

Original Research

Incidence and risk factors of surgical site infections in the orthopedic ward

¹Dr. Mrityunjay Pravesh Sharma, ²Dr. Nagendra Singh Bhadauria I, ³Dr. Arunjay Pravesh Sharma, ⁴Dr. Aayushi Kurmi

¹Senior Resident, Rajiv Gandhi Medical College and CSMH, Kalwa, Thane, India

²Medical Superintendent, Professor and Head, Department of Surgery, SJP Government Medical College Bharatpur, Rajasthan, India

³BDS, Fellowship in Mircodendistry, Govt Dental College, Mumbai, India

⁴Junior Resident, Department of General Surgery, NIMS University, Jaipur, Rajasthan, India

Corresponding Author

Dr. Aayushi Kurmi

Junior Resident, Department of General Surgery, NIMS University, Jaipur, Rajasthan, India

Received Date: 26 August, 2022

Accepted Date: 17 September, 2022

ABSTRACT

Background: Infections that harm the incision or deep tissue at the operation site are known as surgical site infections (SSIs), and they can appear up to 30 days after surgery (or up to a year after surgery in patients receiving implants). The present study was conducted to assess the incidence rate and risk factors of surgical site infections in the orthopedic ward.

Materials & Methods: 174 patients who underwent orthopedic surgeries of both genders were selected. Parameters such as type of orthopaedic surgery, wound class: clean, clean-contaminated, contaminated and dirty, duration of operation, length of hospital stay etc. were recorded.

Results: Out of 174 patients, 90 were males and 84 were females. Orthopaedic surgery performed was ORIF with plating in 58, CRIF with K-wiring in 42, CRIF with IMIL nailing in 30 and CRIF with long PFN in 44 patients. Operative time was <2 hours in 104 and >2 hours in 74 patients. Hospital stay was <4 days in 98 and >4 days in 76 patients. SSI was present in 48 and absent in 126 patients. Type of SSI was superficial in 28 and deep in 20. Surgical wound was clean in 116, clean-contaminated in 4, contaminated in 24 and dirty in 30 patients. The difference was significant ($P < 0.05$).

Conclusion: Incidence of SSI was 27.5%. Open surgical technique, contaminated wound class, and emergency surgery are potentially modifiable independent risk factors for SSI following orthopaedic surgery.

Key words: Surgical site infections, nosocomial infection, wound class

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Introduction

Infections that harm the incision or deep tissue at the operation site are known as surgical site infections (SSIs), and they can appear up to 30 days after surgery (or up to a year after surgery in patients receiving implants).¹ SSIs are the most common nosocomial infection among surgical patients, and studies have shown that they are the primary cause of operation-related adverse outcomes.² According to studies, patients with SSI need longer hospital stays and pay more for similar surgical treatments than patients without the infection.³ Despite improvements in prevention, SSIs remain a significant clinical problem due to their high rates of morbidity and mortality and significant demand on hospital resources.⁴

Depending on the surgical technique, the surveillance criteria employed, and the caliber of data collection, the incidence of SSIs may reach 20%. The infections that cause many SSIs come from the patient's natural

vegetation.⁵ Three main determinants of SSI—bacterial variables, local wound factors, and patient factors—comprise the various risk factors for SSI that have been identified. Bacterial variables include the surgical site's bacterial burden and pathogenicity.⁶ In addition to patient-related factors like age, immune suppression, steroids, cancer, obesity, perioperative transfusions, cigarette smoking, diabetes, other pre-existing illnesses, and malnourishment, local wound factors include the invasiveness of an operation, the surgical technique, and the surgeon's practices.⁷ The present study was conducted to assess the incidence rate and risk factors of surgical site infections in the orthopedic ward.

Materials & Methods

The present study consisted of 174 patients who underwent orthopedic surgeries of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Parameters such as type of orthopaedic surgery, wound class: clean, clean-contaminated, contaminated and dirty, duration of operation, length of hospital stay etc. were recorded. Data thus obtained were

subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table: I Distribution of patients

Total- 174		
Gender	Male	Female
Number	90	84

Table I shows that out of 174 patients, 90 were males and 84 were females.

