3D COMPUTER
NLS-GRAPHY

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This publication contains modern principles of three-dimensional images rendering in accordance with NLS-graphy data.

Also it gives overall evaluation of three-dimensional NLS graphy diagnostic value for revealing of various diseases in comparison with other methods of hardware diagnostics, such as roentgenography, computerized tomography and magnetic resonance imaging. Special attention is paid to advantages and disadvantages of various techniques of three-dimensional images rendering.
CONTENTS

Main tendencies of NLS-technology development ................................................................. 4
Application of three-dimensional NLS-diagnostics in oncology.
New trends and prospects of development ............................................................................. 7
Certain aspects of NLS-diagnostics of liver focal pathology ...................................................... 11
Nonparasitic hepatic cysts: role of NLS-research and CT
in differential diagnostics and choosing of surgical treatment tactics ................................... 16
Application of NLS-diagnostics at extrahepatic biliary ducts diseases ..................................... 18
3D NLS-diagnostics of nasopharynx cancer ............................................................................ 21
NLS-diagnoses of lung cancer ................................................................................................. 26
NLS and radiologic examination methods in diagnostics of acute
purulent abscesses of lungs ....................................................................................................... 30
Diagnostics of multiple aortic aneurysms with NLS-research, 
CT and angiography .................................................................................................................. 32
Computer NLS-graphy and magnetic resonance imaging in evaluation
of surgical intervention extent for brain tumors treatment ..................................................... 36
Ultrasound research and NLS-screening of ovarian cancer ..................................................... 40
Comparative analysis of NLS and MRI diagnostic value at invasive
forms of cervical carcinoma ..................................................................................................... 43
Three-dimensional NLS-graphy in combined diagnostics
of breast diseases ..................................................................................................................... 48
CT and NLS-diagnostics of degenerative-dystrophic damages
of intervertebral disks ............................................................................................................... 51
NLS-diagnoses of ankle joint damages .................................................................................... 54
Potentials of combined NLS-examination and magnetic resonance
imaging in differential diagnostics of soft tissues sarcomas .................................................. 57
Combined radiation therapy and metatherapy of glioblastoma in elderly patients .................. 61
MAIN TENDENCIES OF NLS-TECHNOLOGY DEVELOPMENT

V.I. Nesterov

Being a creator and having 20 years experience of work with NLS-technologies, the author expresses his opinion regarding main tendencies of its development. First decade of the new century will be marked by considerable extension of NLS-technology’s diagnostic features, first of all by means of new technologies introduction, using computer engineering and alliance with pharmaceutical industry. Such concepts as NLS-ultramicroscopy, non-linear spectral and entropy analysis, high-frequency NLS-therapy will become customary in clinics. Together with development of inexpensive portable digital NLS-systems, scope of their application will be extended also; improvement of communication means capabilities will allow to transmit live pictures to medical consulting centers from any place on Earth. Pragmatic market of 3D-visualizing diagnostic technologies will be formed gradually by means of harmless nonionizing methods, allowing to fulfill multiple dynamic researches, i.e. NLS-technologies undoubtedly will come to the fore.

Non-linear (NLS) diagnostics, based on a new physics of quantum-entropy interaction allows to acquire maximum information about gravity, maturity and intensity of functional changes in human organism during medical check-up. In majority of cases application of this technology has a principle meaning for diagnosing and therefore for choosing of proper treatment course. Thereby developing of this method became a great improvement in diagnostic medicine. Using the principle of NLS-diagnostics and taking as the basis researches of academic Svyatoslav Pavlovich Nesterov, who invented underlying trigger sensor, at the beginning of 90’s of the last century the Institute of Practical Psychophysics (IPP) started to design NLS-diagnostics systems. According to EU experts, diagnostic equipment manufactured by the IPP, holds 20% of world market of medical resonance-wave technologies nowadays. Development of NLS-technologies cannot be separated from main problems of medicine – reasons of diseases development, their early diagnostics and objectivization of treatment efficiency. Despite decreasing of cardiovascular diseases mortality rate (according to world statistics), the situation around «epidemic no. 1» is still remains unfavorable. Constant growth of oncological and hereditary pathologies is registered. In modern world protective, less-invasive, bloodless surgery goes together with therapy which becomes more and more «aggressive». And if we take into account that our civilization is technogeneous, it is quite possible that humanity will face new and unknown diseases in future. With this background development of diagnostics methods goes on and NLS-researches is one of the most significant among them.

To achieve significant progress in quality of NLS pictures, considerable increase of amount and accuracy of contained information is required. It is increasing of amount and accuracy of diagnostic information in NLS picture that is the main objective of modern technologies development. Nowadays, new approaches to acquiring and analysis of information can be divided into those related to visualization in three-dimension mode and those related to increasing of devices’ generation frequency, which is directly associated with increasing of resolution during research of organism tissues’ ultrafine structures.

In identification of NLS-systems’ operating characteristics high-frequency generators have principal meaning. Major part of the most significant achievements in picture quality improvement and in growing of our clinical possibilities related to innovations in development of non-linear generators. Working frequency ranges of modern generators are within 1.4 – 4.9 GHz, which allows us to research almost all internal organs, anatomical masses and tissues with up to 30 micron resolution. However non-invasive visualization of ultrafine structure of tissue at separate cell organelles and DNA fragments may be hampered. That is why technology of high-
frequency non-linear generators manufacturing have changed greatly.

At the present time, together with American company «Clinic Tech. Inc», super high-frequency non-linear generators with 40 – 100 GHz operating frequency are developed and clinically tested. It allowed to reach 100 angstrom resolution. These technologies, which are not yet widely applied, are already called «NLS-ultramicroscanning». Most probably in near future thanks to development of this area, we will be able to look at epithelial and endothelial tissues at sub-cell level more closely and to research and correct clusters of reborn cells.

Together with International institute of theoretical and practical physics, which was headed by nowadays late Academician A.E. Akimov, we created analogue-free research equipment allowing to monitor condition of biological object by changes in torsion fields generated by organism tissues, separate cells, chromosomes, DNA molecules and to influence living cell with torsion fields.

The main problem of torsion fields’ influence to a cell ultra-structure and DNA helix is to find an extremely precise instrument which, similar to laser, could influence DNA molecule structure with diameter less than 2 nanometers. Creation of such unique instrument became possible only after super-high-frequency torsion generators were developed. These generators have frequency of few dozens of gigahertz and additional feature of wide-pulse signal modulation to generate field oscillations with parameters peculiar to living cell in order to restore its regulatory mechanisms.
Another promising area of NLS-technology development is creation of non-linear telemedicine monitoring system.

A remarkable opportunity of this method lies in enhancing the sensitivity of the diagnostics and expanding the system functionality due to technologically remote diagnostics (telediagnostics) in asynchronous mode of a dialogue between the doctor and the patient at which they can communicate with one interactively regardless of the location remoteness.

The system, offered by the Institute of Practical Psychophysics, provides opportunity to ensure an audiovisual contact between a patient and a doctor during torsion diagnostics when doctor is at great distance from the patient.

The equipment can be applied in clinics, diagnostic centers and scientific research institutes to carry out distant diagnostics of patients using mobile terminals (in field conditions, in the mountains, at sea).

The body of the obtained data is sent through a specialized server to a medical advisory center with the observance of data safety requirements.

Another technical achievement, which opens up new prospects and features in NLS-diagnostics, is «three-dimensional picture» (3D). Originally 3D appeared in computer tomography, because processing powers allowed to summarize parallel crosscuts into one multidimensional unit.

Even few years ago 3D was considered as hardly applicable long term aestheticism of professionals in NLS-diagnostics. In the present time it is an integral part of not only scientific studies, but practical diagnostics also. There is growing number of such terms as «surgery under control of three-dimensional NLS-visualization» or «3D virtual NLS-graphy».

Preparation of NLS pictures for visual analysis is carried out by means of «4D TISSUE» original technology developed by the Institute, that allows not only getting of virtual multidimensional pictures of anatomic and histological structures, but also mark with color interesting biologic tissue – «additional dimension» and visualize bones, soft tissues and vessels simultaneously or in any desired succession.

Great future of such programs is unquestionable, because these technical achievements facilitates diagnostician’s job and allows to represent clearly anatomic characteristics and pathological changes in researches organism.

It seems that creation of ultrahigh-speed «intellectual» NLS-scanner is one of the most important features of new 3D generation.

More and more clinical therapists realize necessity to master NLS-diagnostic equipment, because need in properly educated experts in this field is obvious. At the same time among traditional medicine specialists there is a tendency to pay more attention to researches with computed X-ray imaging and magnetic resonance imaging. That is why NLS-technologies, unfortunately, is still hidden among more orthodox methods of diagnostics. Clinician will be ready (in many aspects are already ready) to improve their diagnostic possibilities by using of NLS-technology, often without X-CT, MRI and radionuclide methods.

Nevertheless, only in strategic partnership of NLS-diagnostics experts, radiologists and clinicians may be found a key to optimal diagnostic and healing application of this, in all senses, original and efficient medical technology.
APPLICATION OF THREE-DIMENSIONAL NLS-DIAGNOSTICS IN ONCOLOGY.
NEW TRENDS AND PROSPECTS OF DEVELOPMENT

V.I. Nesterova, L.V. Shaposhnikov, L.A. Yankina, O.R. Kojemyakin

Diagnostics and treatment of malignant neoplasms are the most urgent issues in modern medicine. Oncologists face not only problems of primary and updating diagnostics of tumoral diseases, but also evaluation of various methods of tumor treatment efficiency, well-timed diagnosing of recurrent tumors after treatment procedures. Introduction of new three-dimensional technologies of NLS-pictures acquiring into clinical practice allows solving of abovementioned diagnostic problems at qualitatively new and higher level.

Application of three-dimensional visualization of organs and tissues significantly extended potential of NLS-diagnostics. Today we may speak about truly early diagnostics of tumoral diseases at the first, pre-clinic stage of patient examination. Three-dimensional NLS-examination allows not only revealing of minimal structural changes in organs and tissues, but precise evaluating of tumoral process spreading extent, also, together with use of spectral-entropy analysis, it makes possible to identify diseases stage and choose adequate method of patient treatment. The Institute of Practical Psychophysics has great experience of three-dimensional NLS-scopy application; it is not possible to describe it in proper manner in such small article. Due to this fact we decided to dwell on those issues of three-dimensional NLS-diagnostics, which have great practical importance, but still not widely spread in clinical practice.

In group of malignant tumors of liver metastatic invasion hold leading positions. It is well known that the most frequent reasons of liver metastatic disease are malignant tumors of large intestine, rectum, stomach, pancreas, mammary gland and lungs. At metastatic disease shape, structure, size of parenchyma and vascular pattern of liver are more or less changed, depending on duration of tumor existence, number and sizes of tumoral nodes. In addition to three-dimensional NLS-graphy, diverse variants of dopplerography, in the first place energy color mapping, may be used to solve problem of differential diagnostics of benign and malignant changes in liver parenchyma. Three-dimensional NLS-graphy method allows visualizing of three-dimensional picture of vessels location and form, marking them by certain color at the background of organ usual picture. In this aspect the method is rather close to x-ray angiography method and makes possible to visualize accurately great and minute vessels.

Vascular pattern at single metastases is broken due to constriction and dislocation of hepatic branches certain vessels. At massive affection significant breach of vascular pattern happens. In some cases a therapist may detect local, chaotic change of vascular pattern, when hypervascularization of tumoral nodes is present. However tumoral nodes at liver metastatic disease may have both increased and deceased vascularization. Due to this fact data acquired with NLS-graphy is not always sufficient and should be completed with results of x-ray angiography.

Differential diagnostics of tumoral affection of liver complicated by not only marked multiformity of changes, but also by its frequent combination with diffuse
It is well known that one of the leading methods of solitary hepatic metastases treatment is surgical operation. Proof of operation efficacy is the absence of metastases in other parts of liver. This problem may be successfully solved by three-dimensional NLS-ultramicroscopy with application of spectral-entropy analysis. For a long time wide application of ultramicroscopic NLS-examination was limited by absence of special equipment with high resolution. Nowadays devices with super-high frequency non-linear generator (40 GHz) are created, it makes possible to carry out three-dimensional ultramicroscopic revision and evaluation of chromosomal aberrations of almost any cell in human organism. Three-dimensional NLS-research may help to specify character, localization and number of pathological nidi when clinician plans liver resection because of metastatic disease. Our experience shows that application of three-dimensional NLS-graphy at cancer metastases of large intestine allows detection of additional nidi, not registered by any type of introscopy, in 20% of cases. Data acquired at three-dimensional NLS-graphy of liver makes possible to evaluate extent of operation, avoid unjustified surgical intervention and decrease risk of post-operative complications development.

Joint application of video-laparoscopy and NLS-research allows therapist to combine proper examination of abdominal organs and tissues with study of their structure by application of spectral-entropy analysis in selected areas, and to carry out updating diagnostics of tumoral diseases of abdominal cavity organs and retroperitoneal space. At stomach cancer number of mistakes at pre-operation diagnostics of liver metastatic disease reaches 25% – 30%. The first application of such research technology proves that number of mistakes decreases to 3% – 5%.

Ultrasound scan picture of liver tumor

Computed tomography scan of liver – tumor nodes are marked by arrow signs

NLS-graphy of liver cancer

Gall Bladder ( Harmonic )

and dystrophic changes of organ’s parenchyma. All abovementioned stipulates necessity in wide application of spectral-entropy analysis of affection nidus. Our experience proves that availability of NLS-diagnostics equipment makes possible detailed examination of three-dimensional hepatic neoplasms sized less that 3 mm. Therefore at early stage of pathology development a clinician is able to update morphological substrate of detected changes and to acquire sufficient information for diagnosis updating.
Nowadays oncurology is the sphere where methods of three-dimensional NLS-graphy may also be widely applied. However until this day application of three-dimensional NLS-research of patients operated on urinary bladder tumor consisted in dynamic monitoring of organ’s condition in order to detect recurrent tumor and metastases at early stage. Introduction of three-dimensional NLS-methods into clinical practice allow complete changing of point of view to this problem. We believe that this issue is really topical, because majority of surgically operated patients were subjected to traumatic transurethral resections.

Three-dimensional NLS-research with application of spectral-entropy analysis, carried out during surgical oncotomy, allowed us to detect additional tumoral neoplasms, not registered by two-dimensional NLS research in 37% of patients. Application of three-dimensional methods makes possible to specify extent of tumor process local spreading, control depth of urinary bladder wall resection and decrease risk of complication development during oncotomy.

Diagnostics and morphological verification of rectum cancer does not present difficulties, as a rule. However evaluation of organ’s wall invasion degree is not always possible by standard methods of diagnostics. Traditional two-dimensional NLS-research is already widely used as diagnostics method of rectum recurrent cancer after organ extirpation. Nevertheless primary diagnostics of the disease by two-dimensional NLS-graphy is hindered due to several reasons. In the first place it is explained by the fact that at two-dimensional NLS-scanning rectum is visualized only partially (80% of whole organ surface area).
In conclusion, as an outcome of short characteristics of modern three-dimensional NLS-graphy method, we want to emphasize that this method permits efficient fulfillment of such objectives as detection of tumoral changes, identifying of diseases stage and qualitative evaluation of carried out treatment.

Application of three-dimensional NLS-graphy makes possible to differentiate accurately all layers of rectum walls, and thus to diagnose depth of tumor infiltration and identify stage of the disease, using spectral-entropy analysis. This method helps to detect changed lymph nodes sized above 1.5 mm at metastatic disease of pararectal lymph nodes. During monitoring of carried out pre-operational radiotherapy three-dimensional NLS-graphy helps to detect accurately decreasing of tumor sizes, identify changes in its structure, related to medical pathomorphism, identify decreasing of pararectal tissues tumoral infiltration. Therefore three-dimensional NLS-graphy may be considered method of primary diagnostics of rectum cancer. It allows therapist to solve the most important diagnostic issues, related to identifying of tumoral process length, extent of tumor local spreading and monitoring of carried out pre-operative treatment efficiency. At organ preserving operations three-dimensional NLS-graphy may be used as efficient method of recurrent tumors early diagnostics in anastomosis area.
CERTAIN ASPECTS OF NLS-DIAGNOSTICS OF LIVER FOCAL PATHOLOGY

A.Y. Shvack, V.I. Nesterov, N.L. Oguzdina

Recently role of non-invasive diagnostics methods becomes more and more important. New systems, such as «Metatron» system of last generation, appear; this system has great potentials in differentiation of pathological processes, including those at liver diseases. Modern expensive diagnostics equipment can be afforded only by large clinical and scientific centers, but relatively small medial departments may allow themselves to have equipment combining reasonable price and rather high diagnostic potentials. Optimal choice in this case may be computer NLS-graphy by means of «Metatron» system. Not only accurate and well-timed diagnostics of disease has great importance, but also there is need to keep up certain financial limitations. In some cases, especially at planning of surgical intervention, NLS-graphy seems to be more reasonable than radiologic computed tomography (CT). NLS-method makes possible to use multifunctional program that allows therapists to carry out consecutive updating of affection character during one and the same examination.

At the same time many types of pathology are diagnosed even during properly carried out NLS-examination. Often patients come for CT or MRI without results of NLS-examination, but at the same time if it was carried out before, it could ease, in many aspects, tactics of further examination and optimization of offered methods.

In this article we would like to examine rational application of diagnostics equipment depending on detected symptoms of one or another disease of liver. In the first place it concerns focal diseases, which for the long period remain clinically «mute». Almost every visualizing study makes possible to detect focal masses in liver parenchyma, obstruction of biliary tracts, hepatic vessels and inferior vena cava, but diagnosis updating is the prerogative of one or another method (ultrasound, CT, MRI or NLS).

