Original Article

Prevalence of Hospital Acquired Infections in The Intensive Care Unit of University of Ilorin Teaching Hospital, Ilorin Nigeria

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ABSTRACT

Background: Hospital acquired infections (HAIs) are defined as infections which develop 48 hours after hospital admission or within 48 hours after being discharged. This study investigates the prevalence rate of HAIs and the risk factors involved in Ilorin Nigeria.

Materials and Methods: Blood samples were collected from 50 adult patients and environmental swabs were collected from ICU. Socio-Demographic characteristics of the subjects were obtained using closed ended structured questionnaires. Data were analyzed using SPSS version 16 package.

Results: The study revealed 12% prevalence of HAI in the ICU. Risk factors were found to be statistically significant for the patients that used central vein cannula (p=0.000). The use of other devices such as peripheral vein cannula (p=0.594), mechanical ventilation (p=0.756), endotracheal intubation (p=0.378) in this study was found to be statistically not significant. Length of hospital stay (p=0.266), surgical operation (p=0.510) and associated medical diseases (p=0.314) were also considered not significant in association with HAIs.

Conclusions: The use of invasive devices contributes to the development of HAIs in ICU patients and adequate preventive measures should be employed in the ICU to reduce the problem caused by HAIs.

Keywords: Central vein cannula, ICU and HAI.

Hospital-Acquired Infection (HAI) are infections occurring in a patient in hospital or other healthcare facility which were not present or incubating at the time of admission. They include infections acquired in the hospital but appearing after discharge, and also occupational infections among staff of the facility[1].

The Centers for Disease Control and Prevention (CDC) estimated roughly 1.7 milion hospital-associated infections from all types of bacteria combined[2]. Overall HAIs cumulative incidence in surgical wards ranged from 5.7 to 45.8% in studies conducted in Ethiopia[3] and Nigeria[4]. In Nigeria, HAIs rate of 2.7 % was reported from Ife[5], while 3.8% from Lagos[6] and 4.2 % from Ilorin[7].

Intensive Care Units (ICU) have the highest prevalence of hospital acquired infections in the hospital settings[8]. ICU patients are particularly at risk from hospital-acquired infections as a result of mechanical ventilation, use of invasive procedures and their immunocompromised status. Hospital-acquired infections are associated with a great deal of morbidity, mortality and increased financial burden[9]. They add to functional disability, emotional stress and in some cases, may lead to disabling conditions that reduce the quality of life[10]. There are dart of data on

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prevalence of HAIs in University of Ilorin Teaching Hospital, Ilorin Nigeria. An understanding of the causative organisms and risk factors associated with hospital-acquired infections will lead to better prevention and treatment.

MATERIALS AND METHODS:

Study population:

The study was a cross-sectional study of all adult patients of age range 18 to 70 years that were admitted into the ICU within the study period. The sample size was determined using Fischer's formula[11]. The study was carried out between February and July, 2014.

Study location:

The study was conducted at the Intensive Care Unit of the University of Ilorin Teaching Hospital (UITH) where all the samples were collected. The samples were analyzed in the Medical Microbiology and Parasitology Laboratory of University of Ilorin Teaching Hospital, Ilorin, Nigeria.

Ethical clearance:

Approval was obtained from the Ethical Review Committee (ERC) of the University of Ilorin Teaching Hospital after it has met all the necessary requirements of the Committee. In addition, informed consent was obtained from close relatives of the patients after a clear explanation of the study.

Sampling Collection and Processing:

Samples of blood were collected from patients immediately they were admitted into the ICU. Swabs from the surfaces of walls, floors, beds, bedside tables, and trays were also collected from the ICU environment. Bacteriological analysis of each sample was carried out which included culture, isolation and identification of microorganisms. After 48hours, samples of blood were collected from the same patients and subjected to bacteriological analysis.

Data collection:

Data were entered in the Statistical Program for Social Sciences (SPSS version 16.0) and analyzed using chi-square test to verify association of the HAIs with clinical characteristics and demographic variables. Statistical significance of $p < 0.05$ and confidence limit of 95% was used. Descriptive statistics such as mean, frequency, standard deviation, percentage and graph were also used in the presentation of results.

