Brief Description

Imaging modality using sound waves • Tissue-specific wave reflection.

Indications

Evaluation of palpable breast nodules • Evaluation of clinically occult mammographic findings • Complementary assessment of dense breast tissue • Assessment of breast tissue after reconstruction surgery or augmentation with silicone implants • Supplementary examination of women with a high risk for breast cancer • Guidance during interventional techniques.

Device-related Prerequisites

Calibration to 1540 m/s sound velocity • B-mode with automatic scanning • Matrix memory with more than 16 gray scales • Adjustable transmitting power • Measurement error < 3% • Image documentation with measurement scale • Display of rated frequency • Display of signal processing.

Technical Requirements

Digital or hard-copy documentation • Transducer frequency of > 5 MHz or multifrequency transducer • Image rate > 12 images/s • 128 gray scales • Field of view width of at least 5 cm at 1.5 cm depth • Variable focus • Monitor screen must display—patient name, date of examination, transducer identifier, measurement scale, body marker, capacity, depth adjustment, preset, depth scale • Symmetric imaging (right/left) • Depiction of wall irregularities in tumors • Depiction of cysts ≥ 4 mm diameter (better: 2 mm) • Penetration depth ≥ 4 cm.

Evaluation Criteria

- Echogenicity of lesion compared with surrounding tissue.
- Presence of hyperechogenic lesion wall.
- Shape (round, oval, lobular, irregular).
- Margins (circumscribed, microlobulated, obscured, ill-defined, spiculated).
- Surrounding tissue (disruption of continuous structures, e.g., Cooper ligaments).
- Transmission of ultrasound waves (i.e., posterior acoustic enhancement or shadowing).
- Compressibility.
- Internal structure (homogeneous/inhomogeneous).
- Lesion axis in relation to the skin.
- Mobility.
- Architectural distortion.
Fig. 5.6a–d  DCIS (high grade).

a  Histologic specimen.

b  Mammography. DCIS presenting with clustered, pleomorphic microcalcifications.

c  Ultrasonography. DCIS displaying intraductal tumor.

d  MR mammography (subtraction image). DCIS displaying ductal contrast enhancement.
Conclusion

Ultrasonography can be selectively performed in the diagnostic workup of palpable breast findings. In addition, ultrasonography is an important supplementary procedure in the diagnostic workup of ambiguous mammographic lesions, as well as in the assessment of dense breast tissue, where the detection of breast cancer on mammography is limited (ACR 3 and 4).
Fig. 5.7 a–d  Invasive ductal carcinoma.

a  Histologic specimen.
b  Mammography.
c  Ultrasonography.
d  MR mammography (subtraction image).
Definition

- **Epidemiology**
  Malignant stromal tumor • Very rare breast lesion (< 1%).
- **Etiology, pathogenesis**
  Usually an angiosarcoma • Development sometimes related to prior radiation exposure.

Imaging Signs

- **Ultrasound findings**
  Often lobulated, hypoechoic mass • Margins may be well circumscribed or indistinct • Pronounced echogenic rim • Posterior acoustic shadowing.
- **Mammographic findings**
  Usually lobulated, hyperdense mass • Usually indistinct, sometimes well-defined margins.
- **MR mammographic findings**
  Usually lobulated, hypointense mass in T1-weighted precontrast image • Usually hypointense mass in T2-weighted images, sometimes associated with increased signal intensity of surrounding tissues • Usually indistinct, sometimes well-defined borders • Inhomogeneous or peripheral (ring) contrast enhancement in T1-weighted postcontrast image with pronounced, pathologic contrast dynamics • Often displays signs of tumor necrosis.

Clinical Aspects

- **Typical presentation**
  Often large, palpable mass • Occasionally associated with livid skin discoloration (angiosarcoma) • **Histology:** Angiosarcoma, osteogenic sarcoma, rhabdomyosarcoma, malignant fibrous histiocytoma, leiomyosarcoma, fibrosarcoma, heman-giopericytoma, and liposarcoma.
- **Treatment options**
  Usually surgery (mastectomy).
- **Course and prognosis**
  Prognosis is relatively poor • Depends on tissue type and grade.

Differential Diagnosis

Necrotic ductal or lobular carcinoma • Phyllodes tumor.

Tips and Pitfalls

Malignant breast tumors are not fat-containing • Even liposarcomas rarely have fat inclusions.
Fig. 6.3 a–d  Sarcoma of the breast.
a  Ultrasonography (panoramic view). Indistinct, hypoechoic mass with echogenic rim.
b  Mammography, right MLO projection. Lobulated, partially indistinct, hyperdense mass.
c  MR mammography (MIP). Lobulated mass with inhomogeneous contrast enhancement.
d  Macroscopic specimen. Lobulated mass with central necrosis.