Surveillance and Management of Nosocomial Infections in Tertiary Care Teaching Hospital

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ABSTRACT

Aims and Objectives: To monitor and evaluate possible hospital acquired infections and co-morbidities accompanying nosocomial infection, and monitor the risk factors.

Materials and Methods: It is a prospective and observational study of six months in the department of general medicine. 100 patients satisfying inclusion criteria were evaluated.

Results: The present study showed that ceftriaxone was most commonly prescribed antibiotic, followed by combination of piperacillin with tazobactam and amoxicillin with clavulanic acid. However multiple-therapies were found to be 22%.

Conclusion: The present surveillance study suggests that continuous target monitoring, regular analysis of high-risk factors, and timely intervention measures could effectively reduce the incidence of nosocomial infections. The present study points out the need for improved patient education on adherence to therapy and development of antibiotic prescribing guidelines.

Keywords: Hospital acquired infections, prescribing pattern, antibiotics, rationale, and infections.

Introduction

Nosocomial' or 'healthcare associated infections' appear in a patient under medical care in the hospital or other health care facility which was absent at the time of admission. These infections can occur during healthcare delivery for other diseases and even after the discharge of the patients. Additionally, they comprise occupational infections among the medical staff [1]. Invasive devices such as catheters and ventilators employed in modern health care are associated to these infections [2]. Populations at stake are patients in intensive care units (ICUs), burn units, undergoing organ transplant and neonates [3]. With

increasing infections, there is an increase in prolonged hospital stay, long term disability, increased antimicrobial resistance, increase in socio-economic disturbance, and increased mortality rate. Spare information exists on burden of nosocomial infections because of poorly developed surveillance systems and inexistent control methods. For instance, while getting care for other diseases many patients probably get respiratory infections and it becomes troublesome to spot the prevalence of any nosocomial infection in continuation of a primary care facility [4]. These infections get noticed only when they become epidemic, yet there is no institution or a country that may claim to have resolved this endemic problem [5].

Antibiotics are greatly used to cure illness. Antimicrobial use should justify the proper clinical diagnosis or an infection causing microorganism. The Centres for Disease Control and Prevention (CDC) estimates that each year about 100 million courses of antibiotics are prescribed by office-based physicians, while approximately 50% of those are unnecessary [6]. The selection of antimicrobials should be based upon the patient's tolerance in addition to the nature of disease and pathogen. The aim of antimicrobial therapy is to use a drug that is selectively active against most likely pathogen and least likely to cause resistance and adverse effects [7]. Antimicrobial prophylaxis should be used when it is appropriate i.e. prior to surgery, to reduce postoperative incidence of surgical site infections. In case of immuno-compromised patients, prolonged prophylaxis is used until immune markers are reinstating [8].

Antibiotic resistance is responsible for the death of a child every five minutes in South-East Asia region. Drugs that were used to treat deadly diseases are now losing their impact due to emerging drug resistant microorganisms [9]. Self-medication with antibiotics, incorrect dosage, prolonged use, lack of standards for healthcare workers and misuse in animal husbandry are the main factors responsible for increase in resistance. This resistance threatens the effective control against bacteria that causes UTI, pneumonia and bloodstream infections. Highly resistant bacteria such as methicillin-resistant *Staphylococcus aureus* or multidrug-resistant gram-negative bacteria are the cause of high incidence rates of nosocomial infections worldwide [10]. South-East Asian region reports reveal that there a high resistance in *E. coli* and *K. pneumoniae* for third generation cephalosporin and more than quarter of *Staphylococcus aureus* infections are methicillin resistant [11].

The worldwide pandemic of antibiotic resistance shows that it is driven by overuse and misuse of antibiotics, which is a threat to prevent and cure the diseases. The development of new diagnostics and other tools is required in healthcare institutes to stay ahead of evolving resistance [11]. Rational use of medicines requires

that the patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community. 'Nosocomial' or 'healthcare associated infections' appear in a patient under medical care in the hospital or other health care facility which was absent at the time of admission. These infections can occur during healthcare delivery for other diseases and even after the discharge of the patients. Additionally, they comprise occupational infections among the medical staff [12].

