

# Pattern of Bacterial Pathogens in Postoperative Wounds and their Sensitivity Patterns

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## ABSTRACT

- Objective** To identify the common bacterial pathogens involved in postoperative wound infections and their sensitivity patterns.
- Study design** Cross-sectional study.
- Place & Duration of study** Surgical ward 2, Jinnah Postgraduate Medical Centre Karachi, from December 15, 2008 to December 14, 2009.
- Methodology** Wound swabs were collected for patients who developed surgical site infection during the study period. Infected cases were identified using Centre for Disease Control (CDC) definition for surgical site infections. Culture and sensitivity were performed using American Society of Microbiology (ASM) guidelines.
- Results** During the study period, 82 (7.3%) patients developed postoperative wound infection in the selected ward. The most commonly isolated pathogens were *E.coli* (33.8%), *Pseudomonas aeruginosa* (16.9%) and *Staphylococcus aureus* (15.5%). Resistance pattern of *E.coli* isolates showed 100%, 93%, 32% and 12% resistance to ceftriaxone, ofloxacin, amikacin and meropenem respectively. *Pseudomonas aeruginosa* isolates were 100% resistant to tetracyclin and ceftazidime, 91.6% to ofloxacin, 83.3% to meropenem and 66.7% to amikacin. *Staphylococcus aureus* exhibited maximum resistance to cloxacillin (100%) followed by ofloxacin (90.9%), tetracyclin (45.5%), amikacin (45.5%), chloramphenicol (36.4%) and vancomycin (0%).
- Conclusion** Gram negative organisms were frequently associated with postoperative wound infections in general surgery ward and resistance to multiple drugs was noted.
- Key words** Post operative wound infections, Surgical site infections, Pathogens, Antibiotic sensitivity.

## INTRODUCTION:

Hospital admissions expose patient to different types of microbial flora. They are at a high risk and can be infected by these pathogens. The risk of infection is further amplified when they are exposed to any invasive procedure.<sup>1</sup> Postoperative wound

infections (PWI) are important cause of morbidity and mortality in patients undergoing surgery and add substantial financial burden and undue discomfort.<sup>2-5</sup>

Treatment of PWI with antibiotics is becoming a challenge for surgeons as multidrug resistance is reported to be high. It is therefore important to have knowledge regarding the prevalent microorganism in the surgical units and their susceptibility patterns to antibiotics so that proper treatment can be started earlier. It is also essential to take appropriate steps to curtail the spread of infection within the unit.<sup>6</sup>

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This study was undertaken to identify the prevailing bacterial pathogens and their sensitivity patterns in a surgical unit. The information thus gathered shall help planning antibiotic usage policy for PWI.

**METHODOLOGY:**

This was a prospective cross sectional study of one year duration that was carried out from December 15, 2008 to December 14, 2009 at Surgical ward 2 of Jinnah Postgraduate Medical Center (JPMC), Karachi. All patients who underwent surgery during the study period were included. Infected cases were identified by surgeons following the CDC definition for SSI. Sample (wound swab) was collected for patients showing any signs of infection. For collection of sample wound was washed with normal saline and then wound swab was collected to avoid the growth of commensals. Processing and culturing of samples were done in the Microbiology Laboratory of PMRC Research Center, JPMC following American Society for Microbiology guidelines.<sup>7</sup> Blood Agar, Chocolate agar (incubated at 37°C+5% CO<sub>2</sub>)

and MacConkey's Agar (incubated at 37°C) plates were used for isolation of pathogens. SIM, TSI, Simmon's citrate, urea and oxidation fermentation media and oxidase tests were used for identification of Gram negative organisms.

Staphylococcus spp. were identified on the basis of catalase and coagulase tests, reaction on mannitol salt agar and DNase test. Sensitivity testing was performed by Kirby Bauer disk diffusion method on Mueller Hinton Agar (MHA).

