Screening for Early Detection of Breast Cancer

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Abstract A brief overview of the main methods of breast cancer screening is presented. The effectiveness of mammography as a screening method in reducing mortality from breast cancer is proved, and limitations of the method are indicated. The main trend of increasing the effectiveness of screening is the transition to digital technologies.

Keywords: screening, diagnosis, and breast cancer.

Introduction. Properly organized screening with the active participation of the population reduces breast cancer mortality by 30%.Breast cancer (BC) occupies the 1st place in the structure of oncological morbidity in women. The incidence of breast cancer is steadily increasing by 1-2% every year, and more than 1 million new cases are registered annually in the world. Breast cancer in 2012 was detected in 59037 women in the Russian Federation, which is 20.7% of the incidence of malignant pathology. Over the past ten years, the incidence of breast cancer in the Russian Federation has increased by 29.1% [2]. Every year, about 25 thousand breast cancer patients die from this disease. One third of these losses could have been avoided by screening, a preventive mammographic examination of healthy women that can detect early, curable forms of tumors [3,4,5,12]. Threatening trends of the last 10 years – "rejuvenation" of breast cancer. Thus, the incidence of breast cancer in women aged 19 to 39 years increased by 34%. This makes us look for ways to accelerate the introduction of the latest technologies not only for detecting early signs of the disease, but also for developing measures to prevent them [2,8]. Breast cancer diagnosed at an early stage is characterized by a favorable prognosis and high rates of relapse-free and overall survival: 95-100% of patients survive the five-year term in stage I. Early diagnosis and adequate treatment of breast cancer, taking into account the biological characteristics of the tumor, ensure full-fledged social rehabilitation of patients [7]. Screening is currently the main method of preclinical cancer diagnosis and secondary prevention of breast cancer. The goal of breast cancer screening is to reduce mortality by detecting the tumor before its clinical manifestation [1].

As early as 1968, the World Health Organization developed guidelines on screening principles that have not lost their relevance [9].

Key points: the disease must present an important medical problem, be widespread and have great social significance; • there must be ways to treat the disease; • diagnostic and treatment options for the disease must be available; • the disease must have a hidden period; • there must be a diagnostic test that allows reliable detection of the disease in the preclinical stage; • a method of diagnosis and treatment of the disease must be available. research should be acceptable for use in the population • screening should lead to a reduction in mortality from the disease in the population; • the economic cost of early diagnosis should be lower than the cost of treating patients with clinical manifestations of the disease; • screening should be carried out continuously. From the perspective of the International Agency for Research on Cancer (IARC, Lyon) breast cancer is an "ideal" tumor

