The Professional Medical Journal
www.theprofesional.com

ORIGINAL PROF-3682

DOI: 10.17957/TPMJ/17.3682

SURGICAL SITE INFECTION;

FREQUENCY OF CLINICAL ISOLATES INVOLVED. SENSITIVITY AND RESISTIVITY PATTERN ESTIMATE.

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Article received on:
19/10/2016
Accepted for publication:
25/04/2017
Received after proof reading:
03/07/2017

ABSTRACT… Among the Health care associated infection (HCAI) Surgical Site Infection (SSI) is one of the most common complications occur after surgery and increases mortality and morbidity rate. The objective of this study is to identify the common causative organism involved in postoperative wound infections along with their sensitivity and resistivity patterns. **Study Design:** Prospective cross sectional study. **Setting:** Tertiary Health Care setup in Karachi, Pakistan. **Period:** Six month from April 2016 till September 2016. **Method:** A total of 100 patients are included in this study that underwent various surgical procedure. **Result:** In this study E. coli isolated from 32% of cases followed next in frequency by S.aureus in 16%, Coagulase negative Staphylococci in 14 %.the other less common pathogen involved Klebsiella, P. aeuroginosa, Enterococcus & Acinetobacter, Enterobacter, Streptococcus group D. Amikacin limipenem and Meropenem is found to be of more Sensitive against E. Coli while Ampicillin and co trimaxazole showed higher resistivity against E. coli or other various organism. Teicoplann and vancomycin and linzolid have shown absolute sensitivity to various pathogens. Penicillin is found to be highly resistant against Coagulase negative Staphylococci. **Conclusion:** E. coli is the most common pathogens involved in Post-surgical Infection Amikacin, imipenem, Meropenem, Teicoplann, vancomycin. linzolid is found to be more Sensitive against various organism isolated in our study. Acinetobacter are highly resistant to various drugs while P. aeuroginosa have also shown optimal sensitivity pattern against various groups of antibiotics. Present study signifies the adaptation of antibiotic combination in rational way for prophylactic use and the exploitation of a synchronized system of surgical wound management and cure.

Key words: Surgical Site Infection, surgical wound management, sensitivity and resistivity.

Article Citation: Tariq A, Ali H, Zafar F, Hameed K, Sial AA, Salim S, Mallick N, Hasnain H, Fatima R, Naqvi GR. Surgical site infection; frequency of clinical isolates involved. Sensitivity and resistivity pattern estimate. Professional Med J 2017;24(7):1054-1061. **DOI:** 10.17957/TPMJ/17.3682

INTRODUCTION

Among the health care associated infection Surgical Site Infection is one of the most common complication occur after surgery and increases mortality and morbidity rate along with the treatment cost. The practice of irrational use of antibiotic may result in increase antimicrobial resistance where as appropriate use of Surgical Antibiotic Prophylaxis (SAP) can decreases the incident rate of SSI[1]. During hospital admission patient expose to different types of micro flora, these patients are at greater risk of infection and can be infected by these isolates. This infection risk is further amplified when the patient undergone to any invasive procedure. Due to highly reported multidrug resistance, treatment

of Post surgical infection with antibiotics is now become a challenge for the Surgeon so it is a necessary to find out the prevalent pathogen along with their antibiotic susceptibility pattern so the proper treatment can be started on earlier basis.[2] According to the definition of Centre for Disease control and prevention (CDC) if the infection occur within 30 days of surgery or within one year in case of implant is considered as SSI.[3] Rapidly rising multi drug resistance and emerging nosocomial pathogens facilitate periodic review of sensitivity and isolation patterns in surgical unit.[4] Several factors associated with SSI i.e. the inoculums of bacteria introduce into the wound, the integrity of the patient's host defense mechanisms, the microenvironment of the wound. All surgical wounds are contaminated by bacteria, but very few depict the scene of clinical picture of infection.[5] The magnitude of bacterial burden is also the significant risk factor associated with SSI i.e., the rate of SSI increases if more than 105 organisms per gram of tissue contaminate the surgical site, though the use of prophylactic antibiotic along with the advanced surgical techniques hassled to decrease in this risk. For the effective preventive measurement knowledge regarding these factors, is helpful for the effective preventive measurement.[6-7]

