

THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report

of

Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given Horace Raymond Lyons final oral examination for the degree of Master of Science in ^{Otology, Rhinology and Laryngology.} We recommend that the degree of Master of Science ^{Otology, Rhinology and Laryngology} in be conferred upon the candidate.

Minneapolis, Minnesota

May 24 1920

H. J. Gillie

Chairman

Arden Newhart

Arthur S. Hamilton

REPORT
of
Committee on Thesis

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Horace Raymond Lyons for the degree of Master of Science in Otology, Rhinology and Laryngology. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Otology, Rhinology and Laryngology.

H. J. Gillie

Chairman

P. C. Darlow

W. L. Shelden

Horace Newhart

Arthur J. Hamilton

THESIS

BARANY TESTS IN SUPRA-TENTORIAL TUMORS PROVEN BY
OPERATION OR AUTOPSY.

Horace Raymond Lyons

Submitted to the Graduate Faculty of the University
of Minnesota in partial fulfillment of the require-
ments for the Degree of Master of Science in Otology,
Rhinclogy and Laryngology.

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Introduction

A slow but sincere scientific interest, a steady increase in our understanding, and an indefinite amount of discussion, are embodied in neuro-otology in general and the Barany tests in supra-tentorial tumors in particular.

The early neurologist looked upon neuro-otological localizations of intra-cranial lesions with interest but also with considerable reservation. These limitations are being and will be steadily eliminated as our knowledge from proven cases multiplies. The localization by Barany tests of supra-tentorial Tumors is one of the later developments of neuro-otology.

History

In 1905 Robert Barany in the Politzer Ear Clinic of Vienna, as a result of repeated observations, noted that patients who were undergoing douching of their ears frequently became dizzy, and that often nausea and vomiting ensued. After many such observations Barany noted that when the liquid used was very cold or quite warm the nystagmus and vertigo were augmented. By using a mean temperature he practically eliminated this discomfort. He subsequently noted, after douching normal ears, that these patients would have a definite nystagmus, vertigo, past pointing and falling, as we now know them, all of which followed a definite rule.

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This was the start of Robert Barany's colossal study and research which bears his name. His early investigation was more or less confined to the cerebellum. Animals were used in every conceivable way in his untiring efforts to find definite areas in the cerebellum which had specialized functions.

He made use of the turning and caloric tests, in a somewhat crude manner, to elicit reactions. By anaesthetising small areas in the cerebellum with various methods, especially by freezing with ethyl chlorid, he found that there were very different areas which had control over the synergetic movements of certain joints and located specific areas for each. Also, in the human, where large cerebellar decompressions were made, he carried out investigations. He also carried out investigations in the human, where large cerebellar decompressions were made. At operation where cerebellar explorations were performed, his data before and after the surgical interference gave him a wealth of material for localization of specific areas in the cerebellum. In this clinic, and in others where his study was continued, it was a routine method to have every patient subjected to an equilibration test.

His efforts, which were most sincere, original, and untiring, brought forth many papers upon his investigations. These articles appeared from 1905 until the great war in 1914. He, at this time, gave up his work temporarily and entered the Austrian army. He subsequently was taken a prisoner by the Russian army and because of gangrene following the freezing of an extremity, the amputation of a leg was performed.

Throughout this time his work, however, was not forgotten. Unbeknown to him, his wife, at the request of the Noble Prize Commission,

collected all his original articles, and as a most fitting tribute to his colossal studies, he was given the Noble Prize in Medicine for 1914 with the accompanying 147,000 Kronen.

His work did not cease during the war of recent date - January 1920 - several reprints of his further investigations are at hand.

Barany and his Vienna co-workers were the instigators of of the standardization of the Equilibration tests, but by no means the only important individuals responsible for it. In 1825 Purkinji and Flourens made very notable observations upon nystagmus and vertigo by turning individuals and in labyrinthectomized animals. Ménière, also, recognized vertigo as originating in the ear, which resulted in the misnomer "Ménière's Disease". The Goltz Theory of the physiology of the static labyrinth was propounded in 1870. Barany utilized to a great advantage the long and careful study of the internal ear as worked out by Hogyes.

Spain had, and has still, a man of wonderful resourcefulness and ability; a man who early put the labyrinth and its central tracts on a histologic basis. Professor Ramony Cajal was not a small factor in the work instigated by Barany. Cajal, beginning in 1888 with the finer anatomy of the retina and spinal cord of the embryo chick, has written volumes on the histology of the entire nervous system. The brain and its associations have all carefully been worked out. His papers include work on the whole nervous system, cerebrospinal and sympathetic, central and peripheral. In 1909 Cajal made histologic preparations showing a tract from the static end-organ in the labyrinth through Deiter's nucleus, thence by way of the inferior cerebellar peduncle to the cerebellar nuclei.

His technic is very simple as compared with others, notably the methods of Apathy and Bethe. The modifications of Bielschowsky have made Cajal's method within the reach of everyone, and no doubt will make the study of the neurofibrils a part of the standard medical school histology. Of no less importance is Cajal's rapid method of using Golgi procedures, which encouraged the silver-impregnation studies, not his modification of Ehrlich's methylene blue staining, giving us the vitally stained intra-central axons and their subdivisions. It is Cajal's device that permits us to make neurofibril preparations at will.

In this country Mills, E. R. Lewis, Shambough, Freisner, Braun, Geo. Mackenzie, and others, have made very notable contributions to the study of neuro-otology; but it remained for Fisher and Jones to specialize and standardize the work of Barany until today their technic is uniformly accepted.

Fisher and Jones are responsible for much in the rapid response of otologists to the study of the Barany test. They have managed to put the test in its simplest form and to aid the interpretation by relatively simple drawings and phenomenon-complexes.

Intra-cranial tracts.

There are two fundamental reactions in a Barany test, namely, nystagmus and vertigo. The former, in turn, has two components, a central and a peripheral, which is situated in the labyrinth. The central component is the rapid movement, while the labyrinthine is the slow one. The direction of the nystagmus is designated by the direction of the rapid component. Stimulation of the semi-circular canals by the turn-

ing or the caloric tests produces a current in the endolymph towards the ampulla which causes a definite nystagmus.

Vertigo is the other important reaction of this test, and is also produced by the motion in the endolymph. Vertigo may be defined as the sensation of motion not in accordance with facts. It is entirely responsible for the phenomena of past-pointing and falling.

Nystagmus, vertigo, past pointing and falling are responses obtained by stimulation of either the horizontal or vertical semi-circular canals. As above stated, Cajal in 1909 demonstrated a tract from the static end-organ in the labyrinth to the Deiter group of nuclei, and thence by way of the inferior cerebellar peduncle to the cerebellar nuclei. It is assumed that this tract has to do with the horizontal canals only. It has further been postulated that this tract of the horizontal canals proceeds from the cerebellar nuclei to the cerebrum by way of the superior cerebellar peduncle. It is further assumed that there are association tracts between the opposite horizontal canals situated at the base of the inferior cerebellar peduncles which pass through the posterior longitudinal bundles.

The tracts of the vertical canals have an entirely different course. This tract proceeds from the labyrinth through Deiter's nucleus to the brain stem, where its course divides. One branch goes to the posterior longitudinal bundles. The other tract goes through the middle cerebellar peduncle to the cerebellar nuclei. It then proceeds by way of the superior cerebellar peduncles, through its decussation, to the cerebral hemispheres. There are therefore two distinct and different intra-cranial tracts for the horizontal and vertical canals as they pass from the static end-organ in the labyrinth through the medulla, pons, cerebellum and on to the

cerebrum. It becomes necessary then for one to have a fair knowledge of the gross brain anatomy, and to accurately visualize these tracts, to correctly interpret the Barany findings.

Technic.

The technic of the Barany test as used in this clinic is as follows:

The patient is first subjected to a routine medical examination, including the following complete blood tests, x-rays, complete eye examination, urine examination, Wassermann, spinal fluid tests, complete examination of the teeth including the x-ray, and examination of the ear, nose, throat, nasopharynx, and larynx. The results of the above tests determine what further medical tests are to be used. The history and the patient are then sent to the Neurologic Department for further special investigation. After all data is compiled here, the patient is sent to the neuro-otologic division of the Oto-laryngologic Department for the Barany test.

Here another history sheet especially adapted to the Equilibration test is used. A careful examination of the ears with complete auditory function, as determined by the tuning forks, is recorded. Fistula tests, etc., are employed when indicated. The patient is then placed in the standard American modification of the Barany chair which has been changed in two details; namely, no foot-stop pedal is employed and a device is attached which does not allow the patient's feet to swing out when the turning test is employed. The spontaneous nystagmus is obtained by having the patient look straight ahead, to the right, to the left, and up and down, is recorded. Spontaneous pointing from the shoulders is noted with the patient's eyes open and closed.

The patient's head is now fixed in a position 30° forward from the erect posture, which places the horizontal semi-circular canals parallel to the floor. The individual is then turned to the right, with eyes closed, ten times in twenty seconds; the chair is stopped without jerking, and, as the patient is told to open his eyes, the stem of a stop watch is pressed. The patient fixes his eyes on a distant object, and the duration, direction, and amplitude of the nystagmus is accurately noted. Normally a horizontal nystagmus to the left of twenty-six seconds is found. Similarly, a horizontal nystagmus to the right of twenty-six seconds is obtained upon turning the patient to the left. Vertigo is now obtained by turning the patient to the right ten times in ten seconds. He is instructed to rapidly repeat the direction, right or left, that he feels he is turning. After ten such turns the chair is smoothly stopped, the stop watch clicked, and the patient continues to give the direction of his vertigo, with eyes closed, until he no longer feels dizzy. He then says, "stopped", and the time is recorded by the stop watch. The direction of the patient's "falling" is also noted. Normally the vertigo and nystagmus time are equal. The same procedure is followed in testing for vertigo and falling by turning to the left. The vertical canals are similarly tested by placing the patient's head 60° back of the erect posture.

