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PREVALENCE AND DETERMINANTS OF SURGICAL SITE INFECTIONS AT TERTIARY CARE HOSPITAL: A CROSS SECTIONAL STUDY.

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ABSTRACT **Background:** Despite the technical advances in infection control and surgical practices, SSI still continue to be major problem, even in hospitals with most modern facilities. Post-operative wound infections are responsible for the increasing cost, morbidity and mortality related to surgeries accounting for 14-16% cases. Data related to surgical site infection is useful for hospitals and national health care planners in setting programme priorities, monitoring effects of preventive actions and in setting goals for infection control efforts. **Objective:** This study was conducted with the aim of evaluating the rate of surgical site infection in the hospital and various factors contributing to infection. **Materials And Method:** A hospital based cross sectional study was conducted in department of Microbiology at tertiary care hospital over a period of 2 years on patients who had undergone surgery. **Results:** The overall incidence of SSI was 6.91%. There was an increase in percentage of SSI as age advanced, highest in more than 60 years age groups (11.76%). There was an increase in percentage of infection with longer preoperative hospitalization from 5.29 % in the patients hospitalized for up to 5 days to 12.67% in the patients hospitalized for more than 11 days. There was an increase in percentage of SSI with longer durations of surgery, from 3.43% in surgeries which took less than 60 minutes to 18.36% in surgeries which took more than 2 hours. **Conclusion:** Reducing the pre-operative stay and duration of surgery to minimum through adequate training of the staff, proper intra-operative infection control measures and feedback of appropriate data to surgeons regarding SSI would be desirable to reduce the surgical site infection rate. A surveillance programme for SSI need to be applied by the hospital followed by auditing the infection rate on a regular basis.

KEYWORDS : Surgical site infection, pre hospitalization, duration of surgery

INTRODUCTION

Surgical site infection(SSI) is common complication associated with surgery, with a reported incidence rates of 2-20%[1]. Despite the technical advances in infection control and surgical practices, SSI still continue to be a major problem, even in hospitals with most modern facilities[1]. Advances in infection control practices includes different aspects like improved operating room ventilation, sterilization methods, barriers, surgical technique and availability of antimicrobial prophylaxis. Despite all these measures, SSIs remain a substantial cause of morbidity and mortality among hospitalized patients. This may be partially explained by the emergence of antimicrobial-resistant pathogens and the increased numbers of surgical patients who are elderly or have wide variety of chronic, debilitating, or immunocompromising underlying diseases[2]. There are increased numbers of prosthetic implant and organ transplant operations performed.

Post-operative wound infections are considered as the commonest nosocomial infection and are responsible for the increasing cost, morbidity and mortality related to surgical operations accounting for 14 – 16% cases [3]. The risk of developing a surgical site infection depends upon the balance between factors determining the number of bacteria contaminating the site and the factors determining the resistance of the site against infection[3].

This study was conducted with the aim of evaluating the rate of surgical site infection in the tertiary care hospital and various factors contributing to infection. This type of data is useful for hospitals and national health care planners in setting programme priorities, monitoring effects of different preventive actions and in setting goals for their infection control efforts [4]. Effective planning and responses to reduce the incidence of SSIs among patients is not only important to help an organization manage its operation and costs but is also essential to ensure patient safety.

MATERIALS AND METHOD

The study was conducted in department of Microbiology at tertiary care hospital over a period of 2 years from December 2016 to November 2018 after approval by institutional ethics committee. A total of 665 samples were received from patient suffering from SSIs in the various surgical wards (orthopedic, general surgery, obstetrics and gynecology, otorhinolaryngology) of our hospital. The study population consisted of patients of age group >12 years and both sexes who had undergone surgery and developed SSI as diagnosed clinically by physicians within 30 days of having surgical procedure[5]. Procedures in which healthy skin was not incised such as opening abscess, stich abscesses, wounds with cellulitis, burn injuries and donor sites of split skin grafts were excluded from the study.

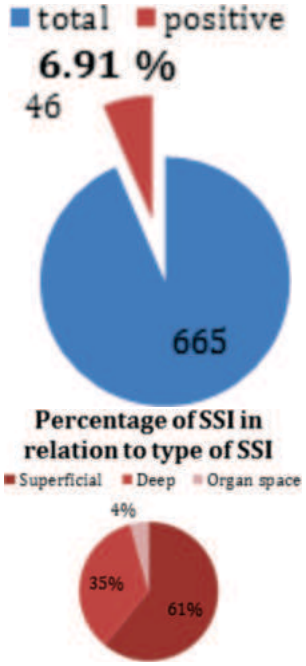
Patient information such as name, age, sex, type of illness, diagnosis, type and duration of surgery performed, antibiotic therapy given and co-morbid diseases was obtained from patient case sheet or record. If one patient had two or more operations of more than thirty days apart each operation was recorded as independent of each other. If the second operation was a result of SSI it was recorded as a consequence of the SSI. Wounds that were confined to the skin and subcutaneous tissue were classified as superficial. Presence of swelling, tenderness obvious oozing of pus were the main determinants for inclusion into this category. Deep/organ space SSI was determined either through ultrasonography, clinical signs of intra-abdominal sepsis or at operation. Certain risk factors like – type of surgical wound, elective or emergency surgery, duration of surgery, and any underlying or predisposing conditions were noted.

