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DIAGNOSIS OF TUMORS OF THE BREAST BY SIMPLE ROENTGENOGRAPHY*

CALCIFICATIONS IN CARCINOMAS

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THE roentgen study of the breast should now be included in the clinical investigation of symptoms in the diagnosis of mammary pathology. In 1935, for the first time in Montevideo, Professors Carlos M. Domínguez and Eduardo Blanco Acevedo called attention to the value of roentgenography in studies of carcinoma of the breast. They had arrived at some very interesting results.

With the improvement of roentgenologic and interpretative techniques in this field we have introduced, we are now usually able to individualize the different images necessary for a precise diagnosis of the mammary parenchyma.

Due to the complex pathology of the breast and to the small difference of opacity between normal and pathologic tissues, the roentgen study demands a perfect technique.

ROENTGENOGRAPHIC TECHNIQUE

Craniocaudal projection is employed. First, a topographic roentgenogram is made, using a cone large enough to cover

the total area of the breast. Then, a second film is exposed, localizing the exact site of the tumor and using a cone of the smallest possible diameter, so as to reduce secondary radiation (Fig. 1).

Technique: Focus-film distance 60 cm., 30 kv. (peak), 5 ma. sec., for each centimeter of thickness of the breast. Non-screen films are employed. Recently, and especially in the fibrous breast, where conditions for roentgenologic contrast are lacking, when looking for calcifications we have successfully reduced the potential to about 20 kv. (peak), employing 30 cm. focus-film distance and an exposure varying according to the thickness of the breast.

We also find it convenient to exert a slight pressure with the cone on a small cotton pad placed between the cone and the breast so that the least quantity of breast tissue is interposed.

Tumors localized near the upper portion of the breast are not seen clearly in the craniocaudal projection; consequently, the technique must be complemented by a lateral film study.

* I wish to thank Professors Carlos M. Domínguez and Larghero Ibarz, and Doctors Mautone, Pradines, Castro, Cassinelli, Scolnik, and Scandroglio for their anatomic and pathologic collaboration; and Professor James T. Case of Northwestern University Medical School, Chicago, for aid in the English translation.



FIG. 1. Position of the patient for obtaining a crano-caudal film. Observe the characteristics of the cone and the compression pad interposed between it and the breast. The film, enclosed in a black paper envelope, is in contact with the breast.

ROENTGENOGRAPHIC INTERPRETATION

We shall present the most frequent and characteristic roentgen findings of positive diagnostic value which we have found.

Benign Tumors. Encapsulated benign tumors, fibroadenomas or cysts produce rounded or multilobulated images with smooth borders, sometimes seen partially or totally surrounded by a transparent halo which separates it from the mammary tissue in immediate relation to the tumor. The size of the tumor on the roentgenogram corresponds very closely to its palpable size. Roentgenographic study of encapsulated tumors must be supplemented by transillumination. Cysts filled with citrine liquid are transparent, fibroadenomas present a medium opacity and cystadenocarcinomas, because of their usual hemorrhagic contents, are notably opaque.

Malignant Tumors. The roentgen shadows of adenocarcinoma of the breast most frequently encountered have the following characteristics:

Size: The diameter may be from 1.0 to 4.0 cm., but the basic element for diagnosis is that the size seen on the roentgenogram is generally smaller than the palpable size.

Borders: These do not usually present the same sharpness of outline as seen with benign tumors; on the contrary, they have ragged borders with numerous spicules of variable lengths, which radiate from the periphery into the surrounding mammary tissue. This spiculated border is character-

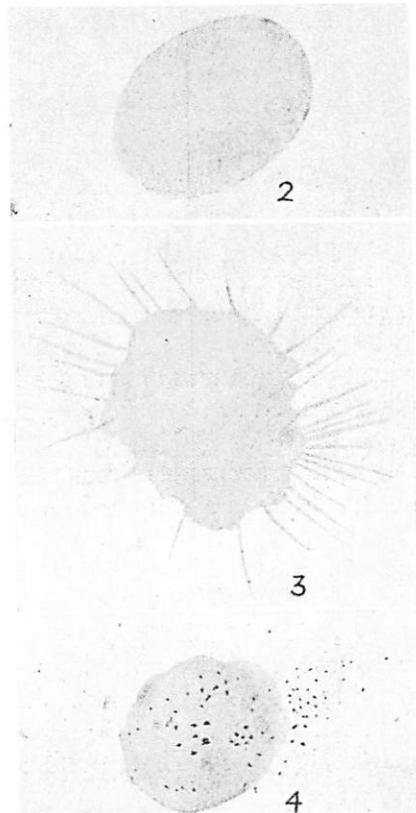


FIG. 2, 3, and 4. Drawings of the principal roentgenographic aspects of mammary tumors. FIG. 2. Encapsulated tumor with clearly defined contours. FIG. 3. Spiculated contours of a scirrrous carcinoma. FIG. 4. Clustering of innumerable calcifications, like fine grains of salt, in the tumor nodule and its surroundings, characteristic of a malignant lesion.

istic of malignant tumors and discloses its eminently scirrhous nature.

