



Diagnostic Imaging Pathways - Breast Screening (Above Average Risk Women)

Population Covered By The Guidance

This pathway provides guidance on the screening imaging of adult female patients at higher than average risk of developing breast cancer.

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Quick User Guide

Move the mouse cursor over the **PINK** text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the **PINK** text box will bring up the full text.

The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	> 10 mSv

Pathway Diagram

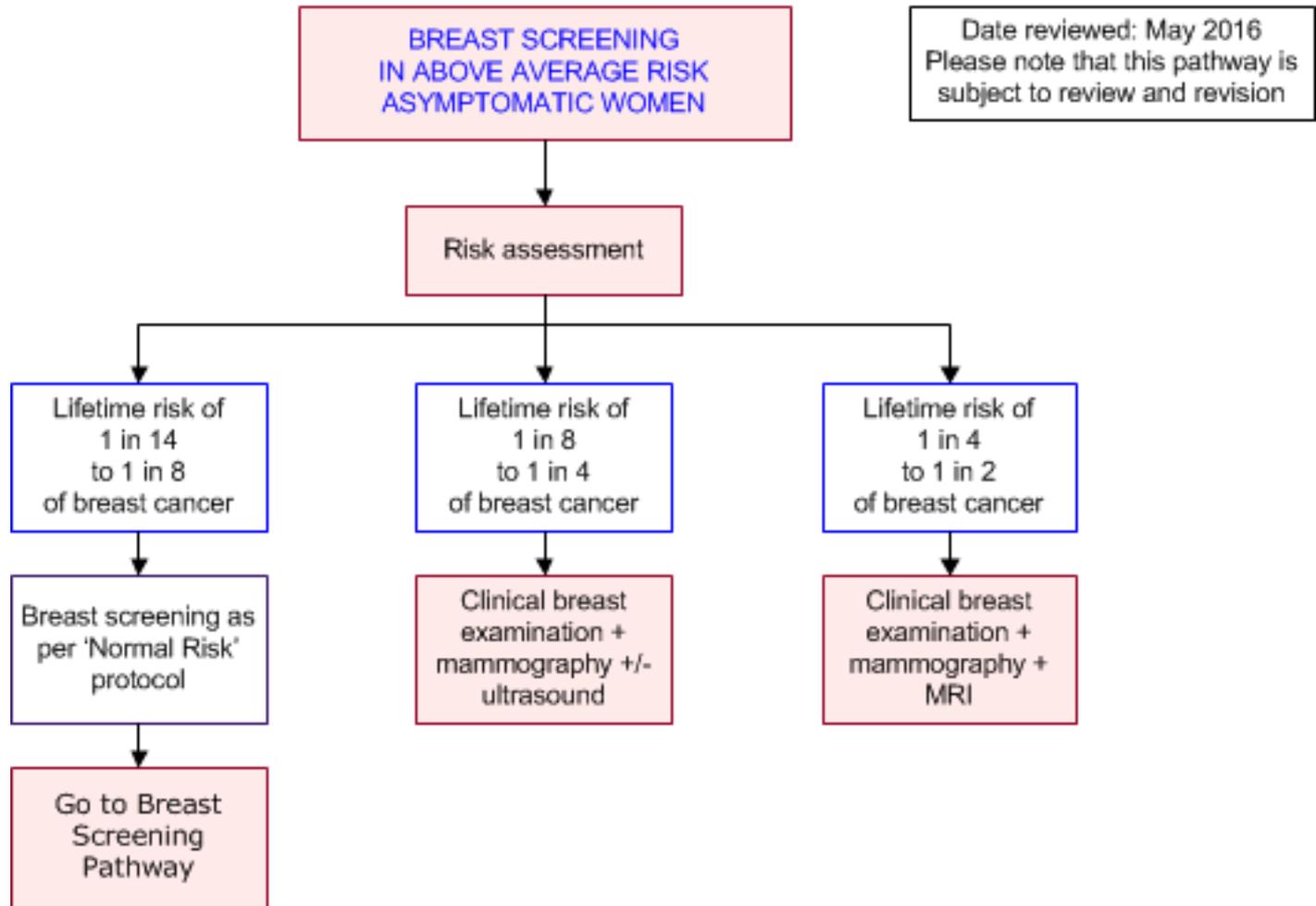


Image Gallery

Note: These images open in a new page

1



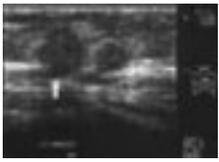
Breast Carcinoma

Image 1 (Breast Mammography): Stellate lesion with malignant calcification. In addition, there is inversion of the nipple and adjacent skin thickening. The features are highly suspicious for a breast carcinoma.

2

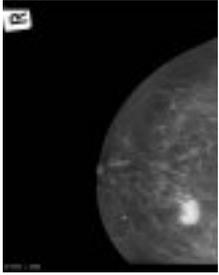
Breast Carcinoma

Image 2 (Breast Ultrasound): Poorly circumscribed region of increased



echogenicity on ultrasound consistent with breast cancer.

3a



Breast Carcinoma

Image 3a (Mammogram, right breast): A non-calcified 22mm mass is present in the upper inner quadrant of the right breast.

3b

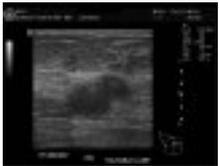


Image 3b (Ultrasound, right breast): Ultrasound of the same lesion showed an ill-defined solid mass with irregular margins, distortion of adjacent stroma and posterior acoustic shadowing, features which are suspicious for malignancy. Biopsy confirmed an invasive ductal carcinoma.

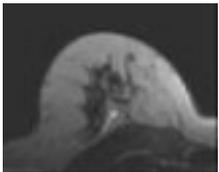
4a



Breast Carcinoma

Image 4a, b and c (Breast Magnetic Resonance Imaging): Images show an irregular spiculated mass causing distortion to the surrounding stroma. The features are those of an invasive breast cancer.

4b



4c



5a



Breast Carcinoma

Image 5a: Mastectomy showing an irregular pale tumour (arrow) with surrounding fibrosis consistent with a breast carcinoma.

5b



