ORIGINAL RESEARCH

Microbiological profile of nosocomial infections among patients admitted to Intensive Care Unit

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ABSTRACT

Background & Aim: Patients admitted to the Intensive Care Unit (ICU) are prone to develop nosocomial infections due to Multidrug-Resistant (MDR) organisms. Inappropriate and overuse of antibiotics play an important role in the emergence of MDR organisms, which cause life-threatening infections resulting in significant morbidity and mortality. Our aim is to study the incidence of nosocomial infection, site of infection, pathogens involved and their susceptibility. **Methods**: Patients those who were admitted to intensive care unit for more than 48 hours were included. Clinical samples like blood, urine, sputum, wound/pus swab, intravenous catheter tips, endotracheal aspirates, urinary catheter, central venous catheter, inter costal drainage catheter tip were collected and sent for culture and sensitivity. **Result**: Out of 350 patients, 70 patients had nosocomial infection. The overall nosocomial infection rate was 20%. Most common infections were bloodstream infections followed by pneumonia and urinary tract infections. Nosocomial infection related mortality was most commonly due to pneumonia. Staphylococcus aureus were the most common blood stream isolates. Pseudomonas aeruginosa and Acinetobacter baumanii were the most common species found in pneumonia. **Conclusion**: The presence of nosocomial infection was associated with prolonged period of hospitalization and use of invasive devices which is associated with increased mortality and morbidity and increased cost of health care.

Keywords: Nosocomial infection, Antibiotics, Intensive Care Unit

INTRODUCTION

Nosocomial infections are infections acquired after 48 h of hospital admission, and they continue to be a significant problem in hospitalized patients across the globe. Nosocomial infection in the intensive care unit is associated with increased mortality, morbidity and length of stay there by increasing the cost of health care[1]. Various studies have shown the incidence of nosocomial infection varies from 5.3% to 27.3% [2]. Nosocomial infection is defined as infection that begins 48 hours after admission to hospital.[3] The most common type of nosocomial infection are ventilator-associated pneumonia , central line-associated bloodstream infection, urinary catheter related infection and surgical site infection[4]. The common pathogens include Staphylococcus aureus, Pseudomonas aeruginosa, ,Escherischia coli , Klebsiella and Candida[5]. Prevention and control of infection can be achieved through proper infection control measures, including hand hygiene and appropriate antimicrobial usage. Microbiological cultures are primarily essential for rapid and accurate diagnosis of nosocomial infection which will improve outcomes and reduces the development of drug resistance[6]. Our study aimed to determine the incidence of nosocomial infection, site of infection, pathogens involved and their susceptibility.

METHODS

This is a prospective study conducted in patients admitted to intensive care unit of a tertiary care hospital from Dec 2022 to Dec 2023. Patients were suspected to have developed nosocomial infections after 48 hours of admission to the intensive care unit if they had (i) unexplained fever >38^{0}C, leucopenia <4000 WBC/mm^3 or leukocytosis >12,000 WBC/mm^3; (ii) new infiltrates on chest X-ray, persistent tracheal aspirates or secretions; (iii) turbid urine, suprapubic tenderness, dysuria, burning micturition; (iv) thrombophlebitis or cloudy effluent containing more than 100 neutrophils/ mm^3.[6]Those having fever prior to admission to the intensive care unit, or any other clinical features of infection secondarily acquired in the wards prior to transfer to the intensive care unit were excluded from study. 350 patients were included in the study. Detailed history , clinical examination and laboratory investigations were done giving special emphasis to risk factors. Blood culture was done at the time of admission to rule out pre existing infection and thereafter as and when required.Central venous catheter or intravenous catheter tips were cultured in patients with suspected thrombo-phlebitis along with simultaneous blood culture from a site different from the site of catheter. Urine and tips of indwelling urinary catheters were cultured simultaneously in patients with suspected urinary tract infections. Culture from wound/pus swab was done when required.Pleural fluid and inter costal drainage catheter (ICD) tips were also cultured. Sputum samples or tips of endotracheal tubes or swabs taken from the tips of endotracheal suction catheter were cultured.Under full aseptic precautions all catheters were removed and the tip of each catheter was cut using a sterile blade and the tip was sent in a sterile container for culture. The isolates were identified and antibiotic susceptibility was determined by Kirby Bauer's disc diffusion method according to Clinical and Laboratory Standard Institute (CLSI) guidelines.[7]

