ANTIBIOTIC EXPOSURE PROFILE AND PRACTICAL WAYS OF USE AT THE HEART INSTITUTE OF ABIDJAN

Koffi Armand Angely*[1,2], Nguessan Clemence[1,2], Aka Sandrine[1], Tuo Awa[1] and Say Assemian Camile[2]

[1]Laboratory of Pharmacie Galenique, TRU for Pharmaceutical and Biological Sciences, Félix Houphouet Boigny University, Abidjan, Côte d'Ivoire, BP V 34.
[2]Heart Institute of Abidjan, Côte d'Ivoire, BP V 206.

*Corresponding Author: Koffi Armand Angely
Laboratory of Pharmacie Galenique, TRU for Pharmaceutical and Biological Sciences, Félix Houphouet Boigny University, Abidjan, Côte d'Ivoire, BP V 34.

ABSTRACT

Introduction: This retrospective study was conducted at the Heart Institute of Abidjan (ICA) in Côte d'Ivoire over a period of 10 months (January to October 2010). The general objective was to determine the socio-demographic and pathological profile of hospitalized patients in the medical and intensive care units who received antibiotic therapy during the study period and then to evaluate the practical modalities of prescribing these antibiotics. **Methods:** The study was conducted along two lines: a documentary review of patient records and a clinical audit of the compliance of prescriptions with clinical practice recommendations. The ATC / DDJ (Therapeutic and Chemical Anatomical / Defined Daily Dose) analysis recommended by the WHO was used. **Results:** 70% of patients receiving antibiotic therapy at ICA belonged to the medical and intensive care units. These patients were generally between 36 and 75 years old. They were mostly male (sex ration 2.27). The main indications for antibiotic therapy were pneumonia (40%), pericarditis (16%) and COPD (9%). The most prescribed family of antibiotics was penicillins and mainly amoxicillin / clavulanic acid, which had a penetration rate of 180.37. The antibiotic exposure rate was 72.8%. 28% of the prescriptions were not in conformity with the recommendations. These non-compliances included the indication (20.7%), the dosage (5.7%), the duration of treatment (1.9%) and the route of administration (2.5%). **Conclusion:** The results confirmed the difficulties of prescribing antibiotics in the context of cardiovascular infections. The periodic evaluation of the anti-infective prescription should be recommended for surveillance of nosocomial infections and reduction of hospital costs.

KEYWORDS: Antibiotic therapy, exposure profile, cardiovascular infections.

INTRODUCTION

Cardiology holds a prominent place in contemporary medicine. According to the WHO, cardiovascular disease is the leading cause of death in the world (29% of global mortality). More than 82% of deaths occur in middle- and low-income countries.[1] Catastrophic health expenditures for households with a family member with cardiovascular disease may account for 30% or more of household annual expenditures. Some of these conditions are cardiovascular infections, such as infectious pericarditis, which is widespread in sub-Saharan Africa; it has an estimated prevalence of 16.6% in Abidjan and an incidence varying between 20 and 50%.[2] Treatment relies heavily on antibiotics. But resistance to these antibiotics is growing worryingly. A study of WHO's Appropriate Health Care Technology (ATH) program based on data collected in hospitals and health centres in 12 countries showed a correlation between the existence of multidrug resistance and the pattern of consumption. Antibiotics. The American College of Physicians' Public Health Committee reported that almost 64% of antibiotic prescriptions in hospitals are useless or with inappropriate dosages.[3] In the United States, the cost of resistance to antibiotics has been estimated at more than $ 100 million a year.[4] In the current context, it is essential to optimize antibiotic prescriptions in hospital services, particularly in African countries. For that, the implementation of an information system allowing the follow-up and the analysis of the consumption of antibiotics is a priority objective hence the importance of our study. The overall goal of this inpatient study in ICA's medical and intensive care units was to determine the pattern of antibiotic use and how it was used. Specifically, it has been questions to describe the socio-demographic and pathological aspects of patients, to characterize qualitatively and quantitatively the exposure to antibiotics, and to evaluate the costs of treatments and the professional practices of prescribers.

