Alexander N. Sencha
Elena V. Evseeva
Mikhail S. Mogutov
Yury N. Patrunov

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Alexander N. Sencha
Department of Ultrasound Diagnostics
Yaroslavl Railway Clinic
Yaroslavl
Russia

Elena V. Evseeva
Department of Ultrasound Diagnostics
Yaroslavl Railway Clinic
Yaroslavl
Russia

Mikhail S. Mogutov
Department of Ultrasound Diagnostics
Yaroslavl Railway Clinic
Yaroslavl
Russia

Yury N. Patrunov
Department of Ultrasound Diagnostics
Yaroslavl Railway Clinic
Yaroslavl
Russia

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About the Book

This book is an ideal manual on the use of modern ultrasound in the diagnosis of breast pathology. It provides a comprehensive overview of current ultrasound techniques and explains the advantages and pitfalls of various ultrasound imaging modalities. Detailed attention is devoted to breast carcinoma, with guidance on differential diagnosis and presentation of pre- and postoperative ultrasound appearances. The most important benign breast diseases are also described and illustrated. Age-related features, including those seen in children and adolescents, are carefully analyzed, and an individual chapter is devoted to breast abnormalities in men. All aspects of lymph node appearances are reviewed in detail, with a special focus on the role of ultrasound in the evaluation of lymph node status. Ultrasound-guided breast interventions and imaging of breast implants are discussed in depth. This up-to-date and richly illustrated book will interest and assist specialists in ultrasound diagnostics, radiologists, oncologists, and surgeons.

Preface

Breast cancer is one dominating malignancy in women all over the world. The incidence of breast cancer is about 68 cases per 100,000 women (Rozhkova et al. 2008; Chissov et al. 2011) and is associated with high mortality. Late diagnosis of breast cancer is registered in 40 % despite seeming availability and the simplicity of breast examination: 25.5 % of patients have stage III and 12.3 % stage IV.

Methods of diagnostic imaging are of great value for breast pathology. US is now widely applied in mammology along with x-ray mammography. Modern US technologies, such as Doppler mapping, 3D, US elastography, and others permit brand new diagnostic possibilities.

The authors hope that this publication will help practical doctors to improve the quality of diagnostics and treatment of breast diseases.

Contents

Abbreviations

3D	three-dimensional image reconstruction
3DPD	three-dimensional image reconstruction in vascular regimen
ARFI	acoustic radiation force impulse
CDI	color Doppler imaging
CT	computed tomography
EDV	end diastolic blood flow velocity
FBD	fibrocystic breast disease
FNAB	fine needle aspiration biopsy
MRI	magnetic resonance imaging
PDI	power Doppler imaging
PET	positron-emission tomography
PI	pulsatility index
PSV	peak systolic blood flow velocity
RI	resistive index
US	ultrasound

Diagnosis of Breast Cancer: Modern Aspects

1

Breast carcinoma demonstrates high incidence and high mortality in female population. It keeps increasing despite the significant achievements in studying of cancer biology and modern approaches to treatment. Therefore, the correct and timely diagnosis of breast diseases is extremely important.

Early detection of breast carcinoma is the principal diagnostic aim. The equipment of medical institutions permits the so-called secondary preventive maintenance (screening) of breast carcinoma in healthy women without palpable breast masses.

Screening is a complex of activities and medical examinations (US in particular), targeted for identification of people with high probability of a certain disease (breast carcinoma in particular). Screening is an initial, preliminary, but effective enough stage of examination of a certain population. Its main objective is to detect the disease at such an early stage, so that the following treatment results in the change in the clinical flow and forecast of the disease. Screening implicates the elements of differential diagnosis that helps to optimally choose further examination methods, apply early treatment, and increase life expectancy. Screening is safe for a patient, easily reproduced, and almost independent on operator's skills and quality of equipment. It is comparatively cheap and not time-consuming. Its cost is definitely less than the expenses on preventive maintenance and treatment of corresponding pathology. One expected disadvantage of screening is low diagnostic accuracy. Negative screening US does not guarantee the absence of the disease. Similarly, the positive test does not testify to absolute presence of the pathology. A practical example of US screening is the breast US performed by a general practitioner with a simple stationary or portable scanner with the minimum set of US options (e.g., only gray scale). Such an examination aims to divide the patients into two groups: the norm or pathology. Early detection of a disease, especially malignant, enables to cure it completely. In cases of breast carcinoma, mammography is of special value. Theoretically, total mammographic screening for breast carcinoma should mainly involve healthy women. It promotes not only revealing the latent cancers but also involves a psychological aspect.