Occasionally the shadows of malignant tumors present smooth borders quite similar to those seen in encapsulated tumors and a differential diagnosis may then be dif-

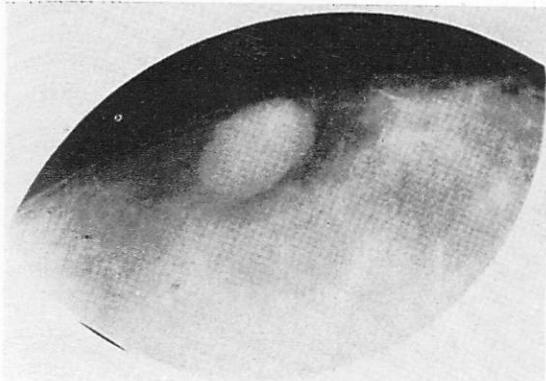


FIG. 5. Encapsulated nodule, with clear sharp contours. Fibroadenoma.

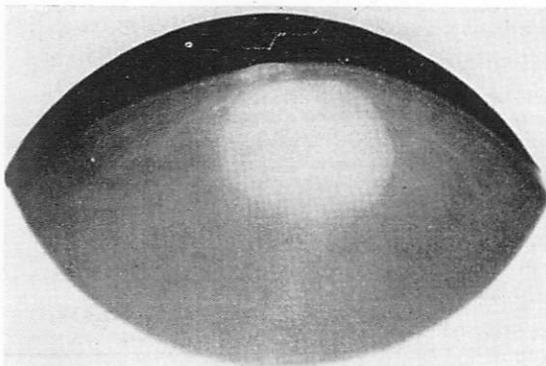


FIG. 6. Rounded, encapsulated shadow. Simple cyst.

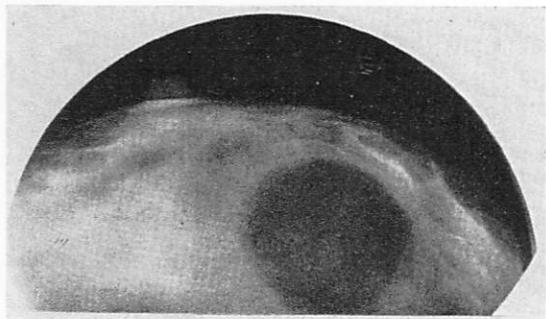


FIG. 7. Encapsulated tumor, transparent to the roentgen rays, characteristic of galactoceles with butter-like content.

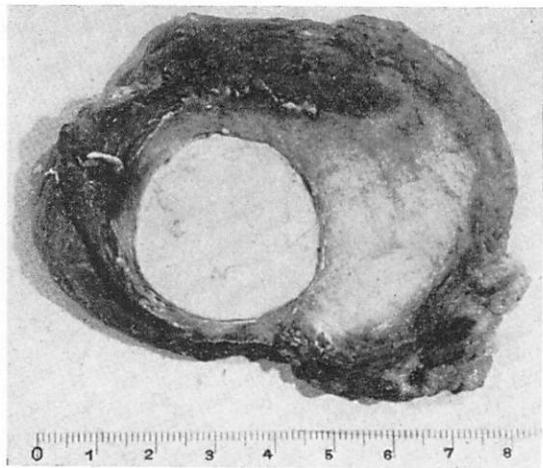


FIG. 8. Partial mammectomy performed on the patient referred to in Figure 7. (Dr. A. Valdez Olascoaga. Anatomo-pathologic study: Professor Carlos M. Domínguez.)

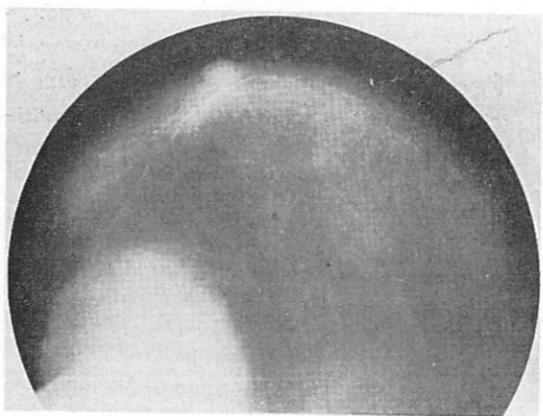


FIG. 9. Rounded shadow, opaque to the roentgen rays, with an encapsulated appearance. Tuberculous abscess.



FIG. 10. Nodule with spicules which radiate to the skin, retracting it. Scirrhous epithelioma. (Halsted operation: Dr. Jaumandreu.)