Table: II Assessment of parameters

Parameters	Variables	Number	P value
Orthopaedic surgery	ORIF with plating	58	0.81
	CRIF with K-wiring	42	
	CRIF with IMIL nailing	30	
	CRIF with long PFN	44	
Operative time (hours)	<2	104	0.02
	>2	70	
Hospital stay (Days)	<4	98	0.05
	>4	76	

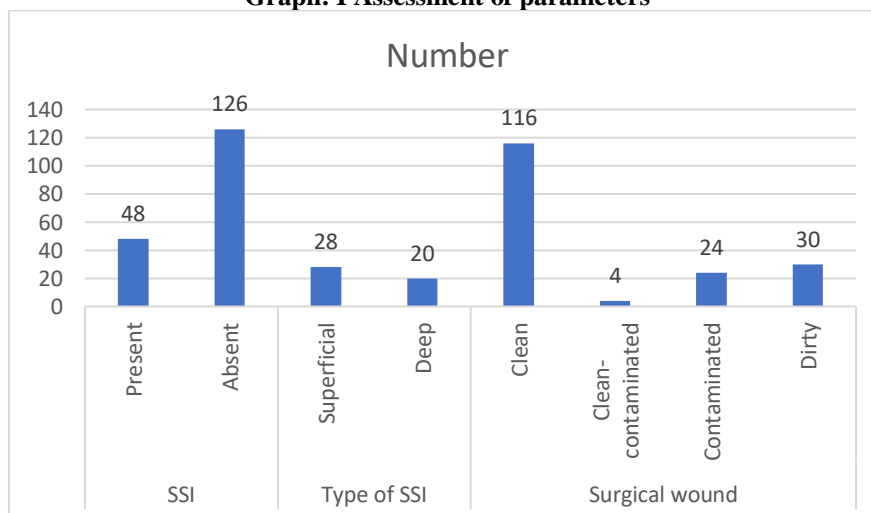
Table II shows that orthopaedic surgery performed was ORIF with plating in 58, CRIF with K-wiring in 42, CRIF with IMIL nailing in 30 and CRIF with long PFN in 44 patients. Operative time was <2hours in 104 and >2hours in 74 patients. Hospital stay was <4 days in 98 and >4days in 76 patients. The difference was significant (P< 0.05).

Table: III Surgical site infection

Parameters	Variables	Number	P value
SSI	Present	48	0.01
	Absent	126	
Type of SSI	Superficial	28	0.95
	Deep	20	
Surgical wound	Clean	116	0.05
	Clean- contaminated	4	
	Contaminated	24	
	Dirty	30	

Table III, graph I show that SSI was present in 48(27.5%) and absent in 126 patients. Type of SSI was superficial in 28 and deep in 20. Surgical wound was clean in 116, clean- contaminated in 4, contaminated in 24 and dirty in 30 patients. The difference was significant (P< 0.05).

Graph: I Assessment of parameters



Discussion

One prevalent form of HAI3 is surgical site infections (SSIs), which are infections of the incision, organ, or operating room that follow surgery.⁸ Following orthopaedic surgery, infections are catastrophic side effects with major clinical and economical implications. According to studies, the incidence of SSI in orthopaedic settings ranges from 0.3% to 25%, with low- and middle-income nations having an incidence that is almost four times higher than that of high-income ones.⁹ Chlorhexidine showers, aseptic practice, careful attention to surgical technique, and good patient preparation have all been advised, especially for patients who have been hospitalized for a few days and for those for whom an SSI will result in significant morbidity (cardiac, vascular, and prosthetic procedures). A germicidal antiseptic, such as chlorhexidine, povidone-iodine, or tincture of iodine, is used to prepare the surgical site's skin.¹⁰ The present study was conducted to assess the incidence rate and risk factors of surgical site infections in the orthopedic ward.

We found that out of 174 patients, 90 were males and 84 were females. Sane et al¹¹ enrolled adult patients admitted in the in-patient wards of Orthopedics and underwent (category 1) clean wound type of orthopaedic surgeries (elective or emergency). Patients' demographics details, clinical history, characteristics of disease, surgery-related variables, pre/post management, hospital stay details and laboratory indexes were inquired and documented. In this study, incidence of SSI in clean wound orthopaedic surgeries was 6.84%. The male to female ratio was 1.8. In this study, SSI was associated significantly with age, comorbid condition, and pre-op hair removal technique. The most common infective organisms identified on culture were *Klebsiella pneumoniae* and Methicillin-resistant *Staphylococcus aureus*.

We found that orthopaedic surgery performed was ORIF with plating in 58, CRIF with K-wiring in 42, CRIF with IMIL nailing in 30 and CRIF with long PFN in 44 patients. Operative time was <2 hours in 104 and >2 hours in 74 patients. Hospital stay was <4 days in 98 and >4 days in 76 patients. Al-Mulhim FA et al¹² included a total of 79 of 3096 patients (2.55%), 60 males and 19 females with the average age of 38.13 ± 19.1 years. Fifty-three patients were admitted directly to the orthopedic wards, 14 were transferred from the surgical intensive care unit, and 12 from other surgical wards. The most common infective organism was *Staphylococcus* species including Methicillin Resistant *Staphylococcus aureus* (MRSA), 23 patients (29.11%); *Acinetobacter* species, 17 patients (21.5%); *Pseudomonas* species, 15 patients (18.9%); and *Enterococcus* species, 14 patients (17.7%). Fifty-two (65.8%) had emergency procedures, and in 57 patients trauma surgery was performed. Three (3.78%) patients died as a result of uncontrolled septicemia. SSI was found to be

common in our practice. Emergency surgical procedures carried the greatest risk with *Staphylococcus* species and *Acinetobacter* species being the most common infecting organisms.