**RESULTS:**

During one year study period postoperative wound infection developed in 82 (7.3%) patients out of total 1120 surgeries performed in the selected ward. There were 48 (58.5%) males and 34 (41.5%) females. Culture and sensitivity testing was performed in 71 (86.6%) cases who developed infection. *Escherichia coli* (n=24 - 33.8%) was the most commonly isolated pathogen followed by *Pseudomonas aeruginosa* (n=12-16.9%),

**Table I: Resistance Pattern of Pathogens Isolated From Surgical Site Infection**

Pathogen Antibiotic	<i>E. coli</i> (n=24) (%)	<i>Ps. aeruginosa</i> (n=12) (%)	<i>S. aureus</i> (n=11) (%)	<i>K. pneumoniae</i> (n=4) (%)	<i>Enterococcus spp.</i> (n=1) (%)
Ampicillin	24 (100)			4 (100)	0 (0)
Augmentin	24 (100)			3 (75)	0 (0)
Amikacin	3 (12)	8 (66)	5 (45)	1 (25)	
Aztreonam		4 (33)		3 (75)	
Meropenem	3 (12)	9 (83)		1 (25)	
Ceftriaxone	24 (100)			3 (75)	
Vancomycin			0 (0)		0 (0)
Ofloxacin	22 (93)	10 (91)	10 (91)	3 (75)	
Clindamycin			8 (72)		1(100)
Fusidic acid			4 (36)		
Tetracyclin		12 (100)	5 (45)		1(100)
Gentamycin	19 (79)	12 (100)	3 (27)	4 (100)	1(100)
Penicillin			11 (100)		1(100)
Tazobactam	11 (47)	9 (75)		2 (50)	
Ceftazidime		12 (100)			
Co-trimaxazole	22 (93)		9 (82)		
Polymixin B		0 (0)			

*Staphylococcus aureus* (n=11 - 15.5%), *Klebsiella pneumoniae* (n=4 - 5.6%) and *Enterococcus spp.* (n=1 - 1.4%). Mixed growth of Gram positive (coagulase negative Staphylococci, Streptococcus) and gram negative organisms (*E.coli*, *Klebsiella pneumoniae*, *Acinetobacter spp.*) were noted in 18 (25.3%) cases. No growth was observed in one (1.4%) patient. Resistance patterns of these organisms to commonly prescribed antibiotics is shown in table I.

#### DISCUSSION:

Postoperative wound infections are one of the most common forms of nosocomial infections that can complicate the surgical procedure.<sup>8</sup> Surveillance for PWI is an essential part in control and prevention of PWIs. Bacterial culture of infected wounds depicted *E.coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* as the common pathogens. These results are similar to other studies carried out in Iran and Nepal that have reported same organisms associated with PWI.<sup>9,10</sup>

Few previous studies showed a higher proportion of Gram positive organisms, specially *Staphylococcus aureus*, associated with PWI.<sup>1,11</sup> In present study and some other recent studies, predominance of Gram negative organisms in PWI is reported.<sup>3,11</sup> This difference in the pattern of distribution of pathogens in different setups can be explained by the fact that distribution of pathogens involved in infection process is usually dependent on the study population and local antimicrobial use pattern which results in the emergence of pathogens that have the potential to resist currently used antibiotics.<sup>12</sup> Another reason for the predominance of Gram negative organisms may be the fact that most of the infected patients in our study had undergone abdominal surgery and gram negatives are predominantly reported to be involved in intra-abdominal procedures.<sup>13</sup>

Antimicrobial sensitivity testing of the isolates showed higher rates of multidrug resistant (MDR) strains of these organisms in PWI. All the *E.coli* isolates were resistant to cephalosporins including ceftriaxone and cefixime and 92% of isolates were also resistant to ofloxacin. Saini et al from India has also described almost similar higher rates of resistance in *E.coli* isolates against ofloxacin and gentamicin but they have reported much higher resistance against amikacin compared to our results. On the contrary we have observed much higher rates against cephalosporins as compared to their study.<sup>14</sup> A similar study carried out in Nigeria has also reported similar rates of resistance in *E.coli* isolates except for cephalosporins which was 66.7%

in their study.<sup>15</sup>

*Pseudomonas aeruginosa* strains also showed increased resistance to various commonly used antibiotics including ofloxacin, ceftazidime, tazocin and tetracycline. Other studies reported from Nigeria, India and Saudi Arabia also suggest increasing resistance in pseudomonas isolates but resistance observed against ceftazidime in our study was quite high than reported in these studies.<sup>14-16</sup>

This increased resistance against cephalosporins and ofloxacin might be the result of increased use of these antibiotics as these antibiotics are extensively used in the selected ward for prophylaxis as well as postoperatively to prevent infections and as empirical treatment for infected cases. Literature suggests that antibiotic use is proportional to antibiotic resistance.<sup>12</sup>

