ORIGINAL RESEARCH PAPER

Microbiology

Volume : 6 | Issue : 12 | December : 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

Resistance Patterns to Beta-lactams and Aminoglycosides of Enterobacteria Strains Isolated From Wounds Infections at University Hospital Center of Brazzaville

KEYWORDS: Hospitallers infections, Enterobacteria, resistance, beta-lactam, aminoglycosides

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ABSTRACT ***Background:*** *In order to contribute to the improvement of antibiotic therapy in hospital medium,, The strains of Enterobacteriaceae isolated of wounds homes hospitalized patients were tested in their sensitivity to beta-lactams and aminoglycosides.*

Materials and Methods: *The pus was inoculated on Hecktöen medium (Biomerieux); different enterobacteria were identified from the cultural characters then using a conventional gallery Leminor. The testes of sensitivity were performed by standard diffusion susceptibility testing on Mueller Hinton agar (Biomerieux).*

Results: *Enterobacteriaceae accounted for 76% of bacteria isolated from wounds; the identification gave the following genres: 23 strains of E. coli (30.26%), 22 strains of Proteus (28.95%), 12 strains of Klebsiella (15.78%), 8 strains of Enterobacter (10.53%), 6 strains of Citrobacter (7.89%), and 5 strains of Providencia (6.57%). The results of antibiotic susceptibility showed high resistance to beta-lactam antibiotics compared with aminoglycosides. These bacteria present in the stem majority the same characteristic phenotypes of inhibition of beta-lactam and aminoglycoside activity*

Conclusion: *Since the beta- lactam antibiotics are the first-line antibiotics, these results show the danger of these multiresistant bacteria that constitute a real problem of public health.*

INTRODUCTION

The hospital ecosystem is a favorable environment for the emergence of germs [1,2,3,4]. Among the frequently isolated germs, enterobacteria prominently. They are a group of Gram-negative bacteria, anaerobic optional aerobic fermentation of lactose or not. Their natural habitat is the colon of warm-blooded animals. Enterobacteriaceae include several genres with several species, the most predominant is *Escherichia coli* [5,6]. The enterobacteriaceae are responsible for many infectious diseases, these infections can are sometimes fatal to humans. Since the discovery of antibiotics, diseases caused by enteric bacteria such as salmonellosis, shigellosis, and bloody diarrhea have been successfully eradicated. However, today we are witnessing a resurgence of these diseases linked not only to poor hygiene, but also the resistance of these bacteria to common antibiotics [7, 8, 9, 10]. It is in this light that we were interested in the study of resistance to beta-lactams and aminoglycosides, antibiotics commonly used in our country.

MATERIALS AND METHODS

The Biological material consisted of pus sores taken inpatient, meeting the definition of nosocomial infection [3,11]. The specific culture media following elective or selective were used: Hecktoën, Mac conkay, EMB, indole urea, citrate simmons, Kliggler Hajna. The antibiotics tested were the follows: Beta-lactam antibiotics: amoxicillin (AMX), Amoxicillin + clavulanic acid (AMC), cephalothin (CF), carbenicillin (CAR), ceftazidime (CAZ) Cefuroxime (CXM), cefotaxime (CXT), Imipenem (IMP), Ceftriaxone (CRO). Aminoglycosides streptomycin (S), kanamycin (K), tobramycin (T), gentamicin (GM), amikacin (Ak), netilmicin (Net).

The pus were collected using sterile swabs and they were each seeded on Petri dishes containing the Hecktoën medium (Sanofi Pasteur). The reading was taken after 24 hours of incubation in an incubator at 37 ° C. Identification was made from the cultural and biochemical characters. The biochemical characteristics were determined using a conventional gallery Leminor with following medium: Kliggler Hajna, Urea indole, Simmons citrate, lysine iron, EMB, Kovacks reactif. Resistance to antibiotics was determined by the method of standard susceptibility scattering on solid medium Muller Hinton (Sanofi Pasteur), as recommended by the French Society of Microbiology [12, 13, 14]. The Quality control of susceptibility testing was performed with the *E. coli* reference strain ATCC25922. The phenotypes of resistance were determined from the results of susceptibility testing by comparing inhibition diameters with standard diameters.

RESULTS AND DISCUSSION

Isolation and Identification

113 gram negative bacteria were isolated; from these bacteria 76 belonged to the Enterobacteriaceae group. The Identification gave the distribution of the 76 strains of enterobacteria as follows: 23 strains of *Escherichia coli* (30.26%) 22 strains of *Proteus* (28.95%), 12 strains of *Klebsiella (15.78%),* 8 strains of *Enterobacter* (10.53%), 6 strains of *Citrobacter* (7.89%) and 5 strains of *Providencia* (6.57%).

The figure 1 represents the frequency of the Enterobacteriaceae identified.

Among the enterobacteria *Escherichia coli* ranked first in the hospital wound infections followed by *Proteus*, *Klebsiella*, *Enterobacter*, *Citrobacter* and *Providencia*. Several studies have demonstrated *E.coli* was string head among the enterobacteria isolated in hospitals [5,15,16,17,18,19]. The frequency of isolated *Klebsiella* is greater than that obtained by Akujobi, Rossilini et al. [20, 21]. As for the percentage of strains of *Enterobacter* and *Citrobacter* obtained, they have slight differences [20, 22, 23]. The

Volume : 6 | Issue : 12 | December : 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

differences can be explained by the fact that the microbial ecology of each hospital depends on environmental conditions and also mastering hygienic processes.

