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Study of the prevalence and the risk factors of bacterial nosocomial infections in the intensive care unit of the provincial hospital of Kenitra city of Morocco

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ABSTRACT

This study is aimed at investigating the prevalence and associated risk factors of bacterial nosocomial infections in the intensive care unit (ICU) of the Provincial Hospital of Kenitra city of Morocco. For this purpose, 165 pathological specimens of 154 patients were collected and analyzed for a period of 11 months; from 1st March 2012 to 30th January 2013. The obtained results showed that 40 of 154 patients develop bacterial nosocomial infections with a prevalence of 25.9%. Analysis of the statistical results revealed that nosocomial pneumonia represents the most common infection of about 48%, followed by urinary tract infection (36.5%), skin infection (9.7 %), and chest drain (5.8%). We have isolated fifty multiresistant bacteria including 46% of *Acinetobacter baumannii*, 20% of *Pseudomonas aeruginosa*, 14% of *Enterobacter cloacae*, 8% of *Klebsiella pneumoniae*, 6% of *Escherichia coli*, and 6% of *Aeromonas hydrophila*. The intubation was the main risk factor.

KEYWORDS

Intensive care;
Nosocomial infection;
Prevalence.

INTRODUCTION

According to the "100 Recommendations for the Surveillance and Prevention of Nosocomial Infections" edited in 1999, nosocomial infections (NI) are the infections developed in a care institution[26]. This definition was updated in November 2006 and it is now integrated in the healthcare-associated infections[21] (CAI).

Over the last twenty years, nosocomial infections have constituted a real concern for the security of patients and an important preoccupation to the healthcare professionals. They constitute a real public healthcare problem due to their frequency, gravity, and socio-economic cost[8,23,36]. They are particularly frequent in intensive care environment because of the patients' immune system suppression, and the multiplication of invasive procedures. Consequently the NI are considered as the important causes of the morbidity and significant mortality[10,1,5]. Additionally, they are mainly triggered by multiresistant bacteria (MRB) such as Methicillin-resistant *Staphylococcus aureus* (MRSA), *Pseudomonas aeruginosa*, and *Acinetobacter*

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baumannii. Therefore, the bacteria multiresistance to antibiotics is a more serious issue of resistance because it notably reduces therapeutic possibilities[11].

Inquiries of prevalence constitute the basic tool for the surveillance of CAI. They have even been recommended by World Health Organization (WHO) for national and/or international studies[7]. Moreover, such inquiries constitute a means for staff sensitization and information. Except developed countries, only few countries have reliable national statistics with regard to healthcare-associated infections[2]. In Morocco, the fight against such infections started and triggered the interest of certain hospitals which have developed their own programs. Thus, the first national inquiry about nosocomial infections were conducted in 1994, and revealed a spread rate of 14%[3]. Other inquiries were done but in a more limited scale. In 2005, the revealed rate was about 6.7% and 17.8 % for University Hospital Center (UHC) Hassan II in Fes-Morocco[16]; and Ibn Sina Hospital in Rabat-Morocco[22] respectively. This present work will pursue the same course mentioned earlier. The main objective has been to determine the occurrence of bacterial nosocomial infection in the intensive care service of Provincial Hospital of Kenitra in Morocco, Know the more frequent site of these infections, study their risk factors, and identify the microorganisms responsible for the infections and their resistance profile as well.

PATIENTS AND METHODS

This present study is conducted in the polyvalent intensive care unit at the hospital of Kenitra in Morocco during eleven months from March 1st to the end of January 2013. In this specific study, we have included patients who were hospitalized for more than 48 hours and have showed no infection symptoms during their hospitalisation.

The data used in this study have been collected from the medical files and in some cases from the resuscitator doctor or from the Senior Nurse in charge of the service. For each patient, the following information has been taken into consideration: age, sex, provincial service, duration of hospital stay, type of pathology, presence of invasive devices (intubation, thoracic drainage, tracheostomy, and catheterization), nature of antibiotics administered, and bacterial colonisation at the intensive care units of admission or hospital stay).

Collections of samples were made in the morning by the resuscitator doctor or by the nurse in charge, then directly channelled to the laboratory where all aseptic conditions were respected. The isolation of bacterial colonies was done by culturing pathogens from clinical specimens on blood agar plates, Chocolate agar Polyvitex, and Chapman medium.

