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Original Research Article

Study Evaluating Relation Between Nasal Carriage of Staphylococcus and Surgical Site Infection in a Tertiary Care Hospital

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Abstract

Introduction: An infection is classified as a healthcare-associated infection (HAI) if it happens on or after the third calendar day of admission to an inpatient facility where the date of admission is a calendar day, according to the NHSN (National Healthcare Safety Network) site-specific infection criterion.

Aims: To evaluate SSI caused by S. aureus including its drug-resistant isolates. To find relation if any between nasal carriage of S. aureus and occurrence of SSI caused by S. aureus.

Materials & Methods: It was an institutional-based, descriptive study**.** The present study was conducted in the department of Microbiology and Department of Surgery, Bankura Sammilani Medical College and Hospital, Bankura, India**.** The duration of the study was for a period of twelve months from February 2015 to January 2016

Result: In our study, nasal carriage of methicillin-sensitive Staphylococcus aureus (MSSA) was present in 364 out of 591 patients (61.6%), with the association found to be statistically significant ($p < .00001$). In our study, surgical site infections (SSI) caused by Staphylococcus aureus were observed in 101 out of 336 patients (30%), with the association being statistically significant ($p < .00001$).

Conclusion: We concluded that the incidence of surgical site infections (SSI) brought on by Staphylococcus aureus in a tertiary care hospital is significantly correlated with nasal carriage of this bacterium, according to this study. Of the 1600 postoperative patients, 336 had SSI, and 364 of the 591 patients were nasal carriers of MSSA.

Keywords: Staphylococcus aureus, Nasal carriage, Surgical site infection (SSI), Colonization and Infection control.

Introduction

An infection is classified as a healthcare-associated infection (HAI) if it happens on or after the third calendar day of admission to an inpatient facility where the date of admission is a calendar day, according to the NHSN (National Healthcare Safety Network) site-specific infection criterion. An infection that develops at the site of a surgical incision following a procedure is known as a surgical site infection (SSI). SSI, formerly known as postoperative wound infection, is defined as an infection that appears up to 30 days following surgery if no prosthetic is implanted and up to 1 year if one is [1]. With an incidence of 2% to 5% in patients following surgery, SSI is considered a significant complication in the United States [2]. Due to insufficient post-discharge data, this is probably an underestimate [3]. According to additional statistics, some high-risk patients have an even greater incidence [4]. According to a 2010 prevalence research, SSI accounted for 31% of all healthcare-associated infections (HAIs) among hospitalized patients, making it the most prevalent

HAI. According to numerous Indian studies conducted in various locations, the SSI rate ranges from 6.09% to 38.7% [5]. Infection rates in Indian hospitals are far higher than those in other nations; for example, in the USA, they are 2.8%, while in Europe, they are 2-5% [6]. The greater infection rate in Indian hospitals could be caused by both the inadequate infrastructure and the disregard for fundamental infection control procedures. 75% of SSI-related deaths are directly attributable, and SSI is linked to a 3% mortality rate if treatment is not received. Despite advancements in asepsis, antimicrobial medications, sterilization, and surgical methods, surgical site infections (SSIs) remain the third most common complication of inpatient admissions and have a significant impact on the costs and outcomes of all hospital surgical specialties. Age, sex, nutrition, immunity, prophylactic antibiotics, the type and duration of the operation (rate <1% for orthopedic surgery, rate >10% for major intestine surgery), the type of shaving, and subsequent infection are some of the risk variables that may be implicated. By taking the right precautions before, during, and after surgery, SSI can be avoided. An effective therapy will reduce infection-related morbidity if an infection does occur.[7] Staphylococci, Pseudomonas, Streptococci, Enterococci, Escherichia coli, Klebsiella, Enterobacter, Citrobacter, Acinetobacter, Proteus, and others are among the frequent pathogenic bacteria found in SSIs.

Materials and Methods

Study Type: It was an institutional-based, descriptive study

Study Area: The present study was conducted in the department of Microbiology and Department of Surgery, Bankura Sammilani Medical College and Hospital, Bankura, India

Study Period: The duration of the study was for a period of twelve months from February 2015 to January 2016

Study Population: All the postoperative patients admitted in the general surgery ward in B.S.M.C.H. during the study period.

