

PLAGUE

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OBJECTIVES

At the end of this session each student will be able to:

1. Define plague.
2. Describe the epidemiology of plague.
3. Describe the cause of plague.
4. Describe the pathophysiology of plague.
5. Describe the clinical features of plague.
6. Describe the complications of plague.
7. Describe the differential diagnoses of plague.
8. Investigate patients with plague.
9. Treat patients with plague.
10. Describe the prognosis of patients with plague.
11. Describe the preventive measures for plague.

Definition

- Plague is an acute, contagious, febrile illness transmitted to humans by the bite of an infected rat flea.

NB:

Human to human transmission is rare except during epidemics of pneumonic plague.

Epidemiology

Risk factors:

- Rat flea bite.
- Contact with a patient or a potential host.
- Contact with sick animal or rodents.
- Residing in endemic areas of plague e.g. south-western USA or Lushoto district in Tanzania.
- Presence of a food source for rodents in the immediate vicinity of the home.
- Camping, mountain climbing, hunting or fishing.
- Occupational exposure e.g. researchers and veterinarians.
- Direct handling or inhalation of contaminated tissues or tissue fluids.

Geographical distribution

The following countries reported more than 100 cases of plague (1990-1995):

South America:

- Peru.

Asia:

- China.
- India.
- Myanmar.
- Vietnam.

Africa:

- Tanzania.
- Uganda.
- Zimbabwe.
- Malawi.
- Zambia.
- DRC.
- Mozambique.
- Madagascar.

Epidemiology

- **Race:**

In USA, most cases occur in whites Americans than black americans.

- **Sex:**

Males and females are equally affected.

- **Age:**

Most cases occur in persons younger than 20 years.

Cause

- Plague is caused by **Yersinia pestis**.
- It is non-motile, non-spore forming, gram negative, a rod-shaped bacteria.

Cause

Host:

- Domestic and wild Rats (common).
- Cats.
- Camels.
- Chipmunks.
- Prairie dogs.
- Rabbits.
- Squirrels.

NB: Human is an incidental host in the natural cycle of this disease.

Vectors:

- Rat fleas (*Xenopsylla cheopis*).
- Ticks.
- Human lice.

Pathophysiology

- When a rat flea ingests a blood meal from an animal infected with *Yersinia pestis*, the coagulase enzyme of the bacteria causes the blood to clot.
- The bacilli multiply in the blood clot.
- The flea inoculates thousands of these bacilli into the host's skin during subsequent blood meals.
- The bacilli migrate to the regional lymph nodes and phagocytosed by the polymorphonuclear cells and mononuclear phagocytes and multiply intracellular.

Pathophysiology

- The bacteria elaborate a lipopolysaccharides endotoxin which is responsible for the initiation and sustenance of fever.
- With the subsequent elaboration of the fibrinolysin, the bacilli lyse the phagocytes causing bacteraemia leading to invasion of distant organs in the absence of specific therapy.

Clinical features

History:

- Travel to endemic areas, history of a flea bite, close contact with a potential host or exposure to dead rodents or rabbits should heighten consideration of a plague diagnosis.

History

I. Bubonic plague:

It is a most common form of plague.

- Incubation period of 2-6 days.
- Sudden onset of high fever and chills.
- Headache.
- Myalgia.
- Extreme exhaustion.
- Abdominal pain.
- Diarrhoea.
- Painful, swollen lymph nodes (buboes) arise, usually in the groin, axilla or neck.

History

II. Meningeal plague:

- Fever.
- Headache.

III. Pharyngeal plague:

It results from ingestion of the plague bacilli.

- Sore throat.
- Fever.
- Painful cervical lymph nodes.

History

IV. Pneumonic plague:

It is highly contagious and transmitted by air-droplets.

- Abrupt onset of fever and chills.
- Chest pain.
- Difficult in breathing.
- Purulent sputum or haemoptysis.

Clinical features

IV. Septicaemic plague:

It is observed in **elderly patients** and causes a **rapid onset of symptoms**.

- Nausea and vomiting.
- Abdominal pain.
- Diarrhoea (it may be a predominant symptom).
- Fever.

NB: This form of plague is associated with high mortality.

Physical examination

I. Bubonic plague:

Rashes:

- Vesicles at the site of the infected flea bite.
- Advanced disease: Pustules, carbuncles, eschar or papules at areas of the skin drained by the involved lymph nodes.
- A generalized papular rash of the hands and feet.

Hepatomegaly.

Splenomegaly.

I. Bubonic plague

□ **Lymphadenopathy:**

- Inguinal lymph nodes are most commonly involved.
- Unilateral, oval and varying in size from 2-10 cm.
- Extremely tender and patient resists any attempt to examine the involved lymph nodes.
- Patients walk with a limp.
- The affected limb may be in a position of flexion, abduction and external rotation.
- Buboes may rupture and discharge of malodorous pus.

Physical examination

II. Meningeal plague:

- Nuchal rigidity.
- Altered level of consciousness.

NB: Axillary buboes are associated with an increased incidence of the meningeal form.

