TYPHUS FEVER.

Thesis for the Degree of M. D.

by

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TYPHUS FEVER.

Introductory. 1 - 3.
Definitions. 3.
Synonyms. 4.
Historical. 4 - 14.
Geographical Distribution. 14 - 17.
Etiology - Bacteriology. 17 - 25.
Microscopic Examination of Blood 25 - 29.
Microscopic Examination of Blood in Manchester Cases 23 - 25.
Widal Reaction in Typhus. 29 - 33.
Widal Reaction in Typhus in Manchester cases 32 - 33.
Infection & Dissemination. 33 - 40.
Predisposing Causes, Age, Sex &c. 40 - 45.
Incubation Period. 45 - 46.
Symptoms - Invasion Stage. 46 - 50.
Short Clinical Description of Typhus. 50 - 59.
Short Account of Manchester Cases. 59 - 83.
Detailed Symptomatology of Typhus. 83 - 117.
Morbid Anatomy. 117 - 119.
Complications & Sequelae. 120-129.
Differential Diagnosis. 129-134.
Prognosis & Mortality. 134-140.
Treatment. 140-149.
Prophylaxis. 149-150.
Conclusions. 150-151.
Literature. 151-152.
Introductory. Some apology may be necessary for presenting as a subject of thesis some account of a disease which may in these days be considered of relative unimportance to the community and which certainly contributes very little indeed to the sum total of disease and death in this country. Formerly one of the most prevalent and most dreaded of scourges, the cause of an appalling annual mortality, typhus has now been practically banished by the progress of modern sanitation.

To such an extent is this the case that there must be many of the younger generation of medical practitioners who have never seen a single case of the disease. But typhus is by no means of merely historical interest. It may still be a force to be reckoned with if introduced into communities where conditions of filth and overcrowding and general misery prevail or in times of distress and want due to famine, war, industrial depression and other causes. And in these days when the restriction upon alien immigration is not so strict as it ought to be its introduction from an endemic quarter can be very readily effected. A small outbreak which occurred in Manchester in 1909 was certainly caused in this way.

The fact that typhus has been so thoroughly stamped out in this country by improved housing and sanitation/
sanitation causes it to be one of the last diseases to be thought of by the practitioner, and on the other hand even when the presence of the fever has been established, his diagnosis, since he may possess only a book knowledge of the disease, is apt to be a little uncertain.

Of course if the case were typical and marked anyone even without previous experience would find the diagnosis easy. But we find many cases in which the symptoms and signs are much modified. The pupils are not always contracted nor the conjunctivae always injected, especially early in the course of the disease. The rash may be modified; one or other of its elements may be absent. Sometimes a slight mottling of the skin is all that can be seen. Occasionally in young people the rash is entirely absent. Sometimes the clinical picture corresponds very closely to that of some other more common disease, so that cases of typhus are frequently diagnosed as measles, influenza, pneumonia, meningitis &c. On the other hand cases of one or other of the latter diseases are not infrequently sent into hospital as genuine typhus cases. In almost every outbreak or epidemic there are some cases, more especially among children, which are so mild or so anomalous that if it were not for their history and their association with typical or definite cases of the disease, it would be very difficult/
cult to arrive at a correct diagnosis. Such cases might readily be missed and might become the origin of an extensive outbreak.

Such considerations as these together with the fact that I had, while engaged as resident physician in the Manchester Fever Hospital, the opportunity of seeing some twenty one cases of the disease have led me to take up typhus as a subject for the M. D. thesis.

The number of my own cases being so small I have by Dr. Ker's Kind permission been enabled to make use of the records and chart of about one hundred and sixty one cases which were treated in the Edinburgh City Hospital 1898-1902.

**DEFINITION**

"An acute specific infectious disease characterized by a petechias rash, marked mental confusion and physical prostration and by a rapid defervescence on or about the fourteenth day" (Ker).

"An acute infectious disease of unknown origin, highly contagious, characterized by sudden onset, maculated rash, marked nervous symptoms and cyclical course terminating by crisis usually about the end of the second week" (Osler).

"An acute specific highly infectious disease which prevails in epidemics: particularly in times of destitution and in the presence of over-crowding/
crowding with deficient ventilation. It is charac­terized by a sudden onset with marked nervous symptoms namely rheumatoid pains, rigors and headaches. A peculiar measly or rubeloid rash appears most commonly on the fifth day of the disease" (Moore: Allbutt & Rolleston's System of Medicine).

SYNONYMS.

Jail fever, camp fever, ship fever, hunger typhus, typhus contagiosus, spotted fever.

FRENCH: Typhus exanthemati gu e; German: Fleckfieber.

Murchison gives no less than ninety four Synonyms.

HISTORICAL.

Typhus fever has been one of the great epidemic fevers of the world. Although now but rarely met with in this country it was formerly prevalent in all the larger cities of Europe. Indeed Murchison has said that 'a complete history of Typhus would be the history of Europe during the last three and a half centuries. It is a disease which has always been closely associ­ated with the greatest public calamities. To quote Hirsch 'the history of typhus is written in those dark pages of the world's story which tell of the grievous visitations of mankind by war, famine and misery of every kind'. Formerly typhus, typhoid, relapsing fever and certain other febrile conditions were all included under/
under the name of continued fever and it was only in 1843 that Henderson and other observers established the non-identity of typhus and relapsing fever, while it was not until 1849-50 that Jenner's work on typhus and typhoid completed that of Gerhard and Pannock in America and Stewart in Scotland and finally differentiated these two diseases. But there can be little doubt that the numerous pestilences in the train of war and famine during the middle ages and in even more ancient times included typhus as a pronounced feature.

The earliest unmistakable reports of the fever date from the middle ages but then and up to about 1552 the disease was confounded with certain other epidemics, infectious diseases, especially plague. Thus the 'plague' which originated in Cyprus and ravaged Italy in the years 1505-30 was certainly typhus and the same is probably true of the disease called 'Morbus Hungaricus' which raged in the army of Charles V during the siege of Metz 1552. The disease as it appeared in Italy in 1505 to 1530 was carefully studied by the Italian physicians, the most notable of whom was Fracastorius and to him we owe the first lucid description of typhus. In his book 'de morbis contagiosis' he speaks of the epidemic under the name morbus lenticularis as 'a contagious disease indigenous to Cyprus and the adjoining islands and now observed/
observed for the first time in Italy.

His account of the disease was followed by others from all parts of Europe and by the end of the sixteenth century the amount of literature on the subject was a striking proof of the wide prevalence of the disease at that time.

The seventeenth century showed a very large number of epidemics which affected every country in Europe. The development of these scourges was for the most part connected directly or indirectly with the many wars of the period which shook European society to its very foundations. Famine, too due in part to the devastations of those wars and in part to the failure of crops was an important factor in the production of the disastrous pestilences which swept the continent and among which typhus played a leading part. In the early part of the century it had been prevalent in Spain, various parts of Germany, Italy and the north of Europe. During the thirty years war (1619-48) the widest diffusion of the disease took place, the whole of central Europe being affected. Germany, being the battle ground of the armies, suffered most severely, but the disease spread to France and to the northern Kingdoms/
Kingdoms, carried by the wars between Norway, Sweden and Denmark. Under similar circumstances typhus made its appearance in England during the Civil Wars, being first seen among the opposing troops at the siege of Reading in 1643. It appeared again later in 1658 and became very widespread. Italy suffered severely during the famine of the first half of the century, while in the latter half we have reports of epidemics in Prussia, the north of Germany, in France and in Sicily where the disease was again associated with famine. In Germany and also in Austria and Hungary typhus was associated with the wars against France and the Turks respectively, while in Sweden and Finland it was associated with the famine of 1695-97. In 1688 it broke out in London and spread over almost the whole of Britain and Ireland.

Severe epidemics of the disease occurred during the early part of the eighteenth century in all parts of Europe: in Germany, Austria and Hungary as well as in Ireland and to a less extent in England and Scotland. Later during the second quarter of the century typhus was again very prevalent in Britain and Western Europe in the time of the Seven Years War and the wars with Spain, and consequent upon the misery and depression caused by these wars and the severe famine which/
which visited large parts of Europe about the same
time. In the last ten years of the eighteenth and
the early years of the nineteenth century, during the
French Revolution and the Napolianic Wars typhus was
again very severe in all the countries affected by these
wars. It was also very prevalent consequent upon the
failure of the crops in Ireland about the end of the
eighteenth century, from which country it spread to
Scotland and England.

Since the overthrow of the Empire of Napoleon
epidemics of typhus have not been nearly so frequent,
nor have they been, with the exception of the wide
spread epidemics of 1846-47, nearly so diffused in
their characters. The disease is now practically
confined to certain places and districts in which it
may be said to be endemic. It occasionally spreads
in epidemic form from such centres, but the wide dif-
fusion which was formerly so marked a feature of the
disease is not now seen. The last great epidemic
occurred in 1846-47 when the disease spread through
Ireland and great parts of Great Britain, through
Poland, Moscow, Novgorod, and other vast districts of
Russia; through Silesia, Galicia, Bohemia and other
parts of Germany and Austria and through parts of
Italy and Belgium. In France since 1815, in
Switzerland, Norway and Sweden and in Denmark and the
Netherlands/
Netherlands, epidemics of typhus have been few and with certain exceptions, limited in extent.

In Britain, typhus has been prevalent at least so far back as the early part of the seventeenth century. In 1622-25 it was widespread throughout England and Scotland in which latter country it was, consequent upon famine, caused by a bad failure of crops. Later in the century it was very common in London. Pepys in his diary has several entries regarding the fever.

There can be no doubt that the 'Fever and Spotted Fever' spoken of by Sydenham the great medical historian of the seventeenth century in his 'Constitutions' was largely typhus. The two or three years immediately preceding the year of the Great Plague were pretty certainly heavy typhus years in London, and there can be little doubt that in the plague years, typhus helped in no small degree to swell the number of deaths caused by true plague. The fever of the years 1685-6 though described by Sydenham as a 'new fever' can hardly have been anything but typhus, and later writers, including Murchison in his short history of typhus in Britain have included it under that name.

In Ireland, though Irish ague has been known since the seventeenth century, it is not until the beginning of the eighteenth that any careful account of epidemics is to be found. The disease however was rife/
rife in Londonderry in 1689, caused by the privations and want due to the siege by the Catholic Army. Later in the year it wrought great havoc among the English forces in camp before Dundalk. In the latter case the disease, of which the predisposing cause was certainly the damp and unsanitary condition of the camp, was of a most malignant type, with gangrene of the extremities as one of its most conspicuous features. The English ships were also severely affected.

During the famine of 1693-99, continued fevers, of which a great part was undoubtedly typhus, were very prevalent and very fatal in Britain generally but more especially in Scotland.

In 1708 and again in 1718 epidemics of typhus were experienced in Ireland particularly at Cork. In the latter year the fever also visited several parts of England. These were not, so far as we can learn, famine years.

As a result of bad harvests and consequent famines, typhus was again severely felt in Ireland in the years 1728-31. The symptoms have been described by Rogers (1734) by O'Connell (1746) and by Rutty (1770) and there can be no doubt as to the nature of the disease. Rogers ascribed the fever to the same conditions which had earlier given rise to Jail Fever.

Later in the century - in 1735 - typhus, the 'Malignant'
ignant Fever' of Dr Brown Langrish was prevalent in London. He believed it to originate from 'the effluvia of human live bodies' and to be caused by overcrowding and deficient ventilation by which 'people were made to inhale their own steams'. The excellent account of the disease makes it quite evident that the fever was true typhus.

Typhus was again exceedingly prevalent in Ireland in 1735-36 and again in 1740-41, and again it was associated with famine. It appeared in England and Scotland a little later and was very fatal. Parotid abscesses and buboes were frequent complications.

Typhus was prominent as Jail Fever in the Taunton Assizes in 1730, but especially in the Black Assizes at the Old Bailey in 1750. It was introduced into the Courtroom from the prison, and hardly one of the officials, jury or audience present at the early trials escaped being infected from the dock. The disease was of a very malignant type and the mortality was enormous. The same condition of overcrowding, filth and hunger accounted for the prevalence of the disease in the debtors prison of the Fleet and of the Marshalsea a little earlier in the century. Another Black Assize occurred in Dublin in 1776 where many of the officials died of the infection. Investigation/
tion revealed that the disease was prevalent in a great-
er or less degree in most of the jails throughout the
country.

In 1770 typhus again associated with famine and
failure of crops was exceedingly prevalent in certain
parts of Ireland. The disease was confined to the
poor and the intemperate middle classes. In Eng-
land it was epidemic about the same time in Manchest-
er and at Carlisle ten years later, and a little
later a very severe epidemic broke out in Ireland
(1797-1802). Once more famine and want was an im-
portant etiological factor. From Ireland the dis-
eease spread to Scotland and England, carried no doubt
by the tide of Irish immigration and fostered by the
distress caused by the wars of the time.

During the nineteenth century the first great out-
break following that of 1797-1802 occurred along with
relapsing fever in the year 1817-19. It sprang from
the misery and starvation of famine and unemployment
caused by the failure of crop consequent upon two ex-
ceptionally severe winters and cold wet summers. It
commenced in Ireland and soon spread to the rest of
Britain. It was estimated that in Ireland no less
than one eighth of the population were affected by
one or other of the two fevers. There can be no doubt
however/
however from the descriptions of the many contemporary writers and from the very low mortality — one in ten to one in thirty — that the fever of this epidemic was mainly relapsing. It was during the epidemic that the practice of blood-letting and the neglect of stimulation, following on the teaching of Clutterbuck and others, came into vogue; and the small mortality of the fever was held up as a testimony to the success of the treatment.

Another mixed epidemic occurred in the years 1826-28, but in it typhus was present in greater proportion than in the earlier one and as a result bloodletting was found to be not nearly so successful, while stimulation was most beneficial. The mortality varied in different parts of the country from one in ten to one in six. In 1846-48 the great epidemic which was wider spread throughout Europe affected very disastrously great Britain and Ireland. It commenced in Ireland during the last quarter of 1846 and was preceded by a failure of the potato harvest which caused great famine and misery. It soon spread to the chief ports and large towns of England and Scotland, to Glasgow, Liverpool, Manchester and London. It was carried by the Irish immigrants who flocked in thousands/
sands into the country, and the ports and towns first affected were just those which the incoming Irish could most easily reach. In Liverpool about ten thousand people are said to have died of typhus, while in Edinburgh one in nine of the population were attacked, and over two thousand five hundred died proving a death-rate equal to one in 7.6.

In America the fever which had occurred in smaller epidemics earlier in the century as a result of Irish immigration was reintroduced from Ireland about 1847. Thousands of emigrants from that country poured into New York, Philadelphia, New Orleans and Baltimore and in these towns and in many others the disease became very prevalent.

In 1854-56 typhus ravaged the armies in the Crimea. The fever first made its appearance among the British troops largely owing to bad housing and defective commissariat. Later the French and Russian armies were still more heavily affected. During the first six months of 1856 it was estimated that of the French troops one in twenty died of typhus. The frequency of glandular complications was a prominent feature in the Crimean outbreak.

In Britain during and after the Crimean War the fever was very prevalent being spread abroad by the returning/
returning troops. Several epidemics occurred between 1861 and 1867 in the manufacturing towns of Lancashire and Cheshire, as well as in other parts of Britain during the cotton famine of the American Civil War.

Since 1870 typhus has not been nearly so common in Britain and Ireland. There have been, of course, numerous epidemics and the chief seaport and manufacturing towns have suffered from time to time. But such outbreaks have not been severe or widespread. During the last thirty or forty years typhus fever has almost disappeared from the practice of most medical men though small outbreaks still occasionally occur in Lancashire and the northern seaports. In Scotland the disease is now and again met with in the chief towns - in Glasgow, Edinburgh, Dundee or Aberdeen.

GEOGRAPHICAL DISTRIBUTION.

Typhus is mostly a disease of the temperate or cold zones which may be due to the mode of living adopted by people resident in cold climates. They do not live such an open-air life as do people in warm climates. There is probably no country in Europe which has escaped the ravages of typhus. Ireland, Russia, Spain, and Italy have suffered most frequently and most severely, while Switzerland, Denmark and France, since the close of the Napoleonic wars, have been remarkably free/
free of epidemics. In Britain, but especially in Ireland, the disease has always been common.

In Asia typhus has been prevalent in Persia and to a less extent in Asia Minor and Syria. In India, Further India and Burma and in the East Indies, typhus has been almost unknown. In 1861, 1863 and 1864 jail outbreaks were described by Walker, Gray and others. The disease resembled typhus in many respects, but the characteristic eruption was wanting. Examination of fatal cases shewed that the intestine was healthy. In 1869 a fever still more like typhus and having an eruption broke out in many of the prisons of the Punjab and was described by Dr Fairweather. Between 1888 and 1894 many epidemics more or less severe broke out and have been described. Between 1894 and 1905 typhus does not appear to have been met with in India but in the latter year it broke out at Peshawar in the First Mule Corps which had just returned from the Thibet mission and again in 1907 the disease obtained a footing. It has been described by Dr. Husband and MacWatters and from their account there can be little doubt that the disease was genuine typhus. The incubation period, the duration of the disease, the nervous and other symptoms and the condition of the blood all correspond/

1. Indian Medical Gazette, June 1908
respond very closely with what has been observed in the later outbreaks in Europe. Out of one hundred and twenty cases no rash was visible in twenty per cent, while only in twenty cases was the rash well out and typical. It must be remembered however that the patients were largely natives. Hepper in the same journal reports a small outbreak in the jail at Peshawar in the same year. In this instance the characteristic rash was present in all of his six cases.

In Japan the fever does not appear to have been met with, but frequent epidemics occur in parts of China, especially in the north and in and around Pekin.

In Australia, Tasmania, New Zealand and the South Sea Islands except where small outbreaks have been caused by immigrants, typhus fever has been unknown.

In Africa the disease is found in Egypt and Nubia, Algiers and the north generally, whilst in the southern parts it is quite uncommon.

Into the new world typhus was early introduced by the Spaniard. Mexico and Peru suffered first. In Chili the fever has frequently been epidemic but in the other parts of south and central America only few and occasional cases have been seen. In the States end/
and Canada typhus had been almost unknown up to the early years of the nineteenth century and it was very rare until emigration from Ireland set it on a large scale. Gerhard described the epidemics in Philadelphia in 1836. Hirsch illustrates the effect of Irish immigration by the following figures for Quebec, from 1833 to 1847 with an annual immigration of 23000, two hundred and ninety one typhus patients were admitted into hospital. In 1847 the number of admissions rose to 3574 out of 98000 immigrants. In addition five thousand immigrants died on the way, mostly from typhus.

The same factor of immigration probably explains why the disease has been almost entirely confined to the east coast of America and the districts near the ports. On the west coast the disease is and always has been very rare.

ETIOLOGY.

