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Interview on Breast Imaging
Australia / Dr. Michelle Reintals

Breast imaging in Australia

An interview with Dr. Michelle Reintals, Director of Breast at IMED Queensland SouthernX Radiology in Brisbane, Australia, Chair of the Breast Imaging Reference Group (BIRG) of the Royal Australian and New Zealand College of Radiologists, and State Screening Program Radiology Coordinator at BreastScreen South Australia.

European Society of Radiology: *Breast imaging is widely known for its role in the detection of breast cancer. Could you please briefly outline the advantages and disadvantages of the various modalities used in this regard?*

Michelle Reintals: Biennial mammography (breast x-ray) is considered the gold standard for screening for breast cancer in women aged 50–74. Breast Screen Australia has been providing mammographic screening for over 20 years, with proven benefits shown by improved survival rates from the early detection of breast cancer. If an abnormality is found on a mammogram or a woman has a symptom, then ultrasound is routinely performed for further investigation.

Mammograms can be used to identify mass lesions, distortion of normal structures and calcifications, whereas ultrasound is used to characterise the abnormality by determining for example if it is solid, cystic, infiltrating or vascular.

As it is operator dependant and time consuming, ultrasound may not detect pre-malignant calcifications in the breast that may only be seen on mammography, and some small cancers may not be appreciated. In addition, ultrasound may detect many benign lesions such as inflamed cysts and this may result in the patient having unnecessary biopsies to prove they are benign.

As with any technology, there are advantages and disadvantages.

The pitfalls of mammography include slow growing lesions where stability is reassuring for a benign lesion and lack of detection of certain types of breast cancers, which may be difficult to perceive due to the nature of their biology and growth pattern.

Another limitation of mammography that is becoming topical amongst breast professionals is breast density. The ability to detect breast cancer depends upon subtle differences in contrast density between the normal breast tissue and the cancer. It is for this reason that women with high breast density are amongst the most difficult mammograms to read, as the cancers may be hidden by the normal background dense tissue.

To compound this dilemma, we also know that high breast density is associated with an increased risk of breast cancer. So not only are the mammograms more difficult to read, as the cancers are camouflaged by the normal surrounding tissue, but these women also have reduced detection of breast cancer on routine screening.

For this reason, and also applicable to women with a strong family history of breast or ovarian cancer, additional imaging technologies may be suggested for screening. These adjunct technologies include digital breast tomosynthesis (DBT) and breast magnetic resonance imaging (MRI).

Tomosynthesis obtains a series of low-dose x-rays through the breast at various angles, reducing the problem of summation effect, which is common in women with dense breasts. Its benefits include increased cancer detection rates, a reduction in the number of extra mammography views and a reduction in the use of ultrasound where the mammography abnormality is cleared.

The disadvantage is the extra radiation dose if it is performed in combination with mammography and the extra compression and discomfort for the women. The radiologist's reading time is significantly increased, as over 400 images are typically generated, compared with the standard four images with a mammogram.

Breast MRI is independent of breast density; it relies upon both the character of the tissue and the blood supply and enhancement pattern of an abnormality within the breast. It is highly sensitive in the detection of breast cancer.
The disadvantages of MRI are that it may detect many benign lesions that require further work-up with ultrasound and the possibility of biopsy, all contributing to patient anxiety. It requires an intravenous injection of contrast media and is therefore an invasive procedure. Also, recent reports have shown that the intravenous contrast medium used has the potential to accumulate in certain parts of the brain. Whilst gadolinium injection is not specific to breast MRI, the dilemma is that it is as yet unknown if this is significant or has long-term repercussions for the patient, and if so, what they may be. Given breast MRI is often performed routinely every year for women at high risk of breast cancer and in many circumstances from a young age (e.g. 25 years old) if known BRCA gene carriers, this has raised concerns. As a consequence of these recent findings, it is recommended that a cyclic structure gadolinium chelate is used in preference to a linear structure agent.

