A CASE PRESENTING AN EPIDERMOID PAPILLARY CYSTOMA INVOLVING THE THIRD VENTRICLE *

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GENERAL NEUROPATHOLOGY OF THE CASE

Epidermoid growths involving the third ventricle have created particular interest with reference to their relation to the pituitary body and the disturbance of its function, the possibility of localization of such tumors, and their source of origin.

Recalling the epiblastic origin of the neural tube, one is not surprised to find in close relation to the central nervous system, ectodermic cells originally intended for skin and mucous membrane. They may develop as if they were in their normal location with the formation of dermoid cysts or cholesteatomas.

The presence of epidermoid tissue in the third ventricle may be explained as being the result of an infundibular anlage. Cushing¹ reports two examples of infundibular cysts filled with a yellowish gelatinous substance, and with numerous verrucose nodules composed of squamous epithelium projecting from the walls, which he considers as possible developmental aberrations in relation to the neurohypophysis. Similar infundibular cysts were described by Langer² and Strada.³

Saxer⁴ reported a tumor which he believed originated from the epithelial lining of the ventricle, or the pars intermedia of the pituitary body, the gland being normal.

* From the Massachusetts State Psychiatric Institute, Massachusetts Commission on Mental Diseases. This paper was one of a series presented to Dr. E. E. Southard on the occasion of the tenth anniversary of the establishment of the Bullard Professorship of Neuropathology, Harvard Medical School, 1906 to 1916.

1. Cushing, H.: *The Pituitary Body and Its Disorders*, Philadelphia, J. B. Lippincott Company, 1912, p. 289.

2. Langer, F.: *Ueber Cystische Tumoren im Bereiche des Infundibulum Cerebri*, *Ztschr. f. Heilk.* **13**:57, 83, 1892.

3. Strada, F.: *Beiträge zur Kenntniss der Geschwülste der Hypophyse und der Hypophysengegend*, *Virchows Arch. f. path. Anat.* **203**:1, 1911.

4. Saxer, F.: *Zeiglers Beiträge* **32**:333, 1902.

Mott⁵ mentions the possibility of epidermoid tissue being transported by the vessels which grew into the third ventricle to form the choroid plexus, also of its having arisen from cells of the hypophyseal diverticulum.

The hypophysis or anterior lobe of the pituitary body originates as a pharyngeal diverticulum (Fig. 1). The exact location of its origin is still a matter of dispute. Minot⁶ considered the diverticulum an outgrowth from the ectodermal lining of the mouth. Normally, the cells forming the original stalk atrophy and the hypophysis loses all connection with the epithelium of the oral cavity. It is not uncommon, however, to have a retention of some cells along the stalk tract, and

Fig. 1.—Origin of the hypophysis as a pharyngeal diverticulum: Inf., infundibulum; Hyp., hypophysis; Chi. op., optic chiasm; Pros., prosencephalon; Or., mouth.

Erdheim⁷ in cross sections of normal glands found inclusions of pavement or ciliated cells near the superior and inferior portions of the hypophyseal cleft and within the gland, presumably representing "rests" of the primitive ectodermic diverticulum. He recorded seven heteroplastic tumors probably arising from such "rests."

Dean Lewis⁸ emphasizes the frequency and importance of tumors arising from craniopharyngeal duct epithelium; reviews the literature with special attention to cases reported by Wagner, Langer and Har-

5. Mott, F. W., and Barrat, J. O. W.: *Arch. of Neurol* **1**:417, 1900.

6. Minot, C. S.: *A Laboratory Textbook of Embryology*, Philadelphia, P. Blakiston's Son & Co., 1910, p. 292.

7. Erdheim, J.: *Ueber Hypophysengangsgeschwülste und Hirncholesteatome*, Sitzungsab. d. k. Akad. d. Wissenschaft Math.-naturh. **150**: 1904; **113**: 537.

8. Lewis, D. D.: *A Contribution to the Subject of Tumors of the Hypophysis*, J. A. M. A. **55**:1002 (Sept. 17) 1910.

bitz, and describes a case. He presents a table by Creutzfeldt, published in 1908, showing that in fifty-five necropsies of tumors of the hypophysis without acromegaly, nineteen were classed as craniopharyngeal duct tumors.

In the thirty cases of tumor of the third ventricle reported by Weisenburg,⁹ only three are stated to be epidermoid in character. These include the cases of Saxer and Mott.

