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MULTIPLE CEREBRAL TUBERCLES

A CLINICAL AND ANATOMOPATHOLOGIC CONTRIBUTION *

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If at times the difficulties of diagnosticating a cerebral tumor are great, especially in those cases in which one wishes to obtain a precise localization, they become almost unsurmountable when one attempts to establish the presence of multiple cerebral tumors. Having had the opportunity to study two cases of multiple cerebral tumors in the Royal Neurological Clinic of Rome, and of performing necropsies on both of them, it seemed opportune to publish a report of these cases, hoping thereby to be able to contribute, even in a small way, to the study of so difficult a question. I shall first outline the clinical histories of the two cases coming under my own personal observation.

REPORT OF CASES

CASE 1.—History.—Ottavi Giovanni, aged 28, a farmer, drank wine moderately, did not smoke and denied syphilis. He had left lobar pneumonia in 1914; in 1918, following a thoracic wound received in the war, he had a left-sided pleurisy, but he stated that he had fully recovered from both conditions. He remained in good health until the end of October, 1919, when he began to complain from time to time of a moderate pain in the back of the neck which spread two weeks later to the occiput and became continuous with exacerbations influenced by nocturnal hours and atmospheric changes. During the early part of December, 1919, he began to notice weakness of the extremities, especially of the lower ones; he could not easily remain in an erect position and, when walking, he had a tendency to fall, first on one side then on the other. During the following two weeks the headache acquired the characteristics of true violent crises of short duration, often accompanied by emesis and occurring several times during the day. By the end of December the patient complained of diplopia, especially after an attack of headache, with bilateral diminution of vision. During the last few days preceding his admission to the clinic, he also noticed paracusia in the right ear and slight diminution of hearing of the left ear. He entered the clinic on Dec. 30, 1919.

Objective Examination.—This revealed a man of medium height, normal build and in a good general state of nutrition. Objective examination of the internal organs was negative. Urinalysis was negative as regards albumin and sugar.

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Neurologic Examination.—While at rest, a slight tendency toward internal deviation of the left eye was noted. Monocular examination for oculomotor movements revealed a moderate limitation of external deviation of the left eye; the same limitation, but to a lesser degree, existed in the right eye. At the same time, nystagmic twitchings were revealed, especially right-laterally. Binocular examination showed that upward movements of both eyes were incomplete and that the left eye, in its upward movements, tended to develop a concomitant internal squint. Downward rotation also appeared to be slightly limited in the left eye. All other eye movements were normal though accompanied by slight though demonstrable nystagmic twitchings. Frowning was bilaterally normal, but closure of the eyelids was more forceful on the right side. While showing his teeth, it was noticed that the patient's left perioral muscles were slightly weaker than those on the right side. Protrusion of the tongue was complete, without deviation, and all of its movements were normal. The left side of the uvula was slightly lower than the right and contracted less fully in phonation. Mastication, deglutition and speech were normal. There were no faulty attitudes of the head. Active and passive movements of the neck were all obtainable, but, beyond a certain range, especially in flexion and lateral extension, these movements gave rise to intense occipital pains. Likewise the upper extremities showed neither abnormal attitudes nor trophic muscular changes. Only on passive movements the various segments of both upper extremities revealed a slight resistance; active movements were all present and complete. When elevating both hands, as in the act of taking oath, more or less accentuated tremors were noted, with occasional isolated finger movements and a slight tendency for the left hand to drop down sooner than the right one. The dynamometer showed: right hand, 19; left hand, 16. The lower extremities, especially the left one, showed an evident tendency toward external rotation. As in the upper extremities, resistance to passive movements was above normal; active movements were all present and complete. When the patient lifted his legs from the bed, the left one was lowered before the right; both limbs oscillated more or less in various directions. When the patient tried to raise himself from a recumbent to a sitting posture, with arms folded across the chest, both heels were simultaneously lifted off the bed (asynergy); the left foot was at times lifted to a higher level than the right one. The patient was able to assume the erect position by spreading his feet, but the body oscillated, especially when the eyes were closed. When walking, the feet were always spread apart; from time to time the patient would start to fall toward the left. Backward flexion of the spinal column was accompanied by flexion of the knees. The patellar and tendo-achilles reflexes were prompt, more so on the left than on the right. The plantar reflexes were usually absent, occasionally normal. The adductor reflexes of the right side were more promptly obtained than on the left; the abdominal reflexes were normal, the epigastric reflexes absent; the tendon reflexes of the upper extremities were slightly more active on the right than on the left side. Both masseter and mandibular reflexes were absent. The conjunctival and corneal reflexes were normal. The various forms of superficial and deep sensation were everywhere well preserved. There were no dynamic ataxic disturbances in either the upper or lower extremities. Percussion over the left side of the occiput and pressure over the paracervical region and supra-orbital and infra-orbital nerves, especially on the left side, all gave rise to slight pain. Vision was 1/6 without any correction. Color perception was present but bilaterally labored. Both fields of vision were also