The patient now is instructed that the test will be completed on the following day. It was our early experience that patients who had both turning and Caloric tests performed in succession not only became very sick, but that the first test would interfere with the second, and hence grave errors in the technic would follow with the result of an incorrect diagnosis.

The patient, therefore, returns the following day and the spontaneous nystagmus is again noted. He is placed in the chair with his head fixed forward at an angle of 30° from the erect. The external canthus of the eye and the external canal of the ear are then on a plane parallel to the floor. A rubber harness with a funnel-shaped end, snugly fitting under the right external ear, is fastened to the head and a rubber tubing connects the funnel with a receptacle on the floor. Tap water at 68° F. is used for douching purposes. This produces an increased specific gravity in the endolymph, causing a downward current, and hence stimulates the right vertical canals.

The patient fixes his eyes upon a distant object and the water is directed upwards in the right external canal by a gently placed nozzle. At the instant that the water begins to flow into the ear, the stop watch is clicked and the eyes are carefully watched from one side. A conjunctive blood vessel is convenient for the early detection of nystagmus. At the onset of the typical nystagmus the stop watch is again clicked, thereby obtaining the length of time before the nystagmus is noted. The water is continued momentarily, as the direction and amplitude of the nystagmus is determined. Divergence or convergence of the eyes are also noted. With eyes closed, the patient is requested to rapidly repeat the pointing tests from the shoulders as above described. Mental note is made of the data obtained.

The patient's head is now rapidly fixed at an angle of 60° backward from the erect posture. After just a few seconds in this position, allowing for maximum stimulation of the horizontal canal, the eyes are opened and all features of the nystagmus are again noted. The

eyes are then closed and the pointing tests from the shoulders are repeated and the results mentally noted. This same procedure is again repeated with the head held at an angle of 120° forward from the erect position. The patient is now returned to the original position, and if nauseated or markedly dizzy, tap water at about 110° F. is run into the ear to produce an opposite stimulation; hence, usually, uncomfortable symptoms are eliminated. The data obtained is recorded in full at once. All notes or impressions are also written on the record.

In a normal individual, upon stimulation of the right vertical canals with cold water a rotatory nystagmus to the left is obtained in about forty to sixty seconds. This nystagmus rapidly increases in amplitude and remains a pure rotatory nystagmus. Divergence of the eyes or any form of a perverted nystagmus is noted on the Barany sheet. A normal pointing test consists in a past-pointing of both arms to the patient's right of the operator's finger. One finger is held at the original position and the operator's left hand finds the patient's finger at the same level as he past points. The amount of past pointing is noted in inches. Similarly the nystagmus from stimulation of the right vertical canal as a rotatory one, to the left, and the past pointing is also to the patient's right. The "falling" in both instances is also to the right.

A similar procedure is carried out by douching the left ear, with similar nystagmus, past pointing, and falling, except that the directions are exactly opposite to those obtained upon douching the right ear. The results of these tests are immediately recorded. This is important, because the results will then be recorded correctly, while if one starts to think of or study a certain reaction the result is that the variation may not appear on the history sheet, purely from neglect. Such mental notes are of no use for future reference.

The patient, especially in the pointing tests, feels sure that the point touched after stimulation is the same as the point touched upon spontaneous pointing without douching. It is, therefore, essential to the patient's psychology, that the operator find the finger of patient as he past points at the same level and in exactly a similar way as in the spontaneous pointing test. This detail eliminates any effort of the patient to willfully change the normal action.

In general, it is also of considerable importance to obtain the co-operation of the patient. Force and commands are often a failure, hereas suggestion and encouragement to the patient brings success.

Indications

A Barany test is indicated in every case of vertigo. Inas-much as the static labyrith is the mechanism which controls equilibrium, it is, a fact that in vertigo, this organ or some of its intra-cranial connections are responsible and should be investigated.

In all cases of suspected brain tumors, a Barany test is indicated. In the Mayo Clinic we have two routine rules, which, while not in general use, are of great productive importance. The Barany test, like most all other tests, is not 100% correct. We must, therefore, do all those things which will increase our knowledge of this test in the future. With that in view, at this clinic we never do a Barany test until every conceivable examination has been completed, most important of which is the neurologic examination. This gives us a complete and thorough record of every case. Next in importance is the fact that we never know or investigate the reason for the Barany test, the neurologic diagnosis, or the patient's history. A card is received asking for a Barany and without further investigation

the test is completed and a diagnosis made. Now, and only now, a consultation with the neurologist is held and the case discussed from all angles. This affords an unbiased diagnosis of the condition from the Barany Test alone and hence, for productive work in the future, is of highest importance. It is a fact that in certain instances after a consultation with the neurologist the original interpretation of the Barany findings is modified.

Likewise, the findings from the operation or necropsy are investigated, and in case of death, the brain is obtained and carefully studied.

These details make for progress and ultimately will result in absolute facts concerning the localization of the intra-cranial lesions by the Barany test.

A report of nine cases of supra-tentorial tumors diagnosed by the Barany test and proved by operation or necropsy follows.

Case A236828, E.L., female, aet 40, July 2, 1918. The patient's family and personal history are negative.

Her chief trouble was dull frontal headaches and loss of strength. Previous to October, 1917 she enjoyed good health. At that time, when combing her hair one morning, she felt a sudden jerk in her left arm and it immediately felt numb. She was unable to use it. Frontal headaches began at that time and were severe and almost continuous. Projectile vomiting often followed the headaches and somewhat relieved them. Her left hand improved somewhat but it still could not be used a great deal. The patient had been partially deaf since childhood and this had increased of late. A jerking of her limbs was noted on lying down.

The physical examination revealed nothing important. Her weight was 132 pounds. The blood pressure, urine tests, and blood counts were all normal. Her eyes showed a double choked disk of three diopters. The blood Wassermann was negative. The spinal fluid Wassermann with 0.4 and 0.5 c.c. was negative. The Nonne was positive. There was one small lymphocyte. A fibroid uterus was found but was not surgical at this time. A moderately severe combined type deafness was also present. The patient was sent home, but she returned on Jan. 16, 1920.

A neurologic examination revealed a bilateral horizontal nystagmus. The facial movements were tardy. The left arm was smaller than the right, but the contour was normal. No atrophy was present. The legs were normal. The left arm reflexes were increased, when compared with the right. The abdominals were considerably increased on the left. The plantar and corneal reflexes were slightly exaggerated on the left. Vibration sense was increased on the left. Joint sensation was slightly more decreased on the left than on the right. All coordination tests were moderately decreased on the right.

Station was normal. Her mentality was very dull, apathetic, and it was difficult to hold her attention. There were no tremors, and speech was normal.

A Barany test revealed a moderate combined type deafness, a bilateral spontaneous horizontal nystagmus, and a spontaneous pointing fault with the left arm. The turning test showed prompt reactions throughout.

The caloric revealed, on the right, a marked and definite exaggeration of all responses from all the canals. Nystagmus began almost at once, and vertigo was both early and severe. From the left verticals we noted a very early onset of nystagmus, of a perverted type, with marked vertigo and vomiting. A pointing fault was present for the left arm. Falling was to the left. The horizontal canal showed marked reactions throughout.

Here again is a Barany test giving marked exaggeration of all responses on the right side. They were all, without exception, increased far above the normal. The same was true of the reactions from the left canals, with the addition that here we have a perverted nystagmus and pointing faults. The reactions from the left canals, therefore, showed interference with the posterior longitudinal bundles and the middle peduncle on the same side. This was interpreted as pressure signs. The diagnosis from the Barany was a supra-tentorial lesion on the right side causing pressure downwards.

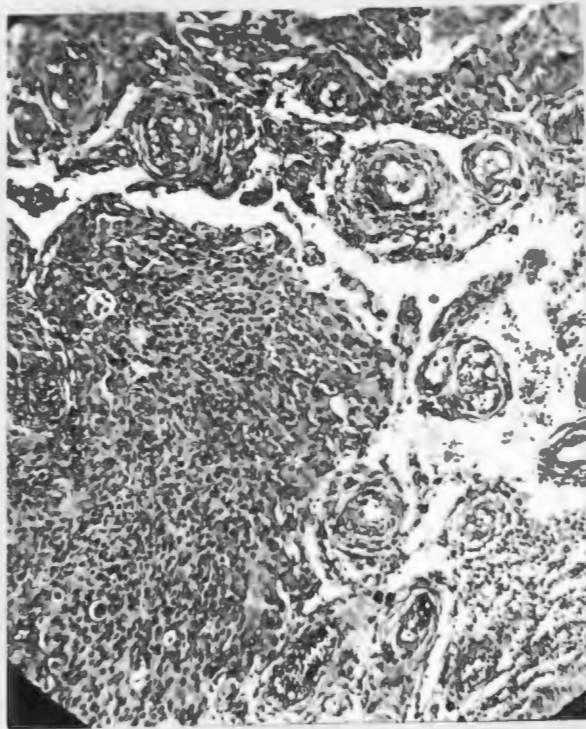
On July 16, 1918, a brain tumor measuring two by four inches and weighing eighty-three grams, was removed from the right fronto-motor area. The tumor was a glioma, a photo-micrograph of which is reproduced.

