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**NLS-TECHNOLOGIES IN MEDICINE –
PROSPECTS OF DEVELOPMENT**

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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 technogeous, 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 nanome-

ters. 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 (telediagnosics) 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

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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 above-mentioned 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 decreased vascularization. Due to this fact data acquired with NLS-graphy is not always sufficient and should be completed with results of -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 and dystrophic changes of organ's parenchyma. All above-mentioned 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 than 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.

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%.

Nowadays oncology 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).

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.

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.

CERTAIN ASPECTS OF NLS-DIAGNOSTICS OF LIVER FOCAL PATHOLOGY

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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.

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.

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 hypochromeity 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 anamnesticly 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 cicatrization, encapsulation and development of large in-

tratumoral 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 single 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 hypointensive hemorrhage in the center, with corresponding central cicatrization, 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 be-

nign 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**

Introduction

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.

Materials and methods of study

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 the following: its hypochromic liquid content, distinct and rounded outlines, thin capsule without fibrous inclusions and local thickenings. Aggregate of these symptoms was registered in 26 patients (81.3%).

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 outpouching 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 nonparasitic 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 con-

tents 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 non-parasitic 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 is 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

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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 cardinally 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 out-patient 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 Olympus, 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 cholecys-

tectomy (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 cholechololithiasis (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 (168); this situation required full scale application of abovementioned algorithm. As a result of the study we registered various reasons of gall bladder and extrahepatic bile ducts diseases and corrected them.

Successfully carried out endoscopic papillosphincterotomy in 41 patients, cholelithotomy and stenosis of choledochus terminal part elimination allowed us to limit interventions only by LCE. 18 patients were subjected to standard cholecystectomy, choledochotomy and sanitization of biliary ducts under NLS-graphy monitoring with followed up drainage of hepaticoholedochus by Kehr drainage. Due to hepaticoholedochus ectasia of more than 15 – 20 mm and presence of multiple small concrements in gall bladder, intrahepatic and common biliary ducts, operation was completed by choledochoduodenal anastomosis application in 3 patients.

At head of pancreas cancer we performed pre-operation preparation aimed at decreasing and elimination of mechanical jaundice symptoms by various methods of bile excretory system drainage under NLS monitoring.

The same tactics was applied at MDP and hepaticoholedochus cancer. In 2 patients pancreaticoduodenal resection was carried out due to MDP cancer spreading into head of pancreas.

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 radiodiagnostics 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 it 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.
4. Cystadenocarcinoma.
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 angiofibroma.

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, agglutination, disorders of sensitiveness, taste and tongue declination.

Abovementioned 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 char-

acterized 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 tuberos 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 lymphosar-

coma 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 hyperchromicity (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' 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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Introduction

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 of 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 cortico-pleural (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 Fleindler’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 suppurative 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 tessellation 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.

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 exobronchial plexuses 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 hypochromogenic 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 intraortic-pulmonary 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 ABSCESSSES 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 than 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 tunic 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.

Acquired 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

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Introduction

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 on 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 “Metaphia 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 “Shimadzu” according 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 for 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 rup-

ture 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

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Introduction

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

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

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

Material and methods

We examined 101 neurosurgical patients. In 56 cases we carried out NLS-research and MRI both before operation (not later than in 2 weeks) and during first two days after surgical intervention; in the rest 45 cases we carried out

only NLS-research during post-operative period. Also we carried out further repeated examinations if the situation required it.

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

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

Age of patients ranged from 31 to 70. They were administered for brain tumor surgical removal. 35 patients suffered from malignant tumors (glioblastoma – in 16 patients, anaplastic astrocytoma – in 10 and metastases – in 9) and 21 – from benign ones (meningioma – in 12, astrocytoma – in 5, oligodendroglioma – in 2, teratoblastoma – in 1 and hemangioblastoma – in 1 patient). 26 tumors were localized in left cerebral hemisphere, 30 – in right cerebral hemisphere. Frontal region of head was affected in 12 patients, temporal region – in 20, parietal region – in 8, occipital region – in 4, parietotemporal region – in 4, occipitoparietal region – in 4 and cerebellar hemispheres – in 4 patients.

Results

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

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

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

In 4 (15%) of 26 patients NLS-research detected remaining tumor masses with the background of hemorrhage in the area of operative intervention, but at the same time MRI of these patients before and after intravenous contrast enhancement did not gave us trustful data confirming presence of post-operative hemorrhage. In 6 (11%) patients NLS-research detected massive

edema in area surrounding tumor bed at early post-operative period, it caused suspicion for presence of remaining tumor masses which was confirmed by further carrying out of spectral-entropy analysis (SEA) of this area, and in 4 (7%) patients, even with the background of lesser post-operative edema, such results were not registered.

At MRI of these patients' operative area with the background of post-operative edema, in 4 cases we registered increasing of MR-signal at T1-weighted scans (WS) after intravenous contrast enhancement, which evidenced presence of remaining tumor masses, in other 4 cases we did not register such data, although in 2 of them tumor was removed subtotaly. 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.

COMPUTED NLS-GRAPHY IN COMBINED CLINICAL-INSTRUMENTAL EVALUATION OF DYSIRCULATORY ENCEPHALOPATHY PROGRESSING

**L.P. Saveliev, V.M. Vagulin,
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Chronic forms of brain vascular pathology have become weightier in structure of cerebrovascular morbidity recently. Dyscirculatory encephalopathy (DE) has the biggest specific weigh among them. Clinical presentation of the disease is well studied, but at the same time problems of structural changes in brain detection, identifying of clinical and instrumental parallels and early defining of treatment optimal tactics became more and more urgent from the point of view of case-based medicine. Objective of the present study is research of clinical and instrumental presentation of dyscirculatory encephalopathy in patients suffering from various stages of the disease.

Material and methods of study

We carried out combined clinical-instrumental and radiation examination of 87 patients suffering from DE, aged from 31 to 86 (average age is 54.5). Majority of patients were male (70%). All patients were administered to laboratory examination (general clinical and biochemical), electrocardiography, ultrasonic Doppler research of head and neck vessels, roentgenography of cervical spine, electroencephalography, rheoencephalography, and according to indications – ultrasound examination of abdominal cavity organs, echocardiography and computed NLS-graphy.

Computed three-dimensional NLS-graphy was carried out with “Metatron”-4025 system (the IPP, Clinic Tech Inc.) with 4.9 GHz generator frequency, with digital trigger sensors and unit of continuous spiral scanning according to standard methods.

Peculiarities of acquired three-dimensional pictures of brain analysis are fulfillment of not only quantitative, but also qualitative evaluation of size, shape, number of leukoaraiosis nidi, chromogeneity of signal taken from detected nidi. To fulfill these goals we used “Metapathia GR Clinical” computer software, which make possible to visualize scanned object in three-dimensional mode.

Results and discussion

According to results of combined examination all patients were divided into three groups depending on DE stage. The first group consisted of 25 patients (28.7%) suffering from DE of 1st stage, the second – 45 patients (51.7%) with DE of 2nd stage and the third – 17 patients (19.6%) with 3rd stage of the disease.

Reasons of disease development we identified on the basis of testing and questioning of patients, study of disease history, detailed combined laboratory and instrumental examination.

We could not identify one leading factor in dyscirculatory encephalopathy etiology; it confirms information about polyetiologic character of DE. Atherosclerosis was the reason of dyscirculatory encephalopathy in 9 patients (10.4%), arterial hypertension – in 23 patients (26.4%), in 44 cases (50.6%) we registered combination of these factors. In 11 cases (12.6%) we detected other etiological factors. Disorder of venous outflow was registered in 73.6% (64) of examined patients.

Cephalgia syndrome was detected in 54 patients (62.1%), and as the disease progressed we registered decreasing of headaches frequency and intensity. 58 patients (66.7%) complained of headache, generally patients with DE of second stage. Major part of patients (65) complained of asthenic problems, the most frequent among them were: concentration problems, emotional disorders and increased fatigability. It should be noted that these symptoms were more frequent during initial stages of the disease and in some cases held leading positions in clinical picture of disease. Memory disorders were registered in 5 patients (20%) suffering from DE of the first stage, in 22 (48.9%) of the second and in 12 (70.6%) patients of the third stage. The most frequent was worsening of fixation memory, at the same time long-term memory was not affected. Sleep disorders were detected more frequently in patients with initial stages of the disease, at the same time at DE of the third stage there were no such complaints. A number of patients mentioned subjective hearing symptoms: tinnitus, hearing impairment. But when tinnitus was registered in patients suffering from the second and the third stage of DE, complaints of hearing impairment were present even at the first stage of the disease.

Neurological examination detected cranial innervation disorders quite often even at early stages of DE in forms of pupillary light reaction worsening, weakness of convergence, central paresis of facial muscles, lesser deviation of tongue; intensity of these signs increased as the disease progressed. Reflexes of oral automatism and pathological hand reflexes were also detected more frequently as the disease progressed. Pathological reflexes of lower extremities we registered very seldom, generally in patients suffering from the second

and the third stage of DE. Static disorders were detected in 60 patients (69%) and generally in those suffering from the second stage of DE (75.6%) and in all patients with DE of the third stage. Coordination disorders were registered not so often (51.7% of cases) and again in the second and the third groups mainly. Vegetative disorders were diagnosed in all examined groups with equal frequency. Intellectual-mnemonic disorders were detected in majority of patients of the third group (70.6%) and according to NINDS-AIREN criteria they reached dementia stage.

Analysis of detected by NLS-research changes included evaluation of quantity, localization, size and chromogeneity of topical nidi and carrying out of resonance-entropy analysis (REA) for identifying of pathomorphological changes character.

According to results of computed NLS-scopy all patients were divided into five groups: 1) – 3 persons (3.5%) – in patients these patients no brain changes were detected; 2) – 32 examined persons (36.8%) – patients suffering from lesser changes of brain (single (up to 5) local small (up to 0.5 cm²) nidi); 3) – 26 patients (29.9%) – patients with 5 – 10 small local and/or less than 2 large local nidi; 4) – 20 persons (23%) – patients with more than 10 small and/or more than 2 large local of few merging nidi; 5) – 6 patients (6.8%) having nidi of merging character.

The first group consisted of 3 patients in which DE of the first stage was diagnosed after clinical examination. In clinical picture of these patients cephalgic and astheno-neurotic syndromes prevailed; neurological examination detected vegetative disorders in form of changed dermographism, vasomotor lability, extremity coldness and acrocyanosis, excessive sweating or, on the contrary, xerodermia.

Main neurovisualization phenomena detected by NLS-research in patients of the second group, which consisted of 19 patients with the first stage of DE and 13 patients with diagnosed second stage of DE, were insignificant nidal changes if 3 – 4 points according to Fleindler's scale. Besides in some examined patients (17 persons) we detected single local small hyperchromogenic nidi (4 – 5 points). It was three-dimensional image that turned out to be the most informative in revealing gliosis small nidi, character of which was updated by REA later on. Using resonance-entropy analysis we also detected signs of initial (3 – 4 points) atherosclerotic changes of intracranial arteries.

The third group mainly consisted of patients suffering from dyscirculatory encephalopathy of the second stage (21 patients), three patients with DE of the first stage and 2 patients with diagnosed by preliminary examination DE of the third stage. Neurological examination of these patients detected, most often than in the previous group, reflexes of oral automatism and pathologi-

cal hand reflexes. As a rule, nidi in these patients were localized in para- and supraventricular areas.

In patients of the fourth group (11 patients with DE of the second stage and 9 patients with DE of the third stage), NLS-research detected large merging hyperchromic nidi (4 – 5 points according to Fleindler's scale) with the background of multiple lesser nidi. Patients of this group complained of giddiness, disorders of coordination and memory. Neurological examination detected various neurological syndromes – discoordination, pyramidal and amyostatic.

The fifth group consisted of 6 patients with DE of the third stage. In these patients NLS-research detected mainly merging nidi (5 – 6 points), REA detected internal and external cerebral hydrocephaly combined with brain tissue atrophy. In this group of patients we registered the most significant changes of intracranial arteries (5 – 6 point). In clinical picture of these patients static and coordination disorders prevailed, also intellectual-mnestic disorders reaching dementia stage were registered.

Conclusion

Clinical picture of DE has progressing course. As analysis of NLS-research results proven, there are no pathognomonic changes in brain at the first stage of the disease, apparent neurological syndromes are not formed; subjective disorders, accompanied by light neurological semeiotics, predominate. The second stage of DE allows us to single out certain prevailing neurological syndromes – discoordination, pyramidal and amyostatic, which are manifested by presence of single or multiple gliosis nidi without tendency to merging, and that is the reason of patients' professional and social adaptation significant decreasing. During the third stage of DE number of complaints significantly decreases, however neurological disorders become more apparent, they are presented in form of quite distinct and significant neurological syndromes, combining with apparent structural changes of brain, according to data acquired by NLS-research with REA.

Thereby together with DE development, structural changes of brain tissue become more frequent: frequency and extent of atrophy, single cystic-nidal changes of brain become multiple.

Diagnostics of DE should be complex and include methods of neuro-visualization, and one of the most informative and prospective of them we consider to be NLS-graphy with REA. Detection and evaluation of nidal and diffuse NLS-changes of brain tissue, in the context of clinical and sub-clinical neurological and neuropsychological data, create condition for early diagnostics of DE progredient forms and carrying out of active therapy targeted for prevention of further brain damage.

