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Surgical Audit of SSI (Surgical Site Infection) In Major Operations in Department Of General Surgery at a Central India Rural Hospital

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ABSTRACT

Introduction: Surgical site infection (SSI) is one of the common causes of hospital-acquired infections, leading to high post-operative morbidity and mortality. SSIs lead to increased health care costs in terms of prolonged hospital stay and lost work days. The infections are different in different areas and it is very important to document and notify the incidence of SSI, which will help in proper categorization and surveillance of the patients, to identify the type of patients susceptible for wound infections.

Aims and Objectives: To study the incidence, bacteriology and factors associated with occurrence of SSI.

Materials and Methods: The present prospective study was conducted in the department of General Surgery, NKPSIMS & LMH DIGDOH HILLS,NAGPUR, India. Clinico-bacteriological follow-up of 151 post-operative cases to the development of SSI, as per the Center for Disease Prevention and Control criteria (1991) was done. Incidence was expressed as the infection rate per 151 operations. Bacteriology was documented by sending pus for analysis. Association was tested by applying the Student's t-test and Chi-square test of significance. $P < 0.05$ was considered as significant.

Results: The SSI rate was estimated to be 6% for clean, 56.7% for clean-contaminated, 83% for contaminated operations, and 76.4% for dirty cases. The most common isolated causative microorganism was Escherichia coli (48%).

Conclusion: The study emphasizes the need for the evidence-based infection control and to identify the patients susceptible for wound infection which helps in reducing the hospital stay and reduces hospital cost.

Keywords: Bacteria, Incidence, post-operative, Central India Rural population, surgical site infections

I. INTRODUCTION

Surgical site infection (SSI) previously termed postoperative wound infection is defined as that infection presenting up to 30 days after a surgical procedure if no prosthetic is placed and up to 1 year if a prosthetic is implanted in the patient **[1].** It is one of the most common health-care–associated infections, occurring following 1%–3% of all surgical procedures. The rates of SSI are much higher with abdominal surgery than with other types of surgery, with several prospective studies indicating an incidence of 15%–25% depending on the level of contamination **[2].** The degree of intra-operative contamination is important as a risk factor of SSI, and it is classified into clean, clean-contaminated, contaminated, and dirty/infected **[3].** In the United States, SSI is found to be a serious complication with an incidence of 2% to 5% in patients undergoing surgery **[4].** Abdominal surgeries have high rates of surgical site infections (SSIs), contributing to increased morbidity and mortality and costs for hospitalization. Wound surveillance in the post-discharge period is necessary for correct estimation of SSI rates **[5].**

Infectious diseases, surgical site infections (SSI) in particular are the most popular perioperative complications, and not only the treatment but also prevention is extremely important. The inappropriate use of antibiotic prophylaxis in surgical patients accelerated the development of drug-resistant strains such as methicillin-resistant Staphylococcus aureus (MRSA) or multiple-drug resistant Pseudomonas

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aeruginosa (MDRP) infections. The importance of the preservation of the normal intestinal bacterial flora and the proper usage of the antibiotics became clear and guidelines have been established. It is important to make a distinction between prophylactic and therapeutic antibiotic administration in the perioperative period. The anti-cross infection measure with the observance of Standard Precautions is also important in infection control **[6].**

Thus antimicrobial prophylaxis plays an important role in reducing significantamountof ssi. Benefits of antimicrobial prophylaxis are limited to the first 24 hours postoperatively. Increasing duration of antimicrobial prophylaxis was associated with higher odds of AKI and C difficile infection in a duration-dependent fashion; extended duration did not lead to additional SSI reduction. These findings highlight the notion that every day matters and suggest that stewardship efforts to limit duration of prophylaxis have the potential to reduce adverse events without increasing SSI **[7-8].** Certain co-morbidities play a subtle role in the causation of SSI. Diabetes has established itself as an independent risk factor for SSIs for multiple surgical procedure types **[9].** Operative duration is often cited as an independent and potentially modifiable risk factor for SSI. Prolonged operative time can increase the risk of SSI. Given the importance of SSIs on patient outcomes and health care economics, hospitals should focus efforts to reduce operative time **[10].**

