International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 7; Issue 4(F); April 2018; Page No. 11717-11721
DOI: http://dx.doi.org/10.24327/ijcar.2018.11721.2037

Research Article

EMPIRICAL THERAPY OF ANTIBIOTICS IN SURGICAL SITE INFECTIONS

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A R T I C L E I N F O

Article History:

Received 18th January, 2018
Received in revised form 13th February, 2018 Accepted 15th March, 2018
Published online 28th April, 2018

Key words:

SSI, PUS Discharge, Ectomies, Nosocomial Infcetion.

A B S T R A C T

Objectives: The main objective of the study was to calculate the incidence of SSI based on gender, age, department, type of surgery, severity of wound using wound grading scale as well as complications of SSI and evaluating the prescribing pattern of antibiotics in SSI based on different departments and type of surgery. **Methodology:** A prospective observational study was conducted for six months in tertiary care hospital. The patients data was collected and analysed from General Surgery, Orthopedics and Gynaecology. **Results:** Out of total number of reviewed cases, 119 cases were found to be SSI cases showing the incidence rate of 23.8% (male-52.9%, females-47.1%). Overall SSI was found to be common in 50-59 age group (21.8%) and was more seen in general surgery department (78.9%). Surgeries like Ectomies (26.8%) were more prone to SSI followed by Meshplasty (14.2%). Clean-contaminated cases (62.1%) were found to be more and 53.7% cases were with Pus discharge complication followed by Wound gapping (28.5%). Metronidazole was used in 39% cases of SSI. Metronidazole (61.3%) was widely used in General surgery followed by Orthopedic (6.7%) and Gyanecology (5%). Metronidazole was used in 23.4% cases of Ectomies followed by Abcess drainage (8.4%) and other surgeries. **Conclusion:** From this study, it was concluded that surgical site infection is frequently occurring nosocomial infection. Males are more prone than Females. Pus discharge and wound gapping are the most common complications in SSI where Metronidazole and Ceftriaxone are also effective along with Cefazolin.

INTRODUCTION

Surgical Site Infection (SSI) is most frequently occurring healthcare associated infection (HAI) which occurs within 30days of surgery at surgical site. [1, 2] According to Centers for Disease Control (CDC) definition for post operative infection, many studies have identified SSI during the pre-discharge as well as post discharge. [3] Surgical site infections are the wound infections which occur within a time period of 30days in superficial incisional SSI and can extend to 1year after surgery in case of prosthesis implantation (deep incisional SSI) or can occur in traumatized organ/space like pleural space, peritoneal space etc. [4, 5] Surgical site infection was considered to be the most prevalent and common infection in orthopedic wards according to the national study of nosocomial infections. [6] There is no gender differences and are procedure specific but males are more prone to surgical site infections than females according to study conducted by Gamal A. Khairy . [7, 8] SSI's diagnosis rate falls between 12% to 84% and are most oftenly seen between 4 to 6 days after surgery. [9] The largest contributor to cost of health care-associated infections is surgical site infection and more than $3 billion dollars are estimated to impact annual financial. [10]

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Incisional Surgical Site Infection

- ***Superficial incisional SSI:*** This type of infection occurs after surgery within 30days and only skin or subcutaneous tissue of incision is involved.
- ***Deep incisional SSI:*** This type of infection occurs after surgery within 30 days and time period can extend upto 1year incase of any prosthetic implantation is placed and deep soft tissue of the incision is involved.
- ***Organ/Space Surgical Site Infection:*** These type of infection occurs after surgery within 30days involving any part of the body apart from incision and organs or spaces are involved. [11]