ULTRASOUND RESEARCH AND NLS-SCREENING OF OVARIAN CANCER

**K.S. Kogan, S.A. Levkun,
V.I. Nesterova**

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 "Metaphia 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 ($D < 0,425$), intermediate ($0,425 < D < 0,710$) and low ($D > 0,710$). 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 registered 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:

Screening efficiency indices	All primary ovarian cancers		Primary invasive epithelial ovarian cancers	
	NLS group	US group	NLS group	US group
Sensitivity	89,7%	81,3%	89,8%	72,6%
Specificity	99,8%	91,7%	99,8%	91,3%
Positive prognostic validity	63,7%	4,8%	43,4%	2,4%

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

N.S. Karpov, I.V. Lemeshenko

Currency

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 inva-

sive 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 “Gyrosan 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 parametrial 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 com-

parative analyses of two-dimensional and three-dimensional NLS-research potentials in evaluation of uterine cervix carcinoma extension.

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, IVA – 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 tunica, 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 area: 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 IIA) 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 histologically confirmed. Carrying out of MR-tomography at the next stage of diagnostics allowed us to identify level of vagina affection in all 18 cases more precisely and to correctly diagnose disease stage as IIIA. Involvement of uterine body into process at tomograms was detected in 6 patients.

Therefore at IIIA stage application of combined examination of patients for detection of uterine body affection allows us to increase its accuracy from 81% at two-dimensional NLS-research to 89% at three-dimensional NLS-research; in detection of vagina affection – from 72% to 89%; in visualization of parametrium invasion – from 56% to 89% at 3D NLS-research. Disease stage in this group of patients according to NLS-research with REA data was identified correctly in 88% of cases due to incorrect identification of vagina affection level.

IIIB disease stage was diagnosed in 7 cases. In 4 patients gynecological examination detected endophytic form of disease, in one – endophytic-ulcerous form (at the background of enlarged, partially destroyed, hyperemic uterine neck we detected crateriform ulceration with dilation of cervical duct lower parts). In two patients tumor was of endophytic-ulcerous form with affection of vagina upper third; vagina was opened in both cases. Histological research diagnosed vagina affection in two cases (upper third).

We detected uterine body affection only two times by two-dimensional NLS-research. Following reconstruction of three-dimensional pictures detected tumor spreading to uterine body in another one patient. Tumor invasion into vagina was detected only in one patient by both two-dimensional and three-dimensional NLS-research. Involvement of parametrium into process was diagnosed in all 7 patients by both two-dimensional and three-dimensional NLS-research. MRI detected parametrium invasion in all women; process expansion to vagina was visualized in 2 cases, to uterine body – in 4 cases.

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 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 IIV – 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 cicatricial 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 radio-diagnostis 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 macroskans 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.

3D NLS-DIAGNOSTICS AND MONITORING OF PROSTATE GLAND DISEASES TREATMENT

V.A. Toropova, S.N. Petrenko,
L.M. Maksimenko

Diseases of prostate gland (PG) represent major part of small pelvis organs diseases in men. The most widespread among them are chronic prostatitis, benign hyperplasia of prostate gland (BHPG) and cancer of prostate gland (CPG), which may be quite often combined. Problems of early diagnostics and monitoring of these diseases treatment are still the most urgent ones in oncurology.

Nowadays NLS-method becomes more and more important in diagnostics of prostate gland diseases. It became possible thanks to introduction of a new system “Metatron”-4025 with “Metapathia GR Clinical” software, which allow carrying out of three dimensional (3D) visualization of an organ, acquire accurate data about dimensions and volume of affection nidus, condition of gland capsule and its internal structure owing to application of ultramicroscopic scans. Ease of diagnostic procedure carrying out, possibility of multiple uses, high information value of the method ensured its unquestionable priority among other methods of visualization and considerably extended capabilities of prostate gland diseases diagnostics. Together with appearance of such methods as 3D NLS-scanning using spectral-entropy analysis (SEA), diagnostics of prostate gland diseases reached new levels. By means of new NLS-technologies of prostate gland tissues and its vascular structure pictures acquiring, it became possible to fulfill highly accurate diagnostics of the earliest forms of diseases. Sensitivity and specificity of NLS in detection of prostate gland cancer increased greatly, study of bloodstream granted possibility of cancer, prostatitis, BHPG treatment monitoring. Expansion of new methods of NLS-study range calls for revision of old algorithm of prostate gland main diseases diagnostics.

Material and methods

To examine possibilities of new NLS methods in diagnostics and monitoring of prostate gland diseases, 328 NLS studies of prostate gland were carried out from January, 2007, till December, 2008. Total number of examined patients is: 181 patients (55%) suffering from benign hyperplasia of prostate gland (BHPG), 100 patients (31%) suffering from prostatitis and 42 patients (13%) suffering from cancer of prostate gland (CPG). Also examination of 5 patients (1%) with no clinical and laboratory data on prostate gland diseases was carried out.

SEA results were proven by analysis of cytological material taken with puncture biopsy, histomorphological research after transurethral prostatic resection or adenectomy and by dynamic monitoring during whole period of the study.

Results and discussion

In majority of cases (63%) tumor area at 3D NLS was moderately hyperchromogenic (4-5 points at Fleindler's scale) and was localized in peripheral zone in 70% of cases. Retrospective analysis of all hyperchromogenic areas showed that hyperchromogeneity was not strictly specific for malignant pathology.

After two-dimensional NLS study carried out without new methods using, it is impossible to judge for sure about whether studied area was benign or malignant. So it happened that up to 45% of moderately chromogenic areas detected by usual two-dimensional NLS study, turned out to be benign after histological research. These areas were detected at acute prostatitis, benign hyperplasia, infarction and muscular hyperplasia. Besides due to absence of difference between tumor chromogeneity and normal tissue, up to 35% of CPG cases were not detected by two-dimensional NLS study. As a rule it was isochromogenic tumors and tumors characterized by infiltrating growth. Up to 40% of isochromogenic prostate tumors were detected only after gland surgical operation (transurethral prostatic resection or adenectomy). In screening large diffuse tumors of prostate gland were rarely detected by common two-dimensional study. As a rule diagnosis was stated only clinically and after digital rectal investigation of prostate. It was explained by the fact that after CPG spreading to central part gland, tumor chromogeneity was changed and border between tumor and healthy tissue disappeared. Information value evaluation of NLS studies in two-dimensional mode showed its low specificity (50%) and low positive prediction value (55%) in diagnostics of CPG. Great number of false-positive conclusions is related to impossibility of hyperchromogenic areas and to difficulties with visualization of isochromogenic areas.

New three-dimensional methods with application of SEA allowed carrying out of differential diagnostics of prostate gland hyperchromogenic areas at the first stage, detection of isochromogenic tumors and more precise evaluating of malignant affection volume.

Using of ultramicroscopic picture scanning made visualization of prostate gland's ultrafine structures more precise. It allowed to acquire additional information about structure, chromogeneity and outlines of tissues, increased detection of small isochromogenic CPG, more accurately characterized borders of hypochromogenic (3-4 points) tumors, helped to diagnose tumors

characterized by infiltrating growth. Ultramicroscanning mode made possible to diagnose 23% of isochromogenic tumors. Also ultramicroscanning mode allowed us to detect areas with overall size of less than 0.3 centimeter, to detect subcapsular invasion more precisely in 27% of cases.

Three-dimensional NLS-angiography method permitted to evaluate vessels condition of hyperchromogenic areas. It is widely known that tumorous angiogenesis differs from normal one. Tumorous vessels have incorrect structure and increased permeability of vascular walls due to defective endothelial lining and irregularly distributed layer of smooth muscle fibers. Study of vessels affection extent is very important for CPG diagnostics; it increases positive prediction value of NLS in detection of infiltrating isochromogenic tumors and tumors with indistinct outlines. In recent years three-dimensional NLS-angiography became the most promising method of prostate gland bloodstream evaluation. Our experience of three-dimensional vessels reconstruction using proves that this method has high quality and allows to evaluate condition of vessel wall and to detect pathology zones at various parts of bloodstream.

Using of NLS-angiography decreased greatly number of false-positive conclusions and increased number of correct diagnoses of prostate gland cancer. Study of vessels affection character and bloodstream condition helped us to detect up to 15% of CPG cases additionally, at the same time in 25% of cases two-dimensional NLS visualization did not detect any changes and CPG was diagnosed only when we used three-dimensional NLS-angiography. These results have principle meaning for diagnostics. They prove that evaluation of bloodstream must become an integral part of NLS researches.

Information of tumor spreading beyond capsule is very important for more precise defining of stages and, therefore, for determination of CPG treatment tactics. Role of common two-dimensional NLS research in defining of CPG stage, due to variability of its chromogenic picture at cancer, is not very important. Common two-dimensional NLS research not always can precisely evaluate size of tumor area, for example at multifocal CPG or infiltrating growth of tumor. That is why in more than 50% of cases values of tumor size, detected by two-dimensional NLS research, are incorrect. Potentials of modern 3D NLS researches in defining of disease stage increased with introduction of spectral-entropy analysis on ultrafine scans for modern devices. Amplifying usual research by vessel wall condition analysis, we are able to assume or deny spreading of CPG for sure. In our studies analysis of vessel wall condition and bloodstream affection character by means of NLS-angiography helped us to evaluate borders of tumor in 30% of patients. Study of vascular pathology character at infiltrating growth of tumor or at its combined chromogeneity helped to evaluate tumor invasion depth.

Therefore application of NLS-angiography methods together with SEA only increased sensitivity of NLS researches in diagnostics of CPG from 73% to 89%, specificity from 38% to 82%, positive prediction test value from 41% to 79%, negative prediction test value from 70% to 88%.

Monitoring of prostate gland cancer treatment. Application of new NLS methods became especially important for monitoring of prostate gland cancer treatment. Issues of monitoring of CPG treatment by means of 3D NLS-angiography were not studied properly until now. It is well known that application of radiation therapy results in slow tumor regress and gradual fibrosis forming at the place of tumor. Digital rectal investigation (DRI) cannot be regarded as reliable method of treatment efficiency monitoring, especially with negative primary data. Together with introduction of new methods of 3D NLS researches, issues of CPG radiation therapy efficiency monitoring reached brand new level. Potential of 3D NLS researches in evaluation of CPG treatment results was significantly extended thanks to development of NLS-angiography methods, which allow non-invasive evaluating of prostate gland vessels condition. It is well known that bloodstream responds first to radiation and hormonal therapy, that is why information about vessel wall condition changing is so important in evaluation of early therapeutic effect.

Peculiarities of vessel wall changes in tumor under influence of combined radiation and hormonal therapy allowed us to evaluate therapy efficiency in large group of patients.

We carried out dynamic research of 150 patients suffering from CPG of various stages, who were treated with combined radiation and hormonal therapy, and studied potentials of 3D NLS with angiography at CPG treatment monitoring. By means of SEA we traced hyperchromogenic and vascular changes in tumor and parenchyma of prostate gland happening under influence of therapy. We developed SEA parameters of CPG treatment efficiency and terms of their evaluation. Also we carried out correlation of SEA parameters changes dynamics and dynamics of prostate-specific antigen (PSA) decreasing in researched group of patients.

All patients were subjected to external-beam radiotherapy on prostate gland and seminal vesicles area by deceleration emission beam of 6 and 18 MeV in classic dose fractionation mode of 2 Gy 5 times in a week, with “Clinac-1800” and “Clinac-600” devices. Total basic dose to prostate gland was from 68 to 76 Gy in two stages. In 80 patients radiation was combined with antiandrogenic therapy (Flucine, dose of 750 mg), 35 patients were subjected to maximum androgen blockade (MAB) (Flucine, 750 mg + Zoladex, 3.6 mg

once in 28 days or Flucine, 750 mg + bilateral orchectomy), in 2 patients MAB was combined with chemotherapy (5-Fluorouracil).

Average duration of monitoring period was 1 year (6 months – 2 years) from external-beam radiotherapy. Digital rectal investigation, PSA level evaluation, NLS-monitoring of all patients was carried out together with oncologist and radiation therapist with 3-6 months interval. In 6 – 12 months after DRI radionuclide skeleton imaging was carried out in order to exclude separate metastases.

Changes of tumor chromogeneity also were important criteria of efficiency evaluation.

In our research we registered gradual decreasing of tumor chromogeneity (from 5-6 to 3-4 points) after exposure to radiation therapy. In 6 months chromogeneity of tumor and gland almost matched and it was confirmed by SEA.

In 67 patients in central parts of residual tumor hypochromogenic area (2-3 points according to Fleindler’s scale) was formed; this area corresponded to “Fibrosis” etalon ($D < 0.425$), its size increased during dynamic monitoring.

SEA mode helped in internal structure evaluation in many cases. When we used this mode it was much easier to detect fibrosis forming zone and true size of residual tumor.

Therefore results of our work prove that combined approach in 3D NLS researches allows us to evaluate tumor response to therapy in full. Consideration of all abovementioned criteria is necessary during monitoring of CPG treatment and recommended for practical application.

In patients suffering from prostatitis application of new NLS methods allowed to reach new functional level of diagnostics.

Total number of researched prostatitis patients was 100. 34 of researched patients suffered from acute prostatitis. 28 of them had acute prostatitis without complications and 6 patients suffered from acute prostatitis with complications: 3 patients – multiple abscesses of prostate gland with background of acute prostatitis, 2 patients – single abscess of prostate gland, 1 patient – seminal vesicles abscess and another one patient – paraprostatitis. Another 66 patients with chronic prostatitis were researched also. Dynamic research with background of treatment was carried out on 35 prostatitis patients.