For strains identification, we are interested in their morphological, nutritional, metabolic, and cropping characters[12]. The Enterobacteriaceae has been identified by using the API gallery system. The ESBL strains confirmation is accomplished by the synergy test involving the combination of amoxicillin-clavulanate (AMC) disks and the third generation cephalosporin.

Resistance detection is studied by using conventional disk diffusion method on Muller Hinton agar medium. The criteria for reading and interpretation were performed according to the guidelines of the "Antibiogram committee of the French Society for Microbiology"[33].

RESULTS

In total, 154 patients have been examined during this study. The average age of the population was 52 year where 67 are situated within the age group 20 to 50. Our population was characterised by a light masculine predominance. The sex ratio was 1.2.

The analysis was focused on a different collection sites collection sites: 110 urinary collections, 38 pulmonary collections have been administered but appropriate collections have been done since the clinical suspicion of infection (17 other sampleS have been done; 7 at the level of chest drain and 10 skin collections).

Forty patients have developed bacterial nosocomial infection which corresponded to a general frequency of 25.9%. The infection rate was considerably higher for men than women with 15.5% and 10.3% respectively.

The majority of patients transferred to the service came from the emergency unit. They accounted for nearly 66% of the cases. 16% came from maternity, 10% from surgery, 4% from medicine, and 3% from pulmonology. On the contrary, cardiology services and emergency units were the least accounted.

All examined patients presented at least a risk fac-

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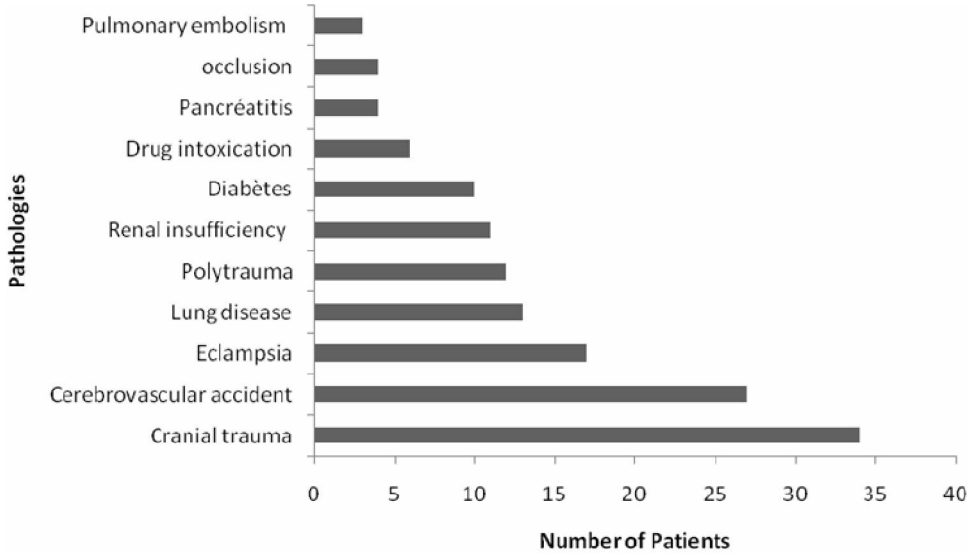

Figure 1 : Patient's repartition according to the reasons for hospitalization in the intensive care service/ Répartition des patients selon les motifs d'hospitalisation en réanimation

tor. Such factors were of 2 types, either intrinsic linked to the patient such as diabetes, renal insufficiency, polytraumatism. And/or extrinsic factors linked to the hospital care such as drainage, catheterizations, intubation, tracheostomy. The fundamental factors of vulnerability have been shown in the Figure 1.

From 154 patients examined, 165 pathological products have been collected and analysed. The urinary sample represented 66.7%, succeeded by bronchopulmonary 23%, and chest drains 4.3%, (TABLE 1).

TABLE 1 : Frequency rate of bacterial nosocomial infections according to the sites collected/ Taux de fréquence des infections bactériennes nosocomiales selon les sites prélevés

collection site	Sample size	Numbers of infections	Frequency (%)
Urinary	110	19	36.5
Bronchopulmonary	38	25	48
Skin	10	5	9.7
Chest drain	7	3	5.8
Total	165	52	100

Nosocomial pneumonia (NP) represented the most frequent infection with a rate of 48%, succeeded by urinary infection (UI) with a rate of 36.5%, the skin infection with a rate of 9.7%, and the chest drain collection with a rate of 5.8% (Figure2).