Despite of the advances in infection control this problem cannot eradicate completely due to the increase resistance of drug. The surveillance of Nosocomial infection along with the antimicrobial audit will decrease the risk of post surgical infections.[7] In Pakistan non existence of formal antibiotic policies and also the lack of the infection control practice, may further amplified this problem There have been reports from all over the country on the rising trend of ESBL(extended spectrum beta lactamase) producing organism.[8] Mostly bacterial pathogens are involved in SSI but if transplantation occur patient may usually develop fungal SSI. The most common causative agent involved in SSI is Staphylococcus though it is the most common normal flora of the skin. Bacteroids and E-coli are common if Gastro Intestinal tract is violated. Whereas group-d staphylococcus, proteus and pseudomonas are most common if urinary tract is involved. Surgical sites produce substantial impact in the development of SSIs etiology which fluctuates greatly from this perspective in magnitude and intensity.[9-10] The pathogenic distribution and frequency in different countries has been reported with paradoxical values. Various studies have revealed causative agents prevalence as 27-40% Staphylococcus aureus, 7-10% to Pseudomonas aeruginosa, 6-11% coagulase-negative Staphylococi (CNS), and 3-15% E. coli from European Union, while in Turkey S. aureus 50%, E. coli 8%, S. pyogenes and P. aeruginosa 7% and CNS 6%.[11-13] In complex situation multiple species of microorganisms may involve and accounts poly therapies for cure and treatment. The aim of our study is to find out the common pathogen involved in surgical site infection along with their antimicrobial sensitivity and resistivity pattern.

METHODOLOGY

Study design and settings

In Tertiary Health Care Setup a prospective cross sectional study was carried out for the duration of six month from April 2016 till September 2016.

Ethical Approval

The research work was approved from Institutional ethical committee prior to carry out study (Ref. No. 0211015ATPHARM).

Data Collection

A total of 100 patients were included in our study after they meet the inclusion and exclusion criteria. Patients who underwent surgical procedure either emergency or elective with reported evidence of SSI are included in our study. This study excluded patients having less than 15 years of age. All diagnostic surgical procedures are also excluded from this study. A Questionnaire was designed to perform this study it include the name, gender, age, address, medical record number, type of procedure, operative findings, culture report result and the name of antibiotic along with their resistivity and sensitivity pattern. In cases of organ/ space infection Ultrasonological reports were also seen. Common Surgical procedure like

Cholecystectomy, Appendicectomy, Incisonal Hernia repair, wound debridement, Incision and drainage and few orthopedic surgeries were included in this study. Detail data of drugs sensitive or resistant are categorized as their generic names and then classified according to their drug categories.

Pledge of quality

Study tool was elucidated in detail before application. In order to defend the exactness (accuracy) of outcomes, all questionnaires were collected under direction of the evaluators and reviewed and checked carefully before they collected.

Data Analysis

SPSS 20.0 and Microsoft Excel 2007 were applied to analyze the outcomes of the study. Percentages and frequencies were calculated for selected variables.

RESULTS AND DISCUSSION

Surgical site infections due to the invasion of pathogens in affected area need to be prevented or cure using the multiple strains of antibiotics in complied situations. Antibiotics/antibacterial use is not only associated with the treatment of infectious condition but also assist in the prevention of the microbial growth due to the purulent discharge in SSI. In present study the age distribution pattern of the patient's shows in Figure-1.

