Localization of Breast Lesions Identified on Only One Mammographic View

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Occasionally, a breast lesion is visible in only one mammographic projection. A simplified method of using parallax in a dedicated mammographic system has been devised to locate accurately lesions that are not visible in two orthogonal projections. In eight patients, a parallax approach from essentially a single mammographic position was used to place a hookwire preoperatively at nonpalpable suspicious abnormalities detected by mammography. Needles were inserted parallel to the chest wall while the breast was compressed in the mammographic unit. In each case, the tissue containing the lesion was pierced by a needle chosen to be longer than the distance from the skin to the abnormality. Simple geometric ratios were used to determine the position of the lesion along the needle shaft after slightly changing the mammographic projection and viewing the needle obliquely.

In all cases, this parallax approach permitted accurate localization of the lesion.

The use of dedicated mammographic equipment has led to a marked improvement in mammography. The need to compress the breast for optimal film/screen imaging has required modifications in localization techniques that have led ultimately to safer, more accurate placement of needles and guidewires [1]. Occasionally, a lesion is encountered that cannot be imaged on 90° projections. Such a lesion poses a challenge. We previously have described methods to triangulate and preoperatively locate such difficult lesions by using sonography or CT of the breast [2, 3]. On rare occasions, however, a lesion visible in only one mammographic view is not amenable to localization by these methods. Some clustered microcalcifications, for example, will not be visible on CT because of volume averaging, and sonography cannot detect microcalcifications. We have devised a simple but quite accurate method for the localization of such lesions.

Subjects and Methods

In eight patients with nonpalpable mammographically detected lesions, we undertook preoperative radiographically guided localization from essentially a single mammographic position. Seven of the eight lesions were visible in orthogonal projections, but because the new technique required the same number of exposures as our standard procedure, the lesions were located by using the parallax technique. The eighth lesion, a small cluster of calcifications, was visible only in the mediolateral oblique and straight lateral view. It could not be seen in the craniocaudal projection and could be located only by using this new technique.

All localizations were performed by using a dedicated mammography unit (Model 500T, Thomson-CGR Medical Corp., Columbia, MD) and the DKBL-A 20-gauge springhook wire localization guide (Cook, Inc., Bloomington, IN). The localizations were begun by using our standard approaches parallel to the chest wall with the breast compressed between a fenestrated compression plate and cassette holder [1]. The breast was positioned so that the lesion would project within the opening in the compression plate (Fig. 1). Needles were selected to be longer than the distance to the lesion from the skin surface should the breast be compressed in the orthogonal projection. This was to ensure that the lesion could be

Received October 10, 1986; accepted after revision March 25, 1987.

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AJR 149:39–41, July 1987
0361–803X/87/1491-0039