Patient factors and operative factors contribute to the risk of development of SSI . Much attention has been given to protocol care to reduce SSI, such as hair removal, skin preparation, and pre-operative antibiotic agents. Other operative factors such as blood loss/transfusion, emergency/urgent cases, duration of the operation, type of anesthesia, and resident involvement are also potentially modifiable to reduce the risk of SSI **[11-12].** Decontamination of the skin with an antiseptic agent is standard practice before any trans-cutaneous invasive procedure, but the antiseptic agent of choice to best reduce the risk of SSI remains controversial. Alcohol-based agents are likely superior to aqueous agents. Chlorhexidine may decrease SSI rates compared with povidone-iodine, and chlorhexidine-isopropyl alcohol likely offers better skin decontamination before clean surgery than povidone-iodine plus isopropyl alcohol or iodine povacrylex plus isopropyl alcohol **[13].**

II. AIMS AND OBJECTIVES

The objective of the study was to estimate the cumulative incidence of SSI in patients undergoing surgery in different categories, study bacteriology, and the different factors associated with the occurrence of SSI in the wards of Department of General Surgery at NKPSIMS & LMH, Nagpur, Maharashtra, India.

III. MATERIALS AND METHODS

Study Design

A prospective observational study was thus undertaken to study the extent of this problem in our hospital and to provide the baseline estimates for subsequent comparisons.

Study Site

This prospective study was carried out in the department of general surgery of NKPSIMS Medical College and LMH Hospital, a rural setup in Digdoh hills ,Nagpur, Maharashtra, India, from January 2018 to June 2021 on 151 cases who underwent surgeries under clean, clean-contaminated, contaminated, and dirty categories.

Inclusion Criteria

1. Age >16 years
2. Patients of either gender
3. Patients with clean and clean-contaminated category operated electively and contaminated and dirty category as emergency surgeries
4. Prophylactic antibiotics administered for the groups of Class II, III, and IV at the right time and duration.

Exclusion Criteria

1. Refusal to participate in the study
2. Patients who were already receiving antibiotics for >1 week
3. Patients undergoing re-operations
4. Patients who were could not come for a follow-up of up to 30 days since the day of the operation.

Statistical Analysis

The data were processed in the Statistical Package for Social Sciences software for windows, version 12. The association was tested using the test of statistical significance for the difference between the two proportions – the Chi-square test, and for the difference between the two means – the Student's t-test, at 5% level of significance.

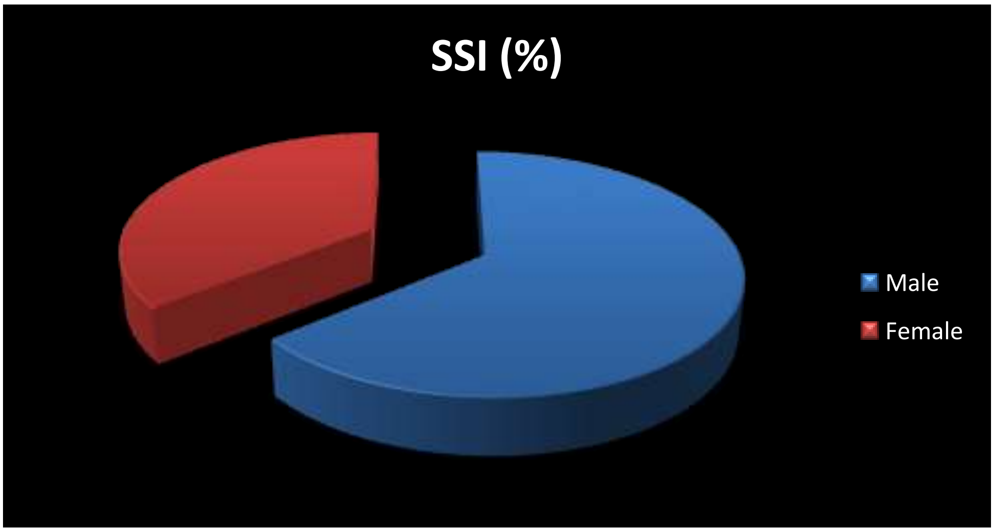
IV. RESULTS

62 operations, out of 151 showed an evidence of post-operative wound infection yielding an infection rate of 41%.. The results

showed a male preponderance with 51 male patients out of total 62 patients with SSI (table 1).