In the case here presented, the growth did not show the large polygonal cells with densely staining protoplasm, characteristic of tumors of the pars intermedia, nor did it resemble those arising from the choroid plexus. The infundibulum was distended, and its tissue

Fig. 2.—Patient, May 10, 1914.

partially replaced by the tumor with a suggestion of a tumor stalk near the right ventrolateral surface. Cross sections through the third ventricle and pituitary body, which was removed intact still attached to the brain, showed the dura-like capsule of the growth to be continuous with the connective tissue of the gland. The pituitary gland was normal. The squamous epithelium of the tumor showed a suggestion of intercellular spines and well marked scaling; but no hair or sebaceous material was found. Vacuolization and cilia formation are not differential, and there does not seem to be any adequate criterion by which one may judge how this epidermal tissue happened to be in this location. From the situation and character of the growth, it probably originated either as a result of a developmental abnormality of the infundibulum or from an hypophyseal "rest."

9. Weisenburg, T. H.: Tumors of the Third Ventricle with the Establishment of a Symptom Complex, *Brain* **33**:236, 1910.

In the grouping of third ventricle tumors according to symptomatology, suggested by Weisenburg⁹ in an excellent review of thirty cases of which he reports three, this case would be in Class 1, i.e., those cases in which a tumor of moderate size is situated in the floor of the third ventricle and in which there is no extension into the foramen of Monro or the aqueduct of Sylvius. Though the aqueduct was not dilated, the posterior part of the ventricle and the peri-aqueductal structures were apparently involved indirectly as shown by the pupillary disturbance without, however, paralysis of associated ocular move-

Fig. 3.—Papillomatous character of the growth, type of epithelium and connective tissue stroma. Hematoxylin and eosin, $\times 70$.

ments and a reeling gait suggestive of involvement of the red nuclei or superior cerebellar peduncles.

The patient's tendency to drag his feet and the weakness of the legs might be interpreted either as evidence of pressure on the internal capsules or of cortical injury.

One of the early symptoms in this case was the evidence of hypopituitarism (loss of sexual power, transient polydipsia and polyuria, and possible gain in weight). These may have been due to the fact that, occupying the base of the third ventricle, the growth at an early

date interfered with the discharge of a secretion of the posterior lobe of the pituitary gland directly into the cerebrospinal fluid, or to disturbance of function due to pressure on the whole gland. Histologically, no change was noted.

Another striking feature was the drowsy, somnolent, apathetic condition of over a year's duration, with periods approaching normality. Weisenburg does not consider this feature as specific of lesions of the third ventricle, but due to impairment of the normal function of the cortex, the result of pressure against the skull through dilatation of the

Fig. 4.—Inner aspect of cyst cavity. Hematoxylin and eosin, $\times 215$.

lateral ventricles. Mott also believed it to be the result of compression of the cortex by internal hydrocephalus, and explained the recurrences by the escape of fluid from the lateral ventricles, thereby relieving the cerebral compression and removing the cerebral anemia. Purves Stewart¹⁰ considered that somnolence in these cases was associated either with direct upward pressure on the third ventricle or with secondary anemia from compression of the vessels at the base of the brain.

10. Stewart, Purves: Four Cases of Tumor in the Region of the Hypophysis Cerebri, *Rev. Neurol. & Psychiat.*, April, 1900, p. 239.

Turner¹¹ thought that it was due to cerebral edema. Cushing¹² notes hypersomnia in many cases of hypopituitarism and suggests, though certain cases showed sufficient increase in cerebral tension to possibly account for the drowsiness, that the condition may be associated with changes in glandular function. This relation has been considered as an explanation of normal sleep. The case reported by Purves Stewart in which a sarcoma (extracerebral) destroyed the pituitary gland without clinical evidence of somnolence, is in opposition to this theory.

Fig. 5.—Relation of the tumor to the thalamus. Cellular infiltration of the connective tissue. Hematoxylin and eosin, $\times 225$.

In the case under consideration there was an internal hydrocephalus with increased intracranial pressure, cerebral anemia, edema and pituitary disturbance: it was not a suitable case for determining whether somnolence is a general diffuse effect, or results from the involvement of a focal center, possibly in the floor of the third ventricle or pituitary body.

The mental condition (change in disposition, enfeeblement of memory, disorientation, untidiness, etc.) is compatible with the fact

11. Turner, J.: *Rev. Neurol. & Psychiat.*, June, 1910, p. 351.

12. Cushing: (Footnote 1) p. 269.

that the chief gross evidences of pressure were in the prefrontal areas. Sections from the second and third frontal gyri on the left showed loss of myelin in the fibers of the zonal layer. There was a slight diminution in the number of cortical cells, and those present showed considerable chromatolysis.