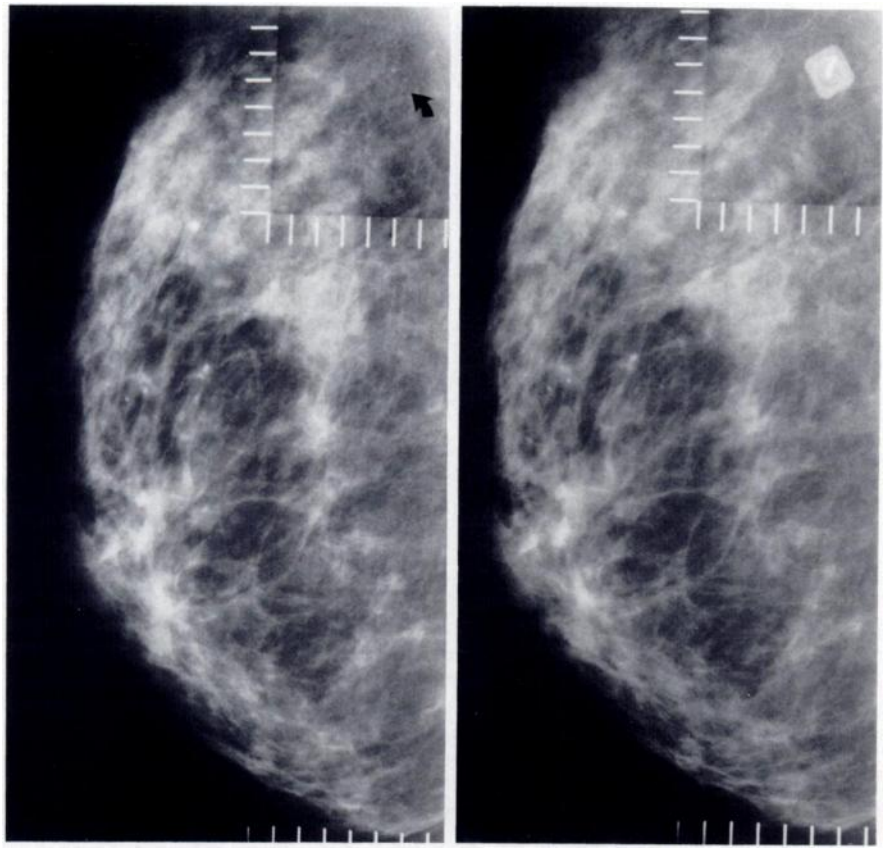

Fig. 1.—Mammogram shows microcalcifications (*arrow*) in upper left breast in window of compression plate.

Fig. 2.—Mammogram shows view looking down needle, which is superimposed on calcifications.

transfixed along the shaft of the needle. All needles were introduced parallel to the chest wall in the direction of the X-ray beam.

In all eight patients, the hub of the needle was superimposed on the shaft of the needle, and this in turn was superimposed on the lesion. This guaranteed that the lesion would be within 5 mm of the shaft of the needle.

With the patient remaining in compression, the superimpositions were confirmed by a mammogram (Fig. 2), and then, without removing the patient from the mammographic unit, the compression was relaxed. The needle was kept within the window of the compression plate, and the breast was repositioned slightly and then recompressed so that the needle was oblique to the X-ray beam. The degree of obliquity was not important. A mammogram obtained in this orientation produced a foreshortened projection of the entire needle and the lesion along its shaft (Fig. 3). By noting that the true distance of the lesion from the tip of the needle bears the same relationship to its projected distance from the tip as the true length of the needle does to its projected length (Fig. 4), we were able to determine the actual distance beyond the lesion that we had passed the needle. We then pulled the needle back this distance and afterloaded the hookwire and engaged it at the proper depth (Fig. 5).

Results

All eight lesions were located successfully by using this technique. In seven of the eight cases, the position of the lesion along the wire was confirmed by obtaining a final image in the orthogonal projection perpendicular to the wire. In these cases, the lesion was no more than 5 mm from the wire and was positioned optimally along the thickened segment of the wire 1 cm proximal to the hook. The eighth lesion was very close to the pectoralis fascia and was too deep to be seen in the orthogonal projection. However, the location of the calcifications was confirmed by using this parallax technique (Fig. 5), and at surgery the calcifications were found along the thickened segment of wire.

Discussion

Localization of a lesion requires knowledge of the lesion's general position. This is accomplished most easily by seeing a lesion in two mammographic projections that are orthogonal to each other. However, when this is not possible, the three-dimensional location of the lesion can be narrowed down to the medial, mid, or lateral third of the breast by noting the lesion's projected shift between two mammographic positions that are at slightly different angles. For example, by obtaining a straight lateral mammogram and a mediolateral oblique view, the apparent shift of the lesion between these two projections can be observed [4]. A lesion in the lateral aspect of the breast will appear to move up within the breast between the straight lateral and mediolateral oblique views, whereas a lesion located medially in the breast will appear to move down when these two views are compared. By knowing which third

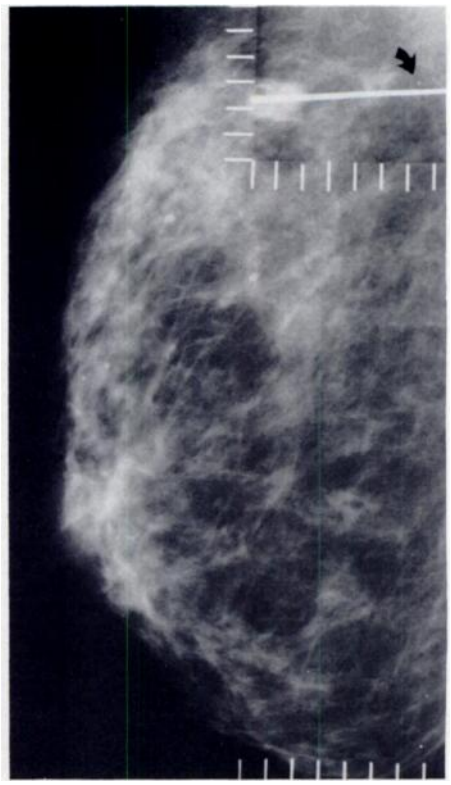

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Fig. 3.—Mammogram shows how recompression projects needle obliquely. Calcifications are visible along shaft (*arrow*).

