Wire Localization In The Management
Of Non palpable Breast Lesions

Thesis
Submitted in partial fulfillment of the degree of M.D .in surgical oncology
Presented by
Ragab Ali Abd El Aziz Sherief
M.B.B.Ch.,M.Sc.

Under Supervision
Prof. Dr. Mohamed Mahmoud Abo El-Ela
Professor of Surgical Oncology
The National Cancer Institute
Cairo University

Prof. Dr. Mohamed Abd El Sabour Shaalan
Professor of Surgical Oncology
The National Cancer Institute
Cairo University.

Prof. Dr. Maha Heussen Helal
Professor of Radiodiagnosis
The National Cancer Institute
Cairo University

Prof. Dr. Mohamed Akram Nouh
Professor of Pathology
The National Cancer Institute
Cairo University.

The National Cancer Institute
Cairo University
2012
علاج أورام الثدى غير المكتشفة اكلنكاً بواسطة
السلك الموجه

رسالته مقدمة من الطبيب/ رجب على عبد العزيز شريف
تمهيدها لنيل درجة الدكتوراة في جراحة الأورام
بالمعهد القومي للأورام
جامعة القاهرة

تحت إشراف
أ.د/ محمد محمود إبراهيم العلا
استاذ جراحة الأورام
بالمعهد القومي للأورام
جامعة القاهرة

أ. د. محمد عبد الصبور شعلان
استاذ جراحة الأورام
بالمعهد القومي للأورام
جامعة القاهرة

أ. د. مها حسين هلال
استاذ الأشعاش التشخيصية
بالمعهد القومي للأورام
جامعة القاهرة

أ. د. محمد أكرم نوح
استاذ الباثولوجي
بالمعهد القومي للأورام
جامعة القاهرة
المعهد القومي للأورام
جامعة القاهرة

٢٠١٢
Abstract

The study included 50 patients with a non-palpable breast lesion seen at the NCI Cairo University during the period from January 2007 to December 2010 who underwent hookwire localization excisional biopsy (HWLB).

The procedure begun by evaluating the location of the lesion on the screening mammograms. If the lesion was closest to the medial surface of the breast initial needle positioning was accomplished by a mediolateral approach, inserting the needle from the medial skin surface. A lesion near the top of the breast was localized from the craniocaudal projection Based on our results we do recommended wire localization before open surgical excision of non-palpable breast masses and suspicious microcalcification and the method of guidance either mammographic or sonographic is left for the radiologist preference and the lesion acceceptibility.

Key word : Wire Localization - Non palpable Breast Lesions -
Aim of the work

To provide safe accurate guidance for the surgeon preoperatively to ensure precise excision of non-palpable lesions or questionable microcalcification aiming at avoiding removal of excess normal breast tissue.
Modalities of Breast Imaging

Mammography

Mammography currently is the most practical method of detecting breast carcinoma at an early and highly curable stage, ideally discovering an occult cancer (<5 mm in diameter). The clinical advantages of discovering breast carcinoma during its earliest stage include higher percentage of localized disease, lower rate for women whose breast cancer is believed to be localized to the breast with negative axillary nodes is approximately 85%. In contrast, the 5-year survival rate is only 53% when axillary nodes are positive. Ten-year survival statistics in women with negative nodes are approximately 74%, and 39% in women with positive nodes. Mammography is also the most accurate conventional method of detecting nonpalpable breast carcinoma. Therefore, with increasing emphasis on conservative surgery for early carcinomas, mammography will not only save lives but also conserve breast (Moss & Steinhauer 2002).

The number of women receiving screening mammography has increased dramatically over the past 10 years. Mammography is not as precise in younger women or in women with dense breasts secondary to fibroglandular tissue. Mammography is most sensitive in older women in which the majority of the breast is composed of fatty tissue (Rosenberg et al., 2006).

Most physicians are able to consistently palpate breast masses when they are 1 cm in diameter or greater. Mammography may discover fine calcifications in breast neoplasms months to years before the carcinoma enlarges to a size that may be palpated on physical examination. Sections are the strongest independent
predictor of relapse-free survival in women with node-negative breast cancer. The average breast carcinoma grows for 3 years, to enlarge from 1 mm to 1 cm \textit{(lewin et al., 2002)}. 

