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TESTS BY THE BARANAY METHOD*

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Robert Baranay, of Vienna, won the Nobel prize by his extensive demonstration of the relation to clinical medicine of the vestibular tests. But to a group of Americans belongs the credit for bringing the work out of chaos and clarifying it so that a man of ordinary brains may understand the subject and apply it to his work. This group is composed of Drs. Jones, Fisher, Randall, Mills, Weisenburg and Brumm, of the University of Pennsylvania, and Major Eugene Lewis, M.R.C., U. S.A.

As a disciple of the Neuro-otological Department of the University, I wish to present to the Section for consideration their teachings.

ANATOMY

The labyrinth is as a rule looked upon by the medical profession as something beyond the conception of a human mind, but if you forget all you have tried to remember about it, and consider it as three canals and two reservoirs containing a fluid capable of being set in motion and supplied with nerves of a special sense

ability, you will have a working basis of the anatomy. The horizontal canal is in the horizontal plane of space and the remaining two are in the vertical plane set at right angles to each other. This arrangement presumes that the head is held in the proper position, which is 30° lower than the usual position. The eighth cranial nerve is divided into two branches, the cochlear and the vestibular, and from the latter are derived the nerve fibres to the labyrinth. "The fibres from the horizontal semicircular canal pass through the eighth nerve to the brain stem and enter Deiter's nucleus in the medulla oblongata. At this nucleus the fibres divide, going on the one hand to the posterior longitudinal bundle, through which they are connected with the various eye muscle nuclei, to be distributed through the third, fourth and sixth nerves to the eye muscles themselves. It is this pathway that is responsible for the eye movement. The other pathway goes from Deiter's nucleus through the inferior cerebellar peduncle to the cerebellar nuclei of the same side, from which it proceeds through the right superior cerebellar peduncle to the decussation of the two superior cerebellar peduncles in the base of the cerebral crura; from this point there are two pathways to the cerebral cortex of both sides, but the main pathway goes to the cortex of the opposite side. The cortical centres that receive these fibres are postulated by Mills to be in the posterior portion of the second temporal convolutions adjacent to the cortical areas for hearing. It is this pathway from the horizontal canal to the cerebral cortex, passing through the cerebellum, that is responsible for the production of vertigo on ear stimulation. The fibres from the vertical semicircular canals have a different pathway after entering the brain-stem, ascending in the pons to a point above the middle of the pons. At this point the fibres divide, on the one hand going to the posterior longitudinal bundle, to be distributed to the eye muscles; on the other hand the fibres enter the cerebellar nuclei through the middle cerebellar peduncle, from which point their pathway is the same as that of the fibres from the horizontal canal. In a nutshell, by the vestibular apparatus we

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mean the static portions of the internal ears, and the pathways from the ears through the brain stem, cerebellum and cerebrum. The nerves from the horizontal canal ascend through the medulla in a different path from the combined fibres of the two vertical canals."—(Drs. Jones and Fisher.) The principal differences are that their courses differ after entering the medulla and likewise their entrance into the cerebellum is through different pathways.

PHYSIOLOGY

When the fluid in the canals has been set in motion either by rotation of the body or by the "thermosyphon" action of change of temperature of the fluid, it will move the cilia processes of the contained nerve fibres which will send a stimulus to the brain. The brain has learned to interpret this in such a manner as to recognize what change of position has occurred and the present position of the head. This ability of orientation we now consider as a special sense and in conjunction with the knowledge obtained from vision and muscle sense it composes the system of equilibrium. Two reactions occur because of these stimulations, a definite movement of the eyes and the sensation of vertigo. We can see the former, but must rely upon the statement of the patient for the latter or else measure it by the two phenomena produced (past-pointing or falling).

The movements of the eyes are called nystagmus and consist of two parts, a slow movement which is always in the direction of the endolymph flow and a rapid movement jerking the eyes back from their newly acquired position. There have been some unnecessary complications attached to these movements by misnaming them in their early work. The slow movement is caused by the flow of the lymph and is the real nystagmus, while the rapid movement is only an attempt upon the part of the cerebrum to correct the disturbed ocular position. The other reaction, vertigo, is in the opposite direction from the flow. Hence when the patient attempts to point he presumes that he has moved in a direction opposite from that of the endolymph flow and in his endeavor to touch the point correctly, will pass be-

yond the point and this direction coincides with the endolymph flow. Two general rules are all one has to remember of the physiology of the labyrinth reactions:

1. The slow movements of the eyes and the past-pointing are in the direction of the endolymph flow.
2. The sensation of vertigo is in the opposite direction to the endolymph flow.

