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RESEARCH ARTICLE
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SURGICAL SITE INFECTION RATES IN ELECTIVE ABDOMINAL SURGERIES: A PROSPECTIVE STUDY AT A TERTIARY CARE HOSPITAL"

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Subject: Surgical Site Infection Rates in Elective Abdominal Surgeries: A Prospective Study at a Tertiary Care Hospital
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ABSTRACT:
Background: Surgical site infection (SSI) is the second most common nosocomial infection, significantly contributing to post-operative morbidity, prolonged hospital stays, increased healthcare costs, and diminished patient comfort. Despite advances in surgical ways, sterile practices, and antibiotic use, SSI rates remain high, especially in developing countries. While the rate of SSI has decreased from around 75% a century ago to less than 10% in some regions, its impact continues to be profound. Local data on SSI, particularly in the context of elective abdominal surgeries, is limited in many developing nations. This study aims to address this gap by exploring the incidence, risk factors, and causative pathogens of SSI in elective abdominal surgeries.
Objectives
1. To determine the incidence of surgical site infection in elective abdominal surgeries.
2. To identify the predisposing risk factors for the development of SSI in elective abdominal

surgeries.
3. To identify the common pathogens causing SSI in elective abdominal surgeries and their antibiotic sensitivity.

Methods

This prospective observational study was conducted at the Department of General Surgery, Rajarajeswari Medical College and Hospital, from January to June 2024. An aggegate of 100 patients undergoing elective abdominal surgeries were included. Sample size was calculated using Yamane equation. Inclusion criteria comprised patients of 12 years and older who developed SSI within 30 days post-operatively.

Exclusion criteria included infections limited to drain sites and laparoscopic procedures. Descriptive and inferential statistics were used for data analysis, with ap- value < 0.05 considered statistically significant.

Results

The overall SSI rate was 6%, higher than that reported in Western countries. The highest SSI rate was observed in clean-contaminated wounds (19.1%) compared to clean wounds (2.5%, p=0.02). SSI rates increased with age, though not significantly (from0%in<40yearsto11.1%in>61years, p=0.3). Females had a higher SSI rate (10.7%) than males (4.2%), though this difference was not statistically significant.

Identified risk factors included diabetes mellitus (25%), hypertension (23.1%), and anemia (16.7%), with diabetes mellitus being the only independent risk factor (p=0.009). Extended pre-operative hospitalization (>5 days) and longer surgery durations (>1 hour) were also associated with higher SSI rates (p=0.03, p=0.04).

Bacteriological analysis identified Escherichia coli and Staphylococcus aureus as the most common pathogens, with resistance to common antibiotics but sensitivity to linezolid, imipenem, meropenem, and amikacin.

Conclusion:

The study highlights the relatively high incidence of SSI in elective abdominal surgeries in a developing country setting, with diabetes mellitus identified as a key risk factor. The most common pathogens identified were E. coli and S. aureus, which exhibited resistance to many common antibiotics. These findings emphasize the need for tailored strategies to prevent and manage SSI, including improved pre-operative care, better antibiotic stewardship, and more localized data to inform clinical practices.

Keywords: Surgical site infection, elective abdominal surgery, risk factors, pathogens, antibiotics, Escherichia coli, Staphylococcus aureus, morbidity, post-operative infection.

INTRODUCTION:

Surgical site infections (SSIs) are the second most common nosocomial infections and continue to be a significant source of post-operative morbidity, contributing to patient discomfort, prolonged hospitalisation, absenteeism from work, and increased healthcare costs.

While advancements in aseptic techniques, surgical practices and antibiotic therapy have reduced infection rates from approximately 75% a century ago to less than 10% today, SSIs remain a substantial cause of morbidity and mortality. A thorough understanding of pathogens, risk factors and infection rates is essential in formulating effective strategies for prevention, early diagnosis, and management.

