Radio-pathologic correlation of malignant breast lesions

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Learning objectives

1. Describe the clinical and pathologic feature of rare malignant breast lesions.
2. List the imaging characteristics of rare malignant breast lesions.
3. Discuss the differential diagnosis of these breast neoplasms.
Background

A variety of lesions may arise from the breast tissue, each with a characteristic clinico-biologic behaviour and imaging pattern. In this article, we describe the imaging features of malignant breast lesions with emphasis on pathologic correlation. Specific topics discussed include breast anatomy, and rare malignant lesions including: Medullary Carcinoma, Metaplastic Carcinoma, Mucinous Carcinoma, Granular Cell Tumor, Tubular Carcinoma, Papillary Carcinoma, and Primary Breast Lymphoma.

For the analysis of the cases, the criteria used was: (a) the consideration of what corroborative evidence might be obtained with radiologic breast studies; (b) implication of such factors as age, family and personal history, and (c) the review of clinical history and physical findings. The analysis concludes with the formulation of a differential diagnosis with focus on the radiologic results and the pathologic findings.
Findings and procedure details

Granular Cell Tumor

Clinical History:

41-year-old woman discovered a palpable lump in her left breast for the past for months. No lymph nodes were detected during the physical examination, and the patient family history reveal a maternal grandmother (88 years), a maternal great-aunt (65 years), and a maternal aunt (45 years) with breast cancer.

Imaging Findings:

Mammography done at a private hospital reported two nodules in the left breast (images not obtain). In our center an ultrasound was perform where a suspicious nodule was seen in superior inter-quadrant line (SIQL). The nodules was 8x5mm, hipoechoic, spiculated with posterior acoustic shadowing (Fig. 1). A second nodule was seen inferior inner quadrant (IIQ), but was consider benign. Axillary ultrasound examination was normal. Ultrasound-guided percutaneous core-needle biopsy was perform, and the result was suggestive of Granular Cell Tumor. Patient was refer to surgery, and the microscopic evaluation of the surgical specimen showed that the SIQL nodules was a breast carcinoma consisting of nests of polygonal cells with abundant eosinophilic cytoplasmic granules (Fig. 2). Immunohistochemical analysis was positive for S100, and vimentin; and negative for AE1/AE3 (Fig. 3). The second nodule was reported as fibroadenoma with sclerosing adenosis. The patient continues to be in follow-up with the Breast Unit, and has not had a recurrence.

Discussion:

Granular Cell Tumor derived from peripheral nerves Schwann cells, it can appear in different locations of the body and be multifocal [Kim EY, et al]. Has a prevalence of 5% to 15% of all granular tumors of the body. It is benign in nature, although sometimes it can be malignant (1 to 2%). It is usually indistinguishable from breast cancer both in its clinical presentation as in the radiological presentation, so it is not possible to tell apart them without a biopsy [Mayoral, et al]. Usually seen in premenopausal African-American women from 30 to 50 years of age [Escudero, et al; De Simone, et al].

It manifest as hard consistency nodules, not painful to palpation, and can be accompanied by retraction of the skin; so clinically there is a high suspicion of malignancy. When presented as malignant lesions, they tend to be large, fast-growing, locally aggressive masses. They are frequently located in the superior internal quadrants of the breast;
it may associated lymphadenopathies, and can metastasize, but is extremely rare [Escudero et al].

Radiologic presentation is variable. In mammography can arise from a circumscribed nodule or mass, to an asymmetric density or a poorly defined mass or spiculated. Microcalcifications are rarely seen associated with it [Mayoral et al]. Ultrasound findings can mimic benign lesions (oval morphology and well defined borders) or malignant (nodules of poorly defined borders and spiculated, with posterior acoustic shadow) [Kim EY et al]. Magnetic resonance is not helpful to differentiate between benignancy and malignancy, since this tumor does not present any specific feature that allows an accurate diagnosis. It can occur as an irregular mass, hypointense on T1 sequence with heterogenous enhancement after administration of contrast.

