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THE VARIABLE SIGNIFICANCE OF FOCAL SYMPTOMS IN THE DIAGNOSIS OF BRAIN TUMORS

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THE VARIABLE SIGNIFICANCE OF FOCAL SYMPTOMS IN THE DIAGNOSIS OF BRAIN TUMORS

[Following is the translation of an article by Yu. V. Konovalov entitled Mnogoznachnost' Gnezdnykh Simptomov v Diagnostike Opukholey Golovnogo Mozga, (English version above), in Voprosy Nevrokhirurgii (Problems of Neurosurgery), Vol. XXIV, No. 3, 1960, Moscow, pages 19-23.]

The detection of symptoms of focal involvement of the brain in the examination of a patient in itself does not solve the diagnostic problem of determining the location of the tumor. The principal difficulties for diagnosis and determination of the localization of the tumor occur when the need arises for differentiating focal symptoms -- distinguishing primary and correctly evaluating secondary symptoms. Not uncommonly, thereby, it is difficult to solve the problem of the connection of the given symptom with injury of various anatomic structures of the brain. This is brought about by the clinical variable significance of the focal symptoms. It is most important to differentiate the symptoms for the clinical analysis of the patient.

The variable significance of symptoms in brain tumors has three principal sources in its origin: 1) displacement of various parts of the brain, their herniation or compression; 2) the development of secondary hydrocephalus; 3) the possibility of obtaining homogeneous or similar

symptoms with an involvement of various portions of the same functional system of the brain, and in individual cases, also of different anatomic structures. While in the first two variants the variable significance of the symptoms lies in the nature of their secondary origin, in the third variant we are dealing with a true difference in their significance, where difficulties for making the diagnosis consist of the correct differentiation of the origin of a given symptom or given group of symptoms with respect to various anatomic structures of the brain.

The best known is the variation in significance of brain-stem and quadrigeminal symptoms in the case of displacement or herniation of the brain-stem at different levels of it in the case of a brain tumor, when the difficulty in diagnosis is determined by the need for differentiating primary tumor symptoms from secondary displacement symptoms. In this category are the symptoms of cerebellar involvement in various cases of tumors of the occipital lobe of the brain, where it is far from always easy to solve the problem of the primary or secondary origin of signs of cerebellar insufficiency.

Any variants of focal symptoms of variable significance, particularly brain-stem, quadrigeminal and cerebellar symptoms in the case of tumors with a supratentorial location, the characterization of them and lines of differentiation of them have been described with adequate detail and completely in the literature (N. N. Burdenko and S. N. Volkov, M. Yu. Rapoport,

I. Ya. Razdol'skiy, A. S. Gurvich, N. A. Popov; Clovis Vincent, Cushing and others) are well known to clinicians at large; therefore, we shall not dwell on them here.

Another group of symptoms, which are manifested as secondary and which acquire variable significance also in cases of tumors of the posterior cranial fossa has a completely different pathogenesis. These are secondary supratentorial symptoms of hydrocephalic origin. Clinicians have made quite a few observations, in which syndromes of frontal or frontal-callosal insufficiency, not uncommonly in combination with signs of the subcortical ganglia, are manifested in cases of cerebellar tumors with such distinctness that it is difficult and at times even impossible to suspect signs of secondary origin in them. Such examples have been given in our works on difficulties in the differential diagnosis between tumors of anterior parts of the cerebral hemispheres and the posterior cranial fossa. (Collection of Works "Problems of Modern Neurosurgery". Moscow, Vol. 1, 1957, page 105-118).

The variable significance of focal symptoms in these two groups comes from involvement of certain anatomic substrates and presents constant difficulties for differentiation of their primary or secondary significance. In this respect, their variable significance clinically may be considered only relative.

A true variation in the significance of focal symptoms is manifested

only where the same symptom is observed with involvement of different sections of the anatomic substrate of the same functional system and in the case of involvement of various anatomic structures in the brain.

An analysis of this group of focal symptoms of variable significance may be begun with homonymous hemianopsia: the principal features in the difference of optic tract hemianopsia from hemianopsia in which the optic radiation and the occipital cortex are involved are sufficiently well known. As a supplement to differentiation of hemianopsia it seems fitting to us to mention here the role of investigation of the visual-space perception in cases of tumors of the posterior portions of the parietal lobe or the parieto-occipital area. Clinical experience has shown that with a systematic examination of the visual fields in a number of patients with tumors located at the point mentioned a disturbance may be demonstrated in spatial perception in the corresponding half of the visual field even before it is possible to detect hemianopsia. Even on the usual digital investigation at the bedside of the severely ill patients it may be noted that the patient, attempting to grasp the physician's finger, which he can discern distinctly in both halves of the visual field, shows a definite waving with excessive movements and searching on one side. Only a certain period after this is hemihypopsia found which frequently changes over into hemianopsia. Such an early demonstration of a disturbance in the visual space perception in the

corresponding half of the patient's visual field without definite hemihypopsia or even when hemihypopsia has already been noted is usually most reliable and sometimes the only sign of a posterior parietal or parieto-occipital location of the tumor. We have already pointed to the importance of this symptom in previous works analyzing the diagnostic errors made in occipital and parietal lobe tumors. (Voprosy neyrokhirurgii /Problems of neurosurgery/, 1954, No. 6 and 1957, No. 5).

