Magnetic Resonance Imaging And Computer NLS-Graphy And In Evaluation Of Surgical Intervention Extent For Brain Tumors Treatment.

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Citation

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Abstract

The article presents generalized estimation of magnetic resonance imaging diagnostic efficiency in comparison with NLS-graphy in evaluation of surgical intervention extent for brain tumors treatment.

INTRODUCTION

Brain tumor eradication extent, especially of malignant one, is the main prognostic issue, affecting lifetime of patients.

Detection of primary tumor of brain, its metastases and response degree for following chemo- and radiotherapy is impossible without modern methods of neurovisualization, such as computer NLS-graphy and magnetic resonance imaging (MRI). Diagnostics of early post-operative period (first two days) complications (haematoma, pneumocephalus, ischemic nidus, edema and displacement) and evaluation of carried out surgical intervention extent is also important. However potentials of NLS-research and MRI in evaluation of carried out surgical intervention extent at early post-operative period were not studied before. At the same time attempts to increase lifetime of patients at post-operative period are related to use of new chemotherapeutic and immune preparations, and also various types of radiotherapy. But to use them efficiently, therapists require accurate information about oncotomy extent which today can be acquired only by application of NLS-research and/or MRI at early post-operative period. Taking into account all abovementioned information, the present study, targeted at increasing of NLS-research and MRI application efficiency for patients suffering from brain tumors at early post-operative period, seems to be quite urgent.

By application of these modern methods of diagnostics during first two days after surgical intervention into brain, we tried to evaluate extent of carried out resection and thereupon to choose the most rational tactics of patient treatment during post-operative period or to make a decision if there is need in repeated intervention in order to remove remaining tumor masses.

MATERIAL AND METHODS

We examined 101 neurosurgical patients. In 56 cases we carried out NLS-research and MRI both before operation (not later than in 2 weeks) and during first two days after surgical intervention; in the rest 45 cases we carried out only NLS-research during post-operative period. Also we carried out further repeated examinations if the situation required it.

NLS-research was fulfilled with “Metatron”-4025 system (the Institute of Practical Psychophysics) with generator frequency of 4.9 GHz and unit of continuous spiral scanning; the system has installed “Metapathia GR Clinical” computer software with three-dimensional visualization of organs feature.

MRI was carried out with “Opart” device (Toshiba) with magnetic field intensity of 0.35 T before and after contrast enhancement by paramagnetic in amount of 0.2 ml per 1 kg of patient’s body weight.

Age of patients ranged from 31 to 70. They were administered for brain tumor surgical removal. 35 patients suffered from malignant tumors (glioblastoma – in 16 patients, anaplastic astrocytoma – in 10 and metastases – in 9) and 21 – from benign ones (meningioma – in 12, astrocytoma – in 5, oligodendroglioma – in 2, teratoblastoma – in 1 and hemangioblastoma – in 1 patient). 26 tumors were

localized in left cerebral hemisphere, 30 – in right cerebral hemisphere. Frontal region of head was affected in 12 patients, temporal region – in 20, parietal region – in 8, occipital region – in 4, parietotemporal region – in 4, occipitoparietal region – in 4 and cerebellar hemispheres – in 4 patients.

RESULTS

In this study we intentionally did not cover potentials and comparative analysis on NLS-research and MRI in detection of such complication of early post-operative period as haematoma, hygroma and haemorrhage. We concentrated on their potentials to detect presence and identify size of residual tumor depending on post-operative changes of removed tumor bed.

According to surgical intervention, total oncotomy was carried out in 32 patients, - subtotal – in 18, partial – in 6 patients; according to neurovisualization methods data – in 30, 16 and 10 patients correspondingly.

Generally, in 42 (75%) of 56 patients, data acquired by NLS-research and MRI at early post-operative period matched completely. At the same time in 26 (46%) cases both methods confirmed surgical extent of operative intervention and in 16 (29%) cases by means of these methods we visualized remaining tumor masses distinctly.

In 4 (15%) of 26 patients NLS-research detected remaining tumor masses with the background of hemorrhage in the area of operative intervention, but at the same time MRI of these patients before and after intravenous contrast enhancement did not gave us trustful data confirming presence of post-operative hemorrhage. In 6 (11%) patients NLS-research detected massive edema in area surrounding tumor bed at early post-operative period, it caused suspicion for presence of remaining tumor masses which was confirmed by further carrying out of spectral-entropy analysis (SEA) of this area, and in 4 (7%) patients, even with the background of lesser post-operative edema, such results were not registered.

