

Prevalence of carbapenemase encoding genes including New Delhi Metallo-β-lactamase in *Acinetobacter* species, Algeria

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Introduction

Acinetobacter spp., especially *Acinetobacter baumannii*, are important opportunistic pathogens responsible for a variety of nosocomial infections [2] with resistance to multiple antimicrobial agents [1]. The number of carbapenem-resistant *Acinetobacter* spp. isolates has dramatically increased and have been disseminated worldwide. Among carbapenem-resistant *Acinetobacter* spp., metallo-β-lactamases (MβLs) and carbapenem-hydrolysing class D β-lactamases (CHDLs) are common contributors to carbapenem resistance[3]. The purpose of the present study was to evaluate the prevalence of antibiotic resistance and the genetic background of carbapenem resistance in a series of 113 *A.baumannii* strains isolated in western Algeria.

Methods

113 *Acinetobacter* spp isolated from hospital environment and patients in north west Algeria during a period from October 2008 to April 2012

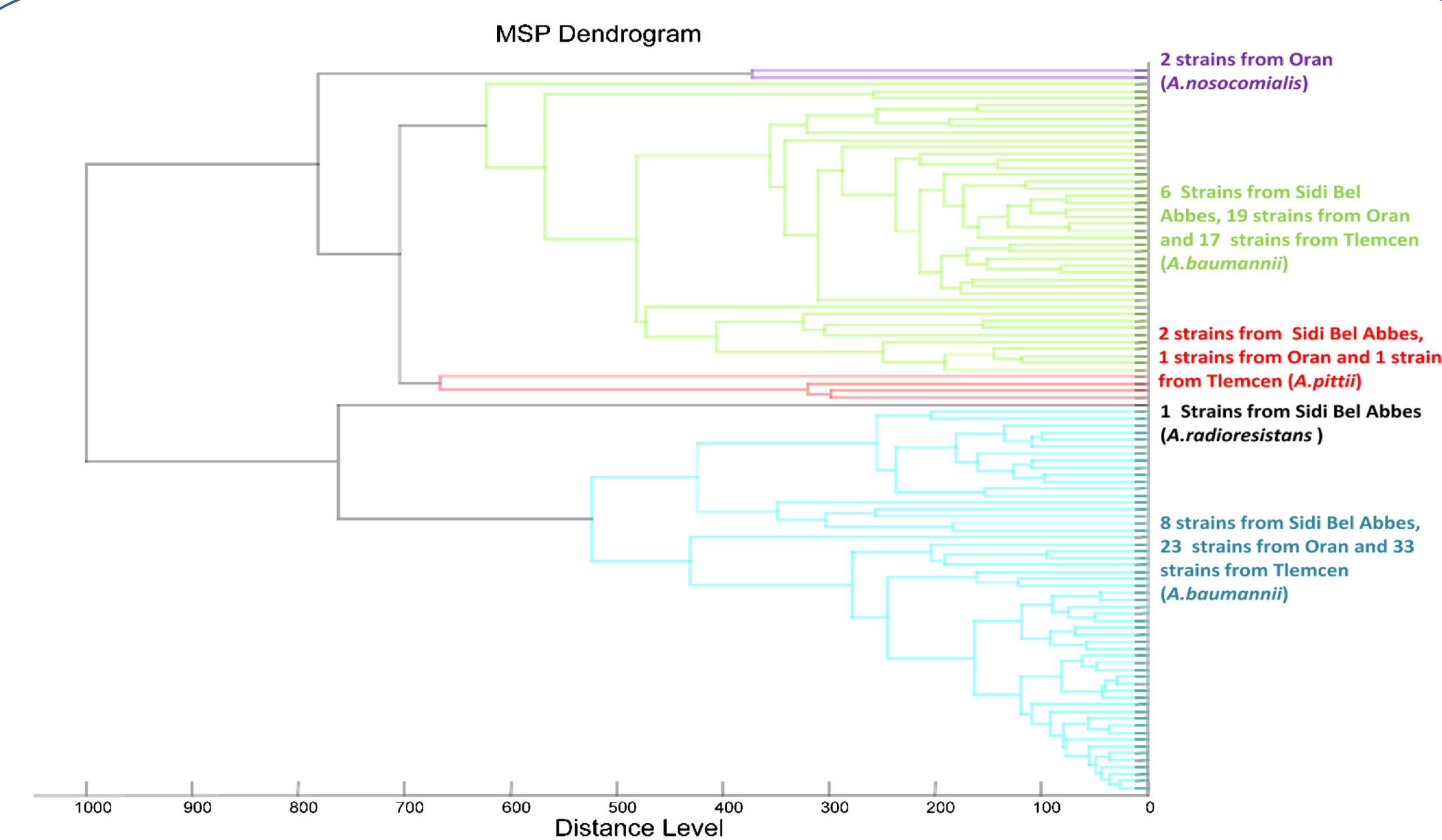
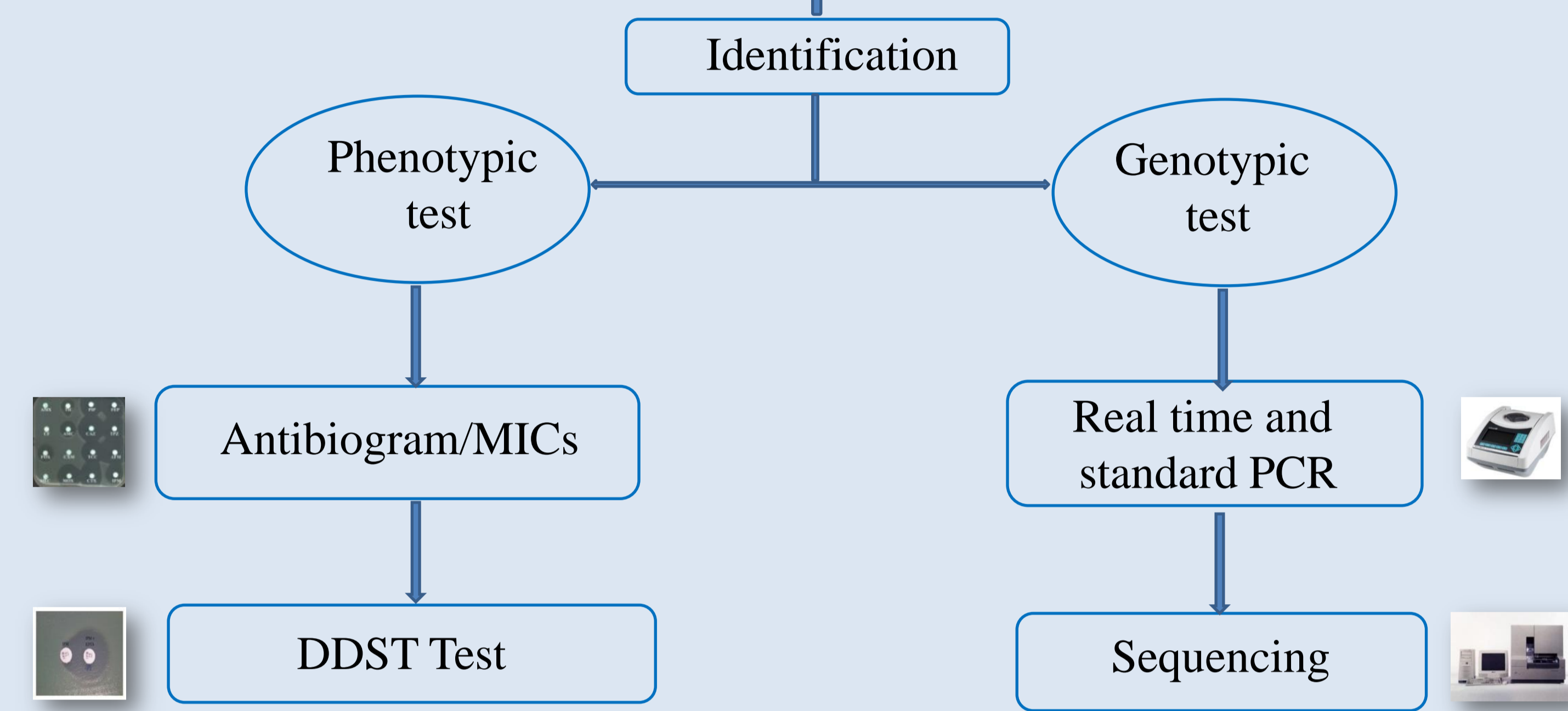


Figure 1. Mean spectra projection (MSP) dendrogram generated by BIOTYPER software (version 2; Bruker Daltonics) of *Acinetobacter* spp. strains.

Table 1. Resistance rates for *Acinetobacter* spp. isolates in this study.