Present recommendations to detect breast cancer include encouraging all adult women to perform BSE monthly. The American Cancer Society recommends a clinical breast exam every 3 years for women younger than 40 and yearly for women older than 40 years of age. Because one third of breast carcinomas occur before age 50, increasing emphasis is being placed on early discovery in young women. After many years of debate there is consensus among the American Cancer Society, the American College of Radiology, and the American College of Obstetricians and Gynecologists that annual screening mammography should be offered to all women starting at the age of 40 \textit{(Rosenberg et al., 2006)}. 

Optimal identification of early breast carcinoma by mammography depends on a competent technician obtaining excellent images and the radiologist searching for subtle changes. For screening mammography, two views of each breast are performed: the mediolateral oblique (MLO) and the craniocaudal (CC). The MLO is the most effective single view because it includes the greatest amount of breast tissue and is the only view that includes all of the upper outer quadrant and axillary tail \textit{(Sickles et al., 1999)}. 

Breast cancer may be detected by visualizing clusters of fine calcifications, spiculations, or poorly defined multinodular masses with irregular contours, all characteristic of malignancy. Isolated clusters of tiny calcifications are the most common and
important diagnostic sign of an early carcinoma. Calcifications are often smaller than 0.5 mm in diameter and thus must be identified by a magnifying lens. The presence of five or more calcifications within a volume of 1 cm³ is termed a cluster. Subsequent breast biopsies will find 25% of clusters associated with cancer and 75% with benign disease. Conversely, approximately 68% of occult breast carcinomas and 34% of palpable breast cancers demonstrate calcifications on mammographic examination (*Moss & Steinhauer 2002*).

Standardized terminology should be used to describe mammographic findings. As a result, the American College of Radiology Breast Imaging Reporting and Data System (BI-RADS) was devised to standardize mammographic terminology, reduce confusing interpretations, and facilitate the monitoring of outcomes. The report includes an overall assessment of the likelihood that the finding represents a malignancy. There are six assessment categories, each associated with a specific risk of cancer. In the conclusion of every mammogram report, the final assessment is provided to prevent confusion and to guide the referring health care professional as to a recommended plan of action (*American College of Radiology 2003*).

Diagnostic mammography is a comprehensive radiologic examination that usually involves multiple individualized and specialized equipment and views. The extra views and magnification increase the sensitivity and specificity of the procedure. Often mammography is used to locate a breast lesion prior to open biopsy or to obtain stereotactic core biopsy during mammographic imaging. Although the primary role of mammography is to screen women with no symptoms or signs of
breast cancer, mammography is also used diagnostically. The diagnostic follow-up to an abnormal screening mammogram is individualized depending on a woman's risk factors, physical examination, and age. The BI-RADS classification of screening mammograms can be helpful in assessing risk and devising a management plan. Obviously, it is ideal to use nonsurgical methods to treat low-risk women and try to perform stereotactic or open biopsy depending on relative risk (Miglioretti et al., 2007).

**Characterization of Mammographic Findings:**

Characterization is the process to determine if a suspected mammographic finding represents normal tissue, a benign finding, or potentially breast cancer. The goal of characterization is to establish a probability of malignancy and threshold the finding to determine if tissue sampling is required. This assessment is based on morphologic appearance of a finding and stability or change over time, Mammography is not tissue specific. Some very low probability appearing abnormalities will prove to be malignant, and conversely, some high probability findings will be benign. Distinguishing between which lesions require biopsy and which can be followed involves thresholds. Most U.S. radiologists recommend biopsy for probability of cancer greater than or equal to 3% (Rakha & Ellis 2007).

**Food and Drug Administration and Breast Imaging Reporting and Data System Final Assessment Categories:**

In order to provide national uniformity for reporting and assessment of mammographic findings, the American College of Radiology developed a lexicon for final assessment
classifications called the Breast Imaging Reporting and Data System (BI-RADS). After analyzing a mammogram, radiologists classify their findings into one of five final assessment categories. MQSA requires the use of final assessment categories paralleling those of the American College of Radiology. This lexicon is now used internationally. The final assessment categories are presented in Table(1). The categories are as follows:

- Category 1: negative,
- Category 2: benign finding,
- Category 3: probably benign finding,
- Category 4: suspicious abnormality,
- Category 5: highly suggestive of malignancy (risk ≥ 95%).

