

PREVALENCE AND ANTIBIOTIC RESISTANCE PATTERN OF NOSOCOMIAL PATHOGENS IN PATIENTS WITH INVASIVE PROCEDURES IN CRITICAL CARE UNITS AND POSTOPERATIVE WARDS IN TERTIARY CARE CENTRE AT KANPUR

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ABSTRACT:

Aim: Nosocomial infections are predominantly seen in the ICU, NICU and the postoperative wards in any hospitals after 48-76 hours of the admission till the date of discharge. This study is mainly aimed to identify the most prevalent pathogen in the patients admitted in intensive care unit (ICU), neonatal intensive care unit (NICU) and post-operative wards and finding out their antibiogram.

Materials and methods: In this study, a total number of 465 patients admitted in the ICU, NICU and post-operative wards of Rama Medical College Hospital & Research Centre were subjected to a series of intervention measures i.e. endotracheal tube (ET Tube) and urinary catheters in ICU, and the patients who had undergone surgery were included.

ET Tube, urinary and blood cultures were processed from the patients admitted in ICU. Pus swabs were collected from patients who had undergone surgical intervention. Similarly ET Tubes were collected from NICU wards and processed by standard procedures in the microbiological laboratory according to CLSI guideline.

Results: of the 465 patients studied, 120(25.8%) patients showed growth of organism from the samples collected. It was found that Klebsiella sp.(20.83%) was the most predominant organism samples followed by pseudomonas sp (17.50%), Acinetobacter sp.(16.66%), and Escherichia coli(15%). Maximum isolates were resistance to most commonly used antibiotics.

Conclusion: This study showed that nosocomial infection are prevalent in our hospital. Nosocomial infection can be controlled with the appropriate measures and antibiotic policy taken by the hospital personnel, by proper hand washing and awareness of infection control measures and antibiotic policy.

Key words: Nosocomial Infection, Antibiogram, Klebsiella sp

INTRODUCTION:

Nosocomial infection (NI) are those that are acquired in a hospital setting. The Centers for Disease Control (CDC) defines nosocomial infection as those

that occur after 48 hours of admission or within 48 hours after discharge.^[1]

Nosocomial infection have been recognized for over a century as a critical

problem affecting the quality of health care and a principal source of adverse health care outcome, Currently, nosocomial infection account for 50% of all major complications of hospitalization, the remaining causes are due to medication errors, patients falls and other non-infectious adverse events.^[2]

Hospital acquired infection encompass almost all clinically evident infections that do not originate from patients admitting diagnosis. Within hours after admission, a patient's flora begins to acquire characteristics of the surrounding bacterial pool. Most infection that come clinically evident after 48 hours of hospitalization are considered hospital acquired. Infection that occur after the patient discharge from the hospital can be considered to have a nosocomial origin if the organisms are acquired in the hospital.^[2] These infections add 5 to 10 days to the affected patient's time in the hospital. Nosocomial infection have increased the morbidity of hospitalized patients and especially the one admitted in an intensive care setup.^[1] In studies conducted by various authors, the incidence of Nosocomial infections ranged from 2.8% to 21.6%.^[1]

Intensive monitoring of patients in different intensive care unit like medicine ICU, Neonatal ICU, Paediatrics ICU is being increasingly done. Urinary catheterization is a routine procedure in an intensive care unit for monitoring urine output of critically ill patients. Hence, it

is not surprising to find the urinary tract infection as one of the most common sites of nosocomial infection along with ventilator associated pneumonia and skin infection etc in the ICU. The incidence of nosocomial urinary infections varies from 17.2% to 44%. The present study aims to determine the prevalence, risk factors, mortality and organisms causing urinary catheter related infections.^[3]

The incidence of nosocomial infections in intensive care unit(ICU) is showing a rising trend mainly because of increasing invasive procedures performed in the ICU. The therapeutic interventions that have been recognised as associated with infections complications include indwelling catheters, sophisticated life support, intravenous fluid therapy, and cardiovascular prosthetic devices. Implantable orthopaedic prosthesis and immunosuppressive therapy.^[4]

It was estimated that 40% all neonatal deaths,^[5] was due environmental factors and differences in clinical practice in Neonatal intensive care unit(NICUs).^[6]