ESR: *Early detection of breast cancer is the most important issue for reducing mortality, which is one reason for large-scale screening programmes. What kind of programmes are in place in your country and where do you see the advantages and possible disadvantages?*
MR: Australia's population-based screening programme, Breast Screen Australia (BSA) has been in existence since 1991. The programme invites women of the screening target group between the ages of 50–74 to attend for a biennial screening mammogram. Statistics have shown a benefit from screening with a significant reduction in mortality rates. In 1991, when BSA commenced, 68 women per 100,000 died from breast cancer, compared with 44 per 100,000 in 2012.
The BSA Evaluation 2009 programme report demonstrated mortality reduction of 21–28% in the target aged women, in line with earlier randomised controlled trials undertaken in Europe.
Australia has six states, and each state provides an individual screening programme, which is held accountable to a high standard of practice by the National Accreditation Standards, under the jurisdiction of the national screening programme BSA.
The challenges that a population-based screening programme experience are numerous, and a country the size of Australia introduces many additional challenges that are unique, including access for rural and indigenous populations and satisfactory participation among the target-aged, resident female population.
Mobile bus units travel around Australia, which assists in breaking down the barriers of accessibility. Participation is centred around breast cancer awareness, which the Australian government promotes through the national screening programme. Participation rates are typically around 55% for the screening target group.
Other non-government programmes, such as the McGrath Foundation, contribute significantly to the awareness of breast cancer through sponsored events and October Breast Cancer Awareness month.
The benefits of a screening programme have been demonstrated with a reduction in mortality rates, but potential disadvantages of a population-based screening programme also exist. These include reduced accuracy of cancer detection in women with high mammographic breast density.
It is recognised that women with a high risk of breast cancer due to their family history or those women who are BRCA gene carriers, are eligible for annual mammographic screening.
So this raises the question, should we be reporting routinely on breast density? Should we be offering personalised screening pathways, incorporating family history, breast density, etc.? Should we be offering magnetic resonance imaging to women with high mammographic breast density?
This is a complex issue, with concerns relating to funding and resources, and patient anxiety.

ESR: *The most common method for breast examination is mammography. When detecting a possible malignancy, which steps are taken next? Are other modalities used for confirmation?*
MR: The imaging guidelines recommended for standard practice include the use of multiple modalities, and the individual application depends upon many factors, including the nature of the lesion detected.

A standard mammogram that reveals a lesion will be further investigated with spot compression views if the abnormality is a mass, density or distortion, or with magnification views if calcification. Typically ultrasound will then be performed to assess for a mass or infiltrative lesion, evidence of skin or chest wall involvement and if there is lymph node spread.
Fine needle aspiration or core biopsy may be performed, usually under ultrasound guidance, however, if the abnormality is not visualised on ultrasound (e.g. calcifications), then it is common practice to perform vacuum-assisted core biopsy on calcifications under mammogram guidance.
A radio-opaque site marker may be placed at the time of biopsy, where appropriate, in order to mark the site of biopsy and assist in localisation if excision of the lesion is required. They are typically used when a lesion is almost completely excised at biopsy or difficult to see under all imaging modalities. The site marker is a few millimetres in size, typically made of titanium or stainless steel, and is safe to remain within the breast long-term if the calcifications are benign.
Once the diagnosis of breast cancer is made, staging investigations are carried out to identify any spread of disease to lymph nodes or organs. The treatment will depend upon this pre-operative staging.
The staging investigations depend upon the size of the primary breast cancer.

1. Breast MRI may be performed for staging the size, extent of breast tumour burden, whether it is multifocal (multiple lesions within a breast quadrant) or multicentric (multiple lesions scattered throughout the breast), and if there is involvement in the contralateral (opposite) breast.
2. Chest x-ray, liver ultrasound or CT scan of the chest, abdomen and pelvis may be performed to assess for any spread to liver, lungs, or bone.
3. Whole body bone scan (WBBS) to assess for spread to bones.
4. Sentinel Node Biopsy (SNB) is performed on the day of surgery to identify the draining node from the site of the cancer, and this or the group of nodes are removed at the time of mastectomy or partial mastectomy. If these nodes prove to be malignant, then a second operation is required to remove any remaining nodes accessible in the axilla.

ESR: *Diagnosing disease might be the best-known use of imaging, but how can imaging be employed in other stages of breast disease management?*
MR: Imaging is used for screening for breast cancer and the diagnosis and staging of the extent of disease. There are circumstances where non-surgical treatment is administered.
Neo-adjuvant treatment is used in advanced cancers where the size of the tumour or the extent of lymph node spread is reduced with chemotherapy prior to surgery. This approach may also be used to reduce tumour size to allow breast conserving surgery.
Similarly, in frail or elderly patients who are not amenable to surgery, neo-adjuvant treatment, where the tumour is hormone sensitive (ER, PR positive), an aromatase inhibitor is used to locally control or reduce the primary cancer.
In all these instances, the tumour burden and extent of nodal disease is monitored at regular intervals, to ensure that the treatment is effective and the disease is responding to the chemotherapy or hormone treatment. If the tumour burden is increasing, then hormonal or chemotherapy agents can be altered. The imaging options available to closely monitor the tumour and nodal response are mammography, ultrasound and MRI. If there is distant spread of disease to common sites such as liver, bone, lung, or brain, then tumour response is typically monitored by CT scans.

