



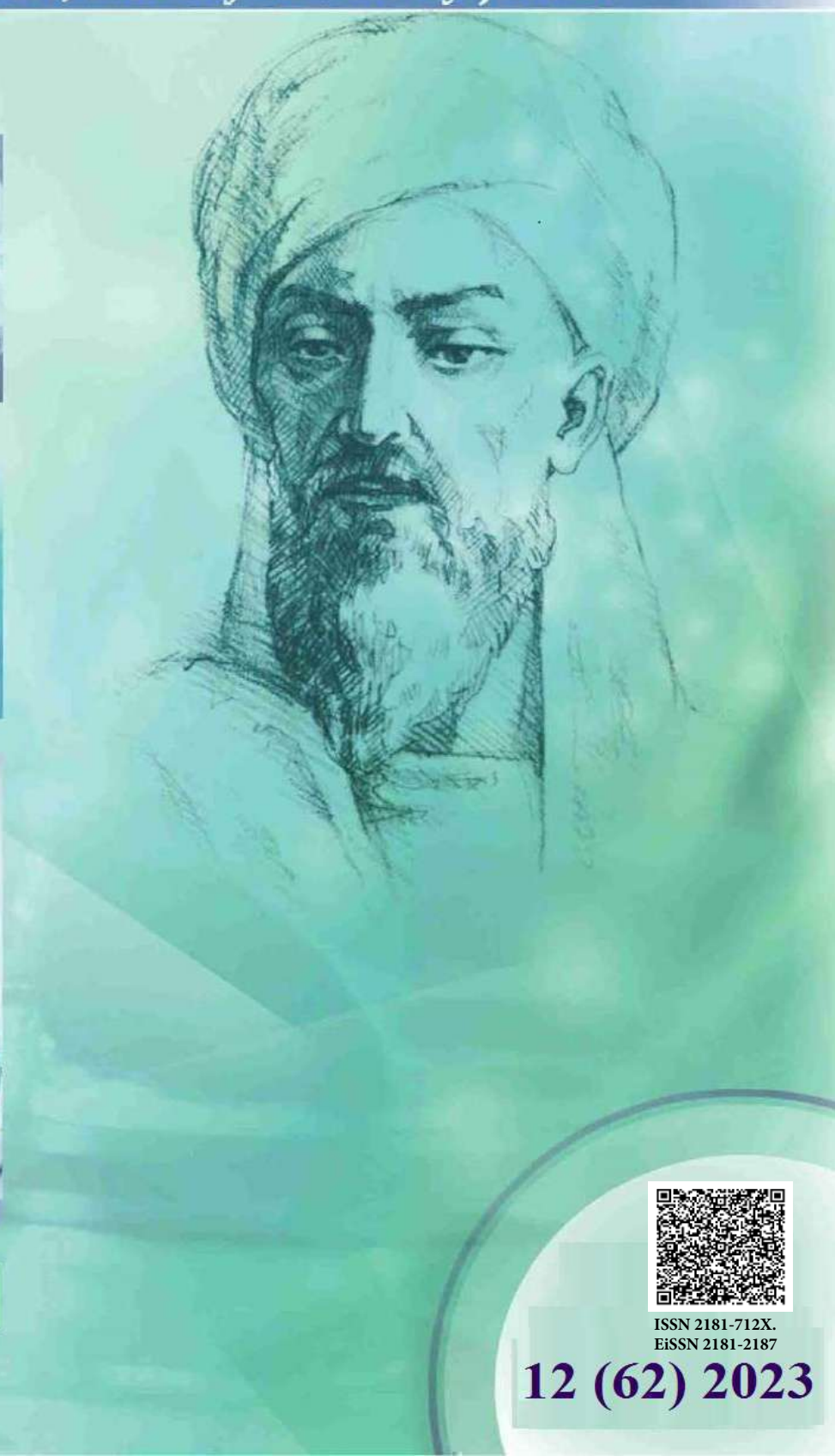
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ТИББИЁТДА ЯНГИ КУН НОВЫЙ ДЕНЬ В МЕДИЦИНЕ NEW DAY IN MEDICINE

*Илмий-рефератив, маънавий-маърифий журнал
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www.bsmi.uz

<https://newdaymedicine.com> E:

ndmuz@mail.ru

Тел: +99890 8061882

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BREAST NEOPLASMS: MODERN DIAGNOSTIC METHODS FOR DETERMINING

Eshpulatov E.Y. Email: EshpulatovE@mail.ru

Bukhara State Medical Institute named after Abu Ali ibn Sina, Uzbekistan, Bukhara,
st. A. Navoi. 1 Tel: +998 (65) 223-00-50 e-mail: info@bsmi.uz

