ORIGINAL ARTICLE

Susceptibility Pattern of Bacterial Isolates from Surgical Site Infections in a Tertiary Care Hospital at Rawalpindi

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ABSTRACT

Objective: To analyze the culture and sensitivity pattern of micro-organisms cultured from patients who develop surgical site infection following various elective surgical procedures.

Study Design: A cross-sectional observational study.

Place and Duration of Study: Department of Surgery, Fauji Foundation Hospital, Rawalpindi, from 7th May 2018 to 7th November 2018.

Materials and Methods: All patients with surgical site infection after a surgical procedure under general anesthesia of any duration were included. The operative site was inspected on 3rd, 7th, 14th, 21st and 30th post-operative day for wound infection and pus swab from infected wounds were sent for culture and sensitivity. The samples positive for growth were further examined for the type of organisms with Gram staining and antibiotic sensitivity according to Kirby Bauer technique.

Results: Among a total of 128 patients included (Male : Female - 1:4.8), a total of 129 organisms isolated, 48.4% were gram-positive, 49.22% were gram-negative and 3.13% others (i.e fungi). Of all specimens, 57.03% showed single organism, 20.31% multiple and 22.66% specimens yielded no growth. Commonly isolated bacteria were Staphylococcus aureus (21.09%), Methicillin Resistant Staphlococcus aureus (MRSA) (20.31%), Escherichia coli (18.75%) and Pseudomonas aeruginosa (14.06%). The majority of gram -ive bacteria were sensitive to Amikacin (83.33%), followed by Imipenem (75%), Meropenem (70.83%), Gentamicin (66.67%) and highly resistant to Ampicillin, Ceftazidime (91.67% each), Cefotaxime (75%), Chloramphenicol, Ciprofloxacin (62.50% each). Gram +ive isolates were mostly sensitive to Vancomycin, Cefradine, Chloramphenicol, Doxycycline and resistant to Penicillin, Amikacin, Imipenem and Cefotaxime.

Conclusion: Both gram positive and negative micro-organisms are responsible for Surgical Site Infection with Staphylococcus aureus, E Coli, MRSA and Pseudomonas are the commonest. None of the antibiotic were found to be sensitive to all micro-organisms culture. Resistant to Penicillin, Cloxacillin, Augmentin and Quinolone were the highest among all antibiotics.

Key Words: *Antibiotics, Culture, Elective Surgery, Micro-Organisms, Pus Swab, Surgical Wound, Surgical Site* Infection*, Surgery, Sensitivity.*

Introduction

Surgical site infections (SSIs) are defined as wound infections up to 30 days after surgical procedure (or up to one year after surgery in patients receiving implants) and that which affects either the incision or deeper tissue at the site of operation.[1] Wound infection is a common post-operative complication and SSIs are found in the incision site after surgery.[2] Despite improvements in surgical techniques and infection prevention strategies, the SSIs remain a significant challenge for clinicians due to their association with substantial morbidity and mortality and also imposes severe burden over healthcare resources. Literature shows that the incidence of SSIs may be as high as 20%, which depends upon the type of surgery, the surveillance criteria used and data collection quality.[3,4] Mostly, in SSIs, the causative pathogens originate from patient's own endogenous flora which usually depends upon the type of surgery or hospital acquired skin and mucosal organisms and rarely due to airborne transmission of skin squames.[2,5] The pattern of isolated micro-organisms and their anti-microbial

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sensitivity may vary from one hospital to another and from one region to the other region.[6,7] Most commonly isolated micro-organisms are Staphylococcus aureus, coagulase-negative staphylococci, Enterococcus spp. Clostridium, Beta-hemolytic Streptococci and Escherichia coli.[5,7,8] A variety of patient and procedure-related factors greatly influence the risk of infection and hence prevention always requires a 'bundle' approach which comprises of systematic attention to different risk factors to reduce the bacterial contamination in wound and improvement in patient's defenses.[1,3,5]

