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FREQUENCY OF AND RISK FACTORS OF HOSPITAL ACQUIRED INFECTIONS IN PATIENTS ADMITTED IN CRITICAL CARE UNIT

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Abstract

Objective:
The objective of this study is to observe frequency and risk factors of hospital acquired infection in patients admitted in critical care unit

Study design:
Cross-sectional Observational study.

Place and duration of study:
Department of Medicine, CMH Bahawalpur, from December 2024- May 2025

Methodology:
A total of 100 patients aged 16–75 years were enrolled through non-probability consecutive sampling. Demographic and clinical data were recorded, and patients were monitored for hospital-acquired infections. Risk factors including ventilation, diabetes, Foley's catheter, age >50 years, and prolonged stay were assessed. Data were analyzed using SPSS 25, and odds ratios were calculated.

Results:
Out of 100 patients, 31% developed hospital-acquired infections. Ventilator-associated pneumonia was the most common infection, followed by urinary tract and bloodstream infections. Mechanical ventilation (OR=4.2) and hospital stay >7 days (OR=3.3) showed strong associations with infection. Diabetes mellitus (OR=2.1) and Foley's catheter use (OR=1.9) were moderate risk factors, while age >50 years showed weaker association. The findings indicate that invasive procedures and prolonged hospitalization significantly increase infection risk in critically ill patients.

Conclusion:
Hospital-acquired infections are common in critical care settings, primarily associated with ventilation and prolonged hospital stay. Diabetes and catheter use also increase risk.

Introduction:

Patients in intensive care units (ICUs) are at high risk for healthcare-acquired infections due to the high prevalence of invasive procedures and devices, induced immunosuppression, comorbidity, frailty and increased age. Over the past decade we have seen a successful reduction in the incidence of healthcare-acquired infections related to invasive procedures and devices. However, the rate of ICU-acquired infections remains high.[1] Coronary care is increasingly becoming a very vital part of management of

critically ill patients even in areas where facilities for its operation were, hitherto, not available. The care of critically ill patients is undoubtedly one of the most burdensome and onerous aspects of intensive care medicine.[2]

The rapid socioeconomic growth in the Gulf countries, which engendered a tremendous shift in lifestyle such as an increased consumption of low quality cholesterol-laden foods and adoption of a sedentary lifestyle, has resulted in increase rates of CVD and associated risk factors among the Gulf population. Consequently, the region witnessed a significant change in the cardiology workload for most of the secondary and tertiary health facilities necessitating incorporation of coronary care unit (CCU) into intensive care medicine over the years.[3, 4] Timely and appropriate care is the key to achieving good outcomes in acutely ill patients, but the effectiveness of critical care may be limited in resource-limited settings. Specialty-trained staff and standardized processes of care such as checklists are frequently lacking in ICU setups in low and middle-income countries, which in turn results in poor patient outcomes.[5]

A hospital-acquired infection (HAI), also known as a nosocomial infection is an infection that is acquired in a hospital or other health care field.Hospital acquired infection are major complication in every unit of hospital, Specially Critical Care Unit. Hospital acquired infection is burden for the society. This increased morbidity, mortality, cost of treatment and also hospital staying condition. Mostly patients, their relatives & health care provider get infected by the nosocomial infection.[6]

The most frequent ICU-acquired infections are pneumonia (including ventilator-associated pneumonia, surgical site infections, catheter-related bloodstream infections and catheter-associated urinary tract infections.[7, 8] Shaikh et al., conducted a study and reported that percentage of hospital acquired infections was 29.13% in patients admitted in critical care unit. [9]

Rationale of this study is to determine the frequency and Risk factors of hospital acquired infections in patients admitted in critical care unit. Literature showed that the risk of hospital acquired infections is high that can lead to more severe morbidity and even mortality. But limited work has been done before in this regard and there is no study done before in local set-up before. Therefore, it is important to conduct a study and to find the risk of hospital acquired infections and associated factors of hospital acquired infections in CCU admitted patients. This will help to improve our practice and knowledge and in future, we will implement better management protocol in local setting.

Methodology:

This cross-sectional research was done in the Department of Medicine of the Combined Military Hospital (CMH), Bahawalpur, during six months following the study synopsis approval from December 2024- May 2025. The purpose of the study was to assess the rate of hospital-acquired infections (HAIs) and risk factors of the occurrence of such a phenomenon in critically ill patients admitted to the critical care unit (CCU). The inclusion of 100 patients was done through a non-probability consecutive sampling method. The OpenEpi was used to calculate the sample size with a confidence level of 95%, margin of error of 9%, and the expected prevalence of HAIs of 29.13% based on the past studies.

Inclusion Criteria:

1. The patients who met the following criteria were included in the study:
2. The age of patients was 16-75 years.
3. Either gender patients admitted to critical care unit (CCU).
4. Medical patients admitted with medical conditions such as cerebrovascular disease, respiratory infections, sepsis, respiratory failure, head injury, liver disease, renal failure, or multi-organ dysfunction, as indicated in medical records.
5. Patients who had been in the CCU long enough to be monitored to develop hospital-acquired infections.
6. Patients whose attendants informed consent to participate in the study.