Choosing of visualization method (depending on potentials) should be started from history taking and evaluation of patient’s external status. So patients with body weight of more than 120 kilograms, with presence of foreign bodies (gunshot or missile wound, metal clips after surgical interventions, etc.) with heart pacemakers and those suffering from claustrophobia cannot be administered to MR-imaging. For some patients (especially in pediatrics) radiation dose should be decreased. There are no contraindications for NLS-examination. Small sizes of neoplasms (less than 0.5 cm) allows to identify their character and do not require additional CT or MRI.

Having data of previous studies, one need to identify diagnostic value of future examinations, deciding if one or another examination will be enough.

This article contains information about NLS-graphy application in diagnostics of liver focal affections: hemangioma, cysts, abscesses, adenomas, focal nodal hyperplasia and malignant tumors. Also we considered issue of difficulties in detection of malignant liver affections by NLS-method.
The most frequent unexpected finding after examination and the object of further diagnosis verification is liver hemangioma.

Hemangioma is a benign vascular neoplasm of liver (prevalence in population is up to 15%). Having heterogeneous internal structure, their visual picture may resemble cancer (especially at ultrasound and CT), which requires additional diagnostic investigations. In majority of cases hemangiomas are clinically asymptomatic.

Diagnostic criteria of hemangioma (according to MRI, CT and NLS data) are considered to be the following: it is never encapsulated, edematous, is drawn towards hepatic veins, sometimes its form is close to form of hepatic lobes. Its outlines may be of irregular form, but distinct. Dynamic study detects very slow growth.

At NLS-examination hemangioma often visualized as hyperchromic (4 – 5 points according to Fleindler’s scale) neoplasm. However if there is corresponding fatty infiltration of liver present, hemangioma acquires hypochromicity and sometimes it is hard to differ it from cysts or metastases. Cavernous hemangioma is represented by hypo- and achromogenic areas (1 – 3 points), which complicates its interpretation. Hyaline fissure, one of the most typical symptoms of hemangioma, not always can be revealed.

It should be noted that if there is possible hemangioma, puncture cannot be administered due to high risk of haemorrhage development. It requires dynamic monitoring of a patient and repeated examinations.

Cyst may often be an unexpected finding during examination on another occasion. At NLS-examination simple cyst may have certain diagnostic symptoms, according to which it may be successfully diagnosed. It has roundish form, distinct outlines, hypo- and achromogenic (1 – 2 points) content. Sometimes cyst wall may resemble capsule; detected heterogeneity of internal content or multichamber character may complicate diagnostics.
If neoplasm with thick wall or heterogeneous internal content is detected, it is reasonable to carry out CT with contrast enhancement. Cyst will not be contrasted. Complicated cysts are accompanied by increasing of densitometric indices and appearance of air bubbles inside cyst, which may be easily detected by CT. Application of CT is reasonable in cases of unknown organ belonging of cyst, visualized by NLS in liver area. In fact, cyst visible in liver area, may be cyst of adrenal gland, mesentery, etc.

Hepatic hydatid at NLS-research shows a number of certain characteristics, differing it from other cyst-like neoplasms. These are roundish form, smoothness of outlines, visualization of satellite beads. Chromogeneity of cyst decreases after parasite death. Final argument in diagnostics of hepatic hydatids is high spectral similarity with (D<0.425) «Echinococcus granulosis» etalon.

If NLS-examination cannot render all signs of cyst or the examination seem to be of low information value, both MRI and CT may be recommended as high information valuable methods at this pathology.

Liver abscess is quite rare focal affection of liver, characterized by local accumulation of suppuration in its tissue with disintegration of parenchyma and stroma. Abscesses may be a result of cholelithiasis complications, drawing towards localization in right lobe of liver and having large size, in majority of cases. Typical signs of biliary abscess are small sizes and multiplicity of foci. Visual picture of liver abscess is not always specific; at the same time clinical symptomatology allows to suspect this exact pathology.

At NLS-examination a therapist may detect thick hyperchromic capsule and heterogeneous internal content of neoplasm. At visualization of fanciful forms and heterogeneity of internal structure, accuracy in diagnostics may be achieved by CT using.

At forming of abscess cavity, NLS-examination detects moderate chromogeneity in the center of focus (3 – 4 points according to Fleidler’s scale).

At the same time we detected gradual (crateriform) density heterogeneity from peripheral areas to the center. Diagnosed focus does not have strict distinguishing from surrounding parenchyma. Heterogeneous lobulation is visualized, air bubbles looks like hypochromic dots in abscess cavity. Final argument is high spectral similarity (D<0.425) to «Liver abscess» etalon. According to some authors, diagnostic reliability of NLS in case of abscess approaches to absolute.

Liver adenoma relates to benign tumors, originating from hepatocytes. It may be anamnestically detected that it is related to taking of peroral contraceptives. More often this pathology is detected in young women. Sometimes it may be diagnosed in men, who use androgenic or steroidal agents. Adenoma diagnostics is very important due to high risk of hemorrhage development, rupture, malignant transformation or need in surgical intervention.

Histological heterogeneity of adenoma (haemorrhage, necrosis, fatty infiltration, central cicatrisation, encapsulation and development of large intratumoral vessels) results in visual picture of heterogeneity at both NLS and MRI and CT; this sign is a distinctive trademark of this pathology. In 30% of cases happens encapsulation of adenoma similar to development of pseudocapsule. Adenoma size ranges from 1 to 19 centimeters (average 5.4 cm). Adenoma may be both singe and multiple. It has distinct outlines. Differing from hemangioma, adenoma is not drawn towards localization next to hepatic vessels and it does not take whole lobe. Malignant neoplasms are more heterogeneous and poorly outlined.

NLS-examination may display signs of liver adenoma when it detects rounded neoplasm with distinct outlines, moderately hyperchromic (4 – 5 points) internal structure,
intratumoral vessels and surrounded by hypochromic ring. As usual, the most important issue in diagnosing is high spectral similarity to «Liver adenoma» etalon.

MRI-signs of adenoma are: good outlined heterogeneous neoplasm, surrounded by ring, more often hyper-intensive, sometimes with focus of hypo-intensive hemorrhage in the center, with corresponding central cicatrisation, heterogeneously contrasting in arterial phase.

Abovementioned characteristics (heterogeneity of structure, pseudocapsule, hyper-intensity at MRI pictures) once again emphasize difficulty of adenoma differentiation, especially from hepatocellular carcinoma.

If there are signs of adenoma one can choose either NLS-examination or MRI of liver.

Focal nodal hyperplasia of liver (FNH) – is quite rare benign tumor, in majority of cases diagnosed in women of fertile age. FNH is single, rounded, non-encapsulated neoplasm with irregular hepatic architectonics, divided by septa reaching central cicatrice. Average size of focus is 5.7 centimeters (from 1.5 to 12.0 cm).

At NLS-research FNH may look like neoplasm of irregular form with diffuse microfocal heterogeneity and absence of capsule. Often hyperchromogenic nodes are detected, but chromogeneity may be of any kind.

FNH has a wide spectrum of MR images. The most typical are considered to be homogeneity and isointensity. Characteristics of central cicatrice have special diagnostic value.

Intratumoral cicatrice has complex structure and knowing of its histological characteristics contents (biliary ducts, blood vessels and cells intrinsic to chronic inflammation) helps to interpret properly MRI acquired data.

The most rational diagnostic method in presence of FNH or liver adenoma signs, we consider to be initial NLS-research of abdominal cavity organs and further MRI with contrast enhancement in order to update a diagnosis. CT has not so great diagnostic value.

Specific diagnostic problems may appear in patients with cirrhotic changes in liver, especially at appearance of liver tissue regeneration nodes, which are poorly differentiated from possible malignization foci. NLS-research accurately detects liver cirrhosis, however when we use spectral-entropy analysis, differentiation of hypochromic or isochromic regeneration nodes from malignization foci nor always possible, because the latter relate to catabolic processes, poorly diagnosed by NLS-method.

CT perfectly detects typical signs of liver cirrhosis: decreasing of liver size, uneven outlines, disproportion of lobes sizes and dilation of intrahepatic connective tissue spaces.

Hepatocellular carcinoma (HCC) is the most widely spread among primary malignant hepatic neoplasms. In 50% of cases it is single, in 15% – 20% – multiple and in 30% – 35% – diffuse. Neoplasm may be both encapsulated and not; its size differs from 6 to 20 centimeters.

NLS-examination data is quite specific – it is heterochromic, more often hyperchromic (5 – 6 points according to Fleindler’s scale) neoplasm with indistinct outlines, sometimes surrounded by hypochromic ring. It is the result of changed architectonics vascular structure, dilatation of large vessels and presence of blood clots in them. Problems in diagnostics may appear at carrying out of spectral-entropy analysis of blast processes, because intensively growing tumors without necrosis foci and tissue disintegration, as any catabolic processes, poorly diagnosed by NLS-research method, due to physics of quantum-entropy interactions.

Diagnostics of metastases into liver is also very important. Analysis of detected metastatic disease foci according to high information valuable methods (MRI and CT) proven, that sometimes NLS-research carried out after tomography detected not all, even well-known,
foci of localization. Presence of different in structure foci is typical exactly for metastatic affection of liver. Potentials of liver metastatic affection detection are significantly extended by CT and MRI with contrast enhancement. Cystic-necrotic neoplasms in liver are more successfully diagnosed with NLS-method. Diffuse infiltrating metastases, as a rule, are diagnosed poorly by NLS-examination; they may resemble diffuse diseases of liver. In some cases one has to use puncture biopsy of liver to confirm diagnosis.

Need in CT or MRI for patients with signs of metastatic affection of liver is obvious.

In conclusion we would like to emphasize that within NLS-method, new and more information valuable methods are being developed. Application of continuous spiral scanning, spectral-entropy analysis, three-dimensional visualization in many aspects improves diagnostics of both malignant and benign neoplasms, approaching accuracy of diagnosing to 81%. Cost of NLS-researches is considerably lower than cost of CT and MRI. Recently, diagnostic role of ultramicroscopic evaluation of chromosome aberrations, detected by ultrahigh-frequency generators (40 GHz), especially in cases of metastatic disease, becomes more and more important. Therefore, diagnostic process in every case is individual and must be based on numerous generalized data of all carried out researches. At the first stage of diagnostics NLS-examination (especially dynamic one) is preferable and further choice of high information valuable expensive methods is advised to carry out depending of acquired from previous examinations data.
NONPARASITIC HEPATIC CYSTS: ROLE OF NLS-RESEARCH AND CT IN DIFFERENTIAL DIAGNOSTICS AND CHOOSING OF SURGICAL TREATMENT TACTICS

A.Ya. Shvack, T.L. Guseva, V.I. Gusarov

We analyzed treatment data of 32 patients suffering from coelomic hepatic cysts. There were 21 women and 11 men among them, aged from 18 to 64; major part was aged 25 to 50. In 53.1% of cases hepatic cysts were solitary, in 28.1% there were from 2 to 5 cysts. In 6 cases (18.8%) we registered polycystic hepatic disease. Sizes of diagnosed cysts ranged from 5 mm to 15 cm.

Group of examined patients consisted of patients in which coelomic hepatic cysts were diagnosed at pre-operation checkup stage.

RESULTS

All patients were subjected to NLS-examination of abdominal cavity with «Metatron»-4025 system at the moment of admission to hospital. Signs of coelomic hepatic cysts were solitary, in 28.1% there were from 2 to 5 cysts. In 6 cases (18.8%) we registered polycystic hepatic disease. Sizes of diagnosed cysts ranged from 5 mm to 15 cm.

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We analyzed treatment data of 32 patients suffering from coelomic hepatic cysts. There were 21 women and 11 men among them, aged from 18 to 64; major part was aged 25 to 50. In 53.1% of cases hepatic cysts were solitary, in 28.1% there were from 2 to 5 cysts. In 6 cases (18.8%) we registered polycystic hepatic disease. Sizes of diagnosed cysts ranged from 5 mm to 15 cm.

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In spite of considerable achievements in medical visualization and treatment of benign volumetric affections of liver, there are still many difficult and unsolved problems of pre-operation differential diagnostics and tactics of surgical intervention in this group of patients.

Echinococcosis is the most frequently registered one among cystic neoplasms of liver. It is registered in 65% – 80% of all cystic affection of liver total number.

Regarding coelomic hepatic cyst: it is registered not so often and is found in 0.15% – 1.86% of all cases, according to autopsy data. Ultrasonography, x-ray and magnetic resonance computed tomography significantly increased detection rate of patients suffering from nonparasitic hepatic cysts (NHC). It changed notion about NHC as quite rare pathology. Continuous presence of NHC may result in development of various complications.

In recent years we see reports about new diagnostics method – computer NLS-graphy; it is characterized by high information value in study of hepatobiliarypancreaticoduodenal area pathologies together with availability and usability.

It should be noted that abovementioned signs of coelomic hepatic cysts not always specific and sometimes clinicians face considerable difficulties in differential diagnostics with parasitic hepatic affections.

Determining factor in differential diagnostics in this case may be considered high spectral similarity to «Echinococcus granulosus» etalon (D<0.425) registered in spectral-entropy analysis (SEA) mode.

Computed tomography was carried out in 12 patients and allowed us to specify topographic-anatomic location of cysts in relation to hepatic porta, to define segmental localization of nidus, which, in major part, formed surgical access and possibility of intervention operation performing and endovisual methods of surgical treatment.

At differential diagnostics with echinococcosis, main signs which made possible to diagnose coelomic hepatic cysts at pre-operation stage, were the following: combination of irregular shape (ellipsoid, with local outpourching due to thin capsule) and distinct outlines of neoplasm (66.6% of examined patients); absence of...
thickening and doubling of cystic walls (83.3%); relatively
homogeneous internal structure at densitometry.

However, presence of questionable information
achieved by visual examination both by CT and NLS-
research is inevitable, which was confirmed by our study.

Decisive importance in differential diagnostics (in 92.4% of
cases) belonged to SEA. In two cases during pre-operative
diagnostics of coelomic hepatic cysts, therapists detected
hepatic hydatid cysts with thin chitin tunics by laparotomy,
it evidenced relatively young age of parasite.

Particularly it explains our unfavorable attitude
towards performing of puncture transcutaneous
methods of coelomic hepatic cysts treatment, diagnosed
only by CT. The exception were cases, when due to
multiple coelomic hepatic cysts, in various periods after
laparotomy and further removing of cysts parts as they
grew, transcutaneous aspiration punctures were performed.
In total such manipulation were performed in 5 cases
in 3 patients. At the same time in 3 cases punctures were
carried out under monitoring of NLS with SEA; in 2 cases
under monitoring of CT. Possibility of transcutaneous
intervention manipulation is explained by the fact that
non-parasitic character of cysts was undoubtedly confirmed
by SEA. Non-invasive character of manipulations,
possibility of performing in conditions of combined
local and intravenous anesthesia, shortening of patients
rehabilitation period permit us to consider this method
rather efficient. In two cases after aspiration of contents we
injected into cyst cavity solution of 70% ethyl alcohol with
iodine in amount of half primary cyst volume with 5 – 7
minutes exposition. In both cases we managed to eliminate
cyst completely in 8 – 10 days.

18 patients, after diagnosing, were subjected to
standard laparotomy operative intervention. Indications for
operation were considered marked clinical presentations
(constant aching pain in right subcostal area, weakness,
fatigability), progressing growth of cyst according to NLS-
research and CT in dynamics, difficulties in pre-operation
differentiated diagnostics.

Together with introduction of endovisual methods of
operations on nonparasitic hepatic cysts, for the first time
laparoscopic operations were performed under monitoring
of NLS with SEA; such operations were carried out in 8
patients due to solitary, coelomic hepatic cysts; in 3 patients
due to polycystic liver disease.

CONCLUSION
Diagnostics of coelomic hepatic cysts must be based on
combined data acquired by NLS-research with SEA and CT.
Due to difficulties in pre-operation differential diagnostics
of coelomic and hydatid hepatic cysts, transcutaneous
intervention healing manipulations must be performed very
carefully. Only under monitoring of SEA such less invasive
methods may be recommended in case of recurrent coelomic
hepatic cysts (at polycystic liver disease, in peculiar),
when non-parasitic character of cyst in undoubted. Main
indications for operative treatment of coelomic hepatic
cysts should be marked clinical presentations, large size
or progressing growth of cyst according to CT and NLS-
research data, and also disputable issues regarding cyst
character during diagnostics stage.

Laparoscopic interventions are the method of choice
for treatment of nonparasitic hepatic cysts, taking into
consideration strict indications.
APPLICATION OF NLS-DIAGNOSTICS AT EXTRAHEPATIC BILIARY DUCTS DISEASES

T.L. Guseva, Z.F. Khabibullina, U.S. Kharlamov

Advancement of medical technologies development presents new methods of diagnostics and treatment of a human’s organs and systems diseases. Introduction of NLS-diagnostics and treatment method into clinical practice cardinaly eased detection of several diseases typical for hepatic-pancreaticoduodenal area (HPDA). Introduction of NLS-methods of biliary ducts screening during first hours after patients were delivered to hospital significantly decreased time of examination and number of complications at the following severe pathological processes: acute cholecystitis and mechanical jaundice. Nevertheless, due to some reasons, number of unsatisfactory results after primary operation on bile excretion system is 8% – 17% of patients.

Thereupon in the recent years the authors have developed algorithm of examination for patients suffering from HPDA organs diseases using NLS-method. NLS-graphy was carried out with «Metatron»-4025 system with «Metapathia GR Clinical» software with features of both two-dimensional and three-dimensional visualization of HPDA organs.

We carried out examination of 247 patients aged from 24 to 84 in 2006 – 2008. Number of male patients was 52, female – 195.

