

## X-RAY WITH TOMOSYNTHESIS AS AN ALTERNATIVE DIAGNOSTIC TOOL FOR ABNORMALITIES OF VARIOUS ETIOLOGIES

**K.A. Riaskin**, *Postgraduate*

**L.A. Titova**, *Doctor of Sciences (in Medicine)*

**Burdenko Voronezh State Medical University**  
(Russia, Voronezh)

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**Abstract.** *The paper highlights tomosynthesis as a novel diagnostic tool in various pathologies, including chest organ disorders. It allows obtaining a certain number of layered images of the patient's study area in one pass of the X-ray tube, thus, improving the detectability. It is emphasised that high-quality tomograms can help to study the nature and features of small limited pathological processes of the main, lobular, zonal, segmental and subsegmental bronchi, lymph nodes of the lungs and mediastinum. The fact that the capabilities of tomosynthesis is comparable in some cases with the data of digital chest X-ray and MSCT is stressed. The aim of the study performed was to reveal the diagnostic value of chest radiography with tomosynthesis in the diagnosis of oncological diseases of various etiologies. The study included medical records of 82 patients of Voronezh oncological regional hospital. The results obtained allow concluding that tomosynthesis combines the advantages of CT, but at a lower radiation dose and cost, eliminates the main disadvantage of standard R-graphy - the overlap of objects in the image, avoids additional costly imaging methods with increased radiation exposure.*

**Keywords:** *tomosynthesis, oncological pathology of various etiology, chest organs.*

**Introduction.** Recently, there has been a growing interest in thoracic diagnostics with tomosynthesis application, which allows obtaining a certain number of layered images of the patient's study area in one pass of the X-ray tube. It improves the detectability and clarifies the characteristics of pathological changes in the chest organs detected in CR, and at the same time has a relatively low radiation load [1].

In the process of the intervention, a certain number of images of the studied area are produced in one pass of the X-ray tube. As a result, an average of 53 tomograms are obtained in the frontal plane. When using tomosynthesis for the study of small intrapulmonary foci, the sensitivity and specificity are about twice as high as with traditional radiography, and the dose load is less than with CT. This allows firstly, "unloading" the CT department, and secondly, seeing a more accurate picture of pathological changes compared with the conventional radiography.

Tomosynthesis allowed in some cases excluding the presence of a pathological process and identify additional changes, namely: signs of limited small-focal dissemination,

destruction of lung tissue, a symptom of "bronchial amputation" and "air bronchography", focal shadows, signs of rib damage, etc. In case of pneumonia, the vehicle reports additional data clarifying the extent and localization of infiltration.

According to a 2013 study by A. Terzi et al., tomosynthesis can be used as a screening method in diagnostics lung cancer in risk groups. Only high-quality tomograms can help to study the nature and features of small limited pathological processes of the main, lobular, zonal, segmental and subsegmental bronchi, lymph nodes of the lungs and mediastinum [2].

Lee et al. in 2015 compared the capabilities of tomosynthesis in determining calcification of the walls of the aortic arch with the data of digital chest X-ray and MSCT. The study showed the advantage of tomosynthesis over digital chest X-ray in identifying pleural plaques characteristic of asbestos [3].

Layer-by-layer examination can play a crucial role in identifying not only the primary cancer, but also the metastatic process. Back in 2012, H. N. Jung in his study determined the sensitivity of tomosynthesis in de-

termining lung metastases in patients with colorectal cancer and also revealed the superiority of tomosynthesis over CR. With the help of tomosynthesis, 83% were noted, and with CR – 27% of the foci of their total number detected with MSCT [4].

Thus, tomosynthesis can be used in the assessment of metastatic lung damage with different localization of the primary focus. Tomosynthesis allows identifying individual small shadows of metastases in metastatic tumors that are invisible when using other methods of X-ray examination.

Thus, it is possible to use 4 options of tomosynthesis to improve the detection of pulmonary foci:

- 1) as an additional technique to the CR instead of BP;
- 2) as a clarifying technique after the identified focus in CR;
- 3) as a method of tracking and monitoring previously identified formations;
- 4) screening of risk groups.

The layered examination of the normal and pathologically altered lungs occupies a special place among other numerous, well-developed and evidenced-based methods of lung investigation.

Therefore, the **aim of the study** was to reveal the diagnostic value of chest radiography with tomosynthesis in the diagnosis of oncological diseases of various etiologies.