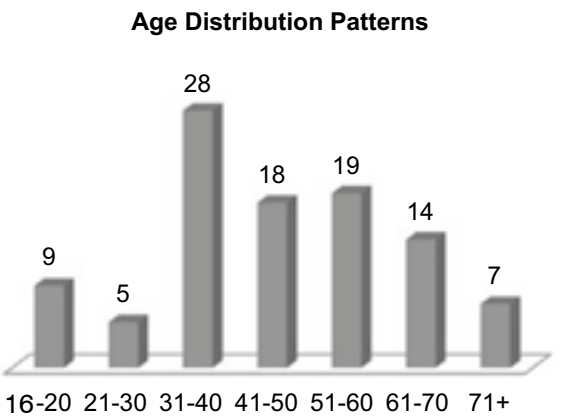

Figure-1. Age distribution pattern

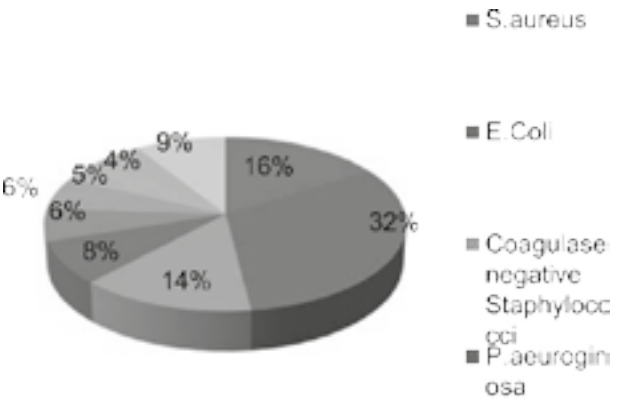

Figure-2. Frequency of Pathogens isolated from Surgical Site Infections

DISCUSSION

Over the couple of years, numbers of studies have revealed the fact of increased cost of care associated with prolong period of hospitalization due to post surgical infections.[12,14-15] One of the such study has estimated the cost of treatment approximately US dollar 2000 with additional stay up to ten days[3], whereas in European region this length may be up to 9.8 days extension in total stay with supplementary cost of 325 (€) / day.[14] Over the decades the SSIs was considered as the second main cause of nosocomial outcomes in hospital settings but with the emergence aseptic technologies, better awareness, prophylactic antibiotic administration and adherence to surgical guidelines for infection control, SSIs has now rated as the 3rd frequent cause of nosocomial infection.[15]

The current study was performed in order to evaluate the resistance and sensitivity pattern of clinical isolates of SSIs. Furthermore frequency of various organisms in the progress of SSIs has also been elucidated. For this purpose culture reports of 100 patients (50 males and 50 females) who underwent various surgical interventions have been collected in this study. Before access to the reports, hospital permission was obtained and study was also ethically approved (Ref. No. 0211015ATPHARM). The mean age of patients was found to be 47.24±16.9 (range 13–85).

Sensitivity Pattern	S.au-reus (n=16)	E.Coli (n=32)	Coagulase negative staphylococci (n=14)	P.aeu-rogino-sa (n=08)	Klebsiella (n=09)	Entero-coccus (n=6)	Acin-eato-bacter (n=6)	Staphy-lococcus group d (n=4)	Entero-bacter (n=5)
Antibiotic	S %	S %	S %	S %	S %	S %	S %	S %	S %
Amikacin	14(87.5)	31(87.5)	14(100)	7(87.5)	8(88.9)				
Cephalexin	7 (43.8)		64(2.9)						
Clindamycin	14(87.5)								
Cloxacillin	7 (43.8)		7(50)						
Co Trimaxazole	10(62.5)	6(18.8)	9(64.3)		4(44.4)		0		
Erythromycin	9 (56.3)		3(21.4)			2(33.3)		1(25)	3(60)
Fusidic Acid	4 (25)		3(21.4)						
Gentamicin	11(68.8)	16(50)	7(50)	6(75)	7(78.8)		0		2(40)
Levofloxacin	8(50)		5(35.7)			4(66.7)			
Linzolid	16(100)		10(71.4)			6(100)	0	4(100)	
Oflox/Cipro	8(50)	4(12.5)	4(28.6)	7(87.5)					2(40)
Penicillin	16(100)		1(7.1)						
Teicoplanin	16(100)		14(100)			5(83.8)		4(100)	
Vancomycin	16(100)		14(100)			5(83.8)		4(100)	
Cef/sul		29 (90.6)		7(87.5)	7(77.8)		3(50)		5(100)
Cefixime		8(25)			4(44.4)				3(60)
Cefotaxime		8(25)			5(55.6)				3(60)
Ceftriaxone		8(25)			5(55.6)		1(16.7)		3(60)
Imipenem		31(96.9)		7(87.5)	8(88.9)		1(16.7)		
Meropenem		30(93.8)		7(87.5	8(88.9)		1(16.7)		5(100)
Tazopipera		27(84.4)		7(87.5)	8(88.9)		1(16.7)		5(100)
Amox Clav		21(65.6)			6(66.7)	5(83.86)			
Ampicillin		2(6.3)				4(66.7)		2(50)	
Aztronam		8 (25)		7(87.5)	6(66.7)				3(60)
Ceftazidime				7(87.5)					
Colistin				8(100)			0(0)		
Polymixin				8(100)					

