Risk factors of nosocomial infections in the Gharb region, Morocco

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Abstract— In Morocco, the published data on the epidemiology of nosocomial infection are rare. The aim of this prospective study was to determine the prevalence and the epidemiology of nosocomial bacterial infections in the services of Kenitra Regional Hospital and to identify the main risk factors associated with these infections.

In total, 248 patients were included in the prevalence survey with 59.3% occupancy of available beds. Among this number, 22 patients had affected by the nosocomial infection that means we have a prevalence rate of 8.9%. This prevalence was highest in intensive care and surgical services (25%). The average age of patients was 35.6 ± 23.17 years and the sex ration was equal to 1.14 for women. The average value of the length of patient's hospitalization on the day of the survey was 8.5 ± 18.8 days with 31.9 ± 47.3 days for infected cases. In the light of the results of the analysis of the odds ratio (OR) and principal component analysis (PCA) invasive devices, the surgery, immunosuppression, ASA score and treatment of patients show a significant association with infection nosocomial which are a serious public health problem in Morocco. The sense that health professionals should be aware of this danger by implementing preventive measures and developing a surveillance program of these infections.

Index Terms — Epidemiology, Nosocomial infections, Prevalence survey, Prospective study, Risk factors.

1 INTRODUCTION

Nosocomial infections are a serious public health problem worldwide. The nosocomial infection is an infectious disease clinically or microbiologically identified, contracted in healthcare facilities. It may concern the patient because of the result of investigations carried out or care during hospitalization, outpatient, or caregivers because of its activity.

The prevalence of IN worldwide varies between 1% and 20% and the overall incidence of 5% to 10% with such a variation from one country to another [1], and according to US statistics, 5-7% of hospital patients contract a nosocomial infection [2,3]. A study concerning the prevalence of nosocomial infections conducted under the auspices of WHO in 55 hospitals of 14 countries in 4 continents found that on average of 8.7% of hospitalized patients had acquired a nosocomial infection [4].

In Morocco, few studies have conducted on the prevention of nosocomial infections. Except one of the first nationwide surveys has conducted in 1994 and showed an overall prevalence of nosocomial infection in hospitals Moroccan 8.1% [5].

The main objective of this study is to determine the rate of nosocomial infections in the hospital and to evaluate the risk factors associated with these infections through the analysis and interpretation of data in order to achieve the prevalence survey within all hospital departments.

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2 MATERIALS AND METHODS

2.1 Study region

Located in the northwest of the country, the region of Beni Hssen Gharb- Chrarda- extends over an area of 8805 km2, or about 1.23% of the area of Morocco. It has bounded to the north by the region of Tangier -Tétouan, to the west by the Atlantic Ocean, to the east by the two regions of Taza-Al Hoceima Taounate and Fez-Boulemane, and south by regions Tafilalte-Meknes and Rabat-Salé-Zemmour-Zaer.

Its population is estimated at 1,859,540 habitants in 2004 (6.2% of the national population) and spread over the two provinces of the region (Kenitra and Sidi Kacem) up to 62.8% for the first cons 37.2% for the second. These include 11 municipalities and 61 rural districts [6].

Fig1. Location of the Gharb Chrarda Beni Hssen Region (RGPH, 2004)

2.2 Studied parameters

Investigations and risk treatments that the patient has undergone during the stay (including surgeries) and nosocomial infections based on definitions recommended by the Public Superior Health Council of France [7], so that definitions established in 1988 by the Centers for Disease Control and Prevention in Atlanta [8].

A data collection form had completed for each patient eligible for the study. It comprises seven sections:

- The demographic and administrative data.
- Potential invasive devices.
- The surgical procedures
- The use of anti-infective systemically.
- The indicators of the severity of the patient's health.
- The existence or non-existence of signs of infection.
- Informations about nosocomial infections.

2.3 Methodology

This work consists on a cross-sectional study on nosocomial infections at the regional hospital of El Idrissi Kenitra that contains 418 beds. The study population concerns 248 patients constituted by all patients who had hospitalized at the time of including newborns investigation.

The study was conducted according to the technique known as "any day", indeed; a hospital had to be investigated the same day on all the hospital services during the same week.

The statistical methodology used was based on the principal component analysis (ACP) that evaluates the correlation existed between the different variables studied. The X^2 test contingency and the calculation of the odds ratio (OR) have allowed us to study the association between the variables studied and nosocomial infection.

