Surgical Site Infection Incidence Following Hip Surgery: A Cross-Sectional Study

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Authors’ contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Objective: To determine the incidence of surgical site infection among patients with hip fracture and undergo a surgical procedure for management. And to spotlight on the risk factors which may lead to surgical site infection among them. Also, to look for other complications following the surgery.

Methods: This is a descriptive, correlational cross-sectional study design. The study was conducted at Orthopedic Department, Mohammad Medical College and Hospital Mirpurkhas, Pakistan for one-year duration from March 2019 to March 2020. All patients had hip fracture and received management at the department of orthopedic. All patients were adults and older than 20 years of age. Data was analyzed using SPSS program.

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Results: The study included 103 patients who had hip fractures. The most frequent age group was 40-50 years. Patients had a mix of modifiable and non-modifiable risk factors for developing surgical site infection. The incidence rate of surgical site infection in this study was 3.2%. It was correlated to having hypertension and diabetes as complications.

Conclusion: This study aimed to spotlight on the SSI following hip surgeries and to look for complications and risk factors. We noticed that the SSI rate among the study populations is almost similar as the worldwide range. This is due to the agreed protocol for managing patients. However, there is a need for long-term follow up for our patient to discover the cases of delayed SSI.

Keywords: Surgical site infection; hip fractures; infection.

1. INTRODUCTION

Hip fractures are occurring frequently among frail, aged patients and have 9% mortality rates in 30 days [1] and up to 30% per one year [2]. If there is deep surgical site infection (SSI) there is 1-year fatality rate of around 50% [3].

However, it’s not clear this mortality is due to infection or due to having multiple medical comorbid to patients [4].

As there is high risk of SSI in hip fractures, it is vital to control risk factors. Nevertheless, the reported risk factors varied, starting from first day of operation to the lead surgeon’s expertise, period of surgery, alternative of implant, and patient-related factors like obesity [5].

Duration of surgery may be a risk issue normally targeted in literature. However, the question remains on whether or not longer period of surgery will increase the danger of SSI by increased exposure to potential microorganism contamination [6]. On the other hand, prolonged surgery time represents a major parameter for a tough procedure or a complication because the main cause for associate augmented risk of SSI [6].

Till today, surgical site infection (SSI) continues to be one among the foremost common kinds of surgical infection, particularly in developing countries [7]. Moreover, prolong hospital stays and increased medical expenses is also noted with SSI [8]. Additionally, the prevalence of SSI continues to be a crucial role in health care facilitates [9]. Thus, the interference of SSI remains a pressing concern. Because of the existence of various microbes within the various body part, the SSI incidence of hip joint surgery is typically beyond those discovered in different kinds of surgeries [10-11]. There are many literatures have identified certain factors related to surgical site infection risk after hip fracture surgery. Example of risk factors established in previous studies concludes surgeon experience, type of implant, surgery duration, obesity, smoking, female gender, delay in surgery more than one-week, prolonged operating time and surgery type (Hemiarthoplasty) time [12-16].

Thus, this study is aiming to understand the rate of infection as it is an essential part of research and disease management for SSI. And since, prevention is the preferable treatment, recognition of risk factors is significant for the sake of individual patient risk assessment associated with hip surgeries and may serve as a breakthrough point for new clinical studies assessing prophylactic therapy.

2. METHODS

2.1 Study Design

A descriptive, prospective design was employed for this study. Since this study aims to assess the SSI and conducted by the hospital. Furthermore, other complications following hip surgery, this is the most appropriate design. This enables the researcher to measure the effect and the outcome at a single point of time. This study design gives reliable results with short time and less effort.

2.2 Study Setting

The study was conducted at Orthopedic Department, Mohammad Medical College and Hospital Mirpurkhas, Pakistan, for one-year duration from March 2019 to March 2020.

2.3 Participants

Participants in this study were patients admitted to the department following hip injury or fracture. All study participants (patients) were above 18 years of age. Patients who were younger were
excluded from the study. A hip fracture was defined, according to our study, as a fracture of the femoral neck (subdivided to sub-capital, trans-cervical, and basocervical) and fracture of the inter-trochanteric area (subdivided into stable and unstable).

