Case Report

Image Guided Core Needle Biopsy (CNB) in Malignancy of The Breast—Part 2: Breast Ductal Malignancies other than Ductal Carcinoma In Situ (DCIS) and Invasive Ductal Carcinoma (IDC)

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Abstract

Breast lesions, both palpable and non-palpable may represent tumours, which can be benign, malignant, or a specific high risk lesion. Breast imaging is advised in order to detect and define lesions and its extension. It is compulsory to have pathological tissue diagnosis prior to surgical management. Breast ultrasound is our routine study in conjunction with mammography. The most common ultrasound (US) appearances of malignant breast mass are heterogeneous hypoechoic mass with angular or ill-defined margins and changes of posterior acoustic shadowing. This paper shows core needle biopsy (CNB) results of lobular carcinoma (LC) and ductal carcinoma with satellitosis, bilateral guided CNB, with nodal metastasis, mucinous carcinoma (MC) with diffuse intraductal papillomatosis, contralateral metastasis from MC and MC with contralateral IDC. The cases showed different clinical presentations and interesting examples of manifestation.

Keywords: image guided CNB, US guided CNB, lobular carcinoma (LC), mucinous carcinoma (MC), IDC with LC, IDC with MC, diffuse intraductal papillomatosis, contralateral metastasis.

Abbreviations

ABVS	=	Automated Breast Volume Sonography
BIRADS	=	Breast Imaging Report and Data System
CBS	=	Conservative breast surgery
CC	=	Craniocaudal
CESM	=	Contrast enhanced spectral mammography
CE-MRI	=	Contrast enhanced magnetic resonance imaging
CNB	=	Core Needle Biopsy
DCIS	=	Ductal Carcinoma In Situ
FNA	=	Fine needle aspiration
HER2	=	Human epidermal growth factor receptor 2
HH-US	=	Handhelds Ultrasound
IDC	=	Invasive Ductal Carcinoma
LC	=	Lobular carcinoma
LCIS	=	Lobular carcinoma in situ
LIQ	=	Lower inner quadrant
MC	=	Mucinous carcinoma
MCB	=	Mucinous carcinoma of the breast
MLO	=	Mediolateral oblique
MRI	=	Magnetic resonance imaging
MRM	=	Modified Radical Mastectomy
SSCM	=	Spot Cone Compression with Magnification
UOQ	=	Upper outer quadrant
US	=	Ultrasound

Breast lesions, both palpable and non-palpable may represent tumours, which can be benign, malignant, or a specific high risk lesion. Breast imaging is advised in order to detect, define lesions and its extension. It is compulsory to diagnose pathological tissue before surgical management. Following The American College of Radiology: Breast Imaging Report and Data System (BIRADS), for any suspected lesion with the chance of malignancy from 2% and above (BIRADS 4 and 5), pathological study is recommended. We present the imaging of malignancy with ductal origin.[1] This paper provides imaging with tissue sampling of breast malignancy other than ductal carcinoma, mainly LC, MC. In part 3: the paper includes benign lesions found from CNB.

Apart from DCIS and IDC, reported in part 1, there are 4 types of less common IDC, reported in this part 2 paper

1. LC begins in the lobes or lobules (glands that make breast milk). The lobules are connected to the ducts, which carry breast milk to the nipple.[2]
2. Lobular carcinoma in situ (LCIS) begins in the lobules and does not typically spread through the wall of the lobules to the surrounding breast tissue or other parts of the body. [2] While these abnormal cells seldom become invasive cancer, their presence indicates an increased risk of developing breast cancer later. About 25% of women with LCIS will develop breast cancer at some point in their lifetime. This subsequent breast cancer may occur in either breast and may appear in the lobules or in the ducts. LCIS is not cancer, so treatment may not be recommended. Frequent interval breast cancer screening is recommended for early breast cancer detection with a better treatment outcome.

Invasive lobular carcinoma (ILC) occurs in 5-10% of invasive breast cancers.[3] It starts in the lobules, invades nearby tissue and may spread (metastasize) to distant parts of the body.

It is often multicentric and bilateral (10-15%). Therefore, imaging evaluation of the contralateral breast is crucial. There can be very subtle changes such as progressive shrinkage or enlargement or reduced compressibility of the involved breast. Imaging often underestimates the disease. The sensitivity of mammography for the detection of ILC ranges between 57-81%. Given the limitations of mammography in detecting ILC, other modalities, such as sonography are recommended in our Centre. Furthermore, the contrast enhanced spectral mammography (CESM) is suggested to be used to detect, define, and assess the extent of disease, replacing MR imaging. ILC are more commonly seen on the craniocaudal (CC), than in the mediolateral oblique (MLO). Mammographic findings in order of frequency are:

- Spiculated mass lesion (most common)
- Asymmetrical densities (3-25%)
- Opacities or architectural distortions (10-25%)
- Microcalcifications (<10%)
- A proportion, 16%, of ILC are mammographically occult or benign[4]

Breast ultrasound is our routine study in conjunction with mammography. The most common US appearance is that of a heterogeneous, hypoechoic mass with angular or ill-defined margins and posterior acoustic shadowing.[5] An ill-defined heterogeneous infiltrating area of low echogenicity with disproportionate posterior shadowing is a characteristic of ILC.

Mucinous ductal carcinoma accounts for less than 2% of breast cancers. Microscopic evaluations reveal that these cancer cells are surrounded by mucus. Like other types of invasive ductal cancer (IDC), mucinous ductal carcinoma begins in the milk duct of the breast before spreading to the tissues around the duct. Sometimes called colloid carcinoma, this cancer tends to affect women after they have gone through menopause. Mucinous cells are typically positive for estrogen and/or progesterone receptors and negative for the human epidermal growth factor receptor 2 (HER2) receptor.

