

2. Nolte KB, Simpson GL, Parrish RG. Emerging infectious agents and the forensic pathologist: the New Mexico model. *Arch Pathol Lab Med*. 1996;120:125–8.
3. Sampson BA, Ambrosi C, Charlot A, Reiber K, Veress JF, Armbrustmacher V. The pathology of human West Nile Virus infection. *Hum Pathol*. 2000;31:527–31. <http://dx.doi.org/10.1053/hp.2000.8047>
4. Zaki SR, Greer PW, Coffield LM, Goldsmith CS, Nolte KB, Foucar K, et al. Hantavirus pulmonary syndrome. Pathogenesis of an emerging infectious disease. *Am J Pathol*. 1995;146:552–79.
5. Nolte KB, Fischer M, Reagan S, Lynfield R; Members of the National Association of Medical Examiners Ad Hoc Committee for Bioterrorism and Infectious Disease. Guidelines to implement medical examiner/coroner-based surveillance for fatal infectious diseases and bioterrorism (“Med-X”). *Am J Forensic Med Pathol*. 2010;31:308–12. <http://dx.doi.org/10.1097/PAF.0b013e3181c187b5>
6. National Research Council of the National Academies. Strengthening forensic science in the United States: a path forward. Washington (DC): The National Academies Press; 2009. p. 241–268.
7. National Association of Medical Examiners inspection and accreditation checklist, 2nd revision. 2009 Sept [cited 2013 Feb 5]. <https://netforum.avectra.com/temp/ClientImages/NAME/069196e4-6f95-437c-a2be-47649a70685e.pdf>

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## **Multidrug-Resistant Acinetobacter baumannii Clone, France**

**To the Editor:** *Acinetobacter baumannii* is an opportunistic pathogen that is a source of nosocomial infections, mostly pneumonia (1). Treatment of infections caused by *A. baumannii* is becoming a serious clinical concern as this microorganism becomes increasingly resistant

to multiple antimicrobial drugs (2). *A. baumannii* resistance to carbapenems is mostly associated with production of carbapenem-hydrolyzing class D  $\beta$ -lactamases and metallo- $\beta$ -lactamases (2). New Delhi metallo- $\beta$ -lactamase 1 (NDM-1) is one of the most recently discovered metallo- $\beta$ -lactamases among various gram-negative species, including *A. baumannii* (3). We recently reported the recovery of NDM-1-producing *A. baumannii* isolates throughout Europe (4). In that study, the genetic background of several strains was identified and corresponded to sequence types (STs) 1, 25 and 85. The ST85 clone was isolated in France from 2 patients previously hospitalized in Algeria (4,5).

The present study was initiated by the recent isolation of 6 more NDM-1-producing *A. baumannii* linked with North Africa. To determine the extent of spread of this organism from Africa to France, we genetically analyzed 8 other NDM-1-producing *A. baumannii* isolates collected from different towns in France during 2011–2012. Of these 8 isolates, 6 were from patients previously hospitalized in different cities in Algeria (including Algiers, Setif, Constantine, and Tlemcen), 1 from a patient previously hospitalized in Tunisia, and 1 from a patient previously hospitalized in Egypt. These 8 isolates came from 2 clinical samples (blood cultures and wound) from 6 screening rectal swab samples collected at the time of hospital admission (online Technical Appendix, [wwwnc.cdc.gov/EID/article/19/5/12-1618-Techapp1.pdf](http://wwwnc.cdc.gov/EID/article/19/5/12-1618-Techapp1.pdf)). Because the 8 samples were recovered from 5 hospitals, nosocomial acquisition can be ruled out.

The isolates were identified by 16S rRNA gene sequencing. Susceptibility testing was performed by disk diffusion (Sanofi-Diagnostic Pasteur, Marnes La Coquette, France) and interpreted according to updated Clinical and Laboratory Standards Institute guidelines (6). The MICs

of  $\beta$ -lactams (imipenem, meropenem and doripenem) were determined by the Etest technique (AB bioMérieux, Solna, Sweden) according to the manufacturer’s recommendations. All isolates were resistant to  $\beta$ -lactams, including all carbapenems (MICs >32mg/L). The isolates were also resistant to fluoroquinolones, gentamicin, sulfonamides, and chloramphenicol but susceptible to amikacin, netilmicin, rifampin, tetracycline, and tigecycline according to Clinical and Laboratory Standards Institute guidelines (6) and colistin according to European Committee on Antimicrobial Susceptibility Testing guidelines ([www.eucast.org/fileadmin/src/media/PDFs/EUCAST\\_files/Disk\\_test\\_documents/EUCAST\\_breakpoints\\_v1.3.pdf](http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Disk_test_documents/EUCAST_breakpoints_v1.3.pdf)).

