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Of the cases here reported, four in number, two came under observation, having passed through typhoid fever prior to admission. One case, with thrombosis of the middle cerebral artery, did not live long enough to have hemiplegia. The fourth case, also a fatal one, had an area of softening in the internal capsule.

Hemiplegia is very rare in typhoid fever, even in children, in whom the condition is not an infrequent accident in the specific fevers. Of 120 cases forming the basis of my monograph on the *Cerebral Palsies of Children*, no instance occurred during typhoid fever. Of the 160 cases collected by Wallenberg only four occurred during the course of enteric fever.

The most careful study of hemiplegia in the disease has been made by Francis Hawkins,[1] who has collected 17 cases from the literature. Three of these occurred in children under fifteen years of age. In the fourteen cases in which the data were given, the time of onset was in the second week in one case, during the third week in six cases, during the fourth week in two cases, during convalescence in five cases. The right side was paralyzed in twelve of the sixteen cases in which the side was mentioned. Aphasia accompanied the hemiplegia in twelve instances. Of the seventeen collected cases only two died, and in both of these a thrombosis was present in the middle cerebral artery. In typhoid fever, perhaps more than in any other disease, there is a tendency to the formation of thrombi in the arteries. Endocarditis is so rare that hemiplegia from embolism must be very uncommon.

More recently Rolleston[2] reported the case of a man aged 30, who became hemiplegic on the twenty-fourth day of an attack of typhoid fever, and in the same journal, Herringham mentioned the case of a girl nine years old, in whom the hemiplegia supervened in the third week.

[1] Clinical Society's Transactions, Vol. xxvi.
[2] British Medical Journal, Vol. i, 1898.

Thayer, in commenting upon one of the cases here reported (J. H. H. Bulletin, April, 1896), referred to two cases which he had seen in the service of Tarbell at the Massachusetts General Hospital. In one, a man aged 21, on the tenth day of the disease, hemiplegia with aphasia developed; the other, a child aged 10, became hemiplegic and aphasic on the twenty-fourth day of the disease.

The condition is referred to very briefly in the monograph on typhoid fever by Brouardel and Thoinot (1895), and more fully by Eichhorst in Nothnagel's Handbuch.

The hemiplegia may be due to hæmorrhage, embolism, thrombosis, or abscess. Eichhorst gives reference to a number of cases of hæmorrhage into the brain occurring during the course of the disease. The following remarkable case illustrates the occurrence of thrombi in the cerebral arteries. It is given in full in Studies II, page 470, but I give here a brief extract.

Case I. *Very mild attack; on the ninth day severe convulsions; most intense on the right side; death in a convulsion; thrombosis of ascending parietal and parieto-temporal branches of middle cerebral artery.*

The patient was a young man, aged 22, of good family history, who was admitted April 24, 1895, on the fourth day of an illness, in which he had headache, pain, and fever. On admission the temperature was 104°, but sank on the following morning to 100.7°. For the following three or four days the temperature range did not reach the bathing point, 102.5°. On the 27th rose-spots were seen, and the spleen was palpable. On the morning of the 28th the temperature was 99.3° and in evening 100°, and he seemed to be doing well in every respect. At noon on the 29th, as we were making the visit in the wards, Dr. Thayer was hurriedly called, and he found the patient in some distress, complaining of uneasy feelings in the head. The pupils were dilated, and in a few minutes he had a short, sharp, general, clonic convulsion, beginning almost simultaneously in both arms. The eyes showed marked conjugate deviation to the left and upwards, the head also being drawn somewhat to the left. For about an hour the convulsions were repeated at short intervals. Morphia was given hypodermically, and chloroform administered. They then became

less intense, and finally ceased altogether for several hours. During the convulsions there was profound unconsciousness, and in the severer ones great embarrassment of the respiration, so that he became quite livid. In the interval the patient appeared to be conscious, and spoke to those about him, and seemed to understand questions, though he had a confused, frightened look. At 5 P. M., the convulsions recurred with great severity, and in spite of inhalations of chloroform, they recurred at intervals until ten o'clock in the evening, when in a severe one the patient died. The convulsions were general, but the more intense movements were on the right side.