Based on the surgical procedures, microorganism causing infections differs. Staphylococcus aureus is the primary cause of infection in Clean surgical procedures and aerobic and anaerobic flora is the main cause of infection in Clean contaminated, Contaminated and Dirty surgical procedures. [12] Methicillin-resistant S aureus (MRSA) is increasing rapidly and is seen in two-thirds of S aureus infections. [13] Many literatures based on outdated laboratory culture techniques declared that Gram positive cocci such as Staphylococci aureus are dominant but in contrast to that study conducted by Randall Wolcott in 2009 suggested that anaerobic rod shaped bacteria like bacteriodes predominate and identified. [14] Generally Monocytes enter the surgical site after 24hours of

incision and will produce chemical signals for wound healing and in very low bacterial contamination neutrophils control the bacteria but if contamination is very high then these monocytes will play role of proinflammatory cells releasing potent cytokine.[15, 16] The most commonly used sampling technique is wound swabbing at the time of dressings and other investigations like serum examinations (elevated WBCs, CRP) and Quantative analysis (wound biopsy). [17] Surgery patients are more prone to risk of SSI and they can be roughly divided into two categories, intrinsic and extrinsic factors. [18] National Nosocomial Infections Surveillance (NNIS) is the common tool which is used to predict risk of surgical site infection and is basic risk index. [19] Higher SSI risk is seen in patients who generally undergo colorectal surgery or obstetric gynecological procedures like cesarean delivery. [20] According to wound grading Scale, there are four different classes of wounds i.e. Clean, Clean contaminated, Contaminated, Contaminated and Dirty and they can be assessed on the few issues like microbes related factors, Host related and operation related. [21, 22] According to wound grading system, most commonly used system is ASEPSI and Southampton wound scoring system. [23] Upto 30% of surgical site infections can show culture negative results on microbiological evaluation limiting the ability to provide good treatment. [24] The three important components of antibiotic prophylaxis are timing, selection and duration of antibiotic. [25] The role of antibiotic prophylaxis is still controversial as they found no reduction of post operative infections.[26] Clindamycin or vancomycin +Aminonglycoside, Aminoglycoside or fluoroquinolones+ Metrogyl are preffered drug instead of cefazolin in patients who are at low risk of MRSA and if β-lactum hypersensivity exists. [27] Surgical removal of devices is preferred in infections caused due to prosthetic devices because it cannot be controlled using antimicrobial drugs. [28] Bacteria's present in hospital environment are resistant to the antibiotics (Amoxycillin-clavulunate, ceftriaxone, cefuroxime, gentamycin) which are commonly used for surgical prophylaxis and also for empirical therapy of SSIs. Empirical therapy before antibiotic susceptibility test reports includes Amikacin and Piperacillin-Tazobactum or Amikacin and Cefoperazone-Sulbactum. [29] Empirical therapy is choosed based on microorganism and antibiotic therapy is selected based on Gram stain culture of purulent material. [30] Bratzler conducted review saying that a single dose of cefazolin or ampicillin-salbactum is recommended for clean and clean-contaminated procedures with other risk factors and alternative agent is beta lactum penicillin's allergy includes vancomycin.[31] The present study is to find out the adherence rate of antibiotics used in surgical site infections in all 3 different departments.

METHODS

A prospective observational study was conducted for six months from August 2016 to January 2017. The patient's data was collected from General Surgery, Orthopedics and Gynaecology departments. The study protocol was approved by Institutional Ethical Committee (IEC). Patients undergone through any type of surgeries were reviewed and amongst those, surgical sites infection cases were studied and data was collected. Patients falling under the age group of 18-80 years without any documented infections before surgery and underwent any elective surgical procedure were included in the study. Pediatric patients as well as the one who did not receive any prophylactic therapy were excluded. Participated in Surgery, Orthopedics and Gynaecology inpatient department on regular basis identifying the surgical site infection cases according to inclusion criteria and documented in structured documentation form. All types of SSIs i.e. Superficial, deep and organ were included but only clean and clean-contaminated wound cases were collected using structured documentation form. Collected cases were analyzed using ANOVA as statistical procedure. Based on previous studies, variables were chosen. The nurse in the operating room recorded the information related to wound class of the particular patient who underwent surgery after verifying from the surgeon who operated. This information was used to check the severity of wound based on wound grading scale.