It is also interesting to know that this patient returned on January 16, 1920, showing a normal mentality, and the power returning in the left arm.

EQUILIBRATORY TESTS

R	HEARING	L
17V	Noise	17V
-	Weber	-
-	Kinne	-
11	Schwabach	11
-14	C	-10
- 0	Cd	- 6
0	Contra	0
0	Pinna	0
0	7th	0

NYSTAGMUS	SPONTANEOUS	POINTING	
Looking to right  Looking to left  Looking up 0 Looking down 0	Shoulder from above Nystagmus Vertigo Fast pointing Falling Romberg Head to right Head to left Overthrow	With right 2 to 1R 1 to 1L T	With left 2 to R T to
TO RIGHT Amp 1 time 24 	TURNING Nystag Vertigo 26" without vomiting Pointing Falling		
TO LEFT Amp 1 time 22 	Nystag Vertigo 22" without vomiting Pointing Falling		
RIGHT Amp 2 time 25  HEAD BACK Amp 3 	CALORIC 60 F. Nystag D.K. rapid onset Vertigo marked Pointing O.K. Falling To the right marked reaction	4 to R to 4 R to	3 to R to 4 R to
LEFT Amp 2 time 25 sec  HEAD BACK Amp 3 	Nystag Early perverted type Vertigo Marked with vomiting Pointing Fault with left arm Falling To left pointing fault to left	2 to 1L T to 4 to 1L T to	2 to R 2 to 1L T T to



Case A235175, R. P. O., aet 47, June 14, 1918. The patient came to the clinic walking but in the need of considerable support. The patient's father died of an accident; her mother is seventy-eight, and in good health. Two brothers are in good health and two died of typhoid fever and scarlet fever respectively. One sister is well. One child, sixteen months of age, died of sarcoma of the kidney.

The menstrual history was not unusual. The last period was in March, 1918. The previous illnesses were also unimportant.

The chief complaint is inability in walking for the past two and one-half years. She felt physically weak and tired mentally. Eight months rest in a sanatorium did not especially benefit her. She had intense bilateral frontal and occipital headache. On Dec. 1, 1917 the patient was in coma for three days and now is very markedly apathetic and has an entire loss of memory for past incidents. She does'nt remember going to a sanatorium. In the spring she again went to a sanatorium for six weeks and was somewhat improved. Upon returning to her home she became worse. Memory is poor and apathy marked. She has involuntaries and urinary frequency with loss of control of the sphincter.

The physical examination revealed that her present weight is 175 pounds, which is thirty pounds above her usual weight. Her left pupil is larger than the right. There was a double choked disk about three diopters right and one to two diopters left. Reflexes were normal. There was a moderate blurring and loss of detail about both disks.

The arm reflexes were quite active, while the abdominal were absent. The knee jerks and tendon Achilles jerks were both active. Co-ordination tests of hands and feet were slightly decreased. Station on the

right leg was slightly decreased but was markedly decreased on the left. Gait was rather uncertain and feeble. Speech was normal. Questions and objections are frequent and the patient seems slightly demented. No head tenderness.

The Wassermann and Nonne tests were negative on the spinal fluid, Lymphocytes were normal. Blood Wassermann was also negative. The routine urine and blood examinations were all negative, as was the combined phthalein test.

A roentgenogram of the head shows an apparent thickening of the base of the sella with obliteration of the posterior clinoid process.

The patient was sent home and asked to report by letter frequently. A local doctor watched her carefully.

After a rather stormy interval, in which the patient was definitely worse, she returned on Jan. 31, 1919. Projectile vomiting was more frequent, consciousness decreased, and double choked disk increased to four diopters.

The neurologic examination revealed a spontaneous horizontal nystagmus in both directions and of moderate amplitude. The pupils were as above reported. There were fibrillating twitchings of the chin. Voice was normal. The cranial nerves were otherwise negative. The mentality was now very much reduced and cooperation was not obtained in many of the tests.

The muscles as tested revealed on the right, amplitude decreased, no atrophy, marked decrease in speed, tonus moderately increased and strength very markedly reduced. On the left side there was generalized reduction in tonus; a moderate decrease in speed; a considerable reduction in amplitude, while atrophy and fibrillating twitchings were absent. Coordination tests were all questionable.

The biceps, triceps, supinators, and patellar reflexes were all moderately increased on both sides and about equally. The Achilles jerks were normal. Ankle clonus was very marked while the corneal reflex was nearly absent. All the abdominal reflexes were absent. The Babinski reflexes were present and very active on the right. Oppenheim's test was negative.

The Barany test, as shown on the following page, presents one of the interesting phenomenon complexes of supra-tentorial tumors. To begin with there was no cochlear fault in either ear, nor was there any spontaneous nystagmus at the time this was done. The patient was in the hospital under observation. She was unable to raise her arms in any way, due mostly to her dementia, but somewhat also to her weakness. A turning test, therefore, was impossible.

Analyzing the caloric test there are two prominent features.

The first and foremost is the fact that vertigo and falling were very much exaggerated over the normal. The second is the absence of nystagmus reaction from the left vertical canals, and perverted delayed nystagmus from the right verticals. Pointing tests, as above mentioned, were impossible. Here is a supreme test in the ability to interpret a Barany syndrome. The marked vertigo and falling, in themselves, at once suggest a lesion above the stem but here we have the stem itself giving an abnormal response. The explanation is most clear cut and truly in accordance with facts.

The most striking effects of supra-tentorial tumors or, in fact, any brain tumor, are those of pressure. This we know may cause symptoms due to injury to quite remote parts of the brain to-wit:- a lesion above the stem may, because of its pressure, cause a paralysis or paresis

of the sixth cranial nerve causing a paralysis or paresis of the external rectus muscle of the eye. Similarly, and by the same process, an enlargement of the sella tursica or an absence of the posterior clinoid process is shown by the roentgenogram. These two facts have been definitely proven in a large number of cases. Therefore, by this same pressure, we have in this particular case, not only a rather typical exaggeration of vertigo and falling but, in addition we have the effect of the pressure from above, downwards, resulting in a brain stem syndrome partially involving the posterior longitudinal bundles.

From the Barany, therefore, we made a diagnosis of a supratentorial tumor in the left cerebral hemisphere.

At operation on Feb. 8, 1919, a subcortical tumor was found in the left frontal lobe, one inch below the surface of the cortex, involving the middle and lower frontal convolutions.

This, therefore, was a most interesting case. It will be noted from the above that the roentgenogram showed an enlarged sella. The typical findings of exaggerated vertigo and falling with the pressure syndrome made the case most instructive.

Case A293010, A. St. L., aet 48, Oct. 13, 1919. The patient entered the clinic walking and without aid. His family history consists chiefly of the fact that two brothers died of tuberculosis. He is a steady drinker and smokes considerably. His appendix was removed in 1918. He is rather dull intellectually and is slow to answer questions.

His chief complaint is fits, which began eighteen months ago. They always involve his right foot, arm, and head, occasionally involving the left side, and may or may not be followed by unconsciousness. These attacks are tonic in nature and always start from the foot on the right side and go up the same side. His head always turns to the right. These attacks last about ten minutes. He never bits his tongue or froths at the mouth. They often are preceded by an electric shock throughout his body. Formerly these attacks occurred about every three weeks but now only once in seven weeks. He has severe frontal and occipital headaches often lasting three days. He complains of diplopia and tinnitus.

Sixteen years ago, in an explosion of dynamite, a board struck him in the left occipital region, but it never gave him any trouble.

His pupillary reflexes were sluggish. There was an eruption over his body with marked pigmentation. He had a bilateral choked disc of two diopters right and one diopter left eye. The routine blood counts and urine tests were normal. The blood and spinal fluid Wassermanns were negative to .4cc. of fluid. The Nonne was positive and there were five small lymphocytes. The head roentgenogram failed to reveal the sella but a suspicious area of erosion was found in the occipital region. His temperature was normal.

The neurologic examination revealed that aside from the above mentioned bilateral choked disk and sluggish pupillary reactions, all his cranial nerves were normal. His muscles showed a bilateral generalized weakness

without any local weakness. Coordination movements were reduced on both sides but much more on the right. He was unsteady in his balance when walking. There was a slight Romberg and he experienced considerable difficulty in balancing on either foot. He had a moderate rapid tremor in his hands. The following reflexes were moderately active on both sides; biceps, triceps, patellar, Achilles, hamstrings, peroneal, clonus and plantar. Sensation was normal, as also were the peripheral nerve trunks.

The Barany test was very interesting. The turning was not done because the patient was quite sick. In reviewing the caloric, it will be noted that the nystagmus time from the right vertical canals was markedly delayed. Vertigo was present, and normal. There was no falling, and the pointing was reduced. The right horizontal canal shows increased pointing. Contrast the above with the almost immediate rotatory nystagmus obtained from the left vertical canals. Also contrast the above with the marked vertigo, vomiting, pointing and falling obtained from the left canals. Obviously, the turning was not necessary in this case, and a diagnosis was made of a left supra-tentorial tumor which was producing pressure signs on the right hemisphere.