ESR: *What should patients keep in mind before undergoing an imaging exam? Do patients undergoing radiological exams generally experience any discomfort?*
MR: A patient undergoing a breast imaging exam will usually be anxious about the process and the possible outcome. As health professionals, we are trained to recognise and manage patient anxiety, and show a personal yet professional side to the patient and express empathy.
It is important to be aware that some women experience significant discomfort during the mammogram and biopsy. It is important to explain the process and describe the experience when

obtaining the patient's consent, allowing time for any questions the patient may have regarding the procedure.
There are some suggestions that can be made when a women books in for a routine screening mammogram, which may reduce the physical discomfort. This applies to pre-menopausal women, where exams may be better tolerated between days 7 to 14 of their menstrual cycle.
If the study is being performed for symptoms, then timing with the menstrual cycle is unimportant, and imaging as soon as possible is optimal.
It is vital that the health professional shows guidance and knowledge of the patient's circumstance and gives advice on the diagnosis and management.

ESR: *How do radiologists' interpretations help in reaching a diagnosis? What kind of safeguards help to avoid mistakes in image interpretation and ensure consistency?*
MR: The detection of a breast cancer is a team approach and influenced by three main factors. These factors include image and display quality, mammogram positioning, and interpretation and perception of mammogram.

1. The quality and display of the image is influenced by image contrast resolution, display algorithms, and resolution of the computer monitors.
2. The quality of the acquired image is a challenge for the radiographer.
   The radiographer has the challenge of positioning the woman's breast such that all quadrants/axillae/infra-mammary folds/nipple are viewed, with minimal to no skin folds on view. The National guidelines for mammography stipulate required standards. These standards are monitored by the College of Radiologists via a Mammography Quality Assurance Program or in-house if within the national screening programme, by routine review of images and by giving constant feedback and ongoing education to the mammographers in the quality assurance programme.
3. The reading of a mammogram by a radiologist is task that involves both perception and interpretation. Whilst failure to detect breast cancer can result from multiple factors, it is important for the radiologist to be aware of any potential missed or interval cancers, as they may be due to a perceptive or interpretive error.
   The larger the number of mammograms read by a radiologist, typically the higher their cancer detection rate and the lower the missed cancer rate.
   Regular quality assurance sessions to review missed and interval cancers, multidisciplinary meetings, and peer education meetings, are important methods of improving cancer detection and maintaining a high quality of reading skill.

ESR: *When detecting a malignancy, how is the patient usually informed and by whom?*
MR: The primary care giver typically informs the patient of their diagnosis of breast cancer. This will depend upon the circumstance and whether the imaging was screening or diagnostic.
If screening was performed by the national screening programme, then the common scenario is that the patient attends a results clinic a couple of days after the assessment clinic workup and biopsy of the abnormality. Within the screening programme, the diagnosis of breast cancer is typically given by a breast surgeon.
In the diagnostic setting, patients in Australia may be assessed within either the public hospital or private imaging practice setting. Typically the doctor referring the woman for assessment will deliver the final pathology result to the patient and arrange referral to a breast surgeon for management.

ESR: *Some imaging technology, such as x-ray and CT, uses ionising radiation. How do the risks associated with radiation exposure compare with the benefits? How can patient safety be ensured when using these modalities?*
MR: Imaging should only ever be performed if there is likely to be a clear benefit, and that the potential benefit outweighs any possible risk from the procedure. There has been a clear benefit shown in the Australian screening programme, with a reduction in breast cancer deaths between 21–28%. Whilst this is significant, there is the potential issue of over-diagnosis. This refers to those

cancers which may not result in patient death if untreated. Whilst a discussion point, it remains a dilemma, as currently there is no way of accurately determining pre-operatively which cancers are harmful versus those that are not harmful, if left untreated.