Although the aim of infection prevention and control program is to eradicate nosocomial infections but epidemiological, surveillance for demonstration of performance improvement is still required to accomplish the aim. Hence, it is decided to undertake an observational study to record any complications and possible risk factors and steps to its management and prophylaxis.

Materials and Methods

Subjects

The present study was a prospective observational study including 100 in-patients carried out in the department of general medicine of Osmania general hospital, Hyderabad, T.S. This study was approved by Institutional Ethics Committee (MCP/IEC/PD/PR/35). An informed consent was obtained prior study.

Inclusion criteria

Patients of more than 18 years of age group of either gender, who were admitted for more than 48 hours in the hospital and all transferred-in cases from other peripheral hospitals, were included in the study.

Exclusion criteria

The patients who refused to be a part of the study, pregnant and nursing women, mentally compromised patients, patients who already had existing infection, patients with symptoms of infection on admission were excluded from the study.

Data Collection

At the study site of in-patient department of general medicine of Osmania general hospital, the prescriptions of patients were chosen based on the inclusion criteria and details of the patient were followed till discharge. During the study, the inpatient case records were reviewed which included patient demographics, specific issue related to antimicrobials use such as names of antimicrobials, their dosage schedule, route of administration, date of discontinuation, generic name and bacteriological investigation. The information collected was documented in the patient profile form (data collection form). The presumed diagnosis and the

medication prescribed along with duration, dosage and dosage schedule were analysed. The selected patients were observed for 6 months and their demographics were collected for study. The parameters were monitored timely and were recorded, while the effect of drugs prescribed for each patient was recorded on daily basis.

Data analysis:

The collected data were analysed, tabulated and represented graphically.

RESULTS AND DISCUSSION

Table 1. Distribution of subjects based on age & gender.

Age Groups (In years)	Male Patient	Female Patient
0 - 20	02	03
21 - 40	19	19
41 - 60	21	11
61 - 80	18	08
81 - 100	06	03

This shows that out of 110 Patients relevant 100 cases were selected of which 60 patients were male which accounts for 60% and 40 patients were females which accounts for 40%, and shows that the age groups that is effected more commonly in male is from 41 – 60 years of age and 21 – 40 years of age in females (Table 1).

Table 2. Distribution of patient based on type of infection.

Type of infection	No. of Patients	Percentage
Pneumonia	08	8%
Hepatitis	10	10%
Urinary Tract Infection	22	22%
Surgical Site Infection	08	8%
Gastroenteritis	07	7%
Septicemia	10	10%
Ventilator associated Pneumonia	11	11%
Gangrene	05	5%
Cellulites	08	8%
Urosepsis	05	5%
Septic shock	06	6%

The prevalence of urinary tract infections in patients suffering from hospital acquired infections was found to be 22% of total number of cases, ventilator associated pneumonia stand for second position with 11% while third and fourth most prevalent infection identified hepatitis and septicemia 10% each followed by cellulites, surgical site infection's and others (Table 2).

Table 3. Distribution of patient's based on culture sensitivity report.

Causative Organism	Percentage of Patients Effected
A. baumanni	21%
E. coli	19%
Klebsiella	17%
P. aeruginosa	15%
S. aureus	8%
S. pyrogenes	2%
Enteroccus	6%
Canidia albicans	4%
Enterobacter	4%
S. epidermis	4%

The prevalence of causative organism isolated during the patient stay in hospital due to hospital acquired infection is elaborated in Table 3. Majority of cases were due to *Acinetobacter, Klebsiella* and *E. Coli* infections accounting for aggregate more than 55.9% of total infections occurred followed by *P. aeruginosa* infections accounting for 14% of cases, followed by others (Table 3).

Table 4. Distribution of patients based on co-morbidities.

Co-Morbidities	Male Patients	Female Patients
Single	19	12
Multiple	41	22

This distribution shows the prevalence of co-morbidities, of which in single co-morbidities hypertension, diabetes mellitus, chronic kidney disease, etc. were common; while in multiple co-morbidities pancreatitis along with diabetes mellitus cerebrovascular accident and chronic kidney disease were found to be common (Table 4).

Table 5. Distribution of patients based on their reason for infection.

Status	Number of Patients
Idiopathic	42
Hospital Associated	22
Patient Associated	36

The maximum infections occurred were idiopathic, while patient associated reasons are significantly more compared to hospital associated/health care associated (Table 5).