MATERIAL
Location and evaluation period
The study was conducted in the Pharmacy, Medical, Critical Care and Archives departments of the ICA. The study period was from January to October 2010.

The patients
The selected patients were those hospitalized in the medical and intensive care departments who received antibiotic treatment in the selected period. The files should be complete. Patients with incomplete records (insufficient information on how to use antibiotics) were excluded.

METHODS
Data Sources and Collection Method
Data was collected from pharmacy records, pharmacy records, archival medical records (DM) and the ICA's "HOSPITAL" administrative management software. In order to facilitate the analysis, the data were grouped together using a collection sheet. DM presented the chronological status of antibiotic consumption. The DM described the practical details of the therapeutic protocols performed during the hospitalization. These data were supplemented by meetings with the practitioners of the selected services allowing the analysis of professional practices. The "HOSPITALL" software provided additional information on patient identity, length of stay and treatment costs. Prior to data collection, file compliance was analysed. They should contain the complete information.

For each patient: sex, age, hospitalization, dates of entry and exit, reason for hospitalization, diagnosis and risk factors.

For antibiotic therapy: the route of administration, the dosage (in the DP and DM), the cost of drugs and the duration of treatment. Only systemic antibiotics were collected (OJ1 of the 2009 ATC classification of the WHO). Consumption of oral imidazole (classified in PO1) has also been noted.

Analysed Parameters
Sociodemographic parameters were age and sex. For age, the average per hospitalization service and the median were calculated.

The morbidity characteristics were the type and frequency of cardiovascular infections, the average duration of hospitalization (D) and the exposure rate. The average duration of hospitalization is a quantitative variable obtained by relating the total number of days of hospitalization (NTJH) to the size of the service studied. For the NTJH calculation, the start day counts as 1, while the arrival day counts as 0.

D = NTJH / Unit Staff

The exposure rate was obtained by comparing the duration of antibiotic treatments with the duration of hospitalization.

Exposure rate = length of antibiotic treatment / length of stay
Prescription parameters were those determined by the WHO Anatomical, Therapeutic and Chemical (ATC) classification system for drugs.
• The quantity (Q) in grams of active ingredient served of the given drug
• The number of treatment days evaluated (TDI) of the antibiotic, obtained by reporting the total amount of the antibiotic to its DDJ.
JTE = Q / DDJ
• Penetration rate (TP) reflects the measure of antibiotic exposure. It was obtained by reporting the number of JTEs to the total number of days of hospitalization and multiplying the result by 1000.
TP = (JTE / NTJH) X 1000
• Prescription rate, obtained by reporting the number of antibiotic cases to the total population.
Prescription rate = number of cases / total workforce
• The average cost of antibiotic therapy (MD) is the ratio of the cost of the antibiotic to the total workforce.
CM = Antibiotic cost / total workforce

Practical terms of use
The compliance rate (TC), obtained by reporting the number of compliant cases of the item assessed to the total number of cases.
TC = compliant files / total records

Data processing
Data were reported on the Excel version 2007 software. Confidence intervals were calculated with an α risk of 5%.

RESULTS
Characteristics of the sample
The services of medicine and intensive care represented 74,8 % (that is n=757 of patients hospitalized in the establishment during the period of study. For the service of medicine, 28,1% of these patients received an antibiotic treatment, on the other hand they are 40,9% of the patients admitted at the intensive care (Table I). 159 pharmaceutical and medical files met all the criteria to be included in the study.

Table I: Sampled population data.

Unit	Patients	Antibiotic treatment	Antibiotic treatment %
Medical	410	125	28.1
Intensive care	347	182	40.9
Surgery	158	86	19.3
Cardio-paediatrics	72	38	8.6
Hemodynamic	25	14	3.1
Total	1012	445	100%

Characteristics of population, morbidity and Medical
Age and sex
For the medical unit, the average age is 56 years [CI $_{95\%}$ = 26; 85] with follow-up of 22 to 81 years and median of 62 chosen. As for the intensive care unit, the average age selected is 51 years [CI $_{95\%}$ = 11; 91] with extension of 7 to 88 years and median age, 51. The sex ratio was 2.27 in favour of men.

