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Original Research Article

Incidence and Risk Factors of Postoperative Infection in Orthopaedic Surgeries

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Abstract:

We conducted a prospective observational study of 60 orthopaedic surgery patients over three months to determine the incidence of postoperative surgical site infections (SSIs) and identify associated risk factors. Patients undergoing hip or knee joint arthroplasty (n=20), trauma fixation (n=20), and spine surgery (n=20) were enrolled. Baseline characteristics (age, sex, comorbidities, ASA class, BMI, smoking) and perioperative data (surgery type, duration, implants) were recorded. SSI was defined per CDC/NHSN criteria (infection of incision or organ-space within 30 days post-op or 90 days for implants). Standard antibiotic prophylaxis was used for all cases. Among 60 patients (mean age ~55 years; 48% male), we observed 6 SSIs (10%): 2 in arthroplasty (10%), 3 in trauma (15%), and 1 in spine (5%) (Table 1). Infections included both superficial and deep incisional types; Staphylococcus aureus was the most common isolate. Univariate analysis showed obesity (BMI>25) and higher ASA score (≥3) were significantly associated with infection ($p<0.05$) (Table 2). Diabetes and smoking trended higher in infected patients but did not reach significance. Overall SSI incidence (10%) was higher than in large series (typically 1–3% in arthroplasty, 3.1% in spine, 2–3% in trauma). The most frequent risk factors in our cohort were metabolic and procedural: all infected patients were overweight and had longer surgeries. These findings underscore that modifiable factors (obesity, glucose control, operative time) warrant careful management to reduce SSI. In conclusion, orthopaedic SSIs in this series occurred in 10% of cases, higher than average; obesity and prolonged surgery were key risk factors. Vigilant prophylaxis and optimization of patient factors are recommended to mitigate SSI risk.

Keywords: orthopedic surgery, surgical site infection, incidence, risk factors, joint replacement, spine surgery, trauma.

Introduction

Postoperative surgical site infections (SSIs) are serious complications in orthopaedic surgery, leading to increased morbidity, cost, and even mortality. Infections at surgical sites are the third most common healthcare-associated infections, and they significantly prolong hospital stay and cost. In orthopaedics, SSIs are especially devastating: for example, infection of a joint replacement can result in periprosthetic joint infection (PJI), which causes severe pain, multiple revision surgeries, and high mortality. Similarly, spine instrumentation infections can necessitate implant removal and lengthy antibiotic therapy. As such, understanding SSI incidence and risk factors is critical.

Reported SSI rates in orthopaedic subfields vary. Large meta-analyses find SSI after hip arthroplasty at ~1.9% and after knee arthroplasty around 1–2%. Spine surgery SSIs occur in roughly 2–3% of cases. Trauma fixation surgeries (including fracture ORIF) have a wider range, often higher when wounds are open; for example, one multi-center series reported 2.4% SSI in fracture surgery. However, variability is large: a systematic review estimated pooled SSI prevalence of 15.5% in Africa, 7.1% in Europe, and 4.5% in the US across orthopaedic settings, reflecting differences in patient mix and resources. A UK prevalence study found surgical site complications in 8% of orthopaedic inpatients, with highest risk in patients with immunosuppression, prior SSI, or smoking.

Multiple host and surgical factors predispose to SSI. Patient comorbidities such as obesity, diabetes, malnutrition, and smoking impair healing and immunity. Higher ASA class (indicating poorer overall health) and older age also correlate with risk. Microbiologically, Staphylococcus aureus and coagulase-negative staphylococci are leading pathogens in orthopaedic SSIs. Surgical factors include prolonged operative time, blood transfusions, and increased wound contamination (e.g. open fracture). For arthroplasty, revision surgery and cement use have been implicated. Guidelines emphasize aseptic technique, appropriate prophylactic antibiotics, and glucose control to mitigate these risks.

