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ORIGINAL ARTICLE

Incidence of Surgical Site Infection in Patients Presented for Orthopaedic Surgery

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ABSTRACT

Objective: To find out the incidence of surgical site infection in clean cases of orthopaedic surgery.
Study design: Retrospective descriptive study.
Setting: Trauma and orthopaedic unit Gulab Devi Hospital.
Duration: April 2018 to November 2021
Methodology: Using non probability (purposive) sampling a total of 800 patients who underwent an invasive surgical procedure during the specified time period was included in the study. While all non-invasive procedures such as manipulations, application of plaster casts and image guided intra-articular injections were excluded from study. p-value< 0.05 was considered as significant
Results: There were 504(63%) male patients and 296(37%) female patients. Age range was between 01 to 86 years. Mean age was 30±6.7 years. After performing surgery, all patients were followed up for minimum of four weeks to record SSIs. Post-operatively infection was detected in 17(2.12%) of our patients. SSI was 5.8% in clean cases, 23.5% in clean contaminated and 70.5% in dirty cases. The prevalence of SSI were significantly higher in those patients already having dirty wound before procedure as p<0.05
Conclusion: Surgical Site infection (SSI) rates reported in this study setting are are comparable to international standards.
Keywords: Orthopedic, Surgical site infections, Trauma, Wound management

INTRODUCTION

Wound infections created by an invasive surgical procedure are referred to as surgical site infections (SSIs). Surgical site infection following orthopedic surgery including trauma and elective procedures is an important clinical concern and can lead to poor outcome and dissatisfaction among patients.[1,2] It is also an economical burden for the health care establishments and patients. High volume trauma centers and busy emergency units with meager resources, increases the risk of complications among which most common is SSI.[3,4]

Healthcare associated infections (HCAIs) have major percentage coming from SSI. Prevalence studies looking at SSI tend to underestimate the real numbers because infections may occur after the patient discharge from hospital.[5,6]

SSIs risk factors are multi-factorial and include hospital related, Patient-related, and procedure-related factors. In elderly patients, the incidence rate of SSI following elective orthopaedic surgery was 1.5% within1 year postoperatively.[1]Prevention of SSIs is to take care of all these factors. This includes maintenance of theatre hygiene, staff training and judicial use of antimicrobial agents both for prophylaxis and in the post-operative period. Various studies have shown that prophylaxis is effective at reducing risk of surgical site infection.[7]

Risk of SSI exists with each surgical incision, but strategies exist to reduce the risk. Best strategy is prevention through clean surgical environment, identification of at risk population and effective antimicrobial therapy according to local policy.[8]

As day case surgeries are increasing in all setups, there is lot of interest in finding out the complications that occur in outpatient procedures. The rates of SSIs after ambulatory procedure are low but exist and the fact that many of these SSI patients may need further hospitalizations or additional procedures. Soprevention remains the best strategy.[9]

One particular challenge in SSI is Methicillin-resistant Staphylococcus Aureus (MRSA) infection or colonization. This is associated with poor outcomes in orthopedic population especially in patients who receive implants. High prevalence of MRSA colonization was reported in many settings in Pakistan, and more local data is required to find out true incidence.[10]Unfortunately data is lacking from all major trauma centers in Pakistan.

SSI rate is variable among different surgical specialties. Analysis of the microbiological results of SSI, one study concluded that microorganisms from the patient's skin- Gram-positive cocci - Staphylococcus and from the patient's own microbial flora - Gram-negative Rods are the most common agents causing SSIs.[11]

One study shows preoperative active supplementation of nutrition, planned weight loss, smoking cessation, and optimization of the operative plan might be effective to reduce SSIs and the detection of SSI can be variable from as early as 2nd day to at the 166th day, postoperatively.[6,7] After diagnosis is made, then clinicians attempt to determine definitively; what pathogen they need to treat, best antimicrobial treatment, how much surgical debridement is necessary and how many surgical debridement are needed.[9,11,12]

As many guidelines are available for prevention of SSI, outcomes are dependent on various factors such as prophylactic measures taken, behavior of surgical staff, local antibiotic policy, minimal standards followed for trauma and elective orthopedic procedures and finally a keen interest in early diagnosis of any potential SSI cases.

We have collected data for this study from one Trauma and Orthopaedic Unit over the period of four years. We are offering both trauma and elective orthopedic services with availability of30 beds. We aim to look for prevalence of SSIs in our Orthopaedic department.

