Pattern of Pathogens in Surgical Site Infections in Tertiary Care Hospitals of Rawalpindi.

Muhammad Hamza*, Noor Fatima**, Noor e Hira**, Quratulain shaukat**, Shaheryar Khan Ghilzai*, Prof Naeem Zia***

*Final year, Rawalpindi Medical College;  
**Fourth year, Rawalpindi Medical College  
***Professor, Surgical Unit 1, Benazir Bhutto Hospital, Rawalpindi

Abstract

Introduction: Surgical Site Infection (SSI), a commonly prevalent condition, not only affects the patients’ quality of life but also drains the health reservoirs. The objective of this study was to determine the various types of pathogens in patients suffering from Surgical Site Infection, presented to surgical departments of Teaching and Tertiary care hospitals in Rawalpindi.

Methods: It is a descriptive cross-sectional study conducted at Benazir Bhutto Hospital (BBH) and Holy family Hospital (HFH), Rawalpindi from January 2016 to November 2016. 583 Patients who developed wound infection (SSI’s) after general surgical procedures within one month of surgery were included. Patients with any co-morbidities, e.g., tuberculosis, diabetes, liver diseases, any known pre surgical infection or operated for malignancies were excluded from the study. The culture reports of patients were observed for presence of various types of pathogens.

Results: Amongst 583 patients, 399 (68.4%) were males and 184 (31.6%) were females. Isolated growth was observed in culture reports of 521 (89.2%) patients, 31 (5.3%) had poly microbial growth, and 31 (5.3%) showed no growth. Staphylococcus aureus (35.5%) was the most common organism isolated followed by E. coli (24%), Pseudomonas (14.8%) and Klebsiella (6.5%).

Conclusion: Staphylococcus aureus is the most common pathogen responsible for causing the infection at surgical site followed by E. coli and Pseudomonas.

Key Words: Surgical Site Infection (SSI), Staphylococcus Aeurus, MRSA, E. coli, Pseudomonas, Klebsiella.

Introduction

Surgical site infection (SSI) is defined as an infection that occurs at the incision site within thirty days after surgery.1 SSI terminology was coined by the Centers for Disease Control and Prevention (CDC) to standardize data collection.2 SSIs are a very common problem and affect approximately one million patients in United States of America (USA) every year, the rate being 2.6 %.3 Different regions have different rates of infections depending on these various factors. In Nepal surgical site infection rate was surveyed to be 7.3%, while Africa showed 19.4%, which was greater than that in Karachi (Pakistan) which was 11.%.4

The majority of SSIs is of bacterial origin, especially the multiple resistant varieties, however, fungal SSIs can be present in transplant recipients.5 Among the bacteria, Gram positive cocci and Gram negative bacilli are being suspected in many of the cases.6 Staphylococcus Aureus is considered as the most common cause by many investigators.4,7,8 Many other reporters found it to be Escherichia coli.9,10,11

The type of pathogen involved usually relates to the type of surgery that the patient undergoes.9

SSI is attributed to be the second most common nosocomial infection.12 2%-5% of all surgeries are complicated due to it every year, posing a 2-11 times greater risk of death in these patients.13 It is the most common post-operative complication causing increased morbidity and mortality. It also increases the hospital stay and the cost of treatment.14 Any pre-existing infection, increasing age, obesity, smoking, diabetes and ischemic injury increases SSI risk.

Infections are more common in prolonged surgical procedures and due to the inadequate antiseptic preparation of the skin, especially in case of abdominal surgeries and contaminated or dirty operations.15

This study can help to determine the various pathogens involved in surgical site infections, which would improve the empirical therapies as the drug sensitivity to these pathogens can be easily established. Early administration of these treatments can improve the patients’ health and save him/her from later complications. The recognition of pathogens and the associated risk factors can help the surgeons to rule
Materials and Methods

