

**ORIGINAL ARTICLE****Study of Bacteriological Profile and Antibiotherapy of Infected Diabetic Feet of Patients at the University Hospital of Sidi Bel-Abbès.**Mounia SAKOUHI<sup>1</sup>, Derouicha MATMOUR<sup>2,3</sup>, Kahina TOUDERT<sup>2</sup>, Samia BRAHIM<sup>3</sup>, Houria MEHAREB<sup>4</sup><sup>1</sup>Diabetology-Endocrinology and Metabolic Diseases Department, University Hospital Center AEK Hassani, Faculty of Medicine, University of Sidi Bel-Abbès, 22000, Algeria.<sup>2</sup>Central Laboratory, University Hospital Center AEK Hassani, Department of Pharmacy, Faculty of Medicine, University of Sidi Bel-Abbès, 22000, Algeria.<sup>3</sup>Department of Pharmacy, Faculty of Medicine, University of Sidi Bel-Abbès, 22000, Algeria.<sup>4</sup>Central Pharmacy, University Hospital Center AEK Hassani, Sidi Bel-Abbès, 22000, Algeria.**ABSTRACT**

**Introduction.** The diabetic foot infection is one of the most formidable complications of diabetes mellitus, it presents a serious public health problem and its vital prognosis is sometimes put into play and amputation is often decided in order to preserve life of patient. The objective of this study was to identify the causal flora and the antibiotic therapy necessary for management of infected diabetic feet of patients at UHC Sidi Bel-Abbès. **Materials and Methods.** It was a retrospective study of 220 diabetic patients, hospitalized in diabetology-endocrinology department of UHC of Sidi Bel-Abbès and carried out for three years from January 1st, 2018 to January 30th December 2020 for a foot infection having benefited of a cytobacteriological examination of pus (CBEP) with antibiogram. **Results.** A total of 220 patients hospitalized for diabetic foot infection, sex ratio equal to 2.14 and mean age of 61.27 ± 10.87 years. Grade 4 was found most frequently (32.27%), followed by grade 3 (28.64%) and amputation was found in 64.09%. Staphylococcus aureus was the majority (35.91%), followed by Pseudomonas aeruginosa (14.55%), Escherichia coli (09.55%) and Proteus mirabilis (06.82%). The ATBs used at effective doses were Metronidazole (88.15%), followed by Imipenem/ Cilastatin (74.07%), Ertapenem (71.43%), Cefazolin (53.34%) and Ciprofloxacin (41.01%). **Conclusion.** Diabetic feet were mostly infected with Staphylococcus aureus, Pseudomonas aeruginosa and Escherichia coli. Prescriptions were readjusted; Metronidazole still combined with other ATBs was widely used, followed by Ciprofloxacin, Gentamicin and Imipenem. Microbiological management is necessary for targeted antibiotic therapy minimizing the scourge of antibiotic resistance.

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**1. INTRODUCTION**

The diabetic foot is the result of three intricate pathophysiological mechanisms: diabetic neuropathy, ischemia and infection, the coexistence of which exposes to severe and extensive infections that can become incurable, thus

jeopardizing the functional prognosis or even the vital prognosis [1-3]. The diabetic foot infection is one of the most formidable complications of diabetes mellitus [4], its management requires a multidisciplinary technical platform and leads to frequent hospitalizations [5,6], the vital prognosis is sometimes involved

and amputation is often decided to preserve the patient's life [7-8]. This infection can range from a simple superficial lesion to necrotizing fasciitis that often results in surgery [9-11]. Given the seriousness of these infections due to microbial proliferation [12-14], it is necessary to identify the responsible germs and to set up a controlled and targeted antibiotic therapy in order to save the infected limb from amputation and preserve the life of patient [15-17]. To our knowledge, no study on the bacteriological profile and antibiotic therapy of infected diabetic feet of patients consulting at the University Hospital Center (UHC) of Sidi Bel-Abbes has been carried out. The objective of this study was to identify the causal flora as well as the antibiotic therapy necessary for the management of infected diabetic feet of patients at the UHC of Sidi Bel-Abbes in Algeria.