3 RESULTS

Two hundred and forty-eight (248) patients were included in the survey. The average age of patients was 35.6 ± 23.17 years and the median age was 32 years. The sex ratio was equal to 1.14 for women. Regarding the average value of the length of hospitalization of patients on the day of the survey was 8.5 ± 18.8 days and the median was 3 days.

Table 1 shows the different characteristics related to patients hospitalized on the day of the survey and infected patients.

Table 1: Characterization of patients surveyed

Variables	Total patients	Patient with at least an infection	%
Sex			
Female	**132**	**8**	**6.1**
Male	**116**	**14**	**12.1**
Total	**248**	**22**	**8.9**
Age group (years)			
≤1	**22**	**0**	**0**
2-5	**15**	**1**	**4.54**
6-10	**6**	**0**	**0**
11-15	**3**	**0**	**0**
16-25	**50**	**6**	**27.27**
26-45	**67**	**7**	**31.81**
46-65	**58**	**6**	**27.27**
≥66	**27**	**2**	**9.1**
Total	**248**	**22**	**8.9**
Services			
Cardiology	**8**	**0**	**0**
Surgery	**36**	**9**	**25**
Infant surgery	**14**	**1**	**7.1**
Hemodialysis	**16**	**0**	**0**
Maternity	**60**	**4**	**6.6**
Medicine	**14**	**1**	**7.1**
ORL	**12**	**0**	**0**
Pediatrics	**32**	**0**	**0**
Respiratory care	**16**	**2**	**12.5**
Intensive care unit	**8**	**2**	**25**
Traumatology	**32**	**3**	**9.4**
Length of stay (days)			
≤ 3j	**128**	**1**	**4.54**
4-7j	**52**	**4**	**18.18**
8-15j	**43**	**10**	**45.45**
≥ 16j	**25**	**7**	**31.81**
Total	**248**	**22**	**8.9**

From the results shown in Table 1, nosocomial infection was present in 22 patients. Thus, infected patients prevalence rate was 8.9% (confidence interval 95%: 5.3 to 12.5). Within the services, patient's prevalence rate having acquired a nosocomial infection was highest in intensive care and surgical services (25%).

The most important infection rates was marked in males (12.1%). The most affected age group was 26-45 years with 31.81% of all cases. The duration of hospitalization of patients on the day of the survey was 3 days to over 16 days for infected cases, 48.48% had a residence time of 8-15 days, with an average duration hospitalization of these infected cases of 31.9 ± 47.3 days and a median of 12 days.

To detect the influence of the risk factors studied to contract a nosocomial infection, we conducted principal component analysis that results have shown schematically in Figure 2 and Table 2.

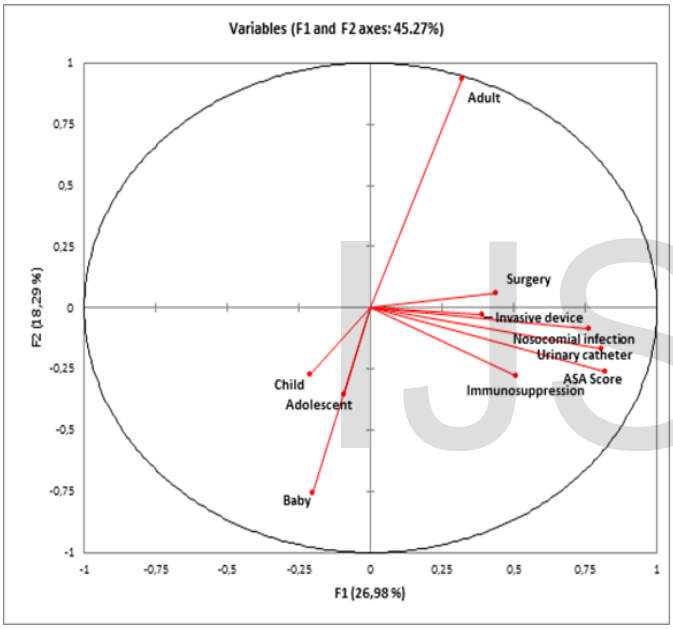

Fig 2. The influence of the age groups, the invasive device, the ASA score, immunosuppression, surgery on nosocomial infection.

