



Surgical Site Infection in a Tertiary Care Teaching Hospital

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Introduction: Surgical site infections [SSIs] are the Third most common nosocomial infections, According to the National Nosocomial Infections Surveillance, patients who are hospitalized account for 15 to 18 percent of all nosocomial infections .increased mortality and morbidity rates associated with Surgery.

Surgical wounds are divided into four categories: clean, clean-contaminated, contaminated and dirty wounds.

Materials and Methods: This was a retrospective study, done throughout for two years period, from June 2018 to May 2020 .785 patients underwent surgery in the Dept. of General Surgery in Saveetha Medical College and Hospital, Thandalam.

Were taken as part of this study. Elective surgical procedures were performed on 495 patients. And 290 were taken to the hospital for emergency treatment. An in-depth examination of these cases was conducted, taking into account the date of admission, clinical features, history, types of surgery [emergency or elective], pre-operative preparation, drain used, and its type and postoperative findings.

Results: Surgical Site Infections were found in 58 cases out of 785 surgeries. In elective clean and contaminated patients, the overall postoperative SSI rate is 4.34 percent of all cases, whereas emergency cases account for 12.41 percent. According to the research, that the most prevalent

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type of surgical site infection is superficial surgical site infection accounting for 72.1 percent of all SSIs in elective cases and 61.11 percent in emergency cases, and deep surgical site infection accounting for 23.25 percent of elective cases and 30.55 percent of emergency cases.

Conclusion: The most common bacteria found in elective surgical wounds are *E. coli*. *Proteus mirabilis* is the most prevalent organism isolated from emergency surgical wounds. A shift in the pre-operative period antibiotics may even diminish the occurrence. Pre-existing medical conditions like diabetes mellitus wound type, operation time, emergency procedures, and wound contamination all had a significant impact on the development of surgical site infection.

Keywords: Surgical site infection; nosocomial; wounds; *E. coli*; *Proteus mirabilis*; organisms; surgery.

1. INTRODUCTION

The most prevalent nosocomial infections are Surgical site infections.

Infection causes morbidity, death, and a significantly large increase in hospital stays, all of which add to the financial burden. They are defined by mechanical failure and are associated with higher morbidity, death, and health care costs. Surgical site infections [SSIs] are the Third most common nosocomial infections, According to the National Nosocomial Infections Surveillance, patients who are hospitalized account for 15 to 18 percent of all nosocomial infections.

Approximately 38 percent of all infections are caused by bacteria. Two-thirds Of the surgical site infections were contained within the incision.

2. MATERIALS AND METHODS

This was a retrospective study was conducted in the DEPARTMENT OF GENERAL SURGERY, in Saveetha Medical College and Hospital, Thandalam over a period of 2 years from June 2018 to May 2020 by analyzing the case sheets. Both Elective and emergency general surgical cases were taken up for study. The study excluded procedures on highly immunocompromised patients, patients with Incomplete initial wound closure, and re-look surgeries.

During the study period, 785 patients were admitted to general surgery wards for elective and emergency surgery, with 495 elective cases and 290 emergency cases, meeting our study criteria. Classification of surgical wounds as Clean, clean-contaminated, contaminated, and dirty wounds. Elective surgery is classified as one of the first two categories while emergency treatments are classified as contaminated and dirty wounds. A clean wound is an uninfected

operative wound that does not have any inflammation and does not penetrate the respiratory, alimentary, genital, or uninfected urinary systems. Clean wounds are also generally closed and drained with closed drainage if necessary. The Surgical wound in which the respiratory, alimentary, vaginal, or urinary tracts are penetrated under controlled settings and without exceptional contamination were described as clean-contaminated wounds. Specifically, biliary tract, appendix, and vaginal are included if there is no evidence of infection or significant technique breakdowns.