Incidence of health care associated infection in PICU has been reported between 6.1%-15.1%.^[7,8]

It is also estimated that patients undergoing surgical procedures, 2%-5% develop surgical site infections.^[9,10] They account for about 24% of all nosocomial infections.^[11]

The higher incidence of infections among surgical patients was largely attributable

to Surgical site infections (SSIs).(Dellinger EP) They account for about quarter of all nosocomial infections.¹¹ These infections have minimal mortality rates but add a considerable cost to patient care, to necrotizing soft tissue infections, which are associated with prolonged hospitalization, significant healthcare expense and a high mortality rate.^[12]

Changes in the population at risk, changes in the spectrum of available pathogens and an increased use of sophisticated and therapeutic modalities including broad spectrum antibiotics have contributed to the evolution of problem with nosocomial infection.

The incidence of nosocomial infection rate in paediatric hospital ranges from 2.8% and 6.5%. The incidence is found to be even higher in the ICUs.^[4]

MATERIALS AND METHODS:

The endotracheal tube tips, Foley's catheters, pus or wound swabs and the blood culture were collected from a total of 465 patients admitted in the hospital studied from January 2015 to December 2015. At the time of endotracheal tube tip are cut and washed with 1 ml of sterile saline. This saline is used for direct smear to examine Pus cell, epithelial cells and microorganisms and used to inoculate Blood Agar (BA), Chocolate Agar(CA) and MacConkey's Agar(MA) plates. Hospitalised patients who have indwelling or Foley's Catheter, the specimen is collected by disinfected portion of the catheter tubing with

alcohol, puncturing the catheter tubing directly with the sterile syringe and aspirating the urine. Direct smear are observed for pus cell and microorganism. Sample inoculates immediately on BA and MA. Aspiratory pus or pus is collected in two swabs. One swab is used for smear preparation and examined for pus cell and microorganisms. Another swab is inoculated on to the BA, CA and MA plate. BA and CA plates of all samples incubate in CO₂ jars and MA plates incubate at 37 °c. All the plates are examined for growth after overnight incubation.^[7] For blood culture 5 ml of blood is collected and inoculated into Brain Heart Infusion Broth (BHI broth). It is inoculated at 37 degree centigrade for 7 days and visually inspected at least once every day. Subculture is done if no visible growth is present to confirm a negative culture.

All the isolates are identified according to the biochemical reaction done. Antibiogram is done up as per the organism isolated and CLSI guideline (2015).^[13]

The standardized Kirby-Bauer disc diffusion test and the Clinical and Laboratory Standards institute was used for antibiotic susceptibility testing and interpretations were carried out accordingly. The antibiotics which were tested were ampicillin (10mcg), amoxicillin (30mcg), piperacillin/tazobactam (100/10mcg), carbanicillin (100mcg), oxacillin (1mcg), cefoxitin (30mcg), ceftazidime (30mcg),

ceftriaxone (30mcg), cefotaxime (30mcg), cefepime (30mcg), cefepipime (30mcg), cefepiperazone salbactam (75/30mcg), amikacin (10mcg), gentamycin (10mcg), netilmycin (30mcg), ciprofloxacin (5mcg), tetracycline (30mcg), imipenem (10mcg), meropenem(10mcg), clindamycin (2mcg), erythromycin (15mcg), vancomycin(30mcg), aztreonam (30mcg), polymyxin B (300mcg), colistin (10mcg), teicoplanin (30mcg), tegicycline (15mcg) procured from Himedia (Mumbai, India).

Ethical clearance was obtained from the institute.

RESULT:

Of 465 samples from ICU, NICU, PICU and post operative wards, 120(25.8%) gave culture positive result from different samples [Fig 1]. Table 1 shows the age distribution of the patients ranging from 18 to 85 years in case of ET tubes, Urinary catheter and pus swabs samples whereas, in case of Paediatric ET tube the age of the neonates ranges from 1 to 14 days. Total no. of sample received in this study showed in figure-2. Table 2 represents the percentage of the microorganism isolated from the different samples. It is clearly seen the Klebsiella sp. and Acinetobacter sp. is the most prominent organism.

