THREE-DIMENSIONAL NLS-GRAPHY IN COMBINED DIAGNOSTICS OF BREAST DISEASES


Breast cancer (BC) holds one of the first places among malignant neoplasms in women. According to evaluation of World Health Organization (WHO) experts, every year 1 to 1.5 mln of new breast cancer patients will be registered in the world by 2015.

Number of women with other pathological processes of benign character and requiring treatment and monitoring will 25 – 30 times exceed number of women suffering from breast cancer. Diagnosing of breast diseases, including cancer, is the primary objective.

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

Our study is based on combined clinical and hardware examination of women, which was carried out during first phase of menstrual cycle to exclude hormonal influence to mammary glands. We examined 292 women suffering from various breast diseases. 240 patients were administered to mammography, in 15 of them it was combined with targeted imaging, in 31 – with ductography (in two cases – with double contrast enhancement), in 6 – with pneumocystography, in 2 – with intratissular sectoring and in another two patients – with puncture biopsy.

202 patients were examined with ultrasound research of breast, in 58 cases it was combined with biopsy. Another 17 patients were subjected to radioisotopic examination of mammary glands and lymph nodes; 288 patients were examined with three-dimensional NLS-graphy, 175 of them – with application of spectral-entropy analysis (SEA).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Therefore rational sequence of diagnostic methods application in combined diagnostics with obligatory morphological component allows carrying out of accurate diagnostics of mammary glands various pathological conditions with the least costs and time.