The scenario of post operative wound infection from a Government hospital in South India

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ABSTRACT

Over the past 50 years, increased interest in the discipline of surgical infection has resulted in advances in post-surgical infection control. Seventy eight clinical isolates in a period of six months were processed and the antibiotic susceptibility was determined by double disk approximation test, the ESBL production was screened with phenotypic confirmatory methods using disks of Ampicillin (A-10 µg), amoxicillin (AM-10 µg), Amoxicillin-Clavulanic acid (AC-20/10 µg), Penicillin (P-30 µg), Cephalexin (CX-10 µg), Norfloxacin (NX-30 µg), Tetracyclin (T-30 µg), Vancomycin (VA-30 µg), Chloramphenicol (C-30 µg), Erythromycin(E-15 µg), Gentamicin (G-10µg), Ciprofloxacin (CF-5µg), Meropenem (MR-10 µg). Among the 78 isolates, (28 %) Staphylococcus aureus, (20 %) Escherichia coli, (8%) Pseudomonas spp. 4(5%) Klebsiella spp. (1%) Proteus spp. (12%) coagulase negative Staphylococcus spp. and (20 %) others were obtained. Of the 14 strains tested, (62 %) were found to be ESBL producers, out of which 46% strains of Escherichia coli and 58 % strains of Klebsiella spp. were detected. Perioperative antibiotic prophylaxis can decrease the incidence of such infections further, but a technically perfect operation is even more important.

Keywords: Surgical site infections, ESBLs, antibiotic prophylaxis

INTRODUCTION

Surgical site infections represent a substantial burden of disease for patients and health services. Although the total elimination of wound infection is not possible, a reduction in the infection rate to a minimal level and spread of resistant pathogens could have significant benefits in terms of both patient comfort and medical resources used [1]. Patients with such infections experience substantial morbidity, pain and discomfort, inconvenience and cost. From the perspective of health services, patients with surgical site infections are prone to stay in hospital on average about twice as long as uninfected patients hence leading to the cost of total care being doubled. The pathogenic organisms which are responsible for wound infections depend on the surgical site, portal of entry, the study population and antimicrobial use within the hospital. Wound infections are among the most common serious complications of anesthesia and surgery so far in nosocomial settings [2, 3]. Post-operative wound infections can be caused through two major sources either exogenous or endogenous bacteria. The probability of wound infections largely depends on the patients’ systemic host defenses, local wound conditions and microbial burden.
Data from the National Nosocomial Infections Surveillance System reveals that the most common incisional surgical site infection pathogens are *Staphylococcus aureus*, *Enterococcus* species, coagulase negative *Staphylococcus*, *Enterobacteriaceae*, non lactose fermenters and anaerobes [4]. The most frequent co-resistances which are found in ESBL producing organisms are aminoglycosides, fluoroquinolones, tetracyclines, chloramphenicol and sulfamethoxazole-trimethoprim [5,6]. The presence of a microorganism within the margins of a wound does not indicate that wound infection is inevitable, but adds to the complications of infections [7]. Some bacteria produce proteins that kill or inhibit other bacteria while in some other cases, bacteria produce a variety of metabolites that competitively inhibits the multiplication of other microorganisms [8]. The development of an infection will be influenced largely by the virulence of the organism and immunological status of the patient. It is obvious that postoperative wound infections produced by resistant bacteria present a doubly serious problem since the patient is deprived of treatment with effective antibacterial agents. This study examined the risk factors for postoperative wound infection prospectively in a government hospital setting.

### MATERIALS AND METHODS

A total number of 78 isolates which were obtained from 100 pus samples / wound swabs were collected with aseptic precautions and were transported to the laboratory without delay. The samples were obtained from patients who were admitted to the hospital between June to December. Patients had their wounds inspected 72 hours post operatively and alternate daily if signs of infection were seen. In all cases preoperative, postoperative information was collected in a case record form for age, sex, date of admission, preoperative antibiotic prophylaxis etc. Wound swabs or aspirates were taken from all discharges for microscopy, culture and sensitivity study. The samples for wound infections were collected and were immediately cultured on Blood agar, Mac Conkey's agar and Nutrient agar, followed by the identification of the isolates based on their cultural characteristics and their reactions in standard biochemical tests.

