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Analysis of Incidence, Risk Factors, Epidemiology, Mortality and Outcome in Device Related Health Care Associated Infections: In Intensive Care Units of a Tertiary Care Hospital

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Pooja Rawat
Research Scholar, SONS, ITM University
Dr. Rakesh Kumar
Associate Professor, SONS, ITM University
Ambali Pancholi
Assistant Professor, SONS, ITM University

Keywords
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Abstract

Patients in the intensive care unit had an infection rate five- to sevenfold higher than other hospital inpatients, making up twenty-five percent of all nosocomial infections. Patients in the intensive care unit had an infection rate five- to sevenfold higher than other hospital inpatients, making up twenty-five percent of all nosocomial infections. A study has been conducted in Apollo hospital, Indraprasth with the objective to determine the incidence, associated risk factors, the causative pathogens and the outcome of device (central venous line, endotracheal tube/ tracheostomy tube, urinary catheter) related HCAI in the ICUs of a tertiary care hospital. The incidence of VAP (76%) was highest among patients whom body position was semi recumbent. There was significant (p=0.0001) association of incidence of VAP with body position. This result is because of all patients are nursed in semi recumbent position, if not contraindicated, as per VAP bundle. The incidence of CLABSI was among all patients who used vasopressor. The incidence of CAUTI was in 29.4% patients who used vasopressor. There was significant (p<0.05) association of incidence of CLABSI and CAUTI with vasopressor used.

1. Introduction

Patients who are in critical condition are usually admitted to the hospital's Intensive Care Unit (ICU). Invasive procedures such as intratracheal intubation for mechanical ventilation, insertion of intravascular and urinary catheters, and the use of monitoring devices as part of a routine or to closely monitor and deliver therapies can lead to Device-associated Hospital-acquired Infections (DA-HAIs) in some patients. Patients in the intensive care unit had an infection rate five- to sevenfold higher than other hospital inpatients, making up twenty-five percent of all nosocomial infections [1]. In the intensive care unit, broad-spectrum or combination antibiotics are commonly used as a first-line treatment for infections before the antimicrobial medication is fine-tuned based on culture and susceptibility results. Misuse and overuse of antibiotics in the treatment of infections is a known contributor to the development of multidrug-resistant bacteria among commonly isolated strains of bacteria. For patients and their families, this means more time spent in the hospital, a higher risk of serious illness or death, and mounting medical bills. There may be wide variations in the prevalence of infections among ICU admissions across different regions, hospitals, and even individual ICUs within a single facility. In addition to differences in antimicrobial susceptibility profiles and the types of illnesses that

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can occur, geographic location also influences the prevalence of certain diseases. Therefore, it is crucial for the treating clinician to have sufficient knowledge about the spectrum of bacteria and the AMR patterns prevalent in that specific setting in order to initiate suitable antimicrobial medicines through empirical treatment. To reduce the prevalence of DA-HAIs, the International Nosocomial Infection Control Consortium (INICC) network employs an online surveillance system called the INICC Surveillance Online System (ISOS) 3 and a systematic multidimensional methodology called the INICC Multidimensional Approach (IMA) [2-4].

2. Need for Study

Healthcare-associated infections (HAI) are nosocomial illnesses that are not present or may be incubating at the time of admission, as stated by this prospective observational study. These infections are typically picked up by hospitalized patients and become noticeable within the first 48 hours of their stay. Organizations like the Centers for Disease Control and Prevention's National Healthcare Safety Network (NHSN) keep a careful eye on the infections (CDC) [5-6]. For the sake of patient safety and the reduction of HAIs, this monitoring is performed. Hospital-acquired infections include things like Clostridium difficile infections, hospital-acquired pneumonia, ventilator-associated pneumonia, and urinary tract infections caused by catheters (CDI).

Hospitals have been increasingly concerned about the spread of hospital-acquired illnesses over the past few decades. To lower the number of HAIs, many facilities have implemented infection tracking and surveillance systems, in addition to rigorous prevention programs. In addition to affecting patients directly, hospital-acquired illnesses have a broader community impact due to their association with multidrug-resistant infections. Identifying individuals at high risk for acquiring hospital-acquired infections or infections resistant to several drugs is crucial for reducing the prevalence of these complications [7-8].

In order to better identify patients at risk for multidrug-resistant (MDR) microorganisms, the definition of pneumonia has been updated in accordance with guidelines from both the Infectious Disease Society of America (IDSA) and the American Thoracic Society (ATS). The ultimate goal here is to reduce the needless administration of antibiotics. Once common, the term "healthcare-associated pneumonia" (HCAP) is now outdated [6]. HCAP has been replaced by the term hospital-acquired pneumonia, or HAP. According to the IDSA, "pneumonia that occurs 48 hours or more after admission to the hospital and did not appear to be incubating at the time of admission" constitutes hospital-acquired pneumonia. "Pneumonia that develops more than 48 to 72 hours following endotracheal intubation," is how the Intubation and Device Society of America (IDSA) describes ventilator-associated pneumonia (VAP). Poorer outcomes and substantial morbidity and mortality are globally related with both HAP and VAP [9-11].

3. Literature Review

Masih et al assessed the rates, infection sites, pathogens and risk factors of health-care-associated infections in ICU of a tertiary care hospital. The Department of Microbiology utilized an Infection Surveillance Proforma to conduct routine surveillance of HAIs such as CAUTIs (catheter-associated urinary tract infections), CLABSIs (central line-associated blood stream infections), and VAPs (ventilator-associated pneumonias). 9.06 per 1000 urine catheter days, 13.35 per 1000 central venous pressure line days, and 5.42 per 1000 ventilator days were the rates of healthcare-associated infections. Pseudomonas aeruginosa was found to be present in 34.48 percent of urine samples, followed by Enterococcus species (13.79 percent), Klebsiella pneumonia (13.79 percent), and Candida species (13.79 percent). Similarly, Klebsiella pneumoniae (32.26%), Acinetobacter species (29.03%), and Pseudomonas aeruginosa (16.13%) were the top three most common blood-isolated microbes. Most tracheal infections were caused by Acinetobacter spp. (40.0%), Pseudomonas aeruginosa (33.33%), and Klebsiella pneumonia (13.33%). Conditions like diabetes and chronic obstructive pulmonary disease, as well as length of intensive care unit stay >8 days, were found to be strong predictors of HAIs. The authors find that a length of stay in the intensive care unit (ICU) of more than eight days is strongly related

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with device-associated infections. Information gathered in this way could be utilized to better organize and fine-tune prospective intervention actions for the management of device-associated infections [12].