Most well-marginated breast masses are benign, but approximately 10-20% of breast malignancies may be well-circumscribed, such as mucinous tumors and papillary, medullary metaplastic carcinomas and malignant phyllodes tumors.[6]

Mammography, due to the presence of mucin, results in a low-density and relatively well-defined lobular mass. Sometimes they may have partly faded or obscure margins. Up to 20% of lesions can be occult on mammography. Calcification is rare in pure mucinous types.

At the ultrasound, MC often display mixed echogenicity with mixed solid and cystic components. Posterior acoustic enhancement is common. At times the lesion can be isoechoic to breast tissue on ultrasound, which can make diagnosis difficult.[7] Typically, US shows mixed cystic and solid components, distal enhancement, and microlobulated margins. Homogeneity on sonography is associated with the pure type of mucinous carcinoma of the breast (MCB), in which margins are usually well defined, and the tumor is iso-echogenic relative to the fat surrounding the breast tissue on ultrasound. A mixed MCB tends to be more hypoechoic.[8]

Medullary ductal carcinoma is rare and accounts for only 3% to 5% of breast cancers. It is called “medullary” because under a microscope, it resembles part of the brain called the medulla. It typically affects women in the late 40s and early 50s, more common in women with the breast cancer 1 (BRCA1) gene mutation. Medullary tumors are often “triple-negative” which means they test negative for estrogen and progesterone receptors and for the HER2 protein. It is less likely to involve the lymph nodes, more responsive to treatment, and may have a better prognosis than more common types of invasive ductal cancer.[2]

Papillary ductal carcinoma, is rare, accounting for less than 1% of invasive breast cancers, found in older, postmenopausal women. These cells resemble tiny fingers or papules. Papillary breast cancers are typically small, and test positive for the

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estrogen and/or progesterone receptors and negative for the HER2 receptor. Most papillary carcinomas are invasive and are treated like IDC.

Tubular ductal carcinoma is rare, accounting for less than 2% of breast cancer, more common in women older than 50. Tubular breast cancer originates in the milk duct, then spreads to tissues around the duct. Tubular ductal carcinoma cells form tube-shaped structures. Tubular breast cancers typically test positive for the estrogen and/or progesterone receptors and negative for the HER2 receptor.

The interesting cases are shown with breast imaging, CNB and surgical pathology of different presentation and imaging patterns, as follows:

1. Palpable breast mass, CNB reveals ILC vs. IDC, Surgical pathology reports a combined IDC and ILC, with lymph node positive.
2. Palpable breast mass, CNB reveals ILC.
3. Palpable breast mass, CNB reveals ILC focal signet.
4. Status postoperative: right CBS for ILC, CNB reveals ILC, and LCIS.
5. Palpable breast mass, CNB reveals IDC grade II, Surgery reveals LC, and ductal carcinoam with satellitosis
6. Yearly-follow up: Surgery: bilateral LC, and right axillary node metastasis.
7. Palpable breast mass, pathology reveals MC grade II, and diffuse intraductal papillomatosis.
8. Status postoperative: left total mastectomy, CNB reveals contralateral metastasis from MC
9. Palpable breast mass, CNB reveals some microcalcifications, no neoplasm. Follow-up: MC and a left IDC grade III.

Case Report # 1

A 51-year-old woman presented with a mass in her right breast. Mammography was performed, showing dense fibroglandular breast tissue. Mammography shows a large focal asymmetry area with spiculations in right upper outer quadrant (UOQ), seen with enlarged right axillary lymph node.

Automated Breast Volume Sonography (ABVS) reveals a large irregular shaped hypoechoic mass with peritumoral tissue reaction and combined pattern of posterior acoustic feature. Additional Handhelds Ultrasound (HH-US) in the right axilla confirms the mammography finding of micrometastatic node. Impression by breast imaging was done by BIRADS 5, suggesting tissue sampling for breast mass and fine needle aspiration (FNA) for axillary adenopathy. The CNB cannot differentiate ILC from IDC. At surgery, an irregular shaped tumour was removed and the surgical pathology reports a combined IDC and ILC, with lymnode positive. (Figure 1)

