

ИНТЕГРАЦИЯ РАДИОЛОГИЧЕСКИХ МЕТОДОВ И ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ ПРИ РАННЕЙ ДИАГНОСТИКЕ ОНКОЛОГИЧЕСКИХ ЗАБОЛЕВАНИЙ

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Аннотация: Онкологические заболевания являются одной из актуальных проблем глобального здравоохранения и характеризуются высоким уровнем смертности. Их раннее выявление является важным фактором повышения эффективности лечения и улучшения качества жизни пациента. Клинические наблюдения, проведенные в Ферганском областном филиале Республиканского специализированного научно-практического медицинского центра онкологии и радиологии, свидетельствуют о том, что интеграция современных радиологических методов (КТ, МРТ, УЗИ, ПЭТ) и информационных технологий, в частности алгоритмов искусственного интеллекта, осуществляется в соответствии с значительно повышает диагностическую точность и чувствительность. В статье говорилось, что эти исследования были рассмотрены в ходе обследования больных.

Ключевые слова: Онкологическая диагностика, радиологическое изображение, ПЭТ-КТ, биомаркеры, интеграция ИИ, компьютерная томография (КТ), классификация TNM.

ONKOLOGIK KASALLIKLARNI ERTA TASHXISLASHDA RADIOLOGIK USULLAR VA AXBOROT TEXNOLOGIYALARINING INTEGRATSIYASI

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Annotatsiya: Onkologik kasalliklar global sog'liqni saqlash tizimi uchun dolzarb muammolardan biri bo'lib, o'lim ko'rsatkichlarining yuqoriligi bilan ajralib turadi. Ularni erta aniqlash — davolash samaradorligini oshirish va bemorning hayot sifatini yaxshilashning muhim omilidir. Respublika ixtisoslashtirilgan onkologiya va radiologiya ilmiy-amaliy tibbiyot markazining Farg'ona viloyat filialida olib borilgan klinik kuzatuvlar shuni ko'rsatmoqdaki, zamonaviy radiologik usullar (KT, MRT, UZI, PET) va axborot texnologiyalarining, xususan sun'iy intellekt algoritmlarining integratsiyasi, onkologik o'simtalarni aniqlashda diagnostik aniqlik va sezuvchanlikni sezilarli oshirmoqda. Maqolada ushbu tadqiqotlar bemorlar tekshiruvida ko'rib chiqilganligi yoritildi.

Kalit so'zlar: Onkologik diagnostika, radiologik tasvirlash, PET-CT, biomarkerlar, SI integratsiyasi, kompyuter tomografiya (KT), TNM klassifikatsiyasi.

INTEGRATION OF RADIOLOGICAL METHODS AND INFORMATION TECHNOLOGIES IN THE EARLY DIAGNOSIS OF ONCOLOGICAL DISEASES

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Abstract: Oncological diseases are one of the urgent problems of global health care and are characterized by a high mortality rate. Their early detection is an important factor in increasing the effectiveness of treatment and improving the quality of life of the patient. Clinical observations conducted in the Fergana regional branch of the Republican Specialized Scientific and Practical Medical Center of Oncology and Radiology show that the integration of modern radiological methods (CT, MRI, ultrasound, PET) and information technologies, in particular artificial intelligence algorithms, is carried out in accordance with significantly increases diagnostic accuracy and sensitivity. The article stated that these studies were reviewed during the examination of patients.

Keywords: *oncological diagnostics, radiological imaging, PET-CT, biomarkers, AI integration, computed tomography (CT), TNM classification.*

Introduction: Currently, cancer is causing high mortality and economic losses worldwide (WHO, 2022). Detecting the disease early will significantly improve treatment outcomes. Therefore, the development of modern diagnostic methods, in particular, integrating artificial intelligence (AI) and deep learning algorithms with medical radiology, is one of the priority scientific areas [3]. Radiological techniques such as computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET-CT), and Dual-Energy CT help determine the morphological and functional properties of tissues. However, AI algorithms significantly reduce subjective errors caused by human factors.

Material and Methods: Clinical observations: Based on practical observations carried out during 2024, the results of a radiological examination of 450 patients were analyzed at the Fergana regional branch of the Republican Specialized Scientific and Practical Medical Center of Oncology and Radiology. The patients underwent computed tomography (CT), ultrasound, and X-ray. Each case was segmented using artificial intelligence and compared with the TNM (International Union Against Cancer) staging algorithm.