Table-I. Antibiotic sensitivity pattern against various clinical isolates in SSI

The age distribution pattern of the patients shows in Figure-1. There are various organism reported in this study which are associated with SSI. In the present study Escherichia coli, was the causative organism in 32% of cases followed next in frequency by S. aureus in 16%, Coagulase negative Staphylococci in 14 %. The other less common but significant organisms observed in present investigation were Klebsiella pneumoniae, P. aeruginosa, Acinetobacter, Enterobacter and Streptococcus group D as shown in Figure 2. In the present study the most common pathogen isolated from SSI is found to be E. coli (32%) in contrast to the survey conducted by Nosocomial Infection National Surveillance service (NINSS) in (1997–2001) which reported Staphylococcus species (47%) is the most common pathogen involved in SSI.[16] Study conducted by Kasatpibal et al., in Thailand reported that the most common pathogens isolated from SSIs is E. coli (15.3%) which is similar to our finding, followed by S. aureus (8.5%), P. aeruginosa (6.8%), Klebsiella pneumonia (6.8%) and Acinetobacter baumannii (3.4%).[13] In another study conducted by Shafqat et al, have shown E. coli (29%), as the major pathogen associated with SSI followed by Pseudomonas (23%), Klebsiella (19%), Proteus(5%), Citrobacter (2.5%) and Staphylococcus aureus (14.5%).[1] Second most common pathogen isolated from the current study was S. aureus. A Nigerian

Resistivity Pattern	S.aureus (n=16)	E. Coli (n=32)	Coagulase negative staphylococci (n=14)	P.aeurogino-sa (n=08)	Klebsi-ella (n=09)	Entero-coccus (n=6)	Acinea-tobacter (n=6)	Staphy-lococcus group d (n=4)	Entero-bacter (n=5)
Antibiotic	R%	R%	R%	R%	R%	R%	R%	R%	R%
Amikacin	2(12.5)	1(3.1)	0	1(12.5)	1(11.1)				
cephalexin	9(56.3)		8(57.1)						
Clindamycin	2(12.5)								
Cloxacillin	9(56.3)		7(50)						
Co Trimaxazole	6(37.5)	26(81.3)	5(35.7)		5(54.6)		6(100)		
Erythromycin	7(43.8)		11(78.6)			4(66.7)		3(25)	2(40)
Fusidic Acid	12(75)		11(78.6)						
Gentamicin	5(31.3)	6(50)	7(50)	2(25)	2(22.2)		6(100)		3(60)
Levofloxacin	8(50)		9(64.3)			2(33.3)			
Linzolid	0		4(18.6)			0	6(100)	0	
Oflox/Cipro	8(50)	28(87.5)	10(71.4)	1(12.5)			5(83.3)		3(60)
Penicillin	0		13(92.9)						
Teicoplanin	0		0			1(16.7)		0	
Vancomycin	0		0			1(16.7)		0	
Cef/sul		3(9.4)		1(12.5)	2(22.2)		3(50)		0
Cefixime		24(75)			5(55.6)				2(40)
Cefotaxime		24(75)			4(44.4)				2(40)
Ceftriaxone		24(75)			4(44.4)		5(83.3)		2(40)
Imipenem		1(3.1)		1(12.5)	1(11.1)		5(83.3)		
Meropenem		2(6.3)		1(12.5)	1(11.1)		5(83.3)		0
Tazopipera		5(15.6)		1(12.5)	1(11.1)		5(83.3)		0
Amox Clav		11(34.4)			3(33.3)	1(16.7)			
Ampicillin		30(93.8)				2(33.3)		2(50)	
Aztronam		24(75)		1(12.5)	3(33.3)				2(40)
Ceftazidime				1(12.5)					
Colistin				0			6(100)		
polymixin				0					

Table-II. Antibiotic resistance pattern against various clinical isolates in SSI

study revealed the S. aureus as the main leading causative agent of SSI.[16] Whereas one year surveillance carried out at the Department of Infectious Diseases and Research Center, Isfahan University of Medical Sciences, in Iran reports Klebsiella pneumoniaea is the major leading causative agent.[17] Various studies have also reported the higher percentages of gram positive organism particularly Staphylococcus aureus, associated with surgical site infection.[18-19] In present study coagulase-negative Staphylococci is also reported as a third major causative agent. Similar study is reported in a tertiary care hospital at Bangalore revealed that Coagulase negative Staphylococcus (CNS) is also the chief organism for such infections.[20] In various setups these differences in the distribution pattern of the pathogen can be clearly elucidated by the fact that the organism involved in process of infection is generally based on the study population as well as the use of local antimicrobial pattern which results in the emergence of pathogens along with their potential to develop resistance against antibiotics which are currently used.[2,21] In present investigation Amikacin is also observed as most sensitive drug to the various pathogens include Escherichia coli, Staphylococcus aureus, Klebsiella, Coagulase-negative Staphylococci, P. aeruginosa which is comparable to the study conducted by Manikandan et al, which also reported 100 % sensitivity to such organism.[21] Sensitivity and resistivity pattern of Escherichia coli in certain drugs are also comparable to the study reported by Gautam.[22]