Category 4 can be subdivided by risk into 4A (low), 4B (intermediate), and 4C (moderate). Functionally, category 1 and 2 represent a normal mammogram without findings of malignancy, Routine screening mammography is recommended for follow-up. Category 2 can include a normal finding, such as a calcified fibroadenoma, normal lymph node, or stable benign appearing calcifications. Category 3, probably benign, represents a finding of such low probability for malignancy that follow-up is recommended instead of biopsy. Multiple studies have established the risk of malignancy to be less than 2%. The risk of malignancy expresses itself generally over the first 2 years (Rosn et al., 2002).

The risk of malignancy expresses itself generally over the first 2 years. Recommended management consists of a follow-up mammogram at 6 months following the initial examination with subsequent follow-up at 12 and 24 months unless biopsy is elected by the patient or physician. Diagnostic mammography should be performed prior to using the probably benign category.
Most probably benign literature relates to nonpalpable mammographic findings. Categories 4 and 5 assessments are abnormalities that require tissue biopsy for diagnosis. These categories represent a broad range (3% to 100%) of risk for cancer, and experienced radiologists can render reasonable probability of malignancy estimates (Mark., 2010).

<table>
<thead>
<tr>
<th>Complete final Assessment Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category 1</strong></td>
</tr>
<tr>
<td>There is nothing to comment on. The breasts are symmetrical and no masses, architectural disturbances, or suspicious calcifications are present.</td>
</tr>
<tr>
<td><strong>Category 2</strong></td>
</tr>
<tr>
<td>Like Category 1, this is a “normal” assessment, but here, the interpreter chooses to describe a benign finding in the mammography report. Involuting, calcified fibroadenomas, multiple secretory calcifications, fat-containing lesions such as oil cysts, lipomas, galactoceles and mixed-density hamartomas all have characteristically benign appearances, and may be labeled with confidence. The interpreter may also choose to describe intramammary lymph nodes, vascular calcifications, implants or architectural distortion clearly related to a prior surgery while still concluding that there is no mammographic evidence of malignancy. Note that both Category 1 and Category 2 assessments indicate that there is no mammographic evidence of malignancy. Note that both Category 1 and Category 2 should be used when describing one or more specific benign mammographic findings in the report, whereas Category 1 should be used when no such findings are described.</td>
</tr>
<tr>
<td><strong>Category 3</strong></td>
</tr>
<tr>
<td>A finding placed in this category should have less than a 2% risk of malignancy. It is not expected to change over the follow-up interval, but the radiologist would prefer to establish its stability. There are several prospective clinical studies demonstrating the safety and efficacy of initial short-term follow-up for specific mammographic findings. Three specific findings are described as being probably benign (the noncalcified circumscribed solid mass, the focal asymmetry and the cluster of round (punctate) calcifications; the latter is anecdotally considered by some radiologists to be an absolutely benign feature). All the published studies emphasize the need to conduct a complete diagnostic imaging evaluation before making a probably benign (Category 3) assessment; hence it is inadvisable to render such an assessment when interpreting a screening examination. Also, all the published studies exclude palpable lesions, so the use of a probably benign assessment for a palpable lesion is not supported by scientific data. Finally, evidence from all the published studies indicates the need for biopsy rather than continued follow-up when most probably benign</td>
</tr>
<tr>
<td>Category</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Category 0</td>
</tr>
<tr>
<td>Category 1</td>
</tr>
<tr>
<td>Category 2</td>
</tr>
<tr>
<td>Category 3</td>
</tr>
<tr>
<td>Category 4</td>
</tr>
<tr>
<td>Category 5</td>
</tr>
<tr>
<td>Category 6</td>
</tr>
</tbody>
</table>
A category “incomplete” (BI-RADS 0) is used when a screening study requires additional imaging such as recall for diagnostic mammograms or comparison with older examinations prior to rendering a final assessment. An incomplete assessment is just that, incomplete. An incomplete examination should not be considered “abnormal” as most will be shown to be normal. Only after diagnostic imaging or comparison with older films can a category 1 to 5 final assessment be rendered. “Incomplete” has been used to categorize a normal mammogram in a setting of a palpable mass with assessment decision deferred to findings on ultrasonography. Although this is an acceptable use per FDA guidelines, it has lead to some confusion in the performance literature based upon BI-RADS codes alone. I prefer a definitive mammographic assessment as “negative” in this situation but recommend ultrasound examination of the palpable finding and report the sonographic finding independently. BI-RADS category 6, “known biopsy proven malignancy,” can be used for cases with known malignant diagnosis (Pisano et al., 2005).