The use of histology and immunohistochemistry is imperative for the diagnosis. Characteristically contains large cells with small nucleus and abundant eosinophilic granules in the cytoplasm and adopt a provision in rounded groups. Positivity of the granules with S100 protein in the cytoplasm of cells with immunostaining supports the diagnosis, since this protein is found in peripheral nerves (Fig 2-3). A high proportion are also reactive to vimentin, which is not often found in carcinomas, so this feature may help distinguish them between the two [Escudero, et al; De Simona et al].

The treatment is wide local excision, without need for axillary lymphadenectomy. In Granular Cell Tumor of malignant lineage, the treatment tends to be the same as with breast carcinoma. The prognosis is good, with low rates of local recurrence (2-8%) [Escudero, et al].

**Differential Diagnosis List:**

Invasive Carcinoma

Fat Necrosis

Fibrosis or fibromatosis

**Final Diagnosis:** *Granular Cell Tumor*

**Medullary Carcinoma**

**Clinical History:**
67-year-old postmenopausal woman undergone screening mammography where a nodule was detected. She has no family history of breast cancer and her physical examination is unremarkable.

**Imaging Findings:**

Mammography shows a well delimited radiopaque nodule in the right breast in the superior external quadrant (SEQ), without any associated microcalcifications (Fig. 4). Ultrasound revealed a 11 x 9 mm hypoechoic, nearly anechoic nodule with well circumscribe margins with posterior enhancement close to the chest wall, that was a first thought to be an echogenic cyst with thick content inside (Fig. 5). Fine needle aspiration of the lesion did not obtain any sample, so a needle core biopsy was done instead, were Medulary Carcinoma was suggested. The patient underwent neoadjuvant chemotherapy, mastectomy, and axillary dissection. Microscopic evaluation done by pathologist show syncytial growth with circumscribe margins, with lymphoplasmacytic reaction. Malignant cells intermediate nuclear grade with high mitotic rates (picture not shown because histological plates were not available for revision) At immunostaining was triple negative, being only positive for E-cadherin and EGFR. Patient continues to have annual mammographies, last one done in February 2015, without any signs of recurrence.

**Discussion:**

Medullary carcinoma is a subtype of invasive ductal breast carcinoma, it is very rare, representing 2-7% of all breast cancers. It is usually more common in young women from the fourth to fifth decade of life and in carriers of BRCA-1 genetic mutation [Martinez, et al]. It presents as a palpable mass with rapid growth, usually in the upper outer quadrant. In some patients it can spread through the lymphatics. These characteristics describe this tumor malignant nature, although diagnosis is histological [Patil al; Gordillo et al].

The mammography findings tend to be masses of irregular borders, spiculated, and high density with respect to the normal breast tissue. In the ultrasound an hypoechoic mass or masses with microlobulated margins can be identified with thick echogenic halo, and/or spiculated edges. Mostly circumscribed margins, and sometimes partially indistinct. In elastography, stiffness of the edges and the surrounding tissue is a suspicion finding [Patil, et al]. For MRI T2 sequences display hyperintensity of signal by the cystic component in necrotic areas. After contrast administration, lobulated or oval shows enhancing mass with smooth margin, and delayed peripheral enhancement; And a plateau or washout type kinetics with rapid initial rise on time-intensity curve [Jeong, et al].

Histologically, it is characterized by well-defined borders, with a lymphoplasmacytic infiltrate and cells of high grade with growth in sheets, without gland formation or fibrosis, with a high mitotic index. Necrosis is common. The most common finding is that they
are positive for p53 and often triple negative for estrogen, Her2/neu, and bcl-2 receiver [Patil, et al; Martinez, et al].

The treatment is similar to ductal invasive carcinoma, which can include radical mastectomy with radiotherapy and/or chemotherapy together, depending on the size and degree of infiltration [Gordillo, et al]. While this tumor shows aggressive characteristics, the majority of studies indicate that the incidence of lymph nodes metastasis was lower in patients with medullary carcinoma (19 to 46%) than in patients with invasive ductal carcinomas (29 to 65%). The 10-year survival rate is 74% and over 90% in patients without lymphatic dissemination [Patil, et al].