Wound contamination with the micro-organisms is a serious health issue in surgical practice. Despite, meticulous application of basic principles of asepsis and wound care, SSI develops among a few patients that require proper management and identification of pathogen as well.[9,10] The SSI can be prevented or reduced effectively by controlling the risk factors preoperatively. Even in sterile operative procedures, micro-organisms can contaminate the wound or enter blood and cause infection.[1,10] pre-operative administration of antibiotics has been proved to inhibit the growth of microorganisms contaminating the wound and thus reduces the risk of infections. The antibiotic prophylaxis to reduce wound infections is indicated for operative procedures associated with high infection rate and procedures with prosthetic material insertion.[3,7]

In underdeveloped and resource-poor countries, SSIs are still an important cause of mortality and morbidity. The studies from these countries generally show local and regional variations in terms of the bacterial isolates and sensitivity of micro-organisms [2,7,9]. Due to these variations, the physicians need to be aware of prevalent pathogens and their antimicrobial sensitivity and resistance patterns existing in their localities.

Economically, patients with SSI incur up to $10 billion in costs yearly as compared to the uninfected patients [5]. Studies show that a patient with SSI stays in the hospital almost 7 days longer, is 60% more likely to spend time in the ICU, his/her incidence of being more likely to be readmitted within 30 days of discharge is five time higher and has almost double the mortality rate.[6,7]

In the context of our existing health system, where average hospital care and postoperative environment is not up to the mark, the risk of postoperative infection is high. Henceforth, it is very important to determine the existing isolates from infected wounds and thereafter rational use of antibiotics according to organisms that are isolated. The present study will not only provide a detailed account of present bacterial isolates from surgical wounds, but also give an overview of sensitivity pattern of isolates which helps in rational prescription of antibiotics and will also guide in reducing the prevalence of surgical site infection.

Our study was designed to establish baseline indices of wound infection at the Fauji Foundation Hospital, Rawalpindi, by looking at the prevalent microorganisms involved in wound infections, associated factors and drug resistance patterns. This will be helpful in establishing the hospital antibiogram on quarterly basis, which will give an idea of trend in pattern of culture and sensitivity of micro-organism from surgical site infection. This will also be helpful in charting out the antibiogram of our hospital in future. So, we conducted this study with an objective to analyze the culture and sensitivity pattern of micro-organisms cultured from patients who develop surgical site infection following various elective surgical procedures.

Materials and Methods

This Cross-sectional observational study was conducted at the Department of Surgery, Fauji Foundation Hospital, Rawalpindi from 7th May 2018 to 7th November 2018.Through non-probability consecutive sampling, sample size was calculated by using WHO standard method of sample size calculation. All patients who developed SSI after a surgical procedure under general anesthesia of any duration, in the main operation theater, were included. Patients who underwent emergency surgical procedures, or had signs of infections pre-operatively (e.g. peritonitis, abscesses, sinus, fistulas) or those who were immunocompromised, on steroids, or on chemotherapy were excluded. Approval of the study was obtained from the hospital's ethical committee (Ltr no. FUMC/EC/Trg/D-23/2018).

All patients underwent elective surgical procedures were evaluated pre-operatively meticulously. After surgery, the surgical site was thoroughly examined on 3rd, 7th, 14th, 21st and 30th post-operative day for any signs of wound infection like erythema, swelling, increased local temperature or pus discharge. In case of SSI, the pus swab was taken directly from infected wound under strict aseptic measures and sent to the hospital laboratory for culture and sensitivity. The samples showing growth were further examined for the type of organisms and antibiotic sensitivity.

All findings, including type of surgical procedure, post-operative day of SSI, wound examination findings, date and time when specimen were sent to laboratory, name of organisms and type (Gram + or -) isolated from wound swab as well as the culture sensitivity pattern of organisms to various antibiotics (as sensitive, intermediate and resistant) as reported by the hospital's laboratory and specimens showing no growth were recorded carefully on a separate proforma for each patient. The collected data was analyzed at the end of study.

Statistical Software SPSS version-20 was used for data analysis. Frequency and percentage of variables i.e. growth, gender, age, types of organisms grown and their sensitivity pattern to different antibiotics were calculated. Mean and standard deviation were calculated for age. P value ≤ 0.05 were considered as significant.

Results

A total of 128 patients were studied during the study period and among them majority were female (n=105, 82.8%) as compared to male (n=22, 17.2%) with male to female ratio of 1.4:8. The age ranging between 4 years to 76 years (mean age 49.1 SD+/- 1.2 years). Majority of patients were from the 6th decade of life (n=35, 27.3%) followed by 5th decade (n=24, 18.8%) and 7th decade (n=18, 14.1%) of life.