The production of metallo- $\beta$ -lactamases was suspected by use of a combined disk test, based on the inhibition of the metallo- $\beta$ -lactamase activity by EDTA as described (4). All isolates were positive for production of metallo- $\beta$ -lactamases.

For all 8 isolates, PCRs aimed at detecting carbapenemase genes, using primers described elsewhere (7), followed by sequencing, led to identification of the *bla*<sub>NDM-1</sub> gene. The isolates also carried a naturally-occurring *bla*<sub>OXA-51</sub>-like gene, namely *bla*<sub>OXA-94</sub> (online Technical Appendix). The *bla*<sub>OXA-51-like</sub>  $\beta$ -lactamase confers a low level of resistance to carbapenems.

Genotypic comparison was performed by multilocus sequence typing as described (8) and by repetitive extragenic palindromic sequence-based PCR by using the DiversiLab system (bioMérieux, La Balme-les-Grottes, France) according to the manufacturer’s instructions. The genomic pattern of all isolates was identical (Figure). Further multilocus sequence typing indicated that all isolates belonged to ST85. This ST was identified in Greece during a nationwide study that focused on carbapenem resistance in clinical isolates of *A. baumannii* and

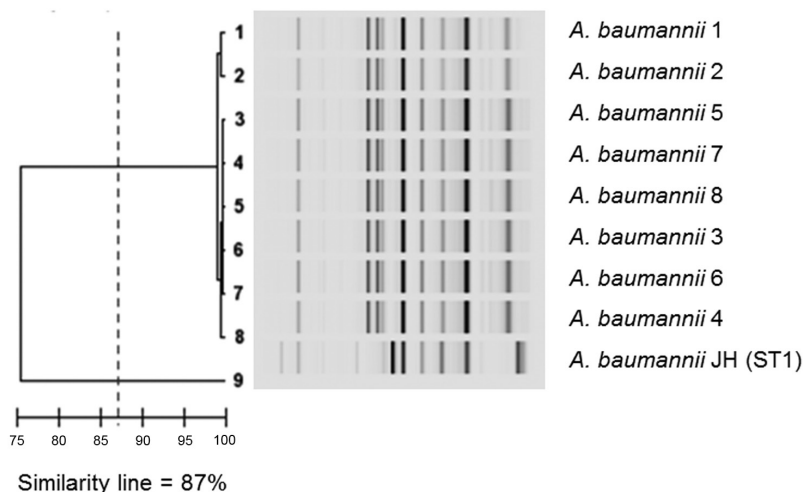


Figure. Results of Diversilab system (bioMérieux, La Balme-les-Grottes, France) analysis of *Acinetobacter baumannii* isolates. Similarity line shows the cutoff that separates the different clones.

identified mainly carbapenem-hydrolyzing carbapenemase OXA-58 (9).

Recently, we showed that the *bla*<sub>NDM-1</sub> gene was carried by a composite transposon bracketed by 2 copies of *ISAbal25* in *A. baumannii* (10). Cloning and sequencing of the genetic context of the *bla*<sub>NDM-1</sub> in the first isolate showed that transposon *Tn125* was truncated at its 3'-end extremity by insertion sequence *ISAbal4*, giving rise to a truncated *Tn125* ( $\Delta$ *Tn125*). PCR mapping of all isolates showed that they possessed this truncated isoform of *Tn125*, which was therefore probably no longer functional.

The identification of several clinical *A. baumannii* isolates that possessed the *bla*<sub>NDM-1</sub> gene and originated from North Africa, with no obvious link to the Indian subcontinent, strongly suggests that 1 NDM-producing *A. baumannii* clone is probably widespread in North Africa and that it might now act as a reservoir for NDM-1. This finding might indicate that control of spread of multidrug-resistant *A. baumannii* would have a primary role in controlling spread of NDM-1.