Iwuafor et al determined the prevalence, risk factors, clinical outcome and microbiological profile of hospital-acquired infections in the intensive care unit of a Nigerian tertiary hospital. The study was a prospective cohort study, patients were recruited and followed up between September 2011 and July 2012 until they were either discharged from the ICU or died. Antimicrobial susceptibility testing of isolates was done using CLSI guidelines. Seventy-one patients were recruited with a 45% healthcare associated infection rate representing an incidence rate of 79/1000 patient-days in the intensive care unit. Bloodstream infections (BSI) 49.0% (22/71) and urinary tract infections (UTI) 35.6% (16/71) were the most common infections with incidence rates of 162.9/1000 patient-days and 161.6/1000 patient-days respectively. Staphylococcus aureus was the most common cause of BSIs, responsible for 18.2% of cases, while Candida spp. was the commonest cause of urinary tract infections, contributing 25.0% of cases. The study concluded that health care associated infections was a significant risk factor for ICU-mortality and morbidity even after adjusting for APACHE II score [13].

Choudhuri et al (2017) described the epidemiology and characteristics of nosocomial infections acquired in a tertiary care ICU and the impact of the various risk factors in their causation. A retrospective study was conducted on the prospectively collected data of 153 consecutive patients admitted in a tertiary care ICU between July 2014 and December 2015. The primary objective was to assess the epidemiology of ICUacquired bacterial infections in terms of the incidence of new infections, causative organism, and site. The secondary end point was to assess the risk factors for developing ICUacquired infections. Out of the 153 patients enrolled in the study, 87 had an ICUacquired nosocomial infection (58.86%). The most common organism responsible for infection was Klebsiella pneumoniae (37%), and the most common infection was pneumonia (33%). The duration of mechanical ventilation and length of ICU stay were significantly prolonged in patients developing nosocomial infections. There was no difference in mortality between the groups. The multivariate analyses identified intubation longer than 7 days, urinary catheterization >7 days, duration of mechanical ventilation more than 7 days, and ICU length of stay longer than 7 days as independent risk factors for nosocomial infections. The study concluded that the study demonstrated a high incidence of nosocomial infection in the ICU and identified the risk factors for acquisition of nosocomial infections in the ICU [14].

Rodríguez-Acelas et al (2017) systematically reviewed the literature and meta-analyze studies investigating risk factors (RFs) independently associated with HAIs in hospitalized adults. Electronic databases (MEDLINE, Embase, and LILACS) were searched to identify studies from 2009-2016. Of 867 studies, 65 met the criteria for review, and the data of 18 were summarized in the metaanalysis. The major RFs independently associated with HAIs were diabetes mellitus (RR, 1.76; 95% CI, 1.27- 2.44), immunosuppression (RR, 1.24; 95% CI, 1.04-1.47), body temperature (MD, 0.62; 95% CI, 0.41-0.83), surgery time in minutes (MD, 34.53; 95% CI, 22.17-46.89), reoperation (RR, 7.94; 95% CI, 5.49-11.48), cephalosporin exposure (RR, 1.77; 95% CI, 1.30-2.42), days of exposure to central venous catheter (MD, 5.20; 95% CI, 4.91-5.48), intensive care unit (ICU) admission (RR, 3.76; 95% CI, 1.79-7.92), ICU stay in days (MD, 21.30; 95% CI, 19.81-22.79), and mechanical ventilation (OR, 12.95; 95% CI, 6.28-26.73).The study concluded that identifying RFs that contributed to develop HAIs might support the implementation of strategies for their prevention, therefore maximizing patient safety [15].

Magill et al (2018) repeated the survey in 2015 which was conducted in 2011 as baseline to assess changes in the prevalence of health care–associated infections. At Emerging Infections Program sites in 10 states, we recruited up to 25 hospitals in each site area, prioritizing hospitals that had participated in the 2011 survey. Each hospital selected 1 day on which a random sample of patients was identified for assessment. In 2015, a total of 12,299 patients in 199 hospitals were surveyed, as compared with 11,282

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patients in 183 hospitals in 2011. Fewer patients had health care–associated infections in 2015 (394 patients [3.2%; 95% confidence interval {CI}, 2.9 to 3.5]) than in 2011 (452 [4.0%; 95% CI, 3.7 to 4.4]) (P<0.001), largely owing to reductions in the prevalence of surgical-site and urinary tract infections. Pneumonia, gastrointestinal infections (most of which were due to *Clostridium difficile* [now *Clostridioides difficile*]), and surgical-site infections were the most common health care–associated infections. Patients' risk of having a health care–associated infection was 16% lower in 2015 than in 2011 (risk ratio, 0.84; 95% CI, 0.74 to 0.95; P=0.005), after adjustment for age, presence of devices, days from admission to survey, and status of being in a large hospital. The study concluded that the prevalence of health care–associated infections was lower in 2015 than in 2011. To continue to make progress in the prevention of such infections, prevention strategies against infection and pneumonia should be augmented [16].