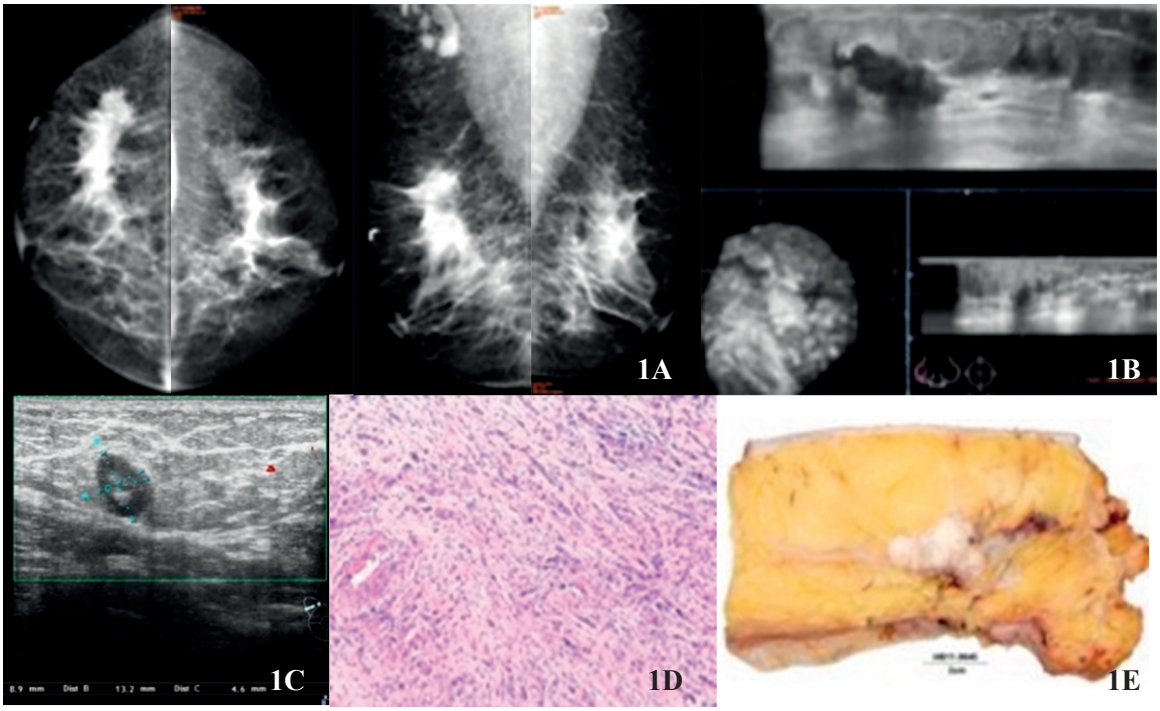

Figure 1: A 51-year-old woman with a mass in right breast.
1A: Mammography shows a focal asymmetry area with spiculation in right UOQ, seen with enlarged right axillary lymph node. **1B:** ABVS shows a large irregular shaped hypoechoic mass. **1C:** US shows micrometastatic node. **1D:** CNB cannot differentiate ILC from IDC. 1E: At surgery, an irregular shaped tumour. The surgical pathology shows combined IDC and ILC, with lymph node positive.

Case Report # 2

A 58-year-old woman presented with a palpable mass in her right breast. Mammography was performed, showing dense fibroglandular breast tissue. Mammography shows a subtle lesion in the palpable abnormality area in the right inferior aspect. Spot cone compression with magnification (SCCM) over the suspected area in both CC, and MLO views shows a round isodensity mass with microlobulation, surrounded by fat density and long spiculations radiated from the mass. Architectural disruption, retraction of skin and surrounding tissue are noted. Strong acoustic shadowing obscured posterior extension of the lesion. Impression by breast imaging was done by BIRADS 5, suggesting tissue sampling of the breast mass. CNB reveals ILC (Figure 2).

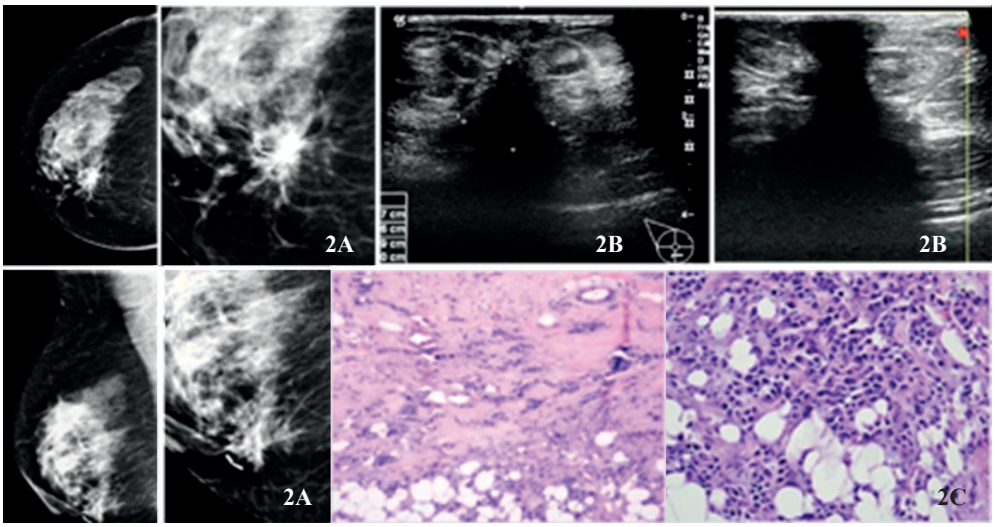

Figure 2: A 58-year-old woman with palpable mass in right breast
2A: Mammography with SCCM shows a mass with long speculation. **2B:** US shows an irregular shaped low-level hypoechoic mass with spiculation and retraction of skin and surrounding tissue. **2C:** CNB reveals ILC.

Case Report # 3

A 59-year-old woman presented with a palpable mass in her left breast. Mammography was performed, showing scattered fibroglandular breast tissue. Mammography shows an irregular-shaped hyperdensity focal asymmetry area (with hidden mass) in UOQ of her left breast. Long spiculations are seen, radiated from the mass. The impression by breast imaging was BIRADS 5, suggesting tissue sampling of the breast mass. CNB revealed ILC (Figure 3).