III. Pharyngeal plague:

- Pharyngeal erythema.
- Tender anterior cervical lymph nodes.

Physical examination

IV. Pneumonic plague:

- Fever.
- Buboes may or may not appear.

V. Septicaemic plague:

- Patients looks toxic in appearance.
- Tachycardia, tachypnoea and hypotension.
- Generalized purpura with progress to necrosis and gangrene of the distal extremities.
- No lymphadenopathy.

Complications

- Acute respiratory distress syndrome.
- Chronic lymphoedema from lymphatic scarring.
- Disseminated intravascular coagulation.
- Septic shock.
- Superinfection of buboes by staphylococci and pseudomonas species.

Differential diagnoses

I. **Bubonic plague:**

- Lymphogranuloma venereum (LGV).
- Rock mountain spotted fever.
- Infectious mononucleosis.
- HIV disease (stage-1).
- Cat scratch disease.

Differential diagnoses

I. Bubonic plague:

- Typhus.
- Syphilis.
- Lymphoma.
- Brucellosis.
- Chancroid.
- Anthrax.
- Cellulitis.
- Reye syndrome.

Differential diagnoses

II. Pharyngeal plague:

- Acute tonsillitis.
- Bacterial pharyngitis.

III. Pneumonic plague:

- Pulmonary oedema.
- Bacterial pneumonia.
- Legionnaire's disease.
- Tulaemia.
- Psittacosis.

Differential diagnoses

IV. Septicaemic plague:

- Systemic inflammatory response syndrome.
- Disseminated intravascular coagulation.
- Bacterial sepsis.
- Dengue fever.
- Malaria.
- Septic shock.

Differential diagnoses

V. Meningeal plague:

- Meningitis.
- Severe malaria.
- Encephalitides.
- Encephalopathies.
- Space occupying lesion.
- Intracerebral or intracranial haemorrhage.

Investigations

- Full blood picture.
- Peripheral blood smear.
- Culture.
- CSF analysis.
- Serology.
- Gram stain (sputum and lymph node aspirate).
- Liver function tests.
- Renal function tests.
- Urinalysis.
- Random blood glucose.
- Chest x-ray.
- Computed tomography scans.

Treatment

A. Surgical:

Incision and drainage of enlarged lymph nodes.

B. Medical:

Support therapy:

- Haemodynamic monitoring (PRN).
- Ventilatory support (PRN).
- Intravenous fluid, epinephrine and dopamine are implemented as required for correction of dehydration and hypotension.

Medical treatment

□ Antibiotic therapy:

I. Streptomycin sulphate:

- It is the antibiotic of first choice in treatment of plague.
- **Dose:** 1 g IV or IM 12 hourly for 7-14 days or continue for 5-7 days once a patient is afebrile. Do not exceed 2 g per day.

NB: Gentamicin may also be used.

Antibiotic therapy

II. Doxycycline:

- It is the antibiotic of second choice in treatment of plague.
- **Dose:** 100 mg PO or IV 12 hourly for 7-14 days or continue for 5-7 days once a patient is afebrile.

Antibiotic therapy

III. Chloramphenicol:

- It is the antibiotic of first choice in treatment of meningococcal meningitis or for patients with hypotension as in patients with hypotension, intramuscular administered streptomycin may be poorly absorbed.
- **Dose:** 500 mg PO or IV 6 hourly for 7-14 days or continue for 5-7 days once a patient is afebrile.

Prognosis

- Untreated patients have a mortality rate of approximately 50%.
- With appropriate therapy, mortality rate drops to approximately 5%.

Prevention

- ❑ Strict respiratory isolation for 48-72 hours after starting antibiotic therapy in patients with pneumonic plague.
- ❑ Personal protection measures:
 - Wearing protective clothing.
 - Application of insect repellents to clothing and skin to prevent flea bites.
 - Control pet dogs and cats in areas endemic to plague and regularly treat pets to control fleas.

Prevention

□ Prophylactic antibiotic therapy :

Indications:

- People who have been exposed to the bites of potentially infected rodents fleas during plague outbreak.
- Persons who have been handled an animal infected with plague bacteria.
- Persons who have had close exposure to a person or an animal thought to have pneumonic plague.

Regimens:

- Doxycycline 100 mg PO 12 hourly for 14-21 days. Or
- Co-trimoxazole 960 mg PO 12 hourly for 14-21 days.

Prevention

□ Plague vaccine:

Not effective against pneumonic plague.

Indications:

- Field workers in areas endemic for plague.
- Scientists and laboratory personnel who routinely work with the plague bacteria.

Prevention

□ Environmental sanitation:

- Remove food sources used by rodents.
- Make homes, buildings or warehouse 'rodent-proof'.
- Trained personnel should apply chemicals to kill fleas and rodents.
- Trained personnel should fumigate cargo areas of ships and docks to kill fleas.

Prevention

- Alert the laboratory to the possibility of the diagnosis of plague so that all fluid specimen are handled with gloves and mask to prevent aerosolization of the infected fluid.
- Report all patients suspected to have plague to local health department.

Thank you for your attention

References

- Minnaganti V.R. Plague.
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