The highest rate of SSI was observed in patients undergoing open cholecystectomy (n=64, 50%), followed by Inguinal Hernioplasty (n=21, 16.40%) and Modified Radical Mastectomy (MRM) were the 3rd commonest operation (n=14, 10.94%). Almost 5.46% (n=7) patients undergoing paraumbilical hernia repair has developed wound infection as compared to only 0.78% (n=1) patients who underwent thyroidectomy.

Table – I, shows the frequency of growth of micro-organisms among 128 pus specimens of the wound having SSIs. The single isolates were cultured from 57.03% (n=73) specimens, whereas 20.31% (n=26) specimens showed multiple organism growth from specimens.

Among 99 pus specimens showing growth of micro-organisms, the frequency of Gram-positive isolates was almost same (62.63%, n=62) as compared to Gram-negative bacteria (63.64%, n=63). Whereas 4.04% (n=4) pus specimens also show growth of Fungi (Figure 1).

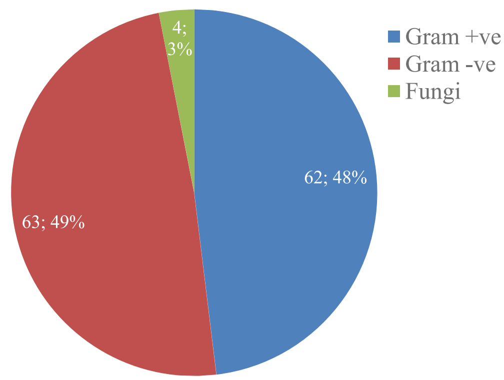

Fig 1: Frequency of Micro-Organism Grown as Per Gram Staining (N=128)

	95% Confidence Interval of the Difference	
	Lower	Upper
Gram +ve	-68.2548	109.5882
Gram -ve	-69.3557	111.3557
Fungi	-4.4035	7.0702

From 128 pus specimens, among all organisms cultured, the Staph aureus was the commonest (n=27, 21.09%) organism cultured followed by MRSA (20.31%, n=26), Escherichia coli (18.75%, n=24) and Pseudomonas Aeruginosa (14.06%, n=18). The frequency of some of the other micro-organisms is Acinetobacter baumanii (8.59%, n=11), Enterococcus faecalis (5.47%, n=7), Klebsiella pneumonia (3.91%, n=5) and Candida albicans (3.13%, n=4). Only one specimen (0.78%) shows the growth of Morganella morganii, Streptococcal Spp., Bacillus subtilis, Stenotrophomonas maltophilia, Proteus mirabilis, Enterobacter agglomerans and VRE (Table-I).

Table – II, shows the varied sensitivity pattern of micro-organisms cultured from pus specimens from SSI wounds. According to this, commonest organism isolated, Staph aureus is highly sensitive to Vancomycine (n=27, 100%), followed by Ceftazidime

Table I: Frequency of Micro-Organisms Grown from Pus Culture (N=128)

Bacteria cultured from wound swabs	Total No of Bacteria Cultured	95% Confidence Interval of the Difference		% of total N=128	
		Lower	Upper		
Staphylococcus aureus	27	4.2984	15.1753	27.27%	21.09%
Escherichia coli	24	-26.4212	42.4212	24.24%	18.75%
Pseudomonas aeruginosa	18	-19.8159	31.8159	18.18%	14.06%
MRSA	26	-28.6230	45.9563	26.26%	20.31%
Enterococcus faecalis	7	-7.7062	12.3729	7.07%	5.47%
Klebsiella pneumonia	5	-5.5044	8.8378	5.05%	3.91%
Acinetobacter baumanii	11	-12.1097	19.4431	11.11%	8.59%
Morganella morganii	1	-1.1009	1.7676	1.01%	0.78%
Streptococcal spp.	1	-1.1009	1.7676	1.01%	0.78%
Bacillus subtilis	1	-1.1009	1.7676	1.01%	0.78%
Stenotrophomonas maltophilia	1	-1.1009	1.7676	1.01%	0.78%
Proteus mirabilis	1	-1.1009	1.7676	1.01%	0.78%
Pontoea agglomerans	1	-1.1009	1.7676	1.01%	0.78%
VRE (Vancomycine Resistance Enterococci)	1	-1.1009	1.7676	1.01%	0.78%
Candida albicans	4	-4.4035	7.0702	4.04%	3.13%
No Growth	29	-169.7400	198.7400		22.66%

