# An Analysis Comparing The Frequency And Severity Of Surgical Site Infections After Elective And Emergency Abdominal Surgeries In A Tertiary Care Centre, Chengalpattu

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**KEYWORDS**
E coli, Staphylococcus aureus, abdominal, laparotomy, surgical site infections, wound\

**ABSTRACT**
**BACKGROUND:** Surgical site infections (SSI) pose a serious threat to patient's ability to heal and resume their regular lives. SSI and its complications have been identified as one of the major causes of postoperative morbidity, specifically with regard to abdominal procedures. The best course of treatment for SSIs is prevention, which can be achieved by identifying risk factors. This enables proper classification and the implementation of precautions to protect the patient from developing SSI during the preoperative phase. The study aimed to examine the prevalence, severity, and microbiological makeup of surgical site infections that resulted from both elective and emergency abdominal surgeries.
**METHODS:** This prospective observational study followed patients who had laparotomies in either an emergency or elective setting (regardless of rationale) at Karpaga Vinayaga Institute of Medical Sciences and Research centre , Chengalpattu from December 2022 to September 2023. Following that, patients with SSI were categorized using the Southampton wound assessment scale and the ASEPSIS wound scoring system. Every patient's SSI type was further recorded. Additional factors that were documented in the study included the length of hospital stay, the microbiological profile, the procedures that were carried out, etc.
**RESULTS:** Out of the 200 cases (hundred and eleven male and eighty nine female) who were enrolled in the study, 35 patients developed SSI( 17.5% patients developed an SSI) (10 elective instances and 25 emergency cases), whereas the remaining 165 patients did not develop SSI . Ecoli was the most common organism cultured (17 cases) followed by Staphylococcus aureus (11 cases) and Pseudomonas (7 cases)
**CONCLUSION:** The nature of the surgery, such as whether it was elective or emergency (P-value 0.040), the type of wound (P-value 0.001), the presence of underlying malignancy (P-value 0.030), and the presence of a concurrent urinary tract infection (UTI) (P-value 0.045) were found to be significant contributors to the development of SSI. The patient's age (P-value 0.699), sex (P-value 0.108), chronic kidney disease (P-value 0.904), diabetes mellitus (DM) (P-value 0.816), and acute respiratory infection (ARI) (P-value 0.909) were not found to be associated with the development of a secondary systemic infection (SSI).

## INTRODUCTION

Infection of the wound that develops within 30 days following surgery, or within a year if an implant is left in place and the infection is believed to be secondary to surgery, is known as a surgical site infection (SSI), according to the Centers for Disease Control and Prevention patient's ability to heal and resume their normal lives is severely hampered by surgical site infections (SSI). A gradual but significant paradigm shift has occurred in favour of early detection and effective treatment of these infections, even though they were formerly seen as a necessary evil, as Osler famously stated: "Except on few occasions, the patient appears to die from the body's response to infection rather than from it."

Particularly when it comes to abdominal surgeries, SSI and its complications have been found to be among the major contributors to postoperative morbidity. SSIs have become a significant obstacle to the effective implementation of these principles in a time when day care surgery and enhanced recovery programs are the norm and the primary focus is on minimizing hospital stays and promoting early return to function. Before considering SSI, surgical site infections (SSIs) must be classified.
The estimated quantity of bacteria present at the time of surgery is another factor used to categorize surgical wounds:
Wounds classified as
Class I clean
Class II clean / contaminated.
Class III clean contaminated
Class IV unclean wounds.
In an ideal world, treating SSIs would begin with anticipation, which would begin with the identifiable components of chance. This enables appropriate stratification and the implementation of protective measures against the worsening of SSI during the preoperative phase. This study was then carried out with the intention of better understanding the variety of surgeries that cause SSIs and connecting that data with the type and severity of contaminations encountered, in order to enable future patient stratification and appropriate treatment. The study aimed to compare the incidence, severity, and microbiological makeup of surgical site infections following emergency and elective abdominal surgeries.

