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Surgical site infections in orthopedic implant surgery and its risk factors: A prospective study in teaching hospital

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Abstract
Background: Surgical site infections (SSI) in orthopaedic implant surgery is devasting complication range from 1-2% to 22%. It leads to increase case cost, prolongs antibiotic use/abuse, increases morbidity and rehabilitation.
Method: This prospective study was conducted on 248 patients with closed fracture cases undergoing clean and elective orthopaedic implant surgeries admitted at Mandya Institute of Medical Sciences, Mandya (Karnataka), India between october-2016 to march-2017.
Results: The surgical site infection was diagnosed in 11 (4.435%) patients within 3 months after surgery. Staphylococcus aureus was most common infective organism islolated in 54.54% cases. On data analysis SSI was significantly associated with increasing age, diabetes mellitus, smoking and anemia.
Conclusion: Incidence of SSI in implants surgeries are quite high, proper measure are needed to control it.

Keywords: Surgical site infection, orthopaedic surgery, risk factors

Introduction
Surgical site infection (SSI) is defined as microbial contamination of the surgical wound within 30 days of an operation or within 1 year after surgery if an implant is placed in a patient [1]. In orthopedics, the surgical site infection after implant surgery is a disaster both for the patient and surgeon [1]. SSI's are one of the most common nosocomial infections besides pneumonia, urinary tract infections, and bloodstream infections [2]. SSI is the second or third most frequent infection among surgical patients. It is responsible for approximately 17% of all healthcare-related infections [3]. Surgical site infections cause increased morbidity, mortality, extended hospital in-patient stays, and economic burden to the hospital resources [4].
SSI's related to orthopedic procedures represents a severe and catastrophic complication for patients, surgeons and hospital institutions, as an infection can extent the patient's hospitalization time by up to two weeks, double re-hospitalization rates, increase care costs by more than 300%, besides causing important physical limitations that significantly reduce patients quality of life after the surgery [3]. Incidence levels of orthopedic SSI's can range between 0.8 and 71%. [5-9]
The pathogenesis of infection in fractures fixation devices is related to micro- organisms, which grow in biofilm and therefore its eradication is difficult [10]. These infections are classified in to three stages, i.e., early (less than two weeks), delayed (2 to 10 weeks) and late (more than 10 weeks) infection [11]. In 1896, Brewer reported the infection rates of 39% in postoperative patients that was reduced to 0.2% with proper aseptic measures in recent times. At the beginning of 19th century, the rate of infection was reduced due to basic aseptic measures and antibiotic use. The most common infecting organism in orthopedic infection is Staphylococcus aureus [12]. Hence the present study designed to estimate the rate of infection in orthopedic implant surgery in a public hospital and also to identify causative organisms and risk factors associated with surgical site infections.

Material and Methods

This prospective study was conducted in department of Orthopedics at Mandya Institute of Medical Sciences, Mandya, Karnataka from october-2016 to march-2017. The inclusion criteria were closed fracture cases of either gender in all age groups admitted for elective implant surgery. Exclusion criteria were soft tissue surgery, open fractures needing external fixation devices, pathological fractures or patient with pre-existing cardiac /pulmonary/renal disease.

The patients particular were recorded on a prescribed proforma which included name, age, sex, diagnosis, co-morbidity, smoking history, nutritional status, type of implant, skin at risk as variables.

All patients were given first generation cephalosporins as a standard practice prophylactic intravenous antibiotics on call to the operating room. Based on the criteria, patients were included in the study after taking informed written consent during postoperative period. Patients were observed for post-operative wound infection till discharge. The follow up will be done up to three months according to a protocol, first visit after two weeks and subsequent visits on monthly basis.

The diagnosis of infection was based clinical observations and microbiology reports which was done as routine investigations. If the aerobic cultures are negative, anaerobic culture will be considered. Infection will be graded superficial or deep and early, delayed or late. The infection will be considered superficial when it did not penetrate the deep fascia while the deep infection was inside the deep fascia. At least 3 swab samples from the most inflamed areas will be sent for culture to improve yield and minimize diagnostic error in a sterile culture tube. The risk factors assessed includes age, sex, duration of hospital stay, nutrition status, presence of diabetes mellitus, smoking habits, hypertension, anemia, whether drainage was performed, duration of drainage, Open/closed reduction of fracture.