Antimicrobial agent	Resistance rate (%)			
	Tlemcen (n=51)	Oran (n=45)	Sidi Bel Abbes (n= 17)	Total (n=113)
Piperacillin	94,1	95,5	87,0	92,2
Piperacillin-tazobactam	84,3	91,0	88,8	88,0
Ticarcillin	98,0	97,7	92,0	95,9
Ticarcillin-clavulanic acid	100,0	97,7	91,0	96,2
Ceftazidime	98,0	100,0	98,0	98,6
Imipenem	78,0	71,0	35,0	61,3
Meropenem	84,0	77,7	38,0	66,5
Gentamicin	50,9	26,6	91,0	56,1
Tobramycin	23,0	57,7	36,0	38,9
Amikacin	82,3	71,0	84,0	79,1
Ciprofloxacin	88,2	91,0	76,0	85,0
Colistin	0,0	0,0	0,0	0,0

Results

Bacterial isolates

During the period from October 2008 to April 2012, 113 strains were isolated. 100 strains from human and 13 from hospital environment. Using MALDI-TOF-MS, all *Acinetobacter* spp. strains were identified at the species level with a log score >2.0. 106 strains were identified as *A. baumannii*, 1 strain as *A. radioresistans*, 2 strains as *A. nosocomialis* and 4 strains as *A. pittii*. A MSP dendrogram was generated on the basis of consensus spectra obtained from each strain (Figure 1).

Antimicrobial susceptibility testing

Antimicrobial susceptibility testing of all the strains showed that most of the isolates were characterized by resistance to β-lactams, to fluoroquinolones and to aminoglycosides, whilst they differed in their susceptibility to imipenem (70,8%) and showed different levels of resistance with MICs ranging from 0.5 to 512 μg/ml. However, all isolates were susceptible to colistin (MIC=0,125-0,25 μg/ml) (Table 1).

The results showed that there is not a variation in the antibiotic susceptibility testing among *A. baumannii*, and *A.nosocomialis*, except for *A.radioresistans* and *A.pittii* which were less susceptible to most antimicrobial agents.

Identification of carbapenem resistance genes

80 isolates were resistant to carbapenems. Of these, five harbored the Metallo-β-lactamase *bla*_{NDM-1} (Figure 2), 40 were positive for *bla*_{OXA-23} gene and 17 were positive for *bla*_{OXA-24} gene. No isolates were positive for *bla*_{OXA-58} (Table 2). The five strains containing *bla*_{NDM-1} isolates showed positivity for DDST. They were from autochthonous cases, isolated from five patients admitted in Oran hospital.

Resistance to aminoglycosides was due to the expression of *aac*(3)-Ia, *aadA*, *ant*(2'')-I, *aph*(3'), *aac*(6')-Ib gene. No isolates were positive for *rmtA*, *rmtF*, *armA*, *arr-2* and the *qnr* genes.

