Mammographic Features of 300 Consecutive Nonpalpable Breast Cancers

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The mammographic presentations of 300 consecutive nonpalpable breast cancers were analyzed to more clearly define the spectrum of radiographic signs needed to detect cancer at such an early stage. Clustered calcifications were the primary mammographic abnormality in 42% of cases, but only 23% demonstrated the rod, curvilinear, and branching shapes that are characteristic of malignancy. Of the 300 cancers, 39% presented as dominant masses, but only 16% showed spiculated or knobby margins typical of carcinoma. Almost 20% of the cancers were detected primarily by "indirect" mammographic signs of malignancy, such as focal architectural distortion, asymmetry, single dilated duct, and the developing density sign. To take full advantage of the capabilities of mammography, radiologists must search diligently not only for the classic mammographic features of malignancy but especially for the more subtle and "indirect" signs that are less specific in predicting the presence of cancer.

Mammography provides the opportunity to detect breast cancer at an early stage, when it is nonpalpable and the likelihood for cure is great [1–5]. With the current increased use of mammography to screen asymptomatic women, it has become more and more important for radiologists to recognize the earliest presenting features of carcinoma [6]. While some nonpalpable cancers present with mammographic signs that are not at all characteristic for malignancy [7–13], how often this occurs is not widely known. To clarify the situation, we designed a study that catalogs the full spectrum of mammographic presentations by which a large series of nonpalpable cancers was detected.

Materials and Methods

From January 1976 to February 1984 300 fully documented nonpalpable breast cancers were examined by mammography at the University of California Medical Center in San Francisco. Since we routinely place preoperative mammograms into a teaching file upon pathologic diagnosis of breast cancer, all of these films were readily retrieved at the time of our retrospective review, insuring the assembly of a consecutive series of cases. Two criteria established eligibility for study: (1) that mammographic lesions were not palpable even in retrospect and (2) that there was clear-cut correlation via radiographs of resected tissue that each mammographic lesion came from within an area of histologically proved malignancy. To prevent diluting our study population with patients already known to have palpable or advanced breast cancer, we excluded patients with palpable cancer in the opposite breast or elsewhere in the same breast and also patients with distant metastasis who had mammography to search for a primary tumor site.

Mammography was done using conventional screen-film or xeroradiographic technique, frequently with additional magnification images [14]. All cases were reviewed retrospectively for the presence of classic, subtle, or "indirect" radiographic signs of malignancy [7, 8, 10, 13] and also to determine the most important mammographic feature prompting biopsy. We also collected data on breast parenchymal patterns, patient age, location and size of cancers, and staging for metastasis at the time of tissue diagnosis.

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TABLE 1: **Maximum Tumor Diameter of Nonpalpable Breast Cancers**

Size	No.	(%)
In situ*	84	(28)
≤5 mm	20	(7)
6–10 mm	78	(26)
11–20 mm	67	(22)
>20 mm	7	(2)
Multifocal	44	(15)
Total	300	(100)

* Ranging from 2 to 96 mm.

TABLE 2: **Breast Parenchymal Patterns in Nonpalpable Cancers**

Pattern	No.	(%)
N1	94	(31)
P1	74	(25)
P2	46	(15)
DY	86	(29)
Total	300	(100)

TABLE 3: **Mammographic Features Prompting Biopsy in Nonpalpable Breast Cancers**

Mammographic Features	No.	(%)
All calcifications:		
Linear/branching	68	(23)
Other irregular	8	(3)
Indeterminate shape	49	(16)
Subtotal	125	(42)
All masses:		
Spiculated/knobby	49	(16)
Irregular/poorly defined	57	(19)
Relatively well defined	12	(4)
Subtotal	118	(39)
All "indirect" signs:		
Architectural distortion	26	(9)
Developing density	19	(6)
Asymmetry	8	(3)
Single dilated duct	4	(1)
Subtotal	57	(19)
Total	300	(100)

TABLE 4: **Classic vs. Subtle Mammographic Signs Prompting Biopsy of Nonpalpable Breast Cancers**

Mammographic Signs	No.	(%)
Classic signs of malignancy:		
Linear/branching calcifications	68	(23)
Spiculated/knobby mass	49	(16)
Subtotal	117	(39)
More subtle signs of malignancy:		
Other calcifications	57	(19)
Other mass	69	(23)
"Indirect" signs	57	(19)
Subtotal	183	(61)
Total	300	(100)

Results

The patients were 24–88 years old (mean age, 57 years). Almost 80% were 40–69 and were fairly evenly distributed among these three decades.

Locations of cancers closely paralleled those from previously published large consecutive series composed primarily of palpable lesions [15, 16]. An absolute majority (52%) of our nonpalpable tumors arose from the upper outer quadrant of the breast, with about 15% each coming from the upper inner, lower outer, and retroareolar regions, and only 5% from the lower inner quadrant.