Table 1: Relation between gender and incidence of SSI

Gender	SSI present	%
Male (109)	51	46.76
Female (42)	11	26.19

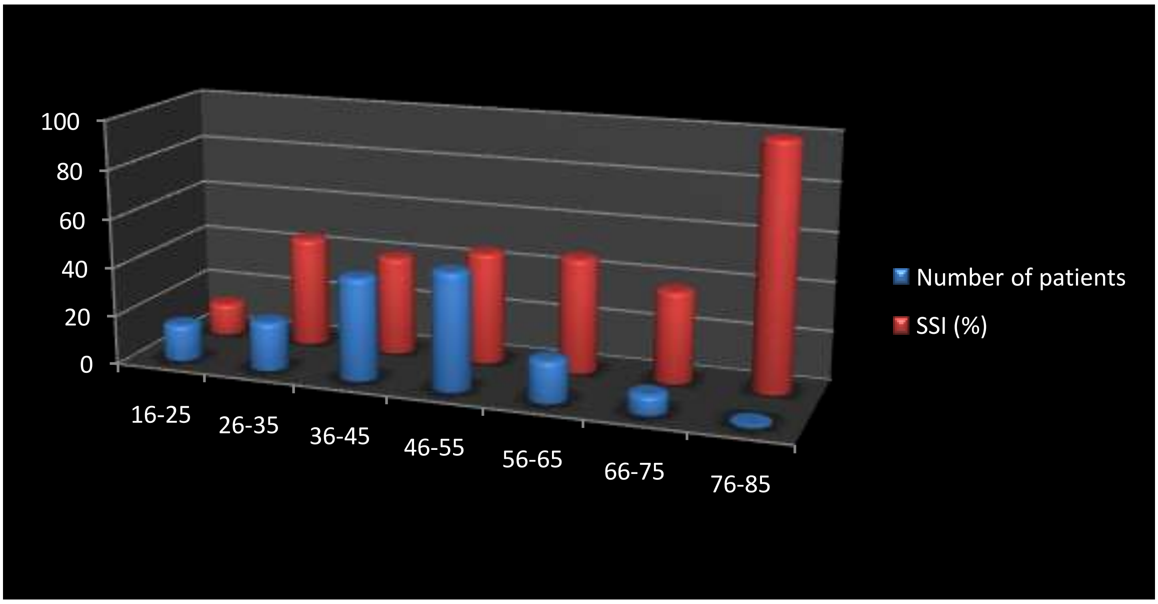


Diag.1.Genderwise proportion of SSI

The highest number of patients belonged to the age of 36-45 and 56-65 years which had 14 patients each, but the infection rate was high among the age of 66-75 years where 10 out of 13 patients (76.92) had SSI (table 2).

Table 2: Age group and incidence of SSI

Age Group	Number of patients (n)	SSI present	%
16- 25	15	2	13.33
26- 35	20	9	45
36- 45	42	17	40.47
46- 55	48	22	45.83
56- 65	17	8	47.05
66-75	8	3	37.5
76- 85	1	1	100