Results

Out of 248 patients, 165 (66.53%) were male and 83(33.46%) were female. Eleven (4.43%) patients developed infections out of which 8 were male and 3 were female. The superficial infection was in 2 (18.18%) patients, while deep infection was in 9 (81.81%) patients. There were 7(63.63%) cases of early infection and 2(18.18%) each in delayed and late stages. The age of the patients was more than 60 years in 7 (63.33%) patients with 5 (45.45%) patient having co-morbidities, 30 to 60 years in 2 (18.18%) patients and below 30 year in 2 (18.18%) patient.

The risk factors are shown in Table-1. The microorganisms implicated are shown in Table-2. The infection rate in different type of implant is shown in Table-3.

Out of 11 infected cases, implant was removed in 2 patients one with ORIF of peri-articular fracture and one operated with PFN, while the rest of the patients were treated with intravenous antibiotics and multiple debridement.

Table 1: Risk factors

Risk factors	Infected
Advancing age(>60 yrs)	2(18.18%)
Comorbidites in elderly patients(Diabetes, anemia)	5(45.45%)
Smoking	3(27.27%)
Skin at risk	1(9.09%)

Table 2: Micro-organisms implicated

Micro-organisms	Infected
Staph aureus	6(54.54%)
E-coli and proteus	2(18.18%)
Klebsiella	2(!8.18%)
Polymicrobial	1(9.09%)

Table 3: Infection in different type of implant surgeries

Surgeries	Performed	Infected
DHS/PFN	42	3(27.27%)
AMP/Bipolar Prosthesis	47	1(9.09%)
Plating of long bone shaft fractures	61	1(9.09%)
Nailing of long bones	56	1(9.09%)
ORIF of peri-articular fractures	27	3(27.27%)
CRIF/ORIF with cannulated screws	11	1(9.09%)
ORIF of tarsal bones	4	1(9.09%)
Total	248	11(100%)

Discussion

The incidence rate of surgical site infections found in the present study is 4.435% which is much higher than accepted standard for postoperative wound infection, which should be less than 1%. Our infection rate is comparable to another study in which the infection rate was 5% [13] and is much lower than other studies by K. S. Dhillon *et al* [14] they found infection rate in 6.8% while I.Onche *et al* [15] found 7.5 % and N. E. Ngim *et al* [16] found 9.38% infection rate.

Marston *et al* [17] reported 5% superficial and 0.25% deep infection in 413 total hip replacements in ideal circumstances. According to some studies, the overall superficial and deep infection rate is 7.8% and 10% respectively [18] while we reported 0.806 % superficial and 3.629 % deep infection. The rate of postoperative wound infection without prophylactic antibiotic is high as compared to the use of prophylactic antibiotic [19]. Our infection rate with prophylactic antibiotic is 4.435% which is higher as compared to another study i.e., 3.97% [20].

The difference in incidence rate of SSI in different studies may be related to different inclusion criteria, different surgical set ups and facilities available.

In our study, we found that SSIs are more common in patients above 60 years of age. It may because of low immunity, increasing catabolism, increasing co-morbidities and low wound healing rates in old age patients [21]. Stephen Apanga *et al*, [22] Aikaterini Masagala *et al*, [23] Ibtesam K Afifi *et al*, [24] A.L. Akinyoola *et al* [25] and Khan MS *et al* [26] also reported that SSI is common in old aged patient.

Significant association of diabetes mellitus was found with SSI. Sachin *et al* [27], Yang K *et al*, [28] Ibtesam K Afifi *et al*, [24] Aikaterini Masgala *et al* [23] and Guo-qing *et al* [29] found that diabetes mellitus as independent risk factor with significant increase in the development of SSI. Delayed wound healing and neutrophil dysfunction may be the cause of increasing SSI among diabetics [24]. Anemia is also an important risk factor in development of SSI. Similar results were observed by Awan MS [30].

The timing of administration of antibiotics prophylaxis is also critical factor in development of SSI. The administration of antibiotics 2 hours or more before surgery or post-operatively was definitely associated with a higher SSI rate. The antibiotics should be administered ideally within 30 minutes and certainly within two hours of the time of incision [31]. So the selection of proper antibiotics and time of its administration can reduce the incidence of SSI to the great extent.

