MASS SCREENING FOR BREAST CANCER: BENEFITS, RISKS, COSTS

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In general, mass screening for health is of doubtful value, but specific programmes like breast cancer screening could be beneficial. Breast cancer is the major cause of death in middle-aged women in many countries. Experience in Sweden shows that properly designed and performed mammography screening can reduce mortality by one-third, and lead to a better quality of life for treated cancer patients. However, if radiation causes damage proportional to the dose even at low doses, these benefits could be offset by radiogenic cancers in younger age groups (particularly under 40 yr of age). In Sweden, the direct cost of screening equals about £15 sterling. Swedish authorities consider well designed screening justified. Optimization is necessary and involves design, technique, staff competence and organization. An optimized program should save one life in 100 in the screened cohort, while perhaps one life in 10,000 might be lost due to radiogenic cancers (with conventional radiation risk assumptions).

Key words: Mammography, Screening, Breast cancer, Radiation protection, Optimization

MASS SCREENING FOR HEALTH — IS IT USEFUL?

The advantages and disadvantages of general mass screening programmes aimed at early detection of various illnesses have been the topic of numerous discussions. On a general level, attitudes appear to be sceptical. It is impossible to achieve a 100% sensitivity or specificity, which means that some cases are not detected and that false positives occur. In addition, the costs may appear high compared to the possible benefits.

Nevertheless, some screening programmes for specific diseases such as distinct types of cancer, could be beneficial. One example is screening for cervical cancer. In several countries, among them Sweden, women of appropriate ages are regularly invited to have cervical smears taken. Although such programmes can be costly, there seems to be a broad consensus that they reduce cervical cancer mortality, and thus are justified from a medical-humanitarian point of view.

Breast cancer is another candidate for specific mass screening programmes. This paper reviews mammography screening from a radiation protection regulator’s view, and with particular reference to experience gained and decisions taken in Sweden.

BREAST CANCER SCREENING

The age-adjusted breast cancer incidence rate in Swedish females in 1983 was 0.09%, corresponding to 4273 new cases during that year (there were also 25 new cases in males). Thus, about 24% of all new cancers in women affect the breast. The incidence rate has increased by on average 1.2% per year since 1964.1

In 1983, 1461 Swedish females died of breast cancer. The total population of Sweden was 8.3 million with 4.2 million females; in total 41,799 females died in 1983.2 About 70% of the new cancer cases in females occur in those aged 40–74. Breast cancer is the leading cause of death among Swedish women aged 40–59 yr.

Primary prevention of breast cancer is not yet possible, since too little is known about its causes. Patient survival is more influenced by the stage of the disease at diagnosis than by the choice of therapy among currently available modalities.3

This is the basis for screening programmes using mammographic X-ray examination, directed towards women for whom no particular indication of disease exists.

Mammography is also used in ‘clinical’ investigations, when cancer is already suspected. This review
however is only concerned with screening of asymptomatic women.

The so-called HIP (Health Insurance Plan) study, started in New York in 1963, is an important example of such a screening programme. This was designed as a controlled prospective trial. Breast cancer mortality was statistically significantly reduced in the study group compared to the controls.

In the HIP study, the technical quality of mammography was low compared to present standards. Much of the success of the programme may be ascribed to the concurrent physical examination rather than the actual X-ray screening.

More recently, screening programmes have begun in a number of countries, among them Sweden. In these programmes, mammography alone is used as the screening method. On the other hand, image quality is substantially improved compared to the HIP study. The largest Swedish study concerns women aged 40-74 yr. In this study, mortality was reduced by about one-third in the study group seven years after the first screening.

**BENEFITS**

Reduced mortality is certainly a very important benefit achieved with breast cancer screening, but it is not the only one.

Long before reduced mortality had been proven, it was clear that mammography screening led to treatment of a large number of breast cancers at an earlier stage. Often, mastectomy can be avoided. In this way, the patients' quality of life improves. At least some of the screening costs might be offset by lowered treatment costs, although the net result of screening is still likely to be a cost to society.

An important psychological benefit is gained by a great number of women for whom a no-cancer diagnosis means relief and reduced anxiety. It has also been argued, but not proven, that mammography screening would have a positive educational effect. This would consist of alerting women to the possibility of breast cancer, and thus inducing them to regularly perform self-palpation. That would lead to earlier detection of 'interval cancers' (occurring between screenings).

Furthermore, screening programmes provide research opportunities, for instance regarding the natural history of breast cancer. In the long run, women will benefit from such research.

Unfortunately, precise evaluation of these benefits is difficult. Even if we limit our discussion to the indisputable reduction of mortality, there are differing views as to which age groups really gain this benefit.

Breast cancer is very rare before the age of 30. The incidence rate then increases steeply with age. Thus, screening mainly reveals cancers in middle-aged and older women. Since the HIP study, it is generally accepted that properly designed and performed screening programmes for women over 50 yr are defendable. It is rarely argued that women younger than 40 yr should be included. The 40-49 yr age bracket however is controversial.

Investigations performed so far have not been specifically designed to study effects in particular age brackets like the 40-49 yr group. Analysis post hoc of subgroups is scientifically dubitable, but frequently occurs anyway. Usually, the small number of cases in such subgroups precludes definite conclusions and leaves room for differing interpretations.

On the other hand, even if the relative benefits were assumed to be equal in all age groups (i.e. a mortality reduction of one-third is postulated for all patients), arguments against screening of younger women exist. Due to the lower baseline breast cancer mortality among younger women, the absolute benefit (number of lives saved) remains lower. In other words, costs and disadvantages such as collective radiation doses are higher per life saved.

The difficulty involved in the assessment is reflected in policy documents such as the recommendations of the U.S. National Council on Radiation Protection and Measurements. In 1980, this body concluded that mammography screening could not be recommended for women under the age of 50. In 1986, it was stated that benefit/risk ratios appeared favourable in women aged 40 or above. No conclusive mortality data specifically relating to the 40-49 yr age bracket had become available between 1980 and 1986.

**RISKS**

The female breast is one of the most sensitive organs for cancer induction by ionizing radiation. Since mammography uses X-rays, screening inevitably entails a theoretical risk of radiogenic cancers.

We believe that this theoretical risk is real, but small in properly designed screening programmes with state-of-the-art techniques. However, just as reduced mortality is not the only benefit, radiogenic cancer is not the only risk.

In fact, a *Lancet* editorial claims that the principal disadvantage of mammography is not the minuscule radiation hazard, but that it detects some preinvasive lesions which, if undetected, might not progress to overt breast cancer, and that it may hence lead to 'over-treatment.'