A total of 58 cases with surgical site infections were included in this investigation. The date of admission, history, clinical features, type of surgery [emergency or elective], preoperative preparation, type of incision, contamination, a procedure performed, intraoperative findings, drain used and type and duration of operation and postoperative management and post-operative results which included the day of 1st dressing and frequency of change, day of wound infection, indicators of wound infection such as fever, erythema, discharge, were documented until the patient is discharged, and then the patient was followed up for 6 weeks on an outpatient basis for any signs of wound infection.

All patients with wound discharge had their wounds cultured and their discharge sensitivity assessed, and they were treated accordingly. Symptomatic treatment was administered based on the severity and mix of specific SSI symptoms.

3. RESULTS

The total postoperative SSI rate in elective clean and clean-contaminated cases is 4.34percent, and the rate in emergency cases had a rate of 12.41percent, according to our research. The study found that superficial surgical site

infections are the most prevalent, accounting for 72.1percent of all SSIs in elective cases and 61.11 percent of emergency cases while deep surgical site infections accounted for 23.25percent in elective cases and 30.55 percent in emergency cases.

The majority of cases in our study were in the middle age range, with about 69.8percent and 77.7percent of elective and emergency cases respectively in the age category of 20-60 years. 6% and 5% of the cases were in the older age

range. According to various studies, Extremes of age are one of the risk factors for SSI. Men had a slightly higher Incidence, with 53.4 percent of elective cases and 58.3 percent of emergency cases.

According to the findings, superficial surgical site infections are the most common, accounting for 72.1 percent of elective cases and 61.1percent of emergency cases, whereas deep surgical site infections account for 23 percent of elective cases and 30.55 percent of emergency cases.

Table 1. Age distribution in SSI

Age in years	No of elective cases with SSI	Percentage	No. of emergency cases with SSI	Percentage
<20	1	4.6	3	8.3
21-40	7	32.5	12	34.72
41-60	8	37.2	16	43.05
>60	6	25.5	5	13.88

Table 2. Elective cases

Type	No of cases	Percentage
Superficial SSI	16	72.1
Deep SSI	5	23.25
Intra Abdominal Abscess	1	4.65

Table 3. Emergency cases

Types	No of cases	Percentage
Superficial SSI	22	61.11
Deep SSI	11	30.55
Intra Abdominal Abscess	3	8.33

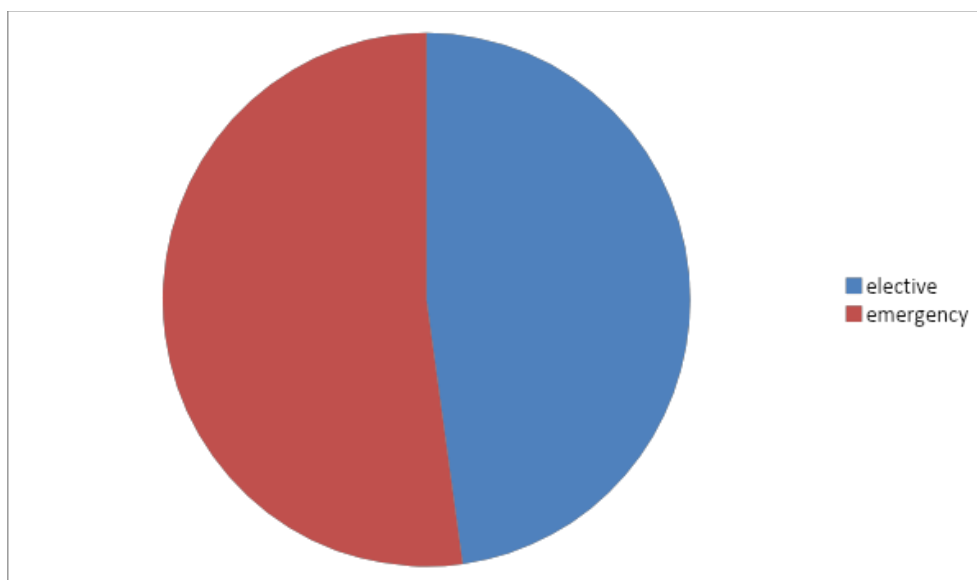


Fig. 1. Percent of elective and emergency cases respectively in the age category

3.1 Drain and Infection Rate

Surgical site infection is more likely when a drain is utilized.