It is not so frequent that it is possible to observe individual phases in the dynamics of transition from disturbance in the visual-space perception in the corresponding half of the visual field to the development of hemianopsia. Recently we had an opportunity of carefully studying the entire dymanics of the regression of this symptom in one patient after a total removal of a parasagittal arachnoid endothelioma of the posterior portions of the left parietal lobe. The principal symptom of the disease was a right-sided hemianopsia. As early as on the third day after operation the patient's vision gradually began to recover on the right and then, on digital examination, the presence of gross disorders of visual-space perception was found against the background of hemihypopsia which was still considerable. For the next three or four weeks, with recovery of the patient's vision, the range of spatial errors in the process of grasping the physician's finger or any object in the right field of vision decreased considerably. After five weeks the patient completely recovered his normal visual

acuity, and only after this were the disturbances in visual-space perception completely eliminated.

An analysis of this observation once again emphasizes the indubitable significance of the fact which we have described for differentiating hemihypopsia or subsequent hemianopsia for purposes of clarifying the diagnosis of the localization of the tumor in the posterior parts of the parietal lobe or in the parieto-occipital area, and simultaneously the given clinical fact once again illustrates the role of the functional system in the organization of complex cerebral activity.

The variable significance of focal symptoms in the case of involvement of various anatomic structures may be seen through the example of ataxia. Clinical experience has shown that, apart from the involvement of the cerebellum, ataxia is also observed with involvement of the superior temporal lobule, particularly its posterior divisions, and thereby it is most pronounced in the hand and is manifested usually against the background of muscular hypotension in the corresponding extremity. A disorder in the analysis of kinesthetic-spatial perceptions in the corresponding extremity underlies ataxia; hence, naturally, in coordination tests the disorder of a spatial orientation in the hand imitates ataxia. Therefore, the demonstration of a disorder in the analysis of kinesthetic-spatial perceptions by the patient and not uncommonly in parallel with disorders in sensation, particularly in

deep types of sensation, readily reveals the true nature of ataxia. However, it should be noted that disorders in sensation in these patients are infrequently found. There are practically no stereognostic disorders; nevertheless, in adults differentiation of the ataxia is possible in practice.

It is much more difficult to solve this problem when the patient is a child. Clinical experience has shown that ataxia in tumors of the posterior parts of the superior parietal lobule in children is observed many times more often and always much more distinctly than in adults. Children with tumors of the posterior portions of the parietal lobe frequently come to the Institute suspected of having cerebellar tumor. How often the first examination of such a child at the Institute confirms or propounds such a diagnosis! Even such a general feature as the comparison of the frequency of the parietal ataxia in adults and children permit us to draw the conclusion that this complicated function -- the analysis of movements of the extremity in space -- is not well consolidated in children, and for this reason it is very easily disturbed. If, incidentally, we also take into consideration the fact that in children the examination of sensation is extremely difficult, it becomes clear how difficult it is to differentiate this form of ataxia in a child. Only a careful examination of the analysis of kinesthetic-spatial perception assists in making the [illegible] diagnosis in such doubtful cases.

We should not overlook the individual problesm of differentiating ataxia in tumors of the deep portions of the brain and of the ventricular system.

Of all the deep portions of the brain the thalamus attracts particular attention. The intravital diagnosis of a thalamic tumor is exceptionally difficult; those categories of thalamic tumor need to be differentiated which are erroneously diagnosed as cerebellar tumor. In view of the fact that the principal part in the erroneous formulation of the diagnosis and in the determination of its localization in the cerebellum is played by ataxia, along with signs of the brain-stem, and ataxia, the variable significance of its clinical manifestation becomes obvious. These errors in diagnosis can hardly be considered accidental, because a retrospective analysis of eight observations in which this error occurred could not show any features or symptoms in the clinical manifestation of the disease which might have been overlooked.

In proceeding with the analysis of these observations it should be noted that in all patients obstructive-hydrocephalic features of headaches were found, not uncommonly with obligatory positions of the head. Even in the history indications are given of staggering on walking. In individual observations, at the height of the paroxysms of headache with vomiting vestibular-type dizziness were noted: in two patients there were indications of loss of consciousness at the peak of various paroxysms of headache; in two patients, attacks were noted similar to the Bruns type. In all patients a spontaneous, chiefly tonic nystagmus was observed. In a number of cases there was a reduction in one or both corneal reflexes and a lessening

of hearing, more frequently on one side. In addition, in all the patients, definite disorders were found on standing and walking with placement of the feet according to the type seen in cerebellar involvement during movement, varying degrees of ataxia in the extremities of one, less often of both, sides with frequent predominance of it in one of the upper extremities. All the coordination and static-kinetic disorders listed were found against the background of muscular hypotension.

