

Plague

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Epidemiology:- Agent:

- Plague is caused by *Yersinia pestis*, is a gram –ve bacillus ovoid in shape, with rounded ends & convex sides.
- In Giemsa or Methylene blue stain, it shows bipolar staining giving it a typical "safety pin" appearance.
- In old cultures it depicts pleomorphism with coccoid, club-shaped, filamentous, and giant forms. It is non-motile, non-spore forming, & non-acid fast with a slimy envelope or capsule.

Reservoir:

- Plague reservoir exists in wild rodents (e.g. field mice, gerbils, skunks etc).
- More than 200 mammalian species are reported to be susceptible to *Y pestis*.

Source:

- The organisms are present in buboes, blood, and sputum.
- sputum of the pneumonic plague case is a source.
- Blood of the infected rodents is the main source.

Incubation Period

- **2-7 days in bubonic & Septicaemic plague &**
- **1-3 days in pneumonic plague.**

Host :

- **Age and Sex:** All ages and both sexes are susceptible.
- **Occupation:** Human activity like hunting, grazing, cultivation, harvesting, construction etc bring him in contact with the fleas.
- **Population movement:** The population movement through ports facilitated the spread of the last pandemic.
- **Immunity :** Man has no natural immunity against the disease.

Environment: Season:

- In Northern India the plague season is from September to May, while in South India no such season exists.
- This is clearly related to the field rodent activity. Heavy rainfall, temperature of 20-25°C, and relative humidity of 60% favour the transmission.
- **Housing:** Houses that are not rat proof will provide opportunities for transmission.

Vectors:

- most common and efficient vector is rat flea
- (*Xenopsella cheopis*.) Other vectors are
- *X. astia*,
- *x. braziliensis*, and
- *Pulex irritans*. (The last one is a human flea.) When the flea has a blood meal from an infected host, the organisms multiply rapidly in its body and block its proventriculus.

"blocked flea."

- Flea is thus unable to feed any more. It becomes restless due to blockage & is thus called ***"blocked flea."***
- Such flea makes every attempt to catch another host, bite it & get itself **"unblocked"**. Infected fleas can live upto an year in rat burrows.

Animal Reservoir:

- There are two distinct groups of rodents involved in the transmission of plague, wild and domestic rodents. Among the wild rodents
- *Tatera indica*, *B. indica*,
- *Bandicota bengalensis varius*,,
- *Bandicota bengalensis kok*,
- *Millardia meltada*,
- *M. gleadowi*, & *Mus booduga* are common animals.

Domestic Rodents

- *Rattus Rattus*,
- *R. Norvegicus*, and
- *Mus musculus* live close to man & are victims of the disease like man.
- They do not serve as natural reservoir.

Transmission:

- **1. Usual Routes:**
- ***Man to Man:*** This route of transmission occurs from a case of pneumonic plague to a susceptible person. This is a typical air-borne transmission through droplets.
- ***Rodents to Man:*** This occurs through bite of infected vector
- ***Rodents to Rodents:*** This occurs either through fleas or direct contact.

Clinical Presentation in Man:

- Plague occurs in man in **3 major forms**.
- **Bubonic Plague:**
- **Pneumonic Plague:**
- **Septicemic Plague:**

Bubonic Plague:

- This characterized by sudden
- **fever, chills**, headache, prostration, and
- **lymhadenitis**. Nodes commonly involved are those of groin, axilla, and neck.
- **The painful, inflammed**, enlarged nodes are called bubos.
- **Suppuration** is considered as a good sign.
Bubonic plague is not a communicable disease.

Pneumonic Plague:

- It usually occurs as a complication of bubonic plague or septicemic plague.
- Patient has watery and bloody sputum with typical chest findings of pneumonia.
- This is a highly infectious form with short **incubation period. (1-3 days).**

Septicemic Plague:

- Bacteremia without bubos is septicemic plague. Clinically it presents as any other gram-negative septicemia. (fever, chills, headache, malaise, and gastro-intestinal symptoms. In absence of treatment complications like shock and organ failure can occur.

