

REPORT OF CASES ILLUSTRATING CEREBRAL LOCALIZATION.¹

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THE following cases seem to me worthy of being placed on record:

CASE I.—*Sarcomatous tumor affecting the motor regions of both hemispheres symmetrically.*—Man aged twenty-eight, married, Bohemian. No history of syphilis or injury. The patient was first seen by me in January, 1888. His previous history was as follows:

Thirteen months previously his sight began to fail in left eye. In about two months sight began to fail in right eye. In six months was completely blind in both eyes. Within a few weeks of the time that his left eye began to fail, he first experienced pain in right knee and right foot. Shortly after this the pain involved the left knee and left foot, and for some time he was treated by a physician for rheumatism. Within one or two months after the pain began, he was not certain about the time, he said he had difficulty in walking. The right leg especially was weak, and he often stumbled and fell, although he walked with a cane. A few weeks after the right leg began to trouble him, he had difficulty in using the left leg. About three or four months later his hands began to grow weak, so that he could not handle his knife and fork or hold a cane. He could not remember that his hands and arms had ever pained him. His legs and arms continued to grow progressively weaker until I saw him thirteen months after the onset of the disease, when he was unable to stand alone. With a nurse assisting him on each side, he could walk across the room, but with a great deal of difficulty. While lying in bed he

¹ Presented to the American Neurological Association Annual Meeting in Philadelphia, June, 1890.

could use his hands for a great many purposes, such as picking up the covers of the bed and using a handkerchief, and while there was some inco-ordination, it was not very marked. He could carry an empty spoon to his mouth, but if it contained liquid always spilled it. In any attempt to use the hand there was a slight jerky tremor. In raising the legs from the bed this tremor was also quite marked, though much finer than that of the hand. He complained of frequent cramps in right arm and right leg. He stated that he had never had these cramps on the left side. Atrophy of the muscles of legs and arms marked. He could locate the position of his limbs correctly. Weights held in the hand were distinguished very imperfectly. Knee-jerk was exaggerated, ankle clonus always marked, superficial reflexes appeared to be normal. He said that during the previous two or three months he had had a constant feeling of pins sticking into his skin which affected the entire body and which persisted to the last. The dynamometer showed twenty for the right hand and nineteen for the left. During the previous three months he had convulsions one or twice a month. These convulsions seemed to be general, and he always lost consciousness; said he felt faint for about a minute before they came on, and always slept afterward. There was marked anaesthesia over the entire body; if anything it seemed to be worse in the legs below the knee. It was more marked in the right arm and right leg. He said that from the commencement of his disease he had severe headache every four or five days in the front and top of his head. This pain usually lasted about six hours and returned regularly every fourth or fifth day. There was partial paralysis of the muscles of the abdomen and spine, though it was difficult to decide upon the degree of their involvement.

At the time of my first visit he could not raise himself in bed, though he could sit up for a short time when once placed in a sitting position. The spinal and abdominal muscles evidently contracted feebly. Abdominal respiration was almost entirely abolished. From an early period of the disease he had to pass water frequently. It should also

have been stated that he had no aphasia and no paralysis of muscles supplied by cranial nerves. I did not see this patient during the last two or three months of his life, but obtained the facts of his later illness from his nurse. Three months before death he became completely paralyzed in his legs. Sphincters were also paralyzed. The paralysis of arms was progressive, and during the last few weeks of his life he could not raise his arms from the bed or move himself in any position. His mind, the vigor of which he stated was slightly impaired when I first saw him, progressively failed, the predominant condition being that of mental weakness. During the last few weeks of his life he was irritable and noisy. Six hours before death he had spasmodic twitching in left arm and hand which lasted a few minutes, then the right arm and hand twitched for about the same length of time. These twitchings of the arms alternated in this way for about an hour, at the end of which time he had severe general convulsions. After having had five or six of these convulsions within three hours, he died in one, November, 1888.

In regard to the convulsions it should be stated that with the exception of the twitching of the arms above mentioned, they always appeared to be general, though it was impossible to obtain from the nurse or from the patient any statement of the order of their development. I could not learn that they were at any time localized in their character, with the possible exception of the twitching of arms that occurred on the day of his death.

When I first saw him he was entirely blind, pupils were widely dilated and eyes staring. Looking at the patient from a distance, the eyes had the appearance of exophthalmic goitre. Examination by the ophthalmoscope showed that there was marked atrophy of both optic nerves. The patient said that he became blind in the left eye before the right.

