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Original Article

A Historical Report of Plague Outbreak in Northwestern Iran, 1966

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Plague is an endemic disease to the west of Iran and has frequently stricken this area over the last decades. In 1954, Pasteur Institute of Iran established a research station in the west of the country and since then has monitored the plague outbreaks as well as the disease status in rodents and carnivores by dispatching research teams to different villages and localities. We noticed that there were some valuable data from the past with no records in Journals, among them, a report of a plague outbreak in Seyed Abad village, West Azerbaijan province in 1966. During this 41-day outbreak, 22 people acquired the infection, and 11 died. Fever and buboes were the most predominant clinical symptoms in the patients. The causative agent *Yersinia pestis* was identified by examination of biopsies from lymph nodes, bacteriological tests, and inoculation of guinea pigs. The bubonic form of the disease and the epidemiological data suggested that the disease might have been transmitted to humans through the infective-bite of the fleas of the wild animals mainly rodents living in the vicinity of the homes of Seyed Abad village. *J Med Microbiol Infec Dis, 2018, 6 (1): 20-24.*

Keywords: Plague, Outbreak, West Azerbaijan province, Iran.

INTRODUCTION

Human plague is a deadly zoonotic disease caused by the bacteria *Yersinia pestis*. The bacteria was first discovered in 1894 by Alexandre Yersin [1, 2]. More than 200 mammalian species from 73 genera have been found naturally infected with this bacterium, among them the rodents are the primary hosts [3, 4].

The disease is transmitted via the infective bite of fleas between rodents, to other animals, and humans. Aerosol transmission and consumption of the infected meat are other routes of human infection [5]. Adult fleas are hematophagous ectoparasites of rodents and other wild animals and pets such as cats and dogs. The proximity of these animals to human societies especially in rural areas is linked with the risk of human infection [5, 6]. The members of *Xenopsylla* genus, in particular *X. cheopis, X. astia, and X. brasiliensis* are the primary vectors responsible for transmitting the infection to the humans [7]. Plague is an acute disease of the humans manifesting in three main bubonic, pneumonic, and septicemic forms. A few reports of rare forms such as gastrointestinal plague are also available. In the absence of the appropriate treatment, the case-fatality rate is 40-70% for bubonic cases and nearly 100% for pneumonic cases [8]. According to the International Health Regulations (IHR), the pneumonic form of the disease must be reported to the World Health Organization (WHO) immediately [9].

Historically, there have been three significant world pandemics with devastating mortalities of people across nations and continents. The first pandemic "The Plague of Justinian (541-542)" claimed 100 million peoples' life [10]. This outbreak is thought to have been carried by the infected rats on ships transporting grains from Egypt spreading through the Middle East, the Mediterranean, and Europe [11].

The second pandemic, the Black Death is thought to have originated in the dry plains of Central Asia. It reached to Crimea by 1343, and from there, the flea-infested rats, the regular passengers on the ships spread the disease throughout the Mediterranean and Europe and caused 75 to 200 million deaths in Asia and Europe [12]. The disease recurred intermittently for more than 300 years [10]. The third pandemic of 1894 originated in Yunnan China and then spread to the rest of the world with a death tool of ≈12 million [10, 13].

The natural foci of plague still exist in tropical and subtropical areas of the world including central Asia, western Arabia, the Middle East, central and southern Africa, northwestern India, and north and south America (USA, Bolivia, Brazil, Ecuador, and Peru) [9, 14]. The plague foci are dynamic, changing in response to the factors such as climate, landscape, and rodent population movement [9]. During the 20th century, several Plague outbreaks occurred in Africa, Asia, and America; but since the 1990s, most human cases have been from Africa.

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Between 2010 and 2015, there have been 3248 registered cases worldwide with 584 deaths. Among the countries, Madagascar, the Democratic Republic of Congo and Peru have experienced significant outbreaks [9].

Plague is one of the known ancient diseases in Iran with periodic re-emergence throughout the history. There have been several outbreaks of human plague between 543 to 1966 CE with devastating impacts on the human populations in almost at all part of Iran, especially near the borders in west and east [15].

In 1947, research on plague was initiated in Iran, and by the time Dr. Marcel Baltazard took office as Pasteur Institute of Iran (PII) director, plague investigations had become a significant part of the activities of this Institutes. This plague-educated physician with vast experience from Morocco organized a filed epidemiology team for investigation and control of the outbreaks (Fig. 1) that occurred in Kurdistan, Azerbaijan, and Kermanshah in western Iran [16, 17].

Later, in 1952 a research center was founded by Pasteur Institute of Iran in the Akanlu village, in Kabudar Ahang county close to the border of Kurdistan province. This center has monitored the plague status in the potential foci of Iran by routine examination of rodents, canines, and their fleas. Today it is known as the Research Center for Emerging and Reemerging Infectious Diseases (Fig. 2) [17].