Bacteriology &c. Although we must assume that typhus like other infectious diseases is caused by some micro-organism we are still ignorant of its precise nature. Not one of the many organisms so far brought forward has given complete acknowledgement. In 1883 Mott and Blos saw what they believed to be diplococci.

Hirsch 1883, p. 572.
coccii and drops of fresh blood. Mosler had found the blood sterile in several typhus cases and his experiments in inoculation with fresh blood were like those of Obermeier, unsuccessful. In 1888 Moreau and Cochez described a bacillus resembling the Eberth bacillus, which they obtained from the blood and urine of typhus patients and which they regarded as the cause of the disease. These results have never been corroborated. A year later Hlava described a Gram-positive strepto-bacillus which he had isolated from the blood of about two thirds of the cadavers he had examined in the Prague epidemic of 1888. He obtained the same organism from the living subject also, but not in so large a proportion of cases. On agar, and in broth good growth occurred whilst there was no growth on gelatine or potato. It was not pathogenic to the ordinary laboratory animals, but two young pigs which were inoculated showed febrile symptoms lasting a fortnight and in one, inoculated in the lung, reddish blotches were seen on the skin. The specificity of this organism however was soon afterwards disputed by other observers. Lewaschew in 1892 described minute coccus-like bodies which he had obtained from the blood of typhus patients and especially from the spleen/
spleen. Many of these were provided with flagellae which stained by Laeffler's method. He also found free flagellae unconnected with the cocci. These various forms he regarded as indicating various stages in the life history of the organism.

Soon afterwards Thoinat and Calmette (1892) described a flagella/amoeboid organism somewhat resembling human spermatozoa which they had seen in the splenic blood of five living subjects, and in one case, in the pulmonary blood after death. Their organism appears to be much the same as that seen by Lewaschew. Next year Calmette obtained from the blood sputum and urine of six typhus cases cultures grown on acid media of a fungus which belonged to the class of Ascomycetes or Ustilaginaceae. He believed that the bodies previously seen by Thoinat and himself were a step in the life history of this organism.

Dubief and Bruhl during an outbreak in the prisons of Paris in 1893 described a small capsulated diplococcus which they cultured from the air passages, lungs and sputum. It grew well on ordinary media and liquified gelatine. On agar it grew as a greyish streak at the end of twenty four hours. It was yellow or orange at the end of forty eight hours and finally became grey again. From the blood it did not grow/
grow well, but could be seen on microscopic examination. Animal inoculation did not give satisfactory results.

Curtis and Combe (1893) could not obtain cultures from the blood of patients during life, but from the spleen and brain of three fatal cases they obtained cultures of diplo-cocci closely resembling those described by Dubief and Bruhl. Weinschal (1892) Fuchs (1896), Spillman (1896), McWeeney (1898) failed to obtain any cultures from typhus blood or secretion.

Balfour and Porter (1899) from drops of blood taken from the finger or thumb obtained cultures of Gram-positive diplococci in thirty six of the forty three cases examined. Broth was inoculated with the fresh blood and subcultures were made on solid media. The organism which was found to be non-motile and non-capsulated took the ordinary stains well. In blood films and hanging drop preparations it was not readily detected. The broth, potato and jelly culture showed nothing very characteristic. The jelly was liquified. On agar and serum the growth resembled a streak of white cement. In nine out of eleven fatal cases examined post-mortem, the diplococcus was got. Inoculation experiment with cultures or subcultures/
cultures from the blood of living patients had in all but one case, very slight effect. Inoculation with cultures from cadavers produced more marked symptoms especially in the case of rabbits. Normal and other controls were used by the observers and while the diplococcus was never obtained from normal blood, it was found curiously enough in no less than eighty seven per cent of the typhoid bloods examined. This point it appears to me must, to a great extent minimize the value of the results obtained.

Stanicherskaja (1906) examined the blood in nineteen cases of typhus. He introduced about 5 c. c. of blood into a flask of bouillon. In six cases he obtained cultures of a small Gram-positive diplococcus. Galesesco and Slatinesano (1906) found the blood sterile in eighteen out of twenty four cases. On four occasions a Gram-positive diplococcus was obtained and in six cases, a gram-negative bacillus. The bacillus was non-motile and was found in the cerebrospinal fluid in eight of the cases. They regarded these organisms as merely secondary and believed that the increase which they noted in the large mononuclear elements of the blood pointed to the disease being due to a protozoon.

Dr. Wilson of Belfast (Journal of Hygiene, Sept 1910/
In 1910) gives an account of the examination of the blood in thirty-three cases of typhus. He took from five to ten c.c. blood from the median basilic vein and introduced it into flasks containing one hundred c.c. broth. The flask was incubated at 37°C for 24-48 hours and subcultures were made on solid media: on agar, ascitic agar and glucose ascitic agar. In eighteen of the thirty-three cases the result was negative. In the remaining fifteen cases cultures of diplococci were obtained. The diplococci were small and Gram-positive and occasionally short chains of from four to five individuals were seen. Growth on agar and gelatine consisted of a greyish film, bluish by transmitted light. There was no formation of pigment. In about half of the cases liquefaction of jelly commenced about the tenth day. In the others no liquefaction was seen. The growth in broth was in the form of a uniform turbidity. The only other difference between the two groups of diplococci was found to be that the non-liquefying organism fermented mannite while the other did not. Mice and guinea pigs inoculated subcutaneously suffered no ill effects. In one case where a post mortem was made agar smears from the spleen gave no growth, but a piece of spleen added/
added to glucose ascitic broth gave a growth of cocci in all respects resembling the diplococcus cultured from the blood. Agglutination tests were performed in thirteen cases and very marked clumping of the diplococcus was observed in a dilution of as much as 1,200 after two hours.

Normal serum gave slight agglutination in a dilution of 1.20, but the typhus serum had from five to twenty times its effect. In a few cases of typhoid and cerebro spinal fever agglutination was got in a dilution of 1.100. Wilson acknowledges that this impugns the value of the reaction, but believes that it may be an instance of heterologous agglutination. This agglutination is of particular interest in view of the fact that Balfour and Porter found their diplococcus also present in eighty seven per cent of their typhoid controls. Wilson does not claim that the diplococcus he describes is the causal organism; he is inclined to believe that it may be a secondary invader.

In the Manchester outbreak of 1909 I examined the blood in six cases, one of them a case which proved fatal on the twelfth day. I chose the cases in which the clinical picture was most characteristic and the blood was examined in each case on some day during the second/
second week. The method of procedure was to take
the blood direct from one of the larger superficial
veins about the bend of the elbow. The skin was
prepared and sterilized as for operation and the
veins were rendered prominent by applying a bandage
from above downwards to the upper arm. An ordinary
sterile serum syringe and needle was used which, with
the object of coagulation, had been kept in sterile
hot water until warmed to a little above blood heat.
The needle was plunged directly into the vein through
the skin without making any skin incision, and about
10 c. c. was drawn off in each case. The operation
did not appear to cause any more pain or inconvenience
than the injecting serum in diphtheria cases. A
little of the blood was at once allowed to flow over
the surface of the solid media used, consisting of
slopes and plates of agar and jelly and tubes of
blood serum, potato and glycerine agar. A few drops
were also mixed with peptone water and glucose litmas
broth but the bulk of the contents of the syringe
was mixed with about 50 c. c. of ordinary broth con­
tained in a flask. The jelly was incubated at 22 °
and the remainder at 37°C. The media were examined
daily for a fortnight, but the broth remained clear
and/
and no growth whatever could be found in or on any of the media. The broth, agar and serum used was part of the stock which we were using daily for our routine examinations, and on which the B. of Typhoid and the B. of Diphtheria grew copiously. This negative result agrees with those of Weinschel, Fuchs, Spillman, McWeeney and others.

MICROSCOPIC EXAMINATION OF THE BLOOD.

The diplococci seen by Mott and Blore (1883) have been already alluded to. The observers also noted the occurrence of leucocytosis.

Thainot and Calmette (1891) found a leucocytosis in four cases, and in the splenic blood of four cases and in the blood from the finger of a fifth, they saw the small ciliated bodies already mentioned. Gotschlich (1903) saw parasites which he thought were related to Piroplasma bovis. They were of three kinds (1) Endoglobular pear-shaped parasites one to four \( \mu \) in size, (2) Flagellated pear-shaped bodies like spermatozoa, similar in appearance to those described by Thainot and Calmette, and by Lewaschaw, (3) cysts of an oval or round form and about the size of erythrocytes. The last were found only in one case and was regarded by Gotschlich as sporulation forms.

Lowe (1905) found a leucocytosis in all his cases.
The average in twenty six cases was 24,000 per c. m. m, and the number ranged from eight thousand to fifty four thousand per c. m. m. He found that it was mainly a polymorphonuclear leucocytosis and that in fatal cases eosinophiles were always absent, whilst in non-fatal cases these are constantly present. He further found that in non-fatal cases there was an increase in the large mononuclear elements and that the red cells were usually increased in number.

Slatineanu and Calesesco (1906) also found a polymorphonuclear leucocytosis, but they found that towards the end of the disease the mononuclears were greatly increased. They presumed that this increase represented the reaction of the body against the unknown parasite. They also found a dumb-bell shaped body sometimes phagocytosed by the mononuclears and lying in a vacuole within them. The polar points stained more deeply than the central part. Lucksch (1907) found a leucocytosis in most cases. The mononuclears were increased and the eosinophiles absent.

Krompecher, Goldzieher and Augyan (1909) examined the blood of forty eight cases in a severe outbreak at Budapest. They found bodies which bore some resemblance to Piroplasma and also to the malarial organism.
ganism but were not quite like either. The bodies were of various forms - globular, pear-shaped, and spindle-shaped - and were found within the red cells. The bodies stained light blue with the Giemsa stain and showed one or two granules which stained red or violet.

These bodies were not at all numerous and were seen only with the Giemsa stain. In some respects they were similar to those seen by Gotschlich in 1903. There were also found in the blood certain bacteria - streptococci and staphylococci. Friedlander's bacillus and a diplococci like that described by Hlaa. The observers, while believing that the disease is caused by the protozoon they describe, are inclined to think that the presence in the blood of the bacteria causes an aggravation of the general symptoms.

Wilson (1910) examined the blood of twelve typhus cases. Only on one occasion was a protozoon organism seen. It was very similar to that described by Krompecher, Goldzicher and Augyan. Wilson found a leucocytosis in most cases and again the most striking feature was the increase in mononuclears and the absence of eosinophiles.

I made blood films from twelve of my own cases. The stains used were Leischmann and Giemsa. A diligent/
gent search for protozoal or other organisms failed to reveal any. A leucocytosis was present during the second week in all the cases examined, but in some cases it was not well-marked, and in no case did it reach so high a figure as has been given by some observers. The number ranged from nine thousand to twenty six thousand per c. m. m., and the average was twenty one thousand. The leucocytosis was largely due to the increase in the polymorphs, but the large mononuclears were also in most cases absolutely and relatively increased, and made up from ten to twenty five per cent of the whole. The eosinophiles, when the film was compared with normal blood, were apparently decreased, but I never failed to find one or two. It was difficult to say definitely whether these cells were really decreased, since their percentage even in the blood of healthy adults has been given by some authorities (Zappert) as ranging within the wide limits of 0.67 and 11. The number of red cells in three cases in which these were counted showed a slight decrease, the average being four million two hundred thousand.

The increase in the mononuclear elements of the blood in typhus which most of the later observers seem to have noted appears to point to the causal agent of the disease being a protozoan. In this connection it is interesting and suggestive that Wilson and Chowning (Jour. Amer. Med. Assoc., July 1902) have described/
described a protozoon in Rocky Mountain Fever. Their observations have been confirmed by Cobb, Wesbrooke and Anderson. According to Sambon, Rocky Mountain Fever is identical with typhus. If this is so, and in the light of the results of Krompecher and the others already referred to, the evidence for the protozoal nature of typhus fever must be regarded as pretty strong. But in view of the widely different results obtained by various observers we must acknowledge that the question of the causal organism of typhus fever is still unsolved.

Regarding the question of leucocytosis in typhus it is to be noted that Ewing (New York Jour 1893) Vom Limbeck (1896) and one or two others found none.

Agglutinative power of typhus serum. Value of the Widal reaction. It has been stated by most writers that the Widal reaction may be taken as a deciding test in the differential diagnosis between typhus and typhoid. Goodall and washbourne (1908) state that the serum of a typhus patient will not clump typhoid bacilli. Curschmann (1902) says that 'it has been found as was to be expected that the serum has no agglutinating action on the typhoid bacillus.' Moore (1906) says that the agglutination test will establish the diagnosis. Love (1905) states that a positive Widal reaction is sometimes obtained in typhus fever.

fever. Dr Ker found that out of about one hundred cases of typhus, agglutination was obtained in only two. In one of these two cases there was found to be a previous history of typhoid and in the other, the daughter of the first, there was the possibility of it.

Iversen (1905) and Gallesesco and Slatineano (1906) had got no agglutination in any of their cases. Hay (Aberdeen 1904) found the widal reaction positive in a dilution of $1.10$ and $1.20$ but negative in all cases with a dilution of $1.50$.

On the other hand Patterson in his report on the bacteriological work of the county of Lanark (1908) states that he made thirty eight widal examinations of the blood of ten cases of typhus, employing seven different stains of typhoid bacilli. He found that nine of these cases gave positive results, and only one a negative. In four of the nine cases agglutination was obtained at some stage of the disease in a dilution as high as $1.1000$. He found that the reaction was got as early as the ninth day, but was most marked about the fourth week and gradually passed off about the sixth.

Wilson (Jour. of Hyg. Novr. 1909) reports that out of thirty five cases of typhus examined for the widal reaction a positive result was obtained in nineteen instances.
instances and a negative in sixteen, the dilution being 1.50. He used several strains of typhoid bacillus and did control experiments with non-typhus blood. The cases tested were clinically typical typhus and the question of previous typhoid infection was apparently excluded in all cases.

It is difficult to account for such a diversity in the results obtained by those different observers. With regard to Wilson's experiments in agglutination it is interesting to note that from the faeces of typhus cases he was able to isolate a bacillus which from its reactions he took to be a variant strain of R. Coli and which he calls Bacillus 'U'. It was agglutinated by normal serum in a dilution of 1.60 but not of 1.100. Typhus serum caused agglutination in a dilution of 1.300. It is of course well known that typhoid serum will in many cases cause agglutination in organisms related to typhosus (R. Coli, the paratyphoid bacillus and R. enteritides (Gaertner) though a higher concentration of the serum is necessary. Again the serum of a person suffering from paratyphoid or from meat poisoning (R. enteritides (Gertner)) has been frequently found to give a positive reaction with B. typhosus, though again a much higher degree of concentration/
centration is required than is necessary with typhoid serum. Had it not been for the relatively high dilution (1.50) in which Wilson obtained agglutination of P. Typhosus with typhus serum I should have inclined to the view that his positive result might be explained either by group agglutination or by heterologous agglutinins in the blood due to the presence of Bacillus 'U' in the intestine. But Wilson himself has precluded this possibility for he found that when the agglutinins of Bacillus 'U' were removed from the serum by saturation with that organism. Such saturation did not remove the agglutinins for typhoid, nor on the other hand did saturation with P. typhosus affect the agglutination of Bacillus 'U'.

My own experience leads me to agree with those who believe that the widal reaction is of value in differential diagnosis. I examined the blood serum of twenty cases, most of them on several occasions, between the seventh and fifteenth days and in no case did I get a positive widal reaction. The typhoid bacilli used were of a 12 to 15 hours broth subculture from a stock agar culture four weeks old and the dilutions employed were 1.30 and 1.60 with a time limit of one and two hours respectively. Controls of typhoid and normal serum were done and typical and marked reactions were/

1 Wilson Jour. of Hygiene Sept 1910 p 168.
were obtained by the former. Unfortunately I did not attempt to get the reaction during convalescence, so that I am unable to corroborate or otherwise the results of Patterson, who found the reaction most marked about the fourth week.

Under all circumstances I still feel strongly inclined to put some reliance on the Widal test as an aid to diagnosis, always remembering that it is not usually got in typhoid before the end of the first week.

**INFECTION & DISSEMINATION OF THE CONTAGIUM.**

Since we must confess our ignorance of the exact nature of the cause of typhus, we cannot tell with certainty how the infective agent leaves the body. Most observers however have been of the opinion that the poison is contained in the exhalations of the patients—the expired air, the emanations from the skin &c. The contagium may attach itself to the dust in the atmosphere and be readily transferred to objects handled by or in the immediate vicinity of the patients, and on these it may under favourable circumstances maintain its virulence for a considerable time. Among such objects are the clothing and bedclothes of the patient, carpets, curtains, furniture, upholstery and all objects having a rough or woolly surface. Washerwomen, sanitary officials/
officials and others whose work necessitates the handling of such articles are particularly liable to infection during epidemic times. If such infected articles are protected from the air they may retain their infectivity for a long time and the contagium may be transmitted a considerable distance by the transport of such infected articles. Definite instances of such occurrences have been quoted by various authors. This transmission of the poison by infected articles is the most probable explanation of the so-called spontaneous outbreaks which have occurred on board ship, in prisons &c., and which formerly lent support to the view of the non-specific or 'de novo' origin of Typhus Fever which the earlier writers held and which even Murchison was inclined to support. It also shows how the poison may linger in apartments which have been inhabited by infected persons as well as in cabs, railway carriages &c used by them if infection has not been properly carried out.

As a rule however the striking distance of typhus is short. Fresh air seems to have a strong germicidal effect on the contagium and to contract the fever it is usually necessary to be in almost absolute contact with the patient if the room in which he lies is properly ventilated. But on the other hand experi-

Murchison 3rd edn 1884 pp 99-119
ience has shown that merely to enter a badly ventilated typhus-infected room may be sufficient to contract the disease. Harvey Littlejohn, during investigation into the last Edinburgh outbreak noted the comparatively close association of sick and healthy which is necessary for the spread of infection. He found that even in large overcrowded tenements where several families occupied different rooms in the same flat, the fever did not spread from one family to another unless individuals were in the habit of entering each others rooms. The persons who were not on intimate terms with the affected persons escaped. Members of the patient's family might mix with other families in the stair or outside the house apparently with impunity. In all cases where the source of infection was traced the patient was found to have been in actual contact with a previous case.

In illustration of the short striking distance of the contagium and the efficacy of circulating fresh air as a disinfectant, we know that in former days it was customary to treat typhus and typhoid in the same wards of the Edinburgh Infirmary. The typhoid cases were placed near the door and the typhus cases at the other end of the ward near the fire. A constant current of fresh air flowed from door to fire and/

\[1\] Harvey Littlejohn & Her Edin. Med Jour. 1899 vol 5 p. 560.
and it was very exceptional for a typhoid case to contract typhus.

Netter and one or two other observers maintain that actual contact with the patient is necessary for the transmission of the disease. Samson who believes that the tick fever of the Rocky Mountains is identical with typhus holds that the latter fever is not at all immediately contagious.