Diagnostics and monitoring of chronic prostatitis treatment. Clinical picture of chronic prostatitis in the half of researched patients was characterized by extraordinary variety of symptomatology, in more than 30% patients we registered asymptomatic disease course and in 20% of patients there were scant symptoms. Thereby it was clinically impossible to diagnose chronic prostatitis at the first stage. After 3D NLS research in 75% of patients from

first group we detected parenchyma changes, specific for chronic prostatitis, which were confirmed by SEA. In patients with diseases duration more than 5 years in 75% of cases we detected unevenness and vagueness of affection area outlines. In patients of this group we detected zones of increased chromogeneity of various intensity and sizes with vague outlines in periurethral area, calcification of roundish and oval form sized from 0.2 cm and more.

In 34% of these patients we detected marked outlines of urethra and ejaculatory ducts, in 27% in periurethral area we detected calcification cluster in form of "chain". In 16% we detected visualized cyst of ejaculatory ducts in form of local achromogenic roundish dilatations of various sizes, linked with duct by narrow achromogenic linear stripe. In 85% of patients suffering from chronic prostatitis we detected affection of prostatic plexuses veins, which evidenced stable hemodynamic disorders and phlebostasis.

Using of NLS-research methods at exacerbation of chronic prostatitis or at acute prostatitis allowed us to carry out accurate diagnostics of severity degree and involvement of organ into inflammatory process.

Diagnosics and monitoring of acute prostatitis treatment. At *congestion prostatitis* we detected specific NLS sign; it was so-called "small-honeycomb" parenchyma in ultramicroscanning mode. And among all researched patients, both with acute and chronic prostatitis, we encountered this sign in 68% of cases. Intensity of this sign was in direct proportion to how congestive this disease was. The more intense process was – the stronger and more widely spread was small-cystous dilation of follicles filled up with prostatic secretion.

In NLS-angiography this picture was accompanied by affection gland vascular wall. These effects were accompanied by affection of prostatic plexuses veins.

Acquiring of this NLS-graphic picture in many aspects defined further tactics of such patients management.

3D NLS research quite often detected appearance of areas of increased chromogeneity with vague outlines in 45% of patients suffering from acute non-complicated prostatitis. In majority of old aged patients differential diagnostics of such changes in SEA mode caused some complicacy due to similarity of spectral picture to cancer of prostate gland. In this case additional information was provided only by NLS-angiography. Area, conforming to inflammation, was characterized by absence of vascular affection, specific for blast processes at this area.

It is hard to overestimate importance of 3D NLS research with new technologies **for monitoring of patients suffering from prostatitis treatment.** It is recommended to carry out dynamic monitoring of acute prostatitis treatment to evaluate efficiency of applied therapy. Monitoring of acute prostatitis pa-

tients treatment made possible to avoid in many cases development of complications, such as prostate gland abscess and paraprostatitis. We carried out dynamic monitoring of 26 patients suffering from acute prostatitis. Against the background of successful therapy we detected disappearance of hypochromogenic areas and restoration of gland vessels condition. Dynamic monitoring of treatment with SEA helped to diagnose abscesses of prostate gland in 11% of cases, which resulted in therapy course correction and prolongation of treatment period.

Prostate gland abscess at early stage was presented by standard two-dimensional NLS research as roundish focus with increased chromogeneity (6 points). Basing on results of two-dimensional NLS research only, it is impossible to carry out its accurate diagnostics, because chromographic picture at early stages was similar to the one at acute non-complicated prostatitis. Formed abscess was visualized as roundish focus with fine outlines, hypochromic capsule and inhomogeneous internal liquid content. Detecting of abscesses at first NLS research was based difference of spectral picture of abscesses and focal parenchymatous prostatitis.

At multiple abscesses in parenchyma of gland peripheral part, we detected appearance of multiple roundish areas of increased chromogeneity (6 points), corresponding to necrosis nidi.

Dynamic research of therapy showed gradual disappearance of these changes. At the same time in all monitored patients of this group we did not find forming of fibrosis areas and calcinations in gland parenchyma in future (in 1 – 2 years). Laboratory indices of all patients were similar to SEA results. Our experience proves that NLS-monitoring of patients suffering from prostate gland abscess must be carried out at least once in a week until structure is completely restored. If abscess is located near to prostate capsule, thorough examination of prostate outlines is necessary in order to prevent burst beyond capsule and forming of paraprostatitis.

In all cases of **paraprostatitis** we detected deformation of outlines with appearance of irregular-shaped area of various sizes, adjoining gland. In majority of cases we registered blur and vagueness of nidus borders; using of ultramicroscanning mode helped to evaluate affection degree. When research of these patients was delayed, we detected forming of hypochromic scar in this area.

Combined research of patients suffering from prostatitis showed that when comprehensive approach was used, accuracy of 3D NLS research increased from 52% to 89%. Therefore, it is rational to use all complex of new NLS-methods in diagnostics of prostatitis. Dynamic research of patients group suffering from prostatitis proved that in 65% of cases results of 3D NLS with angiography led in therapy correction for patients with complicated

course of prostatitis, in 80% of cases – prolongation of anti-inflammatory therapy period, in 27% – increasing of medications dosage and (or) adding of supplementary medication and (or) replacement of one medication by another one. These results prove necessity of 3D NLS-monitoring for patients suffering from prostatitis.

Diagnostics of benign hyperplasia of prostate gland. Benign hyperplasia of prostate gland (BHPG) or adenoma is considered to be the most widely spread disease in men above 50, frequency of which increases with age. In men above 40 years old adenoma is detected in 25%, above 50 – in 32% and 84% of all men above 60 suffer from adenoma. Such prevalence of this disease provokes increased interest in early diagnostics and monitoring of this pathology treatment. New methods of NLS diagnostics, such as three-dimensional reconstruction, ultramicroscanning, three-dimensional NLS-angiography and SEA contribute greatly to detection and treatment monitoring of benign hyperplasia of prostate gland.

As a rule, adenomatous changes of prostate gland are not combined by clinical symptoms of infravesical obstruction, that is why early detection of this disease is quite often complicated. Growth form of BHPG is also influences disease detection; so at primary growth of external glands of prostate, symptoms of infravesical obstruction appear earlier and this form of BHPG can be corrected early, without development of complications. But when adenoma grows in transition areas, clinical symptoms appear rather late, when irreversible changes of gland in forms of fibrosis and sclerosis are already happened. NLS research with application of ultramicroscanning and three-dimensional modes allow us to quite accurately predict development of the disease and primary growth form of adenoma even at the first stage. By analysis of blood-stream in three-dimensional reconstruction mode we found out that urethral arteries affection degree in this group of patients is minimal. However affection intensity of vascular wall of gland central part, where adenomatous tissue was formed, was higher than in patients of screening group.

Three-dimensional reconstruction of BHPG helps in planning of surgical operation. Knowing of nidus form allows surgeon to choose the most optimal surgical approach.

Pre-operation evaluation of paraprostatic venous plexus of prostate gland also contributes in some manner. Affection of great number of vessels on anterior part of gland allows to take it into account during adenomectomy and to avoid of complications.

At benign hyperplasia we often face roundish hyper- and isochromogenic plexuses in transition area. It is known that 20% of malignant tumors may

develop in this area and that is why differential diagnostics of this area is so important. Besides, in 50% of cases, adenoma patients suffer from satellite prostatitis and that is why there are hyperchromic areas in hyperplastic tissue. Similarity of NLS-graphic picture does not allow to carry out differential diagnostics of these changes in NLS-graphy mode only. Variability of NLS-graphic picture at adenoma does not let us to limit examination only by macroscanning mode and requires involvement of additional features – ultramicroscanning and SEA.

In our studies in 65% of examined patients we detected plexuses of various chromogeneity located in central part of the gland. At the same time only in 3% of patients they turned out to be malignant after spectral-entropy analysis, confirmed by histological research. Evaluation of vascular pattern character helped us to carry out differential diagnostics of various focal neoplasms located in central part of the gland.

Results of our studies make believe that new methods of 3D NLS-research have more information value in comparison with standard two-dimensional NLS-researches. We think that combined application of all abovementioned techniques must become a part of NLS. New methods complement standard examinations with information which increases diagnostic confidence of a therapist.

CT AND NLS-DIAGNOSTICS OF DEGENERATIVE-DYSTROPHIC DAMAGES OF INTERVERTEBRAL DISKS

**A.G. Brusova, P.A. Manokhin,
O.V. Stepanchikova**

Numerous studies prove that two thirds of people seek medical advice due to low-back pain. The most frequent reason of low-back pain is degenerative changes of intervertebral disks. Main objective of diagnostics is to distinguish age-related changes in disks morphology from changes related to pathological degeneration of disks leading to neural compression. However it is quite possible that pathological degeneration of disks is just speeding up of normal ageing process; pathophysiology if this process is rather complicated and unknown in many aspects.

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, spondylolysis, 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.

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 hyperchromicity (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 lumbodinia 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 vertebrae 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 tomographs 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 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 и 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 con-

tralateral 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 structures in comparison to surrounding soft tissues. Due to their small size, majority of ankle joint and foot ligaments are not visualized at virtual picture.

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

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O.P. Khlopushina

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-operational 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: fibrosar-

coma – 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 fi-

brosarcoma. 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 sub-fascial 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 form 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.

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 neoplasm. 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.

POTENTIALS OF THREE-DIMENSIONAL NLS-GRAPHY IN EVALUATION OF LOCAL SPREADING OF PRIMARY SKIN MELANOMA

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In this study we analyzed results of three-dimensional NLS-ultramicroscopy research of primary skin melanoma of various localizations in 68 patients. We registered NLS-picture dependence on melanoma thickness. The most frequent NLS-characteristics registered in this study were homogeneous moderately hyperchromic (3 – 4, in some cases 5, points according to Fleindler's scale) structure (67.6% – 83.8%) and fusiform shape (58.8% – 80.8%).

Modern equipment for NLS-researches allows us to identify tumor borders with high precision and even at pre-operative stage measure its thickness with high degree of reliability ($r_s=0.94$; $p<0.00$), evaluate extent of local spreading.

These potentials of NLS-method provide well-timed selection of adequate treatment and increasing of survival rate of patients suffering from skin melanoma.

Introduction

Melanoma represents 10% of all cases in structure of malignant neoplasms of skin, but at the same time melanoma causes 82% of all deaths from tumors of this type. Skin melanoma (SM) prevalence index doubles every 10 – 15 years in the world, mainly due to spreading among young people.

High mortality rate from melanoma is explained by its aggressive course with rapid lymphogenic and hematogenic spreading into regional lymph nodes, skin, hypoderm, brain, lungs, liver and other organs.

Key factor in identifying of disease prognosis and treatment tactics is characteristics of primary SM, in particular its thickness according to Breslow and invasion level according to Clark.

In accordance with standard methods these parameters are identified at histological research after surgical removing of tumor; almost in 30% of cases appears necessity to carry out resection in accordance with Breslow index value.

Therefore, by the moment of treatment beginning SM characteristics values may significantly help in choosing of adequate extent of surgical intervention and influence planning adjuvant chemotherapy and immunotherapy even at pre-operative stage. It could help to avoid repeated surgical interven-

tions, increase efficiency and decrease period of treatment of patients suffering from skin melanoma.

Nowadays solving of such problems became possible owing to using of new technologies in ultramicroscopic NLS-diagnostics and application of high-frequency devices for NLS-researches. Three-dimensional NLS-examination is very likely to be one of the few non-invasive methods, allowing us to study in vivo microarchitecture of skin and hypodermic tissues in normal and pathological conditions.

Materials and methods

We analyzed results of three-dimensional NLS-examinations of SM in 68 patients, carried out in 2007 – 2008.

Studied group of patients consisted of 38 (55.9%) women and 30 (44.1%) men aged from 17 to 85 (average age is 53.4 ± 14.2).

Primary tumor was located at skin of head and neck in 3 (4.4%) patients, of body – in 36 (52.9%) patients, of upper extremities – in 11 (16.1%) patients and of lower extremities – in 18 (26.4%) patients.

According to three-dimensional NLS-examination data, thickness of primary tumor in patients ranged from 0.4 mm to 23.6 mm according to Breslow (median was 3.3 mm; interquartile range was from 2.2 to 5.8 mm), invasion level reached I – V according to Clark.

Three-dimensional NLS-studies were carried out with “Metatron”-4025 system (co-production of the Institute of Practical Psychophysics (Russia) and “Clinic Tech Inc.” company (USA)) with digital trigger sensors and 4.9 GHz generator frequency. The system has installed “Metaphathia GR Clinical” professional software with feature of three-dimensional visualization of tissues structure.

In our study we analyzed three-dimensional NLS-picture of SM and hypoderm in areas adjoining tumor. We evaluated SM localization in relation to skin and hypoderm layers, its form, basis, outlines, borders, structure and chromogeneity according to Fleindler's scale. After evaluation of NLS-picture we measured SM thickness in millimeters from the most superficial to the deepest part of tumor. Tumor type was identified by resonance-entropy analysis according to maximum spectral similarity to etalon process.

In all cases acquired data was compared with data acquired by histological study.

Statistical processing of acquired data was carried out by means of application programs set “Statistica 6.0”.

In case of normal spreading ($p>0.05$), we used parametric methods of data analysis to evaluate and describe results of our study (mean value, root-mean-

square deviation). If spreading differed from normal values ($p < 0.05$), we used non-parametric methods: median, 25 and 75 percentile (interquartile range).

To evaluate interaction of invasion level detection by NLS-research and histological examination we used coefficient of Kendall's grade correlation (t).

To evaluate correspondence of NLS-measurement of SM thickness to Breslow index, we used coefficient of Spirman's grade correlation (r_s).

Analysis of results homogeneity of SM thickness NLS-measurement and Breslow index was carried out using Wilcoxon's criterion to check two dependent selections.

To describe qualitative parameters characterizing NLS-picture of change at SM, we used absolute and relative frequency of specific sign occurrence.