Areas Involved by Tumor.—The tumor directly involved by pressure the gray substance and fiber tracts about the third ventricle including:

Fig. 6.—Relation of base of growth to the pituitary gland. Globule of hyalin material. Hematoxylin and eosin, $\times 23$.

(a) The anterior commissure containing fibers between the two hippocampal regions (pars temporalis), and those derived from the lobus olfactorius connecting the olfactory tract on the one side with the hippocampal region on the opposite side (pars olfactoria).

(b) The fornix composed of fibers arising in the hippocampal region, pursuing an arched course to the corpora mammillaria. Some fibers terminate here, others cross the midline and turn downward into the reticular formation as far as the pons.

(c) The lamina cinerea and lamina terminalis, a thin layer of gray substance between the corpus callosum and chiasma, continuous above

the chiasm with the tuber cinereum and connected at the side with the gray substance of the anterior perforated space.

(d) The optic chiasm and the optic tract, especially on the left, were distorted and flattened. The disks showed a marked papilledema and deposition of new tissue.

(e) The tuber cinereum—a lamina of gray substance extending forward from the corpora mammillaria to the optic commissure to which it is attached. It presents several small collections of ganglionic

Plate A.—Upper surface of the brain. The brain before fixation tended to assume a round form when placed on a flat surface. The brain surface was dry, with a tracing of irregularly injected vessels. The convolutions were pressed out in appearance, the sulci being indicated on the right. The swelling of the brain and the widening and flattening of the gyri were most marked anterior to the posterior parietal lobules. The mesial surface also showed the flattening of the convolutions, especially on the left in the prefrontal region.

Plate B.—Lower surface of the brain. The vessels were small with inequality of the vertebrals. The left middle cerebral appeared small, and its lumen tiny. There was some hyalin change in the middle cerebral vessels, but no sclerosis. The olfactory bulbs were red and slightly unequal. The optic chiasm measured 2 by 1 cm.; it was much distorted as though from pressure beneath. The optic tract on the left was broad and bulging, the right less so. The optic nerves were flattened. The tuber cinereum was translucent gray. There was a small nodular protrusion of tissue on the right. The pituitary was normal in size and consistence. There were several grayish-yellow spots on the surface. The mammillary bodies were slightly flattened.

The pituitary gland, removed attached to the brain, appeared normal in size and outline.

The mammillary body on the left appeared swollen as though from pressure from beneath.

The third nerves were involved in a thickening of the pia between the peduncles. The brain stem in sections at the level of the red nuclei which appear as circular areas just dorsal to the substantia nigra and crusta.

The cerebellum appeared normal.

cells; the lateral eminences; the eminentia vascularis, homologue of the saccus vasculosus of lower vertebrates, especially prominent in the fishes. Johnston¹³ considers the eminentia vascularis as possibly an organ for controlling the character of the spinal fluid. The basal optic ganglion (supraoptic nucleus Cajal)—a tract of gray matter with nerve cells, lying to the outer side of the tuber cinereum close to the optic tract. From each a tract issues, which, after decussating with that of the

Plate C.—Diagram of medial sagittal section showing outline of the cyst and levels at which the following frontal sections were made.

In plates 3, 5, 7, 9, 11 and 13 one is looking toward the posterior pole of the brain.

In plates 2, 4, 6, 8, 10 and 12 one is looking toward the anterior pole of the brain.

opposite side (Meynert's commissure), applies itself to the mesial side of the optic tract and passes back to the lenticular nucleus. (Déjerine.)

(f) The corpora mammillaria, especially the mesial nuclei. Efferent tracts: Bundle of Vicq d'Azyr to the dorsal or anterior nucleus of the thalamus; bundle of Gudden to the red nucleus and adjacent gray matter of the tegmentum.

13. Johnston, J. B.: *The Nervous System of Vertebrates*, Philadelphia, P. Blakiston's Son & Co., 1906, p. 285.

Afferent tracts:¹⁴ (*a*) by way of the columns of the fornix, and (*b*) through its peduncle from the main fillet and arcuate fibers in the tegmentum.

(*g*) Posterior thalamic decussation,¹⁵ behind the mammillary bodies, probably a connection between the corpora Luysii. (Déjerine.)