Resistance to antibiotics of The Enterobacteriaceae identified
Résistance to Bêta-lactams antibiotics

The results of the beta lactam sensitivity tested show a high resistance to most beta-lactam antibiotics tested. Amoxicillin, amoxicillin + clavulanic acid have been inactivated by all Enterobacteriaceae strains to more than 80%. Cephalothin has a mean activity on *Proteus*. A good activity was observed for Ceftazidime on strains of *E. coli, Klebsiella, Enterobacter* and *Providencia*. It is the same for imipenem which showed good activity against all enterobacterial strains with the exception of *Klebsiella* strains that have presented more than 80% of resistance. The Figure 2 gives the results of sensitivity tested to beta-lactams.

E. coli strains have very high resistance of frequencies with respect to the majority of the tested beta-lactams. Of these beta-lactams imipenem and ceftazidime were most active with respective sensitivity rate of 95.7% and 69.6%. These results are in conformity with the results of some studies [24,25,26]. This result can be explained by changing the binding protein to penicillin (PLP) which confers resistance to their most beta-lactam antibiotics [4, 27, 28]. As for the first and second generation cephalosporins, high strength is noted that might be due to the production of cephalosporinases as suggested by Bertrand et al. Then Melano et al. Then Sirot et al. [29,30,31]. An average activity of beta-lactam antibiotics has been observed in strains of *Proteus, Klebsiella* and *Enterobacter* particular with ceftazidime, imipenem and ceftriaxone. These results are consistent with those of Boukadida et al. and those of Hamze et al. [16, 32]. A remarkable activity of ceftazidime and impenem on the strains of *Proteus* of 96 to 100% sensitivity was observed. The sensitivity of these strains to ceftazidime rates are comparable to those obtained by Petra et al. [33]

Résistance to Aminoglycoside antibiotics

Aminoglycoside resistance tests showed high activity of amikacin, and netilmicin on *Proteus* and *Klebsiella*. As for gentamicin and tobramycin, they have an average activity of strains of *Enterobacter*, *Citrobacter* and *Providencia*. Higher sensitivity rate of tobramycin, gentamicin and kanamycin screw opinion of *Proteus* and *Klebsiella* strains were obtained par Djeli et al., Hamze et al., Larabi et al. [16,34,35].

The determination of resistance phenotypes Figures 4 and 5 give enteric bacteria resistance phenotypes to beta-lactams and aminoglycosides.

The beta-lactam resistance mechanism is the production of beta-lactamase (penicillinase and cephalosporinase) [20,30,31,33,36,37,38].The mechanism of resistance to aminoglycosides is enterobacteria enzyme production inactivating aminoglycosides [16,18,23].

CONCLUSION

Isolated enterobacteria of wounds in hospitals have profiles of high resistance to beta-lactams and aminoglycosides. However, there are within these two families a few more active specialties such bacteria as amikacin, ceftazidime and imipenem that can be used to address infections caused by these bacteria

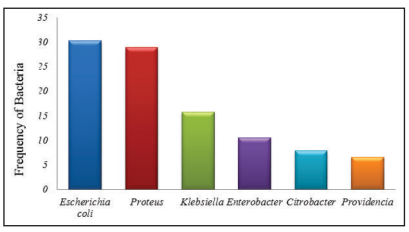

Figure 1 : Fréquency of Enterobacteria identified

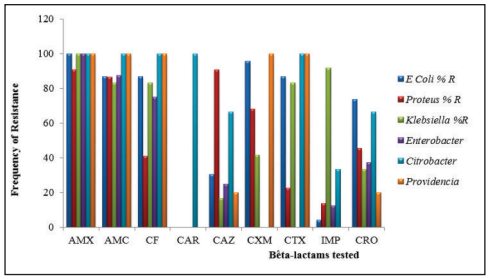

Figure 2: Résistance of enterobacteria identified to Betalactams

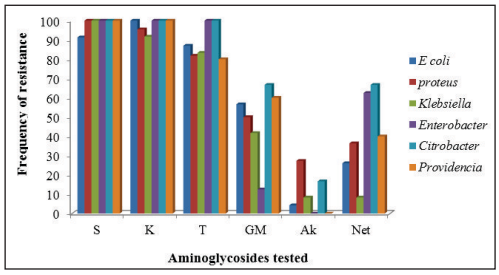

Figure3: Resistance of enterobacteria to aminoglycosides

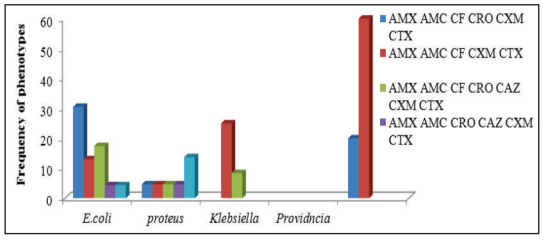

Figure 4: Phenotypes of resistance to beta-lactams observed

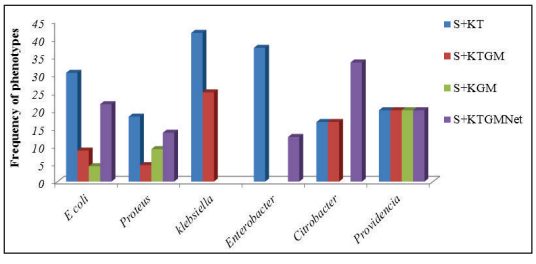

Figure 5: Phenotypes of resistance to aminoglycosides obseved

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Volume : 6 | Issue : 12 | December : 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

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