Sample Size: 1600 post-operative patients admitted in general surgery.

Inclusion Criteria

- Patients aged 18 years and above.
- Undergoing elective or emergency surgical procedures at the tertiary care hospital.
- Willing to provide a nasal swab for Staphylococcus aureus screening.
- Provided written informed consent for participation.
- No antibiotic use in the 7 days prior to nasal swab collection (to avoid false-negative carriage status).

Exclusion Criteria

- Patient discharged before 5days
- Post operated SSI patient operated outside this Hospital and admitted thereafter in B.S.M.C.H.

Parameters to be Studied

- Incidence of anterior nares carriage of S. aureus of all admitted postoperative patients in the surgery ward of B.S.M.C.H.
- Incidence of SSI caused by S. aureus including MRSA in the same patient population.

Study Tools

Basic laboratory equipment's:

- Autoclave
- Hot air oven
- Refrigerator
- Incubator
- Centrifuge machine
- Standard nichrome inoculating wire loop (2-4mm, average 3.26mm internal diameter)
- Bunsen burner
- Sterile swab stick (prepared and commercially procured)
- Sterile forceps and alcohol for flaming
- China marker and sharpie
- Light Microscope

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analysed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5).

Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests, which compare the means of independent or unpaired samples, were used to assess differences between groups. Paired t-tests, which account for the correlation between paired observations, offer greater power than unpaired tests. Chi-square tests (χ^2 tests) were employed to evaluate hypotheses where the sampling distribution of the test statistic follows a chi-squared distribution under the null hypothesis; Pearson's chi-squared test is often referred to simply as the chi-squared test. For comparisons of unpaired proportions, either the chi-square test or Fisher's exact test was used, depending on the context. To perform t-tests, the relevant formulae for test statistics, which either exactly follow or closely approximate a t-distribution under the null hypothesis, were applied, with specific degrees of freedom indicated for each test. P-values were determined from Student's t-

distribution tables. A p-value ≤ 0.05 was considered statistically significant, leading to the rejection of the null hypothesis in favour of the alternative hypothesis.

Result

Table 1: Age-sex wise distribution of patients according to the nasal carriage of S.aureus

Age group	Male	Female	Total	p- value
	Number (%)	Number (%)	Number (%)	< .00001
1- 10 yrs.	37(63.8%)	21(36.2%)	58(9.8%)	
11-20yrs	45(50%)	45(50%)	90(15.2%)	
21-30yrs	62(51.7%)	58(48.3%)	120(20.3%)	
31-40 yrs.	52(56.5%)	40(43.5%)	92(15.6%)	
41- 50yrs	57(56.4%)	44(43.6%)	101(17%)	
51-60yrs	46(59.7%)	31(40.3%)	77(13%)	
Above 60	31(58.5%)	22(41.5%)	53(8.96%)	
Total	330(55.8%)	261(44.2%)	591	

Table 2: Distribution of Nasal carriage of MSSA

Nasal carriage of MSSA	Number (%)	p- value
Present	364 (61.6%)	<.00001
Absent	227 (38.4%)	
Total(n)	591	

Table 3: Distribution of Nasal carriage of MSSA Surgical site infection caused by S. aureus

Surgical site infection caused by S. aureus	Number (%)	p- value
Present	101(30%)	< .00001
Absent	235(70%)	
Total(n)	336	

