



## Multidrug Resistance among Clinical Isolates of *Acinetobacter lwoffii*

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### Abstract

**Background & Aims:** This study has the objective to examine the resistance of the clinical isolates of *Acinetobacter lwoffii* to antibiotics.

**Materials & Methods:** The samples, that were isolated from the patients admitted to Gazi Hospital in Turkey, were defined by the MicroScan 5 WalkAway Identification System (Siemens, Germany) in terms of species and were thus collected. Then, the resistance pattern of 10 isolated *A.lwoffii* strains was assessed to 11 antibodies and four antibiotic compounds in this study.

**Results:** 50% of the strains were found to be Multidrug-Resistant (MDR). Tigecycline was proved to be the most effective antibiotic with 80% sensitivity and 10% intermediate sensitivity.

**Conclusion:** The MDR *A.lwoffii* strains were observed in the clinical isolate of Gazi hospital patients. Hence, the identification and investigation of the model of antibiotic resistance of the microorganisms is necessary.

**Keywords:** *Acinetobacter lwoffii*, Multidrug-Resistant, antibiotic resistance

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### Introduction

*Acinetobacter* species comprises Gram-negative, strictly aerobic, non-fermenting, oxidase-negative, catalase-positive and non-motile coccobacillus (1). Beijerinck (1911), a Dutch microbiologist, was the first to isolate the bacterium from soil and called it *Micrococcus calcoaceticus* (2). Bouvet and Grimont (1986) suggested it to be named *Acinetobacter* (3) then the International Committee on Nomenclature of

Bacteria (1971) designated it into the *Moraxellaceae* family (4). Initially, it was divided into seven groups having their official names and in 2011 it was subdivided into more than 33 individual genomic groups. Now more than 63 species of the bacterium are identified (56). Not all the *Acinetobacter* species are pathogenic; however, certain groups of these microorganisms are hospital-acquired opportunistic bacteria and are factors of nosocomial infections in the immunocompromised people, those suffering

malignancies, those receiving burns and the newly born babies (7).

*Acinetobacter baumannii* is the most pathogenic species. Furthermore, *A. lwoffii* strains are observed in the toxic septic shock, pneumonia, endocarditis, meningitis, ulcer, and urinary tract infections (8). Furthermore, *A. lwoffii* is proved to have caused post-surgery endophthalmic infections, gastroenteritis, peritonitis, and abdominal abscess (9, 10, 11, 12). It is also proved that *A. lwoffii* caused the community-acquired infections among the healthy individuals (13).

*Acinetobacter lwoffii* (formerly *Acinetobacter calcoaceticus* var. *lwoffii*) was found in the natural flora of the skin and the oropharynx and perineum of 20-25% of the healthy individuals that was not normally pathogenic. The bacteria is said to be naturally in water and soil; furthermore, literature shows the Multidrug-Resistant (MDR) *A.lwoffii* strains were isolated from soil (15). Additionally, the bacteria are found to be in such sources of food like poultry, eggs, fish, and milk (16, 17). *A.lwoffii* has long survived in different types of environments with poor nutrition and has easily grown in a wide range of temperatures, low pH, and dry environment, and it is resistant to radiation and disinfectants that are not used in proper concentrations (18, 19). It is also readily replaced in hospital settings and transmitted by contaminated equipment and personnel to hospitalized patients. Reports of *A.Lwoffii* infections in patients with vascular and urinary catheters and linked to ventilators, especially those in the ICU, are available (20, 21, 22). Various articles on the resistance pattern of *A.lwoffii* have been published. Antibiotic resistance in nosocomial infections is a very important treatment problem. Bacterial strains are resistant to at least three classes of antibiotics called Multidrug-Resistant (MDR). Since resistance to antibiotics is constantly changing, it is imperative to examine the pattern of bacterial resistance permanently (16, 24, 23). This retrospective study was conducted to detect the value of sensitivity of 10 isolated *Acinetobacter lwoffii* strains to eleven antibiotics and four antibiotic compounds.

