The *tongue* presents the changes inevitable in a prolonged fever, but there are no distinctive characters. Early in the disease it is moist, swollen, and coated with a thin white fur, which, as the disease progresses, becomes denser. It may remain moist throughout. In severe cases, particularly those with delirium, the tongue becomes very dry, partly owing to the fact that such patients breathe with the mouth open. It may be covered with a brown or brownish-black fur, or with crusts between which are cracks and fissures. In these cases the teeth and lips may be covered with a dark brownish matter called *sordes*—a mixture of food, epithelial *débris*, and micro-organisms. By keeping the mouth and tongue clean from the outset the fissures, which are extremely painful, may be prevented. During convalescence the tongue gradually becomes clean, and the fur is thrown off, either insensibly or occasionally in flakes.

The secretion of saliva is often diminished; salivation is rare.

Parotitis is not so common as in typhus fever. It was present in forty-five of the fatal cases. It is usually unilateral, and in a majority of my series of fatal cases goes on to suppuration. It is regarded as a very fatal complication, but recovery has followed in four or five of my cases. It undoubtedly may arise from extension of inflammation along Steno's duct. This is probably not so serious a form as when it arises from metastatic inflammation.

The *pharynx* may be the seat of slight catarrh. Sometimes the fauces are deeply congested. Membranous pharyngitis is a serious and fatal complication, which may come on in the third week.

The *gastric symptoms* are extremely variable. Nausea and vomiting are not common. There are instances, however, in which vomiting, resisting all measures, is a marked feature from the outset, and may directly cause death from exhaustion. Vomiting does not often occur in the second and third week, unless associated with some serious complication. In a few of these cases ulcers have been found in the stomach.

Of intestinal symptoms, *diarrhœa* is the most important. In some epidemics constipation exists, but in any long series of cases diarrhœa will be found to be a prominent feature of the disease. Its absence must not be taken as an indication that the intestinal disease is of slight extent. I have seen, on several occasions, the most extensive infiltration and ulceration of the Peyer's glands of the small intestine, with the colon filled with solid fæces. The diarrhœa is caused less by the ulcers than by the associated catarrh, and, as in tuberculosis, it is probable that when this is in the large intestine the discharges are more frequent. It is most common toward the end of the first and throughout the second week, but it may not occur until the third or even the fourth week. The number of discharges ranges from three to eight or ten in the twenty-four hours. They are usually abundant, thin, grayish-yellow, granular, of the consistency and appearance of pea-soup, and resemble very much, as Addison

remarked, the normal contents of the small bowel. The reaction is alkaline and the odor offensive. On standing, the discharges separate into a thin serous layer, containing albumen and salts, and a lower stratum, consisting of epithelial *débris*, remnants of food, and numerous crystals of triple phosphates. Blood may be in small amount, and only recognized

