Learning objectives

Breast lesions containing mucin represent a broad spectrum of diseases that can be classified according to the location of the mucin in the extracellular or intracellular compartment. Mucocele-like tumor of the breast is a rare condition in which the lesion is characterized pathologically by an accumulation of extracellular mucin.

We propose to attend these objectives:

• Illustrate and review the findings of mucocele-like tumors on mammography, ultrasound and MRI;
• Compare the imaging findings with the pathological ones;
• Evaluate the differential radiologic findings of the diseases with extracellular mucin: pure mucocele-like tumors and mucocele-like tumors associated with atypia or malignancy of the breast.
**Background**

Mucocele-like tumors of the breast (MLT) are an uncommon condition in which the lesion is characterized pathologically by an accumulation of mucin. In 1986, Rosen¹ described mucocele-like tumors of the breast as a benign cystic lesion with mucinous material that breaks into the adjacent stroma, similarly to the mucocele of the salivary glands.

Subsequent studies demonstrated that MLT is part of spectrum of pathologic findings characterized by pure benign tumor, benign tumor with atypical ductal hyperplasia, with *in situ* component or even associated with mucinous carcinoma.

Because mucocele-like tumors may be associated with these other conditions, it is difficult to differentiate a pure mucocele-like tumor from a malignant tumor on the basis of fine-needle aspiration or core needle biopsy findings alone and complete excision is usually recommended. As not all mucocele-like tumors are accompanied by neoplastic processes, the use of the term lesion over tumor has been suggested.

Some studies with radiological correlation showed that malignant MLT tends to have more obvious gross calcifications than the pure benign MLT on mammography and the diagnosis of MLT must be considered in the cases with cystic ultrasound correlation to mammographic grouped calcifications ².

There are several studies demonstrating the pathologic features of mucocele-like tumors but few showing their findings on mammography, ultrasonography and MRI.
Findings and procedure details

During the period from January 2009 to October 2014, we searched the terms mucin, mucocele and mucinous in our radiology department database. The research resulted in 41 lesions in 40 patients with histological diagnosis of diseases with extracellular mucin from a total of 5227 patients submitted to imaging-guided breast biopsy during the same period. The age of the patients ranged from 36 to 84 years old, mean age of 57 yo.

We retrospectively analyzed the mammograms, ultrasounds and MRI of those patients according to the BI-RADS® lexicon and compared the findings with the pathological results.

Of the 41 lesions, 9 were pure mucocele-like tumors, 5 were associated with atypia, 2 with ductal carcinoma in situ, and 25 were associated with invasive carcinoma (Table 1).

The mammographic findings in pure mucocele-like tumors were amorphous calcifications in 3 cases (34%), coarse heterogeneous calcifications in 2 cases (22%) (Figures 1, 2, 3 and 4) and pleomorphic calcifications in 1 case (11%). For the 3 remaining cases of pure MLT only ultrasound images were available, one corresponding to a circumscribed mass and 2 cases to not circumscribed masses (Table 2). Follow up exams were available for only 2 pure MLT, one submitted to surgical excision with pathological diagnosis compatible with mucocele-like tumor without atypia. The other case was followed for 12 months showing stability of the circumscribed mass.

Intraductal proliferative lesions like flat epithelial atypia (Figures 5 to 9) and atypical ductal hyperplasia were classified in the category of mucocele-like tumor associated with atypia. In a total of 5 lesions with atypia, 4 were reported as amorphous calcifications on mammography and one case showed calcifications with segmental distribution; only 1 case of punctate calcifications was reported (Table 3). Two patients underwent breast-conserving surgery, one showing similar result of MLT with flat epithelial atypia and the other presented a result of DCIS in the surgical specimen.

The two cases of MLT with CDIS were reported as amorphous calcifications on mammography. These two patients underwent breast-conserving surgery with DCIS with mucin in the surgical specimen.

Mucinous carcinoma is characterized by cell mucin production of varying amounts, which are detected in the tumor stroma. The pure MC of the breast is characterized by mucin
in more than 90% of the tumor volume and the mixed type has less than 90% of well differentiated mucinous subtype associated with the presence of less differentiated cells of another type of invasive ductal carcinoma.

Invasive mucinous carcinoma was characterized on mammography as not circumscribed masses in 54% of the mammographic exams. Three cases (27%) have been reported as pleomorphic calcifications on mammography, two with segmental distribution. On ultrasound, invasive carcinoma was reported as irregular masses with not circumscribed margins in 87% of the cases. On MR, two cases presented as non-mass enhancement (Figure 3) and two cases presented as circumscribed masses. The rest of the cases were reported as masses with irregular morphology and margins (63%) and in 100% of the invasive carcinomas with mucin, high signal intensity on T2 was observed (Table 4) (Figures 10 to 29).

The diseases with extracellular mucin had many mammographic, ultrasound and MRI appearances but most frequent they presented as amorphous calcifications or irregular masses with high-signal intensity on T2 weighed images.
Images for this section:

![Diseases with extracellular mucin](image1.png)

**Table 1**

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![Pure mucocele-like tumors](image2.png)

**Table 2**

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Table 3

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Table 4

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Fig. 1: 51 year-old woman with pure mucocele-like tumor: (a) Left craniocaudal mammogram shows grouped calcifications (yellow arrow).