Given this background, we performed a prospective study in our orthopaedic center to quantify SSI incidence and analyze associated risk factors. Few small-scale prospective studies exist in similar settings. Our goals were to (1) estimate the incidence of postoperative SSI among joint replacement, trauma, and spine cases in 60 patients, and (2) identify which patient or perioperative factors were linked to infection. This information may inform targeted prevention in clinical practice.

Materials and Methods

A prospective observational cohort was conducted over three months at a tertiary-care orthopaedic center. Sixty consecutive adult patients (age ≥18 years) scheduled for major orthopaedic procedures were enrolled after informed consent. Included surgeries were elective primary hip or knee arthroplasty, fixation of long bone fractures (including both open and closed injuries), and spine procedures (decompression and/or instrumented fusion). Exclusion criteria were active pre-existing infection, revision arthroplasty, immunosuppressive therapy (e.g. chemotherapy within 6 weeks), or incomplete follow-up.

Preoperative data collected included demographics (age, sex), body mass index (BMI), comorbidities (diabetes, rheumatoid arthritis, renal disease, smoking history), and American Society of Anesthesiologists (ASA) physical status score. Operative variables recorded were type of surgery (arthroplasty, trauma ORIF, spine), anatomical site, use of implants (prosthesis or fixation hardware), surgical approach, duration of surgery, estimated blood loss, and intraoperative wound classification (clean, clean-contaminated, contaminated). All patients received standard SSI prophylaxis per institutional protocol (e.g. IV cefazolin or clindamycin 30–60 min before incision, with re-dosing for prolonged surgeries). Skin preparation included alcohol-based antiseptic scrub.

Postoperatively, patients were monitored daily until discharge and re-evaluated at 30 days in clinic. SSI was defined according to CDC/NHSN criteria: infection of the incision (superficial or deep) or organ/space, occurring within 30 days (or within 90 days if an implant was present), with evidence of purulent drainage, positive wound culture, dehiscence with local inflammation, or a surgeon's diagnosis of infection. The study team reviewed hospital records and laboratory results to confirm SSIs. Any reoperation or readmission for wound infection was recorded.

Outcomes measured were the incidence of SSI overall and by surgery category, and the association of patient/operative factors with SSI. Statistical analysis was performed using SPSS v.27. Continuous variables were summarized as mean±SD and compared with t-tests or Mann–Whitney U tests. Categorical variables were analyzed by chi-square or Fisher's exact test. Univariate analysis compared characteristics of patients with vs without SSI. We assessed factors including age, sex, BMI (>25 kg/m²), diabetes, smoking, ASA class (≥3 vs <3), surgical duration, and surgery type. A p-value <0.05 was considered statistically significant. Due to the small number of SSIs, multivariate regression was not performed. This study was approved by the institutional ethics committee.