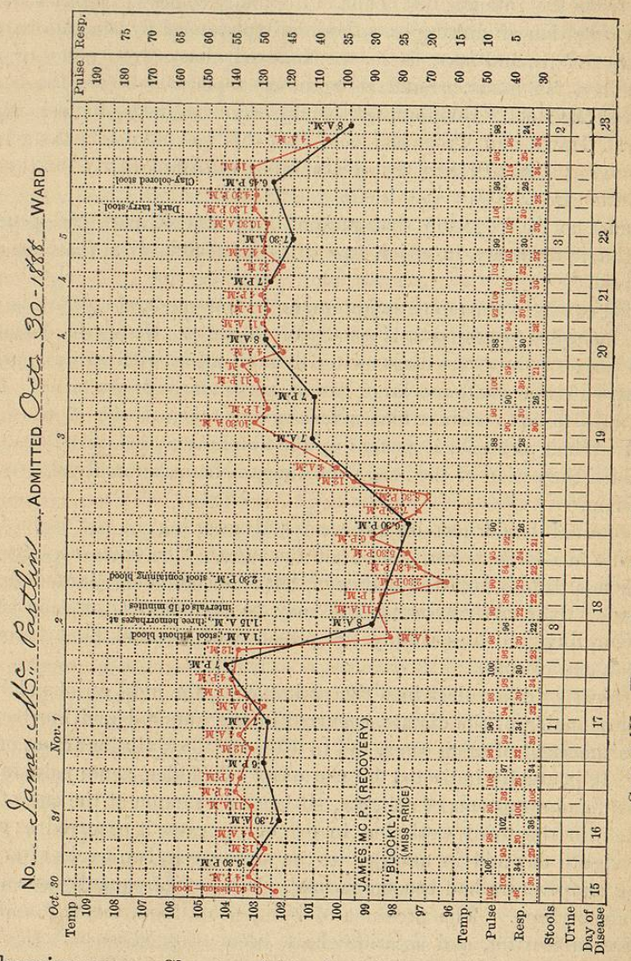

CHART IV.—Hæmorrhage from the bowels. Rapid fall of temperature.

by the microscope. Sloughs of the Peyer's glands occur either as grayish-yellow fragments or occasionally as ovoid masses, an inch or more in length, in which portions of the bowel tissue may be found.

Hæmorrhage from the bowels is a serious complication, occurring in from 3 to 5 per cent of all cases. It occurred in ninety-nine of the two

thousand Munich autopsies, and it was present in nine of my cases. There may be only a slight trace of blood in the stools, but too often it is a profuse, free hæmorrhage, which rapidly proves fatal. It occurs most commonly between the end of the second and the beginning of the fourth week, the time of the separation of the sloughs. Occasionally it results simply from the intense hyperæmia. It usually comes on without warning. A sensation of sinking or collapse is experienced by the patient, the temperature falls, and may, as in the annexed chart, drop eight or ten degrees in a few hours. Fatal collapse may supervene before the blood appears in the stool. Hæmorrhage usually occurs in cases of considerable severity. Graves and Trousseau held that this was not a very dangerous symptom, but statistics show that death follows in from thirty to fifty per cent of the cases.

It must not be forgotten that melæna may also be part of a general hæmorrhagic tendency, in which case it is associated with petechiæ and hæmaturia.

Meteorism is a frequent symptom, and if of moderate grade is not serious, but when excessive it is usually of ill-omen. Owing to defective tone in the walls, in severe cases owing to infiltration with serum, gas accumulates in the small and large bowels, particularly in the latter. It is rightly held to be to some extent a measure of the intensity of the local lesions. When extreme, it pushes up the diaphragm and interferes very much with the action of the heart and lungs. It undoubtedly also favors perforation.

Abdominal tenderness on pressure and gurgling in the right iliac fossa exist in a large proportion of all the cases. The tenderness may be more or less diffuse over the abdomen, but it is commonly limited to the right side It is rarely excessive and may be elicited only on deep pressure. Gurgling indicates simply the presence of gas and fluid fæces in the colon and cæcum.

Perforation of an ulcer into the peritonæum, the most serious abdominal complication of the disease, occurred in one hundred and fourteen of the two thousand Munich cases, and in fifteen of the sixty-four cases of my series It is usually indicated by the onset of sudden acute pain in the abdomen, and symptoms of collapse. It is most common at the end of the second or in the third week, but in one of my cases it occurred as early as the eighth day and in another in the sixth week, two weeks after the evening temperature had become normal. It is not infrequently associated with hæmorrhage. The presence of indigestible food, severe vomiting, excessive meteorism, and ascarides have been assigned as causes. This accident is much more common in men than in women. The perforation is usually in the ileum, but may occur in the colon. As a rule it promptly causes symptoms of peritonitis—distention of the abdomen, marked tenderness, rigidity of the abdominal walls, vomiting, a collapsed, pinched expression, and a rapid, small pulse. In very severe cases with marked

mental disturbance the symptoms may not excite suspicion, but the temperature usually falls and the symptoms of collapse are well marked. The diagnosis is easy, except in cases in which tympanites and tenderness have been prominent features, when it may be very difficult to say whether perforation has occurred. An indication of value in such instances is the obliteration of the liver dulness by gas in the peritoneal cavity, a symptom upon which Alonzo Clark and Flint laid great stress, and the value of which I have on several occasions been able to demonstrate. It is somewhat lessened by the fact that extreme tympany may almost, if not quite, obliterate the liver dulness. Recovery from perforation is undoubtedly possible, though rare.

