

Editorial report of the EUSOBI Breast MRI Training Course 2012.1
by Katja Flieger

EUSOBI introduces standardized education for breast MRI

Vienna, 29th Feb 2012. An outstanding faculty from across Europe presented updates on indication related state-of-the-art breast MR imaging during a two-day CME-accredited EUSOBI Breast MRI Training Course.

The EUSOBI Breast MRI Training Course marks an innovative and important improvement in European medical education. It aims at establishing a pan-European standardization of breast MRI, which will not only optimize MRI practice procedures, but also improve patient health status.

EUSOBI president **Thomas Helbich** and EUSOBI Vice President **Francesco Sardanelli**, who both chaired the course, introduced iPad interaction for continuous medical education in addition to the established oral presentation format: Participants were able to individually study cases, then test their knowledge with multiple-choice case questionnaires and a real-time automated poll system. For the first time participants also rated their confidence level for each diagnostic decision on a 5-point scale. This ensured better self-assessment, and also shed light on each participant's learning curve throughout the course, thus measuring potential patient benefit from the EUSOBI Breast MRI Training Course. The course was well received.

Challenges and perspectives for European Breast MR Imaging

Francesco Sardanelli reviewed the status of breast imaging in Europe. Overall breast cancer screening leaves room for improvement: The average breast cancer mortality to incidence ratio (M/I ratio) in Europe is currently 27%. Even countries with a fully rolled-out mammography-screening programme have not been able to reduce this ratio below 22%. "Although technology evolves fast, there is slow clinical progress", said Sardanelli. Meanwhile, breast MRI, which has long been seen as an adjunct to mammography, is further strengthening its role for breast cancer assessment. The EUSOMA working group was successful in establishing recommendations for MRI use: screening of high-risk women (20-30% or higher life-time risk), evaluation of response to neoadjuvant chemotherapy, augmentation or reconstruction, occult primary breast cancer and local recurrence.

However, breast MRI as a rapidly evolving "moving target" will potentially lead to modifications of these recommendations. Indications like preoperative MRI or DCIS are currently vividly discussed. New research hints that MRI might even be used as a tool for prognosis in the future. Breast MRI technology is established for T1 and T2 imaging, while MR spectroscopy remains under investigation. Sardanelli explicitly mentioned that – contrary to past, but still widely cited studies – MRI shows high specificity in breast cancer indications. He referred to his colleague Werner Kaiser from Jena, Germany, by saying "Please stop the mantra that specificity of breast MRI is low, because it is not true". Sardanelli named contrast-enhanced MRI – gadolinium enhancement of breast malignancies can provide a sensitivity of about 95% for invasive cancers and DCIS – contrast media dynamics, MRI BI-RADS descriptors, and MRI-guided vacuum biopsy as milestones in breast MRI development.

Scientific Updates on breast MR imaging

The first EUSOBI Breast MRI Training Course in Vienna 2012 included 16 scientific talks on state-of-the-art breast MRI imaging. The following summaries briefly touch on these topics and do not claim to be exhaustive. For detailed information please visit the [EUSOMA website](#).

Sequence basics

Despite many possibilities, gradient echo (GRE) dynamic T1weighted sequences remain most important for breast MRI. "If you talk about high specificity in breast MRI, it is this technique we are talking about, not breast MRI in general", explained **Pascal Baltzer**, Jena, Germany. However, every breast MRI should also contain a T2w-TSE sequence.

MR-guided interventions

BI-RADS IV and V are indications for MR-guided vacuum assisted breast biopsy (VABB). MR-VABB is preferable to MR-guided surgery and to MR-guided core needle biopsy. A retrospective ultrasound correlation is needed, possible hormonal influence and contraindications need to be checked. **Sylvia Heywang-Köbrunner**, Munich, Germany, underlined that scans should be performed during the follicular phase of the menstrual cycle, i.e. between day 3 and 14 of a normal 28-day cycle. She also gave detailed advice on how to do the VABB procedure correctly. “It is not recommended to perform MR-guided breast biopsy unless there is significant experience with the method”, she said.

3T breast MRI

Thomas Helbich, Vienna, Austria, clarified indications for 3T breast MRI. “At 3T we assess the morphology more precisely and we see more lesions”, said Helbich. Higher field strengths are also able to depict angiogenesis. “DWI with its apparent diffusion coefficient ADC is a biomarker to monitor adjuvant therapy”, said Helbich. Literature shows high accuracy – between 89.8% and 94.9% – for a combination of ceMRI and DWI.

Descriptors and interpretation

Laura Martincich, Candiolo, Italy, reviewed the correct descriptors for identifying abnormal contrast enhancement, showing various examples of different foci, mass enhancement and non-mass enhancement patterns, as well as dynamic (kinetic) enhancement characteristics. These descriptors should be used to correctly describe the next clinical step for the patient.