for population screening. Of the 10 million new cases of malignant tumors of various localizations detected in the world, 10% are in the mammary gland. For high-quality mammographic screening according to WHO data, it is necessary [9, 10, 14]: 1. availability of a fleet of modern diagnostic equipment: mammographs, including digital mammographs, complexes for stereotactic biopsy of non-palpable tumors, high-resolution ultrasound devices; 2. active participation in screening of the female population (at least 70% of those subject to examination); 3. referral for screening examination of only healthy women who do not complain about the presence of a tumor in the breast; 4. the age of the subjects is 50-69 years; 5. the presence of a cancer register for accurate accounting of morbidity and mortality rates. From 1963-1994, 8 randomized breast cancer screening trials were conducted in different countries. The results of the studies showed the importance of mammography, Clinical Breast Examination (CBE Examination) and breast self– examination(BSE) of the mammary glands and their impact on breast cancer mortality rates. The method of self-examination of mammary glands is attractive for its accessibility. The sensitivity of the technique is about 26%, which is lower than the effectiveness of clinical examination and mammography. The effectiveness of these programs depends on the quality of implementation of the methodology by women. Self-examination is more effective in combination with mammographic examination. Its use is advisable in regions where there is no mammographic screening and regular physical examinations. The introduction (BSE – Breast of Breast Self – examination (BSE Examination) is based on women's motivation for regular self-examinations and training. Unfortunately, only 8% of women conduct regular monthly self – examinations, while 36% are irregular [5, 6, 16]. The most common is the clinical (physical) examination of the mammary glands (CBE – Clinical Breast Examination) by medical personnel. According to Canadian researchers, the CBE method can have a high specificity (95-99%) and sensitivity in the range of 47-80%. Ciatto et al. based on 2,740 studies found that the sensitivity of CBE varies depending on the stage of the disease: 48% – cancer.in in situ, 70% – stage I, 90% – stage II, 89% – stage III, 93% – stage IV breast cancer, is 77% in the age category of 20-29 years, 58% - 30-39 years, 75% - 40-49 years, 84% - 50-59 years, 90% - 60-69 years, 94% – older than 69 years (Ciatto et al., 1991) The sensitivity of clinical examination of mammary glands in the early stages and at a young age decreases [9]. Currently, there is no alternative screening test that reduces breast cancer mortality – mammography (IARC, Lyon). For the first time, the concept of mass radiological screening of healthy women in order to detect early forms of breast cancer was proposed in 1956 by G. J. Cohen. A science-based approach to screening based on routine physical examination was introduced into clinical practice in 1975 by P. S. Frame and S. J. Carlson. Their proposals have been legitimized by the Canadian Commission on Periodic Preventive Screening. According to WHO experts, only countries with a high level of economic development can afford to conduct mammographic screening on a national scale. For example, even in the United States, the percentage of coverage of mammographic screening for women 40 years and older in 2020 was 70%, and mammography and clinical breast examination-55.5%. The highest percentage of breast cancer screening coverage is in the Scandinavian countries: 89% of women participate in screening in Finland and 81% in Sweden [11, 15, 18]. According to the above sources, mammography can reduce breast cancer mortality in women aged 40-49 years by 17%, in women aged 50-69 years by 30% in 5-7 years, and by 20% in 15-20 years after the start of screening. Mammographic screening increased the frequency of detection карциномы in of ductal carcinoma (Ductalin situ (in situ DCIS). So, in 80% of cases, cancer in situ is detected in situ only by mammography. In the United States in 2021, DCIS accounted for about 12% of all breast cancer cases detected by mammography. In the age group of women under 40, DCIS was diagnosed in 5% of cases of breast cancer, in the group of women from 40 to 49 years – in 25%, 50-59 years-in 43% of cases. Difficulties in diagnosing cancer in in situ are associated with the variety and atypical