Peritonitis without perforation may also occur by extension from the ulcer or occasionally by rupture of a softened mesenteric gland. It was present in 2·2 per cent of the Munich autopsies.

The *spleen* is invariably enlarged in typhoid fever, and in a majority of cases the edge can be felt below the costal margin. By the end of the first week the enlargement is evident, unless there is great distention of the colon, when the spleen may be pushed far back and difficult to feel. Even the normal area of dulness may not be obtainable. I have seen a very large spleen post mortem, when during life the increase in size was not observable. Toward the fourth week it diminishes in size. In four of my autopsies it weighed less than normal. Infarcts and abscesses are occasionally found. Rupture of the spleen in typhoid fever, due to a slight blow, has been seen by Bartholow. Spontaneous rupture may also occur.

Liver.—Symptoms on the part of this organ are rare. Enlargement is occasionlly detected. Jaundice is a very rare complication. It may be either of a catarrhal nature or due to parenchymatous changes. It was present in only 1·1 per cent of the Munich autopsies. Abscess of the liver is a very rare sequela.

Respiratory System.—*Epistaxis* is an early symptom in many cases, and precedes typhoid fever more commonly than it does any other febrile affection. It is occasionally profuse and serious.

Laryngitis is not very common. The ulcers and the perichondritis have already been described. Œdema apart from ulceration is rare. In this country the laryngeal complications of typhoid fever seem much less frequent than on the Continent. I have seen ulcers in only four or five instances, and twice only perichondritis, both of which cases recovered, one after the expectoration of large portions of the thyroid cartilage.

Bronchitis is one of the most frequent initial symptoms. It is indicated by the presence of numerous piping râles. It may come on with great severity, and in a case at the Philadelphia Hospital I regarded for several days the bronchial catarrh as the primary affection. The smaller tubes may be involved, producing urgent cough and even slight cyanosis. Collapse and lobular pneumonia may also occur.

Lobar pneumonia is met with under two conditions:

1. It may be the initial symptom of the disease. After an indisposition of a day or so, the patient is seized with a chill, has high fever, pain in the side, and within forty-eight hours there are signs of consolidation, and the evidences of an ordinary lobar pneumonia. The intestinal symptoms may not develop until toward the end of the first week or later; the pulmonary symptoms persist, crisis does not occur; the aspect of the patient changes, and by the end of the second week the clinical picture is that of typhoid fever. Spots may then be present and doubts as to the nature of the case are solved. In other instances, in the absence of a characteristic eruption the case remains dubious, and it is impossible to say whether the disease has been pneumonia, in which the so-called typhoid symptoms have developed, or whether it was typhoid fever with early implication of the lungs. Whether this condition depends upon the pneumococcus or is the result of an early localization of the typhoid bacillus has not yet been settled. I have twice performed autopsies in cases of this *pneumo-typhus*, as it is called by the French and Germans, and can speak positively of its onset with all the symptoms of a frank pneumonia.

2. Lobar pneumonia forms a serious and by no means infrequent complication of the second or third week. It was present in over 8 per cent of the Munich cases and occurred in nine of my cases. The symptoms are usually not marked There may be no rusty sputa, and, unless sought for, the condition is frequently overlooked. Infarction, abscess and gangrene are occasional pulmonary complications.

Hypostatic congestion of the lungs and œdema, due to enfeebled circulation in the later periods of the disease, are very common. The physical signs are defective resonance at the bases, feeble breath-sounds, and, on deep inspiration, moist râles. Pleurisy is by no means an uncommon complication. It was present in about 8 per cent of the Munich autopsies. It may develop slowly in convalescence, in which case it is almost always purulent. Another occasional pulmonary complication is *hæmoptysis*, which I once saw at the height of the disease. After death, no lesions of the lungs or bronchi were discovered. Miliary tuberculosis occasionally develops, and some writers hold that there is a greater susceptibility to infection with the tubercle bacillus after this than after other fevers.

