Antimicrobial activity against gram negative bacilli from Yaounde Central Hospital, Cameroon

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Abstract

Background: Antimicrobial resistance among bacteria pathogens is a world-wide issue. The antimicrobial susceptibility patterns of common pathogenic bacteria are essential to guide empirical and pathogen-specific therapy; unfortunately, these data are scarce in Cameroon.

Objective: To determine the antimicrobial susceptibility patterns of Gram-negative bacilli isolated in Yaounde Central Hospital Laboratory of Bacteriology.

Methods: Gram-negative bacilli isolates (n = 505), obtained from a wide range of clinical specimens (urine, pus and blood) in Yaoundé Central Hospital Laboratory of Bacteriology between March 1995 and April 1998, were evaluated for resistance to antibiotics (amoxicillin, amoxicillin/clavulanate, piperacillin, cefazolin, ceftoxitin, ceftazidime, aztreonam, imipenem, gentamicin, tobramycin, ofloxacin and trimethoprim/sulfamethoxazole) by the Kirby-Bauer disk diffusion method.

Results: High rates of resistance were found in most of the bacteria studied. Resistance to all isolates was mostly observed for amoxicillin (87%), piperacillin (74%) and trimethoprim/sulfamethoxazole (73%). Susceptibilities to third generation cephalosporins (cefotaxime, ceftazidime) and monobactame (aztreonam) were = 91% for Escherichia coli, = 71% for Klebsiella spp., = 98% for Proteus mirabilis, = 50% for Enterobacter spp. and Citrobacter spp. Pseudomonas aeruginosa was less susceptible to cefotaxime (2%) and aztreonam (33%), and highly susceptible to ceftazidime (72%) whereas Acinetobacter baumannii was highly resistant to aztreonam (100%), to cefotaxime (96%) and cefazidime (62%). Imipenem (98%) was the most active antibiotic followed by the ofloxacin (88%). Susceptibility of all isolates to gentamicin was 67%.

Conclusion: These results indicate that surveillance to antimicrobial resistance in Cameroon is necessary to monitor microbial trends, antimicrobial resistance pattern, and provide information for choosing empirical or direct therapy to physicians.

Key words: antimicrobial agents, resistance, Gram-negative bacilli, bacteria susceptibility testing, Cameroon.

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Introduction

Gram-negative bacilli are the most important bacterial pathogen, and are generally resistant to antibiotics . Monitoring for antimicrobial resistance in this group is important because resistance has been reported to be associated with increased patient morbidity and mortality, and contributed to escalating healthcare cost . Antimicrobial resistance is increasing in many bacteria and is a worldwide problem .

The antimicrobial susceptibility patterns of common pathogenic bacteria are essential to guide empirical and pathogen-specific therapy. This information is also important for rational policies against antimicrobial resistance. Unfortunately, in many developing countries, these data are scarce because of dwindling resources. In Cameroon, data on antimicrobial resistance among bacterial pathogens are sparse. In an effort to determine the extent of antimicrobial resistance amongst Gram-negative bacilli isolated in Yaounde Central Hospital Laboratory of Bacteriology, we conducted a survey of 505 Gram-negative bacilli and measured their in vitro susceptibility to antimicrobial agents.

Materials and Methods

Between April 1995 and March 1998, all the aerobic Gram-negative bacilli isolated in the laboratory of bacteriology of Yaounde Central Hospital were collected prospectively. The isolates studied were confined to unrelated first isolates from different patients, and did
not include multiple isolates from the same patient. Isolates were recovered from urine, pus and blood cultures and identified by standard laboratory technique methods and confirmed by Api 20E (BioMerieux, France).

The antimicrobial susceptibility test was determined by the Kirby-Bauer disk diffusion method following the National Committee of Clinical Laboratory Standards (NCCLS) for agar diffusion tests. The antibiotics tested were amoxicillin (30µg), amoxicillin/clavulanate (20/10 µg), piperacillin (100 µg), imipenem (10 µg), cefazolin (30 µg), cefotixin (30 µg), cefotaxime (30 µg), ceftazidime (30 µg), aztreonam (30 µg), gentamicin (10 µg), tobramycin (10 µg), ofloxacin (5 µg) and trimethoprim/sulfamethoxazole (1.25/23.75 µg). The following American Type Culture Collection (ATCC) microorganisms were tested each time susceptibility testing was performed: Escherichia coli ATCC 25922 and Pseudomonas aeruginosa ATCC 27853.

Test results were only validated in the cases where inhibition zone diameters of the control strains were within performance ranges.

Data were analyzed using Whonet 4 (World Health Organization, Geneva, Switzerland) and resistance included combined, intermediary and resistance results.

Results
A total of 505 aerobic isolates were collected, identified, and tested. Enterobacteriaceae (E. coli, Klebsiella spp., Proteus spp., Enterobacter spp., and Citrobacter spp.) represented 79.8% of the isolated strains. Nonfermentative Gram negative bacilli (Pseudomonas spp. and Acinetobacter baumannii) represented 20.2%. The sources of the isolates are shown in table 1.

