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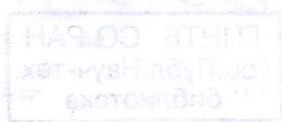
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**Physics of cancer:
interdisciplinary problems and clinical applica-
tions**

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Book of Abstracts

**Физика рака: трансдисциплинарные проблемы и
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colloid ^{99m}Tc -Alotek for visualization sentinel lymph nodes (SLN), colloid was injected peritumoral in four points to 80 MBq one day prior to the planned operation.

Results: The sensitivity of SPECT using both ^{99m}Tc -MIBI and ^{199}Tl for breast cancer detection was shown to be rather high, being 98,5% and 98%, respectively. It should be noted that the sensitivity of SPECT in detection of small tumors (less than 1 cm in diameter) and multicentric tumors was not high irrespective of the radioisotope used (60% and 65% with ^{99m}Tc -MIBI and 65% and 59% with ^{199}Tl , respectively). The difference in sensitivity was found between ^{99m}Tc -MIBI and ^{199}Tl for the detection of regional lymph node metastasis (91% vs 70%).

SLN were detected in 31 patients. The most commonly SLN were defined by us in the axillary region of 96.7%. In 22 (70.9%) patients, there was no metastasis SLN. The sensitivity of the method was 91.2%, specificity of 100%.

Conclusion: The specificity of SPECT with ^{199}Tl was higher than that with ^{99m}Tc -MIBI. The data obtained show that SPECT with ^{199}Tl can be recommended for its use as an additional breast cancer detection method in cases when other imaging techniques and histological findings are not accurate enough. The clinical study of ^{99m}Tc -Alotek, a new radiopharmaceutical agent, have shown that the studied colloid has high uptake level in SLN and can be successfully used for visualization of SLN in patients with breast cancer.



ACCELERATOR-BASED NEUTRON CAPTURE THERAPY: PRE-CLINICAL EVALUATION AND PROSPECTIVE CLINICAL USE

Zaboronok A.A.^{1,2}, Kanygin V.V.^{2,3,4}, Taskaev S.Yu.², Volkova O.Yu.⁵, Mechetina L.V.^{4,5}, Taranin A.V.⁵, Iarullina A.I.^{2,6}, Kichigin A.I.⁶, Byvaltsev V.A.⁶, Sato E.¹, Nakai K.⁷, Ishikawa E.¹, Mathis B.J.¹, Yamamoto T.⁸, Matsumura A.¹

¹ Faculty of Medicine, University of Tsukuba, Tsukuba, Japan,

² Budker Institute of Nuclear Physics, Novosibirsk, Russia,

³ Novosibirsk State Medical University, Novosibirsk, Russia,

⁴ Novosibirsk State University, Novosibirsk, Russia,

⁵ Institute of Molecular and Cell Biology, Novosibirsk, Russia,

⁶ Irkutsk State Medical University, Irkutsk, Russia,

⁷ Ibaraki prefectural University of Health Sciences, Ami, Japan

⁸ Yokohama City University, Yokohama, Japan

a.zaboronok@md.tsukuba.ac.jp

Boron-neutron capture therapy (BNCT) is a unique adjuvant therapy for various malignant tumors, including glioblastoma which is the most aggressive glioma. The main advantage of BNCT is cancer cell selectivity with minimal effect on healthy tissues. Previous experiments at nuclear reactors showed

promising results but the use of reactors in routine clinical practice is extremely impractical. For this reason, global development of accelerator-based neutron sources has become a priority.

Accelerator-based neutron sources at both the University of Tsukuba and Budker Institute of Nuclear Physics (BINP) are in the final stages of development for clinical use. *In vitro* experiments were initially carried out at BINP to evaluate the efficacy of the neutron source to control proliferation of U251MG, T98G, CHO-K1 and V79 cells. The cells were incubated in medium with boronophenylalanine (BPA) or boric acid at various concentrations of boron-10 (10, 20, 40 ppm). Irradiation sessions of 1-3 hours were performed with the following accelerator settings: 2.0 MeV proton energy, 1-3 mA proton current, and flux up to $3 \times 10^8 \text{ cm}^{-2}\text{s}^{-1}$. Cells irradiated without boron and non-irradiated cells were used as controls. Colony forming assays were carried out to estimate cell viability. The data showed that generated neutron flux is effective in controlling tumor cell proliferation with boron and does not influence cell viability without boron.

Additionally, the evaluation of the effect of epithermal neutrons on SCID mice was performed. Animal survival and influence on different organs depending on irradiation dose and the dose of injected sodium borocaptate (BSH) were evaluated and showed the ability of BNCT to both spare healthy tissues without boron and provide tumor growth control.

Our experiments confirm the efficacy and safety of the accelerator-based neutron source, allowing for placement in specialized BNCT treatment facilities.



**DEVELOPMENT AND STUDY OF THE POSSIBILITY
OF USING A NEW RADIOPHARMACEUTICAL
"99mTc-1-THIO-D-GLUCOSE" FOR VISUALIZATION
OF MALIGNANT TUMORS**

Zelchan R.^{1,2}, Medvedeva A.^{1,2}, Sinilkin I.^{1,2}, Bragina O.^{1,2}, Chernov V.^{1,2}, Stasyuk E.², Rogov A.², Il'ina E.², Skuridin V.²

¹Tomsk National Research Medical Center of the Russian Academy of Sciences Cancer Research Institute, Tomsk, Russia,

²National Research Tomsk Polytechnic University, Russia
r.zelchan@yandex.ru

Purpose: to study possibility of using 1-thio-D-glucose labeled with 99mTc for breast cancer imaging.

Materials and method: the study included 11 patients with stage T1-4N0-1M0 breast cancer who underwent SPECT with «99mTc-1-thio-D-glucose» for visualization of primary tumor and regional metastases. SPECT was performed 20 minutes after intravenous injection of 500 MBq of «99mTc-1-thio-D-glucose» into a cubital vein opposite from the tumor side. In addition, the tumor / background index was calculated.