Characteristics of morbidity
The main indications for antibiotic treatments were pneumonia (40.2%), pericarditis (16.3%) and chronic obstructive pulmonary disease (COPD) (9.4%) (Table II).

Table II: division of diagnostics.

Indications	Number of prescriptions	Percentage (%)
Heart patient		
Pericarditis	26	16,3
endocarditis	7	4,4
Implant a Pace Maker	10	6,3
Pulmonary patient		
BPCO	15	9,4
Pneumonia	64	40,3
Other		
Accidental	16	10,1
Others (diarrhoea, appendectomy …)	13	8,1
Not justified	8	5
Total	159	100 %

Length of Hospital Stay
The medical unit chose an average stay of 6.5 days [IC $_{95\%}$ = 2; 11] with follow-up of 1 to 80 days. As for the intensive care unit, it was 7.2 days [CI $_{95\%}$= 2; 13] with follow-up of 1 to 33 days. 51% of the patients were hospitalized for 1 to 7 days, 31% for a period of 7 to 14 days and 18% over 14 days. Antibiotic treatments started generally 1.97 days [95% CI = 1.3; 2.7] after hospitalization and lasted an average of 5.3 days [CI $_{95\%}$ = 2.2, 8.5] with an exposure rate of 72.8%.

Antibiotic treatment
Antibiotic prescription rate
92.5% of patients on antibiotic therapy received a β-lactam, mainly amoxicillin-clavulanic acid (Figure 1).
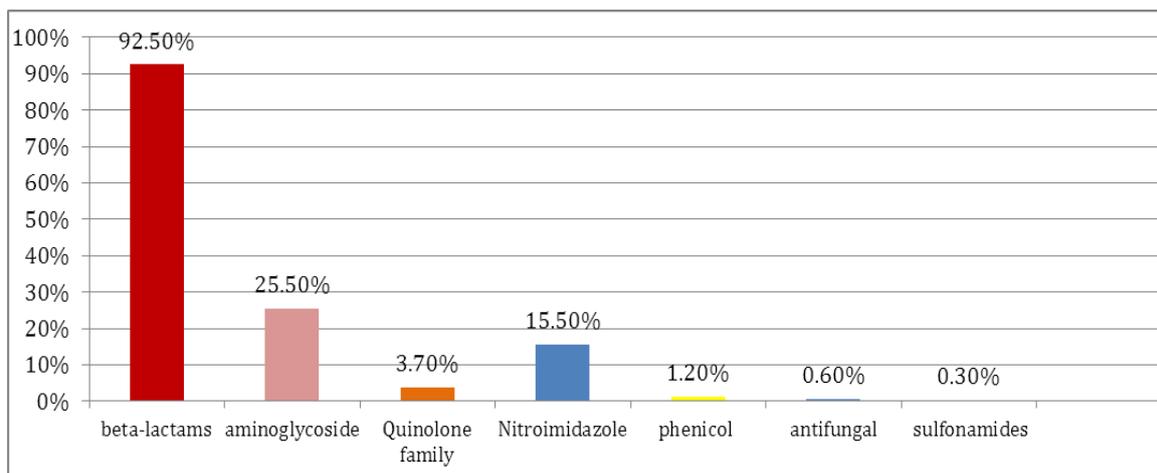

Figure 1: Patients categories according to prescribed antibiotics.

The most prescribed molecules were: amoxicillin / clavulanic acid (44.2%), gentamine (17.8%), amoxicillin (9.8%) and ceftriaxone (8.5%) (Table III).

Table III: Categorization of Molecules.

