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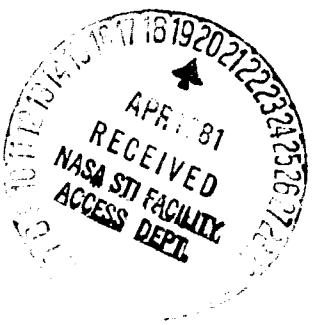
OBJECTIVE APPRAISAL OF TOLERANCE TO VENTRICULOGRAPHY WITH VARIOUS RADIOCONTRAST MEDIA (ACCORDING TO ELECTRONYSTAGMOGRAPHY DATA)

N.S. Blagoveshchenskaya and V.L. Puchkov

Translation of "Ob''ektivnaya otsenka perenosimosti ventrikulografii s razlichnymi rentgenokontrastnymi veshchestvami (po dannym elektronistagmografii)," "Voprosy Neyrokhirurgii" im. N.N. Burdenko, No. 2, Mar-Apr 1980, pp. 47-52.



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16. Abstract
The vestibulo-oculomotor reflex (nystagmus) was recorded by means of electronystagmography in 33 neurosurgical patients in dynamics prior to and after ventriculography. For contrasting the ventricular system a water-soluble medium (Conrey, dimer-X or Amipak) was used in 18 patients and contrast mixtures of water-soluble agents in combination with Myodil emulsion in 15. It was established that after ventriculography with water-soluble media the trunk vestibular reactions in all types of nystagmus grew frequently and sharply and the vestibulovegetative reactions increased markedly.

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OBJECTIVE APPRAISAL OF TOLERANCE TO VENTRICULOGRAPHY WITH VARIOUS RADIOCONTRAST MEDIA (ACCORDING TO ELECTRONYSTAGMOGRAPHY DATA)

N.S. Blagoveshchenskaya and V.L. Puchkov[1]

In ventriculography (VG) the most diverse contrast media are used, and their introduction into the ventricular system of the cerebrum is not without result for the patient. The appraisal of the clinical tolerance of one or another substance is usually based on the subjective perceptions of the patients and the data of a neurologic examination, which, without a doubt, is insufficient. /47*

Of objective data in the literature there are only a few results of electroencephalography in experimental animals (Gonzalez-Cornejo; Ostedal and Kayed; Kunze; Cronqvist; Gemende et al.; Suzuk et al.).

Study of the dynamic changes of vestibulo-oculomotor reactions (nystagmus) after VG is one means of objectively appraising this diagnostic procedure. Electronystagmography (ENG) is an informative, demonstrative investigative method which can provide valuable information about the change of the functional condition of the truncal vestibular nuclei and paths in response to the introduction of contrast medium into the cavity of the cerebral ventricles.

The anatomic formations that cause vestibular eye-moving reactions (nystagmus) are located in the walls of the cerebral ventricular system (fundus of fourth ventricle, aqueduct of Sylvius). Regulation of the vestibulovegetative reflexes takes place in the diencephalo-hypothalamic region. The great information content of various characteristics of nystagmus, the high functional sensitivity of the vestibular apparatus to varied effects and the possibility of an objective record of vestibulo-oculomotor reactions of ENG methods make it possible to

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

record their slightest pathological changes.

The purpose of this work was to discover the effect of radiocontrast media that are introduced into the ventricular system during VG on the alteration of vestibular reactions with their objective recording by means of ENG and to determine the characteristics of the alteration of vestibular reactions with respect to the nature of the contrast medium (Conrey, Dimer-X, Amipak, Myodil) and the quantity used for ventriculography.

We found no description of similar research in the literature.

Materials and Method /48

Vestibular reactions were studied before and after VG with water-soluble and emulsive radiocontrast media in 33 patients (17 men and 16 women) aged from 17 to 64 years (mainly under 30 years). No significant differences with respect to age and sex were found in the tolerance to the examination with different radiocontrast media.

In 18 patients only water-soluble contrast media were used (Conrey, Dimer-X, Amipak), and in 15 one of the water-soluble media (Conrey or Dimer-X) was introduced into the ventricular system in combination with the emulsive radiocontrast medium Myodil.

The localization and nature of the pathologic processes were varied: intracerebral tumors of the great hemispheres of the cerebrum (8), tumors of the third ventricle (4), of the lateral ventricles (2), meningovascular tumors of chiasmal-sellar localization (2), arteriovenous aneurysm of the right parietooccipital region (1), tumors of the cerebellum (4), of the fundus of the fourth ventricle (2), of the trunk of the brain (2), and as a result of arachnoencephalitis with (4) and without (4) occlusion of the spinal fluid pathways.