All the *Staphylococcus aureus* strains were resistant to methicillin (MRSA). Rapidly increasing rates of MRSA causing surgical site infections are being reported in other studies as well.<sup>7</sup> Zoumalan et al reported that 80% of *Staphylococcus aureus* strains involved in wound infection after face-lift surgery were MRSA. Taylor et al has reported 58% of infections in vascular surgery to be contributed by MRSA. Resistance to ofloxacin was also common which may be attributed to its frequent use in routine practice. Resistance to gentamycin was low while none of the *Staphylococcus aureus* strains exhibited vancomycin resistance which is consistent with other studies.<sup>14,15</sup>

Although nosocomial infections are usually associated with resistant organisms due to selective use of antibiotics in the hospital environment but the present study showed much higher rates of resistance among organisms commonly associated with wound infections which is quite alarming. A proper infection control system should be established to continuously monitor the pattern of different pathogens and their source. It is also important to establish guidelines for antibiotic use so as to control the emerging antibiotic resistance problems in hospitals.

#### CONCLUSION:

Gram negative organisms with multiple drug resistance are commonly associated with PWI.

#### REFERENCES:

1. Tacconelli E, De Angelis G, Cataldo MA, Mantengoli E, Spanu T, Pan A, et al.

- Antibiotic usage and risk of colonization and infection with antibiotic resistant bacteria: A hospital population based study. *Antimicrobial Agents Chemother.* 2009;53:4264-9.
2. Lichtenstern, C, Schmidt J, Knaebel HP, Martin E, Bochler MW, Weigand MA. Postoperative bacterial/fungal infections: A challenging problem in critically ill patients after abdominal surgery. *Dig Surg.* 2007;24:1-11.
  3. Emori TG, Gaynes RP. An overview of nosocomial infections, including the role of the microbiology laboratory. *Clin Microbiol Rev.* 1993;6:428-42.
  4. Collier, M. Recognition and management of wound infections. 2004. [Internet] Available online at: [www.worldwidewounds.com/-2004/january/Collier/Management-of-Wound-infections.html](http://www.worldwidewounds.com/-2004/january/Collier/Management-of-Wound-infections.html)
  5. Lapsley HM, Vogels R. Quality and cost impacts: prevention of post-operative clean wound infections. *Int J Health Care Qual Assur.* 1998;11:222-31.
  6. Tahir MS. Surgical wounds and prevention of infection in the hospital. *The Professional.* 1995;2:173-81.
  7. Murray PR. *Manual of Clinical Microbiology*, 7<sup>th</sup> Edition, ASM Washington DC. 1999.
  8. Oluwatosin OM. Surgical wound infection: A general overview. *Ann Ibadan Postgrad Med.* 2005;3:26-31.
  9. Giri BR, Pant HP, Shankar PR, Sreeramareddy CT, Sen PK. Surgical site infection and antibiotics use pattern in a tertiary care hospital in Nepal. *J Pak Med Assoc.* 2008;58:148-51.
  10. Razavi SM, Ibrahimpur M, Kashani AS, Jafarian A. Abdominal surgical site infections: incidence and risk factors at an Iranian teaching hospital. *BMC Surg.* 2005;5.
  11. Geubbels ELPE, Groot JM, Berg JMJ, Boer AS. An operating surveillance system of surgical site infections in the Netherlands: Results of the PREZIES national surveillance network. *Infect Control Hosp Epidemiol.* 2000;21:311-8.
  12. Livermore D. Minimizing antibiotic resistance. *Lancet Infect Dis.* 2005;5:450-9.
  13. Mofiloayo B, Neimogha M, Ogunsola F, Atoyebi O. Bacterial agents of abdominal surgical site infections in Lagos, Nigeria. *Eur J Sci Res.* 2009;38:509-13.
  14. Saini S, Gupta N, Lokveer A, Griwan MS. Surgical infections: A microbiological study. *Braz J Infect Dis.* 2004;8:118-25.
  15. Nwachukwu NC, Orij FA, Okike UM. Antibiotic susceptibility patterns of bacterial isolates from surgical wounds in Abia state University Teaching Hospital Aba-Nigeria. *Res J Medicine Med Sci.* 2009;4:575-9.
  16. Moataz M, Fattah B. Surveillance of nosocomial infections at Saudi Arabian military hospital for a one-year period. *GMS Ger Med Sci.* 2005;3.
  17. Taylor MD, Napolitano LM. Methicillin-resistant *Staphylococcus aureus* in vascular surgery; increasing prevalence. *Surgical Infections.* 2004;5:180-7.