Epidemiological Situation of Human Plague in Nepal

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Introduction:

Human plague is a zoonotic disease which is also called pest or black death or pestilential fever or zootic plague. Natural foci of this disease is distributed geographically in all continents with the exception of Australia. It is caused by *Yersinia pestis* (*Pasteurella pestis*). There were three large pandemics in the past 2000 years – 100 million people died during the pandemic of 542; and during 1346 pandemic which lasted for three centuries about 25 million deaths occurred and the third pandemic of 1894 lasted until the 1930's. In recent year 1960 – 1967 there have been epidemics in Indonesia, India, Vietnam and Nepal. In Vietnam there were 5274 reported cases due to contact with domestic rats and their fleas. From 1965 to 1974 a total of 4078 cases were reported in Bolivia, Brazil, Ecuador and Peru and a further 51 cases in the United States of America (Acha et al 1980).

Plague has been one of the earliest known human diseases (Krishnaswami 1969). The disease was introduced in India in 1896 and caused 12.5 million deaths during the subsequent period upto 1948. After launching the National Malaria Control Programme in 1953-54 by the introduction of DDT the incidence of plague among human populations declined sharply so much so that it disappeared from most parts of India. In 1962 again 600 cases of plague were reported from Kolar district and later in Madras and Andhra Pradesh. However due to use of HCH during 1967 to 1969 no cases have been reported. (Wattal 1971). Ever since Patel et al (1960) for the first time reported DDT resistance in some species of fleas and susceptible to HCH and dieldrin and Malathion in many parts of India (Saxena et al 1985). Positive serological evidence of enzootic commensal rodent plague was also observed in rural and urban areas of Maharashtra even after apparent absence of human plague for 25 years. (Renapurkar 1981).

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Epidemiology of the Diseases:

Plague is a vectorbone zoonotic disease. *Y. pestis* is primarily an infection of animals of the genus *Rodentia*, affecting both wild rats *Rattus indica*, *Musplatythrix*, *Peromyscus* and domestic rodents *Rattus rattus*, to a lesser extent, lagomorphs. Besides these other mammals like carnivores – dogs, ground squirrel *Citellus becoheyi*, marsupials, microtus (guinipigs), *Citellus spp.* *Cynomys* and *Sylvilagus* are also susceptible and serve as a tink to carry the fleas and infection from one place to another. Two species of rodent fleas viz. *Xenopsylla cheopis* (in domestic rates) and *X. astia* (in wild rodents) are primarily involved in plague epidemics. However, indirect man to man transmission (in a sporadic form) by means of ectoparasites such as *Pulex irritans*, *Ctenocephalides felis* and *Pediculus humanis* has also been observed in very infested environments.

About 230 species or subspecies of wild rodents naturally infected by *Y. Pestis* have been found. Generally, susceptible animals die, but as a result of their bacteremia, they increase the population of infected fleas which bite human and an epizootic can develop in which many rodents die. When the epizootic declines, the infection can remain latent in the enzootic foci for a long periods of time and there is a absence of human cases. But, perhaps the specialists should not be kept quiet because plague is a disease of future. Extensive and intensive rodent flea surveys must be carried out in the previous endemic areas of the country.

There are three clinical forms of human plague distinguished.

- bubonic
- septicemic and
- pneumonic

The common symptoms in these above mentioned three clinical forms are fever, chills, cephalagia, nausea, generalized pains, diarrhoea or constipation, toxemia, shock, arterial hypotension, rapid pulse, restlessness, a staggering walk, slurred speech, mental confusion and prostration. In bubonic plague there is a acute swelling and inflammation of the peripheral lymph nodes (buboes) and mortality rate is 25-60 percent. In septicemic form, the nervous and cerebral symptoms developed very rapidly and mortality rate is 100 percent. In pneumonic form, there is dyspnoea, coughing and expectoration.

Plague Transmission epizootic cycle is as follows:

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(a) Epidemiological Information:

So far no epidemiological survey study on different aspects of human plague is conducted in the country. During the year 1960 - 62 the incidence of plague in Rupandehi and Mahotari districts were recorded. About 150 cases were reported from the two districts. The launching of the Nepal Malaria eradication Programme from the year 1958 in all tarai malarious areas to protect people against DDT, Dieldren and HCH. Consequent to the introduction of DDT the incidence of human plague declined sharply because the vector - fleas population was controlled in all tarai areas and other DDT sprayed pockets.

