MULTIPLE TUMOURS OF THE BRAIN; FIBRO-CYSTOMA OF PONS AND CEREBELLUM AND MULTIPLE FIBRO-PSAMMOMATA OF DURA, PIA-ARACHNOID AND CORTEX CEREBRI.

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I saw Miss X., aged 32, brunette, by request of Dr. W. O. Smith on January 15, 1895. Her father and mother were living at advanced age and in good health. Two brothers and two sisters, all of adult age, were living and in excellent health. Two sisters died in infancy; cause unknown. No history of nervous disease or of tumours anywhere in the family.

Personal History.—Patient is one of twins, both girls. She has had measles and perhaps other children's diseases, otherwise enjoying good health until seven years ago, when she experienced a severe attack described as "cholera morbus." Was sick several days at this time and since then has had more or less ill-health, described as "nervous trouble," for which she has consulted various physicians. In November, 1890, she consulted Dr. S. C. Ayres, to whom we are indebted for the following notes: "I first saw Miss ——, in November, 1890. She was deaf in both ears. It seemed to be a case of chronic aural catarrh. There was no obstruction of the Eustachian tubes and but little alteration in the appearance of the drum membrane. Treatment did not relieve her and was not continued long. She had at this time sick headaches. I examined her refraction and found that she had compound hypermetropic astigmatism in both eyes, and gave her correcting lenses; her vision was perfect. On February 27, 1892, I saw her in consultation with Dr. Zenner on account of a marked papillitis of both eyes. Her vision was 0·9, right, and 0·7, left. Two days later I saw her again, and then there was a remarkable and unusual phenomenon in the right eye. In looking at the test card, vision would drop from 0·7 to 0·4 and then in a

moment or two rise to 0·7 again. I watched this change for some time while she remained in my office. No such change was present in the left eye. A perimetric examination showed that the upper part of the field of vision was contracted and also the field for red. I did not see her again until January 28, 1895; she was then suffering so much pain that I could not test her accurately, but I found that her central vision was normal as she could read fine print with either eye. I found, however, that there was paresis of the right abducens, with diplopia on the right side."

Patient states (January 15, 1895) that she had within a few months past, several attacks of vertigo and vomiting, apparently brought on by sudden movements, as turning in bed, &c. Says she *feels nausea before vomiting*. Also complains of numbness of left extremities and left side of body.

Clinical History.—Patient in bed, but has been up and about room more or less daily. Decubitus dorsal. Temperature under tongue 99·4° F.

Nervous System.—Mental state normal; memory excellent; patient converses and writes with intelligence and manifests much interest in her own case. Speech somewhat slow but unhesitating and correct. Handwriting steady, uniform and legible; letters well formed, words correctly spelled and sentences properly constructed.

Sensory Symptoms.—She complains of a general sense of fatigue and excruciating paroxysmal pains in the head, chiefly in right parietal and occipital regions, from which she derives relief by assuming an opisthotonic posture (resting head on vertex). Examination also reveals hyperæsthesia of the scalp over the right frontal, parietal and occipital regions. Tactile paræsthesia of slight degree over left face, body and extremities.

Vision: Pupils moderately dilated, responsive to light. Patient complains of double vision at times, but reads and writes without apparent difficulty. (See previous report.)

Hearing markedly impaired on both sides, practically absent on left. (See also previous report.)

Taste and smell not tested, but no deficiency or perversion noted by patient.

Motor Symptoms.—Left hemiparesis of face and limbs present, and patient says she tends to turn toward left side in walking. Tongue protruded in median line. Later observations (within a month) by Drs. P. S. Conner and W. O. Smith, record a marked deviation to left, which disappeared within a few days to return

later. During the last few days of life, marked symptoms of bulbar paralysis developed—as evidenced by great difficulty in swallowing and articulation.

Patellar and olecranon reflexes not notably altered.

Heart sounds weakened, no bruit detected. Pulse 84 to 90, soft, quick stroke.

The other systems were normal, and urinary analysis showed no abnormal constituent.

The salient features of the case at the time of my first and only visit (thirty-nine days before death) were :—Violent paroxysmal pains in head, hyperæsthesia over right side of scalp, diplopia, bi-lateral deafness, left hemiparesis and vomiting *with nausea*, added to which were the optic neuritis and abducens paralysis, noted by Drs. Zenner and Ayres. Upon these I based my opinion of a tumour at the base of the brain, probably pressing on the pons varolii and involving the fourth, fifth, seventh and eighth nerves or their nuclei. From these symptoms, especially the left hemiparesis, I supposed that the growth was in the upper half of the pons on the *right* side, whereas its actual situation discovered after death was over the lower half and *left* side.

