Typhus Fever – *Rickettsia prowazekii*

Epidemic Typhus,
Louse-Borne Typhus Fever,
Typhus Exanthematicus,
Classical Typhus Fever,
European Typhus,
Brill-Zinsser Disease,
Jail Fever

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Etiology

Epidemic typhus results from infection by *Rickettsia prowazekii*, a Gram negative, obligate intracellular bacterium. At least two strains can be distinguished by genetic analysis. One strain is found only in humans; the other also occurs in flying squirrels in the United States.

Geographic Distribution

R. prowazekii has been found worldwide. Foci of disease currently exist in many countries in Asia, central and east Africa, and the mountainous regions of Mexico, Central and South America. War and famine can result in explosive outbreaks of disease.

In the United States, *R. prowazekii* is endemic in flying squirrels. This form is zoonotic; sporadic human cases have been seen in Georgia, Virginia, West Virginia, North Carolina, Tennessee, Indiana, Illinois, Ohio, Pennsylvania, Maryland, Massachusetts, New Jersey, New York, and California.

Transmission

Transmission of epidemic typhus occurs by arthropod vectors. The primary vector in person–to–person transmission is the human body louse (*Pediculus humanus corporis*). Lice become infected when they feed on the blood of infected patients; the lice defecate when they feed on a new host, excreting *R. prowazekii* in the feces. Transmission occurs when organisms in the louse feces or crushed lice are rubbed into the bite wound or other breaks in the skin. The rickettsia are also infectious by inhalation or contact with the mucous membranes of the mouth and eyes. In most parts of the world, humans are the only reservoir host for *R. prowazekii*. Infections can become latent and later recrudesce; humans with recrudescent typhus are capable of infecting lice and spreading the disease.

In the United States, flying squirrels also serve as a reservoir host. Infections are spread between squirrels by squirrel lice (*Neohaematopinus scuiropteri*), particularly during the winter when populations are concentrated in nests. *N. scuiropteri* does not feed on humans, but squirrel fleas (*Orchopeas howardi*) and other mammalian fleas are susceptible and may be important in spreading the disease to humans. Inhalation of organisms in infected louse feces or contact with squirrels may also be routes of transmission.

Lice infected with *R. prowazekii* excrete organisms in the feces after 2 to 6 days and die prematurely within 2 weeks. Bacteria can survive in the feces and the dead lice for weeks.

Disinfection

R. prowazekii is susceptible to 1% sodium hypochlorite, 70% ethanol, glutaraldehyde, and formaldehyde. It can also be inactivated by moist heat (121° C for a minimum of 15 min) and dry heat (160–170° C for a minimum of an hour).

Infections in Humans

Incubation Period

The incubation period is 1 to 2 weeks; most infections become evident after 12 days.

Clinical Signs

The onset of epidemic typhus is often sudden. The initial symptoms may include headache, chills, fever, prostration and myalgia. In approximately 50% of cases, a rash develops after 4 to 6 days. Small pink macules usually appear first on the upper trunk or axillae then spread to the entire body with the exception of the face, palms and soles. As the disease progresses, the rash usually becomes dark and maculopapular or, in severe cases, petechial and hemorrhagic. Splenomegaly, hypotension, nausea, vomiting and confusion may also be seen. The fever lasts approximately 2 weeks. In seriously ill with gangrene, and symptoms of

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encephalitis or pneumonia may occur. Children and people with partial immunity can have a mild infection with no rash.

R. prowazekii sometimes remains latent and recrudesces years later; this form is called Brill–Zinsser disease. Recrudescent typhus is usually mild, with lower mortality rates.

The symptoms of the zoonotic form resemble classic typhus but are almost always mild. The fever usually lasts for 7 to 10 days and the rash is often barely visible or absent. Deaths are not seen with this form.

Communicability

R. prowazekii is not transmitted from person to person. Patients can infect lice while the fever is present and may continue to be infectious for another 2 to 3 days. Patients with Brill–Zinsser disease are also infectious for lice.

Diagnostic Tests

Epidemic typhus is usually diagnosed by serology; a fourfold rise in titer is diagnostic. Titers usually become detectable during the second week. Serologic tests include the indirect fluorescence antibody test, latex agglutination, complement fixation, enzyme immunoassay (EIA) and the toxin–neutralization test. *R. prowazekii* may cross–react with *R. typhi* (the agent of murine typhus) in some tests.

Organisms can also be identified in tissue samples, including skin biopsies, by immunohistochemical staining. Polymerase chain reaction (PCR) assays may be available in some laboratories. Isolation and identification of *R. prowazekii* is not widely available or used for diagnosis, as rickettsia are both fastidious and dangerous to laboratory personnel.

Treatment and Vaccination

Early treatment with antibiotics is effective and relapses are uncommon. Treatment is sometimes begun before laboratory confirmation, particularly when the symptoms are severe. Antibiotics can also speed recovery in patients with the zoonotic form. No commercial vaccines have been licensed, but experimental vaccines are produced by military sources in the United States and may be available for high–risk situations.

Residual insecticide treatment of the clothing and hair is recommended for people who may have been exposed to infected lice.

Morbidity and Mortality

Epidemics of typhus usually occur where louse populations are high. Infections are typically seen in populations living in unsanitary, crowded conditions; outbreaks are often associated with wars, famines, floods, and other disasters. Most epidemics occur during the colder months. Sporadic cases of zoonotic typhus are seen in the United States.

The overall case fatality rate for untreated infections is 10 to 40%; the mortality rate increases with age. Infections are rarely fatal in children less than 10 years old; in people over 50 years old, the mortality rate can be as high as 60% without treatment. Deaths have not been seen in the zoonotic form, regardless of treatment.

Infections in Animals

In the United States, *R. prowazekii* is endemic in flying squirrels (*Glaucomys volans*). Infections can be transmitted to humans from this species but little has been published about the disease in squirrels. Dogs have been experimentally infected but seroconverted with no clinical signs; no organisms were recovered from the blood.

Internet Resources

Centers for Disease Control and Prevention (CDC)
http://www.cdc.gov/travel/diseases/typhus.htm

Epidemic Typhus Associated with Flying Squirrels– United States - Morbidity and Mortality Weekly Report
http://www.cdc.gov/mmwr/preview/mmwrhtml/00001177.htm

Material Safety Data Sheets – Canadian Laboratory Center for Disease Control
http://www.hc–sc.gc.ca/pphb–dgspsp/msds–ftss/index.html#menu

Medical Microbiology
http://www.ncbi.nlm.nih.gov/books/NBK7627

Rickettsial Pathogens and their Arthropod Vectors Emerging Infectious Diseases
http://www.cfsresearch.org/rickettsia/other/9nf.htm

The Merck Manual
http://www.merck.com/pubs/mmanual/

Surveillance and Reporting Guidelines for Typhus Washington State Department of Health
http://www.doh.wa.gov/notify/guidelines/typhus.htm

Typhus and Flying Squirrels - Southeastern Cooperative Wildlife Disease Study (SCWDS) Briefs
http://www.uga.edu/scwds/topic_index/1999/TyphusandFlyingSquirrels.pdf

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