somewhat restricted. Fundi: On the left side there was slight swelling of the papilla; the edges of the disk were slightly indistinct and somewhat pale in its temporal half. The papillary vessels were congested. Taste and smell were normal.

Examination of the Ears.—Whispering was heard at a distance of 3 meters on the right side and at 1 meter on the left side. The ticking of a watch was heard at a distance of 30 cm. on the right side, and at a distance of 10 cm. on the left side. Acoustic Tests: The Rinne test was inverted on the left side and normal on the right. The Weber test revealed right lateralization with ears open or closed.

Labyrinth Examination: There was (a) thermal nystagmus on applying the cold test (15 C.). When the right auditory canal was irrigated and the patient was asked to look in the opposite direction, that is, toward the left, no nystagmic movements were elicited, whereas the latter became evident when the patient was asked to look in the same direction, that is, toward the right. When the left canal was irrigated for two minutes and the patient was asked to look in the opposite direction, demonstrable nystagmic movements were elicited which became barely perceptible when the eyes were turned to the left. Thermal test was made at 40 C. On irrigating either ear for about two minutes, nystagmic movements appeared when the patient was asked to look in the opposite direction, that is, away from the irrigation, whereas no nystagmus appeared when he looked in the same direction as the irrigation. (b) Voltaic Dizziness: On applying a gradually increasing galvanic current to the bitemporal region a constant inclination of the head to the left was obtained, regardless of the position of the poles of the current. (c) Rotation Test: After twirling the patient around ten times in twenty seconds in a Bárány chair from right to left, no nystagmic movements were elicited when he looked toward the right, but they became evident if he looked toward the left. After twirling him around from left to right and then asking him to look toward the left, there were no nystagmic movements, but the latter appeared if he looked to the right. (d) Bárány's Index Test: When, with closed eyes, the patient was made to carry the tip of his left index finger from below upward in order to reach a previously indicated point, the finger constantly deviated externally. The right index rarely, and to a slight extent, also tended to deviate externally.

Psychic Examination.—Attention was fair; perception was correct; orientation as regards place, time and person was normal; memory was sufficiently normal both for past and present events; he had subnormal calculating ability; he showed scarce *critique*; weak association; no disturbance of ideation and of the psychosensory sphere, and diminution of the affective tone. The patient evinced little interest in his case and made no inquiries regarding the nature of his malady or of the possibility of its being cured.

Course of Disease.—Lumbar puncture resulted in a few drops of limpid, transparent fluid, too small a quantity for the carrying out of any tests. The blood Wassermann reaction was negative. Roentgenograms of the cranium were not obtained.

During his hospitalization in the clinic the patient had repeated violent seizures of occipital headache, sudden in onset, accompanied in the early part of the attacks by reddening of the face and tachycardia of from 120 to 130, terminating in bradycardia of 45 to 50. He died in January, 1920, during one of these seizures.

Postmortem Examination.—The cranial bones were negative. The cerebral convolutions appeared to be slightly collapsed; the meninges were nor-

mal. On the right side of the posterior cranial fossa, in the cerebellum, was a small tumor the size of a hazelnut, of roundish form and firm consistency, firmly adherent to the underlying meninges (Fig. 1). On the inferior aspect of the right cerebellum and precisely on the lateral half of the lobus biventralis was a small depression in which was lodged the tumor without adhering to it. The right cerebellar tonsil, enlarged, deformed and of increased consistency, was pressing against the inferior lateral surface of the medulla

Fig. 1 (Case 1).—Tubercle of the right cerebellar fossa.