It was plain that no one cortical lesion would account for all the symptoms presented ; and the absence of convulsions, monoplegia or mental impairment excluded, to my view, an extensive or multiple cortical involvement. Further, the evidence pointed to disturbance of the right fourth and sixth nerves (or their inter-communications) to the right fifth, left seventh and both eighth nerves also ; and only in the region of the pons was this possible to occur from a single lesion, without loss of consciousness.

The vomiting and rotatory gait would naturally point to the cerebellum, but might easily be accounted for by irritation of its peduncles by a growth in the pons.

Report of Autopsy, February 28, 1895, at four o'clock, p.m., five days after death.

Body well preserved ; no embalming fluid or other preservation used. Rigor mortis present to a slight degree. The head only was examined. Calvarium removed in the usual manner. Dural outlines and general consistence of

brain normal. Dural vessels markedly hyperæmic, the larger meningeal trunks standing out as prominent dark blue cords. Cortical veins appear through dura fuller and more distinct than normal.

The lower border of falx cerebri at a point 6 cm. posterior to the crista galli contained an ovoid neoplasm, the size of a kidney bean, enclosed within the layers of the falx; the left layer, however, had undergone absorption, so that the fibrous capsule was deficient over the central two-thirds of the growth on the left side. Immediately posterior to this growth the falx in the region of the inferior longitudinal sinus, for the space of 25 mm. longitudinally by 5 mm. vertically, presented a recticular or cribiform appearance apparently the result of imperfect development or absorption; but this bore no direct relation to the growth mentioned, nor to any other.

A second neoplasm, half the size of the first, of similar appearance but more flattened, was situated at the superior margin of the falx, slightly posterior to the first mentioned growth, with which it was connected by a narrow isthmus.

Three similar growths, also more flattened than the first projected from the inner surface of the dura of the convexity over the posterior extremities of the first and second frontal convolutions. These measured respectively 3 mm., 6 mm., and 20 mm., in greatest extent and from 2 to 3 mm. in thickness. A sixth neoplasm, ovoid in form and the size of a large kidney bean, projected from the under surface of the dura—but still enclosed between its layers—immediately to the right of the great longitudinal sinus, which it did not invade. This growth occupied a position nearly corresponding with the upper extremity of the Rolandic fissure.

A seventh growth, also the size of a kidney bean, was enclosed in the meshes of the pia, just anterior to the *lamina cinerea*, where it bridged the great longitudinal fissure and penetrated slightly the cortex of both frontal lobes (*gyri recti*).

The eighth and principal tumour (fig. 1) came into view on dividing the *tentorial* attachment to the petrous margin. Its anterior extremity, the size of the end of the little finger,

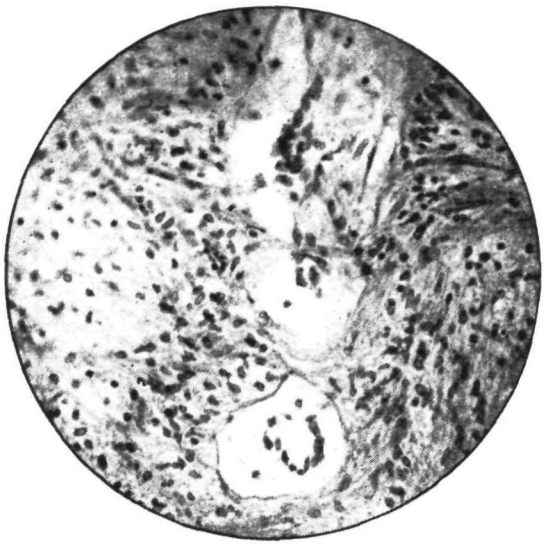

FIG. 2.

A section of solid portion of main tumour (No. 8 in report). x 320. Photo-micrograph by Dr. M. H. Fletcher.