At the moment of delivery to hospital and later on we diagnosed chronic calculous cholecystitis (in 29 cases) and mechanical jaundice (34).

General clinical examinations of NLS patients were carried out in outpatient mode. Together with urine, blood analysis, biochemical researches and study of homeostasis system the following specific researches were also important: blood research for HIV virus, hepatitis B and C, tuberculosis and RW. Patients suffering from acute cholecystitis were subjected to these and other laboratory and instrumental checkups (ECG, x-ray of breast and other) in admission office of a hospital. According to results of NLS-examination we defined or updated tactics of the following treatment.

At this stage we defined indications and carried out drainage of gall bladder (20 cases) and biliary ducts (9) in 29 patients. 6 patients were subjected to biliary ducts drainage during laparoscopy. Decompression of bile excretory system after NLS-research and laparoscopy was carried out in patients suffering from acute cholecystitis and mechanical jaundice of unknown genesis. Later on, in 2 – 3 days, reasons of outflow from biliary ducts to duodenum disorder were defined more accurately by fistulocholangiography.

In order to evaluate condition of major duodenal papilla (MDP) in scheduled and some of emergency patients we carried out mandatory esophagogastroduodenoscopy and duodenoscopy. The study allowed us to diagnose reasons of mechanical jaundice development in 9 patients: postbulbar ulcer – in 1 patient, MDP cancer – in 2, indirect signs of duodenum cancer – in 3, strangulated stone in MDP – in 2, duodenum cancer – in 1.

Besides we detected erosive-ulcerous affections, polyps of stomach and duodenum which affected tactics of main disease treatment.

26 patients who had jaundice in medical history or when after NLS-research or duodenoscopy reasons of choledochus dilatation remained unknown, we carried out
magnetic resonance cholangiopancreatography (MRCP) or endoscopic retrograde cholangiopancreatography (ERCP). In 5 of these patients we carried out contrast CT due to difficulties in acquired results interpretation. The latter, together with NLS-research, proved to be quite valuable method of pre-operation study of biliary ducts anatomy, but not so accurate method of choledocholithiasis diagnosing. Sensitivity, specificity and accuracy of MRCP (14 cases) in diagnostics of choledocholithiasis were 87%, 90% and 97% correspondingly.

After detailed medical checkup due to chronic calculous cholecystitis we carried out laparoscopic cholecystectomy (LCE) in 108 patients. In 6 patients with chronic calculous cholecystitis we detected choledocholithiasis, combination of choledocholithiasis with stenosis of choledochus terminal part during the examination, it required endoscopic papillosphincterotomy (EPST) prior to LCE. In order to monitor results of performed NLS-research in patients, we carried out peroral cholangioscopy by means of duodenoscopes: IF-T30, FD-34W and «baby»-scopes: PF-24, FCP-9P manufactured by Olymus, Pentax (Japan) or repeated NLS-research. Out of 13 patients with diagnosed by clinical and laboratory examination and NLS-research in admission office acute cholecystitis, 5 were subjected to laparoscopy and 2 to duodenoscopy. Drainage of gall bladder and biliary ducts was performed in 3 patients. The rest of patients were subjected to endoscopic (4) and standard cholecystectomy (8) according to indications. In 5 – 10 days patients who had been subjected to decompression drainage of gall bladder, were also administered to standard cholecystectomy. All patients subjected to drainage of gall bladder or performed operation, were thoroughly examined, according to indications 2 patients (choledocholithiasis – 1, stenosis of choledochus terminal part – 1) were studied with NLS-method. Systematic study patients with postcholecystectomy syndrome (PCES) condition according to abovementioned algorithm made possible to identify reason of unsatisfactory results in patients previously subjected to cholecystectomy (26), cholecystectomy + choledochotomy with external drainage of common bile duct (2), cholecystectomy + choledochoduodenostomy – in 1 patient.

As a result of the study and identifying of pain syndrome reasons after primary operation, we detected various not properly corrected pathologic changes which required more than 25 endoscopic or surgical interventions.

Certain surgical interventions results study, according to clinical materials and references, proved that primary operation did not eliminate the reason of main organic affection of biliary ducts, which was the basis of clinical picture, required surgical operation. Major part of researchers believe and our experience proves that frequent reason of primary operation unsatisfactory results are non-eliminated choledocholithiasis (30% – 64%), stenosis of choledochus terminal part (15% – 22%) or undetected chronic hepatitis, pancreatitis and other diseases of HPDA. Reasons of abovementioned shortcomings in treatment of patients are:

a) absence of technical equipment necessary for disease reason identifying prior and during operation;

b) insufficient time for patient examination (peritonitis);

c) underestimation of choledochus terminal part pathology importance;

d) inadequate application of available diagnostic and treatment technologies;

e) insufficient experience of operating surgeon.

More difficult in diagnostics and treatment aspect were patients suffering from mechanical jaundice
During our work we successfully used method of spectral-entropy analysis (SEA) for evaluation of pathomorphological picture character in affection area.

As a rule, prior to SEA we performed ultrasound research, fistulography and three-dimensional NLS-scanning, which allowed us to detect presence or absence of organic damages of intrahepatic biliary ducts.

According to our experience the advantage of NLS-research with SEA over radiodiagnosis methods is the following: absence of medical staff exposure to radiation; low price of NLS due to absence of X-ray TV unit.

NLS-method, differing from CT, does not require use of radiation equipment and can be applied in patients with absolute intolerance to contrast enhancement, usually injected at CT.

**CONCLUSION**

1. Application of NLS-method increases diagnostics accuracy up to 89% – 98%, which positively affects results of operation treatment.

2. Application of new NLS-graphy method under control of chromocholangioscopy decreases or completely excludes x-ray radiation of patient, medical staff; it has significant social and economic importance.
3D NLS-DIAGNOSTICS
OF NASOPHARYNX CANCER

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Problems in modern diagnostics of nasopharynx cancer (NPC) are pressing in the present time, it is proven by the fact that in 70% – 80% of patients treatment starts only at III-IV stages of disease, when average period of patients medical examination is 7 months before final diagnosis is identified.

Reasons of late diagnostics of nasopharynx cancer are: prolonged asymptomatic disease course, anatomico-topographic peculiarities of nasopharynx structure, imperfection of traditional widely used diagnostic techniques, difficulties in interpretation of tumorous and non-tumorous pathology visual pictures, low oncological vigilance of general therapists.

For the last decades NLS-diagnostic methods became widely spread in combined examination of patients; they demonstrate great diagnostic value at various diseases of digestive tract and respiratory organs. 3D NLS-graphy of upper respiratory tracts as diagnostic technique was developed last of all – its development was started by the Institute of Practical Psychophysics in 2006. In the future this examination method may be widely used in diagnostics of various nasopharynx pathologies and differential diagnostics of tumors of various geneses.

3D NLS-graphy allows therapists to visualize primary tumor, evaluate its spreading to pharynx walls, identify form of growth and detect genesis and character of neoplasm on the basis of resonance-entropy analysis (REA). Introduction of 3D NLS-graphy of upper respiratory tract into practical oncology made possible to develop and fulfill practical application of virtual microscopic researches with REA at the same time with routine histological examination. It extends significantly potentials of NLS-diagnostics, has an advantage over existing morphological methods of examination and allows to increase accuracy of diagnostics.

Nasopharynx neoplasms are characterized by variety of morphological forms, differing in their clinical course, histogenesis, applied methods of treatment and prognosis.

NPC is a combined group of tumors and there are many various morphological classifications with variety of used terms for it. Nowadays the most convenient in practical meaning is considered to be Micheau classification:

1. Non-differentiated cancer of nasopharyngeal type (variants: Schminke, Regaud, spindle-cell).
2. Epidermoid cancer (highly-, moderately- and low-differentiated ones).
3. Adenocarcinoma.
5. Malignant mucoepidermoid tumor.
6. Others.

MATERIAL AND METHODS OF STUDY

3D NLS-graphy was applied as examination method for the first time in the Institute of Practical Psychophysics in 2006. Since that time we accumulated great experience in diagnostics of various pathologies of upper respiratory tracts. The Institute developed NLS-graphic semiotics, created spectral etalons of nasopharynx neoplasms of various geneses, developed differential diagnostic criteria of malignant tumors, benign neoplasms and non-tumorous pathology on the basis of wave spectrum.

Indications for NLS-graphy fulfillment are symptoms related to tumor development in nasopharynx, which may be divided into nasal, auricular and neurological depending on localization.

Shortness of nasal breathing happens at tumor localization in nasopharynx. Increasing shortness of nasal breathing is accompanied by mucopurulent and purulent discharge with blood admixtures from nasal cavity. Number
of complains for shortness of nasal breathing depends on exophytic component of tumor that closes openings and on additional inflammations. If surface is ulcerated periodically appearing bleeding can be detected; it becomes dangerous at angiobroma.

If tumor is localized at side wall in front of auditory tube orifice, Trotter’s symptom complex may be developed: hearing impairment at affected side of head, neuralgia and anaesthesia of trigeminal nerve third branch’s branchlet and unilateral limitation of soft palate mobility. If tumor is localized near auditory tube orifice leading positions are taken by hearing impairment, tinnitus aurium, stuffiness in ear.

Neurological symptoms appear if tumor spreads to surrounding tissues. Most frequently neurological disorders develop if tumor spreads into skull base, posterior and side walls of nasopharynx, at the same time symptoms of almost all pairs of cerebral nerves affection are detected: develops paralysis of abducent nerve, facial nerve, appear immobility of one half of larynx, aglutition, disorders of sensitiveness, taste and tongue declination.

Above mentioned disorders develop at continuous presence of tumor. At initial stage of nasopharynx tumor development symptoms of diseases are missing, and the first clinical presentation of NPC is appearance of enlarged lymph nodes at neck in 50% of cases. This fact evidences that NPC is characterized by early regional metastatic disease. Size of primary tumor does not correlate with presence of regional metastatic disease. Even at small and superficial invasions of primary tumor, one can detect multiple metastases both from affection side and crossed and bilateral ones, which often localized in deep group of jugular lymph nodes. Large-sized metastases cause pain sensation and Gorner’s symptom complex is developed, characterized by constriction of palpebral fissure, pupil and eyeball retraction.

Examination of nasopharynx was carried out with modern devices «Metatron»-4025 developed by the Institute of Practical Psychophysics together with American company «Clinic Tech Inc».

Taking into consideration that in 50% of NPC study cases there are indistinct changes, it is necessary to carry out additional REA of pathological tissue area.

The IPP has examined 376 patients suffering from various tumorous and non-tumorous nasopharynx pathologies in the last 4 years. The most widely spread group of pathologies are malignant epithelial affections. NPC was diagnosed in 40.7% of tumorous pathology cases.

Growth forms at NPC are divided into endophytic, exophytic and combined forms, with ulceration or without ulceration of surface. Endophytic form of cancer usually looks like smooth slightly rising over surface infiltrate at NLS-picture, it looks like roundish moderately hyperchromic area (4-5 point at Flendler’s scale). Ulceration of surface at endophytic form of cancer may be superficial and occupy up to few millimeters before it affects one or two walls and looks at NLS-picture like apparent hyperchromic area (in some cases of 5, but mainly of 6 points on Flendler’s scale). The most frequent form of cancer is localized on superior or side wall and is characteristic for non-differentiated cancer of nasopharyngeal type. The most difficult for differential diagnostics is endophytic form of cancer without ulceration, when it is presented only by small and slightly rising infiltrate. Such picture is quite infrequent and sometime it is very difficult to diagnose tumor even according to REA results. In our experience we had 6 cases when primary data did not allow to judge about cancer presence and only wave research of affected cells genome by high-frequency (40 GHz) devices allowed us to detect NPC.
As a rule patients suffering from endophytic form of cancer have no complaints related to nasopharynx. The first and main symptom in such patients is enlarged neck lymph nodes. In 23 patients with cancer metastases to neck lymph nodes, primary tumor in nasopharynx was detected only by NLS-graphic examination of lymph nodes and REA of lymphoid tissue.

Exophytic form of NPC growth is represented by one or few intermixed nodes, moderately hyperchromic (4-5 points on Flendler’s scale). Exophytic form of growth one can detect ulceration with apparent necrosis of surface in form of sharply hyperchromic areas (as a rule – 6 points on Flendler’s scale).

Exophytic growing tumors usually come from fornix, fill nasopharynx cavity, going down to soft palate and constrict nasopharynx opening. These researches with 3D NLS-graphy may show posterior and anterior pole of tumor. At extended processes tumor may obturate choana and spread to nasal cavity.

NPC of combined form in majority of cases localizes on fornix of posterior wall. Tumor is represented by infiltration with ulceration and tuberous enlargement at edges. With the background of tumor, necrosis of various intensities may be detected. At NLS-picture it is visualized as neoplasm with uneven edges of 4-5 points at peripheral areas and 6 points in central area of necrosis. Usually few walls of nasopharynx are involved into process during combined form of growth, therefore area of tumor affection is much larger in comparison with other forms of growth.

Consistency of tumor at NPC is tight-elastic. Instrumental palpation reveals rigidity in comparison with normal condition of mucous tunic. Tumor with ulceration is easily damaged and bleeds.

According to our studies, NPC on the basis of mirror examination can be detected only in 32% of cases. Tumor suspicion based on otorhinolaryngological and digital examination was detected in 13.5% of cases. The main difficulty for diagnostics is tumors located on side walls of nasopharynx and in its anterior area and endophytic form of cancer growth.

3D NLS-research of nasopharynx detected presence of tumor in 82% of cases when cancer was diagnosed. As a rule differential diagnostics of cancer is carried out by ultramicroscanning with REA by comparing of tumor spectrum with etalon processes of various histological forms of neoplasms. Roentgenological method, like computed tomography, may be used in order to specify spreading of tumor process and involvement extent of bone structures.

First of all differential diagnostics of NPC is carried out at malignant neoplasms of hemopoietic nature, in which prevail lymphosarcomas – the second of most frequent of nasopharynx cancers (40.1%), which often localizes in gland of neck at affection of pharynx ring. At the first stages of tumor development differential diagnostics is carried out between lymphosarcoma and tonsils lymphoid tissue hyperplasia. Main role in this monitoring plays spectral similarity with one or another etalon process at REA.

It should be noted that at lymphosarcoma with nasopharynx tonsils affection, in 90% of cases there are no complaints indicating pathology in this area. Main symptom of the disease is occurrence of enlarged lymph nodes, not only in neck area, but of other peripheral also. Peculiarity of lymphosarcoma spreading in lymphoepithelial ring of pharynx is simultaneous affection of few tonsils.
The third of most frequent of nasopharynx affections is soft tissues tumors; neoplasms of myogenous genesis hold first place among them. Rhabdomyosarcoma is located on pharyngeal surface of soft palate and at the border of fornix and posterior wall of nasopharynx. Tumor have the appearance of exophytic mass, represented in form of one node or large-tuberous neoplasm with smooth surface. Ulcerations of mucous tunic are not detected. NLS-picture visualizes it as homogeneous moderately hyperchromic neoplasm (4-5 points on Fleidler’s scale). Most likely tumor develops in childhood or preadult age. Development of exophytic component leads to appearance of complaints for shortness of nasal breathing.

Juvenile angiofibroma is the most frequently diagnosed among benign neoplasms. Tumor comes out of nasopharynx fornix and has the appearance of exophytic mass with smooth surface. Its chromogeneity is moderate and different at various areas. Typical sign of angiofibroma is increased hyperchromeity (5-6 point) of vascular wall at NLS-scanning. If tumor is large it fills all nasopharynx opening; surface ulceration may be detected. Clinical picture of angiofibroma is characterized by shortness of nasal breathing, periodically appearing of bleeding (sometimes quite voluminous) and invasive growth.

Other nasopharynx tumors, in general of non-epithelial nature, have similar NLS-graphic picture and differ in density, localization in nasopharynx and can be detected in single cases.

Value of NLS-graphy is not only in feature of picture 3D-analysis, but in carrying out of high quality REA at ultramicroscopic areas of tumor without traumatic biopsy.

Together with study of nasopharynx pathology NLS-picture we started to develop resonance-wave aspects of diagnostics due to uninvestigated nature of this issue and difficulties of morphological differential diagnostics, especially of low-grade differentiated squamous cell carcinoma, low-grade differentiated cancer of nasopharyngeal type and lympho-proliferative diseases. At the same time it should be noted that it is wave spectrum character of low-grade differentiated cancer of nasopharyngeal type and tonsils that is more close to blast variants of lymphomas, and in some case only ultramicroscopic resonance-genetic analysis, and sometimes process generalization with hematopoietic system organs affection, give a possibility to carry out differentiated diagnostics.

Study of tumor cells cytomorphological peculiarities, character of their positioning, degree of differentiation and direction made possible to single out variants of wave spectrums, reflecting characteristics of histological structure of tumor various types.

Moderate-grade and high-grade differentiated squamous cell carcinoma which, was detected in 11% of our study cases, had typical spectral picture, just like cystoadenoid carcinoma (1.6%) and practically did not cause difficulties in interpretation of resonance-entropy analysis results.

Low-grade differentiated squamous cell carcinoma (67%) almost in all cases of monitoring causes certain difficulties in precise diagnosing and is one of hardly identified variants for resonance analysis. Resonance-wave picture of low-grade differentiated nasopharynx cancer is quite specific and allows therapist to diagnose not only form of tumor, but also to identify its organo-specificity by metastasis study without primarily detected nidus.

Results of carried out studies has proven high sensitivity of REA and detecting of low-grade differentiated cancer of nasopharyngeal type (78.3%), which allows us
to recommend study continuation of NPC resonance-wave peculiarities with low grade of cells differentiation in order to find more precise identification.

