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Epidemiology and Profile of Pathogens in an Intensive Care Unit of University Hospital Center in Marrakesh, Morocco

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Abstract

Background: Pathogens surveillance and antimicrobial resistance are essential for the prompt organization of therapeutic and preventive action in healthcare settings. **Objectives**: The aim of this study was to determine the profile of pathogens isolated among patients admitted to an intensive care unit of a major urban Moroccan city that presented nosocomial infection during their hospitalisation. **Results**: During the study period, 34 patients developed a nosocomial infection during hospitalisation in ICU. The mean age of patients was 42.3 ± 18.3 years (range: 18.0 - 86.0 years) and 68% were males. The main diagnoses were multiple trauma injuries (47%) and thermal burns (18%). In terms of morbidities, 9% of the patients presented diabetes. The most common sites were central line-associated bloodstream infection (38%), bloodstream infection (35%), ventilator-associated pneumonia (32%), urinary catheter-related infection (29%), and soft tissue infection (21%). Most frequently isolated pathogens were: *Acinetobacter baumani* (25%), followed by *Klebsiella spp.* (12%), *Pseudomonas aeruginosa* (8%), coagulase negative *Staphylococcus aureus* (6%), *E. coli* (6%), *Providencia spp.* (6%), *Enterococcus faecalis* (6%), *Raoultella terrigena* (4%). **Conclusion**: The bloodstream was the most common site and Gram-negatives were the most commonly reported causes of ICU infections. The incidence found was high, the mortality was strong, corresponding with that of developing countries. These results will allow to set up a targeted program of prevention and to estimate the efficiency of interventions.

Keywords

Nosocomial Infections, Risk Stratification, Incidence, Prevention, Intensive Care

1. Background

Incidence of nosocomial infections is high in intensive care unit and is associated with increased morbidity and mortality. Understanding the epidemiology of micro-organisms is the only way leading to effective antimicrobial therapy [1] [2]. In addition, the prevalence of infections acquired in Intensive Care Units (ICU) was higher than it was in other hospital units. This might be due to the severity of disease and prolonged stay in the ICU [3].

Intensive care units act as epicentres for Nosocomial infections and the development of antimicrobial resistance due to prolonged hospitalization, serious illness and high use of antibiotics [4]. Device-associated infections include catheter-associated urinary tract infections (CAUTI), central-line-associated blood stream infections (CLABSI), and ventilator-associated pneumonias (VAP). Infection Control Committee, of any hospital, serves as a major tool for the surveillance of these infections. The hospitals in developed countries generate their infection-control surveillance data from time to time.

The aim of this study was to determine the profile of pathogens isolated among patients admitted to an intensive care unit of a major urban Moroccan city that presented nosocomial infection during their hospitalisation.

2. Patients and Methods

We conducted a retrospective study of consecutive patients admitted for more than 48 hours to intensive care unit during a 6 months period between July 2020 and January 2021 and that presented a hospital-acquired infection. Socio-demographic, clinical, bacteriological and follow-up data were extracted from medical records.

The first sample (urine, blood, tracheal aspirate, and others) collected from every patient admitted to the ICU (based on call signs) was sent for bacteriologic culture to exclude infection at the time of admission to ICU and to get the true picture of infection rate.

Microbiology samples were taken from areas such as peripheral venous blood, central venous catheter, urine endotracheal secretions, bronchoalveolar lavage, pus, and other any suspected during the ICU stay. Only the initial isolates were considered in the study and repeat isolates from the same sites were excluded.

3. Laboratory Methods

The bacterial isolates were obtained from clinical samples sent to the medical microbiological laboratory for diagnostic purposes. The specimens were urine, bronchoalveolar lavage, blood, catheters, pus, and cerebrospinal fluid samples. The clinical samples were processed according to the routine laboratory diagnostic protocol, which included identifications by morphological, biochemical and culture characteristics. The identification of antibiotic resistance level of isolated bacteria was performed with the discdiffusion method in Mueller Hinton agar (MH) as recommended by the antibiogram committee of the French Microbiology Society and The European Committee on Antimicrobial Suscepti-

bility Testing 2015.

Risk factors for nosocomial infection were recorded as age, sex, cause of admission to the ICU, surgical history, central and/or peripheral intravenous access, nasogastric or endotracheal intubation, mechanical ventilation, urinary catheter, tracheostomy, and the length of stay in the ICU.

4. Results

Statistical analysis was done with SPSS (Statistical Package for Social Sciences), software, version 19.0 (*SPSS*). Chi-square test, Mann-Whitney U test and logistic regression analysis tests were used. All p values < 0.05 were considered significant.

During the study period, 34 patients developed a nosocomial infection during hospitalisation in ICU. Mean age of patients was 42.3 ± 18.3 years (range: 18.0 - 86.0 years) and 68% were males. Patients were mainly (91%) from an urban area and the majority (88%) were transferred from emergency department.