Although BI-RADS reporting system has been favorably received, confusion can arise from patients and clinicians when a suspicious palpable or sonographic mass has a “negative” mammogram report. In these situations tissue biopsy is recommended when the palpable or sonographic findings are suspicious even if the mammogram is negative. A negative mammogram in the presence of a suspicious clinical finding, suspicious ultrasonogram, or suspicious MRI, should never obviate a needed surgical biopsy. Mammography cannot rule out cancer (Vizcaino et al., 2001).
Mammographic Appearance of Breast Cancer

A- Masses

Masses account for nearly half of all mammographic cancers. Masses refer to space occupying lesions that can be detected in two different projections. Masses are characterized by their shape, margin, and density in order to determine a probability of malignancy. Because of the infiltrative biologic nature of most breast cancers, irregular or lobular-shaped masses are more likely associated with malignancy than round or oval masses. The margin between a mass and the surrounding breast tissue is the key feature for analysis of masses because it relates to the infiltrating pattern of cancer. Often, margins are obscured by breast tissue, rendering this evaluation impossible. Circumscribed, well-defined margins tend to represent a benign process (Fig.1) such as cysts or fibroadenomas. Margins that are indistinct or microlobulated suggest infiltration into normal breast tissue and higher risk for malignancy(Figs. 2&3). Smoothly marginated masses are usually subjected to ultrasound interrogation to assess if they represent a breast cyst for which no further intervention is required or a solid mass, which often requires biopsy (Sickles et al.,2002).
Figure (1) Smoothly marginated round 14-mm mass. Sonogram demonstrated a simple cyst

Figure (2) Spot compression view of a 10-mm mass with slightly irregular borders shown to represent invasive duct carcinoma.
Figure(3). Mass with very spiculated borders shown to be invasive ductal carcinoma. Although the appearance is “classic” for carcinoma, most cancers found on mammography do not have a classic appearance.

B- Calcifications

For reasons not entirely understood, calcifications are formed or are associated with breast carcinomas. Fortunately, calcifications are exquisitely detected by mammography, with particles as small as 50 µm being visible. Because calcium absorbs x-rays, they produce a bright white spot on a mammogram. This inherent contrast between calcification and background tissue is a significant reason why mammography is successful in detecting small tumors, especially those associated with DCIS. (Fig.4). Mammography allows “elemental” imaging of calcifications. Calcifications can be seen reasonably well in dense breasts because calcium absorbs more x-ray energy than dense tissue (Fig.5) (Mark.,2010).

Unfortunately, many benign conditions such as fibrocystic change also produce breast calcifications, which at times mimic breast cancer calcifications. Some type of calcification is present on most mammograms. The radiologist is faced with a common problem regarding the nature and significance of calcifications.
Magnification mammography is critical in characterizing calcifications. This allows better morphologic assessment of individual particles and clusters. Assessment of microcalcifications includes location, morphology, distribution, number, and biologic stability or progression. All of these factors are important in determining a risk of malignancy (Mark., 2010).

Figure (4). A 5-mm area of microcalcifications in a dense breast detected by screening mammography. DCIS found at pathology.

Figure (5). A 20-mm area of pleomorphic microcalcifications in an extremely dense breast. Invasive ductal carcinoma found at pathology.
Distribution of calcifications in addition to morphology, number, and biologic change helps establish a probability of malignancy:

- **Grouped or clustered**: Clustered calcifications refer to a group of calcifications in a less than 2 cm³ volume of tissue. Although “cluster” has historically been associated with malignancy, this term can be used as a neutral designator.

