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The consumption of antibiotics in the intensive care unit of the Moulay Ismail Military Hospital in Meknes

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Abstract:
Objective*: The objective of our work is to evaluate the evolution of the consumption of antibiotics in the intensive care unit and to compare it with other establishments and to propose corrective measures.*
Material and method*: This is a retrospective and descriptive study of the consumption of antibiotics in the intensive care unit for the years 2017-2018. The methodology consisted in listing the drugs dispensed in the intensive care unit, determining hospital indicators, determining indications for antibiotic prescriptions and comparing the evolution of antibiotic consumption for the years 2017-2018, this comparison was carried out in DDD/ 1000DH.*
Results*: 553 patients were hospitalized in 2017 and 443 in 2018, performing 3,504 days of hospitalization. Respiratory infections were the most common (39%). The antibiotics delivered to the intensive care unit, all families combined, represent 9.72% of the budget for antibiotics of the HMMI during 2017 and 10.11% in 2018. The most prescribed antibiotics belong to the beta-lactam family . The overall consumption of antibiotics reached 1,691.95 DDD / 1000DH in 2017 and 1,604.7 DDD/ 1000DH in 2018.*
Discussion and conclusion*: The emergence of bacteria resistant to antibiotics has become a worrying public health problem, particularly in the context of intensive care. Monitoring the consumption of antibiotics and their proper use is essential to review local recommendations. This monitoring of antibiotic consumption is part of a concern for health management and economics, whose expenses are constantly increasing.*
Keywords*: Antibiotic consumption - defined daily dose / 1000 Days of hospitalization (DDD / 1000DH) - Bacterial resistance - Resuscitation*

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I. Introduction:

Antibiotics are natural or synthetic substances that destroy or block the growth of bacteria. They disrupted the practice of medicine by curing previously fatal bacterial infections. It is one of the inventions that had resulted in the greatest reduction in human morbidity and mortality [1]. However, they face an increasingly growing threat. The emergence and spread of bacteria that have acquired antibiotic resistance mechanisms have become a worrying public health problem, particularly in hospitals. There are many causes of the emergence and spread of bacterial resistance; however, excessive or inappropriate use of antibiotics is the key determinant [2]. Monitoring the consumption of antibiotics and their correct use is essential for health professionals to contextualize their local policies and recommendations [3]. Very little data is available on the consumption of antibiotics in intensive care units in Morocco. Hencethe interest of our retrospective study on the consumption of antibiotics in the intensive care unit.

II. Material And Methods

It is a descriptive, retrospective study constituting an inventory of the consumption of antibiotics at the level of the resuscitation service of the HMMI. The study took place in the hospital pharmacy and in the intensive care unit of the My Ismail military hospital in Meknes, a unit comprising 7 hospital beds. This study was based on the number of patients hospitalized in the intensive care unit and on the consumption for the years 2017-2018. The methodology consisted on the one hand in determining the indications for prescribing an antibiotic therapy, in determining the number of days of hospitalizations and in calculating the indicators (the average length of stay, the rotation coefficient, the occupancy rate way) ; on the other hand to list the drugs registered in the therapeutic booklet of the hospital, to determine the part which the antibiotics consumed by the resuscitation service occupy [all the anti-tuberculosis drugs were excluded], to compare the evolution of the

consumption of antibiotics for the years 2017-2018, this comparison was made in DDD / 1000DH. The DDD / 1000 days of hospitalization, is an indicator which makes it possible to carry out an annual monitoring of the consumption of antibiotics in the various care services of the same establishment and allows the comparison between health establishments. All of the data collected was processed using "Excel 2010".

III. Results

1-Activity indicators:

The intensive care unit at My Ismail Military Hospital has premises divided into three zones: an administrative zone, a hospitalization zone, a technical zone. The bed capacity of the resuscitation unit is 7 beds. The number of admissions was 553 patients in 2017 and 443 patients in 2018. This represents a total of 996 admissions over the duration of the study with an average of 1.36 admissions per day. The resuscitation service of the HMMI receives patients with very diverse pathologies, referred either directly from the emergency department, or post-operative patients, or patients referred from other departments. The bacteriological etiological probabilities depend on the local epidemiology, on the patient's colonization by certain bacterial species, and of course on the nature of the infection (oropharyngeal, digestive, cutaneous, etc.). There are many infectious sites that motivate the prescription of antibiotics for intensive care, respiratory infections come first, followed by urinary tract infection (Figure 1).