The colonies from Nutrient agar were used for biochemical tests and antibiotic sensitivity on isolation for Gram positive cocci, catalase and coagulase tests were done. Gram negative bacilli were distinguished using biochemical tests IMViC, oxidase, TSI. After confirmation of the organism, culture growth was tested for in vitro antibiotic susceptibility testing performed by disc diffusion on MHA. All the isolates were tested for antimicrobial susceptibility by the disk diffusion technique according to the Clinical and Laboratory Standards Institute [9] guidelines on Muller Hinton Agar. The included included antibiotics are Amoxicillin (A-10 µg), Amoxicillin (AM-10 µg), Amoxycillin-Clavulanic acid (AC-20/10 µg), Penicillin (P-30 µg), Cephalexin (CX-10 µg), Norfloxacin (NX-30 µg), Tetracyclin (T-30 µg), Vancomycin (VA-30 µg), Chloramphenicol (C-30 µg), Erythromycin(E-15 µg), Gentamicin (G-10µg), Ciprofloxacin (CF-5µg), Meropenem (MR-10 µg); (Hi-Media, Mumbai). The results were recorded and interpreted as per the recommendations of the Clinical Laboratory Standards Institute. The screening for ESBL production was done by the phenotypic confirmatory test by using ceftazidime disk in the presence of clavulanic acid [10].

#### Test for ESBL enzyme production

**Screening for ESBL producers-Double disk approximation method**

Test strains were pre incubated in brain heart infusion broth at 37°C to an optical density of 0.5 McFarland turbidity Standard .This suspension was inoculated in Muller Hinton agar plates by swabbing with sterile cotton swabs, the standard disks containing 30 µg of aztreonam, ceftazidime or ceftriaxone were placed 15 mm (edge to edge) along with other antibiotic disks and incubated overnight at 37°C for 18 to 24 hours to screen for multidrug resistant strains [11]. Bacterial susceptibility to all antimicrobials was determined according to CLSI guidelines. When using disk diffusion method *E.coli* and *K.pneumoniae* a zone inhibition diameter lower than the following values cefazidime (<22mm), cefotaxime and aztreonam (<27mm), ceftriaxone (<25mm), cefpodoxime (<17mm) were investigated with confirmatory tests [12].

#### ESBL phenotypic confirmatory method and MDR screening

ESBL phenotypic confirmatory test was done using standard ceftazidime disks with and without clavulanic acid (js). A greater than or equal to 5mm increase in the zone diameter with clavulanate and ceftazidime versus ceftazidime alone confirmed an ESBL production. Multidrug resistant isolates were screened for metallo beta lactamase production using 0.5M EDTA. The presence of an enlarged zone of inhibition towards the EDTA disk was interpreted as positive double disk synergy test for an MBL producer. MIC was determined by agar dilution method for all meropenem resistant isolates, using 64 µg / mL to 0.25 µg / mL concentration.

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RESULTS

A total number of 78 isolates were obtained from 100 pus samples / wound swabs which were collected from clinically suspected post-operative wound infections. Twenty-three per cent of the samples showed no growth. Fifty one % of the patients were males, while 36 % were females. The male to female ratio was 1.3: 1. Wound infection occurred in (5.2%) males while (2.1%) females developed wound infection. The difference in infection between sexes was not statistically significant (P=0.804). The age range was 7 to 83years. All the infected cases [9 (9.3%)] had a theatre population of more than six persons. The Fisher exact test was used to analyse the relationship between OPD and theatre population. There was no significant contribution from theatre population (P=1).
The colony forming unit for all the isolates were > 32 CFU/ml.

Among the 78 isolates, (28 %) were *Staphylococcus aureus*, (20 %) were *Escherichia coli*, (8%) were *Pseudomonas spp.* 4( 5% ) were *Klebsiella spp.* (1%) were *Proteus spp.* (12%) were Coagulase negative *Staphylococcus* spp. and (20 %) were others (Fig-1). *Staphylococcus aureus* was generally sensitive to Vancomycin(100%), Gentamycin(100%) and Cephazolin (98.2%), but was resistant to Ampicillin (20%) and Ampicillin-Clavulanic acid (37.7% data not shown). A majority of the isolates were resistant to Vancomycin and Gentamycin. 1.8 % of the *Staphylococcus aureus* isolates were MRSA. Most of the gram-negative bacteria isolated were *Escherichia coli*, *Proteus mirabilis* and *Pseudomonas aeruginosa* found sensitive to quinolones and aminoglycosides, and 14 were resistant to ciprofloxacin, cephalosporins (40%). Of these, 14 strains which were tested (Fig-2), (62 %) were found to be ESBL producers, out of which 46% strains of *Escherichia coli* and 58 % strains of *Klebsiella* were detected. The sensitivity pattern of each isolate to various antibiotics which were used in our study, are shown in (Fig-3).

