Prevention and early detection of breast cancer

(Profilaktyka i wczesne wykrywanie raka piersi)

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Abstract – Breast cancer is the most common malignancy in women. Demographic data indicates that it still remains a growing social problem. Women’s activities undertaken in the field of preventive health care and their participation in screening programmes may contribute to early detection of breast cancer and help reduce mortality rate of women with this type of cancer. The aim of the study was to present the principles of breast cancer prevention and diagnostic tools for its early detection.

Key words – breast cancer, prevention, diagnosis, screening.

Streszczenie – Rak piersi jest najczęściej występującym nowotworem złośliwym u kobiet. Dane demograficzne wskazują, że jest to nadal istotny i stale rosnący problem społeczny. Podejmowanie przez kobiety działań z zakresu profilaktyki zdrowotnej oraz udział w badaniach przesiewowych może przyczynić się do wczesnego wyrywania raka piersi i zmniejszenia odsetka umieralności z powodu tego nowotworu. Celem pracy było przedstawienie zasad profilaktyki raka piersi oraz metod diagnostycznych pozwalających na wczesne wykrycie tego nowotworu.

Słowa kluczowe – rak piersi, profilaktyka, diagnostyka badania przesiewowe.

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I. INTRODUCTION

Breast cancer is the most common malignancy in women. The highest incidence is reported in the already developed and still developing countries. The analysis of number dynamics concerning cancer-afflicted persons and deaths, as well as of incidence and mortality rates allows for distinguishing populations with a lower and higher risk of falling ill and dying of malignant breast cancer [1].

The incidence of breast cancer is highest in North America and Europe, a vast majority of countries in South America, North Africa, South-East Asia, Australia and New Zealand. According to WHO’s data from 2008, 1,380,000 cases of breast cancer and 458,000 deaths were reported. In the EU countries, one out of ten women comes down with breast cancer. The highest rates (80–90 cases per 100,000) concern women from North America, some regions in South America, the majority of Northern and Western Europe, and Australia. Then, according to Cancer Incidence in Five Continents of 2007, volume IX, the highest incidence worldwide occurs in the USA, Hawaii (standardised incidence rate by age is 118.9) and among the white female Americans living in District of Columbia (incidence rate is 115.2). When it comes to European countries, the highest rate occurs in Switzerland (Geneva, where it amounts to 103.0), Belgium (the Flanders – 101.3) and in Italy (Ferrara – 100.7). Breast cancer is the lowest in incidence in Mozambique (3.9) [1,2,3,4].
In recent years, breast cancer mortality rate in the US and UK has decreased by 25%. This trend is attributed mainly to the extension of indications for a follow-up treatment and implementation of mass screenings [1]. According to the forecasts, 20 million women will come down with breast cancer in 2020, half of whom will die. Every year 1.5 million women are being diagnosed with breast cancer [5,6].

Also in Poland breast cancer is the most frequently diagnosed cancer among women. In 2007, almost 14,500 women were diagnosed with this illness, whereas three years later — in 2010 — the number of diagnosed cases was 15,784. The number of deaths caused by breast cancer in 2007 were 5,355, whereas in 2010 — 5,226. Thus, the number of women afflicted with this illness is growing, although no growth in the number of deaths of breast cancer has been observed. The data presented by the National Cancer Registry over the years 1999-2011 proves a continuously increasing number of new cases of the illness. In Poland, the five-year survival rate is 75%. If the number of persons developing breast cancer continues to grow so rapidly, the incidence rate will be similar to its value in the countries of Western Europe. Mortality rate, like incidence, differs depending on the province, with the highest rate recorded in the Lower Silesia and Wielkopolskie provinces, and the highest mortality rate in Silesian and Kuyavian-Pomeranian provinces. The most important feature discriminating Polish people from other European countries is malignancy high incidence rate among people aged under 65 [5,6,7].

The aim of the study was to present the principles of breast cancer prevention and diagnostic tools for its early detection.

II. BREAST CANCER PREVENTION

Health protection measures, called preventive healthcare, were known already in the Ancient world, for instance from Egyptian papyri, or manuscripts from Assyria or Babylonia. Schools in Ancient Greece taught and applied the “better prevent than cure” rule. In the 19th century, the first department of hygiene, headed by Jean Halle, was established. He claimed that hygiene and preventive healthcare were crucial for all general medical actions and exerted a direct influence on human’s well-being. Current directions for preventive measures indicated by the World Health Organisation aim to guarantee the best level of health for people, which “will allow them to lead socially and economically efficient lives”. The World Health Organisation distinguishes three phases of prevention: primary and secondary prevention, as well as metaphylaxis [8].