MATERIALS AND METHODS

Study Design and Setting: A systematic review was performed of 800 Orthopaedic procedures performed between April 2018 and November 2021 as recorded in Theater log book, ward records and patient files of Orthopaedic department at Al-Aleem Medical College Lahore.
Sampling: Using non probability (purposive) sampling a total of 800 patients who underwent an invasive surgical procedure during the specified time period was included in the study. While all non-invasive procedures such as manipulations, application of plaster

casts and image guided intra-articular injections were excluded from study

Data Collection: A proforma was filled for each patient. Ward charts, operation notes and follow up notes were reviewed to record study variables. The type of procedure and status of wound was also noted from operations notes. As we performed both trauma and elective cases; open fractures, septic arthritis, soft tissue Abscess and other infective categories were also performed in our theatres and we categorized the wound in all patients as per USA National Research Council Categorization of Incisions.

Study Protocols: Standard theatre protocols were followed for each patient including one dose of Pre-operative Antibiotic 20 minutes before application of tourniquet or start of surgery and two further doses at 12 and 24 hours interval. We used combination of Cefoperazone+Sulbactam, dose adjusted for patient age. Antibiotics were changed if culture reports became available with varying sensitivities. Staff would strictly wear clean theatre kits, face masks, head caps and other personal protective equipment (PPE) at all times inside theatre. Theatre scrubs were not allowed to be worn outside operation theatre premises. Instruments, gowns and sheets were sterilized and chain of sterility maintained till end of surgery. Theatre traffic was kept to minimum. After each surgery all exposed theatre surfaces were cleaned with a disinfectant. Regular Theatre cultures were performed as per Punjab Health Care Commission guidelines.

Operational Definitions

Infection: The invasion and multiplication of microorganisms such as bacteria, viruses, and parasites that is not normally present within the body.

Surgical site Infection: Wound infections created by an invasive surgical procedure are referred to as surgical site infections (SSIs).

Categories of Wound: For each patient wound was categorized according to the USA National Research Council Categorization of Incisions for pre-op and post-op follow-up (Table A). A note of previous surgery and any existing infection was carefully recorded. Minimum follow up was Four weeks or till the wound healing for all patients. Patient ward notes and outpatient follow ups were carefully recorded for identification of any post-operative infection and recorded on ward register.

Table A: (USA National Research Council Categorization of Incisions)

Classification	Criteria
Clean	Wounds that are non-traumatic and/or do not enter the digestive, respiratory or genital urinary tract. These cases involve only the skin and sterile body spaces without breaks in sterile technique. Joint Arthroscopies, Breast surgery, Inguinal hernia repair, Carpal tunnel release
Clean-contaminated	Wounds in which the digestive, respiratory or genitourinary system is entered, without visible contamination and without obvious infection. These cases involve non-sterile viscera, which have a relatively low level of bacterial colonization. Biliary surgery, Bowel surgery with prepared bowel, Hysterectomy, Tonsillectomy
Dirty	Wounds in which there is visible contamination from a hollow viscous or are clinically infected. These cases involve exposure to high levels of bacteria. Excision of perforated appendix/ bowel, Drainage of abscess

RESULTS

We performed total 800 patients from April 2018 to November 2021. We had 504(63%) male patients and 296(37%) female patients. Age range was between 01 year to 86 years. Mean age was 30±6.7 years. Following the criteria of USA National Research Council categorization of incisions, our patients had pre-op assessment and 520(65%) patients had clean Wound, 96(12%) had clean-contaminated wounds and 184 (23%) patients had dirty wounds. All patients with clean-contaminated and dirty wounds i.e. 280(35%) had cultures sent from their wounds. Cultures were taken eitherpre-operatively or intra-operatively. Of these cultures sent, 104(13%) came back positive. This was not SSI, because infection was present before surgical intervention. Table-01 shows the spectrum of organism detected among the positive culture results. 26 patients were diagnosed with Bony tuberculosis and started on anti-tuberculosis regime after surgical intervention and tissue diagnosis. 37 patients had mixed growth of bacteria, 11 patients had MRSA infection, 13 patients had gram negative and 17 patients had Gram positive infection. We went on to operate on all these patients as well to achieve resolution of symptoms.

Table-1: Pre-Operative Spectrum of Organisms Detected in Positive Cultures

	Frequency n= 104
AFB/TB	26
MRSA	11
Gram +ve	37
Mixed Growth	13
Gram –ve	17

After performing surgery, all patients were followed up for minimum of four weeks to record SSIs. Out of these, post-operatively infection was detected in 17(2.12%) of our patients as shown in Figure-01.

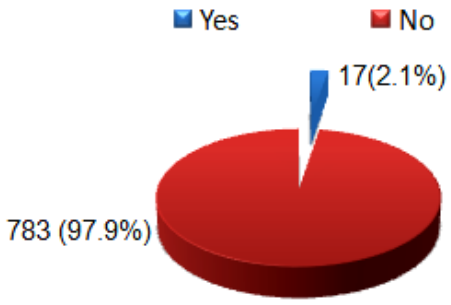

Fig-01: Frequency of Surgical Site Infection

Figure-02 shows post-operative wound closure in our study population, 765(96.6%) patients had primary closure and 35(4.4%) patients had delayed primary or secondary closure.

