A Study on the Antibiotic Sensitivity Pattern in the Post - Operative Wards of a South Indian Hospital

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ABSTRACT

Submitted: 04/02/2013 **Accepted: 21/05/2013**

Purpose: Surgical site infection (SSI) is a common post - operative complication which causes significant morbidity and mortality. Studies showed that surgical site infections prolong the hospital stay, healing of wound and add extra hospital cost. The study was undertaken to explore the antibiotic sensitivity pattern of the microorganisms isolated from the surgical wounds of the patients admit in the post-operative wards in a secondary care hospital. **Methods:** Microorganisms were isolated, identified and the antibiotic sensitivity pattern of the isolates were performed using standard methodology. **Results:** A total of 150 surgical wound swab samples were collected and scrutinized. Among this, 90 samples showed infections. Four microorganisms were identified in the 90 infection cases. *Staphylococcus aureus* and *Pseudomonas* species were the most common microorganisms isolated; other microorganisms were *Escherichia coli* and *Streptococcus* species. The empirical prescribing guidelines of the antibiotics were observed during this study. **Conclusion:** Ceftriaxone and ciprofloxacin showed maximum sensitivity pattern when compared to other antibiotics used in the hospital. Hospital disinfection and treatment protocols should be practiced vigorously and monitored regularly by hospital infection control committee to keep the incidences in control and hospital guidelines for antibiotic prophylaxis are warranted.

Keywords: Surgical site infection, Antibiotics, Microorganisms, *Staphylococcus aureus.*

INTRODUCTION

India has an enormous and growing problem in antibiotic abuse. The overuse and inappropriate use of antibiotics has led to antibiotic resistance. Some diseases such as tuberculosis, gonorrhea and childhood bacterial ear infections that were once easily treated with antibiotics are now again becoming difficult to treat as bacteria have become resistant to these drugs.[1] About 70% of bacteria that cause infections in hospitals are resistant to at least one of the antibiotics most commonly used to treat infections.[2] Methicillin (meticillin) resistant *Staphylococcus aureus* (MRSA) is a particular problem for patients with skin diseases, ulcers and surgical wounds.[3] Antibiotic resistance is becoming a cause of increasing concern and is the most common cause of treatment failure in bacterial infectious diseases. In general, there needs to be a sharp distinction between the resistance problems in the health care setting (nosocomial infections) and those encountered in the community (community-acquired infections) based on vast differences in pathogens and resistance patterns. Nevertheless, there has recently been the development of a hybrid form, referred to as "healthcare-associated infections" in reference to patients who have frequent contact with the medical care system, as with a chronic care facility or on outpatient basis. The post-operative complication has brought about considerable financial burden, undue discomfort to the patient, and sometimes even death. They have been responsible for the increasing cost, morbidity and mortality related to surgical operations and continues to be a major problem even in hospitals with most modern facilities and standard protocols of preoperative preparation and antibiotic prophylaxis.[4-5] The laboratory testing of antibiotic susceptibility contributes directly to patient care and the expertise of the microbiology laboratory can have powerful influence on antibiotic usage.[6]

Surgical site infections (SSIs) are linked to a major cause of patient injury and death and consume substantial health care resources.[1] A large percentage of the number of surgical site infections (40% - 60%) is thought to be preventable and as such, characterized as a "never event" medical error. Surgical site infection rates have been cited in the literature as occurring in 2%-5% of patients after clean extra-abdominal surgeries and up to 20% of patients undergoing intra-abdominal procedures. It is difficult to identify nosocomial infections in patients who have been discharged. [7-9] Surgical site infections rank third among nosocomial infections, representing a global threat, associated with the emergence of multi-drug-resistant bacteria. The monitoring of resistance patterns is vital in order to make required formulary changes in response to emerging resistance patterns and to determine the most effective agents given prevailing susceptibility patterns. Based on the above mentioned facts, the study was undertaken to explore the antibiotic sensitivity pattern of the

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microorganisms isolated from the surgical wounds of the patients admitted in the post-operative wards in a secondary care hospital.

MATERIALS AND METHOD

The study was a prospective study conducted at Government Hospital, Ootacamund, Nilgiris, India for a period of 6 months from July 2011 to December 2011. The study protocol was approved by the Institutional Ethical Committee of JSS College of Pharmacy, Ootacamund, Tamil Nadu, India.