On post-mortem examination the brain, including pons, cerebellum, and membranes, weighed forty-eight ounces. The skull was thickened in about the position of the anterior fontanelle. This thickened part was a little larger

than a silver dollar in extent. It was a little more than one-half inch in thickness in the centre, the bone being finely porous, or honeycombed. Just beneath this, and between the layers of the dura, was a deposit of sarcomatous material. The deposit was nearly circular in shape

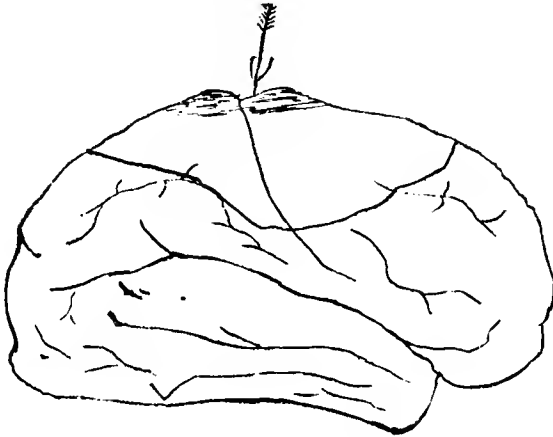


FIG. I.--Line shows approximate depth of tumor. Shaded portion shows superficial destruction of brain substance. Arrow indicates starting point.

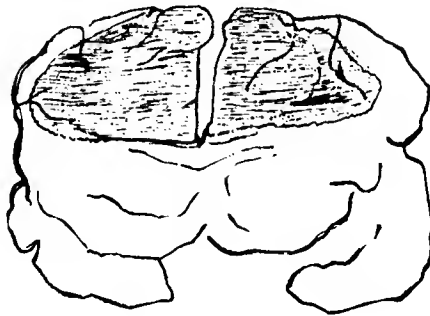


FIG. II. Shaded portion shows depth of tumor in both hemispheres.

and was about one-half inch thick in the centre, shading off towards the edges. The dura in this vicinity was very much thickened, and was adherent along the margins of the hemispheres anteriorly and posteriorly. Neither the superior longitudinal sinus nor the falx cerebri were in-

volved. The upper end of the ascending convolutions in both hemispheres was involved in a destructive process, which superficially extended about two and one-half inches from before backward. In this region the brain substance in both hemispheres was destroyed, there being on each side an excavation into which the dura sank. On the right side this excavated place contained about an ounce and a half of recently coagulated blood. On perpendicular section of the brain the tumor was found to extend as low as to the upper border of the corpus callosum on the left side, and to within about one-half inch of the corpus callosum on the right side. It involved the convolutions on the left side as follows :

The posterior one-third of the first and second frontal, upper two-thirds of the ascending frontal and parietal, and upper one-half of the superior parietal lobule. On the right side the extent was almost identical, with the exception that not quite as much of the superior parietal lobule was involved. With the exception of the entire destruction of the upper one-third of the ascending convolutions the brain had the appearance exteriorly of health, and over all of the extent of the tumor, as here described, there was a mantle of apparently healthy tissue, the tumor being confined almost entirely to the white matter. On the right side, the median aspect of the ascending convolutions, the posterior one-third of the first frontal convolution, and a very small part of the precuneous were involved. On the left side, the extent of the tumor was essentially the same except that a little more of the precuneous was involved. The convolution of the corpus callosum was involved in about the middle one-half on each side, the diseased process extending, as stated above, to the level of the corpus callosum on the left side and to within one-half inch of it on the right. The middle region of both crura was softened, as were also both anterior pyramids. On examination with the naked eye, this descending degeneration appeared to be the same on both sides. Microscopic examination showed the tumor to be a small-celled sarcoma. The brain was accidentally thrown away, so that no further microscopical examination

was male, and the opportunity of studying the descending degeneration was lost, which in this case would have been a most interesting feature.