Primary prevention is intended to reduce the risk of falling ill through positive health activities. It is also oriented towards early detection of any breast changes and reduction of women’s mortality. The factors quadrupling the risk of developing breast cancer include: age, country of residence, cancer in the other breast, and non-invasive breast pathology in the form of atypical hyperplasia. It is virtually impossible to avoid exposure to these factors. The group of factors which triple the risk of developing breast cancer include the time period within which hormones, in particular oestrogen, affect breast gland. Time of exposure to oestrogens depends on the timing of menarche and menoopause, the woman’s age at the first pregnancy, or number of ovulations. These factors may change due to early motherhood, physical activity, right body weight and a healthy lifestyle [8,9].

It is believed that 1% of breast cancer cases is related to the exposure to ionizing radiation, especially in women under 20, which is why its avoidance by young women is important for its prevention [10,11].

Carrying a BRCA 1 gene, especially in the case where breast cancer developed in first-degree relatives before they turned 50, is a significant risk factor. With respect to the patients with the highest risk of the breast or ovarian cancer, primary prevention includes removal of the uterus together or without appendages between 35-40 years of age. Other radical steps include bilateral mastectomy which reduces the risk of cancer even by 90% [8,9,10,11] or chemoprevention, that is using chemical substances to inhibit tumorigenesis. It was proved that tamoxifen and raloxifene — two selective oestrogen receptor modulators — effectively lowered the risk of breast cancer development in women with the highest risk associated with hereditary factors [12].

Secondary prevention consists in early detection of already existing illnesses and their causes, as well as in diagnosing and preventing their consequences. In the case of breast cancer, secondary prevention includes breast self-examination and a clinical examination. Breast self-examination raises health awareness among women and helps detect cancer at its early stage. As a matter of fact, 48% of malignant tumours are discovered by women themselves, 41% — in the imaging examination and 11% in the course of a clinical examination. The greatest advantages of breast self-examination include its common availability and low cost. It is agreed that regular breast self-examining allows for detecting lumps of 5-10 mm in diameter. In contrast, when done randomly or
sporadically, such self-examination helps discover 2-centimetre lumps on average [13,14,15,16].

Every woman should start self-examining breast at the age of 20. It should be done regularly, between 7th and 10th day of the menstrual cycle, when the mammary glands are less tight and tender. Women after menopause should do self-examination regularly once per month on any, personally selected day [17,18].

Breast clinical examination should be an integral part of every visit to the gynaecologist. It should be carried out by a general practitioner or gynaecologist at least once a year. The clinical examination comprises an interview and physical examination. The latter involves carrying out a detailed medical inquiry concerning all breast cancer risk factors in the examined patient (age, BMI, diet, lifestyle, age at menarche and menopause, number of births, genetic susceptibility, social and economic status) and, in the case where the patient observes some disturbing changes in the course of self-control, it is also important to gather information on what type of defects they are, when they first appeared, whether they are growing and if yes, how fast, whether they change throughout menstrual cycle, or whether they coincide with pain and some nipple discharge [8,15].

Physical examination in turn involves visual inspection and palpation of the whole breast by the doctor. The examination should begin with the visual inspection, preferably with the patient standing straight with arms hanging down by her side, and then raised above the head. At this stage, the focus is on the symmetry of breasts, their shape, skin puckering, outline of nipples, redness or breast swelling. Then, the “hands-on” examination (palpation) follows. It is important that palpation include the whole breast, especially an area between one breast and armpit (upper, outer quadrant), the cervico-clavicular region and armpit. The examination should begin with the patient in a standing or sitting position. Palpating breasts in the lying position may also prove helpful, especially with regard to lower quadrants. In the case of large breasts, it is useful to put a pillow under the blade in order to lift the examined side. Otherwise, the breast may fall on one side, which seriously hampers the examination. The best method for examination consists in moving around the breast in circles toward the nipple until the whole breast has been examined. In the course of the palpation, all four breast quadrants and armpits should be examined with regard to breast temperature, skin thickness and structure, lumpiness, general and localised tenderness, breast asymmetry, dense breast tissue, presence and localisation of a lump, and discharge from nipples. In the case of the patient with large breast, she should be asked to stand up and lean forward. This position helps discern, previously overlooked, breast asymmetry [15].

The analysis of studies proves that clinical breast examination, together with mammography, may lead to a decrease in the mortality rate caused by breast cancer by 25% in women aged between 50-69, and by 18% in 40-year-old patients. Other findings indicate that approximately 10-15% of breast cancer cases are detected not in the course of mammography screening, but in the clinical examination. The cost of the clinical examination is an opportunity cost incurred during the visit, i.e. these are the benefits the doctor might have lost as a result of devoting time for examination [19].

