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A Prospective Study On Hospital Acquired Infections In A Tertiary Care Hospital.

Neha Annamma George [1], Jeeva George[2], Dr. Balakeshwa[3]
[1]pharrm.D, [2]assistant Professor, [3]hod Department Of Pharmacy Practice
Department Of Pharmacy Practice, Karnataka College Of Pharmacy, Rajiv Gandhi University Of Health Sciences Bengaluru, Karnataka India – 560064

Abstract
Hospital-acquired infections (HAIs) pose a significant challenge in healthcare, contributing to increased morbidity, mortality, and healthcare costs globally. Despite medical advancements, HAIs remain prevalent, especially among patients with prolonged hospital stays and underlying comorbidities. This prospective observational study, conducted in the inpatient Surgery department of a tertiary care hospital, aimed to assess the incidence, risk factors, and management strategies for HAIs. The study included 55 patients, with data collected on demographics, infection type, causative organisms, risk factors, and treatment regimens. The most common HAIs identified were Ventilator-Associated Pneumonia (VAP) (36.3%) and Central-Line Associated Bloodstream Infections (CLABSI) (29.09%). Acinetobacter (38.1%) and E. coli (21.8%) were the predominant causative organisms. Laboratory findings showed that 80% of patients had leukocytosis, 60% had neutrophilia, and 90% exhibited elevated CRP levels. Significant risk factors included prolonged hospital stays (63.6% of patients hospitalized for more than 10 days), mechanical ventilation, and chronic conditions such as diabetes (32.7%) and hypertension (30.9%). The most frequently prescribed antibiotics were Meropenem (69%) and Colistin (52.7%), underscoring the growing concern over antibiotic resistance. The study highlights the urgent need for targeted infection control measures, including standardized protocols and vigilant monitoring, particularly for high-risk patients. It emphasizes the importance of addressing antibiotic resistance through rational prescribing practices to improve patient outcomes. These findings underscore the necessity of effective interventions and enhanced infection control strategies, particularly in resource-limited settings, to mitigate the burden of HAIs and enhance overall healthcare quality.

Keywords: *Hospital-acquired infections, (HAIs), Ventilator-associated pneumonia (VAP), Central-line associated bloodstream infections (CLABSI), Antibiotic resistance, Acinetobacter, Risk factors, Infection control, Diabetes mellitus, Prolonged hospital stay, Tertiary care hospital*

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I. Introduction

Healthcare-associated infections (HCAIs), also known as nosocomial infections, are infections acquired during healthcare delivery, typically manifesting 48 hours or more after hospital admission or within 30 days post-treatment. They affect approximately 7% of patients in developed nations and 10% in developing countries, with incidence rates ranging from 3.6% to 19.1%, particularly higher in low- and middle-income countries (LMICs) compared to high- income countries (HICs). HCAIs pose serious risks, increasing mortality, morbidity, hospital stays, and healthcare costs, and exacerbating existing conditions such as cancer and surgical recovery.[1] A study by Sheng et al. highlighted that 80% of hospital deaths are linked to HCAIs,[2] emphasizing the need for specialized surveillance and research to mitigate this public health issue. HCAIs lead to significant consequences, including functional disability, emotional stress, reduced quality of life, and economic burdens due to extended hospitalizations andincreased antibiotic resistance.[5] Common types of HCAIs include surgical site infections, bloodstream infections, urinary tract infections, and respiratory tract infections, each with distinct clinical manifestations and associated risks. The higher prevalence of HCAIs in developing nations is attributed to factors such as lack of infection control policies, overcrowding, and inadequate training of healthcare professionals, making effective surveillance and intervention crucial for quality improvement.[5] Despite increased legislation and reporting, challenges remain in fully understanding HCAI epidemiology and implementing effective infection control measures, particularly in high-risk populations such as ICU patients.[3]

The primary objective of this study is to assess the risk factors and management strategies for hospital-acquired infections. Additionally, the study aims to identify the most common types of hospital-acquired infections, review the laboratory tests used for their diagnosis and evaluation, and determine the types of microorganisms most commonly associated with these infections.

