Genetic diversity among selected ESBL and Carbapenem-producing *Klebsiella pneumoniae* isolates from urocultures in a portuguese hospital

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Antibiotic resistance – A public health problem

Fig. 1 and 2 – Campaigns related to the two main factors for antibiotic resistance: overuse and misuse of antimicrobials (WHO, 2018)
**Klebsiella pneumoniae**

- Major pathogen implicated in nosocomial infections that is known to spread easily;
- Frequently associated with resistance to the highest-priority critically important antimicrobials.
✓ Determine the carriage rate of ESBL-producing *K. pneumoniae* in a hospital in Portugal;

✓ Analyze the type of enzymes implicated;

✓ Determine the genetic diversity (MLST) among selected carbapenem-and ESBL-producing *K. pneumoniae* isolates from human urinary infections.
Introduction

Aims

Materials and Methods

Results

Discussion

Conclusions

Sampling

49 CTX/CAZ-resistant *K. pneumoniae* isolates obtained aleatory from patients' urocultures in a Portuguese hospital; December 2016-September 2018.

Bacteria isolation

MacConkey agar and BHI agar

Maldi-TOF

Matrix-Assisted Laser Desorption/Ionization

PCR and sequencing

Presence of *bla*$_{\text{CTX-M}}$ (different groups), *bla*$_{\text{SHV}}$, *bla*$_{\text{TEM}}$, *bla*$_{\text{KPC}}$, *bla*$_{\text{NDM}}$, *bla*$_{\text{VIM}}$, *tetA* and *tetB* genes

13 different antibiotics according to CLSI, 2019$^6$
General resistance phenotype

- ESBL-production was detected in 26.5% of the isolates (13/49);
- Most of them carried the gene of CTX-M-15 enzyme (n=10);
- It is important to note that all ESBL-positive and negative isolates carried the KPC$_{2/3}$ gene and showed carbapenem resistance.
## Resistance phenotype

**Table 1** – Resistance phenotype and genotype associated with different sequence types (ST) for selected *K. pneumoniae* isolates from urocultures in a Portuguese hospital.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Date</th>
<th>ESBL</th>
<th>Resistance phenotype</th>
<th>Resistance genotype</th>
<th>MLST</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2142</td>
<td>15/12/2016</td>
<td>P</td>
<td>AMC, FOX, CTX, CAZ, CHL, CIP, CN, SXT, S, IMP, MRP, ERT</td>
<td>KPC-2/3, SHV-12, TEM</td>
<td>ST147</td>
</tr>
<tr>
<td>X2143</td>
<td>15/12/2016</td>
<td>P</td>
<td>AMC, FOX, CTX, CAZ, CIP, CN, SXT, S, TET, IMP, MRP, ERT</td>
<td>CTX-M-15, KPC-2/3, SHV-27, TEM, tetA</td>
<td>ST280</td>
</tr>
<tr>
<td>X2157</td>
<td>27/04/2017</td>
<td>P</td>
<td>AMC, FOX, CTX, CAZ, CHF, CIP, CN, SXT, S, IMP, MRP, ERT</td>
<td>CTX-M-15, KPC-2/3, SHV-28, TEM</td>
<td>ST15</td>
</tr>
<tr>
<td>X2165</td>
<td>25/05/2017</td>
<td>P</td>
<td>AMC, CTX, CAZ, CIP, CN, SXT, IMP, MRP, ERT</td>
<td>KPC-2/3, SHV-28, TEM</td>
<td>ST15</td>
</tr>
<tr>
<td>X2175</td>
<td>10/06/2018</td>
<td>P</td>
<td>AMC, CTX, CAZ, CIP, SXT, S, IMP, MRP, ERT</td>
<td>CTX-M-15, KPC-2/3, SHV-12, TEM</td>
<td>ST15</td>
</tr>
<tr>
<td>X2232</td>
<td>20/01/2017</td>
<td>P</td>
<td>AMC, CTX, CAZ, CIP, CN, SXT, S, TET, IMP, MRP, ERT</td>
<td>KPC-2/3, SHV-27, TEM, tetA</td>
<td>ST280</td>
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<tr>
<td>X2168</td>
<td>20/05/2018</td>
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<td>AMC, CTX, CAZ, CN, SXT, S, IMP, MRP, ERT</td>
<td>KPC-2/3, SHV-11, TEM</td>
<td>ST348</td>
</tr>
<tr>
<td>X2173</td>
<td>20/05/2018</td>
<td>N</td>
<td>AMC, FOX, CTX, CAZ, IMP, MRP, ERT</td>
<td>KPC-2/3, SHV-26, TEM</td>
<td>ST34</td>
</tr>
</tbody>
</table>

**Legend**:  

- **a**AMC: amoxicillin+clavulanic acid; FOX: cefoxitin; CTX: cefotaxime; CAZ: ceftazidime; CHL: chloramphenicol; CIP: ciprofloxacin; CN: gentamicin; SXT: trimethoprim + sulfamethoxazole; S: streptomycin; TET: tetracycline; IMP: imipenem; MRP: meropenem; ERT: ertapenem;  
- **b**P – Positive, N- Negative;  
- **c**MLST - MultiLocus Sequence Typing.
✓ These findings indicate the genetic diversity among urinary infections isolates in our hospital.

✓ The KPC2/3 is the main mechanism of carbapenem resistance in *K. pneumoniae* isolates in the studied period, frequently detected together with CTX-M-15 gene.

✓ Three different ST were detected among ESBL-producing *K. pneumoniae* isolates (ST15, ST147 and ST280).
Acknowledgments

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Thank you for your attention!

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