Short Communication

Mediastinitis after Cardiac Surgery in Madani Heart Center, Tabriz, Iran

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SUMMARY: Post-sternotomy infections are a kind of nosocomial infection involving the mediastinum space and the sternum, with a high morbidity and mortality rate. The present study was carried out to identify the incidence of mediastinitis following cardiac surgery and the most common risk factors. Cardic patients undergoing surgery were studied for suspicious mediastinitis infection at the Madani Heart Center, Tabriz, Iran from 2004 to 2006. The most common isolated agents included the coagulase-negative staphylococci, Staphylococcus aureus, Pseudomonas aeruginosa, and Enterobacter spp. Incidence of postoperative mediastinitis after cardiac surgery was 1.2%. The mortality rate of postoperative mediastinitis was high (34.3%). Wound infection, especially mediastinitis following cardiac surgery, is rare but can be life-threatening. The most important step in the management of wound infections is prevention, and preventive measures could be strengthened by identifying the risk factors.

The number of patients undergoing coronary artery bypass grafting (CABG) surgery worldwide has increased (1). The site of surgery is the most common site of nosocomial infection. Surgical site infection is a complication of cardiac surgery that generates increased costs and longer hospital stays in comparison with patients without this complication (2). Infections range from superficial involvement of the wound to deeper soft tissue infection such as sternal osteomyelitis and mediastinitis (3). Deep sternal wound infections including mediastinitis are frequent complications of cardiac surgery and are associated with significant morbidity, prolonged hospitalization and high mortality (4). Postsurgical mediastinitis (PSM) is a life-threatening complication, and optimal treatment is based on early and accurate diagnosis (5). The onset and clinical course of infection are rapid, and sepsis is a major presenting symptom (6). The diagnosis of PSM among patients with sternal wound complication after cardiac surgery is sometimes difficult since fever, elevated C reactive protein levels and chest pain can be caused by a general inflammatory reaction to the operative trauma and/or sternal dehiscence without infection (7). Recent studies have shown a downward trend in the incidence of wound infection after cardiac surgery, ranging from 0.1 to 8.5% (8-10). Most cases are due to Gram-positive organisms such as Staphylococcus aureus, though most series also include some cases due to Gram-negative bacteria and other microorganisms (1,3,7). It is generally believed that multiple factors contribute to the occurrence of mediastinitis (11). Risk factors commonly associated with mediastinitis include obesity (4,11), diabetes mellitus (4,12), chronic obstructive pulmonary disease (COPD) (13), longer cardiopulmonary bypass time (7), and blood transfusion (14). The aim of this case-control study was to assess etiological agents and rates of risk factors for mediastinitis after cardiac surgery at the 170-bed university-affiliated Madani Heart Hospital, Tabriz, Iran.

Eligible patients were adults >18 years of age who had undergone median sternotomy for CABG, valve repair and/or replacement or both, during the 2004 - 2006 period. Cases were defined as eligible patients who received a diagnosis of PSM using standardized definitions. Cases were identified through standard active surveillance by surgeons, infectious disease physicians and infection control practitioners, as well as through laboratory reports of positive results of cultures of sternal wound specimens (4). The final diagnosis was made on the basis of a positive bacterial culture from the mediastinum according to standard methods (5,15). Controls were chosen among eligible patients with no evidence of PSM by standard surveillance and chart review. Controls were matched to cases by date of procedure, surgeon, and age. Fourteen possible risk factors were analyzed, including age, weight, sex, redo operations, length of stay in hospital before surgery, blood transfusion, diabetes mellitus, recent myocardial infarction, cigarette smoking, congestive heart failure (CHF), COPD, anesthesia time, foreign body, and hypertension. The risk factors for infection were assessed by univariate analysis. The chosen level of significance was 5%. All analyses were conducted using SPSS software, version 14 (SPSS Inc., Chicago, Ill., USA).

The mean age of the study subjects was 59 ± 10 years. The surgical procedures among our study population were as follows: CABG (76%), valve procedure (23.4%), or combination of CABG and valve procedure and other procedures (0.6%). In two large series, sternal wound infectious complications occurred in 0.16 to 2.2% (11,16), but rates as high as 8% have also been reported (17). In our center, post surgical infection was 9%. Post operative deep sternal wound infection occurred in 1.2% of patients who underwent cardiac surgery using a median sternotomy. The prognosis of soft tissue infections was better than that of PSM. The variance in reported incidence levels may depend on differences in the definition of infection and surveillance and follow-up methods as well as the selection of patients accepted for surgery (18). In many studies on PSM, there is a requirement for a positive bacteriological culture in addition to observable signs and symptoms (19,20). This requirement might serve to limit diagnostic accuracy, as even in cases with undoubted signs of infection,
bacteriological cultures can return negative results due to antibiotics given to the patients pre- or intra-operatively (21). To ensure a microbiologically correct diagnosis, both with respect to the identification of infective cases among patients lacking clinical symptoms of infection and with respect to correct identification of the primary pathogen, we found that multiple samples before administration of antibiotics should be used.

