

DETERMINATION OF INFORMATIVITY OF XYLITOL AND GLYCEROL PREPARATIONS FOR DETECTION OF INTRALABYRINTHINE HYDROPS**Nasretdinova M.T., Normirova N.N.****Normuradov N.A., Xusanova D.A.**

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Summary:The issue of interpretation of the results of dehydration tests, the frequency of detection of intralabyrinthine hydrops and the percentage of concordance of data when using different drugs remains controversial. The aim of the present work was to determine the informativeness of the dehydrating ability of glycerol, furosemide, glucose and xylitol on the basis of changes (increase or decrease) in auditory thresholds, confirmed by a reliable change in serum osmolality after their administration. The aim of the study was to determine the informativeness of the preparations used to detect intralabyrinthine hydrops on the basis of audiologic examination. 96 individuals aged 23 to 42 years (men - 41, women - 55) suffering from Meniere's disease for 3-15 years were examined. All patients underwent glycerol test (in doses of 0.6 and 1.5 g/kg of weight). Other tests were performed before (5-7 days before) or after (5-7 days after) glycerol administration. In each case, the indication for the samples was the need to diagnose cochlear hydrops or hydrops of the non-auditory part of the labyrinth. The standard glucose-tolerant test was used to detect possible disorders of carbohydrate metabolism. Furosemide was administered intramuscularly at a dose of 20 mg once a day. The presence of disadvantages in each of the used drugs led to the necessity of approbation of a new remedy - xylitol. The examination of 96 patients showed that out of 4 studied preparations for diagnostics of intralabyrinthine hydrops the informativity of xylitol and glycerol considerably exceeds that of glucose and furosemide, but the use of the latter is justified in those cases when the above mentioned preparations are absent or cannot be used due to contraindications. The informativity of xylitol and glycerol is significantly higher than that of furosemide and glucose.

Keywords: intralabyrinthine hydrops, xylitol, glycerol, labyrinth, glucose tolerance test

Relevance:Due to the fact that the interpretation of the results of dehydration tests, the frequency of detection of intralabyrinthine hydrops and the percentage of concordance of data when using different drugs remains controversial, it seems important to study the diagnostic informativeness of drugs used in clinical audiology (1,12,14). The variability of the obtained results can be explained by the use of different dosages of the same drug, lack of control over the changes in blood biochemical parameters, mainly osmolality, which determines the dehydration effect, as well as different interpretation of the changes in hearing thresholds during dehydration tests. The task of the present work was to determine the informativeness of the dehydrating ability of glycerol, furosemide, glucose and xylitol on the basis of changes (increase or decrease) in auditory thresholds, confirmed by a reliable change in blood serum osmolality after their administration. In our work, we were guided by the interpretation of the results of dehydration tests and methods of determining

biochemical parameters (potassium, sodium, glucose, total protein, and serum osmolality) described in detail earlier (2,3,7).

The aim of the study was to determine the informativeness of preparations used to detect intralabyrinthine hydrops on the basis of audiologic examination.

Materials of the study. 96 individuals aged 23 to 42 years (men - 41, women - 55) suffering from Meniere's disease for 3-15 years were examined. All patients underwent glycerol test (in doses of 0.6 and 1.5 g/kg of weight). Other tests were performed before (5-7 days before) or after (5-7 days after) glycerol administration. In each case, the indication for the tests was the need to diagnose cochlear hydrops or hydrops of the non-auditory part of the labyrinth. The standard glucose tolerance test (SGTT) was used to detect possible disorders of carbohydrate metabolism. Furosemide was administered intramuscularly at a dose of 20 mg once daily. The presence of deficiencies in each of the drugs used led to the need to test a new agent, xylitol. (3,5,9) Xylitol (in doses of 0.75 and 1.5 g/kg body weight) was dissolved in water and lemon juice was added to improve the taste. The total volume of the mixture was 250 ml. Glycerol, glucose and xylitol were given once in the morning, on an empty stomach.

