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Original Research Article

Prevalence of surgical site infections in a tertiary care teaching hospital in Goa, India: a cross-sectional study

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ABSTRACT

Background: Surgical site infections (SSIs) are a major category of healthcare-associated infections (HAIs), particularly in surgical settings. They lead to extended hospital stays, increased morbidity, and financial burden. The study was conducted in the surgical wards of Goa medical college, a tertiary care hospital, to assess the prevalence of SSIs and identify the key bacterial pathogens and associated risk factors.
Methods: A cross-sectional, prospective study design was employed, involving 378 patients aged over 18 years admitted for surgical procedures. Data collection included daily follow-up for signs of infection, identification of bacterial pathogens, and analysis of potential risk factors such as age, type of surgery, duration of postoperative drain, length of hospital stays, and wound classification. Statistical analyses were conducted using SPSS software, with significance set at $p<0.05$.
Results: The study identified an SSI prevalence of 12.69% among the participants, with *Pseudomonas* being the most common causative agent. Significant risk factors included extended postoperative drain duration, longer hospital stays, emergency surgical procedures, and surgeries involving contaminated or clean-contaminated wounds. Patients with prolonged postoperative drains had a markedly higher incidence of SSIs (63.63%).
Conclusions: The findings reveal a considerable burden of SSIs in the studied setting, with high infection rates in patients undergoing prolonged drain usage, emergency surgeries, and surgeries on contaminated wounds. Strengthening infection prevention measures, particularly in high-risk cases, and enforcing strict adherence to hygiene and sterilization practices are critical. Enhanced infection surveillance programs and targeted interventions could help reduce SSI rates, improve patient outcomes, and minimize healthcare costs.

Keywords: SSIs, Nosocomial infections, HAIs, *Pseudomonas*, Infection control, Risk factors, Postoperative care

INTRODUCTION

"It is health, that is real wealth and not pieces of gold and silver" Mahatma Gandhi.

The term 'health' is a positive and dynamic concept. In common parlance, health implies an absence of disease. However, the world health organisation (WHO) has defined health as: "a state of complete physical, mental and social well-being and not merely the absence of disease or illness or infirmity".

Hospitals are one of the most important pillars of any society. They are the physical execution of one of the pillars that form the backbone of a nation; healthcare. "hospital is the place for cure"-this comes to our thoughts when we think about the hospital. Treating the patients under the same roof was considered a revolutionary idea, and was expected that it would make the healing job easier. However, that idea went wrong in the pre-Listerian era because of a lack of knowledge on sterilization and antisepsis. Sepsis and death were almost common for all the patients suffering from wounds. In

1861, Semmelweis studied the association of puerperal sepsis with the attendants on patients by medical officers and students. He successfully brought a dramatic reduction in infection rate by introducing hand washing with chlorinated lime.[1] Over the years consistent improvement in healthcare happened globally with the newer discoveries in the health sector. Even then the place for cure itself started becoming the place for infection.

A HAIs, also known as a nosocomial infection (NI) (from the Greek "nosokomiakos", meaning "of the hospital"), is an infection that is acquired in a hospital or other healthcare facility. To emphasize both hospital and nonhospital settings, it is sometimes instead called a healthcare-associated infection (HAI or HCAI).[2] HAIs are serious and, oftentimes, preventable if an appropriate prevention plan is in place. The term “HCAI” has replaced the former ones used to refer to such infections, i.e. “nosocomial” or “hospital” infection, as evidence has shown that this event can affect patients in any setting where they receive care.[3]

HAIs include central line-associated bloodstream infections, catheter-associated urinary tract infections, and ventilator-associated pneumonia and as SSIs. CDC works to monitor and prevent these infections as it is an important threat to patient safety and the outcome of treatments.[4]