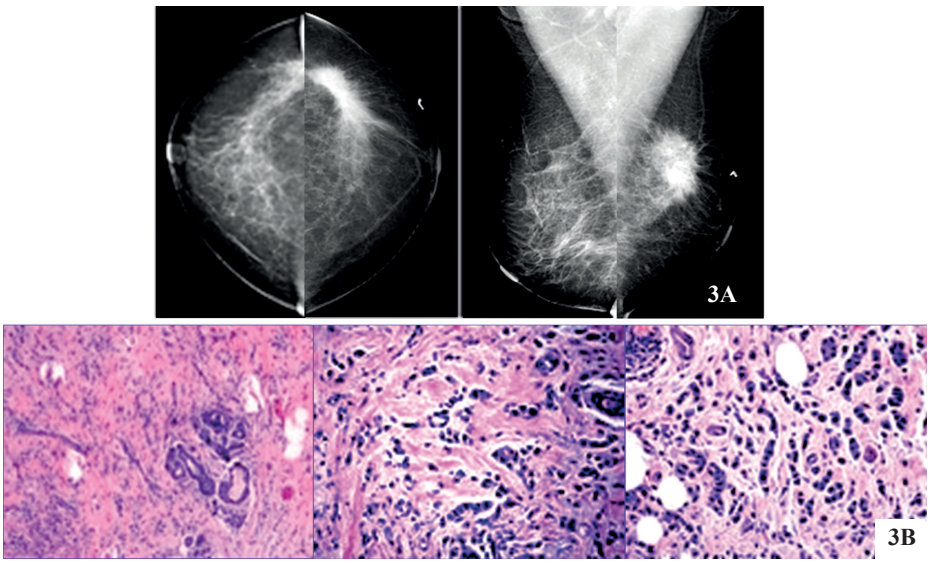

Figure 3: A 59-year-old woman with palpable mass in left breast.
3A: Mammography shows an irregular shaped hyperdensity lesion with long speculation. **3B:** CNB reveals ILC focal signet.

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Case Report # 4

A 57-year-old woman with post right breast surgery (CBS) for ILC, presented with a palpable mass in her right breast. Mammography was performed, showing dense fibroglandular breast tissue with breast asymmetry, smaller from previous CBS. A density is noted in the deep part of the central area of the right breast where metallic clips were placed in this post-op area. Mammography report showed no detectable abnormality in the left breast. This present US in 2007 reveals a small, well-defined oval-shaped homogenous hypoechoic mass with soft posterior enhancement, no peritumoral tissue reaction in the left central area. The lesion measures 3.3 x 8 mm in diameters and is indeterminate nature of solid or cystic lesion. The US in 2006 reveals a subtle tiny hypoechoic nodule, smaller than it is seen in the present study. The progression of the lesion is evidenced. Impression by breast imaging was BIRADS 4B, since cystic lesion can be enalrged over 1 year follow-up, too. Tissue sampling of the breast lesion was recommended. CNB of lesion in left breast reveals ILC and LCIS, found in many locations. It is not an uncommon phenomenon in LC (Figure 4).

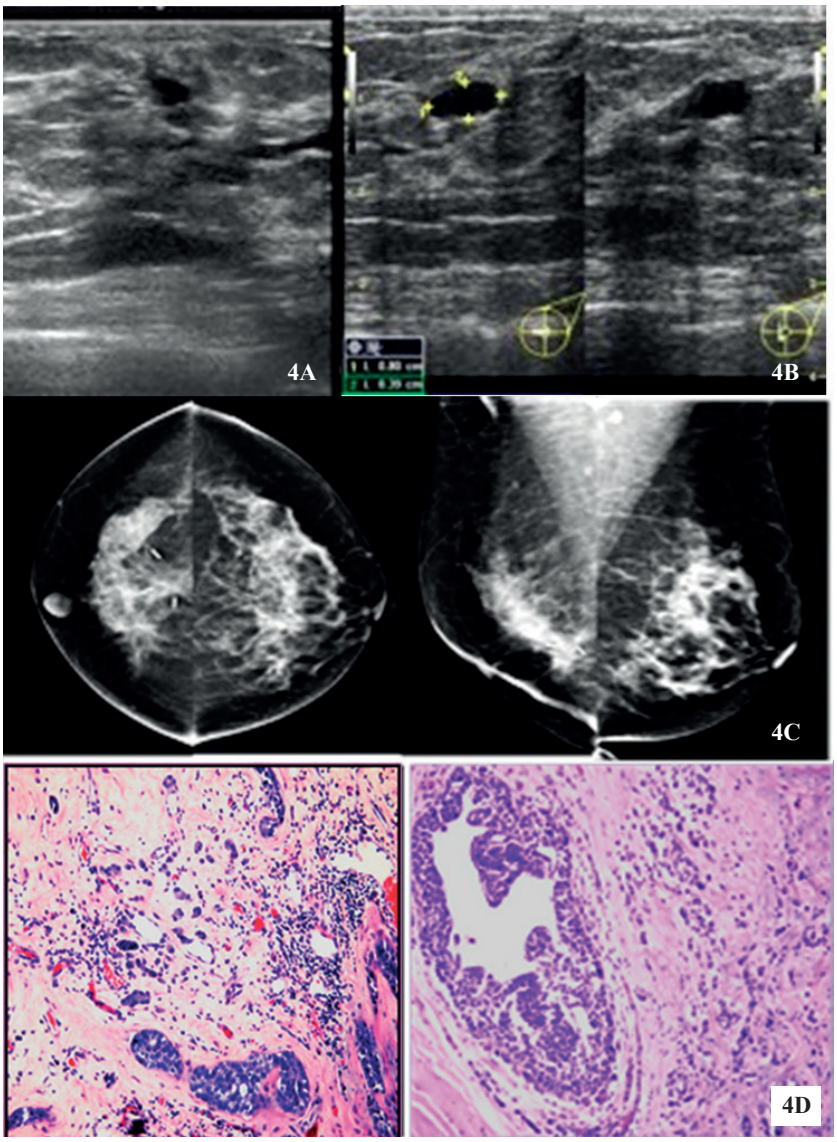

Figure 4: A 57-year-old woman with status postoperative: right CBS for ILC.
4A: US in 2006 showed a subtle tiny hypoechoic nodule. **4B:** US in 2007 revealed progression of a well-defined oval shaped homogeneous hypoechoic lesion in left central area. **4C:** Mammography showed no detectable abnormality in left breast. **4D:** CNB of lesion in left breast revealed ILC and LCIS.

