A Clinical Study of Surgical Site Infections in a Tertiary care Hospital

L Srinivas[1], A Sudhamshu Reddy[2], Samir Ahmad[3]

[1]Assistant Professor , [2]Final year Post Graduate, [3]Second year Post Graduate, Department of General Surgery, Prathima Institute of Medical Sciences, Karimnagar, Telangana.

Address for correspondence : Dr L.Srinivas, Assistant Professor , Department of General Surgery, Prathima Institute of Medical Sciences, Karimnagar, Telangana, India.

E-mail : srinivas.mbbs.ms@gmail.com

ABSTRACT

Introduction: Surgical infections are those that occur as a result of a surgical procedure or those that require surgical intervention as part of their treatment. They are characterized by a breach of mechanical/anatomic defense mechanisms (barriers) and are associated with greater morbidity, significant mortality, and increased cost of care.

Aims & objective: The present study was done to know the incidence of surgical site infections in our medical college, to study the risk factors associated with the surgical site infections and to find out the Most common organism encountered and its antibiotic sensitivity and resistance in surgical site infection (SSI).

Materials and Methods: Patients who underwent various surgeries at Prathima Institute of Medical Sciences, in between 1st January 2016 to 31st March 2017 are considered for this study. The total number of cases studied is 400. This is a prospective study.

Results: Incidence of surgical site infection in this study is 9.75%. Majority of patients in the study belong to age group of 21-30 years which account for 28.5%. Elective had an incidence of 5% and emergency cases had more incidences of 24%. Most of the cases had SSI detected on 3rd post-operative day. Anemia was found to be the main risk factor with more number of SSI's. Infection rate was found to be increasing as the number of pre-op hospitalisation increased. Prophylactic antibiotic therapy was found to decrease the rate of SSI's. Longer duration of surgery and use of drain was associated with increased rate of SSI. As expected the rate of infection increased from clean wounds to contaminated wounds. E- coli was the commonest organism isolated. Most of the organisms were isolated from the clean contaminated and contaminated cases. Overall imepenem and amikacin were the most sensitive antibiotics.

Conclusion : A pre-existing medical illness, prolonged operating time, the wound class, emergency surgeries and wound contamination strongly predispose to surgical site infection. Antimicrobial prophylaxis is effective in reducing the incidence of post- operative wound infections for a number of different operative procedures but, timing of administration is critical. 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 SSIs would be desirable to reduce the surgical site infection rate.

Keywords : Surgical Site Infection, Wound, Contamination, Infection, Antibiotics

INTRODUCTION

Surgical infections are those that occur as a result of a surgical procedure or those that require surgical intervention as part of their treatment. They are characterized by a breach of mechanical/anatomic defense mechanisms (barriers) and are associated with greater morbidity, significant mortality, and increased cost of care.[1]

Despite the advances in surgical sciences post operative wound infection remains one of the common complication which surgeons encounter. This problem if not evaluated and treated in a timely manner can have significant sequel. Infection is encountered by all surgeons by nature of their crafts, they invariably impaired the first line of host defence. The cutaneous or mucosal barrier, the entrance of microbes into the host tissue is the initial requirement for infection.[2]

SSI can double the length of time a patient stays in hospital and thereby increase the costs of health care. The main additional costs are related to re-operation, extra nursing care and interventions, and drug treatment costs. The indirect costs, due to loss of productivity, patient dissatisfaction and litigation, and reduced quality of life, have been studied less extensively[3].

MATERIALS AND METHODS

The material for the present study was obtained from patient's undergone surgery in Department of General Surgery, PIMS, Karimnagar, from 1st Jan 2016 to 31st march 2017. Surgical site were considered to be infected according to the definition by NNIS. The wounds were classified according to the wound contamination class system proposed by U.S. National Research Council.

All patients above 12 years undergoing surgery in Department of General Surgery were included and patients with known preoperative infection including dirty wounds,those undergoing revision surgery and with Stitch abscess cases were excluded.

The wounds were examined for suggestive Signs/ Symptoms of infection in the post operative period, during wound dressing or when the dressings were soaked.

Operative findings which include, wound contamination, drain used and its type, and duration of operation etc, were studied. Postoperative findings which included, day of wound infection, day of 1st dressing and frequency of change of dressing.