Results

In majority of examinations – 66 (97.1%) of 68 we clearly detected SM. In two (2.9%) patients tumor could not be visualized due to low chromogeneity (3 points according to Fleindler's scale).

In result of our study we discovered that thin tumors are more homogeneous according to NLS-characteristics. Along with increasing of thickness, NLS-picture becomes more variable.

So thin SM in majority of cases (less than 1.1 mm – 82% of all cases; from 1.1 mm to 2 mm – 89%) had fusiform shape, homogeneous structure and low chromogeneity (4 points according to Fleindler's scale).

At SM thickness from 2.1 mm to 4 mm fusiform shape of tumor was detected in 66.2% of cases, oval form – in 27.9%, fungiform and irregular shape – 5.9% of cases; at thickness of more than 4 mm all abovementioned forms were detected with approximately equal frequency (29.4%; 22.1%; 25.01% and 23.5% correspondingly).

Tumors of 2 mm thickness in majority of cases were homogeneous. At SM thickness from 2.1 mm to 4 mm tumor structure was heterogeneous almost in 1/3 (32.3%) of all cases. At thickness of more than 4 mm heterogeneous structure was detected twice more (67.7% of cases) than homogeneous (32.3%).

In general, the most frequently detected NLS-characteristics of SM in our study were homogeneous structure of low chromogeneity (4 points according to Fleindler's scale) (66.1% – 85.3%) and fusiform shape (61.8% – 80.9%).

According to results of pre-operative NLS-measurements, SM thickness ranged from 0.4 mm to 26.3 mm (median was 3.1 mm; interquartile range was from 2.2 to 5.3 mm). At the same time according to morphometry data thickness of these neoplasms ranged from 0.5 mm to 25 mm (median – 3 mm; interquartile range – from 2 to 6 mm).

NLS-examination results corresponded with histological research data in 62 (91.2%) cases.

In 3 (4.4%) cases NLS-research data was lower in comparison with morphometry. At the same time SM was located at extensive basis, had diameter of more than 1.2 cm and was localized at calcaneal region (1 patient) and at shoulder (2 patients). In these cases difference in measurements may be explained by loss of skin tension after excision and corresponding contraction of skin and increase of tumor thickness.

Also in 3 (4.4%) cases NLS-research data was higher in comparison with morphometry, which can be explained by presence previous nevus elements (2 cases) and lymphocytic infiltration in basis of tumor (1 case).

Analysis of results homogeneity of SM thickness NLS-measurement and Breslow index using Wilcoxon's criterion detected absence of statistically important differences ($p < 0.106$).

Results of NLS-measurements of SM thickness corresponded to histological research data with high degree of reliability. Correlation coefficient (r_s) was 0.94 ($p < 0.001$).

SM localization in relation with skin layers, detected by NLS-research, corresponded with results histological research (invasion level according to Clark) in 56 (82.3%) patients. At the same time in 43 (63.2%) cases we detected II or III level of primary tumor invasion, in 7 (10.3%) cases – IV, and in 5 (7.4%) – V.

In one case (1.5%) SM of III level invasion according to Clark was erroneously identified by NLS-research as melanoma of IV level invasion.

In 7 (10.3%) cases NLS-research underestimated depth of tumor spreading. In 4 of these cases histological research diagnosed IV invasion level, in 2 – V.

In one case (1.5%) it was difficult to identify presence or absence of derma involvement into process, according to NLS-picture. In this case, according to results of histological research, tumor was identified as SM of III invasion level according to Clark.

So in evaluation of tumor spreading degree into skin and hypoderm information value indices of NLS-research were the following: at II – III invasion level – sensibility is 98.6%, specificity is 81.2% and accuracy is 93.4%; at IV invasion level – 68.1%, 99.4% and 93.7%, at V invasion level – 75.3%, 99.8% and 97.4% correspondingly.

Correlation coefficient (t) of spectral-entropy analysis results in identifying of tumor type with histological research data was 0.96 ($p < 0.001$).

Discussion

The study that we carried out significantly extends knowledge of clinicians about potentials of three-dimensional NLS-diagnostics of SM. We de-

tected relation of NLS-picture of SM and its thickness.

It should be noted that we had not seen any signs of NLS-studies of SM in available sources.

Resonance-entropy analysis of affection nidus allowed us to differentiate tumor clearly and three-dimensional NLS-picture – to identify degree of local spreading.

Achieved data evidences high accuracy of NLS-research in evaluation of SM size and degree of local spreading. Therefore this data may be considered as important additional information at stage of treatment tactics choosing.

Thereby NLS-graphy of patients suffering from SM allows therapists to evaluate structure and character of primary tumor growth, degree of skin and hypoderm involvement, size and depth of tumor, and by means of resonance-entropy analysis – to identify its pathomorphological belonging.

WAVE CORRECTION OF GENOME – A WAY TO LONGEVITY

V.I. Nesterov

At all times many tried to find a formula of eternal youth. In attempt to prolong life they recommended a transfusion of “young” blood, injection of sex hormones, transplantation of ovaries and testicles taken from animals. Alchemists of the Middle Ages sought for elixir of immortality, Chinese Taoists tried to find miraculous elixir inside themselves. Ancient Greeks took milk baths. Some of ancient Romans in order to prolong their lives drank from a floor blood of young gladiators slain in fights. Many people died trying to find elixir of immortality. But even now in laboratories all around the world scientists continue to look for possible ways of life prolongation.

The most spread theory of aging is a theory of free radicals. It was suggested by Dr. Harman back in 1954. The basic idea of this theory is that produced during metabolism active forms of oxygen – free radicals – may damage genetic system of cells. This damage is accumulated with age. The older we get the more damaged cells we have. Our bodies look differently and their functioning worsens. Human organism becomes enfeebled; wrinkles and senile spots appear on skin. Radiation, toxins, carcinogens, stresses and other factors may increase a number of free radicals. In addition enzymes – some kind of instrumentset for cell damages elimination – are not produced quantum satis by cells which are formed in old age.

All components of living cell including chromosomes and DNA molecules are targets for free radicals. But all the time the same specific parts of DNA molecules are damaged. If we try to restore integrity of these DNA parts it will become possible not only to stop process of ageing but to reverse our biological clock.

Based on this idea we have developed a method of DNA “repairing”. It presupposes both elimination of errors in reproducible DNA during stem cell division and restoration of damaged by free radicals DNA molecule of body cells.

This method of errors elimination in DNA molecule was called a method of genome wave correction.

As a result of researches it became clear that DNA molecules, just like lasers, can generate coherent torsion field with re-adjustable wave length. At the same time they function as receiving antenna. These properties of DNA provide exchange of genetic information in an organism. In normal non-damaged condition every cell is precisely adjusted to “virtual” wave part of its DNA, receiving “virtual” objectives and, trying to fulfill them, carry out its main functions: produces specific enzymes and hormones.

Any damage to a cell may be represented as a disorder of harmonic synchronization in biological object. Such disorder may be caused by various sources (radiation, toxins, carcinogens, stresses) which in their turn may be represented as disharmonizing oscillations creating blocks (noises) and preventing normal functioning of biological object. The easiest way to eliminate these effects is to use wave oscillations with negative values so the algebraic sum of disharmonizing and inverted oscillations become equal to zero. According to these conclusions Dr. F. Morell together with electronics engineer E. Rasche created a method and device called “MoRa” back in 70’s of last century.

Method of informational wave correction (Meta-correction) developed by the authors is a further development of “MoRa” method in restoration of organs, tissues and organism’s cells functioning in case of disorders.

Meta-correction method represents influence to tissues and cell structures by combination of various modulated oscillations of torsion fields radiated by torsion generator.

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, may influence DNA molecule structure with diameter less than 2 nanometers. For the last ten years the author and his colleagues had been developing such equipment able to restore DNA helix structure by wave method. Creation of this unique instrument became possible only after super-high-frequency torsion generators with frequency of 40GHz were developed. Because in accordance with laws of physics the higher generation frequency of field is – the lesser ultra-structures of cells and DNA molecules can be influenced.

Thus using this precise instrument we may cardinaly change all processes in a cell and, finally, we may eliminate DNA damages caused by free radicals – in other words to stop process of ageing.

No one ever did something like this. We acquired an instrument of influence to a cell with fantastic possibilities.

Biologist Andrey Schmidt works with simple biological models with small lifetime. *Drosophila*’s lifetime increased 5 times on average after series of corrective wave influence. As a result of genome wave correction he managed to increase lifetime of nematode worms in 7-10 times.

Process of ageing is the reason and latent stage of many diseases.

Billions of dollars are spent to find a medication against senile diseases: Alzheimer’s dementia, arthritis, pancreatic diabetes and of course oncologic diseases. It is a mistake to try to find treatment method for each illness. Senile diseases are caused by one reason – general enfeeblement of an organism. If we solve problem of ageing there will be no need in treatment of senile diseases.

STUDY OF HIGH-FREQUENCY MODULATED TORSION FIELD EFFECT TO A COURSE OF SYNGENEIC TRANSFERRED LEUCOSIS IN MICE OF AKR LINE

T.G. Kuznetsova, A.K. Schmidt

Effect of high-frequency modulated torsion field to a course of syngeneic transferred leucosis in mice of AKR line was studied.

95% of females and 95% of males from this mice line after a time suffer from spontaneous lymphoid leucosis. The main objective of this study is to evaluate capabilities of clockwise polarized torsion field effect in combined treatment of patients with leucosis. To achieve this goal we had to exclude a possibility of leucosis process activating by periodical (once in a week for 3-5 minutes) influence with high-frequency clockwise polarized torsion field to laboratory animals. That is we carried out experiments not on spontaneous, but on transferred leucosis, because latter is more sensitive to effects activating leucosis process.

Experiments were carried out on 18 mice of both sexes, of mass equal to 28.1 ± 0.48 g., of 118 ± 6.1 days old, of 201-203 generations.

Syngeneic transferred leucosis was contracted by introduction into healthy mice abdominal cavity of splenic cells taken from mice with spontaneous leucosis. To fulfill it a mouse with clinical findings was slaughtered by cervical dislocation, spleen was extracted in sterile conditions, and 1% cell dredge was made of it with 0.9% solution of sodium chloride and than 0.5 ml of dredge was introduced into abdomen of experimental animals. In 15-20 days after leucosis cells inoculation mice were slaughtered by cervical dislocation, autopsied, organs were weighted (spleen, thymus, heart, kidneys and liver), amount of red blood cells, leucocytes and hemoglobin (by cyanhemoglobin method) in blood was evaluated. Percentage of separate leucocytes forms was calculated in blood smear stained by Leishman’s eosin methylene and azure-eosin according to Romanovski. By the same method were stained smears – imprints of spleen, in which quantity of blast elements was calculated on five-point scale: 0 – no blast elements, 4 – total blast infiltration. Blood of animals was centrifugated, plasma was separated and content of alanine aminotransferase (ALT) according to Reitman and Frenkel was defined. Results of research were statistically processed using Student’s t-criteria and criteria excluding escaping values.

As a result of 2 series of experiments we found out that leucosis process of mice of AKR line were not activated after exposure to clockwise polarized

torsion field. On the contrary, reliable decrease of lymphoblasts in peripheral blood of experimental animals was observed.

Results of this research give us a right to state that clockwise polarized torsion field effect prevents leucosis development.

EVALUATION OF HIGH-FREQUENCY TORSION FIELD EFFECT ON MICE LUNG CANCER DEVELOPMENT

T.G. Kuznetsova

We found out that effect of high-frequency modulated torsion field prevents lung cancer development of animals with inoculated lung carcinoma cells of exposed to carcinogenic materials.

This discovery gives us hope to develop efficient methods of oncoprophylaxis for people with increased risk of oncological diseases, with congenital predisposition to mammary gland or intestines cancer or exposed to effect of carcinogenic factors.

It was found that effect of modulated torsion field prevents cancer with 85-100% efficiency in cases of inoculated Lewis' carcinoma and in 75-95% in case of exposure to carcinogenic materials.

Mice were transplanted with Lewis' lung carcinoma or subjected to material causing lung cancer (3-methylcholantren after several doses of butylated hydroxytoluene). For generation of torsion field we used torsion generator created together with the Institute of Practical Psychophysics and American company Clinic Tech Inc., with 40GHz field generation frequency and ability to influence an object with right- and left-hand polarized field according to "protector" - "destructor" principle. Influence with right-hand polarized torsion field was carried out during whole experimental period once a week with 3-5 minutes exposition.

In cases of carcinoma disease torsion field effect has prevented tumor growth of 90% of mice. During 28 weeks of observation mentioned percentage of mice did not suffer from tumor growth.

Those mice subjected to torsion field effect and still having tumor growth had tumor size smaller by 80-90% than animals from screening group. Tumors developed in all mice of screening group (which were not subjected to torsion field effect) as a result of carcinoma transplantation and exposure of carcinogenic materials.

Neither of mice subjected to torsion field effect had shown such malignant side effects as autoimmune response or depression of spinal cord stem cells.

We believe that preventing of caused by carcinogenics cancer as a result of torsion field effect – is more important result of our work because this model is closer to real life than transplantation of cancer cells. Now we study a possibility of oncological diseases (cancer of skin, intestines, mammary gland) prevention caused by carcinogenic materials. Besides we started to work with

old animals exposing them to torsion field in order to prevent hormones dependent tumors which develop in majority of such cases and to evaluate possibility of life prolongation.

When we have enough materials for clinical trials, we intend to test effect of torsion field on humans with genetic predisposition to cancer of mammary glands, intestines and, probably, on confirmed smokers having risk of lung cancer.

