# EARLY SURGICAL SITE INFECTION: INCIDENCE AND RISK FACTORS

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## ABSTRACT

**Introduction:** Surgical Site Infection (SSI) is the most common nosocomial infection that occurs in the early postoperative period in patients. SSI develops within 30 days after an operation or within one year if an implant was placed and infection appears to be related to the surgery. Determination of risk factors for the development of SSI has been a major focus of surgical research due to the significant morbidity, mortality, and increased costs associated with SSI. Present study aims to evaluate potential risk factors associated with SSI, to know spectrum of organism causing SSI in orthopaedic implant surgeries.

**Materials & Methods:** 447 patients with closed fracture cases undergoing elective orthopaedic implant surgery were included in this study. Patient with compound injury planned for external or internal fixation, soft tissue surgeries, emergency cases and non-implant surgeries were excluded.

**Results:** 31 (6.94%) patients developed SSI within 30 days of surgery. Out of these infected patients, 25 (80.65%) were male and 6 (19.35%) female. In this study klebsiella&E.coli were most commonly isolated organisms in 35.48% cases & 22.58% cases. Statistically significant association of SSI was found with age >50 years, duration of surgery>120 minutes, duration of hospital stay >7 days, diabetes Mellitus, use of tourniquet, pre-operative Hb less than 12 gm% and weight loss (in prior 6 months).

**Conclusion:** Interventional strategies like pre-operative correction of anaemia, control of blood sugar level should be planned for decreasing incidence of SSI in orthopaedic implant surgeries.

**Key Words:** Anaemia, orthopaedic surgery, outcome, risk factor, surgical site infections.

## INTRODUCTION

Surgical Site Infection (SSI) is the most common nosocomial infection that occurs in the early postoperative period in patients.[1]SSI develops within 30 days after an operation or within one year if an implant was placed and infection appears to be related to the surgery.[2]These are devasting complications for both patient and surgeon after orthopaedic implant surgery. Kirkland et al.found that surgical patients (all specialties) with SSI were twice as likely to die, 60% more apt to be admitted to an intensive care unit, and greater than five times more likely to require hospital readmission.

Infection is a common post-operative event with incidence ranging from 1-2% to 22 % after orthopaedic implant surgeries.[3,4] If infection occurs within 30 days of surgical procedure, it is termed as early SSI, where as intermediate SSI occurs between one and three months and late if it

develops more than three month after surgical procedure. Infection in orthopaedic procedures increase case cost by 300%, prolongs antibiotic use, increases morbidity and rehabilitation.[5,6] A wide variety of risk factors for SSI after orthopaedic surgeries have been reported in the literature like advanced age, diabetes, smoking, malnutrition, obesity, immune impairment, rheumatoid arthritis, infection in other part of body and anemia.

However, limitations in many studies were their relatively small sample size, which restricts the ability to perform multivariate analyses to identify independent risk factors for SSI.[7,8] Also, many studies included only a small fraction of all potential risk factors for SSI in their analyses. In order to accurately identify all of the independent risk factors for SSI, studies with large numbers of patients with SSI need to be performed, with the investigators taking into account a wide variety of potential risk factors. Determination of risk factors for the development of SSI has been a major focus of surgical research due to the significant morbidity, mortality, and increased costs associated with SSI. Thus, present study aims to evaluate potential risk factors associated with SSI, to know spectrum of organism causing SSI in orthopaedic implant surgeries.

## MATERIAL AND METHODS

Present study was conducted at ESIC Model Hospital, Baddi, Himachal Pradesh. 447 patients from 1 February 2014 to 31 January 2015 with closed fracture cases undergoing elective orthopaedic implant surgery were included in this study. Patient with compound injury planned for external or internal fixation, soft tissue surgeries, emergency cases and non-implant surgeries were excluded. All surgeries were performed in well-equipped operation theatre using autoclaved surgical instruments and using aseptic techniques. A standard pre-operative anaesthetic check-up and preparation and institute antibiotic protocol was followed for all patients for surgeries. 3rd generation cephalosporin was given 30 minute prior to surgical incision. If procedure was lasted for more than two hours antibiotic dose was repeated. Post-operatively if any wound was found to be infected discharge was collected in sterile container and immediately sent for bacteriological culture and antibiotic sensitivity. All patients were followed up to 30 days after surgery for evaluation of post-operative wound infection, if any.

