ORIGINAL ARTICLE

Prevalence and risk factors of healthcare-associated infections in a Moroccan teaching hospital

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ABSTRACT

Background: The aims of this study were to estimate the total prevalence of healthcare-associated infections (HAIs) among hospitalized patients and risk factors related to HAIs.

Materials and methods: This was a point prevalence survey conducted in a Moroccan teaching hospital from June 5 to July 19, 2017. We used version 5.3 of the European Centre for Disease Prevention and Control's protocol to collect the data. Statistical analysis was performed using SPSS (version 21.0). Multivariate analysis was conducted using simple logistic regression.

Results: Data on 207 patients were analyzed. The occupancy rate was 43.5%. The prevalence of HAIs was 22.2%, with a 95% confidence interval (CI) (17%-28%). Urinary tract infections were in the first range (17.4%). The most common pathogen causing HAIs was *Staphylococcus aureus*. Third-generation cephalosporins (38.2%) were the most common antibiotic used. Undergoing surgery (odds ratio [OR] = 7.65; 95% CI [2.72-21.51] $p < 0.001$), having a high McCabe score (OR = 1.374; 95% CI [0.417-4.531]; $p = 0.002$), and extended length of stay in the hospital (OR = 1.06; 95% CI [1.019-1.103]; $p = 0.004$) were the primary risk factors associated with HAIs.

Conclusions: The burden of HAIs in our centre is high compared to the recommendations of the World Health Organization. Further research on antibiotic use, assessment of hygiene measures, and urgent implementation of infection control policy is needed.

KEYWORDS

Healthcare-associated infections; prevention; infection control; prevalence

INTRODUCTION

Healthcare-associated infections (HAIs) are a major concern for the healthcare industry worldwide. In the U.S., one out of every 136 hospitalized patients falls seriously ill as a result of HAIs, which equates to 2 million cases and nearly 80,000 deaths each year [1].

According to a systematic review and meta-analysis published in 2011 [2, 3], the prevalence of HAIs is much higher in developing countries than in Europe and the U.S. (15.5 per 100 patients [95% confidence interval (CI); 12.6-18.9] vs. 5% or less).

Prevalence studies can be a useful part of an effective surveillance system to identify areas for further investigation [4, 5]. In Morocco, there is no national HAI surveillance program and no reportable quality indicators. Only a few teaching hospitals in Morocco have functional infection control programs. The teaching hospital in Oujda, capital of the eastern province of Morocco, was built in 2014 with a bed count of 450. The aim of this study was to estimate the prevalence of HAIs in this hospital and determine their related risk factors.

METHODS

Settings and data collection

We conducted a cross-sectional study from June 5 to July 19, 2017 at the Mohammed VI University Hospital in Oujda, Morocco. We used version 5.3 of the European Centre for Disease Prevention and Control's protocol to collect the data [6]. Only infections that were active or under antibiotic treatment on the day of the study were included. Antibiotic use was recorded according to the Anatomical Therapeutic Chemical classification of the World Health Organization [7]. Antibiotic type, route of administration, indication, and whether the indication was listed in the patient's medical record were registered.

For HAIs, we collected information on the nature of infection, onset of infection, any device relationship, and other details. The pathogens that had caused the infection were also recorded when information was available.

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HAI definition

As per the U.S. Centers for Disease Control and Prevention, a HAI is defined as a localized or systemic condition resulting from an adverse reaction due to an infectious agent or its toxin with no evidence of infection or incubation upon admission [8].

Inclusion and exclusion criteria

We included all wards in our acute care facility. The following inclusion criteria were used: all patients admitted to the ward at or before 8 a.m. and not discharged from the ward at the time of the survey; and neonates on maternity and pediatric wards if born at or before 8 a.m. Dialysis patients (outpatients), patients in the emergency room, patients undergoing same-day treatment or surgery, and patients seen in the outpatient department were excluded from our study [6].

Statistical analysis

Categorical and continuous variables were expressed as percentages, means ± standard deviation (SD), or median and interquartile range (IQR). Statistical analysis was performed using SPSS (version 21.0). Univariate analysis was first conducted using simple logistic regression. Then, variables with $p < 0.20$ in the univariate analysis were integrated into multivariate analysis. *P*-values < 0.05 were considered to be significant.

RESULTS

Patient and hospital characteristics

We analyzed data on 207 patients, of whom 63.3% were men and 36.7% women. Mean age was 40 ± 21 years; occupational rate was 43.5%; and median length of hospital stay was seven days (IQR [5-14]).

Prevalence, sites, and HAI pathogens

46 HAIs were recorded, indicating a prevalence of 22.2 per 100 patients (95% CI [17%-28%]). In most cases, the sites of HAIs were not recorded and were unknown (21.73%). Urinary tract infections were most common (17.4%), followed by surgical wound infections (15.21%) and skin and soft tissue infections (10.87%) (Table 1).

Among the 46 infections associated with care, five microorganisms were isolated (10.86%) as follows: Staphylococcus aureus (28.58%), Klebsiella pneumoniae (28.58%), Acinetobacter baumannii (14.28%), Streptococcus agalactiae (14.28%), and MRSA (14.28%).

Antibiotic use

Among the 207 patients analyzed, 96 used antibiotics (46.4%). The most common route of administration of antibiotics was parenteral (86.7%). The five most used classes of antibiotics were third-generation cephalosporins (38.2%), penicillins with beta-lactamase inhibitors (20.1%), imidazoles (13.9%), aminosids (8.4%), and first-generation cephalosporins (3.5%).