Patients with breast pathology are subject to the further complex US examination with all available diagnostic options. Such an examination implicates certain differential diagnosis with subsequent choice of therapeutic tactics or – in cases of suspected malignancy – a biopsy with morphological verification, operative treatment, and dynamic observation.

High preoperative accuracy of early diagnosis of breast carcinoma permits utilization of highly effective methods of treatment to carry out breast-conserving surgery in combination with modern optimized programs of radiotherapy or/and chemotherapy.

Methods of diagnostics of breast carcinoma

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1. Preoperative
   Principal
   A. Noninvasive
      - Clinical examination (anamnesis, survey, palpation)
      - X-ray mammography
      - US of the breast and regional lymph nodes
   B. Invasive
      - Stereotactic core needle biopsy with histology
      - US-guided fine needle aspiration biopsy (FNAB) with cytology
      - Vacuum aspiration biopsy with US or X-ray guidance
      - Nipple discharge cytology
      - Preoperative marking of impalpable tumors with barbed needles

   Additional
      - Ductography
      - MRI
      - CT
      - Scintigraphy
      - Others (electrical impedance tomography, radiothermometry, etc.)
2. Intraoperative
   - Urgent histology
   - X-ray of the excised sector the breast
3. Postoperative
   - Histology of the specimen

Diagnostic accuracy of *clinical examination* in revealing benign breast changes does not exceed 59.5 % in detection of breast cancer – 50–60 %. The sensitivity of clinical examination for breast carcinoma is 40–69 % with specificity of 88–95 % (Korzhenkova 2004). *Palpation* is also far from modern demands in detection of malignant lymph nodes. It fails to reveal metastases in 32–45.8 % (Bazhenova et al. 1985).

X-ray mammography is traditionally recognized all over the world and one of the most informative methods for diagnosis of breast diseases (Figs. 1.1 and 1.2) (Rozhkova 1993; Lindenbraten et al. 1997; Semiglazov 2004; Harchenko and Rozhkova 2005; Komarova 2006).

Mammography is the technology of acquisition of negative images (digital or analogue), which characterize penetration of X-ray through tissue. Mammogram is a two-dimensional image of the breast. It permits to analyze the density of glandular tissue and to detect and assess the location, shape, margins, and dimensions of lesions. Spatial relation of the abnormal focus can be analyzed via obtaining the images in several projections.

Mammography has the following advantages:
- Detection of impalpable breast lesions
- High diagnostic value
- Possibility of invasive and noninvasive diagnostic procedures
- Objective documented data accessible for dynamic analysis

Disadvantages of mammography are the following:
- Ionizing radiation
- Low value in dense and irregular structure of the breast

A patient is indicated for mammography in the following cases:
- Age of 40–50 years (with an interval of 2 years for preventive purposes)
- Age above 50 years (annually)
- Clinical signs or suspicion for breast carcinoma in any age

According to Rozhkova (1993), palpable breast tumor can be negative with mammography in 3.5–6 % of cases.

Tyurin (2011) reported that 2’936’212 mammographic examinations were performed in Russian Federation in 2009. Among them, 2’472’237 were screening mammograms. The sensitivity of mammography in breast cancer was 50–93 %. Impalpable carcinomas can be detected with mammography in 76–82 % of cases (Rozhkova et al. 1995; Shevchenko 1997; Chang et al. 1997; Korzhenkova 2004; Harchenko and Rozhkova 2005).

Utilization of new technologies in mammography and the combination of possibilities of analogue, digital, and 3D mammography is advantageous and opens new prospects in diagnostics of breast malignancies (Rozhkova et al. 2008).

Ductography is an X-ray modality, which implicates artificial contrasting of lactiferous ducts. It supplies information about the anatomy of lactiferous ducts: type of branching, dilation, contours, and lumen condition. It permits

assessment of intraductal lesions, their location, size, shape, and invasion (Fig. 1.3).