CHANNELS OF INFECTION.

Nothing definite can be said on the subject but most authorities agree that the poison enters the body through the organs of respiration. Entrance may also be effected through the skin. The intestinal tract is probably of only secondary importance in this connection.

Later theory of infection. May in his report on an outbreak of typhus in Aberdeen in 1904, puts forward the theory that fleas as in plague and like the mosquito in Malaria, play an important part in transmitting the disease from person to person. He found, as I daresay every one else found, that his cases always showed marked evidence of the presence of the flea. But he also found that those of the hospital staff who were attacked by the fever were those who had complained most of flea bites. The ambulance driver/
driver who had carried patients in his arms and who had been very much bitten by fleas fell a victim to the disease. Again, the disease was not known to spread in any family of perfectly clean habits even though a typhus-stricken patient had been in the house during the greater part of his illness, without any isolation whatever.

It was further found that the nurses who were attacked by typhus were those who had received the patients into hospital or who had bathed them on admission. None of the staff who had attended the patients only after they had been cleaned up, took the disease, no matter how prolonged or intimate their association with the patients. This suggestion of Hay's is very interesting and might explain many of the undoubted facts in connection with the contagiousness of the disease. It would certainly explain the fact frequently demonstrated that close personal contact with an infected person is necessary to contract the disease. It might explain why the contagiousness of the fever seems to vary in different epidemics or in different localities during the same epidemic, for the contagiousness would be great or slight according as fleas were plentiful or the reverse. The old idea as to the high infectivity of the/
the typhus cadaver would also be brought into line with this theory: for as the body becomes cold the fleas desert it and seek a warm living host.

Pay found that when precautions against flea-bites were taken by the attendants, their work could be performed with entire impunity.

Dr MacWatters, who observed an outbreak of typhus at Peshawar in the first Mule Corps pointed out that in India fleas almost entirely disappear in winter, while the fever did not. He inclines to the belief that bed bugs are the carriers of infection, and this view is supported by Dr. Hopper, who saw a few cases in Peshawar jail. Investigation satisfied him that the disease had not been introduced into the jail from outside sources. Four out of the five cases had been exposed to the attacks of bed bugs. Steps were taken to have all the vermin destroyed and Dr. Hopper was of the opinion that the rapid checking of the outbreak and the immunity from attack which the attendants of the typhus patients enjoyed was due to the destruction of the bugs. These suggestions as to the etiology of typhus are very interesting and appear quite plausible, but they require to be confirmed by experimental and bacteriological evidence.

Whatever/  
Whatever the agent in the dissemination of the disease, there can be little doubt that the contagiousness varies in different epidemics. Sambon who believes that typhus is identical with Rocky Mountain Fever entirely denies its contagious character. In my own experience in Manchester the first two cases imported from Russia, did not give rise to a single fresh case, although there must have been many contacts.

Period of greatest danger of infection. Opinions differ on this point but most observers agree that the danger is great during the entire febrile period, becoming less during defervescence. Perry and certain others consider that during convalescence the danger of contagion is greatest, but, while Dr. Ker considers that the danger during that period is still considerable, though not so great, Curschmann1 thinks that there is no reproduction of the poison during that time and that when infection occurs it is caused by the transmission to predisposed of poison which has been produced during the febrile period and deposited on surrounding objects. The latter observer believes that direct infection is possible during the incubation period and certainly during the initial stage before there is any fever.

Hay of Aberdeen found that when an infected person was removed before the end of the first week, no other member of the family contracted typhus. He concludes that the disease is not very contagious, at least during the first week.

PREDISPOSING CONDITIONS.

SEASON appears to have little influence on typhus fever. It is true that most epidemics have reached their height in the cold months of the year, but this may be due entirely to the fact that in winter the conditions of want and unemployment which are so favourable to the spread of the disease are at their height. In winter, too, the poor spend a much greater proportion of their time indoors, crowded together under bad hygienic conditions.

SEX appears to have no influence: males and females are affected about equally. In the Edinburgh outbreak (1898-1902) of the one hundred and sixty one typhus cases seventy eight were males and eighty three females. In the beginning of an outbreak males preponderate slightly, but as the epidemic grows and spreads the females affected are slightly in the majority. This may be explained by the fact that males, by their mode of life and occupation are more exposed both/
both to the contagium itself and to the predisposing factors, while later, when the disease has secured a footing in the community, women act as nurses in, and are more confined to affected houses.

AGE. In considering the age incidence we must remember the difference in the social condition, mode of life and occupation peculiar to the different age periods. We find however that age has not so much to do with the incidence of typhus as it has with most of the other infectious diseases, for instance, typhoid. All ages will be found represented among the patients. Individuals of such extreme ages as ninety four and one hundred and four years and also babies at the breast have been victims of the disease. Probably the greatest number of cases occur between the ages of fifteen and twenty five. In Murchison's statistics of 18,138 cases treated at the London Fever Hospital (1848-70) we find that 5332 cases or 29.4 per cent between twenty and twenty five years of age. Of children up to fifteen years the number is 3619, or almost twenty per cent. During the ten years 1646-57, the mean age of typhus admissions was found to be twenty nine to thirty three years, or about three years above the mean age of the population during that/
that period. Ourschmann gives from the Guttstat statistics a morbidity of 9.7 per cent for children under fifteen years. Dr. Ver believes that the incidence in children is much greater than statistics usually show, owing to the fact that the disease being not infrequently mild and abortive in these cases is often missed. He found that when quarantine of the affected families was rigidly forced, the number of children who contracted the disease was very high. In the last outbreak the percentage of children of sixteen years and under was 37.3.

Behse in the Dorpal epidemic of 1866-67 found that 60 per cent of those attacked were children, but this occurred in a locality in which a large number of adults were immune through a previous attack. Of the 2251 typhus patients admitted into the metropolitan asylum, Board Hospital 1871-1909, 736 or 32.7 per cent were children under fifteen years (Goodall and Washbourne 1908 p 254). In the Aberdeen outbreak of 1904 Hay found that of his one hundred and thirty-one patients rather more than half were children under sixteen years.

As has been already said young babies are sometimes attacked, though this is rather exceptional, but the/
the rate of contracting the disease gradually increases with the age of the child.

After the age of twenty five the chance of contracting the disease steadily diminishes. Still, according to the statistics of Murchison, 11.9 per cent of all persons attacked were fifty years of age and upwards, compared with an average typhoid percentage of 2.4 for the same period.

**Age incidence of typhus admissions to Edinburgh City Hospital 1898-1902:**

<table>
<thead>
<tr>
<th>Age period</th>
<th>No of admissions</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>15 years &amp; under</td>
<td>60.</td>
<td>38.7</td>
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<tr>
<td>17 - 25 years</td>
<td>32.</td>
<td>20.6</td>
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<tr>
<td>26 - 35</td>
<td>29.</td>
<td>18.7</td>
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<tr>
<td>36 - 50</td>
<td>24.</td>
<td>15.5</td>
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<td>over 50</td>
<td>10.</td>
<td>6.4</td>
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<td>age not ascertained</td>
<td>6.</td>
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Physiological conditions in women: Pregnancy, the puerperium & lactation do not appear to have any particular influence on the liability to typhus fever, nor do they confer any immunity. In the last Edinburgh outbreak, three pregnant women were admitted to hospital, and one woman during the puerperium. All four recovered and the fever appeared to have no effect on the pregnancies.
General conditions affecting the predisposition of the disease. The liability to typhus, as in other acute infectious diseases is increased by any condition which tends to lower the resisting power, such as poverty, want, hunger, fear, worry, bodily or mental exhaustion and alcoholism. Such conditions include overcrowding in filthy ill-ventilated houses and unhygienic living in all its aspects. Worry and exhaustion play an important role. Physicians and others worn out by want, worry and loss of sleep are particularly liable to infection during epidemics. Fear may undoubtedly lower the power of resistance, and nurses who dread infection should not be permitted to attend typhus cases.

Exhausting diseases have a marked predisposing influence. Convalescents from other infectious diseases are more likely to contract typhus. In the same way persons exhausted by previous or existing chronic or subacute diseases are especially liable to infection. Curschmann says that those suffering from chronic or subacute gastro-intestinal catarrh or nervous dyspepsia are particularly susceptible.

Immunty: There appears to be no such thing as natural immunity from birth.

Hildebrand believed that a certain amount of immunity/
immunity might be developed in those who were constantly in touch with the disease, but this view is not shared by later writers. On the other hand one attack of the disease almost always confers immunity lasting during the remainder of life. But a few cases have been reported of persons suffering from a second attack of the fever. Dr. Ker in 1899 found one undoubted case of a second attack. Murchison suffered twice from the disease. So far as can be made out second attacks are not more common in typhus than in the other exanthemata. True relapses so common in typhoid are practically unknown in typhus.

Incubation period of typhus. In the vast majority of cases in which it has been possible to fix upon one definite exposure the latent period has been found to be about twelve days, but it seems possible that it may occasionally be considerably longer or very much shorter. Murchison has reported a few cases in which the period was as short as a few hours or a day or two, and as long as twenty one days. But the most usual period was twelve days. Curschmann reports an undoubted case of a four day period of incubation. While Dr. Ker reports the case of a child kept in quarantine beyond the usual period of fourteen days, who developed the fever on the seventeenth day after the last possible exposure. The latter observer:

1. Infectious Diseases p214; 2. Contd Fevers 1884 p92.
server in two other cases in which the date of exposure could be absolutely fixed, found the latent period to be twelve and thirteen days. Fay of Aberdeen gives the incubation period of some of his cases as varying from eight to twenty-four and in one case probably twenty-six days. The most common period was twelve to fourteen days, but the extreme periods were, he tells us, well attested.

**SYMPTOMS: INVASION STAGE.**

The onset of typhus fever is as a rule sudden and severe so that the patient usually feels distinctly ill and takes to bed early. Typhus cases thus come under medical observation much earlier than typhoid cases. One of the most constant complaints is Headache. This may be very severe. The situation is usually frontal but may be occipital or more rarely vertical. Occasionally the pain is felt only on one side of the head and sometimes it is all over. Sometimes the pain is dull and throbbing in character, in other cases sharp and stabbing and it frequently radiates into the neck and shoulders; with it vertigo and tinnitus aurium are often associated. The headache usually persists for some time but tends to become less as the rash comes out. Occasionally the headache persists throughout the entire course of the disease/
disease and may be the chief complaint of the patient. Often too the pain does not readily yield to treatment. Of one hundred and thirty seven cases in the last Edinburgh epidemic in which a definite history could be ascertained I find that one hundred and fourteen or 83 per cent had headache among their early symptoms.

Shivering and chill. This also is a very constant symptom by which the fever is usually ushered in. There may be one or more distinct chills or it may be a feeling of chilliness. The patient feels very cold and sits shivering before the fire, or lies huddled up in bed. An actual rigor may occur but is rather uncommon.

Sickness and Vomiting. The headache and chill are usually accompanied or followed by sickness—a feeling of nausea. Murchison asserts that nausea and vomiting are comparatively rare. I find however in the records of the Edinburgh cases (1898-1902) that 57 per cent of the patients had nausea as an early symptom, while 43.4 per cent had also actual vomiting. Of children under sixteen years who vomited the percentage was fifty four. In thirty nine per cent of the cases headache, shivering and sickness were present together. Of the cases I saw in Manchester Fever Hospital in 1909, out of thirteen in which a definite/
definite history could be got, seven had the above combination of symptoms, and five of these had also actual vomiting.

Another prominent invasion symptom is pain in some part of the body or limbs. It is quite commonly abdominal especially in children. In adults it appears to be more commonly in the back or all over the body. Of the Edinburgh cases already referred I find that rather more than one third of the children under sixteen complained of abdominal pain. Of those sixteen years old and over 25 per cent complained of pain in the back and forty three per cent of pain all over the body. It was not so commonly referred to the chest. The pain was frequently very severe and in at least one case had led to the diagnosis of Rheumatic Fever. True joint pains are however not common.

The above are the most usual invasion symptoms. But there are others of less frequent occurrence. Constipation is the rule in typhus, but of the one hundred and thirty seven Edinburgh City Hospital cases giving a definite history sixteen or 11.7 per cent suffered from diarrhoea. Seven had epistaxis, five had 'sore throat', many had bronchial catarrh and cough. In one case, that of a young child, a convulsion was the only initial symptom: in another case, that of a nurse, the fever was/
was ushered in by a faint and in another case of a child delirium was one of the earliest symptoms.

Of the thirteen Manchester cases in which I could get a definite history, seven had marked sweating in addition to the more usual invasion symptoms. In four cases the larynx was affected, causing hoarseness of voice and slight difficulty in breathing, and in one case, aphonia.

In addition to all these invasion symptoms there are, since the temperature early commences to rise, the usual symptoms of fever, toxaemia, loss of appetite, insomnia, thirst, a feeling of languor and listlessness and a sense of prostration and general malaise. The onset of the disease, as has been already said, is usually sudden and severe, and the patient has, as a rule, to take to bed quite early. It is exceptional for an adult patient to keep on her feet after the third day, though in one or two cases the patient has been known to actually walk into hospital.
Short clinical description of Typhus fever.

The disease is ushered in by some or many of the symptoms already detailed.

The appearance of the patient is often characteristic. The face is flushed and swollen, dusky red in hue, and looks coarse and bloated. The conjunctiva are frequently injected giving the eyes a pinkish or reddish tinge. The pupils even at this early stage may be contracted. The expression is heavy and stupid or drunken, and in marked cases the whole aspect of the patient may be altogether terrifying.

The tongue in a case of moderate severity is tremulous and dry and is covered with a close yellowish fur. Later it becomes brown and tends to show cracks or even fissures. In severe cases the tongue may become hard, pointed and contracted and almost black - the parrot tongue. In some cases, chiefly mixed, the tongue may be fairly moist during the first few days. In children the papillae sometimes show prominently through the white fur, giving the tongue quite a scarlatinal appearance.

The mucous membrane of the throat, palate and nose is turgid and injected and the patient complains of a harsh dry feeling in the throat, or there may be actual/
actual sore throat and dysphagia. The tonsils are frequently enlarged but there is never any ulceration in uncomplicated cases. Occasionally there is some bleeding from the nose, but this is not nearly so common as in typhoid and it is as a rule very slight. Sometimes the inflammation extends to the larynx causing hoarseness of voice or difficulty in breathing. Severe laryngeal symptoms are fortunately rare.

The skin is hot and dry as a rule but in mild cases it may be a little moist for the first few days.

The temperature commences to rise from the first and has usually reached its height by the third or fourth day. The rise is as a rule gradual and it is unusual for the acme to be reached the first evening. Morning remissions may occur but are usually slight and are not invariably seen. The average level of temperature is between $103^\circ$ and $104^\circ$, but this is not unfrequently exceeded. This level is usually maintained throughout the first week but in most cases which do well, the temperature tends to fall a little during the second week.

The pulse rate rises along with the temperature and, in typhus unlike typhoid, the increased rapidity of the pulse corresponds very closely with the rise of the temperature. Even in a male adult, the pulse on the second morning may be a hundred or more and during the second week may in a severe case exceed 130.
The evening rate is usually a little higher than that of the morning. At first the increased rapidity is all that is noticed, but later the volume becomes poor, the tension low and the pulse is soft and compressible. Dicrotism is not usually present during the first week, but is fairly common in severe cases during the second week at which time irregularity or intermittency may also be present.

The respiration is also quickened and may be noisy in sleep. Even in a comparatively mild case 30 per minute or over and in a severe case may be the rate may be much higher so that in absence of the typhus rash a pneumonic condition might be suspected. There is also usually a certain amount of bronchial catarrh and cough. Frequently definite bronchitis is present. Quite early owing to the feebleness of the patient and to the toxaemia hypostatic congestion of the lungs may develop.

At first the mind is usually fairly clear by day, though there may be some mental disturbance at night. But the patient is dull and depressed and apathetic and difficult to arouse. He seems to resent being questioned and answers with difficulty and is quite unable to carry on a conversation. The sleep is fitful and troubled by unpleasant or terrifying dreams and he talks or mutters continuously.

Complaint/
Complaint of headache is frequent during the first week, indeed almost any of the invasion symptoms may persist throughout that period. Abdominal pain may be present and there may also be some tumidity or tenderness. The bowels are usually constipated, but diarrhoea is not very uncommon. The spleen is in most cases somewhat enlarged during the febrile period. The enlargement may be noted early in the first week and as a rule has subsided by the end of the second.

The rash which is the most characteristic feature of the disease is usually to be seen about the third fourth or fifth day. It consists of spots at first of a pale pink or red colour. They are circular or oval in form and vary in size from that of a pin-head to that of a lentil. The outline is somewhat irregular and they fade imperceptibly into the surrounding skin. They are only slightly elevated above the skin surface and at first disappear completely on pressure. They are usually fairly numerous and as a rule are first seen on the lower part of the abdomen or the upper part and side of the chest. Sometimes they are best seen on the back. At other times the spots appear first on the anterior folds of the axillae and in the groins. They gradually spread to the shoulders and arms and to
the thighs. Sometimes the spots are first seen on the wrist and backs of the hands or on the ankle and dorsum of the foot. The rash is not seen on the palms of the hand or the soles of the feet and is usually absent from the face which is as a rule merely flushed. After the first day or two the spots become darker assuming a dusky red or reddish brown tinge. They are no longer elevated above the skin and do not now disappear completely on pressure but only fade a little. Along with these spots are others less distinct, not on the surface of the skin, but apparently under it and having the appearance of being seen through the cuticle. This gives a mottled or marbled appearance to the skin and is the subcuticular element of the rash. The spots are usually all out within from twenty four to forty eight hours of their first appearance and they do not appear and fade in successive crops as in typhoid. At a later stage in most cases of moderate severity haemorrhage takes place into many of the existing spots or independently into other parts of the skin, causing purplish petechiae not unlike flea bites, but of more irregular outline and lacking the central puncture. Sometimes the haemorrhage is more extensive causing an almost purpuric appearance.
The three elements, the spots, the subcuticular mottling, and the petechiae together constitute what Jenner has called, from its resemblance to the stain caused by the juice of that fruit, the 'Mulberry rash' of typhus.