II. Methodology

Study Type and Site:

This was a prospective observational study conducted in the inpatient Surgery department of a tertiary care hospital. The research primarily focused on identifying the risk factors and management strategies for hospital-acquired infections in patients admitted to the hospital. The study was conducted over a duration of ten months, from January to October 2023.

Inclusion and Exclusion Criteria:

The study included patients with central lines, ventilated patients, and post-surgery patients admitted to the ICU and wards, as well as all patients who had been hospitalized for more than 48 hours. However, patients with infections related to urinary catheters and those showing clinical signs of infection at the time of or prior to admission were excluded from the study.

Data Sources and Materials:

Data were collected from various sources, including patient case notes, treatment charts, and laboratory reports. These documents provided comprehensive details necessary for the study.

Study Methodology and Data Collection:

Hospitalized patients were observed, and their medical charts, including microbiological tests, clinical data, and physician diagnoses, were reviewed during ward rounds. Patients meeting the study criteria were enrolled. Data on newly infected patients, diagnoses, use of indwelling devices, mechanical ventilation, surgical procedures, antimicrobial use, and other HAI riskfactors were collected using a standardized form. Relevant investigations were conducted as needed, with laboratory and clinical data documented and monitored until patient discharge.

Ethical Considerations:

Ethical considerations included informing participants about the study's objectives, procedures, and benefits, and obtaining written informed consent. Data confidentiality was ensured through anonymization and secure storage, with restricted access to authorized personnel. Since the study was observational and did not involve medication or treatment changes, ethical approval was not required, but informed consent and confidentiality were upheld throughout.

III. Results

The study analyzed 55 patients, with 64% being male and 36% female. The average age of the patients was approximately 49.91 years, with a standard deviation of 14.88 years, indicating a broad age range among the participants. Most patients (38.1%) were over 61 years old. The mean length of hospital stay was 21.3 days, with a standard deviation of 8.9 days, reflecting varied durations of hospitalization. Over half of the patients (56.3%) had chronic diseases, with diabetes mellitus (32.7%) and hypertension (30.9%) being the most common. The mean number of chronic disease cases was 8.86, with a standard deviation of 7.57, highlighting diversity in chronic conditions. Additionally, prolonged hospital stays (58.1%) and extrinsic factors such as mechanical ventilation for over 48 hours (36.3%) and intubation (27.2%) significantly contributed to the risk of hospital-acquired infections. Other contributing factors included trauma (16.3%) and surgery (14.5%), as detailed in Table 1.

The study also highlights the distribution of hospital-acquired infections (HAIs) and their causative organisms. Ventilator-associated pneumonia (VAP) was the most common HAI, affecting 36.3% of patients, followed by central line-associated bloodstream infections (CLABSI) at 29.09%. Hospital-acquired pneumonia (HAP) and surgical site infections (SSI) were also significant, affecting 16.3% and 14.5% of patients, respectively. Other infections, such as bacteraemia (11%) and bloodstream infections (7.2%), were notable, while septicaemia (5.4%) and skin and soft tissue infections (3.6%) were less frequent. Clostridium difficile infections (1.8%) were the least common. The most prevalent causative organisms were *Acinetobacter* (38.1%), *E. coli* (21.8%), and coagulase-negative staphylococcus (12.7%), with *Klebsiella* and *Pseudomonas aeruginosa* also contributing to infections. These findings underscore the importance of monitoring and addressing specific HAIs and their pathogens, as detailed in Table 2.

Furthermore, the study examined the distribution of antibiotics prescribed within the sample population. Meropenem was the most commonly prescribed antibiotic, accounting for 69% of cases, followed by colistin at 52.7%. Piperacillin combined with tazobactam was also frequently prescribed, with a usage rate of 23.6%. Other antibiotics, such as tigecycline, imipenem-cilastatin, and teicoplanin, were prescribed less frequently, with usage rates ranging from 18.1% to 7.27%. Several antibiotics, including vancomycin, ceftriaxone, and cotrimoxazole, were prescribed at even lower frequencies, each accounting for 3.63% or less. The least prescribed antibiotics,

such as ceftazidime, cefixime, and others, were used in only 1.81% of cases, as detailed in Table 3.