## RESULTS

Out of total 447 patients, 31 (6.94%) patients developed SSI within 30 days of surgery. Out of these infected patients, 25 (80.65%) were male and 6 (19.35%) female. In this study klebsiella&E.coli were most commonly isolated organisms in 35.48% cases & 22.58% cases. Staphyloccocsaureus was most common gram positive organism isolated causing SSI. Pseudomonas (12.9%), group D streptococci (6.45%), and proteus (3.2%) were also isolated. Statistically significant association of SSI was found with age >50 years, duration of surgery>120 minutes, duration of hospital stay >7 days, diabetes Mellitus, use of tourniquet, pre-operative Hb less than 12 gm% and weight loss (in prior 6 months).(Table-1)

## DISCUSSION

In present study, overall incidence of SSI observed was 6.94%, similar result was found in study by N. E. Ngimet al[9], they found infection rate 9.38% while I.Onche et al[10] found 7.5 % and Dhillon KS et al[11] found it 6.8 %. Klebsiella and E coli were most commonly isolated organisms in present study. this finding was in accordance to study done by Tandon S et al.[12], while various other researchers observed conflicting findings and organisms like Onche et al[10], B. K. Das et al[13]

found staphylococcus aureus as main infecting organism in clean orthopaedic surgeries and Thu LTA et al[14] isolated gram negative organism in 79.1% cases. Tandon S stated that in healthy humans, klebsiella is a commensal in the colonic flora. Gram negative bacteria only transiently colonize the oropharynx and skin of healthy individuals. In contrast, in hospital settings, these bacteria become dominant flora of both mucosal and skin surfaces, particularly in association with antimicrobial use, severe illness, and extended length of stay. This colonization may lead to subsequent infection.[12] Infection in implant surgeries is very difficult to eradicate, because implants provide surfaces for bacterial adherence & formation of biofilm that inhibits penetration of antibiotics.[15]

Statistically significant increase in incidence of SSI with advancing age was observed in present study. Patients aged more than 50 years most commonly developed SSI. This finding confirms similar finding observed by various researchers in past.[16-18]It may because of low immunity, increasing co-morbidities and low wound healing rates in old age patients.

Statistically significant association of diabetes mellitus was observed with SSI. various researchers also found that diabetes mellitus as independent risk factor with significant increase in the development of SSI.[18-20]Guo-qing Li et al stated that delayed wound healing and neutrophil dysfunction (median threshold for neutrophil dysfunction-at blood sugar level 200mg/dl) may be the cause of increasing SSI among diabetics.[20]Zerret al. suggested that preoperative control of blood glucose levels may eliminate the increased risk associated with diabetes. They found that infected diabetic patients had higher mean blood glucose levels over the first 2 postoperative days ($P$ _ 0.003). Institution of a new protocol of post operative continuous intravenous insulin infusion to maintain a blood glucose level _200 mg/dL resulted in a decrease in postoperative blood glucose levels with a concomitant significant decrease in the incidence of SSI ($P$ _ 0.02). These results suggest that glycaemic control in diabetic patients postoperatively may have a significant impact on outcome.[21]

SSI was more common among patients having Hb less than 12gm%. Similar result was found by Dunne JR et al.[22] Statistically significant association was seen between increased incidence of SSI & longer duration of hospital stay. UOE Ikeanyiet al[16] observed that prolong duration of hospital stay greater than 13 days was associated with 21% infection rate. It is due to longer pre-operative hospital stay causes colonization of multidrug resistant micro-organism over patient's skin.

Perioperative antibiotic administration was instituted during the time period of this study, but compliance with these protocols was not measured. Present study suggests that preoperative and perioperative measures should focus on optimizing operation-specific (decrease duration of operation, Optimising blood glucose levels etc.) and patient-specific factors in an effort to decrease the incidence of SSI. Future studies should target early preoperative intervention and optimization of patients with diabetes, anaemia, and malnutrition. Early identification of these risk factors and institution of treatment for correction (glucose control for diabetics, determination of the etiology and then the treatment of anaemia) should be implemented in the preoperative and perioperative period.

## CONCLUSION

The potential risk factors found in present study were age more than 50 years, longer duration of hospital stay, longer duration of surgery, anaemia, diabetes mellitus, Weight loss (in prior 6 months), use of intra-operative negative suction and tourniquet. Interventional strategies

like pre-operative correction of anaemia, control of blood sugar level should be planned for decreasing incidence of SSI in orthopaedic implant surgeries.

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**Table-1: Surgical site infection and Risk factors.**

| Risk factors | Number of patients with SSI | Number of patients without SSI | P value | Inference |
|---|---|---|---|---|
| **Male** | 25 (80.65%) | 277(91.72%) | >0.05 | Not Significant |
| **Female** | 6 (19.35%) | 139(95.86%) | >0.05 | Not Significant |
| **Age >50 years** | 14(12.38%) | 99(87.61%) | <0.05 | Significant |
| **Duration of surgery>120 minutes** | 9(23.08%) | 30(76.92%) | <0.05 | Significant |
| **Duration of hospital stay >7 days** | 29(11.11%) | 232(88.9%) | <0.05 | Significant |
| **Tourniquet** | 13(7.6%) | 158(92.4%) | <0.05 | Significant |
| **Negative suction drain** | 11(5.26%) | 198(94.74%) | <0.05 | Significant |
| **Diathermy** | 11(5.07%) | 206(94.93%) | <0.05 | Significant |
| **Diabetes Mellitus** | 5(18.52%) | 22(81.48%) | <0.05 | Significant |
| **Pre-operative Hb less than 12 gm%** | 23(8.95%) | 234(92.49%) | <0.05 | Significant |
| **Weight loss (in prior 6 months)** | 14(19.18%) | 59(80.82%) | <0.05 | Significant |

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