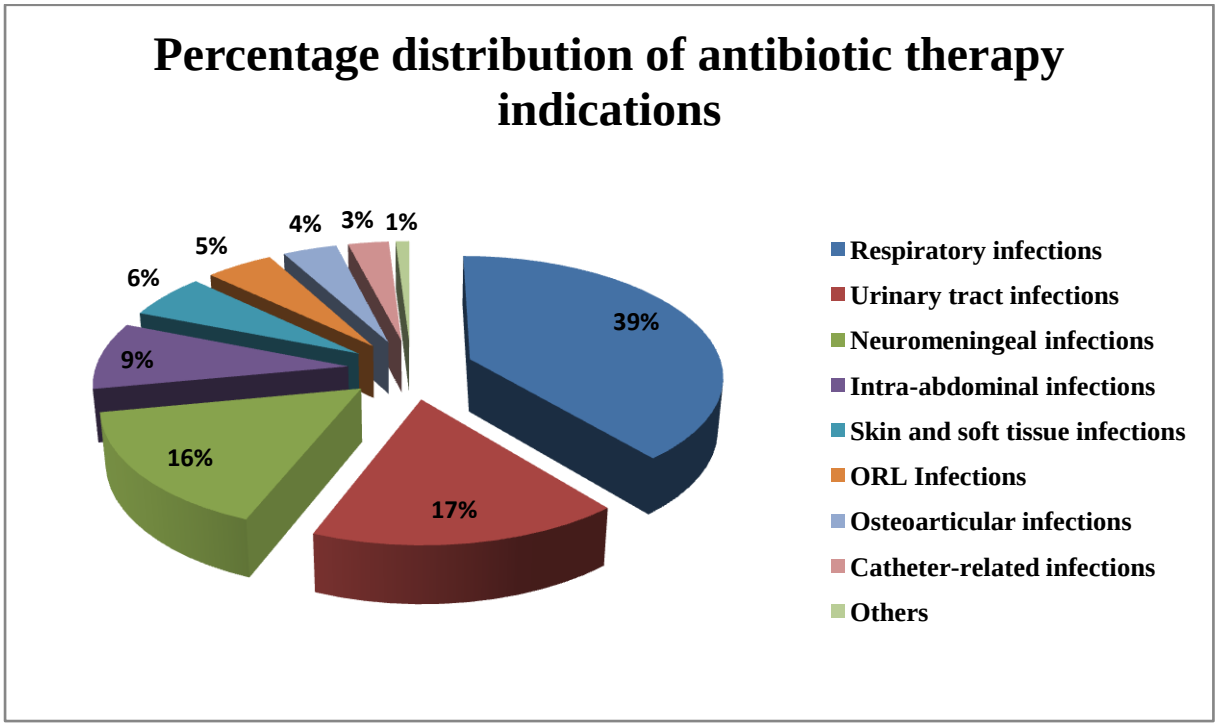

Figure 1: Percentage distribution of antibiotic therapy indications

the average length of stay, expresses the average number of days that the patient spends in a hospital establishment during an observation period; it is obtained by relating the total length of stay of all hospitalized patients to the number of registered (incoming) patients during the same period. For the year 2017, the average length of stay is 3.1 days while for the year 2018 the average length of stay is 4.03 days.

the rotation coefficient, Corresponds to the average number of patients who passed through the same bed during the year of the study. Thus, the turnover rate = number of patients of the year / litter capacity of the service. For the year 2017 the rotation coefficient is 79 patients / bed and for the year 2018 the rotation coefficient is 63.20 patients / bed.

The average occupancy rate, expresses the average number of days of occupation of a bedding capacity of a health facility, calculated by relating the DH to the number of functional beds for a given duration in order to indicate the degree of use of available beds, during this period and to show the performance and efficiency of the establishment in question. For the year 2017 the average occupancy rate is 67.24% and for the year 2018 the average occupancy rate is 69.90%.

1- Consumption of antibiotics in intensive care in DDD / 1000 DH

The results of our evaluation are expressed in DDD per 1000 days of hospitalization, which makes it possible to make comparisons on a local, national and international scale (Figure 2).

The consumption of all antibiotic families combined reached 1,691.95 DDD / 1000DH in 2017 and 1,604.7 DDD / 1000DH in 2018.