At MRI of these patients' operative area with the background of post-operative edema, in 4 cases we registered increasing of MR-signal at T1-weighted scans (WS) after intravenous contrast enhancement, which evidenced presence of remaining tumor masses, in other 4 cases we did not register such data, although in 2 of them tumor was removed subtotally. In 12 (21%) of 56 patients we detected mismatch between intra-operational evaluation of surgical intervention extent and data acquired by NLS-research and MRI. Combined evaluation of data acquired with three-dimensional visualization methods proven that in 6 (11%) of 56 patients, this data matches with intra-operational data, also in 6 (11%) of 56 patients results of NLS-research and/or MRI allowed us to update extent of carried out surgical intervention.

Figure 1

Figure 1. MRI. Cerebral glioma.

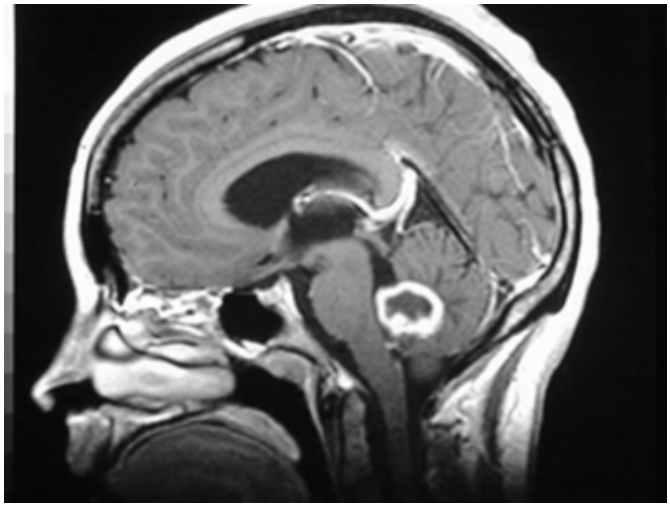

Figure 2

Figure 2. NLS. Cerebral glioma.

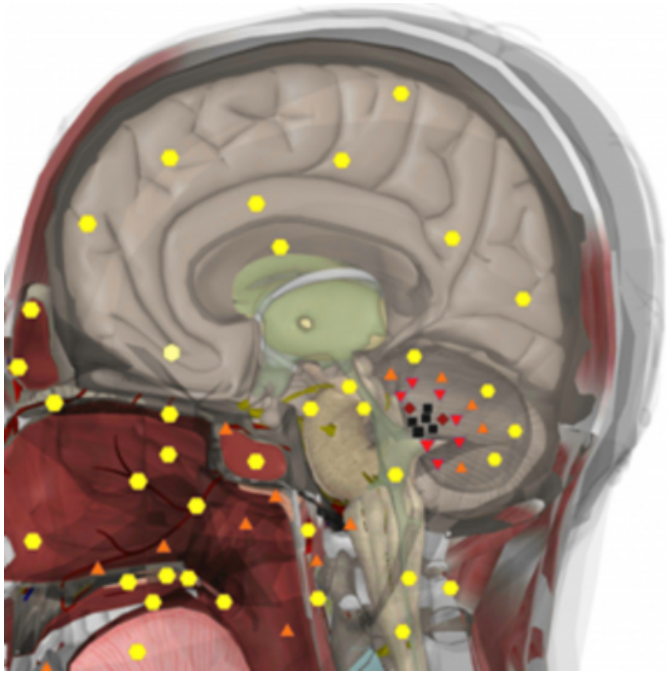

Figure 3

Figure 3. MRI. Cystic cerebral tumor.

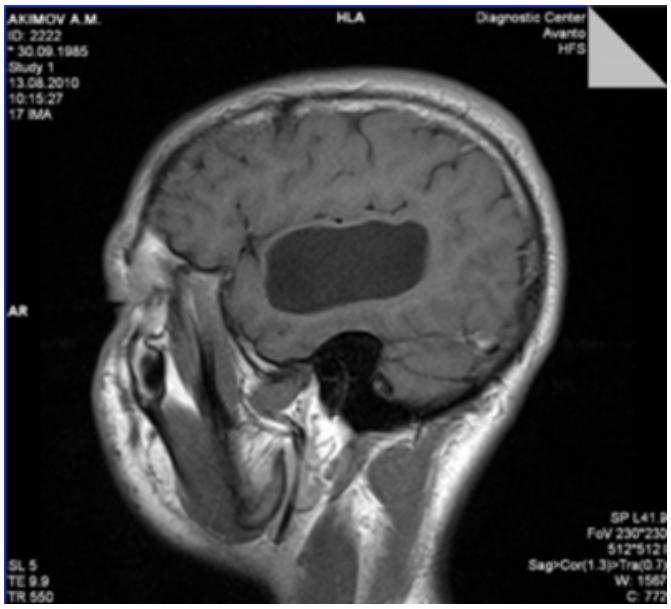

Figure 4

Figure 4. NLS. Cystic cerebral tumor.

