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Incidence of Surgical Site Infections in a Tertiary Care Center

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Abstract

Background: *SSIs are considered to be hospital-acquired if the infection occurs within 30 days ofthe operative procedure or 1 year if a device/foreign material is implanted.* ***Methods:*** *Department of Microbiology, Mediciti Institute of Medical Sciences, Hyderabad Review was carried out of one year of HICC data, Microbiology registers, OT data records for operational notes, MRD for history of case presentation before & after surgery and re-admission data of all patients who underwent surgeries in this hospital, or who visited in the OPD'S for follow up with or without complaint. Common complaints such as increased pain and redness around the wound, delayed healing, the presence of pus, a foul smell, or drainage from the wound or a tissue sample. The total number of surgeries conducted between January 2017 & Dec 2017 was n=2716 out of them n=1958 were major, & n=758 were Minor surgeries.* ***Results:*** *At our center a total of 8 SSI cases for the year 2017. Total clean surgeries were 505 (46.16%), the percentage of SSI in clean surgeries was 1.188% & clean contaminated were 589 (53.33%), the percentage of SSI in clean-contaminated surgeries was 0.33%. Of these 6 are deep-seated SSI & 2 superficial incision SSI. Out of 8 cases reported as SSI's were deep-seated SSI's – 5 were due to orthopedics cases & one was due to gen surgery case – hernioplasty, Among the clean contaminated 2 were reported and both were superficial SSI's., both were caesarian sections. The most prevalent organisms were gram-positive organisms Staphylococcus spp (87.5%). The prevalence of pathogens in the hospital environment especially OT, which is the most likely to cause SSIs in our center were Coagulase-negative Staphylococcus spp.* ***Conclusion:*** *The overall incidence of SSIs in this study the incidence of SSIs in clean surgeries was 1.188% & clean contaminated were 0.33%. One of the limitations of this study was that we have analyzed only clean and clean-contaminated surgeries only. Hence results must be interpreted with this limitation.*

Keywords*: Surgical site infection, Tertiary care center*

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Introduction

Definition **-** SSIs are considered to be hospital-acquired if the infection occurs within 30 days of the operative procedure or 1 year if a device/foreign material is implanted. Theatre-acquired infections are usually deep-seated and often occur within 3 days of the operation or before the first dressing. However, some infections, particularly after prosthetic/implant surgery may not be recognized for weeks or months. Risk factors the risk of SSI is directly proportional to the microbial contamination of the operative wound and virulence of the microorganism and inversely proportional to the integrity and resistance of the host defenses:

$$\text{Risk of SSI} = \frac{\text{The dose of bacterial Contamination X Virulence of microorganism}}{\text{The resistance of patient defense}}$$

It has been shown the risk of SSI is markedly increased if a surgical site is contaminated with greater than 10^5 microorganisms per gram of tissue. However, in the presence of a foreign body, the dose of contaminating microorganisms

required may be much lower, i.e. only 100 staphylococci are required per gram of tissue to produce infection if silk suture is present in the wound [1]. SSI case identification - First, readmission diagnoses were reviewed to identify all patients with infected, Second, microbiology reports of tissue, joint fluid, and wound swabs were reviewed for all patients who had a length of stay greater than 7 days [2] and who were readmitted within 1 month to 12 months. For the ease of identification of sample, the wounds were classified as follows

Clean wounds*:*Non-traumatic, uninfected operative wounds in which no inflammation is encountered; there is no break-in technique; and the respiratory, alimentary, or genitourinary tracts or the oro-pharyngeal cavities are not entered [3].

Clean contaminated*:* Operation in which the respiratory, alimentary, or genitourinary tracts are entered under controlled conditions and without unusual contamination specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered [3].

Superficial incisional SSI [4] Infection occurs within 30 days after the operative procedure.

Deep incisional SSI Infection in 30 days following operation if no implant is left in place. If the implant is in place then a 1-year duration following operation infection appears to be related to the operative procedure and involves deep soft tissues.