(n=26, 96.30%), Gentamycin and Co-trimoxazole (n=22, 81.48% each). The 2nd commonest gram -ive organism, E coli is highly sensitive to amikacin (n=20, 83.33%), followed by imipenem (n=18, 75%), Meropenem (n=17, 70.83%) and Gentamycin (n=16, 66.67%). MRSA the 3rd commonest isolate is found to be highly sensitive to Vancomycine (n=24, 92.30%) followed by Chloramphenicol (n=20, 76.90%) and Doxycycline (n=18, 69.2%). Another commonest organism Pseudomonas aeruginosa were found to be highly sensitive against Polymicin (n=13, 72.22%), Colistin (n=12, 66.67%) and Amikacin (n=11, 61.11%). None of the antibiotic were found to be sensitive to all micro-organisms.

Table II: Frequency of Sensitivity Pattern of Micro-Organisms to Different Antibiotics (N= 128)

	Augmentin	Ciprofloxacilin	Cloxacillin	Cotrimoxazole	Doxyxycline	Erythromycin	Chlorampoenicol	Gentamicin	Vancomycin	Meropenem	Sulzone	Cefotar	Ampicillin	Amikacin	Ceftazidime	Colistin	Polymixin	Imipenem	Linezolid	Cefuroxime	Cefrhadine	Penicillin	Aztreonam	Methicil
S. aur n=27	5 18.52%	18 66.67%	14 51.85%	17 62.96%	22 81.48%	19 70.37%	20 74.07%	22 81.48%	27 100.00%	6 22.22%		2 7.41%		2 7.41%				6 22.22%	1 3.70%		26 96.30%	1 3.70%		3 11.11%
E. coli n=24		8 33.33%		9 37.50%	7 29.17%		4 16.67%	16 66.67%	1 4.17%	17 70.83%			2 8.33%	20 83.33%	2 8.33%			18 75.00%						6 25.00%
P. aeru n=18		6 33.33%						8 44.44%		6 33.33%	5 27.78%			11 61.11%	4 22.22%	12 66.67%	13 72.22%	5 27.78%					5 27.78%	
MRSA n=26		3 11.54%	1 3.85%	12 46.15%	18 69.23%	6 23.08%	20 76.92%	10 38.46%	24 92.31%	2 7.69%						1 3.85%	1 3.85%	2 7.69%	1 3.85%		2 7.69%			
E. face n=7		1 14.29%		1 14.29%	1 14.29%	1 14.29%	2 28.57%	1 14.29%	5 71.43%	1 14.29%			1 14.29%	1 14.29%				1 14.29%	1 14.29%					1 14.29%
Streno n=1																1 100.00%	1 100.00%							
Kleb n=5		1 20.00%			1 20.00%			3 60.00%		3 60.00%				3 60.00%		2 40.00%	2 40.00%	3 60.00%						
Acine n=11					3 27.27%											6 54.55%	6 54.55%							
Morga n=1		1 100.00%		1 100.00%				1 100.00%		1 100.00%				1 100.00%				1 100.00%						1 100.00%
Bacill n=1		1 100.00%						1 100.00%		1 100.00%				1 100.00%				1 100.00%					1 100.00%	
Prot n=1										1 100.00%	1 100.00%							1 100.00%					1 100.00%	
E. aggl n=1		2 200.00%		2 200.00%				2 200.00%		2 200.00%				3 300.00%				2 200.00%						2 200.00%
VRE n=1							1 100.00%			1 100.00%			1 100.00%					1 100.00%	1 100.00%					

The resistance pattern of different micro-organisms against different antibiotics (Table – III) shows that Staph aureus is highly resistant to penicillin (n=23, 85.10%), followed by Ciproxin (n=9, 33.33%). The E coli were resistant to ampicillin (n=17, 70.83%), Cefatar (n=13, 54.17%), Doxycycline (n=12, 50%) and

Ciproxin (n=11, 45.83%). The MRSA were found to be highly resistant to Ciproxin (n=22, 84.60%), Cefradine (n=21, 80.77%), Augmentin (n=19, 73.08%), Penicillin, Cloxacillin, erythromycin and Imipenem (n=17, 65.38% each). Klebsiella is observed to be 100% (n=5) resistant to Ciproxin.