Nervous System.—As already noted, the disease may set in with intense and persisting headache or an aggravated form of neuralgia. There are cases in which the effect of the poison is manifested on the nervous system early and with the greatest intensity. There are headache, photophobia, retraction of the neck, marked twitching of the muscles, rigidity, and even convulsions. In such cases the diagnosis of meningitis is invariably made. I have examined post mortem three such cases, in two of which the diagnosis of cerebro-spinal fever had been made. In not one of them was there any trace of meningeal inflammation, only the most intense congestion of the cerebral and spinal pia. Meningitis, however, may occur, but is extremely rare, as shown by the Munich record, in which

there were only eleven among the two thousand cases. Stokes's dictum that "there is no single nervous symptom which may not and does not occur independently of any appreciable lesion of the brain, nerves, or spinal cord," is too often forgotten.

Delirium is present in all severe cases. It is certainly less frequent under a rigid plan of hydrotherapy. It may be present from the outset, but usually does not develop until the second and sometimes not until the third week. It may be slight and only nocturnal. It is, as a rule, a quiet delirium, though there are cases in which the patient is very noisy and constantly tries to get out of bed, and, unless carefully watched, may escape. The patient does not often become maniacal. In heavy drinkers the delirium may have the character of delirium tremens. Even in cases which have no positive delirium, the mental processes are usually dulled and the patient is listless and apathetic. In severe cases the patient passes into a condition of unconsciousness. The eyes may be open, but he is oblivious to all surrounding circumstances and neither knows nor can indicate his wants. The urine and fæces are passed involuntarily. In this pseudo-wakeful state, or coma vigil as it is called, the eyes are open and the patient is constantly muttering. The lips and tongue are tremulous; there is twitching of the fingers and wrists—subsultus tendinum and carphologia. He picks at the bedclothes or grasps at invisible objects. These are among the most serious symptoms of the disease, and always indicate danger.

Among important complications and sequelæ are several nervous affections. The *paralyses* are due in the majority of instances to neuritis. It may be of a paraplegic type, or may involve only one or two nerves. Occasionally, as in a case reported by George Ross,* all four limbs are affected.

Possibly some of these cases are due to poliomyelitis, not to neuritis. This affection does not always follow, but may come on at the height of the disease, as in a case recently under my care, in which during the second week neuritis developed in both arms. Among other sequences may be mentioned aphasia, which is more apt to occur in young children, and great slowness of speech, which may or may not be associated with mental weakness.

Post-febrile *insanity* is perhaps more frequent after typhoid than after any other disease. Wood regards it as confusional insanity, the result of impaired nutrition and exhaustion of the nervous centres. Five cases have come under my observation, in four of which recovery took place.

Disturbances of the organs of the special senses are rare. Otitis media occasionally develops. Ocular symptoms are uncommon.

Renal System.—Retention of urine is an early symptom in many

* Paralysis in Typhoid Fever. Transactions of the Association of American Physicians, vol. iii.

cases, and is more frequent in some epidemics than in others. The urine is usually diminished at first, has the ordinary febrile characters, and the pigments are increased. Later in the disease it is more abundant and lighter in color.

Ehrlich has described a reaction, which he believes is rarely met with except in typhoid fever. This so-called *diazo-reaction* is produced as follows: Two solutions are employed, kept in separate bottles: one containing a saturated solution of sulphanilic acid in a solution of hydrochloric acid (50 c. c. to 1,000 c. c.); the other a ½ per cent solution of sodium nitrite. To make the test, a few cubic centimetres of urine are placed in a small test-tube with an equal quantity of a mixture of solution of the sulphanilic acid (40 c. c.) and the sodium nitrite (1 c. c.), the whole being thoroughly shaken. One cubic centimetre of ammonia is then allowed to flow carefully down the side of the tube, forming a colorless zone above the yellow urine, and at the junction of the two a deep brownish-red ring will be seen if the reaction is present. With normal urine a lighter brownish ring is produced, without a shade of red. The color of the foam of the mixed urine and reagent, and the tint they produce when largely diluted with water, are characteristic, being in both cases of a delicate rose-red if the diazo-reaction be present; but if not, brownish-yellow.