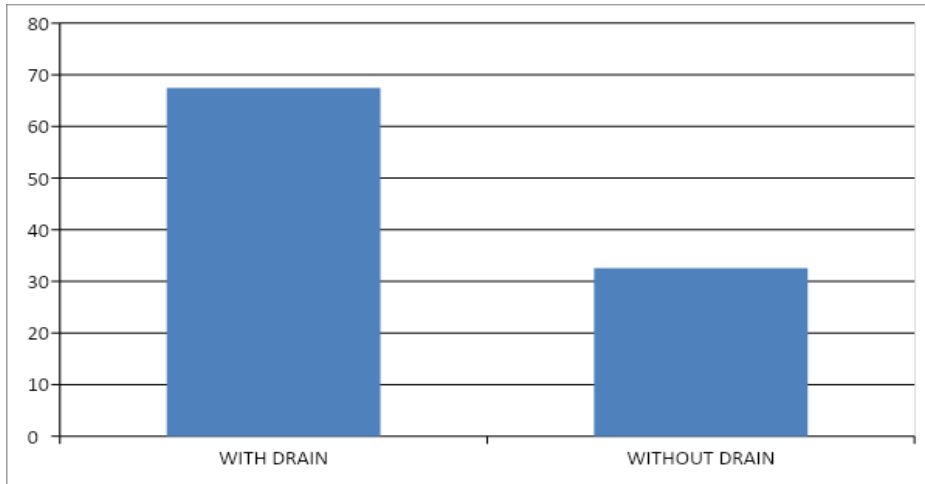


Fig. 2. Elective cases

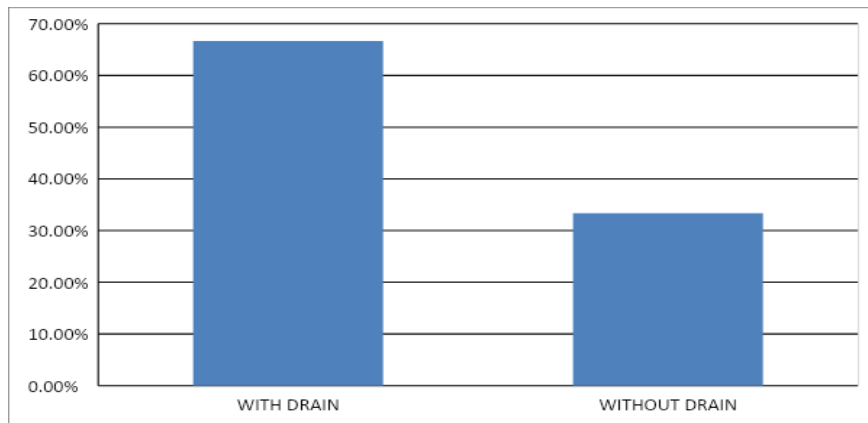


Fig. 3. Emergency cases

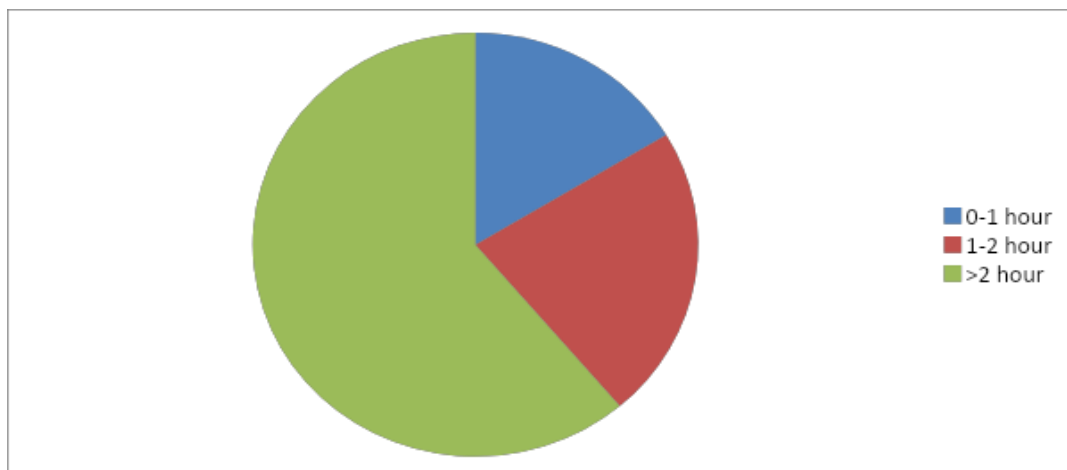


Fig. 4. Duration of surgery of SSI cases

Table 4. Co morbidity and infection rate

Co-morbidity	No of elective cases	Percentage	No of emergency cases	Percentage
Diabetes Mellitus	7	34.9	10	26.4
Obesity	4	16.3	7	20.8
Anaemia	3	11.6	6	16.6
Hypertension	2	7	2	5.5
Others	6	30.2	11	30.5

The most common comorbid condition related to SSI is Diabetes. In our study, SSI developed in 13.04 percent of clean elective cases, 24.3 percent of clean elective contaminated cases, and 62.6 percent of emergency cases.

E. Coli is the most often isolated pathogen from surgical wounds, accounting for 30.93 percent of elective cases. Proteus mirabilis is the most prevalent organism isolated from a wound in an emergency followed by E.coli.

3.2 Sensitivity to Antibiotics

The cephalosporins examined in infected patients showed sensitivity to less than half of the cultured aerobes. Amikacin, gentamycin, imipenem, and vancomycin were the most effective antibiotics against proteus. In addition, E.coli was frequently susceptible to ceftazidime and imipenem.

4. DISCUSSION

The post-operative SSI rate in elective clean and contaminated patients is 2.34 percent, whereas emergency cases are 6.21 percent, for a total SSI rate of 3.66 percent in the current study. Varying workers' SSI reports revealed different infection rates. In prospective research conducted in Ethiopia, 20 patients acquired SSI's out of 105 patients who