On Nov. 27, 1919, a large osteoplastic flap was turned on the left temporal area. The findings at operation copied verbatim are, "Much bleeding encountered. The dura near the middle line bled very freely. The ventricle was entered twice with a trocar but only a few drops of fluid escaped. The stabs felt as though there was a tumor under this area of the dura; it was incised and a tumor the size of a small hen's egg encountered, very closely adherent to the dura but encapsulated on the brain side. The tumor was enucleated with considerable difficulty and bleeding. A large portion of the dura, about an inch and one-half in diameter, was excised attached to the tumor. The tumor extended up to the mid line and made pressure on the falx cerebri. The longitudinal sinus was probably entered as there were marked

venous hemorrhages requiring packing. The excavation in the brain was filled with animal membrane held in place by a silk suture. There will be a cerebral hernia due to the dural defect."

The patient recovered and later a resection of a small cerebral hernia was done.

The tumor was six centimeters in diameter and upon pathologic examination showed an endothelioma. A photograph and a photo-micrograph are reproduced.








This is a very definite and instructive case. From the caloric alone the exact localization of the lesion was made. The pressure signs on the left hemisphere were verified by the location of the tumor.

It is also interesting to know that the patient has had no convulsions since his operation and that he feels considerably stronger.

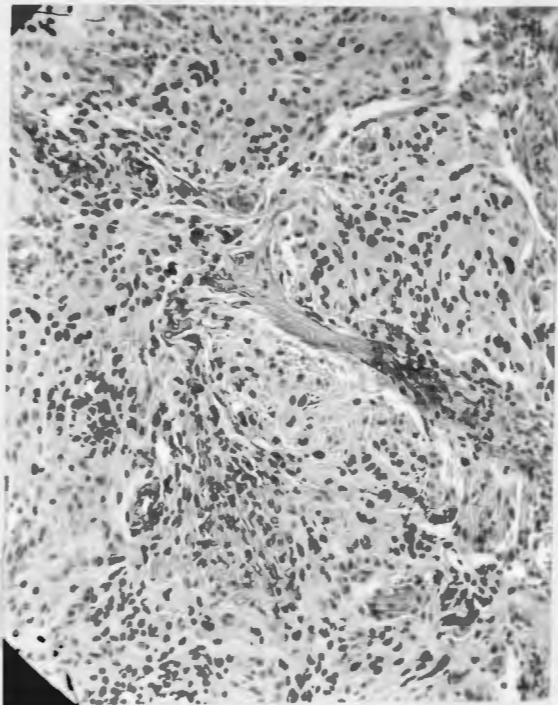
EQUILIBRATORY TESTS

R	HEARING	L
WV	Noise	WV
	Weber	
Normal	Rinne	Normal
	Schwabach	
	C	
	C4	
+	innitus	+
O	Fistula	O
O	7th	O

Patient was very sick and the turning test was not attempted.

NYSTAGMUS	SPONTANEOUS	POINTING	
	Shoulder from above	With right	With left
Looking to right. 	Nystagmus	T to	T to
Looking to left. 	Vertigo	to	to
Looking up. 	Past pointing		
Looking down. 	Falling		
	Romberg		
	Head to right		
	Head to left		
	Overthrow		
TO RIGHT	TURNING		
Amp time	Nystag	to	to
	Vertigo	to	to
	Pointing		
	Falling		
TO LEFT			
Amp time	Nystag	to	to
	Vertigo	to	to
	Pointing		
	Falling		
RIGHT	CALORIC 68° F.		
Amp 1 time 2 sec 40	Nystag. Delayed	T to R	1 to R
	Vertigo. Present with set nausea	1 to R	1 to R
HEAD BACK	Pointing. Reduced reaction		
Amp 2	Falling. Not present		
	Pointing increased	16 to R	10 to R
LEFT			
Amp 2 time sec 22	Nystag. Very active onset	14 to Lt	16 to Lt
	Vertigo. Marked with vomiting	to	to
HEAD BACK	Pointing. Greatly increased		
Amp 2	Falling. Marked to the left		
	Very active reactions	14 to Lt	14 to Lt
			





Case A241430, N.H.W.H., aet 31, Male, Aug. 7, 1917. The patient walked into the clinic without aid. His grandmother was insane and his father a chronic alcoholic. His mother and brother have severe sick headaches. The patient takes no stimulants whatever. He has two children, both of whom, are well. He had a Neisserian infection at fourteen, sixteen and twenty-three years of age.

The clinical history gives the onset of his headaches in August, 1916. Shortly thereafter his left foot became numb, a feeling which gradually extended upwards. He fell down and a convulsion followed. His left leg and arm were cramped badly. He bit his tongue and frothed at the mouth. These spells occurred during the day and lasted about fifteen minutes. The symptoms were always the same and the attacks became more frequent, sometimes coming every day.

The patient has not worked since Dec. 2, 1917, because he feels too weak and has these spells almost daily. There is a tinnitus in his right ear. He has taken bromides for the last few weeks and has not had an attack during this time.

The physical examination reveals a well nourished man weighing 132 pounds, five feet six inches tall. His speech is a little slow. The Romberg is positive. He has bilateral sensitive area in both lower abdominal quadrants. His movements are a little unsteady and he responds slowly. His fundi are normal. The routine urine, blood counts, and blood pressure tests are all normal. A test meal showed free hydrochloric acid of 68 and a combined acid of 14.

A blood Wassermann was negative. The spinal fluid Wassermann in dilutions of .2, .3, .4. and .5 cc. was negative. There was one small lymphocyte, and the Nonne was negative. The stomach roentgenogram was

negative but the head showed a calcified area in the right parietal area. His temperature was normal.

The neurologic examination revealed a spontaneous vertical nystagmus. The pupils were equal and reacted to light and accommodation. The examination of the cranial nerves was otherwise normal. The muscles and all co-ordination tests were normal. The gait was negative. There was a slight Romberg and when standing on one foot, he was unsteady, especially when on the left. He had no tremors. Sensation was entirely normal, as also were the peripheral nerve trunks and the sphincters. The joint sense was greatly reduced in the left foot. As to the reflexes, the Achilles were active, especially on the left. All abdominal reflexes were absent. The plantars were much decreased on the right and absent on the left.

A Barany test was done and as the chart shows we have a spontaneous vertical nystagmus looking up and a nystagmus down upon looking downwards. A spontaneous pointing fault is present with the left arm.

The turning revealed an exaggeration of vertigo. The caloric presents a perverted nystagmus upon stimulation of right and left vertical canals. Also all verticals gave marked vertigo and a pointing fault for the right arm. The horizontal canals showed a pointing fault with the right arm. The perverted nystagmus obtained in this case is due to an interference in the posterior longitudinal bundles. This like almost all similar reactions, shows a partial loss of function rather than a total absence. This disturbed function is typical of the responses due to pressure. There is also a pointing fault for the right arm from all canals. At first glance, this would seem to indicate a cerebellar lesion, because the synergetic movements are controlled by this part of the brain. Such an assumption is wrong in this


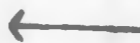


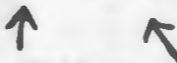

case for two reasons; first because the pointing fault is only with the right arm, and second because stimuli do get through and produce normal past-pointing. This fault therefore, is not due to a cerebellar lesion, but is due to an interference with the tracts leading to the hind-brain. Such an interference is explained by the effect of pressure on the middle cerebellar peduncles.

Here then we have a reaction consisting of exaggerated vertigo throughout all tests, perverted nystagmus from all vertical canals and a pointing fault for the right arm from all the semi-circular canals. A Barany diagnosis was therefore made of a supra-tentorial lesion causing considerable pressure downwards on the peduncles, stem and posterior longitudinal bundles. It was impossible to designate the side.

On Aug. 22, 1918 a large right subtemporal decompression^a was made. The cortex was opened and/diffuse, firm tumor was found in the sensory area of the right hemisphere. It was not encapsulated. Inasmuch as it could not be removed 50 mg. of radium was inserted. The tumor was firm and contained calcium.

EQUILIBRATORY TESTS

R	HEARING	L
	Noise	
Meyers 1	Weber	Meyers 1
	Rinne	
	Wachbach	
	C4	
+	Innitus	+
	Pistol	
	7th	

NYSTAGMUS		SPONTANEOUS		POINTING	
		Shoulder from above		With right	With left
				1 to R	T to
Looking to right	0	Nystagmus		to	to
Looking to left	0	Vertigo			
Looking up	↑	Past pointing			
Looking down	↓	Falling			
		Romberg			
		Head to right			
		Head to left			
		Overthrow			
		TURNING			
Amp 1	TO RIGHT time 25	Nystag	to	to	
		Vertigo	Marked	to	to
		Pointing			
		Falling			
Amp 1	TO LEFT time 22	Nystag	to	to	
		Vertigo	Marked	to	to
		Pointing			
		Falling			
		CALORIC 68° F.			
Amp 1	RIGHT time sec 50	Nystag	Reverted for vertical	T to	2 to R
		Vertigo	Marked	to	to
	HEAD BACK	Pointing	Fault for right arm		
Amp 2		Falling	Normal		
			Point fault for right arm	T to	2 to R
		LEFT			
Amp 1	time sec 50	Nystag	Reverted*	T to	4 to Lt
		Vertigo	Marked	to	to
	HEAD BACK	Pointing	Fault with right arm		
Amp 2		Falling	Normal		
			Pointing fault with right arm	T to	4 to Lt

Case A221019, J. A. M., male, aet 46, Feb. 5, 1918, farmer, married. The family history of this patient was negative in every way. He is rather a nervous individual and has been especially so during the past two years. He sleeps well and uses no stimulant at all except tea once a day. He has one child, seventeen years of age, who is healthy. On Nov. 7, 1916, he had a tumor removed from the back of his right thigh. This tumor was not examined pathologically and after two months his wife threw it away. On Dec. 9, 1917, a second operation was performed in the previous scar, the details of which are uncertain. When twenty-three years of age, he was injured in a railroad wreck and shows three scars on his head as a result. He was unconscious for three hours and was in bed for three or four weeks thereafter. He recovered from his accident without further immediate incident. Early in 1917 he had a fatty tumor removed from right thigh. Also, on Dec. 9, 1917, he had a rectal operation performed to cure his epilepsy.

