Background

SSIs occur following 5-8% of spinal fusion procedures. Typically, gram-negative organisms are found in early-onset SSIs within 30 days of the spinal procedure. However, modifiable risk factors and the correlation between specific types of organisms with different levels of spinal fusion procedures remain poorly understood. Thus, we sought to describe the current epidemiology of SSIs following spinal fusion procedures and to determine risk factors.

Methods

We performed a retrospective cohort study of all patients who underwent spinal fusion (identified by CPT codes), at Duke University Hospital from 1/1/2006 to 04/30/2012. SSIs were defined as those patients who required readmission and operative incision & drainage (I&D) procedure within 30 days of the primary spinal surgery. Descriptive statistics were used and logistic regression was performed to determine covariates that were associated with SSIs.

Results

We analyzed 4191 unique cases of spinal fusions. The median age of patients was 57 years of age and 55% were female. The most common type of spinal fusions were anterior cervical fusion (16%), 20% posterior lumbar fusion (988, 20%) and cervical posterior fusions (945, 19%). We found a total of 138 (2.8%) SSIs that required take back for I&D procedures; the procedures with the highest rate of SSIs were: posterior approach osteotomy (7.2%) and anterior-posterior deformity correction (7%). The spinal fusion approaches with the lowest rates of SSIs were anterior cervical (0.28%) and anterior thoracic (0.8%) approaches. Risk factors that were independently associated with SSIs included: diabetes, COPD, and using a posterior approach to surgery. Lower spinal fusion procedures (e.g. lumbosacral procedures) were significantly associated with SSIs due to gram-negative organisms.

Conclusion

Posterior approach to spinal fusion, diabetes and COPD were independent risk factors of SSIs following spinal fusion procedures; overall rate of SSI was 2.8%.

Aims

• To describe the prevalence of surgical site infections (SSIs) following spinal fusion procedures
• To determine risk factors for development of SSIs following spinal fusion procedures
• To test the hypothesis that surgical procedures on different spinal levels are associated with infections due to different organisms.

Study Methods

Results

138 SSIs were identified after 4918 spinal fusion procedures; overall rate of SSI was 2.8%

Multivariable Analysis for Risks of SSIs

<table>
<thead>
<tr>
<th>Organisms associated with SSIs</th>
<th>Infected</th>
<th>Uninfected</th>
<th>P-value</th>
<th>Adjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomonas 4%</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.coli 9%</td>
<td>12</td>
<td></td>
<td>&lt;0.01</td>
<td>3.0</td>
<td>1.9-4.6</td>
</tr>
<tr>
<td>S.aureus 43%</td>
<td>32</td>
<td></td>
<td>&lt;0.01</td>
<td>1.9</td>
<td>1.3-2.9</td>
</tr>
<tr>
<td>Enterococci 3%</td>
<td>58</td>
<td></td>
<td></td>
<td>1.2</td>
<td>0.6-2.6</td>
</tr>
<tr>
<td>OGNR 9%</td>
<td>81</td>
<td></td>
<td>&lt;0.01</td>
<td>1.4</td>
<td>1.0-2.2</td>
</tr>
<tr>
<td>OGPC 21%</td>
<td>140</td>
<td></td>
<td></td>
<td>1.3</td>
<td>0.9-1.8</td>
</tr>
<tr>
<td>CoNN 11%</td>
<td>102</td>
<td></td>
<td>&lt;0.01</td>
<td>1.2</td>
<td>0.7-2.2</td>
</tr>
</tbody>
</table>

SSIs Rate by Approach and Level of Surgery (%)

Low Segment Spinal Surgery are Associated with Gram-Negative Surgical Site Infections

Duke University Medical Center, Durham, NC.

LF Chen • M Roman • K Michael • T Hopkins • DJ Anderson • W Richardson • DJ Sexton

Key Points

• Overall rate of SSI after Spinal Fusion was 2.8%
• S. aureus was the most common organism (43%)
• Methicillin resistant S. aureus was detected in 9% of SSIs.
• The most common gram-negative organism causing SSIs was E. coli (9%) and Pseudomonas (4%) of all SSIs.
• Highest rate of SSIs were seen in Posterior-approach osteotomy (7.2%).
• Lowest rate of SSIs were seen in the following procedures:
  - Anterior cervical approach (0.28%)
  - Anterior thoracic approach (0.8%)
• Diabetes, COPD and Posterior spinal fusion surgery were independently associated with SSIs.
• High spinal level and posterior approach were associated with SSIs due to gram-positive organisms.

