

## Cholera Epidemic in and Around Kolkata, India: Endemicity and Management

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Cholera, an acute diarrhoeal illness caused by toxigenic strains of *Vibrio cholerae* serogroups O1 and O139, has the potential to appear in explosive outbreak, epidemic and even pandemic. In 1849, the British physician John Snow (1813-1858) explained the association of a cholera outbreak in London with contamination of the drinking water supply by human excreta. Later, in 1854, Filippo Pacini (1812-1883), an anatomist from Italy, and in 1883, Robert Koch (1843-1910) the German bacteriologist, discovered *vibrio cholerae* as the responsible microbial agent for cholera.

Since 1817, the world has already faced six pandemics of cholera, and the seventh one that began in 1961 is in progress and has affected greatly the Indian subcontinent along with almost the whole world.<sup>1,2</sup> Nevertheless, cholera is an under-recognized problem in India; its endemicity in the country has been evidenced since the ancient times,<sup>3</sup> and the Kolkata city of the West Bengal state located in the Gangetic delta has been hailed as the “homeland of cholera,” with regular outbreaks and pronounced seasonality.<sup>4-9</sup> India, where the disease is endemic, cholera outbreaks occur every year in between dry (March-April) and rainy (September-October) seasons. A high population density, along with unsafe drinking water, open drains and poor sanitation provide optimal niche for survival, sustenance and transmission of *V. cholerae* in this part of the globe.

At the beginning of the 21st century, cholera remains an epidemic or endemic disease in much of the world, and many developing countries still endure frequent outbreaks due to the lack of basic sanitation services and clean water, though in order to manage outbreaks WHO recommended emergency interventions, including excreta disposal, sanitary measures and water quality monitoring.<sup>10,11</sup> India, which comprises 28 states and 7 union territories, has a total population of 1.15 billion people, and approximately two thirds of the population live in rural areas, where only 28% use piped drinking water and 26% access to good sanitation.<sup>12</sup> The oral-faecal route of transmission of *V. cholerae* is linked to the lack of safe drinking water and sanitation facilities for people living under low socio-economic conditions; hence, the Indian sub-continent has been the epi-centre for cholera,

which continues to be an important public health problem in the country, and Kolkata (a metropolitan city in India) is plagued by the reoccurrence of cholera outbreaks<sup>8,9,13</sup>; also, the dense and large slum population facilitated the cholera outbreaks.<sup>8,9,13</sup>

In Kolkata, as in other parts of the globe, cholera is changing epidemiologically. The city faced several outbreaks of cholera due to *V. cholerae* strains belonging to both the serogroups O1 and O139, and the biotypes, classical and El Tor of O1 serogroup. Strains of classical biotype, the reason for the past six pandemics, are suggested to be more toxigenic than El Tor strains.<sup>14</sup> There are evidences of spread of El Tor strains harboring classical cholera toxin (CT) gene,<sup>15-17</sup> and the replacement of the seventh pandemic El Tor strains by the classical CT producing El Tor strains as well.<sup>15,18,19</sup> Moreover, of the two biotypes, El Tor strains have better adaptability to survive in the environment and in the human host,<sup>20</sup> and currently, the classical biotype is believed to be extinct.<sup>18,21</sup> However, the fact mentioned above has been taken as the evolutionary optimization of El Tor biotype, which could represent a new and more significant emerging form of the El Tor biotype of *V. cholerae*. Plus, the constant changes in the characteristics of the toxigenic *V. cholerae*, in the serotypes predominating in outbreaks, may be a survival advantage to the strains in the wake of host with less susceptibility to the pathogen, and this has been evidenced by the fact that the *V. cholerae* O1 strains as have been demonstrated to interconvert and to undergo serotype switching between Ogawa and Inaba.<sup>22</sup> The problem has been compounded by the recent emergence of multidrug resistant *V. cholerae* strains, which limit the therapeutic potential of the drugs, and the overall evolution of antibiotic resistance sometimes attributed to R-plasmid,<sup>9,23</sup> mainly because of the selective forces imposed due to the overuse of antibiotics.

As is true for other bacterial diseases transmitted via faecal-oral route, an adequate supply of potable water, improved sanitation and promotion of good hygienic practices, mainly in developing countries like India, remain the mainstay for preventing both endemic and epidemic cholera. Also, vaccination against cholera has been recommended as an attractive additional tool to combat the disease in endemic areas.<sup>24</sup> But, new epidemic strains are likely to develop, evolve, and spread, and thus *V. cholerae* cannot be eradicated; it is a part of the normal flora and ecology of the surface water of this planet, where we have to learn to coexist with the *V. cholerae*. However, continued monitoring and surveillance of all cholera outbreaks becomes a necessity, in order to check the

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changing trends of antimicrobial resistance patterns among *V. cholerae* strains, and vigilance of R-plasmid is a must to combat drug resistance by preparing proper antibiotic treatment regimen for severe cholera cases.<sup>9,25</sup>

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