Open Chest Duration Following Congenital Cardiac Surgery Increases Risk for Surgical Site Infection

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BACKGROUND:
• Surgical site infections (SSI) following congenital heart surgery remain a significant source of morbidity and mortality with an estimated incidence as high as 11% [1]
• Delayed sternal closure (DSC) is often necessitated particularly in neonates to limit the deleterious effects of sternal closure on post-operative hemodynamics.
• While open chest resuscitation is an established risk factor for post-operative infection, the effect of open chest duration on infection remains less well-defined.

PURPOSE:
• Evaluate incidence of SSI in a single institution patient cohort with delayed versus primary chest closure.
• Determine the effect of open chest duration on the incidence of surgical site infection.

METHODS:
• Patients with SSI were identified within a prospectively collected institutional dataset and matched accordingly.
• Definition of infection was standardized prospectively among a multi-disciplinary team reviewing all potential SSI.
• Initiation of antibiotics for presumptive clinically-diagnosed infection
• Positive wound culture obtained by standardized technique
• Requirement for incisional re-opening/debridement as judged by surgeon
• Audits for all DSC patients were performed by retrospective chart review to confirm both SSI diagnosis and open chest duration.

RESULTS:
• 2582 operations were performed in 2492 patients:
  • 195 DSC cases/177 patients
  • 2387 primary chest closure (PCC) cases
  • 177 patients with DSC were evaluated to determine the association of open chest duration on the incidence of SSI.

DSC PATIENT CHARACTERISTICS:

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>SS (n=177)</th>
<th>Non-SS (n=2007)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.34 (0.21)</td>
<td>0.71 (0.27)</td>
<td>0.386</td>
</tr>
<tr>
<td>Female Gender</td>
<td>0.0 (0.50)</td>
<td>0.40 (0.50)</td>
<td>0.216</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>3.6 (1.7)</td>
<td>5.3 (1.6)</td>
<td>0.042</td>
</tr>
<tr>
<td>Apnoea/Vertigo</td>
<td>0.0 (0.50)</td>
<td>0.0 (0.50)</td>
<td>1.000</td>
</tr>
<tr>
<td>Calculation</td>
<td>21 (8)</td>
<td>72 (65)</td>
<td>0.001</td>
</tr>
<tr>
<td>Blood</td>
<td>3 (0.70)</td>
<td>9 (0.44)</td>
<td>0.668</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>9 (5.29)</td>
<td>47 (23.5)</td>
<td>0.007</td>
</tr>
<tr>
<td>Other</td>
<td>2 (1.24)</td>
<td>35 (17.9)</td>
<td>0.480</td>
</tr>
</tbody>
</table>

* Categorical variables are expressed as N (%). Continuous variables are expressed as mean with standard deviation.  
* P values less than 0.05 are bolded.

DSC PATIENT OPERATIVE DETAILS:

<table>
<thead>
<tr>
<th>Operative characteristics</th>
<th>SS (n=177)</th>
<th>Non-SS (n=2007)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonnomed procedure</td>
<td>42 (23.3)</td>
<td>45 (22.5)</td>
<td>0.667</td>
</tr>
<tr>
<td>TAPVC</td>
<td>3 (1.6)</td>
<td>13 (6.50)</td>
<td>0.153</td>
</tr>
<tr>
<td>AF</td>
<td>2 (1.1)</td>
<td>23 (1.15)</td>
<td>0.095</td>
</tr>
</tbody>
</table>

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* P values less than 0.05 are bolded.

DSC PATIENT OUTCOMES:

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>SS (n=177)</th>
<th>Non-SS (n=2007)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative mortality</td>
<td>2.1 (1.8)</td>
<td>26 (16.1)</td>
<td>0.030</td>
</tr>
<tr>
<td>Open chest duration</td>
<td>13.2 (9.8)</td>
<td>3.1 (2.8)</td>
<td>0.004</td>
</tr>
</tbody>
</table>

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* P values less than 0.05 are bolded.

DSC PATIENTS HAD A HIGHER INCIDENCE OF POST-OPERATIVE SSI COMPARED TO PCC PATIENTS

• The incidence of SSI within the cohort was 1.8% (n=47)
• DSC patients had significantly higher incidences of SSI (8.7%) than PCC patients (1.3%, p=.041, OR:6.7)
• Within the DSC cohort, patients that went on to develop SSI had a longer open chest duration (mean=14.2 days) when compared to non-SSI DSC patients (mean=4.31 days)

LIMITATIONS:
• All ages and operations were included.
• Antibiotic utilization was not audited.
• Continuous gram-positive coverage during open chest period is standardized at our institution.
• Day of SSI onset is subjective with limited standardization.

CONCLUSION:
• Incidence of SSI is higher in patients undergoing delayed sternal closure compared to patients with primary chest closure.
• Duration of post-operative open chest resuscitation is associated with an increased risk of post-operative SSI.
• Prolonged open chest duration represents a potentially modifiable risk factor for SSI predisposition.
• Daily post-operative assessment of candidacy for chest closure is supported to minimize the risk of SSI.

REFERENCE: