



Epidemic Typhus: A Re-Emerging Rickettsial Zoonosis

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Abstract

Epidemic typhus is a re-emerging zoonosis of public health concern, and is caused by *Rickettsia prowazekii* that is considered a bioterrorism agent. In earlier centuries, epidemic typhus was responsible for millions of deaths in several parts of the world. The disease is transmitted through infected feces of the body louse, and is responsible for great epidemics in people who live in overcrowded and unhygienic conditions. Outbreaks of louse borne epidemic typhus are recorded in several countries, such as Burundi, Ethiopia, Nigeria, Peru, Rwanda and Uganda. The primary clinical manifestations of disease include fever, headache, and rash. Clinical diagnosis should be supported with laboratory findings and needs to be differentiated from other diseases, which present febrile illness. Presently, doxycycline is considered the mainstay of treatment. The mortality rate in severe cases without antibiotic therapy may reach up to 60%. It is imperative to make an early diagnosis to start a prompt specific therapy to mitigate the suffering of the patient. The public should be educated to avoid visiting crowded areas, avoid sharing clothes, taking daily bath, and maintaining hygienic conditions at home. It is advised that delayed diagnosis and treatment should be avoided as it may lead to increase morbidity and mortality.

Keywords: Epidemic Typhus; Louse; Re-Emerging Zoonosis; *Rickettsia Prowazekii*; Vector

Introduction

The emerging and re-emerging diseases are highly significant from public and economic point of view. These diseases are caused by a variety of infectious agents, and are occurring globally in both sexes, all age groups, in all seasons, in rural and urban settings [1-3]. There are a number of rickettsiosis, such as Brill Zinsser disease, coxilliosis, ehrlichiosis, epidemic typhus, flea borne spotted fever, Indian tick typhus, murine typhus, Pacific Coast tick typhus, murine typhus, Queensland tick typhus, rickettsial pox, Rocky Mountain spotted fever, scrub typhus, Siberian tick typhus, Tidewater spotted fever, and trench fever, which are reported from developing as well as developed nations [1,3-6]. Most of the rickettsial diseases are transmitted through vectors, like flea, lice, mite, and tick [1,6,7]. Among these, epidemic typhus (*Exanthematic typhus*, Jail fever, Louse-borne fever, Ship fever) is a re-emerging zoonotic disease that cause high morbidity and mortality [1,8,9]. The disease is widely prevalent as reported from many countries of the world, such as Algeria, Burundi, China, Democratic Republic of Congo, Ethiopia, India, Kazakhstan, Nigeria, Peru, Russia, Rwanda, Uganda and USA [1,10-15]. Epidemic typhus is considered mainly a disease of cold climates, including higher elevations

in the tropics.

The detailed history of epidemic typhus is documented by Zinsser [16]. Charles Nicolle is credited to demonstrate the role of body lice in transmission of *Rickettsia prowazekii* in 1909 [1]. The etiologic agent, *Rickettsia prowazekii*, was named after the American researcher Howard T. Ricketts and Czech scientist Stanislaus von Prowazek. It is observed that persons who recover from disease can harbor organisms in lymph nodes or other tissues for a long time, and thus give an opportunity to bacterium to again attack other body tissues to cause mild form of disease that usually occur in sporadic form and is called recrudescence typhus. In order to recognize the great contribution of Nathan Brill and Hans Zinsser, recrudescence typhus is called as Brill Zinsser disease [4]. Epidemic typhus without antibiotic therapy may carry mortality up to 60% [13]. However, an early antibiotic and supportive treatment can reduce the fatality below 5% [13].

Before and during the World War I and II, epidemic typhus has been the most widespread and devastating disease of great public health concern affecting a large number of people in many regi-

ons of the world. In Ireland, 700,000 cases of epidemic typhus occurred during 1816-1819. During World War I, around 25 to 30 million cases were encountered in Russia [7]. One epidemic that occurred in Italy in 1943 caused over 1,400 cases and 200 deaths. Despite improvement in living condition, availability of insecticides, and antibiotics, epidemic typhus has the potential to reemerge as evidenced by the major outbreak of disease since World War II that affected about 50,000 people living in refugee camps in Burundi in 1997 and 1998. Further, over 5,600 cases of epidemic typhus were reported in during 1999 in China [13]. The outbreaks are mainly encountered during winter months, and the persons who live in refugee camps, orphan houses, old aged homes, prisons, military personnel, and humanitarian relief workers are at high risk of acquiring infection. The disease is rarely observed in travelers [4]. The spread of epidemic typhus to people occurs through contact with infected body lice [17]. The main objective of this communication is to describe epidemic typhus as re-emerging rickettsial zoonosis of public health concern.

Etiology

Epidemic typhus is caused by *Rickettsia prowazekii* that belongs to the Order: Rickettsiales, Family: Rickettsiaceae, Genus: *Rickettsia*. It is a Gram negative, non-capsulated, obligate, intracellular, non-motile bacterium with bioweapon potential. The organism is easily inactivated by physical and chemical agents, and is susceptible to chloramphenicol and tetracycline but resistance to sulphonamides and penicillin. The etiological agent *R. prowazekii* can survive in dried louse feces for 60 days [4].

