Bubonic Plague: a Brief History of Changes to Current Situation in Brazil

PERSPECTIVE

Jucier Gonçalves Júnior¹,
Maria do Socorro Vieira dos Santos^{2,3,4},
João Vitor Cândido Pimentel¹,
Cláudio Gleidiston Lima da Silva^{2,3,4}

- 1 Medical Students, Federal University of Cariri, Barbalha, Ceara, Brazil.
- 2 Faculty of Medicine, Federal University of Cariri, Barbalha, Ceara, Brazil.
- 3 Faculty of Medicine of ABC, Santo André, São Paulo, Brazil.
- 4 Scientific Writing Lab (LABESCI) –Faculty of Medicine, Federal University of Cariri– UFCA

Abstract

Plague is a globally distributed, zoonotic disease caused by the bacterium *Yersinia pestis*. With recurrent epidemics since the Antique, the plague ravaged the population, producing demographic, political, cultural and religious incommensurable effects. Since 1894 in Brazil, the Plague began to get closer to the federal capital through the intense commercial trading. First the Porto city, in Portugal, was attacked by the disease, after that, some neighbors' countries of the South America, like Paraguay and Argentina, and, finally, Santos, in São Paulo coast, where, for the first time in history, the disease landed in national field, in October of 1899. Data registered since 1935 reveal that the period of most intensity in the occurrence of the disease prior the 70's, declining sooner after that, verifying isolated epidemics in the 1970s, in Bahia, and 1980s, in the states of Ceará and Paraíba. Since that time, all of the foci entered a period of relative inactivity, with few or no human cases. Despite the apparent control of the Plague, the reduction or discontinuity of the vigilance, the poverty, insalubrity, frequent and out of control deforestations, urbanization, and the climate changes that alters the rodents and fleas habitat causing disequilibrium in epidemiological chain, can become influence factors in the resurgent of cases in humans.

Contact information:

Maria do Socorro Vieira dos Santos.

✉ socorro.vieira@ufca.edu.br

Keywords

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Plague is a globally distributed, zoonotic disease caused by the bacterium *Yersinia pestis* [1, 2]. It is hosted by small mammals (mainly rodents) and vectored through bites from infected fleas [3]. Owing to a well-documented history of deadly pandemics that almost disrupted human civilization over the last 1,500 years, plague is often mistaken as a disease of antiquity. Contrary to this view, plague is still a major

public health concern with widespread epidemics and isolated cases occurring in many countries of the world [4].

The *Y. pestis* is a member of the family Enterobacteriaceae, which is visualized in optic microscopy as a small Gram-negative bacillus, small, ovoid (0,5 to 0,8 μm of diameter and from 1 to 3 μm of length), with more accentuated coloration on the extremities (bipolar coloration), does not form spores, it is aerobic or facultative anaerobic, grows well in usual means at 28°C and pH between 5 and 9. It is resistant to cold, conserving itself for a long time in cadavers and also in the exudate of fleas [5].

Y. pestis is a recently evolved descendent of the soil-dwelling bacillus *Yersinia pseudotuberculosis*, which in the course of its evolution acquired two additional plasmids (pMT1 and pPCP1) that provide it with specialized mechanisms for infiltrating mammalian hosts [6]. Thus, *Y. pestis*, a non-motile bacterium, first disseminates from the inoculation site (IS) into the draining lymph node (LN) after inoculation in the skin [7]. The incubation period varies from 1 to 6 days [8]. Colonization of the LN is then followed by bacterial escape into the bloodstream, resulting in septic shock and death [9]. This pathogen has several means of minimizing immune activation, with the effect that bacterial replication can proceed with minimal interference by the immune system. As a result, plague is often characterized by very high bacterial numbers in patient sera and organs [10].

The major clinical forms of plague are bubonic, pneumonic, and septic [11]. The signals and symptoms include fever, chills, general malaise, buboes (in case of bubonic form), may evolve to septicemia, meningitis, hemorrhages, disseminate intravascular coagulation, shock and, not rarely, death. It can occur, still, lung infection (pneumonic form of the disease), with severe respiratory condition, fever, dyspnea, also leading to death [8].

With recurrent epidemics since the Antique, the plague ravaged the population, producing demo-

graphic, political, cultural and religious incommensurable effects [12]. Its first registers are like the "Justinian Plague" (name of the byzantine emperor of the time), having its possible origin in 532 a. C. in North of the Africa. Spread along Nile River, through the merchant route, reaching through Mediterranean Sea the city of Constantinople (Istanbul nowadays) and the Greece in final of 541 and begin of 542, beginning the pandemic that reached the north of the Africa, the Europe, Arabia and the regions of central and south Asia. It is estimated that about a half of the Byzantine Empire population was annihilated by the disease [13].

The Black Plague became famous for the devastation of more than a third of the European population between 1347 and 1353, somewhat like 25 million people (in Asia, the numbers vary from 40 to 60 million) [14]. And the nineteenth century Europeans and Americans were already used to periodical surges of plague, yellow fever and smallpox [15]. Today, in Latin America, human cases and natural foci are present in Bolivia, Brazil, Ecuador, and Peru [16].

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In 1900, the first case was related in Fortaleza, Ceará capital (Brazilian Northeast) [13]. Only in the Brazilian federal capital, Brasília, in 1900 and 1901, about five hundred individuals died. Besides of this, the Plague, which has already reached several cities of the São Paulo State, spread to others areas of the country, like São Luís of Maranhão, Porto Alegre, Recife and other cities of Rio de Janeiro state [18]. Later, between 1906 and 1907, the Plague continued to spread, establishing itself in natural focus of Northeast of Brazilian territory [13].

Data registered since 1935 reveal that the period of most intensity in the occurrence of the disease prior the 70's, declining sooner after that, verifying isolated epidemics in the 1970s, in Bahia, and 1980s, in the states of Ceará and Paraíba. Since that time, all of the foci entered a period of relative inactivity, with few or no human cases [17], concentrated in Bahia, being the last register, in this state, in Feira de Santana city, in 2000. After a silent period of four years, the Ceará registered the last case of the country in Pedra Branca city, in 2005 [19]. Recently published study analyzed the endemic regions to the Plague and found that fifteen out of around 580 regions (first level of the political/administrative divisions) in Latin America, or about 2.3%, show documented presence of human plague cases. Evidence of plague was found in six out of 27 regions in Brazil (Bahia, Ceara, Minas Gerais, Paraíba, Pernambuco, Rio Grande do Norte) [16].

In this context, despite the apparent control of the Plague, the reduction or discontinuity of the vigilance, the poverty, insalubrity, frequent and out of control deforestations, urbanization, and the climate changes that alters the rodents and fleas habitat causing disequilibrium in epidemiological chain, can become influence factors in the resurgent of cases in humans. Becomes necessary, therefore, the professional capacity to the premature identification of the symptoms, the social and environmental vulnerabilities and the susceptibility to the Plague, in order to provide clarification to general population about symptoms and control measures, involving the theme of infectious diseases, the biosecurity, and the biological security, promoting not only the protection of the involved professionals, but also containing the propagation of the disease and the environmental contamination.

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