(bulb), causing the latter to deviate toward the left side (Fig. 2). In the area in which the left side of the pons is continuous with the middle cerebellar peduncle, a roundish tumefaction was found, grayish, and hard to the touch; the cerebellar peduncle itself was atrophied and flattened out dorsoventrally (Fig. 2).

The roots of the left fifth nerve were manifestly thinned out, flattened and dissociated. The rest of the brain and the other cranial nerves showed no appreciable alterations. On cutting anteroposteriorly over the right cerebellar tonsil, the surface of a small grayish tumor the size of a hazelnut came into view; it could be readily enucleated from its bed. No other abnormalities could be detected in making sections of the cerebellar hemispheres, bulb or right half of the pons. On the other hand, a transverse section through the left half of the pons brought to view a third tumor of the same shape, size, color and consistency, which could also be readily enucleated. The depression in which it lay was partly formed at the expense of the lateral portion of the

Fig. 2.—Multiple cerebral tubercles occupying: (a) the right cerebellar amygdala; (b) the left middle cerebellar peduncle and extending into the adjacent portion of the pons; (c) depression in which was lodged the tumor of the right cerebellar fossa in Case 1.

pons, but more largely in the corresponding half of the middle cerebellar peduncle which was not only flattened and distorted but also thinned out.

Anatomopathologic Diagnosis.—Multiple cerebellar tumors of the right posterior fossa, right cerebellar tonsil and left median cerebellar peduncle extending to the contiguous part of the pons were diagnosed. Histologic examination (hematoxylin-eosin stain) confirmed the diagnosis of tubercle.

SUMMARY AND CONCLUSIONS

The case was that of a 28-year old man who, October, 1919, began to complain of moderate headache, at first located in the neck, later occipital in nature. By December of the same year he had difficulty in maintaining the erect position and in walking in a given direction. A few weeks after the onset of headache the headaches became true crises of short duration, fair intensity, usually diurnal and sometimes associated with vomiting; at the same time vision began to diminish and diplopia appeared. A few days before being admitted to the clinic the patient noticed paracusia of the right ear and slight hypo-acusia of the left ear. The neurologic examination revealed bilateral paresis of the sixth cranial nerves, especially on the left side; slight paresis of the left seventh nerve; slight hypertonia of the upper and lower extremities; slight asthenia of the left extremities; bilateral "flexion combinée," more marked on the left side; accentuated Romberg sign; a tendency for the body to fall toward the left when walking; patellar and tendo-achillis reflexes more prompt on the left than on the right side; adductor and tendon reflexes of the upper extremities more pronounced on the right than on the left side; slight tenderness over the left occiput over the paracervical depressions and over the first and second branches of the fifth nerves, especially on the left side; slight static ataxia of both upper and lower extremities, bilateral diminution of the visual field; slight papillary stasis of the left side; slight bilateral weakness of the fifth nerves; left hypo-acusia; signs of vestibular nerve lesion, especially on the left side; positive "index finger test" on the left side; slight intellectual torpor.

As already stated, necropsy revealed the presence of three tubercles, two on the right side in the posterior fossa and cerebellar tonsil, the third one in the middle cerebellar peduncle with extension into the pons.