✓ Resume

High incidence of breast cancer is unchanged; therefore, it is relevant to study the possibilities of modern radiological methods for the diagnostics of breast cancer at an early stage. The purpose of the study was to analyze current trends of breast cancer diagnostics at early stages by modern imaging methods according to the literature. The systematic search was performed for reviews and meta-analyses in RSCI, PubMed, Scopus, Web of Science databases, published from 2012 to 2022, on breast cancer diagnostics using the keywords: breast cancer, mammography, digital breast tomosynthesis, Contrast-Enhanced Spectral Mammography, positron emission computed tomography, computed tomography, single photon emission computed tomography, ultrasound, ultrasound tomosynthesis, magnetic resonance imaging. Out of 100 publications published over the past 10 years, 48 were included in the presented review. The existing methods of diagnosing breast cancer have certain advantages and disadvantages relative to each other, the consideration of which is necessary when drawing up a plan of clarifying diagnostic measures, including women with high breast density.

Key words: breast cancer, screening, early diagnosis, mammography, MRI, US, ultrasound tomosynthesis, digital breast tomosynthesis, contrast-enhanced spectral mammography

НОВООБРАЗОВАНИЯ МОЛОЧНОЙ ЖЕЛЕЗЫ: СОВРЕМЕННЫЕ МЕТОДЫ ДИАГНОСТИКИ

Эшпулатов Э.Я. Email: EshpulatovE@mail.ru

Бухарский государственный медицинский институт имени Абу Али ибн Сины, Узбекистан,
г. Бухара, ул. А. Навои. 1 Тел: +998 (65) 223-00-50 e-mail: info@bsmi.uz

✓ Резюме

Высокая заболеваемость раком молочной железы остается неизменной, поэтому актуально изучить возможности современных радиологических методов диагностики рака молочной железы на ранней стадии. Целью исследования был анализ современных тенденций диагностики рака молочной железы на ранних стадиях с помощью современных методов визуализации в соответствии с литературными данными. Был проведен систематический поиск обзоров и мета-анализов в базах данных RSCI, PubMed, Scopus, Web of Science, опубликованных с 2012 по 2022 год, посвященных диагностике рака молочной железы, с использованием ключевых слов: рак молочной железы, маммография, цифровой томосинтез молочной железы, спектральная маммография с контрастным усилением, позитронно-эмиссионная компьютерная томография, компьютерная томография, однофотонная эмиссионная компьютерная томография, ультразвуковое исследование, ультразвуковой томосинтез, магнитно-резонансная томография. Из 100 публикаций, опубликованных за последние 10 лет, 48 были включены в представленный обзор. Существующие методы диагностики рака молочной железы имеют определенные преимущества и недостатки относительно друг друга, учет которых необходим при составлении плана уточняющих диагностических мероприятий, в том числе у женщин с высокой плотностью молочной железы.

Ключевые слова: рак молочной железы, скрининг, ранняя диагностика, маммография, МРТ, УЗИ, ультразвуковой томосинтез, цифровой томосинтез молочной железы, спектральная маммография с контрастным усилением

SUT BEZI O'SMALARI: ZAMONAVIY TASHXISOT USULLARI

Eshpulatov E.Y. Email: EshpulatovE@mail.ru

Abu Ali ibn Sino nomidagi Buxoro davlat tibbiyot instituti, O'zbekiston, Buxoro, st. A. Navoiy. 1 Tel: +998 (65) 223-00-50 e-mail: info@bsmi.uz

✓ Rezyume

Ko'krak bezi saratonining yuqori darajasi o'zgarishsiz qolmoqda, shuning uchun ko'krak bezi saratonini erta bosqichda tashxislashning zamonaviy radiologik usullarining imkoniyatlarini o'rganish muhimdir. Tadqiqotning maqsadi adabiyotga muvofiq zamonaviy tasvirlash usullari orqali ko'krak bezi saratoni tashxisining dastlabki bosqichidagi zamonaviy tendentsiyalarni tahlil qilish edi. 2012 yildan 2022 yilgacha nashr etilgan rsci, PubMed, Scopus, Web of Science ma'lumotlar bazalarida kalit so'zlardan foydalangan holda ko'krak bezi saratoni tashxisiga bag'ishlangan sharhlar va meta-tahlillar uchun tizimli qidiruv o'tkazildi: ko'krak saratoni, mammografiya, raqamli ko'krak tomosintezi, kontrastli spektral mammografiya, pozitron emissiya kompyuter tomografiyasi, kompyuter tomografiyasi, bitta fotonli emissiya kompyuter tomografiyasi, ultratovush tekshiruv, ultratovush tomosintezi, magnit-rezonans tomografiya. So'nggi 10 yil ichida nashr etilgan 100 ta nashrdan 48 tasi taqdim etilgan sharhga kiritilgan. Ko'krak bezi saratonini tashxislashning mavjud usullari bir-biriga nisbatan ma'lum afzalliklari va kamchiliklariga ega, ularni hisobga olish diagnostika tadbirlarini, shu jumladan ko'krak zichligi yuqori bo'lgan ayollarda reja tuzishda zarur.

