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Imaging Evaluation and Chemical Composition Analysis of Calcified

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At present, mammography is the most accurate imaging method to detect breast calcification. Calcification can be found in benign and malignant breast lesions. Although its performance has different characteristics, it is still difficult to distinguish benign from malignant. The study of calcification in breast benign and malignant lesions is helpful to improve the imaging diagnosis of breast lesions, and provide a reference for the clinical treatment. In this paper, the significance of calcification in the diagnosis of benign and malignant breast lesions and the composition of calcified lesions were discussed. The classification, shape and distribution of BI-RADS in calcified lesions in breast benign and malignant lesions and their diagnostic significance were studied, and the pathological control was analyzed. The morphological and distribution of calcification in different subtypes of breast cancer was statistically significant. The distribution of calcification has some characteristics, which can be used as a basis for differential diagnosis. At present, the chemical composition of calcified lesions cannot be identified by X-ray, but we can use other methods to analyze the chemical composition of calcified lesions. Breast calcification can be divided into two types. The first type is calcium oxalate dihydrate, which appears in benign lesions. The second type is hydroxyapatite, which is found in proliferative lesions and mostly malignant. Although the appearance of mammography has optimized the imaging diagnostic methods of calcification, it still cannot provide information about the chemical composition of calcification, and cannot accurately define the nature of the tumor. In the latest study, Raman spectroscopy can be used to obtain information about the chemical composition of calcification, which can be used to differentiate benign and malignant calcification. This may be the direction of future diagnostic development.

1. Introduction

At present, breast cancer has become the most common malignant tumor in women (Feliciano, et al., 2017). The incidence of breast cancer increased by 1.3 million per year (Hadjipanteli et al., 2017). Its incidence is not only the highest in developed countries, but also growing rapidly in developing countries (Adrada, et al., 2015). At the same time, with the improvement of economic level, health examination has become a part of daily life, especially the development of breast examination equipment and women's health concerns, breast cancer detection rate was significantly improved (Bae et al., 2015).

There were many kinds of examination methods for breast diseases, such as mammography, breast ultrasound, CT, MRI and nuclear medicine. Among them, mammography is the standard of breast cancer screening (Jeffries et al., 2015). The greatest benefit of breast cancer screening is to reduce the mortality of breast cancer and prolong the life of patients. Mammography is one of the most widely used methods for the detection of breast diseases (Bennani-Baiti, et al., 2016). According to the main X-ray performance, we can objectively evaluate the subjects. The main imaging features of breast cancer were mass, calcification, structural disorder and asymmetric dense shadow (Karahaliou et al., 2014; Miccio et al., 2017; Qiao, 2016; Zhao and Yue, 2016; Derian et al., 2016). Mammography is the most sensitive imaging method to detect breast lesions and calcification (Rafferty et al., 2013). In clinical practice, according to the shape and distribution of calcification in the breast, the doctor can evaluate the disease. However, for some types of microcalcifications, it is difficult to make differential diagnosis, and it must be confirmed by pathology (Yepes et

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al., 2014). Through the study of microinjection of breast cancer specimens, Selim (2013) found that the microcrystalization of the 1/3 case was in the tumor, the percutaneous degeneration of the 1/3 case was only in the benign tissue of the malignant lesion, and the degeneration of the 1/3 case was present in both benign and malignant lesions. The results of this study fully demonstrate the importance of mammography and its association with pathologic studies (Matsui, et al., 2015).

The main purpose of this study was to investigate the differences and similarities of microcalcification in breast benign and malignant lesions, different pathological types and different molecular subtypes of breast cancer, in order to improve the understanding of breast calcification. The analysis of the chemical composition of calcification can provide more useful imaging basis for clinical diagnosis and treatment.

2. Analysis of the significance and chemical composition of calcification in differential diagnosis of benign and malignant breast lesions

2.1 Object of study

(1) Case information: to collect calcification cases from March 2014 to December 2016. All cases had preoperative mammography, and had complete clinical data.

(2) Inclusion criteria: All cases were examined by mammography and confirmed by biopsy or surgical pathology. The clinical and surgical pathology data were complete. All female patients were in non-lactating and non-gestational age. Image quality is clear and meets diagnostic requirements.

(3) Exclusion criteria: Image quality does not meet diagnostic criteria. There were no confirmed cases of the disease and no preoperative breast radiographs.