We found that SSI was present in 48 and absent in 126 patients. Type of SSI was superficial in 28 and deep in 20. Surgical wound was clean in 116, clean-contaminated in 4, contaminated in 24 and dirty in 30 patients. Maksimović J et al¹³ performed assessment of 277 patients after operation revealed surgical site infection in 63 patients. In 3 (4.8%) of them, surgical site infections were detected after hospital discharge. The overall incidence rate of surgical site infections was 22.7% (95% confidence interval [95% CI], 17.5-29.1). The incidence increased from 13.2% in clean wounds to 70.0% in dirty wounds. The rates of surgical site infection for the NNIS risk index classes 0 to 3 were 8.1% (13 of 161), 36.4% (32 of 88), 63.0% (17 of 27), and 100% (1 of 1) ($P < 0.001$; χ^2 test). Multivariate logistic regression analysis identified the following independent risk factors for surgical site infections: greater number of persons in the operating room (odds ratio [OR], 1.28; 95% CI, 1.02-1.60), contaminated or dirty wounds (OR, 12.09; 95% CI, 5.56-26.28), and American Society of Anesthesiologists' (ASA) score >2 (OR, 3.47; 95% CI, 1.51-7.95). In patients who were shaved with a razor, the period of 12 or more hours between shaving and intervention was also an independent risk factor. The limitation of the study is the small sample size.

Conclusion

Authors found that incidence of SSI was 27.5%. Open surgical technique, contaminated wound class, and emergency surgery are potentially modifiable independent risk factors for SSI following orthopaedic surgery.

References

1. Pittet D, Allegranzi B, Storr J, Bagheri Nejad S, Dziekan G, Leotsakos A, et al. Infection control as a major World Health Organization priority for developing countries. *J Hosp Infect* 2008;68:285-92.
2. Keely Boyle K, Rachala S, Nodzo SR. Centers for Disease Control and Prevention 2017 Guidelines for Prevention of Surgical Site Infections: Review and Relevant Recommendations. *Curr Rev Musculoskelet Med* 2018;11(3):357-369.
3. Brophy RH, Bansal A, Rogalski BL, et al. Risk Factors for Surgical Site Infections After Orthopaedic Surgery in the Ambulatory Surgical Center Setting. *J Am Acad Orthop Surg* 2019;27(20):e928-e934.
4. Ercole FF, Franco LM, Macieira TG, Wenceslau LC, de Resende HI, Chianca TC. Risk of surgical site infection in patients undergoing orthopedic surgery. *Rev Lat Am Enfermagem* 2011;19(6):1362-1368.
5. Al-Mulhim FA, Baragbah MA, Sadat-Ali M, Alomran AS, Azam MQ. Prevalence of surgical site infection in orthopedic surgery: a 5-year analysis. *Int Surg* 2014;99(3):264-268.
6. Ikeanyi U, Chukwuka C N, Chukwuanukwu T. Risk factors for surgical site infections following clean

- orthopaedic operations. Niger J Clin Pract 2013;16:443-7.
7. Mardanpour K, Rahbar M, Mardanpour S, Mardanpour N. Surgical site infections in orthopedic surgery: incidence and risk factors at an Iranian teaching hospital. Clin Trials OrthopDisord 2017; 2(4):132-137.
 8. Liang Z, Rong K, Gu W, et al. Surgical site infection following elective orthopaedic surgeries in geriatric patients: Incidence and associated risk factors. Int Wound J 2019;16(3):773-780.
 9. Pathak A, Saliba EA, Sharma S, Mahadik VK, Shah H, Lundborg CS. Incidence and factors associated with surgical site infections in a teaching hospital in Ujjain, India. Am J Infect Control 2014;42(1):11-5.
 10. Kimmatkar N, Hrmnani JT. Incidence of Surgical site infections in IPD Orthopedics patients undergoing implant surgery. A Hospital Based Study. Int Arch BioMed Clin Res 2017;3(4):135-138
 11. Sane RM, Samant PD. Incidence of surgical site infections and associated risk factors in clean orthopaedic surgeries. Surgery. 2021 Sep 1;2:14.
 12. Al-Mulhim FA, Baragbah MA, Sadat-Ali M, Alomran AS, Azam MQ. Prevalence of surgical site infection in orthopedic surgery: a 5-year analysis. Int Surg 2014;99(3):264-268.
 13. Maksimović J, Marković-Denić L, Bumbasirević M, Marinković J, Vlajinac H. Surgical site infections in orthopedic patients: prospective cohort study. Croat Med J 2008;49(1):58-65.