## 2. MATÉRIELS ET MÉTHODES

It was a descriptive retrospective study of 220 type 1 and type 2 diabetic patients, of both sexes, hospitalized in diabetology-endocrinology and metabolic diseases department of the UHC of Sidi Bel-Abbes in Algeria, carried out during three years during the period from January 1st, 2018 to December 30th, 2020 for a foot infection and having benefited from a cytobacteriological examination of pus (CBEP) with antibiogram.

The data were collected from medical records, the parameters studied are parameters related to patients, diabetes, trophic disorders as well as the antibiotics (ATBs) used. The samples were taken by swab and strict anaerobic germs were not sought. The prescriptions of ATBs were adapted according to the antibiogram results and the dose of the antibiotic administered to the patient was calculated by weight and creatinine clearance using the Cockcroft-Gault formula [18]. Forty-nine (22.27%) patients had benefited from a second ECBP after a long hospital stay to detect resistant germs. Patient anonymity was respected and the study is in accordance with the Declaration of Helsinki.

## 3. RESULTATS

### 3.1. Characteristics of the study population

The main characteristics of the study population are shown in Table 1. Two hundred and twenty (220) patients with a podiatric infection and benefiting from at least one CBEP were included in the study, a male predominance 150 (68.18%) was observed with a sex-ratio equal to 2.14. The average age of patients included was  $61.27 \pm 10.87$  years with extremes between 30 and 91 years. Six age groups have been identified, with a predominant age group ranging from 56 to 65 years. In addition, the majority of patients (91.36%) were type 2 diabetics, the average duration of diabetes was  $16.18 \pm 10.50$  years and the majority (33.18%) had a duration of more than 20 years.

Eighteen (08.18%) patients had an inaugural diabetic foot, glycated hemoglobin (HbA1c) exceeds 8% in 71.82% of cases, mean blood sugar on admission was  $2.93 \pm 01, 28$  g/L and the mean length of hospitalization was  $32,08 \pm 20,37$  days.

As for complications, 153 (69.55%) patients had peripheral neuropathy, 111 (52.27%) hypertension, 68 (30.91%) retinopathy, 65 (29.55%) obliterating arteritis of lower limbs and 54 (24.55%) osteomyelitis. The majority (92.73%) of foot lesions were unilateral, grade 4 according to Wagner classification was most frequently found (32.27%), followed by grade 3 with 28.64%, amputation was found in 64 .09%, it was trans-tibial or trans-femoral major in 19.09% of cases.

The most used probabilistic antibiotic regimen was dual therapy including Metronidazole and Cefotaxime in 40% and that of Metronidazole and Ciprofloxacin in 37.73% followed by triple therapy including Metronidazole, Ciprofloxacin and Gentamicin in 15.91 % and finally Metronidazole was only used in 06.36%.

### 3.2. Identification and distribution of germs isolated from the first CBEP

The number of germs isolated after ECBP was spread over 20 species. The distribution by species showed the predominance of *Staphylococcus aureus* which represented 35.91% of the isolates, followed by *Pseudomonas aeruginosa* (14.55%), *Escherichia coli* (09.55%) and *Proteus mirabilis* (06.82%) (Table 2).

### 3.3. Sensitivity and resistance of ATB according to the first antibiogram

The sensitivity and resistance of ATBs according to the first antibiogram are represented in Table 3. A high resistance of the germs isolated to the ATBs was revealed, mainly 136 (96.45%) to Amoxicillin, followed by Doxycycline 41 (89,13%), Trimethoprim/Sulfamethoxazole 87 (88.78%), Tetracycline 29 (82.86%), Lincomycin 14 (82.35%), Penicillin G 53 (80.30%), Amoxicillin/ Clavulanic acid 89 (78.76%), Cefotaxime 30 (78.95%), Cefazolin 57 (74.03%), Clindamycin 17 (73.91%) and Ceftizoxime 11 (73.33%).