Case Report # 5

A 65-year-old woman, came for breast screening. Clinical breast examination was negative. Mammography was performed on 12/10/2011, showing almost entirely fatty fibroglandular breast tissue. Two adjacent small hyperdensity masses with minimal speculation, no detectable microcalcifications are clearly defined in the right UOQ. US on the same day shows a hypoechoic mass, irregular shape, increased depth: width ratio. The impression by breast imaging was BIRADS 5, suggest US-guided CNB which revealed IDC, grade II. US guided NL for mass excision was performed on 27/10/2011 which revealed right LC and ductal carcinoma with satellitosis. The excised mass was not margin free and had negative node. The re-excision was performed on 07/11/2011. The specimen pathology is LCIS, multiple foci, free resected margins.

The one-year follow-up mammography was performed on 10/04/12 shows abnormalities in the right axillary lymph node and left SA (Subareolar). Mammography before and after removal tumour were shown for comparison in cone down display over the scar area. Mammography before and after tumour removal were shown in cone down display over the left SA area for comparison, and clearly demonstrates progression of the subtle left SA tumour. US-guided FNA of right axillary adenopathy and CNB of the left SA mass report the presence of LC. Right modified radical mastectomy (MRM) was performed on 12/04/2012 reveals malignancy in both breasts and right axilla (Figure 5).

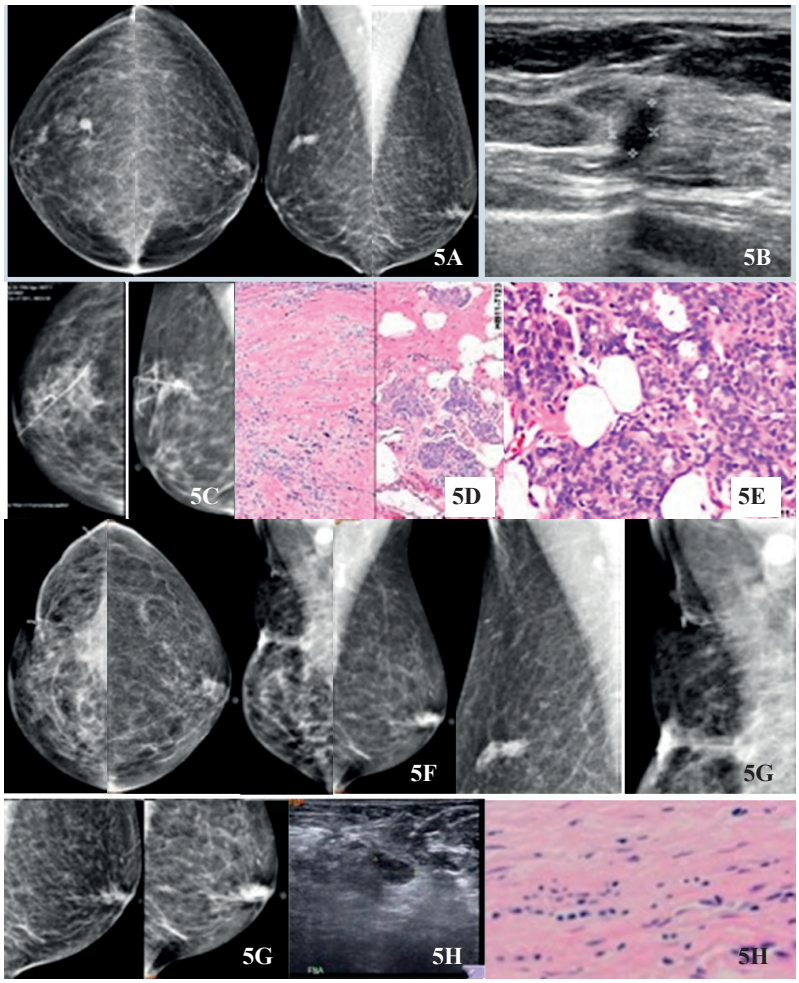

Figure 5: A 65-year-old woman with LC and ductal carcinama with satellitosis.
5A: Mammography (12/10/2011) showed a small spiculated mass. **5B:** US shows a hypoechoic mass, irregular shape, increased depth: width ratio and CNB reveals IDC, grade II. **5C:** US-guided NL for mass excision (27/10/2011) reveals right LC and ductal CA with satellitosis (5D), margin not free with negative node. **5E:** Re-excision (07/11/2011) specimen: LCIS, multiple foci, free resected margins. **5F:** Mammography (10/04/12) shows abnormalities in right axillary lymph node and left SA. **5G:** Compares Mammography before and after removal tumour. **5H:** US of right axillary adenopathy with FNA & CNB showing LC. Right MRM (12/04/2012) revealed malignancy in both breasts and right axilla.

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Case Report # 6

A 64-year-old woman, came with a palpable mass in her left breast. Clinical breast examination confirmed a well-defined mass in left UOQ, rather superiorly located, thus easy to detect by the patient, while the deeply located mass may not be palpable in most cases. Mammography was performed, showing scattered to minimally dense fibroglandular breast tissue. A small hyperdensity mass with fine pleomorphic microcalcifications is clearly defined in left UOQ. There are multiple scattered tiny clusters of microcalcifications in other areas. US shows a large irregular shaped heterogenous hypoechoic solid mass with strong posterior acoustic shadowing in left UOQ, at the complaint area. Increased abnormal vessels are accompanied. US can also show another tiny low level hypoechoic lesion, unknown solid or cystic nature of lesion in left lower. The impression by breast imaging was BIRADS 4C. There is incidence of multicentric and multifoci of LC, thus simple mastectomay was performed and the specimen radiography shows the lesion. Pathology reveals MC, grade II and diffuse intraductal papillomatosis.