Strengths

• SSI definition in this study is highly specific.
• Large study of almost 5000 spinal fusion procedures.
• First to correlate spinal level with microbiological outcomes.

Limitations

• SSI definition not conventional NHSN standard
• SSIs occurring within 30 days of surgical procedure but do not have readmission or return to OR within 30 days of surgery.
• SSI definition using a posterior approach to surgery.
• Comorbidities defined by ICD-9 codes.

Conclusions

• Anterior approach spinal fusion procedures were associated with lower rates of SSIs compared with posterior approaches.
• Posterior approach was found to be an independent predictor of SSIs.
• Lower spinal level fusion surgery were associated with SSIs due to gram-negative SSIs.

Multivariable Analysis for Risks of Gram-Positive SSIs

<table>
<thead>
<tr>
<th>Approach</th>
<th>Adjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Spinal Level</td>
<td>0.52</td>
<td>0.30-0.91</td>
</tr>
<tr>
<td>Post. App.</td>
<td>4.2</td>
<td>1.4-13.2</td>
</tr>
</tbody>
</table>

Study Methods

Univariate & Multivariable Analysis of Risks for SSIs

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Infected</th>
<th>Uninfected</th>
<th>P-value</th>
<th>Adjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>38 (28%)</td>
<td>711 (15%)</td>
<td>&lt;0.01</td>
<td>1.9</td>
<td>1.3-2.9</td>
</tr>
<tr>
<td>COPD</td>
<td>10 (7%)</td>
<td>115 (2%)</td>
<td>&lt;0.01</td>
<td>2.52</td>
<td>1.2-5.1</td>
</tr>
<tr>
<td>CHF</td>
<td>10 (7%)</td>
<td>169 (4%)</td>
<td>0.02</td>
<td>1.1</td>
<td>0.5-2.3</td>
</tr>
<tr>
<td>CAD</td>
<td>28 (20%)</td>
<td>544 (11%)</td>
<td>&lt;0.01</td>
<td>1.3</td>
<td>0.8-2.2</td>
</tr>
<tr>
<td>Afib</td>
<td>14 (10%)</td>
<td>220 (5%)</td>
<td>&lt;0.01</td>
<td>1.8</td>
<td>0.9-3.3</td>
</tr>
<tr>
<td>PVD</td>
<td>9 (7%)</td>
<td>154 (3%)</td>
<td>0.03</td>
<td>1.2</td>
<td>0.6-2.6</td>
</tr>
<tr>
<td>Post.</td>
<td>109 (80%)</td>
<td>2754 (58%)</td>
<td>&lt;0.01</td>
<td>3.0</td>
<td>1.9-4.6</td>
</tr>
</tbody>
</table>

Conclusions

• Overall rate of SSI after Spinal Fusion was 2.8%
• S. aureus was the most common organism (43%)
• Methicillin resistant S. aureus was detected in 9% of SSIs.
• The most common gram-negative organism causing SSIs was E. coli (9%) and Pseudomonas (4%) of all SSIs.
• Highest rate of SSIs were seen in Posterior-approach osteotomy (7.2%).
• Lowest rate of SSIs were seen in the following procedures:
  - Anterior cervical approach (0.28%)
  - Anterior thoracic approach (0.8%)
• Diabetes, COPD and Posterior spinal fusion surgery were independently associated with SSIs.
• High spinal level and posterior approach were associated with SSIs due to gram-positive organisms.
• Low spinal level fusion spinal fusion procedures were specifically associated with gram-negative SSIs.

Strengths

• SSI definition in this study is highly specific.
• Large study of almost 5000 spinal fusion procedures.
• First to correlate spinal level with microbiological outcomes.

Limitations

• SSI definition not conventional NHSN standard
• SSIs occurring within 30 days of surgical procedure but do not have readmission or return to OR within 30 days of surgery.
• SSI definition using a posterior approach to surgery.
• Comorbidities defined by ICD-9 codes.

Conclusions

• Anterior approach spinal fusion procedures were associated with lower rates of SSIs compared with posterior approaches.
• Posterior approach was found to be an independent predictor of SSIs.
• Lower spinal level fusion surgery were associated with SSIs due to gram-negative SSIs.

Multivariable Analysis for Risks of Gram-Positive SSIs

<table>
<thead>
<tr>
<th>Approach</th>
<th>Adjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Spinal Level</td>
<td>0.52</td>
<td>0.30-0.91</td>
</tr>
<tr>
<td>Post. App.</td>
<td>4.2</td>
<td>1.4-13.2</td>
</tr>
</tbody>
</table>