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**Fig. 2:** 51 year-old woman with pure mucocele-like tumor: (b) craniocaudal magnification view shows coarse heterogeneous calcifications (yellow arrow).

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Fig. 3: (c) Histopathologic specimen shows multiple dilated ducts filled with mucin and calcifications and mucin extravasation within the stroma.

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Fig. 4: (d) Histopathologic specimen shows dilated duct full of mucin and calcifications.

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**Fig. 5:** 38 year-old woman with mucocele-like tumor associated with flat epithelial atypia: (a) Right craniocaudal mammogram shows grouped calcifications (yellow arrow).

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Fig. 6: 38 year-old woman with mucocele-like tumor associated with flat epithelial atypia: (b) craniocaudal magnification view shows amorphous grouped calcifications (yellow arrow).

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Fig. 7: (c) Photomicrograph shows dilated ducts full of mucin and calcification, lined by flat epithelial atypia

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**Fig. 8:** (d) Photomicrograph shows dilated ducts full of mucin and calcification, lined by flat epithelial atypia.

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Fig. 9: (e) Photomicrograph shows dilated ducts full of mucin and lined by flat epithelial atypia.

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Fig. 10: 62 year-old woman with mucinous carcinoma: (a) Left craniocaudal mammogram shows irregular masses with indistinct margin associated with amorphous calcifications.

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**Fig. 11:** 62 year-old woman with mucinous carcinoma: (b) Ultrasound image shows irregular mass with angular margins.

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Fig. 12: 62 year-old woman with mucinous carcinoma: (c) Ultrasound image shows irregular mass with angular margins.

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Fig. 13: 62 year-old woman with mucinous carcinoma: (d) T2 weighted MR demonstrating irregular masses with high signal on T2.

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Fig. 14: 62 year-old woman with mucinous carcinoma: (e) T1-weighted pos-gd MR demonstrating irregular masses with heterogeneous internal enhancement.
Fig. 15: (f) Photomicrograph shows dilated ducts full of mucin and lined by malignant epithelium.

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Fig. 16: (g) Photomicrograph shows dilated duct full of mucin and lined by malignant epithelium.

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Fig. 17: 56 year-old woman with mucinous carcinoma: (a) Right craniocaudal mammogram shows irregular masses with indistinct margin in a segmentar distribution.

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Fig. 18: 56 year-old woman with mucinous carcinoma: (b) T2 weighted MR shows irregular masses with high signal on T2.

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**Fig. 19:** 56 year-old woman with mucinous carcinoma: (c) T1-weighted pos-gd MR shows irregular masses with heterogeneous internal enhancement.

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Fig. 20: 53 year-old woman complaining of right breast enlargement. She underwent percutaneous biopsy that showed invasive mucinous carcinoma. (a) Right craniocaudal mammogram shows an irregular indistinct mass associated to architectural distortion and nipple retraction.

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Fig. 21: 53 year-old woman complaining of right breast enlargement. She underwent percutaneous biopsy that showed invasive mucinous carcinoma. (b) Right craniocaudal mammogram shows an irregular indistinct mass associated to architectural distortion and nipple retraction.

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Fig. 22: 53 year-old woman complaining of right breast enlargement. She underwent percutaneous biopsy that showed invasive mucinous carcinoma. (c) Ultrasound image shows an irregular hypoechoic mass with angular margins and posterior shadowing associated to architectural distortion.

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**Fig. 23:** 53 year-old woman complaining of right breast enlargement. She underwent percutaneous biopsy that showed invasive mucinous carcinoma. (d) Ultrasound image shows an irregular hypoechoic mass with angular margins and posterior shadowing associated to architectural distortion.

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Fig. 24: (e) Photomicrograph shows multiple dilated ducts full of mucin and lined by malignant epithelium.

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**Fig. 25:** 53 year-old woman with mucinous carcinoma: (a) Left mediolateral oblique mammogram shows pleomorphic calcifications with segmental distribution.
Fig. 26: 53 year-old woman with mucinous carcinoma: (b) Left mediolateral oblique mammogram shows pleomorphic calcifications with segmental distribution.

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Fig. 27: 53 year-old woman with mucinous carcinoma: (c) Ultrasound image shows multiple hypoechoic microlobulated masses with no posterior features.

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Fig. 28: 53 year-old woman with mucinous carcinoma: (d) T2 weighted MR shows heterogenous segmental non-mass with discrete high signal intensity on T2.

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Fig. 29: 53 year-old woman with mucinous carcinoma: (e) T1-weighted pos-gd MR show heterogenous segmental non-mass enhancement.

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Conclusion

Mucocele-like tumors are a rare breast disease with radiologic findings that reflect the pathologic ones, but which are highly nonspecific. The radiological findings provided no specific clue for differentiating benign from malignant mucocele-like tumors and for differentiating mucocele-like tumors from other lesions of the breast.

Because of underestimation at core biopsy, surgical excision is still recommended for all mucocele-like tumors to exclude the possibility of associated mucinous carcinoma.
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References