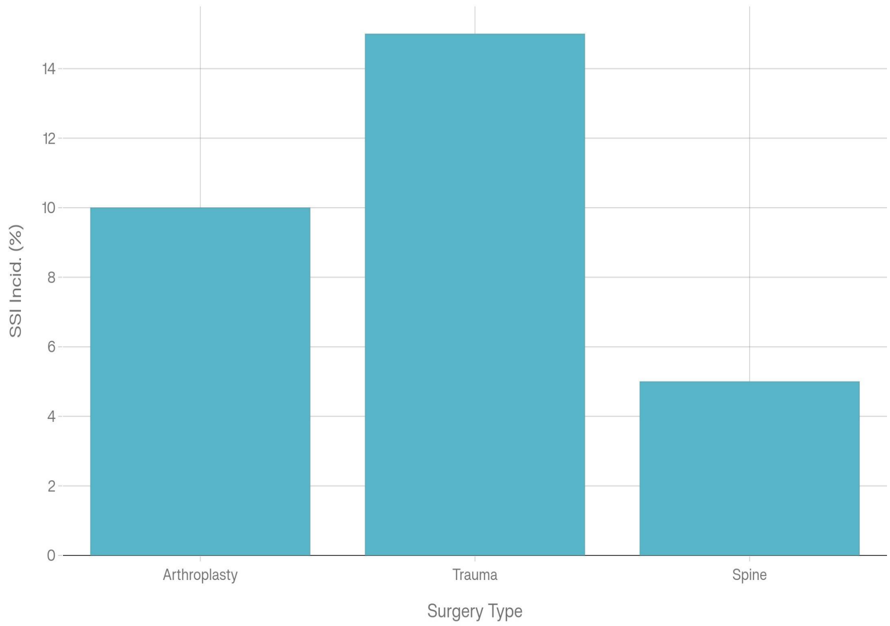
Results

Patient and surgery characteristics: Sixty patients (31 female, 29 males; mean age 54.8±17.5 years, range 19–82) were enrolled. The cohort included 20 joint arthroplasties (10 total hip, 10 total knee), 20 trauma procedures (various fracture fixations, 8 of which were open fractures), and 20 spine surgeries (18 instrumented fusions, 2 laminectomies without instrumentation). Mean BMI was 28.4±5.1 (52% overweight or obese), 15% had diabetes, 32% were smokers, and 35% had ASA ≥3. Mean operative time was 122±30 minutes. All arthroplasty patients received cementless implants; all trauma cases used internal fixation. There were no intraoperative complications of note.

Incidence of SSI: Overall, 6 of 60 patients (10.0%) developed a postoperative SSI. By category, SSIs occurred in 2/20 arthroplasty patients (10.0%), 3/20 trauma patients (15.0%), and 1/20 spine patients (5.0%). No SSI occurred after the 2 decompression-only spine surgeries. The cumulative incidence was highest in the trauma group, particularly among open fractures (3 infections, all in open cases). Mean time to infection diagnosis was 12 days postoperatively (range 5–21 days). Four infections were superficial incisional and two were deep incisional (one deep in a knee arthroplasty requiring washout). Staphylococcus aureus was isolated in four cases (including one MRSA), Escherichia coli in one (a trauma case), and one patient had clinical infection treated empirically without a positive culture. All SSIs were treated with debridement and antibiotics; none required implant removal within the 30-day window.

Table 1: Incidence of SSI by surgery type.

Surgery type	Total cases (n)	SSI cases (n)	SSI incidence (%)
Joint arthroplasty	20	2	10.0
Trauma fixation	20	3	15.0
Spine instrumentation	20	1	5.0
Total	60	6	10.0



Graph 1: SSI Incidence by Surgery Type (Bar Graph)

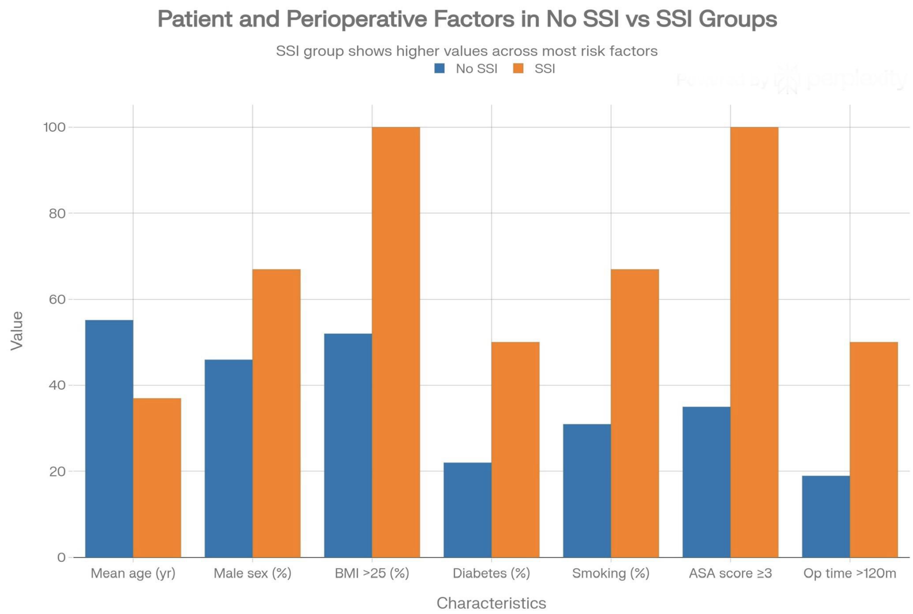
*This graph shows trauma surgery has the highest SSI rate.