Organ/space SSI Infection - occurs within 30 days after the operation if no implant is left in place or within 1 year if the implant is in place and the infection appears to be related to the operative procedure and infection involves any part of the body. (Excluding the skin incision, fascia, or muscle layers) that is opened or manipulated during the operative procedures.

Clean surgeries & clean-contaminated surgeries*:*

Class I represents about 75% of all wounds. Clean wounds are usually elective surgical incisions. Clean wounds have an expected infection rate of (1% - 3 %.) [5]

Class II – Clean-contaminated wounds are clean wounds with a higher risk of infection such as those involving the gastrointestinal, respiratory or genitourinary tracts, as long as the surgery is uncomplicated. Any wound opened to remove pins or wires, chest procedures, ear surgeries or gynecologic procedures are considered class II surgical wounds. Preoperative preparation of the patient was NABH standards, investigations, pre-operative counseling and consents. Sterilization protocols as per CDC guidelines [5].

Materials and Methods

The present study was carried out by the Department of Microbiology, Mediciti Institute of Medical Sciences, Hyderabad. Institutional Ethical Committee permission was obtained for the Study. The study was carried out of one year of HICC data, Microbiology registers, and Operation theatre data records for operational notes, MRD for history of case presentation before & after surgery and readmission data of all patients who underwent surgeries in this hospital, or who visited in the OPD'S for follow up with or without complaint. Common complaints such as increased pain and redness around the wound, delayed healing, the presence of pus a foul smell, or drainage from the wound or tissue. Samples were collected as per standard procedure and analyzed in Microbiology labs. After the arrival of the specimen at the microbiology laboratory, One swab was processed for smear preparation & gram stain (the preliminary report was analyzed for any presence of bacteria, the other swab was processed for culture (aerobic & anaerobic) or aspirates were inoculated on CHROM AGAR and 5% Sheep Blood agar (BA) and aerobically incubated overnight at 37 °C for 24–48 h. The inoculated loop was then transferred in sterile BHI broth & serially sub-cultured for the next 4 days if the primary inoculated plates were sterile after 24 hours. When only a single swab received, it was directly inoculated on blood agar, Chrom agar & swab was placed in BHI broth for further subcultures if required. The inoculated plates were incubated at 37°C overnight (16-20 hr) and examined the next day

morning. The organisms isolated from pus (or pus swab, tissue) culture were identified by standard conventional methods comparatively the antibiotic sensitivity test was done on Mueller-Hinton agar by Kirby-Bauer disc diffusion test as per Clinical and Laboratory Standard Institute (CLSI) guidelines. The results were analyzed using SPSS version 17 statistical software.

Result

The total number of surgeries conducted between January 2017 & Dec 2017 was n=1959 out of them n=1201 were major surgeries & n=758 were Minor surgeries.

Table- 1 – Total cases posted for surgeries for the year 2017, month-wise major & minor surgeries

	Total cases	Major surgery cases	Prophylaxis given	On continuous antibiotics	Minor surgery cases	Prophylaxis given	Not given
Jan	133 (11.1%)	87 (65.4%)	86	1	46 (34.5%)	36	10
Feb	128 (10.6%)	81 (63.3%)	81	0	47 (36.7%)	37	10
Mar	179 (14.90%)	116 (64.8%)	114	2	63 (35.2%)	47	16
Apr	159 (13.2%)	105 (66.0%)	105	0	54 (34%)	36	18
May	164 (13.5%)	91 (55.8%)	88	3	74 (45.4%)	38	36
Jun	157 (13.07)	94 (59.8%)	90	4	63 (40.1%)	28	35
July	192 (15.9%)	121 (63%)	119	2	71 (37%)	40	31
Aug	187 (15.6%)	130 (69.5%)	125	5	57 (30.5%)	31	26
Sept	165 (13.7%)	96 (58%)	93	3	69 (42%)	41	28
Oct	169 (14.1%)	100 (59%)	97	3	69 (40.8%)	49	20
Nov	175 (14.6%)	96 (54.8%)	96	0	79 (45%)	39	40
Dec	151 (12.6%)	84 (55.6%)	81	3	66 (43.7%)	35	31

