Use of Temporary MCS for Management of Cardiogenic Shock Before and After the UNOS Donor Heart Allocation System Changes: Data from the Critical Care Cardiology Trials Network (CCCTN) Registry

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on behalf of the CCCTN Investigators

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Disclosures

• I have no personal disclosures
Background

• In Oct 2018, a revised UNOS donor heart allocation system was implemented in an effort to reduce waitlist mortality

• The revised system prioritizes patients supported with temporary MCS while awaiting heart transplant

• Whether the UNOS allocation system revision is associated with a shift in CS patient management is unknown
UNOS Donor Heart Allocation System Changes

**2006 System**
- **Status 1A**
  - VA-ECMO
  - Temp surgical LVAD
  - IABP
  - Impella
  - TandemHeart
  - MCS + mech failure

- **Status 1B**
  - Inotropes + PAC
  - Ambulatory LVAD
discretionary 30 days

- **Status 2**
  - Inotropes
  - Ambulatory LVAD

- **Status 3**
  - Inotropes + PAC
  - Ambulatory LVAD
discretionary 30 days

- **Status 4**
  - Inotropes
  - Ambulatory LVAD

- **Status 5**
  - Waiting for other organ(s)

- **Status 6**
  - Remainder

**2018 System**
- **Status 1**
  - VA-ECMO
  - Temp surgical LVAD
  - IABP
  - Impella
  - TandemHeart
  - MCS + mech failure

- **Status 2**
  - Temp surgical LVAD
  - IABP
  - Impella
  - TandemHeart
  - MCS + VT/VF

- **Status 3**
  - Inotropes + PAC
  - Ambulatory LVAD
discretionary 30 days

- **Status 4**
  - Inotropes
  - Ambulatory LVAD

- **Status 5**
  - Waiting for other organ(s)

- **Status 6**
  - Remainder

**Time to OHT**
- < 1 wk
- ~ 1 wk
- ~ 2-3 wks
- ~ 1+ mo

1 Cogswell et al. 2019 JHLT.
Objective

To determine if temporary MCS use in CICUs has changed in U.S transplant centers since the UNOS donor heart allocation system revision
CCCTN Registry

• CCCTN is an investigator-initiated, multicenter network of tertiary CICUs in North America coordinated by TIMI Study Group

• U.S. transplant centers (N = 7) and other CICUs (N = 7) contributed 2-month snapshots of consecutive medical CICU admissions between:
  – 9/2017-9/2018 (Pre-Revision)
  – 10/2018-9/2019 (Post-Revision)
Study Population

All cardiogenic shock (CS) (N = 722)

MCS often decided at time of PCI

AMI-CS (N = 221)

Non-AMI-CS (N = 501)

Primary hypothesis cohort

OHT candidacy often part of MCS decision

ADHF-CS (N = 384)

Pre-Revision (n=179) Post-Revision (n=205)

Other* CS (N = 117)

* Post-cardiotomy CS, severe valve disease, etc
Temporary MCS *

- IABP
- Impella axial flow pump
- TandemHeart PVAS
- VA-ECMO
- Non-dischargeable, surgical VAD

* Multiple devices hierarchical classification:
  Non-dischargeable, surgical VAD > VA-ECMO > Impella or TandemHeart > IABP
## Patient Characteristics

<table>
<thead>
<tr>
<th></th>
<th>U.S. Txplt Pre-Rev</th>
<th>U.S. Txplt Post-Rev</th>
<th>P-Value</th>
<th>Other CICUs Pre-Rev</th>
<th>Other CICUs Post-Rev</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>63 [54, 73]</td>
<td>61 [53, 68]</td>
<td>0.09</td>
<td>65 [58, 72]</td>
<td>63 [53, 74]</td>
<td>0.78</td>
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<tr>
<td>Coronary artery disease</td>
<td>41.3%</td>
<td>41.8%</td>
<td>0.93</td>
<td>47.2%</td>
<td>36.1%</td>
<td>0.20</td>
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<tr>
<td>Cardiac Arrest</td>
<td>16.7%</td>
<td>18.9%</td>
<td>0.65</td>
<td>18.9%</td>
<td>14.5%</td>
<td>0.50</td>
</tr>
<tr>
<td>Lactate (mmol/L)</td>
<td>3.4 [1.8, 6.5]</td>
<td>2.9 [1.7, 5.4]</td>
<td>0.27</td>
<td>2.7 [1.7, 6.9]</td>
<td>3.6 [1.8, 5.6]</td>
<td>0.52</td>
</tr>
<tr>
<td>SCr (mg/dL)</td>
<td>1.7 [1.4, 3.1]</td>
<td>2.1 [1.4, 3.1]</td>
<td>0.40</td>
<td>2.1 [1.6, 3.2]</td>
<td>2.2 [1.6, 3.4]</td>
<td>0.55</td>
</tr>
</tbody>
</table>
Temporary MCS Use in U.S. Transplant Centers & Other CICUs Pre- and Post-Revision of UNOS Allocation

<table>
<thead>
<tr>
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<th>Pre-Revision</th>
<th>Post-Revision</th>
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</thead>
<tbody>
<tr>
<td>U.S. Transplant Centers</td>
<td>25.4% (n=32)</td>
<td>42.6% (n=52)</td>
</tr>
<tr>
<td>Other CICUs</td>
<td>24.5% (n=13)</td>
<td>24.1% (n=20)</td>
</tr>
</tbody>
</table>

p = 0.004 for U.S. Transplant Centers, p = 0.95 for Other CICUs.
Temporary MCS Device Breakdown in U.S. Transplant Centers

Pre-Revision

Post-Revision

Percent of Admissions

- Centrimag
- VA-ECMO
- TandemHeart PVAS
- Impella Axial Flow Pump
- IABP
Falsification Analyses: Temporary MCS Use in Other Types of CS, Mech Vent, and RRT (U.S. Transplant Centers)

- **AMI-CS Mixed Shock**
  - Pre-Revision: 64.6%  
  - Post-Revision: 61.5%  
  - p = NS

- **Mech Vent Acute RRT**
  - Pre-Revision: 41.3%  
  - Post-Revision: 39.3%  
  - p = NS

- **Mixed Shock**
  - Pre-Revision: 21.6%  
  - Post-Revision: 21.2%  
  - p = NS

- **Acute RRT**
  - Pre-Revision: 16.7%  
  - Post-Revision: 18.9%  
  - p = NS
Limitations

• Sample size is limited

• Patients managed *exclusively* in surgical ICUs were not captured, which may affect VA-ECMO and CentriMag estimates
  – *Applies to both study periods, and thus shouldn’t influence the primary comparison*

• Transplant listing status not captured

• Unable to exclude an influence of secular temporal trends in MCS use
  – *Falsification analyses support robustness of primary findings*
In the year following the UNOS donor heart allocation system changes:

- Temporary MCS use ↑ significantly in ADHF-CS patients in U.S. transplant centers
- No change in temporary MCS among ADHF-CS patients in other CICUs or for other types of CS in U.S. transplant centers

Prioritization of temporary MCS in the revised UNOS system may have influenced management strategy for ADHF-CS at U.S. transplant centers

The impact of this shift on ADHF-CS patient outcomes and organ distribution should be evaluated
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