T (tumor) - size and local level of spread of the main part:

-T₀ – wire undefined

-T_{is} – *in situ* (restricted locally, not invasive)

-T₁-T₄ – tissue size and extent of tissue spread to closely related tissues.

2.N (Node) – Level of metastasis to nearby lymph nodes:
-N₀ – not spread to lymph nodes.

3.N₁-N₃ – presence of lymph node metastases and their number, size or location

M (Metastasis) – *Metastases to distant organs (eg, liver, lung, brain):*

-M₀ – no long metastasis

-M₁ – with long metastasis

Artificial intelligence model: Based on Deep Convolutional Neural Networks (CNN), medical images were analyzed using a trained model. The model was used to classify radiological images [8].

Analytical methods: Based on the density, shape, absorption of contrasts and changes in vascular

structures, an assessment of the likelihood of the occurrence of the disease was carried out. Also, the conclusions of the AI were compared with the diagnoses issued by clinical radiologists and doctors [2,5,6].

Results: In the Fergana regional branch of the Republican Specialized Scientific and Practical Medical Center of Oncology and Radiology, out of 450 examined patients, oncological pathology was detected in 360 (80%). 170 of them revealed malignant, 190 benign tumors. The most common pathologies are breast, thyroid, neck, and lung cysts, (Figure 1,2,3,4).



Figure 1. Neck cyst.



Figure 2. Bone tissue.



Figure 3. Breast cancer.

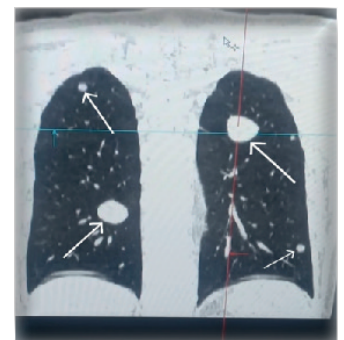


Figure 4. Lung cancer metastasis.

Artificial intelligence was able to correctly isolate malignant and benign tumors with an accuracy of 88%. With the help of radiomic analysis based on density, texture, and vascularization, automatic classification of SI TNM (artificial intelligence) was carried out. Through CT Dual-Energy, tumor imbalances improved substantially, reducing the demand for additional biopsies [7].

Discussion: The integration of AI with radiological diagnostics significantly improves the speed and accuracy of the diagnostic process.

CNN (Convolutional Neural Network) models based on Deep Learning demonstrate high sensitivity in detecting small metastases or changes in clinical practice [1]. Radiological imaging (CT, MRI, PET) using CNN in radiological practice: Automatic detection of symptoms, segmentation of metastases or changes in blood vessels.

Pathological slides: identification of cancer cells on digital microscopy images. Retina, heart electrocardiogram (ECG) / echocardiography: We use it to automatically determine specific diagnostic properties.

The SI (artificial intelligence) model, applied in practice in the Multi Spiral Computer Tomography (MSCT) room, located in the radiology department of the Ferghana regional branch of the Republican Specialized Scientific and Practical Medical Center of Oncology and Radiology, is at a high level consistent with the results confirmed by clinical radiologists and doctors. This opens up opportunities for widespread adoption of these technologies in the health care system. Screening tests (mammography, PAP, PSA) and biomarkers (CA-125, BRCA1/2, CEA) together with AI assays form a diagnostic integrated approach. As a result, high efficiency is achieved in early detection, hospitalization, and drawing up a cancer treatment plan (Table 1).

Screening and biomarker methods Radiological diagnostics in conjunction with biomarkers are widely used in the following cases:[4].

Table 1.

Disease type	Screening method	Biomarkers
Breast cancer	Mammography	BRCA1/2
Uterine growth	PAP, HPV tests	PAP DNK HPV E6 and E7
Prostate cancer	PSA test	PSA
Colorectal cancer	Colonoscopy	CEA
Lung cancer	LDCT	-

Conclusion: From the clinical studies conducted in the radiology department of the Ferghana regional branch of the Republican Specialized Scientific and Practical Medical Center of Oncology and Radiology, these medical conclusions can be noted. The combination of radiological methods and artificial intelligence technologies in oncological diagnostics has led to a new level of the diagnostic process. With

the integration of AI algorithms into visual analysis:
-At an early stage, the detection of seedlings increases significantly.

-Malignant and benign tumors can be differentiated.

- Based on radiological images, TNM staging and clinical decisions are automatically made.

In the future, the full implementation of these technologies in practical health systems will increase the level of early detection and effective treatment of cancer.

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