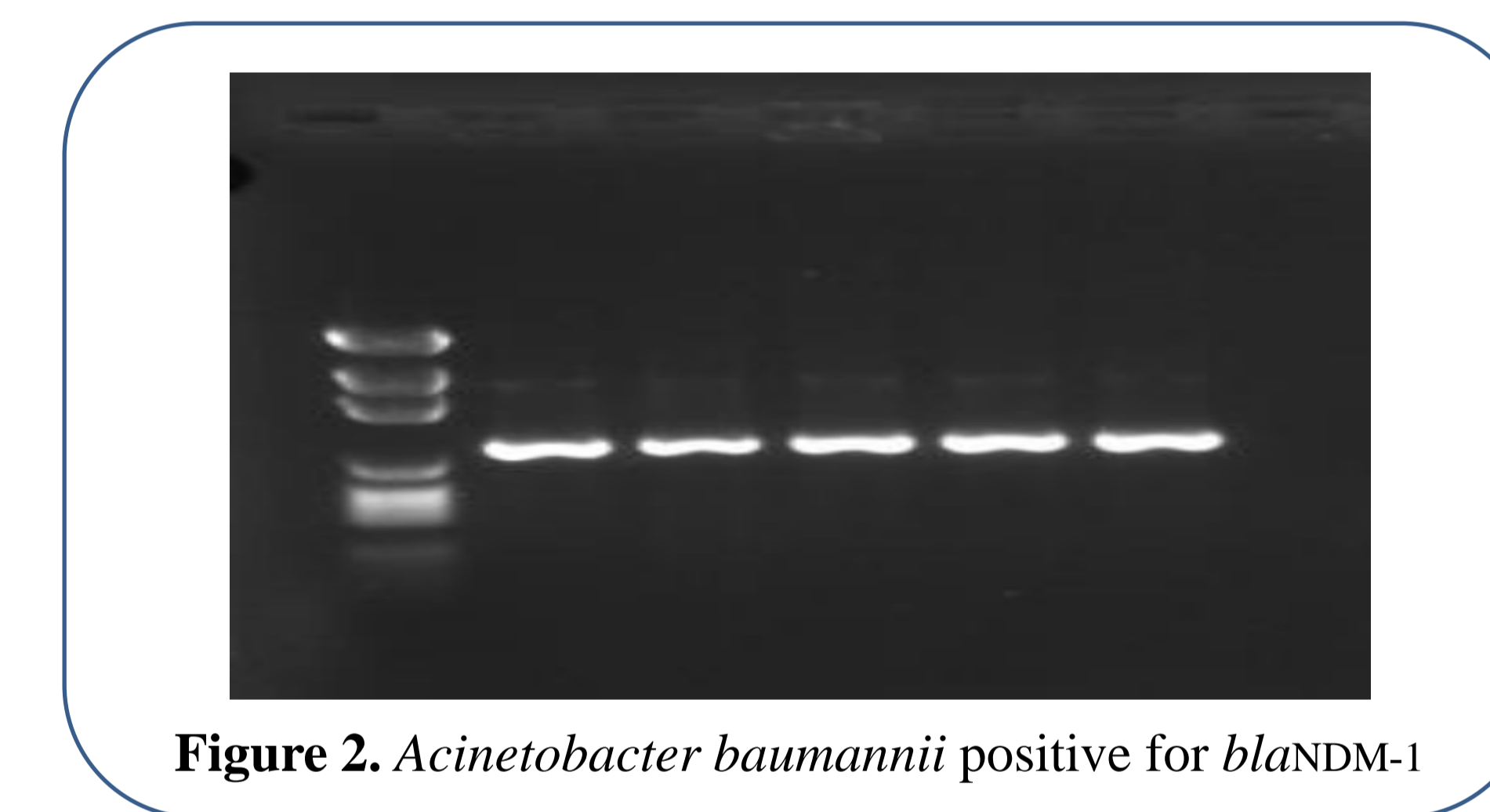


Figure 2. *Acinetobacter baumannii* positive for *bla*_{NDM-1}

Table 2. Isolates of *Acinetobacter* spp. in relation with the presence of carbapenemase enzymes

Carbapenemases					Hospital location	Species	No. of isolates	Samples
OXA-51	OXA-23	OXA-24	OXA-58	NDM-1				
					Tlemcen	<i>A.baumannii</i>	4	Tracheal aspirate, rectal swab, urine, environment
+	+	+	-	-	Oran	<i>A.baumannii</i>	1	Tracheal aspirate
					Sidi Bel Abbes	-	0	-
					Tlemcen	<i>A.baumannii</i>	27	Tracheal aspirate, rectal swab, urine, wound environment
+	+	-	-	-	Oran	<i>A.baumannii</i> (n=6) <i>A.nosocomialis</i> (n=1)	7	wound, Tracheal aspirate
					Sidi Bel Abbes	<i>A.baumannii</i>	1	wound, environment
					Tlemcen	-	0	-
+	-	+	-	-	Oran	<i>A.baumannii</i>	10	Urine, Tracheal aspirate
					Sidi Bel Abbes	<i>A.baumannii</i> (n=1) <i>A.radioresistans</i> (n=1)	2	Tracheal aspirate
					Tlemcen	<i>A.baumannii</i> (n=13) <i>A.pittii</i> (n=1)	14	Tracheal aspirate, environment, urine
+	-	-	-	-	Oran	<i>A.baumannii</i> (n=8) <i>A.pittii</i> (n=1)	9	Tracheal aspirate, urine
					Sidi Bel Abbes	<i>A.baumannii</i> (n=5) <i>A.pittii</i> (n=1)	6	Tracheal aspirate
					Tlemcen	-	0	-
+	-	-	-	+	Oran	<i>A.baumannii</i>	5	Urine
					Sidi Bel Abbes	-	0	-
					Tlemcen	-	0	-
-	-	-	-	-	Oran	<i>A.nosocomialis</i>	1	Urine
					Sidi Bel Abbes	<i>A.pittii</i>	1	wound

Conclusion

The spread of NDM-1 positive *A. baumannii* strains isolated in the hospital setting reemphasizes the need of strict adherence to surveillance programmes in order to prevent the colonization, the infection and the dissemination of this gene worldwide.

References

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