The autopsy showed a marked hæmorrhagic enteritis affecting the ileum, which presented here and there small ulcers in Peyer's patches. The heart was normal. The following is a description of the lesion in the brain by Dr. Flexner: "There was an area of thrombosis in certain of the vessels on the convolutions of the left side. At the time of the autopsy this was seen to involve the branches springing from the middle cerebral artery; but at this time the dissection was not completed. Subsequently in the formalin-hardened specimen it was seen that the thrombi were situated in the ascending parietal and parieto-temporal branches of the middle cerebral artery. The meninges over these vessels contained small hæmorrhages, and the brain substance corresponding to them, while not softened, showed small extravasations of blood, although the surrounding tissue was quite firm. Small, but quite extensive punctiform hæmorrhages could be seen to occupy the cortex and adjacent white substance in the immediate neighborhood of the thrombosed vessels. These areas extend sometimes for a distance of two cm. (usually toward the convexity) from the vessels.

"The internal carotid artery was free from thrombosis, as likewise the Sylvian branch. The ascending parietal and parieto-temporal arteries, including at the points of their origins in the middle cerebral artery, were occluded by an adherent, partly decolorized, and quite firm thrombus. More recent dark thrombi were traceable into the branches of these arteries; for example, into the branches running in the Rolandic fissure, the sulcus between the ascending frontal gyri and the ascending frontal convolutions, and the branches supplying the temporo-parietal region generally.

The inferior external frontal artery, and the arteries of the anterior perforated spaces were free from thrombi.

"On section of the brain there were no gross anatomical lesions. The ventricles were not dilated.

"Cultures of typhoid bacilli grew from different organs."

The following is a history of the cases which have been under observation:

Case II. *Protracted attack of typhoid fever; in the tenth week, while the fever still persisted, sudden convulsions; hemiplegia, with aphasia.*[1]

Annie F., aged 7, admitted to the medical wards October 3, 1895, complaining of inability to use the right hand.

There is nothing of note in the family history. With the exception of measles at four, she has been unusually strong and well; and has always been a very bright, intelligent child.

During the first week of April of the present year, the patient had much malaise with headache and debility and epistaxis. On the 6th she went to bed, complaining of pain in the abdomen, fever and diarrhœa. She had a slow and protracted attack, the diarrhœa and fever continuing for more than ten weeks. She seemed to be doing well until Sunday, June 3, when she was seized with violent convulsions, which were confined to the head, the right arm and leg. She was unconscious. The attack came on in the morning, and in the afternoon the movements ceased in the head, but movements of flexion and extension continued in the arm for nearly two days. It was then noticed that the right side was completely paralyzed, and the child was unable to move arm or leg. The face was also involved. With the hemiplegia there was total loss of the power of speech, and she remained aphasic for seven weeks. She improved, but very slowly. Voluntary movements were first noticed in the right leg six weeks after the convulsion. She has never regained power in the arm, but she has gradually begun to talk again. The child has now the attitude and gait characteristic of hemiplegia, which has partially recovered. As she walks into a room she limps, the right leg being dragged, with the foot inverted. She has worn away entirely the outer portion of the

[1] This case was shown by Dr. Blumer at the Hospital Medical Society; see Bulletin for April, 1896.

sole of the right shoe. Crippled as she is, she gets along very well and is able to run quite briskly. When she attempts to pick a coin up, the right arm is extended from the side and semi-flexed, but she puts the left arm and side forward, and grasps the coin with the left hand. When in repose the right arm is held close to the side, the wrist flexed, and the fingers also flexed. She can voluntarily flex and extend the arm at the elbow; can lift the hand to the head, but the power of extension in the wrist and the power of extension in the fingers, and of grasping with the hand are almost completely lost. When making any exertion, as in running for an object, the paralyzed arm is held out from the side, but there are no irregular movements in it. The condition of the face has improved very much since I first saw her early in October, but there is still paresis of the muscles.