(*h*) The intermediate gray mass or middle commissure, uniting the mesial nuclei of the thalamus across the third ventricle and continuous below on each side with the gray matter of the cavity.

Plate 1.—Frontal section just posterior to the genu corporis callosi. Slightly oblique. The septum pellucidum extends between the truncus and rostrum corporis callosi. Lateral to the anterior horns of the ventricles is the stratum subependymale and on the right the corpus striatum before its division into the nucleus caudatus and the nucleus lenticularis by the traversing fiber bundles of the internal capsule. Converging toward the corpus striatum are seen the strands of the corona radiata. The olfactory bulb and tract are folded back beneath the section. The increased size of the left ventricle may be noted.

(*i*) The mesial series of nuclei of the thalamus (Cajal). There was no suggestion of a thalamic syndrome in this case.

14. Quain, Jones, and Quain, Richard: *Elements of Anatomy*, Ed. 11, New York, Longmans, Green & Co. 3:232, 1909, Part 1.

15. (Footnote 14) p. 228.

(j) Hypothalamus¹⁶—the prolongation of the tegmentum under the posterior part of the thalamus, divided by Forel into three layers from above down—the stratum dorsale, zona incerta and the corpus subthalamicum or nucleus of Luys, the latter having taken the place of the substantia nigra lying next to the prolongation of the crusta.

(k) The internal capsule. The possibility of determining capsular involvement was complicated by the cortical injury.

It has been difficult to estimate the degree of injury suffered by the tissues adjoining the growth, and even more difficult to correlate the injury with any clinical manifestations because of the diffuse area involved and the paucity of data as to the normal physiologic function of the structures.

CLINICAL DETAILS

The case was under the direction of Dr. Frankwood E. Williams.

History.—The history of the patient, a man, aged 52, white, was obtained from his wife. The family history was not important. He had been subject to headaches and vomiting in early life. At 33 he had typhoid fever. His application for life insurance had been rejected six years before because of albuminuria. He had pertussis in 1913. He denied venereal disease. He had lost sexual power one and one-half years before. He used no alcohol, and no drugs, but smoked a cigar occasionally.

The patient had been well until August, 1913, when he had occasional severe frontal headaches and complained of not feeling well. During the following months he had frequent headaches accompanied by constant nausea, but not by vomiting; he was abnormally sleepy and extremely irritable. In February, 1914, he drank large quantities of water, sometimes eighteen glasses in an hour; he again became lethargic and confused mentally, but was not considered seriously ill. He gave up his work. In April, he was frequently disoriented for time, his memory was poor, and his vision seemed to be failing. His speech became thick; he began to drag his feet, and he developed incontinence of urine.

He was admitted to the Psychopathic Department of Boston State Hospital, May 7, 1914. At first, he was excited, tore his blankets and sheets into strips and tied them in a fantastic manner about his feet. He was oriented for person, but not for place or time. There was a marked loss of memory for both recent and remote events with a tendency to fill the gaps with fabrications. He had some delusions of grandeur, magnifying the amount of his wealth and assuring the staff that he built all the buildings around the hospital. Definite evidence of hallucinations was not obtained. Emotionally, he ordinarily had been self-reliant, very cheerful, even-tempered, social (got on well with people), reserved but never seclusive. At the time of examination he appeared self-satisfied, somewhat euphoric and inclined to be restless. He had no insight into his condition.

Examination.—Physical: The patient was a well developed and well nourished man, 5 feet 8 inches in height, weighing 203 pounds, stripped. His face was flushed. The general examination was negative except for very slight edema over the feet and shins. The systolic blood pressure was 150 mm. of mercury.

16. (Footnote 14) p. 250.

Plates 2 and 3.—Oblique section. Left side shows more anterior level than the right. The internal capsule appears dividing the corpus striatum into the now small caudate, and the lenticular nuclei. The latter shows a subdivision into the globus pallidus and the putamen. On the right ventral to the corpus striatum lies the substantia perforata anterior, on the left the tuberculum olfactorium. The fibers of the anterior commissure are seen crossing the ventral part of the globus pallidus on the left, more laterally on the right. Ventral to the septum pellucidum appear the fiber bundles of the fornix, more prominent on the left.

Posterior to the recessus triangularis, rather loosely held to, but distorting, the columnae fornicis, anterior commissure and lamina terminalis is seen the sacular termination of the cyst occupying the base of the third ventricle. The foramen of Monroe is seen on the left. The increased size of both lateral ventricles may be noted.

