

Epidemiology of Infection in Patients with Diabetes Mellitus at the University Hospital of Marrakech

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| Received: 12.03.2019 | Accepted: 26.03.2019 | Published: 30.03.2019

DOI: [10.36347/sjams.2019.v07i03.088](https://doi.org/10.36347/sjams.2019.v07i03.088)

Abstract

Original Research Article

Introduction: Diabetes mellitus is associated with a high risk of bacterial infections. This is related to the harmful effect of hyperglycaemia on cellular immunity. These infections are associated with a heavy morbidity and mortality in this population. The main purpose of this study was to determine the etiological agents of these infections and to establish the current profile of antibiotic resistance of bacteria isolated. **Materials and methods:** This was a prospective study carried out in the Department of Bacteriology-Virology at the University Hospital of Marrakech for a period of 18 months (July 2016-December 2018), including all diabetic patients infected hospitalized Or externally, and who have benefited from a sample for cytobacteriological study. All the samples received were directly examined, and then a culture and antimicrobial susceptibility tests were performed. **Results:** A total of 692 specimens were collected during the study period, containing mainly Bacteriological examination of urine BEU (n = 416) and diabetic foot (n = 263). Mean patient age was 45 years, the Sex ratio F / H was 2.5. The type 1 diabetes accounted for 60% of the infected patients. Microbiologically, Gram Negative bacteria dominated the profile of these infections in 73% of the cases. Enterobacteriaceae were responsible for 58 % of infections, *Escherichia coli* was the dominant pathogen (25.5%) followed by *Klebsiella pneumoniae* (18.5%). High resistance rates to antimicrobial agents were recorded especially to amoxicillin (85.5%), 53% for amoxicillin/clavulanic acid and 50% for cotrimoxazole. third generation cephalosporins and aminoglycosides preserved an effective activity on these enterobacteriaceae. **Conclusion:** The frequency and severity of infections in patients with diabetes mellitus, besides to the increasing resistance of germs underline the importance of prevention based on the education of the patients with diabetes mellitus and the early and adapted management of this patient infected by a multidisciplinary team in which the laboratory plays a key role diagnostically and Therapeutically by adaptation of antibiotics according to antibiogram results with the aim of a therapeutic success.

Keywords: Epidemiology; infection; diabetes mellitus.

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INTRODUCTION

As a chronic and dangerous disease, diabetes mellitus is today one of the main non communicable diseases in the world, whether in developed countries or in developing countries including Morocco. In such a situation, the infectious risk is classically important [1,2], this would be related to the deleterious effect of hyperglycemia on cellular immunity [3,4]. These infections are burdened with a heavy morbidity and mortality in this population despite the improvement in the overall management of diabetic patients [5-7]. These infections are mainly urogenital, cutaneous and bronchopulmonary infections [8].

Thus, the main objective of this work is to study the epidemiology of the infection in diabetics, define the etiological agents of these infections and

establish the current profile of the resistance of bacterial isolates to major antibiotics, used in therapy.

MATERIALS AND METHODS

This is a prospective study carried out at the Bacteriology-Virology Department of the Mohammed VI Medical University Hospital in Marrakech for a period of 18 months (July 2016-December 2018), including all infected diabetic patients hospitalized, received in consultation or externally, in whom a sample for cytobacteriological study was taken. All the samples received benefited from a direct examination with a culture on different agar media and an antibiogram of the identified isolates.

For any positive culture, the identification of bacteria was based on morphological, cultural and biochemical characters.

The study of antibiotic susceptibility was carried out according to the technique of diffusion of the disks in agar medium or by automated method, and the interpretation was made according to the standards of the Committee of the antibiogram of the French Society of microbiology (CA- SFM / EUCAST).

Data collection was done using pre-established farm records and from the Laboratory database.