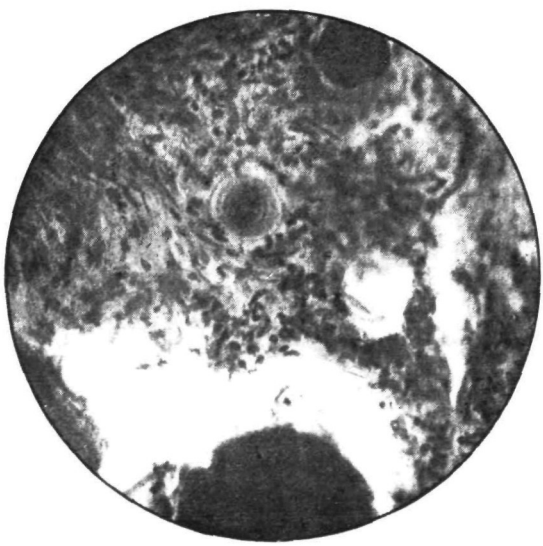

FIG. 3.

Section of tumour from falx cerebri (No. 1 in report) showing concentric laminated nodule near centre of field. x 320. Photo-micrograph by Dr. M. H. Fletcher.

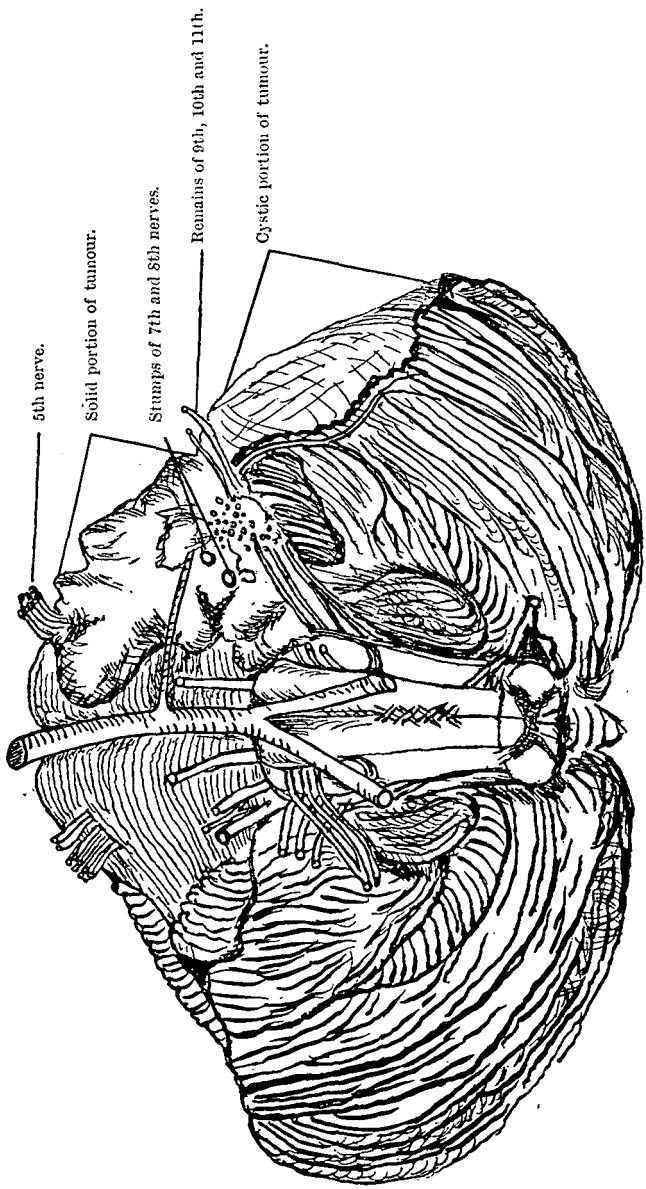

FIG. 1.

Sketch of principal tumour and surroundings—natural size, made immediately after removal.

projected from the under surface of the pons on the *left side.*

As the entire tumour came into view, it was seen to be a firm, irregularly nodular, yellowish, encapsulated mass, in bulk about equal to an English walnut, but more flattened and irregular in form.

This growth involved the left lateral half of the pontine surface—for its posterior two-thirds—and also extended outward and posteriorly, invading the antero-lateral margin of the left cerebellar hemisphere. Extending still further in the same direction, this solid portion of the growth was continuous with a cystic portion, thin-walled, evidently composed of pia and arachnoid, and containing about half an ounce of clear, amber-coloured, somewhat viscid fluid; a small portion of this fluid was decidedly gelatinous in consistency. The left cerebellar hemisphere, where compressed between the growth and the tentorium was softened and semi-diffluent.

The left half of the pons (its posterior two-thirds) was compressed and atrophied by the growth to about one-half its normal lateral extent (on its inferior surface) and *the pons as a whole was displaced to the right.*

The left flocculus was distorted, flattened and continuous with the under surface of the growth.