RESULTS:

During the period of the study, 50 patients were admitted into the ICU of UITH. Thirty-eight (38) of the samples were positive for bacterial growth. HAI in the ICU was suspected in 6 patients with prevalence rate of 12% (6/50). The number of male patients admitted for the study exceeded that of the female. Thirty-one (31) male and 19 female patients were admitted during this study. Four (21%) female and two (6%) male patients had HAIs. The result was not statistically significant (p=0.234). All the reported cases of HAIs were found in patients that are married. Patients that are single, divorced and widowed showed no reported case of HAI in this study (p=589) (Table 1).

The number of Muslims that were admitted was more than that of Christians. Four of the patients that are Muslims had HAIs while only two of the patients that are Christians had HAIs (p=0.339) (Figure 1). Table 2 showed that patients within age range of 50 and above dominate the numbers of patients classified according to the age of the population (38%). Two cases of HAIs were found in patients between age groups 21-30 years and 50 years and above. Patients within age range of 31-40 years and 41- 50 years have one case of HAIs each. No case of HAI is found in patients within age range 11-20 years. (p=0.621). The patients that are involved in other occupations like

Farming, Driving and the Unemployed had the highest number of representatives. Two (29%) of the patients in this category had HAIs. The Patients that are Apprentice had the least value of representatives (4). None of the patients in this group had HAI. The result is not statistically significant (p= 0.297) Table 4 showed that all the patients that had HAIs used peripheral vein cannula. (p=0.594).

Five of the patients that had HAIs used central vein cannula. This result is statistically significant (p=0.000). No case of HAIs was reported in patients that used Nasogastric tube insertion and chest tube insertion.

Table (1): Prevalence rate of HAIs in relation to Gender and Marital Status of Patients.

	HAIs		Total	P-Value	X^2	df
	Percent (%)	Absent (%)				
Sex						
Male	2(6%)	29(94%)	31(100%)	0.234	2.378	1
Femal	4(21%)	15(79%)	19(100%)			
Marrital status						
Single	0(0%)	6(100)	6(100)	0.589	1.923	1
Married	6(15%)	33(85%)	39(100%)			
Divorce	0(0%)	3(100%)	3(100%)			
Widowed	0(0%)	2(100%)	2(100%)			

p< 0.05 is Statistically Significant

All the patients with HAIs were admitted for more than 48 hours while no case of HAIs was recorded in patients that stayed less than 48 hours in the ICU as shown in Figure 2 (p=0.103).

Table 5 shows that 3(19%) of the patients that were admitted with history of disease also acquired HAI (p=0.314). Table 6 showed that five out of the patients that undergone surgical operation have HAIs (p=0.510).

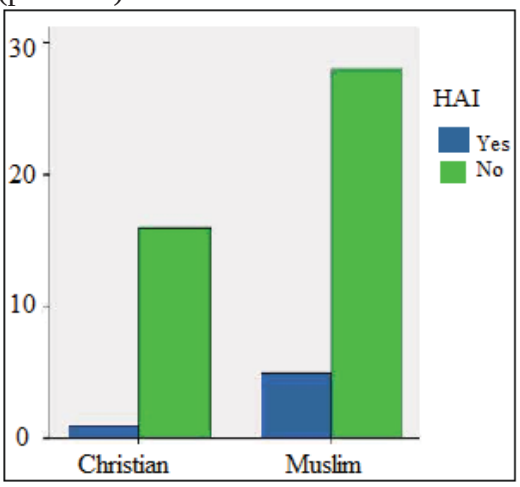

Figure (1): Prevalence of HAI in Subjects in relation to Religion. P= 0.339, X2=0.913, df=1. p< 0.005 is Statistically Significant.

DISCUSSION:

The prevalence of hospital acquired infections in this study was 12.0%. This result is within the range quoted for developed countries of 9-37% [12]. It is much higher than the 8.4% in the 5 year review done by Onipede *et al*[5]. This high rate can be as a result of the use of invasive devices in the intensive care unit. Our result almost agreed with the results of Su et al[13] that recorded 11.4%. Our finding is however lower when compared to the result recorded by Afolabi *et al*[14]. This may be due to the lower number of patients that were involved in this study. It may also be as a result of the measures adopted by the study hospital to reduce or minimize the occurrence of hospital acquired infections. The difference may also be due to the type of ICU, difference in criteria for patients selection, severity of illness, length of ICU stay, rate of invasive devices utilization as recorded by Vague *et al*[15]. Appelgren *et al*[16] reported in a study that there is a significant relationship between gender of patients and HAIs. However, the gender of patients is not