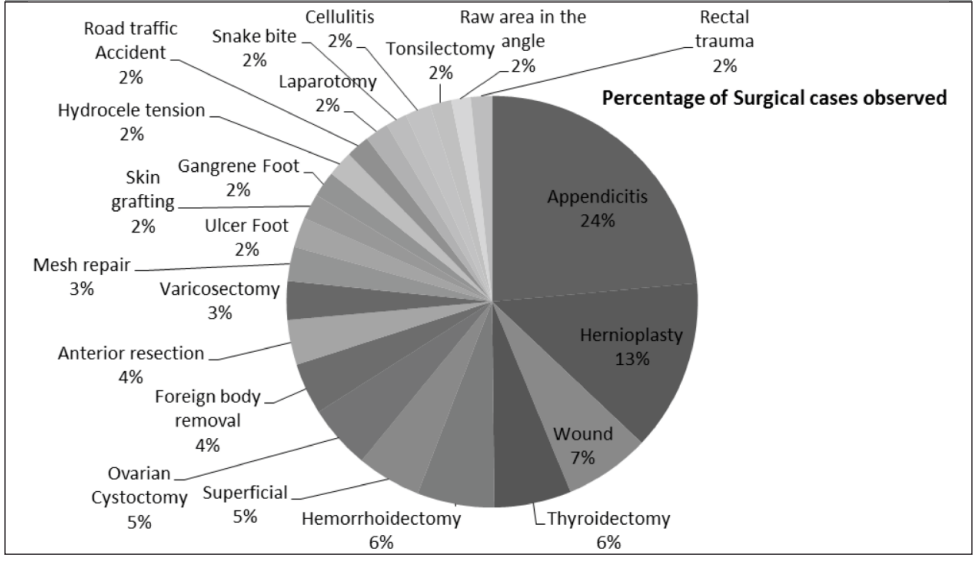
Patients in the post-operative wards after surgery and presence of at least one of the following signs and symptoms of infection: pain or tenderness, localized swelling, purulent drainage site of incision, redness or heat and demonstration of infection on deliberate opening of the wound by surgeons were included in the study. After getting the informed consent, the patient details were entered into the data collection form which included details such as: socio-demographic data, clinical diagnosis, duration of hospitalization, drug data, basis of treatment, and other relevant information. The sources of data collected from the patient medical records and patient case history from the clinic. Those patients who are not willing to give the consent were excluded from the study. The antibiotic usage survey in the surgical wards was performed. The sensitivity of the microorganisms was classified as highly sensitive, medium sensitive and low sensitive based on the diameter of inhibition zone of around the antibiotics disc. An antibiotic where the diameter of zone of inhibition was above 20 cm is highly sensitive, 10 - 20cm is medium sensitive and where the zone of inhibition was below 10 is low sensitive.

The incision swabs were collected from the surgical sites of the patients using sterile Hiculture collecting device (HiMedia). The collected incision swabs were then streaked into the previously prepared agar plates. The plates were then incubated for 24 hours at 32^{0}C. Further these plates were examined for microbial growth cultural and morphological characteristic of the isolates was studied. If growth were found, then a loop of microorganism be taken and again streaked into the different medias. These plates are incubated for 24 hours at 32^{o}C. The antimicrobial sensitivity testing was carried out using standard techniques. The different disc used had contained the following antibiotics: norfloxacin (10mcg), ciprofloxacin (5mcg), erythromycin (15 mcg), ampicillin (10mcg), ceftriaxone (30mcg), cefotaxime (30mcg), doxycycline hydrochloride (30mcg), amikacin (30mcg), chloramphenicol (30mcg), cephalexin (30 mcg), amoxicillin (30mcg), gentamycin (10mcg), cefexime (5mcg), clotrimazole (25mcg), amoxiclav (30mcg), methicillin (5mcg), nitroflurantone (30mcg), ofloxacin (5mcg), meropenem (10mcg), kanamycin (30mcg), rifampicin (5mcg), sparfloxacin (5mcg), clarithromycin (15mcg), trimethoprim (5mcg) and piperacillin/taxobactum (100mcg). The zones of inhibition around the antibiotic disc in the plates were measured using normal measuring scale. Thereby the antibiotic sensitivity level was measured. The data obtained was recorded to develop an antibiotic policy for treatment in the surgical wards.

RESULTS

A total of 594 surgeries were conducted in the surgical wards. Among which, 378 (63%) were male patients and 216 (37%) were female patients who were admitted in the surgical wards. Among the 594 patients, patients with different surgical cases identified was presented in figure 1.

Fig. 1: Comparison of different surgeries carried out (n = 594)



The most commonly used were Cefotaxime (29%) followed by Metronidazole (13%), Ampicillin (13%), Ciprofloxacin (12%), Amoxicillin (12%), Gentamycin (9%), Amikacin (4%), Norfloxacin (3%), Cephalexin (3%), and Ceftriaxone (1%).

A total of 150 incision samples were collected. The number and percentage of surgical cases from which incision swabs were collected is presented in Table 1.

Antibiotics usage in the cases where surgical site infections were identified was noted and it was found that mostly the antibiotics were given as prophylactics. The commonly prescribed antibiotics were Cefotaxime (25%), Metronidazole (12%), Ampicillin (12%), Amoxicillin (12%), Gentamycin (12%), Ciprofloxacin (9%), Ceftriaxone (6%), Norfloxacin (6%), Cephalexin (3%), and Amikacin (2%).