In 2017, the distribution by therapeutic families showed that beta-lactams are the most prescribed with 1079.15 DDD / 1000DH, followed by aminoglycosides with 167.64 DDD / 1000DH, and polymixins with 163.37 DDD / 1000DH, fluoroquinolones with 145.20 DDD / 1000DH, nitro-imidazole products with 125.67 DDD / 1000DH, and finally Glycopeptides with 15.72 DDD/ 1000DH.

In 2018, the distribution by therapeutic families showed that beta-lactam antibiotics are also the most prescribed class of antibiotic in our training, totaling 1025.37 DDD / 1000DH, followed by polymixins with 229.19 DDD / 1000DH and fluoroquinolones with 160.89 DDD / 1000DH.

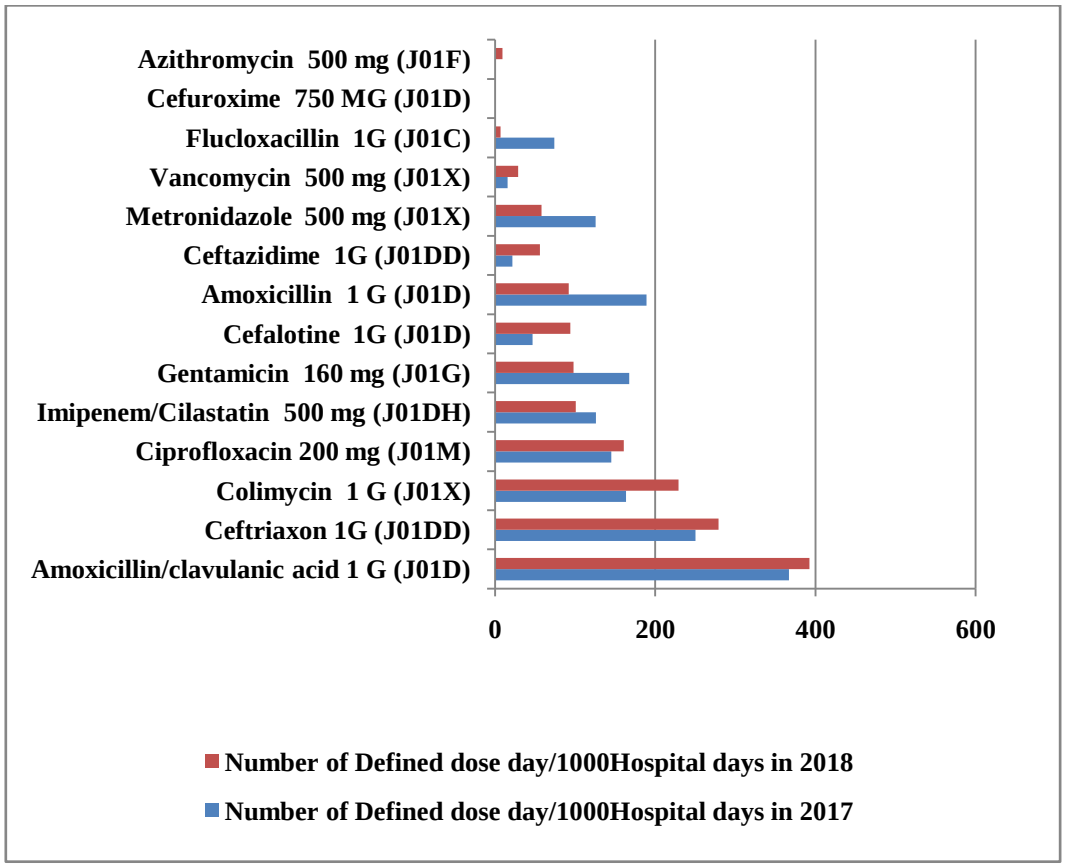

Figure 2: Consumption of antibiotics in intensive care expressed in DDD / 1000DH (anti-tuberculosis drugs excluded)

IV. Discussion of the results:

1-Interest of the evaluation of the consumption of antibiotics in intensive care:

The intensive care units consume more than a quarter of hospital budgets overall [4, 5]. They are heavy consumers of drugs and pharmaceuticals of all kinds, and anti-infective agents represent a major part of this consumption. Thus, the major problem with antibiotic therapy in hospitals is linked to the continual development of new bacterial resistance, which requires regular, qualitative and quantitative therapeutic readjustments. Although difficult to identify perfectly, there is a multifaceted and complex link between antibiotic exposure and resistance [6-8]. It is mainly hospital patients who are the victims of these multi-resistant bacteria. Among them, those who are admitted to intensive care are at particular risk [9]. In intensive care units, the severity of certain infectious pathologies can contribute significantly to the volumes of antibiotics consumed. In fact the admitted patients are heavy and suffer from pathologies which require combinations of antibiotics with high dosage [10], in addition these patients present comorbidities which can favor various infectious complications: diabetes, corticotherapy at high doses, immunosuppression…, d " where the interest of our study of evaluation of the consumption of antibiotics in intensive care.