Image 5b (H&E, x2.5): Histological section of a moderately differentiated (Grade 2) invasive ductal carcinoma, type not otherwise specified, infiltrating through the breast parenchyma and surrounded by desmoplastic stroma. Occasional poorly formed tubules can be seen at the periphery (arrows).

6



Breast Carcinoma

Image 6 (H&E, x10): Histological section of a typical invasive lobular carcinoma showing the classical alignment of single cells in rows.

Teaching Points



- Women with an increased risk of developing breast cancer can develop a malignancy at a relatively young age compared to women at average risk
- It is important to obtain an accurate family history to determine risk clinically
- Screening for higher risk women begins at an earlier age
- Contrast enhanced MRI has been validated as a screening tool in these high risk women

Breast Screening in Asymptomatic Above Average Risk Women

- Women with an increased risk of developing breast cancer can develop a malignancy at a relatively young age compared to women at 'average risk'. It is therefore necessary to begin screening these 'above average risk' women at an earlier age than one would for women at 'average risk'
- This increased risk of breast cancer can usually be ascertained from a positive family history. In a small proportion of these women a gene mutation (most commonly BRCA 1 and BRCA 2) is responsible
- They also have a higher interval cancer rate and therefore screening intervals need to be adjusted to reduce the rate of interval cancers
- Mammography may be less sensitive in younger women where the breast tissue may be mammographically dense
- Contrast enhanced MRI has developed as a potential screening modality in women at 'high risk' of developing breast cancer and several large prospective trials have proved its efficacy in this regard

Risk Assessment

- The selection of the most appropriate screening regimen, begins by establishing the risk of breast cancer in any individual woman
- The following table is a composite of recommendations for risk assessment and is a guide [1](#)