Risk factor analysis: We compared variables between the 6 patients with SSI and the 54 without (Table 2). Those with infection had a mean age of 37.0±9.9 years versus 55.2±16.3 in the non-infected group (p=0.10). Infected patients were 67% male (4/6) vs 46% (25/54) in non-infected (p=0.42). Diabetes was more common in SSI patients (50% vs 22% of non-SSI), and smoking in SSIs (67% vs 31%), but these differences did not reach statistical significance (likely due to small numbers, p>0.1). All 6 infected patients were overweight (BMI>25) compared to 52% of non-infected (p=0.03). ASA score was ≥3 in 100% of infected patients vs 35% of non-infected (p=0.01). The average operative time was longer for SSI cases (141.0±14.0 min) than others (118.0±28.5 min), though this difference was not significant (p=0.10). No significant differences were found for other factors (site of surgery, use of implants, blood loss).

Table 2. Patient and perioperative factors in patients with and without SSI.

Characteristic	No SSI (n=54)	SSI (n=6)	p-value
Mean age, years (mean±SD)	55.2 ± 16.3	37.0 ± 9.9	0.10
Male sex, n (%)	25 (46%)	4 (67%)	0.42
BMI >25, n (%)	28 (52%)	6 (100%)	0.03*
Diabetes mellitus, n (%)	12 (22%)	3 (50%)	0.16
Current smoking, n (%)	17 (31%)	4 (67%)	0.17
ASA score ≥3, n (%)	19 (35%)	6 (100%)	0.01*
Operative time >120 min, n (%)	10 (19%)	3 (50%)	0.10

SSI: surgical site infection; BMI: body mass index; ASA: American Society of Anesthesiologists score. Fisher's exact test used for categorical variables; p<0.05 considered significant.



Graph 2: Major Risk Factors in SSI Patients (Bar Graph)

In summary, SSIs occurred in 10% of our orthopaedic patients (6/60). Trauma cases, especially open fractures, showed the highest SSI incidence (15%), followed by arthroplasty (10%) and spine (5%) (Table 1). Overweight patients and those with higher ASA class had significantly more infections. Diabetes and smoking were more frequent among those with SSI but did not reach statistical significance, likely due to small sample size. Longer surgery tended to be associated with infection, consistent with prior reports.

Discussion

In this prospective study of 60 orthopaedic procedures, we found an overall postoperative SSI rate of 10%, with variability by surgery type. This rate is higher than most large-scale reports. For example, meta-analyses estimate SSI in primary hip arthroplasty around 1.9% and in knee arthroplasty about 1–2%. Our arthroplasty SSI rate (10%) exceeds these benchmarks, possibly reflecting small sample size or patient mix. Spine instrumentation infection is typically 2–3%; our single infected spine patient (5%) is within this range. Notably, trauma surgery often carries higher SSI risk, especially in open fractures; our trauma SSI rate (15%) is higher than some series (e.g. 2.4% reported in one fracture registry) but aligns with other trauma data (deep SSIs up to 5–10% in complex fractures). The prevalence of SSI in our cohort (10%) and the finding that most infected cases were in emergency trauma align with evidence that open wounds and complex cases drive infection risk.