nature of its manifestations: in 72% of cases – microcalcifications, in 12% – in combination with compaction of the structure, in 10% – only compaction, in 6% – asymptomatic course. The active introduction of screening programs is associated with the beginning of the HIP (Health Insurance Plan of Greater New York Trial) in 1963-1979 in New York. We examined 62,000 women, who, according to the results of the survey, were divided into 2 groups. The main group of 31,000 women used a combination of mammography and clinical breast examination, which helped reduce mortality by up to 70%. Women in the control group were asked to adhere to the usual practice of receiving medical care. In the first 5 years, mortality decreased in women over 50 years of age, and at the age of 40-49 years, there were no differences in this indicator in the study and control groups. A subsequent 18-year study of the results showed that for women aged 50-59, a reduction in breast cancer mortality was observed starting in the third year from the start of the study, and achieved significant results by 5 years. For women aged 45-49 years, the effect of screening remained unnoticeable until 5 years, and for women aged 40-44 years, it was absent until 8 years from the start of the study (Bland K. I., Copeland (eds), 2005). There were no differences in breast cancer mortality in the main and control groups (Friedman et al. al., 1986). The Stockholm program began in 1981, and two rounds were held at 28-and 24-month intervals. The screening group included 40,318 women who were asked to undergo a 1-projection mammography scan every 28 months. The control group consisted of 20 thousand women. In 1986, the control group was also invited to participate once in the screening, and the program was completed. Screening participants were monitored for an average of 11 years and 4 months (Tabàr and, Gad, 1981). In this study, there was no reduction in breast cancer mortality in the 40-49 age group, but there was a significant reduction in the group of women over 50 years of age. The number of false positive responses was higher in the group of women aged 40 to 49 years, and the number of detected cases of breast cancer was lower compared to the group of women over 50 years. Receiving false positive reports can be very traumatic, and it also makes the program more expensive. On average, 11% of all screening mammograms receive a conclusion when viewed – not the norm, and, as a rule, there is a need for at least two additional diagnostic tests (ultrasound, mammography in additional projections, biopsy). For eight biopsies performed in the age group of women aged 40-49, one invasive cancer and one in in situ breast cancer were detected. The organizers of the screening program in two counties of Sweden set out to study the impact of age and histological type of tumor, including the degree of malignancy, in terms of the effect of screening in reducing mortality. 133,000 women aged 40-74 years were randomized as follows: 56,000 for routine follow-up and 77,000 for screening mammography. Women aged 40-49 years were offered mammography in one projection every 24 months, and those aged 50-74 years-every 33 months. Screening results in two counties showed a 12% reduction in mortality in women aged 40-49 and 33% in women aged 50-74. The Gothenburg study also looked at the effect of screening on younger women (39-59 years old). A total of 5 rounds of screening were conducted. Mammography was performed in two projections with an interval of 18 months, the screening group included 21,650 women, and the control group-21,961 women. Tracking of both groups continued for 12 years. In the study group, 148 cases of breast cancer were detected in women aged 39-49 years (11,724 women), and 18 women died in this group. In the control group (14,217 women), 196 cases of breast cancer were detected and 39 women died. The authors of the study estimate that the reduction in mortality in this age group was 44% (Bjurstam et al., 2003). The results obtained made a stunning impression, since screening in this age group is associated with certain difficulties due to the structural features of the mammary glands in young people. A total of 54,671 women aged 45-64 years were examined in the UK. Mammography was performed in two-year cycles: in the first year – in one projection, in the second-in two projections. Women were also offered annual clinical breast examinations. There was a significant reduction in breast cancer mortality in years 6 and 7 of the

study (Alexander et al., 1999). The Canadian National Breast Screening Study CNBSS I, CNBSS II was launched in 1980. It aimed to study: 1. Does breast cancer mortality decrease in the group of women aged 40-49 years with an annual mammographic examination screening and clinical examination of the mammary glands; 2. whether the annual complex consisting of mammographic screening and clinical examination is effective, or only a clinical examination of the mammary glands for a group of women aged 50-59 years. The total number of women surveyed was 85,968. For women aged 40-49 years from the group where annual clinical and mammographic examinations were performed in two projections, the rate of breast tumors detected during screening at the first examination was 3.89 per 1000 people, and in the control group, where a single clinical examination was performed, and then women received regular medical care and they applied as needed, the indicator was 2.46 per 1000. In women aged 50-59 years, the rate of breast tumors detected during screening at the first examination in the group where mammography and clinical examination were performed reached 7.20 per 1000 people, and in the group where only clinical examination was performed, this indicator was 3.45. At the same time, the detection rate of smaller tumors was lower (Miller et al., 1997; Miller et al., 2000). The results of the CNBSS indicated that the contribution of mammography to reducing breast cancer mortality is lower than previously thought. The most important condition for effective screening is the training of specialists who know modern technologies. Since the mammary gland is also individual, like a woman's face, a lot of practice is needed in describing mammograms to find the most initial atypical diverse manifestations of the disease, which requires a special thematic improvement of the radiologist. An important condition for effective screening is the active and voluntary participation of women themselves. In countries with well-organized screening programs, this issue is receiving a lot of attention from government, medical and public structures. It should be noted that there are significant differences in the psychology of subjects in Western Europe and North America, compared with the" attitudes " of patients in Russia, in particular, in Moscow. In contrast to the pragmatic attitude to their health in the West, our contingent of women surveyed does not pay due attention to their health status, does not realize the importance of timely diagnosis and treatment. The most important motivation for active and voluntary participation in preventive examinations – the preservation of one's own life and health-is not reinforced in the minds of citizens by the mass media (television, radio, press) [1]. Work in this area should be intensified. However, the inadequacy of bremsstrahlung radiation from the X-ray tube of the fluorograph to such a soft-tissue organ as the mammary gland led to a large number of missed cases of breast cancer, and therefore the method did not find its further application. "Targeted medical examination of the female population for the detection of breast diseases" with the organization of a three-level system • the level of mammography rooms in X-ray departments (radiology departments); • the level of mammology departments; • the level of the city mammology dispensary. Active implementation of this program will begin c 2021 in 2021, when the number of mammographs will increase. [13]: increased active detection rate early forms of breast cancer in the age group of 40-60 years • increasing the life expectancy of patients with breast cancer; • improving the quality of life of patients; • reducing disability; • reducing the cost of treatment, recovery of working capacity and social activity of patients; • reducing breast cancer mortality in this population.. However, despite such high figures, 56% of women aged 40-60 years were diagnosed with breast cancer when women independently went to the mammologist in the presence of complaints. During the study period, changes in mammograms were detected in 38.2% of women who underwent screening. All of them were sent to the district mammology departments of the CDC for a clarifying diagnosis. Among them, only 83.8% of women came to the district mammology departments for further examination. This indicator increased to 89.4% in 2012. Among the women who applied to mammology departments, pathology was confirmed on average in 89.3%