Kalit so'zlar: ko'krak bezi saratoni, skrining, erta tashxis qo'yish, mammografiya, MRI, ultratovush, ultratovush tomosintezi, raqamli ko'krak tomosintezi, kontrastli spektral mammografiya

Introduction

Breast cancer is currently the most commonly diagnosed cancer in the world [1]. According to the global statistics report compiled by Sung et al, 2.26 million new cases of breast cancer were registered in 2020 [2]. According to GLOBOCAN data for 2018, age-standardized indicators of breast cancer incidence are associated with the human development index [3]. Breast cancer is the leading cause of death among women worldwide (684,996 deaths. and adjusted for age 13.6/100 thousand). In 2020 the ratio of mortality to morbidity of breast cancer as a representative indicator of 5-year survival worldwide was 0.30 [4].

According to the report by Sharma et al, in 2019, an increase in the incidence and mortality from breast cancer over the past three decades was registered. In the period 1990-2016, the incidence of breast cancer more than doubled in 60 out of 102 countries, especially in Afghanistan, the Philippines, Brazil, Argentina, and mortality doubled in 43 out of 102 countries, primarily in Yemen, Paraguay, Libya, Saudi Arabia [5]. According to experts, by 2050, the number of new cases diagnosed worldwide will reach 3.2 million [6].

An important observed trend is not only an increase in the number of patients suffering from breast cancer, but also a decrease in the age threshold for the development of this pathology. More often, breast cancer is detected in people of working age, which indicates the socio-economic significance of the problem [44]. A high incidence of breast cancer is inevitable, but it is possible to reduce mortality from breast cancer. In this regard, it is relevant to study the possibilities of modern radiation methods of breast cancer research, which allow detecting neoplasms with high reliability at the earliest stages of its development.

The purpose of the work is to study modern radiation methods of breast cancer diagnosis used to optimize screening programs.

Material and methods

A search was performed for systematic reviews and meta-analyses in the electronic databases of the RSCI, PubMed, Scopus, Web of Science, published from 2011 to 2022, on the diagnosis of breast cancer, by keywords: breast cancer, mammography, magnetic resonance imaging, ultrasound, positron emission computed tomography, computer tomography, single-photon emission computed tomography, ultrasound tomosynthesis, digital mammography with tomosynthesis, contrast spectral mammography.

Result and discussions

We selected 43 studies that corresponded to the search goals. The use of imaging techniques in clinical practice makes it possible to determine the presence and location of tumor tissues, their relationship with surrounding structures, sizes, which is important for clinicians. These imaging methods mainly include mammography (MG), contrast spectral mammography (CMG), digital mammography with tomosynthesis (CMGT), ultrasound (ultrasound), ultrasound tomosynthesis (3D ultrasound), magnetic resonance imaging (MRI), positron emission computed tomography (PET), computed tomography (CT) and single-photon emission computed tomography (SPECT). Due to the high cost, impracticality and radiation load of PET/CT and SPECT/CT scans are not recommended for the diagnosis of breast cancer. These methods can be used as auxiliary in the search for metastatic breast cancer, in the presence of bone and lymphatic metastases [8].

Modern diagnostic methods cannot exist separately from each other, therefore a personalized and multimodal approach to screening programs is needed, taking into account age, anamnesis, heredity and structure of the mammary glands, as well as instrumentation.

MG is the only method of screening for MJ [9-13]. All over the world, screen film MG has been replaced by full-format digital mammography (CMC) due to its technical and practical advantages, the possibility of storing and transmitting images in electronic form. However, the effectiveness of QMS is limited in women with a high density of MJ (types ACR-C: inhomogeneous dense MJ, and ACR-D: very dense MJ) according to the ACR classification. This is due to the fact that there is a possibility of overlap in the image of pathological formation by fibroglandular structures [10, 14, 15]. It should be noted that the literature data confirm the fact that women with dense MH type B have a four—sixfold increase in risk compared to women with a density of MH type A. It is the density of MH in the general population more often than other factors, such as age and genetic mutations - BRCA1/BRCA2, is the strongest predictor of development RMJ [16-19].

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Currently, CMG is a method that combines the best indicators of sensitivity and specificity in the diagnosis of breast cancer. At the same time, these indicators may vary depending on the country (75-90 and 80-90%, respectively) [20, 21]. MG is recommended as the main screening method for women by most of the existing guidelines: the US National Institutes of Health — The National Institutes of Health, The Association for Cancer Research — The American Association for Cancer Research, the National Cancer Institute — the National Sapseg Institute, the American College of Radiologists ACR [21-24].