Graph 1: Antibiotic prophylaxis for both major & minor surgeries

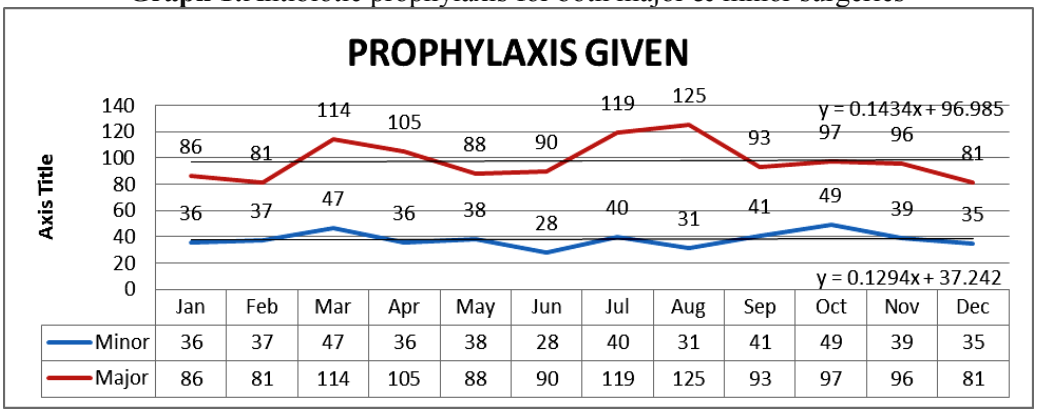


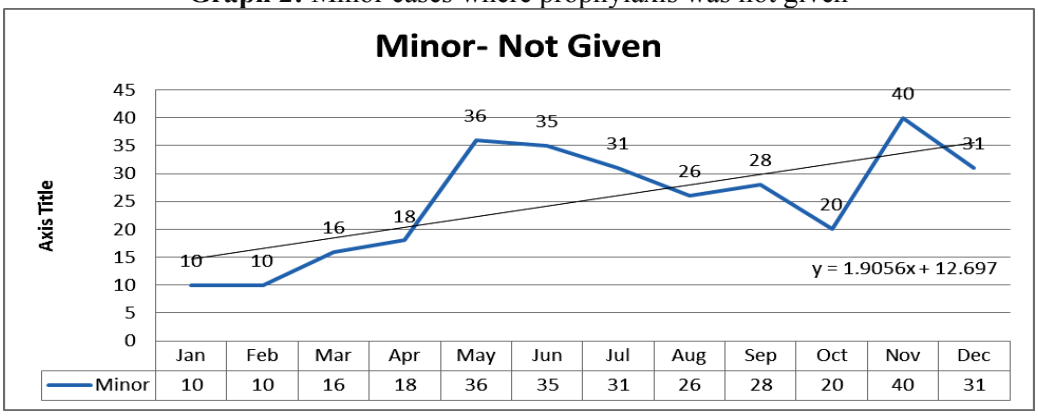
Table 2: Clean & clean-contaminated cases

Total cases	Surgeries	Calculation	SSI %
1094 (100%)	Clean surgeries 505 (46.16%)	SSI= 6/ 505 X 100	1.188%
	Clean contaminated 589 (53.84 %)	SSI= 2/ 589 X 100	0.33%

At our center a total of 8 SSI cases for the year 2017. Total clean surgeries were 505 (46.16%), the percentage of SSI in clean surgeries was 1.188% & clean contaminated were 589 (53.33%), The percentage of SSI in clean

contaminated surgeries was 0.33%. Of these 6 are deep-seated SSI & 2 are superficial incisional SSI.