RESULTS AND DISCUSSION

The outcome of the Institute’s staff long term practical experience is abovementioned aspects of NPC diagnostics. Using of modern diagnostic equipment for 3D NLS-graphy of nasopharynx with feature of target topological ultramicroscopy with REA and resonance-wave genetic examination significantly increased detection rate of cancer and allowed us to develop differential-diagnostic etalons of wave spectrums of various neoplasms and non-tumorous pathology.

In potentials comparison of various diagnostic methods for detection of widely spread tumor pathology — NPC, positive conclusion on cancer presence was acquired: at otorhinolaryngological examination — in 32.5% of cases, at roentgenography — in 41% of cases, at 3D NLS-graphy — in 86.8 cases of study. Tumor was not detected on the basis of visual pictures of mirror examination — in 38.7% of cases, of NLS-graphic method — in 13.2% of cases. Acquired data clearly demonstrates high information value of 3D NLS-graphy.
NLS-DIAGNOSTICS OF LUNG CANCER

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Lung cancer is one of the most widely spread in structure of human oncological diseases. It has continuous hidden course and clinically presented only when disease symptoms are quite apparent and only surgical treatment is possible. Due to this fact improvement of lung cancer diagnostics should be done in two following directions: search of methods for early tumor process detection at pre-clinical development stage and optimization and shortening of pre-operative tumor diagnostics period. Main diagnostic method is roentgenology of chest together with tomography. Roentgenological semiotics of lung cancer depends on form of primary tumor and composed of shadow pattern of tumor itself, caused by tumor airway conductance disorders and secondary metastatic changes in lungs, mediastinum and pleura. Modern computer technologies (computed tomography and its modifications, magnetic resonance imaging) made possible to extend significantly potentials of pathological changes in lungs visualization, but in practice they remain rather expensive and not readily available. At this background new method of hardware diagnostics – NLS-examination of chest remains unclaimed; it is considered to have low information value due the fact that majority of experts are unaware of all potentials of modern NLS-diagnostic devices.

MATERIAL AND METHODS

Objective of this study is to evaluate diagnostic potentials of NLS-research and identifying of NLS-graphic semiotics of lung cancer various forms. NLS-research was carried out by hardware-software system «Metatron»-4025 with «Metapathia GR Clinical» software that allows us to carry out 3D visualization of organs and histological substrates, carry out spectral-entropy analysis (SEA) of affection nidus tissues and lymph nodes in order to identify non-invasively their pathomorphological character. All researches were verified by results of operative interventions and date of histological examination of surgical and biopsy material.

To evaluate potentials of NLS-graphy in pathological neoplasm detection and verification of affection nidus, we carried out roentgenography of chest in two projections prior to NLS-research in majority of cases.

With three-dimensional NLS-graphy we evaluated size, chromogeneity, structure of nidus, outlines and its interaction with surrounding tissues. In all cases we examined pleural cavity to detect pleural effusion and evaluate its volume. We carried out supra- and parasternal examination of upper mediastinum to exclude metastatic affection of intraaorticpulmonary and paratracheal lymph nodes. If it was necessary we examined lymph nodes of supraclavicular and front-neck area.

NLS-graphy with SEA detected symptoms of malignant process in lungs in 146 patients, in 63 of them peripheral cancer of lung was diagnosed, in 61 – obturator atelectasis of lung lobe or segment (in 11 of them we located tumor itself in root of lung), in 9 patients we detected tumors of non-epithelial nature. Exudative pleurisy of tumorous etiology was diagnosed in 30 patients, in 17 of them it was monitored together with other spectral signs of malignant process, in 13 patients it was the only presentation of lung cancer detected by evaluation of spectral similarity with etalon blast processes.

RESULTS AND DISCUSSION

NLS-graphic semiotics of lung cancer includes direct and indirect signs. Direct sign is direct 3D visualization of tumor, indirect ones are obturator atelectasis of lung lobe or segment, hyperchromic (5-6 points according to Fleindler’s scale) mediastinal or supraclavicular lymph nodes and exudative pleurisy. At peripheral cancer we detected malignant neoplasm itself, at central, as a rule – lobar atelectasis caused by endobronchial obstruction. Hyperchromic lymph nodes or pleural effusion evidenced degree of tumorous process spreading.

We categorized NLS picture of peripheral cancer into three main groups: typical (38% – 60.3% of patients),
with disintegration (19% - 30.2% of patients) and corticopleural (6% - 9.5% of patients). The most frequent of them — typical form is characterized by homogeneous, mainly hyperchromic (5 – 6 points) structure and distinct, smooth or wavy, polycyclic outlines. Diameter of neoplasms ranged from 1.5 to 30 centimeters, in majority of cases not exceeding 5 – 7 cm, and, therefore, zone of tumor contiguity to chest wall ranged greatly — from one intercostal space to half of chest. In 5 patients (13.2%) tumor was characterized by very low, hyperchromic, heterogeneous structure making an impression of tumor’s liquid character. Solid character of neoplasm was detected by 3D NLS-graphy of histopictures with application of SEA. Tumors of moderate chromogeneity were detected rarely and had heterogeneous structure due to presence of areas differing from background in chromogeneity. Together with smooth and polycyclic outlines at typical peripheral cancer we detected crenulated, «ray» outlines with spicular or oblong processes. Indistinctness of outlines was detected only in areas of tumor invasion into chest and mediastinum at the level its lateral parts.

NLS-picture of peripheral cancer with disintegration is very diversified and characterized by macroscopic structure of tumor. Depending on disintegration space content we singled out three NLS-graphic variants of this form: with air space (in 11 patients), with liquid space (in 3 patients) and abscess-like form (in 5 patients). All tumors with disintegration are characterized significant heterogeneity of structure due to presence of hyper- and moderately chromogenic liquid inclusions or achromogenic areas with air-dependent reverberations with the background of tumorous tissue. Outer outlines of disintegrated tumors NLS-graphically similar to outlines peculiar for typical form of peripheral cancer.

At first variant of cavernous cancer, position, size and number of linear achromogenic signals, with the background of hyper- and medium chromogenic tumor tissue, were defined by localization, form and number of air, almost «dry», cavities of disintegration. If there was one large central cavity of approximately roundish form we registered achromogenic, arciform or uneven signal in central part of neoplasm. Cavity of irregular form with deep «pockets» was represented at NLS-picture as branching achromogenic line or few separate achromogenic sections, which interconnected with each other at scanning. Few small cavities caused appearance of isolated from each other achromogenic sections in various parts of tumor. Off-center positioning of disintegrating cavity lead to significant difference in tumor walls thickness, located around achromogenic cavity.

Disintegrating peripheral cancer with liquid containing cavities was detected not so often as the one with air cavities. Liquid in disintegration cavity was located in form of moderately and hyperchromogenic areas (4 – 5 points), more frequently multiple, centrally located, of irregular form with uneven and sometimes indistinct outlines. Surrounding tumorous tissue was characterized by increased chromogeneity (up to 6 points according to Fleidler’s scale), due to necrosis, probably. Such picture is typical for early stage of multicentric disintegration.

Abscess-like form (with air and liquid in cavity) of peripheral cancer represented as the most difficult in diagnostic aspect, because in tumor structure there were both achromogenic inclusions of air and hyperchromogenic liquid. NLS-picture of intrapulmonary neoplasm was formed by quantitative ratio of these components. At large amount of liquid, homogeneous moderately chromogenic space prevailed, but more often disintegrating granulated detritus, fibrin and necrotic suppurrative masses caused appearance of heterogeneous suspension with the background of hyperchromogenic liquid. After adequate draining of disintegration cavity through bronchus, air prevailed, but small amount of liquid with suspension settled at the bottom.

In these cases cavernous neoplasm was characterized by heterogeneous NLS-structure due to large amount of separate linear achromogenic signals of air in upper parts of cavity and hyperchromogenic liquid content with heterogeneous coarse-grained suspension in lower parts. Between them there might be area with heterogeneous tesselation structure due to achromogenic air bubbles mixed with hyperchromogenic liquid with suspension. Such content of cavernous neoplasm is typical for lung abscesses and required differential diagnostics, which was even more complicated by abscess formation when disintegration cavity was infected. Evaluation of cavernous neoplasm walls had main diagnostic importance in this situation. Apparently hyperchromogenic (6 points) wall with indistinct internal outlines, 10 millimeters thick, is typical for abscesses. At lung cancer with disintegration wall was characterized by heterogeneous thickness, with uneven outlines, outgrowths, often medium-chromogenic (4 – 5 points); not changing at dynamic monitoring.

**Survey radiograph of chest at peripheral cancer of superior lobe of right lung.**
1 – tumor in form of round shade
2 – Ghon’s calcined focus
The most rarely detected was cortico-pleural form of peripheral cancer, typical for Pancoast tumor. NLS-analysis spotted it in form of homogeneous hyperchromogenic mass of irregular oval or triangular form with typical considerably uneven, sometimes indistinct, «torn» outlines. Tumor was localized in cortical layer of lung and widely adjoined chest wall, spreading into it in some area. Detected by SEA malignant tumors of light non-epithelium nature (angioleiomyoma, lymphosarcoma, sarcoma, metastases of renal cell carcinoma) were large and had conglomerate structure, represented by hyper- and, not so often, medium-chromogenic nidi of heterogeneous structure with uneven tuberous outlines. Only in case of lung sarcoma we detected homogeneous hyperchromogenic structure. All neoplasms spread into surrounding organs. Metastases of lung cancer into lung tissue NLS-graphically did not differ from typical form of peripheral cancer; they were only smaller (diameter up to 2 - 3 centimeters).

NLS allowed us to detect accurately spreading of peripheral cancer into soft tissues of chest wall, ribs, diaphragm and liver. In these cases hyperchromic tumorous tissue replaced normal structure of organ, spreading into it to some extent. Usually NLS-diagnostics of tumor spreading into surrounding structures wasn't difficult owing to SEA of these structures.

NLS-semiotics of lung central cancer was mainly composed of indirect NLS-symptoms: obturator atelectasis of lung lobe and segment and exudative pleurisy. Tumor itself in lung root was diagnosed rather poorly (in 11 patients – 18%) due to diagnostics difficulties of tumor without necrosis nidi as typical catabolic process even at quite large size and atelectasis of a lobe or whole lung. In absence of lobar atelectasis even large exobronchialplexuses were not detected due to the same reason.

At scanning we paid great attention to study lung atelectasis NLS-graphic picture in order to identify its typical differential-diagnostic signs. Comparison of two groups of patients with obturative and compression atelectases we found out that airless lung tissue NLS-graphically looks the same, regardless of atelectasis etiology. It is detected as practically homogeneous hyperchromogenic structure of approximately triangular form. Distinctive feature of atelectasis in comparison with inflammatory infiltration at pneumonia was homogeneity of airless lung tissue, in structure of which achromogenic signals of air in bronchi or respiratory parts of lungs are missing.

Compression atelectasis of inferior edge or whole inferior lobe is caused by compression of lung tissue by marked pleural effusion. According to our data it appeared starting from pleural content of 450 – 500 ml. Area of atelectasis increased in proportion to amount of liquid in pleural cavity. Compression atelectasis had wedge-shaped of triangular form with base facing lung root, smooth distinct outlines with the background of moderately chromogenic liquid and indistinct tessellated border.

Obturator atelectasis, differing from compression atelectasis, was frequently detected without pleural effusion. At exudative pleurisy area of such atelectasis did not depend on amount of pleural content. We faced diagnostic difficulties in detecting of atelectasis etiology only when there were massive pleural effusions of more than 1.5 liters. Theoretically, in such conditions lobar atelectasis could be both a consequence of bronchus obturation by tumor and compression of inferior lobe by effusion. Etiology was identified after pleural tapping: preserving of airless lung tissue in the same amount evidenced obturative origin of atelectasis.

In all cases of visualization central cancer had appearance of hyperchromogenic neoplasm (5 – 6 points according to Fleindler’s scale) with uneven, indistinct outlines, located in lung root and comparable, according to NLS-picture, to atelectasic lung tissue, which hampered its differentiating from airless lung. We identified borders of tumor more precisely if there was peripheral
hypochomogenic area. It was impossible to distinguish primary tumor from conglomerate of significantly enlarged metastatic lymph nodes in lung root even by SEA, though it had no great diagnostic value, because it was detected in inoperable patients due to process spreading.

In 8 patients (13.1%) suffering from lung central cancer we detected spreading of tumor into mediastinum, pericardium and great vessels. Spreading into mediastinum was detected by absence of distinct medial outline of tumor, when it widely «went into» mediastinum. Growing of tumorous tissue into pericardium was detected by SEA according to spectral similarity of this zone with tumor process.

Presence of hyperchromogenic neoplasm with uneven outlines, with the background of moderately chromogenic effusion in pericardium cavity, also definitely evidenced spreading into pericardium.

Exudative pleurisy at malignant lung tumors did not have pathognomonic NLS-picture. It was characterized by homogeneous moderately chromogenic pleural content; components of effusion are not numerous and represented, as a rule, by fine fibrin fibers. Pleura is thin; and only at metastasis we located hyperchromogenic parietal neoplasms with distinct uneven outlines.

Final stage of NLS-research at lung cancer is scanning of superior anterior mediastinum in order to evaluate condition of paratracheal and intraaorticpulmonary lymph nodes. Affected with metastases mediastinal lymph nodes were detected in 15 cases, however purposeful search of them was carried out in all patients and it became obligatory stage of NLS-examination of oncological patients. They were located in space between arch of aorta and pulmonary artery in form of multiple roundish or oval neoplasms of apparent chromogeneity (5 – 6 points according to Fleindler’s scale). If there was extensive metastasis we detected enlarged supraclavicular, subclavicular and front-neck lymph nodes, which was confirmed according to SEA results.

**CONCLUSION**

NLS-research is informative radiologically-safe additional diagnostic method of malignant tumors of lungs. NLS-seniotics of lung cancer includes direct (tumor) and indirect (obturator atelectasis, metastases into mediastinum lymph nodes, exudative pleurisy) symptoms of malignant process. We offered classification of peripheral lung cancer into three groups, according to NLS-graphy, depending on macroscopic structure. Central cancer of lung is characterized by presence of lobar obturator atelectasis, which may be regarded as indirect sign of large exobronchial tumors in lung root, which are poorly diagnosed straight as typical catabolic processes beyond necrosis disintegration stage.
NLS AND RADIOLOGIC EXAMINATION METHODS IN DIAGNOSTICS OF ACUTE PURULENT ABSCESES OF LUNGS

S.N. Makarova

Urgency of diagnostics and treatment of acute purulent abscesses of lungs issue is determined by prevalence and severity of this pathology. Acute purulent abscesses of lungs (APAL) are a part of diseases usually called purulo-destructive diseases of lungs (PDDL). Gangrenous abscess, pulmonary gangrene and pleural empyema are also included into this group.

In our country number of patients with abscesses, pulmonary gangrene and pleural empyema has upward tendency. It is the result of late diagnostics and hospitalization, inadequate therapy of pneumonia.

In spite of treatment methods improvement, mortality at PDDL remains rather high and may reach 70%. In more that one third of patients transition from acute process to chronic is registered. Lethality at acute abscesses of lungs ranges from 7.2% to 28.3%; at gangrenous processes – from 23.4% to 74.1%.

Due to this fact well-timed and accurate diagnostics of disease gains significant practical importance; results of such diagnostics are the basis of patients treatment tactics choosing.

MATERIAL AND METHODS OF RESEARCH

We monitored 48 patients suffering from acute purulent abscesses of lungs; they were divided into three groups: the first group – 20 patients, subjected to standard treatment, including sanation bronchoscopy; the second group – 15 patients, subjected to endoscopic drainage of abscess; the third group – 13 patients, subjected to immunomodulators injection into abscess cavity after drainage. In its turn every group was divided into two subgroups taking into account the most probable pathogenetic mechanism of abscess development – postpneumonic and aspiration abscesses.

NLS-research of breast was carried out with «Metatron»-4025 system, manufactured by the Institute of Practical Psychophysics, equipped with digital trigger sensors of 4.9 GHz and unit of continuous spiral scanning. Radiologic investigation of breast organs was performed with apparatus manufactured by «Philips». We applied both radiography of frontal and lateral projection and, if necessary, tomographic imaging.

RESULTS OF THE STUDY AND DISCUSSION

As a result of the study we described four phases of acute purulent abscesses of lungs, which correspond to clinical phases of disease and characterized by a number of radiological and NLS-graphic signs.

Lung tissue destruction phase was characterized by presence of shadows with heterogeneous intensity with indistinct external outlines at radiographs, which is the result of lung tissue destruction process and marked perifocal infiltration. NLS-examination detected lung tissue with heterogeneous structure, in which, with hypochromic background, hyperchromic (6 points according to Fleindler's scale) areas were detected; they appeared due to liquid (pus) presence. Outlines of a nidus were indistinct.
Capsule forming phase was characterized by presence of cavity with evident capsule, with rather high amount of liquid in it, perifocal infiltration of lung tissue. NLS-examination detected marked hyperchromogenic liquid neoplasm with homogeneous content (if process of lung tissue dissolution was completed). If there in abscess cavity sequestrum of lung tissue remained, NLS-examination showed them as moderately chromogenic (4 – 5 points) inclusions, which tessellated a nidus. Capsule was visualized as hypochromogenic tunics delimiting cavity from surrounding lung tissue.

At radiographs abscess breaking phase was characterized decreasing of abscess cavity size and liquid content in it. NLS-picture was also characterized by decreasing of abscess cavity size, shape of which became irregular and contained small amount of liquid (hyperchromogenic areas). Capsule was visualized partially.

In case of complete recovery, discharging phase was characterized by complete obliteration of cavity and forming linear or stellate scar on the place of abscess and resorption of perifocal infiltration.