IV. Discussion

Hospital-acquired infections (HAIs) are a significant global health concern, contributing to high morbidity and mortality rates among hospitalized patients worldwide. They are particularly prevalent in individuals with prolonged hospital stays, comorbid conditions, and exposure to invasive devices. Gram-negative bacteria, including *Acinetobacter* and *Klebsiella*, are frequently implicated in HAIs, with antibiotic resistance emerging as a critical challenge. Addressing modifiable risk factors and implementing standardized infection control measures are vital to reducing HAI incidence and improving patient outcomes.

This study analyzed 55 hospitalized patients to evaluate the prevalence and risk factors associated with HAIs. Demographic characteristics, comorbidities, length of hospital stay, types of HAIs, causative organisms, and antibiotic usage patterns were documented. The findings were compared with data from prior studies to identify trends and potential areas for intervention.

Among the 55 patients analyzed, 64% were male, and the majority of infections were observed in patients aged over 61 years (38.1%). Diabetes mellitus (32.7%) and hypertension (30.9%) were the most common comorbid conditions. Ventilator-associated pneumonia (VAP) was the most frequently identified HAI, affecting 36.3% of patients, followed by central line-associated bloodstream infections (CLABSI) at 29.09%. Prolonged hospital stays, particularly over 10 days, were identified as significant risk factors. The predominant causative organisms were *Acinetobacter* (38.1%) and *Klebsiella* (29%), consistent with studies from northern India.[4] Meropenem (69%) and colistin (52.7%) were the most commonly prescribed antibiotics, reflecting the reliance on broad-spectrum agents in managing HAIs.

The findings of this study highlight key risk factors for HAIs, including advanced age, prolonged hospital stays, comorbidities, and mechanical ventilation. The high prevalence of gram-negative bacteria, particularly *Acinetobacter* and *Klebsiella*, underscores their role in HAIs and aligns with existing regional data.[4] Length of hospital stay was also a significant risk factor, with infections more common in patients hospitalized for more than 10 days, aligning with previous research indicating that prolonged stays, especially in older patients, increase infection risk due to various factors, including comorbidities and polypharmacy.[5] The extensive use of broad-spectrum antibiotics, such as meropenem and colistin, raises concerns about antibiotic resistance, necessitating stricter adherence to antimicrobial stewardship protocols.[12] Strategies to mitigate HAIs should focus on modifiable factors, such as optimizing the use of invasive devices, reducing hospital stay durations, and implementing evidence-based infection prevention practices. Moreover, there is a pressing need for multi-center research to establish standardized protocols for managing HAIs, particularly in resource-limited settings, to effectively monitor and address epidemiological trends.[4,5]

V. Conclusion

The findings reveal that advanced age, prolonged hospital stays, comorbid conditions such as diabetes and hypertension, and the use of invasive devices are major risk factors for HAIs. Ventilator-associated pneumonia (36.3%) and central line-associated bloodstream infections (29.09%) were the most common HAIs, predominantly caused by gram-negative bacteria such as *Acinetobacter* (38.1%) and *Klebsiella* (29%). Antibiotics such as meropenem (69%) and colistin (52.7%) were extensively used, highlighting the reliance on broad-spectrum antibiotics in managing HAIs.

The study emphasizes the need for targeted infection control measures, including optimizing invasive device use, reducing prolonged hospital stays, and adhering to antibiotic stewardship protocols to combat resistance. The results align with previous studies, reaffirming the role of gram-negative bacteria in HAIs and the necessity of addressing risk factors specific to older patients and those with comorbidities.

Reducing the incidence of HAIs requires a comprehensive approach involving effective infection prevention protocols, rational antibiotic use, and targeted strategies to address high-risk factors. Multi-center studies and standardized protocols, especially in resource-limited settings, are imperative for effectively managing HAIs and improving patient outcomes globally.