ESR: *How aware are patients of the risks of radiation exposure? How do you address the issue with them?*
MR: The internet provides general information on a range of topics, including medical information, and therefore many patients will research what procedure their doctor has requested, and inform themselves prior to their appointment.
Radiation risk versus benefit is topical and is the subject of many questions from patients attending for a mammogram. It is the health provider's role to explain these risks and benefits and to allow the patient to ultimately decide what their preference is.
The Royal Australian and New Zealand College of Radiologists has a teaching portal available to members and also a general consumer section for the public, called Inside Radiology, where there is information on such topics. Breast imaging information at *Inside Radiology* is searched by approximately 13,000 people per month from 180 countries, and the website has approximately 200,000 visits per month. The optimal service is one where the principle of ALARA is adopted: ALARA is the acronym for the phrase 'As Low As Reasonably Achievable', which refers to the practice of keeping radiation doses as low as is practical to achieve a useful quality image.

ESR: *How much interaction do you usually have with your patients? Could this be improved and, if yes, how?*
MR: There is a distinction in service provision between population and personalised private breast screening.
In a population screening programme, there is no individualised service based on risk factors or personal contact with the patient. The patient undergoes their routine mammogram and receives her result via mail. If there is an abnormality seen by two readers interpreting the image, then the patient is recalled for assessment, at which time she will be given the results by a health professional in a results clinic setting.
In a personalised private breast screening programme, there is typically a clinical breast exam done by either a breast physician or breast surgeon and a mammogram read by a breast radiologist. If there is a symptom then further diagnostic workup will be done, which may include ultrasound, MRI, and biopsy.

ESR: *How do you think breast imaging will evolve over the next decade and how will this change patient care? How involved are radiologists in these developments and what other physicians are involved in the process?*
MR: Breast imaging is continually undergoing significant changes, improvements and upgrades. For many years analogue mammography and ultrasound were routine. In recent years there has been a transition to computer radiography (CR) and more recently to digital radiography (DR) with tomosynthesis and magnetic resonance imaging (MRI).
We have also seen the transition from fine needle aspiration biopsy (FNA) to core biopsy and vacuum-assisted core biopsy, due to advances in technology and biopsy equipment, and changes in management that require histopathology and receptor status of the tumour prior to the decision on surgery.
There are also software programmes available that assess the mammographic breast density, and with this awareness comes a consideration for adjunct screening such as tomosynthesis, MRI or ultrasound where deemed appropriate. These adjunct imaging techniques are also used in the setting of known risk factors such as family history and gene carrier status.
Screening imaging techniques are used to detect early, small, curable cancers.
Ultimately, despite these efforts, there remains a relatively high interval cancer rate, where cancers present between screening mammograms.

Whilst the mortality rates from breast cancer are decreasing, the incidence of breast cancer is increasing. Perhaps the future developments will look at how to reduce the interval cancer rates, by determining which are the cancers that cause this. We are already moving towards screening women based upon their breast density, having recognised this is a separate risk factor as well as a compounding factor in the reduced sensitivity of mammographic screening.
Should we be offering personalised screening pathways, incorporating family history, genetics, breast density, etc.?

Michelle Reintals, MBBS, FRANZCR, is an Australian radiologist, specialised in breast imaging, having undertaken fellowships at BreastScreen South Australia and observorships and sabbaticals in breast imaging at Memorial Sloan Kettering Cancer Center NYC, Brigham Hospital Boston, Curie Institute Paris and the Brussels Screening Program, during her 14-year career.
Dr. Reintals has worked in both public and private breast practices in South Australia and Australia in clinical, educational and administrative capacities, holding the role of State Screening Program Radiology Coordinator at BreastScreen South Australia. She has recently relocated to Brisbane to work for IMED Queensland SouthernX Radiology as Director of Breast.
Currently she is the Chair of the Breast Imaging Reference Group (BIRG) of the Royal Australian and New Zealand College of Radiologists and a Committee member of the Breast Imaging Group (BIG) and Mammographic Quality Assurance Program MQAP of the Royal Australian and New Zealand College of Radiologists and Australasian Society for Breast Disease (ASBD).
Dr. Reintals undertook a study into polyimplant prostheses in 2012 in South Australia with Prof. Michael Middleton MD, from San Diego. She has authored numerous papers on breast diagnostics and radiology techniques for Australasian conference presentations and publications, and assists in the tutoring and fellowships of young breast radiologists.