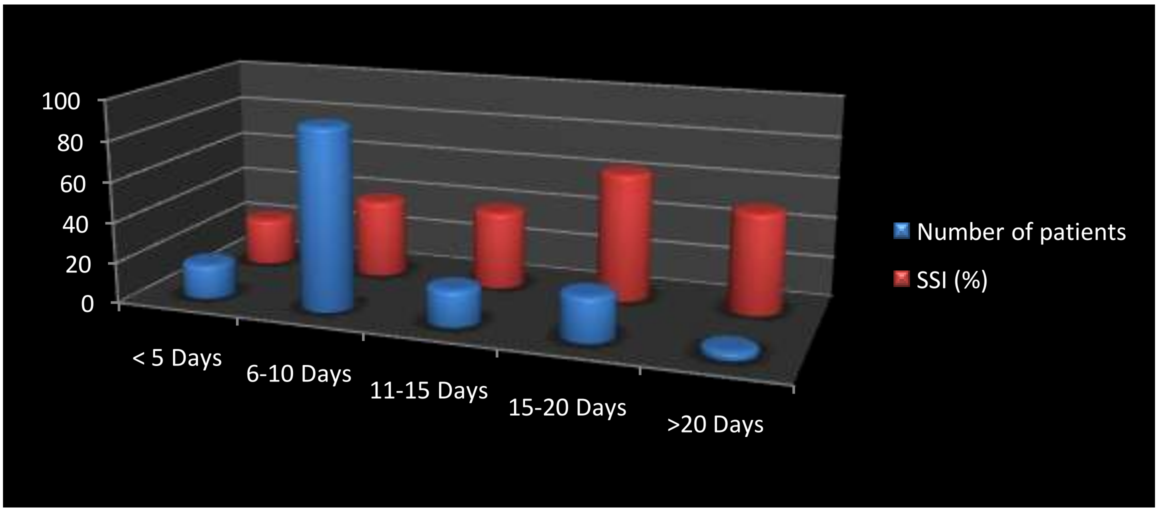


Diag.2. Agewise distribution of SSI

The length of hospital stay showed a statistically significant outcome where 18 patients with SSI stayed for more than 20 days, followed by 19 patients between 15 and 20 days. 17 patients stayed between 11 and 15 days (table 3).

Table 3: Length of hospital stay in days and incidence of SSI

Length of stay (days)	Number of patients (n)	SSI present	%
<5	17	4	23.52
6-10	90	35	38.88
11-15	18	7	38.88
15-20	22	14	63.66
>20	4	2	50



Diag.3. Distribution of SSI on the basis of length of stay

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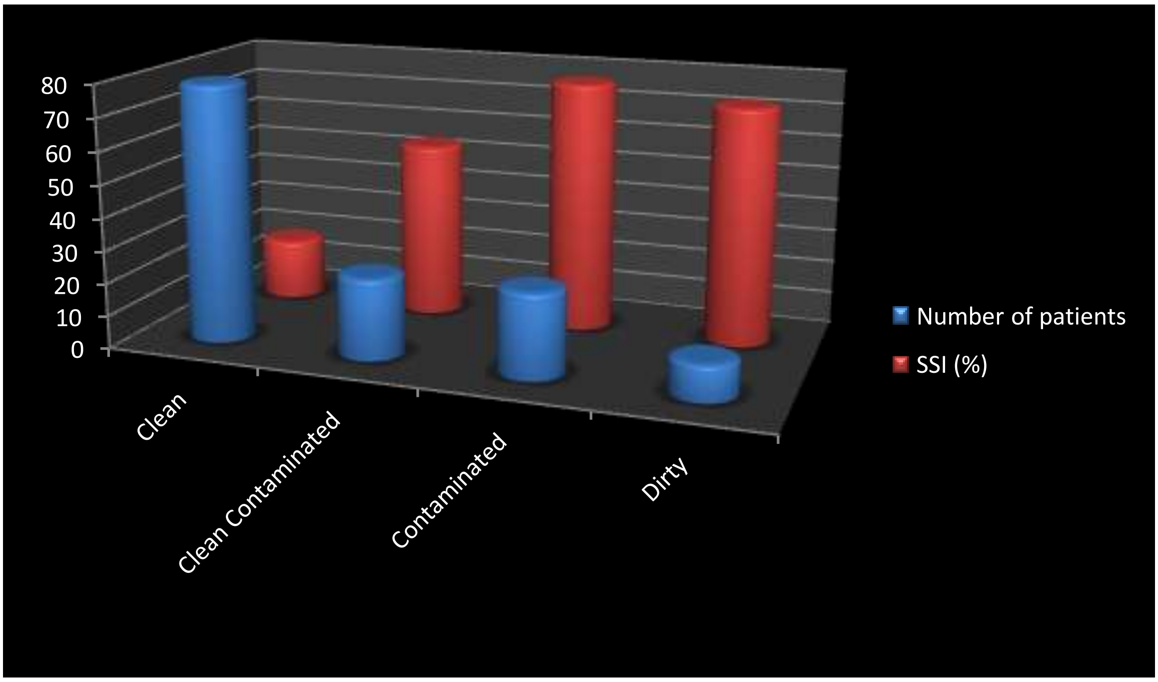
The type of operation also showed a statistically significant result where 12 patients belonged to dirty out of 16 patients that had SSI, 27 patients with SSI belonged to the contaminated group, which indicate the influence of the type of operation that results in wound outcome. The clean and clean-contaminated had 24 and 34 patients, respectively (table 4).