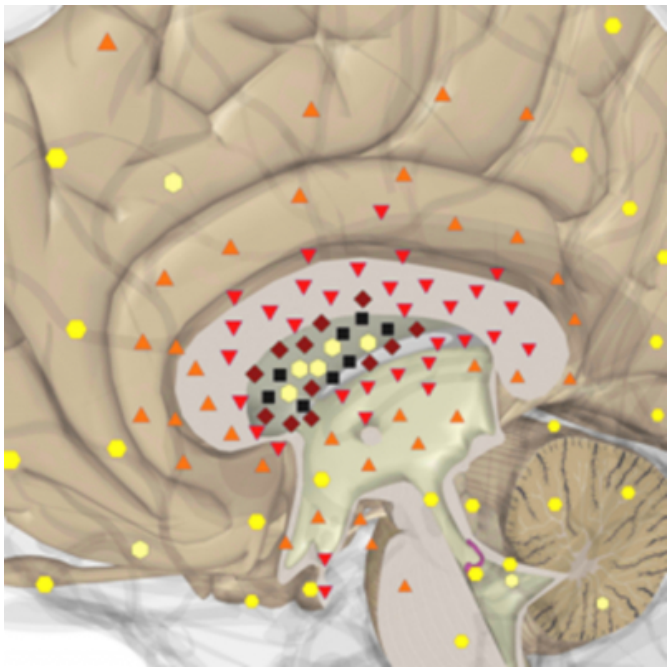

Figure 5

Figure5. Brain tumor. Frontal MRI.

