study needed.

Limitations:
- Retrospective registry-based study
- Lack of data on arrhythmias in controls (no-CIED-D)
- Disparities in CIED-D use in LVADs between Europe and USA limit extrapolation
- Association ≠ causality