In one other respect, too, she has got very much better. She can name objects correctly, recognizes a knife, a watch, and a cent, but is confused somewhat between a cent-piece and a five-cent piece. Her sister says that in the matter of speaking the improvement has been quite rapid of late, and, indeed, she says a great many more words now than she did when she came under observation. She looks also bright and intelligent, and evidently understands what is said to her.

Case III. *Severe attack of typhoid fever in March, 1895; at the end of the second week, without convulsion, slight hemiplegia, which persists.*

W. H. B., aged 25, clergyman, was admitted to the hospital November 30, complaining of paralysis of the left arm and leg.

His family history is good. Patient was not at all strong as a child; but was very well as a young man and while pursuing his theological studies.

On March 10, 1895, he went to bed with headache, fever, and diarrhœa. Gradually all the features of a very severe attack of typhoid fever developed, with much delirium.

On March 24th the paralysis developed suddenly without convulsions. There was also, Dr. R. K. Kneass informs me, no aggravation of the delirium following the attack.

He had no difficulty in speaking; there was no trouble with either rectum or bladder. He had a very protracted convalescence.

Throughout the summer there was a gradual improvement, so that about July 1st he was able to stand and began to walk. The power over the leg muscles has returned more rapidly than in those of the arm. He has never regained any power in the fingers. There has been a steady gain in weight since his illness. This is the history of the case as obtained by Dr. Thomas, who first saw him, and from Dr. R. K. Kneass, who kindly wrote to me about the original attack.

He is well nourished, the face looks pale, but the color of the lips is good. There is no trace of paralysis of the facial muscles, and the eyes are normal in every respect. The left arm can be moved at the shoulder and elbow, and slightly at the wrist in flexion. The hand cannot be extended. The power of pronation and supination is lost. There are only very slight movements of extension of the fingers. The muscles of the arm are very thin, and the interossei are wasted. The left leg can be moved freely at the thigh and flexed and extended at the knee. The feet can be flexed and extended slightly. Movements of eversion and inversion are better performed. The deep and superficial reflexes are everywhere exaggerated on the left side. The ankle clonus is very readily to be obtained. Sensation appears to be perfect.

An interesting feature, not noticeable at first, is the occurrence of wide, irregular, choreiform movements on attempting any voluntary effort with the left arm. The patient's mental condition is excellent.

As the condition is one of such interest, and the cases are so unusual, I shall add the following cases recently seen.

Case IV. *In the third week of a moderately severe attack, gradual onset of paralysis of the left side, with Cheyne-Stokes breathing and delirium; sudden death four days later; area of thrombotic softening in the internal capsule.*

Jos. G., aged 46 (Hosp. No. 28,600), admitted November 27, 1899.

Family history.—Two sisters died of consumption; otherwise nothing of special moment.

Personal history.—Never has had very good health. Has had measles and mumps; no other acute infections. Last year he had slight arthritis of the left ankle. He had syphilis eight years ago; gonorrhœa a year ago.

Present illness.—About six weeks ago he had a sudden pain between the shoulders, which made him catch his breath. He had not been exposed to cold or wet. This was followed by a hacking cough and some bloody expectoration. He lost in weight and strength. All this time he did his work regularly until two days ago. Yesterday and Sunday he felt very much worse.

Condition on admission.—The temperature in the evening was 102°, pulse 88, respirations 36. There were signs of a diffuse bronchitis over the posterior part of the lungs. There was a soft apex systolic murmur. There were no rose-spots; the spleen was not palpable. There was no leucocytosis; red blood-corpuscles just under four millions; no malarial parasites. The sputum was serous, in large amount, and contained many diplococci. During the first week in hospital the temperature ranged from 101° to 103°, gradually falling so that on December 4th it was below 100° all day. The patient looked dull and heavy; his heart's action was somewhat irregular, and the pulse was markedly dicrotic. There was slight impairment at both bases. During the second week the temperature was irregular, ranging from 100° to 102°. On the 9th, 10th and 11th it was a little higher, reaching 103°. Rose-spots were well seen on the 7th.