Findings on the day of diagnosis of wound infection were noted which included fever, erythema, discharge, type and color and the exudates was collected from the depth of the wound using sterile cotton swab and was sent to microbiology department for culture and sensitivity.

The samples collected were processed as follows:

1. Direct microscopic examination of gram stained smear
2. Inoculation of the samples onto different culture media for aerobic and anaerobic organisms.
3. Preliminary identification
4. Bio-chemical tests
5. Antibiotic sensitivity

RESULTS

A study of 400 operated cases was carried out of which 39 were diagnosed to be having surgical site infection as per the CDC criteria. Thus the incidence of SSI in this study is 9.75%. Incidence of infection among males is 9.21.%; whereas incidence of infection among females is 11.01%. Infection is more commonly seen among 51 to 60 years old patients with an incidence of 22.4% followed by among 41 to 50 and 61 to 70 years old patients. Youngest patient being 19 years old and oldest being 70y old. Incidence of infection among Emergency surgery is 24% where as among Elective is 5%.

Most of the patients were anemic (15.5%) with infection rate of 24.59%. Hypoproteinemic (10%) patients had infection rate of 20%, diabetes mellitus (7%) had infection rate of 17.8%, UTI (7.5%) had 16.6%, RTI (9%) had infection rate of 22.2% and malignancies (5.25%) had infection rate of 19.04%.

Acute/recurrent appendicitis and inguinal hernia were the most common operations performed. Surgical site infection was more among ileal perforation (50%), duodenal perforation (25%), cholecystectomy (25%), malignancies (20%) and intestinal obstruction (18.18%) patients.

156 of 400 cases received pre operative antibiotics, 8 cases were infected with incidence of 5.12% where as patients who did not receive pre operative antibiotics (244) had an infection rate of 12.7%. 27 Cases of total infected cases (69.23%) had superficial SSI. 10 cases (25.64%) deep SSI and 2 cases (5.12%) had organ space infection.

48% were clean cases, 36.5% were clean contaminated, and 15.5% were contaminated. Out of which clean cases had 4.68% of infection rate, clean contaminated had incidence of 10.95% and contaminated cases had 22.58% of infection rate. Infection rate increased with increasing contamination.53.5% cases had operation in less than one hour with incidence of infection of 5.14%, 39% of cases had operation in 1 to 2 hours with an incidence of infection of 14.10% and 7.5% of cases had duration of operation >2 hours. Thus incidence of infection was more with longer duration of surgery.

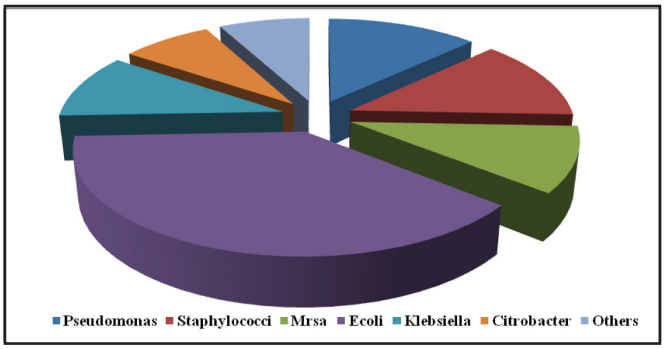
Drain was used in 138(34.5%) of cases out of which 25 cases were infected with an incidence of 18.11%. Mesh was used in 90 cases and 2 patients had infection (2.22%). 11 cases (28.2%) had infection detected on 3rd postoperative day, followed by 8 cases (20.5%) detected on 5th postoperative day and > 6 days. [Table 1]

TABLE 1: INCIDENCE OF INFECTION NOTED ON POST OPERATIVE DAY

DAY	NO. OF INFECTED CASES	PERCENTAGE (%)
2nd	3	7.69%
3rd	11	28.2%
4th	5	12.8%
5th	8	20.51%
6th	4	10.25%
>6 Days	8	20.51%
Total	**39**	

Out of 39 infected cases 15 cases had E-coli infection, 5 had pseudomonas and staphylococci, 4 had MRSA and Klebsiella each, 3 had infection with citrobacter and other organisms. E-coli was the most common isolated organism accounting for 38.46% of cases followed by pseudomonas and staphylococci. [Graph 1]

GRAPH 1: INCIDENCE OF ORGANISM ISOLATED



Staphylococcus is commonly isolated in clean (100%) cases. Pseudomonas is commonly isolated among clean contaminated (80%) cases. E.coli is most commonly isolated with contaminated (76.6%) cases. Klebsiella was associated with clean contaminated (100%) cases.