**Differential Diagnosis List:**

- Circumscribed Breast Cancer (Invasive ductal carcinoma or mucinous carcinoma)
- Non-Hodgkin Lymphoma
- Fibroadenoma
- Phyllodes

**Final Diagnosis:** *Medullary Carcinoma*

**Metaplastic Carcinoma**

**Clinical History:**

38-year-old woman, who is referred by his family doctor to the Breast Unit because a rapidly growing lump in her left breast, since 5 months ago. At physical examination a well-defined mobile, and palpable mass is found. Fine needle aspiration was conducted 2 months ago, with results compatible with inflammatory breast cyst; however the mass continues to increase in size, so she is now refer for breast biopsy.

**Imaging Findings:**

In mammography, a mass of 60 by 50 mm can be seen in superior outer quadrant (SOQ) of her left breast (Fig.6). An irregular solid mass of 50 x 35 mm with cystic heterogeneous areas inside of it with indistinct margins, and internal vascularity was seen at ultrasound examination (Fig. 7). MRI show a mass in the SOQ of 6.3 x 6.8 x 4.4 cm in diameters, without any other foci detected in the ipsilateral or contralateral breast. At T1WI show a hypointense mass, and heterogeneously hyperintense reflecting internal necrosis in the STIR sequence. After contrast administration rim enhancement was prominent (Fig. 10-14). Core needle biopsy is perform, and the histological report is
suspicious for Metaplastic Carcinoma. Tumorectomy and centinal node (non-neoplastic) is performed. The microscopic evaluation of the surgical specimen reveal a densely cellular breast carcinoma, with fusiform with malignant mesenchymal component. Immunohistochemical analysis was positive for CK 19, Vimentin, and Ki 67 was 70% (Fig. 15-16).

After 7 months after surgery and treatment with neoadjuvant chemotherapy, another mammogram is perform (Fig. 8). It shows persistence and increase of the rounded mass, with an approximate diameters of 10 x 9 cm. The lesion displays a cystic component with marked thickening of the wall in the ultrasound study (Fig. 9). The MRI suggests poor response to treatment (less than 50%). Simple mastectomy was perform and patient continue with chemotherapy. Six months later at control CT the patient had bone, lung and liver metastases. She died the following month.

Discussion:

Metaplastic carcinoma is an uncommon entity (less than 0.2% of all breast cancers), appears frequently in women over 50 years of Black or Hispanic race. It is characterized by a mixed component of epithelial and mesenchymal, in which the first is a consequence of a second metaplastic process, which determines the histological classification [Guillén, et al; Moreno, et al]. It’s more usual presentation is as a nodule or palpable mass, of large size, without preference for any quadrant and no lymph node involvement [Ryckman et al].

They are typically divided into two groups: tumors with homologous metaplasia (fibrosarcoma) and metaplasia heterologous (if sample differentiation adipose, cartilage, muscle or bone). Wargotz and Norris have differentiated them into five subtypes: matrix carcinoma (bone or cartilage), spindle cell, carcinosarcoma, carcinoma with ductal or squamous cell origin, and carcinoma with osteoclastic giant cells [Guillén, et al]. The diagnosis requires a thorough histological study to locate the epithelial component and to distinguish it from the pure sarcomas [Amillano, et al].

Both mammography, ultrasound and magnetic resonance imaging present findings of malignancy, without being specific as to distinguish it from other malignant tumors of breast [Ryckman, et to the]. At mammography can be seen as a mass of circumscribed edges, very dense, without attaching calcifications. On ultrasound as a mass with solid and cystic component, and in MRI can be seen as a lobulated mass, smooth margins, with necrosis and cystic degeneration in signal T2 hyperintensity (Fig. 11) And kinetic curves of type III corresponding to the periphery of the mass (Fig. 14). Bone scintigraphy with Tc - 99m, shows metabolic uptake of the isotope in the breast mass due to its osteochondral component [Choi, et al]
Metaplastic carcinoma epithelial component will be positive for keratins of low molecular weight, S-100 protein, membrane antigens and viventin, on the other hand sarcomas will also be. These tumours do not express receptors for estrogen and progesterone due to little differentiation of its components. It presents mostly p63 (+) (which is specific of metaplastic carcinoma) [Ryckman, et al].

