DOI: https://doi.org/10.53350/pjmhs22161642

ORIGINAL ARTICLE

Antibiotic Susceptibility Pattern in Isolates of Postoperative Wound Infections and Bacteriology of Surgical Site Infections: a Cross Sectional Study

OSAMA AZHAR[1], JAMSHED BASHIR[2], NIGHAT GHIAS[3], JAVERIA FARID[4], RAJA MUHAMMAD ADEEL KHAN[5], JUNAID ZAMAN[6]
[1]Medical Officer General Surgery, National Hospital and Medical Center Lahore, Pakistan.
[2]Associate Professor Surgery, Muhammad Medical Collage Mirpurkhas, Pakistan.
[3]Consultant General Surgeon, Sindh Employee Social security Hospital Landhi Karachi, Pakistan.
[4]General surgeon, Sindh Government Hospital Qasimabad Hyderabad, Pakistan.
[5]Assistant Professor Surgery, Suleman Roshan Medical College Tando Adam, Pakistan.
[6]Consultant General Surgery, Sindh Rangers Hospital Karachi, Pakistan.
Corresponding author: Osama Azhar, Email: osamaazhar99@yahoo.com

ABSTRACT
Aim: The goal of this research was to look at the microorganisms that cause infections on surgical site & their antibiotic susceptibility patterns.
Study design: Cross sectional study
Place & duration: This study was conducted at National Hospital and Medical Center Lahore, Pakistan from December 2019 to December 2020
Methodology: Surgical site infection samples were taken from patients who complained of post-operative discomfort, edema, drainage, and a delayed or non-healing wound. Following routine protocol, two swabs were taken from each patient's surgery site. After 18-24 hours of incubation at 35°C-37°C, the diameter of antibiotic discs was classified & measured as sensitive (S), intermediate (I), or resistant (R)
Results: According to the data, 60 (56.07 percent) of 107 samples acquired from post-operative patients with symptoms of wound infection indicated single isolates, 13 (12.14 percent) revealed multiple isolates, and 34 (31.77 percent) samples revealed no bacterial growth. In all, 86 isolates have been identified, including 29 (33.7%) Gram +ve and 57 (66.3%) Gram -ve organisms. Gram positive bacteria were very susceptible to vancomycin & linezolid (100%) and gentamicin (79.3%), while Polymyxin B (94.7%), as well as imipenem, were extremely vulnerable to Gram negative bacteria (79.3 percent).
Conclusion: The most prevalent organisms identified from the surgical site infection were Staphylococcus aureus (MAAS) and E.coli. Microorganisms, both gram positive and gram negative, acquired resistance to more regularly used medications such as penicillin, cephalosporins, and even cost-effective quinolones, according to the findings of this research.
Keywords: surgical site infection, hospital acquired infections, gram +ve bacteria, gram –ve bacteria, antibiotics

INTRODUCTION
The major purpose of intact skin in humans is to manage microorganisms on the surface of skin to inhibit infections from colonizing or invading the underlying tissues as part of innate immunity. Every situation (wounds) that exposes subcutaneous tissue owing to a loss of skin's integrity offers a favorable environment for microbe colonization and growth, putting any wound at risk of infection.(1) Infections in the wound are important hurdles to recovery that have an impact on patients, prolonging hospital stays and lowering life' quality (2) healing of wound also need a healthy environment to ensure a proper healing process and minimum scar formation. (3) (4) Infection caused by pathogenic germs at the surgical site incision is described as the multiplication of pathogenic germs in the skin and subcutaneous fat, Musculo-facial layers, and organ/cavity. (5) In surgical patients, HAI is the most frequent kind of nosocomial infection, with SSI coming in second. (6) SSI usually occurs after 30 days of the treatment, however in the event of any additional implants, the duration of SSI might last up to a year following the procedure. (7, 8, 9) Worldwide, the frequency of surgical site infections (SSIs) ranges from 2.5 percent to 41.9 percent, with the risk of a HAI being especially high in patients undergoing surgery, with SSI accounted for 77 percent of hospital-acquired infection-related mortality. (10) It is becoming increasingly difficult to treat hospital-acquired infections due to the increasing prevalence of multidrug resistant organisms such as MRSA, and other bacteria that cause increased mortality and morbidity while simultaneously decreasing antibiotic resistance. (11) The goal of this research was to look at the microorganisms that cause SSI and their antibiotic susceptibility patterns.