The combination of NI for the patients investigated was infrequent. It has only been observed in 2 patients. The first has developed an infection at the level of urinary and pulmonary sites all at once, while the second has showed an infection at the level of skin and pulmonary sites.

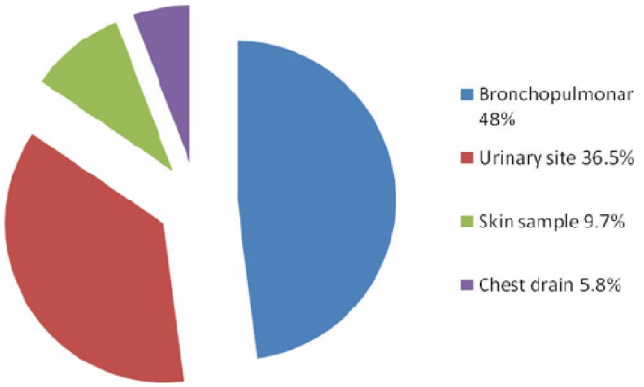

Figure 2 : Repartition of nosocomial infections according to the collection site/ Répartition des infections nosocomiales en fonction du site de prélèvement

The Gram-negative bacilli are the most isolated germs in the intensive care service which represent 78%. The Gram-positive cocci (14%) are essentially represented by the *Staphylococcus aureus*, and the candida sp was isolated in 8% cases.

We have isolated 50 MRB where *Acinetobacter baumannii* is the most frequent species (23 strains), succeeded by *Pseudomonas aeruginosa* (10), *Enterobacter cloacae* (7), *Klebsiella Pneumonia* (4), *Escherichia coli* and *Aeromonas hydrophila* with the same group (3). The Methicillin R character for *Staphylococcus aureus* was not confirmed for any isolated strains.

The *Acinetobacter baumannii* demonstrated resistance to ceftazidime at 100% cases, to ciprofloxacin

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at 69%, to imipenem at 60%, and to amikacin at 30%. All the isolated strains have been sensitive to colistin.

Pseudomonas aeruginosa is the second isolated species. All identified strains have demonstrated resistance to ceftazidime and preserved their sensitivity to imipenem. 90% have showed resistance to Ciprofloxacin, 75% to ticarcilin, 15% to amikacin, and 85% to cefzolidin.

For the *Enterobacter cloacae,* all the strains were resistant to augmentin and third generation cephalosporins, 28% have developed a resistance to fourth generation cephalosporins and to quinolones. 100% of *Enteorobacter cloacae* have preserved their sensitivities to carbapenems

Klebsiella pneumonia is the fourth isolated bacteria. The strains' resistance was of 100% for the combination of amoxicillin-clavulanate (AMC) disks and third generation cephalosporins, 70% for ceftazidime, and 25% for Gentamycin.

Escherichia coli, was isolated thrice. All the strains were resistant to third generation cephalosporins where two were resistant to carbapenemes. One of them was resistant to quinolones.

Aeromonas hydrophila is the second gram-negative bacilli-oxidase positive isolated, where one of its strain was resistance to ciprofloxacin and ticarcillin. Another one has developed its resistance toward tobramycin.

DISCUSSION

This inquiry is the first of a kind in the intensive care service at the hospital of kenitra of Morocco. It has only been concerned with bacterial infections because such infections constitute the majority of nosocomial infections in the intensive care[37,4]. The prevalence found after our study was about 25.9%. It is a rate comparable to the one found in UHC HassanII of Fes (Morocco) in 2009[14], and to the rate found, for instance, in France in 2006 (22.4%) according to the healthcare institute.

Our rate is quite low in comparison with that found in UHC Ibn Sina of Rabat in 2005 (50%)[22]. It is equally low compared to that found at University Hospitals in Sfax in Tunisia in 2005 (42.1%)[18]. The rate is higher compared to the rates found in studies done in Brazil in 2004[20] and in Switzerland in 2002[32]. The intensive care remains the service where the infections associated with care are the most frequent. These observed high rates are generally in correlation with the pathology seriousness, and the frequency of invasive acts. A recent study of WHO conducted in 55 hospitals and 14 countries has shown that the highest rate of NI is registered within the intensive care units[9,29,15].