The treatment is similar to that of breast carcinoma, although it present itself as a mass of large size, subjected to modified radical mastectomy and systemic chemotherapy. [Ryckman, et al]. They do not usually present metastasis by lymphatic route, but when they have axillary involvement have worse prognosis. Due to the low number of cases, there is no sufficient studies that provide reliable survival rates, although some studies mention a rate not exceeding 5-year survival of 62% [Guillén, et al].

**Differential Diagnosis List:**

- Primary Breast Sarcoma
- Malignant Phyllodes Tumor
- Invasive Ductal Carcinoma (IDC) without Metaplasia
- Mucinous Carcinoma
- Breast Metastasis

**Final Diagnosis:** *Metaplastic Carcinoma*

**Mucinous Carcinoma**

**Clinical History:**

A 41-year-old woman who attends to his family doctor due to a lump in the right breast she notice 2 months ago. At physical examination an ill-defined nodule was palpable in the right breast and non-lymph nodes associated in the ipsilateral axilla.

**Imaging Findings:**

A dense polilobulated nodule with partially ill-defined edges in the SIQL of the right breast, was seen on mammography (Fig. 17). In the ultrasound an isoechoic lesion with respect to fat was appreciated, polilobulated, slightly ill-defined of 31 x 23 mm in diameters (Fig. 18). Core-needle biopsy showed that the SIQL consisted of tumoral cells that float in
extracellular colloid or mucinous substance. Immunohistochemical analysis was positive for CK19 and Ki67 was of only 2% (Fig. 19-20). Patient was refer to surgery, but was lost in follow-up.

Discussion:

Mucinous Carcinoma, also known as Colloid Carcinoma is a type of invasive ductal carcinoma of low grade of malignancy that is characterized by tumor cells surrounded by clusters of extracellular mucus (Fig. 19). It represents 1% to 7% of all breast cancers, being frequent in women with average age between 62 and 68 years [Belgin, et al]. Most of times is presented as a palpable tumor, but it is uncommon to find secretions in the nipple or pain. Has a predilection for the superior outer quadrant (SOQ) of the breast [Leon, et al].

In mammogram is typical to find a nodule of low density, with rounded morphology, sometimes microcalcifications can be associated with the lesion. Ultrasound findings reveal usually a well-defined hypoechoic nodules with posterior acoustic reinforcement in 50% of the cases [Ortega, et al]. In MRI high T2 signal intensity due to large mucin component, especially at STIR sequence can be seen [Belgin, et al].

Histopathologically there are two forms: pure and mixed. Pure types are those where the mucinous component reach 90% or more, if it is between 10% and 90% will be mixed and if it is less than 10% will be called according to the dominant component. The diagnosis is usually done by biopsy [Le Petros, et al].

This type of carcinoma has a good prognosis. The treatment is no different from other carcinomas of breast, which includes the modified radical mastectomy and neoadjuvant treatments (chemotherapy) and adjuvant (chemotherapy and/or radiotherapy) [Leon, et al].

Differential Diagnosis List:

Myxoid Fibroadenoma
Invasive Ductal Carcinoma
Mucocele-Like lesion
Cyst with Debris

Final Diagnosis: **Mucinous Carcinoma**
**Papillary Carcinoma**

**Clinical History:**

A 92-year-old woman referred by her primary physician due to a mass in her right breast, locally advanced. Patient has a poor physical state with multiple comorbidities. At physical examination, there was a large palpable mass in her right breast of approximately 6cm in size that associated skin changes. A complete imaging study with breast biopsy is requested.

**Imaging Findings:**

On cranio-caudal, and medio-lateral oblique mammographies there is a solitary, large (3 cm), high density, polilobulated lesion in the inferior inner quadrant (IIQ) of the breast (Fig. 21). Ultrasonography of the breast shows presence of a hypoechoic polilobulated mass with internal vascularity present and a size of 34 x 19mm in the IIQ (Fig. 22). Core needle biopsy was perform and the microscopic evaluation revealed a prominent pattern of papillae with proliferating epithelium in villous-like projections (Fig. 23) with immunohistochemical markers positive for E-cadherine, and Ki 76 of 10% (Fig. 24); and negative for CK14, CK5/6, vimentin and EGFR. Hormone receptors were ER(+), PR(+), and HER2(-). Due to the patient age and comorbidities, the family opted for palliative care. The patient pass away three months later.