Antibiotic sensitivity and resistance spectrum :

Ecoli is most sensitive for Imepenem (93.3%), amikacin and netilmycin (80%) followed by piperacillin-tazobactum (73%), azithromycin (66%) and linezolid (60%) sensitive. Staphylococci is most sensitive for linezolid (100%) followed by imipenem, ceftazidime and cefotaxim and ceftriaxone (80%). Pseudomonas is most sensitive for imipenem (100%), followed by piperacillin, amikacin and cefotaxim (80%). MRSA is most sensitive to vancomycin (100%) followed by clindamycin and linezolid (75% each). Klebsiella is most sensitive for imipenem and ceftazidime(100%) followed by amikacin, netilmycin, azithromycin and ciprofloxacin (75%). Citrobacter is most sensitive to amikacin, netilmycin and imipenem (100% each).

E-coli is most resistant to Gentamycin (6%) followed by Cefixime, Ceftriaxone, Cefotaxim (13% each) and Doxycycline (20%). Staphylococci is most resistant to Cefixime (100%) followed by other antibiotics, pseudomonas is most resistant to Doxycycline (100%), Chloramphenicol, Cefixime (20% each)followed by other antibiotics, MRSA is resistant to most of the commonly used antibiotics especially Gentamycin, Doxycycline, Ceftriaxone.

DISCUSSION

The incidence rate in this study is well within the infection rates of 2.8% to 17% seen in other studies. Different studies from India at different places have shown the SSI rate to vary from 6.09% to 38.7%.[3]

The infection rate in Indian hospitals is much higher than that in other countries; for instance in the USA, it is 2.8% and it is 2-5% in European countries. The higher infection rate in Indian hospitals may be due to the poor set up of our hospitals and also due to the lack of attention towards the basic infection control measures.

The following table shows incidence in various other studies [Table 2].

Table 2 : Comparison of rate of SSI with other studies

AUTHOR	YEAR	COUNTRY	NO. OF OPERATIONS	INFECTION
Cruse and Foord[4]	1980	Canada	62939	4.7%
Edwards[5]	1984	U.S	20,193	2.8%
Anvikar et al[6]	1999	India	3280	6.09%
Umesh s et al[7]	2008	India	114	30.7%
Mahesh c b et al[3]	2010	India	418	20.9%
Present study	2017	India	400	9.75%

The present study shows that the incidence of SSI is more among 51-60 yrs age group followed by 41- 50 yr group. Likewise Cruse and Foord observed in their study that older patients are more likely to develop infection in clean wounds than younger patient.[4] The high incidence of 22.4% in patients aged 51- 60 years in our study is perhaps due to decreased immunocompetence and increased chances of co-morbid factors.

The SSI rate in elective surgeries was found to be 5%, which was found to increase to 24% in emergency cases. Our results are comparable well with the results obtained by other workers. Similar results were obtained in Mahesh C B et al, 2010 for elective 7.61% and for emergency 21.05%.

The high rates of infection in emergency surgeries can be attributed to inadequate pre operative preparation, the underlying conditions which predisposed to the emergency surgery and the more frequency of contaminated wounds in emergency surgeries.

The pre operative antibiotic prophylaxis reduced the rate of SSIs from 12.7% to 5.12%. Antibiotic prophylaxis reduced the microbial burden of the intra operative contamination to a level that could not overwhelm the host defenses. The pre operative antibiotic prophylaxis could decrease post operative morbidity, shorten the hospital stay and it could also reduce the overall costs which were attributable to the infection.

Syed Mansour Razavi et al[8] in 2005, showed that administration of prophylactic antibiotic half an hour before the operation would bring about the best results and the lowest SSI. In 2010 Philipp Kirchhoff[9] showed that antibiotic prophylaxis in preventing postoperative complications in colorectal surgery is well established through many studies. However, there is still a debate about the duration of the antibiotic treatment and the kind of antibiotic which should be used. In summary, most studies favour one to three intravenous doses of a second generation cephalosporin with or without metronidazole with the first dose being administered before skin incision.