Of the 34% patients, 10 patients (29%) patients had one more underlying diseases. The most frequent underlying diseases were diabetes (9%), arteriel hypertension (9%), renal failure (3%), cardiovascular disease (3%). The most frequent causes of admission to ICU were polytrauma (47%), thermal burns (18%), acute pancreatitis (6%) (Table 1).

Table 1. Demographic characteristics, comorbidities and diagnosis on admission of ICU patients.

Patients characteristics	Number	%
Gender		
Male	23	68
Female	11	32
Living environment		
Urban	31	91
Rural	3	9
Admission diagnosis		
Polytrauma	16	47
Thermal burn	6	18
Acute pancreatitis	2	6
Head trauma	3	9
Diabetes ketoacidocis	1	3
Pulmonary embolism	1	3
Intoxication	1	3
Comorbidities		
Diabetes	3	9
Arterial hypertension	3	9
Cardiovascular disease	1	3
Renal disease	1	3

A septic shock appeared in 74% of the patients and the mean SOFA Score was 5.21 ± 2.29 (range: 0 - 13).

The most common sites were central line-associated bloodstream infection (38%), bloodstream infection (35%), ventilator-associated pneumonia (32%), urinary catheter-related infection (29%), and soft tissue infection (21%).

Most frequently isolated pathogens were: *Acinetobacter baumani* (25%), followed by *Klebsiella spp.* (12%), *Pseudomonas aeruginosa* (8%), *Coagulase negative Staphylococcus aureus* (6%), *E. coli* (6%), *Providencia Spp.* (6%), *Enterococcus faecalis* (6%), *Raoultella terrigena* (4%) (**Table 2**).

5. Discussion

ICU-acquired infections constitute 20% - 25% of all hospital-acquired infections [5]. There may be variations in the incidence of ICU infections between centres, depending on the characteristics of patients and ICUs.

A study from India documented ICU nosocomial infection rate of 33.3% [6]. Similar rates, such as 33.5%, 28.6% and 27.6% were also reported in earlier studies from India, China, and Europe, respectively [7] [8] [9]. An infection rate of 58.9% was documented in a mixed medical/surgical ICU report from India in 2017 [10]. Lower incidence rates, ranging from 9% to 16% have also been reported in the literature [11] [12].

In a point-prevalence study including 1417 centres in 17 European countries, the infection rate in ICUs was reported to be 20.6%. The infection rates in ICUs in several other studies reported by authors namely were as follows: Legras *et al.*: 21.6% [13], Appelgren *et al.*: 34% [14], Aly *et al.*: 10.6% [15].

This variation in the incidence of ICU-acquired infections is dependent on the type of ICU, patient population, and the definition used to identify these infections [16]. Furthermore, of all patients admitted to the ICU, 5% - 10% cases acquire one or more infections [17] [18]. More often, there are three types of infections which account for 60% of all nosocomial infections in the ICU. These are usually device-associated, such as VAP (ventilator associated pneumonias), CLABSI (central-line-associated blood stream infections) and CAUTI (catheter-associated urinary tract infections). In the current study it was revealed that incidence rates of health-care-associated infections were 9.06/1000 urinary catheter days, 13.35/1000 central venous pressure line days and 5.42/1000 ventilator days. Another study from Chandigarh is also in concordance with our observations [19].

Regarding risk factors for the development of health-care-associated infections, we found that the presence of diabetes and COPD (chronic obstructive pulmonary disease) as well as length of ICU stay >8 days was significantly associated with health-care-associated infections. The result of this study is in agreement with previous studies from India, Turkey and Italy The longer the patients stays in ICU more are the chances of getting colonized with multi-drug-resistant bacteria and longer will be the time period of insertion of devices [7] [20] [21].

Table 2. Distribution of isolated microorganisme by the sites of ICU acquired infection.

Sites of infection %	BCI	Ventilation with associated pneumonia	UTI	Central line infection	Soft tissue infection
Acinetobacter Baumanii	9	6	9	3	6
Klebseilla spp	6	6	-	3	3
Pseudomonas Aeruginosa	3	6	-	3	-
Coag negative staph	3	3	-	6	3
E. choli	-	-	3	-	6
E. fecalis	3	-	-	-	-

The obtained data showed that 76% of the bacterial infections were due to Gram-negative bacteria. *A. baumannii*, *Enterobactereacae* species and *P. aeruginosa* strains were the main isolated bacteria. This result is similar to what is known from other studies that Gram-negative bacteria are the most common cause of HAIs in low and middle-income countries [22] [23].

6. Conclusion

Antimicrobial resistance is generally increasing, and has emerged from selective pressure from antibiotic use and transmission via health workers. Only knowing the profile and resistance of local pathogens can help for careful and precise use of antimicrobial drugs.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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