Mcr-1 gene seen in K. pneumoniae bacteria

First reported in 2015, the gene had spread to all continents by 2017, says Kashi Nath Prasad (left).

Increased prevalence of mcr-1 gene that confers multidrug-resistance has now been reported in *Klebsiella pneumoniae* bacteria, increasing the fear of infection by pan drug-resistant bugs. This gene endows resistance against last hope antibiotic — colistin. A study published in *Antimicrobial Agents and Chemotherapy* found that about 10% of the *K. pneumoniae* bacteria studied were resistant to colistin.

During January–February 2016, a total of 200 *K. pneumoniae* isolates from pus, blood, sputum, and urine were studied. Of this, 21 were resistant to colistin, and further screening revealed that four harboured mcr-1 gene.

“This gene was first reported in December 2015 in *E. coli* isolated from chicken in China, and by 2017 it had spread to all continents and [is] seen in bacteria isolated from humans, chicken and environment,” says Prof. Kashi Nath Prasad from the Department of Microbiology at Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, and the corresponding author of the work. “Evidence suggests that the overuse of colistin in farm animals has given rise to the emergence of mcr-1 gene. Since this gene is present on a mobile genetic element (plasmid) of bacteria such as *E. coli* and *K. pneumoniae,* the frequency of transmission to other bacteria is likely to be very high.”

Molecular studies revealed that one particular isolate carried mcr-1 gene and blaNDM-1 gene. “The blaNDM-1 encodes for a protein that gives resistance to all beta-lactam antibiotics. This shows that the particular isolate was resistant to carbapenems, third-generation cephalosporins, aminoglycosides and fluoroquinolones (ciprofloxacin, levofloxacin) making the treatment very difficult,” says Sanjay Singh, research scholar at the institute and first author of the work.

Evolved gene

Interestingly, mcr-1 gene was seen in the chromosomal DNA of the bacteria. “The mcr-1 gene is usually found in the plasmid (small DNA in the cytoplasm) and the resistance gene is transmitted among different species. But now we have found this gene in the chromosome showing that it has evolved and stabilised. Whole genome sequence studies are needed to understand the exact location of this gene to decode how they are transmitted from one bacterial species to another,” adds Mr Singh. “The presence of the gene in the chromosome also means that Indian population may be harbouring mcr-1 gene for a longer period of time and it remained undetected.”

Further studies by the group also found that mcr-1 gene was more prevalent in *K. pneumoniae* than *E. coli,* which is in stark contrast to findings from other countries. While less than 1% of the *E. coli* studied was resistant to colistin, it was about 10% in the case of *K. pneumoniae.* More studies are needed to understand this contrasting behaviour. The team is also looking for this gene in other bacteria causing human infection and its mode of dissemination.

“As such K. pneumoniae is considered more notorious and difficult to treat bacterium; hence emergence of mcr-1 gene in this bacterium is a major health-care threat. Adequate measures like total ban on colistin use in veterinary practices as growth promoter and its judicious use in human medicine may prevent the emergence and dissemination of this resistance gene among the bacteria. Preservation of the efficacy of colistin is the need of the hour to treat patients who are infected and likely to be infected by multidrug resistant bacteria,” adds Dr. Prasad in an email to

The Hindu.

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