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New superbugs resist nearly all antibiotics

Multidrug-resistance gene is spreading among several species of bacteria in India and the UK



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A new antibiotic resistance gene has become widespread in several species of bacteria in India, Pakistan, and the UK. Bacteria with the gene are resistant to nearly all classes of antibiotics, reports an international team of scientists today in *The Lancet Infectious Diseases*.¹

The bacteria appear to have been brought into the UK and other European countries by patients who travelled to India for medical procedures including cosmetic surgery.

The gene has the potential to spread worldwide, in part because of the growth in 'medical tourism,' writes Johann Pitout, of the University of Calgary, Canada, in an associated editorial.² "Patients who have had medical procedures in India should be actively screened for multiresistant bacteria before they receive medical care in their home country," he stresses.

One of the strains studied in the research was "truly pan-resistant" — resistant *in vitro* to all available classes of antibiotics, write the researchers, led by Karthikeyan Kumarasamy, of the University of Madras, Chennai, India. This finding "could herald a period in which antibiotics become redundant," according to a press release by *The Lancet*.

The resistance gene, known as New Delhi metallo- β -lactamase 1 (NDM-1), encodes a protein that breaks down a broad range of antibiotics including carbapenems, regarded as one of the drugs in the last line of defence against multidrug-resistant gram-negative bacteria (a large and diverse group of bacteria that includes pathogens such as *Escherichia coli*, *Salmonella*, and *Legionella*).

Because the gene is carried on plasmids — small genetic elements that can be transferred from one bacterium to another — it can spread among unrelated species of bacteria.

The emergence of the gene is of particular concern because there are few new antibiotics in the pipeline designed to treat gram-negative infections, and none that will be active against bacteria with the NDM-1 gene, the authors point out.

To determine the extent to which NDM-1 had spread among different species of bacteria in India, the researchers collected 3521 isolates from patients with bacterial infections in Chennai. After testing them for resistance to carbapenem and for the presence of NDM-1, they found that 141 of the isolates were carbapenem-resistant, and 44 of these had the NDM-1 gene.

In the UK, Kumarasamy and colleagues collected 37 isolates carrying the NDM-1 gene from 29 patients. Seventeen of these patients had a history of travel to India or Pakistan, and 14 had been treated in hospital in these countries.

The bacteria isolated from both countries were genetically diverse and included various strains of *E. coli*, *Klebsiella pneumoniae*, and *Enterobacter cloacae*, among other species. The researchers allowed the isolates with the NDM-1 gene to pass the plasmid on to *E. Coli* bacteria *in vitro*. Most isolates were able to pass the plasmid on to *E. coli*, and, in about 10% of cases, the plasmid changed in size when it was transferred. This suggests that the plasmids containing NDM-1 spread easily between bacteria of different species, mutating as they go, the authors say. "This transmissibility and plasticity implies an alarming potential to spread and diversify among bacterial populations."

Most worrying of all, say the researchers, is that the bacteria isolated in India were mainly community-acquired strains, indicating that the resistance gene is widespread outside hospitals. They blame extensive non-prescription use of antibiotics in India for contributing to the high prevalence of carbapenem resistance.

"The potential for wider international spread of [NDM-1] producers and for NDM-1-encoding plasmids to become endemic worldwide, are clear and frightening," conclude Kumarasamy *et al*.

Reference and links

1. Kumarasamy KK, Toleman MA, Walsh TR, Bagaria J, Butt F, Balakrishnan R, *et al*. Emergence of a new antibiotic resistance mechanism in India, Pakistan, and the UK: a molecular, biological, and epidemiological study. *Lancet Infect Dis* 2010. doi: [10.1016/S1473-3099\(10\)70143-2](https://doi.org/10.1016/S1473-3099(10)70143-2)
2. Pitout JDD. The latest threat in the war on antimicrobial resistance. *Lancet Infect Dis* 2010. doi: [10.1016/S1473-3099\(10\)70168-7](https://doi.org/10.1016/S1473-3099(10)70168-7)

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