2.4 Sample and Sampling

Since the study was a cross-sectional study during a short period of time. Convenient non-probability sample was selected according to the criteria in the section of participants. Thus, the study included only adult patients admitted to the department during the study period.

2.5 Data Collection

Data was collected from patients at time of admission by taking baseline data. Then the patients were assessed during and after the surgery. Patients were also followed up to assess the occurrence of SSI.

2.6 Instruments

The data was collected using self-designed questionnaire. Study questionnaire contained three domains. First, characteristics of study participants. Second, assessment of patient’s risk factors and comorbidities. Third, assessment of the surgical procedure and follow up.

2.7 Statistical Analysis

Data obtained from questionnaire were entered and analyzed using SPSS program version 23 computer software. Sociodemographic data are presented using descriptive statistics as means, median, percentages and standard deviation. Independent T test and one-way Anova are used to show statistical significance among participants characteristics. Chi square test is used to show relationship between categorical variables.

3. RESULTS

3.1 Baseline characteristics

The study included 103 patients in which among them were 57 males (55.3%) and the rest were females. Patient's age ranged from 20 to 80 years, with most frequent age groups were 41-50 (n= 30, 29.1%) and 51-60 (n= 29, 28.2%). Most patients were managed surgically, and they had to wait for a while to receive the first procedure. The mean days to first procedure were 4.46 days with standard deviation of 3.37 days.

3.2 Presence of Comorbidities

Some patients had comorbidities. The most frequent comorbidity hypertension that was present among 51 participants (49.5%). There are many other comorbidities that were present among study sample. Table 1 shows the distribution of these comorbidities by age group and gender.

The presence of comorbidities among groups was statistically significant for two comorbidities which were Diabetes and hypertension, p value was 0.002 and 0.001 respectively. On the other hand, hypertension and diabetes were significant between gender at p value of 0.039 and 0.001 respectively.

3.3 Fracture Site and Type

Most of study participants had fractures at the left side (n= 56, 54.4%). Most of fracture were stable (n= 53, 51.5%). The type of fracture varied among age groups. However, stable fracture was most frequent at all age groups except for 61-70 in which unstable fractures is more than stable fracture. Table 2 shows the distribution of fracture type by age group. Stable fractures were also the most common among both genders. Table 2 also shows the distribution of fracture types by gender.

3.4 Management

Most patients were treated surgically (n= 93, 90.3%). The type of surgical implant depended on the type of fracture. For instance, DHS was used for stable IT. Table 3 shows the type of implant and the use for fracture type.

Most of surgeries were performed by residents (n= 70, 68%). On the other hand, there were 8 Assistant professor and 15 professor performed surgeries.

3.5 Surgery Complications

There were no post-surgical complications among 72 cases. While 19 cases had only one complication and one case had two complications. Complications varied among age groups (Table 3). However, young age group
(20-30) had no complications at all. Table 3 shows the distribution of complications among study participants according to age group. SSI occurred among 3 patients only which makes the prevalence of SSI in this study is 3.2%. Complications also varied between genders.

There was a statistically significant relationship between the presence of complication and type of surgeon doing the operation. The p value was 0.006. Also, type of complication was statistically significant with type of implant at p value of 0.048.

3.6 Surgical Site Infection

Surgical site infection (SSI) was not statistically significant with most other variables in our study. It was noticed that it happens when the procedure is delayed to more than 4 days. It was also noticed that SSI occurred mainly with two types of implants: Sliding Hip Screw (SHS) and Austin Moore Hemiarthroplasty. Furthermore, type of complications especially SSI were not statistically significant with fracture type. There was not statistically significant relationship between surgical complications and level of experience.

4. DISCUSSION

The rate of SSI presented in our study was (3.2%) which is almost similar to the range of previously published data related to our topic (2–7%) [17-20]. Many studies demonstrated that deep SSI was simultaneously occurring around 3.6% with hip fractures [21] and nearly 30% infections were noted after the patient was discharged from hospital [22]. This was due to lack of proper follow up. Also, in this study some delayed infections are not noted, which explains the low incidence of SSI. Thus, the reported incidence in the study may be lower than the actual one.

The strong points of our study are the analysis of treated patients during a period of time. Additionally, the health care standards in the hospital for patients with hip fractures are driven from an agreed protocol among healthcare professionals in the department. On the other hand, the limitation of our study is lack of long-term follow up.