RESULTS

During the study period, 662 samples were collected, mostly consisting of ECU (n = 416) and diabetic foot pus (n = 263). The average age of the patients was 45, the sex ratio F / H was 2.5. 60% of infected patients have type I diabetes.

On a microbiological level, 73% of the germs incriminated in these infections are Gram Negative bacteria. Enterobacteria were predominant (58%) dominated by *Escherichia coli* in 25.5% followed by *Klebsiella pneumoniae* (18.5%) (Figure 1).

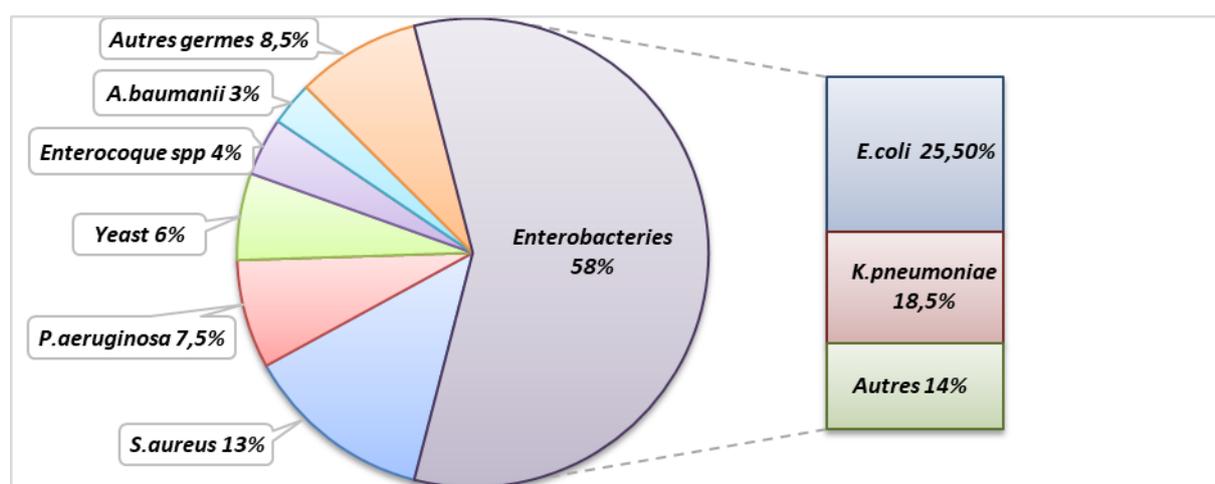


Fig-1: General distribution of isolated germs in patients with diabetes mellitus

The study of antibiotic resistance of the isolated organisms showed high levels of resistance for amoxicillin (85.5%), 53% for amoxicillin-clavulanic acid and 50% for cotrimoxazole. These

Enterobacteriaceae remained sensitive to Aminoglycosides and third-generation cephalosporins (Table I).

Table-I: Percentage of antibiotic resistance of enterobacteriaceae isolated in patients with diabetes mellitus (n = 662)

Antibiotics tested	% of resistance of Enterobacteriaceae at any infectious site (n =662)	% of resistance of enterobacteria isolated in the diabetic foot (n =263)	% resistance of enterobacteria isolated in urinary tract infection (n = 416)
Amoxicillin	85.5	--	81
Amoxicillin and Clavulanic Acid	50	60,6	46,5
third-generation cephalosporins	9	9	9
Ciprofloxacin	25	36	21
Co-trimoxazol	50	27	55
Gentamicin	5	3	8

The main bacterium responsible for urinary tract infection in diabetic patients of this series is *Escherichia coli*, occupying 44.5% of cases (Figure 2). While *Staphylococcus aureus* dominated the isolated

germs in diabetic feet (29%) followed by *Pseudomonas aeruginosa* (18%), *Klebsiella pneumoniae* (16%) and *Proteus* (15%) (Figure 3).

