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CONTRIBUTION ON THE TRANSMISSION OF TYPHUS FEVER

/Following is a translation of an article by Dr. Hartwig Hormann, scientific assistant at the Bernhard-Nocht Institute for Maritime and Tropical Diseases at Hamburg, Germany, which appeared in the German-language periodical Arztliche Wochenschrift (Doctor's Weekly), Vol 1/2, No. 27/28, 1947, pages 441-443./

Despite social disorders such as malnutrition, poverty, lice infestations, crowded living conditions, lack of personal hygiene due to the absence of bathing facilities and non-availability of underclothing, population shifts of unprecedented magnitude and a break-down of public planning and order, typhus fever has not been able to establish a foothold in Germany even in the face of a sufficient number of cases which were not immediately recognized and could have spread the disease among a population which is not immune. The reasons for this are not easy to find; they may be sought in the general cleanliness of the German people which persists in spite of difficulties and in the behavior of the causative agent or the carrier. From the fullness of epidemiological observations of the past year, it is intended, without taking a detailed stand as to the above complex of questions, to describe a number of cases because they tend to support a theory as to the mode of transmission of typhus fever which has been assumed for some time but never absolutely proven -- specifically, the transmission of typhus fever through inhalation of vapor or dust. In the cases which have been described to date, other possibilities of infection have never been eliminated with certainty because these have been cases involving persons who, without exception, worked in typhus fever laboratories for long times (Eyer, Przybylkiewicz and Dillenberg, Ciuca and Ionescu-Mihaesti, Larsen and Lebel, and others). Furthermore, this group infection illuminates the general typhus fever situation and possibly gives an explanation as to why there

has been no epidemic of typhus fever.

In the Allgemeinen Krankenhaus, Hamburg-Langenhorn /Hamburg-Langenhorn General Hospital/, the following cases occurred in connection with the typhus fever ward and the typhus fever laboratory:

1. Doctor of Medicine A. K., Chief of the Chemical Department of the Tropical Institute, 60 years of age.

On-set of illness on 23 March 1946 with listlessness, indisposition and increased temperature. A few days later, collapse of the circulatory system, severe headache, pain in the neck and limbs, restlessness, depression, insomnia. He was slightly delirious, but conscious. During the initial period of sickness, Dr. K. remained at home. On 3 April 1946 he was admitted to the Tropen Hospital in Langenhorn. Temperature was now 38.6°C, the circulatory system failing occasionally. No changes were noted on the skin. Continuous subfebrile temperatures; heart and circulatory system were stimulated with the use of Strophanthin and Sympatol. Leukocytes 4200, Hb /hemoglobin/ 68%, BSG /Blutsenkungsgerat = blood sedimentation device/ 25/44 mm, agglutination proteus OX_{19} 8000 +, typhus 100 +.

Immunization: Patient was never immunized against typhus fever.

Source of infection: The illness was evidently contracted during a visit to the entmology department in Langenhorn. Dr. K. visited the department head on various occasions during the past 6 weeks prior to becoming ill. The office of the department head had not been the scene of any laboratory work but was located adjacent to the typhus fever laboratory. Dr. K. was not connected with the typhus fever workers and had never observed any lice on his person. Since no other possible source can be determined, the infection must have occurred by means of dust inspiration.

Course of sickness: In spite of advanced age and lack of immunisation, the course of the infection was not severe. The patient was discharged on 20 April 1946.

2. Doctor A. St., doctor in charge of ward in the clinical department of the Langenhorn General Hospital, female, 33 years of age.

On-set of illness during a trip on 23 March 1946 with severe headache, indisposition, temperature of about 40°C, conjunctivitis lasting two days, mild bronchitis. Prior to being admitted to the Tropenkrankenhaus Langenhorn of 3 April 1946, temperature had increased to 41°C. Restlessness, depression, insomnia, delirious but always conscious. Between the 5th and 7th day following on-set, an exanthema appeared which disappeared after 5 days. Leukocytes 5400, agglutination

proteus OX_{19} on 17 April 1946 800 +. (For all cases, only the highest agglutination titer is given.)