In developing countries like India, the lack of locally generated data underscores the importance of research to address the various unique challenges in reducing SSI rates and improving surgical outcomes.

OBJECTIVES:

1. To determine the incidence of surgical site infections in elective abdominal surgeries.
2. To identify the predisposing risk factors for the development of surgical site infection in elective

abdominal surgeries.
3. To identify the common pathogens causing surgical site infections in elective abdominal surgeries and their sensitivity to antibiotics.

METHODOLOGY:
1. Study design: Prospective observational study
2. Study period: 6 months, January 2024 – June 2024
3. Sample size: 100 patients
4. Study centre: Department of General Surgery, Rajarajeswari Medical College and Hospital
5. Sampling technique and study population: Patients admitted in-patient to the Department of General Surgery, Rajarajeswari Medical College and Hospital, undergoing elective abdominal surgeries.

INCLUSION CRITERIA:
1. Patients aged 12 years and older.
2. Patients undergoing elective abdominal surgeries.
3. Development of surgical site infection (SSI) in patients within 30 days post-operatively.

EXCLUSION CRITERIA:
1. Infections limited to drain sites.
2. Laparoscopic surgical procedures.

STATISTICAL METHODS:
Sample size was calculated using Yamane equation - $n = N/(1+N(e)2)$. Descriptive statistics were calculated, including mean, standard deviation, and proportions. Inferential statistics were performed using the Chi-square test, Fisher's exact test, and independent t-test. All statistical analyses were conducted using SPSSv23, and graphical representations were generated using Microsoft Excel. Ap-value of less than 0.05 was considered statistically significant.

DATA ANALYSIS AND RESULTS:

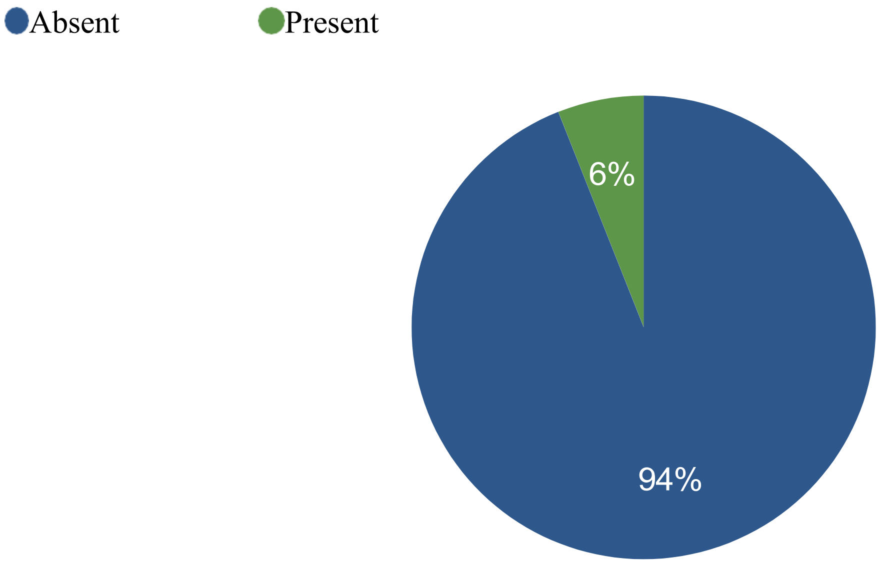

Figure 1. Incidence of Surgical Site Infections in Elective Abdominal Surgeries

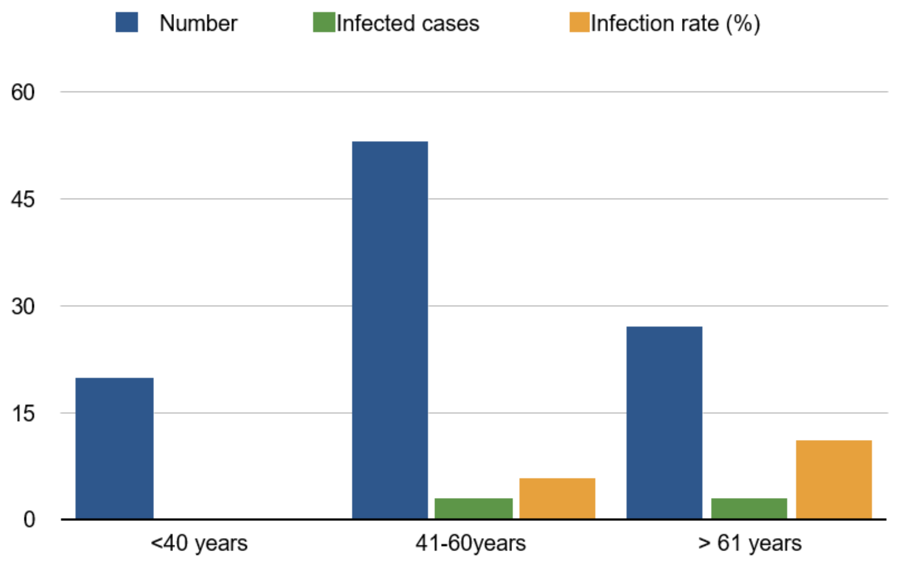

Figure 2. Age distribution of cases

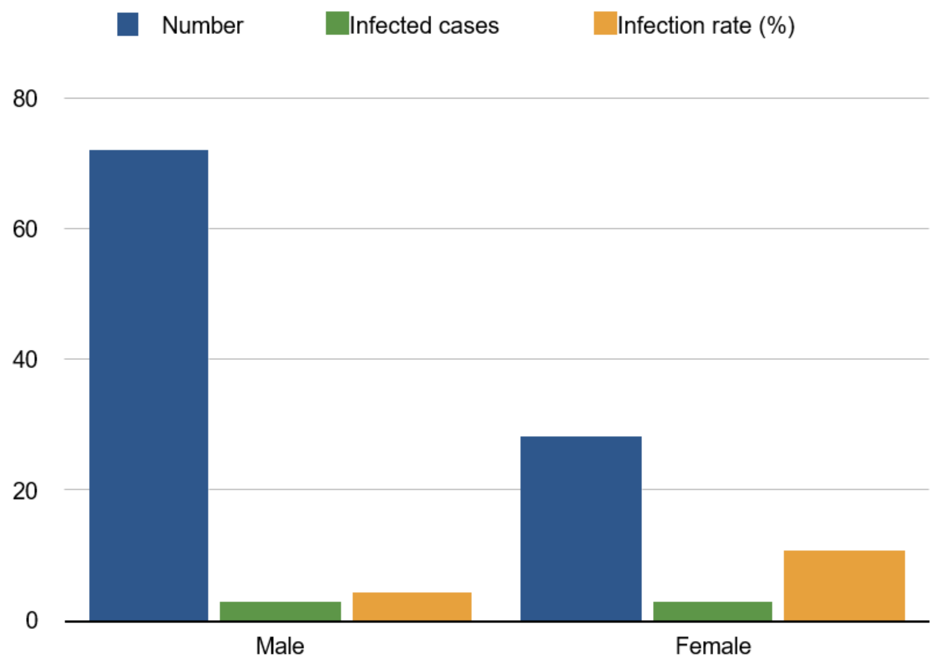

Figure 3. Sex distribution of cases

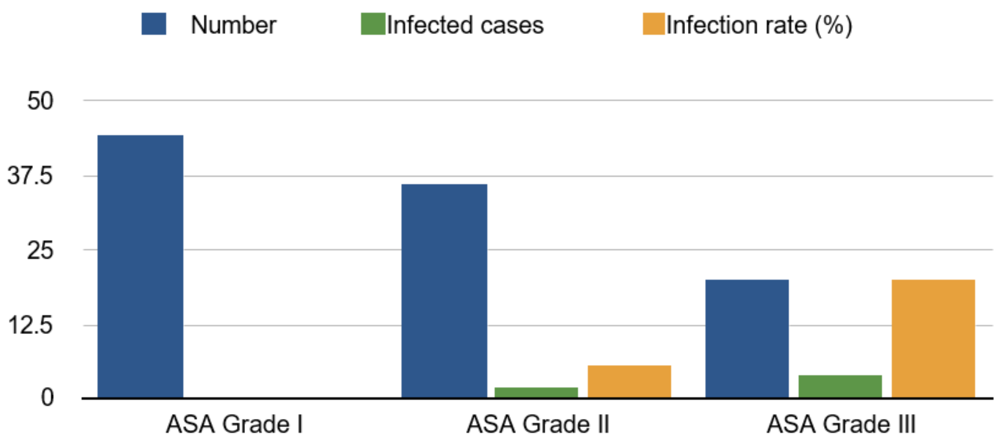

Figure 4. ASA Grading of cases

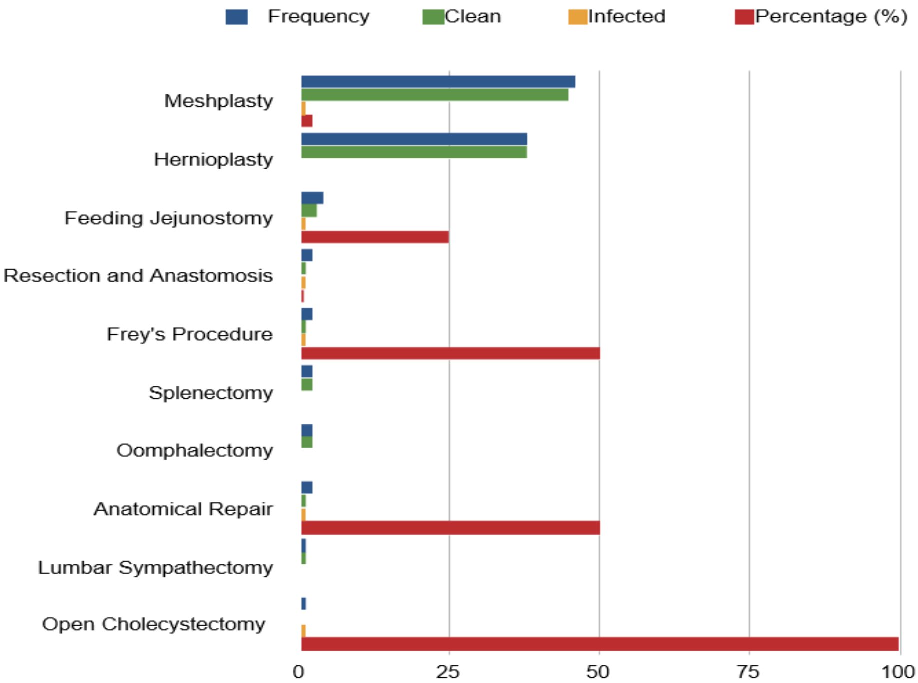

Figure 5. Incidence in relation to surgeries performed

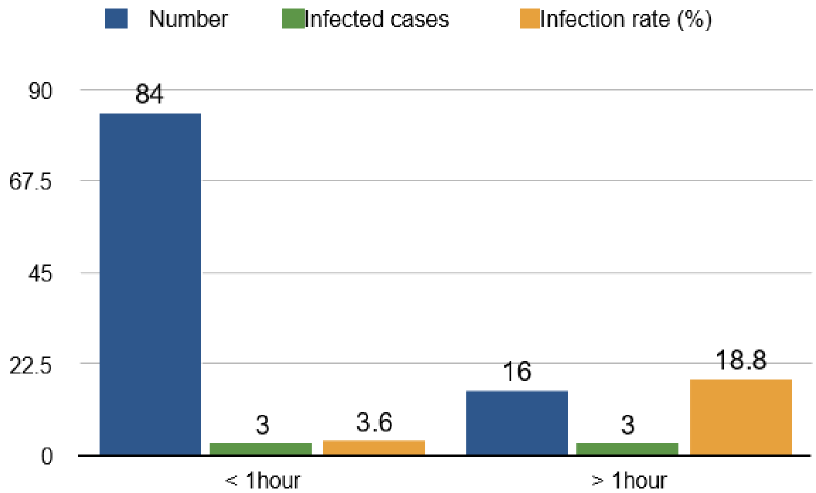

Figure 6. Incidence in relation to Duration of Surgery

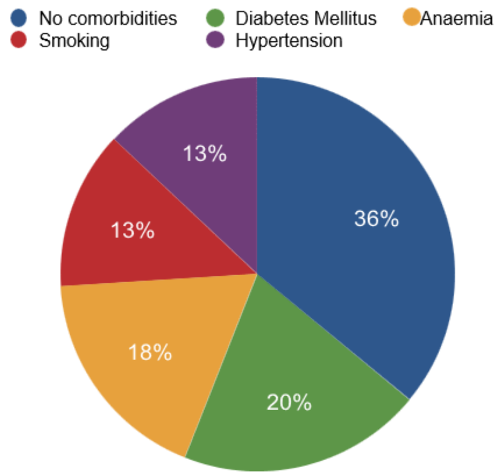

Figure 7. Incidence in relation to risk factors

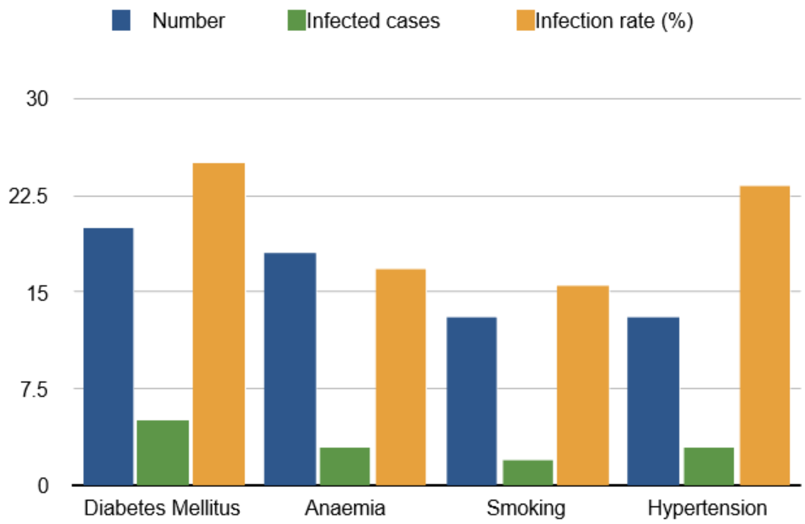

Figure 8. Incidence in relation to risk factors with comorbidity