NLS-examination registered decreasing of nidus size, its filling with fibrin (hypochromogenic areas). With hypochromogenic background we detected small hyperchromic areas, appeared in result of small amount of liquid presence. Nidus outlines again became indistinct, capsule was not visualized.

Aquired results prove that acute purulent abscesses of lungs most frequently develop in right lung, localizing mainly in upper or lower lobe. We registered prevalence of process development in gravi-dependent segments – S2, S6 and S10. This data relates to aspiration abscesses, at the same time postpneumonic abscesses may be detected in almost any part of lungs.

As analysis of presented data proves, separation of disease phases that we offered allows to register certain differences between aspiration and postpneumonic acute purulent lung abscesses. At aspiration abscesses we registered capsule forming phase more often, at postpneumonic abscesses – destruction phase. Abscess sizes ranged from 2 to 8 cm. At aspiration abscesses we detected nidi of 4 – 6 cm, at postpneumonic – abscesses of 2 – 4 cm.

Therefore separation of four phases of acute purulent lung abscesses according to NLS-graphic signs seems to be reasonable. Completing of traditional radiologic examination make possible to study pathologic nidus structure in details; combined evaluation of radiologic and NLS-examinations results may be a basis for patient treatment tactics choosing.
DIAGNOSTICS OF MULTIPLE AORTIC ANEURYSMS WITH NLS-RESEARCH, CT AND ANGIOGRAPHY

L.P. Abramchikov, A.A. Gavrilov, A.M. Litvinenko, M.V. Polynskaya

Aortic aneurysm is a severe and dangerous pathology of cardiovascular system. Affection of aortic walls at systemic diseases and, first of all, atherosclerosis may result in development of few aneurysms at various levels. The problem of diagnostics and surgical treatment of patients suffering from multiple aortic aneurysms is still topical and urgent nowadays.

Treatment of such patients is a difficult task.
Completed earlier analysis of hardware methods role in diagnostics of abdominal aortic aneurysm (AAA) made possible the following conclusions.
1. NLS-research is screening method allowing quick revealing of AAA and eliminating other pathology by additional carrying out of spectral-entropy analysis. It is possible to use this method when patients with severe diseases are taken to admission room or to resuscitation department. Diagnostic accuracy of two-dimensional NLS-research is not more than 68.8%.
2. The most accurate method of ruptures at AAA is CT, which in 83.9% gives reliable results. CT makes possible most precise measurements of aneurysms sizes changes.
3. When we carry out angiography, only functioning lumen of aneurism is contrasted and it is not possible to identify its true size; ruptures are detected only when additional cavity is formed. At the same time angiography is the most precise method for detection of aortic-cavernous fistulas and involvement of aortic branches into aneurism.
Retrospective analysis materials taken from patients with aortic pathology showed that part of these patients suffer not only from AAA, but also from aneurism of other aortic parts.
Objective of this study: improvement of multiple aortic aneurism diagnostics.

MATERIAL AND METHODS
We carried out retrospective analysis of 243 patients examination results. Age of patients ranged from 38 to 92. Ratio of men and women was 4 : 1. We included data acquired at surgical interventions and autopsy into analysis.
We used NLS-research, CT and angiography for diagnostics of aortic aneurism.
NLS-research was carried out with «Metatron»-4021 system, manufactured by the Institute of Practical Psychophysics, Russia, with «Metapathia GR Professional» software, which allowed us to visualize bloodstream in two-dimensional mode.
Computed tomography was carried out with CT MAX device, manufactured by «General Electric» company, USA. Depth of tomographic image was 10 mm, pitch 10 mm; if there was need in more detailed examination of certain area, these numbers were decreased. Intravenous enhancement was carried out by introduction of 76% urografin (40 ml) or omnipack — 300 mg of iodine per ml.
Angiographic study was carried out with the following devices: «Advantex DLX» manufactured by «General Electric», «AngioscopC» manufactured by «Siemens», «Cardiomax CP» manufactured by «Shimadsu» according to
to standard procedure of Seldinger; we consider transaxial access the most preferable method.

RESULTS

Analysis allowed us to detect 26 patients suffering from multifocal affection of aorta with aneurisms development. All patients suffered from atherosclerosis; in one patient we detected Marfan’s syndrome: changes of aortic walls are typical both for Marfan’s syndrome and fro atherosclerosis.

These 26 patients underwent total 24 NLS, 12 AG and 13 CT examinations.

We detected the following pathology in 52 patients:
1. Combination of thoracic aorta aneurism (TAA) with abdominal aortic aneurism (AAA) – in 13 patients;
2. Combination of widening of thoracic aorta with AAA – in 8 patients;
3. Two AAA – in 5 patients.

We included patients suffering from widening of thoracic aorta into present study. Thoracic aorta aneurism – it is local or diffuse widening of aorta lumen by 50% and more. 35% – 45% widening is not a normal condition and may be considered as the first stage of aneurism formation.

We singled out two variants of AAA: the first – when there are two aneurisms with considerable distance between them; the second – distance between two aneurisms is comparatively small, there is something like bridge, aneurisms often look like «hourglass». In one case we detected combination of TAA with 2 AAA (supra- and infrarenal).

In one patient with «hourglass»-shaped AAA radiodiagnostics (AG, then NLS-research) detected aortic-cavernous fistulas, in another one patient – defect of inferior cava wall was detected at surgical operation.

In 3 patients there were 2 aortic aneurisms, in one patient – 4. In 4 of 26 patients we detected aneurisms of one or both iliac arteries; in 1 of 4 patients we diagnosed aneurism of renal artery and in another one patient – aneurism of subclavian artery.

In 12 patients we detected aortic rupture: in 10 AAA (9 infrarenal and 1 suprarenal), in 2 – TAA rupture. In one case we registered consecutive ruptures of pathologically changed parts of aorta: at first it was AAA rupture, then dissection of thoracic aorta.

Here is this case.

Patient T., aged 65, was delivered to clinic with pains in stomach, epigastric and paraumbilical area, loin. He is sick for 2 days. During examination of stomach therapist detected pulsating mass of 10 x 8 cm, systolic murmur was registered above it. Angiography detected infrarenal AAA without extravasation of contrast enhancement; NLS-research detected AAA and retroperitoneal hematoma. At operation rupture of aneurism anterior wall was detected, resection of AAA with bifurcational aortic-iliac prosthetics was carried out. In 5 years the patient was delivered with thoracic pains. Angiography and computed tomography detected dissection of thoracic aorta of 111 type and surgical operation was successfully fulfilled afterwards.

DISCUSSION

We should emphasize the following aspects in study results analysis of patients suffering from aortic pathology:

1. The following methods become more and more popular nowadays: screening NLS-researches of middle and old aged patients, these researches help to detect AAA, including asymptomatic ones; and NLS-monitoring of so-called «lesser» AAA. Benefits of these studies are obvious, but at the same time, they represent quite narrow, not embracing the whole issue approach: aortic aneurisms, except post-traumatic ones, are presentation of systemic diseases and processes. Aortic affection may be of different manifestation degree along its length, but only one part of aorta is studied. Systemic diseases require systemic examination.

2. We cannot say that there were 26 of 243 patients who suffered from multiple aortic aneurisms. Part of patients was urgently operated without complete examination; sometimes patient examination was limited by study of one (semiotic) part of aorta only, part of deceased patients were not autopsied. That is why number of such patients might be greater, probably.

3. Due to severe condition of patients suffering from aortic aneurisms rupture we had to stop NLS-research in 2 cases, angiography – in 2 and CT in one patient. Also there were situations when due to fulminant course of rupture surgeon had to do surgical intervention without sufficient examination. According to our data fulminant course of aneurisms rupture (prescription of rupture is less than 6 hours) is detected in 23.8% of cases, acute course (more than 6 hours but less than one day) in 25.1% and subacute (prescription of rupture is more than one day) in 51.1% of cases. We believe that aorta should be always examined along its whole length. Here are clinical examples, confirming our statement.

Patient Ch., aged 65, delivered to hospital in extremely grave condition. On the basis of disease’s course clinical picture we assumed fulminant course of AAA rupture, that is why patient was urgently operated without preliminary diagnostics. During operation we detected 200 ml of blood in abdominal cavity, huge retroperitoneal hematoma and rupture of infrarenal AAA. We carried out aneurism resection, aortic prosthetics, but after blood flow was restored we registered cardiac arrest, resuscitation was not successful. Autopsy detected atherosclerotic aneurysm of descending thoracic aorta. It was accidental discovery, which did not influence clinical outcome.

Other example proves that incomplete examination may lead to fatal outcome even with perfectly fulfilled surgical operation.
Patient D., aged 68, was operated according to routine procedure after examination, which detected AAA. Operation — AAA resection, aortic-femoral prosthetics. In 13th day after successful surgical operation patient died from cardiac hemotamponade which happened due to rupture of non-diagnosed aneurism of ascending part of thoracic aorta.

4. When NLS-diagnosing is carried out according to analyzed number of two-dimensional virtual images — scans, angiography makes possible to get holistic representation of thoracic or abdominal part of aorta. Angiographic research is the most visual method at multiple aortic aneurisms. We would like to emphasize one technical aspect of angiographic examination — it is choosing of puncture optimal place. We believe that transaxial access is the most preferable one: there is no risk of thrombotic masses detachment in AAA cavity during introduction of wire and catheter; often lesser sinuation of subclavian and axillary artery in comparison with iliac and femoral vessels; absence of femoral artery haematoma after puncture (it decreases risk of infection) — it is quite important for surgeons, carrying out bifurcational aortic-iliac prosthetics.

5. In 8 patients we registered combined widening of thoracic aorta with AAA. In patient we detected rupture of AAA at first, than dissection of thoracic aorta. This case clearly represents tendency of diseases development. Aortic aneurisms appear in patient at various levels not at the one and the same moment, in few years lesser widening of aorta lumen may develop into large aneurism, therefore, such patients should be clinically monitored during whole life period.
CONCLUSION

1. If outpatient screening NLS-examination detects abdominal aortic aneurism in patient, it is advised to carry out NLS-research of whole aorta.

2. If any hardware diagnostic method detects aortic aneurism of any localization in patient (if his condition allows doing that) in hospital, it is advised to carry out evaluation of whole aorta’s length by all possible methods. The following rule must be introduced: systemic diseases require systemic examination.

3. Patients suffering from aorta pathologies, including those after surgical resection of aneurism, should be monitored lifelong.
Computer NLS-Graphy and Magnetic Resonance Imaging in Evaluation of Surgical Intervention Extent for Brain Tumors Treatment

Sh. S. Fazylov, A. J. Gafurov, R. I. Bairakov

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.

**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

1. At edema and ischemia of perifocal brain tissue extent of carried out resection should be evaluated according to MRI data, because remaining tumor masses are diagnosed more precisely.

2. To detect remaining tumor masses with the background of post-operative hemorrhage it is preferable to use NLS-research with SEA.

3. According to results of NLS-researches and MRI in 11% of patients extent of carried out surgical intervention may be updated in comparison with intra-operative data.

4. Accuracy of NLS-research with SEA in evaluation of surgical intervention extent is 93%, accuracy of MRI – 86%. Combined application of these methods allowed us to make more accurate diagnosis in 96% of cases.
ULTRASOUND RESEARCH AND NLS-SCREENING OF OVARIAN CANCER

K.S. Kogan, S.A. Levkun

In spite of recent decades achievements in treatment of certain forms of malignant tumors, ovarian cancer (OC) is still a disease with quite unfavorable prognosis for it. As a rule ovarian cancer diagnosed at III – IV stage; at this time 5 year survival rate is approximately 27% and 16% correspondingly. That is why discovery of OC early detection new methods is very urgent now. For the first time we carried out evaluation of OC screening by means of NLS-examination in combination with ultrasound research role in 2001 – 2003. We found out that such screening program may provide survival rate increasing. However since that time transvaginal ultrasound research became widely spread and ultrasound data interpretation methods were updated; new systems for NLS-researches with digital trigger sensors were created – it allowed us to apply new method of continuous spiral scanning during screening procedure; three-dimensional visualization of study results was introduced. All these changes resulted in considerable increasing of studies accuracy. Therefore there is need in new studies of OC screening.

METHODS AND PROCEDURE OF THE STUDY

OC screening study was carried out from 2007 till 2009. The study included women from 50 to 74 with menopause period over 1 year.

We applied two screening methods. The first was NLS-graphy with «Metatron»-4025 (joint manufacturing of the Institute of Practical Psychophysics, Russia, and Clinic Tech. Inc., USA) with generator frequency 4.9 GHz, digital trigger sensors and equipped by unit of continuous spiral scanning. Together with the system we used professional computer software «Metapathia GR Clinical» with feature of three-dimensional visualization of study results.

The second screening method was ultrasound research, as a rule, transvaginal one. Major part of ultrasound researches was carried out with Kretz SA9900 apparatuses (by Medison company, South Korea). 8 652 women population was divided into three groups. The first one (control group – 2 308 women) was not subjected to screening researches. The second group (4 187 women) was examined with NLS-screening and, as a second line test, with more detailed clinical checkup. The third group (2 157 women) was subjected to transvaginal ultrasound research; it was the only screening method for this group (ultrasound screening – US).

In NLS-researched group we evaluated spectral similarity (D) with three etalons of pathological processes: «ovarian adenocarcinoma», «mucinous ovarian adenocarcinoma» and «malignant Brenner’s tumor». Also we evaluated spectral similarity with for the first time introduced to «Metapathia GR Clinical» digital etalons of tumor markers – «SA-125», «SA 15-3» and «SA 72-4». Acquired information was imported directly to computer program of research management, which calculated OC development risk according to specially created algorithm. During further studies we included dynamics of spectral similarity with abovementioned etalons (ΔD) changes into this algorithm. OC risk degree was divided into high (ΔD < 0,425), intermediate (0,425 < ΔD < 0,710) and low (ΔD > 0,710). According to this risk degree we planned tactics further examination for these women.
Evaluation of spectral similarity with processes and markers in this group was considered as 1st level screening. 2nd level screening meant application of more detailed clinical examination, if certain indications existed.

In US group screening was also subdivided into 2 levels; they were differing in ultrasound therapist qualification degree. Ultrasound research of the 1st level was carried out by therapists of average class. 2nd level ultrasound was carried out by experts specializing in gynecological ultrasound examination; 2nd level ultrasound examination was administered only after apparently pathological findings at ultrasound of the 1st level.

All women included into the study were monitored afterwards; cases of malignant tumors development and deaths from any reasons were registered.

RESULTS

In NLS group (n = 4 187) in 87.7% of women OC development risk was low; they were administered for further annual NLS-research. In 1.7% of women OC development risk was high; they were administered for screening of 2nd level. In 15.6% of this group OC development risk was identified as intermediate; they were subjected to repeated examination in 1.5 months and only 0.3% were subjected to 2nd level screening afterwards. According to results of 2nd level screening only 18 patients were administered for detailed clinical examination and 8 of them were surgically operated. Another 4 patients were operated without previous procedure of complete screening process; in total 12 women from NLS-group were operated.

In US group (n = 2 157) majority of women were subjected to transvaginal ultrasound examination – 84%; the 16%: either transabdominal ultrasound (9%), or both these methods (7%). In 86% of women from this group ultrasound picture was normal; they were subjected to repeated annual ultrasound checkup afterwards. In 6.7% of patients ultrasound examination detected pathological signs in ovaries, they were sent to 2nd level ultrasound.

In 7.3% ultrasound picture was questionable – it required repeated ultrasound of 1st level; only in 0.2% were administered for ultrasound of 2nd level later on. In US group 67 patients were operated on ovaries. Number of surgical interventions in US group turned out to be reliably higher than in NLS group. Number of operations when no malignant tumors of ovaries were detected was 37% of all operated women in NLS group, in US group – 78%. Number of severe complications after operations in NLS group was 4.6%, in US group – 3.2%; perforation of genitals was the most frequent one.

Number of detected during surgical operations malignant ovarian tumors in NLS and US groups was almost equal (4 and 5 cases correspondingly); primarily invasive were 3 and 4 tumors correspondingly. In NLS group more than cases of OC (79.1%) was diagnosed owing to detection of spectral similarity with oncomarkers at the 1st level of screening and only 20.9% owing to similarity with oncoprocesses.

Among all women in which mentioned methods of screening did not register OC, in 6 cases this tumor was diagnosed clinically within following year (1 in NLS group and 5 in US group).