The considerable segment of the left cerebellar hemisphere that was atrophied and absorbed or softened by the pressure, amounted perhaps to one-fourth of the total bulk of this hemisphere.

Except as described the external appearance of the cerebellum was normal.

The cranial nerves in *apparent* relation with the growth, were the left fifth which deeply grooved its anterior (superior) surface for a distance of 11 mm., and apparently terminated in the tumour substance as a yellowish, moderately firm, mixed mass of gelatinous substance and nerve fibres. Tracing the nerve anteriorly from the growth it passed as a similar bundle of mixed gelatinous and normal nerve fibres, to the Gasserian ganglion, beyond which the fibres and divisions appeared normal. The above described conditions involved both roots of the left fifth nerve.

The left sixth nerve, somewhat displaced mesially at its origin by lateral pressure on the pons above referred to, passed forward in the groove formed at the junction of the pons and the neoplasm. It was normal in appearance and not invaded by the growth.

The left seventh and eighth nerves were not visible at their usual superficial origin since this was occupied by the growth, which is here apparently continuous with the pons and oblongata substance.

Two rounded stumps are apparent on the surface of growth corresponding to their usual course, from which the nerves have probably been torn in removing the specimen. (See fig. 1.)

The ninth, tenth and eleventh nerves emerged normally, traversed the under surface of the growth for 20 mm. and partly entered its substance, a few fibres, mainly of the tenth nerve traversing the growth, emerging laterally and continuing their course towards the jugular foramen.

The remaining fibres, by far the larger bulk of these nerves, had softened and disappeared upon reaching the growth; and in this immediate region of disappearance of nerve fibres the surface of the growth is broken into miliary nodules, perhaps a hundred in number.

The left twelfth nerve emerged normally and was not directly compromised by the growth, but was probably subject to mechanical pressure at times during life.

The left anterior inferior cerebellar artery, as shown in fig. 1, traversed the lower surface of the growth for 19 mm., penetrated its substance for 13 mm., and emerged to resume its normal distribution, apparently not infiltrated or compromised in any manner by its intimate connection with the tumour. On section the cerebral cortex and alba were of normal appearance and consistence. The lateral ventricles were markedly dilated, their anterior and posterior cornua readily admitting three fingers; choroid plexuses fringed with numerous clear round cystic dilatations, miliary in size, containing a pellucid fluid.

A brief analysis of the symptoms in the light afforded by the autopsy, may be of interest from the standpoint of

localisation of function. At the outset, our attention is naturally directed to the relationship, if any, between the supposed attack of "cholera morbus" seven years previous to death and the pathological process in the brain. Was the attack of vomiting and diarrhœa to be looked upon as being in any sense an ætiological factor in the disease? Or was it symptomatic of an early stage of the growth in the cerebellar peduncles or the vagus nuclei and trunk? The latter would seem the more probable explanation to my mind.

As regards the area of nervous substance involved, the symptoms presented were less marked up to the last few days of life than might have been expected, having in view only the ordinary facts of localisation. These comparatively slight effects of so serious a lesion are to be accounted for probably by the extremely gradual progress of the growth, allowing time for a considerable degree of accommodative adjustment on the part of the tissues involved. This, however, eventually reached its limit, and hence the sudden development of marked bulbar symptoms toward the final end.

The cranial nerves and nuclei involved symptomatically correspond with the anatomical situation of the growth, as may be seen by our diagram (fig. 1), with the exception of the *fourth* and *fifth* nerves. While ocular examination by Dr. Ayres revealed an apparent paralysis of the fourth, its trunk was not directly involved in any part of its course. Hence the diplopia, which was the apparent result of its impairment, must probably be attributed to the involvement of the co-ordinating fibres (*posterior longitudinal bundle*) by which harmony of action is brought about between the nuclei of the third, fourth and sixth.

It will be noted that, though the fifth nerve was seriously compromised in structure, some symptoms that might have been expected, viz., hyperæsthesia, anæsthesia, and trophoneuroses of *left face* and its organs, with spasm, paresis or paralysis of muscles of mastication, did not occur, as sufficient fibres to carry on the function evidently escaped degeneration.

We are also confronted by the clinical symptom, in this

case, of *right-sided hyperæsthesia*, over the forehead and scalp. Since the main trunk of the *left* fifth was the one apparently irritated by the growth, the hyperæsthesia would naturally be expected to be referred to its terminal distribution. The explanation of this apparent discrepancy in localisation may be due to the fact that the tumour by its pressure exerted from the left side toward the right may have pressed the right fifth nerve against the acute margin of the tentorial attachment to the petrous bone, and so given rise to the symptoms mentioned.

