Osteomyelitis is a complex clinical problem with a high recurrence rate¹ that can occur due to reinfection of the original organism or with a different pathogen². Previous studies suggest that gram positive cocci are the most common cause of bone infections³ and have identified possible risk factors for recurrence, repeated operations, post-traumatic osteomyelitis⁴,⁵, internal fixation at first stage bone exposure⁶, and Pseudomonas aeruginosa infection⁷. However, the comprehensiveness of these studies is lacking. The purpose of this study is to investigate the most common bacteria in traumatic osteomyelitis and infected nonunion cases and identify risk factors for recurrent osteomyelitis in these patients.

Introduction

Osteomyelitis is a complex clinical problem with a high recurrence rate¹ that can occur due to reinfection of the original organism or with a different pathogen². Previous studies suggest that gram positive cocci are the most common cause of bone infections³ and have identified possible risk factors for recurrence, repeated operations, post-traumatic osteomyelitis⁴,⁵, internal fixation at first stage bone exposure⁶, and Pseudomonas aeruginosa infection⁷. However, the comprehensiveness of these studies is lacking. The purpose of this study is to investigate the most common bacteria in traumatic osteomyelitis and infected nonunion cases and identify risk factors for recurrent osteomyelitis in these patients.

Methods

A retrospective analysis of 1825 patient charts following fracture fixation with a diagnosis of an infected non-union or osteomyelitis was conducted from 2006-2018. Included patients must have had a CRP, ESR, or CBC measured within 5 days of diagnosis, must have undergone surgical intervention at the University of Colorado Hospital, and had documented follow-up for >1 year, and have complete documentation in their chart including information on past diagnoses and treatment for osteomyelitis.

Statistical Methods: We performed a descriptive analysis for both nominal and categorical variables and a multivariate analysis for risk factors for recurrent osteomyelitis, including demographic data, comorbidities, location of osteomyelitis, microbiologic data, and surgical outcome data. Statistical analysis with linear regression was performed using JMPSAS software.

Results

141 patients were included with a mean age of 53.6± 14.8 years old, 69.5% of them being male – Table 1. The most common comorbidities were tobacco use (49.6%) and hypertension (49.6%)

Table 2. The most common locations of osteomyelitis were the tibia/fibula (20.6%) and spine (20.6%). The most common type of bacteria isolated in these patients with infected nonunion were MSSA (42.6%) and MRSA (14.9%).

Table 3. The top antibiotics administered were Vancomycin (45.4%), Doxycycline (16.3%), and Daptomycin (14.2%). The top complications were wound healing problems (37.5%) and recurrent infection (38.3%).

Table 5. Odds of developing recurrent osteomyelitis are shown in Table 5. At a p = 0.05, variables with a statistically significant positive effect on odds of developing recurrent osteomyelitis were days until infection (p = 0.025), elevated hematocrit (p = 0.016), and # of complications (p = 0.013). Elevated hemoglobin (p = 0.021) and elevated CRP (p = 0.0017) both had a negative effect on the odds of developing recurrent osteomyelitis.

Table 6. The odds of recurrent osteomyelitis were higher if the patient had a different pathogen.

<table>
<thead>
<tr>
<th>Complication</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>1.408</td>
<td>0.006-24.039</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1.408</td>
<td>0.006-24.039</td>
</tr>
<tr>
<td>Wound Healing Problems</td>
<td>1.408</td>
<td>0.006-24.039</td>
</tr>
<tr>
<td>Recurrent Infection</td>
<td>1.408</td>
<td>0.006-24.039</td>
</tr>
<tr>
<td>CRP</td>
<td>1.805</td>
<td>0.312-10.6</td>
</tr>
<tr>
<td>CRP</td>
<td>1.251</td>
<td>0.996-1.631</td>
</tr>
</tbody>
</table>

Limitations

Limiting factors of this study are largely due to strict inclusion criteria. Of the 1,825 charts originally returned by the ICD codes, only 141 met all inclusion criteria. A significant contributing factor was the high number of diabetic foot wounds who went on to develop osteomyelitis without evidence of fracture and were subsequently excluded.

Conclusions

- Gram positive cocci were the most prevalent causal organisms.
- The most common complications by far were wound healing problems and recurrent infection.
- Factors for increased risk of recurrent osteomyelitis: more days post-fracture until infection, elevated hematocrit, and increased number of complications.
- Factors for decreased risk of recurrent osteomyelitis: elevated hemoglobin and elevated CRP.
- Potential for future streamlined treatment protocol:
  - abx complications to watch for: risk of recurrence

References


Conflicts of Interest: No disclosures