The diffuse intraductal papillomatosis is a risk lesion, and carcinoma may develop later on in her lifetime. Another precaution is that inside this lesion there may be malignant changes in areas where we did not perform tissue sampling. Therefore, if the US shows the typical pattern of this papillary lesion, rather than I do not advise CNB, but rather suggest excisional biopsy is suggested.

Another good practice is to search for multicentric and multifoci of the lesion by CESM which can replace contrast enhanced magnetic resonance imaging (CE-MRI). CESM provides high resolution mammogram as well as direct digital subtraction contrast enhanced of breast lesion / abnormality instantly at the same time. The study was performed by giving IV contrast medium as for any x-ray based imaging (intravenous pyelography (IVP), computed tomography (CT)) around 3 minutes before the study and the enhancement last longer than CE-MRI. The patient was set for positioning (in both CC, and MLO view) then dual energy mammography with direct digital subtraction was performed. With one breast compression, the first energy gives high resolution mammogram, and the second energy in a second afterward, still with the same positioning and compression was exposed. This second energy captures enhancement of the breast tissue and lesion/s. Both images are instantly pre-programmatic subtracted, leaving the abnormal enhaned lesion, such as malignancy shown instantly on the monitor at the same time with the high resolution mammography. This is almost the same principle with CE-MRI.

I did not use CE-MRI thereafter because the machine I bought (High resolution mammography with CESM, tomosynthesis and stereotactic guided intervention) was available at the same price, and was even cheaper than the machinery without CESM. The study time was a few minutes, including the injection of iodinated contrast medium, takes 2 imaging CC&MLO or a mediolateral (ML) per one breast, instant subtraction with no misregistration of pre and post CE-MRI because there is no movement. The contrast medium is cheaper, the resolution is higher (mammography resolution) and microcalcifications are clearly seen in the mammogram, as we know, unlike those seen in magnetic resonance imaging (MRI). It is not that I do not like Breast MRI, I have the first report breast MRI with colour displayed, using circular coil for spine, at a time when breast coils were not available on the market. This paper was reported in 1994 in SIS (International Society for Breast Diseases - "Senology" – also known as breast diseases). I have done hundreds of CESM and lectures in many countries. Among many indications I have written before, CESM should be performed prior to CBS, to search for multiple lesions. Formerly, I did not push CE-MRI because there was a limited supply of MRI units. The study time and cost of the study are high, and might not be appropriate in many institutes.

For the record, another innovation I have reported is the US of the breast, when all textbooks stated that US could not be used on superficial structures. I had this report in the Union for International Cancer Control (UICC) in 1986, using the only available 3 MHz large US probe in the market. I used water bag, as a stand-off device before the commercial stand-off probe was in the market, too. I called it the WB Technique, which stands for "water bag" or Wilaiporn Bhothisuwan Technique. I gave lectures in many places, too (Figure 6).

Case Report # 7

A 84-year-old woman, post left total mastectomy on 19/05/2011, see the right breast mastectomy photograph, confirmed as MC grade II with 10 metastatic left axillary lymph node. Mammography of right breast on 22/03/2012 shows scattered fibroglandular breast tissue with no convincing breast lesion. An enlarged right axillary hyperdense round mass is noted in right axilla. SCCM of right axillary lymph node confirmed a hyperdense mass, round shape with minimal microlobulate outline, compatible with axillary adenopathy. Breast US reveals homogenous hypoechoic lesion in right axilla, associated with blood vessel at nodal hilum. Impression by breast imaging was right axillary metastatic l.n, recommend tissue sampling. US-guided tissue sampling was performed, reveals contralateral metastatic MC (Figure 7).