**Materials and methods**

This study, which took place at the Karpaga Vinayaga Institute of medical sciences and research centre , Mathuranthagam from December 2022 to September 2023, was a prospective observational study. Patients who signed a written informed consent form and gave their consent for the study were included in the study. Following ethical clearance from the institution's ethical committee, the study was launched. The study included all patients older than 12 years who were admitted to Karpaga Vinayaga institute of medical sciences and research centre from December 2022 to September 2023 and had abdominal surgery (regardless of indication) in an emergency or elective setting.

**Exclusion criteria**

Individuals receiving steroid treatment after being diagnosed as immunocompromised. Individuals under the age of twelve. Individuals wearing prostheses. Individuals having relaparotomies for reasons other than surgical site infections. Individuals unwilling to take part in the research.
Every day after the surgery, the patient's overall health was routinely evaluated, and the patient's laparotomy wound was examined locally to determine whether a surgical site infection had occurred or not. The ASEPSIS wound scoring system was then used to stratify the patients who had SSIs. The Southampton wound assessment scale, as well as every patient's SSI type was further recorded. Additional factors were also documented, including the length of hospital stay, the microbiological profile, the interventions made, etc. Depending on the severity of the infection, patients with SSIs were evaluated using wound culture and sensitivity, a full hemogram, abdominal ultrasound, and/or abdominal computed tomography (CT) scans. Tests for liver and kidney function were also performed.

**Estimating the Sample Size**

The following formula was used to calculate the sample size: $N = (Z\alpha + Z\beta)\ 2 \times pq \times 2 / d2$.
where N is the sample size, p is the study's average prevalence, and q is equal to 100 - p.
$Z\alpha$ is equal to the Z score of α error, or 1.96 with a 5% α error.
Zc = Z score of β error, or 0.842 with a 20% β error
D is equal to p1 - p2.

| Age (in years) | No. of Patients | Valid Percent |
|---|---|---|
| < 20 | 7 | 3.5 |
| 21 – 30 | 43 | 21.5 |
| 31 – 40 | 37 | 18.5 |
| 41 – 50 | 31 | 15.5 |
| 51 – 60 | 33 | 16.5 |
| 61 - 70 | 26 | 13 |
| 71 - 80 | 15 | 7.5 |
| > 80 | 8 | 4 |
| **Total** | **200** | **100** |

***Table 1. Age Distribution of Patients Enrolled in the Study***

| Table 2. Type of Surgery | No. of Patients | Valid Percent |
|---|---|---|
| Adhesiolysis | 5 | 2.5 |
| Anterior resection | 7 | 3.5 |
| Appendicectomy | 50 | 25 |
| Appendicular abscess | 11 | 5.5 |
| APR | 2 | 1 |
| CBD exploration | 1 | 0.5 |
| Colostomy closure | 3 | 1.5 |
| Cytoreduction | 4 | 2 |
| Exploratory laparotomy | 21 | 10.5 |
| Feeding Jejunostomy | 3 | 1.5 |
| Gastrojejunostomy | 2 | 1 |
| Hemicolectomy | 3 | 1.5 |
| Ileostomy | 4 | 2 |
| Incisional hernia | 8 | 4 |
| Intestinal obstruction | 2 | 1 |
| Left hemicolectomy | 3 | 1.5 |
| LSCS | 13 | 6.5 |

| | | |
|---|---|---|
| Lumbar sympathectomy | 1 | 0.5 |
| Myomectomy | 13 | 6.5 |
| Obstructed femoral hernia | 1 | 0.5 |
| Open cholecystectomy | 1 | 0.5 |
| Ovarian cystectomy | 3 | 1.5 |
| Hollow viscus perforation | 7 | 3.5 |
| Radical cholecystectomy | 1 | 0.5 |
| Radical cystectomy | 1 | 0.5 |
| Resection and anastomosis | 6 | 3 |
| Subtotal gastrectomy + FJ | 1 | 0.5 |
| TAH+ BSO | 16 | 8 |
| TAH+BSO +PLND | 2 | 1 |
| Trans hiatal esophagectomy | 2 | 1 |
| Whipple procedure | 3 | 1.5 |
| **Total** | **200** | **100** |