The clinical diagnosis had been that of left cerebellar tumor; the presence of two right-sided tubercles was not suspected and the tumor on the left side was found in the brachium pontis and contiguous portions of the pons itself rather than in the cerebellar hemisphere. It was easy to presume that one was dealing with a cerebellar neoplasm, in view of the progressive nature and symptomatology of the morbid process. Regarding the site of the tumor, the Rolandic area was easily excluded on account of the absence of jacksonian convulsions and dissociate paralyses; the occipital lobe likewise, owing to absence of homonymous lateral hemianopsia; the parietal lobe because there were no sensory alterations; the frontal lobe could not have been involved because the psychic disturbances were so slight in degree and tardy in appearing; the basal ganglions (thalamus) were excluded because alterations of sensibility, phenomena of motor irritability and mimic emotional disturbances were all absent. The hypothesis of a tumor of the bigeminal eminence could not be entertained because it was impossible

to demonstrate dissociate and asymmetrical ophthalmoplegia which should have been present from the onset of the malady, constituting the clinical syndrome in this region. Neither could the possibility of a tumor of the cerebral pedicle be considered on account of the absence of even a trace of alternating paralysis of the Weber type; still less could a bulbar tumor be suggested, there being no disturbance of the last pairs of cranial nerves, no isolated or crossed paresis of the extremities, no characteristic alternating syndrome (Avellis, Goukowski-Giannuli) which are found in tumors of this region.

There only remained the hypothesis of a tumor of the temporal lobe, of the pons or of the cerebellum. Suggestive of temporal lobe tumor were the bilateral paresis of the sixth nerves, slight left hemiparesis, paracusia and hypo-acusia, together with the cerebellar phenomena; against this diagnosis were: absence of palpebral ptosis, of mimic paralysis, of alterations of stereognostic sense, of aphasicosensorial or dysarthric disturbances if the tumor had been situated on the left side (first group of Mingazzini); absence of conjugate deviation of the head and eyes, of paralysis of the third nerves and of contralateral hemiparesis (second group of Mingazzini); absence of palpebral ptosis, of isolated paralysis of the seventh nerve and of hemianesthesia (third group of Mingazzini); total absence of olfactory and gustatory disturbances (fourth group of Mingazzini).

On the other hand, the possibility of a pontile localization of the tumor was much more likely. As is well known, the typical syndrome of a pontile tumor includes an inferior alternating hemiplegia, including paralysis of the facial, abducens and of the trigeminus of one side (or of one of the three nerves), with concomitant paralysis of the opposite extremities. Sometimes the cranial nerves may be affected bilaterally and the hemiplegia may be a double one. In this particular case there was exactly a tetraspasm with left hemiasthenia, a bilateral paresis of the abducens, more evident on the left side, and a bilateral lesion of the eighth nerve, all phenomena favoring a pontile localization of the tumor. Nevertheless, the disturbances of station and of gait, which could not be accounted for on the assumption of either spasm or paresis, the cerebellar asynergy and the positive index finger test of the left side spoke against a pontile tumor, especially as the latter symptoms had appeared at the very onset and dominated the clinical picture. For these reasons it seemed more logical to adhere to the hypothesis of a cerebellar tumor, especially as the disturbances of the erect position and of walking, the asynergy of the lower extremities and the index finger test, as well as the headache of occipital type, the occipital and superior paracervical pains all favored this conclusion. The late-appearing bilateral paresis of the abducens did not speak against this same hypothesis, in view of the slight resistance of this nerve to any kind of cerebral hypertension; neither did the signs of eighth nerve

lesion, especially of its vestibular portion, in view of the anatomic and functional connections between the nuclei of the vestibular nerve itself and of the cerebellar gray matter. Furthermore, the tendency to fall to the left, the greater degree of percussion pain over the left side of the occiput, the greater degree of left abducens paresis, positive index finger test, accentuated on the left side, all made one suspect that the tumor must be situated in the left cerebellar hemisphere and that it also compressed the corresponding median cerebellar peduncle. The tetraspasm and slight left hemiparesis were not sufficiently important signs to throw out this hypothesis because, although it is true that some patients show atony and asthenia of the corresponding extremities, it is also a fact that in some cases one may find hypertonia when the tumor causes oblique contralateral symptoms (Murri), because the opposite half of the pons is compressed against the occipital bone. The negative anamnesis, normal general condition of the patient and absence of focal tuberculosis in the other organs, excluded the possibility of a tubercle and favored the existence of a neoplasm of malignant nature.

Yet the necropsy findings were entirely different, consisting, as already stated, in multiple cerebellar tubercles situated in the right cerebellar hemisphere, right posterior cranial fossa and left median cerebellar peduncle, the latter extending into the adjacent portion of the pons.