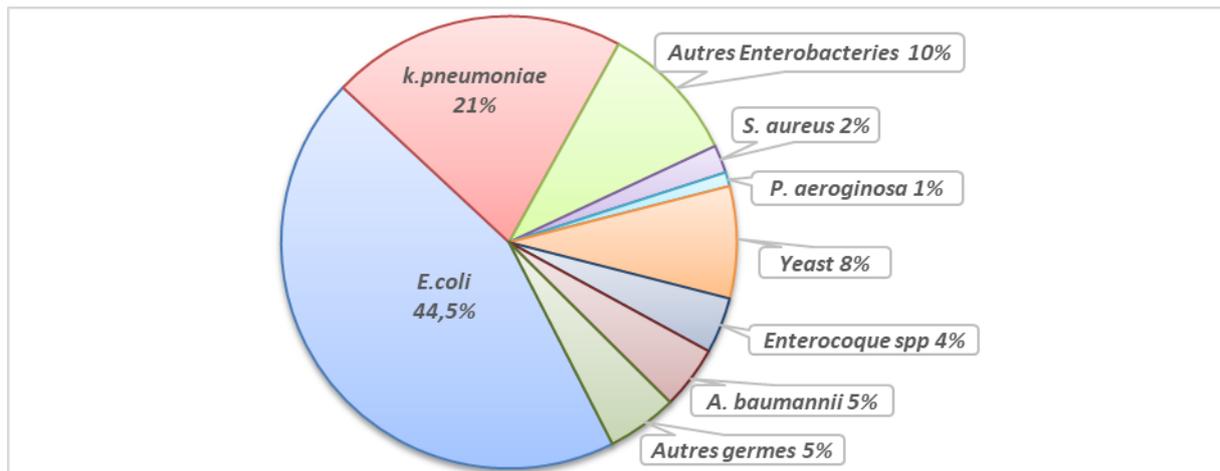


Fig-2: Distribution of uropathogenic germs in patients with diabetes mellitus (n=416)

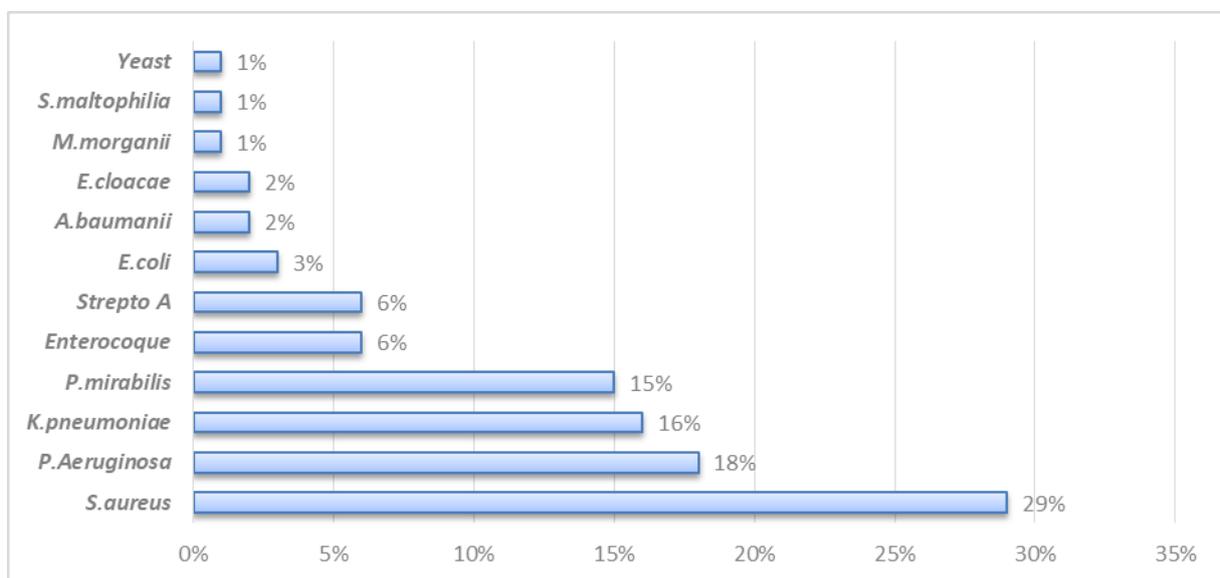


Fig-3: Distribution of isolated germs of diabetic foot (n=263)

Multidrug-resistant bacteria accounted for 10% of all isolates during this period. 9% of Enterobacteriaceae were Third-generation Cephalosporin resistant.

