ORIGINAL RESEARCH PAPER

Volume-7 | Issue-10 | October-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EPIDEMIOLOGY OF PSUEDOMONAS AERUGINOSA IN SURGICAL SITE INFECTION IN A REFFERAL HOSPITAL IN HYDERABAD, INDIA

Medical Science

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ABSTRACT

BACKGROUND: The main objective of this study was to determine the prevalence of pseudomonas aeruginosa's in the surgical site infection patient and its susceptibility to commonly used antibiotics.

MATERIALS AND METHOD: During a period of 1 year, specimens were collected as the postoperative wound swabs in the microbiology department, owaisi hospital and research centre, Hyderabad, India.

RESULT: Out of 100 samples collected, 30 samples were of p.aeruginosa, followed by 20 samples of E.coli, klebsiella sps 17 samples, staphylococcus aureus 14 samples, proteus sps 6 samples, acinetobacter 3 samples, citrobacter freundii 1 sample, there was no growth in 9 specimens.

CONCLUSION: p.aeruginosa isolation was higher in male patients, in the age group of 21-40 years. The susceptibility pattern showed the organism to be most commonly susceptible to imipenem, meropenem, cefoperazone/sulbactam, ticarcillin/clavulanate, and amikacin.

KEYWORDS

Pseudomonas Aeruginosa, Surgical Site Infection, Prevalence, Nosocomial, Antibiotics.

INTRODUCTION:

Surgical site infection is an important cause of infections among surgical patients. Patients who develop wound infections have longer hospital stays, more expensive hospitalizations, and increased mortality.[1] The development of wound infections depends on the integrity and protective functions of the skin.[2]

Pseudomonas aeruginosa is a leading cause of infections, ranking second among gram-negative pathogens as reported by the United States national nosocomial infection surveillance system. *P. aeruginosa* contributes substantially to wound-related morbidity and mortality worldwide. The organism enters into the blood, causing sepsis that may spread to the skin and leads to ecthyma gangrenosum, a black necrotic lesion.[3] It produces several substances that enhance the colonization and infection of host tissue.[4] These substances together with a variety of virulence factors, including lipopolys accharides (LPSs), exotoxin A, leukocidin, extracellular slime, proteases, phospholipase, and several other enzymes, make *P. aeruginosa* the most clinically significant pathogen among non-fermenting bacteria. *P. aeruginosa* carry plasmids containing genes that regulate antimicrobial resistance, and this feature has led to the appearance of some strains that are resistant to antibiotics.[5] Out of these, there are multiple reasons for surgical site infections, which have been validated and documented as risk factors.

A risk factor is any recognized contribution to an increase in surgical site infection.[6] The virulence and invasive capability of the organisms have been reported to influence the risk of infection, but the physiological state of the tissue in the wound and immunological integrity of the host seem to be of equal importance in determining whether infection occurs.[7] Primary infections are usually more serious, appearing within 5–7 days of surgery, are mostly related to endogenous flora and some other environmental sources in the operating theater. The deep-seated sepsis develops within 30 days after a surgery and before the wound has been dressed implies a theater infection.[8] Some of the studies support the concept that a reduction in surgical site infection is directly related to increased education and awareness of its causes, and its prevention is greatly aided by critically evaluated infection control practice.[9] The prevalence of surgical site infection is related to the cleanliness of the operation. Clean operation (<2%) does not involve cutting across mucus membranes. In contaminated operations (20%), involves cutting across mucus membrane and colonization of the bacteria, while in clean–contaminated operations (<10%), a viscous or membrane which is usually sterile, is incised.[10] Surgical site infections tend to be more superficial and frequently follow the dressing of wounds in the ward. The skin infections such as boils or abscesses developing at sites other than the operation site indicate that the infection was acquired in the hospital.[7] surgical site infection after contaminated operations is usually caused by the bacteria normally living in the opened viscous or on the incised mucus membrane, i.e. the bacteria belong to the patient's own normal flora(microorganisms), or have gained entry while the patient is in a hospital.[11]

Bacteriological studies have shown that surgical site infection is universal and that the bacterial types present vary with geographic location, bacteria residing on the skin, clothing at the site of wound, time between wound and examination.[12] Facultative anaerobic gram-negative bacilli, Streptococci and Staphylococci remain in the colon, regardless of the type of preparation.

The incidence of *P. aeruginosa* in surgical site infection is becoming more serious in developing countries because of lack of general hygienic measures, low quality antiseptic and medicinal solutions for treatment, and difficulties in proper definition of the responsibilities among the hospital staff.[13] The hospital-acquired nature of infections with *P. aeruginosa* has been noted and while some patients suffer endogenous infections, the vast majority is acquired from exogenous sources. So, the objective of our study was to determine the prevalence of *P. aeruginosa* in the surgery patients in our hospital and its antimicrobial susceptibility pattern.