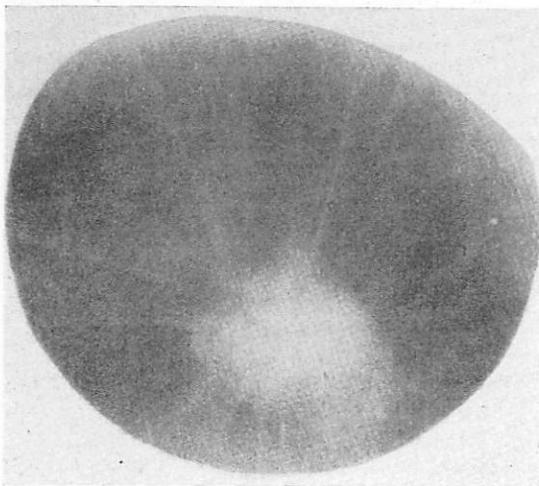


FIG. 11. Tumor with spiculated contours. Epithelioma. (Halsted operation: Dr. L. D. Bottaro.)

ficult; but these difficulties are gradually overcome with experience.

■ **Density:** The shadow of the tumor is uniformly dense, sometimes containing a scattering of multiple, punctate calcifications.

CALCIFICATIONS IN MALIGNANT TUMORS

These calcifications, which constitute a roentgenographic sign to which we attribute a singular diagnostic value, are

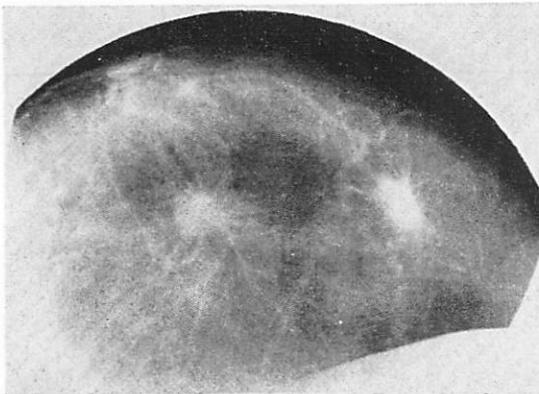


FIG. 12. Two nodules are observed with spiculated contours which, radiating to the neighboring mammary tissue, form a bridge between them. They correspond to two small scirrhous carcinomas, simultaneous in the same gland, one of them not being palpable. (Halsted operation: Professor A. Stábile. Anatomo-pathologist: Dr. Mautone.)

characterized by the presence of innumerable punctate calcifications resembling fine grains of salt, generally clustered in a region of the breast. These calcifications, which at

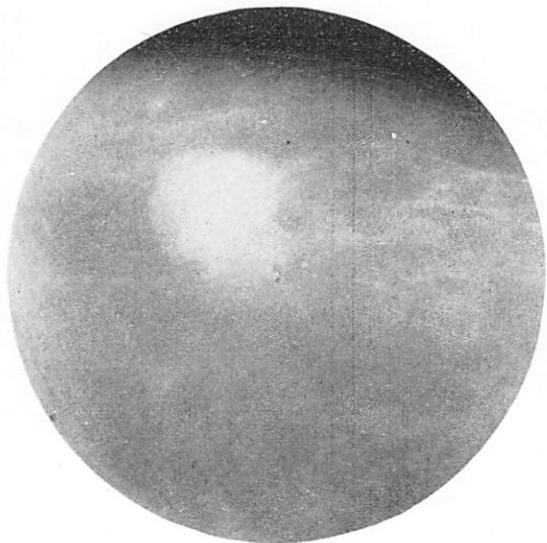


FIG. 13. Nodule with ragged contours. Epithelioma.

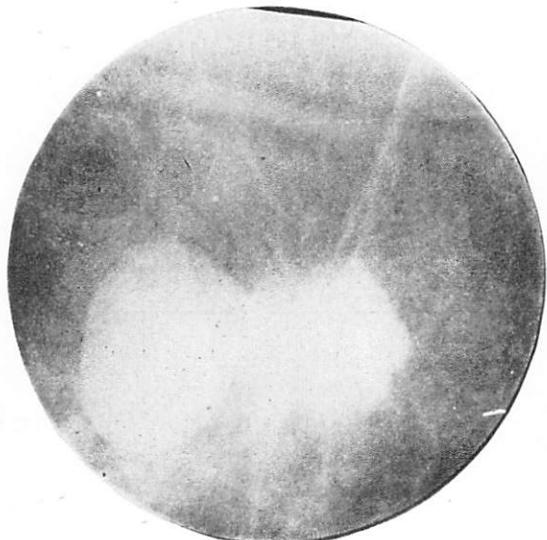


FIG. 14. Two nodules are observed: one of them with spiculated contours, the other encapsulated.

first might pass as defects in the film, may be found as follows:

1. Inside the tumor nodule.
2. Inside and surrounding the nodule.
3. As the only roentgen sign; that is, without nodular image.

