

The Saccus Endolymphaticus and an Operation for Draining for the Relief of Vertigo.

By Professor GEORGES PORTMANN (Bordeaux).

THE contribution to the therapeutic of vertigo which forms the subject of this work establishes the practical result of a series of researches of compared anatomy, human anatomy, and physiology on the saccus endolymphaticus, that I have pursued incessantly for the last eight years.

The study of anatomy had shown me the constancy and the considerable dimensions of the saccus endolymphaticus in the vertebrates and, specially, in man.

Actually an intracranial extension of the labyrinth, lying on the postero-superior surface of the petrous portion of the temporal bone, in a depression which I have called the "fossa endolymphatica," the sac is hollowed in the thickness of the dura mater, the division of which into two forms an antero-inferior wall, juxtapetrous, placed against the bone, and a posterior superior wall, cerebellar, in relation with the arachnoid and cerebellum.

The enormous vessel, namely, the lateral sinus, skirts half its outer circumference and is only at this level separated from it by some connective layers.

Lastly, the saccus, in direct relation through the ductus endolymphaticus with the membranous cavities, utricle, and saccule, contains a clear fluid which is simply endolymphatic fluid.

In October, 1922, I presented before the International Congress of Otology some of my experiments on fish, in which I endeavoured to prove the importance of the endolymphatic organ in auricular physiology. Since then I have continued fresh researches in order to confirm those former results and I believe that at the present moment the functional importance of the saccus endolymphaticus is no longer contested by anyone.

In man, in whom anatomical conditions are widely different, and in whose case only physiology and pathological anatomy can enlighten us, we are right in thinking that this saccus owing to its place in the thickness of the dura mater is in continual pressure against the subarachnoid spaces.

The modification of the tension of the spinal fluid is thus liable to disturb the normal function of the labyrinth. This is a question that is beginning to occupy the minds of some of the researchers, and in January, 1925, Georgio Ferreri published in the *Revista oto-neuro-oftalmologica* the result of his work on the action of the experimental hyperpressure of the spinal fluid on the posterior labyrinth. Quite recently (in June, 1926), and after the results I had obtained with regard to fish, W. J. McNally has, in the Pharmaceutical Laboratory of the University Rijki at Utrecht,¹ undertaken a series of experiments on the rabbit, in which he provoked this increase, and the lessening of pressure on the level of the saccus endolymphaticus.

If he has not noticed any labyrinthine disturbances in producing a hyperpressure on the saccus (but on this subject further experiments seem necessary, as a control), the opening of the saccus, through its causing the issue of the endolymphatic fluid, has invariably produced a lessening of the *tonus* of the limbs on the same side.

A phenomenon, superposed on the lessening of tonus of the limbs, which, as Magnus and de Kleyn have proved, is produced after an opening of the membranous labyrinth, is produced after section of the eighth cranial nerve.

These facts having been admitted allow of our comprehension of the importance of the modifications of pressure either of intracranial, that is to say extralabyrinthine, or endlabyrinthine origin, that may support the saccus endolymphaticus and the consequences that may result.

In this first case, the saccus may be compressed by the pathological modifications affecting an adjacent organ, the lateral sinus, or rather the meninges and cerebellum. The

¹ W. J. McNally, "Experiments on the Saccus Endolymphaticus in the Rabbit," *Journal of Laryngology and Otology*, June, 1926.

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increase of pressure produced by means of the saccus endolymphaticus on the intrapetrous labyrinth may give rise to Ménière's syndrome: vertigo, deafness, buzzing. It therefore appears to be logical to incriminate the saccus endolymphaticus as the vestibular nucleus when these arise during the course of an intracranial hyperpressure, whatever may be the cause of such symptoms.

In the second case the increase of endolymphatic pressure may proceed from an endolabyrinthine cause, and a long while ago attention was drawn by otologists to "serous labyrinthitis"; the increase of the endolymphatic fluid sets up in the cochlear, otolithic and vestibular nerves, functional trouble which evokes the appearance of the triad of Ménière—thus realizing a true "auricular glaucoma."

There exists elsewhere more than one analogy between intra-ocular hypertension and endolabyrinthine hypertension of serous origin. In one case, as well as the other, the question is most often one of crises of localized hyperpressure occurring in subjects of high tensions or subjects with a hyperexcitable sympathetic system.

The recent and very interesting researches performed by Guild, in the Department of Anatomy, University of Michigan, and presented in May, 1927, before the American Otological Society in New York, show us the importance of the saccus endolymphaticus as an organ of filtration of the endolymphatic fluid. It serves as the principal place of outflow of the endolymph; not, as some have thought, as the point of origin of endolymph. The escape of fluid is not through openings in the wall, but by direct passage through the layers of the wall, being thus comparable to the flow of cerebro-spinal fluid through the arachnoid villi. Then in some cases the possible interpretation of abnormal distention of the membranous labyrinth (auricular glaucoma) as an impairment of the normal pathway of the endolymph can be discussed.