Table 2: Correlation of the weights of the variables on factors

	Factor 1	Factor 2
Nosocomial infection	0,761	-0,088
Invasive device	0,388	-0,030
Surgery	0,438	0,060
Urinary catheter	0,807	-0,169
Immunosuppression	0,510	-0,277
ASA Score	0,818	-0,260
Baby	-0,205	-0,757
Child	-0,211	-0,274
Adolescent	-0,093	-0,351
Adult	0,318	0,934

The evaluation of the principal component analysis (PCA) (Figure 2) shows that the two first axes contribute to 45.27% in the total change in age groups and risk factors depending on contraction of a nosocomial infection.

According to the first axis representing 26.98% of the variability, there is an association between the adults, invasive device, surgery, immunosuppression, ASA score and nosocomial infection on the side (X +). Under the second axis (18.29%), there is a connection between the other age groups and risk factors on the side (Y-). On the opposite side, we see that adults are associated with surgical procedures. These results show that the likelihood of contracting a nosocomial infection in the hospital does not depend on the age of patients but reveal therefore an important affinity between invasive devices, surgery, immunosuppression and ASA score of patients with these infections.

To highlight the risk factors of nosocomial infections, we studied the effect of the characteristics studied on the likelihood of contracting a nosocomial infection in hospital.

Table 3: the effect of the characteristics studied on the likelihood of contracting a nosocomial infection.

Variables	Modality	Number of patients	Number of infected case	χ^2	P	OR	confidence interval 95%
Sex	Masculin	116	14	2.757	0.097	0.47	0.19-1.16
	Féminin	132	8				
Age	Bébé	35	1	1.823	0.177	0.269	0.03-2.06
	Enfant	11	0	1.120	0.290	0.907	0.87-0.95
	Adolescent	12	1	0.005	0.946	0.931	0.11-7.57
	Adulte	190	20	2.754	0.097	3.294	0.75-14.54
Invasive device	Non	124	3	12.769	<0.001	7.29	2.10-25.35
	Oui	124	19				
Urinary catheter	Non	231	11	70.384	<0.001	36.66	11.44-117.49
	Oui	17	11				
Immunosuppression	Non	231	19	1.739	0.187	2.39	0.63-9.06
	Oui	17	3				
ASA Score	1	149	0	36.33	<0.001	0.778	0.7-0.86
	2	61	0	7.87	<0.005	0.882	0.83-0.93
	3	18	12	80.19	<0.001	44	13.7-141.3
	4	20	10	45.52	<0.001	18	6.28-51.52
If transfer	Non	128	7	3.788	0.052	2.46	0.97-6.28
	Oui	120	15				
Surgery	Non	204	8	34.842	<0.001	11.43	4.42-29.56
	Oui	44	14				
Anti-infective therapy	Non	139	3	17.628	<0.001	9.57	2.75-33.29
	Oui	109	19				

The prevalence of nosocomial infection increases with the

presence of an invasive device, or a rate of 15.3%. So there is a relationship between the occurrence frequency of nosocomial infection and the presence of an invasive device with an OR of 7.29 (95% CI: 2.10 to 25.35) and the presence of a probe urinary (OR = 36.66; 95% CI 11.44 to 117.49).

There is no significant difference in the prevalence of nosocomial infections in patients with immunosuppression (X^2 = 1.73; p > 0, 05).

Prevalence increases with the severity of the patient's health status according to ASA classification, verification is very significant.

The prevalence rate increased 2-3 times when the patient has undergone surgery, the difference is very significant, with an OR of 11.43 (95% CI 4.42 to 29.56). In addition, there is a very significant connection between the length of stay and the occurrence of nosocomial infection.

Taking anti-infective treatments increases with the occurrence of nosocomial infection and the connection is very significant (OR = 9.57, 95% CI 2.75 to 33.29).

4 Discussion

The comparison of the prevalence rates reported in our work with the values reported in France and in some European countries is difficult due to methodological differences. These differences relate to the definition of nosocomial infections criteria, data collection mode, the number of infectious websites investigated, as well as hospital type or size of the service studied [9, 10]. Quenon [11] specifies that the comparison of the rate may not be useful for these studies, which have not conducted with similar methodologies. According Bosseray [12], the comparison of nosocomial infections between countries or between hospitals rate has thus made more difficult, although there is some agreement in some surveys. It is possible however, despite these reservations; to compare some of our results with those of other surveys. The prevalence of nosocomial infections in the regional hospital in Kenitra El Idrissi had assessed at 8.9%. This figure is in the same range of rates reported in the literature.