***Table 2. Operative Procedures Performed, with the Number of Patients Who Underwent Each Procedure***

**Table 3 . Microbiological profile of surgical site infections**

| ORGANISM (count) | ELECTIVE | EMERGENCY |
|---|---|---|
| Citrobacter koseri | 0 | 1(0.5%) |
| Coagulase negative staphylococcus aureus | 1 | 5 (3%) |
| Escherichia coli | 7 | 10 (8.5%) |
| Enterococcus faecalis | 0 | 1 (0.5%) |
| Enterococcus faecium | 0 | 0 () |
| Pseudomonas | 3 | 4 (3.5%) |
| Methicillin resistant staphylococcus aureus | 0 | 1 (0.5%) |
| Staphylococcus aureus | 1 | 3 (2%) |

| Monitoring days | Infection | Mean CRP values (mg/ml) | Number of patients |
|---|---|---|---|
| PRE OP | Absent | 12.72 | 185 |
| PRE OP | Present | 16.93 | 15 |
| PRE OP | Total | 13.96 | 200 |
| POD 1 | Absent | 12.00 | 174 |
| POD 1 | Present | 29.73 | 26 |
| POD 1 | Total | 17.22 | 200 |
| POD 3 | Absent | 8.31 | 170 |
| POD 3 | Present | 51.60 | 30 |
| POD 3 | Total | 21.04 | 200 |
| POD 7 | Absent | 7.39 | 165 |
| POD 7 | Present | 80.33 | 35 |
| POD 7 | Total | 28.84 | 200 |

***Table 4 : Comparison of C reactive protein levels, presence of infection***

**Results**

Out of the 200 patients included in the study , 35 (17.5%)developed surgical site infections , of which 10 were elective cases and 25 were emergency cases .

Escherichia coli was the most common organism identified to case surgical site infection

**Discussion**

In all, 200 patients were enrolled and monitored during the investigation. Based on the age distribution of the study participants, Data shows that 144 out of 200patients fell into the 20-60 age group. Due to a variety of factors, including age-related attrition (caused by death or surgical refusal) and the relative prevalence of surgical diseases requiring laparotomy in this age group, the majority of series describing SSIs exhibit a similar clustering of patients. Numerous studies have shown that age is an independent risk factor .The observed phenomenon may be attributed to several factors, including the concentration of patients in age groups that do not substantially impact the patient's post-operative trajectory, the relative lack of patients at the extremes of the age spectrum, and the likelihood of older adults having greater access to and comprehension of health care.

The patients included in the study underwent a wide range of surgical procedures, with appendicectomy being the most common procedure (50 out of 200 patients). This is good because it shows that the study's conclusions can be applied to a larger group of surgical patients. As previously mentioned, the type of surgery performed affects the likelihood of developing SSI; however, a conclusive correlation could not be established because of the limited number of cases that resulted in an SSI and the wide range of procedures carried out.

Prophylactic antibiotics were administered to all study participants. Ceftriaxone was the most frequently used antibiotic (60 out of 200 cases), followed by cefuroxime (40 out of 200 cases). This is in line with the hospital's antibiotic protocol, which is based on the body of research supporting the use of cephalosporins as a preventative measure whereas Pathak A [1], Saliba EA et al found that methicillin resistant staphylococcus aureus and Psuedomonas aeuroginosa showed resistance to ciprofloxacin and gentamicin . Serial CRP levels measurements shows that on POD3 85% of those who developed SSI has positive CRP levels. Thirteen Furthermore, recommendations currently in circulation suggest switching to other targeted antibiotics in situations where there is a high degree of clinical suspicion regarding the causing organism. . Subgroup analysis revealed that most patients (7 out of 35 ) who later developed an SSI received ceftriaxone during the pre-operative phase; this suggests that local factors in the study region likely contributed to antibiotic resistance among the organisms under investigation. This emphasizes how crucial local variables are when developing