On December 14th, after the temperature had been between 100° and 101° for three days, and he had been doing well, at ten in the morning he was slightly nauseated, and said he felt "sick all over." At midday he was a little excited, delirious, and tried to get out of bed. The pulse was 92, respirations 28. The pupils were equal and reacted normally. At 2.45 P. M. his breathing was irregular and had a distinct Cheyne-Stokes character. At 3 P. M. there were a few incoordinate movements of the left arm. At 4 P. M. there was definite paresis of the left side. At 4.15 P. M. Dr. Futcher made the following note:

"At present patient is quieter than when seen at 1 P. M., is rational, responds to questions. The temperature has fallen at 4 P. M. to 99.8°. Pulse, fair volume and tension, regular in force and rhythm, distinctly dicrotic, 26 to the quarter. The respirations are of a definite Cheyne-Stokes type. Not complaining of any headache; no stiffness of any neck muscles. Pupils normal in size, equal, react to light and accommodation; no strabismus; tongue protruded in median line. There is appreciable paresis of

muscles on the left side of face; right angle of mouth drawn upwards and outwards. Slight ptosis of left upper lid. There is distinct paresis of muscles of left arm and lower extremity. Patella tendon reflexes are distinctly increased on both sides, possibly a trifle more marked on right side. Kernig's sign fairly well marked on both sides, angle being about 165°. Considerable degree of rigidity of muscles of left upper extremity.

"7 P. M. Paralysis of left side now almost complete; moves left arm and leg slightly, but cannot lift either. Left knee-jerk now definitely more active. Cheyne-Stokes respiration extreme. Slight ptosis of left eyelid; pupils still active and equal."

December 15th. The left-sided paralysis is complete, face, arm and leg. There is no strabismus; slight ptosis of the left side; pupils are equal, react to light. No headache complained of; no stiffness of the neck muscles.

On the 16th I noted that the paralysis of the face was not quite complete; the eyebrow could be lifted a little; still very complete of arm and leg. He had marked Cheyne-Stokes respiration. He responded rationally to questions. On this day a pleural friction was noted under the right nipple.

On December 18th Dr. Futcher's note was as follows: "Temperature had been a trifle higher during the last three days. It rose last night to 103° at 10 P. M. Condition has been distinctly worse in past forty-eight hours. Yesterday the pulse was weak and rapid throughout, responded slightly to infusion of salt solution. Cheyne-Stokes breathing remained marked during the day. This morning his condition has not improved. Cheyne-Stokes breathing present; hemiplegic symptoms have not improved. Cyanosis and œdema of left foot. Pulse is very small in volume, tension low, practically uncountable at wrist, thirty to the quarter over heart, where there is a distinct gallop rhythm. No endocardial murmur, nor pericardial friction rub. Slight impairment of percussion note over lower right back, where fairly numerous moist râles on inspiration; no distinct tubular breathing heard in back. Distinct pleuritic friction rub just below and outside right nipple. Friction rub has a peculiar cardio-respiratory rhythm. Breath sounds rather exaggerated; expiration prolonged. Lumbar puncture performed at 9.15 A. M., 25 cc. of clear fluid obtained."

The patient died suddenly at 8 P. M. on the 19th. He was conscious, and said he felt better five miutes before death.

The urine showed a trace of albumin and latterly a few granular tube casts. The Widal reaction was positive.

Autopsy.—Well marked, ordinary intestinal lesions of typhoid fever. Dr. Barker reported that it was not at all easy to make out the lesion when the brain was cut up at first. After the hardening was complete the lesion was perfectly well defined and easily seen, consisting of an area of softening in the upper part of the right internal capsule about the size of a small hickory nut, situated just lateral from the caudate nucleus, and a little medial and slightly dorsal from the upper border of the cortex of the island of Reil. The necrosis must have involved practically all of the fibres of the pyramidal tract of the right side, and was undoubtedly due to a plugging of a branch of the artery supplying the area.