Table 6. Distribution of patients based on addictions.

Type of Addiction	Male Patients	Female Patients
Smoking	07	05
Alcohol	11	14
Smoking + Alcohol	35	18
Others	13	07

During the current finding it was found that ratio of smoking was predominant in men, while alcohol intake was found to be only slightly varying in both the cases (Table 6).

Table 7. Distribution of patients based on route of administration.

Route of Administration	Percentage of Patients
Intra Venous	57%
Oral	37%
Nebulizer	1.8%
Subcutaneous	2.5%
Others	1.7%

While it was clearly observed in the hospital that the usual route of administration for in-patients usually I.V. (57%) followed by oral route (37%), this usually depends on the patient's condition and the suitability with the compliance and other aspects of patients, yet still caution should be taken while deciding the appropriate route of administration for the patients (Table 7).

Table 8. Distribution based on the use of antibiotics.

Use of Antibiotics	No. of Patients	Percentage
Mono Therapy	8	4
Dual Therapy	18	9
Triple Therapy	30	15
Multiple Therapy	44	22

While the treatment to specific infection is standardized, the use of antibiotics are essential in curing the infection, while in this study it was found that monotherapy was not the choice of physician which is compensated by multiple therapy of antibiotics possibly to prevent any chance of resistance or further progression of infection (Table 8).

Table 9. Distribution based on type antibiotics and other antimicrobials used.

Medication used	Percentage
Vancomycin	6%
Fluconazole	5%
Cotrimazole	5%
Doxycycline	12%
Cefixime	43%
Metrinidazole	66%
Levofloxacine	60%
Amoxicillin + *Clavulanic* acid	74%
Azithromycin	70%
Piperacillin + Tazobactam	78%
Ceftriaxone	92%

As represented the most common drug used is ceftriaxone with a value of 92% followed by piperacillin + tazobactam with 74% followed by other medications. Vancomycin was the least used Drug used in reserved cases, in fungal infections fluconazole and cotrimazole was used (Table 9).

Table 10. Distribution of patients based on their final status.

Status	Number of Patients
Discharged	46
LAMA (left after medical advice)	27
Death	27

It was observed that there were a significant number of populations who left the hospital facility after medical advice which signifies the lack of general knowledge of general population, even some patients who had severe infections died during their course of therapy (Table 10).

Table 11. Potential drug interactions in the study population.

Prescription Indices	Total
Total no of drugs prescribed	865
Average no of drugs prescribed per prescription	08
Average no of antibiotics per prescription	04
Average no of drugs prescribed in generic	03
Average no of drugs prescribed in brand	05

Interactions	No of Patients	% of Drug Interactions
No Interactions	33	33%
Minor	26	26%
Significant (monitor closely)	21	21%
Serious (use alternative)	20	20%

On studying the drug interactions, it was found that 33% of the population was not having any drug interactions in their prescriptions, 21% of the population were having significant Interactions followed by Serious and Minor Interactions which were 20% and 26% of the total population (Table 11).

Table 12. Prescription indices.

From table, it was found that the total no. of drugs that were prescribed were 865, among that avg. no. of drugs prescribed per prescription were 08 drugs, average no. of antibiotics per prescription were 04, the average no. of drugs in generic were 03 and the drugs prescribed in brand names were 05 per prescription (Table 12).

CONCLUSION

The present study showed that ceftriaxone was most commonly prescribed antibiotic, followed by combination of piperacillin with tazobactam and amoxicillin with clavulanic acid. However multiple-therapies were found to be 22%. One third of the study population showed inappropriate prescriptions, suggesting a need for programme to improve prescribing pattern. The present surveillance study suggests

that continuous target monitoring, regular analysis of high-risk factors, and timely intervention measures could effectively reduce the incidence of nosocomial infections. Further studies focused on the rationale for choice of antibiotic for nosocomial infection, duration of antibiotic and drug interactions of drugs in hospital acquired infection would give additional insights into prescribing patterns of drugs. The present study points out the need for improved patient education on adherence to therapy and development of antibiotic prescribing guidelines.

Proper training of hospital staff for biosafety, proper waste management and healthcare reforms and making general public aware of these endemic infections can also help in reduction of nosocomial infections.

CONFLICT OF INTEREST

None declared

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