If in everything presented we take into consideration the absence of indications of any disorders of sensation in these investigations, there is nothing surprising in the fact that all the corresponding observations have been considered cerebellar tumors with the exception of two, in which a tumor of the brain-stem was suspected clinically at the level of the posterior cranial fossa. In only one of the recent observations, where on autopsy a tumor was found in the left side of the thalamus, extending to the corpora quadrigemina, the cerebral peduncles and the medial portion of the right side of the thalamus, ataxia in the right hand (in a child four years of age) was accompanied by distinct intention tremor; on walking the somewhat artificial position of this hand attracted attention, which, in addition, also showed elements of a certain degree of paresis.

Before proceeding with an attempt to evaluate pathogenetically all the symptoms listed, particularly ataxia and static-kinetic disorders which led to an erroneous diagnosis, we should ask ourselves whether today, in retrospect, in the examination material of the corresponding patients we can find any clinical indications of overlooked involvement of the

thalamus? This question has to be answered in the following way: only in a single observation did a comparison of various facts -- ataxia with distinct intention tremor, a certain artificiality of the position of the hand on the same side and a relative paresis of it -- could excite a suspicion of involvement of the opposite side of the thalamus, although no sensory disorders were found here. In the examination data of the other seven patients there were no signs which were in any way characteristic of thalamic involvement.

In solving the problem of the pathogenesis of ataxia in the extremities and static-kinetic disorders in these patients the fact deserves attention first that it was manifested without an associated tremor -- this characteristic feature of thalamic ataxia. Then, , it must be emphasized that in all seven patients, regardless of age (four adults and three children six to 12 years of age), the degree of expression of the disturbance in statics and in locomotion predominated distinctly over the degree of expression of ataxia in the extremities, without mentioning the fact that only indications of static-kinetic disorders figured in the complaints at the time of admission. If these facts are compared with the fact of the presence of the spontaneous brain-stem type of nystagmus in all the patients, and with a reduction of one or both corneal reflexes in some of them, there can be no doubt of the fact that all these symptoms have a cerebellar-brain-stem genesis, but only of secondary displacement origin. We are convinced of this not only by the lack of constancy in the parallelism between the side of the affected thalamus and the side of the ataxia predominant in the extremities but also by the fact of the

presence of the low disposition of the cerebellar tonsils with swelling of the vermis during operations on the posterior cranial fossa in three observations.

As additional confirmation of the brain-stem-cerebellar genesis of the ataxia and static-kinetic disorders an observation may be presented on a tumor of the left caudate nucleus in a nine-year old child, where because of the obstructive-hydrocephalic nature of the headaches and the detection of spontaneous nystagmus, a decrease in the right corneal reflex, coordination disorders in the right extremities against the background of muscular hypotension and ataxic gait with a predominant bend of the trunk to the left and an erroneous diagnosis of the cerebellar tumor was made. Here also, during the operation on the posterior fossa, a swelling of the left cerebellar hemisphere, vermis and a low position of the cerebellar tonsils, particularly on the right were found.

It is easy to see that the signs of disease in the tumor of the caudate nucleus were practically the same as the signs of tumors of the thalamus, which becomes understandable if we accept the same brain-stem-cerebellar genesis of all the principal symptoms with their secondary displacement origin.

We have no space here for discussing the problem of why in the observations under analysis there were practically no signs of involvement of the thalamus or caudate nucleus, because such facts are too numerous in cerebral oncology, but the similar nature of expression of the disease

in all patients once again is evidence of the common genesis of the symptoms, for which it is possible to suppose only a secondary origin.

The varying significance of ataxia in the observations analyzed, therefore, had two sources in its origin -- a principal one which, as we saw, consisted of the displacement of the brain-stem and cerebellum, which accounted for the development of a secondary cerebellar-brain-stem symptomatology; and secondly, the involvement of another anatomic structure, in this case the thalamus, which was present as we saw, only in one case.

The complicated origin of the varying significance of focal symptoms of this kind of brain-stem-cerebellar nature may be observed in tumors of the ventricular system of the brain, which we have analyzed in previous works. (Zhurnal nevropatologii i psikhiatrii imeni Korsakova /Journal of Neural Pathology and Psychiatry imeni Korsakov/, 1957, No. 4, and Voprosy neyrokhirurgii /Problems of Neurosurgery/, 1959, No. 5).

The material presented here from the aspect of the varying significance of a number of focal symptoms in the clinic of cerebral tumors should undoubtedly broaden the lines of our possibilities in the clinical analysis of neurosurgical patients. Realizing at the same time that the data of a single investigation can prove to be inadequate for the diagnosis, the clinical analysis of patients should at the current stage of develop-

increasing requirements for diagnosis should, because of the progress of neurosurgery, be able at the necessary moment to choose the trend of the auxiliary examination which may furnish the precise diagnosis.

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