Table III: Frequency of Resistance Pattern of Micro- Organisms to Different Antibiotics (N= 128)

	Augmentin	Ciproflox	Cloxacillin	Cotrimoxazole	Doxyxycline	Erythromycin	Chloramphenicol	Gentamicin	Vancomycin	Meropenem	Sulzone	Cefotar	Ampicillin	Amikacin	Ceftazidime	Colistin	Polymixin	Imipenem	Linezolid	Cefuroxime	Cefrhadine	Penicillin	Aztreonam	Methicil
S. aur n=27		9 33.33%		8 29.63%	6 22.22%	7 25.93 %	5 18.52 %					2 7.41%	1 3.70%									23 85.19 %		
E. coli n=24		11 45.83%		8 33.33%	12 50.00%	1 4.17%		3 12.50%		2 8.33%	1 4.17%	13 54.17%	17 70.83%	2 8.33%	3 12.50%			2 8.33%		1 4.17 %				
P. aeru n=18		10 55.56%		1 5.56%	2 11.11%	1 5.56%	5 27.78 %	6 33.33%		5 27.78 %	7 38.89%	2 11.11%	2 11.11%	6 33.33%	3 16.67%		1 5.56%	9 50.00%					7 38.89 %	
MRSA n=26	19 73.08%	22 84.62%	17 65.38 %	14 53.85%	6 23.08%	17 65.38 %	1 3.85%	8 30.77%	1 3.85%	15 57.69 %	1 3.85%	1 3.85%	2 7.69%	2 7.69%	1 3.85%			17 65.38%			21 80.77 %	17 65.38 %	1 3.85%	2 7.69 %
E. face n=7		5 71.43%		6 85.71%	6 85.71%	3 42.86 %		1 14.29%	1 14.29%	2 28.57 %		5 71.43%	6 85.71%					2 28.57%						
Streno n=1		1 100.00 %						1 100.00 %			1 100.00 %			1 100.00 %	1 100.00 %			1 100.00 %						
Kleb n=5		5 100.00 %		6 120.00 %	4 80.00%			4 80.00%		3 60.00 %	2 40.00%	6 120.00 %	6 120.00 %	3 60.00%	2 40.00%			3 60.00%						
Acine n=11		10 90.91%		7 63.64%	4 36.36%			10 90.91%		7 63.64 %	3 27.27%	8 72.73%	9 81.82%	10 90.91%	2 18.18%			8 72.73%		1 9.09 %			3 27.27 %	
Morga n=1					1 100.00 %								1 100.00 %											
Bacill n=1	1 100.00 %																							
Prot n=1		1 100.00 %		1 100.00 %	1 100.00 %			1 100.00 %				1 100.00 %	1 100.00 %		1 100.00 %	1 100.00 %	1 100.00 %							
E. aggl n=1													1 100.00 %											
VRE n=1				1 100.00 %	1 100.00 %			1 100.00 %	1 100.00 %			1 100.00 %												

Discussion

Among a total of 128 infected wounds in our study, growth of micro-organism does not follow any specific pattern. Literature review shows that other than institutional or geographic variations, it also varies from time to time.[3,4] Moreover, not all pus specimens show growth of pathogens as 77.35% specimens showed a positive culture in our specimens which is almost comparable to most of the studies.[3,4,9,10] (i.e., 75% to 90%). Few studies[11,12] reported up to 98% of growth or in all their specimens.[11-14] This variation depends upon the different factors such as patient factors, theatre contamination, surgeon's practice, use of prophylactic antibiotics and so on.

Mostly single[9,10,13] and less likely multiple organisms[13,15] can be cultured from a specimen depending upon the nature of contamination, local flora and many other factors. Our findings are consistent with most of the studies[9,10,13,15] published, that 73.73% specimen's single micro-organism growth.

