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Brief Original Article

Extensively drug-resistant *Acinetobacter baumannii* isolated in a university hospital: Role of inter-hospital transmission

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Abstract

Introduction: *Acinetobacter baumannii* causes severe infections that primarily affect intensive care unit (ICU) patients. It has a high prevalence of multidrug resistance, including carbapenems, and a high potential for intra-hospital and inter-hospital transmission. The aim of this study was to determine the origin of extensively drug-resistant (XDR) *A. baumannii* isolates in our hospital during 2009.

Methodology: This was an observational retrospective study. Isolates of *A. baumannii* were obtained from patients hospitalized during 2009. XDR isolates were defined using criteria published by Magiorakos *et al.*. The isolates were classified as community acquired, hospital acquired, and inter-hospital transmission.

Results: A total of 48 isolates of *A. baumannii* were isolated during 2009, corresponding to 34 patients. Of these, 18 (53%) were susceptible, 6 (18%) were multidrug resistant (MDR), and 10 (29%) were XDR. Of the 10 XDR isolates, 9 were isolated from patients transferred from other hospitals. The median time of hospitalization in origin hospitals was 17 days, while the median time of hospitalization in the study hospital, previous to isolation of *A. baumannii*, was 1 day. A total of 6 out of 10 patients had a positive culture taken on the day of admission. None of the patients shared a clinical ward or time during hospitalization. Genotypic characterization demonstrated the existence of two clones (A and B) which were geographically associated with patients transferred from two different regions of the country.

Conclusions: During 2009, all XDR *A. baumannii* isolates were recovered from patients coming from other hospitals, indicative of inter-hospital transmission.

Key words: *Acinetobacter baumannii*; carbapenem resistance; inter-hospital transmission.

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Introduction

Acinetobacter baumannii is a major cause of nosocomial infections worldwide, especially in the intensive care unit (ICU) setting [1,2]. In Chile, carbapenem resistance in the ICU is over 70% [3], leaving few therapeutic options (polymyxins and tigecycline) for treatment of severe cases [4]. Both clonal transmission within hospitals [5] and inter-hospital transmission of *A. baumannii* have been reported [6-9]. However, the mechanism of *A. baumannii* transmission requires clarification to allow for better evaluation of current infection control measures with the aim of preventing hospital outbreaks and decreasing morbidity and mortality caused by clinical infections, especially in critically ill patients [10]. The aim of this study was to determine the origin of extensively drug-resistant (XDR) *A. baumannii* in our hospital during 2009 and to evaluate the importance of inter-hospital transmission.

Methodology

This was a retrospective observational study performed in Hospital Clínico Universidad Católica de Chile, a tertiary care university teaching hospital. Cases were included if *A. baumannii* was isolated from any clinical sample during 2009 and met the definition of an XDR isolate. Cases were detected using records available in the clinical microbiology laboratory. Only the first isolate recovered from a patient was analyzed. Epidemiological information was collected from clinical records.

A. baumannii isolates were identified by conventional methods [11] and by an automatized system with GNI+ card (Vitek 2 Compact, bioMerieux, Lyon, France). Determination of antimicrobial susceptibility was carried out by agar dilution using 2009 Clinical and Laboratory Standards Institute (CLSI) criteria. [12] *A. baumanii* was classified as susceptible, multidrug resistant (MDR),

and XDR using criteria published by Magiorakos *et al*. [13]. XDR isolates were genotyped by pulsed-field gel electrophoresis (PFGE) using the *Sma*I restriction enzyme. Banding patterns were interpreted using the criteria specified by Tenover *et al*. [14].

The *A. baumannii* isolates were classified into three categories: a) community acquired: isolates recovered from patients within 48 hours of admission with no hospitalization or other (*e.g.*, long-term) healthcare treatment in the previous six months; b) hospital acquired: isolates recovered from patients 48 hours after admission, with epidemiological link with patients with the same strain hospitalized in the same service, at the same time; or c) inter-hospital transmission: isolates from patients transferred from or hospitalized in other centers in the previous six months, or from patients receiving healthcare (dialysis, chemotherapy, nursing home) in ambulatory centers in the previous six months and with no epidemiological link with patients hospitalized with the same strain.

Results

During 2009, 48 isolates of *A. baumannii* were obtained from 34 patients. Of the 34 isolates analyzed, 18 were susceptible, 6 were MDR, and 10 were XDR. These 10 XDR *A. baumannii* were resistant to most classes of antibiotics, such as penicillins (including combinations with inhibitors), all classes of cephalosporins, carbapenems, fluoroquinolones, aminoglicosides, and others. They remained susceptible only to polimixin B (100%) and tigecycline (100%).