Postoperative infections account for about 24% of all NIs among 16 million patients who undergo surgery every year.[5,25] Post operative wound infection (POWIs) have a major impact on the patient’s quality of life since they are associated with considerable morbidity, occasional mortality, extended hospital stays, and financial burdens on the patient and the health care provider. SSIs can sometimes be superficial infections involving the skin only. Other SSIs are more serious and can involve tissues under the skin, organs, or implanted material.[5]

The most common cause of the infection includes bacteria *Staphylococcus*, *Streptococcus* and *Pseudomonas*. Germs can infect a surgical wound through various forms of contact, such as from the touch of a contaminated caregiver or surgical instrument, through germs in the air, or through germs that are already on or in your body and then spread into the wound. risk factors for POWIs include: surgery that lasts more than 2 hours, elderly patient and other underlying comorbidities, increased BMI, smoking, cancer, diabetes, diseases that weaken the immune system, emergency surgery, abdominal surgeries

Most studies reporting data on the burden of endemic post-operative HCAI were conducted in acute-care settings and high-income countries. However, an increasing body of evidence has highlighted the epidemiological differences between non-acute care settings and low- and middle-income countries. So, the purpose of the study is to identify the disease burden and the factors leading to an increased risk of transmission of healthcare-associated pathogens and its pattern of occurrence in a surgical ward of a tertiary care center in India. The modern evidence-based approach to infection prevention and control clearly emphasizes that no type of healthcare facility in any country can claim to be free from the risk of HCAI occurrence.[3] A study was undertaken on this topic in Goa 10 years before. However, the pattern and incidence, the profile of micro-organisms and antibiotic resistance patterns vary from one setting to another and period. So, this study was undertaken to evaluate the current pattern of infection validate the hospital-based surveillance program, and forward suitable recommendations for the same.

Aim and objectives

Aim and objectives were to estimate the incidence of hospital-acquired SSIs, to study the microbiological profile of the nosocomial surgical site infection and its sensitivity and resistance pattern, to study the factors associated with the occurrence of these NIs and based on the study result make suitable recommendations to the infection surveillance program in the Goa medical college and hospital.

METHODS

A prospective study was undertaken from March 2020 to March 2021 in the surgical wards of Goa medical college and hospital. The study was undertaken to establish the incidence types, bacteriological patterns, and factors associated with NIs among hospitalized patients in the study setting. Each patient enrolled in the study was followed up daily for the occurrence of NI until the patient was discharged or transferred out from the ward, or died in the ward.

Any patient more than 12 years of age, getting newly admitted to the general surgical ward for any surgery and continuing to remain in the ward under study for more than 48 hours are included as study participants.

Exclusion criteria

Patients less than 12 years of age (because the definition of NI differs in paediatric age groups)-transfer from another ward and transfer from another hospital were excluded.

Patients discontinuing admission in the ward within 48 hours of admission because of discharge, transfer out and death.

The sample size was calculated using the equation-sample size=$4pq/d^2$.

Based on the 16% prevalence of PPD from another study conducted in Gujarat, the minimum sample to be included in the study was 215 patients.[6] The total sample collected in this study was 378. A random sampling approach was used to select eligible participants.

The data was analysed using the SPSS 21 (Statistical package for social science).

The magnitude of the problem is explained in terms of incidence, incidence density i.e.; the number of infections per 1000 patient days, and attack rate i.e.; NI per 100 patients included in the study. The type and microbiological profile are expressed as the proportion of total cases. Associated factors were analysed in univariate analysis by calculating the odds ratio. The chi-square test is employed for detecting significance at 95% confidence ($p<0.05$).

Ethical approval has been taken from the institutional ethical committee.

RESULTS

A total of 378 patients more than 18 years of age who are admitted to the various surgical wards of Goa medical college are studied for the existence of nosocomial surgical site Infection during 1 year.

The study population constituted 196 males (51%) and 159 females (48%). A majority of the population belongs to the age group of 31-50 years.

Table 1: Age and gender distribution of the study population.

Age group (in years)	Male	Female	Total
18-30	54	32	86
31-50	108	82	190
>51	34	68	102
Total	196	182	378

Out of 378 study participants (Table 2), 48 developed SSIs during the study period with an infection percentage of 12.69%.

