Background Information “Breast Care”

Breast Care Solutions by Siemens offer a comprehensive product spectrum for the diagnosis and therapy of breast cancer.

Breast cancer is the most common cause of cancer death in women, with numbers reaching close to 30 percent worldwide. On a yearly basis, 57,000 women\(^1\) are diagnosed with breast cancer and more than 17,000 die from it in Germany.\(^2\) Siemens Healthcare has developed comprehensive solutions for the early detection and treatment of breast cancer under the collective name of “Breast Care Solutions”. These comprise a combination of different imaging methods such as Ultrasound, Mammography and Magnetic Resonance Imaging (MRI) augmented by IT as well as lab diagnostics and radiation therapy solutions. Siemens places special focus on the third dimension: three-dimensional imaging of the female breast using two of the latest Siemens technologies, the ultrasound system Acuson S2000 Automated Breast Volume Scanner (ABVS), and 3D tomosynthesis with the digital mammography system, Mammomat Inspiration. They enable physicians to discern more details than previously.

The multi-modality approach to the diagnosis, treatment and rehabilitation of breast diseases (senology) is becoming more popular among physicians. Imaging techniques such as MRI and ultrasound as well as 3D breast tomosynthesis play an increasingly significant role – from early detection and diagnostics to after-care for breast cancer patients. These new technologies provide improved image quality and optimized workflows which support the physician during the examination. Immunodiagnostic tests provide revealing information about the therapy.

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\(^{2}\) Statistisches Bundesamt (Census Bureau), March 2007.
Digital mammography for screening

The digital full-field system Mammomat Inspiration with its basic function for screening has been on the market since the end of 2007. Presently, it has been implemented in more than 500 hospitals and private practices worldwide. Many new components provide physicians with improved images of the patient’s breasts facilitating diagnostic activities. The system features a MoodLight function which makes the examination environment more comfortable and less stressful for the patient. A host of functions and technical details allow for less radiation exposure during the examination than previously by using, e.g., a special X-ray tube with a Tungsten anode or new AEC algorithms which calculate individual doses depending on the size and tissue characteristics of the breast.

With the Mammomat Inspiration, physicians can perform biopsies in a simple and automated way with an additional biopsy unit that slides onto the mammography platform by hand. The mammography system automatically detects the biopsy unit and converts all functions of the hardware and software for the biopsy mode.

Tomosynthesis is a new mammography technique that expands conventional 2D mammography into an imaging technique similar to computed tomography generating 3D exposures of the breast. Taking exposures from several angles, a software-based algorithm uses the projection images to calculate 3D images without overlapping tissue, providing the radiologist with improved information. To date, Siemens sold around 50 breast tomosynthesis systems.

Ultrasound for early breast cancer detection

In cases of dense breast tissue or ambiguous mammography findings, ultrasound is widely used as an additional imaging modality to support physicians in reaching a more informed diagnosis. According to the New England Journal of Medicine, dense breast tissue increases the risk of breast cancer by a factor of five. While conventional mammography is the method of choice for early breast cancer detection, a study published by the RSNA (Radiological Society of North America) in 2008 found that if a screening ultrasound was added to a routine mammogram, 20 percent more cancers were revealed than with mammography alone.

Operator dependency and the time needed for hand held ultrasound have restricted its role in breast imaging to that of a secondary imaging modality to look at a palpable mass or a finding identified on a mammogram. A new method of acquiring and analyzing ultrasound images has the potential to change that. The Acuson S2000 Automated Breast Volume Scanner (ABVS) from Siemens AG

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3 AEC = Adaptive Exposure Correction (AEC); A new AEC algorithm further optimized dose calculation. All exposure parameters are adjusted automatically to the size and structure of the breast. Adaptive AEC offers significant flexibility in positioning the breast.


5 JAMA, May 14, 2008; 299: 2151 - 2163
Siemens is the world’s first multi-functional ultrasound breast scanner to automatically acquire full volumes of the breast. The system not only allows full-field volumetric image acquisition in less than 10 minutes, the sonographic volumes also provide an improved overview of the anatomy and architecture of the breast. Providing not only offline transverse and sagittal reconstructions, the Acuson S2000 ABVS also allows the display of the unique anatomical coronal view – from the nipple to the breast wall – which to date has not been available with conventional ultrasound imaging. This coronal view accelerates the diagnostic process and is a valuable instrument in operation rooms and resection planning. The Acuson S2000 ABVS is especially suitable for the early detection of breast cancer in women with dense breast tissue and highly suitable for the aftercare of breast cancer patients.

Increasingly promising for the examinations of nodes or changes in tissue (lesions) that are indicative of malignant changes is the relatively new method of elastography in breast imaging. **Elastography** provides physicians with a higher level of accuracy when characterizing breast lesions. Using soft tissue compression, eSie Touch elasticity imaging forms an elastogram that assesses the mechanical properties, or stiffness of tissue which is often correlated with pathology. According to the American Cancer Society, 80 percent of all biopsied breast lesions are benign, which is why a reduction of the number of unnecessary invasive breast biopsies would be highly welcome.

**Innovations in magnetic resonance imaging (MRI) for breast imaging**

Siemens developed the MRI system Magnetom Espree - Pink especially for breast imaging. The large magnet aperture of 70 cm makes examinations more comfortable, particularly for obese or claustrophobic patients than previous systems. Depending on requirements, patients are positioned head or feet first. For patients who felt cramped in previous systems, the design of the Magnetom Espree - Pink is highly advantageous. A so-called coil can be adjusted to different breast sizes and delivers excellent diagnostic image quality. In addition, biopsies can be performed with this MR breast scanner, should they become necessary.

