SHORT REPORT

Antibiotic susceptibility profile of bacterial isolates from post-surgical wounds of patients in tertiary care hospitals of Peshawar, Pakistan

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Abstract

Postoperative wound infections are the infections of the operating site within thirty days after surgery. The infections that develop after surgery are a major problem throughout the world leading to, increased morbidity and mortality. This study was carried out to determine the prevalence of bacterial pathogens causing wound infection in the surgical wards and to determine the antimicrobial sensitivity patterns of the isolated bacteria. A total of 250 wound samples were collected over a period of 6 months from July-December, 2016. The pathogenic bacteria were isolated, identified and their antibiotic susceptibility was determined through disc diffusion method. Among 250 cases, 210 (84%) were culture positive for bacterial pathogens, while 40 (16%) were bacteriologically sterile (Negative). Rate of infection was high in males (55.6%) than females (44.4%). The predominant isolates were E.coli 55 (26.19%), followed by S.aureus 51 (24.28%), Pseudomonas spp. 43(20.47%), S.aureus MRSA 21 (10%), Proteus Marbillis 15 (7.14%), E.coli ESBL producer was 8 (3.81%), Acinetobacter 7 (3.33%) Proteus valgaris 5 (2.38%), β-Streptococci 3 (1.43%) and Klebsella pneumonia were the least, 2 (0.95%). Linezolid, Vancomycin, Amoxycillin, Cefoperazone and Meropenem are the most effective antibiotics for treating post-surgical wound infections.

Keywords: Surgical site infections, Antibiotic susceptibility, MRSA, ESBL.

Introduction

Postoperative wound infection is defined as an infection that take place within 30 days after a surgical procedure and affecting either a surgical cut made in skin or flesh or deep tissues at the surgical site. The infection may occur on the surface or can involve organs or body space or deep incisional infection.[1]

Drug resistance developing due to misuse and mismanagement of antibiotics is a major threat. Another important dimension to the problem of surgical site infections is the recent spread of multi drug (MDR) resistant bacterial pathogens.[2]

Organisms such as Pseudomonas aeruginosa, Proteusvulgaris, Escherichia coli, Klebsiella spp, Staphylococcus aureus, Enterococcus spp, etc are the most common isolates in all types of wounds.[3]

Postoperative wound infections are responsible for increased death rate, disease rate, long hospital stay and improved economic expenses for patient care.[4]

The risk of emerging postoperative wound infections is mostly determined by three factors: type of microbial contamination of the wound, the amount and susceptibility of host.[5]

Postoperative wound infection has always been a threat to surgery as it causes injury to living tissue (trauma).[6]

Two major factors exogenous (Pathophysiological) and endogenous (microorganisms) become the sources of postoperative wound infections, which[7] pose a key public health issue worldwide. These frequently reported nosocomial infections are accountable for increasing treatment cost, long duration of hospital stay and significant morbidity and mortality.

Materials and Methods

This descriptive cross sectional study was carried out at PHRC Research Center, Khyber Medical College, Peshawar. Sample size was calculated using standard formula for estimating a population proportion with specified absolute precision with 97% confidence level, 3% absolute precision and 5% anticipated population proportion. A total of 250 samples were collected by using sterile cotton swabs from different specimens such as pus, wound swabs etc. in a period of 6 months (July-December, 2016). Non probability sampling technique was adapted to collect samples from patients undergoing surgery in different wards of two tertiary care hospitals; Khyber Teaching Hospital (KTH) and Hayatabad Medical Complex (HMC) Peshawar. Patients of both gender between the ages of 10 and 70 years with pus/wound infection who visited the OPD or were admitted in the surgical ward (male and

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female) of KTH and HMC Peshawar were included in this study. People not willing to participate in the study, immune compromised patients and patients already on antibiotic treatment were excluded.

All the samples (exudates) were labelled accurately and immediately transported to the microbiology laboratory of Pakistan Health Research Council (PHRC) Peshawar for further processing.

All wound specimens were inoculated on blood agar, and MacConkey agar and other differential media within two hours of collection and were incubated at 37°C aerobically for 24 hours. Isolates were identified by colony characteristics, gram staining and standard biochemical tests.

Antibiotic susceptibility was performed by standard Kirby Bauer disk diffusion method.

Results

Among 250 cases, 210 (84%) were culture positive for bacterial pathogens, while 40 (16%) were bacteriologically sterile (Negative).