DISCUSSION:

This study was conducted in the ICU, NICU and post operative wards in Rama medical college hospital and research center, which is a teaching hospital to identify the most prevalent pathogens

and to find out their antibiogram. Nosocomial infections are a significant problem in the hospitals and the patients usually developed NI after 48-76 hours of stay in the ICU. A total of 465 cases have been studied prospectively. This is explained by the fact that longer the stay, greater is the contact of the patient with the health care personnel, often in a crisis situation, greater exposure to environmental microorganisms and more frequent are the invasive procedures.^[1]

Nosocomial infection mainly affect the lower respiratory tract, urinary tract, surgical wounds, skin and blood (bacteraemia). The common interventions done in an ICU are endotracheal intubation, urinary catheterization and insertion of central venous lines and not surprisingly, these are responsible for the nosocomial infections.^[4]

The percentage of the growth of isolates in our study has been 25.8% as compared to 40.3%, in a study conducted by Akash Deep et al.^[1] higher and similar to 25.23% in a study conducted by Mod. Issa Ahmed.^[14]

The rate of isolates from NICU in the present study was 24.17% which was similar to Abdel-Wahab et al. (21.4%)^[15]. There was a wide variation in the rates of NI that have been reported in previous studies. As compared to other studies the incidence of Nosocomial infections from NICU was reported by Doaa Mohammed et al.^[16] and El-Fiky et al ^[17] was 38.5% and 54% respectively.

The differences among the studies can be attributed to differences in study populations and locality, availability of resources, proportion of very low birth weight neonates, overcrowding in nurseries, antibiotic use and the difference in surveillance methods for detection of NI.^[16]

In Europe, incidences range from 1% in General Pediatric wards up to 23.6% in Pediatric ICUs (PICU) ^[18]. In present study 16.67% infection from PICU. Nosocomial infections in the pediatric population has characteristics of its own, often different from the adult population, as reported by Harris ^[19] and Richard et al.^[20]

In the present study 30% of microorganisms isolated from patients of post operative wards. The prevalence of SSIs was comparable to Kamat et al ^[21], and Sikka R. et al ^[22] who reported prevalence of 46.7% and 55.4% respectively in surgical patients. However, Littaua R et al ^[23] reported much lower incidence (2.9%). The problem is aggravated in developing countries where resources are scarce and staffs are always in short supply.^[11]

The increasing number of person's ≥ 65 years of age from a population especially at risk for nosocomial infections. The vulnerability of this age group is related to impaired host defences, chronic underlying disease, poor tolerance to therapeutic procedures, and increased time of hospitalization and use of antimicrobial agents.^[24] The authors reported the ages more than 50 or 60

years as an important risk factor for nosocomial infections ^[25,26]. Mikaili et al found rates of nosocomial infections in patients for age groups 61-70 and 71-80 years old, were 17% and 21%, respectively ^[27]. However, they did not find a significant relationship between age of the patients and occurrence of nosocomial infections. While Ganguly et al.^[25] and Michael et al.^[28] reported that there is a significant relationship between the age of the patients and occurrence of nosocomial infections.

Percentage of microbial isolation is different in various studies. Klebsiella sp, Pseudomonas sp. and Acinetobacter sp. were the most common microorganisms isolated in the study when all the 120 cases were taken into consideration but when ET tubes, urinary catheters, pus swabs and paediatric ET tubes cases were considered individually, the occurrence of the microorganism varied. From paediatric ET tube and ET tube, Acinetobacter sp. was the most common isolates, 33.33% and 27.27% respectively. While Pseudomonas, E.coli and S.aureus were common isolates of central line tip, urinary catheter tip and pus and respectively. The other organisms that have isolated are enterococcus, coagulase negative staphylococcus and citrobacter sp.

Comparatively it has been seen that Sikka R. et al ^[22] found predominant pathogen isolated were E. coli (58%) and Mod. Issa Ahmed ^[14] got *S. aureus* (55%) as most frequent organism while Aly NY et al ^[29] found Pseudomonas

aeruginosa (20, 17%) most predominant pathogen of nosocomial infections.