Of the 10 XDR isolates, 9 were recovered from patients transferred from other hospitals, and one was from a patient with a chronic ulcer in the leg who was being treated at an outpatient clinic outside of the health network. Thus, all of these isolates met the criteria for inter-hospital transmission, as outlined above. The median time from admission to isolation was 1 day (range, 1 to 9 days), and all patients had prolonged hospitalization in their origin hospitals, with a median time of 18 days (range, 1 to 60 days). A total of 6 out of 10 patients had positive culture taken on the admission day. None of the patients shared clinical wards or time during hospitalization in the hospital (Table 1).

Genotypic characterization was possible for 8 out of 10 XDR isolates, revealing the existence of two clones. Five isolates were indistinguishable and designated Clone A. These isolates were recovered from patients transferred from four hospitals in the central area of Chile. Two additional isolates were closely related and designated Clone B. These isolates were recovered from patients coming from two hospitals in the south of Chile. The last isolate was unique and was cultured from a patient treated at an outpatient clinic (Table 1).

All 10 patients were under contact precaution during the total length of their hospitalization. Room cleaning had been implemented with no changes until now.

Discussion

A. baumannii is the fifth most common cause of infections affecting patients admitted to ICUs worldwide, reaching 9% of all infections in this group. It is one of the main causes of ventilator-associated pneumonia in Latin American countries [2]. In Chile,

Table 1. Epidemiological data of 10 patients infected/colonized with extensively drug-resistant *A. baumannii.*

Isolate No.	Culture sample	Length of hospitalization (α) (days)	Previous isolation (β)	Time from admission to culture date (days)	Clonal relationship (γ)	Geographical origin (μ)
3	CSF	17	Yes	1	Clone A	South
6	ETA	32	Yes	1	Clone A	Center
7	ETA	19	No	9	Clone A	Center
8	Tissue	1	No	1	Clone A	Center
10	ETA	6	No	6	Clone A	Center
2	Abdominal collection	28	No	1	Clone B	South
9	Blood	4	No	1	Clone B	South
4	Tissue	Outpatient	No	1	Unrelated	Center
1	ETA	60	No	5	NA	Center
5	Blood	1	No	9	NA	Center

(α) Length of hospitalization in previous center; (β) previous isolation: patient already known to be colonized or infected at admission; (γ) clonal relationship based in the pulsed-field gel electrophoresis pattern; (μ) geographical origin in Chile; CSF: cerebrospinal fluid; ETA: endo-traqueal aspirate.

the resistance to imipenem and meropenem in ICU patients was 76% and 80.2%, respectively, during 2012. Carbapenem resistance is mainly caused by carbapenemases belong to the OXA family [15]. Several outbreaks of clonal transmission within hospitals associated with contaminated environment and patient to patient transmission have been reported [16]. Also, inter-hospital transmission of MDR isolates has been frequently reported [6-9,17]. Epidemic MDR strains are usually introduced to the hospital by a colonized or infected patient, from whom it can spread to other patients and contaminate the environment.

In this study, we demonstrated that during 2009 in our institution, all XDR *A. baumannii* strains were isolated from patients coming from other hospitals or healthcare centers, indicative of inter-hospital transmission. We believe that the patients with XDR *A. baumannii* did not acquire the infection/colonization in our hospital because XDR *A. baumannii* has very low incidence in our hospital (during 2009, only 10 patients in our hospital were infected or colonized with XDR *A. baumannii* out of more than 20,000 discharges). A total of 9 out of 10 patients with XDR *A. baumannii* in our hospital were transferred from other hospitals, where *A. baumannii* has been endemic for many years and has a high incidence, especially in ICUs. In addition, 6 of these patients had positive culture on admission. The other 4 patients had had prolonged hospitalization in the previous hospital, had positive cultures on days 5 and 6, and 2 had positive cultures on day 9 after admission. Finally, none of the 10 patients shared a room or time with patients with XDR *A. baumannii* infection.

These data support our belief that implementing contact isolation precautions for transferred patients, both at admission and any time when *A. baumannii* is isolated, is essential for successfully preventing nosocomial transmission in hospitals. In addition, we also believe that environmental cleaning is important to prevent the spread of these strains. PFGE genotyping demonstrated geographic-specific XDR clones in patients (*i.e.*, related to a particular region of Chile), suggesting inter-hospital transmission within these regions.

This study has several limitations. It was a retrospective, one-year, single-hospital study. However, the data allowed us to reach important conclusions regarding appropriate infection control measures for transfer patients potentially colonized with *A. baumannii*, which is especially important given the XDR nature of these organisms in our country.

Conclusions

During 2009 in our institution, all XDR *A. baumannii* strains were isolated from patients coming from other hospitals, indicative of inter-hospital transmission. Future studies are needed to confirm and expand these findings to better inform infection control practices aimed at limiting the transmission of *A. baumannii* in developing countries.

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