**Discussion:**

Papillary breast cancer represents approximately 0.5% of invasive breast cancers, typically presenting with bloody nipple discharge, either bloody or serosanguineous, with mass usually large due to cystic component. It affects postmenopausal women between 65-70 years of non-Caucasian origin. Although it represents the second most common invasive cancer in men [Pal, et al].

At mammography is typically lobulated, dense mass with partially indistinct margins with amorphous or pleomorphic calcifications. Ultrasound tends to show solid or complex cystic and solid mass with papillary projections with posterior enhancement. Frequently has increased vascularity within solid areas or large feeding vessel. MRI findings usually show irregular heterogeneously enhancing mural nodules. After contrast administration in T1WI with fat saturation, and variable kinetics curves. Either plateau or washout are found. Sequelae of hemorrhage may be seen in ultrasaound as well as in MRI [Eiada, et al; Brooks, et al].
The term papillary carcinoma encompasses a morphologically heterogeneous group of lesions, all of which share a growth pattern characterized by the presence of arborescent fibrovascular stalks lined by epithelial cells. Histological characterization suggests proliferations of cells arrange around fibrovascular cores, grossly forming a circumscribed mass. Has a low to intermediate nuclear grade with no myoepithelial cells. Stromal invasion occurs typically at the periphery and concomitantly DCIS can be present in the surrounding tissue; often ER/PR (+), HER2 (-). Classification of papillary neoplasms is difficult on core biopsy it is best made after excision. It is also critical to do the distinction of invasive papillary carcinoma from non-invasive forms, as each entity carries a unique prognosis [Hill, et al].

It has a relatively good prognosis, with a relatively low likelihood of recurrence, better than Invasive Ductal Carcinoma. Axillary metastases are infrequent usually one third of the cases. It should be treated with excision and lymph node sampling. Usually there is a need for neoadjuvant chemotherapy [Pal, et al].

**Differential Diagnosis List:**

- Invasive ductal carcinoma,
- Spectrum of papillary neoplasms (benign, atypical, in situ carcinoma)
- Lymphoma or metastatic disease
- Phyllodes tumor, fibroadenoma, galactocele
- Hematoma, abscess, complicated cyst

**Final Diagnosis:** *Papillary Carcinoma*

**Tubular Carcinoma**

**Clinical History:**

A 66-year-old woman that the screening mammography reveal a new focal asymmetry in her left breast not present on previous mammograms. She was refer to the Breast Unit to complete work-up and do core needle biopsy.

**Imaging Findings:**
A high density spiculated mass was detected in the screening mammograms (not shown) and at ultrasound a small irregular, spiculated hypoechoic nodule of 10x9mm of size with posterior enhancement that was located in inferior outer quadrant (IOQ) of the left breast (Fig. 25). Surgery was performed and the histologic examination revealed breast carcinoma composed of small glands or tubules haphazardly arranged in desmoplastic stroma with low-grade cells (Fig. 27). Immunohistochemical markers were positive for CK 19 and negative for vimentin. Ki 67 was 20% (Fig. 28). Patient continues follow-up at the Breast Unit.

Discussion:

Tubular carcinoma of the breast is an uncommon histological subtype of IDC that is generally associates with an excellent prognosis. Mean age of presentation is 50 years, slightly younger than IDC. It has a prevalence of 1.2% according to a 1997 analysis of the Surveillance, Epidemiology and End Results database. Around 65% of the patients present with a nonpalpable, mammographically detected mass and represents 10% of screen-detected cancers. Most frequent carcinoma found with radial scars and can be found associated with a low grade DCIS [Sullivan, et al; Cabral, et al].