In literature, different studies have reported various frequency of gram staining of organisms.[4,9,13,16] In our study, the frequency of gram-negative isolates is slightly higher (63.64%) as compared to gram-positive isolates (62.63%) and 4.04% of the specimens also show the growth of Candida spp. Similarly, the predominance of gram -ive microorganisms is also observed in majority of local studies [11,15,17-20] as compared to few studies showing predominantly Gram-positive growth.[21,22]

A varied range of both Gram-positive and Gram -ive organisms were detected i.e. Staph aureus (21.09%), followed by MRSA (20.31%), Escherichia coli (18.75%) and Pseudomonas aeruginosa (14.06%). Literature review also shows that Staphylococcus aureus was the predominant isolate [3,9,10,12,,19,23] reported in literature in last decade and our finding are also consistent with national[21,22,24,25,26] and international literature.[13,14,16]

Among Gram -ive organisms, Escherichia coli (18.75%) and Pseudomonas aeruginosa (14.06%) were 3rd and 4th commonest organisms detected among our patients. Literature shows a varied presentation of micro-organisms observed after Staph aureus as a commonest microbe [10,13, 16,27] whereas, some other studies[6,19] also reported varied presentation of microbes in their patients.

Among antibiotics, Penicillin resistance reported highest (96.30%) followed by Amikacin (92.59%), Cefotaxime (88.89%), Imipenem, Meropenem (77.78% each) and Augmentin (71.48%). High resistance of Coagulase Negative Staph aureus reported by Pondei and colleague [4] ie., (88.9%) for Amoxicillin, Ampicillin, Amoxicillin-clavulanic acid and Tetracycline ((77.8% each). Almost same observations were made by Lunawat et al[12] and Mohammad et al[9], Sultana[l3], Kumari[19] and Ahmed et al[22] and Bibi et al in their studies. Our findings are consistent with the literature that Staphylococcus aureus is highly sensitive to Vancomycin and cefradine whereas Penicillin and Augmentin has a poor response to this organism.

The 3rd commonest organism in our study ie., Escherichia coli (18.75%,) most commonly sensitive to Amikacin (83.33%), Imipenem (75%), Meropenem (70.83%), Gentamicin (66.67%) and highly resistant to Ampicillin, Ceftazidime (91.67% each), Cefotaxime (75%), Chloramphenicol and Ciprofloxacin (62.50% each). Different international[4,10,12,16] and national [19]has reported almost same sensitivity and resistance. Findings of all these studies are almost consistent with our findings, that is, Escherichia coli being sensitive to Amikacin, Gentamicin, and Imipenem.

Literature review from different parts of world shows that the sensitivity pattern of Pseudomonas is usually found to be multi-drug resistant at present and in past as well.[3,16,19,20,22,27] Similar resistance pattern was observed among our patients that majority of antibiotics used in hospital are not effective and pseudomonas found highly resistant to Tazobactam and Piperacillin (94.83%), Amikacin (88.89%), Ceftazidime, Cefoperazone and Aztreonam (72.23% each).

Klebsiella pneumoniae another commonest microbe in our patients, observed high sensitivity against Gentamicin, Meropenem and Amikacin (60% each) and highly resistance to Penicillin, Doxycycline and Ciprofloxacin (up to 80% each). In literature, the Pondi et al[4] reported it sensitive to Nitrofurantoin and Lunawat et al[12] observed the maximum sensitivity *to* Amikacin1(00%). However, different studies reported that the Klebsiella species were sensitive to Ceftazidime and Gentamicin which strongly supports that Gentamicin is a suitable antibiotic in Klebsiella infection.[16,22,19,23]

Among gram-negative bacteria, all the Proteus species were observed to be 100 % resistant to Amoxicillin and Tetracycline and 80% sensitive to Gentamicin.[4,24,26] We have observed that sensitivity of Proteus is high against Vancomycin, Cefoperazone, Imipenem and Aztreonam, whereas they were found resistant to Penicillin, Cloxacillin and Polymycin.