RESULTS

During the study period, 119 surgical site infection cases were collected, documented and analyzed. These 119 cases were found to develop Surgical Site Infection showing incidence rate of 23.8% altogether in General surgery, Orthopedics and Gynaecology department in tertiary care hospital. Gender wise distribution of collected cases of SSI showed that 52.9 % (63) patients were males and 47.1 % (56) were females as depicted in Table 1. When collected cases were analyzed according to age groups, maximum numbers of cases were falling under 50-59 age group i.e. 21.8% (26) and very few fell under more than 70 years age group i.e. 4.2% (5) as depicted in Table 2. Majority of the patients who developed SSI after surgery were from General Surgery 78.9% (94) followed by orthopedics 15.1% (18) and Gynaecology 5.8% (7) shown in Table 3. The most common surgery which was prone to SSI was Ectomies 26.8% (32) followed by Meshplasty 14.2% (17), Fixators and others (Subumbilical midline incision, Anatomical repair in rectum, Sac excision and excersion, Hartonson's procedure) 11.7% (14) each, Abscess drainage 10% (12), Secondary suturing 9.2% (11), Perforations and Amputations 6.7% (8) each and ORIF/CRIF 2.5% (3) shown in Table 4. SSI was more frequent in patients with clean-contaminated wounds 62.2% (74) than in contaminated wounds 37.8% (45) shown in Table 5. Amongst these SSI cases, Pus discharge complication 53.7% (64) was common followed by Wound gapping 28.5% (34), Wound infected 9.2% (11), Serosamguineous 8.7% (10) as depicted in Table 6. Metronidazole 39% (47) and Ceftriaxone 21% (25) are mostly commonly recommended antibiotics in overall SSI cases followed by Piperacillin+Tazobactum 14% (17), Amikacin 11% (14), Amoxyicillin+Clavulanate and Cefotaxim 6% (8) each and Other antibiotics like Gentamycin 3% (2) as depicted in Table 7. Amongst all antibiotics, Metronidazole and Ceftriaxone are widely used in all departments. Analysis showed that in general Surgery department, Metronidaozle was used 61.3% (73) followed by Ceftriaxone 32.7% (39), Piperacillin/Tazobactum 23.5% (28) and in orthopedics department, Metronidazole 6.7% (8) followed by Amikacin and Augmentin each 4.2% (5), Ceftriaxone and others (like gentamycin) 2.5% (3) shown in Table 8. Metronidazole is widely used in all types of surgeries 1[29(24.3%)], 2[10(8.4%)], 3[8(6.7%)], 4[8(6.7%)], 5[8(6.7%)], 6[7(5.8%)], 7[9(7.5%)], 8[1(0.8%)] and 9[6(5%)] followed by Ceftriaxone in 1[16(13.4%)], 3[8(6.7)], 4[6(5%)], 5[3(2.5%)], 6[3(2.5)], 8[1(0.8)], 9[4(3.3%)] as depicted in Table 9.

Table 1 Gender wise distribution of surgical site infection (n=119)

Gender	NO. OF Patients (N)	Percentages (%)
Male	63	52.9
Female	56	47.1
Total	119	100

N: Number of Patients with Surgical site infection based on Gender.
%: Percentages of patients with Surgical site infection based on Gender.

Table 2 Age wise distribution of surgical site infection (n=119)

Age Groups	Number	Percentage (%)
20-29	16	13.4
30-39	24	20.1
40-49	23	19.3
50-59	26	21.8
60-69	25	21
>=70	5	4.2
Total	119	100

N: Number of Patients with Surgical site infection based on Age.
%: Percentages of patients with Surgical site infection based on Age.

Table 3 Department wise distribution of surgical site infection

Department	Number	Percentage (%)
General surgery	94	78.9
Orthopedics	18	15.1
Gyneacology	7	5.8
Total	119	100

N: Number of Patients with Surgical site infection based on Department.
%: Percentages of patients with Surgical site infection based on Department.