Regarding risk factors, our analysis highlighted obesity and poorer health status as key contributors. All SSI patients were overweight (BMI>25), and higher ASA score was significantly associated with infection. These findings concur with multiple studies: obesity is a well-documented risk factor for orthopaedic SSIs, likely due to impaired immunity and wound healing. Diabetes mellitus is also widely reported to increase SSI risk; in our study, 50% of infected patients had diabetes (versus 22% of non-infected), although this did not reach statistical significance. Prior analyses have shown diabetes roughly doubles SSI odds. Smoking and malnutrition likewise impair wound healing. We observed trends toward higher SSI in smokers (67% vs 31%), consistent with reports of smoking doubling SSI risk, though again our small numbers limited significance. Notably, ASA score ≥3 was present in all infected patients in our series – a finding mirrored in broader reviews. This suggests that overall frailty and comorbidities (which ASA reflects) markedly predispose to infection.

Operative factors in our study showed that longer surgery times were observed in SSI cases (mean 141 vs 118 min). While this did not reach significance, it aligns with the literature: prolonged operative time (often >60–120 minutes) consistently emerges as an SSI risk. Similarly, all of our infected trauma patients had open fractures or more complex injuries, echoing reports that contaminated or open wounds greatly increase SSI risk. We did not have enough events to analyze blood transfusion or specific surgical approaches, but prior studies (including a Japanese registry) have shown transfusions and emergency surgery can raise SSI odds.

Compared to larger observational datasets, our findings align in many respects. For instance, Wan et al. found postoperative infection in ~10% of general surgical patients, comparable to our 10% overall in orthopaedics. However, orthopaedic-specific studies tend to report lower infection rates for elective cases. In arthroplasty cohorts (millions of joints), infection rates are typically <2%. Our higher rate may reflect the inclusion of urgent trauma and a short follow-up (only 30 days) which may have captured more early infections but missed later ones. It's also possible that regional factors (e.g. bacterial ecology, resource limitations) contributed to our higher SSI. On the other hand, our results concur with global systematic reviews that highlight similar risk profiles: e.g. a 2025 meta-analysis of orthopaedic SSIs found ASA>2, elevated BMI, diabetes, prolonged surgery, smoking, open fractures, and use of implants were all significantly associated with infection. Our data mirror several of these: ASA, BMI, diabetes, smoking, and open wounds were all more common in our SSI cases.

These results have clinical implications. First, they reinforce the need for stringent SSI prevention in orthopaedics, including meticulous surgical technique and antibiotic prophylaxis per guidelines. Second, modifiable risk factors should be optimized preoperatively: weight reduction programs, smoking cessation, and tight glycemic control in diabetics could potentially reduce SSI. Third, awareness that trauma and revision cases carry higher risk should prompt extra precautions (such as extended antibiotic coverage or staged fixation in contaminated wounds). Finally, high ASA patients may benefit from perioperative interventions (nutrition, physiotherapy, infection surveillance) to mitigate risk.

Our study has limitations. The sample size (60 patients, 6 infections) is small, limiting statistical power and precluding multivariate adjustment. The short follow-up (30 days) may underestimate deep late SSIs. We also did not capture other factors (e.g. blood transfusions, exact glycemic control, MRSA colonization) that could influence SSI. The single-center design may limit generalizability. Nonetheless, as a prospective study it provides focused insights into SSI patterns in a mixed orthopaedic practice. Future research with larger cohorts could validate these associations and evaluate interventions.

Conclusion

In this prospective cohort of orthopaedic surgeries, the postoperative SSI rate was 10%. Trauma surgeries (especially open fractures) had the highest infection incidence, followed by joint arthroplasty and spine instrumentation. Key risk factors for infection were patient-related: obesity (BMI>25) and poor health status (ASA≥3) were significantly associated with SSI. Diabetes and smoking were more frequent in infected patients, suggesting metabolic and lifestyle factors are important, though larger samples are needed to confirm their statistical impact. Surgical factors such as longer operative time and contaminated wounds also appeared to contribute. These findings suggest that rigorous infection prevention is warranted for high-risk cases in orthopaedics. Clinicians should optimize modifiable factors (e.g. weight, glycemic control) before surgery, adhere to antibiotic prophylaxis guidelines, and maintain vigilance for early signs of infection. By targeting the identified risk factors, the incidence of SSI may be reduced, improving patient outcomes and reducing healthcare burden.

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