E.coli was predominant organism 55 (26.19%), followed by S.aureus 51 (24.28%),

Pseudomonas sp. 43(20.47%), MRSA 21 (10%), Proteus Mirabillis15 (7.14%), ESBL producing E.coli. 8 (3.81%), Acinetobacter 7 (3.33%) Proteus valgaris 5 (2.38%), β-Streptococci 3 (1.43%) and Klebsella 2 (0.95%) respectively (Table-1).

The antibiogram of Gram-positive cocci showed that Staphylococcus aureus was highly sensitive to Linzolid, followed by Vancomycin and Amoxycillin. In contrast, maximum resistance was shown by Staph.aureus to Pencillin, Erythromycin and Clindamycin. MRSA was found to be most sensitive to Vancomycin followed by Linzolid and Rifampicin. β-Streptococci were mostly resistant to Clindamycin (Table-2).

The Antibiogram of Gram-negative rods revealed that

Table-1: Types and frequency of organisms isolated from different wards of KTH and HMC Peshawar.

Types of organism	Dermatology	Endocrinology	Female surgical ward	Gynae ward	ICU	Neurosurgery	OPD	Orthopaedic ward	Plastic surgical ward	Male surgical ward	Total N (%)
E.coli	1	6	3	12	_	_	2	5	5	21	55 (26.19)
S.aureus	_	3	2	7	_	1	3	8	8	19	51 (24.28
Pseudomonas	_	3	_	10	_	1	3	6	11	9	43 (20.47)
S.aureus MRSA	2	2	1	3	_	_	_	3	2	8	21 (10)
Proteus Marbillis	1	1	_	_	1	_	_	5	4	3	15 (7.14)
E.coli ESBL producer	_	_	_	_	_	_	1	1	2	4	8 (3.81)
Acinetobacter	_	1	_	_	_	_	_	1	2	3	7 (3.33)
Proteus valgaris	_	_	_	_	_	_	_	2	2	1	5 (2.38)
β-Streptococci	_	2	_	_	_	_	_	_	1	_	3 (1.43)
Klebsella Pneumonia	_	_	_	1	_	_	_	_	1	_	2 (0.95)

ICU: Intensive Care Unit. OPD: Out Patients Department.

Table-2: Culture and sensitivity pattern of Gram positive bacteria against different antibiotics.

Drug class	Name of Antibiotics	Staph.aureus (n = 51)		MRSA (n= 21)		β-Streptococci (n =3)	
		S	R	S	R	S	R
Pencillin	Amoxicillin (10µg)	41	4	7	12	3	0
Licosamide	Clindamycin (10 µg)	31	18	9	9	1	2
Tetracyclin	Doxycyclin (30 µg))	38	2	15	4	2	1
Marcolide	Erythromycin (30 µg)	20	24	2	18	1	1
Steroidal	Fusidic acid (10 µg)	33	11	7	9	0	0
Aminoglycosides	Gentamycin (30 µg)	26	15	5	12	2	1
Oxazolidinone	Linzolid (30 µg)	49	1	16	0	0	0
Pencillin	Oxacillin (5 µg)	41	3	0	21	0	0
Pencillin	Pencillin (10 µg)	20	27	1	19	2	0
Ansamycin	Rifampicin (30 µg)	37	6	16	3	0	0
Glycopeptide	Vancomycin (30 µg)	44	1	20	1	0	1

MRSA: Methicillin-resistant Staphylococcus Aureus.

Table-3: Antibiogram of Gram-negative isolates.

Drug class	Name of Antibiotics	E.coli (n =55)		E.coli ESBL producer (n=8)		Klebsiella pneumoniae (n = 2)		Proteus mirabilis (n =15)		Proteus vulgaris (n = 5)		Acinetobacter (n = 7)		Pseudomonas spp. (n = 43)	
		S	R	S	R	S	R	S	R	S	R	S	R	S	R
Aminoglycosides	Amikacin (30 µg)	41	7	6	2	2	0	11	1	4	0	6	0	25	12
pencillin	Amoxicillin (10 µg)	18	33	1	5	0	2	6	7	1	4	2	3	19	14
Cephem	Cefoperazone (30 µg)	42	10	6	1	2	0	14	0	4	1	7	0	38	4
Cephem	Cefotaxime (30 µg)	10	41	0	6	0	1	7	7	1	4	2	2	17	23
Cephem	Ceftazidime (30 µg)	14	24	0	8	0	1	8	1	1	3	1	1	18	23
Floroquinolone	Ciprofloxacin (10 µg)	19	32	0	7	0	1	12	1	1	3	3	3	23	14
Aminoglycosides	Gentamycin (30 µg)	25	24	5	3	0	2	9	6	1	3	2	1	2	32
Carbapenem	Imipenem (10 µg)	8	0	1	0	0	0	2	0	2	0	1	0	6	2
Carbapenem	Meropenem (10 µg)	42	3	6	1	2	0	13	0	3	0	5	0	29	5
β-lactamase inhibitors	TZP/Pipercillin (40 µg)	42	6	7	0	1	1	15	0	4	0	3	3	39	2

ESBL: Extended Spectrum Beta-Lactamase.

