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Brief Communication

Outbreak of \(\textit{bla}_{\text{OXA-72}}\)-producing \textit{Acinetobacter baumannii} in South America

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Thirty-five \textit{Acinetobacter baumannii} isolates were recovered from two medical centres in Guayaquil City, Ecuador, from November 2012 to October 2013. Isolates were identified using MALDI-TOF and confirmed by \textit{rpoB} PCR methods were employed for epidemiological analysis. Thirty-three \textit{A. baumannii} isolates were resistant to all \(\beta\)-lactams. The \(\textit{bla}_{\text{OXA-24/40}}\)-like gene was detected in 30 isolates. DNA sequencing identified the \(\textit{bla}_{\text{OXA-72}}\) amplicon as \(\textit{bla}_{\text{OXA-72}}\). The 30 isolates harbouring \(\textit{bla}_{\text{OXA-72}}\) strains showed the same PCR pattern. We report the first outbreak of \(\textit{bla}_{\text{OXA-72}}\)-producing \textit{A. baumannii} in South America. This is the first study carried out in the Republic of Ecuador.

**Keywords:** OXA-72, \textit{Acinetobacter baumannii}, OXA-type \(\beta\)-lactamase, America, Carbapenem-resistance

Acquired carbapenem resistance in \textit{Acinetobacter baumannii} is frequently associated with the presence of Ambler class D carbapenemases. These carbapenemases are divided into four subgroups: OXA-23-like, OXA-24/40-like, OXA-58-like and OXA-143-like.\textsuperscript{1} The OXA-72 enzyme belongs to the OXA-24/40 subgroup.\textsuperscript{1} The first report of OXA-72 occurred in Thailand in 2004 and then this enzyme was subsequently identified in Taiwan, China, South Korea and in some European countries.\textsuperscript{2–7} In America, only sporadic isolates carrying \(\textit{bla}_{\text{OXA-72}}\) have been reported.\textsuperscript{8,9} To the best of our knowledge, we described the first nosocomial outbreak of OXA-72-producing \textit{A. baumannii} recovered in South America, particularly, in the Republic of Ecuador.

Thirty-five \textit{A. baumannii} isolates were recovered from 35 patients hospitalized at two medical centres (H1, H2) in Guayaquil City, Ecuador, from November 2012 to October 2013. Isolates were identified using the matrix-assisted laser desorption ionization-time of flight mass spectrometry MALDI-TOF (3.1 software, Bruker Daltonik Bremen, Germany). Genomic species identification was confirmed by partial sequencing of the RNA polymerase \(\beta\)-subunit (\textit{rpoB}) gene.\textsuperscript{10} Susceptibility was determined by Vitek-2 system (bioMe’rieux, Marcy L’ Etoile, France) and interpreted according to the breakpoints of the Clinical and Laboratory Standards Institute.\textsuperscript{11}

Genes coding for Ambler class B and D carbapenemases were sought by PCR using specific primers for the \(\textit{bla}_{\text{VIM}}\), \(\textit{bla}_{\text{IMP}}\), \(\textit{bla}_{\text{OXA-51}}\), \(\textit{bla}_{\text{OXA-23}}\), \(\textit{bla}_{\text{OXA-58}}\) and \(\textit{bla}_{\text{OXA-24/40}}\) genes followed by sequencing, as previously described\textsuperscript{12} (Table 1). Standard PCR techniques were used to detect the presence of \textit{ISAba1} inserted upstream of \(\textit{bla}_{\text{OXA-51}}\) and \(\textit{bla}_{\text{OXA-72}}\). The presence of integrons was screened using specific primers for class I and class II integrases. The plasmid was extracted with plasmid DNA-miniprep (INBIO, Argentina). The extracts were treated with restriction enzymes and subject to electrophoresis. Repetitive extragenic palindromic DNA sequence-based PCR (REP-PCR) was employed for epidemiological analysis.\textsuperscript{13} Strains delineation was inferred in terms of percentage of banding patterns using Dice coefficient. Clustering was performed by UPGMA (unweighted pair-group method, arithmetic average). The cut-off level for PCR-pattern delineation was 80% of similarity (Fig. 1).

The patients’ ages ranged from 40 to 97 years (mean age, 66 years). All cases (infections/colonizations) were intra-hospital acquired and the average length of hospital stay prior to the isolation of the \textit{A. baumannii} strains was 19 days. The 35 patients were scattered throughout the hospital and the reasons for hospital admission were diverse. The sites of isolation were respiratory tract (26
**Table 1**  Clinical and microbiological features of the 35 isolates included in this study

<table>
<thead>
<tr>
<th>PCR pattern</th>
<th>n</th>
<th>H1</th>
<th>H2</th>
<th>TRI</th>
<th>IMI-R*</th>
<th>COL-R**</th>
<th>blaoxa-51</th>
<th>blaoxa-72</th>
<th>blaoxa-23</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>32</td>
<td>27</td>
<td>5</td>
<td>25</td>
<td>30</td>
<td>0</td>
<td>32</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

*Imipenem resistant. **Colistin resistant.
Notes: H1: Hospital IESS "Teodoro Maldonado Carbo"; H2: Hospital de Infectología "José Daniel Rodríguez Maridueña"; TRI: respiratory samples.

