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# GLYCEROL TEST IN DIAGNOSING INCREASED INTRALABYRINTH PRESSURE

By

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Increased intralbyrinth pressure is one of the causes of the occurrence of /55** cochlear-vestibular disorders characterized by noise in the ears, diminished hearing and vertigo. The causes of increased intralbyrinth pressure vary: change in the labyrinth capsule during metabolic disorders (Paget's disease, otosclerosis, late syphilis), vascular and inflammatory disorders of the central nervous system, as well as a number of endocrine and allergic diseases (V. S. Olisov, 1973; N. S. Blagoveshchenskaya, 1976; Sekula, Slodyca, 1975, and others). Currently, a lot of attention is focused on the difference in increased intralabyrinth pressure from a number of other diseases, since this predetermines the nature of the medicinal or surgical treatment (V. T. Pal'chun, 1977; I. B. Soldatov, N. S. Khrappo, 1977; House, 1962; Segers, 1972; Boles et al., 1975; Morrison, 1976).

The occurrence of sudden deafness and impaired hearing, as well as acute vestibular disorders in a considerable number of cases is based on disorders in the local circulation that also can lead to an increase in intralabyrinth pressure (Tiedeman, Borger, 1975; Morrison, 1976).

Increased intralbyrinth pressure subjectively creates a sensation of fullness in the ear. The noise bears a ricochetting or pulsing nature. Resistance is increased (impedance) of the fluids in the inner ear, which has a special

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**Numbers in margin indicate pagination in original foreign text.

effect on the conducting of the low tones--up to 1000 Hz inclusively (A. Mitrinovich-Modzhevska, 1965). If the receptor does not suffer here, then the curve of air and osseous conductivity has an ascending nature. As a result of increased intralbyrinth pressure hydrodynamic suppression of Corti's organ occurs which up to a certain time is reversible. It is important for the correct diagnosis to be made as early as possible, before the onset of morphological changes in the receptor formations of the labyrinth. As was proven in experiments, the latter develop already in 6 weeks with the presence of a simple mechanical change in the intralabyrinth pressure without disorder in metabolism (Arenberg et al., 1974). /56

Shea and Katabchi (1973) note that in patients with increased intralabyrinth pressure at the moment of decline in hearing vertigo can be missing. According to the data of Densert et al., (1975) in 22% of the cases Meniere's disease begins with fluctuating impaired hearing without vertigo. However, in experimental tests (rotating and caloric) in such patients, as a rule, asymmetry was revealed in the responses of both labyrinths with signs of suppression on the affected side.

For early diagnostics of increased intralabyrinth pressure a number of tests were recommended with whose help an analysis was made in the change in hearing and vestibular function with removal of the labyrinth edema. The glycerol test became the most widespread. It was suggested by Klochhoff and Lindblomb in 1961. This test uses glycerine (trihydric alcohol $CH_2OH-CHOH-CH_2OH$) whose action is determined by its dehydrating properties. In essence redistribution of the fluid occurs. Here diuresis is slightly increased since part of the glycerine is metabolized in the renal cells, as a consequence of which the osmotic load on the kidneys is reduced. An important factor that governs the dehydration of the tissues is the threshold concentration of glycerine in the blood to which its threshold osmotic capacity must correspond. With a lower concentration the dehydrating properties of glycerine are not displayed. The optimal dose recommended for removal of cerebral edema is 1.25 g per 1 kg of body weight (B. A. Khimochko, 1975). Approximately the same doses are recommended by the foreign researchers for conducting the glycerol test in order to reveal hydrops of the labyrinth.

According to published data (N. S. Misyuk, L. S. Ilyushina, G. I. Kryuk,

1969; L. Ye. Pinegin, B. A. Khimochko, G. A. Shipilova, 1974; A. S. Fedyanin, 1975, et al.), glycerine stops the strongest hypertension crises, reduces spinal-cerebral (by 100 mm Hg and more), intraocular and intralabyrinth pressure. Glycerine does not have a significant effect on arterial pressure, pulse rate, content of protein fractions of the blood and the general protein amount, including albumin and globulin. However it does increase the coagulability of the blood, which should be considered in its prescription.

Internal administration of glycerine is difficult due to its sickly sweet taste. In addition, pure glycerine can induce burning in the stomach region due to irritation of the mucous membrane, therefore it should be diluted in fruit juice or water.

An indication for conducting the glycerol test is the hypothesis on the presence of increased intralabyrinth pressure made on the basis of anamnesis, general otolaryngological, audiometric and vestibulometric studies. First of all it is necessary to make a general blood analysis of the patient, general urine analysis, blood-sugar and prothrombin analysis. Then the patient should be examined by a neuropathologist and therapist.