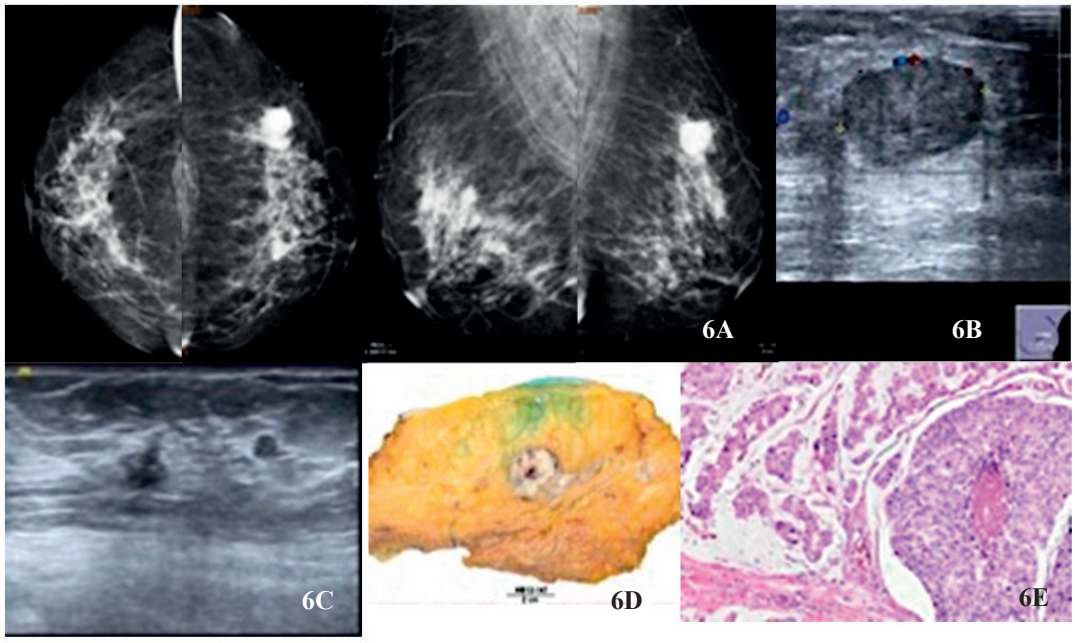

Figure 6: A 64-year-old woman with mass in left breast
6A: Mammography shows a hyperdensity mass with fine pleomorphic microcalcifications and multiple scattered tiny clusters. **6B:** US shows an irregular shaped heterogeneous hypoechoic solid mass in left UOQ. **6C:** US of another tiny lesion in left lower. **6D:** Gross specimen of the simple mastectomy. **6E:** Pathology

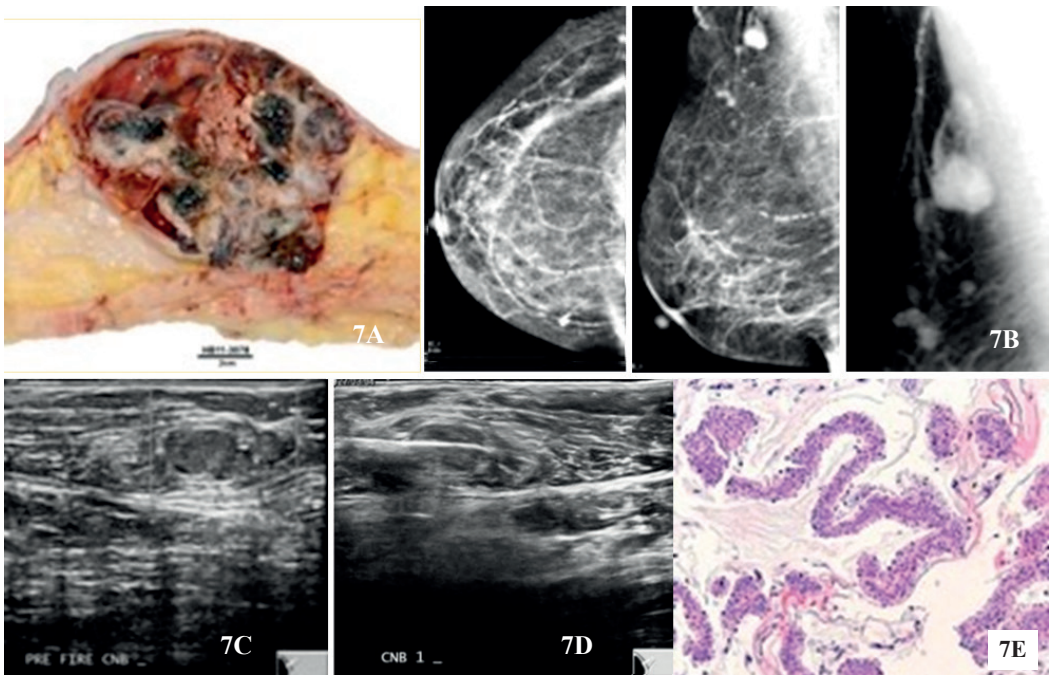

Figure 7: A 84-year-old woman with status postoperative, left total mastectomy (19/05/2011).
7A: MC grade II with 10 metastatic left axillary lymph node. **7B:** Mammography of right breast (22/03/2012): Enlarged right axillary adenopathy, confirmed by US (**7C**). **7D:**US guided CNB was performed, reveals contralateral metastasis from MC **(7E**).

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Case Report # 8

A 42-year-old woman had palpable difficulty due to a larger dense breast. Mammography of her larger breast shows dense fibroglandular breast tissue with subtle focal breast asymmetry. No abnormal calcifications, architectural distortion, nor enlarged axillary adenopathy was detected. US reveals a well-defined rather homogenous hypoechoic mass containing multiple tiny cystic lesion in right UOQ. Increased blood vessels to the lesion and slightly inhomogeneous extensive posterior enhancement were noted. The impression by breast imaging was done by BIRADS 4b, which advised tissue sampling. CNB was performed, reported as breast stroma, a few ductal epitheliums, with some microcalcifications, no neoplasm.

The patient came 18 months later for reduction mammoplasty. Mammography revealed a large round hyperdense mass with lobulated outline in right lower inner quadrant (LIQ) which is obscured in dense breast in the previous study. The left breast was unremarkable. The US clearly showed a large round heterogeneous hypoechoic mass with minimal lobulation. Increased blood vessels inside the lesion (pathological vessels) and slightly inhomogeneous extensive posterior enhancement were demonstrated. Surgical specimens during reduction mammoplasty reported as a right MC and a hidden left IDC grade III (Figure 8).

The precaution for US-guided CNB as a negative study might be due to the cutting chamber of 15 mm, located 5 mm from the needle tip which is between 5-20 mm from needle tip, may pass through and far beyond the lesion. Therefore, the image will show the needle well inside the lesion. Checking the needle tip is essential. Do not mistake the off field of view (FOV) needle as its tip.