Molecules	Number of prescriptions	Percentage (%)
Amoxicillin + clavulanic acid	99	44,2
Gentamicin	40	17,8
Amoxicillin	22	9,8
Metronidazole	11	4,9
ofloxacin	4	1,8
cefuroxime axetil	13	5,8
Ceftriaxone	19	8,5
Levofloxacin	3	1,3
Ciprofloxacin	6	2,8
Cefotaxime	2	0,9
Cotrimoxazole	4	1,8
Cefixime	1	0,4
Total	224	100%

Penetration rate
The overall penetration rates of all antibiotics used is 42.5% for medical unit and 57.5% for the intensive care. The penetration rates of penicillin (JO1C), cephalosporin (JO1D), metronidazole (JO1X), aminoglycosides (JO1G), quinolones (JO1M) and sulphonamides (JO1E) is of 63%, 17%, 7%, 6%, 6% and 1% each. Molecules with the highest penetration rates are amoxicillin + clavulanic acid (180.4), amoxicillin (88.6), ceftriaxone (60.6), metronidazole (28.1) and gentamicin.

Other data
The average cost of antibiotic treatment is XOF 33,880 [95% CI = 28,392; 39,632], for a total cost of 30.4% drug buy.

Practical ways of using antibiotics
The hereinafter Table IV summarizes compliance of records based on indication, dosage, administration route, length of antibiotic treatment and combination of all four criteria (overall).

Table le IV: Compliance of Medical Records.

Item	Compliant	Non-compliant
Indication	79,3%	20,7%
dosage	94,3%	5,7%
administration route	98,1%	1,9%
length of antibiotic treatment	97,5%	2,5%
Global	**72%**	**28%**

In total, 115 prescriptions (i.e. 72%) comply with recommendations. Table IV provides details about the 20.7% non-compliant prescriptions indication.

Table V: Type of non-compliance with prescriptions indication.

Number of files	Type de compliance	Recommendations
9	Non-severe pneumopathy: first-line prescription of amoxicillin / clavulanic acid for patients without co-morbidities	Amoxicillin
9	Pericarditis: prescription of amoxicillin / clavulanic acid	combination of Amoxicillin / clavulanic acid + aminoglycoside
2	Lung abscess: prescription of cefuroxime	Association amoxicillin/ clavulanic acid + aminoglycoside
1	Streptococcal endocarditis: prescription amoxicillin / clavulanic acid	Amoxicillin
1	Pleurisy: prescription of metronidazole	Combination of amoxicillin/ clavulanic acid + aminoglycoside
3	Severe pneumopathy: prescription of amoxicillin / clavulanic acid or ceftriaxone	Association of amoxicillin/ clavulanic acid + macrolide
8	**reasons for antibiotic therapy not mentioned** 3 cases with heart failure: prescription of amoxicillin / clavulanic acid 3 files with dilated cardiomyopathy: prescription of amoxicillin / clavulanic acid Loss of consciousness: prescription of amoxicillin / clavulanic acid Intravenous thrombus: prescription of ceftriaxone	

The combination of Amoxicillin and clavulanic acid was the main molecule involved in 71% of non-compliances.

DISCUSSIONS

Patients involved in the study were relatively young (average age 56 years for medicine and 51 years for intensive care). These characteristics differ from that of the Kacou A.[5] study conducted in the multipurpose intensive care unit of the University Hospital of Yopougon in 2010 where the average age of patients was 39 with extension to 12 and 81 years. A study carried out in two intensive care units in the cities of Lyon and Paris on the use of antibiotics showed a population of predominantly male patients with an average age around 50 years similar to that of our population.

The percentage of patients receiving antibiotic therapy is significantly lower than those in other studies. We respectively obtained 28.1% for the service of medicine and 40.9% for intensive care. The Kacou A. study[5] found that 74.6% of patients received antibiotic therapy. A study in Denmark in a university hospital showed that 71% of patients received antibiotics.[6] The low rate observed in our study may be partly explained by the fact that the Heart Institute received a particular profile of patients suffering from cardiovascular diseases and the prevalence of cardiovascular infections does not exceed 10%.[7]

Antibiotic therapy usually started at 1.97 days after hospitalization and lasted an average of 5.3 days. The antibiotic exposure rate was 72.8%. These results were lower than those of Kacou A. who showed that the average duration of exposure was 8.5 days and the exposure rate was 86.4%. On the other hand our data were superior to those observed in the resuscitation department of Bichat Claude Bernard of Paris.[8] The exposure rate was 60%. Pneumonia and COPD, which accounted for 49% of the prescribing causes, lasted 7 and 14 days respectively.