In summary, among the Gram-positive organisms isolated from our specimens (i.e., Staph aureus, Enterococcus faecalis, Streptococcus spp., Bacillus subtilis, VRE and candida species) most are commonly sensitive to Vancomycin and Cefradine. Chloramphenicol and Doxycycline were also effective in varied frequency against these micro-organisms but these Gram-positive were resistant to Penicillin, Amikacin, Imipenem and Cefotaxime. Similarly, Gram -ive organisms isolated from our patients (i.e., Escherichia coli, Pseudomonas aeruginosa, Klebsiella, A. baumanii, Proteus, S. maltophilia and Enterobacter agglomerans) were sensitive to Amikacin, Polymicin B, Colistin, Meropenem, Gentamicin and Imipenem. They were found to be highly resistant to Ampicillin, Doxycycline, Co-trimoxazole, Ceftazidime and Cefotaxime.

The antibiotics susceptibility pattern of Staph aureus shows 100% resistant to Penicillin, cefoxitin, Erythromycin, Clindamycin, Nalidixic acid, Ciprofloxacin, chloramphenicol, Doxycycline each, 50% to Teicoplanin, 33% to Vancomycin and 17% to Co-trimoxazole, Gentamicin, Amikacin each. The second most prevalent organism of the study coagulase negative Staphylococci were multidrug resistant (MRSA) but few isolates showed sensitivity at least towards antibiotics such as Cefoperazone (20%) and Cotrimoxazole (20%).

Conclusion

It is concluded that both gram positive and gram-negative microorganisms are responsible for Surgical Site Infection with Staph aureus, E Coli, MRSA and Pseudomonas are the commonest organisms in order of frequency. On culture sensitivity, none of the antibiotic were found to be sensitive to all micro-organisms culture. Resistant to Penicillin, Cloxacillin, Augmentin and Quinolone were the highest among all antibiotics. Judicious use of antibiotics according to hospital anti-biogram or antimicrobial guidelines, which should be revised at frequent intervals to minimize the incidence of Surgical Site Infection is recommended.