Table 2: NI statistics.

Patient category	Total (a)	Patients with NI (b)	NI percentage b×100/a
Surgical	378	48	12.69

It was a surprise to note that, most SSIs are caused by *Pseudomonas.*

It is noted that 63.63% of patients who had post-operative drain developed POWI with a $p<0.05$ which is statistically significant.

Table 3: Bacteriology of POWI.

Organism	POWI
Pseudomonas	30
Klebsiella	2
Ecoli	3
Enterococci	6
MRSA	4
Citrobactore	3
Proetus mirabilis	6
Staphylococcus pyogenes	2
Coagulase negative *Staphylococcus aureus*	2
Haemolytic *Streptococci* other than group A or B	2
Candidiasis	0
Burkholderia	0
Acinetobacter	1
Total	61

Out of 378 patients who underwent surgical procedures in the study group, 48 developed POWI. There are no significant changes noted as age increases and age distribution and POWI is not statistically significant ($p>0.05$).

Table 4: POWI and age distribution.

Age group (in years)	Total number	POWI present	POWI absent
<21	1	0	1 (100)
21-30	37	2 (5.4%)	35 (94.5)
31-40	72	99 (12.5)	63 (87.5)
41-50	102	13 (12.74)	89 (87.25)
51-60	69	9 (13)	60 (86.95)
61-70	52	12 (23.07)	40 (76.92)
>70	19	3 (15.78)	16 (84.21)
Total	378	48	330

*$\chi2$= 48.303, df=6, p=0.230.

Table 5: Post-operative drain and POWI.

Post-operative drain	Total number	POWI present		POWI absent	
		N	%	N	%
Yes	66	42	63.63	24	36.36
No	312	6	1.9	306	98.07
Total	378	48	12	330	88

*$\chi2$=4.117, df=1, p=0.042.

Along with the duration of the drain, the post-operative stay also was an important risk factor for the development of POWI. From Table 6 it was obvious that as post-operative days increase chance of getting POWI also increased and is statistically significant ($p<0.05$).

Table 7 explains the incidence of POWI at the site of surgery. It was noted that perineal surgery and surgery on the back had the maximum incidence of POWI. Then comes abdominal and Thoracic surgeries. Most of the surgeries that happened on the back side were infected sebaceous cyst or carbuncle. This may be the reason for the increased infection rate in this site than the perineal site. The perineal site and abdominal site are always more prone to infection. Most of the surgeries that happened in limbs were amputation surgeries and in that out of 142, 14 developed POWI (9.8%).

Table 6: POWI by duration of post-operative stay.

Duration in days	Total number	POWI present, N (%)	POWI absent, N (%)
1-5	118	12 (10)	106 (89.83)
6-10	110	18 (16)	92 (84)
11-15	93	5 (5.3)	88 (94.7)
16-20	45	7 (15.5)	38 (84.5)
>20	12	6 (50)	50 (50)
total	378	48 (12.69)	330 (87.32)

*$\chi 2$=61.114, df=4, p=0.000.

Table 7: POWI and site of incision.

Site of incision	Total number	POWI present, N (%)	POWI absent, N (%)
Abdominal	91	12 (13.3)	79 (86.7)
Thoracic	32	4 (12.55)	28 (87.45)
Perineal	45	8 (17.7)	37 (82.3)
Back	40	8 (20)	32 (80)
H and N	28	2 (7.1)	26 (92.9)
Limbs	142	14 (9.8)	128 (90.14)
Total	378	48 (12.69)	330 (87.31)

*$\chi 2$=38.025, df=6, p=0.000.

Table 8: POWI and type of wound.

Type of operation	Total number	POWI present, N (%)	POWI absent, N (%)
Clean	78	3 (3.8)	75 (96.2)
Clean-contaminated	120	13 (10.83)	107 (89.17)
contaminated	180	32 (17.7)	148 (82.3)
Total	378	48 (12.69)	330 (87.31)

*$\chi 2$=32.041, df=2, p=0.000.