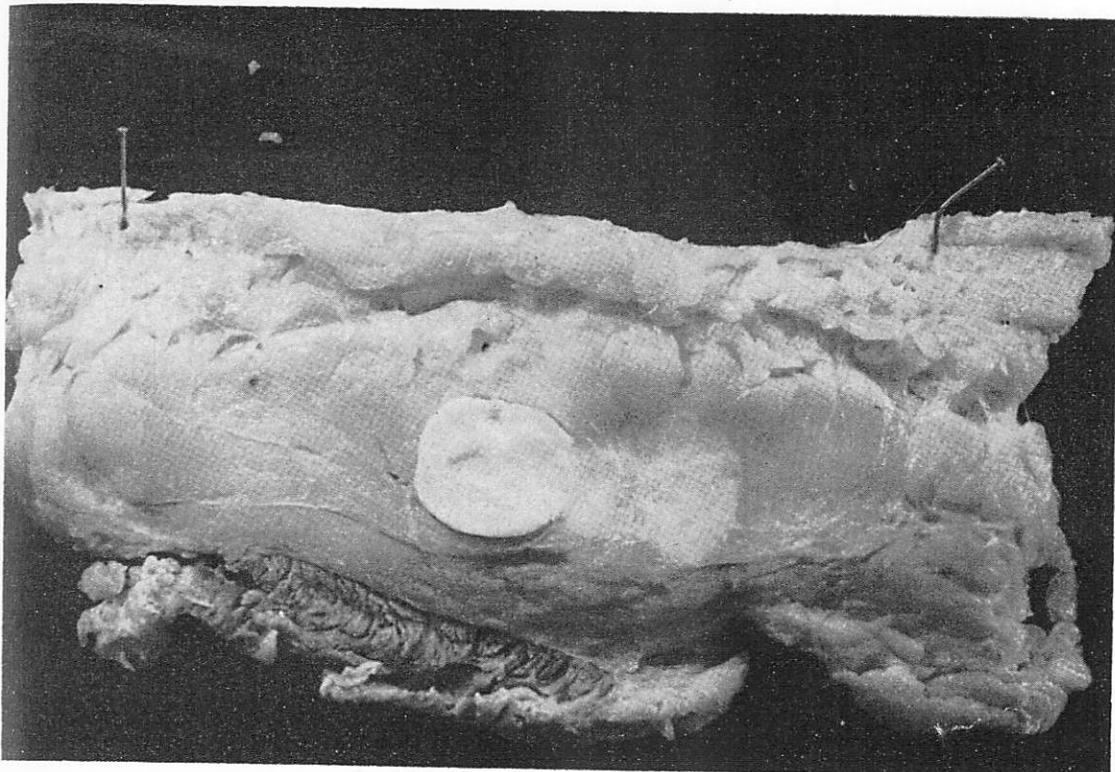


FIG. 15. Halsted operative specimen of the preceding case (Fig. 13 and 14): Professor J. J. Crottogini. Photograph of a cross section of the operative specimen. The spiculated nodule corresponds to a scirrhous epithelioma, and the encapsulated nodule to a benign tumor. Professor C. M. Domínguez.

These calcifications seen inside the tumor nodule frequently correspond to a scirrhous

epithelioma the diagnosis of which depends upon the roentgenologic characteristics of the nodule. When calcifications surpass the borders of the tumor nodule or when they are seen without a tumor nodule, they generally correspond to canalicular forms, and especially to comedocarcinoma. This is the anatomic form in which calcifications are most frequently seen, even without the existence of a palpable tumor.

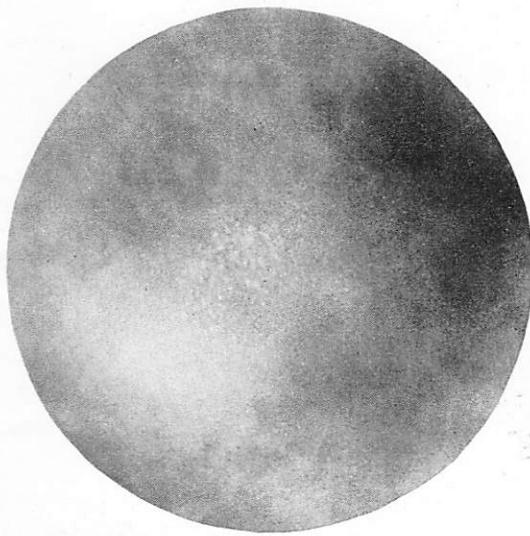


FIG. 16. Cluster of small calcifications, like fine grains of sand, in the tumor nodule.



FIG. 17. Halsted operative specimen of the preceding case (Fig. 16); Dr. E. Schaffner. Roentgenogram of the anatomic section of the operative specimen, where the calcifications can be seen more clearly. Histopathologic study: Ductal epithelioma of the comedo type. Professor C. M. Domínguez.