Wang et al (2019) determined the epidemiology and risk factors for nosocomial infection (NI) in the Respiratory Intensive Care Unit (RICU) of a teaching hospital in Northwest China. An observational, prospective surveillance was conducted in the RICU from 2013 to 2015. The overall infection rate, distribution of infection sites, device-associated infections and pathogen in the RICU were investigated. In the study, 102 out of 1347 patients experienced NI. Among them, 87 were device-associated infection. The overall prevalence of NI was 7.57% with varied rates from 7.19 to 7.73% over the 3 years. The lower respiratory tract (43.1%), urinary tract (26.5%) and bloodstream (20.6%) infections accounted for the majority of infections. The device-associated infection rates of urinary catheter, central catheter and ventilator were 9.8, 7.4 and 7.4 per 1000 days, respectively. The most frequently isolated pathogens were Staphylococcus aureus (20.9%), Klebsiella pneumoniae (16.4%) and Pseudomonas aeruginosa (10.7%). Multivariate analysis showed that the categories D or E of Average Severity of Illness Score (ASIS), length of stay (10–30, 30–60, ≥60 days), immunosuppressive therapy and ventilator use are the independent risk factors for RICU infection with an adjusted odds ratio (OR) of 1.65 (95% CI: 1.15~2.37), 5.22 (95% CI: 2.63~10.38)), 2.32 (95% CI: 1.19~4.65), 8.93 (95% CI: 3.17~21.23), 31.25 (95% CI: 11.80~63.65)) and 2.70 (95% CI: 1.33~5.35), respectively. The authors concluded that a relatively low and stable rate of NI was observed in RICU through year 2013–2015. The ASIS-D E, stay ≥10 days, immunosuppressive therapy and ventilator use were the independent risk factors for RICU infection [17].

Duszynska et al (2020) studied device associated – health care associated infections monitoring, prevention and cost assessment at intensive care unit of University Hospital in Poland. The crude infections rate and incidence density of DA-HAIs was 18.69% and 17.49 ± 2.56 /1000 patient-days. Incidence density of ventilator-associated pneumonia (VAP), central line-associated bloodstream infection (CLA-BSI) and catheter-associated urinary tract infection (CA-UTI) per 1000 device-days were 12.63 ± 1.49, 1.83 ± 0.65 and 6.5 ± 1.2, respectively. VAP(137) constituted 54.4% of HAIs, whereas CA-UTI(91) 36%, CLA-BSI(24) 9.6%.The most common pathogens in VAP and CA-UTI was multidrug-resistant (MDR) Acinetobacter baumannii (57 and 31%), and methicillin-resistant Staphylococcus epidermidis (MRSE) in CLA-BSI (45%). MDR Gram negative bacteria (GNB) 159 were responsible for 63.09% of HAIs. The length of hospitalisation of patients with a single DA-HAI at ICU was 21(14–33) days, while without infections it was 6.0 (3–11) days; p = 0.0001. The mortality rates in the hospital acquired infection group and no infection group were 26.1% vs 26.9%; p = 0.838; OR 0.9633;95% CI (0.6733–1.3782) [18].

Despotovic et al (2020) studied HAIs in an adult ICU and identify risk factors for acquisition of HAIs and mortality. The study included 355 patients hospitalized over a 2-year period. Patient characteristics, antimicrobial resistance patterns, and risk factors of acquisition and predictors of mortality in patients who had a HAI were examined. : HAIs were diagnosed in 32.7% of patients. Resistance rates > 50% were observed in all antimicrobials except for tigecycline (14%), colistin (9%), and linezolid (0%). Predictors of HAI acquisition were underlying viral CNS infections and invasive devices—urinary and central venous catheters, and nasogastric tubes. Diabetes mellitus and intubation (odds ratio 2.5 and 6.7, P = 0.042 and

< .001) were identified as predictors for increased mortality in patients who had a HAI. The study concluded that prevalence of HAIs and resistance rates were high compared to ICUs in other European countries. Risk factors for both acquisition of HAI and mortality were identified. Large-scale studies were necessary to look at HAIs in adult ICUs in Serbia [19].

Voidazan et al (2020) analyzed the cases of HAI identified in public hospitals at the county level, through case report sheets, as they are reported according to the Romanian legislation. They performed a cross sectional study design based on the case law of the data reported to the Mures Public Health Directorate, by all the public hospitals belonging to this county. They tracked hospital-acquired infections reported for 2017–2018, respectively, a number of 1024 cases, which implies a prevalence rate of 0.44%, 1024/228,782 cases discharged from these hospitals during the studied period. Urinary infections had a similar distribution in the intensive care units, the medical and surgical sections, with Klebsiella pneumoniae being the most commonly incriminated agent. The study concluded that there was a clear correspondence between the medical units and the type of HAI: what recommended the rapid, vigilant and oriented application of the prevention and control strategies of the HAI [20].

Alfouzan et al (2021) studied the epidemiology and Microbiological Profile of Common Healthcare Associated Infections among Patients in the Intensive Care Unit of a General Hospital in Kuwait. The study conducted over two consecutive years 2018 and 2019, looking at ICU related infections of a regional secondary care general hospital and the data were recorded using the methods and definitions of the Kuwait National Healthcare-associated infections Surveillance System (KNHSS). The HAIs included Bloodstream Infections (BSI) – 42.3%, pneumonia – 28.8%, Urinary Tract Infections (UTI) – 15.3%, skin and soft tissue infections – 9.6% and Clostridium difficile infection – 3.4%. The overall infection rate was 13.14 per 1000 patient-days. The rates for Device-associated (DA)-HAIs were 6.27 for Central Line-associated BSI (CLABSI) per 1000 Central Line (CL)-days, 4.21 for Ventilator-associated Pneumonia (VAP) per 1000 Mechanical Ventilator (MV)-days, and 1.91 Catheter-associated UTI (CAUTI) per 1000 Urinary Catheter (UC)-days. Data showed that device use ratios for CL, MV, and UC were 0.81, 0.74, and 0.98, respectively. Acinetobacter baumannii and Klebsiella pneumoniae were the most common organisms isolated from the ICU infections with highest rates of antibiotic resistance. The study concluded that among DA-HAIs, CLABSI was found to be most common in our ICU, followed by VAP and CAUTI. Gram-negative organisms with A. baumannii and K. pneumoniae being the leading causative agents with high antimicrobial resistance profiles [21].