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Abbreviations

HAI: Hospital-Acquired Infection, **VAP**: Ventilator-Associated Pneumonia, **CLABSI**: Central Line-Associated Bloodstream Infection, **HAP**: Hospital-Acquired Pneumonia, **SSI**: Surgical Site Infection, **ICU**: Intensive Care Unit, **HICs**: High-Income Countries, **LMICs**: Low- and Middle-Income Countries, **CDC**: Centers for Disease Control and Prevention, **MRSA**: Methicillin-Resistant *Staphylococcus aureus*, **MDR**: Multi-Drug Resistant, **ESBL**: Extended-Spectrum Beta-Lactamase, **UTI**: Urinary Tract Infection, **WHO**: World Health Organization, **CRBSI**: Catheter-Related Bloodstream Infection, **CNS**: Coagulase-Negative Staphylococcus, **LOS**: Length of Stay

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Table 1: Demographic and Clinical Characteristics of Patients with Hospital-AcquiredInfections

Characteristic	Category	Number of Subjects	Percentage(%)	Mean	StandardDeviation
Gender	Male	35	64	-	-
	Female	20	36	-	-
Age Group	20-29	8	14.5	49.91	14.88
	30-49	16	29.09	-	-
	>50	31	62	-	-
	20-30	9	16.36	-	-
	31-40	6	10.9	-	-
	41-50	10	18.18	-	-
	51-60	9	16.36	-	-
	Above 61	21	38.1	-	-
Length of Stay(Days)	<10	5	9	21.3	8.9
	11-20	19	34.5	-	-
	21-30	15	27.2	-	-
	>31	16	29.09	-	-
Intrinsic RiskFactors	DM (Diabetes Mellitus)	18	32.7	8.86	7.57
	Hypertension (HTN)	17	30.9	-	-
	Cardiovascular disease (CVD)	13	23.6	-	-
	Chronic kidney disease (CKD)	9	16.3	-	-
	Respiratory diseases (COPD)	1	1.8	-	-
	Cancer comorbidities	2	3.6	-	-
	HIV	2	3.6	-	-
Extrinsic Risk Factors	Central venous line	16	29.09	-	-
	Intubation	15	27.2	-	-
	Mechanical ventilation >48h	20	36.3	-	-
	Surgery	8	14.5	-	-
Other Factors	Trauma	9	16.3	-	-
Chronic Disease	Yes	31	56.3	-	-
	No	24	43.6	-	-

Table 2: Hospital-Acquired Infections and Causative Organisms					
Hospital-AcquiredInfections (HAI)	**Frequency**	**Percentage(%)**	**Causative Organism**	**Frequency**	**Percentage(%)**
Ventilator-AssociatedPneumonia (VAP)	20	36.3	Acinetobacter	21	38.1
Central-Line AssociatedBlood Stream Infection (CLABSI)	16	29.09	E. coli	12	21.8
Hospital-AcquiredPneumonia (HAP)	9	16.3	Coagulase-negative staphylococcus	7	12.7
Surgical Site Infection(SSI)	8	14.5	Klebsiella	6	10.9
Bacteraemia	6	11	MSSA	2	3.6
Blood Stream Infection(BSI)	4	7.2	MRSA	2	3.6
Septicaemia	3	5.4	Candida parapsilosis	1	1.8
Skin and Soft Infections(SSTI)	2	3.6	Enterobacter species	1	1.8
Clostridium difficile (CDI)	1	1.8	Serratia Marcescens	1	1.8
			Streptococcuspneumoniae	1	1.8
			Morganella morganii	1	1.8
			Pseudomonasaeruginosa	2	3.6

Table 3: Distribution of Antibiotics Prescribed in the Sample Population		
Antibiotics	**Frequency**	**Percentage (%)**
MEROPENEM	38	69
COLISTIN	29	52.7
PIPERACILLIN+TAZOBACTAM	13	23.6
TIGECYCLINE	10	18.1
IMIPENEM+CILASTATIN	6	10.9
TEICOPLANIN	4	7.27
VANCOMYCIN	3	5.45
CEFTRIAXONE	2	3.63
COTRIMAXAZOLE	2	3.63
LINEZOLID	2	3.63
METRONIDAZOLE	2	3.63
LEVOFLOXACIN	2	3.63
SULBACTAM & CEFOPERAZONE	2	3.63
CEFTAZIDIME	1	1.81
CEFIXIME	1	1.81
CEFUROXIME	1	1.81
FLUCONAZOLE	1	1.81
ERTAPENEM	1	1.81
AMIKACIN	1	1.81