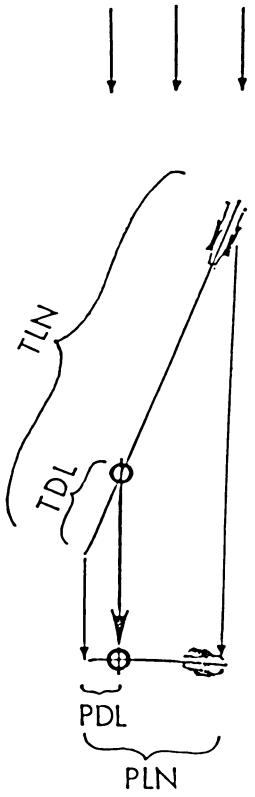

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Fig. 4.—Schematic drawing shows simple geometric relationship between true needle and lesion relative to projected lesion and projection of needle. TDL = True distance of lesion from needle tip; this is distance needle must be pulled back to position its tip in the lesion. TLN = True length of needle. PLN = Projected length of needle. PDL = Projected distance of lesion from needle tip. Because TLN, PLN, and PDL are known lengths, TDL can be calculated by the following equation: TDL = (TLN/PLN) × PDL.

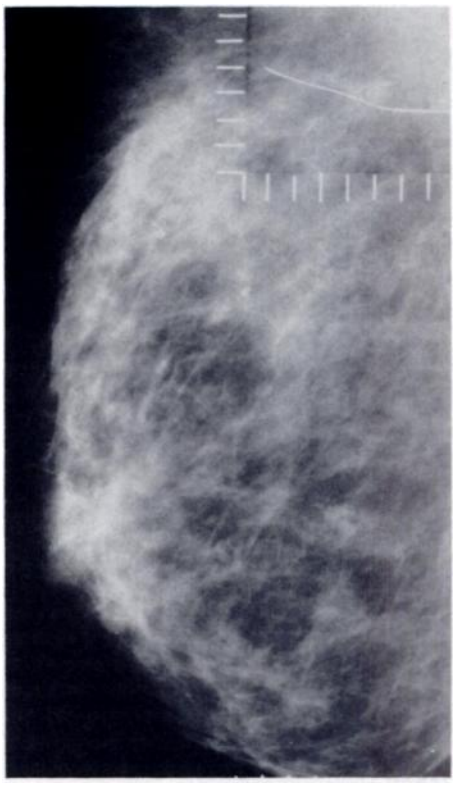

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Fig. 5.—Mammogram shows hookwire projected at an oblique angle at calcifications.

of the breast the lesion is in, one can choose an appropriate needle that is longer than the expected distance to the lesion. Once the lesion is along the shaft of the needle, this parallax technique and simple geometry can be used to determine the true distance.

This technique is slightly more complicated than our usual procedure, but it provides a method for positioning guides at lesions that are not visible in 90° projections. Because of beam divergence, the ratios are not exact, but with long source-to-image distances this lack does not, in practice, affect accuracy.

Measurements of the true length of the needle must take into account that the projected needle includes the entire shaft. If, for example, springhook wires are used, the 9-cm needle actually measures 11.4 cm from the point to the proximal end. This number is used in the calculations.

When using this parallax technique, one also must be aware that the breast is compressed when the hook is engaged. The breast will reexpand when uncompressed, and the hook will move with the tissue volume in which it is engaged. Because of this basic elasticity, distances are amplified with reexpansion. To account for this, the needle tip should be pulled back to the lesion to engage the hook of the wire at the lesion. Then, when the breast reexpands, the lesion will be at or proximal to the hook along the thick segment.

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