underwent surgical procedures, giving an overall incidence rate of 19.1% [1]. The results were similar to those of research conducted in India (20.09 percent)[2]. Nigeria 20.3 percent[3], India 21.66 percent [4] And Egypt 22.6 percent[5], but at a lesser rate than studies in Tanzania 26 percent[6], India

33.5 percent [7] and Mikelle, Ethiopia 75 percent[8]. In comparison to other studies, the findings were higher. The results were higher than those found in studies conducted in the United States 7.2percent [9], France 2.5 percent [10], Egypt 9.2 percent [11], and Sudan 9percent [12]. Only elective surgery was included in Studies in Egypt and Sudan, while both elective and emergency surgery was included in our study.

In our analysis, over 69.8% and 77.7% of elective and emergency cases were in the age category of 20-60 years. Ethiopia was the site of a study that revealed patients over the age of 40 were 7.72 times more likely to acquire SSIs than patients between the age of 19 and 40, with an AOR of 7.72.

The findings were consistent with those of earlier research [12,13] indicating that the chance of developing SSIs increased with age [14].

Over the course of six years, Giacometti et al. looked at 676 surgical patients who came with signs and symptoms of wound infections. A total of 614 people were tested for bacterial infections.

Aerobic bacteria were found in abundance.

Staphylococcus aureus (28.2%), Pseudomonas aeruginosa (25.2%), Escherichia coli (7.8%), Staphylococcus epidermidis (7.1%), and Enterococcus faecalis (5.6%) were the most prevalent pathogens [15].