Many studies presented data of hip fractures with 491 surgical site infections from 3740 hip fractures [23]. We compared our results to various studies with different sample sizes. The largest rate was reported by a study was 105 SSI among 10,061 patients (1.04%) from two high-volume centers [23]. The lowest reported rate was contained only 230 cases, with 28 infections (12.2%) [24].

There was one study was a considerable for an outlier in that the surgical site infection rates were more than the other studies substantially [25]. This study had small sample size however the results of the study could be generalized. The study also didn’t state the definition of SSI according to their context. Thus, it is possible to have higher incidence of SSI according to the international definition of SSI [25,26].

The highest data is reported on DHS (SHS) [27]. This study demonstrated an 18,014 neck of femur which were treated with DHS and found 80 (0.44%) cases of infection [27].

There were various SSI definitions across the studies we compared our results to seven studies reported their results by formally recognized diagnostic system such as the CDC definition or another validated definition [28].

Few published studies focus on SSI after SHS for the more common indication of intertrochanteric fractures. According to our literature search, all of the studies reported SSI among patients with hip fractures. Other published estimates are as high as 3.9% [29].

For clinical practice, the most essential step is to determine patients with modifiable risk factors for SSI. Pre-existing cognitive impairment can be considered non-modifiable, while delirium, which has a high incidence amongst hip fracture patients [29], and therefore probably accounts for some of the reported cognitive impairment among patients.

Some intraoperative complications are modifiable and may be prevented by adequate preparation in the preoperative period and experienced staff; however, it is not possible to prevent all complications with excellent preparation. An association between a longer duration of surgery and SSI has been shown before in several other studies [30]. On this basis, some authors have advocated measures to reduce duration of surgery [30], such as expeditious surgical technique [30]. However, the question remains how much of this association is due to the prolonged exposure to possible microbial contamination [30] and how much is due to a longer duration of surgery could be a parameter for complex procedures that may increase the risk for SSI.
Table 1. Distribution of comorbidities among study sample by age group and gender

| Comorbidity       | Age         | Gender | Male | Female |
|-------------------|-------------|--------|------|--------|
|                   | 20-30  | 31-40 | 41-50| 51-60 | 61-70 | 71-80 | > 80 | Male | Female |
| HTN               | Yes     | 4     | 9    | 23   | 15    | 0     | 0    | 34   | 28    |
|                   | No      | 6     | 10   | 7    | 14    | 8     | 4    | 3    | 1     |
| Congestive heart failure | Yes   | 0     | 0    | 1    | 1     | 0     | 0    | 1    | 1     |
|                   | No      | 10    | 19   | 29   | 28    | 8     | 4    | 3    | 56    |
| Diabetes          | Yes     | 4     | 8    | 12   | 8     | 0     | 1    | 0    | 9     |
|                   | No      | 6     | 11   | 18   | 21    | 8     | 3    | 3    | 48    |
| CVA               | Yes     | 2     | 2    | 5    | 1     | 0     | 0    | 7    | 3     |
|                   | No      | 8     | 17   | 25   | 28    | 8     | 4    | 3    | 50    |
| IHD               | Yes     | 0     | 2    | 3    | 3     | 0     | 0    | 6    | 2     |
|                   | No      | 10    | 17   | 27   | 26    | 8     | 4    | 3    | 51    |
| COPD              | Yes     | 0     | 2    | 0    | 1     | 0     | 0    | 3    | 0     |
|                   | No      | 10    | 17   | 30   | 28    | 8     | 4    | 3    | 54    |
| Asthma            | Yes     | 0     | 1    | 2    | 1     | 0     | 0    | 3    | 1     |
|                   | No      | 10    | 18   | 28   | 28    | 8     | 4    | 3    | 54    |
| CKD               | Yes     | 0     | 1    | 0    | 2     | 0     | 0    | 2    | 1     |
|                   | No      | 10    | 18   | 30   | 27    | 8     | 4    | 3    | 55    |
| ILD               | Yes     | 0     | 0    | 1    | 1     | 0     | 0    | 1    | 1     |
|                   | No      | 10    | 19   | 29   | 28    | 8     | 4    | 3    | 56    |
| Epilepsy          | Yes     | 0     | 1    | 0    | 0     | 0     | 0    | 0    | 1     |
|                   | No      | 10    | 18   | 30   | 29    | 8     | 4    | 3    | 57    |