Let us now see whether, after confronting the clinical history with the necropsy report, it might have been possible to have arrived at a more complete diagnosis *intra vitam*. The absence of any portion of the bulboprotuberantial syndrome which characterizes neoplasms of the posterior cranial fossa made it impossible to suspect the existence of a tumor in this region. The absence of symptoms in this case in all probability depended on the special location of the tubercle on the lateral half of the cerebellar fossa and its small size which prevented it from causing any pressure upon the pons, bulb or its adjacent cranial nerves. It is strange that all signs pointing to a cerebellar localization should have been absent in spite of the close relationship of the tubercle and the lobus biventer of the right cerebellar hemisphere between which it had formed a true depression, and the existence of a second tubercle in the cerebellar tonsil of the same hemisphere. If one admits the possibility that the medullary zones of the lobulus biventer and of the tonsil are functionally silent, a plausible explanation for this absence of symptoms is found. As for the symptomatology which we attributed to the supposed tumor of the left cerebellar hemisphere, which, on the contrary proved to be normal, it is evident that it could only depend on the presence of the tubercle situated in the median cerebellar pedicle and adjacent portion of the pons. As a matter of fact, the slight tetraspasm, bilateral paresis of the abducens, especially marked on the left side, and bilateral lesion of the eighth nerves, all of which we believed to be due

to an oblique contralateral action of the supposed tumor of the left cerebellar hemisphere against the occipital bone of the opposite side, were merely the result of the pontile location of the tubercle. If, therefore, it was impossible to make an intra vitam diagnosis of the tubercles in the right cerebellar fossa and cerebellar tonsil, one might have suspected the presence of the pontile tumor; the constant tendency for the patient to fall toward the left when walking can probably be fairly explained on the basis of invasion of the corresponding median cerebellar peduncle. One may therefore deduce that the error in not diagnosing the multiplicity of neoplasms was almost inevitable, as was also the nature of the neoplasms in view of the total absence of a history and of clinical findings pointing to a tuberculous lesion.

CASE 2.—History.—Giotti Angelo, aged 14 years, had never had any serious illnesses. The father was neither alcoholic nor syphilitic; the mother had given birth to eight sons, of whom three died in infancy of acute infectiousness; she had had no miscarriages. Toward the end of 1913 the patient began to complain of rather intense headache coming on especially in the afternoon, continuous from the onset and localized at the bregma, later intermittent and localized in the occiput. At its acme the headache was often accompanied by vomiting and sometimes by diplopia. The mother stated that during the previous two months the boy had become pale and complained of fatigue and prostration; she did not know whether he had ever been feverish.

Objective Examination.—Dec. 30, 1913: Examination revealed a normal skeletal structure, a limited amount of panniculus adiposus, global muscular atrophy and the skin and mucous membranes markedly pallid. There was left apical sclerosis. The heart was normal, and there were no abnormalities of the abdominal organs. There was no albumin or sugar in the urine.

Neurologic Examination.—Normal oculomotion was revealed on both monocular and binocular examination with the exception of slight nystagmic twitchings in the horizontal direction in extreme lateral movements of the eyes. Normal movements of all muscles were supplied by the seventh and twelfth cranial nerves. There was normal passive and active motility of the various segments of both upper and lower extremities, with the exception of a slight, hardly perceptible, hypertonia, not constant, of the left extremities. The patellar and Achilles reflexes were prompt, as were also the epigastric and abdominal and those of the superior extremity tendons. The pupils were slightly anisochoric (D. > S.); there was normal prompt bilateral reaction to light; the corneal and conjunctival reflexes were normal. The superficial as well as the deep sensibilities, were intact. Cranial percussion did not elicit pain. The sense of smell was well preserved; hearing was slightly decreased on the right side. Vision was diminished on the left side, normal on the right. Lumbar puncture revealed: limpid fluid of increased tension, globulin present, albumin, seven lines of the Nissl's test tube. There were a few lymphocytes in the sediment. The Wassermann reaction was weakly positive.