DISCUSSION

The infection and diabetes complex is a classic theme, the diabetic patient is presented in all the treatises of diabetology or infectiology as subject to the risk of infection, diabetes is indeed part of the long list of different conditions likely to cause alteration of immune defenses [9]. The mechanisms are more or less elucidated by the influence of hyperglycemia on the functions of neutrophils. Indeed, specific defects in the innate and adaptive immune system have been identified in diabetic patients in a series of in vitro studies [10,11].

Dominance of Enterobacteriaceae in the diabetic patient infections was noted including *E. coli* and *K. pneumoniae*. These Enterobacteriaceae showed high levels of resistance for Amoxicillin (85.5%), for

Amoxicillin Clavulanic Acid and (53%) and for Cotrimoxazole (50%). Third-generation cephalosporins and aminoglycosides have maintained potent activity on these Enterobacteriaceae. Enterobacteriaceae are the microorganisms that are often responsible for infection in diabetics, antibiotic resistance in this family continues to increase due to the pressure of selection due to the antibiotic massive prescription and the often abusive use of broad-spectrum antibiotics both in hospitals and in community settings [12].

In urinary infection in diabetics, a predominance of Enterobacteriaceae was also noted with *E.coli* as the leader; *E.coli* continues to dominate the first rank of uropathogenic germs followed by *K. pneumoniae* [13-16].

The knowledge of the responsible bacteria is a valuable tool for the choice of first-line antibiotic therapy that needs to be adapted to the site of the infection and the patient's history Urinary tract infections are common in diabetics resulting from

glycosuria, neurogenic bladder, and the existence of a residue that represents a true Bactrian lodge usually without clinical expression [13, 14]. Other mechanisms have been cited including the alteration of neutrophil functions, urinary tract functional and (or) anatomical abnormalities related to its autonomic neuropathy, hypo- or bladder hyperactivity and incontinence [15, 16]. All of this justifies routine screening for urinary infection, which is often asymptomatic [17, 18]. Its asymptomatic nature should not make us forget that it evolves on a particular ground: the diabetes, especially if it is unbalanced.

The etiological profile of diabetic feet is also dominated by Enterobacteriaceae followed by *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Indeed, the diabetic foot represents a medical and economic problem of primary importance, responsible for long hospitalizations and a major risk of amputations [19-21]. Infection is rarely the only cause but often complicates the neuropathy and distal arterial disease that are predisposing factors. Thus, the preventive treatment is capital: correction of the static troubles, education of diabetics regarding hygiene and foot protection measures; research and treatment of any distal trophic disorder.

In terms of multidrug-resistant bacteria, Diabetes itself is not a risk factor for acquiring these germs since the prevalence of BMR was 10%.

CONCLUSIONS

This study reports the important role of Enterobacteriaceae among the responsible germs of infection in the diabetic patient. In addition, antimicrobial resistance, in perpetual evolution, threatens a certain number of antibiotics used in current practice limiting their indication. The frequency and severity of infections in the diabetic population as well as the increasing resistance of the responsible germs underline the interest of a prevention, based on the reinforcement of the education of the diabetic patient as well as an early and adapted care of this patient infected by a multidisciplinary team in which the laboratory plays a key role in terms of diagnosis and also in terms of adaptation of the treatment to the results of the antibiogram for the purpose of therapeutic success.

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