Table 4 Shows distribution of surgical site infection based on type of surgery

S.No	Surgery Type	Number	Percentage (%)
1.	Ectomies	32	26.8
2.	Abscess Drainage	12	10
3.	Meshplasty	17	14.2
4.	Perforations	8	6.7
5.	Secondary Suturing	11	9.2
6.	Amputation	8	6.7
7.	Fixators	14	11.7
8.	Orif/Crif	3	2.5
9.	Others	14	11.7
	Total	119	100

N: Number of Patients with Surgical site infection based on Type of Surgery.
%: Percentages of patients with Surgical site infection based on Type of Surgery.

Table 5 Severity of wound using wound grading scale

S.NO	Wound type	Number	Percentage (%)
1.	Clean-Contamintaed	74	62.2
2.	Contaminated	45	37.8
	Total	119	100

N: Number of Patients with different type of wound.
%: Percentages of patients with different type of wound.

Table 6 Complication of surgical site infection

S.no	Complications	No.of Patients	Percentage (%)
1.	Pus Discharge	64	53.7
2.	Wound Gapping	34	28.5
3.	Wound Infected	11	9.2
4.	Serosamguineous	10	8.7
	Total	119	100

N: Number of Patients with different complications.
%: Percentages of patients with different complications.

Table 7 Antibiotic usage in surgical site infection

S.No	Antibiotics	Number	Percentage (%)
1.	Metronidazole	47	39
2.	Ceftriaxone	25	21
3.	Piperacillin+tazobactum	17	14
4.	Amikacin	14	11
5.	Amoxycillin+clavulanate	8	6
6.	Cefotaxim	8	6
7.	Other drugs	2	3
	Total	121	100

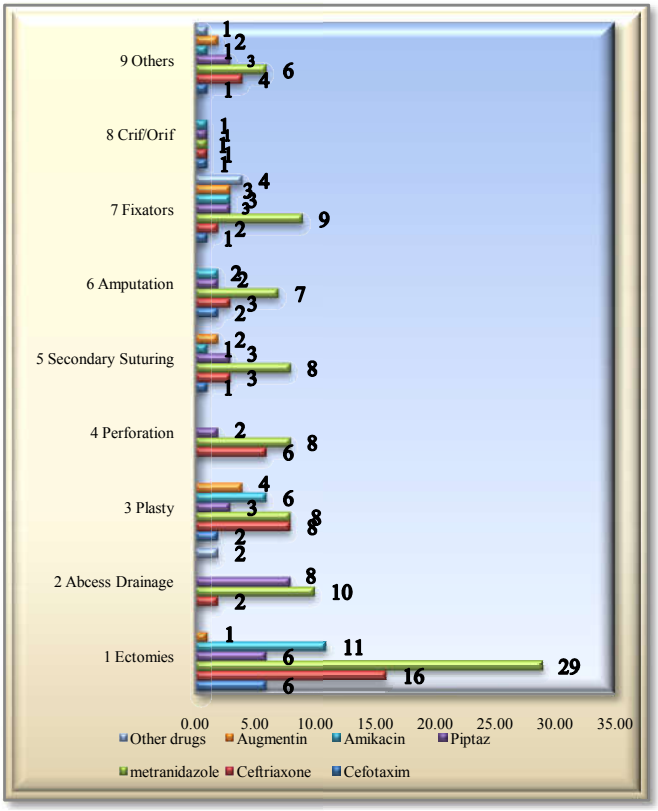
N: Number of times a particular antibiotic was used in patients with Surgical site infection.
%: Percentages of times a particular antibiotic was used in patients with Surgical site infection.

Table 8 Antibiotic usage in different departments

Depatments / Antibiotics	General Surgry		Orthopedics		Gynaecology	
	N	%	N	%	N	%
MTZ	73	61.3	8	6.7	6	5
CRO	39	32.7	3	2.5	4	3.3
PIPTAZ	28	23.5	4	3.3	0	0
AMK	15	12.6	5	4.2	5	4.2
CTX	12	10.8	2	1.6	0	0
AUGMENTIN	7	5.8	5	4.2	1	0.8
OTHERS	5	4.2	3	2.5	0	0

N: Number of times a particular antibiotic was used in patients with Surgical site infection in different departments.
%: Percentages of times a particular antibiotic was used in patients with Surgical site infection in different departments.