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Table 2. Distribution of fracture type according to age groups and gender

| Fracture Type                        | 20-30 | 31-40 | 41-50 | 51-60 | 61-70 | 71-80 | > 80 | Male | Female |
|--------------------------------------|-------|-------|-------|-------|-------|-------|------|------|--------|
| Stable IT                            | 6     | 11    | 15    | 19    | 1     | 2     | 2    | 30   | 26     |
| Unstable IT                          | 1     | 2     | 3     | 3     | 1     | 0     | 0    | 10   | 3      |
| Sub-Capital Neck of femur fracture   | 1     | 4     | 7     | 5     | 0     | 1     | 0    | 11   | 7      |
| Transcervical Neck of femur fracture | 2     | 1     | 3     | 1     | 4     | 0     | 1    | 4    | 8      |
| Baso-cervical Neck of femur fracture | 0     | 1     | 2     | 1     | 0     | 0     | 0    | 2    | 2      |

Table 3. Distribution of post-surgical complications by age group and gender

| Type of complications | Mortality within 1 month (early) | Age | Gender |
|-----------------------|----------------------------------|-----|--------|
|                       |                                  | 20-30 | 31-40 | 41-50 | 51-60 | 61-70 | 71-80 | > 80 | Male | Female |
| Pneumonia             |                                  | 0    | 2     | 1     | 0     | 0     | 0     | 1    | 3    |
| CVA                   |                                  | 0    | 0     | 1     | 0     | 0     | 0     | 0    | 1    |
| CAD                   |                                  | 0    | 0     | 0     | 0     | 0     | 0     | 0    | 0    |
| UTI                   |                                  | 0    | 0     | 1     | 2     | 0     | 0     | 0    | 2    |
| VTE                   |                                  | 0    | 1     | 0     | 0     | 0     | 0     | 1    | 0    |
| SSI                   |                                  | 0    | 0     | 2     | 0     | 0     | 1     | 0    | 2    |
| Failure of implant    |                                  | 0    | 0     | 0     | 2     | 2     | 0     | 1    | 3    |
|                       |                                  |  |  |  |  |  |  |  |  |

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Some studies conducted logistic regression analysis to determine the most attributed risk for developing SSI. The controlling of occurrence of complications during the operations according to surgeon's experience is eliminated in the analysis due to the duration of the surgery could interfere with this fact and may be the reason behind the SSI. However, this finding highlights the uncertainty that the prolonged exposure to possible bacterial contamination is the main reason for an association between duration of surgery and SSI [24-25].

In summary, this study aimed to assess incidence for development of surgical site infection (SSI) after surgical repair of femoral neck fracture. Also, to evaluate the risk factors including the potential comorbidities for the development of SSI after surgical repair of femoral neck fracture by evaluating all suspected risk factors from collected clinical data. And to assess relationship between using prophylactic antibiotic pre-operatively and the risk of developing surgical site infection.

5. CONCLUSION

To conclude, this study aimed to spotlight on the SSI following hip surgeries and to look for complications and risk factors. We noticed that the SSI rate among the study populations is almost similar as the worldwide range and it is statistically significant. This is due to the agreed protocol for managing patients. The most occurred comorbidities were Hypertension and Diabetes found in this study. However, there is a need for long-term follow up for our patient to discover the cases of delayed SSI. It was also noticed that SSI occurred mainly with two types of implants: Sliding Hip Screw (SHS) and Austin Moore Hemiarthroplasty. Thus, it is not statistically significant in this study. SSI is related to modifiable and non-modifiable risk factors. Patients are encouraged to avoid obesity and many other modifiable risk factors for better outcomes. We recommend for further prospective studies and put our hands on the perfect management of patients who had operations for hip fractures.

CONSENT AND ETHICAL APPROVAL

An approved permission was gained from hospital ethical committee to collect quantitative data from patients. After explanation of study objectives, patients who consented were included in our study. In addition, verbal informed consent was gained from patients before asking questions.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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