Likewise study conducted by Shahriar et al., reported Imipenem is more sensitive drug to E coli which is similar to our finding.[23] In present study Escherichia coli is more resistant to the third generation cephalosporin unlike the study conducted by Shah, who reports higher sensitivity.[24] Likewise Ciprofloxacin Ofloxacin Co trimaxazole, also have shown resistivity against the strains if Escherichia coli. Similarly Cef/sul, Meropenem and Tazopipera also found comparibily sensitive drugs in present investigation. Furthermore, S. aureus have shown absolute (100%) sensitivity to vancomycin, and this finding is in agreement with the work of Gautam R et al[22], Mama et al., [25] Nwankwo and, Nasiru[26], who have reported that clinical Staphylococci are 100% sensitive to vancomycin. Another group of co-workers have conducted the sensitivity pattern determination against the strain of S. aureus and reported the comparable sensitivity trends against Penicillin 100% and 37.5 % resistivity to Co-trimaxazole in contrast to the study carried out in the tertiary health institution in Kano, Northwestern Nigeria by Nwankwo et al., which shows only 7.1 sensitivity to Penicillin while Co-trimaxazole show 84.5 % resistivity.[24-26] Sensitivity pattern of certain drugs (Erythromycin, Cotrimaxazole, vancomycin gentamicin, penicillin) used against Coagulase negative Staphylococci showed the similar results as presented by Al Tayyar et al., in Northern of the Jordan.[27] Resistivity pattern of Coagulase negative Staphylococci of Penicillin, Cloxacillin, Erythromycin, Tiecoplanin and Vancomycin show comparable result to Begum et al.,[28] Conflicting results of drug sensitivity has been observed with Pseudomonas aeuroginosa with optimal suitability to this strain of organism. Authors also elucidated the similar studies in various regions with comparable findings.[29]

Imipenem showed 88.9 % sensitivity to Klebseilla and cefotaxime and ceftriaxone have shown 55.6 % to this organism. Manikandan and Amsath have shown 81.9 % sensitivity to Imipenem and 59.7 % for cefotaxime and 66.7 for ceftriaxone.[30] In our study mostly drug are highly resistant to the Acenetobacter. Moreover, Enterococcus species showed higher sensitivity to Cef/sul, Meropenem, tazopipera. Linzolid is found to be 100% sensitive to Enterococcus and 66.7 % resistivity to Erythromycin. In the present study for staphylococcus group D, linzolid, vancomycin and Teicoplanin were found with optimal sensitive range whereas Erythromycin has shown 75% resistivity. The difference found in the sensitivity pattern to these most commonly used drugs in current study could be credited to the widespread use and abuse of the drugs in the respective area of the study. The lower sensitivity to the most commonly used drugs point towards the dependence of the prescribers on these drugs. This also explains the relation between antibiotic usage and the level of drug resistance encountered. The cautiously use of antibiotic by the health care professional along with the efforts to control procurement and use of antibiotics officially in the vicinity will possibly help to limit the rate of increase drug resistance in the pathogens.

CONCLUSION

The present study gives an insight to the frequency of the causative pathogens and their resistivity and sensitivity pattern to their respective setting. Every hospital should restricted to adopt antibiotic guide lines and strict adherence to these guideline is mandatory in order to avoid increase rate of the antibiotic resistance. Inappropriate and irrational use of antibiotics should not be used in order to limit the development of resistance. When formulating prophylaxis in addition to empirical therapy guideline for individual in surgical site we suggest Surgeon, Pharmacist, microbiologist, Epidemiologist, to take their local infecting organism, their resistivity and sensitivity pattern should taken in account. In the light of this original article we also suggest that antibiotic that is used must be checked for susceptibility pattern for the common prevalent pathogen.

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"We build too many walls and not enough bridges."

Isaac Newton

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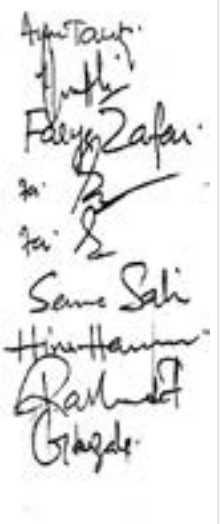
1	Anum Tariq	Equal contribution by all author	
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