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#### References

1. Peleg AY, Seifert H, Paterson DL. *Acinetobacter baumannii*: emergence of a successful pathogen. Clin Microbiol Rev. 2008;21:538–82. <http://dx.doi.org/10.1128/CMR.00058-07>
2. Poirel L, Bonnin RA, Nordmann P. Genetic basis of antibiotic resistance in pathogenic *Acinetobacter* species. IUBMB Life. 2011;63:1061–7. <http://dx.doi.org/10.1002/iub.532>
3. Nordmann P, Poirel L, Walsh TR, Livermore DM. The emerging NDM carbapenemases. Trends Microbiol. 2011;19:588–95. <http://dx.doi.org/10.1016/j.tim.2011.09.005>
4. Bonnin RA, Poirel L, Naas T, Pirs M, Seme K, Schrenzel J, et al. Dissemination of New Delhi metallo- $\beta$ -lactamase-1-producing *Acinetobacter baumannii* in Europe. Clin Microbiol Infect. 2012;18:E362–5. <http://dx.doi.org/10.1111/j.1469-0691.2012.03928.x>
5. Boulanger A, Naas T, Fortineau N, Figueiredo S, Nordmann P. NDM-1-producing *Acinetobacter baumannii* from Algeria. Antimicrob Agents Chemother. 2012;56:2214–5. <http://dx.doi.org/10.1128/AAC.05653-11>
6. Clinical Laboratory Standards Institute. Performance standards for antimicrobial susceptibility testing. M100–S22. Wayne (PA): The Institute; 2012.
7. Bonnin RA, Rotimi V, Al Hubail M, Gasiorowski E, Al Sweih N, Nordmann P, et al. Wide dissemination of GES-type carbapenemases in *Acinetobacter baumannii* in Kuwait. Antimicrob Agents Chemother. 2013;57:183–8. <http://dx.doi.org/10.1128/AAC.01384-12>
8. Diancourt L, Passet V, Nemeč A, Dijkshoorn L, Brisse S. The population structure of *Acinetobacter baumannii*: expanding multiresistant clones from an ancestral susceptible genetic pool. PLoS ONE. 2010;5:e10034. <http://dx.doi.org/10.1371/journal.pone.0010034>
9. Gogou V, Pourmaras S, Giannouli M, Voulgari E, Piperaki ET, Zarrilli R, et al. Evolution of multidrug-resistant *Acinetobacter baumannii* clonal lineages: a 10-year study in Greece (2000–09). J Antimicrob Chemother. 2011;66:2767–72. <http://dx.doi.org/10.1093/jac/dkr390>
10. Poirel L, Bonnin RA, Boulanger A, Schrenzel J, Kaase M, Nordmann P. *Tn125*-related acquisition of *bla*<sub>NDM</sub>-like genes in *Acinetobacter baumannii*. Antimicrob Agents Chemother. 2012;56:1087–9. <http://dx.doi.org/10.1128/AAC.05620-11>

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## Genomic Analysis of *Salmonella enterica* Serovar Typhimurium Definitive Phage Type 104

**To the Editor:** *Salmonella enterica* is among the leading causes of foodborne diseases worldwide. Multidrug-resistant *S. enterica* serovar Typhimurium definitive phage type (DT) 104 emerged during the early 1990s in the United Kingdom and spread worldwide thereafter (1). This phage-type strain harbors a chromosomally encoded genomic island, *Salmonella* Genomic Island 1, which is typically responsible for resistance to ampicillin, chloramphenicol,

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## Technical Appendix

Technical Appendix Table. Clinical features of New Delhi metallo- $\beta$ -lactamase-producing *Acinetobacter baumannii*

Isolate	Origin of patient	Date of isolation	Specimen
1 (Ora-1)	Oran, Algeria	2011 Jul	Rectal swab and blood culture
2 (StN)	Constantine, Algeria	2011 Aug	Rectal swab
3 (112)	Tlemcen, Algeria	2011 Dec	Wound
4 (HAM)	Unknown, Algeria	2012 Apr	Rectal swab
5 (AYA)	Setif, Algeria	2012 Sep	Rectal swab
6 (BOU)	Unknown, Tunisia	2012 Aug	Rectal swab
7 (BER)	Alger, Algeria	2012 Sep	Rectal swab
8 (ABO)	Gizeh, Egypt	2012 Sep	Blood culture