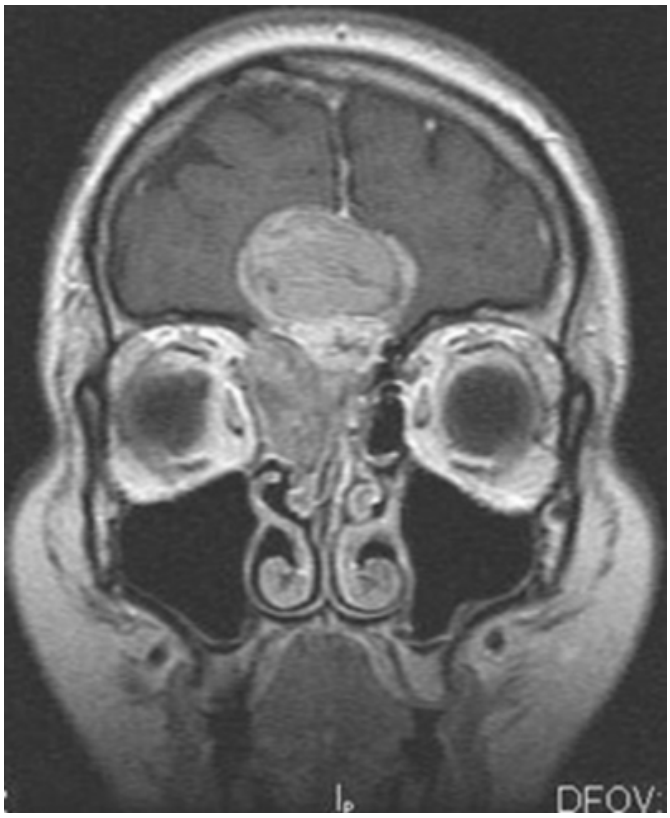

Figure 6

Figure 6. Brain tumor. Frontal NLS

Figure 7

Figure 7. MRI. Brain tumor

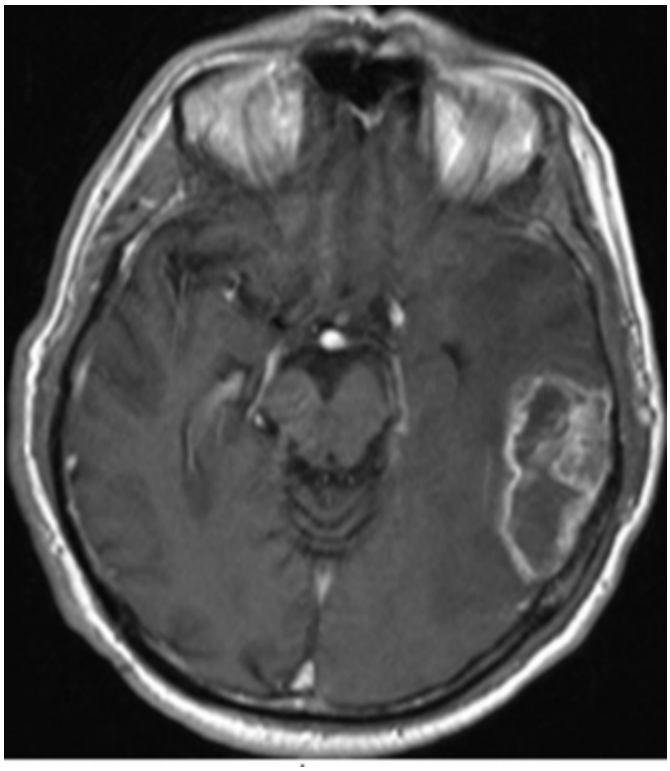

Figure 8

Figure 8. Brain tumor.Horizontal projection NLS.

DISCUSSION

In spite of introduction of highly information valuable and less-invasive research methods into surgical practice, evaluation of carried out surgical intervention extent in brain tumors treatment still remains an urgent issue in neurosurgery. Using of NLS-researches and MRI considerably improved not only detection of brain tumor remaining masses, but also made possible to detect it with the background of post-operative edema and/or hemorrhages areas. Nowadays we speak not only about simple diagnostics, but about most early detection of incompletely removed brain neoplasms. Early diagnostics by combination of hardware diagnostic methods provides improvement of treatment results of patients suffering from brain tumors. At the present moment no one questions that if there are possible remaining brain tumor masses, NLS-research with SEA and/or MRI with contrast enhancement should be carried out. As a rule, data acquired with NLS-research and MRI is quite enough to evaluate adequacy of carried out operative intervention.

It is necessary to carry out NLS-research and/or MRI not later than 10 – 14 days before operation to provide neurosurgeon with accurate information about tumor process in CNS so he could plan surgical intervention adequately. Post-operative examination (NLS-research with SEA and/or MRI with contrast enhancement) should be carried out not later than third day after operation. It is explained by the fact that consequences of hematoencephalic barrier breach and breach of barrier between normal brain tissue and tumor in form hemorrhage, edema and other post-operative changes may corrupt data acquired by examination carried out in 3 – 5 days after operation and complicate accurate evaluation.

At MRI, carried out at the first day after operation, increasing of signal from methemoglobin complicated acquired data interpretation in 44% of cases. In 79% of cases we detected contrasted of remaining tumor masses, in 12% - linear contrasting along edge of operative wound due to post-operative changes.

In 44% of cases NLS-research results without SEA was poorly informative, but when we added SEA – only in 18% of cases. The most difficult for NLS-research were cases when blood clots and air were located near edges of operation wound; for MRI – with presence of areas with linear strengthening along edges of resection. Neither case was characterized by difficult interpretation of MRI data due to forming methemoglobin.

In our study, according to surgical intervention data, total removing of tumor was carried out in 32 patients, subtotal – in 18, partial – in 6 and according to three-dimensional visualization methods data – in 30, 16 and 10 patients correspondingly. According to results of NLS-research and MRI in 6 (11%) of 56 patients we managed to update extent of carried out surgical intervention in comparison with intra-operational data; in 2 patients (suffering from melanoma and anaplastic astrocytoma) tumor masses after their subtotal removing were not diagnosed by three-dimensional visualization methods.

On the basis of our study results we may assume that extent of carried out resection should be evaluated according to MRI data, because at edema and ischemia, with the background of surgical wound, remaining tumor masses are visualized more accurately. In our research in 12 (21%) of 56 patients results of NLS-research were questionable – in 6 of them in area surrounding tumor bed we detected massive edema, which is the sign of remaining tumor masses presence. In 4 patients, even with the background of lesser post-operative edema, we did not register such data. In

another 2 cases tumor masses were not detected by NLS-research against the background of hemorrhage.

At MRI of these patients, with the background of post-operative edema, in 8 of them we detected increasing of MR-signal after intravenous contrast enhancement at T1WS (including 4 patients with no information concerning remaining tumor masses, acquired with NLS-research), which evidenced presence of remaining tumor masses, and in 4 patients we did not get such data. On the other hand, using of NLS-research with SEA for detection of remaining tumor masses with the background of post-operative haematoma is more preferable. So in 4 of our patients NLS-research with SEA detected remaining tumor masses with the background of hemorrhage in the area of operative intervention, at the same time MRI of these patients before and after contrast enhancement did not give us reliable data regarding its presence with the background of post-operative hemorrhage. Thereby extent of carried out surgical intervention was updated in 26 (93%) of 28 patients by NLS-research. Combined application of these methods allowed us to make more accurate diagnosis in 27 (96%) of 28 cases.

CONCLUSION

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