4. Material and Methods

This was a prospective observational study conducted in some chosen intensive care units and microbiology and infection control department of a tertiary care hospital. The study group comprised of 142 patients admitted in these chosen intensive care units (MICU, MGLICU, SICU, CCU, CTVS ICU, RENAL TRANSPLANT ICU,) and are having indwelling devices (central line, ventilator and urinary catheter). Data regarding device days was taken.

Study Site: Indraprastha Apollo Hospital, New Delhi.

Study population: 142 patients admitted in some chosen ICUs (MICU, MGLICU, SICU, CCU, CTVS ICU, RENAL TRANSPLANT ICU) and having indwelling devices (central line, endotracheal tube/ tracheostomy tube, urinary catheter).

Study design: This was a prospective observational study. All the patients with above inclusion and exclusion criteria, were recruited in the study. All patient must had at least one or more indwelling devices ie, CV line, ET/TT, Urinary catheter. The device must had present in situ for at least 48 hrs to establish the device related infection.

Inclusion criteria being: Patients admitted in ICU and on at least one indwelling device (CV line/ETT,TT/Urinary Catheter)

2) Adult patient aged more than 18 yrs.

Exclusion criteria : Patient having specific laboratory confirmed infection on admission. Patients with symptoms/sign of any incubatory infection at the time of admission.

3) All patients of age less than 18 years

Sample Size: For the margin of error at 5% and confidence level of study at 95%, a minimum of122patients (According to WHO prevalence survey an average of 8.7% of hospital patients had HCAI) are required to study the Epidemiology of device related HCAI and their risk factors association.

Data was collected regarding severity of the illness, primary reason for ICU admission, presence of risk factors, presence of infection, infecting agent, length of ICU stay, and survival status. If suspicion of infection was present paired blood sample i.e, blood from central line and from peripheral line collected simultaneously and aseptically, broncho -alveolar lavage and urine samples might be sent for culture. To assess the severity of illness on the 1st day in the ICU, the Acute Physiology and Chronic Health Evaluation II (APACHE II) score (Erbay et al, 2004) was used (Knaus et al, 1985). Decision on infection or colonization was based on laboratory and clinical evidence. Health care associated infection to be diagnosed according to the standard definition of the (United States centers for disease control and prevention [CDC]) (Horan and Gaynes, 2004).

For the determination of other risk factors which present besides presence of devices, were recorded. These includes: Age, gender, site from where the patient was transferred to the ICU, diagnosis at admission and the APACHE II score during the first 24 h of admission to the ICU. The following factors apart from presence of devices were recorded as present (at any time during the ICU stay) or absent in a particular patient before the development of health care associated infection: 1)diagnosis at admission, 2)co morbidity, 3)surgical procedure, 4)prior antimicrobial therapy, 5)antacid and stress ulcer prophylaxis therapy, 6)sedative-analgesic therapy, 7)vasopressor therapy, 8)parenteral nutrition, 9)enteral nutrition, 10)horizontal body position with head at <30°, 11)blood transfusion, 12)hypoalbuminemia, 13)diabetes mellitus,14)hypertension 15)chronic renal failure, 16)chronic alcoholism, and 17)immunocompromised.

Central line associated blood stream infection (CLABSI), catheter associated urinary tract infection(CAUTI) and ventilator associated pneumonia(VAP) were studied, among device related infections in such patients.

5. Results and Observations

The present study was conducted in the Department of Critical Care Medicine, Department of microbiology and infection control, Indraprastha Apollo Hospitals, New Delhi with the objective to determine the incidence, associated risk factors, the causative pathogens and the outcome of device (central venous line, endotracheal tube/ tracheostomy tube, urinary catheter) related HCAI in the ICUs of a tertiary care hospital. A total of 142 patients were included in the study. Fig.1 shows the distribution of patients according to incidence of HCAI. The incidence of VAP, CLABSI and CAUTI was 0.47, 0.24, and 0.19 respectively (per 1000 device day).

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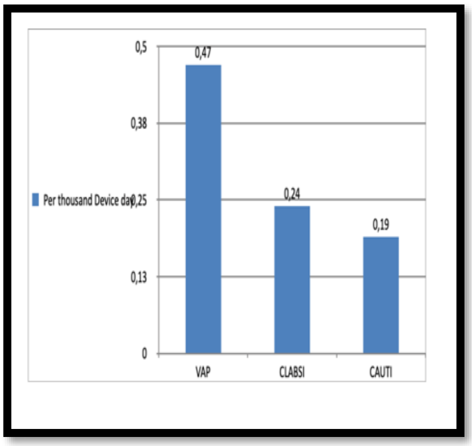