Of 23 bacterial isolates, 5 were coagulase-negative staphylococci (21.7%), 4 were Staphylococcus aureus (13.04%), 3 each were Pseudomonas aeruginosa (13.04%) and Enterobacter spp. (13.04%), 2 each were Serratia marcescens (8.69%) and Klebsiella pneumoniae (8.69%), and 1 each were non-fermentative Gram-negative bacilli (4.34%), Hafnia alvei (4.34%), Enterococcus spp. (4.34%), and fungi (4.34%). Polymicrobial infections were observed in 2 cases. In this study, 59% of the cases were due to Gram-negative bacteria and 41% due to Gram-positive bacteria. The major group of bacteria isolated in this study was Gram-negative rods, for which the typical pathogenic mechanisms could be entirely different from those of staphylococci. Gardlund et al. argued that if Gram-negative mediastinitis is a major problem in an institution, strict enforcement of hygienic barrier routines that contribute to the infection rate. Weight reduction regimen, shortening of the operating time and length of stay in hospital, and identifying and promptly treating the high-risk groups will help in further reducing the incidence of wound infection in cardiac surgery.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Case (n = 23)</th>
<th>Control (n = 1,804)</th>
<th>OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean blood transfusion units</td>
<td>5</td>
<td>1</td>
<td>1.7 (1.0-2.9)</td>
<td>0.04</td>
</tr>
<tr>
<td>Mean anesthesia time (h)</td>
<td>6</td>
<td>6</td>
<td>1.0 (0.8-2.6)</td>
<td>0.45</td>
</tr>
<tr>
<td>Age more than 60 (y)</td>
<td>13</td>
<td>920</td>
<td>1.2 (0.5-2.8)</td>
<td>0.60</td>
</tr>
<tr>
<td>Obesity</td>
<td>13</td>
<td>609</td>
<td>3.7 (1.3-7.6)</td>
<td>0.02</td>
</tr>
<tr>
<td>Redo</td>
<td>4</td>
<td>212</td>
<td>1.5 (0.5-4.6)</td>
<td>0.001</td>
</tr>
<tr>
<td>Diabetes</td>
<td>12</td>
<td>196</td>
<td>2.5 (1.1-5.5)</td>
<td>0.001</td>
</tr>
<tr>
<td>Recent myocardial infraction</td>
<td>3</td>
<td>365</td>
<td>0.5 (0.1-2.0)</td>
<td>0.60</td>
</tr>
<tr>
<td>Smoker</td>
<td>7</td>
<td>829</td>
<td>0.5 (0.2-1.2)</td>
<td>0.10</td>
</tr>
<tr>
<td>Foreign body</td>
<td>11</td>
<td>257</td>
<td>0.53 (0.1-2.9)</td>
<td>0.48</td>
</tr>
<tr>
<td>CHF</td>
<td>5</td>
<td>146</td>
<td>3.1 (1.1-8.6)</td>
<td>0.03</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>19</td>
<td>1,040</td>
<td>3.4 (1.1-10.2)</td>
<td>0.01</td>
</tr>
<tr>
<td>Hypertension</td>
<td>9</td>
<td>659</td>
<td>1.1 (0.4-2.5)</td>
<td>0.80</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>13</td>
<td>1,045</td>
<td>0.9 (0.4-2.1)</td>
<td>1.00</td>
</tr>
<tr>
<td>COPD</td>
<td>2</td>
<td>174</td>
<td>2.0 (0.3-6.3)</td>
<td>0.35</td>
</tr>
</tbody>
</table>

(1): Hospitalization more than 3 days before surgery.
CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; OR, odd ratio; CI, confidence interval.

The mortality rate for mediastinitis in this study was high (34.3%). Mortality rates were greater in female patients and older patients. The mortality rate due to Gram-negative bacteria was higher than that of Gram-positive bacteria. Almost all cases had more than one of the known risk factors for sternal wound infection (Table 1). Fifteen percent of patients received high-dose treatment with corticosteroids before undergoing the operation. Patients with mediastinitis were more likely than the control subjects to have received more than 4 units of packed cells. The median interval between surgery and the onset of infectious signs was 14 days. In our study, obesity, diabetes, re-exploration, CHF, hospitalization more than 3 days before surgery, and transfusion of blood were associated with mediastinitis (P < 0.05). Diez et al. reported that the risk for mediastinitis increases by 3% per additional kilogram body mass per square meter body surface (28). On the other hand, several studies also have demonstrated that obesity may not be a risk factor for significant adverse outcome after cardiac surgery (29,30). Reoperation, mainly as acute reoperation due to bleeding, has been recognized as a risk factor for mediastinitis in some studies (2,4). Gardlund et al. observed that reoperation is generally preceded by unusually long and complicated primary operations, and the increase in mortality in these patients is most likely associated with the surgical problems encountered (22). The multitude of different risk factors described in different studies, sometimes with contradictory results, suggest both that postoperative mediastinitis is a multifactorial event and that the patient group may be inhomogeneous.

Although postoperative wound infections after cardiac surgery are rare, several risk factors have been identified which contribute to the infection rate. Weight reduction regimen, shortening of the operating time and length of stay in hospital, and identifying and promptly treating the high-risk groups will help in further reducing the incidence of wound infection in cardiac surgery.
REFERENCES