Other MR signs of breast MRI

Werner Kaiser, Jena, Germany, confirmed that MRI shows a very high diagnostic accuracy, i.e. both high sensitivity and specificity. However, “MRI could be done much better”, said Kaiser. For example, only few trials make use of all possible signs to differentiate between benign and malignant tumours. If the available signs are used, specificity goes up to 95%, said Kaiser. He showed various examples from a whole library of signs that represent various shades of malignancy and went well beyond wash-in, wash-out, darkness in T2 and perifocal oedema.

Normal breast, benign and borderline lesions

Federica Pediconi, Rome, Italy, explained features of the heterogeneous group of benign or borderline disease, which is classified by BI-RADS 2 (benign) and 3 (probably benign). MRI can improve the evaluation of borderline breast lesions. It has a high negative predictive value – a recent paper by Pediconi found an NPV of 93.1%. Contrast enhanced MRI is quite able to exclude the presence of malignancy in BI-RADS 3, even though it tends to underestimate the cases of DCIS, said Pediconi. She recommended checking the appearance on T2w images as a useful adjunct. 87% of breast cancers are iso- or hypointense on T2. Although hyperintensity on T2 is thus often associated with benignity, one needs to keep in mind that certain cancers may show areas of hyperintensity on T2, e.g. mucinous or medullary tumours.

DCIS

Christiane Kuhl, Aachen, Germany, strongly argued in favour of systematic MRI use for DCIS screening. This might improve the detection rate of prognostically relevant DCIS. It could also be used as a guide for DCIS treatment. Kuhl explained why: Mammographic diagnosis of calcifications used to be taken synonymously for DCIS. This, however, solves only half of the problem. Most likely more than 50% of all invasive breast cancers are not associated with calcifications and could, therefore, not be diagnosed with mammographic screening. Diagnosing DCIS thus requires a different set of diagnostic tools. Contrary to mammography, MRI sensitivity increases with biologic aggressiveness of cancer. MRI might thus avoid underdiagnosis of prognostically relevant DCIS. She suggested that every patient with BIRADS V or biopsy proven DCIS should get an MRI. Management decisions for BIRADS III or IV or “don’t know” cases would also benefit. Kuhl recommended MRI as the most sensitive tool for high grade DCIS.

Invasive carcinoma

Ritse Mann, Nijmegen, Netherlands, gave an overview of features of invasive breast carcinomas. With a sensitivity of about 95%, contrast enhanced MRI is a very sensitive modality: Breast cancers over 2mm in size show neovascularization, which can be depicted in dynamic contrast-enhanced T1-weighted MRI. Decreasing T1 relaxivity leads to an increase in signal: “Basically, breast cancer enhances.” Mann built awareness for the fact that typical malignant signs – like an irregular mass with speculated margins, heterogeneous internal enhancement, a type 3 curve, clear diffusion restriction and choline peak enlargement – do in fact cover two thirds of all malignant lesions. However, the remaining third shows various patterns. “You will need to integrate all signs for adequate diagnosis – if you are in doubt, don’t forget to do a biopsy”, recommended Mann.

High risk screening

Francesco Sardanelli commented on MR screening in high-risk women. While the American College of Radiology recommends MRI only as an adjunct to mammography, EUSOMA draws different conclusions, recommending MRI screening for patients with a 20-30% or greater life-time risk for developing breast cancer. He presented results from the Italian HIBCRIT (High Breast Cancer Risk Italian Trial)-1 and -2 studies. These findings demonstrate that adding MR to the screening regimen for high-risk women may enable detection of otherwise unsuspected breast cancers. Similar results were obtained in the German EVA trial. MRI may be seen as a stand-alone approach for screening high-risk women. Triple-negative cancers should, however, be cautiously evaluated, as there may be false negatives with MRI screening, especially in BRCA1 carriers.