Maximum tumor diameter, measured by the pathologist in each case, varied from 2 to 96 mm (table 1). More than one-third of the lesions fit the Gallager-Martin definition of minimal breast cancer, being either noninvasive (in situ) or no larger than 5 mm in greatest diameter [17]. Multifocal cancer (tumor foci separated by at least 20 mm of benign tissue) was found in 15% of our patients. This certainly is an underestimate of the true frequency of multifocality since whole-breast histopathologic evaluation could not be done on the many patients whose surgery was limited to lumpectomy or quadrant excision based entirely on mammographic findings [18]. Only seven unifocal cancers (2%) were larger than 20 mm, most of these presenting mammographically with innumerable clustered calcifications that were found to represent extensive areas of comedocarcinoma.

Similar to the malignancies found by mammographic screening of asymptomatic patients, most nonpalpable cancers in this study were confined to the breast itself [1, 5, 12, 19]. Over 80% of our patients had no evidence of axillary nodal or systemic metastasis at the time of initial tumor staging, with only 6% having more than three positive axillary lymph nodes and just 2% demonstrating distant metastasis.

The breast parenchymal patterns associated with our 300 nonpalpable cancers are shown in table 2. More than half of the patients were in the lower-risk N1 and P1 groups. This observation has been made previously in populations heavily weighted with small breast cancers and strengthens the contention that parenchymal patterns are not sufficiently strong predictors of breast cancer risk to guide management decisions such as frequency of follow-up screening [19–21].

The major radiographic signs of carcinoma, tumor mass and clustered calcifications, were found to at least some degree in most patients. Indeed, more than half of the cancers had mammographically visible calcifications, 36% presenting with calcifications alone. In another 26% the sole mammographic finding was a dominant mass. However, almost 20% of our cases presented with neither mass nor calcifications, but were detected only by "indirect" mammographic signs of malignancy.

Table 3 catalogs the presenting signs of our nonpalpable cancers, concentrating on the most important mammographic feature that prompted biopsy in each case. Clustered calcifications were the most common finding, but in only slightly more than half of these cases did we identify the linear, curvilinear, or branching shapes characteristic of malignancy [7–9, 13, 14, 22]. Calcific particles seen in the rest of the cases were mostly of indeterminate shape; these lesions were biopsied primarily because malignancy could not be excluded

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rather than because it was strongly suspected. Among the cancers presenting as mass lesions, again only about half demonstrated spiculated or knobby margins typical of carcinoma [7, 8, 13], the rest appearing to have simply irregular or poorly defined borders. Although a few cancers were actually relatively well defined, none showed the completely smooth, sharply defined margins characteristic of benign masses. The most frequent among the "indirect" presentations of malignancy were focal architectural distortion and the developing density sign (a newly apparent or enlarging area of glandular tissue density). Only a few tumors were identified by the demonstration of a single dilated duct or an asymmetric area of increased density as compared with mirror-image location in the opposite breast. All in all, more than half of our nonpalpable cancers presented with mammographic features less than classic for malignancy (table 4).

Discussion

Mammographic detection of nonpalpable breast cancer permits earlier diagnosis and almost certainly reduces mortality from the disease [2–5]. The increasing emphasis on using mammography to screen asymptomatic women for breast cancer is placing the responsibility for tumor detection more and more with the radiologist. While it has long been known that cancer occasionally presents mammographically with less than "textbook" features of malignancy, we are only now beginning to appreciate the great extent to which this occurs for nonpalpable neoplasms, just those tumors that we are expected to discover by screening. In this large series of nonpalpable cancers, 61% were detected solely by recognition of either subtle or "indirect" mammographic signs. The message to radiologists is clear: To take full advantage of mammography we must search diligently not only for characteristic tumor masses and clustered calcifications, but especially for more subtle signs of malignancy.

In so doing, we must anticipate all the consequences of lowering our threshold for recommending biopsy. While the detection of many small, otherwise overlooked carcinomas surely will occur, it is equally certain that there will be a large number of additional biopsies for lesions that prove to be benign. Furthermore, the percentage of benign biopsies likely will increase compared with current practice, because the more subtle mammographic features of malignancy are less specific indicators of underlying cancer than are the classic signs [11, 13]. Therefore, we should prepare for the increase in "false-positive" interpretations that inevitably will accompany the attempt to detect smaller and smaller cancers. To do this, we must convince our referring physicians and patients that it is only by accepting the philosophy of searching aggressively for the earliest, most subtle signs of malignancy that we all will derive the maximum benefit from mammographic screening.

Identification of numerous cancers in this series was facilitated by the use of magnification imaging as an adjunct to conventional mammography. In many cases the added information provided by fine-detail magnification views prompted the immediate biopsy of a small carcinoma instead of the alternate approach of periodic mammographic follow-up. The specific role of magnification mammography in the diagnosis of nonpalpable breast cancer will be the subject of a separate publication.

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