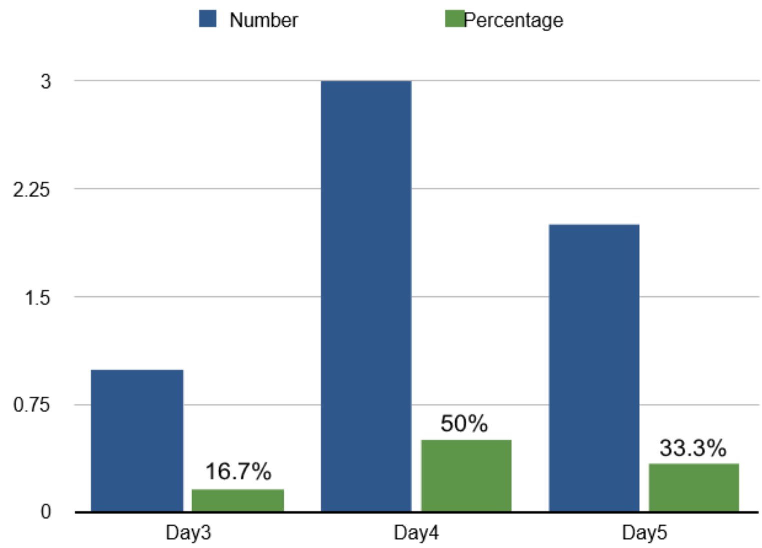

Figure 9. Incidence in relation to post-operative day of infection

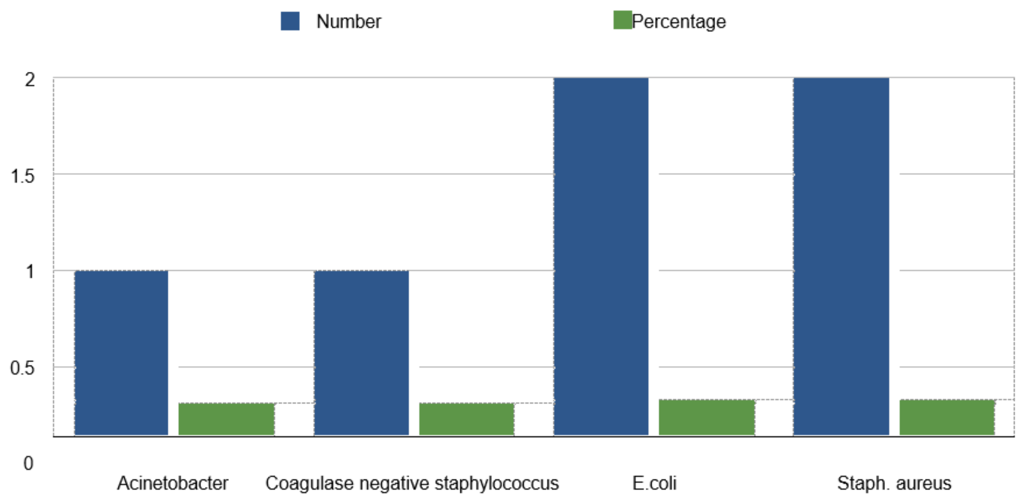

Figure 10. Incidence in relation to organism isolated

DISCUSSION:

The present study was conducted in the Department of General Surgery of Rajarajeswari Medical College and Hospital, Bangalore, from January 2024 - June 2024. It included 100 patients who underwent elective abdominal surgeries, followed up from the day of surgery to 30 days post-operatively.

Incidence of SSI:

The overall incidence of surgical site infections (SSI) in this cohort was 6%, which falls within the range of 2.8% to 17% reported in other studies. However, this rate is higher than those in Western countries, such as the UK (3.1%) and the Netherlands (4.3%) [3,4]. In India, a lack of comprehensive surveillance and consistent feedback on SSI rates contributes to significant variability across hospitals. The higher infection rate in Indian settings maybe attributed to inadequate infrastructure and insufficient attention to basic infection control measures. A coordinated approach is needed to develop effective strategies to address this issue.

Wound Classification and SSI Incidence:

In our study, the incidence of surgical site infections (SSI) varied by wound class, with the highest incidence in Class II wounds. No Class III or Class IV wounds were included, as this was primarily a study of elective abdominal surgeries. The SSI rate in clean wounds was 2.5%, compared to 19.1% in clean-contaminated wounds (p=0.02). Our findings align with other studies, such as those by Lul Raka et al. (2006), Seyd Mansour Razavi et al. (2005), and Mahesh C B et al. (2010), which report higher infection rates in clean-contaminated wounds.[8,9]The relative risk for SSI in contaminated wounds was significantly higher than in clean wounds (5.4-fold in Raka et al.'s study). In our study, Class II wounds had a significantly higher risk of SSI compared to clean wounds, and the SSI rate in clean cases (2.5%) was similar to that found in SP Lilani's study at Grant Medical College, Mumbai.