Status of the Patient on April 12, 1914: The patient still complained of headache of varying intensity, sometimes accompanied by vomiting. From time to time he was seized with vertigo of a subjective type, which was especially likely to come on while changing the position of his body. He also complained of paracusia sometimes of the left and sometimes of the right ear

and of bilateral amblyopia. In the quiescent state a slight convergent left strabismus was noticed. Both monocular and binocular examinations for oculomotion revealed a slight insufficiency of the external recti muscles and the onset of nystagmiform twitchings in the horizontal sense, during lateral movements of the eyes. At the same time a homonymous diplopia appeared with images at the same level whenever the patient looked either to the left or to the right. Frowning and palpebral contraction were more forcible on the right side. The right angle of the mouth contracted better than the left when the patient showed his teeth. The tongue was protruded normally, without deviation, and was mobile in all directions, but in the act of protrusion it was nearer to the left angle of the mouth than to the right. The uvula was normal and moved normally during phonation. No dysarthric disturbances were noted. Passive movements of the neck were all slightly resisted with the patient in the dorsal position; this resistance increased as soon as the patient sat up. These same movements, especially those of right flexion, caused severe pains in the neck. Lateral movements of the head to the left were normal, but they were incomplete and forced in all other directions, the right lateral ones especially being painful. All passive and active movements of the upper extremities were obtainable and complete. There was decreased muscular strength in all of the upper-limb segments. Elevation of both hands, as in the act of taking an oath, did not bring out any premature lowering of either hand but only caused a slight oscillation, more marked on the left side. There was no adiadokokinesis.

Passive movements of the lower extremities did not elicit any abnormal degree of resistance. It was impossible to test the active motility of the thighs, the patient complaining of severe pains in the back on making this attempt. For the same reason, the patient could flex but not extend his legs. Movements of the feet and toes were all possible and complete. Muscular strength, especially in the thighs, was subnormal. While lying down, the patient could not raise his lower extremities with the legs in extension; this was more noticeable on the left side. He was able to assume the sitting posture but only with difficulty and by concomitant flexion of the knees; every attempt to obtain passive extension of the legs caused severe pain. With his eyes open, the patient could maintain the erect position with slight oscillations of the body; the latter increasing as soon as he closed his eyes. There was at the same time a tendency for him to fall toward the right, even when walking, though the latter symptom was not constant. The patellar reflexes were active, more so on the right side; the Achilles reflex was present on the right side, almost abolished on the left. Stimulation of the plantar reflex caused flexion of the four little toes and either no response or only slight flexion of the big toes. Oppenheim's sign was absent; abdominal and epigastric reflexes were present and active. The biceps contractions were normal, the triceps weak, the radial and ulnar absent. The Chvostek sign was absent on both sides; the mandibular sign was very weak. The pupils were almost rigid to light and reacted slightly to accommodation; the corneal reflexes were slightly more active on the left than on the right side. Pressure over all of the peripheral nerves caused pain; this was true to a lesser degree of the muscles. The lightest kind of pressure of the neck was extremely painful, especially along the paravertebral depressions. Pressure over the eyes caused pain which was more marked in the left eye.

On palpation of the cranium, a depression, apparently caused by a loss of bone substance was found corresponding to the right cerebellar region; at

times a pulsation could be obtained over this depression which was synchronous with the patient's pulse. On applying the stethoscope over this depression a vague bruit was obtained which did not exist over any other part of the occipital bone. Cranial percussion was more painful on the right than on the left side. Objectively, both superficial and deep general sensibility were well preserved. Taste and smell were normal. Bilateral hypo-acusia (watch and Galton whistle) was present; the Rinne reaction was normal; the Weber test was not lateralized.

There was bilateral choked disk, more marked on the right, with hemorrhage of the disk. Vision: right, $1/2$; left, $1/6$. The basic colors were correctly interpreted, though slowly. The field of vision was shortened in all directions. The pulse rate was 100; respirations, 25.

Psychic Examination.—Attention was weak; perception in general was correct; memory was fairly good both for past and recent events; orientation as to place, time and person was preserved; he was somewhat depressed but only in proportion with his sufferings, otherwise the affective life was normal; neither psychosensorial disturbances nor delusions were present.