Screening efficiency indices are shown in the following table:

<table>
<thead>
<tr>
<th>Screening efficiency indices</th>
<th>All primary ovarian cancers</th>
<th>Primary invasive epithelial ovarian cancers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NLS group</td>
<td>US group</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>89.7%</td>
<td>81.3%</td>
</tr>
<tr>
<td>Specificity</td>
<td>99.8%</td>
<td>91.7%</td>
</tr>
<tr>
<td>Positive prognostic validity</td>
<td>63.7%</td>
<td>4.8%</td>
</tr>
</tbody>
</table>

Differences between NLS and US groups according to abovementioned indices of specificity are statistically reliable.
CONCLUSION

Efficiency indices of both NLS and ultrasound screening of OC, presented in this study, may be considered encouraging. NLS-screening showed higher specificity, which is evidenced by lesser amount of repeated screening tests and in lesser amount of surgical operations. Nevertheless this statement is of preliminary character; screening procedures will be continued until 2012 and patients monitoring will be carried out until 2015. Only after this date authors intend to publish results of control group monitoring and compare survival rate in this group and in two screening groups. Besides, nowadays we carry out analysis of psychological and social value of screening and also its economic importance.
COMPARATIVE ANALYSIS
OF NLS AND MRI DIAGNOSTIC VALUE
AT INVASIVE FORMS
OF CERVICAL CARCINOMA

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Malignant neoplasms of uterine neck have leading positions and considered to be the main reasons in structure of oncological morbidity and mortality reasons in the world. Carcinoma of uterine cervix (CUC) holds 4th place in prevalence after cancer of stomach, respiratory organs and skin. In spite of mass prophylactic check-ups with use of cytological screening, morbidity rate of invasive carcinoma of uterine cervix decrease slowly. Thereupon precise evaluation of diseases extension becomes very important issue – without it is very hard to choose adequate therapy. Nowadays, in order to fulfill this requirement, not only various invasive diagnostic methods are used, but we see more and more cases of NLS-research using. Thanks to rather high information value, non-invasive basis, absence of radiation stress and feature of multiple uses NLS-research becomes quite widespread as the most economical, simple and at the same time reliable method of small pelvis organs evaluation. However detection of uterine neck pathology by NLS-method is still a controversial and unexplored issue. Due to active development of computer technologies and introduction of three-dimensional NLS-research, we face insistent need in revision of previously described potentials of NLS-graphy, which were based on results of two-dimensional studies only. Taking into consideration that operative treatment of patients suffering from invasive forms of uterine cervix carcinoma is impossible, we decided to correlate data acquired with NLS and MR-imaging by evaluation of tumor sizes, its borders and diseases extension, in order to check accuracy of NLS-researches results.

OBJECTIVE OF THE STUDY
Objective of this study is comparative evaluation of diagnostic value of two-dimensional and three-dimensional NLS-research and its comparison with MRI data in evaluation of uterine cervix carcinoma extension in patients suffering from invasive stages (IIB–IVB according to FIGO classification) of disease.

MATERIALS AND METHODS
OF THE STUDY
The present study is based on analysis of two-dimensional and three-dimensional NLS-research and MRI results taken from 54 patients with invasive forms of uterine cervix carcinoma (IIB–IVB according to FIGO classification), observed from 2006 to 2008 in polyclinics and hospitals of Moscow. Verification of diagnosis was carried out on the basis of cytological research; to evaluate extension of disease we used combination of gynecological examination, NLS-research, magnetic resonance imaging procedure, computed tomography and scintigraphy.

NLS-research of uterine neck was carried out using of «Metatron»-4025 system (the IPP, Omsk) with 4.9 GHz generator frequency and unit of continuous spiral scanning with professional computer software «Metapathia GR Clinical», which allowed us to carry out both two-dimensional and three-dimensional visualization of uterus. Examination was carried out on 5-7 day of menstrual cycle or at the day of visit to a hospital for menopause patients.

At the first stage neck of uterus was visualized in two-dimensional mode, after it we carried out three-dimensional computer reconstruction of picture. We evaluated condition of uterine neck and body, ovaries, uterine tubes, parametrium and urinary bladder.

Three-dimensional NLS-graphy allowed us to detect presence of neck damages, endocervix condition. Longitudinal virtual crosscuts showed pictures of anterior and posterior walls of uterine neck. Frontal crosscuts allowed to get full picture of right and left walls, parametrium condition. Using vessels three-dimensional reconstruction mode (3D-angio) we got spatial virtual map of uterine
neck vascular structure, which helped us to detect vascular plexuses affections more precisely. Simultaneous 3D visualization of all three scanning planes allowed us to get reliable conception of pathological nidus dimensions. At the same time we carried out resonance-entropy analysis (REA) of tissue structures allowing us define more precisely pathomorphological picture of uterine neck affection by approximation of pathology spectrum to etalon processes.

At the next stage we carried out MR-imaging of patients' small pelvis organs using «Gyroscan NT» tomographic scanner manufactured by «Philips» with magnetic field intensity of 0.5 T. The examination was carried out in supine position of a patient with use of built-in coil. MRI procedure included routine examination, which, if necessary (for detailed evaluation of parametrium, urinary bladder condition and tumor borders), was supplemented by examination with intravenous contrast enhancement. Routine examination was started with T2WS in axial projection (from the level of superior 2/3 of vagina to third lumbar vertebra with 6 mm crosscut depth) for visualization of small pelvis organs, cellular tissue areas, regional lymph nodes. Then on the basis of acquired data (arrangement of pelvis anatomic structures) we planned sagittal T2-suspended tomograms (capturing ovaries and uterine body, 6 mm crosscut depth), allowing us to detect tumor, define its sizes, upper and lower borders, presence or absence of extension to uterus, vagina, urinary bladder and rectum, condition of cervical canal. At coronary T2WS (from hypoderm of inguinal region to anterior part of lumbar vertebrae bodies, 6 mm crosscut depth) we seen properly visualized increased inguinal and paraaortic lymph nodes (at the background of fatty tissue), bilateral tumor size, condition of walls and contents of urinary bladder, pelvis bones. Oblique axial T2WS (along short axis of uterine neck, 3 mm crosscut depth, from level of superior third of vagina to inferior segment of uterine body) were used for more precise detection of tumor borders, revealing of parametral invasion. All three T2 programs together allowed us to evaluate size of uterine neck and tumor, vagina, parametrium, surrounding organs (urinary bladder, rectum). Besides we got visualization of other organs of small pelvis condition: ovaries size, presence or absence of follicular apparatus in them, additional volumetric masses; we evaluated condition of myometrium, endometrium and cavity of uterus (in some cases we detected its dilatation due to internal or external fauces tumor stricture formation). T1WS in axial projection (from inguinal region to bifurcation of aorta, 8 mm crosscut depth) allowed to visualize regional lymph nodes, presence of haemorrhagic component in tumor tissue, condition of cellular tissue areas, pelvis bones and lumbosacral section of spine. Research with intravenous contrast enhancement was carried out in 21 patients and included native oblique transversal T1WS along short axis of uterine neck, 3 mm crosscut depth (from level of superior third of vagina to inferior segment of uterine body), and after that the same procedure as carried out after contrast injection (in 3-4 minutes). For MR-imaging with contrast enhancement we used «Magnevist» and «Omnipack» preparations, which were injected intravenously to ulnar vein, dosage 0.2 ml per 1 kg of patient weight.

After we received results of MRI and NLS-research, we compared them. We paid special attention to such parameters as spreading of process to myometrium, vagina, parametrium and adjoining organs (urinary bladder, rectum, urinary ducts); on the basis of this work we defined diseases stage according to results of MRI and NLS-research independently. In case of diseases stage mismatch according to both methods, we carried out analysis of results in order to reveal false conclusions and reasons of their arising. After it we calculated statistic data: sensitivity, specificity, accuracy, predictability of positive test and predictability of negative test of two-dimensional and three-dimensional NLS-research method in evaluation of extension and stage of disease. Results of REA were compared to gynecological examination (of vagina affection) data and MRI data (of uterine body and parametrium affection), because there were no operative treatment of patients suffering from invasive stages of uterine cervix carcinoma. On the basis of acquired data we carried out comparative analyses of two-dimensional and three-dimensional NLS-research potentials in evaluation of uterine cervix carcinoma extension.

MR-image of small pelvis – carcinoma of uterine cervix

NLS. Carcinoma of uterine cervix
RESULTS OF THE STUDY

We examined 92 patients with diagnosed (according to REA and cytological evaluation) uterine cervix carcinoma. Verification of tumor spreading and disease stage was defined according to combined data acquired from gynecological examination, NLS-research with REA, histological research, results of hardware approach (MRI, ultrasound, computed tomography, scintigraphy). At the same time non-invasive or less invasive forms of disease were detected in 38 women, invasive forms (late stages of disease – IIB–IVB according to FIGO classification) – in 54. Taking into consideration that objective of our study is evaluation of two-dimensional and three-dimensional NLS-research and MRI diagnostic value in detection of invasive forms of uterine cervix carcinoma extension in women, patients suffering from less invasive forms of disease were excluded from the study. According to results of combined examination of patients suffering from late stage of disease we diagnosed the following: IIB stage in 23 patients, IIIA – in 18, IIIB – in 7, IV A – in 3 and IVB – in 3 patients. Patients with non-invasive forms of disease were subjected to operative treatment, patients with late stages of disease – radiation therapy.

In patients with IIB stage (23 women) altered uterine neck was detected at gynecological examination. In 8 women we diagnosed exophytic tumor, at the same time vaginal part of uterine neck was represented by tuberous enlargement in form of cauliflower, projecting into vagina opening, infiltration of vaginal fornices was also detected; in two women we detected patulous vagina due to large tumor. In 6 women tumor was characterized by endophytic growth: uterine neck was hardened, enlarged, with dark crimson mucous tunic, easily bleeding at examination; vaginal fornices were not infiltrated. Ulcerous form of uterine cervix carcinoma was detected in 3 patients, uterine neck was partially destroyed, with severe ulceration. At the bottom of ulcer we detected dirty gray incrustation. Besides in 6 patients tumor was of combined character (exophytic-ulcerous), when at the background of tuberous enlargement, large ulcer with pitted edges and tuberous bottom; in 2 of these women vagina was opened, vaginal fornices were infiltrated. Affection of vagina was diagnosed histologically in 14 cases. At rectal-abdominal examination in 20 women uterus was immovable.

At NLS-research in all patients from this group we detected in two-dimensional mode hyperchromic neoplasms (4-5 point according to Fleindler’s scale) of irregular form, without distinct outlines, corresponding to tumor tissue. At two-dimensional research tumor outlines were indistinct; it was hard to evaluate its borders accurately. Further research in three-dimensional mode allowed us to visualize tumor borders more precisely, define sizes of uterine neck and tumor more accurately. Virtual longitudinal crosscuts showed pictures of anterior and posterior uterine neck walls, when frontal crosscuts helped to get complete representation of left and right walls, condition of perimetrium. So according to results of two-dimensional research spreading of tumor to uterine body was detected in 4 women, to vagina – in 9, to parametrium – in 16. After three-dimensional research at the next stage affection of uterus was visualized in 2 more women (besides 4 abovementioned), of vagina – in 3 more patients (besides 9 abovementioned), parametrium invasion was detected in 20 patients.

3D-angiography programs turned out to be the most information valuable for evaluation of parametrium condition. Energy mapping detected hyperchromic areas of bloodstream in uterine neck stroma. Hyperchromicity areas had similar location as hyperchromic parts of uterine neck, however sizes of vascular pathology nidi exceeded sizes of corresponding hyperchromic areas in organ 1.28 – 1.33 times.

Tumor sizes, measured in three-dimensional mode in patients from this group were: length – 49.5 ± 6.84 mm (40 – 70 mm), width – 45.5 ± 6.18 mm (31 – 55 mm), thickness – 43.9 ± 3.52 mm (38 – 50 mm); sizes of vascular destruction areas: length – 65.5 ± 9.16 mm (50 – 85 mm), width – 58.3 ± 7.68 mm (42 – 71 mm), thickness – 56.6 ± 5.65 mm (45 – 64 mm). In 22 patients from this group 3D-angiogram program has visualized extension of vascular affection zones beyond uterine neck into parametrium.

In patients suffering from IIB stage of disease MR-tomograms represented tumorous mass as an area with rather distinct uneven outlines, of irregular shape in majority of cases, homogeneous structure, with increased intensity of MR-signal at T2WS, isointensive uterine neck stroma at T1WS. According to MRI data extension of tumor parametrium was detected in all 23 cases and was visualized most clearly at oblique-transversal T2WS-tomograms, carried out perpendicularly to long axis of uterine neck and cervical duct. At the same time we detected integrity breach of lowintensive ring of unchanged stroma and tumor prolapse beyond uterine neck. Uterine neck outlines in parametrium invasion area were uneven and tuberous. Vagina affection was detected in 13 patients (besides 12 detected according to NLS data, in another one patient vagina infiltration was detected according to MRI data), uterine body – in 7 (according to NLS-research data in one case there was false negative result).

Therefore, at IIB stage application of combined examination for detection of uterine body affections helps to increase its information value from 76% at two-dimensional NLS-research to 93% at 3D NLS-research; for detection of vagina affections – from 71% to 89% at 3D NLS and to 91% at MRI; for parametrium invasion visualization – from 70% at two-dimensional NLS-research to 87% at 3D NLS-graphy. Disease stage in this group was identified in 67% of cases (all the rest were diagnosed IIIA) according to 2D NLS-research, according to 3D NLS – in 87% of cases, according to aggregate data of 3D NLS in angiographic mode – in 96% of cases.

Stage IIIA was diagnosed in 18 women. In all cases gynecological examination detected exophytic large-tuberous tumor, infiltrating fornices and walls (to the lower third) of vagina, with ulcerous bleeding at a touch mucous membrane. In 8 patients vagina was opened. In all cases affection of vagina to the lower third (inclusive) was
Carcinoma of uterine cervix

Therefore, using of three-dimensional NLS-research at IIIB stage of disease allows to improve diagnostics of myometrium invasion from 50% to 85%. Parametrium invasion and hydronephrosis in women at this stage of disease were detected according to REA in all cases correctly, which led to correct identifying of process stage.

In 6 women disease was detected at IV stage. In 5 patients gynecological examination revealed endophytic-ulcerous form of disease (with process extension to lower third of vagina; it was confirmed histologically) and in one patient – endophytic form. In three cases vagina was opened.

Vagina affection was detected according to two-dimensional NLS-research data: – in 3 women; by three-dimensional NLS-research – in 4 women; by MRI – in 5 women. Extension of process to myometrium according to two-dimensional NLS-research data: in 1 patient; by three-dimensional NLS-research – in 3 women; by MRI – in 4 women. According to both methods involvement of parametrium was detected in all cases. In 4 patients MRI and NLS diagnosed tumor extension to urinary bladder walls; it was confirmed by results of cytological research. Besides, in one patient MRI detected tumor extension to Douglas cul-de-sac and rectum; these processes were not detected by NLS-research. At additional examination by computed tomography in 2 women we detected secondary affection of liver and in one patient – of lungs (IVB stages).

Therefore using of combine examination of patients for uterine body affection detection allows to increase its information value from 50% by two-dimensional NLS-research to 89% by three-dimensional NLS-research; for detection of vagina affection – from 67% to 88%. In detection of parametrium and urinary bladder affections both methods (NLS and MRI) are equally information valuable. Disease stage in this group of patients was correctly detected by NLS-research in 87% of cases and by MRI – in 73% of cases.
RESULTS DISCUSSION

Nowadays, NLS-diagnostics in gynecology, which uses all modern diagnostic methods and equipment with high resolution capability, becomes leading diagnostic method. However, issues of NLS-graphic evaluation of uterine neck condition were not brought up yet. In available sources, studies of uterine neck NLS-graphy are missing. Previously, examination of uterine neck condition was not seen as an objective of NLS-researches, because bimanual vaginal examination and mirror survey allowed the therapist to acquire quite accurate information. Nowadays, thanks to quick development of computer technologies, NLS-diagnostics got features of three-dimensional information acquiring and analysis, which leads to revision of old diagnostics methods. So this was the objective of our study: evaluate potentials of three-dimensional NLS-research in comparison with two-dimensional research for examination of uterine neck tumor, its expansion and comparing of this data with MRI data. Analysis of acquired data revealed that in evaluation of vaginal and myometrial invasions three-dimensional NLS-graphy approximately two times excels in information value two-dimensional NLS-graphy. We believe that three-dimensional NLS-graphy data in many cases allows to get additional information and get closer to nosological diagnosis and thus to choose patient management tactics.

Analyzing all acquired three-dimensional NLS data altogether, we made a conclusion that this method allows to increase percentage of corrects disease staging from 57% to 88%. Three-dimensional examination plays major role at IIB and IIIA stages, when tumor sizes and expansion are not too large yet. At late stages such symptoms as hydroureter, hydronephrosis and urinary bladder affection allows even two-dimensional research to identify disease stage quite precisely, although border and size of tumor are not visualized clearly.

CONCLUSION

According to abovementioned study we made the following conclusions:

– In comparison with two-dimensional research data, carrying out of three-dimensional NLS-graphy together with REA increases diagnostic value of the method for detection of invasion to parametrium, myometrium and vagina an IV – IV stages of disease.

– Application of three-dimensional NLS-graphy increases accuracy of uterine neck cancer staging from 57% to 88%.
THREE-DIMENSIONAL NLS-GRAPHY
IN COMBINED DIAGNOSTICS
OF BREAST DISEASES

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Breast cancer (BC) holds one of the first places among malignant neoplasms in women. According to evaluation of World Health Organization (WHO) experts, every year 1 to 1.5 mln of new breast cancer patients will be registered in the world by 2015. Number of women with other pathological processes of benign character and requiring treatment and monitoring will 25 – 30 times exceed number of women suffering from breast cancer. Diagnosing of breast diseases, including cancer, is the primary objective.

Together with introduction to clinical practice of modern x-ray, ultrasound and radiological equipment, and also new diagnostic method – three-dimensional (3D) virtual NLS-graphy, we now can carry out combined examination of female patients in order to diagnose breast diseases.

Our study is based on combined clinical and hardware examination of women, which was carried out during first phase of menstrual cycle to exclude hormonal influence to mammary glands. We examined 292 women suffering from various breast diseases. 240 patients were administered to mammography, in 15 of them it was combined with targeted imaging, in 31 – with ductography (in two cases – with double contrast enhancement), in 6 – with pneumocystography, in 2 – with intratissular sectoring and in another two patients – with puncture biopsy. 202 patients were examined with ultrasound research of breast, in 58 cases it was combined with biopsy. Another 17 patients were subjected to radioisotopic examination of mammary glands and lymph nodes; 288 patients were examined with three-dimensional NLS-graphy, 175 of them – with application of spectral-entropy analysis (SEA).

Clinical examination includes history taking (age, complaints, information about procreation and lactation, gynecological diseases, heredity, traumas and character of menstrual cycle); inspection and palpation of breast with regional groups of axillary lymph nodes. If there was nipple discharge it was taken for cytological research.