By the time the characteristic eruption has fully developed the clinical picture as a whole has greatly altered. The tongue is dry and parched with brown or blackish fur and may show cracks or fissures which readily bleed. When at a later stage the fur peels off it leaves a smooth glazed surface behind. Intense thirst is complained of. The pulse is rapid and the volume and tension may be diminished. The respirations are also increased in frequency and there may be some bronchitis and cough. The skin is hot and dry, but occasionally there is some sweating. The peculiar odour of typhus is in most cases now well marked. The mental condition of the patient soon undergoes a change. The dullness and apathy have passed away. Headache and thirst are no longer complained of. He becomes restless and excited. He cannot sleep and soon becomes acutely delirious. The patient is often quite unconscious and experiences wild hallucinations and often takes violent dislikes to his attendants and tries to get out of bed to escape from them. If he sleeps at all he has horrid dreams. In old/
old or weak or debilitated people the delirium is usually of the low muttering type. Often the patient is quiet and stupid when awake but very noisy and delirious in sleep. But in the case of a young vigorous adult the type is as a rule acute at first and may be violent. In some cases it may be so violent as to justify the term delirium ferox. In this condition the patient is extremely difficult to manage. He becomes very violent and shouts and screams and struggles with his attendants. The strength exhibited in this condition of delirium is often remarkable, and forcible, restraint is frequently required. Such cases are extremely serious and are very often fatal.

From the state of excitement the patient passes into a condition of stupor. He is weak and exhausted and apathetic, and lies on his back with open lids, muttering incoherently. Deafness is often pronounced. The pupils are now markedly contracted and the conjunctivae are still injected. The eyes may be quite ferrety in appearance. The pulse is rapid and soft and compressible. It may be intermittent or irregular, and dicrotism may be present in severe cases. In the worse cases the pulse may be running and almost imperceptible towards the end of the second week. The heart sounds are feeble and indistinct and the apical impulse may not be felt. The respirations are rapid and/
and there is usually marked hypostatic congestion. The tongue is hard and contracted and can with difficulty be protruded. The lips and teeth tend to become covered with sordes. Muscular tremors and subsultus are frequently seen at this stage and there is often involuntary discharge of urine and feces. Retention may be present necessitating the repeated use of the catheter. Diarrhoea is sometimes troublesome. The skin may still be hot and dry but it is frequently moist and clammy and marked sweating about the time of the crisis is not uncommon in bad cases. In very severe cases the patient lies on his back, sunk low down in the bed with wide staring eyes and open mouth and hanging jaw. There are marked tremors especially of the facial muscles with subsultus and picking at the bed-clothes. From this condition he may pass into a state of profound and fatal coma, or death may take place from heart failure or from engorgement of the lungs.

But frequently about the twelfth or fourteenth day there is a marked improvement. In mild or in uncomplicated cases of moderate severity it may occur a little earlier. The temperature begins to fall usually by a not very abrupt crisis and becomes normal or subnormal within about forty eight hours or three days. With the fall of the temperature there is a marked
marked amendment in the other symptoms. The patient usually falls into a refreshing sleep from which he awakes much clearer mentally. Though still confused he is free from delirium and recognises his friends and attendants. The tongue begins to clear and to become moist, at first at the edges, afterwards all over, and the fissures and cracks begin to heal up. The pulse improves, the rate begins to diminish and the volume and tension become more satisfactory. The pulse rate however is at first readily increased by the slightest exertion, mental or physical, and there is frequently marked prostration about the time of the crisis and sometimes there may even be collapse requiring energetic treatment and free stimulation. Marked sweating about this time is usually a bad diagnostic sign.

With the improvement in the temperature and pulse following the crisis there is a desire for food. The appetite may be ravenous and the patient though still very weak gradually acquires strength and progresses towards complete recovery. The rash has by this time disappeared or a brownish staining of the skin may be seen for a few days longer, especially if there have been petechiae. Sometimes a branny desquamation may be noticed particularly on the chest.
In many cases the memory is somewhat affected. The patient may remember nothing of the beginning of his illness, or of being brought to hospital. Usually this quickly improves, but occasionally the improvement is not so rapid. As a rule however, convalescence once established goes on rapidly and without interruption and in the course of a week or so in moderate uncomplicated cases the patient feels quite well. Complications are few and sequellae are not common. The deafness which is so common a feature of the disease, clears up during convalescence. Occasionally the mental balance is not fully restored for a few weeks after convalescence has set in. In the great majority of cases the health of the patient is not permanently affected by typhus.

The foregoing clinical description is that of a pretty severe type of typhus but although the proportion of such cases appear to vary in different epidemics and also in the different localities visited by the same epidemic fortunately there are as a rule a large proportion of much milder cases.

Short description of typhus cases in Manchester 1909. In a small outbreak which occurred in Manchester in 1909 I had while Senior Resident Physician in Monseall Fever Hospital the opportunity of observing the disease in the twenty one persons affected and I found that/
that out of that number only in four cases did the severity of the disease approximate to that I have described and in only one of these cases did the disease end fatally. This would of course indicate a much milder type of the disease than is usually observed but it must be remembered that the number of cases was very small and a further explanation lies in the fact that a large proportion - fourteen out of twenty one - of the patients were young people under twenty years of age.

The fever was introduced into the Chestham Hill district of Manchester by Russian Jews who arrived in the town from one of the Baltic Ports apparently incubating the disease. Two such immigrants, father and daughter, arrived late in February 1909, took ill within a day or two of arrival and were eventually sent into Monsall on March 5th. Unfortunately I could get no definite history of their movements, but no fresh case of typhus was sent into the hospital until May 23rd when another fresh immigrant, again a Russian Jew, was admitted. It was apparently from this case and from another who came to join his family already settled in Manchester that the rest of the cases sprang. The outbreak was very limited in extent, comprising in all twenty one cases most of whom were relatives.
relatives and friends closely associated with the newly arrived aliens.

The fact that no fresh cases sprang from the first two admitted seems to some extent to discount the accepted views as to the extreme contagiousness of the disease but the important factor of close personal contact in typhus infection is well illustrated by the fact that of the twenty-one, no less than nine were members of one family - a mother and eight children. Curiously enough the father escaped. Of the other twelve patients three were members of one family, two of another and the others were all of different families.

On the other hand the short striking distance of the contagium and the ease with which the disease may be controlled by the aid of prompt and efficient hygienic measures under fairly good modern conditions of housing and sanitation is, I think strikingly shown by the small dimension of the epidemic and by the fact that no cases occurred outside the small district primarily affected.

The outbreak as I have said was in the Jewish quarter and the general cleanliness of the patient on admission left much to be desired. Evidence of external parasites in the shape of fleas was present in/
Sex incidence.

Out of the twenty one cases, nine were males and twelve females.

Age of incidence.

\[
\begin{align*}
0 - 5 \text{ years} & : 2 \\
6 - 10 \text{ } & : 4 \\
11 - 15 \text{ } & : 3 \\
16 - 20 \text{ } & : 5 \\
21 - 25 \text{ } & : 1 \\
26 - 30 \text{ } & : 1 \\
30 - 40 \text{ } & : 5 \\
\end{align*}
\]

In all cases.

Incubation period.

I had never any contacts under observation and could find no history of a single exposure. The history was often difficult to get for many of the patients spoke little or no English. In the few cases where a more or less definite history could be got the incubation period was certainly not less than ten days.

Invasion symptoms.

In only twelve cases could a definite history be got. In eleven of these cases there was headache, in one case along with severe giddiness, seven had felt chilly and had shiverings, five had had sickness and/
and vomiting. Abdominal pain had been present in five cases, pain in the back in two and pains in the limbs in one case. In one case there had been diarrhoea, but in the others more or less constipation. Loss of appetite, insomnia, and general malaise were usual features of this period. One early symptom which was more common than usual was sweating which had been present in five cases. Slight difficulty in breathing and hoarseness had been present in four instances and aphonia in one case. Sore throat was complained of by one patient. Headache, shivering, nausea and vomiting were present together in five cases. So far as a definite history could be obtained it was found that on admission two patients were in their second day, three in the third day, one on the fourth day of his illness, one on the sixth day, two in the seventh, one in the eighth, one on the ninth and one (which proved fatal within twenty-four hours) in the twelfth day.

Except in the mildest cases the appearance of the patient was characteristic. The face was usually flushed and rather swollen and bloated in appearance. The complexion was somewhat muddy. In two cases the face was rather pale than flushed.
The expression was stupid and apathetic or even drunken, and the eyes were in almost all cases markedly injected even in those admitted in their second day. On the other hand contraction of the pupil was not noticeable in any patient admitted before the fifth day of his illness. In four cases the pupils on admission were rather dilated than normal and no marked contraction was observed throughout the illness of three patients. Where contraction occurred subsequent to admission to hospital, it was most frequently first seen on the sixth or seventh day. In some cases the aperture of the pupil varied from time to time: it became markedly contracted towards the end of the first week and remained so for a day or two then back to normal size for another day or two after which it again became and remained contracted until the crisis, after which it soon regained the normal once more.

TEMPERATURE.

The temperature of most of my cases was rather lower than the average, ranging as a rule from 101° - 103°. In only three cases did it ever rise above 104°. I was unable to observe any case from the first day, but in two cases admitted on the second day the temperature was 101.6° and 101.4° respectively.
Complications

Occasional Notes and Prescriptions (To be copied into the General Report)
Complications

Occasional Notes and Prescriptions (To be copied into the General Report)
The latter reached its highest point 104.6° next day from which point a more or less gradual decline brought it down to 99° on the tenth day. On the twelfth day it rose again to 101° and the normal was reached next morning by an abrupt drop of 3° (see Chart 1) - a mild but quite well marked case. Another of my charts shows a well marked remission the difference between morning and evening temperature being sometimes as much as 3° (see Chart 2 ). In this case there was not seen the marked improvement in the general symptoms which so often accompanies the morning remission in typhoid, nor was there any marked decrease in the morning pulse rate.

A sort of pseudo-crisis on the eighth and ninth days is shown on Chart 3.

Chart 4 shows a pre-critical rise to 104.6° on the eleventh day, defervescence being completed on the fourteenth day. In this case a transient scarlatina-form erythema made its appearance on the day of the pre-critical rise.

The most usual day of crisis was found to be the twelfth. The latest day was the fourteenth and in two cases, one an adult, the crisis occurred as early as the ninth day. Defervescence by lysis was seen in three cases. In all these cases the temperature commenced/
commenced to fall early in the second week.

In the one fatal case death occurred with a rising temperature.

THE SKIN.

Three of my cases - all adults - had typical mulberry rashes. In two of these cases the rash was well developed on admission on the eighth and twelfth day respectively while in the third case, admitted on her second day, the rash, as first seen, consisted of numerous small spots over abdomen and flanks. The spots were of a dirty red colour and faded, but did not quite disappear on pressure. A good typhus rash was well out by the fifth day. The fatal case had a most magnificent rash when admitted on the twelfth day. All the elements of the typical typhus rash were present in great profusion and besides the smaller petechiae there were numerous subcutaneous haemorrhages of much larger size. In none of the cases of children sixteen years and under was the rash so typical or so marked.

In the case of a young adult (Chart 1) the rash on admission on the second day appeared as a general erythema of the skin showing however many discrete spots of oval or rounded shape and slightly raised.

On/
On admission the spots were pink and disappeared on pressure but the next day did not disappear well. On the fourth day the general erythema had disappeared and a faint mottling of the skin was left. Next day many of the spots had become petechial. In the case of the sister of this patient, admitted on her sixth day, the spots did not disappear on pressure and petechiae were already numerous. The subcuticular element was seen in this case.

In two children under ten years, a well-defined mottling was all that represented the rash, while in another young child admitted on the fifth day, the rash consisted of an indefinite mottling with numerous discrete spots over the chest, arms and legs. They were also well seen on the back. The spots did not fade on pressure. In this case there was injection of the eyes, and the nervous symptoms were, for a child, well marked. In yet another case of a child, a transient erythema made its appearance on the eleventh day.

The average duration of the rash appeared to be from nine to ten days. In most cases an indefinite mottling was present for a day or two longer, where the rash had become petechial, a dark brown staining of the skin persisted for a short time after defervescence.
Sweating was an early symptom in five of my cases and in three it was fairly profuse late in the second week and during the crisis. No sudaminous rashes were observed.

The characteristic odour was noted in two cases during the second week.

CIRCULATORY SYSTEM.

The pulse rate ranged from 105 - 130 in adults and in children was usually higher.

As a rule the general character of the pulse was quite good during the first week, but afterwards the volume and tension were affected making the pulse rather soft and compressible. In two cases diastasis was observed late in the second week, and irregularity in three cases. The heart's action usually showed some enfeeblement as evidenced by a muffling of the heart sounds and a decrease in the apical impulse. Cyanosis was not marked in any case.

THE BLOOD.

(Details of the examination of the blood have already been given under Etiology of typhus fever pages 23-26, 27-28, 32-33.

RESPIRATORY SYSTEM.

The respirations were already increased in frequency and ranged from 24 - 40 in adults. In the severest/
severest cases the type of breathing was shallow and noisy, with expiratory grunt. Cheyne-Stokes breathing was never seen. Slight laryngitis was present in four cases, as already mentioned. A certain amount of bronchial catarrh and cough was quite usual. Evidence of hypostatic congestion was present in more than half the cases, but in only two was there marked dullness posteriorly. Bronchial breathing was never observed. In the case of a child of nine a condition of broncho-pneumonia was made out about the thirteenth day of the fever after the rash had faded. The temperature, which had fallen to 99°, rose again to 102° and continued to swing for other nine days, by which time the lung condition had cleared up (chart 6).

DIGESTIVE SYSTEM.

The tongue in almost half the cases was on admission fairly moist and covered with whitish fur. In three cases, those of young children, the papillae were prominent and the appearance of the organ quite scarlatinial. In adults admitted beyond their fourth day the tongue was usually dry and brown and a little tremulous. Even where moist at first the tongue in most cases became dry and brown towards the end of the first week. In a few cases, especially of children, the tongue kept moist and fairly healthy throughout/
throughout the course of the disease, and only in three cases was the condition of the tongue severe. Two of these cases showed a hard contracted tongue, glazed and brown: protrusion was difficult and painful. In the one fatal case the tongue was large and almost black and fissured with a heaped up accumulation of fur and sordes. Sordes were also seen on the lips and teeth. In most cases there was some injection of the throat and tonsils. Loss of appetite was general, while thirst was usually complained of during the first week. In two cases vomiting was present during the second week and in one case after the crisis, but it was not severe and was readily controlled. Diarrhoea gave a little trouble towards the end of the second week in two cases. Abdominal pain was complained of by five patients during the first week and in one case it was more or less present during the entire course of the fever and for the first few days of convalescence. In two cases the seat of the pain was the left Iliac fossa and in one case the epigastrium. Abdominal tumidity was not marked in any case.

NERVOUS PHENOMENA.

Headache, chiefly frontal but in two cases occipital, was a very constant early symptom. In two cases/
cases it continued throughout the course of the disease. Sleeplessness was more or less present in all cases, and in most the mental aspect of the patient was characteristic. They seemed apathetic and stupid and took no interest in anything. In many cases they had to be roused to answer questions and seemed to resist being troubled. The disposition was frequently suspicious or sulky. Delirium was present in more than half the cases observed. It was not usually seen before the fifth or sixth day but in the case of one child there was delirium on the third day. The low muttering type was that most usually observed, being present in rather more than half the adult cases. In children under sixteen years it was not so frequent. Delirium of a more acute nature was present in five adults and one child. In two of the adults it was pretty severe, the patient requiring restraint in one of the cases. In no case was true delirium ferox present. Neither was the coma vigil of Jenner seen, but in two adults there was a condition approaching coma following acute delirium, in which the patients lay quiet with fixed half-open eyes picking at the bed-clothes. Recovery followed in one of these cases. Deafness was common among the adults during the second week. Its earliest/
earliest appearance was on the seventh day. It was never associated with pain or otorrhoea and was probably due to a toxic action on the auditory centre or nerve. It lasted through the crisis and well into convalescence but in no case was it present when the patient was discharged. Pain in some part of the body or limbs was complained of by about one third of the cases. Besides the headaches and abdominal pains already referred to there was lumbar pain in two cases and in one case pain in the chest under the sternum. In another the lower extremities especially the thighs were affected.

_Subsultus tendinum_ was seen in two cases and was associated in one - the fatal case - with marked tremors and twitchings of the facial muscles.

_Incontinence of urine_ was present in three of the most severe cases, in one along with incontinence of motions. It was not seen before the beginning of the second week. Retention was present in five cases, two males and three females. In most cases the condition was relieved by fomentations, but in one case, that of a woman, the use of the catheter was necessary.

The urine was always scanty and highly concentrated, of a dark colour and high specific gravity, in most cases over 1030. Toward the end of the febrile period
and in the crisis the amount was much increased and
the urine more dilute. Urates were commonly abundant.
Albuminuria was more or less marked in most of the
adult cases after the first few days. In children it
was present in only three out of nine cases. I had
no case of nephritis. The diazo reaction was positive
in all cases and in some cases it was very marked, es-
pecially in the second week.

The spleen was palpable in only two cases but in
twelve, though it was not palpable it was apparently
enlarged to percussion. In one case enlargement was
made out as early as the second day of the disease,

Complications and sequelae were few and for the
most part unimportant. Some degree of bronchitis was
observed in most cases and was rather a symptom than
a complication. The broncho-pneumonia which occurred
in a child about the time of the crisis has already been
mentioned. Boils gave a little trouble in the early
days of convalescence in two cases. In one they
occurred on the nates and in the other on the chin and
neck. Severe pains in the head, neck and limbs, ap-
parently neuralgia, developed shortly after the crisis
in one case. They were readily controlled by aspirin
Paralges was not present in any of my cases.

THE FEVER IN CHILDREN.

The/
The course of the disease was found to be much milder in children than in adults and in most cases did not cause any anxiety. The nervous symptoms were never severe, though delirium was present in three cases. The duration of the febrile period was shorter than that in adults, the latest day of the crisis being the thirteenth and the earliest the ninth. The rash was seldom typical and the tongue never severe. Indeed if it had not been for the association with other obvious cases it would have been difficult in some instances to determine the exact nature of the disease.

The treatment, except that the patients were treated so far as possible in the open air, was purely symptomatic and will be given in more detail later on.

The diet was pretty liberal, such articles as custards, milk puddings, bread and milk and jellies being given in most cases before the temperature became normal. Great care was taken to secure adequate ventilation and a free supply of fresh air. The patients were accommodated in an airy ward which had a verandah on one side. The verandah was roofed but otherwise open on three sides and the beds were placed there during the day and the patients remained in the open air but sheltered from the rain and the direct rays.
rays of the sun until after sunset when the beds were again removed to the ward.

Most of my cases were up by the end of their first week of convalescence and as a rule were discharged from hospital about five weeks after developing the disease. In no case were there any permanent effects, physical or mental, but in three cases the memory was affected during the first few days of convalescence.

I may add that no nurse or attendant contracted the fever.

Below are given the records of three cases,

CASE 1. L. D. (M) age 37, admitted 5th March 1909.

History - Headache, shivering, pains in back and abdomen commencing Feb 22nd. He is therefore in his twelfth day. Delirium said to have been present for about a week.

State on admission - The patient is a big heavily built man and fairly well nourished. Face darkly flushed and features swollen.

Eyes - Markedly injected and pupils contracted: marked ferretly eyes.

The lips and teeth are black with sores.