Another technology is the proton MRI spectroscopy of the breast, which may replace biopsies for helping to determine the malignancy or benignity of lesions. This method provides the physician with essential metabolic information about the bio-chemical characteristics of breast lesions, which might help to support him in differentiating between malignant or benign lesions. According to a study in Radiology, 68 percent of biopsies for breast lesions could be avoided with proton MRI spectroscopy without underdiagnosing malignant cases in this patient cohort. With the syngo Grace software, Siemens offers a solution for proton MRI spectroscopy of the breast that may

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prevent unnecessary biopsies for many patients. Syngo Grace uses choline as the biomarker which not only improves differential diagnosis, but also provides simultaneous analysis of the biochemical characteristics of breast lesions.

The Magnetom Espree - Pink breast scanner, as well as a comprehensive range of applications specifically for MR breast imaging are enhanced by specialized syngo BreVis and syngo BreVis Biopsy software solutions. syngo Brevis is easy to use while simultaneously providing efficient diagnostic reporting. It enables almost fully automated reporting, elastic image correction of data should the patient move, color display of dynamic image information, and calculation of lesion volume. Diagnostic workflows are further optimized because the syngo Brevis diagnostic report is based on the BI-RADS classification.

Molecular imaging in breast cancer diagnosis

Siemens offers applications of various molecular imaging procedures for the diagnosis and therapy of breast cancer. Many types of cancer – including breast cancer – are prone to spread regionally to the lymph nodes because tumor cells travel and can metastasize via the lymph channel in the vicinity of the initial tumor. Lymphatic drainage scintigraphy using the Symbia SPECT/CT system (Single Photon Emissions Computed Tomography / Computed Tomography) enables the tracking of sentinel lymph nodes using radioactively marked substances that concentrate in them. Precise localization of these lymph nodes is possible even in complex locations because the anatomic landmarks can be displayed in a CT scan. Laboratory examination of these sentinel lymph nodes can eliminate the need to remove all axillary lymph nodes, and the resulting complications, for many patients.

The newest system from Siemens – the Biograph mCT molecular computed tomography system – helps in providing a precise cancer diagnosis. The system can be used in both radiology and nuclear medicine and is suited for PET/CT (Positron Emissions Tomography) as well as pure CT examinations. Various biomarkers help here in localizing remote metastases in bones and other tissue, supporting the physician in more precisely planning the follow-up therapy.

7 Biomarkers are molecules that make certain processes or substances in the human body visible, that is, they "mark" them. Detectable in blood, other bodily fluids or tissue, they can be indicators for diseases. Biomarkers can be produced by the body itself (e.g., special proteins after a heart attack) or in the lab: specifically developed biomarkers mark suspicious substances that indicate cancer or special proteins that are considered the cause of Alzheimer’s. Biomarkers also indicate whether a certain therapy is likely to be successful, i.e. HER.-2/neu: Reduced concentrations indicate successful treatment.
**Advances in radiation therapy providing individualized treatment**

For clinicians, treating breast cancer presents a number of challenges and care must be taken to spare healthy tissue; particularly the contralateral breast tissue, as well as the heart and lungs. Siemens’ latest linear accelerator, Artiste Solution, conveniently integrates imaging and treatment delivery technologies into one machine, giving clinicians the flexibility to provide specialized care. One of the imaging options, MVision Cone Beam Imaging, is efficient at providing the sharp soft-tissue contrast needed to precisely position the breast cancer patient. Using the 3D images acquired with MVision and Artiste’s 160 MLC Multileaf Collimator’s fast leaf speed allow clinicians to quickly and accurately deliver higher radiation doses to the target while helping to protect surrounding healthy tissue and vital organs.

**Therapy monitoring - advances in immunodiagnostics**

Twenty to thirty percent of all breast cancers are HER-2/neu positive. Traditional HER-2/neu assessment has been generally limited to tissue testing from primary breast cancer, where HER-2/neu status may be difficult to obtain, due to the location of the metastasis. The Serum HER-2/neu test by Siemens is the only blood test available in the U.S. for measuring HER-2/neu status in the blood of patients with metastatic breast cancer whose initial serum HER-2/neu level is greater than 15 ng/mL. It is the only serum test available to monitor HER-2/neu baseline values and serum HER-2/neu level changes over the course of the disease. Monitoring serum HER-2/neu levels yield important information about response to therapy, and may help physicians make more informed decisions when developing and modifying patient treatment regimens.

The **Siemens Healthcare Sector** is one of the world’s largest suppliers to the healthcare industry and a trendsetter in medical imaging, laboratory diagnostics, medical information technology and hearing aids. Siemens offers its customers products and solutions for the entire range of patient care from a single source – from prevention and early detection to diagnosis, and on to treatment and aftercare. By optimizing clinical workflows for the most common diseases, Siemens also makes healthcare faster, better and more cost-effective. Siemens Healthcare employs some 48,000 employees worldwide and operates around the world. In fiscal year 2009 (to September 30), the Sector posted revenue of 11.9 billion euros and profit of around 1.5 billion euros. For further information please visit: [www.siemens.com/healthcare](http://www.siemens.com/healthcare).

The products mentioned in this document are not commercially available in all countries. Due to regulatory reasons the future availability in any country cannot be guaranteed. Further details are available from the local Siemens organizations.