Immunization: May 1942, Cox-Behring egg vaccine, 0.5-0.5-1.0. June 1942 lice vaccine (Weigl, Krakau-Lemburg, Dose I, II, III). Same immunization repeated every six months. Last immunization April 1945 with lice vaccine, dose II and III.

Source of infection: Dr. St. was a member of a group of doctors from the General Hospital of Langenhorn who, of their own volition, visited the entomology department for a demonstration on 14 March 1946. The danger of infection during this time was apparently great since a highly virulent strain of rickettsia was being maintained in mice lungs in the laboratory rooms. It was this mouse lung passage which was demonstrated for the doctors and others (mouse lungs infected with rickettsia were ground with sand, mixed with salt solutions and given to other mice through nasal instillation). The demonstration lasted one half an hour. All precautionary measures were taken in order to prevent an infection (washing the floor and furniture with disinfectants, etc.). The visitors were also warned not to touch any object or material in the laboratory. The infections of the doctors must have been brought about by the explosive expiration of the mice during the intranasal instillation and resultant inhalation of vapors containing rickettsia by the visitors. Apparently the panting of the mice was sufficient to create a rickettsia spray. The respective doctors had had nothing to do with typhus fever patients either before or after this occasion and none had ever had lice on their persons.

Course of sickness: Relatively mild illness with exanthema but without complications.

3. Doctor of Medicine G. P., doctor in charge of ward in the clinical department of the Langenhorn General Hospital. Female, 32 years of age.

On-set of illness on 31 March 1946. Temperature increase to 38.2°C. Soon thereafter, chills, pains in limbs and joints. Temporary drop in temperature after taking Novalgin-Chinin. Admission to hospital on 2 April 1946. Major symptoms were insomnia, restlessness, mild conjuntivitis. Dry, cracked tongue, pharyngitis. Slight enlargement of the liver. Temperature about 39°C. Exanthema which disappeared after 3 or 4 days. Spleen slightly enlarged. Upon admission, leukocytes 3600, BSG 2/5 mm, RR 165/70. Several days later, BSG 8/19 mm, RR 90/50. Agglutination Proteus OX_{19} on 11 April 1600 +, typhus 100 +.

Immunisation: Patient had never been immunised against typhus fever.

Source of infection: Same as 2.

Course of illness: Mild typhus fever with exanthema, no complications.

4. Doctor of Medicine J. K., ward doctor in the clinical department of the Langenhorn General Hospital, 32 years of age.

On-set of illness on 1 April 1946. Initially the clinical symtoms were not clearly defined and resembled abdominal typhoid. Admitted to hospital on 6 April 1946 with high temperature, headache and slightly delirious condition. BSG 28/59 mm. Temperature subsided on 14th day. Agglutination proteus OX_{19} on 15 April was 800 +.

Immunization: 1942 with lice vaccine (Weigl, Krakau-Lemberg, dose I, II and III). Re-immunization 1944 and 1945 with lice vaccine (dose II and III). Last immunization in Feb. 1946 with egg vaccine (Hamburg Serumwerk, dose 1.0).

Source of infection: Same as under 2.

Course of illness: Mild case, normal convalescence, no complications.

5. Doctor of Medicine G. H., ward doctor in the typhus fever department of the Tropenkrankenhaus, Langenhorn, female.

On-set of illness on 6 April 1946 with chills (to 40°C) and weakness. Admission to hospital on 9 April 1946. Temperature above 40°C, insomnia, delirious from time to time. Exanthema appeared on 5th day, spreading to soles of feet and palms of hands on 8th day and then quickly disappeared. Mild conjunctivitis. Temperature dropped on 17 April. BSG 4/9 mm. Agglutination proteus OX_{19} 1600 +, typhus 400 +.

Immunization: In August and November 1945 with egg vaccine (Behring, Marburg), dose 0.5-0.5-1.0.

Source of infection: Dr. H. worked in the women's department of the typhus fever ward and very probably was infected by the patient E. F. She had been admitted on 29 March 1946 with typhus fever and infected with lice (agglutination proteus OX_{19} 12,800 +). Dr. H. had never had lice.