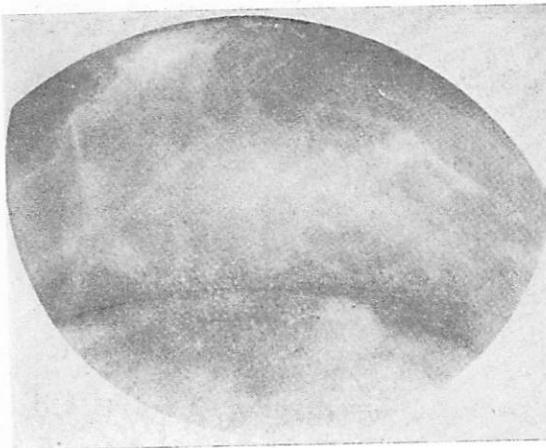


FIG. 18. Scattering of innumerable punctate calcifications grouped in and around the tumor nodule.

As the clinical and histopathologic diagnosis of this form of mammary cancer may present serious difficulties, we stress the

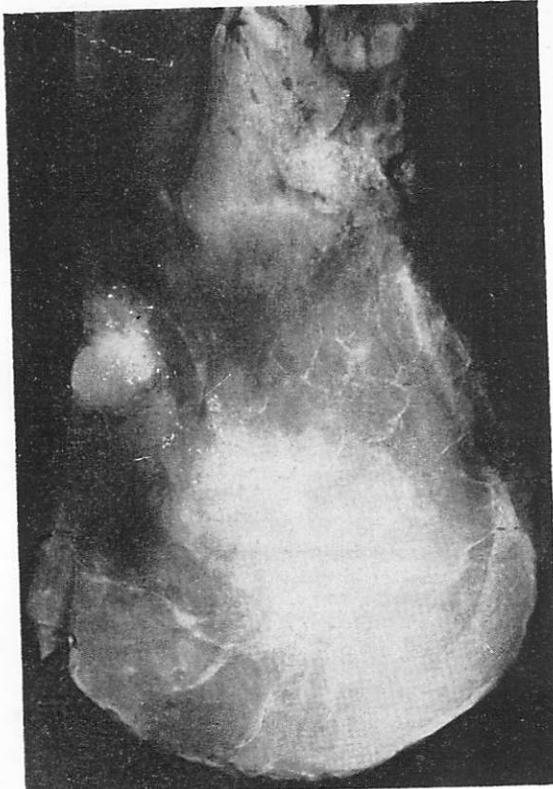


FIG. 19. Roentgenogram of a cross section of the operative specimen of the preceding case (Fig. 18). Halsted operation: Dr. E. Schaffner. The small calcifications, like fine grains of salt, are clearly seen.

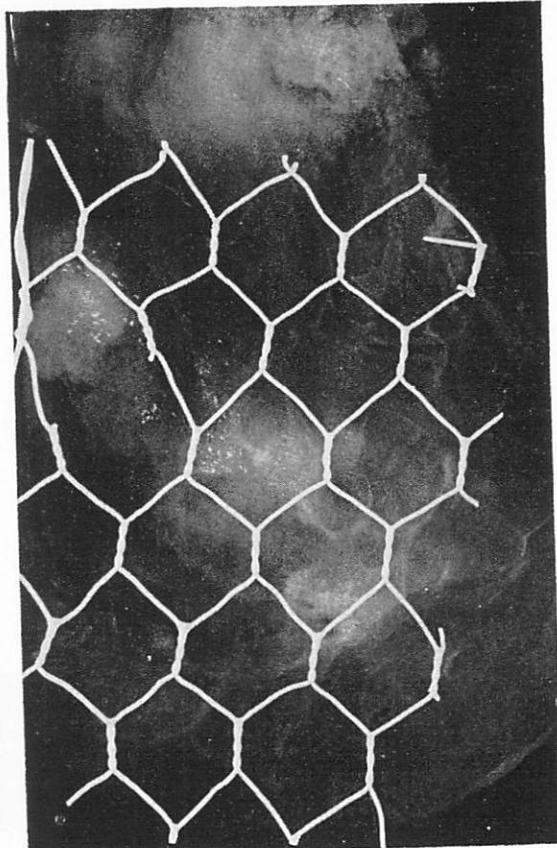


FIG. 20. Technique employed for localizing the calcifications in the operative specimen. All zones showing calcifications were studied. Their histopathologic examination revealed the existence of a solid epithelioma with large alveoli, with small cells, and central caseous necrosis with calcareous infiltration. (Professor P. Larghero Ibarz and Dr. Pradines.)

importance of these calcifications, which may be seen in extensive as well as in incipient lesions.

The roentgenographic study of the opera-

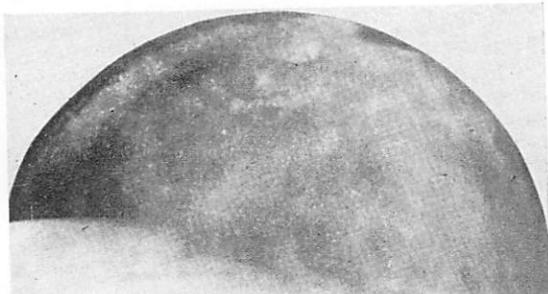


FIG. 21. Scattering of dotlike calcifications in all the breast.

tive specimen also permits the localization of the tiny calcifications for histopathologic study, and thus aids in finding a small cancer which would otherwise be overlooked.