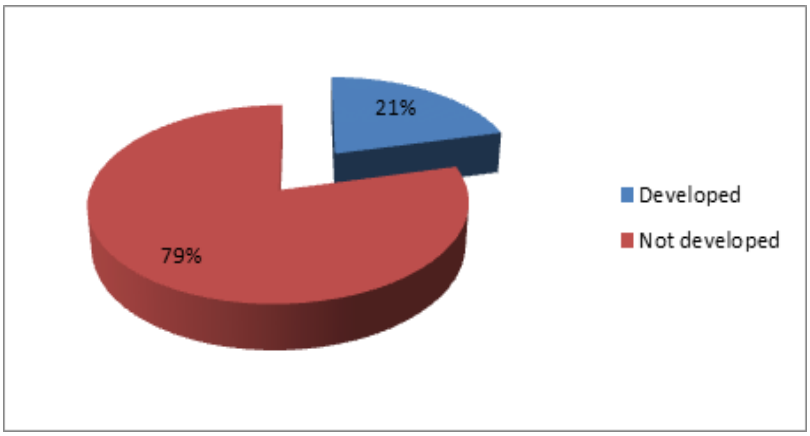

Figure 1: Distribution of SSI in postoperative patients

In our study of 591 patients, 330 (55.8%) were male and 261 (44.2%) were female, with a statistically significant gender distribution across age groups ($p < 0.00001$). The majority of patients were in the 21–30 years age group (120; 20.3%), followed by 41–50 years (101; 17%) and 31–40 years (92; 15.6%). Males predominated in all age groups except the 11–20 years group, which had an equal number of male and female patients. In our study, nasal carriage of methicillin-sensitive Staphylococcus aureus (MSSA) was present in 364 out of 591 patients (61.6%), with the association found to be statistically significant ($p < 0.00001$). In our study, surgical site infections (SSI) caused by Staphylococcus aureus were observed in 101 out of 336 patients (30%), with the association being statistically significant ($p < 0.00001$). In our study, surgical site infections (SSI) developed in 336 out of 1600 postoperative patients (21%), showing a statistically significant occurrence ($p < 0.00001$). Among these postoperative patients those who have MRSA or MSSA in both of their anterior nares and SSI wound site were analyzed for autoinfection with the help of resistogram analysis which showed 6 out of 20 patients and 3 out of 11 patients were having the same resistogram pattern of the MRSA and MSSA strains respectively, which implied the rate of autoinfection were 30% in case of MRSA and

27% in case of MSSA variants.

Discussion

In similar study by Flouchi et al [8] (2021) found that the highest number of participants was in the 21–30 years age group (120), followed by 41–50 years (101) and 31–40 years (92) and Khosravi AD et al [9] (2014) observed that males showed a slightly higher rate of nasal carriage (26.6%) and SSIs (13.3%) compared to females (20.8% and 11.7%, respectively), though not statistically significant. We found that involving 591 patients, the highest number was observed in the 21–30 years age group (120 patients; 20.3%), followed by 41–50 years (101 patients; 17%) and 31–40 years (92 patients; 15.6%). Males were more prevalent in most age groups, with an overall male predominance of 330 (55.8%) compared to 261 females (44.2%). The gender distribution across different age groups was statistically significant ($p < 0.00001$).

In others study by Weiser MC et al [10] (2012) found that out of 250 patients, 60 (24%) were nasal carriers of MSSA. We observed that out of 591 patients, nasal carriage of methicillin-sensitive Staphylococcus aureus (MSSA) was detected in 364 individuals (61.6%), with the finding being statistically significant ($p < 0.00001$).

In others study by Schweizer ML et al [11] (2015) observed that surgical site infections occurred in 42 patients (13.1%), with 22 cases (52.4%) occurring among nasal carriers. We showed that among 336 patients with surgical site infections, 101 cases (30%) were caused by Staphylococcus aureus, showing a statistically significant association ($p < 0.00001$). We found that 1600 postoperative patients, surgical site infections (SSI) developed in 336 cases, accounting for 21%, with this incidence being statistically significant ($p < 0.00001$).

Conclusion

We concluded that the incidence of surgical site infections (SSI) brought on by Staphylococcus aureus in a tertiary care hospital is significantly correlated with nasal carriage of this bacterium, according to this study. Of the 1600 postoperative patients, 336 had SSI, and 364 of the 591 positive nasal carrier patients were nasal carriers of MSSA. Interestingly, S. aureus was responsible for 101 of these infections, indicating a substantial correlation between nasal colonization and SSI. The results highlight how crucial it is to screen for and treat nasal carriage in order to lower the risk of SSI even by autoinfection caused by S. aureus and enhance patient outcomes. Therefore to reduce the incidence rate of SSI by S. aureus and MRSA it could be suggested that each patient should be tested for presence of nasal carriage of S. aureus prior to the operation and should be treated accordingly in order to eliminate the bacteria.

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