Tongue/
Tongue - very dry and brown, thickly heaped up on dorsum with fur and sordes except in the middle line where it is raw-looking with some transverse fissures reaching almost to the edges.

Abdomen - no tumidity and no diarrhoea.

Spleen - not palpable but enlarged to percussion.

Heart sounds - feeble and not at all clear, but no definite murmur.

Pulse - rapid 142 per minute, very feeble, soft and compressible with well marked dicrotism.

Respiration - rapid 42 per minute, noisy with expiratory grunt, resonant note all over the lungs, but breath sounds are very harsh with some bronchitis.

Skin - an exceedingly well marked and abundant typhus rash showing all the three elements is present all over the body and limbs. It is seen on the neck but not on the face. Some subcuticular haemorrhages, much larger than ordinary petechiae are also present. Odour is noted.

Nervous condition - very delirious and noisy - talking nonsense. Cannot be got to put out his tongue or answer questions. The patient is extremely ill and restless.

Temperature - 101.2°. Ordered whisky 3 p 2 hourly.

Milk diet.

In the early evening patient quieter. Pulse a/
a little better but still dicrotic 136 per minute.
Respiration 38. Subsultus and picking at bedclothes.
Looks very poisoned and done. Subcutaneous salines
(1 pint) ordered. At the midnight visit the pulse
seemed a little steadier, but patient is very restless.
Has had incontinence, twitching of the facial muscles
seen especially of the mouth. Has not slept at all.
Thought advisable to order chloral hydrate and Pot.
Brom. XV. grains of each. Patient slept a little but
about 3 a.m. the condition became worse and the pulse
was almost imperceptible. There was marked cyanosis
and in spite of a hypodermic of strychnine and free
stimulation he died with a rising temperature at 3.45
a.m., having been in hospital about twelve hours.

The daughter (age fourteen years) of this
patient was admitted along with him. She had a tem-
perature of 100° and was apparently in her crisis.
She was stupid and apathetic. Pulse 106. Some
bronchitis and cough. There was a mottling of the
skin with some brown staining. Next day the temperature
was normal and her convalescence was uninterrupted.

CASE II. L. R. (M). Age 18 years. Ad-
mitted July 19th. (Chart 1).

History - Headache, shivering, vomiting, sore throat
and sweating on day before admission.

On admission general condition fairly good. Face
flushed/
flushed, eyes injected, pupils normal. Tongue sticky and covered with a dense whitish fur. Throat markedly injected. Abdomen - no tumidity and no diarrhoea.

Spleen - not palpable.

Heart Sounds are clear. Pulse 100 per minute regular, of fair volume and tension.

Cough troublesome, but there is nothing in the lungs. Respiration 26 per minute.

Skin - The rash consists of a general erythema which entirely disappears on pressure. Scattered through this there are some pale red spots round or oval in shape and slightly raised above the surface. They fade almost imperceptibly into the general flush of the skin and disappear on pressure. They are most plentiful on the chest and abdomen. Numerous flea bites are visible. The skin is moist. Vin Ipecac n X Tinct Camph:m XV 4 hourly ordered. Milk diet.

July 20th - had a sleepless night. Was some diarrhoea

Pulse satisfactory. Pupils still normal. Tongue dry with yellowish fur. The general flush of the skin is somewhat faded to-day and the spots are more numerous and some do not entirely disappear on pressure. There is a suggestion of mottling.

Milk/
Milk ordered to be peptonised.

In the evening diarrhoea still present and some complaint of pain in L. Iliac region. Nothing to be made out. Fomentations ordered to be applied. Dovers powder grain V to be given. Cough much improved.

July 21st - Vomited after Dovers powder last night; but diarrhoea has now ceased. Slept about two hours.

Quite clear mentally. Pulse a little softer and more compressible but fairly satisfactory. Tongue brown and dry - clean at edges and tip.

Mottling of the skin more distinct to-day.

July 22nd - Slept pretty well most of last night. The rash is now quite definitely out. The mottling is quite marked and some of the spots are petechial. Conjunctivae much injected. Pupils about normal. Spleen slightly enlarged. There is some return of diarrhoea to-day with undigested stools. The milk was stopped and the patient put on albumen water for twelve hours. Ordered Salol gr X four hourly. Complains much of pain in the back; ordered aspirin gr X.

July 23rd - Still a little diarrhoea; did not sleep well, but has slept a little this morning. Complains greatly of thirst and is drinking a lot.

July/
July 24th - Did not sleep well last night and was delirious in the early morning. Seems quite clear mentally at present, but seems much more ill. Diarrhoea has quite ceased and the pain has gone. Pulse 128 per minute, regular but of low tension. Heart sounds not clear. Ordered whisky 34 four hourly. Salol stopped.

In the evening patient was delirious again and as he had not slept for two nights chloral hydrate and Potass. Brom grain XV of each were ordered.

July 25th - Slept pretty well last night after chloral and bromide. Pulse fair but sweats a good deal. Rash still bright. Tongue dry and brown. Whisky stopped.

July 26th - Restless and delirious yesterday afternoon and the early part of the night, but slept well after chloral and bromide given at midnight. Pulse satisfactory. Is having milk, beef tea, custard and jellies.

July 27th - Mental condition not very clear to-day. Can answer questions when roused but seems very stupid. Looks ill. Complains of pain in the back. There was some retention this morning, but this was relieved by fomentations. Pupils normal.


July 29th - Slept well again. Seems much brighter. Rash fading and tongue now moist. Pulse not satisfactory.
isfactory - 120 per minute and tension rather low. Ordered whisky \frac{3}{4} four hourly. In the evening was delirious again and was ordered chloral hydrate and bromide.

July 30th - Slept well after midnight and is still sleeping. Pulse improved and temperature normal. Whisky stopped.

July 31st - Had a splendid night and looks much better to-day. Pulse satisfactory. Some brown staining is all that is left of the rash. To have fish etc.

Aug. 1st - Doing very well. Temperature subnormal.

4th - Quite well. Wanting up. On full diet.

6th - Crop of boils on gluteal region: treated by boracic poultices. Convalescence otherwise uninterrupted.

CASE 111 J. W. (M) Age 3 years (Chart 7).

Admitted August 15th.

History - Headache sickness and vomiting. August 11th sweating and delirious on 15th.

State on admission - Child appears very restless. Face is flushed. Eyes slightly injected. Pupils normal.

Tongue - furred with prominent papillae and fairly moist. Throat injected. Tonsils slightly enlarged.

Abdomen - slightly tumid. Spleen not enlarged.

Skin
SKIN - There is a rash consisting of an indefinite mottling with a large number of small dark red spots which do not disappear on pressure. They are most numerous on the chest, but are also present on the back and extremities.

PULSE - fair 120 per minute. Heart sounds are clear.
RESPIRATIONS 32: slight cough, nothing in the lungs.

Aug. 16th - Condition much the same as yesterday.
Cough troublesome: ordered tinct ippecac four hourly.
Pulse satisfactory. Rash unchanged in character.

Aug 17th - Had a restless night with some delirium.
Looks much worse to-day. Pulse rapid 142 per minute and irregular. Respiration also more rapid. Lungs clear.
Ordered brandy 2f four hourly.

Aug 18th - Restless last evening, but slept fairly well later, after sponging and a hot drink. Cough much better. Pulse not quite so rapid and more regular. Takes his drinks well. Rash a little faded.

Aug 19th - Condition much the same as yesterday. Respiration rapid but lungs quite clear. Tongue still furred and moist. Rash fading. Eyes still pink.
Pupils normal.

Aug 20th - Child seems improved to-day: slept well last/
last night. Takes his food readily: having bread and milk and custard. Temperature 100°, pulse 136. Brandy stopped.

Aug 21st. - Very little change from yesterday: pulse 130.

22nd - Apparently in crisis: pulse and temperature both coming down. The eyes are clear and the rash has practically disappeared only a faint mottling being seen. The tongue is almost clean.

Aug 23rd - Seems well. Temperature 98°. Pulse 100

Aug 25th - Temperature subnormal (97) Pulse 80 per minute. Taking food well.

DETAILED SYMPTOMATOLOGY OF TYPHUS.

The temperature. The fever is ushered in by chills, headache, sickness &c., and the temperature rapidly rises, so that by the evening of the first day it may have reached 102°. The morning temperature may show a slight remission usually not more than 1°. It mounts again and on the second evening reaches a higher point than on the first evening, it may be 102.5° or 103. After another slight remission the temperature may reach its height on the evening of the third day or it may be a day later. The acme may be 103.5 or 104 or higher (see Chart 8).

In some cases the height may be reached at the end of thirty six or forty eight hours, but it appears to
be rather unusual for the acme to be reached on the evening of the first day. Still it sometimes does occur. (see chart 9).

While the morning remissions are usually slight it sometimes happens that the morning fall on the second or third day may bring the temperature to the normal line (see chart 8). When the morning remissions are marked and the rise of temperature gradual, the curve may during the first week present an appearance not unlike that of typhoid.

Curschmann has found that the initial stage is more frequently abridged in mild than in severe cases, and he has never observed a gradual rise in the fever to be followed by an abortive course.

After the temperature has reached its height which it usually does not later than the fourth evening it remains about the same level during the remainder of the first week or longer. The morning remissions may be altogether absent. In some cases the chart shows almost a straight line for four or five days after the acme has been reached. But whether there are marked remissions or not there is usually in cases which do well a slight lowering of the general level of the temperature during the second week.
Chart 10 Showing most usual type of delirium by a modified crisis. Chills also a sort of pneumonia crisis on the 12th day.
week. In severe cases however it may remain at its height throughout the second week or it may even show a gradual rise. Sometimes a well marked fall in the temperature - a sort of attempt at a crisis-occurs about the seventh day (see chart 3). The fall is only temporary, seldom lasting more than a few hours or a day, but as a rule the temperature does not again rise so high and it is usually observed that there is a gradual decline in the curve from this point. The older observers believed in a critical day about the seventh day. Marchison and others believed the absence of this remission to be a most unfavourable sign. Many modern authors are inclined to attach some diagnostic importance to it. Dr Ker believes that something may be learned from a careful study of the chart about this time. Curschmann thinks that this fall about the seventh day does not occur with equal frequency in all epidemics: out of 470 cases he saw it in only three charts.

Defervescence

The temperature usually falls by a not very sudden crisis about the thirteenth day, the normal being reached about 48 to 72 hours afterwards. (see chart 10). Occasionally the crisis is much sharper. Chart No 11 shows in a child of six years a fall from 103.4 to 98.6 within twelve hours.
The crisis usually takes place about the end of the second week. Curschmann observed it most frequently between the twelfth and fifteenth days. Murchison found the most frequent days to be the thirteenth and fourteenth and the average duration of the fever 13.43 days. In one case the crisis was on the twentieth day. Wanderlich gives the time of crisis as between the thirteenth and seventeenth days.

In the Edinburgh cases (1898-1902) the crisis occurred most frequently at the twelfth or thirteenth day for adults and on the eleventh day for children. Taking all the cases in which a definite history was got the average day of the crisis was the twelfth. For adults alone the average was the thirteenth day, and for children the eleventh. In adults the earliest day was the eleventh and the latest the nineteenth. In children the earliest day was the sixth and the latest the sixteenth.

In my own experience the earliest date on which the crisis occurred was the ninth day and the latest the fourteenth. The average works out at the twelfth day which was also the most usual.

In some cases a sharp pre-critical rise is noticed after which the normal is reached either by a sharp crisis/

\(^1\)Murchison 1884 p 185; \(^2\)Wanderlich 1873 p 330.
crisis or by a more gradual fall (see chart 4).

This is the perturbation critica of the older writers. It does not appear to have any diagnostic significance. Sometimes the contrary occurs and the final fall of the temperature is preceded by a drop to the normal or subnormal. Within a few hours the temperature rises again after which the final fall takes place (see chart #). This is rather rare, such a pseudo crisis when seen usually occurring about the end of the first or early in the second week or anytime between the seventh and eleventh days.

Rarely the final subsidence of the fever is preceded by very marked irregularity of the temperature curve which lasts for two or three days with low morning and high evening temperature (see chart 12).

Sometimes there are corresponding disturbances in the general condition of the patient.

Charts # and 12 are those of cases in a small but interesting outbreak of typhus which occurred a few years ago in one of the convalescent scarlet wards of an hospital in the west of Scotland. A patient had been sent in as a desquamating scarlet case and was placed in the convalescent ward. This patient was afterwards found to have had, not scarlet fever but typhus and other patients suffering from the disease.
Chart 13 - Reference by lymph from the 10th day.
disease were afterwards removed to hospital from the same
district and one from the same house. Before however
the true nature of the man's illness had been dis-
covered four patients - one young adult and three
children - and a ward maid had contracted the disease.
In the case of the latter the disease was typical and
moderately severe, with a good rash and pronounced
nervous symptoms. In the case of the other young
adults the rash was well marked but the disease ran a
mild course. In the children however the character-
ISTIC erupTion was entirely absent. The temperature
curve was that of typhus and the flushed faces and
injected eyes were typical, but there were no symptoms
of any kind and the children felt quite well and could
not understand why they were kept in bed.

While the fever terminates in most cases by a
not very abrupt crisis, a more gradual fall by lysis ex-
tending over four and five days or even from the end of
the first week is not at all uncommon (see chart 13).
In the City Hospital cases, a defervescence by lysis
was noted in seventeen cases a percentage of 11.6. It
was usually seen in the milder cases and was rather
more common in children than in adults. Sometimes the
step-like lysis commencing about the beginning of the
second week does not quite bring the temperature down
to/
to normal, that being reached about the fourteenth or fifteenth day by an abrupt fall of 2° or 3° (see chart 14).

It seems very usual for the temperature in typhus to become subnormal after the febrile period is over and to remain so for at least two or three weeks. Few of my own cases had a temperature higher than 97° at the time of their discharge.

Terminal temperature in fatal cases. A pre-agonic rise appears to be most common. (Chart 15)

Sometimes however the opposite occurs. Curschmann reports a case in which death was immediately preceded by a rapid fall to 33.10° C.

CIRCULATORY SYSTEM.

The pulse in the early stages of the fever has increased in frequency but of fair tension and volume. The increase in frequency is about proportionate to the temperature and is even in male adults usually over 100 early in the first week. In women it is rather more and in children it may be 120 or more even in a mild case. There may be slight morning remission. Except in very severe cases the increase in frequency is usually the most noticeable point during the first few days, but late in the first or early in the second week as the toxaemia increases and the heart muscles become/
become more affected the volume becomes less and the tension low. The pulse is soft and compressible and its rate is now rather higher. It tends to become weaker day by day and dicrotism may be observed during the second week. Curschmann remarks that dicrotism is by no means frequent that it occurs in 5.9 of the cases. Murchison observed that it occurred in most severe cases. In examining the records of the Edinburgh cases (1898-1902) I find that it was present in fourteen cases out of 161, or 8.75 per cent. All these were severe cases, two of them fatal. The dicrotic condition of the pulse was in most cases observed early in the second week but in one of the fatal cases, as early as the fifth day. In severe cases the pulse may be irregular or intermittent during the second week. The rate continues high and the pulse may be so weak that it is scarcely perceptible at the wrist and can be counted with the greatest difficulty. Rarely the pulse instead of being rapid, is much decreased in frequency. In one of Murchison's cases the pulse did not exceed forty while the temperature remained high, but gradually rose to the normal standard as the other symptoms improved. He observes that Barrallier met with a slow pulse in several cases, in one a man of fifty five the pulse remained for three days at twenty/

1 Murchison p 138. 2 Barrallier 1861 p 70, 87 & 248.
twenty eight. Curschmann found a moderately low rate such as is found in typhoid to be exceptional in typhus and only present in mild cases.

During the period of defervescence the pulse gradually becomes stronger and decreases in frequency. But if the heart has been much affected the fall in the pulse rate lags behind the fall in temperature so that in some cases the temperature may have been normal or subnormal three or four days before the pulse has fallen to the normal standard. Any triv­
ial exertion in the patient is apt to be followed by considerable temporary rise in the pulse rate. In milder cases the pulse falls with the temperature and the rate becomes normal along with the temperature. Sometimes the pulse does not improve at all with the crisis but on the contrary appears to become weaker. Such cases are very grave and require free stimulation.

THE HEART.

The condition of the heart and state of the pulse are of the utmost importance in typhus and afford the chief indication for treatment. Valvular lesions, occurring in the course or as sequelae to typhus are hardly known, but weakness of the heart muscle causing a certain degree of dilation is usually present and/
and in most cases the heart sounds are muffled and obscured. In severe cases the first sound of the heart may be lost, the second remaining clear and distinct. The cardiac impulse may be absent or much diminished. Murchison draws attention to the fact that in some cases the arterial pulse may be distinct and fairly strong, though the heart is much enfeebled, while on the other hand the cardiac impulse may appear so strong as to distress the patient and yet the radial pulse may be imperceptible. It is thus of great importance that the heart and pulse should be taken together in considering the question of the exhibition of stimulant.

THE BLOOD.

(see Etiology pages 17-33)

THE SKIN.

The rash. The general characteristics of the typhus eruption have been already referred to (page 53). The rash is usually well out by the fourth day but is often later and may be earlier.

Stewart in an analysis of fifty two cases found that on the average the rash appeared most commonly on the sixth day. Murchison states that in his seldom epidemics the eruption appeared later than the fourth or fifth day and most commonly on the fourth. In two/

1 Stewart 1840 p 318. 2 Murchison 1884 p 134.
two or three instances he found it as early as the second day.

Curschmann found that the times of appearance of the rash varied in different localities and in different epidemics. In the Berlin epidemic 1873 he found that it appeared early on the second, third or fourth days, while in the epidemic of 1879 it usually occurred later - on the fourth or fifth or even the seventh day. He agrees, however, that the most usual day is the fourth or fifth.

Dr. Ker finds that the rash is usually well out by the fourth day. He finds that the subcuticular element is usually seen earliest and he has frequently seen it well developed on the third or even as early as the second day. I find that of the Edinburgh cases in which the rash appeared after admission to hospital the subcuticular mottling or spotting was observed on the third day in eleven cases, and on the second day in 5 cases. In most cases the mottling was the first element to be observed, and the rash was usually well developed by the fourth day and nearly always by the fifth day. In eight cases however the rash did not appear until the sixth day and in two cases until the seventh day. In a like number of cases it was first seen on the/

1 Curschmann p 529, 2 Infectious Diseases p 206.
the eighth day. I do not find any instance of a later appearance than this.

Of the cases admitted with the rash out one was on the second day and showed a well marked mottling. In four cases admitted on the fourth day of the disease the rash was well out: of those admitted on their fifth day it was present in two cases, of those in the sixth and seventh day in three cases each and of those on eighth day in seven cases. The average day of first appearance of the rash as observed in those admitted previous to its appearance, was the fourth.

Distribution of the Rash.