2.2 Research methods

(1) Instruments and methods of examination

We mainly use the Siemens digital mammography machine (Mammomat Novation DR). All cases were performed CC (Cranio-Caudul, CC view), and MLO (Medial-Lateral-Oblique, MLO view). If necessary, add the side or partial pressure to enlarge.

(2) Evaluation standard

By using a double-blind method, two radiologists diagnosed the x-ray film. The characteristics of mammary gland calcification were analyzed by reference to the Breast Imaging-Reporting and Data System (BI-RADS) classification of the American Society of Radiology.

(3) The classification of the report

According to the American Society of Radiology standards, the shape is divided into benign, intermediate and highly malignant.

Typical benign calcification: including skin calcification, vascular calcification, fibrous adenoma in the coarse or popcorn calcification, coarse bar calcification (diameter usually>1mm), hollow calcification (1mm<diameter usually<1cm), dot-like calcification (diameter usually<0.5mm), "ring" or "egg shell calcification" (diameter <1mm), milk-like calcification, suture calcification, malnutrition and other calcifications.

Intermediate calcification (suspected malignant calcification): rough heterogeneity calcification, calcification> 0.5, and it has a convergence trend; amorphous or blurred calcification.

Highly malignant potential calcification: small pleomorphic calcification: this type of calcification is more amorphous, the size is different, and the diameter is often less than 0.5mm. Fine or fine-like branching calcification: the performance of this type of calcification is small irregular lines, it is often discontinuous, the diameter is less than 0.5mm.

(4) The description of the report and the classification of calcification were done with BI-RADS as the standard. BI-RADS: category 0: it requires other images to check for further evaluation or comparison with the front. Category 1: abnormal positive was not found. Category 2: it must be benign. Category 3: it may be benign, and we recommend a short follow-up. Category 4: it is a suspicious anomaly that needs to be taken a biopsy. It has the possibility of malignant transformation. Among them, class 4A indicates the pathological changes that need for intervention but the malignant lesions are low. Class 4B represents moderately malignant lesions. Class 4C represents the moderate slightly quasi malignant lesions. Category 5: it has a high probability of detecting malignancy. Category 6: it was confirmed by biopsy as malignant.

(5) Statistical analysis

SPSS 13.0 was used to analyze the data. The BI-RADS classification of calcification was performed by rank sum test. The shape, distribution, shape and distribution of calcification, and pathological types were detected by X^2 test. The test level is set to $\alpha=0.05$, $p<0.05$. It has statistical differences.

3. Results and discussion

1. Chemical constituents of mammary gland calcification.

Mammography shows that calcification can be divided into two categories. The first category is mainly calcium oxalate. HE staining is amber and has strong refractive power. Under ordinary microscope, it is easy to be ignored, which is one of the reasons why the detection rate of microcalcification is not consistent with mammography. The second category is calcium phosphate and calcium carbonate, and its main component of hydroxyapatite. HE staining is dark blue partial alkaline. Calcium oxalate is most commonly found in benign breast lesions and is less likely to be found in breast cancer. However, calcium phosphate is found in both benign and malignant tumors. The main components of calcification in benign breast lesions were hydroxyapatite and carbonate. The calcification of malignant lesions is mainly hydroxyapatite, which is purer and contains more protein.

2. Classification of calcification and the relationship between benign and malignant breast lesions.

In this group of patients, benign breast lesions were 140 cases (149 side). Among them, breast adenosis is 60 cases (62 sides), fibrocystic breast disease is 65 cases (71 side), other benign lesions were 15 cases (16 side). Malignant lesions were 284 cases (284 sides). Among them, the infiltrative ductal carcinoma was 200 cases (200 sides), ductal carcinoma (with / without micro-infiltration) was 60 cases (60 sides), invasive lobular carcinoma was 11 cases (11 sides), and other malignant lesions were 13 cases (13 side). Preoperative calcification lesions BI-RADS classification and postoperative pathological results were as shown in Table 1.

Table 1: The correlation of the breast micro calcification and patholog.

BI-RADS classification	Benign lesion (149 side)	Malignant lesions (284 side)
Category 2	29	13
Category 3	53	22
Category 4	67	142
Category 5	0	107
Z	-10.939	
P	0.000	

Table 2: The difference of shape and distribution of calcification in benign and malignant breast lesions.