E.coli was highly sensitive to Tazobactum/Piperacillin, Cefoperazone and Meropeneme and showed resistance to Cefotaxime followed by Amoxicillin and Ciprofloxacin. It was observed that Pseudomonas species were highly sensitive to TZP|piperacillin and resistant to gentamycin, cefotaxime and ceftazidime. Antibiograms of the Gram negative isolates are shown in Table-3.

Discussion

During the current study, gram-negative organisms were more frequently encountered than gram-positive which supports the finding of Amatya et al., in 2015.[8]

In our study E.coli and S.aureus were the most common isolated pathogens, followed by Pseudomonas aeruginosa and Klebsiella pneumoniae. Similar findings were recorded by Srivastava et al.[9]

The current study showed that the gram-negative isolates as E.coli were found to be sensitive to Tazobactam/Pipearcillin, Meropenem and Cefoperazone and highly resistant to Cefotaxime which is similar to the result acquired by Waqar et al., in 2010.[10]

In our study Extended spectrum beta lactamase (ESBL) producing Escherichia coli was found to be resistant to most of the antibiotics except cefoperazone, meropenem, and piperacillin/tazobactam. This is supported by the study done by Gadepalli, et al., in 2006.[11]

In our study Pseudomonas showed highest sensitivity towards penicillin derivatives (Pipracillin/Tazobactum) which is already reported earlier.[12] but this organism was resistant to Gentamycin and Ceftazadime as reported elsewhere.[13] K. pneumoniae showed least resistance to Gentamycin in the present study which support the findings of Kitara et al., in 2011.[14] Furthermore, sensitivity of K. Pneumonia to amikacin could mean that there is a possibility of sensitivity to other Aminoglycosides such as gentamycin which is similar to our study.

In our study the antibiotics such as Cefoperazone and Amikacin were the most effective and useful combination where all the isolates of Proteus spp were sensitive but this organisms showed high resistance to Amoxicillin. Similarly the highest percentage of resistance to ampicillin was recorded earlier in a study done in Kingdom of Saudi Arabia[15] where more than 80 % of Proteus isolates showed resistance to Amoxicillin. It was found that the rate of sensitivity of Acinetobacter against cefoperazone is high following amikacin and meropenem which has been proved by Purva et al., in 2013,[16] but this organism was resistant to Ciprofloxacin following Cefotaxime and Gentamycin which is similar to the result of the study conducted by Lagatolla et al.[17]

In the present study Linezolid was found highly sensitive against S.aureus. Further effectiveness of Linezolid has been proved in 2001 by Gemmell.[18] Whereas, it is found highly resistant to Pencillin and erythromycin which is related to the previous findings (Devrieseet al., 1997).[19] where 81% of the isolates were resistant to the given antibiotics. In the present study MRSA showed highest sensitivity to Vancomycin and Linezolid which has also been proved by Ranjhan et al.,[20] but found completely resistant to oxacillin similar to the study done by Boyce.[21] Furthermore β-Streptococci isolates showed the highest sensitivity to Amoxicillin which is in agreement to the previous study done by Brook.[22]

Conclusion

In the current study, the predominant pathogens were

E.coli, followed by S.aureus, Pseudomonas sp., MRSA, Proteus Marbillis, E.coli ESBL producer, Acinetobacter, Proteus valgaris and β-Streptococci respectively.

It is concluded from the current study that Linzolid, Vancomycin and Amoxycillin are preeminent antibiotics which are suitable for the treatment of Gram positive bacterial infections. Similarly Tazobactum/Piperacillin, Cefoperazone and Meropenem are the drugs of choice against gram negative bacteria.

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Conflict of Interest: None.