As for the sensitivity to ATB, the germs were mainly sensitive 110 (63.95%) to Gentamycin, followed by Ciprofloxacin 120 (65.93%), Ofloxacin 106 (69.74%), Vancomycin 98 (70.50 %), Amikacin 94 (75.20%), Pristanamycin 63 (79.75%), Rifamycin 29 (76.32%), Imipenem 29 (100%), Teicoplanin 26 (74.29%), Fosfomycin 21 (77 .78%) and Ampicillin 19 (90.48%).

### 3.4. Adaptation of ATB prescriptions and evaluation of their effectiveness

Taking into account the results of the first antibiogram and the specificity of each case, the prescriptions were adapted so that Metronidazole, always associated with other antibiotics, was widely used (95.91%) followed by Ciprofloxacin (63.18%), Gentamicin (58.18%) and Imipenem (24.55%) (Table 4).

The evaluation of ATBs efficacy was made by calculating of creatinine clearance showed that the ATBs used at effective doses are mainly represented by Metronidazole (88.15%), followed by Imipenem / Cilastatin (74.07%), Ertapenem (71.43%), Cefazolin (53.34%) and Ciprofloxacin (41.01%). The ATBs used in underdose are represented by Gentamicin (76.56%) followed by Ciprofloxacin (43.88%) and those used in overdose; Ceftisoxime (33.33%), Ciprofloxacin (15.11%) and Cefazolin (13.33%) (Table 4).

### 3.5. Identification and distribution of germs isolated from the second CBEP

Among the 220 patients included in study, 49 patients (22.27%) had benefited from a second CBEP. The germs found were mainly (83.67%) gram-negative bacilli (BGN), *Pseudomonas aeruginosa* had dominated (42.86%) the isolated bacterial flora followed by *Staphylococcus aureus* (22.45%) and *Proteus mirabilis* (16.33%) (Table 5).

## 4. DISCUSSION

Diabetic foot is one of the most common devastating complications among other chronic complications of diabetes mellitus. It is the leading cause of non-traumatic amputation throughout the world [19]. There are multiple factors which lead to development of foot ulcer in diabetic patients which may even result in amputation if not treated [20,21].

In this study, 220 patients hospitalized for a diabetic foot infection, with a sex ratio equal to 2.14 showing a male predominance. This corroborates with the results of Kateel's. R study et al. [22] evaluating the clinical and microbiological profile of patients with diabetic foot ulcer in a tertiary care hospital in India who found a male predominance in diabetic foot infection.

The average age of patients was  $61.27 \pm 10.87$  years with the most predominant age range ranging from 56 to 65 years and the majority (91.36%) were type 2. In the study of Hammami. M et al. [23] on the etiopathogenesis of diabetic foot infection in 136 cases in Tunisia, the average age was 58 years, younger than ours, and the diabetes was mainly type 2 (65%).

The mean length of hospitalization was  $32.08 \pm 20.37$  days, longer than that ( $18.55 \pm 5.58$  days) of the clinical-microbiological study of Gadepalli. R et al. [24] on the ulcerated diabetic foot in an Indian tertiary care.

The majority (69.55%) had peripheral neuropathy, (52.27%) hypertension, (30.91%) retinopathy, (29.55%) obliterating arteritis of the lower limbs and (24.55%) osteomyelitis. On the other hand, in the study of Gadepalli. R et al. [24], (72.70%) had neuropathy, (72.70%) nephropathy, (70.70%) hypertension, (68.20%) retinopathy and (40.90%) osteomyelitis.