METHODOLOGY
107 samples from either gender or various age groups were gathered throughout a one-year period after permission by the institution's ethical committee. SSI samples were taken from patients who complained of post-operative discomfort, edema, drainage, and a delayed or non-healing wound. Following routine protocol, two swabs were taken from each patient's surgery site. They were immediately taken to a microbiology laboratory where nutrient; chocolate, blood and MacConkey agars were used to inoculate them. The first swab was stored in a sterile test tube, and the second was placed in a sterile nutrient broth and incubated aerobically for 24 hours before being checked for growth at 35oC-37oC. Plates that do not

demonstrate growth after that time were re-incubated for an additional 48 hours. Escherichia coli and Staphylococcus aureus were used as control strains in the investigation. SPSS version 22 was used for data analysis.

RESULTS

Our institution conducted 4642 surgical operations throughout the research period, with 107 (2.30%) (Table 1) samples taken from symptomatic SSI patients. After 48 hours of aerobic incubation, 60 (56.07%) of samples acquired from post-operative patients showed single isolate growth, 13 (12.14%) samples showed multiple isolate growth, and 34 (31.7%) samples showed no bacterial growth. (As shown in Table 2) In this study, 29 (33.7 percent) of the 86 isolates tested were gram-positive bacteria, while 57 (66.3 percent) were gram negative bacteria (As shown in Table 3). Gram-negative bacteria were found in greater number than Gram-positive bacteria (As shown in Table 4)

Escherichia coli was found in 24 of the 57 Gram-negative isolates (42.1 percent), followed by Klebsiella species (17.9 percent), Pseudomonas aeruginosa (15.3 percent), and Acinetobacter baumanii (1.8 percent) instances, all of which were found in Gram-positive isolates. (As shown in Table 5). MSSA (15.78 percent) pathogen among gram positives in superficial SSI, while Escherichia coli (26.31 percent) among gram negatives pathogens (Table 6).

Table 1: shows the amount of surgical operations, SSIs, and HAIs performed at the hospital.

No. of symptomatic SSI	107
No of surgical procedures	4642
HAI	86

Table 2: lists the isolates found in clinical samples.

No bacterial growth	34
Multiple isolates	13
Single isolates	60
Total	107

Table 3: In clinical specimens, the detection of Gram positive and Gram-negative organisms

Total number of isolates	86
Gram +ve organisms	29
Gram –ve organisms	57

Table 4: Types of Gram-positive bacteria

Organisms	No. of isolates
Staphylococcus aureus (MAAS)	13
Staphylococcus aureus (MRSA)	9
Coagulase negative staphylococci	3
Enterococcus species	3
Streptococcus pyogenes	1
Total	29

Table 5: Types of Gram-negative bacteria.

Organisms	No. of isolates
E.coli	24
Klebselia species	17
Pseudomonas aeruginosa	15
Acinetobacter baumanii	1
Total	57

Table 6: SSI class of bacterial isolates distribution

Bacterial isolates	Superficial SSI	Deep organ or tissues SSI	Total
Staphylococcus aureus (MAAS)	2	4	13
Staphylococcus aureus (MRSA)	7	2	9
Coagulase negative staphylococci	3	0	3
Enterococcus species	2	1	3
Streptococcus pyogenes	1	0	1
E.coli	15	9	14
Klebselia species	10	7	17
Pseudomonas aeruginosa	9	6	15
Acinetobacter baumanii	1	0	1
Total	57	29	86

Table 7: In Gram-positive bacteria, a pattern of antibiotic sensitivity to diverse antibiotics

Antibiotic's name	No. of isolates		
	Sensitive	resistant	intermediate
Vancomycin	29	-	-
Linezolid	29	-	-
Erythromycin	13	14	2
Tetracycline	22	7	-
Oxacillin	13	9	-
Penicillin	1	2	-
Co-amoxyclav	14	15	-
Cotrimoxazole	10	19	-
Ceftriaxone	13	9	-
Cephalothin	13	9	-
Gentamicin	23	6	-
Ciprofloxacin	8	16	5
Neomycin	16	13	-

Table 8: The pattern of antibiotic resistance of Gram-negative bacteria to different antibiotics.