Role of ultrasound examination among other methods of breast diseases diagnostics is evaluated according to level of applied equipment, type and stage of disease, age and hormonal status of a patient, therapist’s experience. Ultrasound examination of breasts was carried out with ultrasound scanners manufactured by Hewlett-Packard (Sonos-5550, Image Point) equipped with high-frequency sensors and also by means of Doppler examination.

Ultrasound evaluation of breast blood flow parameters was used as auxiliary non-invasive method of early diagnostics of benign and, particularly, malignant neoplasms.

Ultrasound examination of breasts was carried out for differential diagnostics of cysts and solid masses detected by palpation and mammography; homogeneous-dense structure of breasts; examination of women above 40; examination during acute trauma period and inflammation; indurations of unknown etiology evaluation; ultrasound monitoring of puncture biopsy of palpated and non-palpated neoplasms in form of node.

Diagnostic intervention controlled by ultrasound allows achieving of morphological verification of affection in 72% only.
In variety of mammary glands research methods, roentgen examination (standard mammography, combined with application of special methods) holds an important place. Roentgenography of breast was carried out with «Mammodiagnost-4000» device manufactured by Philips, equipped by set of tubes for dosed compression and stereotactic apparatus for core biopsy.

Examination of breast structure includes targeted imaging which allows to get precise and contrast images of selected areas and pathological nidi for differential diagnostics of indurations, such as nodal mastopathy, to detect calcareous inclusions and specify condition of selected areas of tumoral node.

Mammography in lateral projection of study is carried out, as a rule, in order to specify localization of pathological nidus for further intratissular sectoring with introduction of localizing needle prior to excisional biopsy controlled by roentgenography.

Ductography is carried out if there are nipple discharges of serous or sanguinolent character. According to standard procedure we introduced water soluble contrast enhancement (76% urografin) to breast nipple duct by galactographic system «Giu-3.0» N:68008-05M. Contraindications for ductography are: acute inflammatory process and clinically detected cancerous tumor in duct sphere discharging secretion, due to risk of tumor cells migration into ducts system.

Standard method of ductography not always makes possible to detect intraductal neoplasms of 2 – 3 mm size, and to identify condition of ducts walls internal surface at initial changes, such as intraductal cancer or papillomatosis.

Pneumocystography allows us to detect parietal growths; also it is treatment procedure, which is carried out by introduction into of air, in amount equal to amount of removed liquid, into cyst cavity.

First attempts to visualize mammary gland tumors using radionuclides were taken in 70’s of the last century. Nowadays, when we can use emissive gamma camera and new radiopharmaceuticals, we can answer many questions about character of a process in mammary gland.

For mammoscintigraphy we used the following domestic preparation: methoxyisobutyl isonitrile (MIBI), produced by «Diamed» company, named «Tekhnetrill». The research was carried out with digital two-sensor tomography gamma camera «GCA-7200A» manufactured by Toshiba.

The method is based on using of structure and functioning of tumor cells, providing accumulation of Tekhnetrill in tissue of primary node and metastases of mammary gland. All examination at two-sensor gamma camera in two projections takes 20 – 30 minutes.

After the research we analyze size of nidus and spreading of radiopharmaceuticals in selected area, compare intensity of preparation inclusion into various structures.

NLS-graphy may be regarded both as screening diagnostics method and updating diagnostics (when ultramicroscanning and SEA are used) for solving of controversial issues concerning tactics and treatment of mammary gland pathologies. Three-dimensional NLS-graphy allows us to acquire three-dimensional picture of whole structure of mammary glands and sections of any plane, axillary areas with lymph nodes, retromammary space with all layers of breast wall and to differentiate retrosternal lymph nodes. Three-dimensional NLS-research makes possible to detect changes in mammary glands at various pathological processes, identify their size, form and structure.

NLS-ultramicroscopy allows us to carry out accurate layerwise visualization of gland’s structure (skin, hypoderm, glandular, connective and fatty tissue, blood vessels).
SEA makes possible to identify morphological character of neoplasm by its spectral similarity to etalon processes, evaluate metastatic invasion of lymph nodes, identify presence and character genetic aberrations in tumoral subclones, which, finally, will identify extent of surgical intervention.

Application of three-dimensional NLS-graphy is most reasonable in the following cases:

– to detect primary nidus at metastatic invasion of axillary lymph nodes;
– to specify extent of tumor spreading;
– for differential diagnostics of cicatrical changes and malignant neoplasms;
– for diagnosing of lesser forms of breast cancer, especially when there are vastly developed glandular tissue and fibrous-cystic mastopathy;
– at multicentric and infiltrating forms of cancer;
– when patient have large breasts and research by other methods of radiodiagnostis is not possible;
– for research of sharp painful glands at fibrous-cystic mastopathy, when palpation and compression of mammary gland is not possible;
– for planning of organs-preserving operations.

The research was carried out with «Metatron»-4025 system (the Institute of Practical Psychophysics, Russia; Clinic Tech Inc., USA). Together with the system we used professional computer software «Metapathia GR Clinical» with feature of microscans research and three-dimensional visualization of pictures.

Information value of SEA at NLS-ultramicroscopy is conditioned by potential to detect such specific symptoms of tumoral affection as carcinogenesis at gene level. At malignant tumors in chromosome apparatus of mammary glands cells one may detect loci with specific aberrations, related to tumor development. Aberrations number increasing reliably proves presence of malignant neoplasm and degree of tumor malignisation.

Malignant tumors were visualized at macroscans as nidi of hyperchromic signal (5 – 6 points according to Fleindler’s scale) of various form and size, often with uneven, indistinct outlines.

Information value of mammary glands NLS-examination in all cases was 42% – 67% higher than when we used x-ray mammography and ultrasound examination.

Metastasis was detected quite accurately if in lymph node was hyperchromic area (6 points), which at SEA had high spectral similarity to «Metastatic tumoral subclon» etalon (D<0.425).

Application of three-dimensional NLS-graphy opens up great possibilities in diagnostics of both primary and poorly diagnosed forms of breast cancer due to its low price, non-invasive character, high resolution and accuracy (especially when used together with SEA), absence of radio stress and usability.

Therefore rational sequence of diagnostic methods application in combined diagnostics with obligatory morphological component allows carrying out of accurate diagnostics of mammary glands various pathological conditions with the least costs and time.
Degenerative changes of intervertebral disks may be registered after first 10 years of life of a man and 10 years later in women. However etiology of neurologic symptomatology at lumbodynia is much more complicated than simple mechanical compression of neural structures. Origins of pain are described in many studies: issues concerning roles of chemical stimuli, autoimmune complexes, etc. are debated. It is well known that in many cases weak correlation between results of radio examination and clinical symptoms is registered, i.e. in patients with marked degenerative-dystrophic damages no clinical presentations are registered, at the same time in patients with severe clinical symptoms radiologist detects minor signs of vertebral region degeneration only.

Scientific progress provided therapist with high-precision methods of spine examination, such as computed tomography (CT).

Some people believe that routine methods of spine radio research, such as radiography, myelography and discography became things of the past and represents historical interest only. Sometimes clinician has no exact idea for what kind of examination low-back pain patient should be administered.

There is an opinion that computed tomography replaces all other diagnostic methods and must be applied as the only diagnostics method, but it is not true. Computer NLS-graphy method, introduced in recent years, with all its usability and low price, in many cases is more informative and, in general, more available than computed tomography. Objective of this study is to demonstrate potentials of both methods in diagnostics of spine degenerative-dystrophic damages.

Examination of patients with degenerative-dystrophic diseases of intervertebral disks should be started with radiology examination of damaged part of spine with functional (dynamic) test, according to its results therapist chooses further tactics of patient examination. Radiography of spine may detect conditions related to pathological changes of mainly bone structures of spine and, which is more important, to detect instability of spinal part, that evidences dislocation of vertebra more than 4 – 5 mm forward or backward.

Concerning such invasive research method as myelography: with available modern CT and NLS equipment practicability of myelography application may be considered only for examination of patients with spinal stenosis combined with scoliosis.

CT provides acquiring of required information about topographic and anatomical relations in spinal segment, specifying of bone tissue pathological damages character,
visualization of vertebral canal and paravertebral area structures. CT has high sensitivity in detection of protrusions and vertebral hernia, allowing us to specify their localization and degree of volumetric damage. In the first place CT is prescribed in cases when according to radiology reason of pain syndrome is, probably, in changes of vertebrae bone structure (osteophyte, stenosis of vertebral canal, dysplasia, development abnormalities, spondylolisthesis, spondyloysis, spondylarthrosis and tumors). Taking into consideration radio stress, CT examination is usually limited by two intervertebral disks, where radicular syndrome is detected clinically.

Nowadays, in our opinion, the most accurate method of degenerative damages diagnostics is NLS-scanning together with spectral-entropy analysis (SEA) of cartilaginous and bone tissue in affection area.

Computed tomography of hernia

NLS-graphy of vertebral column at hernia

Thanks to high resolution of NLS-equipment, this method not only reveals morphological damages, but also provides information about degree of changes in degenerating disks. Degeneration of intervertebral disk results in its tissue dehydration, which leads to gradual constriction of disk space and increasing of signal chromogeneity at images. The latter is related to changes in proteoglycan structure of intervertebral disk; but it is not caused by absolute changing of water content. Loss of water by disk results in its height decreasing and elimination of border between nucleus pulposus and fibrous ring. Together with degeneration degree increasing, small filled with liquid fissure appear; they are detected as linear areas of high hyperchromeity (5 – 6 points according to Fleindler’s scale). Later on in degenerating disk calcipexis may happen.

We can single out (without protrusion place topics):
1) Disk protrusion – displaced disk (nucleus pulposus) stretches fibrous ring, in its outer part microfissures appear, but not perforating it;
2) Disk prolapse – parts of disk perforate fibrous ring and come out to epidural cavity;
3) Disk sequestrum – substance of nucleus pulposus migrates above or below disk level.

Typical changes of bone-marrow tissue NLS-picture in adjacent to degenerative disks parts of vertebrae can be divided into three types for convenience: vascular, fatty and sclerotic.

Due to this fact in majority of cases adequate amount of research includes the following examinations: two-dimensional scanning of damaged disk in sagittal projection and axial projection at the level of detected changes. Application of three-dimensional scanning method is practical to emphasize closing plates in order to detect their erosion and condition bone-marrow tissue.

Application of NLS-microscanning is important for evaluation of deformation degree and constriction of dural sac, condition of dural funnels in order to detect their deformation and dislocation.

Taking into account non-invasive character and absence of ionizing radiation, NLS-method may be used for dynamic monitoring of post-operative changes. To distinguish recurrent disk hernia from post-operative scar we use spectral-entropy analysis. Mature scar tissue has its specific specter differing from disk tissue, which can be perfectly seen at SEA.

We developed single treatment and diagnostics algorithm of lumbodynia patients management.

We present following results of two patients examination as an example of combined application of NLS-methods, which allowed us to diagnose accurately and choose correct tactics of treatment.
Patient B., performed NLS-examination of lumbosacral spine segment detected osteophyte of S1 vertebra together with marked degenerative-dystrophic damage of disks and sequestrum at L5 vertebra body level; it was confirmed by SEA and further on resulted in correction of operative intervention tactics.

Patient G., NLS-microscanning registered, besides L5 – S1 disk prolapse, areas of hyperchromic (6 points) NLS-signal in epidural cavity. Three-dimensional NLS-graphy with SEA confirmed destruction of nucleus pulposus in this area.

Therefore, patient suffering from spondylogenic pain syndrome should be subjected, first of all, to radiology examination of spine with functional tests. In cases when there is clinical picture of irritation or spine neural structures compression and radiography did not register significant deformation of vertebra bone elements, it is recommended to carry out NLS-microscanning of damaged area with SEA.

Optimal algorithm of patients with degenerative-dystrophic diseases of spine examination makes possible not only to decrease material expenses of a healing institution and a patient, but also to optimize diagnostics process which promotes increasing of patients treatment quality.
NLS-DIAGNOSTICS OF ANKLE JOINT DAMAGES

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Ankle joint damages is urgent medical and social problem according to its prevalence, loss of working time, material cost of treatment and covering of temporary disability and also by frequent unfavorable outcomes.

Main reasons of consulting a traumatologist are damages of tendo-ligamentous apparatus of this area. Due to this fact dominating role of medical visualization in diagnostics of ankle joints mechanical damages seems to be obvious. Feature of combined evaluation of musculoskeletal system grants magnetic-resonance imaging (MRI) advantage over roentgenological examination in diagnostics of tendo-ligamentous apparatus damages. However low spreading of magnetic-resonance tomorphgraphs and high cost of examination considerably limit application of this method in search of ankle joint damages.

NLS-examination may become an alternative method in diagnostics of musculoskeletal system pathology. Advantages of NLS-method are simplicity, availability, high information value and relatively low price. Taking into consideration complex structure of ankle joint and foot, easiness of poly-projecting virtual examination of extremity seems to be quite important issue. Possibility of microscanning, contactless atraumatic examination which may be repeated many times provided priority of NLS-graphy among methods of medical visualization of ankle joint and foot damages.

STUDY TECHNIQUE

NLS-research of ankle joint was carried out with «Metatron»-4025 system with software that allows three-dimensional visualization of extremities.

Virtual examinations were started from evaluation of anterior part of ankle joint. Afterward were evaluated:
- muscles tendons: tibialis anterior, extensor hallucis longus, extensor digitorum longus, peroneus longus and brevis, posterior tibialis, flexor hallucis longus, flexor digitorum longus;
- Achilles tendon;
- Achilles bursa;
- ligaments: tibiofibulare anterius, talofibulare anterius, calcaneofibulare, deltoideum;
- plantar aponeurosis.

Evaluation of tendons and ligaments was carried out in three orthogonal projections. To confirm detected changes we carried out comparing with contralateral part. Method of three-dimensional panoramic scanning of tendons considerably increases demonstrative character of studies.

During scanning of tendon we evaluated its structure, outlines, transition to muscular tissue and chromogeneity at dynamic monitoring. NLS-picture of tendons is based on their histological structure. Tendons consist of long collagenous fibers and at microscans, in normal condition, they look like homogeneous, hypochromogenic fibrillar structures surrounded by low-chromogenic line (synovial membrane).

At NLS-pictures ligaments in normal condition look like hypochromogenic fibrillar structures surrounded by low-chromogenic line (synovial membrane).

Plantar aponeurosis has homogeneous structure with insignificantly marked fibrillar pattern.

Hyaline cartilage of ankle joint in normal condition is presented, as a rule, as moderately chromogenic linear structure, adjoining hypochromogenic cortical layer of a bone.
METHODS
During analysis of virtual NLS-picture of ankle joint anterior part we see visualized tendons of anterior tibial muscle (m. tibialis anterior), long extensor muscle of fingers (m. extensor digitorum longus) and tendon of long extensor muscle of toe (m. extensor hallucis longus). Tendon of anterior tibial muscle (m. tibialis anterior) is located most medially of all; it is twice thicker than tendon of long extensor muscle of toe (m. extensor digitorum longus). To study anterior talofibular ligament (talofibulae anterius) we identified cortical layers of shin bone and fibular bone; between them ligament fibers are visualized.

In lateral projection at three-dimensional picture we analyzed tendons of short and long peroneal muscles (m. peroneus longus et brevis). Tendons of short and long peroneal muscles are located behind lateral malleolus. Tendon of short peroneal muscle adjoins cortical layer of ankle and located in front of long peroneal muscles tendon. Tendon of short peroneal muscle can be traced down to basis of V metatarsal bone at plantar side. Long peroneal muscles tendon is visualized down to attachment to medium cuneiform bone and I metatarsal bone at plantar side.

Anterior talofibular ligament (lig. talofibulae anterius) is visualized at NLS-picture between anterior edge of lateral malleolus and ankle bone. Fibers of calcaneofibular ligament (lig. calcaneofibulare) are detected from external surface of lateral malleolus and going downwards and backwards they attach to lateral surface of heel bone. Achilles tendon is studied from place of attachment to heel bone until place of transition to gastrocnemius muscle.

TENDONS DAMAGES
Three-dimensional visualization of tendons’ fibrillar structure at microscans is a distinctive feature of NLS-research in comparison with other methods of radiodiagnostics, including MRI.

The most frequent form of ankle joint and foot tendons traumas is tendosynovitis. It makes up more than 70% in structure of mechanical damages. At the same time comparative analysis of various methods of radiodiagnostics demonstrates maximum efficiency of NLS-research in detecting of tendon sheath pathological affection. Sensitivity of this method is almost 95%. We want to emphasize greatest demonstration efficiency of transversal scanning of tendon with various degree of scaling.

NLS-graphic semiotics of tendonitis includes abnormality of tendon’s fibrillar pattern, heterogeneity of structure with hyperchromogenic nidi (5 – 6 points according to Fleindler’s scale). Hyperchromogenic nidi correspond to tendon edema and xanthomatosis. Posttraumatic tendonitis in ankle joint area is diagnosed in 10% of cases.

NLS-research is also method of choice for diagnostics of tendon ruptures, percentage of which is 20%.

At type I partial rupture microscans detect abnormalities of fibrils integrity, uneven outlines of tendon. Longitudinal ruptures, according to NLS-research data, are accompanied by appearance of hyperchromogenic fissures (5 – 6 points), oriented obliquely along tendons, which may reach surface.

At NLS-graphy of type II partial rupture microscans detect abnormalities of collagenous fibers integrity.

Type III (total rupture) according to NLS-research and other radiodiagnostics methods data is
characterized by complete destruction of tendon’s fibers at microscanning (6 points). However differing from radio computed tomography and magnetic-resonance imaging, NLS- research makes allows us to identify place of tendon rupture more precisely and technically easily.