Currently, breast cancer screening has been introduced in the vast majority of developed European countries (in 25 out of 28 countries, except Bulgaria, Greece and Slovakia), as well as in China, positive results have already been noted [25, 26]. At this point in time, experts have not determined the exact age of a woman at which breast cancer screening programs, intervals, and diagnostic standards for women with increased breast density should be initiated, which underscores the relevance of further research in this area. In the available world and domestic literature there is a small amount of information about the use of CMG, which allows to visualize formations against the background of dense tissue of the MJ [27]. The authors note that the diagnostic effectiveness of CMG is higher than that of traditional X-ray MG and approaches that of contrast-enhanced MRI. However, further studies are needed to assess the diagnostic accuracy and cost-effectiveness of CMG compared to MRI to determine the appropriate role of this research method in the future. For several decades, there has been an active development of special radiological studies of MJ, the most promising of which is digital mammography with tomosynthesis (CMGT). Its use makes it possible to differentiate the violation of architectonics and volumetric changes, to detect pathological formations that are not always distinguishable on

mammograms. The results of a number of reviews and studies indicate an increase in the effectiveness of breast cancer detection when using CMGT (TOSYMA, etc.) [29].

Examination of the mammary glands using ultrasound is safe, since the method is non-invasive and does not have ionizing radiation. To date, ultrasound is mainly used to supplement other diagnostic examinations, and also allows performing a biopsy under ultrasound control. To verify the small size of breast calcification, a new MicroPure ultrasound image processing technique has been developed, which allows creating images with high contrast resolution and high tissue uniformity. In a study by Machado et al in 2019 when processing surgical samples of breast cancer ex vivo, the use of MicroPure made it possible to recognize breast cancer microcalcifications with a high degree [30, 31].

The development of 3D ultrasound is one of the most promising areas, which allows you to get an average of 3 scanning planes (coronary, sagittal and axial) image of the entire MJ. We have identified works devoted to the differentiation of malignant and benign tumors of the MJ using 3D ultrasound [32, 33]. Some researchers have noted in their works that 3D ultrasound, due to good visualization of the MJ, is also a new method of operational planning [34-36]; the size of the lesion determined using 3D ultrasound correlates well with the results of MRI and histopathological changes [37]. In addition, special software for 3D ultrasound has been developed for the purpose of automated detection of pathological formations (CAD, QVCAD™, QView Medical), which has received FDA approval [37]. 3D ultrasound can be used to evaluate the results of MRI as a clarifying technique: for example, 3D ultrasound surpassed ultrasound as a secondary study after MRI of the MJ, revealing additional foci [38].

The variability of the MRI sensitivity index ranged from 75.2 to 100%, on average exceeding 80%; specificity — from 83 to 98.4% (EVA study and the Italian HIBCRIT-1 study) [39, 40]. The use of a short MRI protocol by Kuhl et al is associated with a reduction in scanning time by an average of 18.8 minutes and image interpretation by 4.9 minutes. The MRI method, which does not involve the introduction of contrast, is under development and evaluation. However, the limited spatial resolution and the frequent presence of artifacts may reduce the value of this method when detecting lesions smaller than 12 mm [41]. Therefore, at the moment, MRI methods without intravenous contrast injection cannot compete with contrast-enhanced MRI for screening purposes.

To date, several guidelines have been issued in many developed countries on the main provisions of the screening process. At this point in time, scientists have not determined the exact age of the woman at which breast cancer screening programs should be started. Countries with an early start (in the age range of 40-45 years) include the Republic of Korea, Spain and Hungary; with a late end (age range 73-75 years) — Great Britain, France and the Netherlands. Even in the homeland of screening in the USA, there are contradictions between the data of such organizations as the US National Institutes of Health, the Association for Cancer Research, the National Cancer Institute and the American College of Cardiology. In addition, the exact algorithm for breast cancer screening has not been determined, including in women with dense MJ type C and B.

In this regard, the problem of early detection of breast cancer, which determines the algorithm of further therapeutic measures, is of crucial importance in clinical practice. There are promising technical solutions for 3D ultrasound, CMGT, CMG, and a short MRI protocol. However, further research is needed to assess the diagnostic accuracy and cost-effectiveness of the methods. These methods are one of the most promising directions for optimizing the screening of breast neoplasms among the category of women with high breast density.

Conclusion

The existing methods of breast cancer diagnosis have certain advantages and disadvantages, the consideration of which is necessary when drawing up a plan of clarifying diagnostic measures, including in women with high breast density. The little-studied nature of new promising methods for the diagnosis of breast neoplasms—digital mammography with tomosynthesis, ultrasound tomosynthesis, dual-energy spectral contrast mammography, short mammary MRI protocol, requires further research to clarify their effectiveness in screening programs and determine indications for use, taking into account anamnesis, family history, breast density type, genetic factors, to improve the indicators of early detection of breast cancer.

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