Lumbar Puncture.—The spinal fluid was ejected under tension; albumin was present (six lines in Nissl's test-tube); there was no lymphocytosis or reticulæ.

Radiographic examination of the cranium revealed a clear space corresponding to the medial portion of the right cerebellar hemisphere.

Conclusions.—The case was that of a 14-year old boy, of rather poor general health who, toward the end of September, 1913, began to suffer from continuous headache of varying intensity, terminating in vomiting. In April, 1914, subjective vertigo appeared with bilateral paracusia. Neurologic examination revealed the following conditions: slight convergent left strabismus; slight bilateral paresis of the sixth nerve and slight paresis of the left seventh nerve; increased resistance to passive movements of the head, with onset of severe pains in the neck; slight hypertonia of the left extremities; slight oscillation of the elevated hands, slightly more accentuated on the left side; the Romberg sign; a tendency for the body to fall toward the right side; greater promptness of the left patellar reflex; almost complete absence of pupillary reaction to light; slight decrease of the corneal reflex on the right; tenderness over the paracervical region; pain on cranial percussion, especially on the right side; bilateral hypo-acusia; choked disk more accentuated on the right side; vision on the right, $1/2$, on the left, $1/6$; marked hypertension of the spinal fluid with increased albumin content.

In this case also it was easy to suspect a cerebellar neoplasm on account of the decidedly progressive nature and symptomatology of the morbid process. For the reasons given in the preceding case, it was easy to exclude the Rolandic zone, frontal, parietal, temporal, occipital lobe, the basal ganglions, the bigeminal eminences, the cerebellar peduncles, the pons and bulb. The only possible clinical localization was that of a cerebellar tumor. The increased resistance to passive movements of the head, Romberg sign, tendency for the body to fall to the right, pain in the neck and on compression of the paracervical regions, and intense papillary stasis, though not constituting a characteristic syndrome, nevertheless, justified a cerebellar localization on account of the impossibility of ascribing these phenomena to a neoplasm situated in any other part of the brain. For the same reasons one was justified in locating the tumor in the right cerebellar hemisphere. The patient's youth, poor general health, left apical sclerosis and slight elevation of temperature also prompted the diagnosis of tubercle.

Treatment and Course.—Operative intervention having been decided on, on June 24, 1914, Professor Alessandri performed a craniotomy of the right occipital fossa over the cerebellar region. On incising and elevating the skin over the pulsating area, the latter proved to be a dilated, sacculated emissary vein of Santorini, the walls of which had produced pressure necrosis of the bony vault. Section of the vessel near the occipital foramen caused profuse hemorrhage, which was controlled by application of wax. On removal of a portion of the right cerebellar bony lamina, the dura appeared under great tension. As soon as the dura had been opened a tumor the size of a small round plum compressing the medial portion of the lobus quadratus was delivered with the fingers. It was partly adherent to the most superficial lamellae of the lobus. On section it proved to be moderately firm and composed of yellow caseous tissue. Microscopic examination confirmed the diagnosis of tubercle. The patient died six days after the operation.

Necropsy Report.—On removal of the brain a large depression with irregular contour was found in the posterior part of the right side of the cerebellum. A horizontal section through the right cerebellar hemisphere revealed the presence of a well outlined tubercle, the size of a small nut, lying on the lateral extremity of the superior and inferior semilunar lobules. A similar section through the right side of the cerebellum revealed two other isolated tubercles also the size of small nuts lying in the cerebellar substance, one in the anteromedian part of the lobus quadratus, the other at the lateral angle of the two semilunar lobules (Fig. 3).

After section of the cerebral peduncles it was noticed that the lamina quadregemina was manifestly deformed, more on the left side. Section of the posterior bigeminal eminence brought to view a small grayish tumor the size of a pea, situated almost entirely in the left posterior bigeminal and partly in the anterior bigeminal of the same side. It crushed and pressed the aqueduct of Sylvius toward the opposite side. There were no appreciable alterations in the pons. Other sections through the brain revealed only a high grade of internal hydrocephalus.