Graph 2: Minor cases where prophylaxis was not given

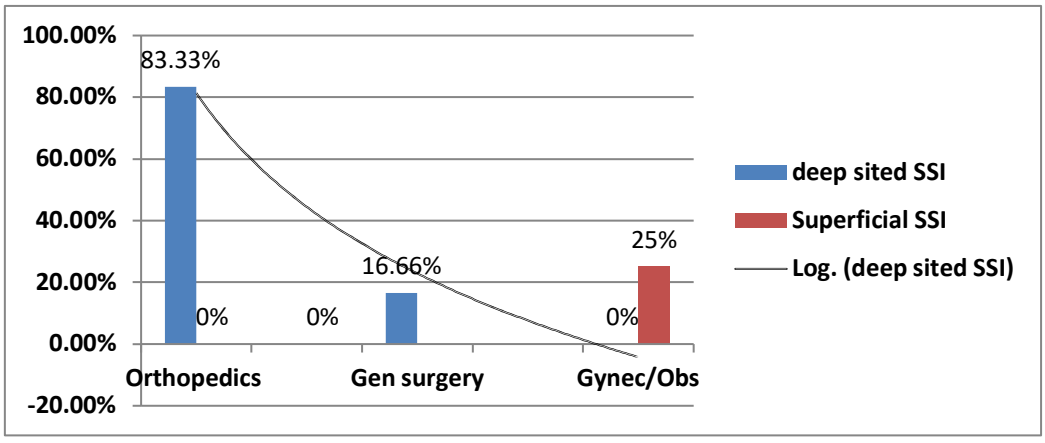


In the study group were categorized under clean & clean-contaminated surgeries constituted to about 40.27% of total cases conducted during the study period Out of 8 cases reported as SSI's were deep-seated SSI'S – 5 were due to orthopedics cases & one was due to gen surgery case – hernioplasty. Among the clean contaminated 2 (25%) were reported and both were superficial SSI's, both were caesarian sections. Of these SSI's 3 cases presented with symptoms in less than 10 days, 5 were identified after more than 30 days in the OPD's, of these 3 were admitted for a thorough treatment, and 2 were done on OPD basis. The treatment follow-up was done with all the cases. 2 ortho cases & hernioplasty cases required re-exploration.

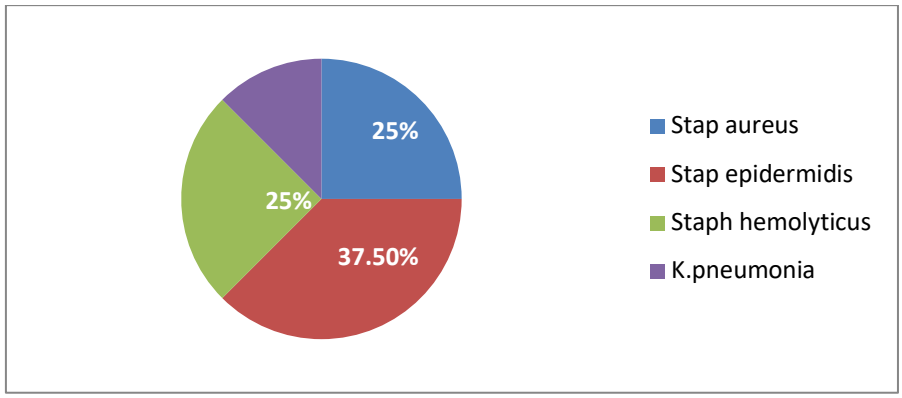
Table- 3 – Total cases posted for SSI's

Month	Cases	Surgery	Nature of SSI	Culture report
Feb	1	ORIF plating With CC screw fixation	Deep incisional	MSSA
Feb	1	Left TKR	Deep incisional	Staphylococcus epidermidis
March	1	B/L TKR	Deep incisional	MSSA
April	1	LSCS	Superficial incisional	Staphylococcus epidermidis
July	1	TKR	Deep incisional SSI	Klebsiella pneumonia
Aug	1	LSCS	Superficial incisional SSI	Staphylococcus epidermidis
Sept	1	Hernioplasty	Deep incisional SSI	Staphylococcus hemolyticus
Oct	1	SubAcromial Decompression	Deep incisional SSI	Staphylococcus hemolyticus