Table 4: Classification of operation and incidence of SSI

Classification of operation	n	SSI present	%
Clean	79	15	18 .98
Clean contaminated	35	19	54.28
Contaminated	26	20	76.92
Dirty	11	8	72.72



Diag.4. Categorical distribution of SSI

Duration of drain placement had a significant impact on the outcome of wound healing, where 36 patients had drain in situ, of which 24 patients had SSI (table 5).

Table 5: Duration of drain kept in situ and incidence of SSI

Duration of drain in situ (in days)	n	SSI present	%
1-3	36	10	27.77
4-7	15	8	53
>7	4	2	50

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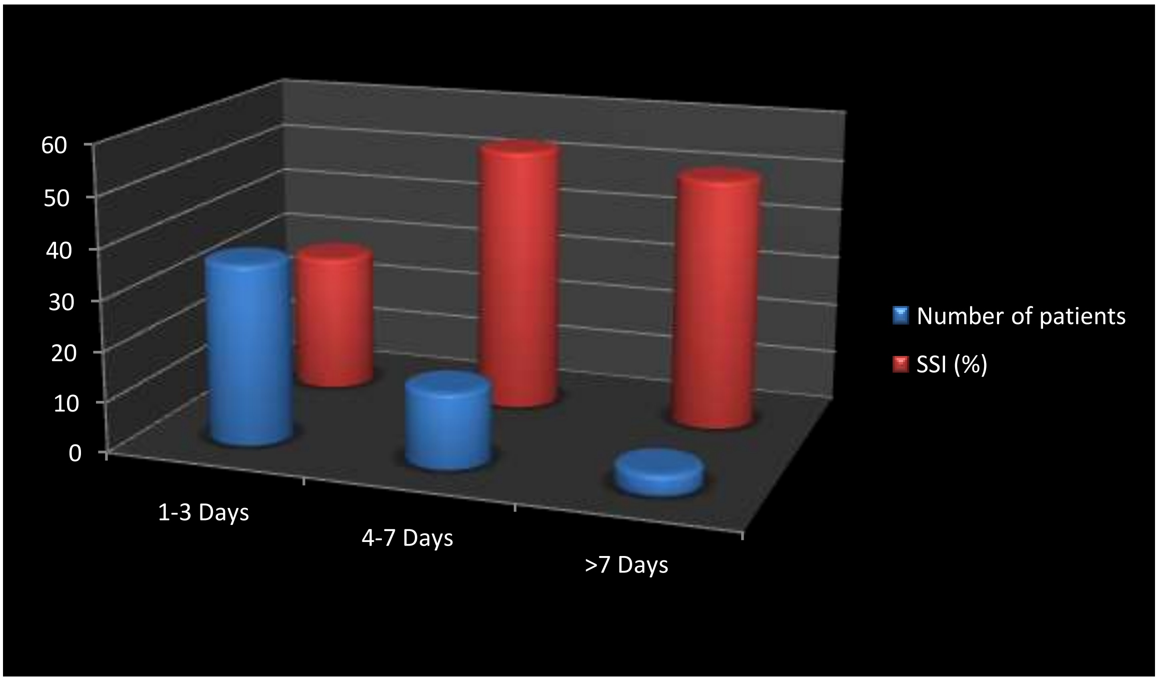
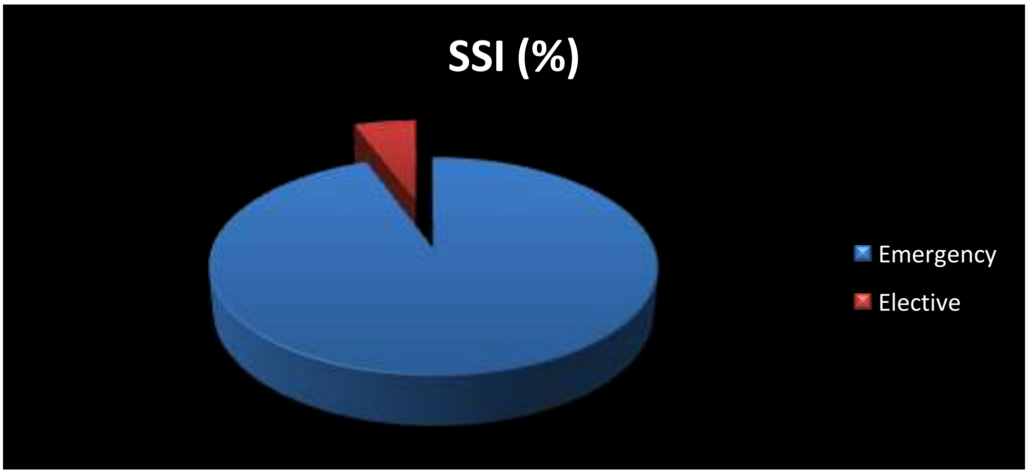