policies for the avoidance and treatment of SSIs. Out of the 200 patients that were examined, 35 patients-or 17.5% of the patients-developed an SSI. The incidence of SSI that has been quoted in the literature varies greatly; authors have reported rates as low as 5%, 15% to 20%, and 55.56%, which suggests that the study was conducted within acceptable bounds. The first factor to be taken into consideration was the type of surgery-that is, whether it was elective or emergent. Like the Dryden M et al concluded that patients with diabetes have a higher chance of developing surgical site infections and more likely to experience complications than those without diabetes [2], but in our study all patients exclusive of co morbidity status were included. Golpanian S et al suggested that the use of micrografts have very high potential to accelarate epithelialisation in surgical site infections leading to chronic ulcers [3].

Of the thirty five patients who later developed SSIs, twenty five had emergency surgery, and ten had planned elective procedures on a regular basis. Additionally, a statistically significant difference was noted , confirming that the type of surgery (elective versus emergency) also acts as a risk factor for the development of SSI. Bandaru NR et al concluded that infections were more common between the age group of 50-60, but in our study age did not play a major role [4], additionally also concuded that obesity also was a causative factor for developing surgical site infections . Nonetheless, this study and the comparative studies previously mentioned unequivocally show that surgery itself carries a risk for the development of SSIs, meaning that patients undergoing surgery should be treated with extra caution and awareness. Tiwari S et al proposed that post operative wound infection was found to be the same irrespective of clean or contaminated wound [5].Satyanarayana V et al concluded that pre-existing medical illness, prolonged operating time, the wound class, emergency surgeries and wound contamination strongly predispose to wound infection [6].

Tovar JR et al advised to adopt guidelines of scientifically-validated processes for prevention of surgical site and central-line catheter infections and sepsis [7]. Mekhla et al showed that individuals with ASA 3 or 4 had higher risk of surgical site infections which was similar to our study[8] . The microbiological profiling of the SSIs showed that the most common organism cultured was E. coli (17 out of 35 ) , Staphylococcus being the second most common organism (11 of 35 cases), and Pseudomonas being the third (7 out of 35). Most studies have shown that the most common organism cultured in SSIs are Staphylococcus aureus followed by coagulase-negative staphylococci CoNS, owing to the ubiquity of S. aureus as skin flora. However, as demonstrated , only 4 cases of S. aureus were isolated in this study. The remainder of the organism spectrum was stable and comparable to available literature. Not many studies reviewed the microbiological make up of surgical site infections

## CONCLUSION

Even though they are still a major source of pain for surgeons, the burden can be considerably reduced by analyzing risk factors, providing the best care possible during the perioperative phase, and using targeted therapy for infections that have already manifested. Correct patient stratification and risk factor treatment are made possible by the clarification of risk factors like the type of wound, underlying comorbidities, presence or absence of remote infections, and type of surgery (emergency vs. elective). This study highlights the geographic and demographic distributions of SSIs and illustrates the evolving nature of the microbiological flora implicated in SSI and the resulting antibiotic resistances. This highlights the need for additional regional and hospital-based surveillance programs and permits modifications to antibiotic protocols. In summary, risk factor management for prevention and appropriate therapy for established infections are the two pillars of an effective management strategy for surgical site infections (SSIs).