At mammography you usually see a small, irregular, spiculated mass with microcalcifications in up to 50% of the patients; can also present itself as an architectural distortion or asymmetry. Ultrasound most commonly shows an irregular, spiculated mass with indistinct margins [Sheppard, et al]. The typical MRI findings include irregular, spiculated, enhancing T1-isointense to slightly hypointense mass with rapid initial enhancement and washout kinetics. Multifocality in 20% of the patients, with ipsilateral multicentric involvement in 20-50% of the cases. Hormone receptors are: ER(+) 80-90%, PR(+) 68-75%, and HER2(-) with a Ki-67 low (< 10%) [Cabral, et al].

Microscopically is composed of small glands or tubules of relatively uniform calibre. Usually is a single layer of neoplastic epithelial cells arranged in tubules Glands may demonstrate irregular shapes and angular contours. Cell characteristics are of low grade, with low mitotic rate [Mitnick, et al].

This well differentiate variant is linked with a low incidence of lymph node involvement, low rate of local recurrence, and a high overall survival rate when compared to standard invasive ductal carcinoma. The treatment of choice is breast conserving surgery with clear margins, which can be adequate except for multicentric disease. Sentinel node biopsy is recommended and the use of radiation and chemotherapy is controversial, due to the fact of low risk of local recurrence without radiation, 4% at median 5-year follow-up, and adjuvant therapy may not provide significant benefit, even with node positive disease, especially in older patients (1 series) [Livi, et al; Sullivan, et al].
Differential Diagnosis List:

Radial Scar or Radial Sclerosing Lesion (although it may coexist)

Sclerosing Adenosis

Postsurgical Scar, Fat Necrosis

Granular Cell Tumor

Invasive Lobular Carcinoma (ILC)

Ductal Carcinoma In Situ (DCIS)

Final Diagnosis: *Tubular Carcinoma*
Fig. 1: Ultrasound perform show a suspicious nodule was seen in superior inter-quadrant line (SIQL) of the left breast. The nodules was 8x5mm, hipoechoic, spiculated (yellow arrow) with posterior acoustic shadowing (blue arrow).

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Fig. 2: Ultrasound perform show a suspicious nodule was seen in superior inter-quadrant line (SIQL) of the left breast. The nodules was 8x5mm, hypoechoic, spiculated (yellow arrow) with posterior acoustic shadowing (blue arrow).

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Fig. 3: Microscopic evaluation showed that the SIQL nodules was a breast carcinoma consisting of nests of polygonal cells with abundant eosinophilic cytoplasmic granules. Immunohistochemical analysis was positive for S100, vimentin (not shown) and negative for AE1/AE3.

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Fig. 4: Mammogram of preoperative wire localization: Cranio-caudal (A) and mediolateral oblique views in a 67-year-old woman shows a high-density, indistinctly marginated, oval mass (yellow circles) on the right breast.

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Fig. 5: US with mass seen on mammograms (Fig. 4) shows a hypoechoic, nearly anechoic mass with well circumscribe margins and posterior enhancement, very near to the thoracic wall, that was a first thought to be a complicated cyst.

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Fig. 6: Mammogram (May 2013): Cranio-caudal (A) and mediolateral oblique views in a 38-year-old woman shows a mass of 60x50mm in the SOQ of a highly glandular left breast.

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**Fig. 7:** Ultrasound (May 2013) shows an irregular solid mass of 50 x 35 mm with cystic heterogeneous areas inside of it with indistinct margins (green arrow) and internal vascularity (yellow arrow). Core biopsy showed triple-negative metaplastic carcinoma.

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Fig. 8: Mammogram (December 2013): Cranio-caudal (A) and mediolateral oblique views in a 38-year-old woman shows recurrence of the mass of 10x90mm (arrows) with metallic clip (yellow circle) in the SOQ of the left breast.

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Fig. 9: Ultrasound (December 2013) shows persistence and increase of the irregular heterogenous mass with a mark thickening of the wall (yellow arrows). Fine needle aspiration is performed, and 50cc of serohematic material is extracted.

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Fig. 10: (A) Axial T1WI MR done in May of 2013 shows an well define hypointense mass (arrow) of the left breast that does not affect skin or the pectoral muscles. (B) Axial T1WI done in January of 2014 shows an heterogeneously hyperintese mass that has increased in size when compare to previous MR.