STUDY OF TORSION FIELD EFFECT TO LIFETIME OF MICE WITH LOU GEHRIG'S DISEASE

A.Kh. Schmidt

Torsion field effect increases lifetime of mice suffering from Lou Gehrig's disease in 2.5 times.

Lou Gehrig's disease or amyotrophic lateral sclerosis (ALS) – it is a rare but untreatable neurodegenerative illness affecting motor neurons of spinal cord. The disease develops in middle-ages and it leads to weakening and dystrophy of muscles. With such diagnose patients live from 3 to 5 years. There is no radical cure and the only preparation – riluzole – provides the prolongation of patients' lives for only several months.

In human cases Lou Gehrig's disease causes SOD 1 gene mutation. Similar symptoms also develop in cases of mice with an artificially caused mutation of this gene. The experiments on such mice models discovered that reactive forms of oxygen are able to destroy cells that increase disease progression.

It is known that reactive forms of oxygen are formed in the process of some proteins functioning at stable vital activity, for example at intercellular signal exchange and at inflammatory processes.

We discovered that the effect of high-frequency (40 GHz) modulated torsion field on mice leads to quantitative decreasing of reactive forms of oxygen and increases lifetime of mice with ALS up to 326 days (which is 194 days more than mice of control group with ALS).

Acquired results help scientists to create new and more effective methods of Lou Gehrig's disease treatment.

EXPERIMENTAL STUDY OF TORSION FIELD EFFECT ON LIFETIME

A.Kh. Schmidt, V.I. Nesterov

The goal of this study is to find out if there are any changes of an organism's lifetime after it was subjected to torsion field effect. For an obvious reasons it is not possible to carry out such study with humans. Theoretically such experiments are possible but in this case we will face some problems because such kinds of experiments take a lot of time. To answer this question the most suitable experimental models are mice of AKR inbred line, because these animals represent short-living line of mice. Their average lifetime is 9 months, but lifetime of non-linear mice is at about 2-3 years.

Another peculiarity of these animals is that in 95% of females and 85% of males are subjected to development of spontaneous leucoses in the course of time. Thus experiments with torsion field effect on mice of AKR inbred line may answer to a question if such effect can prolong lifetime but also give us information if this effect influences clinical course of leucoses. On this ground we have carried out this study.

According to latest scientific data torsion fields have principal meaning in organization, structure and functioning of living systems both in healthy condition and in cases of diseases. Inside and between cells permanent exchange of information by means of torsion waves is carried out.

Functional disorders in a cell and in its chromosome apparatus arise when control processes are disturbed by intervention of pathological effects non-specific for an organism (radiation, toxins and carcinogens). In future these disorders lead damage or death of a cell, if its regular systems are not able to compensate them adequately.

Materials and methods of the research

For generation of torsion field to which animals will be subjected we used high-frequency (with 40 GHz field generation frequency) torsion generator designed by A. Akimov – G. Ignatiev, modified by the authors with additional function of signal modulation to correlate torsion field oscillations with parameters specific to a living cell in order to support its regulatory mechanisms.

Experiments were carried out on 67 mice of AKR inbred line of F 201-203 generations. Series of experiments was fulfilled in which blood values, clinical course of leucosis and lifetime of these mice subjected to torsion field were studied. Influence was brought by specially designed external oscillators

to temporal regions of animals. Influence in accordance with “noon-mid-night” was carried out before noon.

To carry out research of blood and internal organs mice were decapitated, autopsied; leucocytes and red cells content in blood was determined in Gorjaev's count chamber, haemoglobins were determined by cyanhemoglobin method in blood smear stained by Leishman's eosin methylene and azure-eosin according to Romanovski, percentage of separate leucocytes forms was calculated. By the same method were stained smears – imprints of thymus, spleen, liver and mesenteric lymph nodes in which quantity of blast elements in percentage related to hemopoietic cells was calculated. Blood of animals was centrifugated, plasma was separated and content of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) according to Reitman and Frenkel was defined

Results of research were statistically processed using Student's criteria and Fisher formulas.

Results and discussion

As previous researches show effect of modulated torsion field on animals may significantly increase their lifetime.

We used a procedure when experimental animals were subjected to single impact by modulated torsion field within 3 minutes once a week.

Control group consisted of 21 females and 11 males, experimental group consisted of 23 females and 12 males. In these conditions in control group 9 of 32 mice lived longer than average lifetime (279 days), in experimental group – 3 times more: 29 of 35 mice. Difference according to Fisher is trustworthy – $P < 0.03$. Also we witnessed one significant circumstance, the facts are the following. In researches when effect of various conditions on lifetime is studied, it is customary to compare lifetime of 10% of animals which appeared to be long-livers. In control group it was 2 females and 1 male, one female lived for 367 days, other female lived for 378 days and male lived for 360 days. In experimental group there were 3 female which lived for 1006, 1064 and 1137 days! Average lifetime of long-livers in control group is 368 ± 11 days, in experimental group 1069 ± 18 days, the difference is trustworthy – $p < 0,05$.

And another one observation. In blood of mice from experimental group number of leucocytes and lymphocytes was significantly lower than in control group. A number of leucocytes in mice from experimental group was equal to $7,18 \pm 1,032 - 10^9/l$ ($n = 10$), in control group – $14,62 \pm 1,096 - 10^9/l$ ($n = 8$), a number of lymphocytes correspondingly $4,34 \pm 1,325 - 10^9/l$ ($n = 10$) and $9,78 \pm 0,656 - 10^9/l$ ($n = 8$), in both cases $p < 0,05$.

In other words effect of modulated torsion field slowed down leucosis leucomisation.

During analysis of the experiment the following fact attracted out attention. Mice appeared to be very sensible to effect of modulated torsion field. In fact one s a nce of torsion field impact on organism of an animal was only 3 minutes long and one such s a nce once a week was enough to significantly increase lifetime and slow down leucosis leucomisation.

Conclusion

Carried out research has proven that effect of modulated torsion field may increase 3 times mice lifetime and slow down leucosis development.

EXPERIMENTAL VERIFICATION OF MAMMALS ORGANISMS REJUVENATION AFTER EXPOSURE TO HIGH-FREQUENCY MODULATED TORSION FIELD

V.I. Nesterov, A.K. Schmidt

The goal of the present research is to verify experimentally increasing of non-specific resistance and rejuvenation of rats' organisms after its exposure to high-frequency modulated torsion field.

Experiments were carried out on 11 inbred female Wistar rats of 24-27 months old with marked symptoms of ageing, with mass of body equal to $272,5 \pm 38,1$ g. at the beginning of the experiment. Control group consisted of 5 animals; experimental group consisted of 6 animals.

For generation of torsion field to which animals will be subjected we used high-frequency (with 40 GHz field generation frequency) torsion generator designed by A. Akimov and modified by the Institute of Practical Psychophysics, with additional function of low-frequency broad-impulse signal modulation with right- and left-hand polarized field according to "protector"- "destructor" principle.

Exposure to right-hand polarized torsion field was carried during whole experiment (6 months) once in a week with exposition of 5-8 minutes. Effect was brought by specially designed remote oscillators to both temporal regions of animals.

Statistical manipulation of acquired data was carried out according to standard methods; reliability of differences was evaluated by Student's criterion.

Results of the experiment

1. Evaluation of animals' appearance.

In 1-2 weeks after beginning of exposure to torsion field animals showed first signs of rejuvenation; after 4-5 months animals could be distinguished from younger ones only by size of bodies. They were more active than animals from control group. Thin yellow hardened hair was changed by thick white and soft hair. Yellowish eye sclera became bright-pink. Skin changed from rough and thick to soft and flexible. Thymus increased.

2. General blood characteristics.

Analysis of peripheral blood characteristics of female rats from control and experimental groups proved that both groups had similar tendencies of changes within whole period of observation. It means that at increasing of hemoglobin level distinction between groups was not apparent.

The same tendency was observed in relation to increasing of red blood cells number. However the increase (Δ) of these values in experimental group was 2.3 times higher than in control group. Globular value decreased equally in both groups. Absolute content of leukocytes in peripheral blood decreased. At the same time difference between initial and final values of Le content in experimental group was reliably higher ($P > 0.5$) than in control group. Taking into consideration that initial values in both groups were equal to upper limits of normal values, the decrease of Le content in animals during experiment evidenced the optimization of leukocytes quantitative composition.

3. Structure of general adaptive response.

It is well known that blood leukocytes qualitative composition expressed through blood formula by Shilling is an identification criterion of general non-specific adaptive response of an organism (L. Kh. Garkavi and co-authors).

Evaluation of adaptive response structure (training – T; quiet activation – QA; strong activation – SA; stress – S) of rats from control and experimental groups in initial condition revealed that all animals in experiment were in chronic stress condition.

At the same time low level of lymphocytes – the main signal criterion of adaptive response, forming on average 46% in experimental group, was combined with signs of response intensity (monocytosis higher than 10%, eosinophiles increase up to 5-7%), which evidenced development of stress at very low levels of reactivity.

Structure of initial adaptive response of female rats from control group differed by identification of not only stress response, but also of training response related to anti-stress physiological type of responses.

It is known that correlation of various by character types of response may be expressed through coefficient $C(QA/S)$ which makes possible to find out anti-stress potential in groups structure. In experimental group $C(QA/S)$ was equal to 0, in control group it was 1.5, which evidenced better initial position of animals in control group. Besides, according to degree of intensity these adaptive responses could be related to low reactivity levels, at the same time in experimental group the most negative (energetically and functionally) very low levels of reactivity prevailed. After exposure to torsion field, identification of adaptive response revealed withdrawal from deep stress response and development of training, quiet and strong activation responses in majority of experimental animals. At the same time reactive levels significantly increased (it means shift from very low to average and high reactivity levels was observed). Even in the single case of stress retaining, background values of lymphocytes content increased by 14%, decreasing of monocytic intensity by 4.8%, which

evidenced shift from very low to high reactivity levels. It is important that $C(QA/S)$ from 0 increased to 3.5.

In control group of animals, change of adaptive conditions was also observed: shift from training response into stress or strong active and shift from stress into quiet and strong activation (3 cases). Together with general group structure of responses, which appeared in increasing of $C(QA/S)$ in 3.1 times, retaining of responses intensity signs characterizing low levels of reactivity was marked.

Thus at comparison of acquired data it is possible to single out the following peculiarities of general non-specific adaptive responses development in female rats at exposure to high-frequency torsion field.

- 1) withdrawal from deep stress condition of very low reactivity levels.
- 2) forming of anti-stress responses of average and high reactivity levels.

The following signs were typical for animals from control group: shifting of adaptive responses into more active forms at the same low levels of reactivity.

4. Endogenous intoxication values.

It is known that endogenous intoxication, being a non-specific syndrome, is typical for various pathologic conditions, including those appeared at ageing of an organism. Evaluation and correction of endogenous intoxication syndrome became very important for verification of rejuvenation processes.

We have studied cell tests of reactivity and intoxication, calculated according to blood leukogram (A.V. Samokhin, M.S. Tomkevich).

Index of leukocytes shift according to Yabluchanskiy:

$$ILS = (e+b+n) \cdot (m+lph) = 1,94 \pm 0,42 \text{ (norm)}$$

Lymphocytic index of intoxication according to Kapitanenko and Dochkin :

$$LI = lph/n = 0,55 \pm 0,04 \text{ (norm)}$$

Leukocytic index of intoxication according to Kalf-Kalif:

$$LII = (4mc + 3y + 2st + s) \cdot (pl + 1) \cdot (m + lph) \cdot (e + 1) = 0,3/1,6 \text{ (norm)}$$

Where e – eosinophiles, b – basophiles, n – neutrophil (π st – stab, s – segmented), m – monocytes, lph – lymphocytes, mc – myelocytes, pl – plasmacytes, y – young.

Analysis of rats' reactivity and intoxication test results in observed groups showed the following. In initial condition total amount of normative intoxication tests in control group was 1.5 times higher than in experimental group. At the same time group difference in frequency of normative tests revealing gradually increased starting from ILS, then LI and finally LII which represents the most precise picture of toxic-dystrophic condition of blood cell systems, and indirect value of detoxicating functions of an organism. Therefore observed level of correspondence in intoxication indices norm in control group evidenced satisfactory condition of protective functions and their weakening in rats from experimental group.

After exposure to torsion field the situation changed due to redistribution of normative tests: in rats from experimental group in all cases normal values of intoxication indices were completely restored: ILS, LI, LII.

In control group only one animal retained ILS and LII test normal values, and in one case LII index within normal values. In majority of cases standards of ILS, LI, LII were breached and their level was decreased in 5 times in comparison with background values. Thus if we only consider total amount of standard intoxication tests in open group without discussing of their intra-group distribution, we may note reliable difference with control group ($P < 0,001$), where quantity of standard values of ILS, LI and LII indices decreased in 3.2 times. It evidenced that without effect of torsion field natural course of protective-detoxicating processes in organism prevailed, however application of high-frequency torsion field promoted their energization.

5. Torsion field effect to a functional potential of blood neutrophilic granulocyte.

Protective function of neutrophilic granulocytes as cell factors of non-specific resistance is widely known (G.E.Brill et al., 1995; E.A.Korneva et al., 1995). Main factors providing functional potential of neutrophiles are cationic proteins, defined by lysosomal-cationic test (LCT).

In blood preparations taken from animals from control and experiment group, colored by green azure A, we defined mean cytochemical coefficient (MCC) in mature neutrophiles. In each blood preparation we processed at least 100 cells and calculated MCC after G. Astaldi and L. Verg. Initial values of MCC in both groups are decreased to the same level, which evidences decreasing of cells percentage containing cationic proteins granules. After completion of the experiment in control group MCC values remained at the initial low level, but in animals from experimental group, which were subjected to high-frequency torsion field effect, MCC values proved reliable increase of cells with high amount of cationic proteins content ($P < 0,001$).