**Materials and methods.** The study included diagnostic findings of 82 patients who were admitted to Voronezh oncological hospital in February 2022: 30 women, 52 men, aged 36-85. All patients had oncopathology of various etiologies; they were administered R-graphy of the chest with tomosynthesis to specify the diagnosis. Visualization was performed with a Shimadzu apparatus. Alternative methods of instrumental examination of chest organs - ultrasound, CT, MRI - were not used.

**Results.** Malignant neoplasms of the mammary gland were diagnosed in 17 patients: in 7 of them, R-graphy of the chest with tomosynthesis revealed R-signs of subtotal/total exudative pleurisy, in 10 of them pneumofibrosis of the upper/lower lobes of the lung was observed. In 13 patients, the

main diagnosis was a benign neoplasm of the breast. Visualization of the chest showed single focal compaction of the lung parenchyma, focal/diffuse-focal fibrosis.

Malignant neoplasm of the bronchi was diagnosed in 9 male patients. Imaging revealed R-signs of subtotal/total exudative pleurisy. 15 patients had benign neoplasms of the skin, in 17 patients the main diagnosis was a benign neoplasm of the pancreas. Their X-ray images showed pneumofibrosis, focal fibrosis; X-ray data for mts of the chest organs were not revealed. Benign neoplasms of bones and articular cartilage were diagnosed in 9 patients; no X-ray data for mts were found on their images. Small-focal lesions of bone structures (mts?) were observed.

One patient was referred to the hospital with complaints of dysuria; since 2013 he was observed by a urologist with prostatic hyperplasia. The examination plan included R-graphy of the chest with tomosynthesis. The picture showed rough fibrous bands, areas of compaction of the stranded structure of the lung tissue and pleura, calcifications; in the left lung in S6, areas of compaction up to 2.4x0.5 cm with cords to the costal pleura and root; domes of the diaphragm are deformed by adhesions; formation on the head of the left lung up to 4.2x3.8 cm with a bumpy contour. A conclusion was made about post-tuberculous changes in the lungs and the formation of the head of the left root (Susp centr. c-r).

**Conclusion.** Tomosynthesis combines the advantages of CT, but at a lower radiation dose and cost. This method allows multiple sections to be reconstructed from a single image, thus providing improved visibility of anatomical structures. Tomosynthesis eliminates the main disadvantage of standard R-graphy - the overlap of objects in the image, which can lead to misdiagnosis. It avoids additional imaging methods with increased radiation exposure and high cost.

R-graphy is the main tool in the diagnosis of chest organ diseases. R-graphy with tomosynthesis allows to accurately and quickly visualizing the anatomical structures, making a diagnosis, prescribing treatment, which is vital for cancer patients.

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## РЕНТГЕНОГРАФИЯ С ТОМОСИНТЕЗОМ КАК АЛЬТЕРНАТИВНАЯ ДИАГНОСТИЧЕСКАЯ ОПЦИЯ ПРИ ПАТОЛОГИЯХ РАЗЛИЧНОЙ ЭТИОЛОГИИ

**К.А. Ряскин**, аспирант

**Л.А. Титова**, д-р мед. наук

**Воронежский государственный медицинский университет им. Н.Н. Бурденко  
(Россия, г. Воронеж)**

***Аннотация.** В статье рассматривается томосинтез как новый метод диагностики при различных патологиях, в том числе при заболеваниях органов грудной клетки. Этот метод позволяет получить определенное количество послойных изображений исследуемой области за один прием, тем самым повышая выявляемость. Подчеркивается, что качественные томограммы позволяют изучить характер и особенности мелких ограниченных патологических процессов главных, долевого, зональных, сегментарных и субсегментарных бронхов, лимфатических узлов легких и средостения. Обращается внимание на тот факт, что возможности томосинтеза в ряде случаев сопоставимы с данными цифровой рентгенографии органов грудной клетки и МСКТ. Целью проведенного исследования явилось выявление диагностической значимости рентгенографии органов грудной клетки с томосинтезом в диагностике онкологических заболеваний различной этиологии. Был проведен анализ медицинских карт 82 пациентов Воронежского областного онкологического диспансера. Полученные результаты позволяют сделать вывод, что томосинтез сочетает в себе преимущества КТ, но при меньшей дозе облучения и стоимости, устраняет основной недостаток стандартной Р-графии - перекрывание объектов на изображении, позволяет избежать дополнительных затратных методов визуализации с повышенной лучевой нагрузкой.*

***Ключевые слова:** томосинтез, онкологическая патология различной этиологии, органы грудной клетки.*