HAI risk factors

In univariate analysis, patient characteristics and exposure to invasive devices increasing the risk of HAIs were: McCabe score, undergoing surgery, longer duration of hospital stay, and exposure to intravascular catheter (Table 2).

In the stepwise forward logistic regression, the variables found to be significantly associated with HAIs were undergoing surgery (odds ratio [OR] = 7.64; 95% CI [2.72-21.51]; $p < 0.001$), longer duration of hospital stay (OR = 1.06; 95% CI [1.019-1.103]), and McCabe score (ultimately fatal disease OR = 1.374; 95% CI [0.417-4.531], $p = 0.002$).

TABLE 1: Types of HAIs.

Type of Infection	Number	Prevalence (%)	Cumulative Percentage
Unknown infection	10	21.73	21.73
Urinary tract infection	8	17.39	39.12
Surgical wound infection	7	15.21	54.33
Skin and soft tissue infection	5	10.87	65.20
Lower respiratory tract infection	4	8.70	73.90
Central nervous system infection	4	8.70	82.60
Systemic infection	4	8.70	91.30
Prolonged fever	2	4.35	95.65
Eye, ear, nose, or mouth infection	1	2.17	97.82
Other gastrointestinal infection	1	2.18	100
Total	**46**	**100**	

DISCUSSION

One limitation of this study was a low patient occupancy rate of 43.5% attributed to Ramadan, a religious month. During Ramadan, patients prefer to be at home with their families and there is only skeletal staffing in the facility. Hence the data reported is partly biased, as it represents only the patients who had to remain in the hospital due to serious illness, or who had no family members to care for them at home. Another limitation was that the diagnosis of infections associated with care was based on the clinical criteria alone.

The prevalence of infections associated with care in our hospital was high in comparison to the prevalence of several similar studies at national (University Hospital of Rabat, Morocco in 2007; 17.8% [9]) and international (Tunisia, 17.9% [10]; Malaysia, 13.9% [11]; Senegal, 10.9% [12]; and Cuba, 7.3% [13]) healthcare centres. The prevalence of HAIs is lower in developed countries, such as Switzerland (7.2%) [14], The Netherlands (7.2%) [15], France (5.4%) [16], Norway (5.4%) [17], Germany (5.1%) [18], and Italy (4.9%) [19]. According to Allegranzi et al., HAIs are more severe and higher in prevalence in developing countries than in developed countries [2].

Patients in our intensive care unit were at the highest risk of HAIs, which is in line with findings of other studies [19, 20].

This can be explained by the large number of admissions with serious diseases, broad-spectrum antibiotic therapy, and the frequent use of invasive medical devices.

Zaidi et al. [21] reported rates of neonatal infection three to 20 times higher in resource-limited countries than those in industrialized countries. In our case, four out of five newborns hospitalized in neonatal intensive care on the day of the survey were infected.

Due to substandard documentation practices, 21.7% of infections were of unknown type. Although the number of isolated cases was small because of the high percentage of unknown and undocumented information in patient records, our study identified two main types of HAIs: urinary tract infection and surgical wound infection. These sites are the most frequently reported in prevalence surveys [9, 19, 16, 22].

Antibiotic prescription in the patients surveyed was particularly alarming, with 46.4% of the patients taking antibiotics. This high antibiotic prescription rate has been reported in the majority of studies in developing countries [23, 24]. Third-generation cephalosporins were the most commonly administered antibiotics (38.2%), which is in contrast with other studies: Germany in 2011 [18] and Malaysia in 2005 [11] reported using second-generation cephalosporins, and penicillins were more often used in another university medical centre in Rabat, Morocco in 2012 [9]. Rational antibiotic use can reduce selective pressure for the development of resistance to antibiotics [25].

In our investigation, risk factors associated with HAIs were longer duration of hospital stay, higher McCabe score, recent surgery, and exposure to an intravascular catheter. Identical risk factors were reported by other studies [12, 26, 27].

TABLE 2: Univariate and multivariate analysis for risk factors of HAIs.

Risk Factors	Univariate Analysis			Multivariate Analysis		
	OR	CI 95%	*p*-Value	OR	CI 95%	*p*-Value
Age (mean ± SD)	1.01	[1.00-1.03]	0.023			
Gender	1.01	[0.51-1.99]	0.969			
Ward						
Medical						
Surgical	6.37	[2.82-14.37]	<0.0001			
Intensive care unit	6.53	[1.93-22.14]	0.003			
Surgery						
Yes	4.70	[2.35-9.39]	<0.0001	7.64	[2.72-21.50]	<0.001
No						
McCabe score						
Non-fatal disease						
Ultimately fatal disease	1.80	[0.64-5.08]	0.261	1.37	[0.41-4.53]	0.002
Rapidly fatal disease	0.22	[0.077-0.66]	0.007	0.21	[0.05-0.85]	
Length of stay	1.05	[1.01-1.08]	0.007	1.06	[1.01-1.10]	0.004
Central intravascular catheter						
Yes	3.30	[1.05-10.36]	0.041			
No						
Peripheral intravascular catheter						
Yes	16.92	[3.96-72.20]	<0.0001			
No						
Urinary catheter						
Yes	1.708	[0.61-4.77]	0.308			
No						
Intubation						
Yes	3.67	[0.71-18.8]	0.119			
No						

Return to TABLE OF CONTENTS

HAIs are a major risk in our hospital. The results of this study provided us a complete picture of the risk factors for HAIs. An action plan of infection control and improving hygiene is urgently recommended with the participation of all stakeholders: pharmacists, doctors, nurses, the hygiene team, and administration. More efforts should be made to improve surgical procedures and reduce patients' length of stay in the hospital.

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