It is often first seen on the lower part of the abdomen and upper part of chest. Frequently it is most marked on the back. The folds of the axillae may be first invaded. The petechial element is often best and earliest seen in the flexures of the body. Frequently the macular part of the rash appears first on the wrists and ankles, on the dorsum of the foot or the back of the hand. The soles of the feet and palms of the hands are never invaded. The face usually escapes and is merely flushed. Sometimes however it is affected, but even in such cases the only evidence of the rash on the face is a blotchy spotting.
spotting around the jaws. Of the Edinburgh cases I find that the face was invaded by the rash in only four instances.

**DURATION OF RASH.**

Unless the rash has been haemorrhagic the macules usually begin to disappear after two or three days, at any rate from the beginning of the second week. Often however an ill-defined dark mottling persists through and for several days after the crisis. A dark staining is also often seen, which if the rash has shown haemorrhages, may be dark brown or sometimes purplish in colour.

**MODIFICATION OF RASH.**

The rash in children may be quite fully developed but the petechial element is usually absent. Sometimes an indefinite mottling of the skin is all that can be made out. This is frequently better seen at a little distance from the patient and in a shaded light. Sometimes the rash is not seen at all (see charts II & III) Generally speaking, and certainly in my own experience, the abundance of the rash appears to be directly proportionate to the severity of the disease.

**SWEATING IN TYPHUS.**

During the initial stage the skin is usually hot and dry. Sometimes however, as in a few of my own cases/
cases, sweating is present during this stage. Curschmann observes that it is seen only in cases where the initial rise in the temperature is followed by a marked remission lasting several days. During the crisis the skin is frequently more or less moist. Anything like profuse sweating at this time is usually an ominous sign. I find that more or less profuse sweating was seen in seventeen of the Edinburgh cases that is 10.6 per cent. In most it was towards the end of the second week or in the crisis. All were pretty severe cases and five ended fatally. Sudamino rashes are sometimes seen. Miliaria crystallina was found in 6 - 8 per cent of Curschmann's cases, toward the middle or end of the second week. The contents of the vesicles were found to have an acid or neutral reaction, never alkaline. Tenner found miliary vesicles in only two of his forty-three fatal cases. Murchison found that such rashes were rare. I find a miliary rash noted in only one of the Edinburgh cases and among my own cases I had no instance of such a rash. Herpes is not common but its frequency appears to vary in different epidemics and Jaquot saw it in a fifth of his cases, while in other epidemics it was altogether absent.

The odour has been/
been commented upon by most observers. It has been compared to rotten straw, the odour of deer or of mice or of certain reptiles or to that given off by rubbing the leaves of rue between the fingers. Murchison thinks it rather an odour 'sui generis' and with this Dr. Ker agrees. Curschmann professes that he has never noticed any specific odour and he believes that its absence was due to the efficiency of the ventilation in his barracks at Moabit.

I have noticed the odour in only two of my own cases but I find that in the Edinburgh cases whose records I have examined it was noted as present in thirty-five of the one hundred and sixty-one cases. In most instances it was not observed until the end of the first or the beginning of the second week but, in several it was observed on the fourth day and in one as early as the second. The odour is apparently given off by the skin and must not be confounded with the ammoniacal odour given off in the respired air or that due to incontinence of urine.

**RESPIRATORY SYSTEM.**

The respirations are always more or less increased in frequency. It is quite usual for the rate to exceed thirty per minute. They are often noisy especially in sleep. Sometimes in severe cases the breathing/
ing is not quite regular in rate and depth. There may be several shallow respirations between two deeper ones, but true Cheyne-Stokes breathing is not common. In the Edinburgh cases it is only recorded in one, a fatal case. There may be some involvement of the larynx, causing hoarseness of the voice and difficulty in breathing. These symptoms were early present in three of my own cases; in a fourth there was aphonia. This appeared to be due to some simple catarrhal condition of the larynx and the condition had markedly improved by the beginning of the second week. More serious conditions such as ulceration or necrosis or oedema of the larynx though not unknown are fortunately very rare. Curschmann relates that he had four cases of tracheotomy in Moabit Lazaretto 1879 out of sixteen cases with severe laryngeal symptoms. Tracheotomy was necessary owing to perichondritis of one of the arytenoids and subsequent oedema of the glottis.

A certain amount of cough usually accompanied by or bronchitis some bronchial catarrh is quite usual and may be considered a symptom of the disease. Hypostatic congestion is frequently present in the most dependent part of the lungs and in some cases may be very marked. The physical signs are dullness or impairment/
ment of note a little above the bases, harsh but not tubular breathing, with accompanying crepitations. It may be present during the first week and is due to the enfeebled heart action and weakness of the vessel walls and also probably to a nerve toxaemia. In the later stages of the fever some cyanosis may be present and is especially marked if the lungs are extensively congested and the cardiac action very feeble.

ALIMENTARY SYSTEM.

The tongue at first may be moist and covered with a whitish fur, but soon becomes dry and tremulous in all but the mildest cases. By the end of twenty four to thirty six hours it may be covered with a dirty brown exudate. It is apt to become cracked or fissured and crusted and requires to be carefully attended to. In some cases the tongue is larger than normal and in others it may become pointed and contracted and hard and almost black—the typical parrot tongue. Often protrusion is painful and difficult. In some cases, particularly in children, the papillae of the tongue may be prominent, and the organ almost scarlataline in appearance.

The teeth and lips tend in a severe case to become covered with sordes and regular attention is required to prevent this.

The/
The mucous membrane of the throat is usually injected & swollen. The tonsils may be enlarged. The patient often complains of a hard dry feeling in the throat and there may be complaint of actual pain and dysphagia. Rarely there may be definite patching of the throat followed by ulceration. Curschmann had three such cases of which two ended fatally. In one of the Edinburgh cases there was a definite membrane on the fauces, which when removed showed a deep punched out ulcer. In this case however the Klabs-Loeffler Bacillus was found and there were also very definite evidences of primary syphilis.

Jenner found ulceration of the pharynx in only one of his forty three fatal cases.

Thirst is usually severe during the first week but as the patient's sensations become deadened it ceases to be complained of. The appetite is lost, but in one of the Edinburgh cases - a child - there was a great complaint of hunger during the first week. Digestive disturbances are few and usually unimportant in typhus.

Abdominal pain is said to be uncommon, but it was present in five of my twenty one cases and I find it noted among the invasion symptoms in twenty three of the Edinburgh cases in which a definite history could be/
be got, a percentage of almost seventeen. As a rule the first
it was not complained of after/two or three days.
It was never localized in the right iliac fossa.
Tumidity of the abdomen is common. Of the Edinburgh cases it was present in 23.5 per cent, but was never associated with any great distention. Meteorism is rare and when present usually occurs late in the disease and is a very grave symptom.

Vomiting common as an invasion symptom usually clears up early in the first week but sometimes it persists much longer. In two of my own cases it was a little troublesome more or less throughout the course of the disease, in one for a day or two after the crisis also. Of the Edinburgh cases eighteen adults had more or less troublesome vomiting during the height of the disease - a percentage of eighteen, while of children in only two out of sixty did the vomiting continue beyond the first day or two. Of the eighteen adults four were fatal cases and had both vomiting and diarrhoea, while one of these fatal cases had also severe and persistent headache and another profuse sweating in the second week.

While constipation is the rule in typhus, diarrhoea is not uncommon. It was present for several days in one of my own cases and in thirteen of the cases/
cases last treated at the Edinburgh City Hospital. Four of the cases complicated with diarrhoea proved fatal. In most cases it was seen in the second week but in one case it first appeared on the fifth day. The stools sometimes bear a superficial resemblance to typhoid but do not show the separation into layers on standing. Dr. Ker found that troublesome diarrhoea often followed the use of purgatives.

**URINARY SYSTEM.**

During the first week the urine is scanty and concentrated, of a dark colour and of high specific gravity. In my own cases the daily amount was rarely over thirty ounces and specific gravity was usually over 1030. The reaction was always acid. The amount of urea is increased during this period. Rosenstein found that this urea was considerably increased in amount at first but was markedly decreased later in the course of the fever, while during convalescence it gradually rose again. Toward the end of the febrile period the urine becomes clearer and more dilute and increased in amount and shows a deposit of urates and sometimes of phosphates. Curschmann has observed the occurrence of large quantities of clear/
clear pale urine especially shortly before the beginning of defervescence. Greissinger has noted the same. I have not noticed this but I find it was observed in one case in the Edinburgh outbreak, the patient passing 80-100 ounces in the twenty-four hours for two or three days in the second week. The chlorides are very much diminished and may be absent during the second week. A moderate degree of albuminuria is usually present at least in adults throughout the entire febrile period. In my own cases it was present in fifteen out of twenty-one cases and it was noted in about four-fifths of the Edinburgh cases 1898-1902. It usually commenced about the middle of the first week. In a few cases blood as well as albumen may be present and also epithelial and hyaline casts indicating a condition of true nephritis. In some cases it may end fatally with uraemia. True nephritis was present in only three of the Edinburgh cases and was first evident at the beginning of the third week, one case ending fatally.

The diazo reaction is in my experience always got with typhus urine. I found it particularly marked in the first week. Dr. Ker found it invariably present during the stage of advance. Many other recent/
recent observers have likewise obtained a positive reaction. Since the reaction is got in enteric, miliary tuberculosis, and in many other conditions it is of little value as an aid to diagnosis, or at best it is only useful in process of exclusion.

NERVOUS PHENOMENA.

The nervous phenomena are one of the most characteristic features of the disease and except in the mildest cases are much more marked than in any other of the exanthematous diseases. They are apparently due not so much to the increased temperature as to the toxaemia of the disease itself. A marked sense of prostration is usual from the very beginning of the disease.

Headache which is one of the most constant of the invasion symptoms usually lasts until the middle of the first week or a little longer. Sometimes however it persists throughout the entire course of the disease and, in cases where the patient has not been rendered quite apathetic or insensible to pain by the toxaemia it may be his chief complaint. In the Edinburgh cases (1898-1902) headaches persisted beyond the first week in one fifth of all the cases. While frontal/
frontal headache is most common, it is sometimes occipital and sometimes vertical. Occasionally it is felt all over the head. In a few cases it is confined to one half of the head. The pain may be dull and throbbing or sharp and shooting in character. Sometimes it radiates into the neck and shoulders. The headaches are frequently very severe and may not yield readily to treatment. They are often accompanied by giddiness and tinnitus aurium. Pain in some part of the body is a common symptom (see invasion symptoms). It is very frequently in the back, in the sacral or lumbar regions. In about an equal proportion of cases it is abdominal. It appears to be less commonly situated in the chest, but in a large number of cases it is generally all over the body. Pain in the limbs is also pretty common. Pain in one situation or another may occasionally persist throughout the course of the disease and may be very severe and may, especially when associated with sweating, lead to a diagnosis of rheumatic fever. It is rare however for the pain to be articular. Hyperaesthesia especially of the extremities, toes and fingers may be present, and may be very distressing.

There is usually very slight mental disturbance the first day or two of the disease, but the patient is dull/
dull and languid and apathetic. Although he feels drowsy and prostrate he is usually restless and wakeful at night. He lies as a rule supine on his back and if he sleeps his slumber is disturbed by horrid dreams. His intelligence becomes blunted, but he is usually still conscious of what is going on around him. He can be roused to answer questions, hates to be disturbed and has difficulty in collecting his thoughts or in giving attention to anything. There is usually, quite early in the disease, marked loss of memory. The patient cannot remember when or how he came to hospital and may be ignorant of his whereabouts. Soon, in most cases towards the end of the first week, delirium sets in. Occasionally it may be present from the first. When it is present during the first week it is usually of an acute nature at least in young vigorous adults. Often it is of the type of delirium tremens especially in alcoholics and it may be so intense as to justify the title of delirium ferox. In this condition the patient is very violent and may, if not restrained, do injury to his attendants or himself. He tries to get out of bed and if he succeeds he may rush to the window and attempt to throw himself out. He rages and shouts.
shouts and struggles with his attendant and may try to injure them. Extraordinary strength is exhibited by even the most poorly nourished individual and it may require several strong attendants to keep him in bed.

At first delirium may be present only during the night or only at intervals during the night. In the morning the patient may be quite clear mentally. Afterwards it becomes more continuous or it may be more pronounced towards evening and in the night, the mental aspect during the day being one of stupor.

By the beginning of the second week the patient is usually too exhausted to exhibit the more or less violent type of delirium. The low muttering type is most common at this stage. The patient lies quietly on his back muttering incoherently. At first he may be roused to answer questions which he does in a rambling unintelligible fashion. Sometimes instead of lying quietly he is restless and irritable. Later, on in either case he becomes more or less unconscious and lies helpless on his back picking at the bedclothes. This is the "typhoid stage" of typhus. Subsultus is often seen at this stage and is commonest in the tendons of the wrist. Twitchings and tremors of the muscles especially of the/
of the face, less commonly the arms are also often present in very severe cases. In the City Hospital 1898-1902 subsultus was noted in thirty four of the one hundred and sixty cases; seven of these were fatal cases and in these twitching and tremors of the facial muscles were seen. Convulsions however are uncommon, except where associated with uraemia. They were noted during the second week in two of the Edinburgh cases, but in neither case were they uraemic in origin although albumen was present. In the case of a third patient - a child - a convulsion was the sole invasion symptom.

From the typhoid state the patient may fall into a refreshing sleep and awake practically free from any sign of mental disturbance. In some cases however the patient passes into a deep coma which in most instances ends fatally after a few days or less. Occasionally however recovery takes place even after deep and lasting coma. But the condition of coma vigilant as defined by Jenner, which is sometimes seen in typhus is invariably fatal. In this condition the patient lies with open eyes staring at the roof or into space, with mouth open and hanging jaw, his face pale and expressionless. The pulse is rapid and feeble or almost imperceptible, the respiration scarcely to be perceived, the skin cold and bathed in perspiration.

1 Jenner 1849.
tion. He is evidently awake but is quite insensible to all around him. Nine of Jenner's forty three fatal cases experienced coma vigil for from one to four days immediately preceding death. In mild cases there may never be any delirium. Of the one hundred and sixty one Edinburgh cases thirty five patients - sixteen adults and nineteen children - were quite rational throughout the disease.

Sensory disturbance in the shape of well marked neuralgic pain sometimes appear during defervesence. The nerves of the lower limbs are most usually attacked. As regards the trigeminus, Curschmann found in his experience only six cases and these all supra-orbital. Hyperaesthesia occasionally is present and sometimes anaesthesia. Any or all of the pains which are common during the early stages of the disease may recur after the delirium and stupor have passed.

Loss of control of the bladder and bowel reflexes, the result of the profound-toxaemia, is common during the second week.

In the Edinburgh cases incontinence of urine was seen in over 21 per cent. It appears to be more common in women than in men, the percentage being 25.5 women in Edinburgh cases, compared with 18.3 in men.
In severe cases incontinence both of urine and faeces may be present. It was present in the Edinburgh epidemic in 9.3 per cent of cases.

The same condition of toxaemia sometimes causes the patient to be insensible to the need to empty the bladder, and retention results. The bladder of every patient should be carefully examined on each visit or at least twice a day. Retention was observed in 12.5 per cent of the Edinburgh cases and like incontinence appeared to be more common in females than in males. In many cases both incontinence and retention were found at different times in the same patient. Some cases of retention yield to treatment by hot fomentations but many require the repeated use of the catheter.

**SPECIAL SENSE ORGANS.**

The eyes are usually affected in a greater or lesser degree. Injection of the conjunctivae is early seen in almost all cases and may be present from the very first day. The conjunctivae appear pink or red and the eyes have, in marked cases, quite a ferrey appearance. A certain amount of lacrimation and catarrh is also frequently seen. Jenner however found that marked vascularity was not usually apparent till the second week. It is usually stated that the pupils are concentrated early in the fever. In
my own experience contraction is not usually very marked before the end of the first week. The city Hospital records of the epidemic of 1898-1902 which I have examined point to the same fact. Of 32 cases admitted early with normal pupils in only two were the pupils contracted on the second day, in three cases on the third day; three cases in the fourth day; and in one case it was first seen as late as the ninth day, while the most common days were the sixth, seventh and eighth. Of the total of one hundred and sixty one cases the pupils remained normal throughout the entire course of the disease in thirty three. In a good many cases they were dilated.

In the outbreak in Aberdeen 1904 Dr. Hay also found that the pupils were not usually contracted early in the disease. They were often normal or dilated and in most cases contracted only in delirium.

Pin-point pupils are usually a grave diagnostic symptom and occur only in very acute delirium or in deep coma. Marked diminution of the light reflex or of the conjunctival reflex are also very unfavourable symptoms. When the conjunctival reflex is inactive and the patient lies with eyes open, superficial corneal ulcers are apt to form.

MUSCLES/
Curschmann mentions two cases in which squint occurred. It disappeared after recovery from the fever.

THE EAR.

Tinnitus aurium is sometimes associated with the headache of typhus. The hearing is very frequently affected. Curschmann found that as a rule auditory disturbances did not make their appearance until the period of convalescence. He found they were chiefly due to swelling of the mucous membrane of the Eustachian tubes. He found deafness rare during the febrile period. Murchison found deafness a very common symptom after the fifth day, while it was present in one fifth of Jenner's fatal cases.

In the last Edinburgh epidemic it was marked in thirteen per cent of the cases. The earliest day on which it was noted was the third and it was usually present by the end of the first week. The deafness is probably due to a toxic effect on the auditory centre or nerve, and as a rule the condition clears up early in convalescence. Huss however maintains that it is sometimes permanent. Earache is not very common. It occurred in four of the Edinburgh cases during convalescence and in three cases was followed by/

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Huss 1855 p 225.
by otorrhoea.

THE NOSE.

A catarrhal condition of the nose and nasopharynx is very frequently present. Epistaxis is rather uncommon in typhus. It was not present in any of the forty-three fatal cases of Jenner and of his other cases, it was seen in only two doubtful cases. Murchison tells us that it rarely occurs in uncomplicated typhus. He saw it about a dozen times in seven thousand cases.

Curschmann however mentions that the occurrence of epistaxis during the first stage and even before the beginning of the fever is worth noticing. None of my twenty-one cases showed epistaxis but I find there was a definite history of its occurrence in the early stage of the disease in seven of the one hundred and sixty-one cases treated in the Edinburgh City Hospital 1898-1902, while in four cases it was seen later in the disease from the sixth to the eighth day. In no case was it very severe.

Spleen.

Jenner found the spleen markedly enlarged in rather more than one fifth of his forty-three fatal cases. Murchison quotes Barrallier as having found enlargement/

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1 p 178. (ed 1884), 2 p. 542.
enlargement in 10.8% of his cases. Murchison found
the enlargement to be more common than these figures
imply and in his experience it was usually made out
by the fifth day. Curschmann found that splenic en-
largement was determined clinically much more fre-
quently than by autopsy. This was due, he thought
to the fact that enlargement did not usually persist.
until the beginning of defervescence. He has found
enlargement as early as the first febrile days or even
before the beginning of the initial stage. Of 70
cases admitted during the first week of their dis-
eease definite enlargement of the spleen was noted,
usually between the third and fifth days, in fifty
three cases.