RESULTS

Among the 350 patients, 70 patients had nosocomial infection . The overall nosocomial infection rate was 20%. Primary bloodstream infections (37.3%), pneumonia (30.5%) and urinary tract infections (25.5%) were most frequent and were almost always associated with use of an invasive device. Staphylococcus aureus (45%) were the most common bloodstream isolates. Aerobic Gram-negative bacilli were reported in 40% of primary bloodstream infections. Pseudomonas aeruginosa (45%) followed by Acinetobacter baumanii (35%) were the most common in patients with pneumonia. Escherichia coli (48%) was found in patients with urinary tract infections (Table 1). Nearly, 95% of blood stream infection, 80% of pneumonia, 65% of urinary tract infection were associated with central venous catheter, ventilator use and urinary catheter respectively. The presence of nosocomial infection was associated with a prolonged period of hospitalization and use of invasive devices. Nosocomial infection related mortality was 28.5%. Pneumonia-associated mortality rate was 65.5% and the primary bloodstream infection-associated mortality rate was 38.5%. All bacterial isolates showed high frequency of resistance to multiple antibiotics. In case of gram negative bacilli, susceptibility to meropenem (75%), imipenem (85%), piperacillin-tazobactam (60%), cefoperazone-sulbactam (58%) and amikacin (70%) was better than ampicillin, gentamicin, co-trimoxazole, cefotoxime. Ceftriaxone, ceftazidime, ciprofloxacin and levofloxacin (Table 2). In case of gram positive Cocci, teicoplanin and linezolid showed 100% sensitivity.

Table 1: Microbiological growth from samples from different site of infection

Sample	Growth obtained/total no sent	Percentage
Blood cultures	18/80	22.5
Peripheral lines	26/92	28.2
CVP line	12/18	66.6
Urine	15/30	50
Foley's catheter	15/24	62.5
ET/TT aspirate	14/30	46.6
Pleural fluid	6/15	40
Endotracheal tube	18/35	51.4
Tracheostomy tube	6/12	50
Intercostal drain tube	6/8	75
Peritoneal fluid	4/6	66.6
TOTAL	140/350	40

Table 2: Distribution of nosocomial infections by site of infection)

Organisms	Primary blood stream infection	Pneumonia	Urinary tract infection	Wound infection	Total number
Pseudomonas aeruginosa	4	10	2	0	16
Acinetobacter baumanii	1	7	0	0	8

Echerichia coli	2	0	8	0	10
Klebsiella pneumonia	1	5	3	0	9
Staphylococcus aureus	12	5	1	1	19
Streptococcus spp.	0	1	0	1	2
Enterococcus spp.	2	0	0	0	2
Candida spp.	0	0	4	0	4
Total	**26**	**22**	**18**	**04**	**70**
Percentage	**37.4**	**30.5**	**25.5**	**6.6**	**100**