Fig. 1. Dr. Marcel Baltazard looking for the ectoparasites in the soil from a rodent barrow, Kurdistan 1950

Fig. 2. Inauguration of the Plague research Center in Akanlu, Hamadan in 1952 (Left) later changed to Research Centre for Emerging and Reemerging Infectious Diseases (Right)

Between 1966-1967 a research showed that among 14102 rodents in the west of Iran, 66 had *Y. pestis* infection [18]. During the 1947 and 1966, nine plague outbreaks occurred, most in Kurdistan province, and 156 persons died. The human Plague in this area was the last reported outbreak from Iran [18]. Kurdistan province of Iran in the north of the Zagros Mountains is a part of the historical natural foci of plague that extends to southern Turkey, northern Iraq and Syria [13].

This paper reports one of the last plague outbreaks in northwestern Iran in 1966. The data of this outbreak is reflected in the notebook reports of the investigation team of Pasteur Institute of Iran (Fig. 3). We noticed that there was no record of this outbreak in scientific journals. This article aimed to review the data of that outbreak and make the information available to the peers. We hope that this report shed more lights on the past status of the plague in Iran.

Outbreak report

The outbreak occurred in Seyed Abad village, 12 kilometers from southwest of Bukan city, south of Uremia Lake in West Azerbaijan province, (Fig. 4).

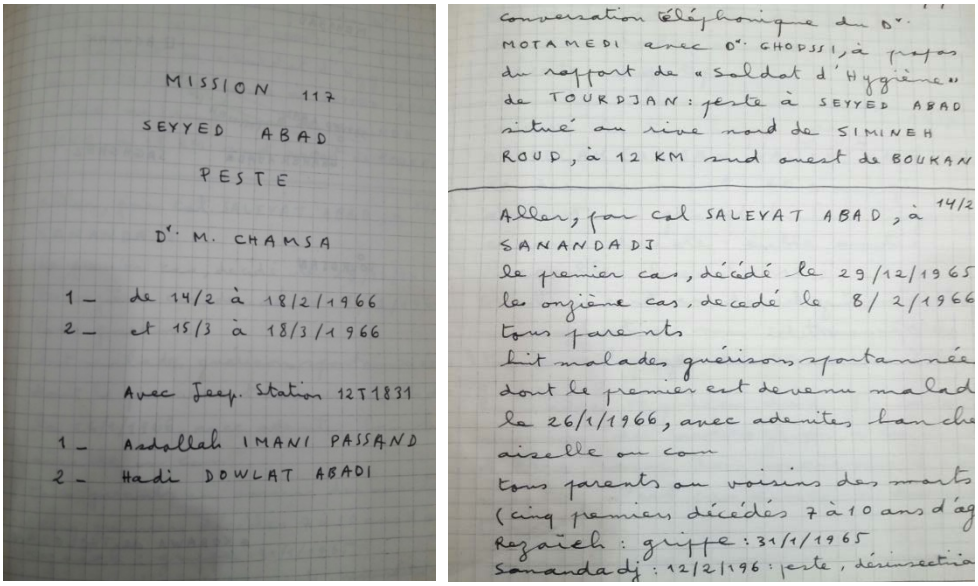

Fig. 3. The original notes on the Seyed Abad village plague (in French), West Azarbayjan province, northwestern Iran

Seyed Abad village comprised 28 families then, and the occupations of the people were agriculture and animal husbandry. They also used kept hares and rabbits in their farms for amusement and sometimes for consumption. The disease was reported by the public health team of health and treatment center of the region to Tehran. The patients had a fever, one or more swollen, tender and painful lymph nodes (buboes), headache, chills, and weakness, but fever and buboes were the typical clinical signs. One patient had a ruptured bubo in the axillary lymph node. The outbreak started in early January and lasted until late February 1966. Based on the clinical features and the history of plague in the neighboring regions bubonic plague was suspected. The local physician, Dr. Lighvani, and his colleagues immediately distributed sulfonamides (antibiotic) and Dichlorodiphenyltrichloroethane (DDT) insecticide among people all over the village, and the quarantine was established to isolate the infected individuals and restrict the commute between the villages. After distribution of antibiotic and DDT, the plague research team of Pasteur Institute of Iran was dispatched to the village for further studies. Postmortem investigation was performed by taking specimens from buboes in the inguinal, submandibular, axillary lymph nodes of the dead patients. Also, similar samples from some exhumed victims' bodies were obtained (Fig. 5). Examination of the enlarged lymph nodes smears showed no organism in tissues and no bacteria grew in culture media, but guinea pigs showed allergic reactions in the skin to inoculation of a suspension from the affected lymph nodes. Also, the mice subcutaneously inoculated with a suspension of lymph nodes died after 24 hours. Following the transfer of the samples from dead mice to the culture media, the growth of *Y. pestis* was visualized by the presence of bipolar bacterial cells in the stained smears. All the patients presented only the bubonic form of the plague.