2- Indications for antibiotic therapy in intensive care:

the comparison of our results concerning the indication for antibiotic therapy in intensive care with other international studies [11, 12], confirmed the predominance of respiratory infections followed by urinary tract infections or bacteremia according to the studies; similar results were noted in the Tunisian study of polyvalent resuscitation at the Tunis University Hospital [11] where respiratory infection represents 69% of infectious sites, followed by urinary tract infection (15%) then bacteremia (12 %). Studies carried out in intensive care of the Lyon University Hospital in France [12] found results close to our study (Figure 2), with a predominance of respiratory infections (32.90%) and urinary tract infections with (20.30%). Resuscitation infections require the implementation of a nosocomial infection surveillance program. This program should target clinically significant infections, that is, potentially serious and preventable. Monitoring colonizations (urinary, pulmonary, etc.) is generally not very useful, consumes a lot of time and can lead to inappropriate prescriptions of antibiotics. Based on these few principles, we can designate the priority objectives of a resuscitation surveillance program: bacteremia linked to intravascular catheterization (and not catheter infections less easy to distinguish from simple colonizations) and pneumonia acquired under mechanical ventilation. Monitoring urinary tract infections in intensive care is questionable, because most often these are infections related to urinary catheterization. In this context, it is generally difficult to make a good distinction between infections and colonizations. In addition, preventive measures to date are quite limited and mainly boil down to the use of urine catheterization in a closed system, a measure which is a priori well integrated into services [13]. Finally, their impact on the prognosis of resuscitation patients does not appear to be very significant, with the possible exception of bacteremic infections. One way of approaching surveillance for this infectious site may be to carry out an annual prevalence survey at establishment level, which limits the workload and improves the profitability of monitoring by increasing the power of the investigation [14].

3- Analysis of antibiotic consumption in DDD / 1000DH: This new indicator makes it possible to include, in addition to the number of drugs consumed, the number of hospital days per care unit. It allows a comparison by molecules and by families of antibiotics taking into account a standard dosage (DDD). In addition, this indicator makes it possible to carry out annual monitoring of the consumption of antibiotics in the various care services of the same establishment or between different health establishments.

3-1. Analysis of the overall consumption of all the antibiotics combined (Table 1): The average consumption of all antibiotic families combined over the study period reached 1,653.06 DDD / 1000DH. These results are close to certain data from the literature, namely a French study carried out by the grape antibiotic network in 2016 with 1468 DDD / 1000DH [15]; however, our results remain very far from other studies, namely a study in a German intensive care unit in 2004 with 1090 DDD / 1000DH [16]. This result prompts us to reflect on the reasons for this significant difference in consumption in DDD/1000DH which prove consumption higher than the other comparison structures and to propose corrective measures.

Classe d'antibiotique	Intensive care of My Ismail Military hospital 2018: DDD/1000DH	Intensive care allemande : DDD/1000DH [16]	Intensive care Réseau ATB Raisin 2016DDD/1000DH [15] :
Total	**1653,06**	1090	1468

Table 1: comparison of antibiotic consumption in different intensive care units (all antibiotic families combined)

3-2. Analysis of consumption by family of antibiotics: (table 2)

Analysis of consumption by antibiotic families has shown that beta-lactams represent the most consumed family with 1023.64 DDD / 1000DH; this confirms that beta-lactams are therefore essential anti-infective weapons and considerably prescribed in intensive care; result confirmed by the Raisin Antibiotic study of 2016 with 1030 DDD / 1000DH [15] and the German study with 943 DDD / 1000DH [16]. Protected amoxicillin has increased consumption from 367.09 DDD / 1000DH in 2017 to 392.35 DDD / 1000DH in 2018, for ceftriaxone 1g consumption has increased from 250.29 DDD/ 1000DH in 2017 at 279.12 DDD / 10000DH in 20018.