Even, to continue our comparison, as in glaucoma the ophthalmologists puncture the cornea in order to suppress the intra-ocular hypertension, capable of destroying for ever the value of the eye, so it seems logical in some cases of serous labyrinthitis, when medical treatment has failed, to make a decompression of the internal ear by the removal of the excess of the endolymphatic fluid.

Then the membranous labyrinth protected in the heart of this thick, strong box, that is the bony capsula of the labyrinth—separated even from this bony capsule by the perilymphatic spaces, is practically inaccessible and safe from destruction. At one point only it is vulnerable, namely, at the level of the endolymphatic sac, placed in the fossa which bears its name, on the posterior surface of the petrous bone. It is there that it is well to carry out a decompression operation on the labyrinth.

In this way the otologist obtains a new perspective of surgical therapeutics in those cases in which one might suspect the existence of a serous labyrinthitis, or in which a cranial hyper-pressure, whatever the cause, will produce a violent reaction of the labyrinth.

My operation consists in reaching the fossa endolymphatica and in discovering the saccus in order to open its petrous wall. An exact knowledge of the relation of the fossa endolymphatica is indispensable. Let us recollect that, situated on the level of the posterior surface of the petrous bone, this triangular fossa, at the supero-internal angle of which opens the aqueductus vestibuli, is in external relationship with the lateral sinus which convolutes its outside and lower part before projecting itself into the jugular bulb at the level of the outside portion of the posterior lacerate foramen.

It is therefore the external third portion that would be the easiest route of access to the fossa endolymphatica, the lateral sinus being in fact the most invariable landmark. On the other side, the fossa extends to 5 mm. anterior to the vertical portion of the aqueductus Fallopii. By starting from the internal border of the lateral sinus, but remaining at the level of the intersinifacial zone, one reaches the fossa.

In a word it will be necessary to search for the saccus through the mastoid in the area of a triangle formed, above, by a line corresponding to the lower surface of the antrum; in front, by the aqueductus Fallopii, behind, by the lateral sinus.

OPERATIVE TECHNIQUE.

First step.—Incision to the bone at the level of the retro-auricular groove. Exposure of the surface of the mastoid; one then discovers the spine of Henlé and the external petrosquamous suture.

Portmann: *Saccus Endolymphaticus*

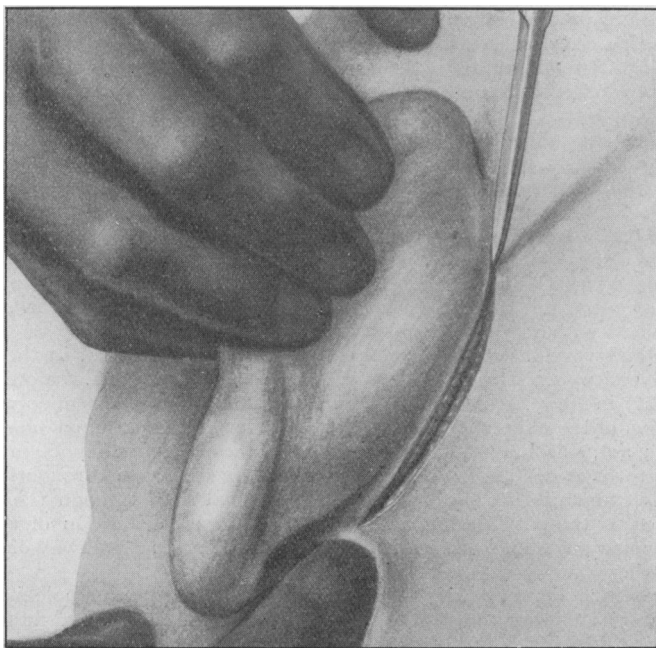


FIG. 1.