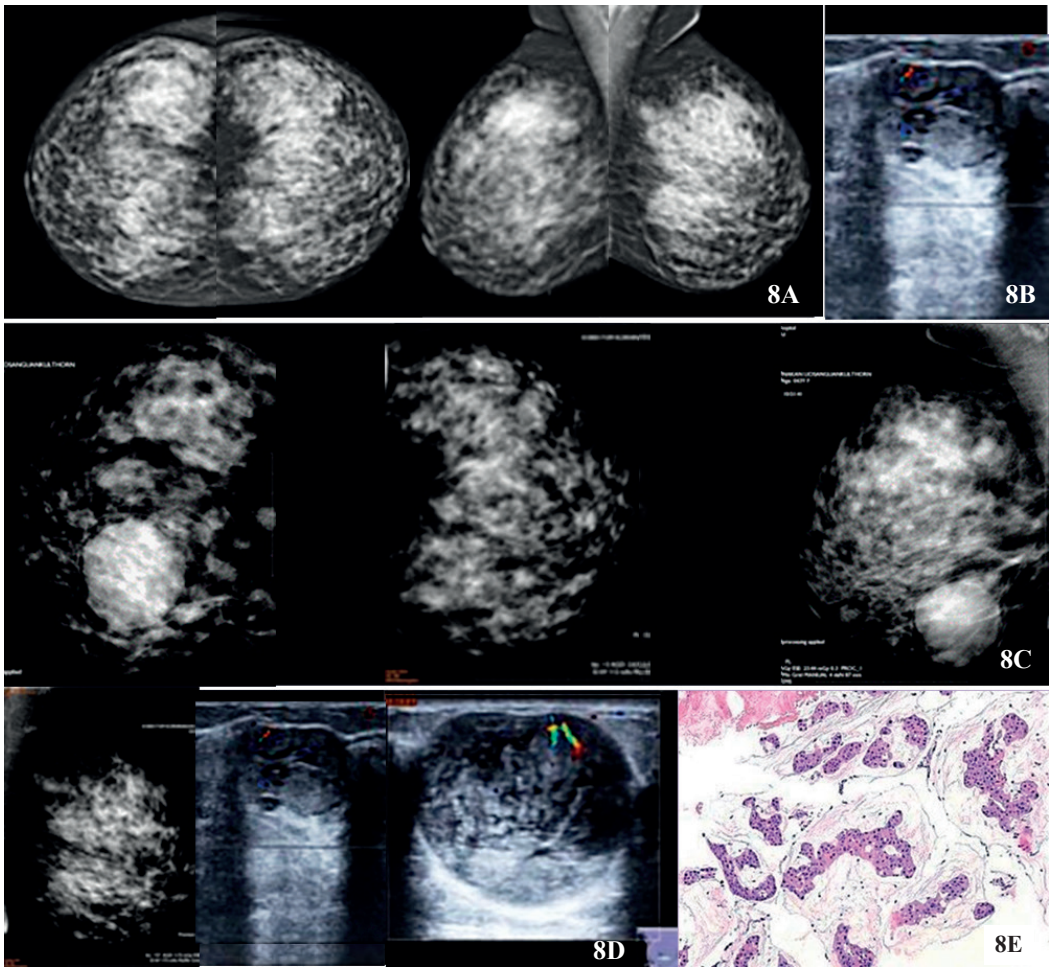

Figure 8: A 42-year-old woman with palpable difficulty due to a larger dense breast.
8A, 8C: Mammography. **8B:** US revealed a well-defined mass of homogenous hypoechoes and multiple tiny cystic lesions in right UOQ. CNB reports as breast stroma, a few ductal epitheliums, with some microcalcifications, no neoplasm. The patient came, 18 months later, for reduction mammoplasty. **8D:** US revealed a rapidly developed mass in right LIQ, not in the same area of the previously seen biopsied lesion. The mass in the left breast is not recognized. **8E:** Surgical specimens reveal a right MC and a left IDC grade III.

Discussion

Image-guided tissue sampling has reduced operation time and risks during frozen section of the incisional biopsy of the breast lesion in the operating room. The breast lesion and the axillary node histology and cytology are known before the operation, this allows the clinician to plan the management with the patient before the operation. If the axillary lymph node is positive, axillary dissection can be performed with no need for sentinel node study or frozen section. The procedure is very simple and easy, takes less time and the outcome is highly beneficial.

The core needle biopsy is becoming a universal practice in diagnosing breast lesions suspected of malignancy. Unfortunately, breast core needle biopsies also bear the risk of having false-negative results. Malignant lesions were diagnosed in 43.12%, atypical hyperplasia in 6.98%, and benign lesions in 49.90%. False negative was found in 2.23%. The main radiological causes of false-negative results of breast core needle biopsy are as follows: sampling from an inappropriate site and histopathological non-homogeneity of cancer infiltration.[9]

If malignancy is diagnosed, it requires proper management. The pathologist should compare pathology with imaging; if they do not match with each other, discussion with a radiologist is advised. If the specimen contains only fatty tissue or normal fibroglandular tissue, no discrete mass, excisional biopsy is suggested or repeated CNB if the image fails to show the cutting chamber is inside the lesion.[2] From time to time, the needle might traverse further, deeper than planned, thus the cutting chamber was not at the lesion. The image might demonstrate the needle inside the lesion, so it is good practice to move the needle up and down, without changing the position of the needle, to identify the artifact from needle tip vs. breast tissue (different acoustic impediment).[10] In my practice, I measure the distances from the needle tip to 5 mm, where the location of cutting chamber is, and another 15 mm of the length of the cutting chamber. This will confirm where the cutting chamber is.

Conclusion

Breast imaging is beneficial in detecting, defining lesions and its extension. It is compulsory to have pathological tissue diagnosis prior to surgical management. Imaging-guided CNB provide pathological diagnosis which is confirmed by surgery. This paper includes varieties, involvement patterns, and combinations of the IDC, LC and MC

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