Table 5. Organisms isolated from SSI wounds

Types of organisms	No of elective cases	Percentage	No of emergency cases	Percentage
E. Coli	7	30.93	6	19.22
Proteus mirabilis	5	20.23	9	22.44
Klebsiella pneumonia	4	16.97	5	12.3
Klebsiella xytoca	1	6.27	3	8.27
Proteus vulgaris	2	9.62	4	9.33
No growth	3	11.30	7	20.83
others	-	-	2	6.9

In other investigations like Mofikoya Bo et al. pseudomonas was the most prevalent isolate. However, E.coli was shown to be the most frequently isolated bacterium from surgical wounds in our investigation, accounting for 30.23 percent of elective cases. Proteus mirabilis (19.64percent), then K. Pneumoniae (16.27percent) were the next most common. The most prevalent organism involved in SSI in emergencies situations is Proteus mirabilis, followed by E.coli, which is the second most prevalent organism isolated from the wound.

Infections are more in wounds that have been drained and in procedures that include the placement of prosthetics such as mesh.

In a 2007 study, Umesh S. Kamat et al., discovered that patients with a post-operative drain were 5.8 (2.33e14.66) times more likely than those without drain to develop SSI acquired after surgery was two times higher in our research.

Furthermore, the infection rate raises when the drain is left open longer. As a result, unless otherwise specified, we can avoid keeping the drain. In some circumstances, using a closed drain for a minimum of 48 hours will lower the risk of postoperative SSI.

Sixteen research were available to evaluate the link between hyperglycaemia and SSI, ten articles (n = 27,844 operations) involving pre- or intra-operative blood glucose levels, and eleven articles (n = 32,625 operations) involving post-operative blood glucose levels. Blood glucose levels are checked after surgery.

In meta-analyses of studies that took hyperglycaemia into account [16]. In the prevention of SSI, the introduction of standard surgical antimicrobial prophylaxis(SAP) was a game-changer. In the absence of a significant prevalence of resistant bacteria, current guidelines imply that a single dose of a first or second-generation cephalosporin is enough to prevent SSI. Because most cephalosporins have limited anaerobic action, metronidazole is added to the treatment when necessary. Importantly, two major prospective trials found that giving SAP within 30 minutes of incision reduced the incidence of SSI. The first vulnerable phase of surgery is the translocation of skin germs into the wound during incision, and providing SAP only a few minutes before incision may not be sufficient to attain the tissue levels required to prevent SSI [17]. Proteus was found to be susceptible to

aminoglycosides and cephalosporin. Piperacillin, clavulanic acid, and cephalosporin were the most sensitive antibiotics against E.coli. As a result, the prophylactic antibiotics administered before the surgical surgery must be adjusted correspondingly.

5. CONCLUSION

The most common bacteria isolated from elective surgical wounds are E.coli, while the most common bacteria isolated from emergency surgical wounds is Proteus mirabilis. Overall, the sensitive medications for SSIs developed in our hospital are Amikacin, Gentamycin, Ciprofloxacin, and Imipenem as a result, a modification in pre-operative antibiotics may further reduce the occurrence. We can reduce our SSI rate even more by applying the following measures: regular and intensive drain care, Effects to shorten surgery time without compromising the patient's safety or positive outcome. periodic SSI surveillance will aid the infection control committee in establishing rigorous rules to reduce SSI occurrence in our setup.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

The ethical approval of the hospital authority was acquired prior to the start of the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Legesse Laloto Tamrat, Hiko Gemeda Desta, Hussen Abdella Sadikalmahdi. Incidence and predictors of surgical site infection in Ethiopia: prospective cohort. BMC Infect Dis 2017;17:119.
2. Mahesh CB, Shivakumar S, Suresh BS, Chidanand SP. A Prospective study of surgical site infections in a teaching hospital. J Clin Diagn Res. 2010;4:3114e9.
3. Nwankwo EO, Ibeh IN, Enabulele O. Incidence and risk factors of surgical site infection in a tertiary health institution in Kano, Northwestern Nigeria. Int J Infect Control. 2012;8(4):8e13.