Ductography sometimes exhibits curative features. Pathological discharge from the nipple stops after a ductography in 40 % of cases due to the lavage of the ductal system with iodine-containing contrast agents.

Pneumocystography is the technology of introduction of gas (air) into the lumen of a breast cyst, accompanied by X-ray in two projections. The

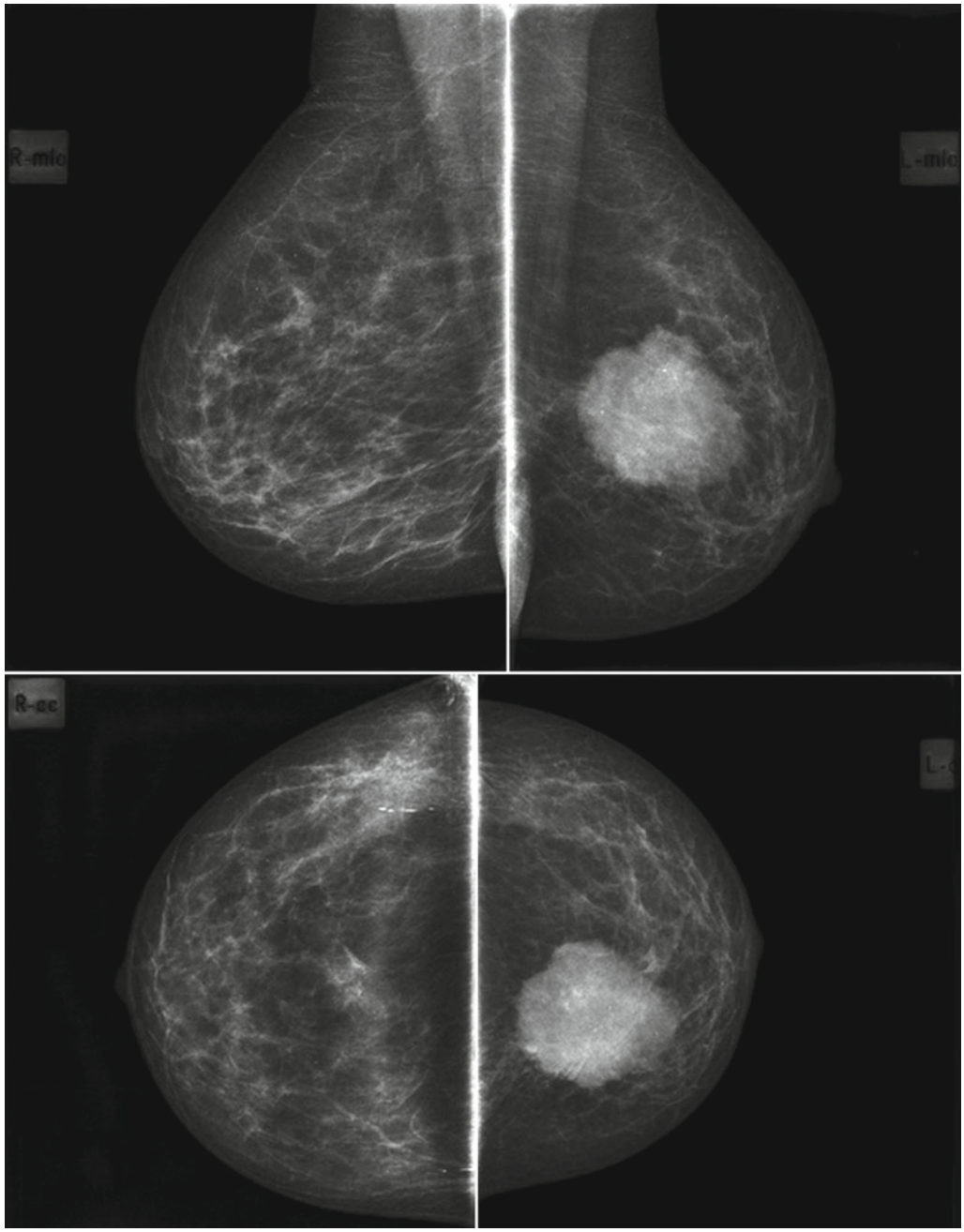

Fig. 1.1 *1–8* Mammography. Different types of breast cancer