TESTS

A thorough examination of the nose, throat, tonsils and sinuses is made and recorded for further use in the consideration of any pathology afterward located. The usual ear tests are made to determine the condition of the vestibular branch of the eighth nerve. In order to determine the condition of the labyrinth system as a unit we have the rotation tests; and in order to test each canal separately, we have the caloric or douching tests. We first determine if there is any spontaneous nystagmus or if it may be produced by the changing of the position of the eyes. This is best made by having the patient fix his vision on a distant object and turning him first to the left (eyes go to the right) then to the right. Next, while retaining the position of the head, have him look up as high as he can and then down at the floor in front of him. The rotation test is made by placing the patient in the Pennsylvania chair, adjusting his head properly (30° incline forward) and having him close his eyes. Then the patient is turned to the right ten times in twenty seconds and brought to a stop. He is commanded to open his eyes and fix his vision on a distant object, still retaining the correct position of the head. A stop-watch is the only reliable means of timing the duration of the nystagmus. We observe the slow component and the fast component, as likewise their amplitude. The patient is turned in the opposite direction ten times in twenty seconds and the same observations made. The correct number of seconds for the nystagmus is twenty-six seconds. Next the patient is demonstrated the proper way to test the touching and his spontaneous touching is recorded.

With the eyes closed the patient is turned to the right ten times in as many

seconds, which is twice the rate of the previous turning, and brought to a fixed stop. His touching is rapidly tested, first his right, then his left, and back and forth until he touches with both hands. These are recorded in inches to the right or left, as he missed to the right or to the left. The tests are again repeated after he is turned in the opposite direction.

The douching tests are made by having the patient sit in the chair with the head in the proper position and the ears are irrigated with water at 68° F. With the stop-watch the time is estimated from the beginning of the flow until the first twitch occurs. This is noted as the time necessary for the production of the nystagmus and should be 40 seconds. We allow the water to flow a while longer in order that the labyrinth may be thoroughly cooled. A notation of the character of the nystagmus is made and the patient told to close his eyes. His touching is again tested, noting the direction and distance of his miss. These tests are for the vertical canals.

The position of the patient's head is changed so that the horizontal canals may come into the vertical planes and this is obtained by having the patient's head held 60° backward. The nystagmus is noted as to direction and amplitude. He is again told to close his eyes and the past-pointing tested of the horizontal canals. When the horizontal canals cause the nystagmus the directions of the movements are in the same plane of space as the canals at present are in; that is, when the canals are horizontal they are in the horizontal, and when the canals are in the vertical plane they are from side to side.

INTERPRETATION OF THE REACTIONS

The interpretation of the reactions requires a consideration of all the possibilities that may produce such a deviation from the normal and necessitate experience and an analytical mind. But certain little rules may be used to help the beginner.—(Drs. Jones and Fisher.)

1. *Peripheral Lesions.*

- (a) An impairment of the function of both the auditory and vestibular branches. If this impairment is proportional it is the more decisive.
- (b) Tinnitus. History of presence.

- (c) Proportional impairment of the responses from both the horizontal and vertical canals.

- (d) Proportional impairment of vertigo and nystagmus.

2. *Central Lesions.*

- (a) A normal cochlear, but impaired or non-responsive semicircular canal.

- (b) Normal response from horizontal, but not from vertical canals, or vice versa.

- (c) Normal nystagmus, but impaired vertigo from the same canal, or vice versa.

- (d) Normal vertigo and nystagmus from the same canal, but impaired past-pointing in any direction of an extremity.

- (e) Spontaneous vertical nystagmus is pathognomonic of brain-stem lesion.

APPLICATION OF THE TESTS

1. To the general practitioner these tests are a means of determining the cause of his patient's vertigo. He may have the same confidence to continue treatment along a definite line after the tests have made a diagnosis of functional or organic vertigo just as he has to carry on strenuous anti-syphilitic treatment after a positive Wassermann. It is a great satisfaction to tell a patient suffering from vertigo that you are sure that he is not afflicted with a brain tumor or any other serious nervous disease, but that he is only disturbed because of some circulating toxin.

2. How often after testing the patient with the forks, Gaulton whistle and the whispered voice you are unable to tell him definitely whether or not he has a nerve deafness or only a chronic salpingitis of the Eustachian tubes? In these cases a simple appliance of the turning tests alone or the complete tests will give you data of sufficient security to tell the patient whether or not his vestibular nerve is involved. Because we can locate an involvement of the end-organ and the vestibular branch of the eighth nerve and the neurologists tell us that a peripheral neuritis is not liable to select a branch of a peripheral nerve, but rather include the entire nerve. But still more important in clearing up the diagnosis are the tests after a mastoid operation, when the

complex of symptoms points to a brain abscess or suppurative labyrinthitis.