Categories of Risk	Family History Criteria
<p style="text-align: center;">At or slightly above average risk</p> <p style="text-align: center;">> 95% of the female population</p> <p>Risk of breast cancer up to age 75: between 1 in 11 and 1 in 8</p>	<ul style="list-style-type: none"> • No confirmed family history of breast cancer • One first-degree relative diagnosed with breast cancer at age 50 or older • One second-degree relative diagnosed with breast cancer at any age • Two second-degree relatives on the same side of the family diagnosed with breast cancer at age 50 or older • Two first-degree or second-degree relatives on different sides of the family diagnosed with breast cancer at age 50 years or older
<p style="text-align: center;">Moderately increased risk</p>	<ul style="list-style-type: none"> • One first-degree relative diagnosed with breast cancer at age 50 or older



<p style="text-align: center;">< 4% of the female population</p> <p>Risk of breast cancer up to age 75: between 1 in 8 and 1 in 4</p>	<p>before the age of 50</p> <ul style="list-style-type: none"> • Two first-degree relatives, on the same side of the family, diagnosed with breast cancer • Two second-degree relatives, on the same side of the family, diagnosed with breast cancer before the age of 50 • No additional features of potentially high risk
<p style="text-align: center;">Potentially high risk</p> <p style="text-align: center;">< 1% of the female population</p> <p>Risk of breast cancer up to age 75: between 1 in 4 and 1 in 2</p>	<ul style="list-style-type: none"> • Two first-degree or second-degree relatives on the same side of the family diagnosed with breast cancer and one or more of the following on the same side of the family <ul style="list-style-type: none"> ◦ Additional relative(s) with breast cancer ◦ Breast cancer diagnosed before age 50 ◦ Bilateral breast cancer ◦ Breast and ovarian cancer in the same family ◦ Jewish ancestry ◦ Breast cancer in a male relative • One first-degree or second-degree relative with breast cancer at age 45 or younger or one first-degree or second-degree relative with sarcoma (bone / soft tissue) at age 45 or younger • Member of family in which the presence of a breast cancer gene mutation had been confirmed • Women who are potentially high risk

Clinical Breast Examination + Mammography ± Ultrasound

- Clinical breast examination (CBE) has been shown to solely detect between 4.6-10.7% of breast cancers. [2](#) However, this systematic review of the literature included patients who were both asymptomatic and those presenting to their physician with a breast symptom. Thus this may overestimate the usefulness of CBE in a truly asymptomatic population [3](#)
- There have been no randomised control trials to demonstrate whether CBE improves mortality [3](#)
- Evidence generally suggests there is a reduction in breast cancer-specific mortality with mammography screening [4,5,6](#)
- However there has been mixed evidence thus far regarding mortality in younger women specifically screened with mammography. A trial that enrolled women between the ages of 39-41 to screening mammography or control group, showed a significant reduction in breast cancer mortality in the intervention group in the first 10 years after diagnosis (RR 0.75, 95% CI 0.58-0.97) but no significant reduction from 10 to 17 years of follow-up (RR 1.02, 95% CI 0.80-1.30) [7](#)
- Radiation dose is a concern when using mammography to screen young women. The risk of annual screening with mammography (for radiation induced breast cancer) versus the benefit

- (detecting de novo breast cancer) is greatest when screening is begun below the age of 30 [8](#)
- Mammography is less sensitive in younger women due to an increased likelihood of the breast tissue being dense. This has led to a call for ultrasound to be used in addition to mammography in screening for breast cancer. Several series have demonstrated a higher diagnostic yield with sonography in clinically and mammographically occult breast lesions, in women with dense breast tissue [9,10](#)
 - In one trial looking at combined screening of high risk women with ultrasound and mammography to mammography alone, ultrasonography + mammography had a higher diagnostic accuracy (0.91 vs 0.78) compared to mammography alone and greater diagnostic yield (11.8 per 1000 vs 7.6 per 1000). [11](#) However, there are currently no trials which have proven a mortality benefit
 - Women at a lifetime risk of breast cancer of between 1 in 8 and 1 in 4, annual mammography should commence screening at age 40. The addition of bilateral whole breast ultrasound examination should be considered in women with mammographically dense breast tissue. [8](#) Though CBE is of questionable value, it may reinforce the need for ongoing screening and thus should be encouraged [3](#)