The patient's clinical history is centered about his epileptic spells. The first attack occurred on Oct. 21, 1917. His first premonition was a temporary blindness, followed by twitching of his eyes. He gave a cry and fell over unconscious. He had a generalized convulsion accompanied by vomiting and frothing at the mouth. He says that he was unconscious for one and one-half hours and awoke very tired and nervous. Frequently his eyes would twitch but he did not become unconscious. He had about fifteen attacks in the last three months. These have become more frequent but less severe. The last one was ten days ago.

Of late his stomach has been upset frequently and patient has belched considerable gas. About Jan. 1, 1918, he had a severe colic for one and one-half hours, during which he had upper abdominal pain associated with

vomiting. No jaundice was noted afterwards. His bowels are regular, his appetite good, and he has no food distress.

The patient complains of having had almost constant severe headaches in back of his head ever since his trouble began. This headache is most intense behind the right ear but frequently is diffuse and bilateral. His vision is not good. He says it is often difficult to find his nose with his finger when it itches. The patient walked to the clinic unaided. He was five feet and nine inches tall and weighed 171 pounds. Four months ago he weighed 200 pounds. There was a scar on his right thigh posteriorly with no signs of recurrence of the former tumor, which probably was a fatty tumor. The rectal and abdominal examination was negative. He had a definite pyorrhea alveolaris. Blood pressure was 108 systolic and seventy-six diastolic.

A twelve hour specimen of 350 c.c. of urine showed a specific gravity of 1021 and was acid in reaction. All other macroscopic and microscopic tests were normal. His blood showed a hemoglobin of 70 per cent. The red count was 4,448,000 and the white was 9,400. The blood Wassermann was negative. Roentgenograms of the head and chest were also negative. His stool examination revealed a few red blood cells and pus cells. No parasites were found. His temperature was 98.6.

All other features of the general physical examination are omitted, as they are negative.

The spinal fluid in dilutions of .2, .3, .4, and .5 c.c. using Naguche and Melange antigen, gave negative Wassermans. There were seven small lymphocytes in the spinal fluid. The Nonne test was negative.

The blood cholesterol estimated in mg. per 100 c.c., in Bloor I was .400 and in Bloor II was .444, a difference of .044.

The vision in the right eye was 6/6 and in the left 6/7. The

pupils were contracted and all reflexes normal. The visual fields were not contracted and the fundi were normal.

Neurologic examination of the cranial nerves revealed that all were normal, except for the fact that the pupils were irregular in contour although about equal in size. The examination of the musculature showed that the grip with his left hand was twenty and with the right twenty-six. The power in the left arm was moderately reduced in comparison with the right, also the power of the left leg was reduced in comparison with the right. The reflexes of the right arm were normal, while on the left they were moderately increased. The upper abdominal reflexes were moderately decreased. The middle abdominal reflexes were both decreased but very much more so on the left than on the right. The lower abdominal reflexes were normal. The knee jerks were both slightly increased, but slightly more so on the left than on the right. The tendon Achilles jerks were also slightly increased, but somewhat more so on the left than on the right. The plantar reflexes were normal.

Sensations as to touch, pain, temperature, joint, tendon and vibration were all about normal. In coordination, especially in the finger-nose test, the responses were both decreased or slightly uncertain, but more so on the left than on the right. The heel-knee-toe reflex was moderately decreased with the left but normal with the right. His station was uncertain on both feet, but much more so when balancing on the left foot than on the right. His gait was normal. He had a moderately static tremor and a slurring speech. His mentality and comprehensiveness were both markedly below normal, the dementia apparently being based upon some organic disease of the brain.

The examinations of the ear, nose, nasopharynx, throat, larynx, and auditory acuity were all normal.

Barany Test.

An examination of the following Barany chart, as used in this clinic, shows that there were no spontaneous pointing faults; that the hearing was normal, and that there was no spontaneous nystagmus. The turning tests were normal in every respect except that the vertigo was unusually marked and was accompanied by much nausea and retching. The caloric test revealed a rotatory nystagmus to the left of moderate amplitude upon stimulation of the right vertical canals in thirty seconds. The vertigo was more than normal, as also were the pointing and falling tests. So also the responses from the right horizontal canal were increased, following the onset of a horizontal nystagmus to the left.

Upon stimulation of the left vertical canals there was a rotatory nystagmus to the right of moderate amplitude in forty seconds. All tests and responses from these canals were exaggerated. Stimulation of the left horizontal canal produced a horizontal nystagmus to the left of moderate amplitude with the accompanying responses exaggerated.







It will therefore be noted that here we have a Barany test characterized by a generalized exaggeration of all responses without any reactions being absent or diminished.

A diagnosis, from the Barany test, of a supra-tentorial lesion was made. It was impossible in this case to name the hemisphere. After a consultation with the neurologists, a final diagnosis of a tumor cerebri located in the right motor area was made and exploration advised.

The surgical card dated Feb. 26, 1918, shows that a brain tumor of about two and one-half inches in diameter was removed, by blunt dissection, from the right fronto-motor area. It was nodular and moderately vascular.

EQUILIBRATORY TESTS

R	HEARING	L
WV	Noise	WV
=	Weber	=
-	Rinne	+
W	Wiedebach	W
W	IC	W
W	C4	W
O	innitus	O
O	Fistul	O
W	7th	W

NYSTAGMUS	SPONTANEOUS		POINTING	
	Shoulder from above		With right	With left
Looking to right 0	Nystagmus		to	to
Looking to left 0	Vertigo		to	to
Looking up 0	Past pointing			
Looking down 0	Falling			
	Romberg			
	Head to right			
	Head to left			
	Overthrow			
TO RIGHT Amp. 2 time 26" 	TURNING Nystag. Marked and pure		to	to
	Vertigo. Marked & nausea and retching		to	to
	Pointing Normal			
	Falling Slight to right			
TO LEFT Amp. 2 time 26" 	Nystag. Marked and pure		to	to
	Vertigo. Marked & nausea and retching		to	to
	Pointing Normal			
	Falling Slight to left			
RIGHT Amp. 2 time sec 30  HEAD BACK Amp. 2 	CALORIC 68°F. Nystag. Marked		12" to R	10" to LT
	Vertigo. Increased from normal		to	to
	Pointing Exaggerated			
	Falling Very marked			
	Responses increased		8 to R	6 to LT
LEFT Amp. 2 time sec 40  HEAD BACK Amp. 2 	Nystag. O.K. moderate amplitude		8 to LT	5 to LT
	Vertigo. Increased		to	to
	Pointing Exaggerated			
	Falling Present			
	Response exaggerated		5 to LT	5 to LT

Case A246431, D.D., female, aet 17, single, Sept. 21, 1918.

This patient entered the clinic walking but she was given assistance in direction by her father. Her family history shows considerable tuberculosis and cancer. Her grandfather and aunt on her mother's side died of tuberculosis. One aunt died of cancer. The grandmother and two sisters on the father's side died of tuberculosis.

The patient enjoyed fair health. She had typhoid fever at six; malaria in 1917 and repeated rheumatic attacks. Her menses began at twelve and were painful. Since nursing at the breast she had attacks simulating petit mal.

Her chief complaint is blindness and headaches. In February 1918, she first noticed that her vision was getting poor and she found difficulty in playing the piano. At this time severe pains in her eyes appeared in conjunction with severe right fronto-temporal headaches. Photophobia was marked. She frequently vomited when the headaches were severe, but it was not of projectile type. Headaches were relieved by lying down and closing her eyes. Sight began to rapidly disappear and was gone in ten days. The right eye had always pained her most and her sight disappeared in that eye first. At present she can only see bright lights at night. The above mentioned petit mal attacks now occur two or three times daily. Patient is rapidly gaining in weight; her entire family is inclined towards obesity. One brother weighs 315 pounds. She was a seven months child. Her weight is 227 pounds. She is five feet and eight inches tall.

The physical examination was normal with but few exceptions. Her entire abdomen was tender to touch. The eyes showed a doubtful light perception in the right. The disks have swollen margins with complete secondary atrophy of the nerve heads. Vitreous contains many small stringy floating opacities from a low grade uveitis. The blood Wassermann is di-

lutions of .3 and .4 c.c. were negative. Vaginal smear showed gonococci.

A roentgenogram of the head showed a calcified area in the right temporal region with evidence of intra-cranial pressure. There was a trace of albuminuria and her white count was 14,000. The other routine tests, as blood pressure, etc., were normal.

The neurologic examination of the cranial nerves was negative except the following: vision was absent; there was a bilateral spontaneous nystagmus of the horizontal type; the pupils were large and equal.

Speech was undisturbed. Her intelligence was slightly decreased and she cooperated poorly. The usual neurologic tests of the muscles and coordination were normal on both sides except a possible decrease in diadokokinesia. Her gait was of the blind type. Station was normal except slightly decreased when standing on one foot. There were no tremors. Sensation on both sides was normal except a bilateral hyper-acuteness upon pressure.