Anatomo-Pathologic Diagnosis.—Multiple cerebral tubercles, one in the posterior bigeminal eminence, and also in part in the anterior, of the left side, two in the right cerebellar hemisphere—medial portion of the lobus quadratus and lateral extremity of the inferior and superior semilunar lobules, and two others in the left cerebellar hemisphere—anteromedial portion of the lobus quadratus and lateral angle of the two semilunar lobules.

Histologic Examination.—Examination with a hematoxylin-eosin stain confirmed the diagnosis of tubercle.

DIFFICULTY OF DIAGNOSIS OF MULTIPLE CEREBELLAR TUMORS

The neurologic diagnosis formulated *intra vitam* had been that of a tubercle of the right cerebellar hemisphere; the tubercles lying on the lateral extremity of the inferior and superior semilunar lobules of the same side, the two of the left cerebellar hemisphere and the one on the left posterior bigeminal eminence had not been recognized. After reviewing the necropsy findings, was it possible to have suspected these other localizations? There was nothing favoring the hypothesis of multiple tubercles in the right cerebellar hemisphere; the absence of

all symptoms attributable to quadrate and semilunar lesions did not allow any other diagnosis than that of tubercle of the cerebellar hemisphere. Neither were there any symptoms pointing to a lesion of the left cerebellar hemisphere; there were no hypotonia, asthenia, hyper-

Fig. 3.—Multiple cerebral tubercles: (A) site of the tumor removed during the operation; (B) tubercle occupying the lateral extremity of the right inferior and superior semilunar lobules; (C) tubercle occupying the lateral angle of the left semilunar lobules in Case 2.

metria, asynergy, etc. In fact, on the left side, we found a slight but evident hypertonia with exaggeration of the patellar tendon, phenomena which fitted in with a localization of the lesion in the cerebellar

hemisphere of the opposite side. If, on the right side, the tubercles had caused a cerebellar syndrome, this was due to the fact that the tubercle of the quadrate lobe was not limited to the medullary substance alone, as on the left side, but had invaded a large part of the cortical tissues as well. It would seem, therefore, that cerebellar symptoms depend less on the lesion of the medulla cerebelli than on that of the cortical portion of the cerebellar hemispheres.

One could not have had the faintest suspicion of the presence of a tubercle in the left lamina quadrigemina, all criteria for making such a localization being absent. There were in fact no pareses of the extrinsic eye muscles innervated by the third and fourth cranial nerves, no paralysis of associated movements of the eyes, no cerebellar ataxia. Only the bilateral hypo-acusia and almost complete pupillary rigidity to light could possibly have been laid to a lesion of the bigeminal eminences, but it would have been absurd to make such a localization on the basis of these two symptoms alone because the hypo-acusia appeared late and both could be explained on the hypothesis of a cerebellar localization with increased endocranial pressure. At any rate, the necropsy fully confirmed the absolute absence of localizing signs; the tubercle, although occupying almost the entire left posterior bigemina and a portion of the anterior bigemina of the same side, did not impinge on the underlying tegmen mesencephali. It is known that in man the bigeminal eminences possess a rather limited physiologic importance and that symptoms provoked by a lesion of the same are essentially due to concomitant involvement of the underlying tegmen. As the latter was not involved in the tubercle which was growing dorsally rather than ventrally, the syndrome of neoplasms of this region was necessarily missing. Not few are the cases of bigeminal eminence tumors reported in the literature which did not, *intra vitam*, give rise to localizing symptoms. Among others may be mentioned Clarke's case in which a neoplasm the size of a nut occupied the velum medullare and lamina quadrigemina without causing ophthalmoplegia or cerebellar ataxia.

My two cases once more demonstrate the enormous, almost insurmountable difficulties which confront a diagnosis of multiple cerebellar tumors, especially of multiple tuberculomas of the brain. I can add nothing to the infrequent and uncertain criteria of probability furnished up to date by other authors. Nevertheless, by taking into account the frequent multiplicity of cerebellar tubercles, it is the better advice, even when the symptomatology points toward a single tubercle, to be very cautious regarding the hopes of surgical intervention which, often, can only hasten a lethal exitus.