Calcification feature	Breast benign cases (149 side)	Breast malignant cases (284 side)
Shape		
Dotted	58 (38.9%)	12 (4.2%)
Rough	31 (0%)	1 (0.4%)
Bad	0 (38.9%)	0 (0%)
Rough and uncertainty	12 (8.1%)	33 (11.6%)
Rough and heterogeneity	18 (12.1%)	33 (11.6%)
A variety of intermediate calcifications mixed	4 (2.9%)	10 (3.5%)
Small diversity	41 (27.5%)	117 (41.2%)
Linear or linear branching	0 (0%)	41 (14.4%)
A variety of malignant calcification mixed	3 (2.7%)	37 (13.0%)
Distributed		
Cluster	55 (36.9%)	105 (37.0%)
Line-like	11 (7.4%)	11 (3.9%)
Segmental	21 (14.1%)	90 (31.7%)
Diffuse	28 (18.8%)	17 (6.0%)
Scattered	24 (16.1%)	20 (7.0%)
Regional	10 (6.7%)	41 (14.4%)
F_1 value	148.72	
P_1 value	0.000	
F_2 value	42.449	
P_2 value	0.000	

Note: F_1 and F_2 were respectively used to express the difference of shape and distribution of calcification in benign and malignant breast lesions. P_1 and P_2 were respectively used to indicate the value of calcification in breast benign and malignant lesions.

In malignant lesions, BI-RADS4-5 is accounted for 249 side (87.7%). In benign lesions, BI-RADS3-4 is accounted for 120 sides (81.1%). Breast benign and malignant lesions were the most common in the four categories, and they were 67 side (45.3%) and 142 side (50.0%). However, the calcification of category 5 is only found in malignant breast lesions.

In this group of patients, benign breast lesions were 140 cases (149 side), malignant lesions were 284 cases (284 side). The morphological and distribution of calcified lesions in benign and malignant breast lesions were statistically different, p_1=0.000. The shape and distribution of calcification in breast benign and malignant lesions were shown in Table 2.