Laboratory Diagnosis:

- Bacilli can be demonstrated in buboes, sputum, and blood. The plague bacilli are not very exacting in nutritional media, thus can be grown on ordinary culture media like nutrient agar and blood agar. Antibodies to F-I antigen can be detected by passive hemagglutination test. Rise in titer in paired sera or titer of 128 or above in single sample is diagnostic.

Treatment:

- **Treatment:**
- Antibiotics of choice are
- Strptomycin (30 mg / kg, IM, daily), &
- Tetracyclin (30-40 mg /kg, OD) x 7-10 days

PLAGUE VACCINES:

Killed Whole Cell Vaccine:

- A formalin-killed vaccine is for IM administration. An alternate heat killed vaccine is for sub-cutaneous administration. The dose schedule is as below. form. It is indicated in the event of epidemic only as other measures take some time. No controlled trials on the vaccine have been performed. The data from the Vietnam (local residents and *immunized* American Soldiers) indicate protection from bubonic plague. The protective efficacy of this vaccine against pneumonic plague is doubtful.

Side-effects:

- **Side-effects:**
- These include headache, malaise,
- local erythema, induration, and
- mild lymphadenopathy.
- Allergic reactions like urticaria may occur rarely.

Newer Vaccines:

- A live attenuated vaccine pre-cared from EV76 strain has been used in humans.
- was used in former USSR, but is not available commercially.
- A recombinant F-I antigen using *Each. -oli*, and subunit vaccines using F-I/ V antigens are under trial .
- Oral vaccine using *Salmonella typhi* as a vector offers some promise.

PREVENTION AND CONTROL OF PLAGUE

- **Measures Directed At Reservoir:**
- **Rodents:** Rodent control through sanitation, improved housing, and food protection are the long-term measures. During epidemic drastic measures like closing rat-burrows and mass destruction with 'the use of rodenticides have to be adopted. An unexplained increase in rat deaths should arouse suspicion of epizootic.

Cases:

- Although, most of the human cases are bubonic, and hence non-infectious, some of these can turn into pneumonic. Thus case detection and treatment form an important activity.
- Plague is an internationally notifiable disease.
- All plague cases need isolation. Disinfection of sputum is required to avoid transmission.

Surveillance:

- This should cover all aspects of human and rodent plague.
- These include clinical, microbiological, and entomological surveillance.

Measures Directed To Transmission:

- **1. Flea Control:** To be effective, flea control measures should be carried out along with rodent control measures. DDT (10%) / BHC (3%) dust is used. Alternatively, carbaryl (2%) or malathion ((5%) can be used.
- **Spraying** should cover entire floor and walls up to 3 feet height. It should also cover roofs of thatched houses, crevices, rat-runs, clothing, linen, cats, dogs, and other pets

Measures Directed At Susceptibles:

- **Vaccination:** During epidemic all persons above 6 months of age should be vaccinated.

Chemoprophylaxis:

- All contacts of plague case should be given chemoprophylaxis.
- The drug of choice is **tetracycline** in the dose of 500 mg. six hourly in adults. (30-40 mg/kg divided doses in children.
- **Sulphonamides** 2-3 gm daily, in divided doses is another alternative.
- Duration of chemoprophylaxis for 7 days.

Health Education

- Contacts need to be educated about transmission of plague, role of rats/ fleas in transmission utility of vaccine/ chemoprophylaxis, and need of notification of a case.

Outbreak Containment Measures

- Plague is a notifiable disease and its occurrence should be notified to health authorities immediately.
- It is the responsibility of medical officer to undertake epidemiological investigation of plague outbreak and undertake control measures.

Flea-Indices:

- Flea-indices help monitoring the anti-flea measures.
- Total Flea Index: Average number of fleas per rat of all species.
- Cheopis index: Average number of *X. cheopis* per rat.
- Percentage of fleas: Percentage of different species of fleas found on rats.
- Burrow index: Average number of free living fleas per species per rodent burrow.

Thank You