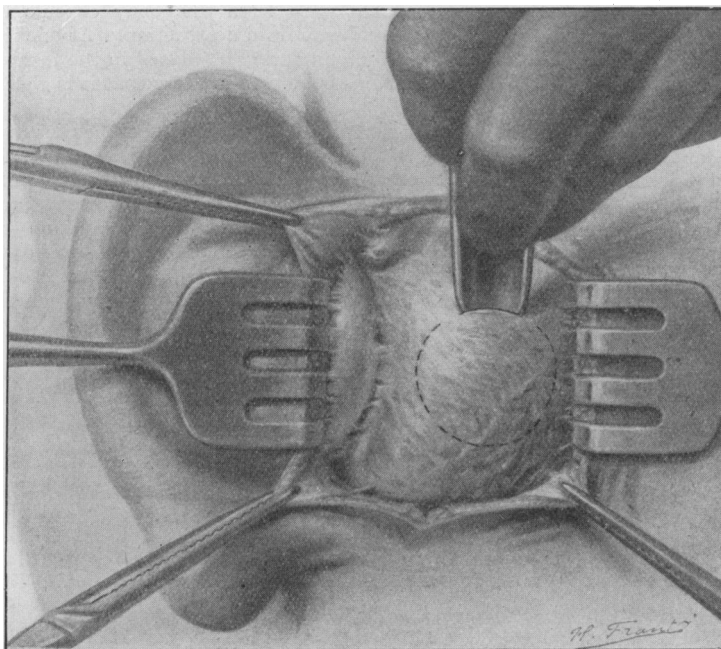


FIG. 2.

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Second step.—Trepanning of the mastoid at the level of a square of attack situated lower down than that of the classic trepanning area for mastoiditis. The first stroke of the gouge is made on a horizontal line passing under the spine of Henlé. The second in front, on a vertical line situated 3 mm. behind the posterior edge of the external auditory meatus. The third is made horizontally at 1 cm. below the first. These three first strokes of the gouge are made perpendicularly on the surface of the bone; for the fourth, on the contrary, the instrument is held obliquely on the bony surface, 1 cm. behind the second. In gouging out this deeply, one finds the lateral sinus, the true landmark of the operation.

This "square of attack" has as its aim to approach the lateral sinus without opening the antrum, thus keeping the operation as aseptic as possible, without extensive communication with the middle ear.

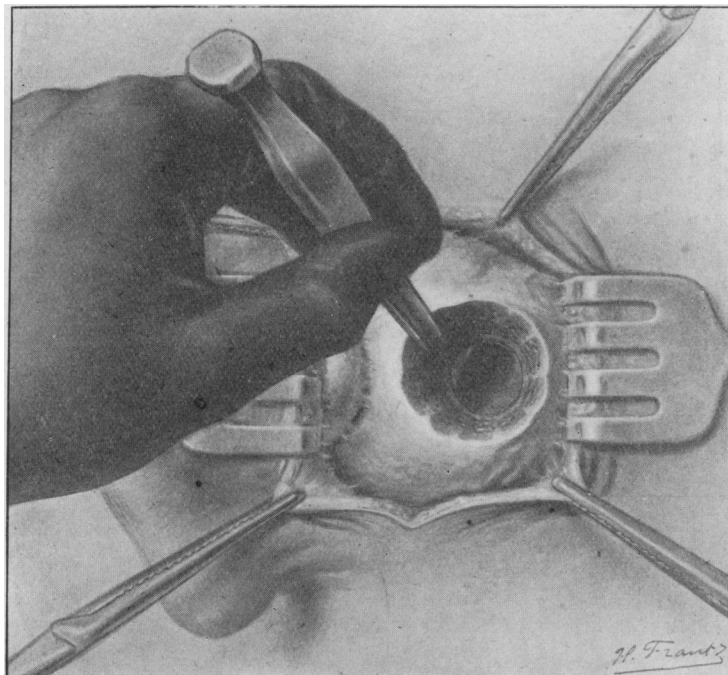


FIG. 3.

Third step.—The bony wall of the sinus having been scraped and its internal part removed, one detaches with a blunt elevator, as delicately as possible, the dura mater which covers the posterior surface of the petrous bone, inclining inside and slightly above, at a length of about 3 to 4 mm. A dura mater protector is then put in place, for it is now indispensable to divide with a fine graving tool the bony region which represents the most external part of the fossa endolymphatica. Recollect at this moment that the aqueductus Fallopii is near, and that the facial nerve could be injured by an unlucky stroke of the operator.

This bony region having been ablated, one again unfolds the dura mater, inclining always inside and slightly above until one comes to a zone of closer adhesion of the dura mater at the bone and a slight bony dip. We have now arrived at the level of the supero-internal part of the fossa, at the exact point where the aqueductus vestibuli begins.

