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Original Research Article

Micu Related Hospital-Associated Infection Rate

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Abstract: MICU-related hospital-associated infection rates must be highlighted due to their significant impact on patient mortality, prolonged ICU stays, and healthcare costs. These rates also serve as key quality indicators for infection control practices and benchmarking improvements in critical care setting. Thus in our study we have assessed HAI in MICU in total of 81 patients with the help of observational study done through different samples like pus, blood (5-10ml), urine, sterile fluids. We found that, out of 81 patients, HAI affected 12 (14.8%), equating to a rate of 14.8 per 100 admissions (95% CI: 7.9–24.5). So, the incidence density stood at 24.4 per 1000 patient-days (95% CI: 13.9–42.7). Thus, they conclude that, gathering data in advance on outcomes such as the use of ventilators, the duration of ventilation, and proper cleanliness practices in the MICU will allow for the enhancement of both quality and process.

Keywords: HAI, Incidence, MICU, Indicators, Ventilation.

INTRODUCTION

Hospital-associated infections (HAIs), also known as nosocomial infections, which affects millions of patients annually, with higher burdens in low- and middle-income countries like India.[1] Global estimates indicate around 136 million antibiotic-resistant occur each year, predominantly in middle-income nations.[1] Worldwide, its impact is about 1 in 10 patients receiving healthcare, rising to 15% in low- and middle-income countries compared to 7% in high-income settings.[2] 1 in 31 hospitalized patients has an HAI on any given day, equating to 687,000 cases in acute care hospitals in 2015, with ongoing reductions in specific types like CLABSI and CAUTI.[2] A 2023 analysis from point prevalence surveys across 195 countries estimated 136 million hospital-associated resistant infections yearly, with middle-income countries bearing 119 million cases.[2]

In India, its prevalence ranges from 7-18 per 100 patients, similar to other low- and middle-income countries, driven by overcrowding and limited infection control.[3] Recent data show 9 million resistant annually, ranking third globally after China and Pakistan.[3] ICU-specific rates include 9.06 infections per 1,000 patient-days per a 2024 study, with point prevalence up to 30.4% in trauma centers and bloodstream infections at 5.08 per 1,000 device-days in 2024-2025 ICMR surveillance.[3] Surgical site infections, ventilator-associated pneumonia, catheter-associated urinary tract infections, and bloodstream infections dominate, often involving gram-negative pathogens like Klebsiella and Acinetobacter.[4] Risks include longer stays, emergency admissions, and dirty wounds, with prevalence reaching 17.2% in surgical patients. In

Medical intensive care unit (MICU), rates vary from 4.62% to 38.5% across studies.[5,6]

Therefore, studying HAI incidence in India is crucial due to its massive burden around 2 million cases yearly causing 80,000 deaths and 20-fold higher risk than in high-income countries, driven by overcrowding and poor surveillance. Thus, in our study we have decided to assess its incidence in MICU.

AIM

To assess the incidence of HAI in MICU.

MATERIAL & METHOD

We have conducted a prospective observational cohort study in the Department of Microbiology of Lady Hardinge Medical College in collaboration with the Department of Medicine, Smt. Sucheta Kripalani Hospital, New Delhi starting from November 2019 ending to March 2021. A total of 81 patients who all were admitted in MICU and suspected after proper assessment and investigated by the physician were enrolled to collect different samples like pus, blood (5-10ml), urine, sterile fluids like tracheal aspirates and sub-hepatic drain and were assessed in laboratory within 2 hours for further processing . In cases of delay like urine sample was stored in sterile containers at 2-8^0C in refrigerator. Samples such as pus (pus swab), blood (in blood culture bottle) were kept at room temperature (22-25^0C). These samples were transported to the laboratory and processed within 24 hours for suspected pathogens. Serum was stored at -200 C in deep freezer. Data collection & management was done using self-designed, pretested proforma such as age, gender, dietary history, history of intake of antimicrobial or steroids, clinical presentation, sample collected and techniques undertaken.

INCLUSION CRITERIA

1. Age of patients above 18years.
2. Patients initially admitted and has remained in for at least 48 hours in MICU.
3. Cases meet the criteria of HAI (as defined by CDC).

EXCLUSION CRITERIA

Patients having infection at admission/ manifestation of any infective illness within 48 hour of admission as suggested by clinical picture and investigations.