In this study incidence in relation to the type of surgery, clean cases had infection rate of 4.68%, clean contaminated had incidence of 10.95% and contaminated cases had 22.58%. Lul Raka et al[10] in 2006 at Kosovo Teaching Hospital had the incidence rate of SSI differed by wound classification: 3.1% for clean (n=64), 9.8% for clean- contaminated (n=143), 46.1% for Contaminated (n=13), and 100% for dirty infected wounds (n=5). Seyd Mansour Razavi[8] 2005 found clean wounds in 109 cases (13.6%); clean-contaminated wounds in 214 cases (26.7%); contaminated wounds in 307 cases (45.8%); and dirty infected wounds in 112 cases (14%).

Mahesh C B et al.[3] in 2010 at Bagalkot had SSI rate of 11.53% in clean surgeries, 23.33% in clean contaminated ones, 38.10% in contaminated ones and 57.14% in dirty surgeries.

53.5% cases had operation in less than 1hr with incidence of infection of 5.149%, 39% of cases had operation in 1 to 2 hrs with an incidence of infection of 14.1% and 7.5%

cases had operation >2 hrs with incidence of 20%. Incidence was more in longer duration of surgery. Similar results were present in many studies, Seyd Mansour Razavi 2005; Lul Raka et al in 2006, Mahesh C B et al in 2010 all had similar results.

Use of drain had infection rate of 18.11% in our study. Umesh S. Kamat et al[7] studied that patients with post-operative drain were 5.8 (2.33–14.66) times more likely to develop SSI compared to those without the drain.

Most common organism isolated in our study is E-coli 38.46%, followed by staphylococci 12.8%, and pseudomonas 12.8%. Similar finding are obtained in some studies like Umesh S. Kamat[7] 2008. Seventy-nine per cent (79.33%) of the isolates were gram-negative bacteria; pseudomonas being the commonest one, followed by Staphylococcus pyogenes in the prospective study of surgical site infections in a teaching hospital in Goa.

Pseudomonas was most common isolate in other studies like Mofikoya Bo et al[11] Bacterial Agents of Abdominal Surgical Site Infections in Lagos Nigeria in 2009. 25(17.4%) of the 144 patients studied developed surgical site infections. Pseudomonas was the most frequently cultured aerobic organism in 28% (n=7) of the cultures, while Bacteroides species was the most common anaerobe isolated.

Most of the study showed that virtually all of the pathogens were resistant to the commonly prescribed antibiotics such as Ampicillin and Doxycyclin. The cultured aerobes also demonstrated less than 50% sensitivity to the cephalosporin's tested (Ceftaxidine, Cefuroxime and Ceftriaxone) in over 80% of the infected patients. This finding further supports the well known high prevalence of multiple antibiotic resistant nosocomial pathogens in our environment and may reflect the widespread abuse of antibiotics in the general population.

The relative frequency of different isolates also varied between different studies. Thus, it can be concluded that the organisms that cause SSIs change from place to place and from time to time in the same place. The antibiotic sensitivity testing of different isolates showed multidrug resistance by most of the isolates

Mofikoya Bo et al[11] had Pseudomonas species 37.5% sensitive for Ceftaxidine followed by 12.5% Ceftriaxone, and it was most resistant for Cefotaxime. Umesh S. Kamat et al[7] had pseudomonas species 21.4% sensitive for Cephoperazone-sulbactum combination. The proportion of bacteria resistant to all antibiotics for which tested was as high as 63.93% (39/61).

CONCLUSION

A pre-existing medical illness, prolonged operating time, the wound class, emergency surgeries and wound contamination strongly predispose to surgical site infection. Antimicrobial prophylaxis is effective in reducing the incidence of post- operative wound infections for a number of different operative procedures but, timing of administration is critical.

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 SSIs 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.

Each and every hospital should adopt an antibiotic policy and strict adherence to the same is necessary. Apart from this regular review and monitoring of the implementation of guidelines is equally important.

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How to cite this article: Srinivas L, Sudhamshu A R, Samir Ahmad. A Clinical Study of Surgical Site Infections in a Tertiary care Hospital. Perspectives in Medical Research 2019; 7(1):35-39.

Sources of Support: Nil,Conflict of interest:None declared.