MATERIALS AND METHOD: The study out in the bacteriology laboratory, department of microbiology, owaisi hospital and research center, Hyderabad, India. All the specimens collected from patients hospitalized from September 2017 to August 2018 were processed for isolation and identification of bacterial pathogens, according to the standard microbiological techniques.[14]

Specimens: Surgical site infection swabs were collected aseptically with two sterile cotton wool swabs for each sample. One swab was for Gram stain and the other one was for culture.

Culture media and biochemical test: The following media were used and tests were conducted in this study: blood agar, MacConkey agar, chocolate agar, nutrient agar, mannitol salt agar, Simmon citrate agar, peptone water, indole production test, motility test, methyl red test, voges proskauer test, catalase, coagulase, urease, and oxidase tests. The plates were incubated at 37°C for 18–24 hours in an incubator. Isolated colonies were subjected to Gram staining and biochemical tests for identification. Identification was carried out according to the standard biochemical tests.[14]

Antimicrobial susceptibility: Antimicrobial susceptibility test were carried out on isolated and identified colonies of *P. aeruginosa* using commercially prepared antibiotic disk on Mueller Hinton agar plates by the disk diffusion method, according to the Central Laboratory Standards Institute (CLSI) guidelines.[15]Antibiotics used in the study were piperacillin (100 µg), ceftazidime (30 µg), cefepime (30 µg), imipenem (10 µg), meropenem (10 µg), ampicillin/sulbactam (10/10 µg), piperacillin/tazobactam (100/10 µg), ticarcillin/ clavulanate (75/10 µg), cefoperazone/sulbactam (75/10 µg), gentamicin (10µg),

tobramicin (10 µg), amikacin (30 µg), and ciprofloxacin (5 µg).

RESULT ANDD DISCUSSION: A total of 100 specimens were obtained from postoperative wounds, including superficial and deep-seated infections of all patients hospitalized

Isolation: Out of 100 samples,30 samples were of p.aeruginosa, followed by 20 samples of E.coli, klebsiella sps 17 samples, staphylococcus aureus 14 samples, proteus sps 6 samples, acinetobacter 3 samples, citrobacter freundii 1 sample, there was no growth in 9 specimens

ORGANISM	NO OF SAMPLES(100)	%
p.aeruginosa	30	30%
E.coli	20	20%
Klebsiella sps	17	17%
S.aureus	14	14%
Proteus sps	06	6%
acinetobacter	03	3%
Citrobacter freundii	01	1%
No growth	09	9%

The occurrence of Pseudomonas aeruginosa in post-operative wound infection in relation to age. The age groups were divided into several categories: 10-20, 21-30, 31-40, 41-50, 51-60, 61-70 and 71 and above. The result showed that the occurrence of Pseudomonas aeruginosa was higher in young groups than in the other groups.

AGE	NO OF SAMPLES total	NO OF SAMPLES OF P.aeruginosa	% of p.aeruginosa
10-20	10	4	0.4%
21-30	25	10	1%
31-40	22	6	0.6%
41-50	14	3	0.3%
51-60	10	2	0.2%
61-70	07	1	0.1%
71- above	12	4	0.4%

Susceptibility: *P. aeruginosa* was most commonly susceptible to imipenem (77%), followed by meropenem (70%), cefoperazone/sulbactam (59%), ticarcillin/clavulanate (51%), and amikacin (43%)

ANTIMICROBIAL AGENTS	% SUSCEPTABILITY
Imipenem	77%
Meropenem	70%
Cefoperazone/sulbactam	59%
Ticarcillin/clavulanate	51%
Amikacin	43%

This study shows that *P. aeruginosa* was most prevalent (30%) among all the pathogens isolated from the surgical wound. In this study, it was most commonly isolated in procedures involving drainage of abscesses and diabetic foot operations, followed by cesarean section operations.

When factors such as age and sex of the patient were considered, we found the occurrence of *P. aeruginosa* to be higher in males and in patients in the age group 21–40 years. We found the prevalence rate to be higher in male (58%) patients compared to females (42%).

The maximal susceptibility of *P. aeruginosa* isolates was against imipenem (77%) and meropenem (70%).we found carbapenems to be the most successful drugs against *P. aeruginosa*, there is a likelihood of resistance to even these as seen in studies carried out on multidrug-resistant phenotype of *P. aeruginosa*.[24] Resistance to carbapenems is most likely to occur by the interplay of excess β-lactamase production, impermeability via a loss of porin protein Opr D, together with the up-regulation of multidrug efflux systems, primarily MexA MexB Opr M.[25] This study shows that there is an increased rate of incidence of *P. aeruginosa* in surgical site infections. The most common causative agent of postoperative infections was *P. aeruginosa*, followed by *E. coli*, *Klebsiella* spp., *S. aureus*, *Proteus* spp., and *Acinetobacter* calcoaceticus. Other less common causes were *Streptococcus pyogenes, Enterococcus faecalis* and *C. freundii* [26]. This is in agreement with survey studies carried out in various hospitals. The infection appears to be common in hospitals with less hygienic measures and is dependent on age, sex and even duration of stay in the hospital. The primary reason for this increase in surgical site infection rate with prolonged preoperative hospitalization may be the colonization of patients with hospital-acquired resistant microorganisms.

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