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Research Paper

Effect of Demographic, Host and Preoperative Factors in Development of Surgical Site Infections: A Prospective Study at A Tertiary Care Hospital of Western Rajasthan

Microbiology

KEYWORDS : Hospital acquired infections (HAI), Surgical site infections (SSI), surveillance.

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ABSTRACT

Hospital acquired infections (HAI) have always been a nuisance among inpatients; with surgical site infections (SSI) being a major contributor to it. Multiple factors are said to increase the likelihood of surgical site infections. The present study was carried out to assess occurrence of SSI and; effect of various demographic, preoperative and host factors on frequency of SSI among patients operated in General Surgery department. A total of 609 patients were enrolled and were questioned using a pre-structured questionnaire. Samples were collected from patients clinically suspected to have wound infection within 30 days of surgery, and sent for further processing. Among all clinically suspected patients 88 were confirmed to have SSI. Defining the SSI occurrence rate and assessment of factors that predispose to SSI will help to refresh the magnitude of problem in the given set- up and accordingly introduce modifications in SSI surveillance.

Introduction:

Surgeries invariably impair the first line of host defences between environmental microbes and the host's internal milieu; leaving patient exposed to pathogenic or opportunistic microbe in the hospital environment. According to 2014 CDC (Centers for Disease Control) guidelines SSI is defined as an infection occurring within 30 days or in some specific surgeries 90 days after a surgical operation. Up to the end of nineteenth century, infection was the greatest risk associated with any surgical procedure **(Dellinger E.P. 1998)**. Surgical site infection still causes considerable morbidity and high cost to the health care system and is becoming increasingly important in medico-legal aspects. Multiple risk factors and perioperative characteristics can increase the likelihood of superficial surgical site infections.

Objectives:

The study intended to find out:

i) Occurrence rate of SSI,
ii) Relative occurrence of Gram positive and Gram negative organisms and,
iii) Significance of SSI associated factors, among patients operated in General Surgery department of our set up, which will be helpful to prevent infection in future following similar types of operations.

Material:

The present study was carried out in Department of Microbiology, Dr. S.N. Medical College, Jodhpur, Rajasthan.

Study Unit:

The samples for the present study were obtained from patients who had undergone operation in the General Surgery Department at M.G. Hospital, under S.N. Medical College, Jodhpur, Rajasthan; and developed signs and symptoms of post-operative wound infections.

Inclusion criteria:

- Patients of all age groups except neonates.
- Patients undergoing elective procedures in Department of Surgery at M. G. Hospital, Jodhpur.
- Presence of sign and symptoms of infection at incision site, within 30 days from the day of surgery.

Exclusion criteria:

- Wounds from burn patients.
- Patients with trauma.

Sample size:

Sample size for this study was calculated using the following formula,

$$N = \frac{Z^2 P (1-P)}{E^2}$$

Total 609 patients were studied.

Methodology:

Patient data collection:

Structured questionnaire was used to extract data; regarding patient's age, gender, level of education, socioeconomic status, presence of co morbidities (such as diabetes mellitus) and preoperative preparation; from the patients and case notes.

Sampling technique:

Samples were taken from the suspected patients at the time of surgical dressing before the wound was cleaned with antiseptic solution, either in hospital or in outpatient department, till the time criteria were completed as in accordance with CDC guideline. The specimens were collected aseptically using sterile cotton wool swabs. Two separate swabs (one for Gram staining and another for culture) were obtained from surgical site from the depth of wound, without contaminating with skin commensals and were transported to the laboratory immediately.

Processing of samples:

a) Direct microscopic examination of gram stained smear:
The smear was screened for pus cells, gram reaction, morphology, arrangement and number of cells.
b) Inoculation of the samples onto different culture media for organisms:
The 2nd swab was inoculated onto Mac Conkey agar and 5% Sheep blood agar plates by rolling the swab over the agar and streaking from the primary inoculum, using a sterile bacteriological loop and then immersed in nutrient broth. These plates were incubated at
37° C for 24- 48 hours. Primary plates were observed for any visible growth and in absence of any growth within 24 hours; subcultures were made from nutrient broth onto the

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same solid media.

Observations and results:
Age of the patients in study ranged between 7 years to 80 years, most of the operated patients was between 21- 40 years.

Among the 609 patients, 102 patients with clinically suspected post-operative wound infections were enrolled and 88 were found to be culture positive which yielded a total of 91 isolates. Table 1 shows Gram stain morphology in relation to culture results.

Table 1: Gram stain morphology in relation to culture results.