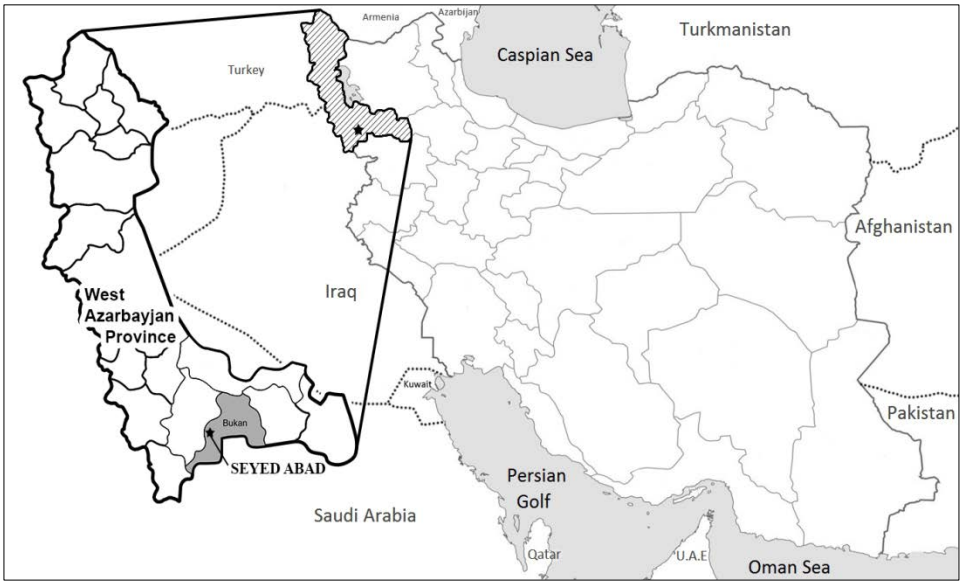

Fig. 4. Map of Iran. The asterisk (*) marks Seyed Abad village in the west Azarbayjan province

Fig. 5. An exhumed plague victim from Seyed Abad village, west Azarbayjan province (1966) that was used for investigation

During the outbreak, 22 individuals acquired the infection, and 11 died. All the victims were relatives or neighbors. The patients' age ranged from 5 to 66 years old all the 11 deaths were among the two to ten-years-old children. Among the survived patients, six had received antibiotics, while the other five received no treatment.

The outbreak started on 29 December 1965 and was controlled after 41 days on 8 February 1966 with the cooperation of Kurdistan public health center and Pasteur Institute of Iran.

DISCUSSION

Here we are reporting the last human plague outbreak from Iran in 1965-1966. Despite infection of 22 individuals and 11 deaths, no previous detail record of this outbreak is available in scientific journals. The previous plague outbreaks in western and northwestern Iran that were controlled by Pasture institute of Iran were in Sameleh and Sarbaghleh, Kurdistan (1947, 56 deaths), Aghbolagh Morshed, Kurdistan (1947, 56 deaths), MazidAbad, Kurdistan (1951, 2 deaths), Gozar-darreh, Kurdistan (in 1952, 45 deaths), Gavmichan, Kermanshah (1952, 8 deaths), ZenalKandi, Western Azerbaijan (1958, 6 deaths), Ghaderabad, Kurdistan (1961, 7 deaths), Sarumal, Kurdistan (1963, 14 deaths) [15, 19]. Three out of the nine plague outbreaks during the last century from 1947 to 1966 in Iran were of the pneumonic type with high mortalities. The rest including the Seyed-Abad outbreak were septicemic and bubonic types [19] with the latter being less deadly and more common and then the other types. The bubonic form is transmitted via flea bite or by exposure to infected materials of open wounds [5].

Distribution of sulfonamides and DDT among people in the village had a critical role in treatment and control of disease in the area. Today, in Iran, DDT is not used for public health purposes due to its potential impact on the environment and human health and has been officially replaced by organophosphates and synthetic pyrethroids [20].

Kurdistan province of Iran remains as one of the significant plague foci in the country. A survey in 2011-2012 exhibited anti-*Y. pestis* antibodies in 1.02% of the rodents and 3.42% of the dogs in this province suggesting an active enzootic cycle of plague in this area and the potential of plague outbreaks in future [21]. Other comprehensive studies in the plague foci especially in western Iran must be performed to monitor infectious status in wild rodents and other animals.

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We honor our deceased colleagues at Pasteur Institute of Iran, Dr. Mansour Shamsa, and the public health team in the region, Dr. Lighvani, Abdollah Imani Passand and Hadi Dowlat Abadi, who investigated, controlled and documented the outbreak. Their memory will stay with us forever.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

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