Staphylococcus aureus was predominant causative organism in this study which is 54.54%.

Jadranka Maksimovic [8], Ibtesam K Afifi [24], Khan *et al* [26] and Wassef MA *et al* [32] also found same organism. About 10-30% of healthy people carry this organism in their nares. Infections by these organisms can also be caused by patients themselves. Although eradication of Staphylococcus aureus nasal carriage with mupirocin was found to be effective, this measure reduced the surgical site infections rates only in some studies [33]. Bedsheets, instruments and dressing have also been found to act as reservoirs of S. aureus. Rajvir Singh *et al* [34] recorded gram negative infections as major threat and isolated gram negative organisms in 75.6% cases.

There are some limitations of the study. It covered a period of only 6 months and thus may not account for seasonal variations. Demographic characteristics of hospital population may be changed during winter. We have followed post-operative patients for only 3 months, but in implant surgeries infection can develop 1year long after surgery.

Conclusion

Surgical site infections are a considerable problem in orthopedic patients. Our infection rate was quite high and needs proper measures to control it because it had great financial burden on patient and on hospital resources and could lead to increased morbidity and mortality in patients

References

1. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections.Infect Control Hosp Epidemiol. 1992; 13(10):606-608
2. Centers for Diseases Control and Prevention. The National Healthcare Safety Network Manual – NHSN. Pacient Safety Component Protocol. Division of Healthcare Quality Promotion National Center for Preparedness, Detection and Control of Infectious Diseases Atlanta, GA, USA, 2009, 225.
3. National Nosocomial Infections Surveillance (NNIS) System Report, data summary from January 1992 through June 2004, Am J Infect Control. 2004; 32:470-85.
4. Awad SS, Palacio CH, Subramanian A, Byers PA, Abraham P, Lewis D *et al*. Implementation of a methicillin resistant Staphylococcus aureus (MRSA) prevention bundle results in decreased MRSA surgical site infections. Am J Surg. 2009; 198(5):607-610.
5. Ercole FF, Chianca TCM. Infecção de sítio cirúrgico em pacientes submetidos à artroplastia de quadril. Revista Latino-Am. Enfermagem. 2002; 10(2):157-65.
6. Lima ALLM, Zumiotti AV, Uip DE, Silva JS. Fatores preditivos de infecção em pacientes com fraturas expostas nos membros inferiores. Acta Ortop Bras. 2004; 12(1):23-39.
7. Maksimovic J. Incidence of surgical site infections in the departaments of orthopedics and traumatology. Vojnosanit Pregl. 2006; 63(8):725-9.
8. Maksimovic J, Markovíc-Denic L, Bumbasrevic M, Marinkovic J, Vlajinac H. Surgical site infections in orthopedics patients: prospective cohort study. Croat Med J. 2008; 49(1):58-65.
9. Zimmerli W, Trampuz A, Ochsner PE. Prosthetic-joint infections. N Engl J Med. 2004; 351:1645-54.
10. Trampuz A, Zimmerli W. Diagnosis and treatment of infections associated with fracture fixation devices. Injury. 2006; 37(suppl 2):S59-66.
11. Brewer GE. Operative surgery at city hospital with a preliminary report on the study of wound infection. Surgery of musculoskeletal system. Evarts M. 1990; 5:4316.
12. Esterhai J, Gelb I. Orthopaedic infection. Ortho. Clin. North Am. 1991; 22:503-10.
13. Tago IA, Asfhaq K, Gill P, Memon K, Kumar N, Mahboob G. Post operative infection in clean cases with the use of implant and their management. J pak orthop assoc. 2007; 19(2):46-56.
14. Dhillon KS, Kok CS. The incidence of post-operative wound infection in orthopaedic surgery. Med. J. Malaysia. 1995; 50(3):237-40.
15. Onche I, Adedeji O. Microbiology of post-operative wound infection in implant surgery. Nigerian Journal of Surgical Research. 2004: 6(1, 2):37-40.
16. Ngim NE, Etokidem AJ, ikpeme IA, Udosen AM. Surgical site infection in clean orthopaedic operations: experience from the third world. Asian J Med Cli Sci. 2013 2(1).
17. Martson RA, Cobb AG, Bantley G. Stammor compare with Charnely total hip replacement. J Bone J Surg. 1996; 78:178-84.
18. Tayyab S, Hussain N, Sharaf T. Low dose cephradine prophylaxis in caesarean section. Med Channel 1999; 5(3):13-5.
19. Williams DN, Gustilo RB. The use of preventive antibiotic in orthopaedic surgery. Clin Orthop Relat Res. 1984; 190:83-8.
20. Jamali AR, Mehboob G, Majid A, Bhatti A, Minhas S, Akhtar R *et al*. Postoperative wound infections in Orthopaedic surgery. J Coll Physicians Surg Pak. 2001; 11:746-9.
21. Rao NB. A Prospective Study on the Postoperative Wound Infections. Journal of Clinical and Diagnostic Research. 2012; 6(7):1266-71.
22. Stephen Apanga, Jerome Adda, Mustapha Issahaku, Jacob Amofa, Kuewu Rita Ama, Mawufemor *et al*. Post-Operative Surgical Site Infection in a Surgical Ward of a Tertiary Care Hospital in Northern Ghana. Int J Res Health Sci. 2014; 2(1):207-12.
23. Aikaterini Masgala. Efstathios Chronopoulos, Georgios Nikolopoulos, John Sourlas, Stergios Lallos, Emmanuel Brilakis, John Lazarettos, Nikolaos Efstathopoulos. Risk Factors Affecting The Incidence Of Infection After Orthopaedic Surgery: The Role Of Chemoprophylaxis. Cent Eur J Public Health. 2012; 20(4):252-256.
24. Ibtesam K Afifi, Ehssan A Baghagho. Three months study of orthopaedic surgical site infections in an Egyptian University hospital. International Journal of Infection Control. 2010; v6:i1.
25. Akinyoola AL, Adegbehingbe OO, Ogundele OJ. Factors influencing the outcome of elective paediatric orthopaedic operations in Ile-Ife, Nigeria. Tanzan J Health Res. 2008; 10(2):68-72.
26. Khan MS, Rehman S, Ali MA, Sultan B, Sultan SJ. Infection in orthopedic implant surgery, its risk factors and outcome. J Ayub Med Coll Abbottabad, 2008; 20(1):23-5.
27. Patel S. Surgical Site Infections: Incidence and Risk Factors In A Tertiary Care Hospital, Western India. National Journal of Community Medicine. 2012; 3(2):193-196.