REFERENCES

1. Carvalho RLR, Campos CC, Franco LMC, Rocha AM, Ercole FF. Incidence, and risk factors for surgical site infection in general surgeries. Rev LatinoAm Enfermagem. 2017;25: e2848. doi: http://dx.doi.org/10.1590/1518-8345.1502.2848.
2. Hodiwala AB, Mandal A. Surgical Site Infection. Int J of Pharma & Bio Sci 2018;8(2):316-329.
3. Sultana S, Mawla N, Kawser S, Akhtar N, Ali K. Current Microbial Isolates from Wound Swab and Their Susceptibility Pattern in a Private Medical College Hospital in Dhaka city. Delta Med Col J. 2015;3(1): 25-30.
4. Pondei K, Fente BG, Oladapo O. Current Microbial Isolates from Wound Swabs, Their Culture and Sensitivity Pattern at the Niger Delta University Teaching Hospital, Okolobiri, Nigeria. Trop Med and Health. 2013;41(2):49-53. doi:10.2149/tmh.2012-14.
5. Kumari PHP, Rani PU, Vijayalakshmi P. Evaluation of microbiological profile and antibiogram of aerobic bacteria isolated from pus samples. J Med Allied Sci 2018; 8(1): 26-30.
6. Dryden M. Surgical antibiotic prophylaxis. Surgery 2019;37(1): 19-25.doi: https://doi.org/10.1016/j.mpsur.2018.11.003.
7. Carvalho RLR, Campos CC, Franco LMC, Rocha AM, Ercole FF. Incidence, and risk factors for surgical site infection in general surgeries. Rev. Latino-Am. Enfermagem. 2017;25: e2848. doi: http://dx.doi.org/10.1590/1518-8345.1502.2848.
8. Bauer A W, Kirby WMM, Sherris JC, Turck M. Antibiotic susceptibility testing by a standardized single disk method. Am. J. Clin. Pathol. 1966 36:493-496.
9. Mohammed A, Seid ME, Gebrecherkos T, Tiruneh M, Moges F. Bacterial Isolates and Their Antimicrobial Susceptibility Patterns of Wound Infections among Inpatients and Outpatients Attending the University of Gondar Referral Hospital, Northwest Ethiopia. Int J of Microbiology. 2017, 1-10 doi.org/10.1155/2017/8953829.
10. Mengesha RE, Kasa BG, Saravanan M, Berhe DF, Wasihun AG. Aerobic bacteria in post-surgical wound infections and pattern of their antimicrobial susceptibility in Ayder Teaching and Referral Hospital, Mekelle, Ethiopia. BMC Res Notes 2014 7:575.
11. Erum R, Samad F, Kazmi SU. Wound Etiology, Resistance Pattern, and Incidence of Bacteremia in Patients with Surgical Site Infections. J Surg Pak 2014;19(1):12-17.
12. Lunawat A, Vashistha RK, Patidar H, Patel V. Current trend of bacteriological sensitivity patterns from superficial and deep wounds in pressure ulcers. nt Surg J. 2016;3(3):1414-1419 doi: http://dx.doi.org/10.18203/2349-2902.isj20162720.
13. Akinkunmi EO, Adesunkanmi A, Lamikanra A. Pattern of pathogens from surgical wound infections in a Nigerian hospital and their antimicrobial susceptibility profiles. Afr Health Sci. 2014;14(4): 802-805. doi: http://dx.doi.org/10.4314/ahs.v14i4.5.
14. Janssen H, Janssen I, Cooper P, Kainyah C, Pellio T, Quintel M et al. Antimicrobial-Resistant Bacteria in Infected Wounds, Ghana, 2014. Emerging Inf Dis. 2018;24(5): 916-19.doi: https://doi.org/10.3201/eid2405.171506.
15. Malik ZI, Nawaz T, Tariq RAM, Waqar S H, Zahid M A. Surgical site infections in general surgical wards at a tertiary care hospital. Pak J Med Res 2013;52(4):116-119.
16. Roy S, Ahmed MU, Uddin BMM. Evaluation of antibiotic susceptibility in wound infections: A pilot study from Bangladesh. Research 2017; 6:2103. doi: 10.12688/f1000research.12887.1.
17. Surahio AR, Talpur AA, Memon AS, Junejo A, Laghari AA. Surgical site infections: culture & sensitivity pattern of micro-organisms isolated in a tertiary care hospital. Professional Med J. 2017;24(1):57-63.
18. Ijaz A, Amer S. Post-operative wound infection. Professional Med J. 2010;17(2):174-179.
19. Bibi S, Channa GA, Siddiqui TR, Ahmed W. Pattern of bacterial pathogens in postoperative wounds and their sensitivity patterns J Surg Pak 2012;17(4):164-167.
20. Tariq A, Ali H, Zafar F, Hameed K, Sial AA, Salim S et al. Surgical Site Infection; Frequency of Clinical Isolates Involved Sensitivity and Resistivity Pattern Estimate Professional Med J 2017;24(7):1054-1061.
21. Malik AZ, Ali Q. Surgical Site Infections after Elective Surgery in Pakistan: SURGIPAK Study J Rawal Med Coll Sep - Dec 2015;19(3):209-214.
22. Ahmad A, Saeed M, Hussain S, Ahmad M, Tahir A, Rasheed F. Bacteriological Spectrum of Surgical Wound Infections. Ann Pak Inst Med Sci 2016;12(2):68-74.
23. Guideline for Prevention of Surgical Site Infection. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection. 2017 website:

[[https://www.cdc.gov/infectioncontrol/guidelines/index.html] Accessed on Nov 30, 2018.
24. Nwachukwu NC, Orji FA, Okike UM. Antibiotic susceptibility patterns of bacterial isolates from surgical wounds in Abia State University Teaching Hospital (ABSUTH), Aba–Nigeria. Res J of Med & Medical Sci. 2009; 4(2): 575–579.
25. Afroz H, Fakruddin M, Masud MR. Incidence of and risk factors for Hospital Acquired Infection in a Tertiary Care Hospital of Dhaka, Bangladesh. Bangladesh J of Med Sci. 2017; 16(3): 358–369.
26. Mohammed A, Adeshina GO, Ibrahim YK. Incidence and Antibiotic Susceptibility Pattern of Bacterial Isolates from Wound Infections in a Tertiary Hospital in Nigeria. Tropical J of Pharma Res.2013; 12 (4): 617-621. http://dx.doi.org/10.4314/tjpr.v12i4.26.
27. Fluit AC, Jones ME, Schmitz FJ. Antimicrobial susceptibility and frequency of occurrence of clinical blood isolates in Europe from the SENTRY antimicrobial surveillance program, 1997 and 1998. Clin Infect Dis. 2000; 30(3): 454–460.