Diag. 5.Relation of Drain kept and SSI

Patients with emergency surgery show a high infection rate of 54.17 compared to the elective surgeries of 18.18 (table 6).

Table 6: Type of surgery and incidence of SSI

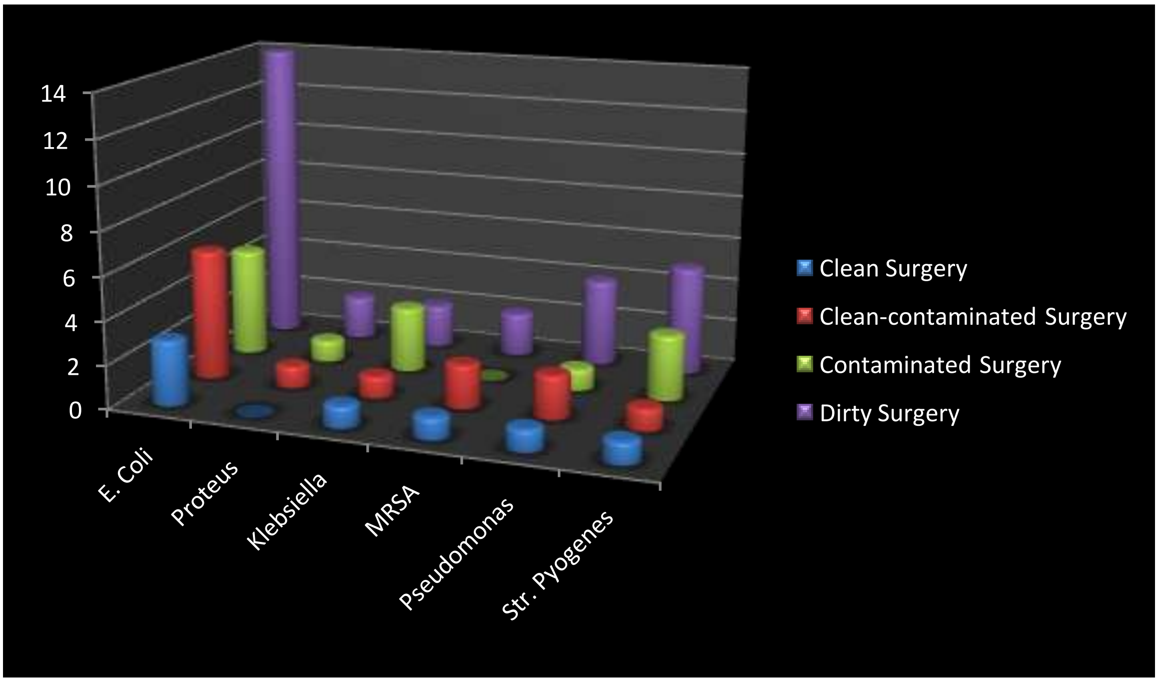
Type of Operation	n	SSI present	%
Emergency	96	52	54.17
Elective	55	10	18.18



Diag.6. Typical distribution of SSI

The frequency of bacterial isolate obtained from 62 cases of SSI is presented in Table 7.