Observed increase of MCC values in 5.8 times after exposure to torsion field obviously showed improving of detoxicating resistance as one of the mechanisms of organism resistance improving.

At its turn mobilization of organism's natural resistance cells, manifested in increasing of neutrophiles number with high LCT values after exposure to torsion field, was confirmed and coordinated with reactivity and intoxication cells tests, and increase of its standard values was observed in experimental group.

Besides, high-amplitude dynamics of lysosomal-cationic test correlated with significant increasing of reactivity levels by parameters of general adaptation response, at the same time in control group reactivity levels remained lower despite anti-stress character of adaptation response.

Exposure of ageing experimental rats to high-frequency torsion field promoted synchronization of processes proceeding at cell level and integral response of an organism, including multi-system mechanisms.

6. Study of female rats' sex cycle after exposure to torsion field.

We used vaginal smear test to study a restoration possibility of age-related loss of hypothalamic-gonadotropic regulation reactivity in ageing female rats. To carry out these tests every morning and evening water lavage of vaginal contents was taken from animals and its cell structure, showing stages of hormonal cycle, was analyzed: leukocytes mass – diestrus, presence of epithelium cells only – proestrus, shrunken epithelium cells (scales) – estrus, all types of cells – metestrus (according to Eskin). We have studied stages of sex cycle during 9 days before exposure to torsion field and during 9 days after the experiment.

According to results of ageing female rats sex cycle initial condition study in majority of cases diestrus stage prevailed, it continued for 5 to 9 days.

Duration of proestrus stage significantly decreased, in majority of cases it was not revealed at all. Frequency of estrus (main active stage of sex cycle) revealing in rats of experimental group is significantly decreased. Also disorders of metestrus (final stage of cycle) were revealed.

After completion of the experiment all experimental animals restored duration and sequence of sex cycle stages, both active stages – proestrus and estrus, which were missing earlier, were restored.

During the same period in control group minor changes of sex cycle structure were observed, it was individual variations of hormone-dependent processes staging at ageing.

By summarizing of acquired data we may ascertain marked bio-adaptive and gero-protective effect of high-frequency modulated torsion field.

Non-specific mechanisms of its effect to vibration processes characterizing cell, system organismal adaptive responses were stated due to study of inter-related blood characteristics, including increasing of red blood cells content and decreasing (normalization) of leukocytes general amount, increasing of immunocompetent cells content. Number of latter allowed to identify types of anti-stress responses and to ascertain their correspondence to average and high levels of reactivity.

Using multi-component cell contents of blood and with help of estimated reactivity and intoxication indices we managed to define inter-group reconstruction of protective-detoxicating processes standard values in female rats after exposure to torsion field. The most informative proof of non-specific resistance improving is lysosomal-cationic test, results of which reliably increased in comparison with control level.

Of course, endocrine regulation – the oldest form of control – is subjected to significant involution during ageing. Due to this fact complete restoration of age-related loss of hypothalamic-gonadotropic regulation reactivity in ageing female rats after exposure to torsion field is the most significant result.

All six experimental female rats showed complete multi-stage sex cycle with restoration of sequence and duration of stages. We achieved not only metabolic and visible rejuvenation of animals, but also restored childbearing function.

Application of high-frequency modulated torsion field for rejuvenation and restoration of age-related loss of organism's functions is a great prospect and requires detailed research.

RESULTS OF AGE-SPECIFIC GENOME STABILIZATION AT TORSION FIELD (TF) EFFECT

A.K. Schmidt

It is well known that increasing of cytogenetic damages spontaneous level in organism's cells is detected with age, which is a typical sign of ageing at cell level and its nuclear material. Exposure to right-hand polarized torsion radiation may cause continuous adaptation effect in bone marrow cells on mice, which is manifested in genome stabilization and preventing of age-related cytogenetic damages increasing. This effect was detected after single exposure and was preserved during whole monitoring period, equal to whole mice lifetime. It is proven that adaptation effect is caused by TF influence to repair enzymes of genome and to antioxidant system of cells, which is the main protective system of an organism against many types of physical and chemical injuries. Duration of the effect resembles organism immune response form, stability of monitored changes allows us to speak about possibility to bring organism into continuous increased resistance state – practically into state of multiple stability, which may be regarded as delayed aging mode, however, this should be proven by direct study of mice mortality data.

In our studies we already described survival potential increasing of mice previously exposed to torsion field effect. By the present moment effect of torsion field influence is generally studied on various cells cultures according to such criteria as cell death, chromosome aberrations, mutations and neoplastic transformation. Fact of torsion field cytogenetic effect is also represented in organismic level, but in majority of cases these studies of torsion field effect were carried out in short terms and results not always were unambiguous.

In our previous studies for the first time we registered effect of continuous, comparable to animal life time, preserving of cytogenetic response to torsion field effect, induced by both left-hand polarized and right-hand polarized field. As a rule, mechanisms, causing induction during right-hand polarized field exposure, also increase resistance of an organism to other mutagenic agent, particularly to alkylating agent, heavy metals and UV-radiation.

It is known that ageing leads to increasing of cytogenetic damages level and that is why great interest is provoked by study of mechanisms underlying influence of right-hand polarized field affect accumulation of age-related cytogenetic disorders with still unidentified reason.

Objective of this study was research of single-time high-frequency right-hand polarized torsion field effect to accumulation of spontaneous cytogenetic damages during life time of an animal. For experiments we used male

mice of SHK inbred line, 2 months old. Animals were contained in vivarium in standard environment. Influence was brought by high-frequency (of 40GHz field generation frequency) torsion generator with feature of biological object influencing by left-hand polarized and right-hand polarized field by turns.

Another group of animals was kept in the same conditions as a control group.

In 1 day, 2 weeks, 1, 3, 6, 9, 12, 18 and 20 months mice from experimental and control group were slaughtered by cervical dislocation method and cytological preparations of bone marrow were prepared according to standard procedure.

We counted quantity of polychromal erythropites (PCE) with micronuclei. For each experimental point we used at least 5 mice and analysed 25 – 30 thousand PCE. Total number of experimental animals was 170. In error calculation we considered both data spread according to single animals, and errors related to final number of cells.

In verification of statistical reliability of differences between groups we used Student's criterion.

Table No.1 contains results of PCE with micronuclei quantity identification in bone marrow of control and radiated mice in various time periods after exposure. To increase accuracy of results we processed data acquired from both experiments altogether.

Last line of the table and diagram point takes into consideration data over 15, 18 and 20 months. It is obvious that mice which were switched to adaptive state by single-time torsion field effect have decreasing level of cytogenetic disorders and by the end of life time was significantly lower that level of spontaneous responses in control group of non-radiated animals ($P < 0.001$ for 12 months, $P < 0.0001$ for last evaluation taken).

Table

Output of PCE with micronuclei in bone marrow cells after exposure to torsion field and in control group of mice, depending on age (result of genome stabilization)

Variant	Time after exposure	Number of mice	Number of counted PCE	PCE with micronuclei	PCE with micronuclei*, %
Control		10	60276	260	0.43+/-0.06
Experimental	1 day	10	48727	817	1.64+/-0.12
Control		10	60447	234	0.37+/-0.05
Experimental	2 weeks	10	60847	532	0.88+/-0.06
Control		10	60611	276	0.46+/-0.06
Experimental	1 month	10	61190	337	0.59+/-0.05
Control		10	60044	316	0.53+/-0.05

Variant	Time after exposure	Number of mice	Number of counted PCE	PCE with micronuclei	PCE with micronuclei*, %
Experimental	3 months	10	66748	509	0.75+/-0.06
Control		10	61126	494	0.81+/-0.05
Experimental	6 months	10	61531	536	0.89+/-0.09
Control		10	57944	452	0.95+/-0.06
Experimental	9 months	10	63540	475	0.74+/-0.05
Control		9	55521	544	1.01+/-0.07
Experimental	12 months	10	57245	357	0.67+/-0.05
Control		15	111884	1112	1.01+/-0.06
Experimental	17.7 months**	17	118994	742	0.62+/-0.05

* Average values +/- error of both data spread according to single animals, and errors related to final number of cells.

** Data for 15, 18 and 20 months merged together.

Therefore, represented data proves that organisms switched adaptive state by right-hand polarized torsion field effect have continuous and increased resistance to factors causing ageing of animal. Revealed effect may be called genome stabilization, implying continuously preserving condition characterized by increased resistance to various types of mutagenic factors and ageing.

Then, if we take into account hypothesis of somatic mutations accumulation, explaining ageing process, we may expect that genome stabilization effect will be manifested in increasing of average lifetime – index reflecting organism condition in full. Also we may suggest that increased stability of organism genome will result in decreasing of oncological diseases development probability. Indirect proof of this fact is our data on decreasing of spontaneous neoplastic transformation of cells as a result of torsion field effect, and results of studies showing that after exposure to torsion field risk of lung cancer development decreasing.

It is still unknown to what extent adaptive states caused by torsion fields are similar relatively induction mechanisms, duration and intensity of effect. We carry out experiments to clarify these issues now.

We want to emphasize that revealed in this study effect of genome stabilization differs from well known effect of anti-mutagenesis by the fact that chemical antimutagenes have effect only when they are present in an organism and in order to have significant effect influencing lifetime, they need to be injected into organism constantly. Concepts developed in this study more similar to such concepts as adaptive medicine, activation medicine and non-specific resistance of an organism. But brand new factor of our studies is continuous preservation of adaptive state, acquired after single-time exposure, as

opposed to abovementioned examples requiring constant support of this special condition of an organism.

To discuss presented results of genome stabilization by torsion field, we believe that it will be appropriate to deliver hypothesis of development strategy change, used by living organism in process of evolution. In specific conditions population may switch to strategy “X”, notable for its increased resistance to mutagenic factors, decreasing of oncological diseases and increasing of lifetime. This study supposes that main factor switching organism to a new strategy is torsion field with right spin of polarization.

Therefore in the context of this theory we may assume that single-time exposure to torsion field can switch an organism to continuous stable condition.

Presented data allows us to make conclusion that effect of right-hand polarized torsion field suppresses increasing of cytogenetic disorders level caused by ageing, down to below spontaneous level, i.e. switches organism to a new stable condition notable for increased stability of genome. This effect discovers new trend in biology – research of revealed genome stabilization effect and its further application in medicine.

ANALYSIS OF LIFE PROLONGATION TECHNIQUES AND METHODS

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INTRODUCTION

Prolongation of life is the problem for all times and for all nations. In evolution this problem concerns humans only. Realizing immortality of live nature due to reproduction of mortal organisms and having instincts of survival and self-preservation, humans always tried to resolve this contradiction of life and death.

At all epochs humanity showed a great interest in means of youth and health preservation and achieving of extra-longevity. Such means were sought in ancient China, India, Greece, Egypt, by great civilizations of Central and South America. Traces of this search are lost in ages and belong to ancient history. The oldest Chinese medical hand-written book “Nei Kine” contains many articles about ageing.

We can find descriptions of rejuvenation and immortality means in manuscripts of Middle-ages alchemists.

Facts of human extra long life which are mentioned in ancient books seem to be exaggerated, because archeological data proves that ancient people lived not longer than a modern people. Species limit of lifetime was not overcome.

Since the end of XIX century systematic studies of human and mammals life prolongation were started. For a hundred years scientists gathered a vast material about biology of ageing, lots of studies describe solving of gerontology’s main objective – life prolongation. These studies contain information about how various factors affect lifetime of humans and animals.

The most important contribution to increasing of some countries’ population lifetime was done by social factors, environmental conditions and achievements of medicine which are not related to ageing deceleration as such. These factors allowed to get closely to biological limits of lifetime, which are almost reached in USA and in some of developed countries.

Application of geriatric medications is targeted on prophylaxis of many diseases accompanying ageing. Some scientists believe that extremely expensive measures curing main diseases of elderly people may add 10 years of life approximately. Thus humanity is almost exhausted potentialities of lifetime

increasing by traditional medical means and now comes ahead a question of development of means and methods of radical affection on ageing process itself.

Many well known medications increase average lifetime of human and animals. At the same time maximum lifetime is not increased which means that these medications are targeted on correction of ageing pathological consequences, but not on fundamental processes of ageing itself.

In many life prolongation experiments scientists used various lines of short-living laboratory animals with well known inherently proven diseases. If a medication was efficient for treatment of these diseases then average lifetime of animals increased, not affecting process of ageing. Other methods evoke signs of human and animals rejuvenation, at the same time maximum lifetime is also increases.

Expert analysis of modern situation and prospects of gerontological researches development presented by 47 leading gerontologists at the beginning of 2006 showed that majority of experts believe that a possibility of human maximum lifetime increasing is a solvable in near future problem.

Nowadays various techniques, methods and systems of lifetime increasing are being studied. These techniques and methods can be divided into two groups on the basis of ageing process affection efficiency: those increasing both average lifetime and maximum lifetime and those increasing only average lifetime. The first group is of greater interest to us. Applied methods are of various natures: physical, chemical and others. Here we examine the most studied means and methods known in gerontology.

CHEMICALS AND MEDICATIONS

There are lots of chemicals affecting lifetime. Selection of chemicals for research and approbation of their effect on life prolongation is usually based on specific concepts and hypotheses of ageing.

Antioxidants

Application of antioxidants is based on their ability to bind free radicals – reaction compounds with unpaired electron which appear during metabolism process, amount of which increases with age (Harman's hypothesis). These radicals may damage organism's metabolism by affecting high-molecular compounds of chromatin (DNA, RNA), collagen and other proteins, thus causing cell membranes lipids peroxidation. Mammals have strong antioxidant system regulation free radicals activity; however efficiency of this system is decreased with age.