DISCUSSION

Nosocomial infections can spread in a variety of medical settings, including wards, surgical rooms, nursing homes, and others. There are numerous mechanisms by which infection occurs in the healthcare setting. In addition to contaminated tools and equipment, bedding, or aerosols, healthcare personnel can also spread illness. Nosocomial infections are importantant preventable cause of increased morbidity and mortality in hospitalized patients.Patients in intensive care unit are always at higher risk of developing nosocomial infections with antibiotic resistant strains. Also nosocomial infections varies from one intensive care unit to another. The study conducted by various authors regarding the incidence of nosocomial infections in intensive care unit ranged from 5.3% to 27.3%. In our study, the overall nosocomial infections rate was 20%.Higher incidence of nosocomial infections in our study may be due to low socio economic status and malnaurishment. Chandrashekar G S et al in his study concluded that out of 288 patients studied , 34 patients had nosocomial infections. The overall nosocomial infections rate was 9.26 % and the incidence density was 16.8 per 1000 patient-days. Primary blood stream infections (38.2%), pneumonia (29.4%), and urinary tract infections (26.5%) were most frequent. Nosocomial-related mortality was 23.5% and most commonly due to pneumonia (62.5%). Staphylococcus aureus (46%) were the most common bloodstream isolates. Pseudomonas aeruginosa (40%) followed by Acinetobacter baumanii (30%) were the most common species reported from pneumonia and Escherichia coli (44%) from urinary tract infections. Nearly, 78% of pneumonia, 82% of urinary tract infection and 94% of blood stream infection were associated with ventilator use, urinary catheter and central venous catheter respectively. All bacterial isolates showed high frequency of resistance to multiple antibiotics[8] .Zaveri Jitendra R et al in his study found that the commonest organism isolated was E coli in NICU and PICU and was susceptible to amikacin.other bacterias were pseudomonas and acnetobacter.The most common multidrug resistant organisms were citrobacter,proteus and enterococus.[9] In our study ,infection rate was more in blood stream infection followed by pneumonia and urinary tract infections which was similar to other studies. In the present study, an increased duration of stay in PICU and the number of days of intervention were associated with increased nosocomial infection rate which was similar to study done by Porto JP et al.[10] However, Richards MJ and colleagues" had refuted this observation. Further they have reported primary bloodstream infections and surgical site infections were more frequently seen in infants aged 2 months or less as compared with older children. Urinary tract infections were reported more frequently in children > 5 years old compared with younger children was similar to present study. They have also found that nosocomial infection was almost always associated with use of an invasive device[11]. Nosocomial infection associated mortality is multi factorial, and depends on the patients' characteristics, infection site, etiologic agent and adequate use of initial empirical antibiotic therapy. Nosocomial infection related mortality in our study was 28.5%, the pneumonia-associated mortality rate was 62.5% and the primary bloodstream infection-associated mortality rate was 37.5%. Bowen-Jones et al. analyzed mortality rates in children admitted to the ICU and found 41% mortality rate in the presence of NI and a mortality rate of 18% in children without nosocomial infections.[12] However Patwardhan RB et al had found highest nosocomial infection in urinary tract followed by wound infections and pneumonia.[13] In their study, blood stream infection was less common condition causing nosocomial infection.In the present study, most common bacterial pathogens were Staphylococcus aureus and Pseudomonas aeruginosa followed by E. Coli, Acinetobacter baumannii, and Klebsiella pneumonia. Richards Mj and his team have noticed, coagulase-negative staphylococci (38%) were the most common blood stream isolates, and aerobic Gram-negative bacilli were reported in 25% of primary bloodstream infection. Pseudomonas aeruginosa (22%) was the most common species reported from pneumonia and Escherichia coli (19%), from urinary tract infections. In our study staphylococcus was most common in blood stream infection and pseudomonas was most common in pneumonia followed by acenetobacter and E coli was most common in urinary tract infection. All bacterial isolates showed high frequency of resistance to multiple antibiotics but maximum resistance was observed in Acinetobacter baumannii. This observation was similar to study done by Safavi A et at.[14] Aiesh et al[15] found that the incidence of nosocomial infections is progressively increasing despite the current infection control measures, which accounts for an increased mortality rate among

critically ill patients. They recommend that all healthcare workers in ICU departments strive for better strategies to minimize the incidence of nosocomial infections.

CONCLUSION

The presence of nosocomial infection was associated with a long period of hospitalization and use of invasive devices leading to increased cost of health care. So adherence to infection control guideline laid by Center of disease control and short term use of invasive devices and judicious use of antibiotics can play important role in preventing such nosocomial infections.

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