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References

1. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for Prevention of Surgical Site Infection. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee. Am J Infect Control 1999; 27: 97-132.
2. Sule A, Thanni L, Sule-Odu O, Olusanya O. Bacterial pathogens associated with infected wounds in Ogun state University Teaching Hospital, Sagamu, Nigeria. Afr J Clin Exp Micro 2002; 3: 13-6.
3. AmritaS, Sheetal R, Narendra N. Aerobic microorganisms in postoperative infections and their antimicrobial susceptibility patterns. J Clin Diagn Res 2010; 4: 3392-6.
4. Weigelt JA, Lipsky BA, Tabak YP, Derby KG, Kim M, Gupta V. Surgical site infections: Causative pathogens and associated outcomes. Am J Infect Control 2010; 38: 112-20.
5. Nwachukwu NC, Orija FA, Okike UM. Antibiotic susceptibility pattern of bacterial isolates from surgical wounds in Abia State University Teaching Hospital (ABSUTH), Aba-Nigeria. Res J Med and Med Sci 2009; 4: 575-9.
6. Pradhan G, Agrawal J. Comparative study of postoperative wound infection following emergency lower segment caesarean section with and without the topical use of fusidic acid. Nepal Med Coll J 2009; 11: 189-91.
7. Shriyan A, Sheetal R, Nayak N. Aerobic micro-organismsin post-operative wound infections. J Clin Diag Res 2010; 13: 3392-6.
8. Amatya J, Rijal M, Baidya R. Bacteriological Study of the Postoperative Wound Samples and Antibiotic Susceptibility Pattern of the Isolates in B&B Hospital. JSM Microbiology 2015; 3: 1019.
9. Srivastava SP, Atal PR, Singh RP. Studies on hospital infections. Ind J Surg 2015; 1969: 612-13.
10. Waqar AJ, Sajjad MK, Muhammad J, Muazzam. Surgical site infection and pattern of antibiotic use in a tertiary care hospital in Peshawar. J Ayub Med Coll Abbottabad 2010; 22: 141-5.
11. Gadepalli R, Dhawan B, Sreenivas V, Kapil A, Ammini AC, Chaudhry R. A clinicmicrobiological study of diabetic foot ulcers in an Indian tertiary care hospital. Diabetes Care 2006; 29: 1727-32.
12. Amoran, OE, Sogebi, AO, Fatugase OM. Rates and risk factors associatedwith surgical site infections in a tertiary care center in South-Western Nigeria. Int J Trop Dis Health 2013; 3: 25-36.
13. Majeed, MT, Izhar, M. Glycopeptides sensitivity pattern in staphylococciisolated from clinical specimens in a tertiary care hospital. Ann. KE Med Coll 2005; 11: 263-717.
14. Kitara LD, Anywar AD, Acullu D, Odongo-Aginya E, Aloyo J, Fendu M. Antibiotic susceptibility of Staphylococcus aureus in suppurative lesions in Lacor Hospital, Uganda. Afr Health Sci 2011; 11 suppl 1: S34-9.
15. Bahashwan SA, El Shafey HM. Antimicrobial resistance patterns of Proteusisolates from clinical specimens. Eu Sci J 2013; 9: 188-202.
16. Purva M, Vivek T, Kamran F, Vijay S, Neetu J, Nidhi B, et al. Implementation of a short course of prophylactic antibiotic treatment for prevention of postoperative infections in clean orthopaedic surgeries. Indian J Med Res 2013; 137: 111-6.
17. Lagatolla C, Tonin EA, Monti-Bragadin C, Dolzani L, Gombac F, Bearzi C, et al. Endemiccarbapenem-resistant Pseudomonasaeruginosa with acquired metallo-β-lactamase determinants in European hospital. Emerg Infect Dis 2004; 10: 535-8.
18. Gemmell CG. Susceptibility of variety of clinical isolates to linezolid: a European inter-country comparison. J Antimicrob Chemother 2001; 48: 42-52.
19. Devriese LA, Haesebrouck F, Hommez H, Vandermeersch R. A 25-yearsurvey of antibiotic susceptibility testing in Staphylococcus aureus from bovine mastitis in Belgium, with special reference to penicillinase". Vlaams Diergeneeskundig Tijdschrift 1997; 66: 170-3.
20. Ranjan KP, Ranjan N, Gandhi S. Surgical site infections with special reference tomethicillin resistant Staphylococcus aureus experience from a tertiary carereferral hospital in North India. Int J Res Med Sci 2013; 1:108-11.
21. Boyce JM. Increasing prevalence of methicillin-ressistant S.aureus in the United States Infect. Infect Control Hosp Epidemiol 1990; 11: 639-42.
22. Brook I. Treatment of patients with acute recurrent tonsillitis due to group A betahaemolytic streptococci: a prospective randomized study comparing penicillin and amoxycillin/clavulanate potassium. J Antimicrob Chemother 1989; 24: 227-33.