Antibiotic's name	No. of isolates		
	Sensitive	resistant	intermediate
Polymyxin B	54		-
Imipenem	43		1
Meropenem	41		2
Piperacillin	30		4
Cefaperazone	25		4
Ciprofloxacin	23		-
Amikacin	42		1
Gentamycin	37		2
Co-amoxyclav	19		-
Ceftriaxone	6		-
Cephalothin	4		-
Cotrimoxazole	15		-
Polymyxin B	54		-

DISCUSSION

Following the implementation of several infection control strategies & antibiotic regimens into surgical practice, surgical site infections (SSI) still happen in both poor and rich countries.(12, 13) Drugs such as antibiotics are important in the prevention and treatment of infectious diseases, and the management of patients with SSI, If it is caused by gram +ve or gram -ve organisms, the choice of an effective and appropriate antibiotic or regimen to fight them is very important. (14, 15) Nandita Pal et al found that 23.3 percent of the samples had single isolates, whereas 36.7 percent had multiple isolates. Mama et al found that 91.6 percent of the samples had single isolates, while 8.4 percent had multiple isolates. They also found that 87.4 percent of the samples were culture positive, while 12.6 percent had no bacterial growth. (16)

Single isolates grew more often (56.07 percent) than multiple isolates in the current investigation (12.14 percent). Gram positive organisms made up 33.7 percent of the study, while Gram negative organisms made up 66.3 percent, with Escherichia coli accounting for 42.1 percent of gram negatives and Staphylococcus aureus (MSSA) accounting for 44.8 percent of gram positives. According to Mama et al, 47 percent of the organisms were gram positive, whereas 53 percent were gram negative. (17)

According to Amare et al, 44.1 percent of the organisms tested positive for gram positive bacteria, while 55.9% tested negative, with Escherichia coli (24.3 percent) and Staphylococcus aureus (23.4 percent). It turns out vancomycin and linezolid were 100% resistant in this study. Gentamicin was the next most resistant drug, with 79% of patients being resistant. Erythromycin, cephalothin, ciprofloxacin, and penicillin were the next three most resistant drugs (27.6 percent). It is 3.4%. In people who took 19 gram of vancomycin, 100% of them were able to take it. It turns out that Mama et al. say that the most common antibiotics used in the study are gentamicin (91.2 percent), ceftriaxone (80.9%), ciprofloxacin (89.7%), and erythromycin (77.9 percent), as well as penicillin (48.5 percent) and cephalosporin (57.3 percent) (13.2 percent). As reported by Goswami et al., vancomycin had a susceptibility rate of 61.4 percent, followed by ciprofloxacin (47.4 percent), tetracycline (42.1 percent), erythromycin (38.6 percent), penicillin (29.8 percent), and gentamicin (0.1 percent) (29.8 percent). Polymyxin-B, an antibiotic, was found to be able to kill 94.7 percent of Gram-negative bacteria when it was used. Almost three-quarters of people who go to the doctor get imipenem, meropenem, amikacin, piperacillin-tazobactam, gentamicin, and ciprofloxacin. The next most popular antibiotics are ciprofloxacin (40.3 percent), coamoxyclave (33.3 percent), and cotrimoxazole (33.3 percent) (10.5 percent). Imipenem, meropenem, piperacillin-tazobactam, cefaperazone-sulbactam, amikacin, and cefaperazone-sulbactam were found to be 18 percent susceptible in a study done by Nandita Pal et al. Then, ciprofloxacin (85.7 percent), gentamicin (71.4 percent), ceftriaxone (30 percent), ceftazidime, and cotrimoxazole (28.6 percent) were found to be the most resistant. At 67.5 percent, ciprofloxacin was the most susceptible antibiotic, with meropenem (48.4 percent) and cotrimoxazole (both 48.4 percent) in third and fourth place (47.4 percent). (19.8%) (18)

CONCLUSION

The most prevalent organisms identified from the surgical site infection were Staphylococcus aureus (MAAS) and E. coli (Escherichia coli). According to the results of this study, microorganisms, both gram positive and gram negative, developed resistance to more commonly used drugs such as penicillin, cephalosporins, and even cost-effective quinolones. Only a few reserve medications remain, such as carbapenems, which should be used with caution. To summarize, even 150 years after the discovery of SSI by Louis Pasteur and Joseph Lister, there is still much to learn about the pathogenesis, prevention, and monitoring of SSI and other infectious diseases.