We firmly believe that the recognition

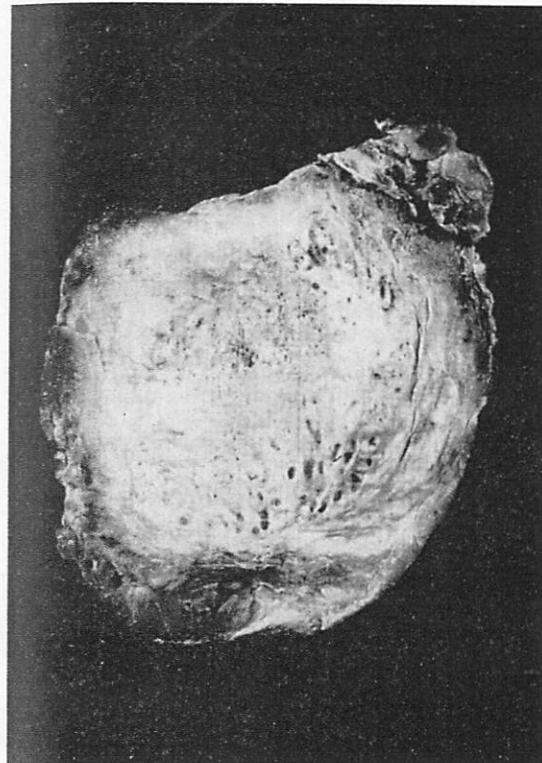


FIG. 22. Halsted operation on the same case by Professor J. C. del Campo. Photograph of a cross section of the operative specimen.

and demonstration of this roentgenographic sign constitutes one of the easily observed aspects in which mammary cancer is presented, especially in its ductal forms which seem to have slow growth during the first stage of evolution, and therefore susceptible of detection in prophylactic examinations of women who do not yet present clinical tumor symptomatology. With a systematic prophylactic roentgenographic examination of all women with antecedents of cancer in their family, we enter a new stage in the fight against mammary cancer.

Not all mammary calcifications are associated with malignant processes; they may



FIG. 23. Roentgenogram of the operative specimen of the same case (Fig. 21), showing the dotlike calcifications.

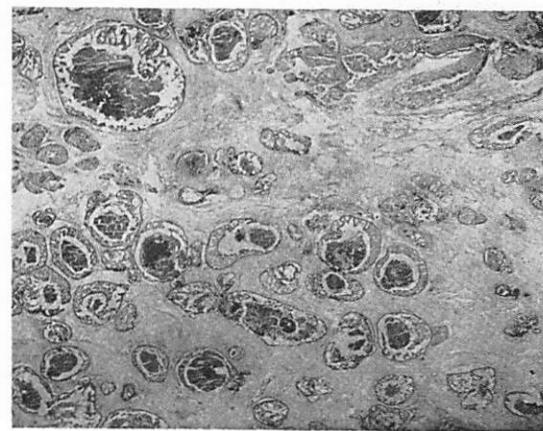


FIG. 24. Photomicrograph of the same case (Fig. 21) (Dr. J. F. Cassinelli.) Ductal epithelioma with central necrosis, and calcifications (comedocarcinoma). No glandular metastasis.

be found, much less frequently, in benign processes, whether in tumors, in blood vessels or as incrustations in the milk ducts.



FIG. 25. Scattering of dotlike calcifications.

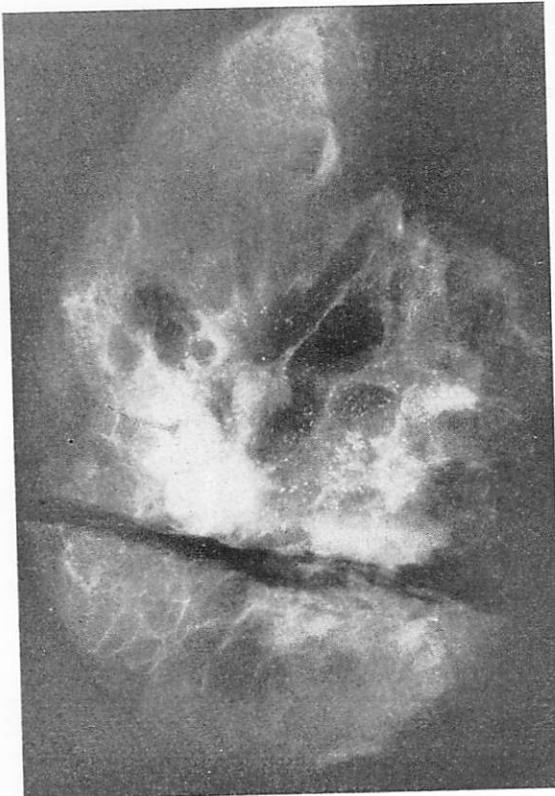


FIG. 26. Roentgenogram of the operative specimen of the preceding case (Fig. 25), where the calcifications are seen more clearly. Histopathologic study performed by Dr. J. J. Scandroglio revealed a comedocarcinoma.