In twenty-six cases at my clinic, Simon found the reaction in twenty-two. It may be present previous to the occurrence of the rash, and as late as the twenty-second day. The value of the test is lessened by its occurrence in cases of miliary tuberculosis, and occasionally in the acute diseases associated with high fever.

The renal complications in typhoid fever may be thus grouped:

(*a*) Febrile albuminuria, which is very common and of no special significance; thus, in the first seventy-five cases admitted to the Johns Hopkins Hospital, albumen was present in forty-six, and in twenty-five cases casts were also found. In only two of these cases were there indications of an acute Bright's disease.

(*b*) Acute nephritis occurring at the onset or during the height of the disease—the *nephro-typhus* of the Germans, the *fièvre typhoïde à forme rénale* of the French—may set in, with all the symptoms of the most intense Bright's disease, masking in many instances the true nature of the malady. After an indisposition of a few days there may be fever, pain in the back, and the passage of a small amount of bloody urine. In a recent case * the early symptoms were all those of the most severe nephritis, and death occurred on the fourteenth day from perforation of the bowel. In other instances, as in a case reported in the same paper, the nephritis sets in at the end of the first or during the second week, and may modify considerably the character of the disease, and even render the diagnosis doubtful.

(*c*) The nephritis of convalescence. This is more common but less serious. It develops after the fall of the fever, and is usually associated with œdema. It does not present characters different from the ordinary post-febrile nephritis.

(*d*) The remarkable lymphomatous nephritis described by E. Wagner and others, and already referred to in the section on morbid anatomy, produces, as a rule, no symptoms.

(*e*) *Post-typhoid pyelitis.*—In this the pelves of the kidney and the calices are at first covered with a membranous exudation, but erosion and ulceration may subsequently occur. There may be blood and pus in the urine. This condition occurred in three of my cases, in one of which it was associated with extensive membranous inflammation of the bladder.

Simple catarrh of the bladder is rare.

Orchitis is occasionally met with during convalescence. Sadrain collected sixteen cases in the literature. It is usually associated with a catarrhal urethritis. Induration or atrophy may occur, and more rarely suppuration.

Osseous System.—A multiple arthritis occasionally occurs; more commonly it is limited to a single joint, and may pass on to suppuration. Spontaneous luxation may develop. Necrosis is not uncommon during convalescence. Keen collected thirty-seven cases after typhoid fever. It is probably always the result of a secondary infection. Its most usual seat is the tibia.

The *muscles* show in some cases the degeneration already referred to, but it does not cause any symptoms. Hæmorrhage occasionally occurs into the muscles, and late in the disease abscess may develop.

Association of other Diseases.—Erysipelas is a rare complication, most commonly met with during convalescence. In 1,420 cases at Basle it occurred ten times. Griesinger states that it is met with in 2 per cent.

Measles may develop during the fever or in convalescence. Chickenpox and noma have been reported in children. Pseudo-membranous inflammations may occur in the pharynx, larynx, or genitals. Malarial and typhoid fevers may be associated, but a majority of the cases of so-called typho-malarial fever are either remittent or true typhoid.

Varieties of Typhoid.—Typhoid fever is an extremely complex disease. Many forms have been described, some of which present exaggeration of common symptoms, others modification in the course, others again greater intensity of action on certain organs. As we have seen, when the nervous system is specially involved, it has been called the cerebro-spinal form; when the kidneys are early and severely affected, nephro-typhoid; when the disease begins with pulmonary symptoms, pneumo-typhoid; when the disease is characterized throughout by profuse

* Acute Nephritis in Typhoid Fever. Johns Hopkins Hospital Reports, February, 1890.