It is a descriptive cross-sectional study, which was carried out from January 2016 to November 2016. This study was carried out in four surgical units of the Benazir Bhutto Hospital and Holy Family Hospital, Rawalpindi, Pakistan. These hospitals cater to patients from lower middle socioeconomic status. All patients who suffered from wound infection at surgical site within one month's duration after being operated in the surgical departments were included. The diagnosis of wound infection in our study was based on developing fever, pain at the operative site, wet dressing and the later appearance of frank pus from the wound site usually within 5–7 days. Affected patients with surgical site infections after laparotomy, appendectomy, mastectomy, cholecystectomy, debridement, hemorrhoidectomy, hernia repair, thyroidectomy and colorectal surgery were included. Patients of age group 5-60 years irrespective of gender were included. Using WHO sample size calculator, keeping the level of confidence 5%, absolute precision 5% and the anticipated proportion of population 0.5032%, the minimally required sample size came out to be 385, but we included 583 patients. Pur swabs were collected from the infected sites of patients, using standard technique. These specimens were transported to the Pathology Departments of the respective hospitals. They were inoculated on blood and MacConkey’s agar and incubated at 37°C. Bacterial pathogens were identified by conventional biochemical methods according to standard microbiological techniques. Patients’ files were also consulted and all relevant information was recorded in our study’s structured Forma. Any patient who has had co-morbidities, e.g., tuberculosis, diabetes, liver disease or operated for malignancies or had any diagnosed infection even prior to surgery was excluded from the study.

Data analysis was carried out using SPSS 21. All categorical variables are presented as Frequencies and percentages, whereas means along with standard deviations were calculated for Numerical data.

Results

During the study period, 583 patients were included amongst whom 399 (68.4%) were males and 184 (31.6%) were females. 364 (62.5%) and 219 (37.6%) patients of surgical departments the Benazir Bhutto Hospital (BBH) and Holy Family Hospital (HFH) were included respectively. The mean age of study participants was 32.8±11.76 years. Our study had culture reports of patients displaying both isolated as well as poly microbial growth as shown in table 1.

TABLE 1: Growth of Microorganism in Surgical Site Infections.

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Frequency(Percentages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated Growth</td>
<td>521(89.4%)</td>
</tr>
<tr>
<td>Polymicrobial Growth</td>
<td>31(5.3%)</td>
</tr>
<tr>
<td>No Growth</td>
<td>31(5.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>583(100%)</td>
</tr>
</tbody>
</table>

Table 2. Distribution of SSI Pathogens in both health care facilities

<table>
<thead>
<tr>
<th>Pathogens</th>
<th>Hospital BBH Frequency (Percentage)</th>
<th>Hospital HFH Frequency (Percentage)</th>
<th>Total Frequency (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococcus aureus*</td>
<td>119 (32.7%)</td>
<td>88(24.0%)</td>
<td>207 (35.5%)</td>
</tr>
<tr>
<td>E. coli</td>
<td>86 (23.6%)</td>
<td>34 (24.7%)</td>
<td>140 (24.0%)</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>62 (17%)</td>
<td>24 (11%)</td>
<td>86 (14.8%)</td>
</tr>
<tr>
<td>Klebsiella pneumonia</td>
<td>24 (6.6%)</td>
<td>14 (6.4%)</td>
<td>38 (6.5%)</td>
</tr>
<tr>
<td>Acinetobacter</td>
<td>23 (6.3%)</td>
<td>14 (6.4%)</td>
<td>37 (6.3%)</td>
</tr>
<tr>
<td>Proteus species</td>
<td>4 (1.1%)</td>
<td>11 (5%)</td>
<td>15 (2.6%)</td>
</tr>
<tr>
<td>Enterobacter cloacae</td>
<td>3 (0.8%)</td>
<td>5 (2.3%)</td>
<td>8 (1.4%)</td>
</tr>
<tr>
<td>Streptococcus pyogenes</td>
<td>8 (2.2%)</td>
<td>0 (0%)</td>
<td>8 (1.4%)</td>
</tr>
<tr>
<td>Candida albicans</td>
<td>6 (1.6%)</td>
<td>0 (0%)</td>
<td>6 (1.0%)</td>
</tr>
<tr>
<td>Moraxella</td>
<td>4 (1.1%)</td>
<td>0 (0%)</td>
<td>4 (0.7%)</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>2 (0.5%)</td>
<td>0 (0%)</td>
<td>2 (0.3%)</td>
</tr>
<tr>
<td>Providencia stuartii</td>
<td>1 (0.3%)</td>
<td>0 (0%)</td>
<td>1 (0.2%)</td>
</tr>
<tr>
<td>Total</td>
<td>364 (100%)</td>
<td>219 (100%)</td>
<td>583 (100%)</td>
</tr>
</tbody>
</table>

*In Case of Staphylococcus aureus, 41 cases (17.4%) were Methicillin Resistant Staphylococcus aureus(MRSA).