The bi-lateral deafness, most marked on the left, was evidently due to two factors: (1) The direct involvement of the left acoustic nerve by the growth; and (2) Pressure on the pons affecting the fibres from the right nuclei in their course toward the cortex, through the pons, crus and internal capsule.

The absence of complete left facial paralysis (there being only paresis present) is explicable by the fact that some fibres of the *portio dura*, though surrounded by the growth, maintained their power of conduction, as was also the case with the greater portion of the glosso-pharyngeal, vagus and accessorius up to the last few days of life.

The left motor paresis was apparently due to pressure on pyramidal fibres *after* their crossing.[1]

It is evident, moreover, that a very limited lesion of the *right upper* half of pons (above the facial decussation) would produce practically the same motor symptoms as here presented by our tumour in its *lower left* segment.

[[1] In the discussion which followed the reading of this paper before the American Medical Association at Baltimore, May, 1895, Dr. Charles K. Mills and Dr. H. T. Patrick very pertinently directed attention to the fact that it was difficult, even with the specimen before us, to account for the motor and sensory paresis existing on the same side as the tumour, since the latter was above both the motor and sensory decussations. It was this circumstance also which led me in the first instance (*ante-mortem*) to locate the lesion on the right side of pons. After a careful weighing of the matter in all its aspects, I have concluded that the only rational explanation, in the light of our present knowledge of the subject, is that the motor paresis and sensory paræsthesia were due to a "*contre coup*" effect, *i.e.*, of pressure by the tumour of the right periphery of the medulla against the comparatively acute margin of the foramen magnum at a point above (before) the motor decussation and also above (after) the sensory (fillet) decussations. The left *facial* (motor and sensory) symptoms, on the other hand, are sufficiently accounted for by the direct involvement of the tri-facial and the portio dura by the tumour.—(L.)]

It is worthy of note that the vomiting, which occurred chiefly or entirely upon sudden movement, was *preceded by nausea*, contrary to the rule in cerebellar vomiting. This would perhaps indicate that the *involvement* of the vagus trunk or its nuclei was the cause of the nausea and vomiting.

We may also note the protrusion of the tongue to left side (left paralysis) and its apparent recovery within a few days. If due only to direct pressure of the solid growth a right-sided tumour pressing on *upper half* of pons would also account for this symptom, by involvement of cortical tract to medulla. In this case, however, the symptom would have been permanent, whereas its sudden disappearance is accounted for by fluid pressure on the hypoglossal trunk (shifting of fluid in cystic portion of growth).

One more symptom deserves mention. The patient derived great relief from the severe intra-cranial pain by assuming a semi-opisthotonic position, resting head on vertex. It is evident that by this position the weight of superimposed brain mass was removed in a measure from the growth, and especially from the left fifth nerve, which in the ordinary position of head was compressed between the tumour and its solid backing of dura and bone below, and the brain above.

Therapeutically, Dr. Smith informs me, the greatest relief to pain was derived from *antipyrine*, its effects being superior even to morphine in this case, and without disagreeable accompaniments.

Pathological Report on the Tumours.

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Microscopical Examination.

Two small pieces from different peripheral portions of the main tumour (No. 8 in report) were examined. Both specimens show practically the same conditions; that is, fibroid material arranged irregularly in intercrossing fasciculi

and in some areas in whorls. One specimen was of quite close texture and not very vascular. There were present numerous small bodies which stained most deeply, round, oblong, and spindle-shaped; evidently nuclei of connective tissue cells and embryonal cells.

The second specimen was of a much looser texture and more vascular. It showed similar nuclei, but very much fewer spindle-shaped ones. The fibres were not so frequently arranged in bundles, but were interwoven in all directions. The vessels, around which the fibres were arranged more or less concentrically, were filled with red blood cells. (Fig. 2.)

From the examination of these specimens, from two different parts of the tumour, it is concluded that the growth is a fibroma.

There was also examined a small mass (tumour number one in report) ovoid in shape, measuring 10 mm. in length, 7 mm. in width, and 4 mm. in thickness, which was removed from about the centre of the falx cerebri. This mass under the microscope showed a highly cellular fibrous tissue, containing numerous concentrically arranged chalky concretions, the latter characteristic being evidenced in the cutting of the sections. It is concluded that this mass is a psammoma. (Fig. 3.)