In my own cases definite splenic enlargement was
noted only in two of the twenty one cases: in one case
on the second day. The enlargement was evident
throughout the remainder of the febrile period. Of
the City Hospital cases sixty six out of one hundred
and sixty one showed enlargement. It was made out
as early as the third day in two cases. In typhus
the spleen when palpable has not the firm resistant
feeling which is found in enteric fever.

DURATION OF THE DISEASE.

Unlesa"
Unless there are complications or sequelae the period of defervescence is usually reached within from twelve to seventeen days. In mild cases and especially in children it may be much earlier. When death occurs and is not due to some complication it takes place as a rule towards the middle or end of the second week. Hay of Aberdeen found the duration of fatal cases to be from eight to thirteen days and in one case (in which there must have been complication) twenty seven days.

**TYPES OF THE DISEASE.**

The most common is that known as the ataxo-adynamic type in which both nervous symptoms and physical prostration are great. In the nervous or ataxic form of typhus the nervous phenomena such as delirium, stupor, tremors and subsultus predominate. Adynamic typhus is the name given to that form of the disease in which early and marked muscular prostration with weakness of the heart's action are the most prominent features.

The most severe type is a fulminant form of the fever known as typhus siderans in which the disease proves fatal within a few days or even a few hours. This form was common among besieged garrisons during the Napoleonic wars and was also frequent among the French.
French troops in the Crimea.

Mild forms of the disease are very often met with in which the patient passes through the fever without any marked mental or nervous symptom and without any great prostration or heart weakness. In such cases the rash is frequently ill developed. Occasionally the mottling element is present. As a rule even in such cases the temperature is quite well marked.

Abortive forms are sometimes met with in which the fever may be well marked and sometimes very severe for a few days at the end of which time the temperature suddenly falls to normal by crisis and remains so. In such cases the rash may be quite typical and the condition of the patient very alarming as long as the febrile state lasts.

In children the disease is usually much less severe than in adults. The rash is not so well developed or so profuse and though the mental symptoms are often quite marked they are not usually so severe. The circulatory system and the central nervous system are apparently more resistant to the toxins in children than in adults. Physical prostration is not so great and the heart symptoms are not such a cause of worry. The pulse is usually very rapid but the tension/
Chart 16  Short Course in a Child
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Chart 14: from 1st day; observation completed by 15th day.
tension keeps good. The duration of the disease is usually less than in adults, the crisis occurring on an average one or two days earlier. It seldom occurs later than the twelfth day and is often much earlier, sometimes as early as the seventh. (Charts 10, 17, 18) The rash is frequently represented only by its subcuticular element and may even be absent, and the only indication of the disease may be the temperature and sensation of general malaise, headache, sickness &c.

RELAPSES & SECOND ATTACKS.

True relapses must be very rare. Murchison reports that out of eighteen thousand two hundred and sixty eight cases of typhus reported at the London Fever Hospital during twenty three years there was only one instance reported by Dr. Buchan of true relapse with return of the rash and other symptoms. Many other observers have not had a large number.

Second attacks have been seen with a little greater frequency, but are also very rare. They have already been referred to (page 45).

MORBID ANATOMY.

There are no constant or characteristic post mortem changes in typhus fever. Sometimes the skin shows traces of the rash, but there is nothing else from which a diagnosis could be made. Since the/
the course of the disease is so short there is seldom any marked emaciation of the body. Decomposition sets in early and the blood is dark and more than usually fluid. The muscles are red and dry and under the microscope show atrophy of the fasciculi with fatty degeneration and cloudy swelling.

Respiratory System - Swelling and congestion of the mucous membrane of the upper air passages is usually to be seen. Ulceration is rare, but Curschmann found marked involvement of the larynx consisting of marked swelling of the mucous membrane with oedema and erosions and fissures and a condition of perichondritis. In the lower air passage a condition of diffuse bronchitis is usually found. Hypostatic congestion of the lower lobes of the lungs is present in most cases. Emphysema was found along with congestion in one City Hospital case.

A condition of lobar pneumonia is usually considered as of rare occurrence. Curschmann however found it in 15 per cent of his typhus cadavers.

The heart is very frequently dilated and the muscles flabby and soft and friable and of a pale yellowish red colour: a condition of myocarditis. Endocarditis is very rare in typhus.

Alimentary Tract

The/
The changes are few and unimportant. The oesophagus is usually normal and the gastric and intestinal mucous membrane seldom shows more than a catarrhal condition. Peyer's patches and the solitary follicles are never affected nor are the mesenteric glands. Occasionally however in severe cases small haemorrhages have been found on autopsy.

The liver is affected as in other acute infectious diseases. It is enlarged, harder than normal and shows cloudy swelling. It two cases in Edinburgh outbreak 1898-1902 it was found to be cirrhotic.

The spleen - Post mortem enlargement is found in the majority of cases. Murchison found it in two thirds of his autopsies; Curseimann in fifty out of seventy two. The organ is of soft consistency and may be diffuent. Infarcts were present in two of the Edinburgh cases which came to the table.

The kidneys are usually enlarged and congested and may show cloudy swelling. Occasionally true nephritis may be observed.

The nervous system - hyperaemia and congestion of the membranes of the brain, and increase in the ventricular fluid are the most usual findings. True meningitis is very rare, meningeal haemorrhage much more common. Haemorrhage in the Arachnoid had occurred in one eighth of Jenner's fatal cases. The brain tissue is found to be softer than normal.
Complications and sequelae of typhus

These appear to vary in character and in frequency in different epidemics of typhus but on the whole they are fewer than in most of the other acute infectious diseases and it is seldom that a case of typhus gives trouble once the crisis is successfully passed.

Lungs and Respiratory System.

Cough and Bronchial Catarrh are quite commonly present.

Bronchitis is a frequent complication of the disease and when it is widespread and severe with profuse secretion may cause great anxiety, for the patient is often unable by reason of his feeble condition and his decubitus, to properly clear his tubes, and asphyxia may result.

When as commonly happens hypostatic consolidation is present along with extensive bronchitis, the danger is greatly increased.

Laryngitis.

This is as a rule an exceedingly dangerous but fortunately rare complication. It has been already referred to (page 98).

Pneumonia is a rather rare complication of typhus fever. Mirchison\(^1\) believes that most so-called pneumonias/

\(^1\) p. 192.
Pneumonias are really examples of hypostatic consolidation combined with bronchial catarrh. In his experience pneumonia when it occurs in typhus fever is usually basal, rarely apical. Lyons on the other hand found pneumonia first implicated the upper and anterior part of the lungs. Curschmann in 1879 found pneumonia present in fifteen per cent of his fatal cases. Only three in which this diagnosis was made ended in recovery. Dr. Ker had but two cases of true lobar pneumonia. In the small outbreak at Manchester I found in a child of nine a definite broncho-pneumonia commencing on the twelfth day. Pleurisy is also rare, but may follow the pneumonia. When it occurs the effusion is usually considerable and very often it is purulent necessitating operation for empyema. There is usually no friction and no complaint of pain and the condition is apt to be missed until the quantity of the fluid becomes so large as to embarrass the breathing.

Pulmonary tuberculosis has been said by many authorities (Stokes, Huss, Stewart) to be predisposed to by typhus. Christison and Murchison however asserted that when tuberculosis followed typhus there had been a previous history of phthisis and they believed typhus to be a very problematical predisposing cause.

Digestive tract—Constipation is the rule in typhus but/
but diarrhoea often occurs. It is seen most frequently in the second week and during defervescence but occasionally it may be present more or less during the entire course of the disease. It is sometimes very severe and difficult to check. It markedly increases the prostration of the patient and undoubtedly makes the prognosis much more grave. Murchison found it in five of the 14,589 cases admitted to the London Fever Hospital 1862-70. The mortality among the 734 cases complicated with diarrhoea proved to be 24.25 per cent. Diarrhoea was noted in twenty one of the one hundred and sixty one cases of typhus treated in the City Hospital Edinburgh 1898-1902. Of these, three cases ended fatally. Of my own cases there was pretty severe diarrhoea in two both ending in recovery. Dysentery was a pretty common complication of typhus in some of the Irish epidemics; in the garrisons of besieged cities; and in the French and Russian armies during the Crimea.

Haemorrhage from the bowels is rare in typhus unless caused by some concomitant condition of the bowel or of the blood. Jenner found that out of about 2000 cases admitted to London Fever Hospital haemorrhage from the bowel occurred in only one case and was due to haemorrhoids.

Murchison found haemorrhage from the bowel very rare/
rare and very fatal and its occurrence was usually associated with haematemesis and other haemorrhages, in this respect differing from the intestinal haemorrhages of typhoid. He quoted Russell's figures of three cases of Intestinal Haemorrhage out of from 3000-4000 cases of typhus observed in Glasgow. All three died. Curschmann found in a fatal case of Intestinal Haemorrhage in the course of typhus, that the source of the haemorrhage was a duodenal ulcer of long standing.

Jaundice is a very rare complication of typhus. Jenner never had a case, Murchison saw fifteen. Four were due to coexistent conditions - congestion of the liver and gastro-duodenal catarrh. Of the eleven whose jaundice was coexistent with the typhus rash, nine were fatal cases. Jaundice was seen in one of the Edinburgh cases. It occurred on the sixth day and was not at all severe. The patient recovered.

Circulatory system.

Valvular lesions apparently do not occur in typhus.

Venous thrombosis especially of the lower extremities occasionally occurs during convalescence in typhus as it may in other acute infectious diseases. It usually takes place in the veins of the left leg and is/

1 p 548.
is rather more rare in typhus than in typhoid. Gangrene of nose, fingers and toes, which occasionally in typhus occurs may be due partly to the enfeebled action of the heart and partly to the degeneration changes in the vessels.

**Urinary System**

More or less albuminuria is the rule in typhus but true nephritis as indicated by the presence of blood and tube casts in addition to albumen in the urine is uncommon, but three cases are noted in the records of the Edinburgh cases I have so often referred to. In one case, a male age 55, it occurred in the second week and the case ended fatally. In the other two cases both young adults it commenced early in convalescence and ended in complete recovery.

**Nervous symptoms**

While tremors are common in severe cases true convulsions are rare and are probably due in the majority of cases to uraemia. Christison found that all cases of convulsions in typhus which he had seen were associated with albuminuria and organic changes in the kidney. In one case he found urea in the blood in large quantities. Murchison pointed out that even when the urine is albumen free the uraemia origin of convulsion cannot be excluded for in the case of relapsing/1

1 p 170.
lapsing fever convulsions, large amounts of urea have been found in the blood, while the urine was free of albumen the kidney was apparently healthy. In the Edinburgh cases (1898-1902) there is a record of convulsions in one case that of an adult during the second week. The convolution was general and was not uraemic in origin. In the case of a child convulsions were present in the invasion stage of the fever. Cataleptic rigidity has in rare instances been observed associated with stupor and coma-vigil.

Paralysis

Hemiplegia has been described in some epidemics as a sequel. It is caused by haemorrhage into the meninges or into the brain substance, or in some cases by embolism or thrombosis of the cerebral arteries. Murchison records two such cases. In one the patient had an apoplectic seizure followed by hemiplegia in the second day during convalescence, with death on the 42nd day. The second case had right hemiplegia and aphasia, but recovered. A good many more cases have been recorded by other authors. Sometimes the paralysis is partial—of single extremities or of groups of muscles and if there be much atrophy considerable distortion may result. When parotid abscess is present with sloughing facial paralysis/
paralysis may be caused. Unilateral facial paralysis not however associated with parotid abscess occurred during the convalescence in one of the Edinburgh cases. Curschmann suggests that monoplegias are due in the majority of cases to a neuritis.

Meningitis Murchison who in the first edition of his book denied the existence of such a complication afterwards saw two undoubted cases which were verified post mortem. He also quotes Corrigan in Dublin, Jacquot in the Crimea and Russell in Glasgow, as having also met with meningitis in typhus fever. Many observers however have altogether denied its occurrence.

Muscular contractures are rarely observed. The fingers may be tightly clenched or the forearm firmly flexed. The same condition may affect the muscles of the calf or of the thigh. Murchison and Perry both mention cases of well-marked opisthotonos and head retraction.

Complications affecting the special sense organs have already been mentioned (page 110).

Mental disturbances - Delirium may continue for the first few days of convalescence, especially towards night. Associated with this there is frequently also loss of memory, the patient may remember nothing of his illness or only the outstanding events.

Mania, melancholia and hallucinations are very rare as sequelae of typhus. When they do occur they are usually of a mild type and according to Murchison seldom/
seldom lasts more than two to three months. Dr Ker is inclined to believe that the mental condition of a patient may be altered permanently.

Inflammation of Glands are according to most observers fairly common in typhus. Those most commonly affected appear to be the parotid and submaxillary. The frequency of such swellings appear to vary. Murchison found parotitis in one in 50.3 of his London cases, in 1861-63, while in 1867-70 the proportion was one in 30.3. Parotid swellings were a common complication of typhus in the French army in the Crimean, and in many other epidemics they have been equally common. The complication appears to be a very dangerous one and apart from its own local and general effects it is a measure of the severity of the general intoxication. When the inflammation goes on as it usually does to suppuration and sloughing it greatly increases the prostration of the patient. Murchison found a mortality of 41.23 per cent among the 211 cases of typhus with parotid bubo which were admitted to London Fever Hospital in 1861-70.

I have not had any cases of bubo of the parotid or any other gland in my own experience and there is no instance of the complication in the Edinburgh records to which I have had access. It has not been seen/

1 p 215.
seen in any of the Leith cases during late years and Dr. Hay does not appear to have met with any case of parotitis in the Aberdeen outbreak of 1904. It seems certain that this complication formerly so common has not been nearly so frequent in the outbreaks of the last few years. It seems possible that this may be due to the much greater attention now paid to the care of the mouth and tongue, by which all septic matter is removed and the accumulation of sordes prevented.

Murchison dwells on the frequency of this complication as a strong point of similarity between typhus and plague, which resemble one another also in the general conditions which favour their origin and spread.

The boils and superficial abscesses which often cause trouble during convalescence have already been mentioned. Bedsores usually over the sacrum will occasionally occur in spite of the most careful nursing.

Diagnosis - The diagnosis of typhus fever presents little difficulty if the case is a well marked and typical one or if the fever is already epidemic in the district and the history points to association or contact with other definite cases. The sudden onset and early prostration are very suggestive. So too is the general appearance of the patient, the congested bloated face, the drunken expression, the injected/
injected eyes. The initial symptoms of headache, chill, sickness and vomiting, pain in body and limbs, the mental disturbance—all these together point to the fever being typhus. But even remembering all these points the diagnosis of typhus before the rash is out must always be difficult. When the rash is out and well developed no difficulty will be experienced, but it is often ill developed and may in children be absent. Frequently it consists only of a faint subcuticular mottling which owing to the dirty condition of the patient's skin and to the badly lighted room in which the first examination is made may not be well seen. It is often best seen in the fold of the axillae and in the groin or on the wrists and ankles and may sometimes be best seen in a shaded light and at a little distance from the patient. Flea bites which are usually plentiful may be distinguished from true typhus petechiae by their more definite outline and by their central puncture. The odour if present and recognised is a great assistance in diagnosis.

**Differential diagnosis**

**Pneumonia.** The quickened respiration, the prostration and it may be the cyanosis of the patient added to dulness at or near the bases is apt to point/
point to the lungs as the seat of the mischief. In the absence of the characteristic rash the lungs should always be carefully examined. In typhus the dulness posteriorly is not restricted to the limits of the lobes. It is always present on both sides and the breathing is not tubular in type. A true pneumonia is sometimes mistaken for typhus. As a rule the respirations in pneumonia are more rapid than in typhus. The history is a guide to a certain extent. If there are signs of pneumonia and especially at the apices, no rash and no history of contact with typhus, the case is probably a true pneumonia. Herpes so common in pneumonia is said to be fairly often seen in typhus and its presence or absence is of no great value as an aid to diagnosis.

Meningitis may present a picture very like typhus with severe nervous symptoms. In meningitis the mental state in the early stages is more acute than in typhus and the headache is usually more severe. The squint, ptosis and other eye symptoms common in meningitis have all been reported as occurring also, though rarely, in typhus. The typhus patient is never so irritable as in meningitis and the characteristic cry of the latter disease is not heard. The type of delirium of meningitis is usually more violent than in typhus and there is great intolerance of light and sound. In both diseases/
diseases there is the flushed face and injected eyes, but the expression in meningitis is anxious and pained or wild, while in typhus it is usually stupid and dulled. But delirium ferox may closely resemble the delirium of meningitis. The absence of the rash in meningitis is perhaps in some cases the main essential difference.

Cerebro spinal meningitis might present some difficulty especially if there are petechiae on the skin and if the case is an early one, before the head retraction has become marked. There is no subcuticular element associated with the petechiae of cerebro spinal meningitis and lumbar puncture will clear up the diagnosis. Delirium tremens may very closely resemble typhus, but in this condition the tongue is usually moist and furred, not dry as in the delirium of typhus. There is also the absence of temperature in delirium tremens and the history will present strong evidence one way or the other.

Uraemia has sometimes been mistaken for typhus. The dry brown tongue, the contracted pupils, the stupor and low delirium may closely resemble typhus. The urine of typhus cases, too, frequently contains albumen and sometimes tube casts and this further confuses diagnosis. The absence of rash and temperature in uraemia/
uraemia should settle the point, though a temperature in uraemia due to some other existing cause may have to be taken into account.

Purpura might be confounded with typhus. But in purpura there is no fever and no head symptoms. The purpuric spots are usually larger than in typhus and there are also usually haemorrhages from the mucous surfaces.

Typhus in children may readily be mistaken for measles. The rash is often very like a fading measles rash. In both diseases the rash comes out about the fourth day, but in measles it is usually well seen in the face, which in typhus is not usually invaded. A history of sneezing and catarrh points, of course, to measles. When the measles rash is well out, there should not be much difficulty as the spots in measles/brighter and larger and more raised than in typhus in which too the crescentic arrangement is not observed.

Scarlet fever In a few cases the rash as seen on the third or fourth day in children may be very like scarlet fever. It may consist of small pink or red spots closely crowded together or there may be simply an erythematous flush. The tongue too in children may be moist with white fur and prominent papillae. But the eyes and face and expression are different and the character of the rash has as a rule altered within the/
Influenza may present considerable difficulty. As in typhus the onset is sudden and there may be great prostration. Pains in the body or limbs and some bronchial catarrh may be present in either condition. In some cases it may be quite impossible to make a diagnosis before the rash is out.