It is contraindicative to conduct the test in sugar diabetes, increased blood coagulability and pregnancy.

## Technique for Conducting the Glycerol Test

A 12-hour fast is recommended before the examination begins. Directly before taking the glycerine the main audiometric and vestibulometric studies are made: the thresholds of perception of tones up to 1000 Hz are determined (including for air conductivity); in the presence of a disorder in speech intelligibility a curve is derived for the increase in intelligibility of the word test on the affected side, and the main experimental vestibular tests are conducted--caloric and rotating. Since increased intralabyrinth pressure is a phenomenon that is often temporary and in the period of remission in individual patients restoration of the auditory and vestibular function is observed, then it is desirable to conduct the glycerol test in the presence of the following signs of of cochlear-vestibular dysfunction: reduction in hearing primarily for low tones on the affected side and asymmetry of the excitability of both labyrinths in vestibulometry.

For this test distilled glycerine of the highest sort (GOST 6824 No 4 [State Standard]) was used with a calculation of 1.25-1.5 g per 1 kg of body weight of the patient:

Rp: Glycerini 100.0

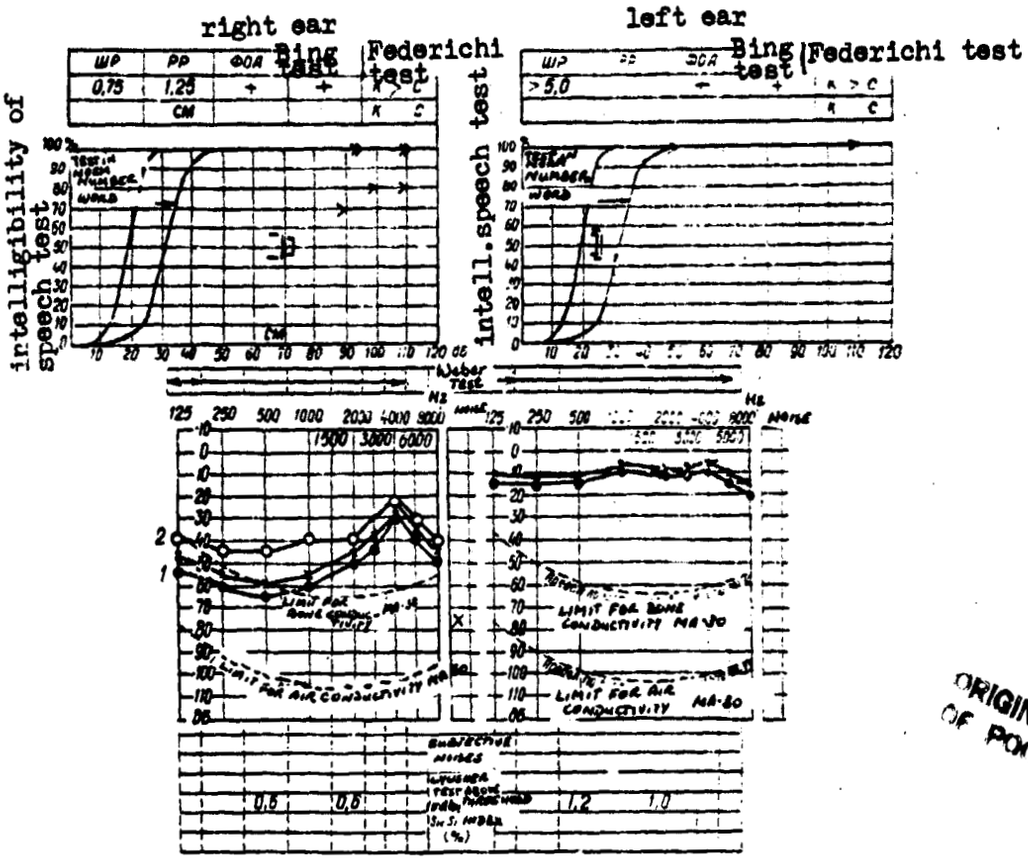
D.s. Day of internal intake

Its necessary quantity was dissolved in cooled fruit juice in a ratio of 1:2. To improve the taste qualities a piece of lemon was added to the mixture. The patients drank the entire mixture immediately on an empty stomach, and before the control audio-vestibulometric examination that is made in 3 hours, did not take liquids. The possible side effect of glycerine that was manifest in certain patients (headache, chill, sometimes nausea) usually disappeared by this time.