Samples were collected using two sterile cotton swab moistened with saline[6] .Sample was collected by rubbing the deepest accessible area of the lesion without touching wound edges. In case of deep seated infection sample was obtained by aspiration of pus by using a needle and syringe. Gram stained preparations were made from one swab and other swab was inoculated on 5% sheep blood agar and MacConkey agar plates and incubated at 37°C for 48 hours before being reported as sterile. Growth on culture plates was identified by its colony characters andstandard biochemical tests. Antimicrobial sensitivity testing was carried out by modified Kirby Bauer disc diffusion method on Muller Hinton agar and results were interpreted in accordance with Clinical Laboratory Standards Institute guidelines.

RESULTS AND OBSERVATIONS

The study included 665 operated cases. Among the 665 patients, 51 were clinically diagnosed of having SSIs. Out of the total 51 samples processed, 46 were culture positive and were considered definite cases of surgical site infection as per the CDC criteria. . The overall rate of SSI was 6.91%. Out of total infected cases 28 cases (60.86%) had superficial SSI, 16 cases (34.78%) deep SSI and 2 cases (4.34%) had organ space infection. Percentage of SSI was more in clean contaminated (9.69%) compared to clean wounds (4.64 %).

The present study included 361 males and 304 females. Incidence of infection among males is 7.47% whereas among females is 6.25 %. Infection is more commonly seen in more than 60-year-old patients with an incidence of 11.76% followed by among 51 to 60 and 41 to 50y old patients. The least is in the age group of 12-20 years being 2.77%, which increased gradually with increase in age of the patient.



The rate of SSI showed an appreciable increase in patients with a longer preoperative hospital stay. Among the 378 patients who had a preoperative hospitalization of upto 5 days, the infection rate was 5.29 %. The rate of infection showed an increase to 7.87 % in patients hospitalized 6 to 10 days before surgery and it further increased to 12.67 % in patients admitted for more than 10 days prior to surgery. In this study, the duration of surgery in majority of the cases was less than 1 hour. The infection rate showed a marked increase with longer durations of surgery. In 379 cases which took less than 1 hour, 13 cases (3.43%) were infected. In 188 cases which took 1 hour to 2 hours, 15 cases (7.97%) were infected. Among the 98 cases which took more than 2 hours 18 cases (18.36%) were infected.

Table 1: Factors Associated With SSI

Factors	Surgeries performed	Culture positive cases	% positive cases
Gender			
Male	361	27	7.47
Female	304	19	6.25
Age (years)			
12-20	36	1	2.77
21-30	138	8	5.79
31-40	194	13	6.70
41-50	189	14	7.40
51-60	74	6	8.10
>60	34	4	11.76
Wound class			
Clean	366	17	4.64
Clean-contaminated	299	29	9.69
Pre-operative stay (days)			
1-5	378	20	5.29
6-10	216	17	7.87
11-15	71	9	12.67
Duration of surgery(min)			
60	379	13	3.43
61-120	188	15	7.97
>120	98	18	18.36
TOTAL	665	46	6.91

DISCUSSION

A study of 665 operated cases was carried out at department of Microbiology, of which 46 were diagnosed of having surgical site infection as per the CDC criteria. Thus the rate of SSI in this study is 6.91%. The rate of SSI has been reported to be 2.5% to 41.9%. [1] However in comparison to the Indian hospitals the rate of infection reported from other countries is quite low, for instance in USA it is 2.8% and in European countries it is reported to be 2-5% [1]. The lack of attention towards the infection control measures, inappropriate hand hygiene practices and overcrowded hospitals can be the major contributory factors for high infection rate in Indian hospital. The high rate of surgical site infection was reported by some authors which may be due to inclusion of all types of wounds. The lower rate of surgical site infectionwas reported by some authors, may be due to differences in working conditions and hospital set up[7].