Table 7: Bacterial isolates from the cases of SSIs					
Organisms	**Clean surgeries**	**Clean contaminated surgeries**	**Contaminated surgeries**	**Dirty surgeries**	**Tot al**
Escherichia coli	3	6	5	14	28
Proteus	0	1	1	2	04
Klebsiella	1	1	3	2	07
MRSA	1	2	0	2	05
Pseudomonas	1	2	1	4	8
Streptococcu pyogens	1	1	3	5	10
MRSA: Methicillin-resistant Staphylococcus aureus, SSI: Surgical site infections					



Diag.7.Categorical distribution of organisms

Escherichia coli was the most common isolate which was seen in 28 patients out of 62 SSI, followed by Streptococcus pyogenes and Pseudomonas.

V. DISCUSSION

The incidence of infection rate in this study is comparable to that of other studies in India. Various studies have been conducted to analyze the rate of surgical site infections (SSIs), the type, the frequency of the commonly-associated microorganisms and their relation with hospital accreditation strategy implementation. One of the similar studies conducted in Saudi Arabia shows a significant decrease in the rate of SSIs was observed when self-assessment strategies in preparation for the accreditation of the hospital were implemented. A significant shift in the SSI rate from type I and II wounds to type IV wounds was observed coinciding with implementation of accreditation procedures. Escherichia coli was the most common pathogen. Antibiotic susceptibility patterns showed reduced resistance to ceftazidime and tazocin, while Acinetobacter baumannii was resistant to most of the antibiotics over 10 years. This study demonstrated the status of SSI over the past 10 years in Saudi Arabia and also the effect of hospital accreditation on healthcare organization performance regarding infection control and antibiogram pattern **[14].**

A study conducted by Subramanian et al. in AIIMS showed an infection rate of 24.8%. Similar such study by Ganguly et al. in Aligarh reported an infection rate of 38.8% **[15].** The incidence of infection, however, is much higher than that in other countries; for instance, in the USA, the SSI rate is estimated to be 2.8% and 2-5% in the European countries **[16].** A recent study in Tehran showed an estimated infection rate of 8.4% **[17].** The higher rate of wound infection in Indian hospitals mainly reflects the poor consciousness about the health care associated infections and depressing infection control practices.

The aetiology of SSIs is dependent on the emplacement of the surgery, the bacterial load in the tissue or blood peri-operatively, and the integrity of host defences **[18].** The overall infection rate is around 41% for all surgeries (emergency/ elective), but varies from one surgeon to another, hospital to hospital, from one procedure to another, and even from one patient to another. The infection rate was more with emergency surgery of 62% when compared to elective surgery of 17%. The reason for high rates of infection in our study can be assigned mainly due to all four categories were included in the study, where many patients landed in Category 3 and 4, so there was inadequate time for pre-operative preparation, inappropriate evaluation, and control of underlying conditions. Other reason being a rural area; patients came late because of poor knowledge of the underlying disease leading to worsening of the disease, and sometimes patients coming in resistant shock which made difficult for surgeon to carry out the surgery on time.

Overall, E. coli was the most common isolate in our study; it was the causative agent for wound infection in 28 out of the 62 infected cases. E. coli was the most common isolate responsible for the wound infections in the contaminated and clean-contaminated surgeries. Methicillin-resistant Staphylococcus aureus is the most common organism encountered in wound infection among the clean surgeries. Other organisms found on culture included Proteus, Pseudomonas aeruginosa, Klebsiella, and Streptococcus pyogenes.

VI. CONCLUSION

SSI is a common complication in surgical wards and is responsible for increased morbidity and financial burden to the patient. This can be prevented by competent pre-operative, intra-operative, and post-operative management of patients. This requires a thorough understanding of various patient-related, microbial, and surgical factors which have an aggregate effect on the causation of SSI. Since these risk factors and determinants of SSI are largely modifiable or preventable, it is the collective effort of the operating team and not just the operating surgeon who can prevent its occurrence.

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