## Materials & Method

Isolated samples from patients admitted to Ankara Gazi University Hospital from 2009 to 2011, were diagnosed by MicroScan 5 WalkAway Identification System (Siemens, Germany) and they were collected at the species level. The resistance of 10 isolated *Acinetobacter lwoffii* strains was examined by the device. The classes of antibiotics, considered in this study, include Cephalosporins (Cefotaxime, Ceftazidime, Cefepime), Aminoglycosides (Tobramycin, Amikacin, Nethilmisin, Gentamicin), Quinolones (Ciprofloxacin), Carbapenems (Imipenem, Meropenem), Thigecyclines, the Beta-lactam antibiotic compounds, and Beta-lactamase inhibitors (Piperacillin/Tazobactam, Ampicillin/Tazobactam, Ampicillin/Sulbactam, Cefoprazone/Sulbactam).

## Results

Out of 10 strains of *A. lwoffii* a clinical isolates, one bacteria strain was taken from the Pediatric Infectious Diseases Unit (PIDU), two bacteria strains were collected from the Pediatric Intensive Care Unit (PICU), two bacteria strains from the Neonatal Intensive Care Unit (NICU), one bacteria strain from the Paediatric Surgical Unit (PSU), two bacteria strains from the Adult Intensive Care Unit (AICU), and one bacteria strain was collected from the Plastic Surgery Unit (PLSU) and one bacteria strain from the Nephrology Division (NU). Fifty percent of the bacteria isolates were from the ICU patients and all the 10 patients under this study suffered weak immune system due to being admitted to ICU or medical intervention and treatments. Four out of 10 species, tested in this experiment, were related to the Endotracheal Aspirate, three to blood, one to wound, one to sputum and one to peritoneal liquid.

Tigecycline with 80% sensitivity and 10% intermediate sensitivity is the best antibiotic for treatment. Five of the 10 strains of the isolated *A.lwoffii*, with resistance to more than three or four antibiotic classes, are MDR.

Two out of five MDR bacteria strains were found to be resistant to all antibiotics excluding the Tigecycline,

Tobramycin and Netilmicin, and the Sulbactam/Cefoprazone combination drugs. Furthermore, a strain of Multidrug-Resistant (MDR) bacteria was resistant to all antibiotics excluding Tigecycline, Imipenem, Meropenem, and Cefepime. On the other hand, one strain of MDR bacteria was sensitive just to Imipenem and Meropenem, while one strain of

the bacteria was sensitive only to Tigecycline. Compared to other types of synthetic drug combinations, Cefoperazone / Sulbactam compounds were proved to be more (60%) sensitive. Table 1 shows the susceptibility pattern of 10 *Acinetobacter lwoffii* isolates.

**Table 1.** Antimicrobial drug susceptibility patterns of 10 *Acinetobacter lwoffii* strains

No	Source	TGC	CTX	CAZ	CPM	CP	TOB	AK	NET	GM	IMP	MER	P/T	A/S	A/C	C/S
1	PIDU	S	R	R	S	S	S	S	S	S	S	S	S	S	S	S
2	PLSU	S	R	R	R	R	S	R	S	R	R	R	R	R	R	S
3	PICU	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4	NU	S	R	S	S	S	S	S	S	S	S	S	I	S	S	S
5	NICU	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
6	AICU	S	R	R	R	R	S	R	S	R	R	R	R	R	R	I
7	PICU	I	R	R	R	R	R	R	R	R	R	R	R	R	R	R
8	PSU	S	R	R	S	R	R	R	R	R	I	S	R	R	R	R
9	NICU	R	R	R	R	R	R	R	R	R	S	S	R	R	R	R
10	AICU	S	R	R	S	R	S	S	I	I	S	S	R	S	R	S

Tigecycline, TGC; Cefotaxime CTX; Ceftazidime CAZ; Cefepime CPM, Ciprofloxacin CP; Tobramycin TOB; Amikacin AK; Netilmicin NET; Gentamicin GM; Imipenem IMP; Meropenem MER;

Piperacillin /Tazobactam, P/T; Ampicillin /Sulbactam, A/S; Amoxicillin/ Clavulanic acid A/C; Cefoperazone /Sulbactam C/S

Pediatric Infection Disease Unit (PIDU), Plastic Surgery Unit (PLSU), Pediatric Intensive Care Unit (PICU), Neonatal Intensive Care Unit (NICU), Nephrology Unit (NU), Adult Intensive Care Unit (AICU), Pediatric Surgical Unit (PSU)