Typhoid is undoubtedly the disease which presents the greatest difficulty in differential diagnosis. The profusion and distribution of the rash is nothing to go by for although it is usually scanty and confined to the abdomen, chest and back in typhoid, it is often abundant all over the body and limbs. I have seen several very profuse eruptions. On the other hand in typhus it may be very scanty and the subcuticular and petechial elements may be absent. The time of appearance of the rash is of importance. In typhus it is usually well out between the third and fifth days, earlier than the rash in typhoid makes it appearance. The appearance and colour of the spot is different in the two fevers and the fact that in typhoid they come out and disappear in successive crops is a further distinguishing point. The mode of onset is of importance, sudden in typhus with early prostration, slow, insidious in typhoid, so that the patient/
patient may be attending his occupation right through the first week or longer. The expression is different, dull and bloated in typhus; anxious and much more refined in typhoid. In the latter disease the eyes are usually clear. The temperature curve is also quite different in the two diseases. In typhus the temperature rises rapidly and within 24 or 48 hours may have reached its height, a height to which it seldom rises in typhoid, in which disease the temperature mounts by a relatively slow and step-like rise extending in most cases over several days. The marked morning remissions of typhoid are usually absent in typhus. The character of the pulse should not be forgotten. In typhoid it is in most cases relatively slow: in typhus it is commonly 110 or over. Picrotism may be present in either disease. The appearance of the abdomen and the symptoms referable thereto are not of much importance. In typhus there may be ten humidity and distension and abdominal pain. Diarrhoea is not so common in typhoid as is commonly supposed, while it is pretty frequently present in typhus. The stools in the diarrhoea of typhus are often yellow and thin and watery and bear at least a superficial resemblance to the stools of typhoid. The demonstration of the characteristic bacillus in the blood, stools/
stools and urine or nose spots will of course clinch the diagnosis. The Widal reaction in spite of the results got by Wilson, Patterson and certain others is according to my experience of great value in the differentiation of typhus and typhoid after the first week. The microscopic examination of the blood will I believe prove useful. In typhus there is (see pages 25-28) a certain degree of leucocytosis, more or less well marked. In typhoid leucocytosis is constantly absent. It must be remembered however that in both diseases there is an increase in the large mononuclear elements and also in most cases a diminution of the eosinophiles. The diazo reaction is of no value, since it is present in both conditions.

PROGNOSIS AND MORTALITY - Age is a most important factor in prognosis. Murchison gives the mortality for all ages admitted to the London Fever Hospital during 23 years as 18.92. In other hospitals it varied between 25 per cent (Kings College Hospital 1840-58) and 9.56 (Cork Fever Hospital 1862-69). The average hospital rate was 15.26. It must be remembered of course that hospital cases in these days were largely selected cases including the worst cases and also the oldest patients. Murchison believed that a corrected mortality would be not more than 10 per cent. The mortality however/
however varies greatly in different epidemics and in different circumstances. The mortality is often lowest when the disease is least prevalent. Thus mortality of 12, 10 and even 8 per cent have been reported in minor epidemics. In times of war and famine and privation the type of disease is usually very malignant and the mortality very high. Thus the mortality among the French troops in the Crimea and at Constantinople was over 50 per cent. Murchison gives the mortality of children under 10 as 6.59 per cent. From 10-14 it is lowest at 2.28. From 15-29 the mortality was 4.86, from 25-39 it was over 15 per cent, from 35-39 25 per cent and so on increasing until the mortality of people 60 years was over 60 per cent. Goodall and Washbourne give the mortality among 2251 patients admitted to the Metropolitan Asylum Board Hospitals (1871-1907) as 19 per cent. Under five years it was 2.1: 5 - 9, 0.5. The mortality above 10 years increases with the age. From 20-24 it was 19.9, about equal to the rate for all ages, while among patients 55 years and over, the mortality was over 70 per cent. In the last small outbreak in Edinburgh there was but one death among seventy three patients twenty years and under, while of the remainder over 20 years, 88 in number, 16 died.

Sex also exercises some influence on the mortality in typhus. Most authorities agree that it is lower in females.

1. Jacquot 1858 pp 63, 150, 156. 2 pp 254, 263.
females than in males. Among 11,887 males admitted to Edinburgh, Glasgow and Dundee Infirmaries the mortality was 17.64%; among 11,506 females it was 13.42. Of the Metropolitan Asylum Board admissions above referred to the percentage mortality in males was 21.9, in females 18.2. In the Edinburgh outbreak 1898-1902 the total mortality was 10.6 per cent. The mortality among women was 6.8 per cent, while in men it was 15.4. This disproportion is of course too great and is explained by the small total number of cases. The greater male mortality may be due as Murchison suggests to the greater prevalence of alcoholism in men, for there can be no doubt that alcoholism is one of the most important factors in prognosis. In such a condition the nervous symptoms are markedly exaggerated, the resistance is weakened and in addition the morbid condition of the liver and kidneys impedes elimination of the toxin. The greater muscular development of men may also be a factor in the higher mortality. Murchison found that the fever is usually much more fatal in such individuals than among men of slighter physique. Fat persons also whether male or female, suffer more than thin. Dr. Ker thinks it almost an open question whether so far as prognosis is concerned it is not better to be alcoholic and thin than temperate.
ate and fat. Previous disease especially chronic debilitating disease and also gout and kidney disease renders the prognosis much more grave.

Over exertion and fatigue whether bodily or mental undoubtedly increase the chance of a fatal termination in typhus. Thus the mortality is usually very high among nurses and doctors who contract the disease in the course of their duties. The very high mortality among troops due to the effect of fatigue and privation has already been mentioned.

Pregnancy does not appear to increase to any extent the risk of a fatal termination in typhus. Of 107 pregnant females admitted to the London Fever Hospital 1862-70, 49 aborted from the tenth to fourteenth day of the fever. Of those 49, 9 died. All the remaining 98 patients recovered. In the last Edinburgh outbreak 3 of the female patients were pregnant, none aborted and all recovered. One woman was admitted during the puerperium, but puerperal fever did not develop and she made an excellent recovery.

The condition of the circulatory system is of great importance. There can be no doubt that the extreme difference in the mortality of children and adults over 40 while partly due to a difference in the/

1 Murchison p 212.
the type of the disease is also to be explained by the healthier circulation in children and the consequent decreased liability to hypostatic congestion and heart failure.

A consistent pulse rate of 130 or over is an unfavourable sign. So also is a pulse which early becomes soft and compressible or irregular or intermittent or dicrotic. The condition of the nervous system is also of very great importance. Any great disturbance occurring early is an unfavourable sign. Continued sleeplessness during the first week is often followed by coma vigil. Early stupor and coma and also early and wild delirium are also grave indications. Delirium ferox is usually of very grave importance, and most cases appear to end fatally. Picking at the bed-clothes, tremors and twitchings of the facial muscles and convulsive movements are seen only in the most serious cases. The fine point pupil of Graves is seen as a rule only in cases which end fatally.

The temperature curve according to some authorities may be helpful in prognosis. Many observers believe that a pseudo crisis on or about the seventh day is a distinctly favourable sign. Murchison found that a tendency of the temperature to rise rather than fall/
fall during the second week an unfavourable sign. A well-marked morning remission of 1° or more is a satisfactory feature in the temperature curve. The absence of the crisis when expected does not necessarily indicate an unfavourable ending to the disease, but a marked rise at that time is often the indication of a speedy fatal ending.

Any complication in the lungs such as extensive bronchitis, pneumonia or well-marked hypostatic congestion renders the prognosis much more grave. A constant respiration rate of over 40 is also unfavourable especially if it is accompanied by marked cyanosis. Profuse sweating just before or in the crisis usually occurs only in the worst cases. The rash may afford some indication of the severity of the disease. Very profuse rashes with petechial element well marked are as a rule found in the most severe cases. Cases which show a scanty rash are usually mild.

The decubitus also gives an indication of the prognosis. It is a favourable sign if the patient can turn himself and lie upon his side; unfavourable if he lie constantly on his back and specially if he tend to slip lower and lower down towards the foot of the bed.
Treatment - The most important considerations are to provide plenty of fresh air, and to use every means to tide the patient through his crisis. The cases should be treated in well ventilated wards with ample air-space. A cubic space of 3000 feet per patient should be aimed at and all the ventilation possible should be provided. My own cases in Manchester were given open air treatment as far as possible. The ward was provided with a verandah open on three sides but with a roof which gave protection from rain and direct sun-light and the patients were accommodated there during the day-time. Although I had no previous experience in the treatment of typhus and so could not compare results, I am of opinion that the open air treatment was most beneficial. The patients appeared to keep cooler and more comfortable outside. The nervous symptoms were apparently modified and in most cases insomnia gave no trouble. Headaches were infrequent and stupor was never prominent. The temperature too seemed to be favourably affected and hyperpyrexia did not occur. The danger of infection among the attendants is also very much lessened by open air treatment.

Careful nursing is of vital importance in the treatment of typhus. A strong and experienced nurse who is not too fearful of infection is necessary. The bed-clothes/
bedclothes of the patient should be light and in view of the frequency of incontinence, it is desirable that his attire should be so arranged as to permit of its being readily changed without causing any undue disturbance. In severe cases a water-bed is necessary. The patient should be sponged at least twice a day with some dilute antiseptic and the mouth must be carefully attended to. The tongue, lips and teeth must be thoroughly cleansed to prevent the accumulation of sordes and the tongue should be anointed with a mild antiseptic, for example boracic acid and vaseline. The skin must also be carefully looked after to prevent the formation of bed-sores. The tendency to retention must be borne in mind and the bladder should be percussed at least twice daily and the catheter employed if other methods of treatment fail to give relief.

The diet. - Since there is often a marked impairment of the digestive functions in typhus the diet should for the most part consist of fluids and should be given in definite quantities at fixed intervals of two or three hours, and twice or thrice during the night. Beef tea, chicken tea and clear soups give a little variety to the diet and have a stimulant effect and may be given unless there is diarrhoea. When diarrhoea or vomiting is present lime water should be added to the/
the milk or the latter may be peptonised. In mild cases semi-solid food may be given after the first few days if there is no tendency to gastro-intestinal disturbance. I usually gave my cases thin milk puddings, custard jellies, bread and milk and thin bread and butter and weak tea as early as the beginning of the second week. They certainly seemed to appreciate the more solid diet and the greater variety it was possible to give, and I observed no harmful results. Fish and chicken were given soon after the crisis was completed, while full diet was allowed by the end of the first week of convalescence.

To alleviate the intense thirst lemonade and other drinks made from fresh fruits may be given. Imperial drink is also to be recommended. There is not the same objection to aerated waters in typhus as there usually is in typhoid. Very often however the patient gets tired of any drinks he may be given and finds water more refreshing than anything else.

The forcing of large quantities of water upon the patient as a therapeutic measure was strongly advocated by the older physicians as long ago as the end of the eighteenth century. Dr. Ker has tried this line of treatment in many of his cases. In some cases.

1 Infectious Diseases p 222.
cases as much as from 8 to 10 pints daily was ingested by the patients. It requires a careful and patient nurse to persuade the patients to take such large quantities. The results obtained by this treatment were found to be very satisfactory. There was a marked diminution of the toxic symptoms such as delirium, insomnia and subsultus and an improvement in the condition of the mouth and tongue. The temperature curve also appeared to be favourably affected.

Treatment by baths: Cold affusion as a treatment for typhus was advocated by Currie and also by Jackson towards the end of the eighteenth century. The patient was seated in an empty bath and water at a temperature of 40° - 50° F. was poured over the head and chest from a height of from two to three feet. He was then dried and put back to bed and the operation was repeated once or twice daily. Currie stated that in some cases if carried out during the first three days this treatment arrested the disease. The pulse and temperature were reduced and the most distressing symptoms such as headache, delirium and insomnia alleviated. In later years however Christison found the treatment more or less a failure. But it has been found by Curschmann and others to be very useful in cases of coma or excessive stupor.
The best form of bath treatment is Ziemssen's method of reducing the temperature of the water after the immersion of the patient. The water should be at first about 10 ° lower than the body temperature and it is gradually cooled down to about 68 ° by the addition of cold water. The patient should remain in the bath for about half an hour or until shivering comes on and all the time his limbs should be well rubbed by assistants. The frequency of the baths depends on the general condition of the patient, and especially on the condition of the central nervous system, the pulse and the respiration. Curschmann has found that while the effect on the temperature is slight and temporary the effect on the cerebral functions and on the respiratory and circulatory systems was very favourable and well marked. When as sometimes in private practice, the facilities for bathing are limited, lukewarm and cold sponging combined with douches may be a useful substitute.

Question of stimulants - Marchison has said that patients under 20 as a rule do best without alcohol and that most patients over 40 are benefited by it from the beginning of the second week or earlier. It is certainly true that the majority of patients under
20 years do quite well without alcohol, because the disease is as a rule mild in people of that age. Over 20 and certainly over 40 years the disease is usually much more severe and in most cases alcohol is necessary. But quite apart from the age the administration of alcohol must depend on the condition of the patient and especially on the prostration and the condition of the circulatory system. In mild uncomplicated cases with a steady pulse of fair volume and tension alcohol should be withheld, but at the slightest indication of failure when the pulse becomes soft and compressible stimulants should be given. As a rule the best stimulant is alcohol. Good wines may be used but good whisky is to be preferred. If however there is a tendency to vomiting or diarrhoea brandy should be given instead. The dose should be small at first and increased if necessary but it must be remembered that alcoholics require more than temperate persons.

There can be no doubt however that some people do not do well with alcohol. In such cases strophananthus or digitalis should be tried. The former often acts very well. Digitalis though having the advantage of its diuretic action, acts as a rule too slowly to be of much use in typhus.
with strychnine it may be very useful, but if there are marked nervous symptoms with subsultus and jerking strychnine should be avoided.

In collapse which may occur especially during defervescence, hypodermics of ether, strychnine or brandy with hot bottles and hot applications over the heart will be necessary. Camphor and caffeine have also been found to act well in such a condition.

Treatment of nervous symptoms: For the troublesome headaches cold compresses with a little vinegar or methylated spirit or Eau de Cologne will sometimes give relief. Hot applications too are found to be useful in some cases. Cold douches to the head or the application of an icecap is often of great benefit.

Of drugs I found aspirin in 10 gr. doses to act well. The effect on the pains in the back and limbs was also marked and I never saw any ill effect on the pulse. Dr. Ker got best results from caffeine-gr V of the citrate. Curschmann prefers lactophenin to other drugs and found that it had a less depressing effect than antipyrin or antifebrine. Insomnia and delirium were favourably affected by its use.

Insomnia: I did not find this very troublesome when open air treatment was adopted, but it is undoubtedly/
doubtedly a very frequent symptom. Treatment by baths was found by Curschmann to have/most favourable effect. Very often drugs are necessary. The patient should not be allowed to have more than one sleepless night. Bromides are sometimes useful. Sulphonal in doses of 20-30 gr frequently acts well. Paraldehyde has less depressant effect on the heart than any of the other hypnotics and in doses of 3.2-3 is often successful. Chloral hydrate usually acts well, but it must be used with great caution and should be avoided if the pulse is very soft and compressible or if there is marked cyanosis. If the first dose of a hypnotic has not the desired effect it should be repeated after a suitable interval or another drug may be given. Sulphonal gr. 25-30 followed by Paraldehyde 3/4 four hours afterwards has been found by Dr. Kor to act very well in most cases. If the paraldehyde fails to give the desired effect it may be repeated in 3/4 doses every half hour until sleep is obtained.

For the delirium as for insomnia hydrotherapeutic treatment is said to be most efficacious. Curschmann also recommends lukewarm packs or baths with the application of an icecap or cold compresses to the head. The drugs useful in insomnia may also be tried in delirium. If these measures fail morphia may be necessary.
necessary but must be used with very great caution where the lungs are much engorged or the pupils markedly contracted. Dr. Ker recommends hyoscine hypodermically. In delirium ferox restraint of the patient will usually be necessary. This may be by means of a sheet passed over the chest and the ends secured under the side of the bed, or better, by proper restraint straps with wristlets. The room in which the patient lies must be kept absolutely quiet and the patient disturbed as little as possible.

In coma or deep stupor stimulation may be necessary. Cold douches have been recommended. Strong coffee or tea may be of value and blisters to the nape of the neck have been advised.

For the vomiting which sometimes proves so troublesome the sucking of ice and the application of icebags to the epigastrium is to be recommended. Dilute hydrocyanic acid is also useful. In severe cases it may be necessary to stop all food by the mouth and give nutrient enemata.

When there is diarrhoea beefsteak etc. must be stopped and lime water given along with the milk. Chalk and catechu mixture may be useful. Washing out the bowel with large warm water enemata may prove of benefit.

For constipation it is best to use simple enemata or to give mild cathartics. Dr. Ker found that very/
very troublesome diarrhoea was sometimes caused by the use of purgatives.

No drugs appear to have any effect upon the general course of the disease but in cases where it is thought desirable to give some medicine an acid mixture with or without quinine may be prescribed.

**Prophylaxis**

Typhus has been practically banished from this country by the progress of sanitary reform. The pulling down of old unsanitary property, the widening of streets, the opening up of air-spaces in over crowded slums and the control of lodging houses have made anything like an extensive outbreak practically impossible. Abolition of one-roomed houses and the strict enforcement of a proper standard of air and window-space and of cleanliness would materially lessen even the small dimensions which modern outbreaks usually assume.

When typhus does break out in a locality the case should be at once removed and isolated in a hospital and the house and all its contents carefully cleansed and disinfected. All nuisances in the affected locality should be carefully sought out and removed and the house should be lime washed.

Contacts should be sought for and kept in quarantine/
antine for at least a fortnight. In the Aberdeen outbreak already referred to the working men were permitted to attend their work as long as they appeared to be in good health. At night they slept in the reception house. This system was found to work admirably. If removal to quarantine be found impossible the contacts and their clothing and the house and its contents should be thoroughly cleansed and disinfected and a qualified inspector should visit every day for at least a fortnight.

Patients should be kept in hospital for at least five and preferably six weeks from the commencement of the fever. On several days previous to discharge they should be bathed with warm water and carbolic soap, care being taken that the hair is thoroughly cleansed. The last bath should be taken in a special discharge room at some distance from the ward and the patients should then dress in their disinfected clothing prior to removal from hospital.

Conclusions

That typhus fever is much more commonly a disease of children than has been usually supposed, but that on the other hand the disease is usually much modified and much milder in children.

That the contagiousness of the disease under modern/
modern sanitary conditions is probably less than that of the other acute exanthemata.

That nothing is yet definitely known of the causal organism of typhus: that either the blood is sterile or our present methods of staining and culture are unsuitable for the detection and growth of the organism.

That leucocytosis is invariably present in typhus and that the character of the leucocytosis may in doubtful cases give some indication of the disease.

That the Widal reaction is negative in typhus fever and that this test is still of great importance in the diagnosis between typhus and typhoid.

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