Metaphylaxis, the third phase of prevention, involves actions concerning an already developed illness. They include preventive measures against its consequences (e.g. restriction of functioning or disability) and systematic treatment. The third-phase prevention is intended to retrieve, in a possibly shortest time, the patient’s self-reliance by means of appropriate medical, social and professional rehabilitation.

III. DIAGNOSTIC EXAMINATIONS FOR EARLY DETECTION OF BREAST CANCER

Screening is the best strategy for early detection of breast cancer. Its effects are conditioned by appropriate preparation, implementation, performance, results and the patient’s readiness to accept them. According to the European Commission, the patient is the most important person in the course of screening examinations [21].

The most effective breast cancer detection method consists in massively organised long-term mammography screenings of healthy women. The screening’s effectiveness is assessed relative to the decrease in breast cancer mortality statistics. Recent reports show that 40% of cancer cases are detected in mammography screenings. Oncologists claim that mammography screenings help detect breast cancer even four years later than clinical examinations, in the course of which it is possible to detect one centimetre lumps, whereas in the case of mammography even 0.5 centimetre changes are detectable. Detection of such small changes increases the chance for a five year survival even by 25%. Regularly undergone mammography decreases breast cancer risk even by 50% in all age groups. Sensitivity of this method in detecting clinically asymptomatic changes is estimated at even more than 90%, whereas tumours detected in the course of screening constitute in 70–80% cases with good prognosis, where it is possible to implement sparing treatment
methods. The price of mammography constitutes its additional asset; it is estimated that the cost of the screenings which can prolong women’s life by one year is 1,000 złotys, whereas treatment of an already developed disease costs 10,000 złotys. In Poland, the National Health Fund has for many years been covering the cost of “Population-based Programme for Early Breast Cancer Detection”, under which free-of-charge mammography examinations are offered to women between 50-59 years of age every two years [20,22].

This examination is considered the best method for breast tissue micro-calcification imaging. Their detection is important for diagnosing pre-invasive and invasive breast cancer as 40% of cancer cases are visible in X-ray images in the form of micro-calcifications. Thanks to mammography, it is possible to detect lumps before symptoms are observed, as well as distinguish clinically diagnosed lumps. Benign breast lumps are usually homogenous, smooth and surrounded by a properly structured gland. In contrast, malignant lumps have usually irregular shapes, dense substance and the gland structure around them has most often undergone some change [22].

Many authors claim that mammography screening should be carried out by women over 40 every two years, and once a year by women over 50. The Polish Gynaecological Society recommends that mammography be performed every two years in case of women over 45, and each year in case of women 50+. The examination should be carried out during the first phase of the menstrual cycle, approximately on the 7th day, because dense breast parenchyma in the second phase hinders interpretation and usually requires additional ultrasound scan. Mammography is used as a scanning examination at regular intervals in high-risk group of women, and as an examination of suspicious or difficult-to-diagnose changes discovered in a clinical examination, as well as a patient behaviour and examination pattern at yearly intervals in order to detect potentially curable changes. Furthermore, it is performed to detect any cancerous changes before plastic surgeries or biopsy, and monitor condition of the patients undergoing sparing surgery or radiotherapy [22,23,24,25].

Ultrasound scanning uses the effect of the ultrasound wave rebound from the examined structure. This method is applied especially with regard to young women (under 35 years of age), when mammography does not bring satisfactory results due to a densely patterned gland. Some changes in the mammary gland are detectible exclusively by means of ultrasound scanning. The method is applied to differentiate solid and cystic changes, but also as an addition to mammography screening in women who are at the high risk of developing cancer. Besides, the examination may be particularly useful when the patient feels the change, while the doctor is unable to detect it and mammography fails to bring satisfactory results. Complementing mammography with an ultrasound scan in the case of the abovementioned group of women may enhance detection sensitivity of early forms of cancer even by 10% [8,21,26,27].

Recommendations for performing an ultrasound scan include a description of palpable irregularities, lack of any clear mammogram results, any changes in young women (under 30) or those pregnant or lactating, control of invasive procedures, and additional imaging in the case of high risk. As per the Polish Gynaecological Society’s recommendation concerning detection of hereditary, high risk of breast cancer, an ultrasound scan should be performed each year along with palpation examination in the case of women aged 20–25 [24-28].