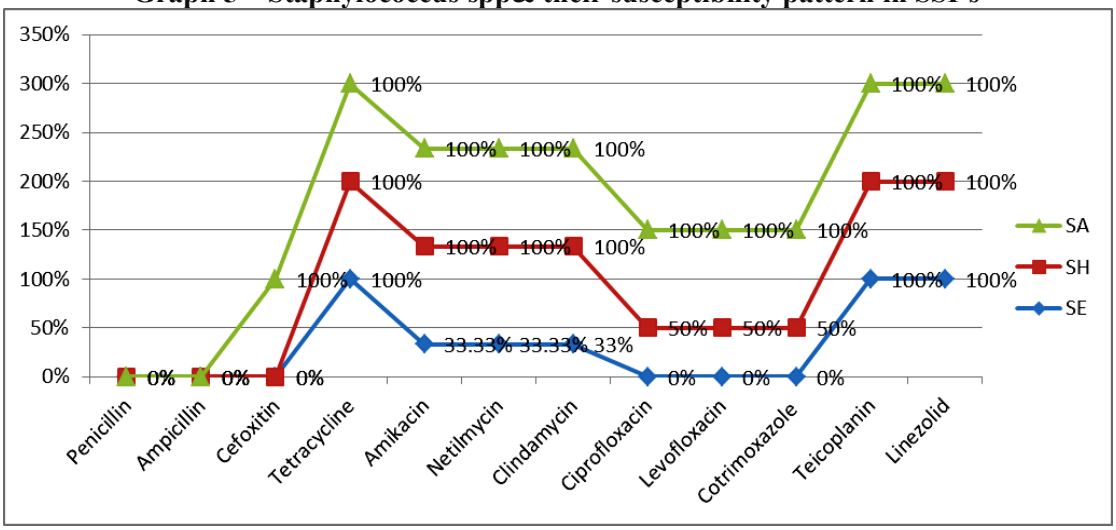
Graph 3 – Clean & clean-contaminated cases percentage-wise



Graph 4: Organisms isolated from surgical site infections



Graph 5 – Staphylococcus spp& their susceptibility pattern in SSI's



Discussion

Surgical site infection surveillance is an integral and critical component of current hospital infection control programs. The results of such activity can be used to analyze the epidemiology of SSIs in the hospital. In the present study, we found the incidence of SSIs in clean surgeries was 1.188% & clean contaminated were 0.33%. Of these 6 are deep-seated SSIs & 2 are superficial incisional SSIs. The incidences of SSI in other studies have shown varying from as low as 6% to as high as 76.9% in some studies [6-12]. The lower incidence of SSI in our study points out to our exceptionally high standard of surgical procedures and maintenance of strict aseptic precautions. One of the causes of increased incidence of SSIs also depends on the duration of the operative procedure which results in increased exposure of operation site to air, prolonged trauma and stress of anesthesia combined with increased blood loss increases the susceptibility of SSIs in patients [13]. Studies conducted in several places across India have revealed that there is an increase in the number of SSI cases where the duration of surgery has been prolonged than 2 hours [6 -10]. In the present study, the Total clean surgeries were n=505 (46.16%), the percentage of SSI in clean surgeries was 1.188% & clean contaminated were n=589 (53.33%), percentage of SSI in clean-contaminated surgeries was 0.33%. Of these 6 are deep-seated SSI & 2 are superficial incisional SSI. In similar studies done by Anvikar AR et al; [7] the percent of infection rate was 10.6% and 4% in clean-contaminated and clean cases respectively. Lilani SP et al; in Mumbai [8] found 22.4% and 3.0% respectively. In this study, the most prevalent organism was gram-positive organism *Staphylococcus Spp*(87.5%). *Staphylococcus aureus* was