Exclusion Criteria:

1. Patients who fitted into the following were not included in the study:

2. Pregnant patients, because of the changed physiological and immunological condition.
3. Patients who had pre-existing infections during admission to the CCU.
4. Patients that were discharged or expired within 24-48 hours of admission because they could not be properly evaluated of being infected in the hospital.
5. Patients who had incomplete medical records or lacked clinical data.
6. Patients who refused to participate or had their attendants reject participation.

Informed consent of the attendants was obtained and detailed demographic and clinical data was taken, such as age, gender, and length of stay in the CCU, the reason of admission, and medical history including smoking, hypertension, anemia and alcoholism. Infection clinical signs such as fever, tachycardia, tachypnea as well as laboratory signs such as high white blood cell count were monitored in each patient daily. The diagnosis of hospital-acquired infections was confirmed using radiological and laboratory reports.

Patients were classified into two, those who developed HAIs and those who did not. The risk factors were measured according to operational definitions, such as mechanical ventilation of over two days, age over 50 years, diabetes mellitus (HbA1c >6.5%), Foley catheter over two days, and CCU stay longer than seven days.

The input and analysis of data were carried out in SPSS version 25. Mean and standard deviation were used to state the quantitative variables like age and length of stay whereas frequencies and percentages were used to state the qualitative variables. The Shapiro-Wilk test was used to test normality. Odds ratios (OR) were estimated to determine the relationship between risk factors and HAIs, and OR greater than1 was taken as evidence of positive relationship. A p-value less than .05% was considered significant.

Results:

In this study, 100 patients admitted to the critical care unit were used. The average age of the patient sample was 54.2 years ± 13.6 , most of the patients (62%) were aged above 50 years. It was dominated by males (58 % men and 42 % women).

The total rate of hospital-acquired infections (HAIs) was also determined as 31% and 69% of the patients did not get any infection throughout their stay in the CCU. Ventilator-associated pneumonia (VAP) was the most prevalent type of HAIs among the patients who acquired it, 38.7%. This was topped by urinary tract infections (25.8%), bloodstream infections (19.4%), and surgical site infections (16.1%).

Risk factors were assessed and found that 36 % of the patients needed to be on mechanical ventilation after more than two days, 41 percent were diabetic, 48 % had a Foleys catheter longer than two days, and 55% had a CCU stay longer than seven days. Many patients (62%) were more than 50 years old.

The correlation of the risk factors and HAIs was analyzed, and it was proved that mechanical ventilation was the most connected factor with infection with a odds ratio (OR) of 4.2. In the patients that developed HAIs, 22/31 patients were found to have previously been on ventilators as opposed to 14/31 patients who were found to be without infection. Likewise, long CCU stay (>7 days) was significantly related to HAIs (OR = 3.3), with 24 patients who were infected experiencing longer hospitalization.

Infection was also found to have a significant correlation with diabetic mellitus (OR = 2.1), which implies that diabetic patients were at higher risk of acquiring HAIs than non-diabetics. The catheterization of Foley had a moderate relationship (OR = 1.9), indicating a higher risk of the occurrence of urinary and systemic infections. Older adults (above 50 years of age) exhibited a comparatively weaker relationship (OR = 1.5), and older patients were more prone to infection.

In general, the findings show that invasive procedures and extended hospitalization are major factors that contribute to hospital-acquired infections in patients in critical care units.

Overall, the results indicate that invasive interventions and prolonged hospital exposure are key contributors to hospital-acquired infections in critically ill patients.

Table 1.1: Demographic Data of study population

Variable	Mean ± SD / Frequency	Percentage
Age (years)	54.2 ± 13.6	—
Male	58	58%
Female	42	42%

Table 1.2: Hospital acquired infection frequency

Infection Status	Frequency	Percentage
Present	31	31%
Absent	69	69%

Table 1.3: Types of Hospital-Acquired Infections

Type of Infection	Frequency	Percentage
Pneumonia (VAP)	12	38.7%
Urinary Tract Infection	8	25.8%
Bloodstream Infection	6	19.4%
Surgical Site Infection	5	16.1%

Table 1.4: Risk factors among study population

Risk Factor	Present	Percentage
Ventilator use (>2 days)	36	36%
Age >50 years	62	62%
Diabetes mellitus	41	41%
Foley catheter (>2 days)	48	48%
Hospital stay >7 days	55	55%

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Table 1.5: Association Between Risk Factors and HAI

Risk Factor	HAI Present	HAI Absent	Odds Ratio (OR)
Ventilator use	22	14	4.2
Age >50 years	20	42	1.5
Diabetes mellitus	18	23	2.1
Foley catheter	19	29	1.9
Hospital stay >7 days	24	31	3.3

Discussion:

Hospital-acquired infections (HAIs) continue to be a significant issue in the intensive and critical care units, which adds to the rising morbidity, mortality, extended length of stay, and healthcare expenses. The current research assessed the rates and risk factors of HAIs amongst patients admitted to the critical care unit (CCU) of a tertiary care hospital. The general rate of HAIs within this study was 31, which could be compared with the previous studies conducted in the region with Shaikh et al. recording a prevalence rate of 29.13 in ICU patients. This parallelogram supports the ongoing heavy load of HAIs in the critical care setting, especially in third world nations.