Figure 1: Distribution of patients according to incidence of HCAI

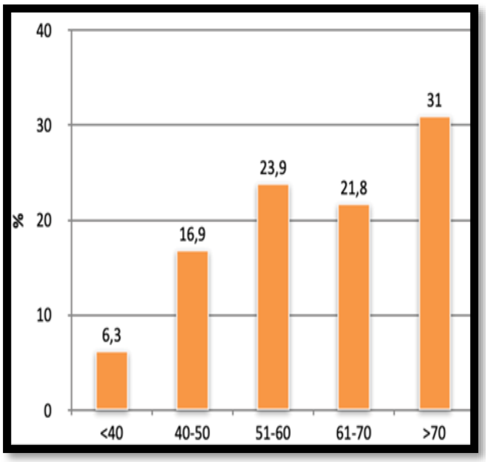

Figure 2: Distribution of patients according to age

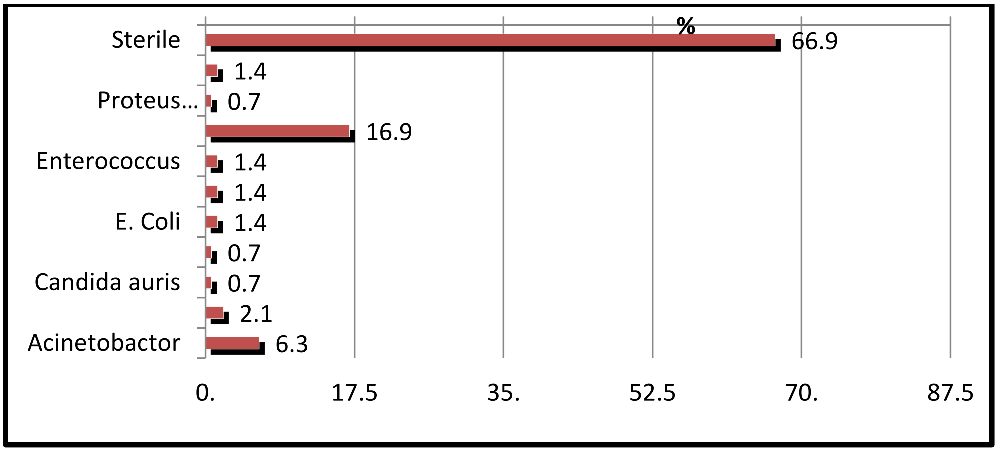

Figure 3: Distribution of patients according to organism from blood specimen

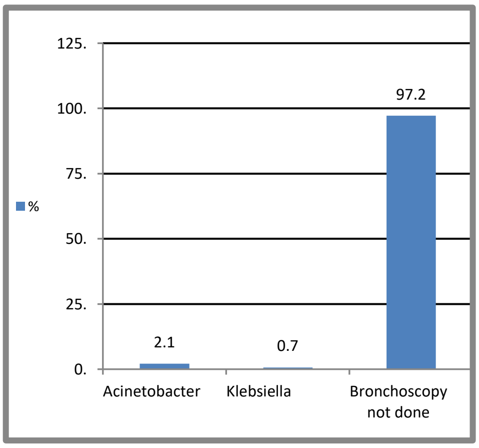

Figure 4: Distribution of patients according to ET Organisms

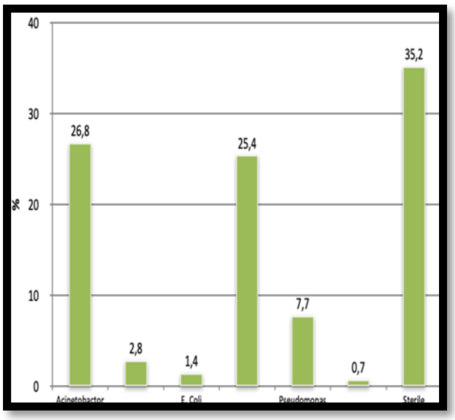

Figure 5: Distribution of patients according to BAL Organisms

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Fig.4 shows the distribution of patients according to organism from blood specimen. The most common organism isolated from blood specimen was Klebsiella spp. (16.9%). Acinetobacter was the second most common organism isolated from blood specimen (6.3%).

Fig.6 shows the distribution of patients according to urine organism. E coli was the most common organism isolated from urine specimen (8.5%). Klebsiella was the second most common organism isolated from urine specimen (3.5%).

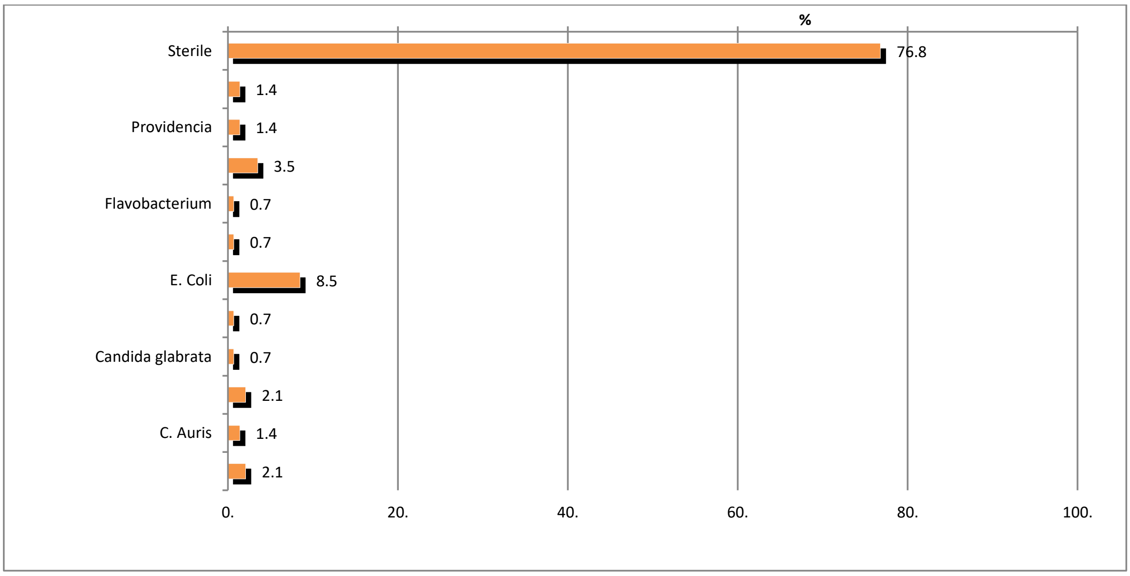

Figure 6: Distribution of patients according to Urine organism

Fig. 7 shows the comparison of APACHI II score with incidence of HCAI. APACHE II score was found to be significantly (p=0.004) higher among whom CAUTI was present (26.35±10.12) than absent (21.08±9.69). There was no significant (p>0.05) difference in APACHI II score between presence abs absence of VAP and CLABSI.