- Available:<https://doi.org/10.3396/ijic.v8i4.035.12>.
4. Kikkeri N, Setty H, Shimoga M, Halumatthigatta D, Giriyaiah S, Ramanagaram N, et al. A study on Surgical Site Infections (SSI) and associated factors in a government tertiary care teaching hospital in Mysore, Karnataka. *Int J Med Public Health*. 2014;4(2):171e5. Available:<https://doi.org/10.4103/2230-8598.133126>.
 5. AfifilK, Labah EA, Ayad KM. Surgical site infections after elective general surgery in Tanta University Hospital: rate, risk factors and Microbiological profile. *Egyptian J Med Microbiol*. 2009;18(2):61e72.
 6. Mawalla B, Mshana SE, Chalya PL, Imirzalioglu C, Mahalu W. Predictors of surgical site infections among patients undergoing major surgery at Bugando Medical Centre in Northwestern Tanzania. *BMC Surg*. 2011;11(1): 21. Available:<https://doi.org/10.1186/1471-2482-11-21>.
 7. Amutha B, Viswanathan T, Science I, Association C. A retrospective study on the pattern of pathogens isolated from surgical site wound infection in tertiary care hospital in coimbatore, India. *Int Res J Med Sci*. 2014;2(10):1e6. Available:<https://doi.org/10.5455/2320-6012.ijrms20140511>.
 8. Mengesha RE, Kasa BG-S, Saravanan M, Berhe DF, Wasihun AG. Aerobic bacteria in post surgical wound infections and pattern of their antimicrobial susceptibility in Ayder Teaching and Referral Hospital, Mekelle, Ethiopia. *BMC Res Notes*. 2014;7(575):4e9.
 9. Garey KW, Dao T, Chen H, Amrutkar P, Kumar N, Reiter M, et al. Timing of vancomycin prophylaxis for cardiac surgery patients and the risk of surgical site infections. *J Antimicrobial Chemother*. 2006;58:645e50. Available:<https://doi.org/10.1093/jac/dkl279>
 10. Wassef MA, Hussein A, Abdul Rahman EM, El-Sherif RH. A prospective surveillance of surgical site infections: study for efficacy of preoperative antibiotic prophylaxis. *Afr J Microbiol Res*. 2008;6(12):3072e8.
 11. Elbur AI, Sayed A, Elsayed A, Abdelrahman ME. Prevalence and predictors of wound infection in elective clean and clean/contaminated surgery in Khartoum Teaching Hospital, Sudan. *Int J Infect Control*. 2012;8(4):1e10. Available:<https://doi.org/10.3396/ijic.v8i4.036.12>.
 12. Lakshmidevi N, Suchitra Joyce B. Surgical site infections: assessing risk factors, outcomes and antimicrobial sensitivity patterns. *Afr J Microbiol Res*. 2009;3(4):175e9.
 13. Astagneau P, Miliiani K. Non-compliance with recommendations for the practice of antibiotic prophylaxis and risk of surgical site infection: results of a multilevel analysis from the INCISO Surveillance Network. *J Antimicrobial Chemother*. 2009;64:1307e15. Available:<https://doi.org/10.1093/jac/dkp367>. 2016 Jan;37(1):88e99
 14. Legesse Laloto Tamrat, Hiko Gemedeta, Hussen Abdellasadikalmahdi. Incidence and predictors of surgical site infection in Ethiopia: prospective cohort. *BMC Infect Dis*. 2017;17:119
 15. SpagnoloAM, OttriaG, Amicizia D, Perdelli F, Cristina ML operating theatre quality and prevention of surgical site infections. *J Prev Med Hyg*. 2013;54(3):131-7.
 16. Martin Emily T., KeithS, Knott Caitlin. Nguyen Huong. SantarossaMaressa, Evans Rithchard, et al. Diabetes and risk of surgical site infection: a systematic review and meta analysis. *Infect Control Hosp Epidemiol*. 2016;37(1):88-99.
 17. Mujagic E, Zwimpfer T, Marti WR, Zwahlen M, Hoffmann H, kindler C, et al. Evaluating the optimal timing of surgical antimicrobial prophylaxis: Study protocol for randomized controlled trial. *Trails*. 2014;15:188.

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