- **Linear**: Calcifications that appear to be arranged within a line or duct imply a ductal origin. This is of moderate suspicion.

- **Segmental**: Calcifications restricted to a segment or wedge-shaped portion of the breast may arise within a single ductal system and its branches. This is a distribution frequently associated with malignancy. Diffuse/scattered: Calcifications that appear to be randomly distributed throughout the breast are referred to as diffuse or scattered. Compared to linear or segmental, scattered calcifications are associated with lower risk of malignancy (Pisano et al., 2005).

**C- Architectural Distortion**

Architectural distortion may be a very subjective appearance on a mammogram or a straightforward observation. Architectural distortion refers to an unusual pattern that includes spiculations and retraction (Fig.6). Unless associated with an area of prior biopsy or area of prior infection, architectural distortion requires tissue diagnosis. A benign entity, radial sclerosing lesion, may have this appearance, but biopsy is necessary to establish histology. Skin retraction and nipple retraction carry significant risks of malignancy and require tissue biopsy (Miglioretti et al., 2007).
Figure(6). A: Subtle area of architectural distortion (arrows). B: Spot compression views demonstrate distortion with questionable mass to a better advantage. Invasive lobular carcinoma diagnosed at biopsy.

**Digital Radiography**

Digital radiography is the technique by which X-ray photons are detected after passing through the breast tissue and the radiographic image is recorded electronically in a digital format and stored in a computer. Digital technology has multiple advantages compared with conventional mammography. Image acquisition, display, and storage are much faster, and image manipulation through adjustments in contrast, brightness, and electronic magnification of selected regions enables radiologists to obtain superior views. This technology makes it possible to subtract various layers of computerized imagery in order to examine suspicious areas and improve the ability to detect and diagnose breast carcinoma. Digital mammography is particularly
helpful in screening women with very dense breasts and breast implants. With the ability to manipulate the images, digital mammography will reduce the number of women recalled for more images. Computer-aided diagnosis is also possible with this technique as well as the ability to transmit the image electronically. Because of low background “noise” and superior contrast capabilities, the final image is superior to conventional mammography (Rosen et al., 2002).

**Breast Ultrasound**

Ultrasound has a definite role as a complementary procedure to other imaging techniques in the diagnosis of breast disease, particularly in differentiating cystic from solid masses. It should not be used as a “screening test” except for women with very dense breasts who cannot be adequately screened with mammography. Ultrasound screening increased the detection of otherwise occult cancers by 37% in a recent study involving 3626 women age 42 to 67, with dense breasts and no visible abnormalities on mammography. In the general population the effectiveness of ultrasound “screening” is more limited (Stavros et al., 2003).

**Indications for the use of breast ultrasound include:**

- Characterization of palpable mass and distinction from lumpiness.
- Evaluation of mammographically detected mass, developing density, or focal asymmetry.
- Evaluation of a finding suspicious for cancer.
• Evaluation of extent of disease in a newly discovered breast cancer: multifocality, multicentricity, axillary adenopathy in the ipsilateral breast, and occult cancer in the contralateral breast.
• Evaluation of clinically significant nipple discharge.
• Evaluation of the inflamed breast: mastitis, abscess, or inflammatory carcinoma.
• Evaluation of the postoperative surgical bed.
• Evaluation of locally advanced breast cancer before, during, and after preoperative chemotherapy.
• Evaluation of MRI-detected, mammographically occult lesion (second-look ultrasound).
• Evaluation of possible problem with implants.
• Guidance for interventional procedures.
• Screening for high-risk individuals with dense breasts (Khouri, 2010).

The primary advantage of ultrasound is the ability to produce images of breast tissue on multiple occasions without harmful effects. It is most useful in evaluating solitary masses greater than 1 cm in diameter. The greatest limitation of ultrasonography of the breast is the limited spatial resolution. Microcalcifications are not visualized because resolution of less than 2 mm is difficult with ultrasound. Whether it can distinguish benign from malignant lesions has been a topic of great debate. When describing lesions on US, the following characteristics should be Included: margins, echogenicity, internal echo pattern, retrotumoral pattern, lateral/anterior–posterior (AP) pattern, and compressibility (Cho et al., 2006).