The patellar reflexes were absent but when reinforced were only slightly decreased. Achilles jerk was moderately reduced. All other reflexes were normal. The peripheral nerve trunks, sphincters, etc., were also normal.

The Barany test is reproduced here. Turning was not done because of the patient's physical condition. There was a spontaneous bilateral horizontal nystagmus. The hearing tests showed the high fork slightly reduced as also was the Schwabach test. The pointing was normal.

Analyzing the caloric test we noted a prompt response in the nystagmus from all vertical canals. Vertigo was exaggerated in both instances but much more on the left side than on the right. The pointing tests were questionable chiefly because the patient complained of her vertigo and her cooperation was poor. However, a response with the left hand came through upon stimulation of the right horizontal canal and this eliminates the cerebellum. Upon testing the left canals there was a tendency to hold the eyes to the left.

The questionable pointing tests obtained from all the left semi-circular canals is entirely due to the poor cooperation of the patient. The right cerebellum is considered normal, because a normal reaction is obtained. The Barany test shows, therefore, prompt nystagmus associated with exaggerated vertigo, falling, conjugate deviation of the eyes, and pointing faults.

The Barany diagnosis was, therefore, that both the stem and middle cerebellar peduncles show the effect, more on the left, of pressure from a supra-tentorial tumor.

Here we have a case showing a positive roentgenogram, eye findings and a Barany test indicating a brain lesion, with the former and latter indicating a supra-tentorial lesion.

On Nov. 1, 1918, a large subtemporal decompression was done on the right side. One inch below the surface a mass was found in the right cerebral hemisphere which contained a yellow mucilaginous fluid. The tumor was not encapsulated and hence enucleation was not attempted. The patient recovered and went home.

Case A224782, E. S., female, aet 7, Mar. 11, 1918. This patient walked into the clinic without ail. She was the second child of a large family. She had scarletina at three, pertussis at five, measles and chicken pox in February, 1918. Her early childhood and development were entirely normal.

Her chief complaint, that of bilateral frontal headache, had begun in August, 1917. At that time she was dazed for ten minutes. Two months later the headaches were more frequent and severe. They were also accompanied by vomiting of the projectile type. Vision in the right eye had been failing. A choked disk had been diagnosed in December, 1917.

The right eye showed a vision of 20/200. Both fundi presented choked disks of $1\frac{1}{2}$ diopters accompanied by marked neuroretinitis.

The routine blood counts and urine tests were normal, as was the rest of the physical examination. Her temperature was normal.

Blood Wassermanns on the child and both parents were negative. The vonPirquet was likewise normal. A roentgenogram of the head did not give any aid.

The neurologic examination revealed a slight tremor in the finger-nose test. Her mentality was good. This examination was negative in every respect.

A Barany test revealed active nystagmus upon turning with the absence of vertigo. The caloric test of the right canals showed an absence of vertigo and falling. On the left, however, an absence of nystagmus was obtained from the vertical canals accompanied by the absence of vertigo and falling. There was also a pointing fault for both arms. The right horizontal tract responded in a normal manner. In view of the active nystagmus

on turning, the entire absence of vertigo and falling, and the absence of nystagmus from the caloric stimulation of the left vertical canals, a diagnosis was made of pressure from above, upon the mid-stem region especially on the left, accompanied by a disturbance in the cerebellar tracts in the middle cerebellar peduncle on the left.

A summary of the entire case revealed the pressure of an intracranial lesion without localizing signs. On account of the few findings present, it was decided to do a lumbar puncture every three to five days withdrawing 8 to 15 c.c. of fluid. Within a few hours after each puncture the fundi were examined.

The therapy did little good and the choked disks did not change. It was then decided to do a right subtemporal decompression and exploration. This was done on April 1, 1918. No tumor was found.

The patient did not improve and on Sept. 19, 1918, she returned to the clinic. It was stated that she inclined towards the left in walking or sitting. She had involuntaries upon awakening in the morning and upon arising would tend to fall backwards. She also had tinnitus in the right ear, and had had one spell of unconsciousness in October, after which her right hand felt numb. No loss of motion was noted but she felt dopy all that day.

A complete physical and neurologic examination, including the eye grounds, added nothing to the above described findings.

A second Barany test was done which presented very definite changes from the first. There was now a spontaneous bilateral horizontal nystagmus and vertical nystagmus upon looking up. A spontaneous pointing fault with the left arm was also found. The right canals, upon turning, gave a perverted nystagmus composed of a rotatory and horizontal nystagmus accompanied by a vertical nystagmus. There was also conjugate deviation of the eyes. There was falling to the right without subjective vertigo.

Upon turning to the left a perverted nystagmus consisting of a rotatory and horizontal nystagmus to the right was noted. The patient presented falling to the right.

By stimulating the right vertical canals with cold water, a perverted nystagmus occurred in fifty seconds consisting of a vertical and a left rotatory nystagmus. The stimulation of the horizontal canal produced a rotatory nystagmus to the left and conjugate deviation. There were also pointing faults with both hands in each case.

When the left verticals were similarly stimulated a perverted nystagmus began almost at once, consisting of a vertical, horizontal and rotatory nystagmus to the left. There was no nystagmus found upon stimulation of the horizontal canal. There was no subjective vertigo or falling. A pointing fault with both hands occurred when the horizontal canal was activated.

These two Barany tests are most interesting to study. The second one shows very definitely the effect of prolonged and increased pressure on the stem, posterior longitudinal bundles and on the middle cerebellar peduncles. The pressure was more intense on the right side as evidenced by the perverted nystagmus and conjugate deviation, which only occurred on the right side. This effect was also evidenced by the fact that the middle cerebellar peduncle on the right was interfered with to the extent that stimuli did not get through to the cerebellum. Evidences of marked pressure signs appear throughout both Barany tests, especially the last one.

A diagnosis, from the Barany, was now made of a lesion in the right cerebral hemisphere causing great pressure downward.

In this very interesting case the data at hand consisted of a double choked disk; intracranial signs of increased pressure without localiz-

ing signs; a negative right cerebrum by exploration and lastly a very positive Barany localizing a lesion in the right side of the cerebrum.

After considerable thought a cerebellar decompression was done on Sept. 20, 1918. This exploration revealed nothing, so only a simple decompression was performed.

The patient died on Sept. 22, 1918, of a bilateral lobar pneumonia. The necropsy revealed a glioma of the right frontal lobe measuring 6 by 8 by 5 cm., just anterior to the explored area. A picture of the brain with the tumor and a photomicrograph are reproduced.

EQUILIBRATORY TESTS

R	HEARING	L
Normal	Noise	Normal
	Weber	
	Rinne	
	Schwabach	
	C	
	C4	
	innitus	
	Fistula	
	7th	

First Barany.

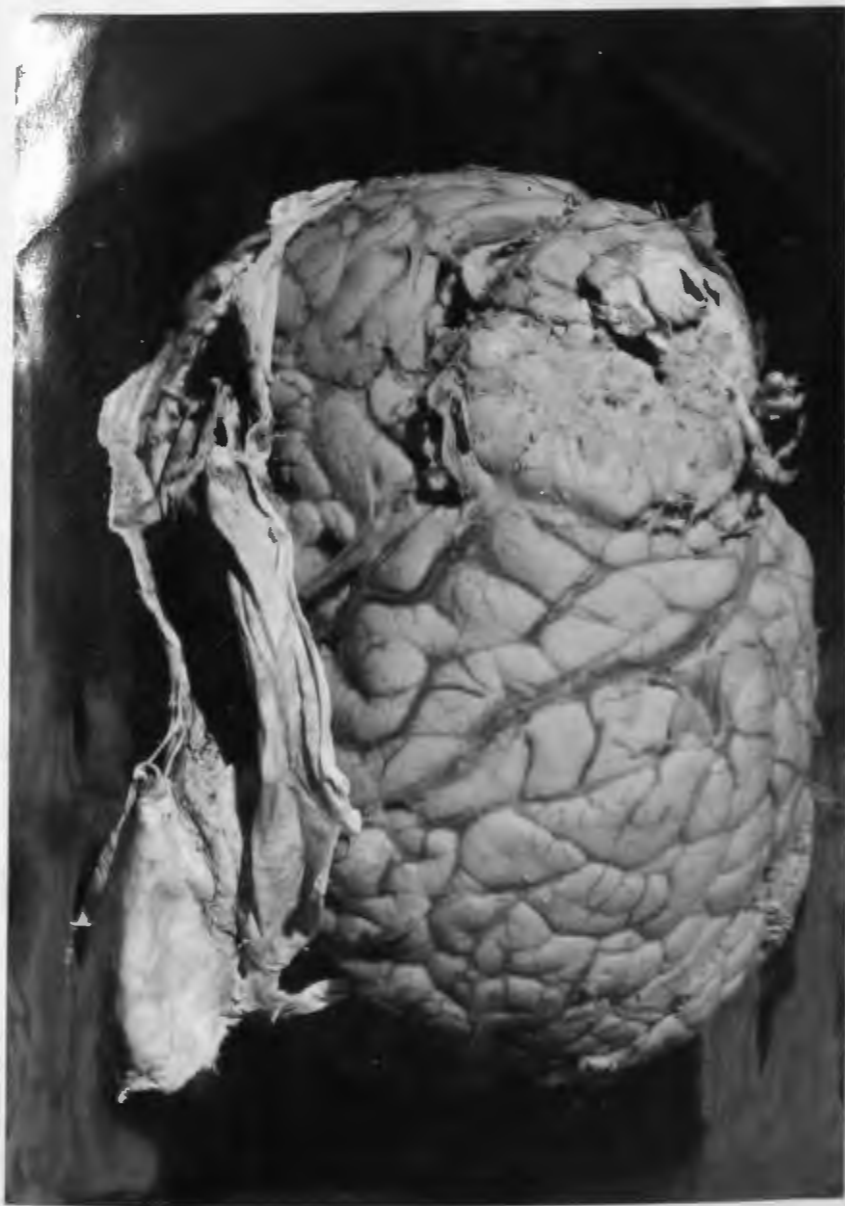
NYSTAGMUS	SPONTANEOUS	POINTING	
	Shoulder from above	With right	With left
Looking to right 0	Nystagmus	T to	T to
Looking to left 0	Vertigo	to	to
Looking up 0	Past pointing		
Looking down 0	Falling		
	Romberg		
	Head to right		
	Head to left		
	Overthrow		
TO RIGHT	TURNING		
Amp 1 time 15"	Nystag Rapid onset	to	to
→	Vertigo Absent	to	to
	Pointing		
	Falling		
TO LEFT	CALORIC 68° F.		
Amp 1 time 16"	Nystag Rapid onset	to	to
←	Vertigo Absent	to	to
	Pointing		
	Falling		
RIGHT	HEAD BACK		
Amp 1 time 1° sec	Nystag Normal	3 to R	2 to R
↻	Vertigo None	to	to
HEAD BACK	Pointing Normal		
Amp 1	Falling Not present	2 to R	2 to R
→	Normal		
LEFT			
Amp time 4' sec	Nystag None in 4 minutes	T to	T to
↻	Vertigo Absent	to	to
Only jerks	Pointing Fault with both arms		
HEAD BACK	Falling Not present	4 to Lt	3 to Lt
Amp	Normal		
←			