In order to prove his hypothesis D. Harman studied a number of antioxidants in experiments with short living lines of mice (i.e. hereditary pathology). Increase of lifetime was insignificant.

The most efficient antioxidants – mercaptoethylamine increased average lifetime by 26%, butylhydroxytoluene – by 45% mainly due to tumors development deceleration, maximum lifetime of animals was not increased. When abovementioned antioxidants were given to mice of long-living and diseases-resistant lines no life prolongation was observed. Thus the conclusion is the following: antioxidants do not decelerate ageing processes.

S. Baron carried out numerous experiments on mice of short-living lines. She used 2-mercaptoethylamine, epigid, ionol, ethoxyquin, dimethylaminoethanol, centrophenoxin and other antioxidants. AO were given to young, middle aged and old animals. It was proven that lifetime after beginning of the experiment increased by 10-27%.

In experiments on other lines of animals with application of ascorbic acid, glutathione, tocopherol, sulfur amino acids no effect of these antioxidants to lifetime were observed. In experiments carried out by other scientists the effect of tocopherol, ascorbic acid, ionol and methionine caused decrease of animals' lifetime.

Many studies of invertebrates (nematodes, insects, etc.) proved that effect of antioxidants fades with age and in old animals antioxidants do not affect ageing process.

Some of antioxidants (vitamins C, E, A) are used in geriatric treatment. There is information that effect of ascorbic acid in people of 75 and older increased statistic values of forthcoming life up to 102 months, at the same time lifetime of people from screening group was 70 months (D. Smith).

Analysis of information gathered from antioxidants studies make possible a conclusion that it is not possible to achieve significant ageing deceleration and increasing of maximum lifetime when using antioxidants. However many of them are officinal preparations and efficient at many diseases and necessary for normal vital functioning of an organism and health strengthening. That is why application of antioxidants is advised for increasing of human average lifetime. Nowadays antioxidants are vastly used in medicine.

Lathyrogens

According to Bjorksten's hypothesis process of ageing is related to development of linkages in DNA molecules, collagen and other proteins by covalent and hydrogen links. Bjorksten singled out bacterial enzyme destroying these linkages. Its introduction to mice resulted in average lifetime increasing which, according to the author, decelerated ageing. After that was discovered

a group of lathyrogens, which prevented development of linkages, in particular molecules of conjunctive tissue collagen: penicillamine, semicarbazide, aminopropionitrile and others. Now in experiments on rats, mice and other animals it is proven that lathyrogens while inhibiting development of cross linkages almost do not affect maximum lifetime of animals.

Complexons

Bjorksten presumed that transition metal (calcium, aluminum and others) participating in process of high-molecular compounds cross linking are important aspect of ageing. In order to bind these metals and decelerate process of ageing he offered a group of complexons: ethylenediaminetetraacetic acid and its salts, unithiol, penicillamine and others. Ethylenediaminetetraacetic acid is the most studied among them. In numerous experiments carried out by A. Brie application of Na₂EDTA as a complexon and geroprotector showed according to the author herself: "Ethylenediaminetetraacetic acid does not interfere in process of ageing, it increases average lifetime (in rats by 25%) and survival probability of animals due to decreasing of tumors, infectious-inflammatory and other diseases development frequency, decelerates development of atherosclerosis, hypertension and hypercholesterolemia". Other scientists also proved that complexons do not increase maximum lifetime of animals. In general, metal linkages do not accelerate ageing process, because excluding of calcium from diet did not affect mice lifetime.

Adaptogens

It is tonic medications which increase adaptive properties and resistance of an organism to various factors. To provide abovementioned effects and to decelerate age-related changes mostly the following tinctures and herbal extracts are used: ginseng, eleuthero, rhodiola, devil's-club, leuzea, aralia and pantocrine. However application of this preparation is limited because major part of adaptogens is counter-indicated at essential hypertension and other age-related diseases. Exaggerated attitude towards these and some other herbs (euphorbia, Adams' rhododendron, gastrodia elata and others) as to "elixirs of life" is often explained by cosmetic effect and stimulation influence to some processes in an organism. Direct experiments prove that only minor part of adaptogens (extracts of ginseng, eleuthero and licorice root) increased average lifetime of rats by less than 10%, almost without any effect to maximum lifetime of animals.

Biostimulants, preparations of cell and tissue therapy

Biostimulants are produced under specific conditions in isolated animal and phylogenous tissues. In geriatric treatment the following preparations are

successfully used: aloe extract, dredge and extract of placenta, Fibs, peloidistillate, peloidinum, pyrogenal, prodigiosan, humisolum, biossedum, torfotum and others. Also used transplantation of skin and other tissues of other people.

These preparations cause stimulating effect to metabolic processes, regulatory effect to functions of central nervous system, endocrine and other systems, activate restorative and regeneration processes, decelerate development of atherosclerosis and arthritis. For example, effect of aloe extract to people of 71 and older with cerebroscerosis decreased headache, dizziness, improved memory. Fibs has weaker effect. Treatment with placenta preparations caused normalizing effect to central nervous system, metabolism, eyesight, endocrine, cardiovascular and immune systems, decelerated development of atherosclerosis and polyarthritis.

Many preparations produced from various tissues of animals are successfully used in veterinary in order to decrease sickness rate and death-rate of animals. Some preparations, according to experimental data, may cause rejuvenation effect to single organs and systems of animals, however such preparations do not have any significant effect to lifetime.

Also biostimulants include a line of cytotoxic serums: antireticular (ACS), antiovary, antitesticular and others, which are used in geriatrics. The most known ageing prophylactic preparation is ACS created by S. Shoataller in 1943 who linked ageing process with changes in conjunctive tissues. ACS cause positive effect to conjunctive tissue system (treatment of arthritis), cardiovascular, nerve, endocrine, immune, hemopoietic systems which evidences improving of organism's general resistance. However there are no conclusive facts that ACS affects human lifetime.

Immunotropic preparations

Application of these preparations and techniques in order to prevent ageing is based on hypothesis linking ageing process with age-related changes of immune system and first of all with thymus involution in humans and animals. There is information that hormonal matter of thymus (thymic humoral hormone, thymopoietin, thymosin and others) and interleukine-2, isoprinosine, immunocytal, LPS (immunostimulant), azathioprine (immunosuppressant), thymex and thymalin (thymus extracts) and others decelerate thymus involution, cause normalizing effect to functions of various systems, prevent tumors development, stimulate protective properties of organism, but do not cause any marked effect to lifetime. For example, effect of thymalin and epytalamine immunomodulators to rats of 3.5 months old increased forthcoming average and maximum lifetime mainly thanks to decreasing of tumors development. In

elderly people both preparations affect central regulatory mechanisms causing normalizing effect to immune, neuro-endocrine and urogenital systems. There was a notification that in experiments on rats peptide immunomodulator thymogen caused increase of maximum lifetime of animals from 946 to 1048 days, average lifetime was not changed, but preparation promoted deceleration of tumors development (D. Vinsemius). This information requires verification.

T. Makinodan carried out transplantation of thymus and bone marrow from young to old mice. The author notified that after that “rejuvenation” of immune system and prolongation of mice’s lifetime was observed. Other scientists noted that numerous transplantations of thymus in old age (at ageing) are ineffective; numerous transplantations of newborn mice’s thymuses to mice of long-living lines during pubescence period decelerated worsening of T-dependent functions of immunity and development of diseases, at the same time average lifetime increased, maximum lifetime didn’t change. New interest to this problem was provoked by studies of B. Benibotti, in which he marked central role of T-lymphocytes in growth and ageing of an organism.

Hormones

Studies of hormones’ effect to lifetime are based on important role of neuro-endocrine regulation mechanisms in the process of ageing. Attempts to rejuvenate human and animals by transplantation and extracts from sexual glands (Brown Sequard, Turner, Steinach) appears to result to shortening of life because in majority of experiments, in order to facilitate operations, male animals and old men were used. Nowadays it is proven that introduction of testosterone decreases lifetime of females and especially males of mammals. Minor life prolongation of animals was observed after injections of estradiol, oxytocin, vasopressin and glucocorticoids. It is noted that large doses of dehydroepiandrosterone injected to mice caused rejuvenating effect. Large doses of this hormone injected to humans causes side effects. Scientist J. Glaser found that persons practicing psychotechniques of transcendental meditation have increased level of this hormone, especially elderly men (by 23%) and women (by 47%), at the same time biological age was decreasing.

Preparations affecting genetic system

In worldwide gerontological scientific literature about half of all works is based on studying of ageing genetics. In order to delay realization of genetic program and to decrease synthesis of proteins – possible initiators of ageing – a number of transcription and translation initiators was tested (actinomycin D, olivomycin, cyclohexamide and others). The major effect was achieved

after injection of olivomycin to rats: average lifetime increased by 15.4%. Any attempts to stimulate activity of ageing genome with DNA and RNA preparations did not show significant results in life prolongation. Sulfazin preparation of pyrimidines group caused signs of rejuvenation in rats, mice and dogs and slightly prolonged their lives. Injection of this preparation together with vitamins and microelements to elderly people suffering from atherosclerosis, impaired cardiac function, diabetes, essential hypertension, joints affections and consequences of stroke caused improvement of health state, memory, condition of muscles, skin and eyesight.

B. Frank developed a method of rejuvenation, which he called RNA-therapy. Treatment consists of three forms: diet rich in nucleic acids, food supplements (yeast RNA) and organospecific method (introduction of RNA from organs of animals). Frank stated that thousands of elderly people treated by him felt amazing sense of rejuvenation. He didn’t say about life prolongation though. Experiments carried out by V. V. Frolkis and his colleagues proved inefficiency of this method.

In order to prolong life R. Walford offered to use genetic engineering to graft “main complex of histocompatibility” from long-living mice into ovules of short-living mice. These studies are still underway. Possible effect is based on affection to immune system.

Chemicals of various groups

The following ways are offered as atherosclerosis prophylaxis, which is the main syndrome of ageing: exclusion of saturated fats excessive amount from diet, consumption of unsaturated fatty acids, use of estrogens for increasing of high-density lipoproteins in blood, decreasing of cholesterol level by psychotropic agents and use of anti-diabetic preparations.

To correct disorders of central and hypothalamic regulation a number of preparations from various pharmacological groups was offered: anti-diabetic preparations adebit, phenformin, metformin, anti-epileptic preparation L-DOFA, polypeptide epiphyseal extract and others. In experiments on cancerous lines of mice it was stated that some of these preparations increase average lifetime of animals.

Vitamins and microelements

In geriatrics vitamins and vitamins complexes are used for deceleration of age-related changes. Effect of vitamins to lifetime was studied in experiments.

Vitamin E did not affect lifetime of mice of various lines (H. Sakamoto).

In experiments on C57BL mice carried out by G. Massy effect of large doses of vitamin C resulted in increasing of average lifetime by 20%, however

maximum lifetime did not change. The author makes a conclusion that vitamin C cannot prolong human life significantly, as it was stated by L. Poling.

There is information that vitamin A, retinol-acetate exactly, is offered as efficient cosmetic preparation for “skin rejuvenation” related to cells renewal and associated with wrinkles smoothing out and improvement of skin elasticity.

BIOLOGICAL METHODS

Limited nutrition

First systematic experiments on mammals were carried out by T. Osborne. Experiments on rats proved that calories-limited (by 20-30%) adequate diet resulted in prolongation of animals' life. In 1930-1943 intensive studies were carried out by McKay's scientific group, after that by M. Ross, K. Barrows, M. Freeman, A. Everitt and others. Results of some experiments describe lifetime increase by 20-40% under effect of various conditions of nutrition limitations and even excluding from diet only one of amino acids – tryptophan. The greatest life prolongation results were achieved in experiments which were started from infancy. Limitation of nutrition in middle and old ages was inefficient. Some authors noted decreasing of animals' mortality rate during late period of life and increasing of mortality rate in early ages. Recently we face growing number of studies which prove only minor increase of maximum lifetime, especially in experiments on long-living lines of mice and rats. Analysis of study files carried out prior to 1980 which included 195 groups of animals showed that in all experiments effect of calories limited diets caused increase of average and maximum lifetime by 15% and 16% correspondingly, with significant spread of lifetime values in both directions.

Acupuncture

Age-related desynchronization of biorhythms causes acupuncture points' electrical activity decreasing.

It is possible to normalize biorhythms functioning by affecting acupuncture points and channels of a human. It is known that when some acupuncture points are affected energy of an organism significantly improves.

Zusanli point is considered to be the point curing 100 diseases. Influence on this point causes normalizing, regulating and tonic effect to an organism. According to traditional Chinese medicine abovementioned point is used for life prolongation. There is health-improving system, according to which biologically active areas are massaged, acupuncture points E36 (Zusanli), 13-Ap, C14, C111, C7, MC6, RP6 are affected, graduated starvation diet, treatment by preparations made of garlic and honey. Similar influence activates “hypo-

thalamus-reticulated formation-amygdalaris complex” system. As a result of such activation in humans the following signs were noted: age-related changes deceleration, improvement of cell and tissue metabolism and immune reactivity. There is no data about effect of this method to maximum lifetime.