In our study Staphylococcus aureus was the most common causative organism found in 207 (35.5%) of...
cases followed next by E. coli 140 (24%) and Pseudomonas aeruginosa 86 (14.8%). The other isolates were Klebsiella pneumonia, Acinetobacter, Proteus, Enterobacter. In Case of Staphylococcus aureus, 17.4% were Methicillin Resistant Staphylococcus aureus (MRSA). The percentage and frequency of all pathogens causing SSI in BBH and HFH are shown in Table 2. Distribution of pathogens was also observed based on gender as displayed in figure 1, that showed that a majority of pathogens are more prevalent among males.

Discussion

Surgical site infection, a common problem faced worldwide, has increased the morbidity and mortality of patients. These infections have also burdened the country reserves due to the mounting expenditures required in their management and treatment. A pattern of pathogens is involved in such infections. They not only complicate the surgeries, but threaten the life of patients.

In our study Staphylococcus aureus (35.5%) was found as the most frequently involved pathogen which was in accordance with studies carried out by Mahmood A in Karachi. Nosocomial infection national surveillance service (NINSS) survey (1997-2001) and 1 year surveillance carried out in Isfahan, Iran, also showed Staphylococcus, including Staphylococcus aureus (MRSA) as the most common cause of SSI. Whereas in our study only 41 cases of MRSA were isolated. According to Engemann J J, patient suffering from MRSA had greater mortality, longer hospital stay and more hospital expenses as compared to methicillin susceptible Staphylococcus aureus.

Our study also showed that the second most common pathogen involved in SSI is E coli (24%). The results were contrary to what Erum R found in Karachi ranking Staphylococcus as the third and E coli as the first most common pathogen involved.

Other important pathogens isolated in the above study were Pseudomonas aeruginosa (14.8%) and Klebsiella pneumonia (6.5%). 6 cases (1%) of fungal SSI were also found which are mostly present in transplant recipients. Our result were similar to those isolated in other studies except for 2 cases (0.3%) infected with diphtheria and 1 case (0.2%) infected by Providencia stuartii.

The total numbers of patients in our study were 583 among them 399 (68.4%) were males and 184 (31.6%) were females. The male to female ratio was 2.16:1. This showed that the proportion of male patients suffering from SSIs was higher which is also seen in literature. This might have a relation to the types of injuries sustained and the possibility that males were more prone to such infections.

The above evidence and data gives an insight of the current pattern of pathogens in those patients who were suffering from SSIs and reported to Benazir Bhutto Hospital (BBH) and Holy Family Hospital (HFH) Rawalpindi, Pakistan. This can aid in reshaping the empirical therapies as the most common pathogen infecting the wound is found which can help to better deal with such infections when laboratory diagnosis is still pending. Quick and accurate empirical therapy can prevent further complications and it also lessens the burden on hospitals and patients. Once the pathogens are known, their source can be identified which would assist in their prevention by improving the sterilization techniques and procedures.

Our study attempted to determine the frequencies of different type of pathogens in SSI. The weakness of our study is that it does not explore the risk factors, etiological factors are associated with a type of surgical procedures. Moreover not only the surgical procedures were different even the surgical units and settings were not consistent. Cross sectional analytic studies are recommended in our setting to explore these relationships which can contribute to.
identification of potential etiological factors, pertinent to our Pakistani population. These can provide vital information that can play a role in recommendations regarding the prevention of SSIs.

SSI has to be prevented timely by taking certain measures. Both, the patient and hospital based factors need to be addressed and evaluated. Our study excluded those patients who had any co-morbidities. But if any patient has co-morbidities, it should be controlled preoperatively.15 Dire attention should be paid to theatre environment and skin cleansing as this would improve asepsis technique.6 Certain studies also showed that infection rate was linked to the expertise of the operating surgeons.8 Cases operated by junior surgeons showed higher rate as compared to those operated by senior surgeons.13 Infection rate was less in those patients who were operated first in the operation theater as constant movement of staff and patients compromised the sterility of the theatre and the instruments.13

Infections are a common complication of surgical procedures; they require proper understanding and a well-established system to track, analyze and monitor them along with their associated pathogens. New rules and recommendations should be made to control this problem in order to improve quality of life of patients and to reduce expenditure associated with its treatment. This study can help formulate prophylactic and empirical therapy by taking the above statistics into consideration. We suggest the doctors take their local infecting organism into account for better treatment of such infections.

Conclusion

In this study Staphylococcus aureus was the most common causative organism found in 207 (35.5%) of cases followed next by E. coli 140 (24%) and Pseudomonas aeruginosa 86 (14.8%). This shows the prevailing state of causative pathogens involved in Surgical site infections.

Acknowledgements

We are highly thankful for the continuous support and guidelines of Dr. Faiza Aslam and Team of Rawalian Students Resrach Society of RMC.

References