Table 9 Antibiotic usage in different surgeries



1- Ectomies
2- Abscess Drainage
3- Plasty
4- Perforations
5- Secondary suturing
6- Amputations
7- Fixators
8- CRIF/ORIF
9- Others

DISCUSSIONS

Surgical Site Infection is considered to be frequently occurring nosocomial infection and is also prevalent in India due to many factors. Out of total number of reviewed cases, 119 surgical site infection cases were collected, analyzed and interpreted from General Surgery, Orthopedic and Gynaecology department during Aug 2016 to Jan 2017. From our study, we observed that collected cases have shown almost equal distributions in gender where males were slightly higher than females. Our findings contradicted with the previous study which was conducted by Khairy GA et al., who concluded that gender difference exists but are procedure specific. [7] The Previous study conducted by Kaye KS *et al*., who concluded their study saying that as the age increases, risk of SSI also increases but risk gradually decreases after 65 years of age contradicted our observation which showed that maximum number of patients developing SSI were from 50-59 age group. [32] We have seen that majority of the cases of SSI were in General surgery mainly because of other infected surgical cases. The findings are in agreement with previous study conducted by Nirupa S *et al.,* who concluded that increase in preoperative stay increases the infection rate also. [33] We have seen in this study that metronidazole followed by ceftriaxone were widely used in all departments which was contradicted by Singhal H who reported that cefazolin is widely used antibiotic for SSI, as it covers all likely pathogens. [34] From our study, we found that majority of the cases were clean-contaminated followed by contaminated which was contradicted by Olson M *et al*. They reported that contaminated wound infection rate was higher than clean contaminated. They saw slow increase in infection rate due to improper preoperative skin preparation in clean wounds and in contaminated cases, it was due to delayed secondary wound closure but infection rate was less in clean contaminated cases due to uniform and appropriate usage of preoperative antibiotics. [35] From our study it was found that maximum number of the cases were at risk and developed Surgical Site Infection and complications like Pus Discharge, Wound Gapping and Wound Infected followed by Serosamguineous discharge. It was diagnosed using clinical criteria which include purulent discharge from Surgical site as well its positive culture sensitivity results. [36] Further studies are required to evaluate the reasons for this type of complications. It was observed from our study that ceftriaxone and metronidazole are two most commonly prescribed antimicrobial in majority of surgical cases. The choice of broad spectrum antibiotic like ceftriaxone for prophylactic purpose is mainly based on gram negative and gram positive bacteria whereas metronidazole which is a potent anaerobic antimicrobial acts superior in surgical procedures. Combination of ceftriaxone and metronidazole broadens the empiric coverage with different spectra of activity, to reduce antimicrobial resistance, adverse effects and costs. After ceftriaxone and metronidazole, Amikacin and piperacillin-Tazobactum were used and it was supported by study conducted by Nandita Pal who concluded that empirical therapy before antibiotic susceptibility test reports includes Amikacin and Piperacillin-Tazobactum or Amikacin and Cefoperazone-Sulbactum are recommended. [29]

CONCLUSION

This survey showed that surgical site infection is frequently occurring nosocomal infection. From ourstudy, it is concluded that pus discharge and wound gapping are most commonly seen complications in surgical site infections where metronidazole and ceftriaxone are also effective against surgical site infections along with cefazolin.

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How to cite this article:

G.Ramya balaprabha *et al* (2018) 'Empirical Therapy of Antibiotics in Surgical Site Infections', *International Journal of Current Advanced Research,* 07(4), pp. 11717-11721. DOI: http://dx.doi.org/10.24327/ijcar.2018.11721.2037

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