From the study, it was noted that patients who underwent clean-contaminated (3 times) or contaminated wounds (5 times) are more prone to contracting infections postoperatively than patients who are operated on with clean wounds. The risk of infection is lowest in clean wounds (3.8%) and highest in clean-contaminated wounds (10.83%) and in contaminated wounds (17.7%). This relation is statistically significant with p<0.05 (OR for clean contaminated=3.03 and 95% CI=0.836-11.03, OR for contaminated wound=5.40 and 95% CI=1.603-18.229).

Table 9: POWI and type of operation.

Operation theatre	Total	POWI present, N (%)	POWI absent, N (%)
Emergency	260	38 (14.6)	222 (85.38)
Elective	118	10 (8.4)	108 (91.5)
Total	378	48 (12.6)	330 (87.4)

*$\chi 2$=12.890, df=1, p=0.000.

Depending on the type of operation, procedures were classified as emergency and elective. Compared to elective procedures (8.4%), emergency (14.6%) procedures had an increased chance of getting affected by POWI which is around 1.8 times greater. This relation is statistically significant with p<0.05 (OR=1.8, 95% CI=0.888-3.850).

DISCUSSION

Out of 378 patients who underwent surgical procedures in the study group, 48 developed POWI. There are no significant changes noted as age increases. Age distribution and POWI is not statistically significant (p>0.05). However, some other studies, have found some statistical significance between age and the incidence of POWI. A study conducted by Preethishree et al found out incidence was higher in the age group >48 years (35.37%), 28-37 years (24.39%).[7]

In our study post operative drain use was statistically significant. In a study conducted by Adogwa et al named “post-operative drain uses in patients undergoing decompression and fusion” explained that no statistical relation exists between the use of drain and the incidence of POWI. The postoperative complications profile was similar between both cohorts, including deep and superficial SSIs (p=0.52 and p=0.66, respectively).[8]

Post-operative days increase the chance of getting POWI and is statistically significant (p<0.05). In their study, Chavan et al stated that of patients who stayed >7 days, 65.5% of them had POWI.[9] A study “risk factors of surgical site infection” conducted by Cheadle reported that a higher rate of infections is associated with abdominal surgery.[10] While my study found, that perineal and back surgery had the maximum infection rate.

The results that the type of wound influences the post-operative infection are consistent with many other researchers. In a study conducted by Janugade et al in Maharashtra following results were obtained. Out of 100 cases, 14 were clean cases with no infection, 50 were clean contaminated with 6% incidence of infection, 21 were contaminated that had 23.8% SSI, and 15 were dirty cases, wherein the infection rate was 40%.[11]

In our study, emergency surgeries had a higher incidence of infection. The same was agreed upon by many researchers. A study by Janugade et al it was found that SSIs were less in elective surgeries (6.5%) than the emergency (26.3%).[11]

Limitations

Patients could not be followed up after their discharge, though NI can manifest after discharge (up to 7 days). Factors like a clinical procedure or surgical techniques which can be faulty and could possibility be an etiology for infection could not be assessed. Chronic infections like HIV and tuberculosis could not be included in the study as it has a long incubation period. So, it will be difficult to conclude that the infection source is the hospital.

CONCLUSION

This study highlights the significant prevalence of SSIs in Goa medical college, with key risk factors such as prolonged drain use, type of surgical wound, extended hospital stays, and emergency surgeries contributing to infection rates. The predominance of *Pseudomonas* infections suggests the need for revised sterilization protocols and vigilant monitoring of postoperative drains and wound types. Strengthening infection surveillance programs and enforcing stringent adherence to hygiene and sterilization protocols can reduce SSIs, enhance patient outcomes, and decrease healthcare costs. Further research is warranted to explore the influence of surgical techniques and post-discharge follow-up on SSIs.

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