Table 4: Prevalence of nosocomial infections in different studies.

Authors / References	Country	Date	Number of Hospitals	Number of patients	Prevalence (%)
Emmerson [13]	UK	1994	157	37111	9
Carlet [14]	France	1996	800	236364	6,7
Gastmeier [15]	Germany	1996	72	14996	3,5
Gikas [16]	Greece	1996	8	1279	5,9
Scheel [17]	Norway	1997	71	12775	6,1
Christensen [18]	Denmark	1999	48	4561	8
Carlet [14]	France	2001	1530	305656	5,9
Klavs [19]	Slovenia	2001	19	6695	4,6
Atif [20]	Algeria	2001	1	264	9,8
Duerink [21]	Indonesia	2002	2	2222	6,9
Floret [22]	France	2004	40	14905	5,6
Atif [20]	Algeria	2005	1	297	4
FKI [23]	Tunisia (Sfax)	2005	2	731	9,03

The three main infectious sites listed in our survey (urinary tract infection, pneumonia and surgical site infection) were also found among the five most frequent sites in most prevalence surveys [26-27; 24-25].

Within the services, patient's prevalence rate having acquired a nosocomial infection was highest in intensive care and surgical services (25%).

The high rates in intensive care units could be related to the severity of the underlying disease, the relatively prolonged stay of patients and the frequency of invasive procedures for diagnostic purposes and / or therapy [28, 29, 30, 31, 32].

Regarding the causative organisms, the main germs encountered in our series are in descending order: *Klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas aeruginosa, Enterobacter cloacae* and *Proteus rettgiri.*

The majority of these germs have been documented but their frequencies were different between studies, influenced mainly by the different distributions of anatomical sites [28, 31, 33, 34].

I 'North American experience of "SENIC Project" has shown how monitoring was a vital component of the prevention of nosocomial infections. [35] In France, the nosocomial infections surveillance system has evolved considerably over the past ten years. By cons, few studies have established in Morocco in the prevention of nosocomial infections. This prevention has based on understanding the modes of acquisition and transmission of nosocomial infections. It has based on the use of standard and additional precautions.

Mandatory reporting of nosocomial infections to health authorities (Ministry, direction, C-CLIN) should be initiated by

various regulatory texts, laws and decrees in each health and hospital services for all. This report concerns nosocomial infections that meet specific criteria like nosocomial infections with rare or specific (due to the nature of the agent, its antibiotic resistance profile or location of infection) deaths directly related to nosocomial infection. These infections suspected have caused by an agent present in the water or air (eg legionellosis or nosocomial aspergillosis) or have suspected reportable disease to be nosocomial.

The report aims at conducting an investigation and implementation of corrective actions to prevent the occurrence of new cases.

Compliance with good care practices and the aseptic technique in particular, that is to say all measures to prevent any external supply of seeds, is another must-prevention means. Indeed, many of nosocomial infections are due to invasive care gestures (perfusion, catheterization, mechanical ventilation ...). The first concern is always to determine if the patient's condition requires such care gestures. It should compare the risk of infection incurred for the benefit expected from these actions, to practice only the actions necessary for the patient's health. When an invasive device is in place, the necessity of its maintenance has reassessed daily.

5 Conclusion

Nosocomial infections represent a non-quality indicator. Their mastery increases the credibility of the hospital structure. They accept multiple risk factors; some of these factors have avoided by monitoring and prevention.

Currently, the awareness that hospital acquired infections are a major public health problem is evident in the hospital world. In Morocco, despite this decision in conscience, few studies have done on surveillance and prevention of nosocomial infections that understanding the modes of acquisition and transmission of these infections.

The completion of the first study of prevalence of nosocomial infections in the hospital El Idrissi, has allowed us to evaluate, in an objective manner, the frequency of these. This study therefore well achieved its initial objectives, despite the difficulties we have made.

Although the risk 0 does not exist in the field of nosocomial infection, reducing the proportion of preventable nosocomial infections is fundamental to the safety of care. The mastery of nosocomial infections requires a comprehensive strategy combining surveillance, prevention, training, information and evaluation.

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