A fine needle aspiration biopsy (FNAB) is a diagnostic method which allows for cytological diagnosis of changes of the benign or malignant nature. Indications for FNAB include cyst discharge, a suspected benign change in imaging tests, diagnostics of potential, locally advanced lumps, tumour local recurrence, and collection of the material needed for marking ER and PgR receptors status in the case of breast cancer. The fine needle aspiration is the most common biopsy due to the fact that it is inexpensive and easy to perform, carries the lowest risk of injury and, above all, brings reliable results. Its accuracy in differentiating between benign and malignant changes exceeds 90%. The risk of a false positive result is 0.6%, while of the false negative one – 0.4%. Such good results are attributable to the combination of three methods, i.e. a clinical evaluation, evaluation of mammography and FNAB result. Lack of atypical cells requires the applied method to be repeated or, in clinically palpable suspicious cases, a histopathological examination to be taken. A positive result of the FNA allows for undertaking an oncology therapy, while the material collected in the course of the examination helps evaluate the number and quality of steroid hormone receptors. It can also be applied in the cytometric analysis. The test is performed with the use of a syringe with an attached needle. The procedure consists in puncturing a breast lump and aspirating a small amount of tissue. A solid change puncture is used to collect a small number of cells into the needle lumen. Then, the material is transferred on a microscope slide where it is further examined. The material is held in the needle for a specific purpose as it prevents cell mass from disseminating in
the syringe. The advantages of this method include short waiting time for the result confirming atypical cell presence, its easiness and minor pain. The test does not require anaesthesia, can be performed in ambulatory conditions and does not cause serious injuries. If the material sample collection fails and the result proves unclear, or there occur certain differences in the clinical evaluation, the test should be repeated or a surgical (open) biopsy should be performed with an intraoperative histopathological evaluation [8,29].

A core needle biopsy (CNB) is classified as a method for collecting a tissue material. The examination may involve ultrasound, less often a mammogram, too. Its effectiveness is 94%. The core needle biopsy is more invasive than a fine-needle aspiration biopsy, but the collected material is more valuable. On the basis of the tissue material collected in the course of the core needle biopsy it is possible to determine presence of in situ or invasive cancer, as well as estimate pathology grading (with limitations), steroid hormone receptors and HER2 receptor. The method must be performed under local anaesthesia and involves making a 3-mm local skin puncture. The method uses a specially designed needle which allows for removing a small cylinder-shaped, 2-3mm in diameter and 1-2 cm long, part of tissue. It is recommended in the case of changes on the surface whose diameter exceeds 2 centimetres. After the examination it is recommended that a binding dressing be put to eliminate hematoma. The advantage of this method is collection of the tissue material which allows for more comprehensive microscope diagnostics than the fine needle aspiration biopsy. However, its minuses include a more extensive skin and gland injury and impossibility of removing the whole change, which can be done through mammotome biopsy. In the case of vacuum-assisted core biopsy the amount of collected material is larger and the information obtained matches the results of the core needle biopsy. Although the analysis of in-situ cancer material may include evaluation of the presence and degree of differentiation of micro-calcifications and necrosis, it does not allow for determining surgical margins and the size of a change [8,29,30,31,32].

Surgical biopsy is the oldest method which allows for obtaining the tissue material for histopathological examination. It is done by removing the entire abnormal part following its clinical and imaging examination. In the case of small breast lumps indicative of cancer it is best to remove them whole together with an edge of normal breast tissue (excisional biopsy). When changes are too extensive and hence impossible to remove, only part of the tumour is removed to make a diagnosis (incisional biopsy). Surgical biopsy is often considered a medical treatment. Its assets allow for micro- and macroscopic examination of the entire removed abnormal part, extension of a surgery with verification procedures involving the sentinel node or armpit lymph nodes and simultaneous termination of the surgical stage of the cancer therapy and collection of the tissue material in its entirety. Its minuses, in turn, include the necessity for general anaesthesia, use of a binding dressing, preventive antibiotic treatment, higher blood loss than in other types of biopsy, a scar after the surgery and a breast deformation [30,33].

Effects of biopsy depend on the experience and skills of a person performing the surgery or making a preparation, and of a pathomorphologist. Diagnostics and treatment procedures concerning breast abnormalities should be handled by a multidisciplinary team comprised of a radiology technician, radiologist, pathomorphologist, surgeon, oncologist and gynaecologist [34].

IV. SUMMARY

Breast cancer constitutes a serious medical and social problem among women. Preventive measures aiming to reduce cancer incidence and mortality should raise women’s awareness of the degree to which it is possible to eliminate risk factors and modify their lifestyle, as well as encourage them to undertake secondary prevention measures and take part in breast cancer screening programmes.

V. REFERENCES

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