Table 1

Changes in blood serum biochemical parameters after a single injection of various dehydration preparations 120 min after administration

Medication	Blood serum biochemical parameters				
	Potassium mEq/L	Sodium mEq/L	Blood sugar mg%	Total protein g/l	Osmolality mOsm/kg
Control n=40	4,64±0,09	135,7±1,24	81,9±1,75	7,28±0,12	293,0±1,60
Glycerol 0,6 g/kg n=41(male)	4,52±0,09	135,6±1,51	89,9±1,83	6,91±0,17	289,2±1,80
1,5 g/kg n=55(female)	5,16±0,21 p<0,001	142,8±2,39 p<0,05	93,6±2,60 p<0,01	7,46±1,16	314,0±2,90 p<0,001
Glucose 1,5 g/kg n=20	4,23±0,30	138,5±2,03	153,0±8,3 p<0,001	6,80±0,21	282,0±2,70 p<0,01
Furosemide 20 mg n=40	4,28±0,31	131,1±2,57	89,7±3,20	89,7±3,20	284,0±3,20
Xylitol 0,75 g/kg n=20	5,14±0,11 p<0,001	140,0±1,14	96,8±2,01 p<0,01	7,62±1,00	300,7±2,10 p<0,001
1,5 g/kg n=20	5,29±0,14 p<0,001	143,5±1,54 p<0,01	101,7±2,33 p<0,001	7,94±1,15	316,6±2,60 p<0,001

The results of biochemical studies in 40 practically healthy individuals of the same age group were taken as control indicators. Audiometric control was carried out using conventional tonal threshold audiometry. Changes in audiometric and biochemical parameters were determined 30, 60, 120 and 180 min after the drug administration. Table 1 presents the results of maximum changes in blood serum biochemical parameters observed 120 min after drug administration. Table 2 presents the absolute values of changes in auditory tone thresholds 60, 120 and 180 min after dehydration administration.

Table 2
Change in auditory thresholds after a single injection of drugs

Drug	Dose	Change in auditory thresholds after			Change in auditory thresholds in dB	Informative value of auditory thresholds' change
		60 min	120 min	180 min		
Control Glycerole	-	-	-	-	4,0 \pm 0,46	Physiological variations
	0,6 g/kg	-	+	+	4,5 \pm 0,80	
Glucose	1,5 g/kg	-	++	+++	13,2 \pm 1,70	80%
	1,5 g/kg	+	+	+	5,7 \pm 1,79	30%
Furosemide	20 mg	+	+	+	7,3 \pm 1,06	40%
Xylitol	0,75 g/kg	++	+++	++	12,8 \pm 1,07	70%
	1,5 g/kg	+++	+++	+++	14,5 \pm 2,58	80%

When glycerol was administered at a dose of 0.6 g/kg, serum biochemical parameters and auditory thresholds changed insignificantly, whereas glycerol administration at a dose of 1.5 g/kg caused an increase in potassium, sodium, total protein and osmolality in 50 of 55 patients 1 h after administration. These changes reached their maximum value after 2 h and remained at this level until 3 h, although they did not exceed the physiologic norm. The analysis of audiometric parameters allowed to reveal a reliable change of auditory thresholds in 39 patients in 2 h with maximum changes in 3 h after glycerol administration. When comparing the results of changes in auditory thresholds and serum osmolality after the drug administration, a proportional relationship between the increase in osmolality and the change in tonal thresholds was noted. It follows that in the absence of a reliable increase in serum osmolality, the results of the test, from the audiometric point of view, should be regarded as doubtful.

Results of the study. Thus, the obtained data showed that glycerol at a dose of 1.5 g/kg is effective in detecting hydrops (with lowering of auditory thresholds and improvement of speech intelligibility) in 70% of cases, which complements the results of our previous studies (2,4,5). Reducing this dose is inadvisable, as the reliability of changes in auditory thresholds in all periods of observation decreases. Conducting SGTT allowed us to study the dehydrating effect of glucose and the possibility of using it to diagnose hydrops. (8,11)

Examination of 20 patients showed that ingestion of 1.5 g/kg glucose causes a decrease in serum potassium levels in the majority of patients both after 30 min and after 3 hours. This is probably due to the mobilization of potassium under the action of insulin from extracellular to intracellular fluid (Mendelsohn and Roderigue, 1972). Serum osmolality increased in 10 patients and decreased in the other 10 after 30 min. After 3 h, osmolality was unchanged in 5 patients and returned to baseline in the other 15. In most cases, a significant decrease in serum potassium level coincided with a decrease in osmolality and impaired glucose tolerance.