Generally and according to certain authors, in healthcare services other than the intensive care, the urinary infections and the operation sites' infections are found to be at the top of IAC. On the contrary, in intensive care services, they are the lung diseases that constitute the first cause of CAI[19]. Therefore, in our study, the nosocomial lung diseases were the most developed (48.3%). This outcome is in accordance with the literature[35]. According to a study done in 2005 in a healthcare centre in Algeria[6], pneumonia's infection sites were the most attacked with a percentage of 41.7%. According to the Brazilian study published in 2004[20], and that done in France in 2009, pneumonia constituted 80% of CAI. For the study published in 2007 which was done in UHC Hassan II in Fes, and which focused on 282 patients, the prevalence of nosocomial lung diseases was only in a percentage of 11%, and represented 25% of infections acquired in the intensive care services acquired infections[16].

The risk of occurrence of nosocomial pneumonia (NP) in our study is directly linked to intubation. Thus, the patients who presented severe pathologies and required an extended intubation were the patients most exposed to the risk of NP, as well as tracheostomy which was also incriminated for the occurrence of NP. Our results are consistent with that of the literature[34,17,31,13].

The urinary infection was the second nosocomial infection in our service with a percentage of 36.5%. This result is comparable to that of other studies[24]. Only 19 specimens out of 110 were positive. That makes us think that carrying a urinary catheter does not constitute a major source of infection, contrary to other studies that strongly linked to the presence of urinary catheterisation with urinary nosocomial infection[25]. The note is that all the patients being tested carried a urinary catheterisation. In our study, we have linked the UI with the polling management as well as the hygienic quality.

The other remained 17 collections administered concerned the chest drains and skin collections. They

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have ranked 3rd with a percentage of 15.5%. These infections are directly linked to the patient's endogenous flora or/and to the insured crossed transmission by the staff. In our study, we have not noted the link between certain intrinsic factors and NI, namely the age, sex, and diabetes.

In some Moroccan studies conducted in intensive care services in UHC Ibn Rochd in Casablanca in 2000, and that done in UHC in Fes in 2009, the Gram-negative bacilli (GNB) were the most incriminated germs in bacterial nosocomial infections. In our study, the GNB also represented 78% of isolated germs. 50% of isolated strains of biological collections including *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter cloacae* are identical with the environmental strains found during a study which we did during the same service along 2011 and which was concerned with tracing the bacterial ecology of the service.

Resistances acquired from bacteria have forever been increasing for the last decades and constitute a worrying phenomenon, and a problem of increasing importance in medical practice[27,28,30].

With the discovery of new antibiotics, bacteria are increasingly accumulating in their genetic material the genes that lead to multi-resistance. The use of antibiotics leads to the risk of the selection of resistant germs. In our service, augmentin was the most prescribed antibiotic which explains the resistance of all isolated bacterial strains to the combination of amoxicillin-clavulanate (AMC) disks and third generation cephalosporins (namely triaxon). The aminosides, the quinolones, and the colistin were prescribed in the second step.

CONCLUSION

We have conducted the first study of the prevalence of Bacterial nosocomial infections in the intensive care service at the hospital of Kenitra city of Morocco. The prevalence rate was with 25.9% where Gram-negative bacilli were the most isolated bacteria and intubation represented the main risk factor. The nosocomial lung disease represented the most frequent infection with a rate of about 48%, succeeded by the urinary infection with a rate of 36.5%. The skin infection represented 9.7% and chest drain collections a rate of 5.8%. We have isolated 50 multiresistant bacteria where 46% was represented by *Acinetobacter baumannii*, 20% by *Pseudomonas aeruginosa*, 14% by *Enterobacter cloacae*, 8% by *Klebsiella pneumonia*, 6% by *Escherichia coli*, and 6% by *Aeromonas hydrophila*.

The prevalence rate found after this study is comparable to that observed in other hospitals. The bacterial nosocomial infection is an indicator of the lack of care quality. The basic rules of healthcare hygiene must be respected, and the staff must be well trained and sensitised.

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