With the help of an ENG the vestibulo-oculomotor reactions (nystagmus) were recorded in dynamics begore and after VG; a total of 66 electronystagmograms were done. The background recording was done, as a rule, immediately before the ventriculographic examination. After ventriculography the vestibulo-oculomotor reactions were studied 45-50 min after the introduction of the contrast medium into the ventricular system, when, despite the already begun excretion of contrast medium, there was still a high concentration of it in the ventricular fluid.

Of the vestibular symptoms we determined spontaneous nystagmus, caloric nystagmus (100 ml of water at 25° C, which were poured into the external auditory canal for 10 sec), optokinetic nystagmus and its change after the caloric test. The nystagmus was recorded on a two- and four-channel electroencephalograph.

Results and Their Discussion

The changes of vestibular reactions as a result of VG, according to the ENG data, were quite varied, and at the same time a definite clear relationship was discovered between the degree of disturbance of vestibular reactions and the nature of the introduced contrast medium. In connection with this all the patients were divided into two groups: 1st--18 people in whom only water-soluble contrast medium (Conrey, dimer-X, Amipak) was introduced for VG; 2nd--15 patients who received water-soluble and emulsive contrast media at the same time (Conrey or dimer-X in conjunction with emulsion of Myodil).

In VG with water-soluble contrast media the clinically good tolerance of this diagnostic procedure attracted attention. On examination of the vestibular reflexes in 9 patients an improvement was noted in the vestibular reactions after introduction of the water-soluble contrast media, which was manifested in the disappearance of the hyporeflexia of caloric nystagmus (Fig. 1) and the appearance of a more

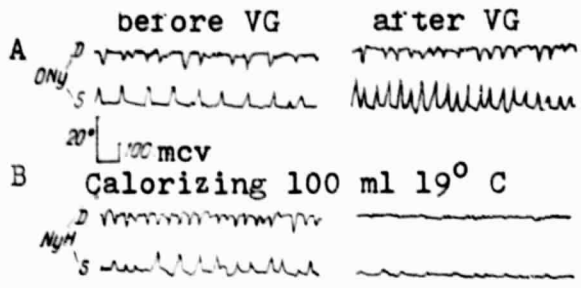

Fig. 1. Small changes of optokinetic and caloric nystagmus in dynamics before and after VG with the water-soluble radiocontrast medium Amipak. Diagnosis: tumor of the subcortical nodes on the left with growth into the lateral ventricle.

A - before VG the optokinetic nystagmus is active, almost without asymmetry; after VG the rhythm of the nystagmus remained clear, but a slight weakening of it to the right appeared; B - before VG, hyporeflexia of caloric nystagmus; after VG--obstruction of caloric nystagmus.

correct rhythm of nystagmoid impulses (Fig. 2).

In 17 patients the changes in the vestibular reactions were weakly expressed, were not apparent visually, and were detected only with the help of ENG. The fluctuations of the nystagmus before and after VG were so insignificant that they could have been found even in patients who had not been subjected to surgical and diagnostic intervention. The shifts were very diverse and occurred both in the direction of a slight growth of vestibular pathology and in the direction of its decrease after VG (Fig. 3). It is possible that the latter is explained by a certain dehydrating effect of the water-soluble contrast media, and also by spinal fluid discharge of the ventricular system. /49

The spontaneous vestibular reactions were barely changed. Most frequent and clear was a disturbance of vestibular reflexes after functional loads (caloric test); the optokinetic nystagmus was also changed after the caloric test.

According to the ENG data, changes of the optokinetic nystagmus after VG with water-soluble media were noted in 13 patients. In 4 after VG there was a significant improvement of the rhythm of the optokinetic nystagmus or an increase of its amplitude (Fig. 3). In 9 patients the optokinetic nystagmus deteriorated after VG, which was seen in its more clear weakening in one direction or weakening in both directions. It should be noted that with intracerebral tumors with inclu-

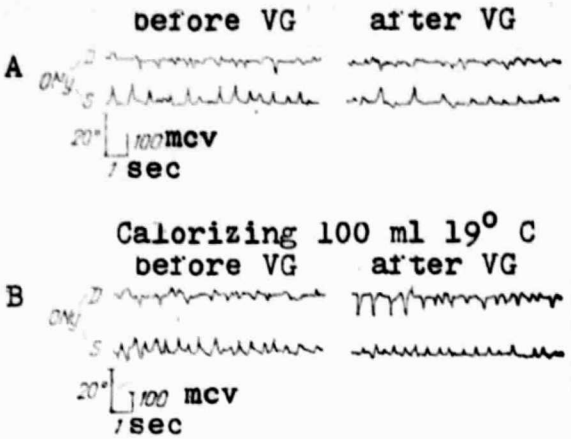

Fig. 2. After VG with Amipak, improvement of the rhythm of the optokinetic nystagmus to the right after calorizing. Diagnosis: astrocytoma of the triangle of the right lateral ventricle.