**Figure 1** Dendogram of PCR patterns.

Dendogram constructed following determination of PCR-pattern using UPGMA. IMI-SUS: susceptibility to IMI; H1: Hospital IESS "Teodoro Maldonado Carbo; H2: Hospital de Infectología "José Daniel Rodríguez Maridueña"
patients), surgical wound, urinary tract and intravenous catheters.1

Thirty-three A. baumannii isolates showed resistance to all β-lactams, including carbapenems, and were resistant to ciprofloxacin, amikacin, gentamicin, ciprofloxacin and cotrimoxazole but remained susceptible to colistin, whereas the other two isolates were susceptible to carbapenems and colistin. The presence of the blaOXA-51-like gene was detected in all the isolates, while the blaOXA-24/40-like gene was detected in 30 isolates and the blaOXA-72 in the other three isolates. DNA sequencing identified the blaOXA-40-like amplicon as blaOXA-72 (GenBank accession No.KP190117). ISAbaI was neither associated with blaOXA-51 nor with blaOXA-72. The PCR mapping indicated that blaOXA-72 was not part of a class I integron. Plasmid extraction of the 1E isolate, showed that blaOXA-72 was located in plasmid of 90 kb.

The study of clonal relatedness among the strains showed that the 30 isolates harbouring blaOXA-72 and the two carbapenem-susceptible A. baumannii strains displayed the same PCR pattern, but they differed from the three OXA-23-producing isolates.

In America, carbapenem resistance in A. baumannii is principally mediated by the presence of oxacillinases, mainly OXA-23 and OXA-58.14 OXA-40 and OXA-143 have also been described in the United States and Brazil, respectively.15,16

As regards the OXA-24/40 subgroups, although there are two previous reports from Brazil and Chile, the specific OXA-type carbapenemase has not been described in those studies.14,17 More recently, the presence of blaOXA-72 was reported as sporadic cases in A. baumannii in Brazil and in Acinetobacter pittii in Colombia.5,18

There are previous reports from multicentric studies carried out in the Republic of Ecuador which revealed that the imipenem resistance rate was 36% in A. baumannii.19 However, this report is the first study that focuses on the molecular mechanism of carbapenem resistance in A. baumannii in this country.

The arrival of blaOXA-72 to the Republic of Ecuador remains unknown. The sporadic cases that had been communicated in South America were distant (700 km) from Guayaquil city.

We were unable to detect risk factors which could explain the presence of this carbapenemase in the country like journeys from patients or medical staff to or from countries with blaOXA-72 presence.

The genetic relatedness observed among the OXA-72-positive and the carbapenem-susceptible A. baumannii isolates suggested that blaOXA-72 may have spread among carbapenem-susceptible A. baumannii isolates. Furthermore, the same PCR-pattern observed among OXA-72 isolates from both medical centres studied is indicative of the spread of a resistant clone across Guayaquil city.

In summary, we report the first outbreak of A. baumannii harbouring blaOXA-72 in South America. This is the first study carried out in the Republic of Ecuador; therefore, we consider that a national study would be necessary to underscore the magnitude and extension of the presence of the OXA-72 carbapenemase in this country.

Disclosure statement
No potential conflict of interest was reported by the authors.

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Her publications appear in J Glob Antimicrob Resist. 2014, 
30:1973947814Y0000000213.

References


2 Poirel L, Naas T, Nordmann P. Diversity, epidemiology, and genetics 

3 Lu P-L, Dounith M, Livermore DM, Chen TP, Woodford N. 
Diversity of carbapenem resistance mechanisms in Acinetobacter baumannii 

epidemiology of clinical isolates of carbapenem-resistant Acinetobacter spp. from Chinese hospitals. Antimicrob Agents 

Wide dissemination of OXA-type carbapenemases in clinical 

6 Barnaud G, Zihoune N, Ricard JD, Hippeaux MC, Evilleard M, 
Dreyfuss D, et al. Two sequential outbreaks caused by multidrug-
resistant Acinetobacter baumannii isolates producing OXA-58 or 

7 Di Popolo A, Giannouli M, Triassi M, Brisse S, Zarrilli R. Molecular 
epidemiological investigation of multidrug-resistant Acinetobacter baumannii 
strains in four Mediterranean countries with a multilocus 

8 Werner J, Pica R, Carvalhaes CG, Cardoso JP, Gales AC. 

9 Tian GB, Adams-Haduch JM, Bogdanovich T. Identification of diverse 
OXA-40 group carbapenemases, including a novel variant, OXA-160, 
from Acinetobacter baumannii in Pensylvania. Antimicrob Agents 

10 Gundi VA, Dijkshoorn L, Burignat S, Raoult D, La Scola B. 
Validation of partial rpoB gene sequence analysis for the identification of clinically 

11 Clinical Laboratory Standards Institute. Performance standards 
for antimicrobial susceptibility testing; 23nd Informational Supplement, 
M100–S23. Wayne (PA): Clinical Laboratory Standards Institute; 
2013.

al. Multiplex PCR for genes encoding prevalent OXA carbapenemases 

13 Quelle LS, Catalano M. Efficacy of two DNA fingerprinting methods 

14 Opazo A, Domínguez M, Bello H, Amyes SG, Gonzalez-Rocha G. 
OXA-type carbapenemases in Acinetobacter baumannii in South 

15 Higgins PG, Poirel L, Lehmann M, Nordmann P, Seifert H. OXA-
143, a novel carbapenem-hydrolyzing class D β-lactamase 

16 Lolans K, Rice TW, Munoz-Price LS, Quinn JP. Multicity outbreak 
of carbapenem-resistant Acinetobacter baumannii isolates producing 

17 Gales AC, Custanheira M, Jones RN, Sader HS. Antimicrobial 
resistance among Gram-negative bacilli isolated from Latin America: 
results from SENTRY/Antimicrobial Surveillance Program (Latin 

18 Montealegre MC, Maya JJ, Correa A, Espinal P, Mojica MF, Ruiz SJ, et 
al. First identification of OXA-72 carbapenemase from Acinetobacter 

19 Zurita Jeanette. Informe anual de la red de monitoreo / vigilancia de 
la resistencia a los antibióticos – 2008 [annual report of the network 
for monitoring/surveillance of antibiotic resistance – 2008]. Revista 
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