DISCUSSION

Post-operative wound infections have been posed a major problem in the field of surgery for a long time. The surveillance of nosocomial infections with an emphasis on antimicrobial audit will reduce the risk of post-operative wound infections this should be replaced with newer antibiotics [14]. The impact of organism such as *methicillin-resistant S.aureus*, vancomycin-resistant enterococci, and resistant gram-negative non lactose fermenting organisms on hospitalized patients in general, but on causation of wound infection in particular, cannot be overemphasized [15]. In this study we found that age is not influenced by wound infection contrary to [16], and it is unlikely except for immuno compromised age groups. The overall wound infection rate subsequently decreased from 4.2% to 2.5%.12. Most of our isolates had > 30 (CFU), 30 or more colony-forming units (CFU) of bacteria cultured from a wound are predictive of wound infection, regardless of wound class involved [17]. Antibiotic prophylaxis can decrease postoperative morbidity, shorten hospital stay, and reduce overall costs attributable to infection and mortality [18].1. It is important that timely use of antibiotics will prevent wound infections after surgery and longevity [19].

As indicated in many previous studies [20], *Staphylococcus aureus* was the most frequently isolated pathogenic bacteria from post-operative wounds. Cephazolin can be the antibiotic of choice for the surgical prophylaxis of this organism. Most of the gram-negative bacteria which were isolated *Escherichia coli*, *Proteus mirabilis*, *Klebsiella spp.* and *Pseudomonas aeruginosa* were sensitive to quinolones and aminoglycosides. Extended Spectrum Beta Lactamase producing strains of *Escherichia coli* and *Klebsiella* spp. among the clinical isolates have been steadily increasing over the past few years, resulting in limitations of therapeutic options [21]. There is a need to reduce the cost which is potentially associated with antibiotic misuse viz. use of high-end antibiotics, multiple antibiotics / irrational combinations and the prolonged duration of treatment. The frequency (65.2 %) of ESBL producers found in our study was comparable to that found in previous studies which were reported [3]. All the ESBL producer isolates were found to vary in their sensitive to the beta-lactam and beta lactamase inhibitor combinations and had 97 % sensitivity to Carbapenems. With the spread of ESBL positive strains in hospitals, co-resistances can be found to Aminoglycosides, Fluoroquinolones, Tetracyclines, Chloramphenicol and Sulfamethoxazole-Trimethoprim. Updating the antibiogram periodically will further reduce the rate of post-operative wound infections to a considerable extent and will reduce therapeutic challenges [22]. *Pseudomonas aeruginosa* showed reduced sensitivity to commonly used antibiotics except ciprofloxacin (83.7%) and meropenem (51.3%). The duration of surgery is one factor that influences the wound infection. Surgical Procedures that take longer than two hours are largely associated with higher infection rates [23]. Fewer bacteria are required to produce an infection in the...
presence of necrotic tissue, foreign bodies, haematomas, seromas and poor tissue perfusion enough to aggravate the health of ailing patients. In this study, the theatre population during the procedure was found to be significantly associated with occurrence of postoperative wound infection following surgery. Other risk factors which were found to be contributory to development of postoperative infection in other studies including age and sex, were found not to be contributory in this study.

Figure-1 Percentage of organisms isolated from wound infection

![Figure-1 Percentage of organisms isolated from wound infection](image1)

Figure-2 Test for ESBL detection with Ceftazidime and Amoxy-clav antibiotic disks

![Figure-2 Test for ESBL detection with Ceftazidime and Amoxy-clav antibiotic disks](image2)

CONCLUSION

Surgical wound infections are common and consume a considerable portion of health care finances. Although surgical wound infections cannot be completely eliminated, a reduction in the infection rate to a minimal level could have significant benefits, by reducing postoperative morbidity and mortality, and wastage of health care resources. Infections are established during a decisive period lasting a few hours after contamination. Adequacy of host immune defenses is the primary factor determining whether inevitably wound contamination progresses into a clinical infection. A pre-existing medical illness, prolonged operating time, the wound class and its contamination strongly predispose to infection. Recent improvements in antibiotic prophylaxis, including the timing of initial administration, appropriate choice of antibiotic agents, and shortening the duration of administration have established the value of this technique in many clinical surgical settings. A single dose systemic regimen of an appropriately chosen cephalosporin given during the immediate preoperative period is safe. A concentrated effort should be made in areas of clinical surgery, where the value of antibiotic prophylaxis has not been proven. Major outcome studies demonstrate that the risk of surgical wound infection is reduced threefold simply by keeping patients normothermic. The judicious use of antibiotic prophylaxis and the use of an organised system of wound
surveillance and reporting are the most effective means to reduce the wound infection rate to an attainable minimum.

Figure-3 Antibiotic sensitivity pattern of isolates

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REFERENCES