FIG. 27. Extensive dissemination of calcifications.

With sufficient experience, differential diagnosis between calcifications of malignant processes which we have described and calcifications in benign processes is generally easy. In the latter, especially in fibro-adenomas, they differ from malignant calcifications in that they are larger, and therefore more easily visible, fewer in number, and are sometimes disposed around the

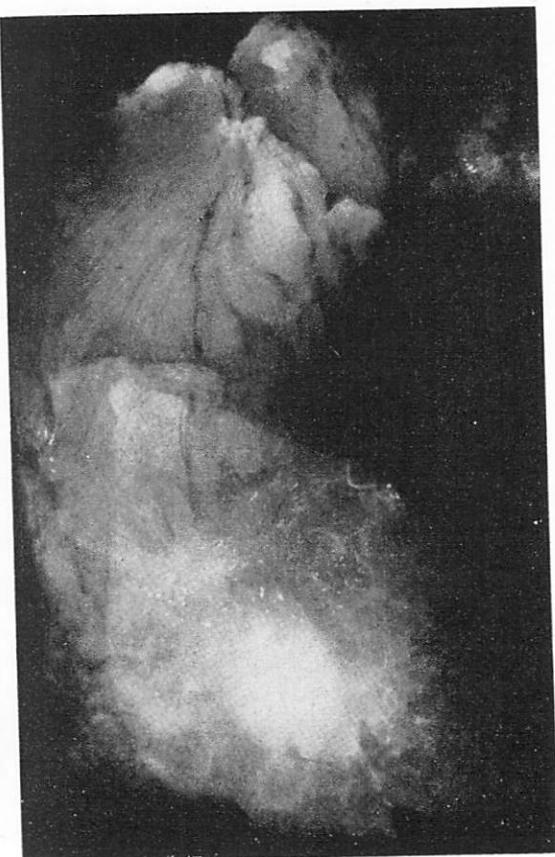


FIG. 28. Roentgenogram of the operative specimen (Fig. 27) of the preceding case, which shows mammary calcifications as well as those of an axillary gland. The histopathologic study performed by Professor Larghero Ibarz and Dr. Pradines showed scirrhous epithelioma with small cells, contained in large and small alveoli at the level of the mamma.

Caseous necrosis: The large alveoli have a comedocarcinoma appearance; but there is a predominance of cordlike infiltrations and small alveoli. Calcic infiltration.

Ganglia: Infiltration of the adenocarcinoma; complete obliteration of the structures of the lymphatic tissues. Fibroplastic reaction of the stroma. The afferent lymphatic cells are filled by carcinomatous cells.

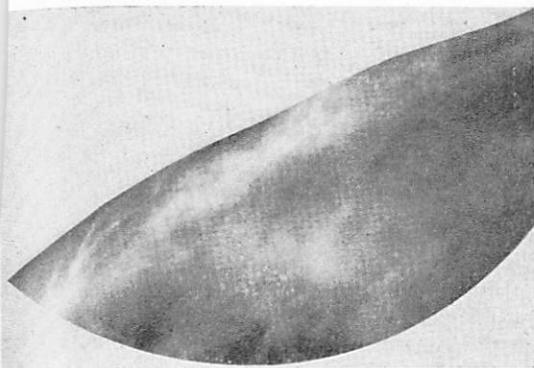


FIG. 29. Multiple dotlike calcifications inside a tumor nodule: scirrhou s epithelioma.

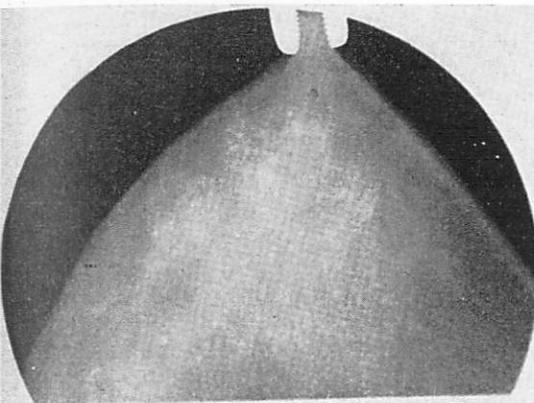


FIG. 30. Dissemination of the calcifications like grains of sand, scattered through the breast in a papillary epithelioma.