STATISTICAL ANALYSIS

The data underwent transformation and coding before being entered into SPSS version 20. Categorical variables were reported as proportions, while continuous variables were expressed as mean (±SD) or median (IQR). For comparisons between two groups, a t-test was employed for continuous variables that followed a normal distribution, while the Wilcoxon rank sum test was utilized for continuous variables that did not conform to a normal distribution. The chi-square test or Fisher's exact test was employed for the analysis of categorical variables. The comparison among three or more groups was conducted utilizing ANOVA or the Kruskal-Wallis test. A p value below 0.05 was deemed significant.

RESULT & DISCUSSION

In our study we have found that, the mean age of the enrolled patients was 47.1 (±16.5) years. The median age was 50 (IQR: 32-60) years. Thus, the age range of admitted patients was 18 -81 years. Furthermore, mean duration of hospital stay was found to be 6.1 (±3.2) days and thus median duration of hospitalization was 6 (IQR: 4- 7) days.

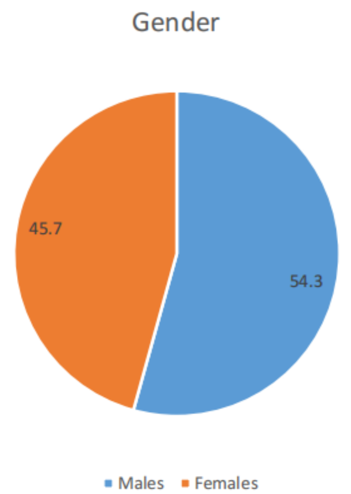

FIGURE 1 : GENDER DISTRIBUTION

In our study we have found that, majority were males with 54.3% followed by females with 45.7% respectively.

S.NO.	DIAGNOSIS	N(%)

1.	Sepsis	22(27.2%)
2.	Respiratory Diseases	21(25.9%)
3.	Renal Disease	7(8.6%)
4.	Neurological Illness	5(6.2%)
5.	Liver Disease	7(8.6%)
6.	Pancreatitis	4(4.9%)
7.	TB	4(4.9%)
8.	Heart Diseases	5(6.2%)
9.	Gastrointestinal Illness	2(2.5%)
10.	Diabetes Related	2(2.5%)
11.	Anemia	1(1.2%)
12.	Dengue	1(1.2%)

TABLE 1 : DIAGNOSIS OF ADMITTED PATIENTS

In our research, we have found that, majority of the cases were having sepsis issue with 22 in number (27.2%) followed by respiratory disease with 21 in number (25.9%), then renal & liver disease with 7 cases (8.6%), neurological illness & heart disease in 5 (6.2%), pancreatitis & TB in 4 (4.9%), gastrointestinal illness & diabetes related in 2 case(2.5%) and finally, anemia & dengue in 1 case (1.2%) respectively.

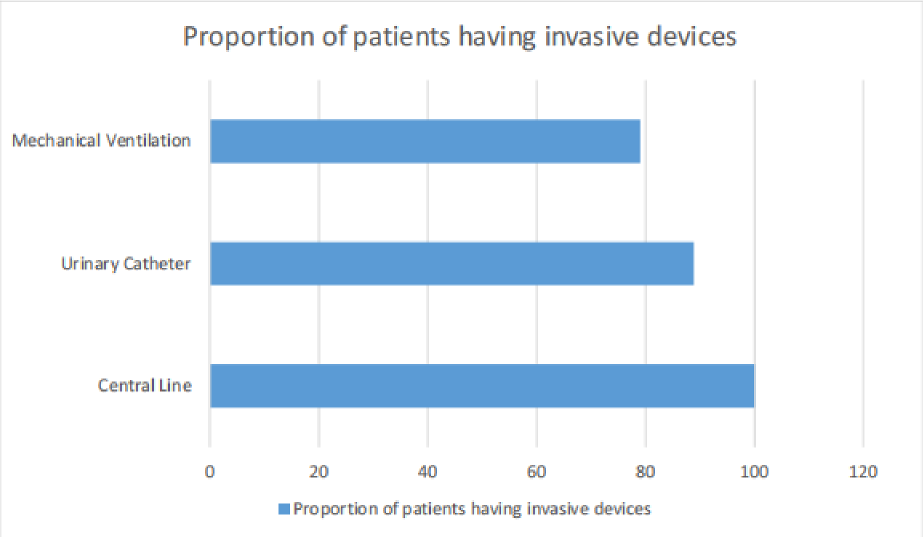

FIGURE 2 : INAVASIVE DEVICE

In our study central line was inserted in all 81 (100%) patients. Urinary catheter was inserted 72 (88.9%) patients. 64 (79%) patients were mechanically ventilated respectively.