## REFERENCES

1. Pathak A, Saliba EA, Sharma S, et al. Incidence and factors associated with surgical site infections in a teaching hospital in Ujjain, India. Am J Infect Control 2014;42(1):e11-5. doi 10.1016/j.ajic.2013.06.013

2. Dryden M, Baguneid M, Eckmann C, et al. Pathophysiology and burden of infection in patients with diabetes mellitus and peripheral vascular disease: focus on skin and soft-tissue infections. Clin Microbiol Infect 2015;21(Suppl 2):S27-32. doi 10.1016/j.cmi.2015.03.024
3. Golpanian S, Kassira W. Full-thickness skin graft. In: Operative dictations in plastic and reconstructive surgery. Springer International Publishing 2016: p. 199-201. doi 10.1007/978-3-319-40631-2_48
4. Bandaru NR, Rao AR, Prasad KV, et al. A prospective study of postoperative wound infections in a teaching hospital of rural setup. J Clin Diagnostic Res 2012;6(7):1266-71. doi 10.18689/mjs-1000113
5. Tiwari S, Chauhan M, Shahapurkar VV, et al. Importance of southampton wound grading system in surgical site infection. J Evol Med Dent Sci 2014;3(20):5491-5. doi 10.14260/jemds/2014/2618
6. Satyanarayana V, Prashanth HV, Bhandare B, et al. Study of surgical site infections in abdominal surgeries. Journal of Clinical and Diagnostic Research 2011;5(5):935-9. doi 10.7860/JCDR/2011/.1814
7. Tovar JR, Badia JM. Prevention of surgical site infection in abdominal surgery. A critical review of the evidence. Cir Esp 2014;92(4):223-31. doi 10.1016/J.CIRENG.2013.08.003
8. Mekhla,Borle FR. Determinants of superficial surgical site infections in abdominal surgeries at a Rural Teaching Hospital in Central India: A prospective study.J Family Med Prim Care. 2019;8(7):2258-63.doi 10.4103/jfmpc.jfmpc_419_19
9. Janugade HB, Nagur BK, Sajjan KR, Biradar SB, Savsaviya JK,Reddy M. Abdominal surgical site infection occurrence and risk factors in krishna institute of medical science,Karad. Int J Sci Stud. 2016;3(11):53-6.doi 10.17354/ijss/2016056
10. Singh LM,Yadalwar V.Study of post-operative surgical site infection in patients of emergency laparotomy in teaching hospital of central India. J Surg. 2018;4(1):59-64 doi 10.18203/2439-2902.isj20214000
11. Cheng K,Li J,Kong Q,Wang C, Ye N, Xia G. Risk factors for surgical site infection in a teaching hospital: a prospective study of 1,138 patients.Patient Prefer Adherence. 2015;9:1171-7.doi 10.2147/PPA.S86153
12. NIHR Global Research Health Unit on Global Surgery. Reducing surgical site infections in low-income and middle-income countries (FALCON): a pragmatic, multicentre, stratified, randomised controlled trial. Lancet 2021; 398: 1687e99 doi 10.1016/S0140-6736(21)01548-8
13. Narula H, Chikara G, Gupta P. A Prospective Study on Bacteriological Profile and Antibiogram of Postoperative Wound Infections in a Tertiary Care Hospital in Western Rajasthan. J Family Med Prim Care. 2020;2020(4):1927–3410.4103/jfmpc.jfmpc_1159_19
14. Oh AL, Goh LM, Nik Azim NA, Tee CS, Shehab Phung CW. Antibiotic usage in surgical prophylaxis: a prospective surveillance of surgical wards at a tertiary hospital in Malaysia. J Infect Dev Ctries. 2014; 8(2): 193-201. doi 10.3855/jidc.3076
15. Giri S, Kandel BP, Pant S, Lakhey PJ, Singh YP, Vaidya P. Risk factors for surgical site infections in abdominal surgery: a study in Nepal. Surgical infections. 2013 Jun 1;14(3):313-8. doi 10.1089/sur.2012.108
16. Alkaaki A, Al-Radi OO, Khoja A, Alnawawi A, Alnawawi A, Maghrabi A, Altaf A, Aljiffry M. Surgical site infection following abdominal surgery: a prospective cohort study. Canadian Journal of Surgery. 2019 Apr doi 10.1503/cjs.004818