Neurologic: The pupils were central, the right slightly larger than the left, and both were irregular. Consensual reaction and reaction to direct light were sluggish. Accommodation was normal. Extra-ocular movements were normal. There was no ptosis, strabismus or nystagmus. Examination was made of the fundi by Dr. Gerhardt in consultation, May 25, 1914. There was slight hyperemia of the disks, not pathologic. The deep reflexes were normal. Abdominal and cremasteric reflexes were not obtained. The gait and station were normal. There were no areas of anesthesia or hyperesthesia. There was no tenderness over the nerve trunks. Muscle sense was retained except for slight inaccuracy in the finger to nose test.

Laboratory Studies.—Urine: An occasional slight trace of albumin and a rare hyalin cast were found in the urine. A study of the acidity by the hydrogen-ion concentration method¹⁷ gave evidence of a slight acidosis (plus 0.9, two hours after 4 gm. of bicarbonate of soda). The phthalein output was 18 per cent. The time was not stated.

Blood: The Wassermann reaction was negative. The cytologic examination was negative. Quantitative examination of uric acid, urea and nonprotein nitrogen showed a nitrogen retention (100 per cent. increase over the maximum normal values as given by Folin and Denis¹⁸).

Spinal Fluid: Three examinations were made. Cells, 2 to 6. Globulin was negative, and albumin was found in small amounts. The Wassermann reaction was negative. The colloidal gold test was negative for syphilis. There was 100 per cent. total nonprotein nitrogen increase. Urea at the pathologic threshold, based on normal values given by Mestrezat.¹⁹

Head: Roentgenographic examination of the head was negative, June 24, 1914.

Course of the Disease.—During the spring and summer, the patient remained confused, retarded and apathetic, took no care of his person, was untidy, and was frequently found lying about exposed. In October, because of the slight acidosis shown by the laboratory studies, he was given sodium bicarbonate by mouth. He became oriented for time, place and person; his memory improved, and he appeared to take more interest in current events. There were still periods when he was confused and when he had some difficulty in locomotion. At times he would walk like a drunken man. He had lost 39 pounds. Though not well, he was allowed to go home. In three weeks, he returned in a confused state, continually incontinent and very untidy. He remained in bed and refused to eat unless fed. There were a few short periods when he would brighten up and seem to know what was going on about him.

Jan. 3, 1915, after a febrile period of three days (white count 16,800), he became stuporous and died.

Summary.—The patient was a man of 52 years, who had been ill for sixteen months, and whose past history was negative except for typhoid fever nineteen years before and pertussis one year before the present history. There were loss of sexual power; rather acute onset of severe frontal headaches, with nausea but no vomiting; irritability and drowsiness, with increasing mental confusion; transient polydipsia; speech defect; difficult equilibration; distur-

17. Palmer, W. W., and Henderson, L. J.: Clinical Studies on the Acid Base Equilibrium and the Nature of Acidosis, *Arch. Int. Med.* **12**:162 (Aug.) 1913.

18. Folin, O., and Denis, W.: Protein Metabolism from the Standpoint of Blood and Tissue Analysis, *J. Biol. Chem.* **14**:29 (Feb.) 1913.

19. Mestrezat, W.: *Le Liquide Cephalo-Rachidien*, Paris, 1912, pp. 108, 249.

Plates 4 and 5.—On the left the section strikes through the anterior end of the thalamus. The columnae fornicis lie lower on both sides while the crurae assume a dorsal position. Their attachment to the corpus callosum has been torn. On the right, the thalamus exhibits differentiation into the nucleus anterior, and the nucleus lateralis and the nucleus amygdalae appear within the temporal lobe. The third ventricle is increased in size, irregular in outline and almost completely replaced by the cyst. There is a free upper surface which lies folded on itself across the distended upper portion of the ventricle. The grayish limiting wall can be traced in apposition with the remaining structures about the ventricle. The basal portion of the cyst contains a whitish cauliflower-like growth displacing the fibers of the optic chiasm, more markedly on the left, and causing the rounded swelling of the left optic tract noted in the description of the base of the brain. Around that portion of the growth, extending into the pocket in the optic tract, is a semicircular mass of colloid material.