INCIDENCE

HAI was observed in 12 (14.8%) patients in a total of 81 patients. Thus, it was 14.8 per 100 patient admissions (95% CI: 7.9 – 24.5). Its Incidence density was 24.4 per 1000 patient days (95% CI: 13.9 – 42.7).

CLABSI RATE

Central line was inserted in all 81 (100%) patients. Mean duration of central line was 5.9 (±3.3) days. Median duration of central was 6 (IQR: 4-7) days. No episode of CLABSI was observed in the study population.

CAUTI RATE

Urinary catheter was inserted 72 (88.9%) patients. Mean duration of urinary catheterization was 6.4 (±3.2) days and its median duration was 6 (IQR: 5-7) days. No episode of CAUTI was observed in the enrolled population.

VAP RATE

64 (79%) patients were mechanically ventilated. Mean duration of mechanical ventilation was 5.7 (±3.0) days. Median duration of mechanical ventilation was 6 (4-7) days. The duration range of mechanical ventilation was 2 – 20 days. Nine episodes of VAP were observed in the study population. Total ventilator days during the study period

was 369. VAP incidence rate was 24.4 per thousand ventilator days (95% CI: 12.8 – 46.5) as per CDC/NHSN definition.

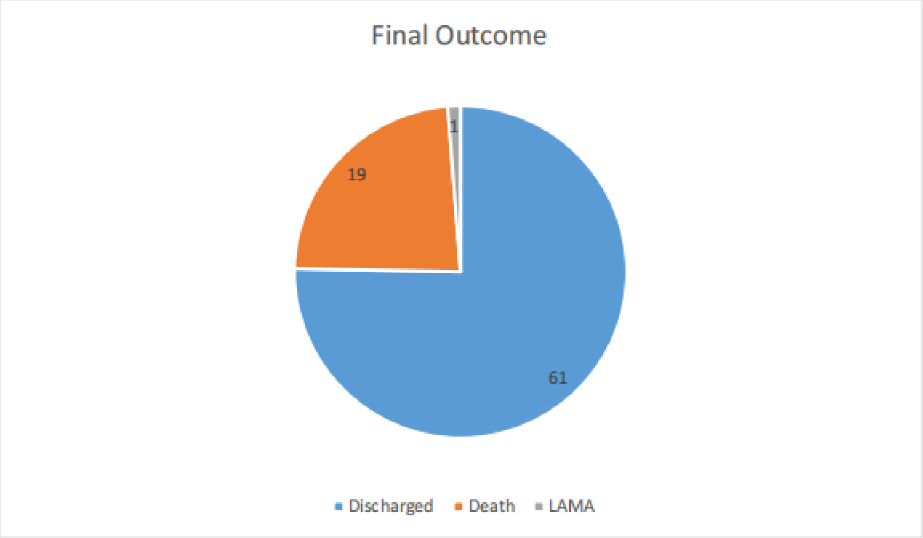

FIGURE 3 : FINAL OUTCOME

Through our research, we found that, out 81 of enrolled patients, 19 patients (23.5%) died during hospitalization, only 1 patient left against medical advice (LAMA) and remaining, 61 patients were discharged.

DISCUSSION

A total of 12 patients (14.8%) were observed to have HAI. Central line insertion was performed in all 81 patients, representing a 100% completion rate. A urinary catheter was inserted in 72 patients, representing 88.9% of the total cohort. A total of 64 patients, representing 79%, were subjected to mechanical ventilation. The incidence was recorded at 14.8 per 100 patient admissions, with a 95% confidence interval ranging from 7.9 to 24.5. The incidence density of healthcare-associated infections was recorded at 24.4 per 1000 patient days, with a 95% confidence interval ranging from 13.9 to 42.7. In many developed countries, HAI surveillance systems are established at both national and sub-national levels.[7] A survey by the WHO, on the other hand, shows that only 23 out of 147 developing countries (15.6%) have said that they have a working national surveillance system.[7] Its prevalence in different studies ranged from 5.7% to 19.1%, with a combined prevalence of 10.1 per 100 patients (95% CI 8.4-12.2).[8] Most studies indicated that the proportion of infected patients exceeded 10%.[9,10] Additionally, the pooled prevalence of affected patients was calculated at 10.2 per 100 patients (95% CI 9.0-13.0).[10]