Table (2): Prevalence rate of HAIs in relation to Age and Occupation of Patients

	HAIs		Total	P-Value	X^2	df
	Percent (%)	Absent (%)				
Age						
11- 20	0 (0%)	10 (100%)	10 (100%)	0.621	2.631	4
21- 30	2 (22%)	7 (78%)	9 (100%)			
31- 40	1 (20%)	4 (80%)	5 (100%)			
41- 50	1 (14%)	6 (86%)	7 (100%)			
51and Above	2 (11%)	17 (89%)	19 (100%)			
Occupation						
Civil Servant	2 (25%)	6 (75%)	8 (100%)	0.297	4.906	4
Trading	0 (0%)	7 (100%)	7 (100%)			
Apprentice	0 (0%)	4 (100%)	4 (100%)			
Student	2 (29%)	5 (71%)	7 (100%)			
Others	2 (8%)	22 (82%)	24 (100%)			

p< 0.05 is Statistically Significant.

statistically significant with the prevalence of HAIs in this study (p=0.234). Marital status (p=0.589), religion (p=0.339) and occupation (p=0.297) of patients are considered as risk factors in this study but there are no documented literatures to support that these parameters have significant relationship between the occurrences of HAIs in the Intensive Care Unit. In our study, these factors are not

Table (3): Prevalence of HAIs in relation to use of devices.

Invasive Device	HAIs			Total	P-Value	X^2	df
	Percent (%)		Absent (%)				
Peripheral Vein Cannulation	Yes	6(13%)	42(87%)	48(100%)	0.594	0.284	1
	No	0(0%)	2(100%)	2(100%)			
Central Vein Cannulation	Yes	5(100%)	0(0%)	5(100%)	0.000	40.741	1
	No	1(2%)	44(98%)	45(100%)			
Mechanical Ventilation	Yes	2(14%)	12(86%)	14(100%)	0.756	0.096	1
	No	4(11%)	32(89%)	36(100%)			
Endotracheal Intubation	Yes	3(18%)	14(82%)	17(100%)	0.378	0.778	1
	No	3(9%)	30(91%)	33(100%)			
Nasogastric Tube Insertion	Yes	0(0%)	9(100%)	9(100%)	0.221	1.497	1
	No	6(15%)	35(85%)	41(100%)			
Urethral Catheter	Yes	6(12%)	44(88%)	50(100%)	_____	____	
	No	0(0%)	0(0%)	0(0%)			
Chest tube Insertion	Yes	0(0%)	3(100%)	3(100%)	0.509	0.435	1
	No	6(13%)	41(87%)	47(100%)			
Nasal Oxygen Cannula	Yes	2(13%)	13(26%)	15(30%)	0.849	0.036	1
	No	4(8%)	31(87%)	35(100%)			
Face Mask	Yes	1(25%)	3(85%)	4(100%)	0.404	0.696	1
	No	5(11%)	41(89%)	46(100%)			

p <0.05 is statistically significant

statistically significant with the prevalence of HAIs. Patients within age range of 21-30 years and 50 years showed higher occurrence of HAIs. This shows that older patients are not more susceptible to HAIs than the younger age. This is in disagreement with the results of the studies conducted by Ganguly *et al*[17] and Michael *et al*[18] that there is a significant relationship between the age of the patients and occurrence of hospital acquired infections. The susceptibility of older patients may be as a result of their weaken immune system as a result of old age and diseases combined. The ages of patients were not significantly associated with HAI in this study (p= 0.621).

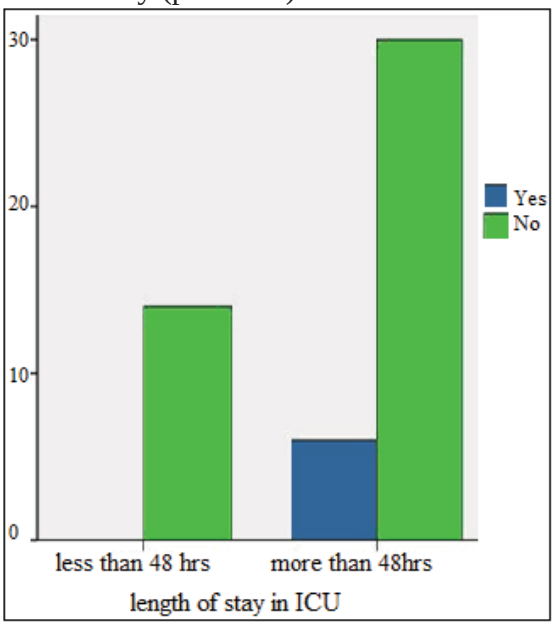

Figure (2): Prevalence of HAI in relation to Patient's length of stay in ICU.