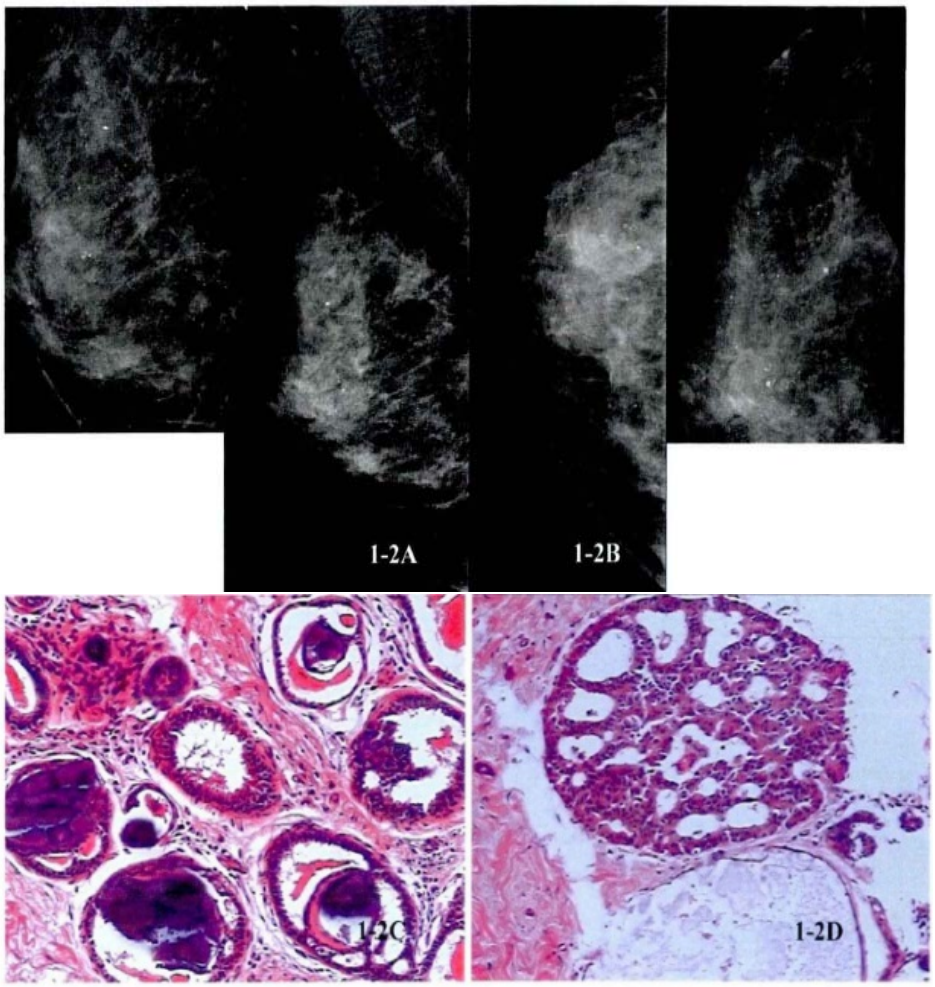

Figure 1: Right breast defibrillation cystic breast disease with focal calcification and ductal epithelial hyperplasia.

Calcification can be found in benign and malignant breast lesions, but its mechanism for calcification is still unclear. Some scholars believe that benign calcification of the breast is mainly due to vascular surgery, surgery, trauma, benign tumor tissue degradation and transpwerency caused by change. It is generally believed that malignant calcification is associated with tumor cell degeneration and necrotic salt deposition. The nature of calcification in the breast is distinguished by its shape, distribution, size, number, variability and stability. The shape and distribution of calcification were two important factors to judge their histological origin. Among them, lobular calcification refers to calcification in the expansion of the leaf follicle. It has regular shape, uniform density and clear edge, and often diffuse or scattered in bilateral breast. Therefore, it is more common in benign breast lesions. Catheter calcification refers to the cell pores that were blocked by calcification or secretions. The shape, density and distribution of this kind of calcification were various. Irregular, pleomorphic, linear, branching and amorphous calcifications were common. It has a vicious possibility, and often identified as BI-RADS4-5 class.

In this group, benign lesions were mainly 58 cases (38.9%) of dotted, 41 cases (27.5%) of small pleomorphic, and 18 cases (12.1%) of rough heterogeneity. Malignant lesions were mainly 117 cases (41.2%) of small pleomorphic, 41 cases (14.4%) of linear or linear branches, and 37 cases (13.0%) of various malignant calcification. Among them, the line-like or line-like branch calcification is formed by necrotic debris, which mainly originated in the catheter or its branch of the lumen. This type of calcification is often segmented or regionally distributed and is considered to be highly malignant calcification. There was no mitochondrial calcification in benign breast lesions. Drotic calcification can be found in benign breast lesions, such as sclerosing adenosis and lactation. Small pleomorphic calcification is the most common calcification of breast line examination. The calcification of benign breast lesions (such as fibrocystic breast disease, fibroadenoma and papilloma) and malignant lesions originating in the terminal lobular unit is to be identified. The incidence of fine pleural dissipation in breast benign and malignant lesions was about 40% and 60%. The incidence of fine pleomorphic calcification in benign and malignant breast lesions was about 27.5% and 41.2%. After retrospective analysis of its preoperative line, it is found that the density of malignant breast lesions is often slightly lower than the benign lesions, and the edge is more blurred with increased density of the substance, which may be related to the short time of malignant calcification.

(3) Comparison of shape and distribution of calcified foci and pathological results of breast malignant lesions.

As shown in Figure 1, fibrocystic breast disease is the most common in the distribution of punctate calcification. X-ray: dot shape and fine-like calcification in the right breast is the most common. The areola is most significant. Calcification morphology and density were slightly higher than the normal density of the nipple. There were no obvious structural distortions. Microscopic findings: there were breast lobular structure. The number of vesicles in the mammary gland was increased. Small interstitial fibrous connective tissue has hyperplasia. Calcified lesions can be found in the local.

4. Conclusions

In benign breast lesions, calcification is mainly punctate calcification, clustering or diffuse distribution. In malignant lesions, calcification is mainly small pleomorphic calcification, clustering or segmental distribution. Benign and malignant breast lesions of most cases can be identified. However, some cases are difficult to identify. At this time, we have to make a decision according to micro-morphology, distribution and clinical manifestations.

There are some characteristics of breast calcification in breast lesions, and we can make a preliminary judgment according to the preoperative performance. However, it is difficult to distinguish the different pathological types according to the features of calcification. Therefore, in clinical work, in addition to analyzing calcification characteristics, we must closely integrate the features of calcification and other imaging examinations to diagnose, so as to provide more imaging basis for clinical treatment.

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