**Screen Detected Breast Carcinoma, with Coarse Calcification**

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<tr>
<td>Authors:</td>
<td>L. Ebrahim, D. Abeywardhana, D. Dissanayake, C. Metcalf, E. J. Wylie; Perth/AU</td>
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Learning Objectives

Breast calcifications are among the most common abnormal radiographic findings detected at screening mammography.

This essay illustrates the clinico-pathological features of nine screen detected breast carcinomas which had mammographically coarse, benign appearing macro-calcifications.

We aim to demonstrate that benign appearing calcifications within a breast lesion is not diagnostic of a benign process if the other imaging characteristics of the lesion are suspicious of malignancy.
Background

Screening for breast cancer in asymptomatic women is by two-view mammography in Australia. Calcifications detected on mammograms are evaluated to determine whether they are likely to be benign, suspicious or malignant. There are distinguishing imaging features for differentiating benign from malignant calcification described in the literature.

The American College of Radiology Breast Imaging Reporting and Data System classifies mammographic calcification into three categories: typically benign, intermediate concern, and high probability of malignancy, according to the type and distribution of calcification.¹
Between 1998 and 2011, a total of 1,109,849 screening examinations were performed by BreastScreen WA.

5,220 women were diagnosed with invasive breast carcinoma and 297 of these carcinomas contained mammographically detected calcifications.

We have retrospectively reviewed these women's mammograms and have found nine examples of morphologically benign, coarse, macroscopic calcifications in the index lesion on mammograms.

Out of these nine women, six were recalled in view of an associated mass or assymetric density on their screening mammograms. These were not all palpable. These six women underwent ultrasound guided core biopsies for histological diagnosis.

Two other women were recalled for further assessment of indeterminate calcifications, which then required stereotactic vacuum assisted core biopsies.

One woman had benign appearing calcifications associated with a mass on serial screening mammograms. It was initially thought to represent calcifications within a fibroadenoma but was subsequently diagnosed as breast cancer following ultrasound guided core biopsy targeting a sonographically indistinct lobulated anterior margin.

On histological assessment, four women were diagnosed with invasive duct carcinomas. Preexisting benign coarse, breast calcification appeared to have been engulfed by the tumour in two women (figs. 1-4). The malignant tumour was abutting a calcified fibroadenoma in another woman, where the conjoined lesions appeared as a single entity on mammogram (figs.5-6). In the fourth woman, the calcifications were dystrophic calcification of tumour necrosis (fig.7).

Two other women were diagnosed with Ductal carcinoma in situ (DCIS) (figs. 8-11).

Two women had Colloid carcinomas. In one case, the tumour was abutting preexisting breast macrocalcifications (figs. 12-13), and in the second case calcification in infarcted tumour was demonstrated (figs. 14-16).

Tumour bone formation in a Metaplastic carcinoma was seen on histology in the ninth woman in this series (figs.17-18).

It was the bone formation in this tumour that accounted for the mammographic appearance of coarse calcifications.
In summary we found a number of causes for coarse, apparently benign appearing calcifications occurring in malignant lesions in our series.

In three women the malignant tumour abutted adjacent benign calcifications and appeared as a single entity at imaging. In two women the malignant lesion had engulfed pre-existing benign calcifications in the breast.

Malignant macrocalcification was associated with tumour bone formation in a Metaplastic carcinoma and as calcification in an infarcted colloid carcinoma.

Two women had comedo DCIS, in which casts of dilated ducts appeared as macrocalcifications.

In general, there are a number of causes for breast calcifications on mammography.

Some breast calcifications represent casts of the spaces in which they occur, which determines their shape and arrangements. The matrix for these calcifications may be inspissated material (cysts), or damaged cells (comedo necrosis), where calcifications result from deposition of calcium salts on necrotic cells or tissue. Calcification not only occurs in the lumina of ducts and lobules, but also in the stroma. The calcium particles enlarge through appositional growth "calcium accretion" becoming detectable on conventional mammography when they reach a diameter of 0.1mm. These dystrophic calcifications may be coarse, dense, large and irregular as seen in inflammatory conditions. Calcification developing in the hyalinized fibrous stroma of fibroadenomas gradually coalesces to form coarse calcification.

Coarse calcifications are irregular mammographically conspicuous calcifications measuring more than 0.5mm as opposed to microcalcifications which are less than 0.5mm in diameter.

The commonest manifestation of DCIS is calcifications detected on screening mammogram in otherwise asymptomatic patients.

DCIS represents 22-45% of all detected breast cancers. The mammographically visible calcifications correlate with the histological subtypes of DCIS. High grade DCIS is usually associated with microcalcifications which may be pleomorphic, linear, branching or coarse clumps. In comedo DCIS, calcification of the extensive necrosis results in calcified casts of the ducts involved by tumour. As the ducts become further distended with large amounts of microcalcifications, these may appear as macrocalcifications on mammograms.
Metaplastic breast carcinoma is a rare form of breast cancer. It consists of a highly heterogeneous group of tumours. The commonest components include squamous or cartilaginous elements and the rarest component is osteosarcoma.\textsuperscript{6}

The differential diagnosis of bone forming breast tumours includes osseous metaplasia in a phylloides tumour, primary breast sarcoma and mixed breast fibromatoses.\textsuperscript{7}
Fig. 1: Left breast CC view. A 25mm. irregular mass, containing a 4mm coarse calcific focus anteriorly and finer micro calcification posteriorly.