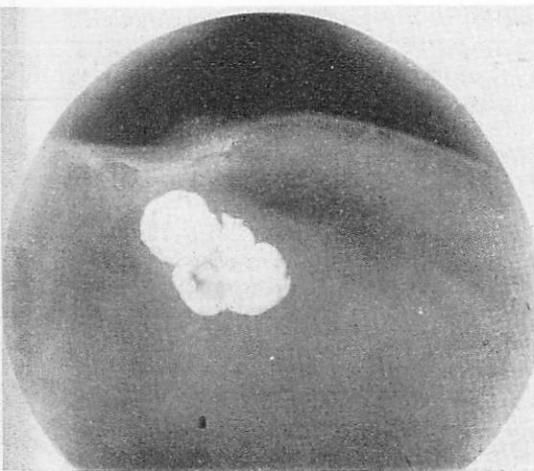


FIG. 31. Gross calcification in a fibroadenoma. Resection of the nodule. (Dr. R. Bellos.)

periphery of the tumor capsule. Calcifications in the lactiferous ducts may also

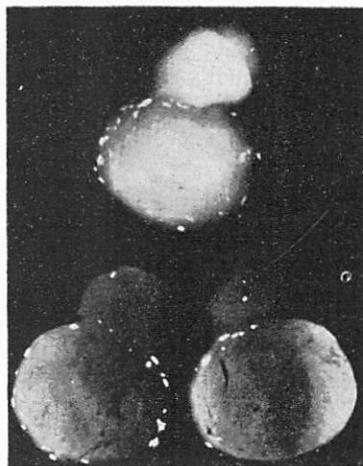


FIG. 32. Multiple calcifications disposed in the periphery of a fibroadenoma.

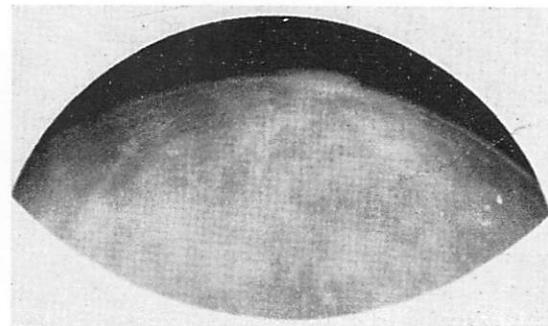


FIG. 33. Three easily seen calcifications. Small fibroadenoma.

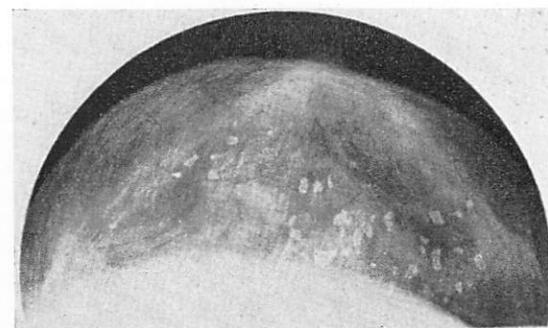


FIG. 34. Multiple calcifications are seen in the lining of the milk ducts. They must not be confused with those described herein as pertaining to malignant tumors.

present certain diagnostic difficulties, although frequently they have parallel or circular borders, depending upon the roentgenographic projection, and a certain tendency to converge towards the nipple when the process is generalized.

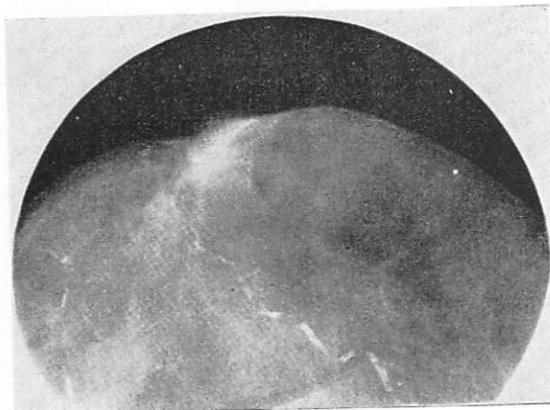


FIG. 35. Calcifications in the mammary arteries.

Calcifications in breast tumors have been recognized by pathologists; in our circles, Professor Carlos M. Domínguez and Dr. A. Lucas in 1930 had observed them on a roentgenogram of an operative specimen of the breast with papillary epithelioma; but until the present time they have not been given the extraordinary diagnostic value which we now attribute to them.

The fact that no tumor is seen on the roentgenogram has no diagnostic value, as some forms exist without roentgenographic visualization. In general, when no roentgenographic image is visualized coincident with a palpable tumor we advise that an exploratory biopsy be carried out without delay.

SUMMARY

A new roentgenographic sign demonstrable in many cases of malignant tumor of the breast is presented. It consists of multiple, punctate calcifications lying within, within and outside of, or entirely outside of a tumor shadow. They differ essentially from the convergent arrangement seen with lactiferous duct encrustations from blood vessel wall calcific deposits and from the coarser, fewer and sometimes peripherally distributed calcific deposits in fibroadenomas. A special low voltage roentgenographic technique with craniocaudal projection is required, best with the patient standing. Attention is also drawn to the differential roentgenographic aspects of benign and malignant breast tumors, aside

from the frequently encountered calcifications.

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