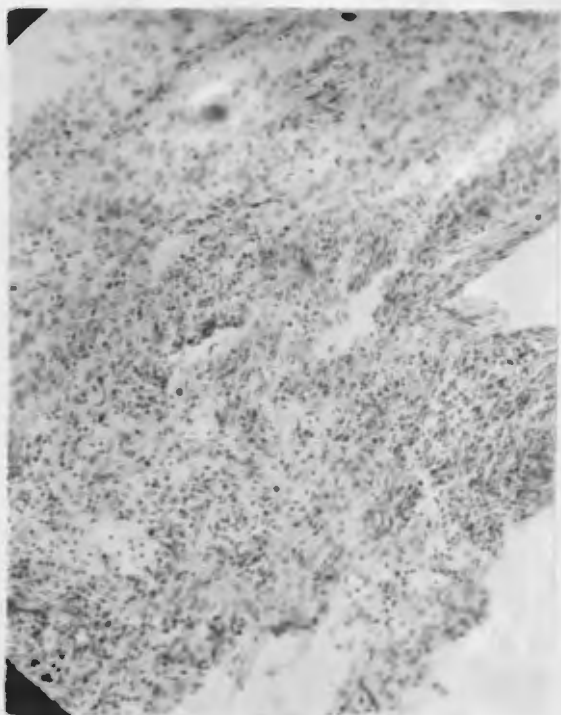
EQUILIBRATORY TESTS

R	HEARING	L
.....	Noise.....
.....	Weber.....
.....	Rinne.....
.....	Schwabach.....
.....	C.....
.....	C4.....
.....	innitus.....
.....	Fistula.....
.....	7th.....

(Second Barany)

NYSTAGMUS	SPONTANEOUS	POINTING	
	Shoulder from above	With right	With left
Looking to right.	Nystagmus.....	2 to Lt	T to
Looking to left.	Vertigo.....	to	to
Looking up.	Past pointing.....		
Looking down.	Falling.....		
	Romberg.....		
	Head to right.....		
	Head to left.....		
	Overthrow.....		
TO RIGHT	TURNING		
Amp. 2 time 30	Nystag. Rt. rotary and horizontal also vertical		
	Vertigo. None		
Conjugate deviation	Pointing.....		
TO LEFT	Falling..... To right		
Amp. time 25"	Nystag. Perverted		
	Vertigo.....		
	Pointing.....		
	Falling..... To right		
RIGHT	CALORIC 68° F.		
Amp. 2 time sec 50	Nystag. Perverted	T to	T to
	Vertigo. None	to	to
HEAD BACK	Pointing. Faults with both arms		
Amp.....	Falling. None	T to	T to
Tendency to conjugate deviation			
LEFT			
Amp. 2 time sec	Nystag. Perverted	2 to Lt	1 to Lt
	Vertigo. None	to	to
HEAD BACK	Pointing. Reduced		
Amp.....	Falling. None	T to	T to
None	Pointing faults with both arms.		





Case A248887, E.B., aet 32, Oct. 16, 1918. The patient's family history is not of importance. He was a steady alcoholic until March, 1918.

His health was good until March, 1918, when he had severe occipital headaches, more marked on the right side. They were often accompanied by vomiting. In April, 1918, he first developed a progressive weakness in his left arm which went to his left leg. In June, 1918, he had a left facial paralysis. His weakness has gradually increased up to this date.

His physical examination was not of great importance. The blood pressure, urine, and blood counts were normal. The blood Wassermann was negative, as was the spinal fluid Wassermann with .3 and .4 c.c. There was one lymphocyte; its Nonne was negative. The roentgenogram showed a very large sella and apparently a calcified pineal body. There was no choked disk.

The neurologic examination showed all the cranial nerves to be normal except that the pupillary reflexes were slow, there was a facial paralysis on the left, and a decreased amplitude of movement in the left eye. Speech was slow. His mental condition revealed a marked decrease in intelligence, memory, attention, and cooperation. The muscle tests were all normal on the right side. On the left the muscle test showed a marked decrease in strength, tonus, speed and amplitude. There was no atrophy or fibrillary twitching. The coordination tests showed a marked decrease in the finger-nose test on the left and a slight bilateral decrease in the heel-knee-toe test. His gait was that of a man with a left sided hemiplegia. There was no tremor.

A Barany test was done and upon study we note a generalized hyper activity of responses throughout, except the nystagmus from the right verticals. It is noted that, upon turning, the responses of nystagmus is of

decreased duration. The calori shows an absence of nystagmus upon stimulation of the right vertical canals for three minutes; this is accounted for on the basis of pressure from above. Likewise, the effect of pressure from above explains the absence of falling, and the slightly reduced vertigo. The left vertical canals presented normal nystagmus time, but vertigo was markedly increased, and associated with vomiting, thus giving evidence of exaggerated responses. Likewise, falling was to the left. Pointing was normal for all canals with the right arm, but absent with the left due to the hemiplegia. There is present, therefore, exaggerated responses especially on the left, with pressure effect on the left brain stem. This, in the presence of a definite hemiplegia, makes the diagnosis absolute. The Barany report was the presence of a supra-tentorial lesion in the right cerebral hemisphere.

On Oct. 26, 1918, a cyst was removed from the right fronto-motor area. The microscopic diagnosis showed the tissue to be that of a smooth walled cyst. A photograph of the cyst is here reproduced.

EQUILIBRATORY TESTS

R	HEARING	L
WV	Noise	WV
-	Weber	=
+	Rinne	+
-5	Schwabach	-5
n	C	n
n	C1	n
+	annitus	+
o	Fistula	o
o	7th	+

NYSTAGMUS	SPONTANEOUS	POINTING	
	Shoulder from above	With right	With left
Looking to right 0	Nystagmus	T. to	to
Looking to left 0	Vertigo	to	to
Looking up 0	Past pointing		Paralysis
Looking down 0	Falling		
	Romberg		
	Head to right		
	Head to left		
	Overthrow		
	TURNING		
TO RIGHT	Nystag	to	to
Amp. 2 time 16	Vertigo 17"	to	to
→	Pointing		
	Falling		
TO LEFT	Nystag	to	to
Amp. 2 time 17	Vertigo 17"	to	to
←	Pointing		
	Falling		
	CALORIC 68° F.		
RIGHT	Nystag Absent	4 to R	to
Amp. 0 time 3 sec	Vertigo Present	to	to
0	Pointing O.K. with right		Paralysis
HEAD BACK	Falling Not present	4 to R	to
Amp 1			
→			
LEFT	Nystag Hyperactive	6 to Lt.	to
Amp 1 time 1 sec 00	Vertigo Marked with vomiting	to	to
↶	Pointing O.K. with right		Paralysis
HEAD BACK	Falling To left	8 to Lt.	to
Amp 2	Hyperactive		
←			



Case A308888, N.K., aet 10, March 16, 1920. The patient's family history is unimportant. He had two tonsil and adenoid operations. The patient was well until October, 1918. After a walk in the woods he developed a headache, and that evening had convulsions which continued several hours until chloroform was given. Convulsions were marked on the right side. Occasional spells of unconsciousness occurred every week or two. In March, 1919, following a blood test, he had several Salvarsan injections, followed by iodides and bromides. He was entirely free from trouble for two months last fall. In December, 1919, he had attacks of headaches followed by unconsciousness. About six weeks ago he had a pain in the right leg which lasted several hours. In February, 1920, his father noticed a definite weakness of the right arm and leg. The patient limped when he walked. Of late convulsions have become more frequent and severe. The right side is affected most. He has been unable to walk for the past week. The muscles of the right side of his face twitch.