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Fig. 2: Excision biopsy showing invasive Duct carcinoma (TUMOUR) surrounding a central space (SPACE) with a thin wall of dense pale fibrous tissue containing 1mm particles of shattered calcification (arrows, perhaps representing duct ectasia (original magnification 1.0X)). Inset shows calcification (arrows) within the dense fibrous tissue (original magnification 3.8X). Haematoxylin & Eosin.

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Fig. 3: Left breast magnified MLO view. A 30mm irregular density, containing coarse benign appearing calcification peripherally, and central microcalcification

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**Fig. 4:** Excision biopsy showing invasive duct carcinoma (TUMOUR) surrounded by fat (FAT). Multiple particles of calcification (arrows) measuring 0.5mm or less occur in the tumour or in DCIS (original magnification 0.6X). Inset shows calcification (arrows) within DCIS and tumour (original magnification 3.8X). Haematoxylin & Eosin.

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Fig. 5: Left breast MLO view. A 16mm scattered coarse calcifications within a significantly dense breast

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Fig. 6: Excision biopsy showing invasive duct carcinoma (TUMOUR) and an adjacent fibroadenoma (FIBROADENOMA) with a 0.5mm particle of calcification (arrow) in stroma (original magnification 1.0X). Lower right inset shows the calcified particle in dense collagenous stroma (original magnification 2.6X). Lower left inset shows infiltrating duct carcinoma (original magnification 6.6X). Haematoxylin & Eosin.

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**Fig. 7:** Left breast MLO view. A 30mm irregular mass, with coarse calcification extending from its anterior aspect towards the nipple.

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Fig. 8: Right breast MLO view. Widespread calcifications in the upper quadrant some of which are coarse.

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Fig. 9: Core biopsies showing duct carcinoma in situ (DCIS) (original magnification 1.0X). Upper left (original magnification 14.0X) and upper right insets (original magnification 14.4X) shows 0.25mm partly shattered calcifications (arrows) within dense eosinophilic fibrous tissue projecting into a space lined by tumour cells representing papillae. Lower right inset (original magnification 6.1X) shows a 1mm calcification (arrows) within dense eosinophilic fibrous tissue within a space lined by tumour cells. Lower left inset (original magnification 3.3X) shows DCIS with central comedonecrosis (NECROSIS) without calcification. Haematoxylin & Eosin.

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Fig. 10: Left breast CC view. A 17mm cluster of coarse calcification in the retro-areolar region, with no associated mass lesion.

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**Fig. 11:** Core biopsies showing high grade duct carcinoma in situ with particles of shattered calcification (arrows) ranging from 0.25 to 1mm including one large free-lying particle (original magnification 0.6X). Inset shows high grade duct carcinoma in situ (DCIS) with multiple calcified particles (arrows) associated with tumour (original magnification 7.3X). Haematoxylin & Eosin.

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**Fig. 12:** Right breast CC view. 2 discrete coarse calcific foci within a 4mm irregular density in the retro-mammary space.

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Fig. 13: Core biopsies showing high grade duct carcinoma in situ with particles of shattered calcification (arrows) ranging from 0.25 to 1mm including one large free-lying particle (original magnification 0.6X). Inset shows high grade duct carcinoma in situ (DCIS) with multiple calcified particles (arrows) associated with tumour (original magnification 7.3X). Haematoxylin & Eosin.

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**Fig. 14**: Left breast MLO views. A well defined 13mm mass superiorly, with coarse rim calcification towards its posterior inferior aspect.

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Fig. 15: Follow-up of the same woman in figure 14 three years later, the mass is now measuring 20mm with indistinct anterior lobulated margin

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**Fig. 16:** Excision biopsy showing a well circumscribed Colloid carcinoma (TUMOUR) with aggregates of often necrotic tumour cells lying within pale eosinophilic mucin (MUCIN). Multiple small round particles of calcification (arrows) are present in stroma (original magnification 0.9X). Inset shows calcified particles in fibroblastic stroma extending over 1.5mm (original magnification 16.8X). Haematoxylin & Eosin.

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Fig. 17: Right breast CC view. A 25mm ill defined mass with central irregular coarse calcification

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**Fig. 18:** Excision biopsy showing Metaplastic carcinoma (TUMOUR) with an area of metaplastic bone measuring 10mm and consisting mostly of osteoid with focal mineralisation (original magnification 0.5X). Inset shows 1mm calcification (arrows) within the dense eosinophilic osteoid interspersed with tumour cells (original magnification 6.7X). Haematoxylin & Eosin.

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Conclusion

Breast cancer is now the world's commonest life threatening cancer in women.

With the improvements in breast screening, cancer mortality rates are decreasing.

Mammographic calcifications can be the sole radiographic manifestation of breast cancer. It is important for the radiologist to be familiar with the common appearances of benign and malignant calcifications on mammography.

All the radiographic features of a potentially significant mass, or a new cluster of calcifications need to be further evaluated.

Benign appearing calcifications per se should not deter the radiologist from obtaining a biopsy if the lesion has other suspicious features, such as large size, irregular borders, or clinically enlarging mass.
References


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