Only 20.8% of inpatients were screened. This proportion is lower than that of the study conducted in the intensive care units of hospitals in Lyon and Paris[9] respectively by 31% and 54%. Nevertheless it was higher than that of Kacou A. which was 8.3%. Thus, the probabilistic treatment rate is around 80%. This value shows a risk of nosocomial infections. The prescription of extended-spectrum molecules (amoxicillin / clavulanic acid, ceftriaxone, gentamicin.) was carried out in the absence of any bacteriological documentation.

The overall penetration rate of the systemic anti-infective class of 423.75 was lower than that of Kacou A. which was 864.2 over 8 months. The predominantly prescribed antibiotics were amoxicillin / clavulanic acid (TP = 180.4), amoxicillin (TP = 88.5) and ceftriaxone (TP = 60.6). These data were similar to those obtained in university hospitals in France in 1998.[10]

Pneumonia, pericarditis and COPD accounted for 2/3 of the causes of prescriptions. These conditions, which belong to the respiratory and cardiac spheres, justify the prescription of the majority of active antibiotics on aerobic germs.

The amoxicillin / clavulanic acid combination has been prescribed in the first intention 9 times for pneumonia in young people, whereas the use is to reserve it for more serious situations. This association of molecules was involved in 71% of nonconformities. The recommended dosages were generally well followed. The compliance rate of 94% was significantly higher than that of Bontemps H. et al obtained at Grenoble University Hospital (France) (77%).[11] Similarly, during the review of the relevance of fluoroquinolone prescriptions in hospitals in the Lorraine region of France[12] for the year 2008, compliance of the dosage was 88%.

The non-compliance of the prescriptions also concerned the duration of treatment with a rate of 2.5%. This result differs from that observed in the 1997 study conducted at the Léon-Bérard regional centre (France)[13] where 20% of the treatment duration was inappropriate.

At the level of overall compliance, the rate of compliant prescriptions was 72%. This proportion was higher than those determined in other studies[14, 15, 16] which varied between 22 and 40%. These results should not be considered as a satisfaction for the Abidjan Heart Institute. It should be noted that the comparison between the various studies is problematic in the absence of homogeneous evaluation and methodology criteria. The main interest of this study lies in the local evaluation of practices in order to optimize the quality of prescriptions according to international recommendations.

CONCLUSION

The evaluation of practices should be a priority at the hospital. It determines to what extent the actual practice corresponds to the recommended practice, taking into account the scientific knowledge at a given moment. It aims to improve the quality of care in terms of public health while including the notion of economic efficiency. The study found that 70% of patients receiving antibiotic therapy at ICA belonged to the medical and intensive care units. These patients were generally between 36 and 75 years old and mostly male (sex ration 2.27). Antibiotics were prescribed to treat mainly pneumonia (40%), pericarditis (16%) and COPD (9%). The most prescribed family of antibiotics was penicillin and mainly amoxicillin / clavulanic acid, which had a penetration rate of 180.37. Antibiotic effects started on average 1.97 days after hospitalization, lasted on average 5.3 days and extended to 72.8% of the duration of treatment.

Unfortunately, the study proved that 28% of antibiotic prescriptions were non-compliant with clinical practice guidelines. These non-compliances regard indication in 2

antibiotics prescription on a rate of 20.7%, a dosage at 5.7%, the duration of treatment at 1.9% and the route of administration at.5%.

The results of this study confirm the difficulties of prescribing antibiotics in the context of cardiovascular infections, where the use of broad-spectrum molecules is often necessary. The use of microbiological diagnostic tools should be optimized and could thus promote the use of reduced spectrum antibiotics. Periodic evaluation of the anti-infective prescription therefore remains on the agenda.

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