Fig-02: Post-op Wound Closure

Among primary closure patient population, 5(0.6%) patients had superficial wound infection which was treated with extended dose of broad spectrum antibiotics. No further intervention was required and they all achieved full wound healing without any further complication.

Among secondary closure population12(1.5%) had SSI with positive culture as shown in Table 02. Seven of these12 patients were treated with extended antibiotic therapy. Five of these 12 patients had their wound left to heal by secondary intention with

regular surgical debridement at 48 hours till clean granulation tissue was noted and then further dressings till complete healing. One of these five patients needed a further deep debridement at three weeks interval with primarily closure over suction drain and went on to complete healing at the end of four weeks with no further reported complications.

Among remaining patient of secondary closure, 18patients had delayed closure due to poor soft tissue condition and no SSI was recorded and cultures were negative. These patients had a wound wash out within 72 hours interval, delayed primary closure and all of them went on to heal without any further problems.

Table-2: Post-Operative Spectrum of organisms detected in positive cultures SSI

	Frequency n= 17
Gram +ve	12
Mixed Growth	3
Gram –ve	2

We also made a note of SSI prevalence as per pre-operative category of wound that is shown in Table-03. Out of 104 positive cultures, 05 were clean wounds, 12 were clean-contaminated and 87 were dirty wounds. P-value was ≤ 0.05 which indicates that SSI are significantly associated with patients having dirty wounds.

Table-3: SSI with respect to various types of Wound

	Infection before surgery n=104	Surgical site Infection (Post-op Infection) n=17	p-value
Clean	5	01(5.8%)	<0.05
Clean contaminated	12	04(23.5%)	
Dirty	87	12(70.5%)	

p-value ≤ 0.05 significant

DISCUSSION

Surgical site infection is always a challenge in any surgical field but this is particularly true for trauma and orthopedic because of frequent use of Implants, poor bioavailability of antibiotics in the bone and complex trauma wounds.[13,14,15]A standardized definition of SSIs was published by the Surgical Wound Infection Task Force USA in 1992; “the presence of purulent drainage; spontaneous drainage of fluid from the wound, regardless of whether it is culture positive for bacteria; localized signs of infection for superficial sites or radiological evidence of infection for deep sites; an abscess or other type of infection on direct surgical exploration; or a diagnosis of an infection by a surgeon”.[16] SSIs have been categorized by the CDC into 3 categories: superficial, deep, and organ/space infections[16]. Superficial infections is in the skin or subcutaneous tissue; deep infections involve the muscle or fascia; and organ/space infections involve the body cavities such as pelvis.[17]

All surgical wounds are prone to infection but luckily, only few will actually demonstrate clinical signs and symptoms. Multiple factors are involved in the SSIs: theatre cleanliness, staff behavior, sterilization of surgical instruments,exposure of the wound to contaminants at trauma site, duration of the procedure, the virulence of the contaminants, and the patient’s immune response. Research by the National Nosocomial Infections Surveillance (NNIS) program USA has indicated that three factors: surgical risk, as measured by the ASA, length of surgery, and level of bacterial contamination of the wound, give insight into theinfection rates of various surgical procedures.[18]

Among SSI research work done in Pakistan, one study has found SSI in 7.09% patients in elective Orthopedicprocedures[19, 20], another study shows SSI in 5.3%[21] and Ishaq et al found SSI in 9% patient[22].

Our results revealed SSI rate 2.12% in 800 patients. Large international multicenter studies have varied SSI rate of 1.5%–5% in the United States[19]. In our study,SSI rates is2.12%. Looking at detailed results with individual wound categories, SSI was 5.8% in clean cases, 23.5% in clean contaminated and 70.5% in dirty cases. So risk of infection is higher with initial dirty wound presentation but meticulous attention to the SSI factors have proved to control infection rate very effectively.[23, 24]

We always follow strict theatre protocols, a standard antibiotic policy, involvement of local microbiologist and a close surveillance on our patients helped us to keep SSI comparable with international standards. Few other Non-quantifiable factors, such as length of operating time, prophylactic use of antibiotic and protocol for skin preparation have been found important in other studies[17, 25, 26, 27].Our study looked at our orthopedic theatres infection rate and our SSI rate give us an encouraging picture to continue good practice and improve it further.

CONCLUSION

Surgical Site infection(SSI) rates in the Orthopaedic department at Al-Aleem medical College / Gulab Devi Hospital Lahore, are comparable to international standards. We aim to continue the good practice and further improve the SSI rate by a standard policy of theatre cleanliness and patient care.

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