Age and SSI Incidence:

A gradual increase in SSI incidence with age was observed, from 0% in the <40 age group to 5.7% in the 41-60 age group, and 11.1% in those >61 years. However, the differences between age groups weren’t statistically significant (p=0.3). Older age is associated with increased co-morbidities and reduced immunity, which may increase susceptibility to SSI, as noted by Cruse and Foord.[10]

Sex and SSI Incidence:

Females had a higher SSI incidence (10.7%) compared to males (4.2%), though the difference was not statistically significant. This maybe due to the smaller number of female participants in the study.

Risk Factors for SSI:

In univariate analysis, the incidence of SSI was statistically significant for anaemia (16.7%), hypertension (23.1%), and diabetes mellitus (25%). The incidence in smokers (15.4%) was not statistically significant (p=0.17), though smokers were 3 times more likely to develop SSI compared to non-smokers (OR=3.77, CI: 0.62– 23.05). Multivariate analysis identified diabetes mellitus as the only significant independent risk factor (p=0.009), consistent with findings from other studies.

Pre-operative Hospitalization:

Pre-operative hospitalization >5 days had a significantly higher SSI incidence (17.6%) compared to <5 days (3.6%) (p=0.03). Longer stay may increase the risk of nosocomial infections and reflect more severe illness or comorbid conditions requiring extended workup. Similar findings were reported by Syed Mansour Razavi et al. (2005), with SSI rates rising from 18.6% for 1–5 days to 25.9% for >15 days of pre-operative admission.

Duration of Surgery:

Longer surgeries (>1 hour) had a significantly higher SSI rate (18.8%) compared to those <1 hour (3.6%) (p=0.04).[1] This is consistent with other studies, including those by Syed Mansour Razavi et al. and Mahesh C Betal. Major surgeries, such as biliary and gastrointestinal procedures, tend to last longer and are associated with higher SSI rates due to prolonged exposure to microorganisms.[7]

ASA Grade:

SSI incidence was highest in ASA Grade III patients (20%) and was statistically significant (p=0.008). Patients with higher ASA grade have increased risk of developing SSI.[6] Higher ASA grades indicate more severe systemic illness, increasing post-operative morbidity.

Bacteriology:

The most common organisms isolated were Escherichia coli (33.3%) and Staphylococcus aureus (33.3%), followed by Acinetobacter and coagulase-negative staphylococci (16.7% each) [5]. These organisms were sensitive to linezolid, imipenem, meropenem, and amikacin, but resistant to cefoperazone, ceftriaxone, ciprofloxacin, and piperacillin-tazobactam. Two cases of MRSA were identified. Most infections were caused by the patient's endogenous flora, with E. coli and other Gram-negative bacilli more common in gastrointestinal surgeries due to the opening of the GI tract. These hospital-endemic organisms are resistant to common antiseptics and contribute to hospital-acquired infections.

CONCLUSION:

The incidence of surgical site infections (SSI) in elective abdominal surgeries was 6% in this study. Class II wounds had the highest SSI rates, and risk factors such as anaemia, diabetes, and hypertension were associated with increased infection rates.

Longer pre-operative hospital stays and surgery durations, as well as higher ASA grades, were linked to higher SSI risk. Escherichia coli and Staphylococcus aureus were the most common pathogens, with many organisms showing resistance to commonly used antibiotics.

To reduce SSI rates, the following measures are recommended:

1. Regular surveillance and feedback to improve surgical technique
2. Minimizing pre-operative hospital stays and surgery duration
3. Treating existing infections and optimizing patient health prior to surgery
4. Using proper surgical techniques and reducing known risk factors in elderly patients
5. Ensuring appropriate specimen collection and antibiotic therapy to prevent resistance.

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Disclosure of conflicts of interest - NIL
Ethical approval – Received from IEC committee of Rajarajeswari Medical College and Hospital.

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