Whereas for reserve antibiotics the consumption of ceftazidime 1g increased from 21.68 DDD / 1000DH in 2017 to 56.13 DDD / 1000DH in 2018; vancomycin 500 mg consumption increased from 15.72 DDD / 1000DH in 2017 to 28.84 DDD / 1000DH in 2018, the main indication of which is Staphylococcus Aureus Resistant to methicillin MRSA; except that for imipenem consumption decreased from 125.73 DDD / 1000DH in 2017 to 100.78 DDD / 1000DH in 2018.

The polymixin family has experienced a significant increase from 163.37 DDD / 1000DH in 2017 to 229.19 DDD / 1000DH in 2018. However, no consumption of this family has been recorded in other studies,

this finding confirms that the Prescription of this family within our resuscitation service is justified and documented by the emergence of multidrug-resistant bacteria (BMR). Colistin is, however, considered an antibiotic of last resort by the ANSM, that is, prescribed if no other therapeutic alternative is available [17].

Then finds the family of fluoroquinolones with an increase in consumption from 145.20 DDD / 1000DH in 2017 to 160.89 DDD / 1000DH in 2018, antibiotic family playing an important role in the selection pressure of BMR, this consumption remains very high compared to other comparison studies [15, 16], the aminoglycosides experienced a decrease in consumption going from 167.64 DDD / 1000DH in 2017 to 97.80 DDD / 1000DH in 2018 and nitrated products also experienced a decrease in consumption going from 125 DDD / 1000DH in 2017 to 57.79 DDD / 1000DH; the molecules of the two families are prescribed in combination with other antibiotics, these results remain very close compared to data from other comparison studies [15, 16].

Other classes of antibiotics such as cyclins or sulfa drugs were not used at all in our training or in the other resuscitation services raised.

A European study [18] compared the use of antibiotics in two cohorts of intensive care services in university hospitals (N = 17) and non-university (N = 75) and the conclusion was that consumption is greater in services university students 1360 against 1100 DDD/ 1000DH.

Similar studies in Taiwan [19] and Sweden [20] have found that the amount of antibiotics used is strongly correlated with the level of care provided by the hospital. One of the most advanced explanations is that the length of stay in tertiary level structures is more prolonged which favors the occurrence of nosocomial infection [19-21]. A study carried out at the university hospital center of Dijon in France [22] found an annual consumption of antibiotics in adult resuscitation oscillating around 1200 DDD / 1000DH.

Antibiotic Class	Intensive care of My Ismail Military hospital 2018 : DDD/1000DH	Intensive care of allemande : DDD/1000DH [16]	Intensive care of Réseau ATB Raisin 2016 DDD/1000DH [15]
Pénicillins	491,15	508	686
Carbapénèmes	100,78	78	93
Céphalosporins	429,03	357	251
Glycopeptides	28,84	21	56
Polymixins	229,19	0	0
Aminoglycosides	97,80	72	107
Macrolides	9,24	27	74
Cyclines	0	0	0
Fluoroquinolones	160,89	54	105
Sulfamides	0	0	0
Nitrated products	57,79	75	55

Table 2: comparison of the consumption of antibiotic families in different intensive care units (consumption 2018)

4- Recommendations

The problem of resistance to antibiotics is at the origin of the prolongation of the disease and the duration of the treatment, often within the framework of a hospitalization, it increases the expenses of health, as well as the financial burden weighing on the families and society.

A global desire to control hospital prescriptions for antibiotics was born from these observations. The learned societies of infectious pathologies regularly publish consensus recommendations for a prescription adapted to each diagnosis. These recommendations recommend:

¬Control of the use of antibiotics (CLIN),

¬Prevention of bacterial resistance to antibiotics

¬A better prescription strategy.

¬A better diagnostic strategy

¬ the use of written protocols

¬Limitation of prescription with reduction of the duration of treatment,rotation of antibiotics to BMR.

V. Conclusion:

At the end of our work of evaluation of the consumption of antibiotics within the intensive care unit, the results of which highlighted a high consumption of antibiotics, of which certain data from the literature confirmed the trend. The consequences of this increase are the emergence of BMR, the increase in the cost of care and the lengthening of the length of hospital stay for patients.

The development of a policy of antibiotic therapy in intensive care units appears to be one of the essential strategies for the prevention of infections with multidrug-resistant bacteria and the reduction of the cost of treatment with anti-infectives.

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