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Assessment of surgical site infection risk factors at Imam Reza hospital, Mashhad, Iran between 2006 and 2011

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Abstract

Background: The present study was conducted to establish the patterns and risk factors of surgical site infections in our institution between 2006 and 2011.

Methods: This was a retrospective cross-sectional study. The surgical site infection (SSI) was identified based on the presence of ICD-10-CM diagnostic code in hospital discharge records. By using a standardized data collection form predictor variables including patient characteristics, preoperative, intra-operative and postoperative data were obtained.

Results: Ninety five patients fulfilled the inclusion criteria. The patients were admitted for various procedures including both elective (62.1%) and emergency (37.9%) operations. Colectomy (13.7%) was the leading procedure followed by umbilical herniation (12.6) and appendix perforation (12.6%). The mean age was 47.13 years with standard deviation of 19.60 years. Twenty percent were addicted to opium. Midline incision above and below the umbilicus (40%) had the highest prevalence of infection. Most patients (46.3%) had clean-contaminated wounds and 30.5% had contaminated one. The quantitative variables which were also measured include duration of surgery, pre-operative and post-operative hospital stay with the mean of 2.9±1.45 hours, 1.02±1.42 and 7.75±6.75 days respectively. The most antibiotics prescribed post-operatively were the combination of ceftriaxone and metronidazole (51.6%).

Conclusion: The contaminated and clean-contaminated wounds are associated with higher rate of SSIs. Also, there was a converse relation between length of surgical incision and rate of SSIs. In overall, we found type of surgery as the main risk factor in developing the SSIs.

Keywords: Risk factor, Surgical Wound Infection, Contamination, International Classification of Diseases.

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Introduction

Surgical site infections (SSIs) as one of the most common causes of nosocomial infections is accounted for 20 to 25% of all nosocomial infections worldwide (1, 2). The SSIs are the most common complication following surgery, with reported rates up to 30% (2, 3). These infections place a substantial burden on healthcare cost as a result of increased post-operative morbidity and mortality (2, 4-7). They are responsible for 30 to 40% of the deaths in the postoperative period (8).

With regard to the multifactorial condition of SSI, it is important to detect these factors, to investigate the procedures that bear the highest risk and, if possible, define suitable indices that can predict the risk of SSI (9).

The present study was conducted to establish the patterns and risk factors of surgical site infections at Imam Reza hospital in Iran between 2006 and 2011.

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Methods

This is a retrospective cross-sectional study. The SSI was identified based on the presence of ICD-10-CM diagnosis code in hospital discharge records of patients admitted to general surgery ward of Imam Reza hospital, Mashhad, Iran between 2006 and 2011.

Surgical site infections were defined according to the CDC (The Centers for Disease Control and Prevention) criteria. All patients who met inclusion criteria were enrolled into the study. By using a standardized data collection form predictor variables including patient characteristics, preoperative, intra-operative and postoperative data were obtained. Study data included type of surgery, wound class, infection degree, incision site, type and duration of operation, type of prophylaxis and duration of antimicrobial therapy, use of drain, preoperative and postoperative hospital stay. Data were analyzed using The SPSS software

Patients diagnosed with surgical site infections who were identifiable based on the presence of ICD-10-CM diagnosis code in hospital discharge records were included.

Patients with more than one surgery during hospitalization and those who underwent minor surgery (surgeries that doesn't require anesthesia or respiratory aid) were excluded from the study.

Statistical analysis

Descriptive statistics such as frequency table is derived for categorical variables and mean and standard deviation (SD) for numerical variables. All statistical analysis was done using SPSS statistical software.

Results

Retrospective review of patients' medical records showed that 95 patients fulfilled the inclusion criteria. Study population included 51 (53.7%) males and 44 (46.3%) females with age ranged 12-88 years. The mean age was 47.13 (SD: 19.60) years. The patients were admitted for various procedures of both elective (62.1%) and emergency (37.9%) operations as shown in table 1. Colectomy (13.7%) was the leading procedure followed by umbilical herniation (12.6) and appendix perforation (12.6%) (Table 1).

Table 1. Various surgical procedures and their frequency.

Surgical Category	No.	%
Colectomy	13	13.7
Umbilical Herniation	12	12.6
Appendix Perforation	12	12.6
Colon Cancer	8	8.4
Cholecystectomy	6	6.3
Appendectomy	4	4.2
Bowel Obstruction	3	3.2
Mesenteric Ischemia	2	2.1
Bowel Fistula	1	1.1
Volvulus	1	1.1
Aortic Aneurysm	1	1.1
Iliac Aneurysm	3	3.2
Gastric Perforation	2	2.1
Hydatid Cyst	5	5.3
Limb Amputation	4	4.2
Bowel Perforation	1	1.1
Mastectomy	1	1.1
Inguinal Herniation	4	4.2
Pilonidal Sinus	5	5.3
Gastric Banding	2	2.1
Bronchobiliary Sinus	1	1.1
Gastrointestinal Bleeding	1	1.1
Trauma	2	2.1

Patient history of smoking, addiction, past history of diseases (including hypertension, diabetes and autoimmune diseases) and medications (corticosteroid and antibiotic therapy) were assessed. Nineteen patients (19.7%) were addicted to opium 8 (8.3%) with diabetes, other factors ratio was less than 8% for each.

Except one case (laparoscopic gastric binding), all patients had undergone open surgery (96.8%).

The highest incidence of infection were identified in patients with midline incision above and below the umbilicus (40%) followed by midline incision below the umbilicus (8.4%) and above the umbilicus (4.7%).