**Table 1.** Characteristics of the study population.

| Characteristic                             | Effective (n=220) | Relative Effective (%) |
|--|-------------------|------------------------|
| Sex  | 150               | 68.18                  |
| Male                                       | 70                | 31.82                  |
| Female                                     | 11                |                        |
| Age range (years)                          | 14                | 05.00                  |
| 30-39                                      | 62                | 06.36                  |
| 40-49                                      | 88                | 28.18                  |
| 50-59                                      | 38                | 40.00                  |
| 60-69                                      | 07                | 17.27                  |
| 70-79                                      | 19                | 03.18                  |
| ≥ 80                                       |                   |                        |
| Diabetes type                              | 201               |                        |
| Type 1                                     |                   | 08.64                  |
| Type 2                                     |                   | 91.36                  |
| Diabetes duration (years)                  | 35                |                        |
| < 05                                       | 48                |                        |
| 05-09                                      | 64                | 15.91                  |
| 10-19                                      | 73                | 21.82                  |
| ≥ 20                                       |                   | 29.09                  |
| Diabetes diagnosis                         |                   | 33.18                  |
| Inaugural diabetic foot                    |                   |                        |
| Glycated hemoglobin                        | 18                |                        |
| Glycated hemoglobin (HBA1C) (%)            | 202               | 08.18                  |
| < 07 (norms)                               |                   | 91.82                  |
| 07- 08                                     |                   |                        |
| ≥ 08                                       |                   |                        |
| Duration of hospital stay (days)           | 13                |                        |
|  | 49                |                        |
| 11-30                                      | 158               | 05.91                  |
| 30-59                                      |                   | 22.27                  |
| ≥ 60                                       | 118               | 71.82                  |
|  | 77                |                        |
| Complications                              | 25                |                        |
| Hypertension                               |                   | 53.64                  |
| Arteritis obliterans of lower limbs        |                   | 35.00                  |
| Myocardial infarction                      | 115               | 11.36                  |
| Stroke                                     | 65                |                        |
| Angor                                      | 20                |                        |
| Neuropathy                                 | 24                | 52.27                  |
| Retinopathy                                | 14                | 29.55                  |
| Nephropathy                                | 153               | 09.09                  |
| Osteomyelitis                              | 68                | 10.91                  |
| Foot lesions                               | 11                | 06.36                  |
|  | 54                | 69.55                  |
| Unilateral                                 |                   | 30.91                  |
| Bilateral                                  |                   | 05.00                  |
| Ulcer grade (Wagner)                       | 204               | 24.55                  |
| Grade 1                                    | 16                |                        |
| Grade 2                                    | 19                | 92.73                  |
| Grade 3                                    | 46                | 07.27                  |
| Grade 4                                    | 63                |                        |
| Grade 5                                    | 71                | 08.64                  |
| Treatment                                  | 21                | 20.91                  |
|  | 71                | 28.64                  |
| Surgical (Amputation: minor + major)       | 141 (99+42)       | 32.27                  |
| Medical                                    | 79                | 09.55                  |
| Probabilistic antibiotic therapy           |                   | 64.09 (45+19.09)       |
| Metronidazole                              | 14                | 35.91                  |
| Metronidazole + Cefotaxime                 | 88                |                        |
| Metronidazole + Ciprofloxacin              | 83                |                        |
| Metronidazole + Ciprofloxacin + Gentamycin | 35                | 06.36                  |
|  |                   | 40.00                  |
|  |                   | 37.73                  |
|  |                   | 15.91                  |

Grade 4 was found most frequently (32.27%), followed by grade 3 with 28.64% and amputation was found in 64.09%, on the other hand, in Kateel's. R et al. study [22], grade 2 was found most frequently (46.60%), followed by grade 1 (43.30%).

A predominance (52.83%) of BGN was noted, which is comparable to Gadepalli. R et al. study [24] where BGN represented (51.40%) but unlike to Macdonald's. E et al. study [25], BGNs (96.10%) were predominant.