Plates 8 and 9.—Section passes through the anterior end of the massa intermedia which is flattened by the distention of the third ventricle and pressure of the cyst which protrudes into it from below involving chiefly the mesial nucleus of the thalamus and bundle of Vicq d'Azyr on the right. There is a small pocket between the cyst wall and the overlying commissure on the left. The portion of the third ventricle above the massa intermedia is flattened but patent. The infundibulum is filled with the growth which bulges into the left side. The pituitary in section shows grayish areas. Microscopic preparations were made from this section.

bance of vision; disorientation; memory defect with tendency to fabrication; expansive delusions; restlessness; untidiness, with a lack of appreciation and indifference to his condition.

Physical Signs: The right pupil was larger than the left. Both were irregular and reacted sluggishly to light. There was a slight speech defect. There were tremor of the extended fingers, increasing weakness of the legs, a tendency to drag the feet, and a loss of control of both the rectal and vesical sphincters.

Laboratory Findings: All tests for syphilis were negative. A slight trace of albumin and casts was found in the urine. There was low kidney function. The blood pressure was 150 systolic. There was retention of nitrogenous products in the blood and spinal fluid, and an increased white count shortly before death.

The case was presented at a meeting of the staff of the Psychopathic Department, May 16, 1914. It created considerable interest and discussion; but no consensus of opinion was reached. It was noted that the case clinically resembled general paralysis; but such diagnosis would hardly be ventured with all tests for syphilis negative. The picture in some respects simulated the terminal stage of Korsakoff's syndrome, but presented no etiologic factor, as alcohol or other toxic agent. No definite indication or localizing sign of arteriosclerosis was present. The evidence of chronic infection, pyogenic or tubercular, was not convincing. Brain tumor was considered; but there were negative eyegrounds, and no localizing signs; an intracranial growth was considered improbable. Although the findings were not typical of uremia, because of the low kidney function, retention of nitrogenous products in the blood and spinal fluid and urinary findings, the case was classified as a cardiorenal psychosis.

Necropsy.—Two hours after death, necropsy was performed by Drs. Solomon, Bunker and Bloomer.

A summary of the positive findings with reference to the body is noted in the anatomic diagnosis.

Kidneys: They weighed 240 gm. They measured 11 by 5 by 2.5 cm. Five small cysts dotted the surface. The capsules were slightly adherent, and the pyramids were poorly differentiated.

Thyroid: It was firm, and section showed nothing of note.

Suprarenals: They were very small, the cortex measured 0.1 by 0.2 cm. in thickness. Two lines of the cortex approximated in one limb; the second limb was separated by a brownish medulla which showed a slight hyalin change in one suprarenal.

Pancreas: It was normal.

Testes: Threaded well.

Head: Description of the brain is given by Dr. Canavan. The hair was somewhat scant. The periosteum was negative. Calvarium measurements were: frontal, 1 cm.; temporal, 0.4 cm., and occipital 0.7 cm. Depressions for the paccchionian bodies were slightly to the right of the median line and pierced the inner table at the vertex. Grooving for the middle meningeals was shallow on both sides.

The dura was not adherent, but was tense; and the brain filled the dura completely. Convulsions were seen through the dura. There was no subdural fluid; and on peeling back the dura mater, the pia appeared not to be present, only a tracing of irregularly injected vessels pressed on a smooth brain surface. The pial surface of the brain was dry.

Plates 6 and 7.—The distention of the third ventricle is more marked; the tumor mass at the base of the cyst now filling the tuber cinereum is larger, and there is a small knob-like extension of the growth on the right. There is marked distortion of the optic tracts. The columnae fornicis lie deeper. The relation to the thalami, and on the right, approximation to the internal capsule which now penetrates farther baseward and is traversed ventrally by the fiber strands from the nucleus lenticularis assembling to form the fasciculus lenticularis (Forel) may be noted. Microscopic preparations were made from the anterior portion of this section.

The superior surface of the brain tended to assume a round form when placed on a flat surface. The hemispheres strained from each other. At the frontal poles, particularly on the left, the convolutions were smooth and pressed out in appearance. The sulci were indicated on the right. The swelling of the brain and the widening and flattening of the gyri were most marked anterior to the posterior lobules. Even the mesial surface showed the flattening of convolutions, especially on the left in the prefrontal region.

At the base of the brain, the vessels were small, the vertebral arteries were unequal, the left being larger than the right. There was some hyalin change in the middle cerebrals, but no sclerosis. The middle cerebral artery on the left appeared very small, and its lumen tiny.

The olfactory bulbs were red and slightly unequal; but the tracts were white. There was a sharp differentiation between the bulbs and the tracts.