A recent multi-center study of twelve Indian critical care units reported an overall rate of 9.06 HAIs per 1000 intensive care days, which is comparable to the worldwide norm in high-income nations.[11] The infection rate, however, varies greatly between facilities throughout the nation.[11] Several single-site studies have shown much higher rates, with values ranging from 25 to 40 infections per 1000 patient days.[12] A study found an infection rate of 33.9 ± 4.2 per 100 patients.[13] The most prevalent NI was UTI (26.63%), followed by surgical site infection (23.67%), wound infection (23%), and nosocomial pneumonia (18.34%). The pooled HAI prevalence was determined to be considerably higher in high-quality studies (15.5% vs. 8.5%, respectively).[7] Similarly, high-quality studies showed a greater number of infected individuals (13.5% versus 7.2%). The most common kind of infection in these diverse patient groups was SSI (29.1%), followed by UTI (23.9%), BSI (19.1%), HAP (14.8%), and miscellaneous infections (13.1%). 4.4%, with 9.06 HCAIs per 1000 ICU days.[10] In a study CVC-BSI rate was 7.92 per 1000 catheter days, the VAP rate was 10.46 per 1000 catheter days, and the CAUTI rate was 1.41 per 1000 catheter days.[14] Overall, methicillin-resistant strains caused 87.5% of all Staphylococcus aureus HCAIs; 71.4% of Enterobacteriaceae were resistant to ceftriaxone and 26.1% to piperacillin-tazobactam; 28.6% of Pseudomonas aeruginosa strains were resistant to ciprofloxacin, 64.9% to ceftazidime, and 42.0% to imipenem. Patients' LOS was 4.4 days without HCAI, 9.4 days with CVC-BSI, 15.3 days with VAP, and 12.4 days with CAUTI. Excess mortality rates were 19.0% [RR 3.87; P < 0.001] for VAP, 4.0% (RR 1.60; P=0.0174) for CVC-BSI, and 11.6% (RR 2.74; P=0.0102) for CAUTI. Moreover, in our study we have also found that, 79 percent of the patients were given mechanical ventilation. The mean duration of it was 5.7 days, with a standard deviation of 3.0 days and median of six to seven days. There was a range of two to twenty days for the duration. In the population under study, there were nine instances of

VAP that were detected. During the course of the study, there were a total of 369 ventilator days. The CDC/NHSN definition of the VAP incidence rate was 24.4 per thousand ventilator days, with a 95% confidence interval ranging from 12.8 to 46.5. In a study similar, the incidence of ventilator-associated pneumonia (VAP) was found to be 57.14%, and the incidence density of VAP was found to be 31.7/1000 ventilator days.[15] An observational study conducted in Cuttack indicated a prevalence of ventilator-associated pneumonia (VAP) at 35%. They found that, enterobacteriaceae (66.66%) and Staphylococcus aureus (20%) were prevalent in early-onset VAP, while nonfermenters (50%) and Enterobacteriaceae (40.61%) predominated in late-onset VAP. Approximately 60.87% of the bacterial pathogens exhibited multidrug resistance (MDR).16

Moreover, in our study all 81 patients (100%) underwent central line insertion. The average duration of the central line was 5.9 days (±3.3 days). The median duration of central was six days (interquartile range: four to seven). The study population did not experience any episodes of CLABSI. 72 patients (88.9%) underwent urinary catheterization. The average duration of urinary catheterization was 6.4 days (±3.2 days). The median duration of urinary catheterization was six days (interquartile range: five to seven). The duration of catheterization varied from two to twenty days. In the enrolled population, no episode of CAUTI was observed. In a study, the absence of CLABSI and CAUTI in our study is indicative of the excellent hand hygiene practices and adherence to standard protocols against HAIs in the MICU of S. S. K. H. Data from other institutions indicate a very high incidence of CAUTI and CLABSI.[7]

CONCLUSION

The incidence of HAI in our study is consistent with studies conducted in different regions of India and several other countries across the globe. We can attribute this variability to the diverse patient profiles, unique underlying conditions, and the wide range of accessible resources. Data available from an institution makes it possible to use infection control practices that identify bottlenecks and suggest ways to further reduce it which will assist us in gathering data on VAP instances.

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