Preoperative MRI

Christiane Kuhl, Aachen, Germany, added thought-provoking insights to the ongoing debate about pre-operative breast MRI. Kuhl underlined MRI’s undisputable diagnostic superiority for local staging compared to mammography with or without ultrasound. Accurate staging, i.e. delineating local disease extent in the ipsilateral and contralateral breast, is a prerogative for treatment decisions in patients with operable cancer. Although contrast-enhanced MRI should, therefore, be an integral part of the pre-operative work-up of patients undergoing breast-conserving treatment, clinical adaptation is slow for a number of reasons. Kuhl went into detail about two main arguments used against preoperative MRI, one being that there was no evidence from randomized controlled trials (RCT) on MRI impact on reoperation rates, recurrence rates and mortality, the second being that MRI leads to overdiagnosis and unnecessary surgery. She refuted the first argument with comprehensive data showing that there is no necessity for RTCs, as MRI for local staging already has the highest level of evidence. With regards to potential overdiagnosis and overtreatment, Kuhl identified a structural problem, which needs to be solved in the future: MRI depicts additional lesions, but adequate guidelines on the management of these MR-found lesions are lacking. Current guidelines, which are based on the mammographic demonstration of multicentric cancer are now applied to MR, i.e. a situation for which they were not established. They should consequently not be used. “Overtreatment does not occur because of MRI, but because of what the medical community does with the information – don’t kill the messenger”, said Kuhl. She encouraged the audience to realize the huge diagnostic possibilities of breast MRI, while acknowledging that the depiction of more and potentially physiopathologically different lesions must lead to novel treatment guidelines.

Neoadjuvant chemotherapy (NAC)

Fabienne Thibault, Paris, France, pointed out that radiologists are dealing with two target groups looking for different information from MRI in the neoadjuvant setting: Surgeons expect loco-regional assessment, which is derived from morphological information, while oncologists need more multi-level information. Both dynamic contrast enhanced (DCE) MRI and DWI achieve that goal, while both have different pros and cons. DCE MRI is more accurate than clinical and ultrasound examinations, but residual enhancement may be difficult to affirm. Additionally, histological changes following NAC contain the possibility of under- (rather than over-) estimation of residual disease. For DWI, studies

have shown that successful treatment of many tumour types can be detected by an early increase in ADC values. DWI holds promise as a response biomarker, as it is sensitive to tumour changes that can occur at a cellular level earlier than anatomical changes.

CUP Syndrome

Carcinoma of unknown primary (CUP) are a EUSOMA-recommended indication for breast MRI: It can identify occult breast cancer in 50% of all patients, said **Pietro Panizza**, Milan, Italy. It may facilitate breast conservation and if negative, breast MRI predicts low tumour yield at mastectomy. It is, however, not indicated in patients with extensive metastatic disease or when prognosis is poor. If MRI is negative, surgical treatment of the breast may be avoided. An MRI should only be performed if the results are likely to affect a treatment decision.

Breast implants and oncoplastic reconstruction

Julia Camps Herrero, Valencia, Spain, reminded the audience of indications for breast implant MRI. These include symptoms, suspected injury, diagnosis of abnormalities found on mammography and ultrasound, screening for implant rupture, planning for revision of plastic surgery, follow-up patients with oncoplastic procedures and high-risk patients. MRI remains the most accurate method for diagnosing silicone gel implant abnormalities.

Recurrence and equivocal findings from mammography and ultrasound

Fiona Gilbert, Cambridge, UK, stated that several small studies have identified MRI as the most sensitive technique for detecting breast cancer recurrence. However, these studies do not show cost-effectiveness. MRI should be used in BRCA 1/2 carriers who develop cancer, in the group with the highest risk of recurrence (i.e. under 40 years of age, grade 3 carcinoma, incomplete margins, no radiotherapy and no hormonal therapy), in dense breasts or when an occult primary is present (CUP). "We need better evidence to base our recommendations on", noted Gilbert. She said that MRI was not justified as a surveillance tool in patients with previous cancer. If conventional imaging suggests recurrence, needle biopsy should not be replaced by MRI. An MRI should, however, be performed when needle biopsy has been inconclusive.

New emergent indications: nipple discharge and B3 lesions at needle biopsy

Anna Linda, Udine, Italy, introduced MRI as a diagnostic modality for nipple discharge in patients with negative conventional imaging. In the clinical setting of nipple discharge, MRI shows excellent sensitivity and negative predictive value. A negative result on MRI would support clinical follow-up (as opposed to surgery). For B3 lesions at needle biopsy, i.e. lesions of uncertain malignant potential, management is still a subject of discussion. MRI has a high negative predictive value, i.e. it safely excludes the presence of malignancy in these B3 lesions. It might thus help to determine whether surgical intervention or radiological follow-up is better suited for a patient. Linda suggested that clinical and radiological follow-up instead of surgical excision could be safely recommended for two patient groups:

1. women with papilloma without atypia and
2. women with radial scar with normal MRI findings.

Reporting breast MRI

Karen Kinkel, Geneva, Switzerland, gave an overview on breast MRI documentation. Minimal requirements are maximum intensity projection (MIP) of both breasts in at least two dimensions for normal findings.

Additional information for single lesions includes early T1, T2 and arrow or colouring on MIP. Thin slice MIPs and the documentation of each lesion should be added for multiple lesions. She opted for clarity and effective choice of wording (e.g. by making use of the lexicon). This will increase the understanding of MRI reports as well as their reproducibility.