A - slight reduction of the rhythm of optokinetic nystagmus after VG; B - after VG the optokinetic nystagmus evoked after the caloric test has improved markedly; its rhythm to the right has become more frequent and correct.

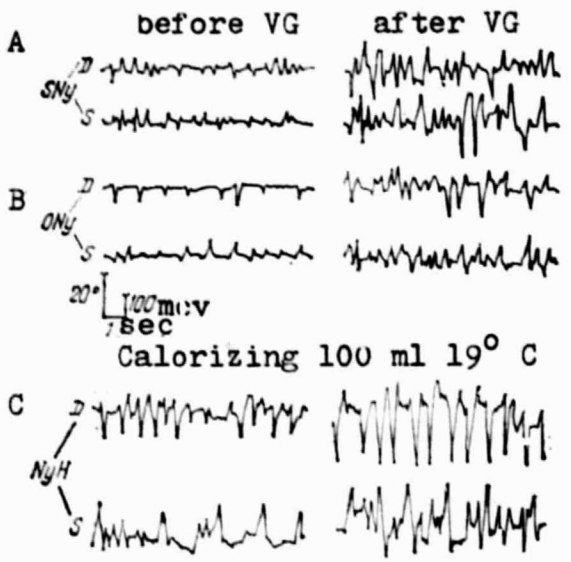

Fig. 3. Sharp growth of the vestibular syndrome after VG with Conrey in conjunction with emulsion of Myodil. Diagnosis: tumor of the right optic tuber.

A - before VG the spontaneous horizontal bilateral nystagmus is weakly expressed, after VG there was a deep bilateral large-amplitude spontaneous **arrnythmic nystagmus** of amplitude 15-20-25°; B - before VG the optokinetic nystagmus was slightly **irregular, after** VG study of the optokinetic nystagmus was slightly complicated, since large **arrhythmic impulses** of the spontaneous nystagmus were superposed on the curve; C - before VG marked hyperreflexia and **arrhythmiz of the caloric nystagmus** after VG - deep bilateral hyperreflexia, 27-30° amplitude of nystagmus, rhythm very wave apices of nystagmus waves.

sion of deep subcortical structures in the pathologic process there was growth of the disturbances of optokinetic nystagmus in the direction opposite to the pathologic location. Thus, after this examination the local subcortical symptoms of the damage of the optomotor pathways were pointed out.

Caloric nystagmus was often altered after VG, which was noted in 12 of 18 patients; in 3 the pathology of the vestibular reactions de- /50

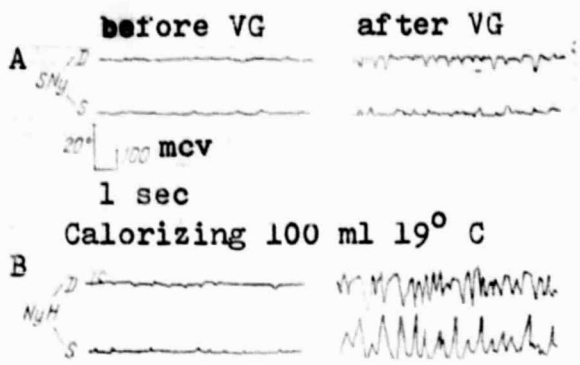

Fig. 4. Clear growth of the vestibular syndrome after VG with Conrey in conjunction with emulsion of Myolid. Diagnosis: craniopharyngioma.

A - absence of spontaneous nystagmus before VG, after VG - clear bilateral spontaneous nystagmus, more marked on the right; B - caloric nystagmus before VG is symmetrically inhibited from both sides, after VG - deep bilateral hyperreflexia in duration and nature of caloric nystagmus, amplitude 15-20°, rhythm irregular.

creased, and in 9 their growth was noted.

Improvement of the vestibular reactions was manifested in the disappearance of hyperreflexia, tonicity, arhythmia of the nystagmus, and asymmetry of caloric nystagmus, or these indices of the nystagmus became stronger in the case of deterioration of the vestibular tests.

In a number of patients the caloric nystagmus changed only from on one side. In all cases the changes of the vestibular reactions after VG with water-soluble radiocontrast media were expressed very weakly.

In the patients of the second group, in whom VG was done with a contrast mixture consisting of water-soluble and emulsive contrast media, a very sharp growth in truncal vestibular symptoms was seen more frequently. These were 3 young patients (about 30 years) with pathologic processes differing in nature and localization: vascular malformation of the fundus of the fourth ventricle, tumor of the optic tuber and craniopharyngioma. In all of them the VG was easily carried out. Only in 1 case was it necessary to cut two openings and puncture the ventricles more than once.