The physical examination, including the laboratory tests, shows only a choked disk of three diopters in the left eye, and two diopters in the right. All other findings were negative.

A neurologic examination revealed that there was only a very slight change from the normal in all the tests of the cranial nerves. The exceptions are the double choked disk, and the slight ptosis and strabismus in the left eye. The seventh nerve showed a moderate decrease in the forehead and mouth muscles on the right side. The trapezius muscle on the right was moderately reduced in strength and tonus. Speech was markedly reduced, he only occasionally could repeat words or call a pencil or pen when handed him. Motor aphasia was marked. The muscular tests were normal on the left, but there was a marked and uniform decrease in speed, tonus and strength of all muscles on the right side. All coordination tests were normal with the left arm, but

were impossible to do with the right arm due to the hemiplegia. Station was decreased with the right leg. There was no Romberg. No tremors were present.

A study of the accompanying Barany chart reveals normal hearing, and no spontaneous nystagmus. Pointing was impossible with the right arm due to the hemiplegia. There was a pointing fault with the left arm. The turning test showed a wide nystagmus in each case of 35 seconds duration. Vertigo was present.

The caloric test of the right vertical canals showed a mixed type of rotatory and horizontal nystagmus to the left, which were of wide amplitude. Vertigo was exaggerated, as were the pointing tests for the left arm. The hemiplegia made all pointing tests with the left arm impossible. The right horizontal canal showed a horizontal nystagmus to the left of wide amplitude with exaggerated past-pointing with the left arm. The stimulation of the left vertical canals with cold water revealed a rotatory nystagmus to the right of wide amplitude, and of very prompt onset. Vertigo and past-pointing were exaggerated. Stimulation of the left horizontal canal revealed increased vertigo and past-pointing. The eyes throughout remained turned to the left.

In this case we have, therefore, a very early onset of nystagmus with exaggerated vertigo and past-pointing, associated with definite disturbance in the ocular tracts and a right sided hemiplegia. Here there is definite evidence of increased intra-cranial pressure on the posterior longitudinal bundles, resulting in the unusual eye reaction. The cerebellum was entirely normal, as there was no pointing fault, in fact they were exaggerated. Stimuli passed through the stem and all peduncles freely.

A Barany diagnosis was therefore made of a supra-tentorial tumor in the left hemisphere.







This patient was operated on Mar. 15, 1920, and a large tumor was partially removed from the surface of the left temporo-parietal lobe, posterior to the fissure of Rolando. The tumor was not encapsulated, and it was impossible to remove the entire tumor.

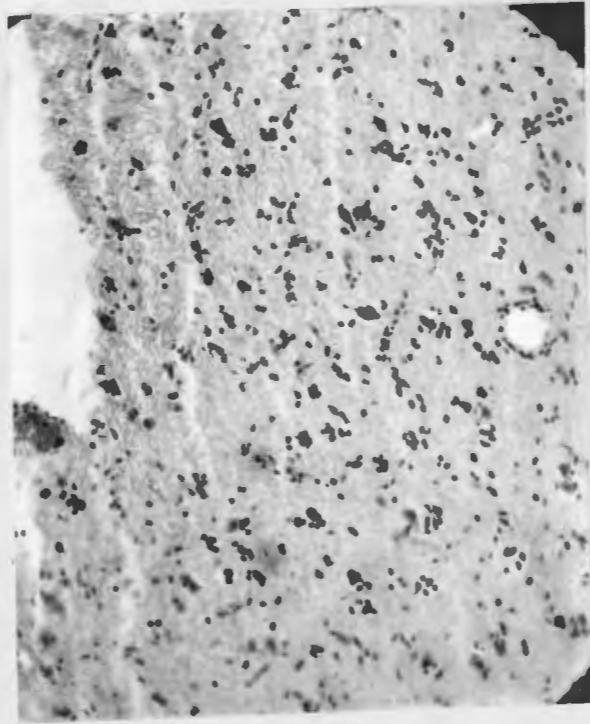
The tumor removed measured 5 by 4 by 3 cm. and the pathologic report was a glioma. A photo-micrograph is reproduced.

EQUILIBRATORY TESTS

R	HEARING	L
WV	Noise	WV
n	Weber	n
n	Rinne	n
	Schwabach	
n	C	n
o	C4	o
o	innitus	o
o	Fistula	o
	.7th	

Unable to turn eyes upwards or to right.

NYSTAGMUS	SPONTANEOUS		POINTING	
	Shoulder from above		With right	With left
Looking to right... 0			to	2 to t
Looking to left... 0	Nystagmus		to	to
Looking up... 0	Vertigo			Paralysis
Looking down... 0	Past pointing			
	Falling			
	Romberg			
	Head to right			
	Head to left			
	Overthrow			
TO RIGHT	TURNING			
Amp 1 time 35	Nystag Wide amplitude		to	to
	Vertigo Present		to	to
	Pointing			
	Falling			
TO LEFT	CALORIC 68° F.			
Amp 1 time 35	Nystag Wide amplitude		to	Paralysis to R
	Vertigo Present		to	to
	Pointing			
	Falling			
RIGHT	Nystag Wide amplitude prompt onset			Paralysis 5 to R
Amp 2 time 45	Vertigo Increased over normal		to	to
	Pointing Absent with right			
HEAD BACK	Falling Not induced			
Amp 2	Eyes turned to left throughout		to	10 to R
				
LEFT	Nystag Prompt onset			Paralysis to Lt
Amp 2 time 43	Vertigo Increased over normal		to	to
	Pointing Absent with right			
HEAD BACK	Falling Not induced			
Amp 2	Eyes turned to left throughout		to	8 to Lt
				



Discussion

The above nine cases of proven tumors above the tentorium, all of which were primarily and independently diagnosed by the Barany test, present many interesting features for study.

In general, there are two large groups of phenomenon-complexes which are typical of supra-tentorial tumors. The first group shows a very clearly and marked response of nystagmus, vertigo, falling and past-pointing. If the lesion is near the surface in one cerebral hemisphere this reaction will be on the side of the lesion. Such a unilateral activity of all responses cannot present any difficulty in the localization of the lesion. The second large group of cases are those which, while not so common, are just as typical of cerebral tumors as is the first group. In this class we have a very early and active response of the nystagmus from one set of canals only, associated with an interference with the tracts in the stem or peduncles, giving rise to diminished responses or to absence of the responses ordinarily attributed to these areas. In other words, the predominating feature, aside from an early and exaggerated nystagmus, may be those responses due to pressure. It has long been a fact that the pressure of these tumors frequently present the only signs and symptoms of an intra-cranial lesion. Choked disk and enlargement or obliteration of the sella are two notable examples which have little to do with the location of a brain lesion, but which are due to the increased intra-cranial pressure. So too, the Barany test may show an apparent predominance of responses ordinarily attributed to the stem or peduncles which yet, with an exaggerated nystagmus, are due to pressure.

Furthermore, these pressure responses may be on the same side or on the opposite side of the lesion. So also, with an exaggerated and early response of nystagmus, a Barany test may reveal only these responses ordinarily attributed to a fault in the cerebellum, yet this latter response is entirely due to the pressure effects on the tracts leading to the hind-brain. This effect of pressure may be so marked that a pointing fault may be obtained for both arms from all the canals on one side, but, as a rule, by prolonged stimulation it is possible in these cases to get a stimulation through and thus obtain normal post-pointing from one or both arms.

It is noteworthy, as in one case given above, that the Barany test is frequently the only test or group of tests, which localize an intracranial lesion. While this is perfectly true, it is a colossal error for anyone doing such tests to be independent of all other factors in a case. It is frequently of the highest value to establish close cooperation with the neurologist after the Barany diagnosis has been made.

There is another interesting observation noted in an experience of over fifty Barany tests indicating supra-tentorial lesions, which may explain the absence or predominance of pressure-phenomena attributed to pressure associated with cerebral lesions in different areas. In lesions on or near the surface of the cerebrum, the Barany usually shows all responses exaggerated, with little or no pressure-phenomena. On the other hand, lesions deep in the cortex usually show but slightly exaggerated responses, associated with marked reduction of other responses due to pressure. This observation, while very striking, is not conclusive. Many Barany tests can more easily be explained along this theory than by any other. Some of the cases presented here exemplify this observation.

In order to make clear the relative position of the Barany in the tumors localized in the cerebrum, it will only be necessary to state that the diagnosis of the location of an intra-cranial lesion by this test is considered as only one of a chain of evidence when the final diagnosis is determined by the neurologist. Hence, the final location of such a tumor is made by the neurologist, who considers all symptoms and signs including the Barany test.

One must also make himself acquainted with the operative and necropsy findings, to check up on Barany responses which apparently do not fit, or which at least make the exact localization of a lesion difficult.

Conclusions.

It is realized that conclusions drawn from nine proven cases of supra-tentorial tumors are not sufficient to settle for all time, the relation of the Barany test to lesions above the stem. These cases, however, do indicate the following conclusions.

1. A phenomenon-complex consisting of exaggerated nystagmus, vertigo, falling and past-pointing establishes a Barany diagnosis of a supra-tentorial lesion.
2. The more typical reactions may be complicated by response due to pressure.
3. Variation in the responses may depend upon the location of the lesion within the cerebrum.
4. Study of the operative and necropsy findings will materially aid one to correctly interpret subsequent responses due to a supra-tentorial tumor.
5. The ear tests add important and frequently definite localizing information but the final disposition of a given case must result from the consideration of the sum total of information.
6. The results so far warrant further study in this direction.

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