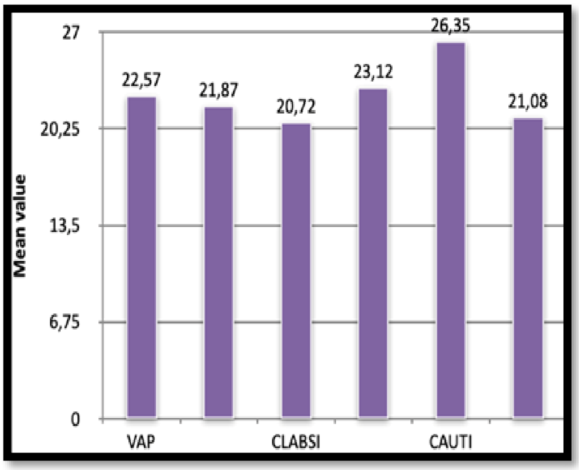

Figure 7: Comparison of APACHI II score with incidence of HCAI

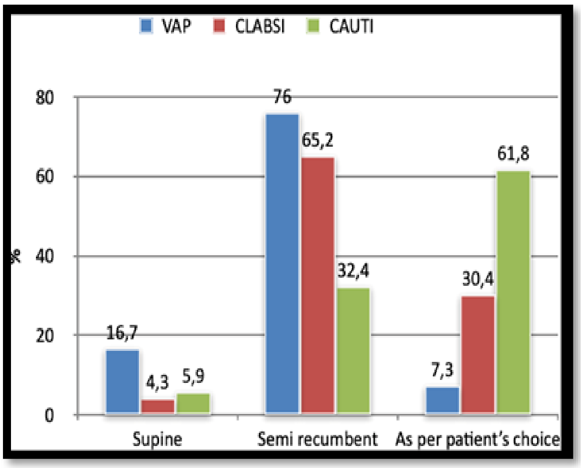

Figure 8: Association of incidence of HCAI with body position

Fig. 8 shows the association of incidence of HCAI with body position. Semi recumbent body position was among more than half of patients (56.3%) followed by prone (31.7%) and supine (12%). The

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incidence of VAP (76%) and CLABSI (65.2%) was highest among patients whom body position was semi recumbent. However, the incidence of CAUTI was highest among patients whom body position was prone (61.8%). There was significant (p=0.0001) association of incidence of VAP and CAUTI with body position.

Fig. 10 shows the association of incidence of HCAI with re-intubation. Re-intubation was present in 3.5% patients. The incidence of CAUTI (11.8%) was higher than CLABSI (8.7%) and VAP (5.2%) among whom re-intubation was present. There was significant ($p<0.05$) association of incidence of CLABSI and CAUTI with re-intubation, this has no clinic-pathological correlation.

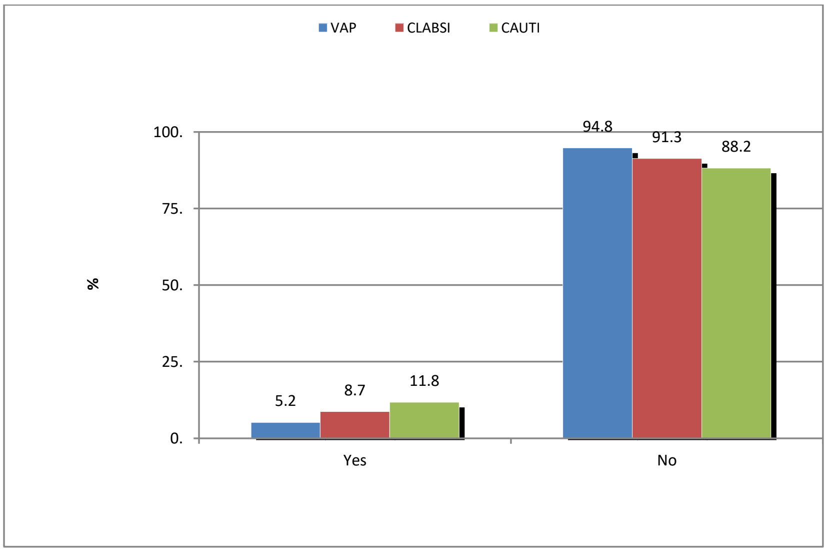

Figure 10: Association of incidence of HCAI with Re-intubation

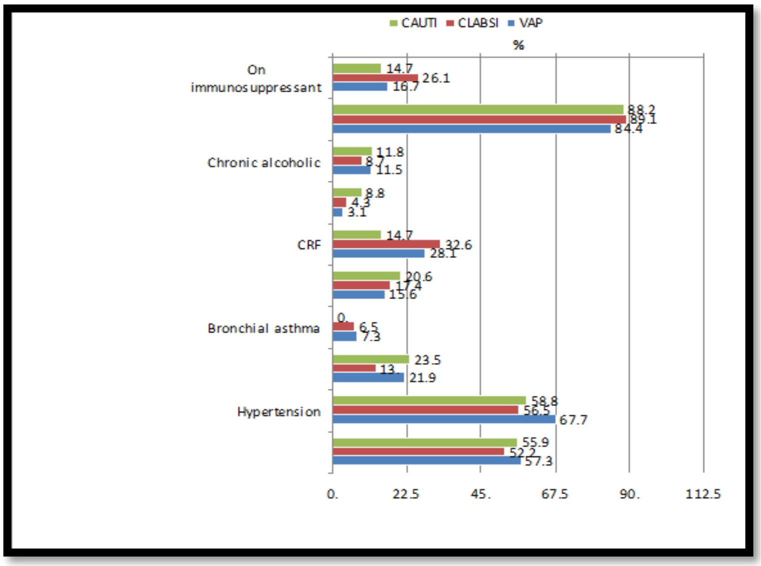

Figure 11: Association of incidence of HCAI with comorbidity

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Table-12: Association of incidence of HCAI with co-morbidity