28. Yang K, Yeo SJ, Lee BPH, Lo NN. Total Knee Replacements In Diabetic Patients, A Study Of 109 Consecutive Cases. J arthroplasty. 2001; 16:102-106.
29. Guo-qing Li, Fang-fang Guo, Yang Ou, Guang-wei Dong, Wen Zhou. Epidemiology and outcomes of surgical site infections following orthopedic surgery. AJIC. December 2013; 41(12):1268-1271.
30. Awan MS, Dhari FJ, Laghari AA, Bilal F, Khaskheli NM. Surgical Site infection in Elective Surgery. Journal of surgery Pakistan. 2011; 16(1):33-7.
31. Satyanarayana V. Study of Surgical Site Infections in Abdominal Surgeries. Journal of Clinical and Diagnostic Research. 2011; 5(5):935-939.
32. Wassef MA, Hussein A, Abdul Rahman EM, El-Sherif RH. A Prospective Surveillance of Surgical Site Infections: Study for Efficacy of Preoperative Antibiotics Prophylaxis. Afr. J. Microbiol. Res. 2012; 6(12):3072-8.
33. Kalmeijer MD, Coertjens H, van Nieuwland-Bollen PM, Bogaers-Hofman D, de Baere GA, Stuurman A *et al*. Surgical site infections in orthopedic surgery: the effect of mupirocin nasal ointment in a double-blind, randomized, placebo-controlled study. Clin Infect Dis. 2002; 35:353-8.
34. Singh R. Prevalence and Antibiotic Sensitivity Pattern of Bacteria Isolated from Nosocomial Infections in Orthopaedic Patients. J. Orthopaedics. 2010; 7(2):153-159