Permission: It was taken from the ethical review committee of the institute

Funding source: None

Conflict of interest: None

REFERENCES

1. Dai T, Huang Y-Y, K Sharma S, T Hashmi J, B Kurup D, R Hamblin M. Topical antimicrobials for burn wound infections. Recent patents on anti-infective drug discovery. 2010;5(2):124-51.
2. Kotz P, Fisher J, McCluskey P, Hartwell SD, Dharma H. Use of a new silver barrier dressing, ALLEVYN? Ag in exuding chronic wounds. International wound journal. 2009;6(3):186-94.
3. Al-Waili N, Salom K, Al-Ghamdi AA. Honey for wound healing, ulcers, and burns; data supporting its use in clinical practice. TheScientificWorldJournal. 2011;11:766-87.
4. Ashby E, Haddad F, O'Donnell E, Wilson A. How will surgical site infection be measured to ensure “high quality care for all”? The Journal of bone and joint surgery British volume. 2010;92(9):1294-9.
5. Bagnall NM, Vig S, Trivedi P. Surgical-site infection. Surgery (Oxford). 2009;27(10):426-30.
6. Martone WJ, Nichols RL. Recognition, prevention, surveillance, and management of surgical site infections: introduction to the problem and symposium overview. Clinical Infectious Diseases. 2001;33(Supplement_2):S67-S8.
7. Richards C, Edwards J, Culver D, Emori TG, Tolson J, Gaynes R, et al. Does using a laparoscopic approach to cholecystectomy decrease the risk of surgical site infection? Annals of surgery. 2003;237(3):358.
8. Kozak LJ, Owings M, Hall MJ. National Hospital Discharge Survey; 2002 annual summary with detailed diagnosis and procedure data. 2005.
9. System NNIS. National Nosocomial Infections Surveillance (NNIS) system report, data summary from January 1992 through June 2004, issued October 2004. Am J infect control. 2004;32:470-85.
10. Amare B, Abdurrahman Z, Moges B, Ali J, Muluken L, Alemayehu M, et al. Postoperative surgical site bacterial infections and drug susceptibility patterns at Gondar University Teaching Hospital, Northwest Ethiopia. J Bacteriol Parasitol. 2011;2(8):126.
11. Gelaw A, Gebre S, Tiruneh M, Fentie M. Antimicrobial susceptibility patterns of bacterial isolates from patients with postoperative surgical site infection, health professionals and environmental samples at a tertiary level hospital, North West Ethiopia. International Journal of Pharmaceutical Sciences Review and Research. 2013;3(1):1-9.
12. Lilani S, Jangale N, Chowdhary A, Daver G. Surgical site infection in clean and clean-contaminated cases. Indian journal of medical microbiology. 2005;23(4):249-52.
13. Siguan SS, Ang BS, Pala IM, Baclig RM. Aerobic surgical infection: a surveillance on microbiological etiology and antimicrobial sensitivity pattern of commonly used antibiotics. Phil J Microbiol Infect Dis. 1990;19(1):27-33.
14. Bradford PA. Extended-spectrum β-lactamases in the 21st century: characterization, epidemiology, and detection of this important resistance threat. Clinical microbiology reviews. 2001;14(4):933-51.
15. Garner JS. CDC guideline for prevention of surgical wound infections, 1985. Infection Control & Hospital Epidemiology. 1986;7(3):193-200.
16. Pal N, Guhathakurta R. Surgical site infection in surgery ward at a tertiary care hospital: the infection rate and the bacteriological profile. 2012.
17. Mama M, Abdissa A, Sewunet T. Antimicrobial susceptibility pattern of bacterial isolates from wound infection and their sensitivity to alternative topical agents at Jimma University Specialized Hospital, South-West Ethiopia. Annals of clinical microbiology and antimicrobials. 2014;13(1):1-10.
18. Goswami NN, Trivedi HR, Goswami APP, Patel TK, Tripathi C. Antibiotic sensitivity profile of bacterial pathogens in postoperative wound infections at a tertiary care hospital in Gujarat, India. Journal of pharmacology & pharmacotherapeutics. 2011;2(3):158.