Course of illness: Relatively severe with typical exanthema. Temperature broke on 20 April. Other than difficulties of hearing and speech, no complications.

6. Sister I. S., Langenhorn General Hospital, typhus fever ward,

27 years of age.

On-set of illness on 6 April 1946 with chills (to 40°C), severe headache, weakness and delirious condition. Admitted to hospital on 9 April. Temperature above 40°C, insomnia, delirious from time to time. Failure of circulatory system, no exanthema. BSG 50/80 mm. Leukocytes 11,200. Agglutination proteus OX_{19} 800 +, typhus 800 +.

Immunization: June 1945 with egg vaccine (Serum works, Hamburg, dose 0.5-0.5-1.0). Re-immunization January 1946 with egg vaccine, 0.5-0.5-1.0).

Source of infection: Same as 5.

Course of illness: After 20 April, no temperature, no complications.

7. Laboratory technician W. L., employed in the typhus fever laboratory of the entomology department of the tropical institute, Langenhorn. 34 years of age.

On-set of illness on 13 April 1946 with severe headache, 2 to 3 days later limb and joint pains, weakness and nausea. Temperature rose to 40°C. Depression, mild bronchitis, exanthema which soon disappeared. BSG 27/57 mm, RR 110/70. Agglutination proteus OX_{19} and typhus negative. Despite negative agglutination, the clinical symptoms of typhus fever existed.

Immunization: First immunization 1940 with egg vaccine (Geheimrat Otto, Frankfort am Main). Various re-immunizations with lice vaccine, (Weigl, Krakau-Lemberg). Last re-immunization on 3 and 10 January 1944 with lice vaccine, dose II and II, and in September 1944 and 1945 with lice vaccine dose III.

Source of infection: Infection during the course of his professional work. L. had never had lice on his person.

Epidemiological Analysis:

The group infection, which was observed among the members of the hospital who had been infected in the typhus fever laboratory, in which previously similar demonstrations had been conducted without unfavorable effects, was caused by an increase in the virulence of the rickettsia through the mouse lung passages. Experiences had at other laboratories under like conditions vouch for the fact that, despite all possible precautionary measures, susceptible persons become infected by virulent rickettsia.

In cases 2, 3, and 4, it can be assumed with seeming certainty that the infection resulted from inhalation of vapors and penetration of the rickettsia to the mucous membranes (an infection from dust is less likely due to the thorough disinfection made of the room), since these persons were only present in the laboratory for a brief half hour and had neither been infested with lice nor had they had any contact with typhus fever patients. In this connection, it is very noteworthy that of the five doctors who visited the laboratory demonstrandi causa, three were infected (two of whom had been immunized against typhus fever), while two others who had not been immunized but who were exposed in the same manner as their colleagues, did not become sick. There is no explanation as to how important the amount of rickettsia taken in or the inherent resistance of the members of the group who escaped infection played a role. The difference in the incubation periods of those who did become sick gives an indication of a parallel relationship with the massivity of infection, however, Nevertheless, the cases observed show that prior immunization and even repeated re-immunization does not prevent infection — a fact which was seen on many occasions during the war. The degree of immunity given by immunization is not great enough to prevent a clinically manifested illness. No influence of the typhus fever vaccine upon the severity of the case nor any difference in various vaccines could be determined.

The course of illness in the case of these laboratory infections was not severe; even patients who had not been previously immunized survived the infection without strong exanthema or brain complications. The 60-year-old Dr. K. withstood the typhus fever without being previously immunized.

In cases 5 and 6, even though they may never have observed lice on their persons, the transmission must be assumed to have occurred through louse bites and lice excretions entering the bite or an infection through the blood of the sick. The necessary close association with the live-infested and very sick patient E. F. hint at this possibility more than dust inspiration. Despite being infected from this relatively severe case, no variation of the course of illness in the doctor and sister as compared to the others was evident. This observation indicates that — in agreement with the majority of the cases which have occurred in recent months — the general type of infection is not very severe. This might be an explanation for the past typhus fever situation which has been characterized by the fact that, in spite of the favorable conditions for an epidemic as were mentioned initially, there has been no wide-spread outbreak from the repeated individual cases which have occurred in various communities.

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