The organ involvements were also recorded based on the information contained in the operation description sheet. In most cases (26%) all abdominal viscera such as appendix, colon, small intestine, ovaries and fallopian tubes have been involved during operations. The small intestine and the

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Table 2. Organ involvements during operation

Organ involvements	No.	%
Abdominal Viscera	25	26.3
Colon and Small Intestine	20	21.1
Colon	7	7.4
Liver	5	5.3
Limbs	5	5.3
Genital Organs	5	5.3
Gall Bladder	4	4.2
Breast	1	1.1
Stomach	1	1.1

Table 3. Wound infection degree in patients

Wound infection degree	No.	%
Inflammation and redness	8	8.4
Serous secretion without wound dehiscence	62	65.3
Superficial wound dehiscence	17	17.9
Deep wound dehiscence	4	4.2
Abscess unassociated with the operated organ	2	2.1

colon involvement alone occurred in 21.1% of cases (Table 2).

The highest incidence of wound infections was observed in 44 patients (46.3%) with clean-contaminated wounds. Ninety nine patients (30.5%) had contaminated and 20 patients (21.1%) had clean wounds, and 2 cases identified as dirty wounds. The highest degree of infection (65.3%) was serous secretion without wound dehiscence (Table 3).

The mean duration of surgery, preoperative and post-operative hospital stays was 2.9±1.45 hours, 1.02±1.42 and 7.75±6.75 days respectively. The missing data included duration of surgery and preoperative and post-operative hospital stay in 40% and 33% of patients, respectively.

Surgical drains were used in 44.2% of cases and in 82.1% of cases, the wound was closed initially.

Only for 4.2% of patients, preoperative antimicrobial prophylaxes were recorded. Ceftriaxone and metronidazole were administered for 2.1% of patients; and equal proportions of patients received metronidazole and erythromycin or ceftriaxone, metronidazole and ciprofloxacine (1.1%).

The most antibiotics prescribed postoperatively were the combination of ceftriaxone and metronidazole (51.6%).

Discussion

In this study, the mean age was 47.13 years with standard deviation of 19.60 years. There were 51 (53.7%) males and 44 (46.3%) females in age range of 12-88 years. Similar demographic observation was reported by other studies. The rate of SSI was higher in males than in females. This could be explained by multiple risk factors in males such as addiction to opium. In accordance with our study, previous studies have shown that patients suffering from pre-morbid diseases, such as diabetes mellitus and hypertension are at high risk of developing SSI (6-8, 10, 11). Cigarette smoking was significantly found to be associated with SSI in other studies (5, 10, 2). In contrast, in our study only 3.2% had a history of cigarette smoking; on the contrary 20% were addicted to drugs, which showed significant association with development of SSI.

In the present study the patients were admitted for various procedures including both elective (62.1%) and emergency (37.9%) operations. The higher rate of SSI in elective surgeries can be explained due to the higher rate of contaminated and clean contaminated wounds in elective surgeries of our institution. Colectomy (13.7%) was the leading procedure followed by umbilical herniation (12.6%), and appendix perforation (12.6%) (Table 1). The highest inci-

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dence of infection were identified in patients with midline incision above and below the umbilicus (40%) followed by midline incision below the umbilicus (8.4%) and above the umbilicus (4.7%).

Fiorio et al meta-analysis on 3066 surgical procedures demonstrated highest incidence of SSI in small bowel (16.3%) and colon surgery (12.5%) (7). Our findings confirmed previous knowledge that surgeries with an increased microbial load in the operative field are associated with higher risk of SSI (7, 13).

For a long time, surgical wound classification has been recognized as an important predictive factor in developing surgical site infections after surgery (6, 7, 14-16). In our study, as well as previous studies, the incidence of SSI was statistically higher in clean contaminated (46.3%) and contaminated (30.5%) wounds.

A prolonged pre-operative hospital stay has been reported to increase the rate of surgical site infection (17). A length of operation of more than 3 hours leads to 4 times higher risk of SSI (9). In present study, the means for duration of surgery, pre-operative and post-operative hospital stay were 2.9 ± 1.45 hours, 1.02 ± 1.42 and 7.75 ± 6.75 days, respectively. This is not in accordance with the literature regarding the risk of SSI determined by the duration of the surgery and pre-operative hospital stay (5-7, 9). In addition, the use of surgical drains has been reported to be associated with an increased risk of SSI which was confirmed in this study (28-30).

Preoperative antimicrobial prophylaxis was only administered in 4.2% of patients. This can be explained by using routine antibiotics for every procedure, and also it necessitates the use of antibiotic policy regarding different therapeutic procedures for these patients. The most prescribed antibiotics used post-operatively were ceftriaxone -metronidazole (51.6%) and metronidazole (8.4%). Other studies however reported using different antibiotics (7, 9).

This investigation had limitations because of missing data including prophylactic antibiotics and ICD-10-CM diagnostic code in hospital discharge records.

The comparison of SSI incidence between hospitals from various locations and countries must always be attentive, due to specific characteristics for each place and patient population that make it difficult to reach valid conclusions. The ideal situation would be for each hospital to critically analyze its own data, preferably focusing on the historical series and then particularizing it for various types of surgery.

Conclusion

Surgical site infection is highly related to the type of wound, namely contaminated and clean contaminated wounds and associated with higher rate of SSI. Also, it seems that there is a converse relation between length of surgical incision and the rate of SSIs. In short, we found that the type of surgery considered to be the main risk factor in developing SSI.

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