## Discussion

*A.lwoffii* is the root cause of mild to severe and fatal groups of human nosocomial and community-acquired infections. This group of bacterium has been isolated over recent years from all other bacterial infections. The patients with burns, patients undergoing major surgeries, patients admitted to the ICU hospital wards and suffering chronic diseases, the patients who stay long in hospitals as well as the ventilator-dependent patients are proved to be vulnerable to the opportunistic nosocomial infections of *Acinetobacter* (8-12). As for smokers, the alcohol-dependent patients, as well as those believed to have chronic respiratory illnesses and background diseases that are also instances of the *Acinetobacter* community-acquired infections (13). Furthermore, they can exhibit a very different resistance

pattern due to environmental factors and how antibiotics and biocides are used. We determined and studied the MDR *A.lwoffii* strains for three years.

Out of 100 non-fermented Gram-negative bacilli isolates, Mozafari et al. (2006) succeeded to isolate 10 strains of *A.lwoffii* and reported the bacteria as the fourth most common bacterium widely seen in Tehran hospitals (25). Moreover, 650 samples were isolated in two Tehran hospitals in the years 2014-2015 and out of the group of species, 195 strains were distinguished to be *Acinetobacter* and 27 of them were reported as *A.lwoffii* (26). MDR *A.lwoffii* was an emerging pathogen and it was detected in blood infections of the low birth weight neonatal ICU patients in India (24). *Acinetobacter* has become resistant to different kinds of antibiotics like Penicillins, Aminoglycosides,

Cephalosporins and even Quinolones, as Carbapenems have been considered the most active drug against the infections. Studies on blood samples of the infants, kept in the ICU of hospitals in Thailand from 2005 to 2008, revealed that 17 species of the microorganisms were *A.baumannii* and four were *A.lwoffii*, while Carbapenems, with or without Nethilmycine were introduced as the forerunner in medication of neonatal *A.lwoffii* infections (28). Tega et al. argued the role of *A.lwoffii* in catheter infections, while reporting MDR to more than four classes of antibiotics. The scholars reported that all the 10 *A.lwoffii* strains were sensitive to Meropenem and Imipenem (21). Studies, conducted in the same vein, showed that *A.baumannii* and *A.lwoffii* resistance to Carbapenems has been on the growth and turned into a global problem. They maintain that the resistance levels are not controlled, patients' medication will come across problems, entailing grave consequences (29). Vahedi et al. proved that six percent of 595 blood cultures were *A. lwoffii* positive, while highest level (96.2%) of drug resistance was observed in Imipenem (27). This study revealed that three out of 10 isolated strains were resistant to Imipenem and Meropenem and one strain was semi sensitive to Imipenem. The Carbapenem-resistant strains were the MDR strains and were proved resistant to more than three classes of antibiotics. Six of the 10 isolates of *A.lwoffii* were resistant to Ciprofloxacin. On the other hand, the strains were resistant to many of the antibiotics under consideration.

This study showed that MDR bacteria existed in five out of 10 isolates of *A.lwoffii* strains, which were isolated from hospitalized patients from 2009 to 2011, fearing to cause complications in treatment of the hospital-acquired infections. Tigecycline and Colistine are suggested to be the best and the most preferred method of treatment for the Multidrug-Resistant (MDR) *Acinetobacter* strains (29, 8), justified by the community's refusal to embark on willful consumption of antibiotics and refraining to prescribe less of the drugs (30). This study showed that the strains were most sensitive to Tigecycline. The findings are in line with the literature. However, one out of five MDR bacteria were

revealed to be resistant to Tigecycline and one strain was found to be intermediate sensitive. This may be detrimental to treatment of infections caused by the MDR *Acinetobacter* strains.

### Conclusion

Regarding excessive consumption of antibiotics and the swift increase in antibiotic resistance and the emergence of MDR strains, it is crucial to detect the pattern of pathogenic bacterial resistance, especially in the hospital-acquired infections, to plan and select the appropriate medicinal medication in proportion to each geographical area.

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### Conflict of interest

Nil

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