May 3rd, 12:15 PM - 12:30 PM

Safety, Timing and Outcomes of Early Postoperative Cardiac Catheterization Following Congenital Heart Surgery

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Children's Mercy Hospital

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Safety, Timing, and Outcomes of Early Postoperative Cardiac Catheterization Following Congenital Heart Surgery

Children Mercy Research Days
May 3rd, 2022
Karoline Krzywda, MD
Primary Mentor: Kelly Tieves, DO
Disclosures

• None
Background

• Improvements in outcomes following congenital heart surgery
  • 3.1% discharge mortality
• There remains a high rate of morbidity and mortality
• Residual post operative lesions remain a common cause of morbidity and mortality
Background

- Different modalities for assessing residual lesions
  - Echo
    - Transthoracic
    - Transesophageal
  - CT Angio
  - Cardiac Catheterization
Background

• Early postoperative cardiac catheterizations (EPOCC) were considered high risk and often delayed, especially in patients on extracorporeal support (ECMO)

• Few studies have shown that it is safe to perform a catheterization within six weeks and even within 30 days of surgery.

• There remains significant institutional variability in timing and willingness to perform early post op catheterization.

• Lack of understanding on impact of EPOCC on hospital outcomes
Aim

• Describe our experience with EPOCC and its impact on patient management, length of stay, and duration of mechanical ventilatory support.
Methods

• Single center, retrospective cohort study
• Patients who underwent congenital heart surgery between January 1, 2010-December 31, 2019
• Cardiac catheterization within 30 days of surgery
• Exclusion:
  • Cath solely for left atrial decompression on ECMO
  • Endomyocardial biopsy
  • Routine balloon atrial septostomy post hybrid procedure
Methods: Variables Collected

- Patient demographic and clinical variables
- Timing of cardiac catheterization
- Indication for cardiac catheterization
- Complications of catheterization
- Duration of mechanical ventilation and ECMO support
- Duration of CICU and hospital length of stay
Methods

• Compared clinical variables between patients who underwent early and late EPOCC
  • Early EPOCC: Cardiac catheterization less than or equal to 72 hours post op
  • Late EPOCC: Cardiac catheterization greater than 72 hours post op
• Routine statistics using IBM SPSS, version 28
Results

2,542 Surgeries

167 caths within 30 days

26 patients excluded

141 patients for analysis
Results - Timing

• Median time from surgery to EPOCC was 10 days
  • Range 1-30 days
• Early EPOCC: 26 patients (18.4%)
• Late EPOCC: 115 patients (81.6%)
### Results - Patient Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Early EPOCC (≤72 hours)</th>
<th>Late EPOCC (&gt;72 hours)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Age, months</td>
<td>3.0</td>
<td>1.5</td>
<td>0.02*</td>
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<tr>
<td>Median Weight, kg</td>
<td>5.4</td>
<td>3.9</td>
<td>0.006*</td>
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<tr>
<td>Mechanical Ventilation prior to EPOCC</td>
<td>85%</td>
<td>63%</td>
<td>0.04*</td>
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<tr>
<td>Arrhythmia prior to EPOCC</td>
<td>30%</td>
<td>23%</td>
<td>0.40</td>
</tr>
<tr>
<td>Median Vasoactive Inotropic Score (VIS)</td>
<td>6.0</td>
<td>7.5</td>
<td>0.20</td>
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<tr>
<td>ECMO Prior to EPOCC</td>
<td>50%</td>
<td>19%</td>
<td>0.002*</td>
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</table>
## Results - Patient Characteristics

### RACHS-1 Score

<table>
<thead>
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<th>Early EPOCC (≤72 hours)</th>
<th>Late EPOCC (&gt;72 hours)</th>
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<td>4</td>
<td>4</td>
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<td>3</td>
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<tr>
<td>6</td>
<td>5</td>
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### STAT Category

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<th>Score</th>
<th>Early EPOCC (≤72 hours)</th>
<th>Late EPOCC (&gt;72 hours)</th>
</tr>
</thead>
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<td>6</td>
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<td>4</td>
<td>7</td>
<td>29</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>28</td>
</tr>
</tbody>
</table>

*p = 0.67*  
*p = 0.68*
Results - Interventions

- 70 patients (49.6%)
  - Early EPOCC (≤72 hours)
    - 9 patients (12.9%)
  - Late EPOCC (>72 hours)
    - 61 patients (87.1%)

- Most common location of intervention:
  - Aortic Arch (n=9)
    - Balloon dilation or stent placement
  - Atrial Septum (n=9)
    - Septostomy or stent placement
  - Collateral occlusion (n=9)
    - AP collateral or VV collateral
  - Combination procedures (n=13)

p = 0.09
Results - Complications

10 patients (7%)

- Early EPOCC (≤72 hours)
  - 6 patients (60%)
    - 5 interventional
    - 1 diagnostic
  - Late EPOCC (>72 hours)
    - 4 patients (40%)
    - 3 interventional
    - 1 diagnostic

• Complications occurred in:
  • 8 interventional caths
  • 2 diagnostic only caths

• Complication Types:
  • Arrhythmia/ST segment changes* (n=5)
  • Cardiac arrest requiring brief chest compressions (n=3)

• There were no deaths or strokes
## Results - Outcomes

<table>
<thead>
<tr>
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<th>Early EPOCC (≤72 hours)</th>
<th>Late EPOCC (&gt;72 hours)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CICU LOS (days)</strong></td>
<td>17.9</td>
<td>28.0</td>
<td>0.09</td>
</tr>
<tr>
<td><strong>Hospital LOS (days)</strong></td>
<td>29.6</td>
<td>49.9</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Mechanical Ventilation (days)</strong></td>
<td>11.4</td>
<td>13.4</td>
<td>0.11</td>
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<tr>
<td><strong>Duration of ECMO (days)</strong></td>
<td>7.0</td>
<td>15.0</td>
<td>0.06</td>
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</table>
Conclusions

• Low occurrence of complications with EPOCC
  • No serious complications such as death or stroke
• No significant differences in outcomes for CICU LOS, Hospital LOS, mechanical ventilation duration, or ECMO duration
  • Though the early EPOCC group did have shorter lengths of time for each of the variables
• Earlier catheterization may result in earlier intervention and a resultant decrease in extracorporeal support, ICU, and hospital length of stay.
Limitations

- Retrospective nature
- Small sample size
Future Directions

• Comparing imaging modalities and cath findings
  • Echo findings
  • CT angio

• Further analysis of subgroups
  • Class of congenital heart disease
Acknowledgements

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• Ryan Romans, MD