In 3 patients an especially marked increase in the vestibular reactions appeared during the examination of caloric nystagmus, and the

greatest disturbances had to do with the amplitude of the nystagmus, which grew sharply (by 3½-5 times, reaching 35°; see Figs. 3 and 4). The length of the nystagmus grew significantly (more than 2-3 min), its tonicity appeared, and vestibulovegetative reactions in the form of nausea and vomiting after the caloric test became stronger. In 2 of 3 patients the spontaneous horizontal nystagmus increased, the amplitude of which was sharply raised; it became extremely arrhythmic with all directions of the glance. Because of the clearly expressed spontaneous nystagmus it was not possible to study the optokinetic nystagmus.

In the remaining 12 patients of this group, growth of vestibular symptomatology after the introduction of the contrast mixture (Conrey + Myodil) was slight (weakly expressed fluctuation of symptoms). Spontaneous nystagmus was changed in 4 patients; in 3 it increased, and in 1 it decreased. A slight fluctuation of symptoms could also be observed in the other patients.

In 12 subjects the optokinetic nystagmus was disturbed; it either stopped developing (in 4), or its changes were insignificant both in the direction of improvement and in the direction of deterioration.

In 3 patients after VG the optokinetic nystagmus improved; it became more rhythmic and of uniform amplitude. In 2 patients its disturbances after VG were both in the direction of improvement and in the direction of deterioration. In 1 patient the side of weakening of the nystagmus changed; in 3 disturbances of the optokinetic nystagmus were slightly increased; nonuniformity of amplitude and rhythm and asymmetrical weakening to one side appeared.

Vestibular tests during calorizing in the patients of this group /51
proceeded primarily in the direction of slight increase of caloric nystagmus. Caloric nystagmus was absent or was sluggish; slight bilateral hyperreflexia, arrhythmia, tonicity of nystagmus, vomiting (in 2 patients) and nonuniformity of amplitude arose.

It should be stressed that with the use of only water-soluble con-

trast media the vestibulcvegetative reactions were not sharply increased and there was no vomiting.

Nature of changes of caloric nystagmus after VG with different contrast media

Change of caloric nystagmus	Number of patients who received	
	Myodil + water-soluble contrast medium	water-soluble contrast media
Intense growth of truncal vestibular symptoms (appearance of sharp hyperreflexia, tonicity, arrhythmia of the nystagmus), sharp increase and nonuniformity of amplitude	3	1
Slight growth of truncal vestibular symptoms (appearance of slight hyperreflexia, asymmetry of the nystagmus)	6	5
Positive dynamics of some vestibular symptomes with deterioration of others	1	1
Decrease of truncal vestibular symptomatology during caloric test	1	9
None	4	2
Total	15	18

On comparison of the caloric reactions after VG with the use of water-soluble contrast media and contrast mixtures containing emulsive and water-soluble substances a clear difference was found in the vestibular reactions, depending on the nature of the contrast medium used (see table).

Vestibulovegetative reactions of patients in this group were weakly expressed, and more frequently were not present; a weakly expressed nausea was only sometimes noted. Vomiting was not found in a single patient. An insignificant growth of vestibular symptomatology was noted

in 5 patients; it was manifested as slight hyperreflexia of the caloric nystagmus and its asymmetry.

As an exception, intense growth of truncal vestibular symptoms was encountered in 1 patient after the introduction of Amipak; after VG an intense spontaneous nystagmus of second degree of large amplitude and a bilateral hyperreflexia of the caloric nystagmus that was sharp in duration and nature appeared. However, this sharp increase in truncal vestibular symptoms was caused, evidently, not so much by the introduction of contrast medium as by complications during the ventricular puncture, which had to be done many times from 4 cut openings. The amount of contrast medium used in this patient was double that introduced into all the other patients (she received 12 ml of Amipak solution with 250 mg of iodine).

Conclusions

1. With ENG of spontaneous, caloric and optikinetic nystagmus in 33 patients before and after VG with different contrast media (water-soluble and their combination with Myolid) a clear relationship was discovered between the change of vestibular reactions and the nature and quantity of the introduced contrast medium.

2. After VG in 4 patients there was very strong growth of ves- /24
tibular truncal symptoms, which was irrespective of the localization and nature of the pathologic process. In 29 patients the vestibular reactions after VG changed very slightly both in the direction of growth (in 11) and in the direction of decrease (in 12) of vestibular symptoms, or remained as before (in 6).

3. A sharp growth of truncal vestibular symptoms occurred after VG with the introduction of Myolid in combination with water-soluble contrast media (in 3 patients).

4. During VG the addition of Myolid to water-soluble media caused a more frequent and strong growth of truncal vestibular reactions in

all types of nystagmus and a sharper increase in the vestibulovegetative reaction than those observed with the introduction of only water-soluble media. The latter more frequently (in half the patients) caused reduction of the vestibular disturbances after VG, which can probably be explained by their dehydrating effect.

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