Pus cell	Culture results	
	Bacterial growth	No bacterial growth
Seen (89)	80(89.90%)	9(10.10%)
Not seen (13)	8 (61.50%)	5(38.50%)
Bacterial cell morphology	Culture results	
	Bacterial growth	No bacterial growth
Present (94)	86(91.50%)	8(8.50%)
Absent (08)	2(25.00%)	6(75.00%)

The SSI incidence was highest in the age group of > 60 years. The change in SSI incidence among different age groups was significant ($p < .05$).

Figure 1 shows that gender difference in SSI incidence was not statistically significant ($p > 0.05$).

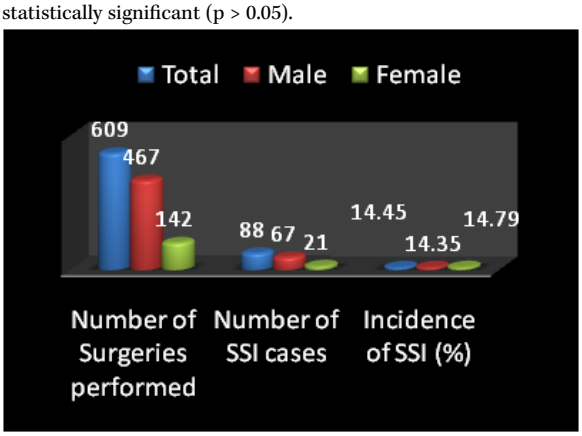

Figure 1: Incidence of surgical site infections with respect to gender.

It was observed that rate of SSI was higher (17.01%) in patients educated till ninth or less, in comparison to patients having education till high school or more (11.31%).

Our study demonstrated a significantly ($p < 0.05$) higher SSI incidence (21.39 %) in lower socio- economic status (below poverty line, BPL) patients in comparison to above poverty line patients (11.03 %).

The difference in SSI rate between patients diagnosed to have one or more co morbidity (Diabetes Mellitus, hypertension, anemia), in comparison to patients without any, was statistically significant ($p < .05$) (Table. 2).

Table 2: Incidence of surgical site infections in relation to Co- morbidity.

Co- morbidity	Surgeries performed	SSI cases Number (%)
Present	146	32 (21.92)
Absent	465	56 (12.04)
Total	609	88 (14.45)

SSI incidence was higher in smokers but the difference in SSI rate among the two groups was statistically not significant ($p = 0.231$).

It was observed that shaving with a razor is associated with higher (16.23 %) SSI occurrence in comparison to use of depilatory cream (9.64%).

The present study observed gram negative organisms to be the more frequent culprits in causing surgical site infections. (Table 3).

Table 3: Incidence of Gram positive and Gram negative organisms in 88 samples

Gram stain morphology	Incidence (%)
Gram positive organisms	38 (43.18)
Gram negative organisms	53 (60.23)

Discussion:
The overall SSI incidence rate of 14.45% in our study is in consensus with infection rates observed in earlier Indian studies (Ganguly PS et al., 2000; Mahesh C B et al., 2010). A lower infective rate in developed countries indicates a better implementation of proper surveillance system (Cruse PJE & Frood, 1980; Creamer et al., 2002).

Increase in SSI rate with increasing age; suggests a weak immune system in them and role of chronic ailments present. Similar finding was observed in previous studies (Mahesh C B et al., 2010)

There are studies supporting our study finding that, gender of the patient has no influence on SSI occurrence (Mahesh C B et al., 2010; Shanthi J. Et al., 2012) but; there are few studies pointing in the opposite direction (Sahu. et al., 2009).

Higher SSI rate among low socio-economic status patients is supported by a USA study (Ad Hoc Committee 1964). Association between level of education and rate of SSI was not significant ($p > 0.05$).

Presence of underlying chronic ailment significantly increased the risk of SSI, as observed in previous works (Shahane V.et al., 2012; Narasinga Rao Bandaru et al., 2012). This may be due to altered or decreased wound healing process.

Study supports that, hair removal if required for a clinical reason, then clippers or depilatory creams should be used in preference to razors. (Tanner et al., 2006, 2007).

102 patients were clinically suspected of SSI, but 88 (86.27 %) were found to be culture positive (Giacometti A et al., 2000).

Our study results embraces the fact, that in recent years Gram negative bacilli have supplanted Gram positive cocci as the cause of majority of local wound infection (Prasanna Gupta, 2012).

Conclusion:

This study is an honest effort to identify the significance of multiple demographic, host (presence of co-morbidity) and preoperative factors (preoperative preparation) in causing surgical site infections. Significant fact is that, SSIs are preventable in most of the cases if proper assessment and appropriate measures are taken by the surgeons, nursing staffs, patients and others in the perioperative period.

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