Table 2 summarizes the results of susceptibility tests of Gram-negative bacilli studied against antimicrobial agents. Imipenem (98% susceptible (S)) was the most active agent against all pathogens tested followed by ofloxacine (88% S) and ceftazidime (86% S). Amoxicillin (13% S), piperacillin (26% S), trimethoprim/sulfamethoxazole (27% S), cefoxitin (30% S) and amoxicillin/clavulanate (37% S) were the least active agents.

Against E. coli, susceptibility rates range from 15% (amoxicillin, piperacillin) to 99% (imipenem). The least active agents against Klebsiella spp. were amoxicillin (0% S) followed by piperacillin (10% S) and trimethoprim/sulfamethoxazole (15% S). The most active agents were imipenem (93% S) and ofloxacin (98% S). Proteus mirabilis was the most sensitive pathogen of all microorganisms. The susceptibility rate ranged from 40% (amoxicillin) to 100% (imipenem, ceftazidime and aztreonam). Concerning Enterobacter spp., only two antimicrobial agents had activity rate >80% ((ofloxacin (98%) and imipenem (97%)). For Citrobacter spp. the most active agents were imipenem (96% S) followed by ceftazidime (76% S) and ofloxacin (73% S). Only 94% of P. aeruginosa isolates were susceptible to imipenem, as compared to 100% observed for A. baumannii. However, 72% of P. aeruginosa were susceptible to ceftazidime as compared to only 38% of the A. baumannii. All the A. baumannii isolates tested were resistant to aztreonam.

Table 1. Distribution (%) of bacterial species by clinical specimen

<table>
<thead>
<tr>
<th>Organism</th>
<th>Clinical specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pus</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>33.7</td>
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<tr>
<td>Klebsiella spp.</td>
<td>43.3</td>
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<tr>
<td>Proteus mirabilis</td>
<td>58.0</td>
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<tr>
<td>Enterobacter spp.</td>
<td>47.5</td>
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<tr>
<td>Citrobacter spp.</td>
<td>50.0</td>
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<tr>
<td>Indole positif Proteus spp.</td>
<td>50.0</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>71.6</td>
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<tr>
<td>Acinetobacter baumannii</td>
<td>54.2</td>
</tr>
<tr>
<td>Pseudomonas spp.</td>
<td>70.0</td>
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This study represents an extensive examination of the susceptibility patterns of Gram negative bacilli isolated in the laboratory of bacteriology of Yaounde Central Hospital. Our isolates represent both nosocomial and community acquired-pathogens, and were collected from April 1995 to March 1998. The results of this study show that in general, high rate of resistance occurs among Gram-negative bacilli to commonly used antibiotics (penicillins, first generation cephalosporin and trimethoprim/sulfamethoxazole).

For *E. coli* and *Klebsiella* spp., the rate of resistance to third generation cephalosporins and other â-lactam antibiotics can be explained by the high production of penicillinase and the production of extended spectrum â-lactamase \(^3,9\). However, the rate of this resistance is high compared to those reported in developed countries \(^10,11\).

*Enterobacter* spp. and *Citrobacter* spp. were highly resistant to ceftazidime, cefotaxime and aztreonam. Similar results were observed in Cairo (Egypt) by El Kholy et al., 2003 \(^12\) and in developed countries \(^10,13\). This resistance could be explained by the high production of cephalosporinase and the production of extended spectrum â-lactamase by these strains \(^3,9\).

Our data showed that *P. mirabilis* is the most sensitive species. The susceptibility rates of this species to all antibiotics tested are compared to those observed in developed countries \(^10,11\).

### Table 2. Susceptibility (%) of Gram negative bacilli studied

<table>
<thead>
<tr>
<th>Isolates</th>
<th>Antibiotic</th>
<th>Amoxicillin</th>
<th>Amoxicillin</th>
<th>Piperacillin</th>
<th>Cefazolin</th>
<th>Cefoxitin</th>
<th>Cefotaxime</th>
<th>Ceftriaxone</th>
<th>Trimeprazine</th>
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<td>49</td>
<td>100</td>
<td>50</td>
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</table>

* not tested

**Discussion**

Non-â-lactam antibiotics resistance rates among the species of the *Enterobacteriaceae* family studied were comparable to the reported rates in other parts of developing countries \(^14,15\), but higher than those reported in developed countries \(^10,11\). The combination of trimethoprim/sulfamethoxazole is extensively used in Africa owing to its antimicrobial spectrum of activity, and its low cost \(^16\). In addition, extended spectrum â-lactamase production is usually associated with resistance to non-â-lactam antibiotics such as aminoglycosides, fluoroquinolones and trimethoprime/sulfamethoxazole \(^17\).

The susceptibility rates of isolates of *P. aeruginosa* and *A. baumannii* in this study to all antibiotics tested except for imipenem, were low compared to those reported in developed countries \(^10,18,19\) and similar to those observed in Egypt \(^12\) and in West Africa \(^15\).

In conclusion, our study suggests the high rates of antimicrobial resistance among Gram-negative bacilli. The presence of *E. coli* and *Klebsiella* spp. isolates resistant to third generation cephalosporin suggests the importance of monitoring this phenotype. Particularly alarming is the appearance of low level imipenem resistance among different species of Gram negative bacilli studied. The results of this study indicate that more resources should be allocated to encourage good antibiotics utilization and practice. In addition, to provide information for choosing either empirical or direct therapy to physicians, surveillance to antimicrobial resistance is necessary.
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References