Multiple devices are used in the ICU to treat patients. Invasive devices have been shown to result in more HAIs than non-invasive devices as reported by Appelgren *et al*[16]. In this study, non-invasive devices like face mask and nasal oxygen cannula were not significantly associated with HAIs. Of the invasive devices, central vein cannulation was strongly associated with HAIs as almost all the patients with central vein cannula developed HAIs.

Device – associated hospital acquired infections have been reported to be high as well in developing countries and account for high mortality rate in patients[19]. Critically ill patients in intensive care unit are at a higher risk of hospital acquired infection due to multiple causes including disruption of barriers to infection by endotracheal intubation, urinary bladder catheterization and central venous catheterization[20]. Catheter related blood stream infection is a common HAIs acquired in ICU, and in the USA alone, central venous catheterization is the cause of up to 28,000 deaths annually among patients in ICUs[21]. All the patients involved in this study used urinary catheters and some of these patients also had other invasive devices on them thereby increasing the risk of transmission of infections that are of hospital origin. The source of hospital acquired UTIs occurred through placement of Foley's catheter for longer duration. Richards and colleagues reported in the National Nosocomial Infections Surveillance System (NNIS) database that UTI was responsible for 20-30% of Hospital acquired infections in medical/surgical ICUs[22].

By nature, devices such as catheters and respirators carry high risk of hospital acquired infection, because they bypass normal defense barriers, giving microorganisms access to normally sterile fluids and tissues. Most of the recognized causes of HAIs are bacterial or fungal. The risk of infection is related to the degree of debilitation of the patient and various factors concerning the design and management of the invasive device[23].

Any device that crosses the skin or a mucosal barrier allows flora in the patient or environment to gain access to deeper sites around the outside surface. Possible access inside the device (e.g, in the lumen) adds another and sometimes greater risk.

In some devices, such as urinary catheters, contamination is avoidable; in others, such as respirators, complete sterility is either impossible or impractical to achieve[23].

ICUs are specialized departments of hospitals looking after critically ill patients. Increased risk of infection in the ICU patients is associated with severity of illness. Some of the patients suffered immune suppressing diseases/conditions like diabetes, anaemia, hypertention. Studies report that patients with any infection diagnosed by the ICU admission had higher risk of developing HAIs in the Unit compared with those who did not have prior infection[24].

Table (4): Prevalence of HAI in relation to Associated Medical Diseases in Patients

		HAI		Total
		Present (%)	Absent (%)	
Associated Medical Diseases	Yes	3(19%)	13(81%)	16(100%)
	No	3(9%)	31(91%)	34(100%)

p=0.314, X^2=1.051, df=1, p< 0.05 is Statistically Significantly.

Table (5): Prevalence of HAI in relation to Surgical Operation in Patients.

		HAI		Total
		Absent (%)	Present (%)	
Surgical Operation	Yes	5(16%)	31(84%)	36(100%)
	No	1(7%)	13(93%)	14(100%)

p=0.510, X^2=0.434, df= 1, p< 0.05 is Statistically Significant.

The extended length of stay in the ICU is also considered as a risk factor in the acquisition of infections from the ICU as reported by Allegranzi *et al*[25]. The length of stay of patients were not significantly associated with HAIs in this study (p=0.103). Surgical procedures increase a patient's risk of getting an infection by giving the bacteria a route into normally sterile areas of the body. An infection can be acquired from contaminated surgical equipment or from the hands of health care workers. The infection is usually acquired during the operation itself; either exogenously (e.g. from the air, medical equipment, surgeons and other staff), endogenously from the flora on the skin or in the operative site or, rarely, from blood used in surgery. The infecting microorganisms are variable, depending on the type and location of surgery, and antimicrobials received by the patient. The main risk factor is the extent of contamination during the procedure (clean, clean-contaminated, contaminated, dirty), which is to a large part dependent on the length of the operation, and the patient's general condition[26]. Surgical procedures were not significantly associated with HAIs in this study. This may be because of strict adherence to protocols that ensure the use of sterile instruments for surgery, adequate surgical scrubbing before operations and good surgical technique.

CONCLUSIONS:

The knowledge of the risk factors involved in the acquisition and transmission of Hospital Acquired Infections will play a great role in controlling the spread of infections in the intensive care unit.

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