Transmission

Human can get infection from infected louse (*Pediculus humanus humanus*) (Figure 1) feces through traumatized skin, mucous membrane or conjunctiva. Contamination of abraded skin with body fluid of the infected crushed louse can also cause infection. Occasionally, infection can be acquired through inhalation of dried louse feces from bedding or clothing [1]. In USA, transmission may also occur through close contact with flying squirrels (*Glaucomys volans*) (Figure 2) [17]. Further comprehensive studies should be conducted to elucidate the exact role of other animals as reservoir of *R. prowazekii*. It is reported that body lice are transmitted mainly by direct contact with an infested person, and also through fomites, such as bedding and clothes [4].

Clinical spectrum

The incubation period of disease is 2 to 15 days. The affected person exhibits a variety of clinical signs and symptoms such as high fever, severe headache, anorexia, general malaise, body aches,



Figure 1: *Pediculus humanus corporis*, the human body louse.
Source: CDC (2019)



Figure 2: *Glaucomys volans*, the southern flying squirrel.
Source: CDC (2019).

muscle aches, chills, nausea, vomiting, confusion, vertigo, seizures, prostration, rapid breathing, cough, constipation, conjunctivitis, rashes, low blood pressure, weak and irregular pulse, seizures, confusion, and coma. Bronchitis, bronchopneumonia and nephritis are common complications [1]. Coma and very low blood pressure are indicative of serious cases [4].

Diagnosis

Signs and symptoms associated with epidemic typhus are not very characteristic to warrant a correct diagnosis. Hence, a number of laboratory techniques, such as isolation of pathogen from patient's blood during acute phase of disease by inoculation of guinea pig, Vero cell monolayers, latex agglutination, Weil Felix, slide im-

munoperoxidase, immunofluorescence analysis, western blotting, dot blot assay, monoclonal antibodies and real time polymerase chain reaction are used in confirming the diagnosis [1,18,19]. When using immunological test, a four-fold increased titer of specific antibodies against *R. prowazekii* in acute and convalescent serum samples supports the diagnosis of disease. It is mentioned that monoclonal antibody technique is simple, practical and specific and hence, can be widely employed for epidemiological investigations [18]. Epidemic typhus should be differentiated from other diseases like dengue fever, enteric fever, infectious mononucleosis, leptospirosis, malaria, and relapsing fever [14].

Treatment

Several antibiotics, such as chloramphenicol, doxycycline, oxytetracycline, tetracycline are effective in the treatment of epidemic typhus [1]. In addition, supportive treatment like enemas to maintain bowel movement, ample fluid administration, and protection of the skin from bed sores is also necessary for patient [1]. The patients, who are given doxycycline at the early stage of infection, usually get quick and complete recovery. Doxycycline, being a drug of choice, can be used in children as well as in adults [4]. It is pertinent to mention that during outbreak of disease, a single 200 mg oral dose of doxycycline has been suggested to limit the occurrence of relapses [13,20].

Prevention and Control

Currently, commercially manufactured vaccine is not easily available to protect the susceptible population against epidemic typhus [17]. Therefore, certain measures, such as early diagnosis and chemotherapy, delousing of patient and all contacts of acute cases, avoiding sharing of clothes, restrain to visit overcrowded places, frequent changes of clothes, wearing of clothes impregnated with lousicide (permethrin), provision of protective garments to persons in potentially infected environment, improvement in living condition, creation of daily bathing facilities, sterilization of louse

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can certainly reduce the incidence of this life threatening zoonosis [1,4]. The simple way to control the infestation of lice is to discard the infected clothes of patient [4]. It is advised that people should avoid contact with flying squirrels and their nests [17]. It is important to note that permethrin products should not be applied directly on the skin [17].

In India, several persons including the author has started using Veilect (Creative Pharma Industries, Gujarat, India), a 100% natural mosquito repellent. It contains eucalyptus oil, citronella oil and lavender oil, and is applied on fabric to keep mosquitoes away. As it is natural vector repellent, its wider application to repel all vectors including body louse is highly emphasized.

Conclusion

Epidemic typhus is a louse borne rickettial zoonotic disease of worldwide distribution. In recent years, most outbreaks occurred in Burundi, Ethiopia and Rwanda. Disease can occur in epidemic and also in sporadic form. Clinical symptoms are not specific and mimic with other infectious diseases, thus require standard laboratory methods to make an unequivocal diagnosis of epidemic typhus. It is recommended that Veilect, a natural mosquito repellent, should be applied on fabric to keep the vector away from body. The role of other rodents in the transmission cycle of *R. prowazekii* needs to be investigated. Diagnosis of epidemic typhus presents challenges as all laboratories are not well equipped. Therefore, sincere attempts should also be made to develop a simple, and low cost diagnostic, which can be easily employed by poor resource nations to make an early diagnosis on epidemic typhus.

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Conflict of Interest

None.

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