Ease of NLS-examination defined prerogative of this method in diagnostics of short and long peroneal muscles’ tendons damages in lateral malleolus area. Flattening of ankle incisure at abnormality of retinaculum peroneum superius may result in development of lateral group tendons subluxation. This condition appears at ankle joint bending and external rotation, and also at joint extension and internal rotation. Clinical dislocation may be manifested by rupture of collateral ligaments of lateral malleolus. Visualization of forward tendon rupture at bending and joint extension in real time mode by NLS-method allows correct formulating of diagnosis in all cases.

DAMAGES OF TENDONS AND PLANTAR APONEUROSIS

MRI slightly yields to NLS-method in diagnostics of tendons damages, because majority of them are poorly visualized by MRI. Semiotics of tendons ruptures includes the following signs: total damaging of fibers, increasing of its chromogeneity and deformation of structure at microscans in comparison with the same ligament of other extremity.

In majority of cases three-dimensional NLS-examination allows us to differentiate total and partial ruptures of tendons.

Differing from MRI, NLS-examination is quite sufficient for evaluation of plantar aponeurosis condition. Information value of NLS-research and MRI in aponeurosis damage evaluation is identical. However, besides fusiform thickening, intramural and perifocal edema, detected by MRI, NLS-examination detects hyperchromogenic fibrillar structures (6 points) at microscans and increasing of aponeurosis chromogeneity.

Therefore NLS-diagnostics method is highly informative in study of ankle joint damages. It may be regarded as additional method for examination of tendo-ligamentous apparatus.

In majority of cases when tendons and plantar aponeurosis are damaged, NLS-examination is adequate alternative of magnetic-resonance imaging.
POTENTIALS OF COMBINED NLS-EXAMINATION AND MAGNETIC RESONANCE IMAGING IN DIFFERENTIAL DIAGNOSTICS OF SOFT TISSUES SARCOMAS


Non-organic sarcomas of mesenchymal origin are less than 1% of malignant neoplasms total number. Clinical presentations of tumors at the early stage of development do not differ in any specific symptoms, that is why still there are no significant achievements in differential diagnostics at this stage of their development; errors in ambulatory diagnostics are approximately 40% – 60%.

Prognosis at treatment of non-neglected forms of tumors is relatively positive and depends on few factors, including age of a patient, size and stage of a process, degree of differentiation and extent of tumor spreading. After local excision number of local recurrences reaches 93%, after extended excision – 49%, after repeated extended excision – 73%, after radical resection – 20% and after amputation – 6%. Hardware methods of examination play major role in diagnostics of soft tissues sarcomas, because according to results acquired using these methods, issues of tactics, amount and terms of operative interventions are settled. Taking into account all abovementioned we can say that successful treatment in many aspects depends on well-timed and accurate pre-operative diagnosing even before complications occur, due to which risk and prognosis of operative intervention significantly increase.

Magnetic resonance imaging (MRI) had influenced and still influences greatly development of radiologic diagnostics of musculoskeletal system diseases. This method provides the best visualization of soft tissues and bone marrow in comparison with other methods.

Objective of our study is improvement of diagnostics of soft tissues tumor diseases, development of criteria for three-dimensional NLS-graphy and MRI in differentiation of malignant and benign neoplasms of soft tissues.

Our experience of one of potential algorithms of soft tissue tumors hardware diagnostics application, including NLS and MRI, will be considered in this study by example of diagnostics of soft tissues primary malignant tumors.

MATERIALS AND METHODS
We have examined 107 patients: 68 (71.6%) men and 39 (28.4%) women suffering from primary malignant tumors of soft tissues, including: fibrosarcoma – 31 (29%), liposarcoma – 21 (20%), synovial sarcoma – 13 (12%), leiomyosarcoma – 11 (10%), malignant schwannoma (neurofibrosarcoma) – 9 (8%), rhabdomyosarcoma – 8 (7%), angiosarcoma – 7 (6.5%), malignant fibrous histiocytoma of soft tissues – 7 (6.5%). Age of patients ranged from 8 to 52 (32 ± 18).

All patients were administered for combined NLS-graphic research with use of three-dimensional...
scanning and MRI: NLS-examination was carried out by «Metatron»-4025 system (Russia) with digital trigger sensor and generator of 4.9 GHz frequency and feature of process visualization; MRI by Magnetom Open Viva apparatus (by Siemens). We identified optimal parameters of MRI: T1 (SE) – parameters TR/TE_532/15 ms, FA – 90. T2 (TSE) – parameters TR/TE – 5000/102 ms. T2 tirm – parameters TR/TE – 5000/48 ms, TI – 107 ms. To evaluate condition of great vessels we carried out MR-angiography (MRA) according to time of flight (TOF) method: parameters TR/TE – 70 ms, FA – 55 ms. In 63 cases we carried out MRI with contrast enhancement (Magnevist). Acquired study data was compared to results of morphological research of post-operative material or material acquired by puncture biopsy.

RESULTS

Patients suffering from soft tissues sarcoma in majority of cases complained about nagging pains and appearance of slowly growing tumor with extremities malfunctions. Medical history was from 3 to 6 – 7 months long, in average. Objective examination of soft tissues detected dense and dense-elastic painless neoplasm, with limited displacement range, without distinct outlines.

Tumors of small size (up to 5 cm) were diagnosed in 33 (31%) patient. In other cases tumor size ranged from 5 cm to 22 cm.

In majority of cases fibrosarcomas were localized in proximal part of thigh at internal surface. In 8% of cases we detected myxomatosis nidi in tumor structure. Fibrosarcoma of soft tissues is represented at three-dimensional NLS-pictures by heterogeneously hyperchromic signals (3 – 6 points according to Fleindler’s scale). Heterogeneity of a signal was explained by presence of hypochromic parts of fibrous tissue and fibrous interlayers in tumor. We clearly detected signs of infiltrating growth: in all cases tumor outlines were indistinct and uneven. Type of tumor was confirmed by according to resonance-entropy analysis (REA) by high spectral similarity to «Fibrosarcoma» etalon (D<0.425).

In 3 cases we registered presence of hyperchromic (5 – 6 points according to Fleindler’s scale) necrosis areas. We detected no pseudocapsules at fibrosarcoma. In 3 patients suffering from fibrosarcoma we detected secondary bone changes: in the first case there was lesser marginal destruction of shoulder-blade body cortical layer for a distance of 1.5 – 2 cm; in the second case – complete destruction of thigh cortical layer for a distance of 3 cm; and in the third case – marginal destruction of shinbone body cortical layer. These pathological changes were registered by NLS only in one case.

According to World Health Organization classification we singled out two groups of soft tissues liposarcomas: 1) polymorphous liposarcoma with low-differentiated structure and high degree of malignancy (in 12 patients); 2) myxoid liposarcoma characterized by high-differentiated structure and low degree of malignancy (in 9 patients).

Generally, polymorphous liposarcoma was localized in thigh area. Size of a tumor ranged from 7 cm to 18 cm. In two patients it spread beyond one anatomic zone and was of large size (12 cm – 18 cm). Myxoid liposarcoma in all cases was localized in only one anatomic zone on thigh or anterior chest wall and it did not spread into surrounding anatomic zones. Size of tumor ranged from 9 cm to 22 cm.

NLS-examination of liposarcoma in majority of cases (16 cases – 76%) detected distinct, but uneven
outlines, inhomogeneous (mainly hyperchromogenic) structure with hypochromic inclusions. At polymorphous liposarcoma heterogeneity of structure was conditioned by presence of dense fibrous areas and connective tissue in tumor. Type of tumor was identified by REA according to spectral similarity to «Liposarcoma» etalon (D<0.425).

Polymorphous liposarcoma at MRI was represented by heterogeneous iso-intensive, similar to surrounding muscle tissue, signal at T1WS and heterogeneously hyperintensive signal at T2WS. Besides, with the background of tumor, in all 9 patients we detected numerous areas (1 – 2 cm diameter), containing liquid, necrotic tissues and hemorrhages. In all cases we registered signs of infiltrating tumor growth: tumor spreading into surrounding muscles with loss of their outlines clearness, disappearance of intramuscular and subfascial fatty layers, fascia bulging.

Myxoid liposarcomas at NLS had distinct, but uneven outlines, characterized by inhomogeneous structure and presence of massive hypochromogenic myxomatous inclusions in tumor depth (3 – 4 points according to Fleindler’s scale).

At MRI myxoid liposarcomas were characterized by heterogeneous moderately hyper-intensive signal at T1- and heterogeneous apparently hyper-intensive signal at T2WS. Outlines of neoplasm were displayed as distinct ones owing to presence of thin hypo-intensive ring of pseudocapsule. However at separate areas of tumor outlines were indistinct and uneven, pseudocapsule could not be differentiated clearly – that evidenced infiltrating growth. Heterogeneity of signal at T1WS was conditioned by lobar structure of myxoid liposarcoma. At the same time in central areas of tumor intensity of signal was lower due to less mature fat cells and presence of large number of myxomatosis areas. Intensity of signal at T1WS gradually increased approaching peripheral areas: from less intensive intermediate signal due to myxomatosis elements to high hyper-intensive signal conditioned by mature fat. In 6 patients we detected necrosis nidi of 1 cm to 2.5 cm diameter in tumor.

In majority of cases leiomyosarcoma was detected in for of single node (in 9 cases). NLS-examination characterized tumor as neoplasm of oval form; with distinct outlines, with inhomogeneous, mainly of hypochromogenic (4 points) structure. In 6 cases in tumor depth we registered hyperchromogenic areas — destruction of tumor. Leiomyosarcoma at three-dimensional picture was represented by isochromic signal of heterogeneous structure due to presence of single and multiple small hyperchromogenic areas (5 – 6 points) of necrosis.

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Synovial sarcoma in majority of examined patients (12.92%) was localized in extremities, near joints. At MRI T1WS synovial sarcoma was characterized by moderately hyper-intensive signal, at T2WS – by marked hyper-intensive signal of heterogeneous structure due to numerous areas of calcification and fibrosis.

Malignant fibrous histiocytoma (myxofibrosarcoma) of soft tissues was localized in muscle tissue in 6 patients and in hypodermic tissue in one patient. Myxofibrosarcoma gave heterogeneous signal at T1- and T2WS; in its structure we detected areas of both low (fibrous tissue) and high intensity (fat tissue).

Hypervascular type of sarcoma blood supply was confirmed in 63 cases according to MRI with contrast enhancement (Magnevist). At the same time we registered heterogeneous increasing of tumor signal intensity and continuous delay of contrast in its central and peripheral areas, which evidenced hypervascularization of heoplasm. In all cases after enhancement of MR-picture we detected heterogeneous signal, mainly due to presence of fibrous walls and necrosis areas.

MRA of tumor diagnosed neogenic vessels of both large and small size, which evidenced malignancy of tumor. Study of tumor and adjoining neurovascular plexus interaction showed that in 78 cases (73%) tumor tightly adhered to neurovascular plexus, but there was no invasion detected; tumor was adjoined to neurovascular plexus of thigh, fatty interlayers were absent. In 20 cases (19%) we registered compression of neurovascular plexus by tumor and its retrodisplacement; in 9 cases (8%) spreading of tumoral masses into it, due to this fact large vessels were traced indistinctly for a whole tumor distance. Extravascular compression of neurovascular plexus was suspected after ultrasound diagnostics in 18 cases, tumor spreading in all 9 cases.

**DISCUSSION**

Role and place of hardware methods of soft tissues tumors study became more important after extended introduction of NLS and MRI into clinical practice. At the same time these soft tissues tumors study methods face the following objectives: 1) detection of tumor; 2) identification (differential diagnostics) of tumor; 3) identifying of disease stage. Three-dimensional NLS-examination together with REA allows us to detect presence of tumor, its size and structure with high precision. In evaluation of local spreading of soft tissues sarcomas information value of MRI and NLS is almost equal. Advantage of NLS-research is feature of differentiation of solid and cystic tumors when it is used together with REA, which is especially important in cases of myxomas or mixoma-like neoplasms, which may be incorrectly interpreted as cysts due to high content of water by CT or MRI. Besides, NLS-research makes possible to identify tumor area optimal for puncture biopsy (to differentiate hyperchromic solid area from necrosis). Another one advantage of NLS-research is monitoring of patient after surgical intervention and after chemotherapy.

MRI is generally acknowledged and the most efficient method of soft tissues affection diagnostics, because it fulfils all three abovementioned objectives of soft tissues study with high precision. Combined evaluation of the most important MRI criteria of tumor examination (size, outlines, homogeneity, intensity of signal) allows us to forecast malignization in 82% – 96% of cases. Together with high sensitivity of MRI in study of soft tissues tumors, its specificity is rather low. Approximate histological diagnosis may be found in 25% – 50% of cases (in 65% – 80% of cases when we apply NLS-research together with REA).

In interpretation of MRI-picture the most important indicator is intensity of MR-signal from tumor. In case of various tumors of soft tissues, we can see at MRI-pictures typical appearance of nidi and foci of changed MR-signals, and according to their intensity and homogeneity (or heterogeneity) together with localization, form, structure and outlines of neoplasm and condition of surrounding tissues we may decide if pathology character is malignant or benign, its staging, and in some cases – approximately identify histological belonging of tumor.

One of the main criteria of tumor differential diagnostics is evaluation of neoplasm blood supply. MRI is highly information valuable detection method of tumor vascularization, character and type of neogenic vessels. Study of soft tissues tumor vascularization in majority of cases detected neogenic vessels mainly in peripheral areas of tumor or so-called combined type of vascularization (vessels both in peripheral areas and in center of neoplasm).

Neovascular vessels differ from normal ones by uneven diameter, sinuation, branching and presence of numerous arteriovenous shunts.

Therefore, acquired data allows us to conclude that both MRI and NLS-research have high information value in examination of patients suffering from tumors of soft tissues. But when NLS-research is efficient screening method of diagnostics, MRI data is quite pathognomonic for such tumors and displays their morphogenesis. Combined examination with application of NLS, MRI and MRA makes possible to solve many concrete problems of soft tissues tumors diagnostics: identify localization, form, size, structure, volume and local spreading of tumor, evaluate signs of malignancy, vascularization of neoplasm, its relation to large vessels and bone structures, which is the main criterion for choosing of treatment tactics.
COMBINED RADIATION THERAPY AND METATHERAPY OF GLIOBLASTOMA IN ELDERLY PATIENTS

Rengan J., Turrisi T.

To the date there are no standards of brain glioblastoma therapy in patients above 70. This type of tumors is characterized by unfavorable clinical course at any age. If glioblastoma develops in an elderly patient, a therapist faces even more complicated problem, because at that age a patient’s tolerance to anti-tumor treatment is much worse. What can a therapist do in such case — carry out supportive therapy only or try to slow down tumor development using radiation?

METHODS AND COURSE OF THE STUDY

The present study was carried out in several clinics of France. The study involved 81 patient of 70 and above with incurable glioblastoma of brain. Karnofsky scale point was 6 MB, 1.8 Gy once per day, 5 days in a week; total dose of radiation — 50 Gy. Additional treatment included application of «Metatherapy» using «Metatron»-4027 system, one session once in a day for 1 — 2 minutes to affected region of brain. Supportive therapy consisted of corticosteroids, anticonvulsant, professional help of psychologist and palliative treatment team. First of all patients were operated on and randomly divided into two groups: the first (control) group (42 patients) was subjected to symptomatic treatment and radiation therapy (RT) only, the second group (experimental — 39 patients) along with supportive treatment was subjected to radiation therapy (RT) together with «Metathery».

RT method was the following: radiation of region with increased accumulation of contrast in a tumor in accordance with MRI + «safety zone» of 2 cm wide around it. Linear accelerator photons with nominal energy were applied.

Quality of life was evaluated in accordance to EORTC QLQ-C30, version 2.0 and its module specially created brain tumors - QLQ-BN20. Evaluation of brain condition was carried out by means of the following systems: Mini–Mental State Examination – MMSE, Mattis Dementia Rating Scale - MDRS and Neuropsychiatric Inventory.

Progressing of a tumor was understood as increasing of tumor size by 1/4 and more, and also as development of metastases in accordance with CT, MRI and NLS.

The main criterion for comparison of treatment effectiveness was general survival rate. The secondary criteria were: survival rate without tumor progressing, tolerance to treatment, quality of life, cognitive function.

RESULTS

Median of observation was 21 weeks. During this period 69.1% of all studied patients died. However certain indices were much better in experimental group in comparison with control group:

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<tr>
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<th>Experimental group (RT + Metatherapy)</th>
<th>Control group</th>
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<tr>
<td>General survival rate, median</td>
<td>39.1 weeks</td>
<td>16.9 weeks</td>
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<tr>
<td>Relative death risk for general survival rate (practically; death risk ratio)</td>
<td>0.32</td>
<td>1</td>
</tr>
<tr>
<td>Survival rate without tumor progressing, median</td>
<td>18.9 weeks</td>
<td>5.4 weeks</td>
</tr>
<tr>
<td>Relative risk of disease development</td>
<td>0.2</td>
<td>1</td>
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Indices of quality of life, cognitive activity and index of neuro-psychiatric evaluation were steadily declined in researched patients with course of time, at the same time these indices in both groups were significantly different.

Radiation reaction for RT in combination with Metatherapy was minimal. Only in one patient somnolentia transient syndrome developed shortly after radiation.

CONCLUSION
RT in combination with Metatherapy at glioblastoma in elderly patients leads to significant prolongation of life, including prolongation of a period without progressing of a tumor. At the same time Metatherapy does not have negative effect on quality of life and neuro-psychiatric status.
3D COMPUTER
NLS-GRAPHY

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