3. Sometimes before the Wassermann test has developed, by a careful comparison of the daily tests we are able to diagnose the syphilitic character of a lesion. For in the early days of the infection we have a consistent shortening of the vestibular reactions. In the early meta-syphilitic conditions we also have a valuable means at our disposal of apprehending nerve degeneration by testing the nerve pathways involved in these reactions.

4. The eye man may use the nystagmus movements to determine the nerve control of the endolymph in the right horizontal recently a young girl, aged three, who, after a decompression operation for fracture of the vault of the skull, presented an internal strabismus of the eye of the same side. I was able by douching with cold water the ear of the same side to test the nerve supply of the external rectus. It failed to be drawn to the right while the eye of the opposite side came over to the right. This satisfied me that she had a paralysis of the sixth nerve. As time passed by, a repetition of the tests showed the returning enervation to the muscle until finally the right eye would move to the right upon producing a flow of the eye muscles. For instance, I had canal to the right.

5. A proper conception of the tests and their scope is indispensable to a modern neurologist. For here he has a means of determining whether a lesion is intracranial or peripheral. Also he is able definitely to localize lesions in the medulla, pons, cerebellum and cerebrum by tracing these nerve impulses through the various nerve tracts traveled by the impulses either as efferent or afferent. He is able to ascertain the cause for the patient's staggering and as applies to the ear tests, it gives him a solid foundation upon which to build his opinion.

6. Last but not least is the part these tests are playing in the selection of the "bird-men." When a man is in the air he depends upon his equilibrium sense to steady his machine and prevent accidents. This sense being derived from a combination of the impressions obtained from his sight, muscle-sense and labyrinth, we find

that when he is up in the clouds, the first two are of very little or no value to him and upon the third he is wholly dependable. So before the "would-be aviator" is accepted, we test very carefully his labyrinth and its nerve tracts. If he is subnormal we make sure there is no loss of this new sense before he is accepted, or in the face of a serious disturbance of it we flatly reject him. America was first to test her bird-men thusly, but now a commission is going over to establish these same units in the schools of the Allies.

CONCLUSION

America has a right to be proud of the University of Pennsylvania for harboring a group capable of such work upon so complicated a subject; and it is my advice to all members who can take leave of their practice to journey to the University and take the course in Neuro-otology.

I wish to express my thanks to Drs. Jones and Fisher for their teachings and their permission to present this new work.

DISCUSSION

Dr. W. Likely Simpson, Memphis, Tenn.—The equilibrium tests which we give our embryo aviators were only made possible by the discovery of Baranay, and I feel very proud of the Russian who took as a prisoner Baranay, but I am glad to say he has been exchanged and is now in Sweden. I am sorry that we can not have with us today both I. Jones and Baranay. All credit should be given Jones and Fisher for working out the different nystagmic and equilibrium fibres, but I do wish we could hear Baranay and have him tell of his late findings.

In discussing the equilibrium tests, there are some points which might be of interest. For instance, in making the falling test, it is well to be on the side of the chair to which the candidate normally falls. A few evenings ago I saw a moving picture of the equilibrium tests and the examiner was on the wrong side. On turning to the right, the examiner should stand on the right, and on the left when turning to the left, or, if one turns the chair correctly, and just far enough, one need not change the position of standing at all. It is well to be in a position to catch the candidate if he has a very marked falling reaction. Some few minor accidents have occurred. If the candidate has a very marked falling reaction, it is well to have him open his eyes at once.

Another point is that our instructions to one being examined should be very definite. The eyes must be kept closed during the whole pointing test. The location of the finger must be kept in mind by the candidate at the time, and the movement of the arm must be a gradual, moderately slow, up and down movement.

Dr. J. B. Greene, Asheville, N. C.—I want to ask a question. Dr. Shea spoke of the importance of the turning test in diagnosing an internal ear lesion in acute otitis media from a brain lesion. It seems to me that the trauma produced in the turning test, if there be acute labyrinthitis present, may tend to cause a brain lesion (meningitis). I mention this because Duel, of New York, recently warned us against the turning test in suspected acute internal ear trouble. This caution seems wise from a theoretical standpoint. He (Duel) advises the irrigation test in these cases, and I should like to ask Dr. Shea whether or not the irrigation test with cold water may not be sufficient in such cases for diagnostic purposes?