Audiometric study showed that changes in hearing thresholds were observed in 9 patients after 1 h. Changes in hearing thresholds in all periods of observation did not exceed 10 dB, whereas after glycerol administration they reached 25 dB and more. In patients with a significant decrease in potassium level, osmolality and impaired glucose tolerance, no changes in auditory thresholds were observed.

Based on these data, it can be concluded that the dehydrating effect of glucose is much weaker than glycerol at a dose of 1.5 g/kg, and that it should be used for dehydration (in the absence of other dehydrating agents or in the presence of contraindications to them) only with normal tolerance and normal serum potassium levels. The dehydrating effect of glucose is manifested as early as 1 h after administration. Furosemide is also used for the diagnosis of intralabyrinthine hydrops (2,4). Being a saluretic, it has a pronounced diuretic effect. In 2 and 3 h after its administration, the protein content in serum increased, whereas the potassium, sodium and osmolality decreased. The maximum change in these parameters was observed after 2 h in 28 out of 40 patients. Changes in auditory thresholds after 2 and 3 h were observed in 22 patients.

Thus, the results show that furosemide is less informative than glycerol at a dose of 1.5 g/kg, but more informative than glucose. However, it should be taken into account that furosemide reduces blood pressure, is contraindicated in patients with kidney disease, low blood potassium, and has ototoxic effects (4,5). The presence of disadvantages in each of the used preparations served as a basis for approbation of dehydrating ability of xylitol. Unlike glucose, xylitol is utilized more slowly, but it has the same energetic, plastic and antitoxic properties, promotes normalization of protein, fat and carbohydrate metabolism and can be used in case of impaired glucose tolerance (4,6). In medical practice, xylitol is used as an energy material in parenteral nutrition in the postoperative period, in diabetes, obesity, and as a choleric and loosening agent (4,5).

Analysis of the results of the study showed that the most pronounced dehydrating effect has xylitol at a dose of 1.5 g/kg of weight. This dose causes a significant change in all determined biochemical parameters in all periods of observation. Maximum changes were observed 2 h after xylitol administration.

Audiometric determination of changes in auditory thresholds in patients after glycerol and xylitol administration showed that in 1 h after 1.5 g/kg xylitol administration the change of auditory thresholds was observed in 15 out of 20 patients, in 5 out of 20 patients when glycerol was administered at a dose of 1.5 g/kg; in 2 h - in 15 and 14 patients respectively, in 3 h - in 12 and 10 patients. In 2 patients the change of auditory thresholds, noted in all periods of observation after xylitol administration, was not manifested during the glycerol test, in 2 others it was expressed much weaker after glycerol administration and manifested in later periods of observation. In some patients xylitol administration was accompanied by loosening effect.

To sum up, the examination of 96 patients showed that out of 4 studied drugs for diagnostics of intralabyrinthine hydrops the informativeness of xylitol and glycerol significantly exceeds that of glucose and furosemide, but the use of the latter is justified in those cases when the above-mentioned drugs are absent or cannot be used due to contraindications, etc. Among side effects, patients noted increased tinnitus, headache, thirst, nausea more often after taking glycerol, much less often - after taking other drugs (10-12).

When conducting diagnostic tests, it should be taken into account that the absence of changes in auditory thresholds may be due to the absence of dehydrating effect (no drug was effective in 100% of cases), as well as to the peculiarities of the inner ear lesion in Meniere's disease. Therefore, in case of unilateral localization of the pathological process, a change (increase) of auditory thresholds in the healthy ear can serve as a control of the dehydrating effect of the drug, while in case of bilateral localization - only a change in serum osmolality. In the absence of a reliable change in auditory thresholds on the side of the diseased ear, repeated dehydration with the same drug in the same dosage or another drug is carried out. It is not excluded to increase the dosage for a single dehydration (13-17).

Outputs.

1. Xylitol at a dose of 1.5 g/kg has a pronounced dehydrating effect and can be used in the diagnosis of intralabyrinthine hydrops.
2. The informativity of xylitol and glycerol is significantly higher than that of furosemide and glucose.
3. Glucose, which has minimal dehydration informativity, can also be used in the diagnosis of hydrops with normal tolerance to it.
4. Determination of serum osmolality increases the reliability of the audiometric study.

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