Clinical Breast Examination + Mammography + Magnetic Resonance Imaging (MRI)

- Clinical breast examination (CBE) has been shown to solely detect between 4.6-10.7% of breast cancers. [2](#) However, this systematic review of the literature included patients who were both asymptomatic and those presenting to their physician with a breast symptom. Thus this may over-estimate the usefulness of CBE in a truly asymptomatic population. [3](#) A more recent trial that screened a cohort of 'high risk' women with CBE, mammography and MRI reported sensitivities of 17.9%, 33.3% and 79.5% respectively for the detection of invasive breast cancer [12](#)
- There has been no randomised control trials to demonstrate whether CBE improves mortality [3](#)
- Evidence generally suggests there is a reduction in breast cancer-specific mortality with mammography screening, [4,5,6](#) however the benefits are less clear at younger ages
- A recent meta-analysis showed that in women aged 39 to 49 years there was a statistically non-signification reduction in breast cancer mortality with screening (combined RR of 0.92 (95% CI 0.75-1.02)) [13](#)
- In a diagnostic setting, MRI is a very sensitive tool for the detection of breast cancer. Especially for invasive breast cancer, the sensitivity of this imaging technique is reported to be above 95% [14](#)
- MRI has gained recognition as a potential tool in the screening of 'high risk' women for breast cancer, as mammography alone has been shown to have limited efficacy in this cohort of patients [15](#)
- There have been several large trials in high risk women that utilised MRI in a screening program. Sensitivities of 71-100% have been reported [12,16,17,18,19](#)
- This compares favourably to screening mammography and ultrasound in the same trials; mammography 33-36% and ultrasound 33-40% respectively [16,17](#)
- The increased diagnostic yield with MRI comes at the price of a higher number of false positive cases. Specificities of 90-97% have been reported with MRI. [12,16,17](#) This results in the need for further diagnostic tests, more biopsies of suspect lesions, increased costs and anxiety to the patient
- Whole breast ultrasound has not been shown to increase the cancer detection rate where contrast enhanced breast MRI and mammography are also being performed as part of surveillance. [17](#) Targeted ultrasound may have a role however, in the further evaluation of concerning lesions identified on MRI
- As distinct from mammography, no trials have yet been conducted to demonstrate a mortality

- benefit from the increased detection of breast cancer in these 'high risk' women with MRI. [20](#) Indirect measures of early tumour detection, such as lesion size and affected node disease may provide an indirect measure of the benefits of MRI compared to other diagnostic modalities [8](#)
- Women at a lifetime risk of breast cancer of between 1 in 4 and 1 in 2, should have annual mammography commencing at the age of 40 (or 5 years before the youngest family member affected by the disease, with the earliest commencing age being 30 years). [8](#) Women being considered for MRI should be referred to a high risk genetic clinic. Whether the investigations should be done concurrently, or spaced at 6month intervals have yet to be determined and no evidence currently exists to support either regime. [21](#) Though CBE is of questionable value, it may reinforce the need for ongoing screening and thus should be encouraged [3](#)
 - Given the ongoing research into MRI as a screening tool in 'high risk' women, consideration should be given to **referring eligible patients to multidisciplinary teams / high risk genetic clinics** with developing expertise in the field. This will lead to the collation of audit data, expertise in radiological interpretation / MRI based biopsy techniques and adequate follow-up of such women

References

Date of literature search: May 2016

The search methodology is available on request. [Email](#)

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. [Download the document](#)

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Information from this website	Information from the Royal Australian and New Zealand College of Radiologists' website
Consent to Procedure or Treatment	Gadolinium Contrast Medium



Radiation Risks of X-rays and Scans	Magnetic Resonance Imaging (MRI)
Magnetic Resonance Imaging (MRI)	Plain Radiography/X-rays
Ultrasound	Radiation Risk of Medical Imaging During Pregnancy
Plain Radiography (X-ray)	Radiation Risk of Medical Imaging for Adults and Children
	Ultrasound
	Breast MRI
	Breast Ultrasound
	Diagnostic Mammography
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