As for the species, *Staphylococcus aureus* was the majority (35.91%), followed by *Pseudomonas aeruginosa* (14.55%),

Escherichia coli (09.55%) and Proteus mirabilis (06.82%). These results are similar to those of Kateel. R et al. study [22], where Staphylococcus aureus represented (40.81%), Escherichia coli (34.69%), Pseudomonas aeruginosa (30.61%). In Hammami's. M et al. study [23], Staphylococcus aureus was the most isolated germ (31%) followed by group A Streptococcus (14%). In Bouharkat. B et al. study [26], evaluating the ATB resistance mechanism of resistant strains of diabetic foot infections in northwestern Algeria, a high prevalence of BGN (61%) with predominance of Escherichia coli and Pseudomonas aeruginosa. The Zemmouri. A et al study [27] on bacteriological profile of diabetic foot and its impact on ATB choice on 105 patients in Morocco, the predominance of BGP with predominance of Staphylococci (34%) followed by Escherichia coli (20%) and Pseudomonas aeruginosa (12%).

**Table 2.** Identification and repartition of germs isolated from the first CBEP

| Germ                         |                           | Effective (n)             | Relative Effective (%)  |                       |
|------------------------------|---------------------------|---------------------------|-------------------------|-----------------------|
| Gram Negative Bacillus (GNB) | Enterobacteries           | Serratia marcescens       | 7<br>03.18              |                       |
|                              |                           | Enterobacter spp          | 12<br>05.45             |                       |
|                              |                           | Escherichia coli          | 21<br>09.55             |                       |
|                              |                           | Klebsiella spp            | 8<br>03.63              |                       |
|                              |                           | Morganella morganii       | 3<br>01.36              |                       |
|                              |                           | Proteus spp               | 23<br>10.46             |                       |
|                              |                           | Non-fermenting GNB        | Pseudomonas aeruginosa  | 32<br>14.55           |
|                              |                           |                           | Acinetobacter lwoffii   | 5<br>02.27            |
|                              |                           |                           | Acinetobacter baumannii | 5<br>02.27            |
|                              |                           | Gram Positive Cocci (GPC) | Staphylococci           | Staphylococcus aureus |
| Enterococci                  | Enterococcus faecalis     |                           |                         | 7<br>03.18            |
|                              | Streptocoque spp          |                           |                         | 10<br>04.55           |
|                              | Streptococci no hemolytic |                           |                         | 8<br>03.64            |
| Total                        | 20                        |                           |                         | 220                   |

The isolated germs were sensitive to Gentamycin (63.95%), followed by Ciprofloxacin (65.93%), Ofloxacin (69.74%), Vancomycin (70.50%), Amikacin (75.20%), Pristanamycin (79.75%), Rifamycin (76.32%), Imipenem (100%), Teicoplanin (74.29%), Fosfomycin (77.78%) and Ampicillin (90.48%). These results do not corroborate those of Gadepalli. R et al. study [24], the isolated germs were mainly sensitive (71.40%) to Rifamycin, followed by Chloramphenicol (64.30%), Amikacin (57.10%), Ciprofloxacin (35.70%), Tetracycline (35.70%) and Erythromycin (14.30%).

Thus in Zemmouri. A et al study [27], the streptococci were multi-sensitive to the ATB tested, the Klebsiella pneumoniae (82%)

were constantly sensitive to carbapenems, on the other hand, the constant sensitivity of Klebsiella oxytoca to Amoxicillin / clavulanic acid contrasts with a resistance increased Klebsiella pneumoniae (44% resistance). Morganella (7%), Enterobacter (4%), naturally resistant to Amoxicillin/clavulanic acid all remain sensitive to Ertapenem. For other Enterobacteriaceae, Serratia