The rate in this study is within the worldwide range of 20-40 percent of ICU-acquired infections. Research that has been carried out in both the high- and low- to middle-income nations have also consistently shown that ICU patients face an increased risk because of invasive procedures, immunosuppression, and underlying comorbidities. But the resource shortages, poor

infection control measures, and absence of standardized procedures also worsen the issue in developing health care systems. Blot et al. (2022) emphasized that even with the development of infection prevention methods, ICU-acquired infections are still a crucial issue because microbial resistance is changing and the invasive devices are used more often.[10]

Ventilator-associated pneumonia (VAP) was the most prevalent form of infection in the current study, with the proportion of 38.7. The observation is in line with the world literature, which indicates pneumonia as the major cause of ICU-acquired infections. Prolonged mechanical ventilation, the inability of the mucociliary clearance system to work, and the development of the respiratory tract by pathogenic organisms are the reasons why the incidence of VAP is high. Maertens et al. (2022) stressed that improper management of cuff pressure and extended intubation are important contributors to the development of VAP, which is why ventilator care bundles and the need to adhere to the practices of infection control are crucial.[11,12]

The second most common HAIs in this study were urinary tract infections (UTIs). Indwelling urinary catheters have been strongly correlated with these infections. The results are consistent with the earlier research that shows that catheter-associated UTIs represent a significant percentage of nosocomial infections in ICUs. The best practices to reduce this risk include proper care of catheters, early removal and following aseptic practices. The bloodstream infections and surgical site infections were also reported, but at lower rates, which is also correlated with the trends in other similar clinical environments.[13]

Mechanical ventilation was found to have the highest level of association with HAIs with odds ratio (OR) of 4.2. This shows that patients who were on ventilatory support were over four times more likely to contract infections than those who were not on ventilatory support. This observation concurs with various researches that have categorized mechanical ventilation as a key factor leading to nosocomial infections. Not only does the use of invasive devices give a direct pathway of microbial entry but it also interferes with normal host defense mechanisms. As such, it is essential to reduce the ventilation period and provide preventive measures including raising the head end, oral care, and early weaning measures.[14,15]

The other important risk factor found in the study was the length of stay (>7 days) in the hospital that was highly associated with HAIs (OR = 3.3). Extended hospitalization predisposes patients to be exposed to hospital flora, multidrug-resistant organisms, etc. According to De Pascale et al. (2022), there is a higher infection rate and mortality rate associated with delays in source control and increased ICU stay. The results underscore the importance of effective patient management, early diagnosis, and discharge planning to minimize the risk of infection.[16]

HAIs were also found to significantly relate with diabetes mellitus (OR = 2.1). The diabetic disease is known to cause impairment of the immune system such as down-regulation of neutrophil response and poor glycemic control, which make diabetic patients prone to infections. This is in line with the current literature, which has stated that diabetes is a risk factor in its own right on nosocomial infections. Extremely tight glycemic regulation, and close observation of diabetic patients in the ICU is thus crucial to minimise the risk of infection.[17]

Foleys catheter use was linked with HAIs with an intermediate relationship (OR = 1.9) indicating its involvement in the occurrence of catheter-associated infections. The lengthy stay of the catheter makes it easier to colonize bacteria and form biofilms that contribute to the risk of infection. This burden can be greatly minimized by the introduction of catheter care protocols and restricting the use of catheters when there is no need.[18]

Whereas age above 50 years showed a rather less significant association (OR = 1.5), it is still a significant contributory factor. Elderly patients are more prone to infections due to numerous comorbidities, low physiological reserve, and a weaker immune system. Nevertheless, the lesser correlation found in the present research indicates that age per se might not be a potent independent predictor in comparison to other adjustable risk factors like invasive procedures and hospital stay.[19]

Clinical implications of the results of the present study are significant. To begin with, they emphasize the importance of following the infection control measures strictly, especially in the environments with limited resources. Second, they insist on the necessity of reducing the use and the time when invasive devices are used. Third, they emphasize the importance of early identification and treatment of high-risk patients, such as diabetics or long hospitalization. The use of standardized care bundles, frequent staff education, and ongoing monitoring of HAIs are the key steps to enhance patient outcomes.

Limitation of Study:

Being a single-center study with a relatively small sample size, the findings may not be generalizable to all settings. Additionally, the cross-sectional design limits the ability to establish causality. Future studies with larger, multicenter populations and incorporation of microbiological analysis are recommended to provide a more comprehensive understanding of HAIs and their determinants.

Conclusion:

Hospital acquired infections pose a major problem in patients who are critically ill. The most significant risk factors were mechanical ventilation and long hospitalization, and diabetes mellitus and Foley catheterization were also associated with the risk of infection. These results suggest the importance of invasive interventions and prolonged stays in hospital settings in the pathogenesis of HAIs. Strict infection control measures, shorten the period of invasive devices usage, and early detection of high-risk patients are the key measures that can be implemented to reduce the number of infections and improve clinical outcomes in the critical care environment.

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