Comorbidity#	No. of patients (n=142)		VAP (n=96)			CLABSI (n=46)			CAUTI (n=34)		
	No.	%	No.	%	p-value[1]	No.	%	p-value[1]	No.	%	p-value[1]
Diabetes mellitus	80	56.3	55	57.3	0.74	24	52.2	0.48	19	55.9	0.95
Hypertension	92	64.8	65	67.7	0.29	26	56.5	0.15	20	58.8	0.40
COPD	29	20.4	21	21.9	0.53	6	13.0	0.13	8	23.5	0.60
Bronchial asthma	8	5.6	7	7.3	0.21	3	6.5	0.75	0	0.0	0.10
CAD	24	16.9	15	15.6	0.55	8	17.4	0.91	7	20.6	0.51
CRF	35	24.6	27	28.1	0.16	15	32.6	0.12	5	14.7	0.12
CVA	7	4.9	3	3.1	0.15	2	4.3	0.82	3	8.8	0.22
Chronic alcoholic	16	11.3	11	11.5	0.91	4	8.7	0.50	4	11.8	0.91
Hypo albuminuria	122	85.9	81	84.4	0.44	41	89.1	0.44	30	88.2	0.65
On immunosuppressant	27	19.0	16	16.7	0.30	12	26.1	0.13	5	14.7	0.46

Table-12 & Fig. 11 shows the association of incidence of HCAI with comorbidity. Hypo albuminuria was the most common comorbidity (85.9%) and Hypertension was the second most common comorbidity (64.8%). Diabetes mellitus was the third most common comorbidity (56.3%). CVA was the least common comorbidity (4.9%). There was no significant (p>0.05) association of incidence of HCAI with comorbidity.

Fig. 12 shows the association of incidence of HCAI with prior antimicrobial used. Prior antimicrobial was used by majority of patients (71.1%). There was no significant (p>0.05) association of incidence of HCAI with prior antimicrobial used.

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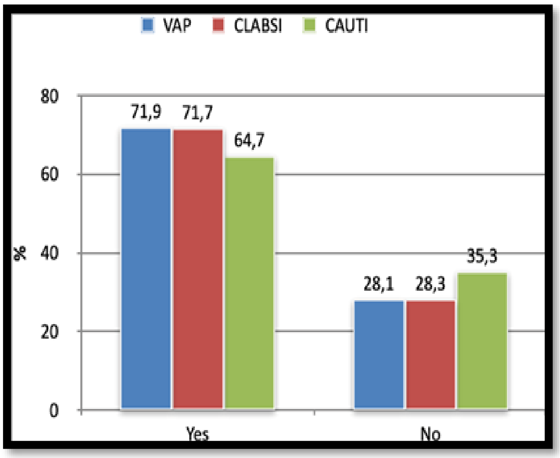

Figure 12: Association of incidence of HCAI with prior antimicrobial used

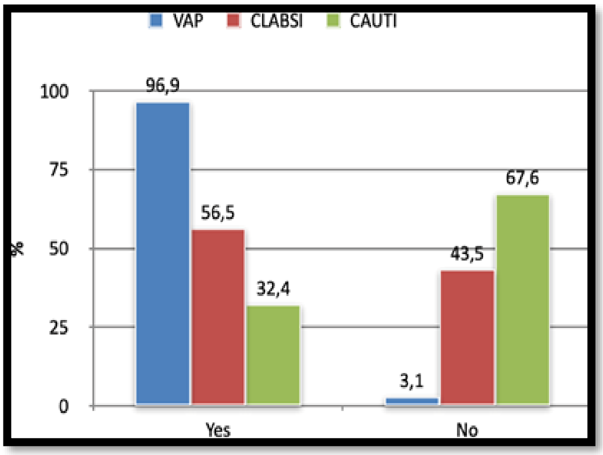

Figure 13: Association of incidence of HCAI with sedation used

Fig. 13 shows the association of incidence of HCAI with sedation used. Sedation was used by 65.5%. There was significant (p=0.0001) association of incidence of VAP and CAUTI with sedation used.

Fig. 14 shows the association of incidence of HCAI with vasopressor used. Vasopressor was used by more than one third of patients (46.5%). The incidence of CLABSI was among all patients who used vasopressor. The incidence of CAUTI was in 29.4% patients who used vasopressor. There was significant (p<0.05) association of incidence of CLABSI and CAUTI with vasopressor used.

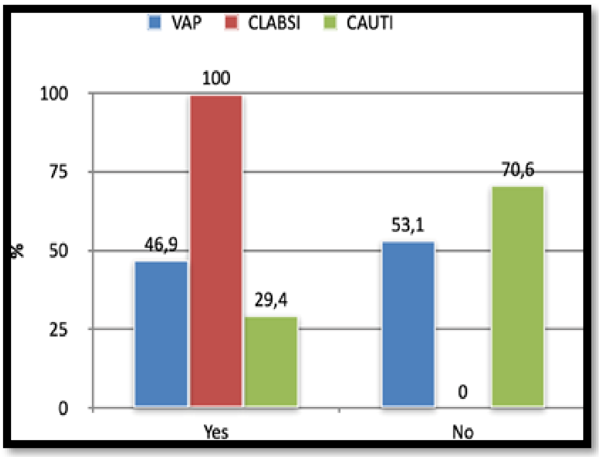

Figure 14: Association of incidence of HCAI with vasopressor used

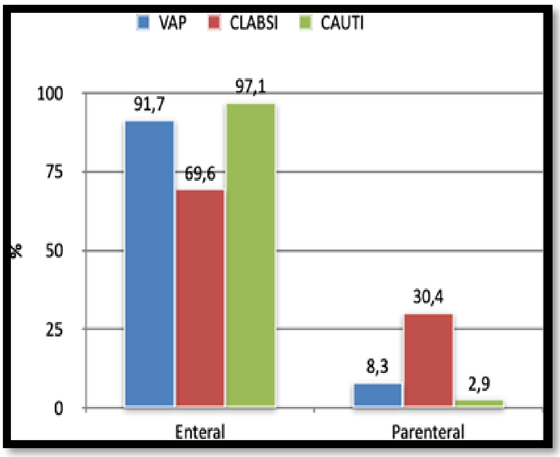

Figure 15: Association of incidence of HCAI with nutrition

Fig. 15 shows the association of incidence of HCAI with nutrition. Enteral nutrition was among majority of patients (90.1%). The incidence of CLABSI was among 69.6% patients who had enteral nutrition. There was significant (p=0.05) association of incidence of CLABSI with nutrition.