Table 1: Comparison of samples collected from different surgeries

Surgical cases	Number of samples (n = 150)	Percentage (%)
Hernioplasty	30	20
Appendicitis	24	16
Road traffic accident	18	12
Raw area	18	12
Gangrene Foot	12	8
Rectal trauma	9	6
Hydrocycle excision	9	6
Cellulitis	9	6
Varicosectomy	9	6
Ulcer Foot	6	4
Mesh Repair	3	2
Thyroidectomy	3	2

The growth of microorganism in various surgical cases using incision swab were evaluated and studied by colony forming units (CFU were presented in table 2.

The sensitivity of the microorganisms isolated from the incision swabs to the various antibiotics prescribed in the hospital is presented in Table 3. Ciprofloxacin was found to be highly sensitive to all of the microorganisms isolated. Metronidazole was found to be highly sensitive to *Escherichia coli* and *Pseudomonas*. Amoxicillin was found to be medium sensitive to *Staphylococcus aureus*. Gentamycin was found to be low sensitive to P*seudomonas*. Ampicillin was found to be low sensitive to *Streptococcus*. Ceftriaxone was found to be low sensitive to *Staphylococcus aureus*.

DISCUSSION

Out of 594 surgeries performed during the study period, the incision swab was collected for culture and sensitivity testing for 150 cases which were found to develop surgical site infection. Mainly four micro-organisms were identified and isolated namely *Staphylococcus aureus, Streptococcus, Escherichia coli and Pseudomonas*. The study showed that some drugs prescribed in the hospital were resistant to the microorganisms isolated. The present study showed that the *Staphylococcus aureus* was the most common micro-organism isolated from the swab samples which was the most common cause for the surgical site infection. This study finding is in concordance with the results of the studies conducted by Siguan *et al* and Giacometti *et al*. [10, 11]

The antibiotic sensitivity analysis showed that Ciprofloxacin to be highly sensitive antibiotic to all of the microorganisms isolated. Metronidazole was found to be highly sensitive to *Escherichia coli* and *Pseudomonas*. *Amoxicillin* was found to be medium sensitive to *Staphylococcus aureus*.

Table 2: Microorganisms identified in various surgical procedures

Sl no	Diagnosis	Microorganisms identified (CFU)			
		Staphylococcus aureus (n = 6)	Streptococcus (n=5)	Escherichia coli (n=3)	Pseudomonas (n = 3)
1	Hernioplasty	+	-	+	-
2	Road traffic accident	+	+	-	-
3	Rectal trauma	+	-	-	-
4	Hydrocele excision	-	+	-	+
5	Raw area	-	+	-	+
6	Cellulitis	-	-	+	-
7	Gangrene Foot	-	+	-	-
8	Ulcer Foot	-	-	-	+
9	Appendicitis	+	+	+	-
10	Varicosectomy	+	-	-	-
11	Mesh Repair	+	-	-	-
12	Thyroidectomy	-	-	-	-

Table 3: Sensitivity pattern of individual microorganisms isolated to various antibiotics used in the hospital.

Micro-organisms	Metronidazole	Ampicillin	Cefotaxime	Ceftriaxone	Amoxicillin	Gentamycin	Ciprofloxacin
Staphylococcus aureus	R	R	R	LS	MS	R	HS
Streptococcus	R	LS	R	R	R	R	HS
Escherichia coli	HS	R	R	R	R	R	HS
Pseudomonas	HS	R	R	R	R	LS	HS

HS: Highly Sensitive; MS: Moderate Sensitive; LS: Less Sensitive; R: Resistant

Gentamycin was found to be low sensitive to *Pseudomonas*. Ampicillin was found to be low sensitive to S*treptococcus*. Ceftriaxone was found to be low sensitive to *Staphylococcus aureus*. The result of this study clearly emphasizes that the magnitude of surgical wound infection problem may be increasing because of many of the causative organism have probably started to develop some form of resistance to the currently used antibiotics. The overall infection rate in this hospital was 6% which is relatively high based on the generally acceptable surgical infection rate of 5%.[11] The study warrants surveillance of surgical site infection with the feedback of appropriate data to surgeons to reduce the surgical site infection rate.

CONCLUSION

The study showed that the microorganisms isolated from the swabs were resistant to some of the antibiotics prescribed in the hospital. The antibiotic therapy observed in the study was empirical. The various antibiotic sensitivity and resistance pattern of commonly used anti-microbial agents were presented to show a changing trend towards unsatisfactory drug performance. The development of effective control programs through adoption of measures that restrict use of specific antibiotics, establishment of therapeutic guidelines, a constant monitoring of antibiotic resistant pattern of the common pathogenic organisms in the hospital are recommended in order to improve the use of antibiotics. This information can guide surgeons in particular and physicians in general in the fight against surgical site infection. These efforts offer patients a more optimistic outlook on their change of acquiring this post-operative complication.

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