**Table 3.** Sensitivity and resistance of ATB according to the first antibiogram.

| Antibiotic                    | Resistance Effective (Relative Effective %) | Sensitivity Effective (Relative Effective %) |
|-------------------------------|---|--|
| Amoxicillin                   | 136 (96.45)                                 | 05 (03.55)                                   |
| Amoxicillin/Clavulanic acid   | 89 (78.76)                                  | 24 (21.24)                                   |
| Cefalexin                     | 15 (68.18)                                  | 07 (31.82)                                   |
| Cefazolin                     | 57 (74.03)                                  | 20 (25.97)                                   |
| Ceftizoxim                    | 11 (73.33)                                  | 04 (26.67)                                   |
| Cefoxitin                     | 09 (56.25)                                  | 07 (43.75)                                   |
| Ceftazidime                   | 03 (33.33)                                  | 06 (66.67)                                   |
| Cefotaxime                    | 30 (78.95)                                  | 08 (21.05)                                   |
| Penicillin G                  | 53 (80.30)                                  | 13 (19.70)                                   |
| Ampicillin                    | 19 (90.48)                                  | 02 (09.52)                                   |
| Imipenem                      | 00 (00.00)                                  | 29 (100.00)                                  |
| Amikacin                      | 31 (24.80)                                  | 94 (75.20)                                   |
| Gentamicin                    | 62 (36.05)                                  | 110 (63.95)                                  |
| Kanamycin                     | 20 (58.82)                                  | 14 (41.18)                                   |
| Tobramycin                    | 02 (25.00)                                  | 06 (75.00)                                   |
| Doxycycline                   | 41 (89.13)                                  | 05 (10.87)                                   |
| Tetracycline                  | 29 (82.86)                                  | 06 (17.14)                                   |
| Erythromycin                  | 32 (62.75)                                  | 19 (37.25)                                   |
| Spyramycin                    | 09 (69.23)                                  | 04 (30.77)                                   |
| Streptomycin                  | 04 (57.14)                                  | 03 (42.86)                                   |
| Lincomycin                    | 14 (82.35)                                  | 03 (17.65)                                   |
| Clindamycin                   | 17 (73.91)                                  | 06 (26.09)                                   |
| Pristanamycin                 | 16 (20.25)                                  | 63 (79.75)                                   |
| Nalidixic acid                | 09 (52.94)                                  | 08 (47.06)                                   |
| Rifamycin                     | 09 (23.68)                                  | 29 (76.32)                                   |
| Ciprofloxacin                 | 62 (34.07)                                  | 120 (65.93)                                  |
| Ofloxacin                     | 46 (30.26)                                  | 106 (69.74)                                  |
| Pefloxacin                    | 31 (67.39)                                  | 15 (32.61)                                   |
| Vancomycin                    | 98 (70.50)                                  | 41 (29.50)                                   |
| Teicoplanin                   | 26 (74.29)                                  | 09 (25.71)                                   |
| Fusidic acid                  | 18 (62.07)                                  | 11 (37.93)                                   |
| Fosfomycin                    | 06 (22.22)                                  | 21 (77.78)                                   |
| Chloramphenicol               | 83 (54.25)                                  | 70 (45.75)                                   |
| Colestin                      | 17 (39.53)                                  | 26 (60.47)                                   |
| Nitroxoline                   | 01 (14.29)                                  | 06 (85.71)                                   |
| Trimethoprim/Sulfamethoxazole | 87 (88.78)                                  | 11 (11.22)                                   |
| Norfloxacin                   | 00 (00.00)                                  | 01 (100.00)                                  |

(2%) and Bacillus (2%) remain sensitive to both Amoxicillin/clavulanic acid and Ertapenem while Corynebacterium species (89% of corybacteria) is Amoxicillin/clavulanic acid resistant. Acinetobacter baumannii isolated on three occasions was resistant to Ertapenem.

The ATBs used at effective doses were Metronidazole (88.15%), followed by Imipenem/Cilastatin (74.07%), Ertapenem (71.43%), Cefazolin (53.34%) and Ciprofloxacin (41.01%). The ATBs used in underdose are represented by Gentamicin (76.56%) followed by Ciprofloxacin (43.88%) and those used in overdose Ceftisoxime (33.33%), Ciprofloxacin (15.11%) and Cefazolin (13.33%). These results imply rehabilitation of overdosed and underdosed ATBs

for better management. Regular monitoring of serum concentrations of certain ATBs is necessary in order to guarantee therapeutic efficacy and avoid toxicity, mainly for glycopeptides and aminoglycosides [28-30].