Fig. 16 shows the association of incidence of HCAI with any blood product transfused. Any blood product was transfused among 47.2% patients. The incidence of VAP, CLABSI and CAUTI was almost similar among whom any blood product was transfused. However, there was no significant

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(p>0.05) association of incidence of HCAI with Any blood product was transfused.

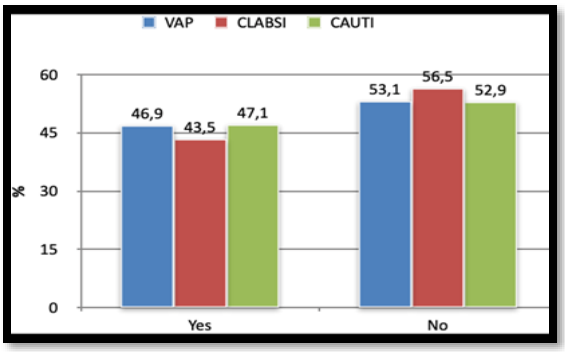

Figure 16: Association of incidence of HCAI with any blood product transfused

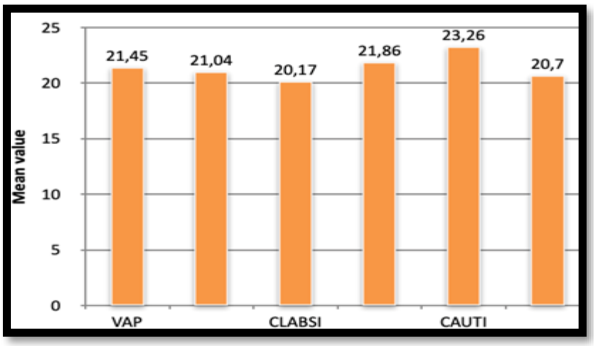

Figure 17: Comparison of duration of ICU stay with incidence of HCAI

Fig. 17 shows the comparison of duration of ICU stay with incidence of HCAI. The duration of ICU stay was significantly (p=0.04) higher whom VAP was present (23.26±7.24 days) than absent (20.70±6.22 days). There was no significant (p>0.05) difference in ICU stay between presence and absence of CAUTI and CLABSI.

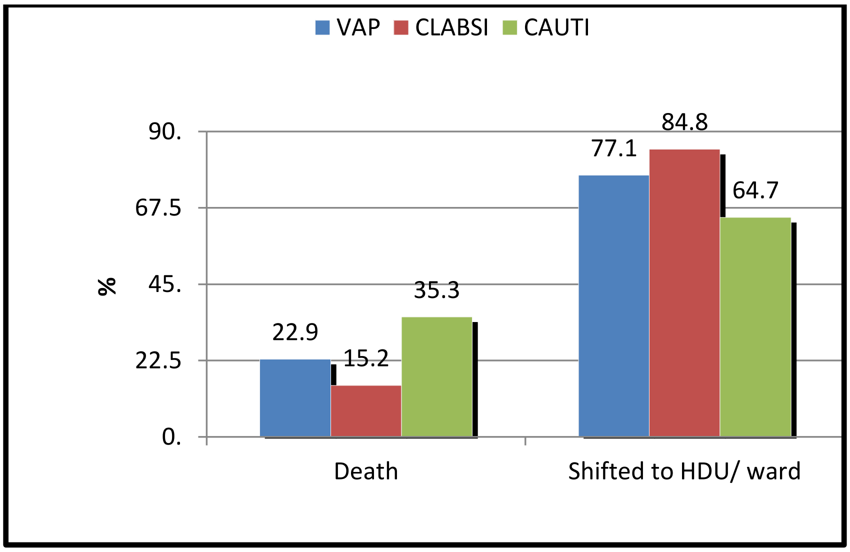

Figure 18: Association of incidence of HCAI with outcome

Fig. 18 shows the association of incidence of HCAI with outcome. The mortality was in 23.2% patients. There was significant (p<0.05) association of incidence of HCAI with outcome.

6. Conclusions

The present study was conducted in the Department of Critical Care Medicine, Indraprastha Apollo Hospitals, New Delhi with the objective to determine the incidence, associated risk factors, the causative pathogens and the outcome of device (central venous line, endotracheal tube/ tracheostomy tube, urinary catheter) related HCAI in the ICUs of a tertiary care hospital. A total of 142 patients were included in the study. The following are the significant findings:

1) APACHI II score was found to be significantly (p=0.004) higher among whom CAUTI was present (26.35±10.12) than absent (21.08±9.69).

2) The incidence of VAP (76%) was highest among patients whom body position was semi recumbent. There was significant (p=0.0001) association of incidence of VAP with body position. This result is because of all patients are nursed in semi recumbent position, if not contraindicated, as per VAP bundle.

3) The incidence of CAUTI was highest among patients whom body position was prone (61.8%). There was significant (p=0.0001) association of incidence of CAUTI with body position.

4) The incidence of VAP (5.2%) among whom re-intubation was present. There was no significant (p=0.11) association of incidence of VAP with re-intubation. This result is because very few incidences of re intubation was there.

5) Sedation was used by 65.5%. There was significant (p=0.0001) association of incidence of VAP with sedation used.

6) The incidence of CLABSI was among all patients who used vasopressor. The incidence of CAUTI was in 29.4% patients who used vasopressor. There was significant (p<0.05) association of incidence of CLABSI and CAUTI with vasopressor used.

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