Fourth step.—We have freed the petrous wall of the saccus endolymphaticus by removing the greater part of the fossa endolymphatica. By the help of a very fine needle, mounted on

Portmann: *Saccus Endolymphaticus*

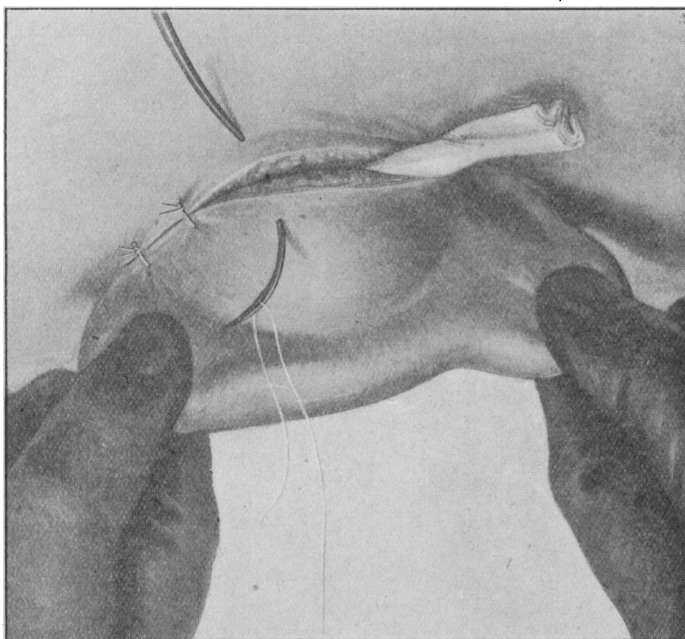


FIG. 5.

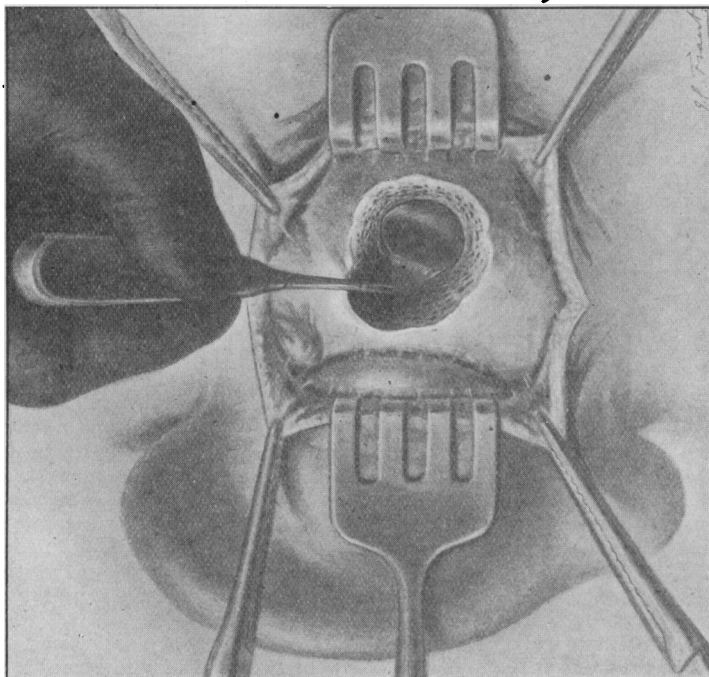


FIG. 4.

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a Luer syringe, one makes an exploratory puncture of the saccus, *in contact with the zone of adherence*. The operator, who feels perfectly the sensation of penetration in the little cavity of the saccus, then makes, with a paracentesis knife, an incision of from 2 to 3 mm. at the most in the saccus. One or two drops of fluid, like spring water, flow from the opening of the wound.

The operation now being over, the retro-auricular wound is sutured. Slight drainage is rendered possible by the insertion of a piece of gauze, in the event of any considerable bleeding in the course of the bony trepanning.

It is a particular point of this detail in technique that the puncture, just as much as the incision of the saccus, ought to be made, as far inside as possible, near the zone of the adhesion.

It should be recollected, in fact, that the saccus which is occasionally atrophied in old age, would be reduced only at its juxta-canicular part so that, in making an incision far from the zone of adhesion, one would risk reaching only the meninges and missing the saccus. By operating at the contact of the bony wall which constitutes the supero-internal part of the fossa, one is sure to reach it even if it were much atrophied.

This operation, though a delicate one, is generally comparatively simple, as I have shown in my Clinic at the University of Bordeaux before the Members of the Sixth Meeting of the Visiting Association of Ear, Nose and Throat Surgeons of Great Britain in April, 1927. To me it seems to be the method of choice for reaching the saccus endolymphaticus and appears to be full of promise for the surgical therapeutics of a great number of labyrinthine diseases, one symptom at least of which, namely, the vertigo, is particularly painful to the patient.

I have on several occasions performed this operation most successfully, and quite recently (October 10, 1926) I reported (1) at Gröningen, before the International Oto-Rhino-Laryngological College, and (2) at Rome (October 23, 1926) before the Italian Congress of Oto-Neuro-Oculists—two typical cases of vertigo, cured by opening of the saccus endolymphaticus. The severity of the vertigo had prevented the unhappy patients from doing any kind of work.

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