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Efficacy of miniaturized imacor trans-esophageal echocardiographic (TEE) probe in mechanical circulatory support.

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Application of the Miniaturized ImaCor Trans-Esophageal (TEE) Probe in Heart Transplant/Mechanical Cardiac Support Patients

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Introduction
In the surgical cardiac intensive care unit (ICU), therapeutic interventions often need to be done at the bedside, necessitating the need for a rapidly employable diagnostic tool for the cardiac intensivist. Cardiac function and volume status are critical components to patient care. Intravascular volume status is difficult to establish. Current modalities use indirect methods to gather data which can misdirect patient care. Conventional TTE and TEE are unsuitable for continuous and effective hemodynamic assessment.

ImaCor hTEE Probe
- A miniaturized TEE probe
- FDA approved
- Real time monitoring, able to use for 72 hours continuously.
- Allows direct visualization of intravascular volume and cardiac function
- No need of anesthesia or sedation.

Methods
IRB approved retrospective review of mechanical circulatory support patients and post heart transplant patients who had ImaCor TEE (hTEE) monitoring in ICU.

3 categories of intervention based on hTEE
Major: Tamponade, ECMO wean
Moderate: Device wean, inotrope management, fluid and hemodynamic management
Minor: ECMO cannula placement, other data

Results
N = 34 patients with hTEE monitoring
N = 21 post MCS or HTX
- Devices employed: 6
  - ECMO: 13
  - Post LVAD: 9
  - Impella: 3
  - Post HTX: 4
  - Pts with multiple: 6

<table>
<thead>
<tr>
<th>Pre-hTEE Dx</th>
<th>Post-hTEE Dx</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major (n=4, 19%)</td>
<td>Post Heart TX Hemodynamic Instability (n=1)</td>
<td>Tamponade (n=1) Operative Evacuation</td>
</tr>
<tr>
<td>ECMO (ECMO/VAD)</td>
<td>ECMO Wean (n=3)</td>
<td>Biventricular failure (n=3) Contraindication of LVAD, Withdraw of Care</td>
</tr>
<tr>
<td>Moderate (n=13, 62%)</td>
<td>Post Heart TX Hemodynamic Instability (n=6)</td>
<td>RV Failure (n=4) No Tamponade (n=2) Increased Fluids, Inotrope management, Medical management</td>
</tr>
<tr>
<td>ECMO (ECMO/VAD)</td>
<td>ECMO Wean (n=3)</td>
<td>Recoverable RV function (n=3) LVAD</td>
</tr>
<tr>
<td>Minor (n=4, 19%)</td>
<td>Post Heart TX Hemodynamic Instability (n=4)</td>
<td>No LV thrombus (n=1) Observation</td>
</tr>
<tr>
<td>ECMO (ECMO/VAD)</td>
<td>ECMO venous cannula Clot (n=1)</td>
<td>ECMA cannula malposition (n=2) Reposition</td>
</tr>
</tbody>
</table>

Financial
The cost difference between this new device and the traditional TEE is also significant ($900 USD vs $4600 USD).
Our institution saved in excess of $150,000 USD with the use of this device instead of traditional TEE.

ImaCor hTEE
- Device : $65,000
- Probe : $900
- TEE : Prof fee $380, Technical fee $3906
- Not including technician basic after hour call in charge of $225 per echo.

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Comparative Cost of Conventional TEE vs. hTEE for 5 studies in 72 hours

$0
$5,000
$10,000
$15,000
$20,000
$25,000
$30,000

<table>
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<tr>
<th>24 hrs</th>
<th>36 hrs</th>
<th>48 hrs</th>
<th>60 hrs</th>
<th>72 hrs</th>
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</thead>
<tbody>
<tr>
<td>TEE</td>
<td>hTEE</td>
<td>$0</td>
<td>$5,000</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

Conclusions
This device has proven to be an invaluable new adjunct in the ICU by allowing previously unobtainable continuous real time monitoring of MCS/Post HTX.

The use of the ImaCor hTEE probe provides the intensivist with timely important clinical data that improves patient care and is economically advantageous. Using serial hTEE data, the clinician can reliably make accurate decisions in regards to operative interventions.