The optic chiasm was flattened from pressure beneath, especially on the left side, and the form of the optic nerves was much distorted. The optic chiasm measured a little more than 2 cm. from side to side and spread for a distance of nearly 1 cm. on the left. The tract which leaves the chiasm for the geniculate bodies on the left was broad and thin in appearance from pressure of a swelling from beneath. The distal ends of the optic nerves appeared infringed on and did not assume their round contour, but were irregularly wishbone in shape. The space between the chiasm and the mammillary bodies was translucent gray, it measured 3 by 3 cm., and a puncture of it for securing fluid from the third ventricle showed a thick, purulent, pinkish semifluid substance, a smear from which by Gram's stain, showed many large mononuclear cells with large nuclei; some polymorphonuclears that looked remarkably small in comparison. There were no organisms. When stained by Wright's stain they showed polymorphonuclears (small), red blood cells, and large endothelial and transition lymphocytes. The lobus pyriformis on either side was flattened and thin. The pons measured 4 by 3 cm. and the medulla 2 by 2 cm. The third nerves were involved in a thickening of the pia which forms a part of the floor of the third ventricle.

The optic nerves in their orbital portion showed nothing of note.

The middle ears, Gasserian ganglions and pituitary gland were negative.

The brain's weight was 1,575 gm. Tigges' formula 8 by 172: 1,376 gm. The gain in brain weight was 199 gm.

The cord was firm and showed nothing of note.

A frontal section revealed a marked difference in size in the anterior section of the lateral ventricles, the right measuring 4 by 3.5 cm. at the wider end, and 1.5 cm. at the inferior portion. The left ventricle cut at the same plane measured 5.3 by 4.2 cm. at the upper, and 1.5 cm. at the inferior. On cross section of the third ventricle, the tissues were found to be soft and edematous, and the capacity of the third ventricle markedly increased.

Anatomic Diagnosis.—The man was well nourished. There were, injection of appendix; sclerosis of the coronaries and aorta; chronic fibrous endocarditis, tricuspid; chronic fibrous endocarditis, mitral; chronic fibrous endocarditis, aortic; fenestration of the aortic valve; apex—scar; pulmonary congestion; chronic interstitial nephritis; chronic perihepatitis; a cyst in the liver. The calvarium was thick; the pia dry; the brain was swollen and smooth. Chronic internal hydrocephalus. Chronic cerebral abscess of the third ventricle and hyaline basal vessels were present. The brain weighed 1,576 gm., the gain in brain weight being 199 gm.

Plates 10 and 11.—Section passes obliquely through the posterior portion of the massa intermedia and the mammillary bodies. Separating the latter and completely occupying the lower portion of the third ventricle, the cyst is triangular in shape, and there is no growth in the basal portion at this level. The terminal fibers of the fornix are seen entering the lateral nucleus of the mammillary body, and the bundle of Vicq d'Azyr ascending from the mesial nucleus toward the anterior nucleus of the thalamus. Weigert's specimen from the anterior portion of this section shows no loss of myelin in the surrounding structures.

Microscopic Findings.—The visceral organs were fixed in Zenker's solution, embedded in paraffin and stained by eosin and methylene blue and Mallory's connective tissue stain.

Kidneys: There was focal infiltration of the interstitial tissue of the cortex by cells of the lymphocytic series. There was a rare sclerosed glomerulus, compatible with a slight degree of chronic vascular nephritis. They were essentially normal kidneys for a man of 52.

Pituitary: There was normal glandular structure.

Testes: The spermatogenous epithelium showed development of spermatocytes and occasional spermatids, but no mature spermatozoa. There was a decrease in the interstitial cells.

Thyroid, suprarenal and pancreas showed no pathologic change.

Spleen: The capsule was thickened. A large amount of intracellular dark brown pigment was present. There was an increase in the connective tissue of the end arteries. Malpighian bodies showed some edema and focal destruction of cells with amyloid deposits.

Liver: Formaldehyd fixation followed by sudan III showed increase of fat in small droplets, chiefly around the portal vessels.

Other organs showed increase in connective tissue around vessel walls. There were a large number of eosinophils in the lymphoid tissue of the large intestine.

The brain and other nervous tissues were fixed in liquor formaldehydi embedded in celloidin, and stained by the methods of Weigert and Marchi, and with cresyl-violet for cell studies.