The results of the glycerol test were evaluated as follows. A positive glycerol test was an improvement in the thresholds of perception of tones for air conductivity at 10-15 db and more at frequencies to 1000 Hz inclusively, an improvement in speech intelligibility by 12% and more (Arenberg et al., 1974), as well as a change in the parameters of the experimental nystagmus reaction by 25% and more towards a change in excitability in relation to the initial data on the affected side (I. B. Soldatov, N. S. Khrappo, 1977).

At the Kiev Scientific Research Institute of Otolaryngology a clinical /57
examination was made of 50 patients who took the glycerol test for a diagnostic purpose. We cite the following observation as an example.

Patient K., 49 years old, came to the Institute with complaints of periodically occurring attacks of vertigo accompanied by a disorder in equilibrium, nausea, sometimes vomiting, intensifying noise in the right ear, as well as diminished hearing, a sensation of fullness and heaviness in it. It is known from the anamnesis that the first attack of cochlear-vestibular dysfunction occurred 2 years ago in the midst of complete health and lasted 3-4 h. Further attacks were renewed in 2-3 months, and in the period between attacks the state of health was satisfactory. During the next year the attacks increased in frequency and became more intensive. The conclusion of the therapist and neuropathologist: pathology on the part of the internal organs and nerve system was not revealed. The arterial pressure was 100/70 mm Hg. On the survey x-ray of the skull, cervical section of the spine and temporal bones according to Stenvers no pathology was

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perception of bone-conducted sounds;
1 perception of air-conducted sounds before intake of glycerine;
2 perception of air-conducted sounds after intake of glycerine;
intelligibility of digital test for bone;
intelligibility of the same for air;
intelligibility of word test for air before intake of glycerine;
intelligibility of word test for air after intake of glycerine;

found. The fundus oculi was normal, the otorhinolaryngological organs did not show any peculiarities.

On the audiogram (see figure) a decrease was defined in the acuteness of hearing on the right according to the type of affection of the sound-perception apparatus with low thresholds of differentiation according to Lyusher at 500 and 2000 Hz, the intelligibility of speech was somewhat delayed and did not reach 100% on the limit of intensity of the audiometer (type of tonal curve--ascending).

In the vestibulometric examination conducted according to the technique accepted in the Kiev Scientific Research Institute of Otolaryngology (V. G. Bazarov, 1977) the following results were obtained: stato-kinetic resistance /58

DYNAMICS OF CHANGES IN PARAMETERS OF EXPERIMENTAL NYSTAGMUS REACTION ACCORDING TO DATA OF ELECTRONYSTAGMOGRAPHY BEFORE AND AFTER CONDUCTING GLYCEROL TEST

| Studied ear | Caloric test ($\frac{25°-60.0\ ml}{10"}$) | | | | | Rotating test (10 r/20") | | | |
|---|---|---|---|---|---|---|---|---|---|
| | latent period, s | duration, s | average amplitude, degrees | frequency, Hz | SMF* o/s | duration, s | frequency Hz | average amplitude degrees | SMF* o/s |
| Right (before glycerine | 36 | 58 | 5.8 | 1.8 | 11.0 | 20 | 2.0 | 7.5 | 16.7 |
| Left intake) | 27 | 86 | 8.5 | 2.2 | 21.4 | 42 | 3.2 | 12.5 | 47.6 |
| Right (3 h after gly- | 30 | 72 | 7.4 | 2.0 | 16.7 | 32 | 2.6 | 10.5 | 31.0 |
| Left cerine intake) | 25 | 80 | 9.4 | 2.1 | 22.4 | 44 | 3.2 | 12.0 | 45.2 |

* Expansion unknown

was insignificantly disrupted, no spontaneous nystagmus or nystagmus of position was revealed. The data of the experimental vestibular tests (caloric stimulation with water--60 ml at temperature 25°C for 10 s, as well as rotation on an improved Barany chair in the plane of stimulation of the semicircular horizontal canals with rate 180° for 1 s during 20 s) and electronystagmography indicate the reduced excitability of the right labyrinth.

With repeated audio-vestibulometric examination within 3 h after the intake of glycerine an improvement is noted in the perception of tones up to 1000 Hz inclusively (curve No 2, see figure), intelligibility of speech (complete intelligibility of speech is attained at level 95 db), as well as reduction in the asymmetry of the nystagmus reaction towards an improvement in the excitability of the right labyrinth (see table).

Based on the conducted studies one can draw the conclusion that the patient has increased intralabyrinth pressure, and the glycerol test can be evaluated as positive. From the data of examination of the patient one can conclude that he has Meniere's disease.

Thus, the presented statements make it possible to recommend the glycerol test for introduction into clinical practice as a method of diagnostics of increased intralabyrinth pressure. The positive glycerol test serves as an indicator for conducting the dehydration therapy, and also indicates the possibility of conducting decompression and draining of the endolymphatic sac.

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