**Table 4.** Adaptation of ATB prescriptions and evaluation of administered dose.

| ATB                         | Total Effective (%) | Under Dosage Effective (%) | Overdose Effective (%) | Effective Dose Effective (%) |
|-----------------------------|---------------------|----------------------------|------------------------|------------------------------|
| Amoxicillin                 | 04(01.82)           | 02(50)                     | 02(50)                 | 00(00)                       |
| Amoxicillin/Clavulanic acid | 05(02.27)           | 00(00)                     | 03(60)                 | 02(40)                       |
| Cefazolin                   | 15(06.82)           | 5(33.33)                   | 02(13.33)              | 08(53.34)                    |
| Cefotaxime                  | 04(01.82)           | 00(00)                     | 00(00)                 | 04(100)                      |
| Ceftioxime                  | 03(01.36)           | 01(33.33)                  | 01(33.33)              | 01(33.33)                    |
| Peni G                      | 02(00.91)           | 01(50)                     | 00(00)                 | 01(50)                       |
| Imipenem/Cilastatin         | 54(24.55)           | 14(25.93)                  | 00(00)                 | 40(74.07)                    |
| Ertapenem                   | 07(03.18)           | 2(28.57)                   | 00(00)                 | 05(71.43)                    |
| Amikacin                    | 16(07.27)           | 12(75)                     | 00(00)                 | 04(25)                       |
| Gentamicin                  | 128(58.18)          | 98(76.56)                  | 00(00)                 | 30(23.44)                    |
| Pristinamycin               | 45(20.45)           | 00(00)                     | 00(00)                 | 45(100)                      |
| Ciprofloxacin               | 139(63.18)          | 61(43.88)                  | 21(15.11)              | 57(41.01)                    |
| Ofloxacin                   | 02(00.91)           | 00(00)                     | 00(00)                 | 02(100)                      |
| Metronidazole               | 211(95.91)          | 12(5.69)                   | 13(6.16)               | 186(88.15)                   |
| Fusidic Acid                | 08(03.64)           | 00(00)                     | 00(00)                 | 08(100)                      |

**Table 5.** Germs isolated from the second CBEP.

| Germ                         | Effective (n=49) | Relative Effective (%) |
|------------------------------|------------------|------------------------|
| Family                       |                  |                        |
| Gram Positive Cocci (GPC)    | 8                | 16.33                  |
| Gram Negative Bacillus (GNB) | 41               | 83.67                  |
| Species                      |                  |                        |
| Staphylococcus aureus        | 11               | 22.45                  |
| Proteus mirabilis            | 8                | 16.33                  |
| Pseudomonas aeruginosa       | 21               | 42.86                  |
| Other germs                  | 9                | 18.37                  |

The second CBEP was carried out after a long hospitalization of patients and which revealed the presence of multi-resistant strains to ATB, this could be explained by the presence of nosocomial infections in hospital environment or by the inadequate dosages use. In addition, long hospitalizations lead to superinfections, multi-resistant nosocomial germs which will be grafted onto the infected feet of diabetics, which require new bacteriological examinations followed by multiple anti-infectious therapy based on three to four antibiotics, often unsuccessful and iatrogenic. Antibiotic therapy must be readjusted according to the antibiogram results and the previously prescribed regimens can be maintained in the event of germs sensitivity to ATB and changed in the event of resistance. The main limitations of our study lie in its monocentric, retrospective nature and lack

of regular monitoring of serum concentrations of certain ATBs for dosage adjustment.

## 5. CONCLUSION

Diabetic foot infection is a serious public health problem, the study concluded that most diabetic feet were infected with *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli*. Prescriptions were readjusted, Metronidazole still combined with other ATBs was widely used, followed by Ciprofloxacin, Gentamicin and Imipenem.

**Competing interests:** The authors declare that they have no competing interest.

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