Dr. John Franklin Rowland, Hot Springs, Ark.—I want to thank Dr. Shea for his clear, concise explanation of this test. In a very brief speech, he has given us a clear conception of the test, and of the anatomy and pathology covered by it. Those of you who were present at the meeting of the American Medical Association in New York saw the Vitagraph pictures demonstrated by Mr. Isaac H. Jones before the Section on Oto-Laryngology and got a pretty good insight into this work, and those of you who took this work under Barany, Bondy, Ruttin and Beck, of Vienna, readily see the advantage this American Model Nystagmus Chair has over the Vienna Model, which they used. It demonstrates very conclusively to my mind the predominance of the American inventive genius. You cannot obtain accurate results from the Vienna chair, because it does not tilt the head thirty degrees forward. I first used the Vienna model, but later exchanged it for this kind; in a few seconds, with this test, you have a pretty clear conception of the condition of the patient's central nervous system, as well as the condition of his equilibrium. You saw from the first applicant used in the demonstration by Dr. Shea, that after turning him to the right ten times, you had a good idea whether he was a fit subject for the Aviation work, and if you are not satisfied with the results obtained from the turning method, you may use the caloric test, which is more delicate, and better results can be had.

Dr. Shea did not speak of the conditions that may modify the result of the caloric test. Cerumen in the external auditory canal, a congested thickened drum membrane, may cause the nystagmus to take twice as long to appear as it would otherwise. Dr. Beck demonstrated that point before the clinic in Vienna by swabbing the drum membrane with adrenalin chlorid, the nystagmus appeared within twenty seconds instead of forty.

Now, Mr. Chairman, this test helps the otologist to be of valuable service to the neurologist and syphilographer in arriving at a diagnosis of diseases in the central nervous system, and in the diagnosis of syphilis. You take this in conjunction with the Rienne, Schwabach and Weber tests, and I think you have a better way in which to diagnose syphilis than you have in the Wassermann test.

Dr. Shea (closing).—I think that I did not make it clear in regard to aviation. We do not turn a man down because he is not one hundred

per cent. perfect. It is not fair to do that. We turn him down if there is a disproportion between the two sides. He can have a little imperfection on both sides, but if he has it on only one he loses his balance. Why? If you think of the one labyrinth's sending impulses to the brain that are not in proportion to those of the other, you will see that there is a tendency to go like a vehicle when the front wheels are out of line. The man may go out to thirty-six seconds nystagmus on both sides, or even miss one in three or both when pointing. The boys are so patriotic and want to get in so badly that they try too hard. We have to tell them to quit trying and be natural. We have to say: "You are registering a difference in your position. We want you to register what your brain tells you is the change in your position, and not the real position." Do not say: "Touch the finger," but "Register what you think is your position."

When douching patients in bed, they are in the best position for this test. You test the horizontal canal first. Just have them lie down with no pillow under their head and you have them in the right position—60 degrees back; and if you want to test the vertical, have them held up straight. Bedside irrigation can be done readily. The greatest thing is the interpretation. You have to take into consideration everything that you find, the anatomy, physiology, etc., and balance them up; and then decide what you think would fit their condition best. Try to make it the simplest thing. Remember that the law of probabilities is the greatest law in applying any test in medicine.

AUTHORS' ABSTRACTS

Eye, Ear, Nose and Throat

The Use of Non-Specific Protein in Ophthalmology. T. J. Dimitry, New Orleans, La. New Orleans Medical and Surgical Journal, Vol. 70, No. 3, September, 1917, p. 231.

In this article Dr. Dimitry cites the results obtained by various workers in the field of non-specific therapy, and reports results in the use of milk as a non-specific protein. It is interesting to note the good results in trachoma, acute gonorrheal conjunctivitis and interstitial keratitis by its treatment.

The writer advises using milk to secure protein because of its being so easily obtained. The importance of this is realized when it is recalled that most of the workers in non-specific treatment are dependent upon the laboratory or some complicated technique.

Dr. Dimitry quotes good results obtained by Muller, Thaner and Friedlander when using the protein of milk for conditions similar to those reported in this paper.

The method employed was that of boiling milk for five or ten minutes, allowing it to cool, and injecting 5 c. into the gluteal region, repeating the dose every four or five days. In some cases 10 c. c. and in others a few drops were used. Subconjunctival injections were also made in a few cases.

The reaction following the injections was a rise of temperature. Those cases showing a