The above case seems to be unique in that the disease involved the two hemispheres almost precisely to the same extent and in the same region. An experiment deliberately conducted could not have been more accurately localized. Though my study of the case was obviously imperfect, there are certain points in localization upon which it bears and to which I will briefly refer. First, if we assume that the morbid process began in the upper part of the ascending convolution and worked downward (and this seems probable), then the first sensory and motor symptoms were referable to the involvement of this region, and the order of development of symptoms would correspond to the accepted views of the function of this region. Second, it will be observed that defective sight was the first symptom, though the disease was probably at that time superficial and in the upper part of the motor region. This simply emphasizes what has been noted by others, that impairment of sight may be the first symptom of cerebral tumor. Third, it should be noted that pain in the knees and in the feet was among the early symptoms pointing to a probable early involvement of the sensory centres. The patient was very positive about the existence of pain at an early stage of the disease. If the assumption is correct that the progress of the tumor was from above downwards, then it follows that the early sensory symptoms were due to involvement of the upper part of the so-called motor region, or rather of sensory centres in this vicinity. It should be remembered, however, that the convolution of the corpus callosum on both sides was involved. Fourth, according to Ferrier, irritation of the base of the first and second frontal convolutions in the monkey gives rise to lateral movements of the head and eyes, with dilatation of the pupils, and an expression of attention and surprise. In this case there was dilatation of the pupils and a staring expression that was always very noticeable, and it will be observed that the posterior part of these two convolutions was involved

in the morbid process. Fifth, the patient stated that his memory began to fail within about one year from the onset of the disease. During the last four months of his life there was, as stated, decided mental impairment. Was this due to a gradual involvement of the frontal region where some have located the higher psychical faculties?

CASE II.—Man aged seventy-three. He had been intemperate and was subject to chronic rheumatism and had an aortic murmur. On getting out of bed one morning he found that he was paralyzed on the right side, and fell to the floor. He could not speak until about noon, when, on seeing his son, he called him by name, saying, "This is 'P.'" During the day he tried to talk, but could only speak in an unintelligible jargon, except that once he said, "I will soon get well." He seemed to comprehend everything that was said to him, hearing and sight were normal, and he readily comprehended written and printed words. In the early part of the day the paralysis was incomplete, patient being able to move his arm and leg, though he could not grasp anything or stand alone. The paralysis grew worse during the day, and at five o'clock was complete. At time of examination in the afternoon there was evident anaesthesia of entire right side, though, owing to the mental condition of the patient its degree could not be determined. The face was drawn slightly to the left. He died on the same day the paralysis developed, at ten P. M.

On autopsy, the vessels at the base of the brain were atheromatous, having the appearance of a series of pipe stems. On looking at the left hemisphere, the operculum was lifted up, the convolutions of the island being plainly visible and bulging out. On section of the brain, a recent clot, weighing a little over two ounces, was found to be located chiefly in the convolutions of the island of Reil and outside of the claustrum. The hemorrhage was in the white matter and extended from about the middle of the second frontal convolution along the whole extent of the island, and extending to and involving a small part of the first temporal convolution. The white substance of the hinder part of the third left frontal convolution was also destroyed by the hemorrhage.

The interesting point in this case is the possibility of reaching the clot and evacuating it by surgical procedure. This could easily have been done if the lesion had been distinctly located during life. As part of the third left frontal was involved the aphasia could not have been cured by an operation, but as the paralysis and anaesthesia were due to pressure upon the internal capsule, the evacuation of the clot would have relieved both.

THE PHYSIOLOGY OF SLEEP.

An editorial in "The Medical Age," March 25, 1890, contains the following: The sleep state follows that fatigue, which is the expression of waste, unbalanced by repair. There is a diminution of cerebral molecular energy, owing to diminution of force-giving intra-cellular material. All the brain functions are languidly performed; the heart and the lungs participate in the lessened production of force; the blood contains an excess of carbonic acid, which increases the depression by hindering metabolism. We are ignorant of the mechanism and only know that it comes about through fatigue. According to Preyer it is an intoxication from retention of waste products, one being lactic acid. This acid is not the only poison produced in the system, for every cell is a laboratory yielding *leucomaines*. These waste products are found largely in the urine, and when this secretion was injected into animals, Bouchard found that the urine of the day was twice as toxic as that of the sleeping state; the former producing narcosis, and the latter convulsions. The inference is that during waking activity, disassimilation yields products which by accumulation cause sleep, and during sleep the convulsivant substances resulting from denutrition bring about awakening. Pilüger also connects sleep with the process of disassimilation. His theory is that brain work requires nutrition and oxygen. During waking hours, waste gets ahead of repair, and carbonic acid and other products accumulate in the system. The oxygen in the cerebral cells combining with the carbon of albuminoid matters causes little explosions from which arises the waking state. When the oxygen of the tissues diminishes by reason of its consumption, the cause of the excitation is lacking and sleep occurs.