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**Fig. 11:** Axial DWI and ADC maps from May 2013 (A-B) and from January 2014 (C-D) shows a mass with diffusion restriction (high signal intensity) thickening wall (pink arrows). Corresponding grayscale parametric ADC map shows darker pixels indicating low ADC values in mass wall (yellow arrows) compared with surrounding background parenchyma and FCC. These findings are compatible with high celularity and highly suggestive of malignancy.

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**Fig. 12:** MRI from May 2013 and (B) from January 2014. Axial T1 C+ 3D FL with subtraction (same patient) shows a large lesion of the left breast with rim-enhancing component with central necrosis more prominent in (B) than in (A).

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**Fig. 13:** (A) MRI from May 2013 and (B) from January 2014. Axial T1 3D MR with fat saturation (same patient) shows a large lesion with rim-enhancing component; (A) shows central necrosis of the lesion, while (B) shows central hyperintensity reflecting high protein content, which is compatible hemorrhagic changes of the lesion.

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Fig. 14: MR perfusion from May 2013 in the same patient shows an increased rCBV in the solid parts of the tumor (black arrow) and a low rCBV in the necrotic center (white arrow), and kinetic curves of type III corresponding to the periphery of the mass. Perfusion MR is helpful to provide an accurate preoperative diagnosis.

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Fig. 15: The microscopic evaluation of the surgical specimen (hematoxylin-eosin stain) reveal a densely cellular breast carcinoma, with fusiform with malignant mesenchymal component.

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**Fig. 16:** The microscopic evaluation of the surgical specimen reveals a densely cellular breast carcinoma, with fusiform with malignant mesenchymal component. Immunohistochemical analysis was positive for CK 19, Vimentin, and Ki 67 was 70%.

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Fig. 17: Mammogram: Cranio-caudal (A) and mediolateral oblique views in a 41-year-old woman shows a dense polilobulated nodule with partially ill-defined edges in the SIQL of the right breast (pink arrows).

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Fig. 18: In the ultrasound an isoechoic lesion with respect to fat was appreciated, polilobulated, slightly ill-defined of 31 x 23 mm in diameters (yellow arrows).

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Fig. 19: Core-needle biopsy showed that the SIQL consisted of tumoral cells that float in extracellular colloid or mucinous substance. Immunohistochemical analysis was positive for CK19 and Ki67 was of only 2%.

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**Fig. 20:** Core-needle biopsy showed that the SIQL consisted of tumoral cells that float in extracellular colloid or mucinous substance. Immunohistochemical analysis was positive for CK19 and Ki67 was of only 2%.

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**Fig. 21:** Mammogram: Cranio-caudal (A) and mediolateral oblique views in a 92-year-old woman shows a solitary, large (3 cm), high density, polilobulated lesion in the inferior inner quadrant (IIQ) of the breast.

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Fig. 22: Ultrasonography of the breast shows presence of a hypoechoic polilobulated mass with internal vascularity (not shown) present and a size of 34 x 9mm in the I1Q.

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Fig. 23: Microscopic evaluation of the core needle biopsy revealed a prominent pattern of papillae with proliferating epithelium in villous-like projections.

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Fig. 24: Immunohistochemical markers positive for E-cadherine, and Ki 76 of 10% (shown); and negative for CK14, CK5/6, vimentin and EGFR. Hormone receptors were ER(+), PR(+), and HER2(-).

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**Fig. 25:** Ultrasound of a 66 year-old-woman showed a small irregular, spiculated hypoechoic nodule of 10x9mm of size with posterior enhancement that was located in inferior outer quadrant of the left breast.

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Fig. 26: Specimen mammogram (same patient) shows spiculated mass. At pathology, it was confirmed to be a Medullary Carcinoma.

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Fig. 27: Histologic examination of the surgical specimen revealed breast carcinoma composed of small glands or tubules haphazardly arranged in desmoplastic stroma with low-grade cells.

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**Fig. 28:** Immunohistochemical markers were positive for CK 19 and negative for vimentin. Ki 67 was 20%.

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Conclusion

A basic understanding of the underlying pathologic findings of a disease allows recognition of its radiologic appearance and spectrum. This factor improves image interpretation, with more limited differential diagnoses in many cases.
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