Longitudinal sections through the heads of the optic nerves showed the disks to be twice the normal thickness, with retention of a definite cupping but deposition of new tissue. There was slight cellular infiltration along the more minute vessels. The retina showed low folds near the disks. There were distention of the vessels within the optic nerves and marked dilatation of the intervaginal spaces with the arachnoid prominent. Cross section of the left nerve showed a small triangular area with loss of myelin.

Peripheral Nerves: They were negative.

Sympathetic Ganglions: The nuclei were centrally placed. There was peripheral arrangement of the Nissl substance and abundant pigment.

Gasserian Ganglion: The cells were large, and the nuclei were centrally placed. The Nissl substance was finely granular, and evenly distributed through the cells. Few cells showed pigment. The cells were shrunken from the nucleated sheaths.

Cord: Sections from the cervical, thoracic and lumbar regions showed no loss of myelin. A few of the anterior horn cells at each level were filled with fat in very fine droplets.

Sections of the tumor were stained with cresyl-violet, hematoxylin and eosin, Mallory's phosphotungstic acid hematoxylin, Verhoeff's elastica and Van Gieson.

The cyst appears encapsulated by a supporting layer of vascular connective tissue on which is a stratified epithelium, varying in thickness from a few to many cells with extensive desquamation of the superficial layers. There is a tendency to the formation of prickle cells, but no epithelial fibrils or "pearls." Mitotic figures are not numerous. Though the contour of the infundibulum is essentially retained, its tissue is largely distorted by the growth which fills the cavity and which, in this region, appears as a papillary cauliflower-like mass. On the right ventrolateral aspect, there is more abundant vascular connective

Plates 12 and 13.—Oblique section behind the massa intermedia and passing through the red nuclei. The posterior portion of the cyst wall is seen in the third ventricle lying below the massa intermedia just anterior to the red nuclei. There is dilatation and flattening of the third ventricle above the massa intermedia. Sections at this level stained by Weigert and Weigert-Pal show no lesion.

tissue with radiations into the papillae suggesting a tumor stalk. There are several finger-like projections and a small cystic protrusion latterly from this area. In the center of the basal proliferation, there are a few narrow spaces surrounded by a single layer of large deeply staining columnar vacuolated cells resembling goblet cells, and occasionally a few columnar cells with a suggestion of cilia formation. No hair or sebaceous material was found. The stroma is relatively small in amount, contains numerous blood vessels and in some places is infiltrated with polymorphonuclear leukocytes. There are a number of finger-like projections from the tumor but no definite break in the connective tissue capsule was found. The capsule resembles dura in structure and is continuous with the connective tissue about the pituitary gland which was removed intact with the brain. There are a few hyalin globules just below the growth between it and the gland.

There is some gliosis of the surrounding brain tissue, and there is evidence of retrograde metamorphoses. There are numerous collections of polymorphonuclears and endothelial cells containing fat and pigment. Some areas seem to have undergone a hyalin degeneration.

There are none of the large polygonal cells with densely staining protoplasm characteristic of tumors originating from the cells of the pars intermedia. The growth has not the extensive vascularity or angiomatous character frequently seen with plexus tumors.

Sections from the second and third left frontal convolutions were stained with Weigert, Marchi and cresyl-violet. There is a loss of myelin in the fibers of the zonal layer as compared with Campbell's charts. The cortical cells are slightly decreased in number. The remaining cells appear edematous. Frequent cells show eccentric, poorly staining nuclei and diminution in the Nissl substance. This is more marked in the larger cells. Marchi preparations show an increased fat content in a few of the ganglion cells. There is no phagocytosis.

SUMMARY

In this case presenting an epidermoid papillary cystoma involving third ventricle, the tumor probably originated either from a hypophyseal "rest," or as a result of a developmental abnormality of the infundibulum. The clinical signs and symptoms of sixteen months' duration did not lead to a localization before death. Correlation of clinical and pathologic findings has been complicated by the difficulty of separating local from remote and general effects, and the paucity of data as to the normal physiologic function of the structures involved.

It gives me great pleasure to acknowledge my indebtedness to Dr. E. E. Southard for creating the atmosphere that made this study possible and for constant stimulating and helpful suggestions.

20. In addition to the references already given, the following will be found of interest:

Farnell, F. J.: An Extra Cerebral Tumor in the Region of the Hypophysis, New York M. J. **40**:462, 1911.

Pollock, L. J.: Tumor of the Third Ventricle, J. A. M. A. **64**:1903 (June 5) 1915.