isolated in 2 cases and among the coagulase, negative *Staphylococcus spp* 2 were *Staphylococcus hemolyticus* and *staphylococcus epidermidis*. Other similar studies in this field have also agreed with our results where the predominant microorganism isolated was *Staphylococcus aureus*. The use of pre-operative antibiotics is known to decrease the incidence of SSIs [14]. However, the use of antimicrobials also depends on the patient's general conditions and susceptibility to infection. In the present study out of total n=1959 out of them, n=1201 were major surgeries all of the cases received antibiotic prophylaxis and n=758 were Minor surgeries out of which n=301(39.70%) were not given antibiotic prophylaxis. One of the reasons for the reduced incidence of SSI in our study could be the usage of antibiotics in all cases involving major surgeries. In this study, *Staphylococcus aureus* showed 100% sensitivity to Tetracyclines, Amikacin, Nitilmycin, Clindamycin, Teicoplanin, and Lenizolid antibiotics. *Staphylococcus epidermidis* showed sensitivity to tetracycline along with Teicoplanin and Linezolid. *Staphylococcus hemolyticus* also showed sensitivity toTetracyclines, Amikacin, Nitilmycin, Clindamycin, Teicoplanin and Linezolid shown in Graph 5. In other studies just like the present study, penicillins have shown a very poor sensitivity pattern [7-11]. One study in Hyderabad [10] has shown cephalosporins to be very effective for both grams positive and gram-negative cocci. However, that study was conducted in the distant past hence the change of pattern is now observed.

Conclusion

The overall incidence of SSIs in this study the incidence of SSIs in clean surgeries was 1.188% & clean contaminated were 0.33%. This is an acceptable range as per the global estimated SSIs are concerned ranging from 0.5% to 15%. However, several factors may influence the incidence such as pre-operative care, Operation theatre environment, post-operative care and type of surgeries. One of the limitations of this study was that we have analyzed only clean and clean-contaminated surgeries only. Hence results must be interpreted with this limitation.

Conflict of Interest: *None declared*
Source of Support: *Nil*
Ethical Permission: *Obtained*

References

1. WHO Guidelines for Safe Surgery 2009 - World Health Organization. https://mafiadoc.com/who-guidelines-for-safe-surgery-2009-world-health-organization_5a1da33b1723dda8c298c068.html [Accessed on August 20, 2019]
2. Potter, Brian & Thompson, Christin & Green, Philip & Clancy, Seth. Incremental cost and length of stay associated with post-procedure delirium in transcatheter and surgical aortic valve replacement patients in the United States. Catheterization and Cardiovascular Interventions 2018; 93 (6).
3. Culver DH, et al. Surgical wound infection rates by wound class, operative procedure, and patient risk index. National Nosocomial Infections Surveillance System. Am J Med1991;91(3B):152S-7S.
4. Center for disease control https://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf [Accessed online July 2019]
5. I Onyekwelu, R Yakkanti, L Protzer, CM Pinkston, C Tucker, D Seligson. Surgical Wound Classification and Surgical Site Infections in the Orthopaedic Patient. J Am AcadOrthopSurg Glob Res Rev 2017; 1(3):e022.
6. V Shahane, S Bhawal, U Lele. Surgical site infections: A one-year prospective study in a tertiary care center. Int Journal of Health Sciences, Qassim University 2012;6(1):79-84.
7. Anvikar AR, Deshmukh AB, Karyakarte RP, Damle AS, Patwardhan NS, Malik AK.et al. A one-year prospective study of 3280 surgical wounds. Indian J Medical Microbiol.1999; 17(3):129-32.
8. Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. Indian J Medical Microbiol. 2005; 23(4):249-52.
9. Khan MA, Ansari MN, Bano S. Postoperative wound infection. Ind. J. Surg. 1985; 48:383-86.
10. Rao AS, Harsha M. Postoperative wound infections. J. Indian M.A.1975; 64(4):90-3.
11. Tripathy BS, Roy N. Post-operative wound sepsis. Ind. J. Surg.1984; 47:285-8.
12. Prabhakar H, Arora S, A bacteriological study of wound infections. J Indian Med Assoc.1979; 73(9&10):145-48.
13. Berard F, Gandon J. Factors influencing the incidence of wound infection. Ann Surg 1964; 160:32-81.
14. Wong ES. Surgical site infections. In: Mayhall CG, editor. Hospital epidemiology and infection control. 1st ed. U.S.A: Williams and Wilkins; 1996;154-74.