PHYSICAL FACTORS

Electromagnetic fields

It is found that after mice exposure to negative charge low voltage electrostatic field average lifetime of experimental animals increased by 10%. V. Turnbull studied effect of electrostatic field (voltage 15 kV/m) on male mice of CBA inbred line. In comparison with lifetime of animals from screening group average lifetime of experimental animals in negative charge field was longer by 14.3%, maximum lifetime increased by 17%. But mice of CBA line have high probability of tumors development. Specific maximum lifetime of mice (not subjected to high risk of tumors development) is 1030 – 1070 days. In abovementioned experiment maximum lifetime (1049 days) did not exceed specific limit; the result was achieved thanks to decreasing of tumors development frequency after exposure to electrostatic field.

Starting from 1939 and until our days scientists carried out a number of experimental researches showing influence of magnetic static fields on lifetime and survival rate of various types of animals. Experiments carried out by Van Dijk and M. Halpern showed decreasing of mice and rats lifetime when they were placed into shielded space where charge of geomagnetic field was few times lower than normal values. Strong magnetic field (more than 100 kE) did not cause any visible effect to survival rate of mice and monkeys. However numerous clinical and experimental studies prove that continuous exposure of a human to strong magnetic fields may cause damaging effect.

Torsion field

Torsion field have caused great effect in experiments carried out by V. Nesterov and A. Schmidt. Effect of modulated field (of 40 GHz frequency) was brought to heads of old rats. Objective of experiments was to increase adaptive reaction of activation in animals. In 1-2 weeks after beginning of exposure to torsion field animals showed first signs of rejuvenation; after 4-5 months animals could be distinguished from younger ones only by size of bodies. They were more active than animals from screening group. Thin yellow hardened hair was changed by thick white and soft hair. Yellowish eye sclera became bright-pink. Skin changed from rough and thick to soft and flexible. This effect was strong and prolonged. Many scientists (R. MacLaine, D. Wal-

ters, K. Djun, S. Hobbard, L. Pak, T. Kuznetsova) proved that torsion field promoted significant increase, in some cases in times, of average lifetime of mice, rats and other animals, at the same time tumors development decelerated significantly. These experiments represent a great interest for studying of torsion field effect as a way to prolong human life.

CONCLUSION

Given analysis of methods and techniques of life prolongation allows to note effect of torsion field to human's organism as one of the most promising for human and requiring further deep studies.

Other methods: special geroprotective diets and starvation; enterosorption; techniques of organism's endoecology normalizing; hypnobiosis; antioxidants; complxons and adaptogens – do not have any visible effect to life prolongation.

STUDY OF TORSION FIELD EFFECT TO LARGE INTESTINE CANCER DEVELOPMENT IN MICE OF MIN LINE

R. Maclane

Laboratory of genome wave modeling at medical department of Texas University Scientists from Texas managed to cure mice's genetic predisposition to large intestine cancer by exposing them to high-frequency torsion field.

Carried out experiments with mice of MIN line which have 100% probability of gastrointestinal tract malignant tumors development (abbreviation MIN stands for multiple intestinal neoplasia). These mice were exposed to high-frequency left-hand polarized torsion field and as a result Mbd 2 gene responsible for cancer development was "turned off". Mbd 2 gene was discovered not long ago – at the end of 90's of last century. Soon it was proven that this gene belongs to oncogenes.

Mice exposed to torsion field distinguished by perfect body and sexual condition and live two times longer than common MIN mice. 5% of experimental mice showed primary cancerous nidi, but these tumors developed very slowly and represented no serious threat.

Thus "turning off" of Mbd 2 gene by left-hand polarized torsion field successfully suppresses such strong predisposition to cancer which is peculiar to mice of MIN line.

Before starting clinical trials of this method it is necessary to ensure that human variant of Mbd 2 gene functions in development of intestinal (or others) tumors in the same way as mice's analogue (we should note that such studies are already carried out in McLane's laboratories).

It is necessary to create, together with Clinic Tech Inc. Company (Austin, Texas)¹ developing torsion field equipment, an apparatus which may "turn off" Mbd 2 gene in human organism (or other genes responsible for oncopathology development).

These studies make possible creation of efficient methods which may prevent such type of development in humans.

¹ Clinic Tech Inc. Company (USA) was founded in 2002 thanks to academician A. Akimov by the International Institute of theoretical and practical physics together with the Institute of Practical Psychophysics, with help of investors from USA and South Korea, in order to actively introduce torsion technologies into biology and medicine sphere.

APPLICATION OF TORSION FIELD FOR AIDS TREATMENT

R. Maclane, A. Schmidt

Laboratory of genome wave modeling at medical department of Texas University International Academy of nonlinear system diagnostics

We carried out evaluation of left-hand polarized torsion field effect to apes suffering from AIDS.

By application of left-hand polarized modulated torsion field we managed to turn off ENV gene, responsible for production of integrase enzyme which virus uses to seize cells and develop in organism.

After exposure to torsion field we registered complete recovery almost of apes with early stage of disease and in case of apes with severe stage of diseases – significant improvement of health condition.

Nowadays there are many medications taking effect only after virus spread into organism cells by blocking two of three enzymes (reverse transcriptase and protease) which are used by HIV to introduce its genetic material into cells for further reproduction and spreading. Combination of such medications helps thousands of patients to live longer and be healthier; however they do not heal completely and gradually lose efficiency. This forced us to examine third enzyme – integrase which plays major role in fusion of HIV genetic material and human DNA.

Attempts to block integrase by any other means turned out to be rather difficult task.

We carried out tests of left-hand polarized modulated torsion field effect to eight apes, which were infected by combined HIV (human/ape). In these animals we registered minor decreasing of CD 4 immune cells only; in six of them virus content decreased to the level when it was hardly detected. On the contrary in other six infected animals, which were not exposed to torsion field, number of CD 4 cells decreased greatly, virus concentration significantly increased.

12 weeks later we exposed apes with severe stages of disease to left-hand polarized torsion field. Their condition considerably improved, virus concentration in organism decreased greatly.

During next years we plan to begin clinical examination of this method in people suffering from AIDS.

TORSION-WAVE THERAPY AT METASTASES IN LUNGS: CLINICAL STUDY OF I/II STAGE

P. Williams, D. Walters,
S. Alexander, D. Murray

Texas medical center of experimental and clinical oncology

After complete resection of metastases in lungs 2-year survival rate is 58%, after partial resection – 21%. Characteristics of torsion-wave therapy (TWT) make possible to use this method at early stages of non-small cell carcinoma of lung.

Objective

We evaluated TWT efficiency in treatment of patients having 1 – 3 metastases in lungs.

Characteristics of patients and study methods

Clinical study of I/II stage included patients with 1 – 3 metastases in lungs of any primary tumor, except germinogenic neoplasms, leucosis and lymphomas. Maximum total diameter of nidi was less than 7 cm. We evaluated initial function of lungs. Systemic treatment with TWT application was performed for 24 weeks. TWT was carried out with non-linear high frequency (field generation frequency is 100 GHz) torsion generator (Clinic Tech Inc.) with feature of low-frequency broad-impulse modulation of signal and inverting of field polarization. Exposure to left-hand polarized torsion field was carried out within first 12 weeks, two times in a week with 5 – 7 minutes exposition. During the rest 12 weeks we applied right-hand polarized field according to the same procedure. The main evaluated index was frequency of tumor local control (LC); to fulfill it we analyzed nidi detected by radiographic and NLS-graphic methods within 6 months at least. Additional evaluated indices were side effects and survival rate.

Results

The study included 38 patients with 63 nidi; treatment was carried out in hospital from September, 2006, till September, 2008. Prior to TWT systematic treatment was performed in 71% of patients; not less than 2 cycles (range 0 – 5) – in 34% of cases. Two patients had local recurrence after previous resection. We registered no side effects of IV stage. Side effects of III stage were detected in 8% (3 of 38) of patients. Clinically apparent pulmonitis developed

in one (2.6%) patient. 50 nidi were convenient for LC evaluation. Median of evaluated nidi monitoring period was 13.1 months (range 6 – 18 months). Median tumor size was 4.2 ml (range 0.2 – 52.3 ml). LC actuarial frequency during first and second year after TWT was 100% and 96% correspondingly. Local progressing in 13 months after TWT was detected in one patient suffering from highly malignant sarcoma. Median life time was 19 months.

Conclusion

The present clinical study of I/II stage proved that in treatment of patients with 1 – 3 metastases in lungs high-frequency TWT is safe and efficient.

Archival data

APPLICATION OF TORSION FIELDS IN BIOLOGY AND MEDICINE

V.A. Sokolova

We studied Japanese encephalitis virus in Institute of virology named after D.I. Ivanovskiy of AMS USSR. The following scientists took part in this study: A.A. Deev, senior staff scientist of AS USSR, M.U. Grigoriev, head of bioregulation sector of Theoretical issues department, S.D. Svetlyshev, senior expert of Ministry of Healthcare of USSR, K.S. Deryabin, senior staff scientist of Arboviruses genetics laboratory of Institute of virology and author of this research – V.A. Sokolova, candidate of biological science.

These studies were carried out during four years (since 1984 till 1987). Upon completion of every stage of study test reports were arranged and approved according to existing requirements. On the basis of the study application for inventions were claimed.

In our experiment we used CEF (chicken embryo fibroblast) cultures infected by Japanese encephalitis virus right after trypsinization. Time after infection is 48 hours. We studied vial with CEF with Japanese encephalitis virus using microscope and exposed it to torsion field. We used torsion generator designed by V.V. Gorchakov with 512 KHz frequency of torsion field generation (code name “Lightning”). Exposure was carried out for 20 minutes. At the same time we observed through microscope cells monolayer with various evidence of virus' cytopathogenic effect, with granulation and roundness of cells and their moving from glass.

Two vials were left as control ones. After exposure was finished all five vials were placed into thermostat at 37°C for 10 days. On the 3rd and 7th days vials were examined with microscope and we found out that in control vials not exposed to torsion field virus cells were destructed, but in experimental vials we observed intact layer of cells on the bottom of vial. Thus we made a conclusion that exposure to torsion field increases viability of cell structures against destructive effect of Japanese encephalitis virus.

Later in the same Institute we carried out experiments with malignant tumor (sarcoma). White outbred mice of 20 grams weight each were injected with ascitic sarcoma T-80 to get normal ascitic liquid; group of 6 mice were injected with sarcoma cells 3 days later than other group of 6 mice. Thus we used in experiment 16 mice, 12 with injected sarcoma cells and 4 mice formed control group.

Animals were separated into two groups, 8 mice in each group, consisting of 6 mice infected in different periods and 2 control animals. They were placed into two cages; we placed a vial with water exposed to torsion field into one cage, a vial with usual – not exposed to torsion field – water was placed into another cage. Results of monitoring were the following: 4 of 8 mice in the cage with water exposed to torsion field died in the beginning of the second week, 2 of them had ascites in abdomen, another 2 deceased mice were control ones. At the same time in another cage only one mouse marked as a control one died. But after a while in the cage with water exposed to torsion field no changes were registered except that two mice sired healthy breed, because one of 6 infected mice turned out to be a male.

All survived mice did not show any signs of ascites accumulation, but at the same time in the cage with usual water another 2 mice died from ascites in 20 days. 1.5 months later we found in this cage 5 mice: one accumulated ascitic liquid, 3 of 4 were diseased and one control mouse looked healthy.

Thus in the cage with water exposed to torsion field 4 mice survived infection, in the cage with usual water only 2 mice survived. Besides mice that were born by parents taking water exposed to torsion field were resistant to sarcoma: they had very strong immunity against that incurable disease. Results of this single experiment with sarcoma give some positive hope for health condition improving of persons suffering from this incurable disease.

On the proposal of livestock department of Ministry of Agriculture of USSR we carried out a series of researches “Kamenka” farm of Podolskiy district of Moscow region. There was a problem with cattle leucosis (blood cancer) at this farm. During the experiment we carried out transferring with blood from healthy animals to diseased ones, i.e. we placed to torsion field generator vials with blood of healthy and diseased animals in the same order, i.e. first of all we placed on generator vial with leucosis blood then with blood of healthy animal. We registered 43% decreasing of cattle leucosis after triple exposure to torsion generator. Such purification of experimental “Kamenka” farm’s cattle allowed them to get rid of manufacturing limitations due to leucosis and they were allowed to use their cattle for breeding sales.

Also at the same farm we carried out experiments with specific cattle breed exposed to torsion field starting from March 22 and till May 25 of 1985. Upon completion of these experiments blood was taken from animals from experimental and control groups. Blood sampling and full blood research was carried out not by our Institute, but by authorized veterinary department which then removed limitations due to leucosis for this farm.

In the next two years we continued experiments with chicken embryo fibroblast cultures infected by Japanese encephalitis virus in the Institute of vi-

rology. As a source of torsion field we used generator placed in 3.5 meters away from vials with objects. Eight vials with cells culture were separated into two equal groups (experimental and control). We exposed them to torsion field for 20 minutes and after that all 8 vials were placed into thermostat for 10 days, after that vials were studied with microscope. We found out that in control vials virus cells were completely destructed but in experimental vials cell layer was intact on the bottom of vial. Thus we confirmed positive effect of torsion field which is very important in case of bacteriological warfare.

Ministry of Defense of USSR showed some interest in results of our experiments.

Also we had another experiment when object of study was hopeless patient (severe form of sepsis). Blood of this patient was transferred from Institute of blood transfusion to our bio-physical laboratory of Peoples’ Friendship University named after P. Lumumba. Blood of healthy donor was delivered together with blood of the patient.

To save this patient we carried out for the first time transference of blood quality for few dozens of kilometers in the center of Moscow, of course with consent of Institute of blood transfusion experts, patient himself and his relatives. To fulfill this difficult task we urgently produced cylindrical vials covered with stopper. These cylindrical vials were manufactured equal in size to oscillator of torsion generator.

After this remote transferring carried out from afar, patient recovered and was released in a few days.

Scientific literature

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