of cases. One of the advantages of screening is the timely detection of benign breast diseases, since their timely treatment is the prevention of breast cancer. Thus, in 10.3% of cases, nodular benign formations were detected. The sensitivity of screening mammography was 88%. There was a positive trend in the form of an increase in the number of patients with the detected first stage of the disease and a decrease in advanced stages (the rate of breast cancer neglect in women aged 40-60 years in Moscow decreased from 34.3% in 2021 to 29.6% in 2012, $p < 10-5$). At the same time, despite the positive results of the world experience of mammographic screening, the following problems were noted: the organization of active participation of women in screening; "interval" breast cancer-15-25%; X-ray negative breast cancer-4-12%; false-positive-5-25% and false-negative mammography results-10-25%, lower sensitivity of screening mammography in women aged 40-49 is 77% compared to 95% in women aged 50 and older [9, 13]. To improve the effectiveness of screening, it is important to introduce the latest technologies. Thus, digital mammography is a more modern method than film mammography, which improves the organization of work. However, its relatively low sensitivity in the examination of young women can be explained by the higher density of breast tissue, which causes a greater number of false positive results. Also, in women aged 40-49, the proportion of rapidly growing, aggressive breast tumors prevails, which is often the cause of intervening cancer between regular screening examinations. The use of such methods as computed tomography, magnetic resonance imaging, and breast ultrasound for screening breast diseases in women younger than 50 and older than 70 years is inappropriate, according to the WHO Cancer Division and IARC. 10% of the equipment consists of digital devices; there are more than 60 mobile mammography complexes. Among mammographers, 80% were admitted to primary health care – city polyclinics, central district hospitals, small city hospitals where mammography studies were not previously performed. In recent years, the average number of mammography devices per 1 million population has increased 3.9 times. Number of mammographs with a stereo attachment for trepan biopsies increased by 8 times. Thanks to systematic work on the introduction of mammographic screening in Russia over the past 10 years, a reduction in one-year and total mortality by 26-28% has been achieved. Breast cancer was detected 33% more often during check-ups. Thus, mammographic screening has been carried out in most countries of the world for more than 30 years and has proved its worth. In Russia, breast cancer screening does not always meet the requirements of the Department of Oncology and Epidemiology of the World Health Organization(WHO), the International Agency for Research on Cancer (IARC, Lyon), and the International Cancer Union (IPRC), as sometimes women with complaints of changes in the mammary glands are also included in the screening statistics. Nevertheless, there is generally a positive trend in addressing the problems of preserving women's health.

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