In a study done by Tullu MS et al [4] found E.coli, Klebsiella sp and Pseudomonas sp. were isolated as the commonest organism colonizing the Endotracheal tube. It has been shown in other studies that Serratia sp, Staphylococcus aureus and gram negative bacilli are the microorganism that have been more prominent.^[25]

Present study revealed that Ventilator Associated Pneumonia (VAP) occurred in 18.33% of the adult patients (22 patients out of 120) and 10% of children (12 out of 120) on mechanical ventilators. Whereas it was 64.7% of patients (11 out of 17 patients) considered in a study conducted by Sallam SA, et al.^[2] They found out that, Acinetobacter sp., followed by Klebsiella sp and Pseudomonas sp. were the organisms that were similar to our study.

Akash Deep ^[1], the percentage of growth of organism in paediatric endotracheal tubes was 77.8%. Comparatively, it was seen that the Klebsiella sp. was found to be the most predominant organism while Acinetobacter sp. was the most predominant isolates present the studies.

E.coli were the predominant organisms isolated from urinary catheter tips, followed by Klebsiella sp, Pseudomonas and CONS. The occurrence of E.coli was 26.82% as compared to 46.43% in a study conducted by Tullu MS et al.^[3]

In a study conducted by Lilani SP et al.^[30] found S. aureus was the commonest isolate followed by Pseudomonas aeruginosa from pus surgical sites similar to our study.

In the present study, more than 70% of gram negative bacilli were ESBL producer and the remaining was sensitive to Imipenem, meropenem, polymyxin B, colistin and tegicycline whereas Sallam SA ^[2], et al observed that Klebsiella sp. were sensitive to imipenem, and resistant to meropenem, amikacin and Cefoperazone/salbactam, Pseudomonas sp. were sensitive to amikacin and ceftazidime and resistant to meropenem and Cefoperasone/sulbactam. In present study Klebsiella sp. and Pseudomonas were sensitive to Cefoperazone/salbactam and amikacin.

In a study done by Tullu MS ^[4], E.coli had maximum susceptibility to amikacin(55.36%), cefuroxime(52.62%) and cefotaxime(67.57%) and ciprofloxacin (62.5%). Pseudomonas was susceptible to amikacin(45%), cefotaxime(40%) and ceftriaxone (36.84%). Proteus was maximally susceptible to amikacin (76.92%), ceftriaxone (53.85%) and cefuroxime (46.15%). Acinetobacter was susceptible to ciprofloxacin (63.64%), amikacin (57.14%), cefuroxime (57.14%) and ceftriaxone (57.14%). In our study E.coli were sensitive to amikacin. Acinetobacter were resistance to amikacin but sensitive to ciprofloxacin.

Our study revealed that the S. aureus strains were the second most

causes of nosocomial infections from post-operative wound infections. 60% strains were identified as MRSA. Vancomycin and linezolid, teicoplanin appeared to be of greater choice because of their effectiveness.

According to Mohamed Issa Ahmed et al. [14] the susceptibility to fluoroquinolones, Gentamicin and Ciprofloxacin was 81.8% and 63.6%, respectively, which some extent accepted while In study conducted by Faria NA at al. [31] reported, isolated MRSA were typically resistant to fluoroquinolones and macrolides.

The antibiograms of these isolated organisms has been shown and represented. The incidence of nosocomial infection rates in paediatric hospitals ranges from 2.8% and 6.5%. [3] This incidence is even higher in the management of patients in the ICU. General improvement of hygiene can decrease the incidence of nosocomial infections. In spite of their importance, very little is known about the incidence, risk factors and type of Hospital Acquired Infections. Most medical attention depends on governmental Institution and infection control polices have to face two crucial problem: limited resources for health care and lack of awareness of the importance of prevalence of nosocomial infections. [32]

CONCLUSION:

The study has shown that Klebsiella sp, Acinetobacter sp, Pseudomonas sp. and E.coli, are the most commonly isolated microorganism when considered from all the cases.

The infection control team has been informed to take the appropriate control measures so as to reduce the spread of nosocomial infections and maintain a registry about the prevalent organisms and their antibiograms.

Poor hand washing practices were associated with high nosocomial infection rate, where as good hand washing practices were associated with low nosocomial infection.

Hand hygiene with antiseptic products effectively reduces the hand contamination during patient care activities. The best technique is hand rubbing with alcohol based solution. This significantly decreases the risk of cross transmission of microorganisms and thus, decreases the risk of acquiring the infection especially in intensive care unit patients.

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