Study	Year	Country	SSI (%)
S P Lilani et al [8]	2005	Mumbai	8.95
Rafeal lima et al [9]	2011	Brazil	3.4
Gamal et al [10]	2011	Saudi arabia	6.8
Varsha shahane et al [11]	2012	Pune	6
Hariom et al [7]	2012	Kanpur	12.67
Neelam et al [12]	2014	Nanded	5.4
Naveen et al [13]	2014	Mysore	21.66
Vikrant negi et al [1]	2015	Uttarakhand	17.8
Sawdekar H et al.[14]	2015	Amravati	30.23
B Ananthi et al [15]	2017	Chennai	59.80

In the present study more proportion of males (7.47%) developed SSI compared to females (6.25%) which may be due to more number of male population in the study. In another study in chennai, there was a marginal preponderance of male patients developing SSI(57.38%) over female patients with SSI (42.62%)[15]. In Karnataka, females(13.78%) showed preponderance of SSI than males (11.13%)[16]. However according to Berard F and GandonJ sex is not a pre determinant of the risk of SSI[17].

The study confirms the understanding that there is a gradual rise in incidence of wound infection as age advances. Advancing age is an important factor for the development of SSI, as in old age patients there is low healing rate, low immunity, increased catabolic processes and presence of co-morbid illness like diabetes, hypertension, etc[1] . Age obviously is an immutable patient characteristic and even, if it is a risk factor for wound infection, it is the most modest one.

Among the clean wounds, which accounted for more than half the number of cases, the rate of infection was only 4.64%. But in clean contaminated cases, the rate of infection almost doubled to 9.69% probably because of profound influence of endogenous contamination. This was in comparison to many other studies like Varsha shahane et al [11], Avnikar et al [18],Navuru et al [19], Satyanarayan et al [20], which showed higher rate of SSI in clean contaminated wounds.

The rate of SSI in clean wounds in our study of 4.64%, is slightly higher than those of the other studies like Lilani et al [8], Waseem et al [16], Navuru et al [19] and lower than the rates observed by Suryawanshi et al [21] and Ansul et al [2]. The lower SSI rates can be attributed to improved sterilization techniques, new techniques in surgical procedures and use of preoperative and perioperative prophylactic antibiotics.

It is a common observation that a longer preoperative hospitalization is associated with wound infection which was evident in our study. The increased rate may be due to severity of illness and comorbid conditions requiring therapy before operation [7]. Preexisting illness might lower the immune status of the surgical patient and may itself contribute to the increased incidence of SSI. The higher rates could also be attributed to the increased colonization of patients with nosocomial strains in the hospital. Similar results were obtained in other studies like in the study by Neelam AbdulraufBagwan et al [12] which showed SSI of 19.08% between 8-14 days of hospitalization whereas more than 15 days stay had infection rate of 21.43%. Hariom et al [7], Waseem et al [16] also had increased risk of SSI with increasing duration of pre operative hospital stay.

In the present study, majority of the surgical procedures lasted for less than 1 hour (56.99%) and the infection rate among these cases was 3.43%. The rate roughly doubled to 7.97% when the duration of the procedure was 1 hour to 2 hours (28.27%), and it was 18.36%, in procedures lasting for more than 2 hours(14.73%). Incidence was more in longer duration of surgery. The increased rate of infection may be due to contamination of the wound by bacteria sedimented from

exogenous sources over the duration of time. The length of incision is usually less, in surgeries which take a shorter duration, than in longer surgeries where the area exposed to the environment is more due to longer incisions and also a larger degree of damage to tissues and local disruption. Similar results were present in many studies like Waseem et al[16], Neelam et al[12], Ansul et al[2], Varsha et al [11], Hariom et al[7] which showed increasing rate of SSI with increase in duration of surgery. Duration of operation explained by decrease in resistance due to increase blood loss and surgical trauma due to operative instruments also increase bacterial contamination [7].

Most of the SSI were superficial type constituting 60.86% of infected cases followed by deep type (34.78%) and least was organ space type (4.34%) of SSI. This finding was similar to other studies like Lakshmi et al [22], Ansul et al [2] which showed superficial incisional type as most common type of SSI.

CONCLUSION

It is concluded from the study that the rate of surgical site infection is governed by the pre-operative and postoperative management protocol in a patient. Reduction of length of procedures through adequate training of the staff on proper surgical techniques, proper intra-operative infection control measures and feedback of appropriate data to surgeons regarding SSI would be desirable to reduce the surgical site infection rate. Reducing the pre-operative stay and duration of surgery to minimum, ensuring that the patient is as fit medically as possible especially in elective cases can help reduce the infection rate. A surveillance programme for SSI need to be applied by the hospital followed by auditing the infection rate on a regular basis. This will help the Hospital Infection Control Team to lay down strict guidelines to reduce SSI rates which is an important indicator of health care system. Surgical site infection is a very wide topic and can be tackled from various perspectives.

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