In 1967 plague outbreak was reported and recorded in Bajhang district, Seti Zone, Far - Western Development Region of the country. There were 26 cases and of which 18 died. On October 31 a first joint team from the Ministry of Health, Ministry of Agriculture, HMG, USAID and WHO including myself, was helicoptered to the village for preliminary epidemiological investigation. On November 9 and 12 Drs. Brachman, LaForce, Kaufmann and Mr. Clapp from CDC, USA joined the previous team and remained there until November 14. Detail epidemiological investigation work was started. This type of outbreak was never recorded previously in Bajhang district.

First case of plague was appeared on September 6 in Laxmi, a 16 year old girl who was at Surke Mela a small village at 8,500 feet elevation about 3 miles walk from Nawara Village.

She had symptoms of fever, cough, diarrhoea, vomiting, abdominal pain and hematemesis. She died unattended at Surke Mela on September 8. Two weeks after her death, Sanke a 24 year old boy went from Nawara to Surke Mela on September 21 and stayed in the same house where Laxmi died. On September 24 he became ill and on 26th came back to Nawara with the symptoms of fever, cough, blood stained sputum, diarrhoea and vomiting and died on September 28. On October 2 third case was reported and on 5th October, 4 more cases were reported and likewise till November 5 all together 26 cases were recorded. Detail picture of the cases, age, sex, house, family, morbidity mortality records and symptoms are shown in Table 1. Over an eight week period nine households has been affected in five separate houses. Twenty-six of their forty members had been ill and 18 had died. The attack rate and case fatality rate were 65% and 45% respectively. Pneumonic and bubonic type of plague was recorded in this outbreak.

(b) Laboratory Diagnosis of the Cases:

Bacteriological specimen were taken and patients ill at the time were examined. Swab cultures from the shoulder serum specimen, and calf lesion as well as aspirate from the right inguinal node were taken. Initial bacteriological investigations and identifications in Central Health Laboratory, Kathmandu and confirmatory laboratory studies conducted at All India Institute of Medical Services New Delhi, Haffkine Institute, Bombay and the National Institute of Communicable Diseases, New Delhi. *Pasteurella pestis* was found positive. Purulent material aspirated from a supraclavicular node and the inguinal bubo was also positive for *P. pestis*. Post mortem specimen of sternal marrow revealed *P. pestis* on fluorescent antibody examination. Microscopic sections of lungs tissues was also revealed gram negative rods as *P. pestis*.

(c) Investigation of Animal Reservoir:

Wild and domestic rats were seen in Surke Mela as well as in Nawara Village. Villagers had stated that there were deaths of few rats recorded in Surke Mela but not in Nawara and also six other villages visited by the team. Four blood samples from four dogs, 2 from Surke Mela and 2 from Nawara, were taken, tested and 3 sera were found positive titers for antibodies against Fraction I of *P. pestis*.

(d) Vector Identification:

All the affected homes were examined for fleas (*X. Cheopis* and *X. astia*) but none were found. Ten fleas were collected from dogs at Nawara and Surke Mela. One of the fleas

was identified as *Pulex irritans* and other nine were *Ctenocephalides felis felis*. All ten fleas were also cultured and *P. pestis* was not isolated.

(e) Curative and Prophylactic Measures:

Therapy was initiated with parenteral penicillin (800,000 units per day), tetracycline (1 gram per day) was also added. In some cases streptomycin (1 gm per day) was given and subsequently showed more rapid improvement. About 640 villagers in Nawara and 197 people living in a nearby village were begun on prophylactic sulfadiazine (Orisul 0.5 - 1.0 gm orally) or streptomycin (1 gm intramuscularly) daily for seven days.

(f) Control Measures:

There was a self imposed quarantine measures taken by the villagers. Five percent carbolic acid was sprayed in all affected houses. In addition all houses in Nawara were resprayed with residual DDT (1-2 gm/m²) by a team of Nepal Malaria Eradication Office and this had eliminated the temporary reservoir of plague within Nawara and stopped the spreading the disease in the areas.

Finally, plans were formulated for an ecological investigation of the area in order to better define the sylvatic reservoir of plague in Bajhang district.

(g) Conclusions:

Human Plague was confirmed in this outbreak with 26 cases and 18 deaths. It has been hypothesized that Surke Mela was the focal point and then infection came to Nawara with a patient which died in Nawara. In addition to evidence of rodent deaths in Surke Mela, blood samples from two dogs living in this area were positive for antibodies against *P. pestis*.

Clinical and epidemiological evidence suggests that the plague, was tonsillar plague, pneumonic plague and classical bubonic plague. Since there was no evidence of rodent epizootic and fleas identified *Pulex irritans*, the human flea, was felt to be the most likely vector of this outbreak. However there is a need to study more on ecological aspects of vectors and rodents in the area.

References:

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