JKAU: Med. Sci., **Vol. 19** No. 2, pp: 75-87 (2012 A.D. / 1433 A.H.)
DOI: 10.4197/Med. 19-2.6

The Role of Fine-Wire Localization Breast Biopsy in the Management of BI-RADS Category 4-5 for Non-Palpable Breast Lesions: An Experience at King Abdulaziz University Hospital, Saudi Arabia

Zuhoor K. Al Gaithy, MD, FRCSI
Department of Surgery, Faculty of Medicine, King Abdulaziz University
Jeddah, Saudi Arabia
zkngaithy@hotmail.com

Abstract. The aim of this study is to determine a positive predictive value for malignancy in patients initially categorized as having Breast Imaging Reporting and Data System categories 4 and 5 with non-palpable breast lesions that underwent fine wire-localized biopsy. 116 patients underwent this process at the Surgery Department, King Abdulaziz University Hospital, Saudi Arabia: from December 2007 through November 2009. By histopathology, out of 116 patients, 76 (65.52%) were benign and 44 (37.93%) malignant lesions. According to Breast Imaging Reporting and Data System categories: 89 (76.72%) were category 4 and 27 (23.28%) were category 5. In category 4, 70.80% (n=64) of cases were benign and 28.10% (n=25) were malignant given positive predictive value 28.09%. In category 5, 29.60% (n=8) of cases were benign and 70.10% (n=19) were malignant given positive predictive value 70.73% after fine wire-localized biopsy for non-palpable breast lesions. In conclusion, combination of Breast Imaging Reporting and Data System categories and fine wire-localized biopsy for non-palpable breast lesions is safe, but the positive predictable value of malignancy of Breast Imaging Reporting and Data System was low especially in category 4. Preoperative histological confirmation is very important for suspicious non-palpable breast lesions to avoid unnecessary open breast biopsy.

Keywords: Biopsy; BI-RADS category; Cancer diagnosis; Localization; Mammography.

Correspondence & reprint request to: Dr. Zuhoor K. Al Gaithy
P.O. Box 80215, Jeddah 21589, Saudi Arabia
Accepted for publication: 08 February 2012. Received: 30 October 2011.

Introduction

In 1993, the American College of Radiology (ACR) developed the breast imaging reporting and data system (BI-RADS) to standardize the interpretation of mammographic findings, to communicate with referring physicians, and to recommend appropriate care according to imaging findings. The fourth edition of BI-RADS was introduced in 2003 and proposed a BI-RADS system for the ultrasound (US)[1].

Many studies focus on the reliability of radiologists' grading for tumors[2,3]. Moreover, it has been shown to improve the positive predictive value (PPV) of breast biopsy[4]. Tissue diagnosis for mammographic abnormalities in non-palpable breast lesions (NPBLs) obtained by imaging-guided core needle biopsy, by Mammotome biopsy, by open-surgical biopsy, by radioactive seeds localization (RSL) or with wire localization. The sensitivity of needle-localized excision biopsy is 99% for non-palpable lesions[5].

The purpose of the present study is to determine the PPV for malignancy found in female patients who initially were categorized in BI-RADS as 4 and 5 in our center, and underwent fine wire-localized biopsy (FWLB) for NPBLs by comparing the BI-RADS results with histopathological diagnosis. The positive predictive value for biopsies with malignant histological findings characterizes the number of unnecessary biopsies induced by false positives in non-malignant breast masses.

Patients and Methods

From December 2007 to November 2009, 116 women underwent screening and diagnostic mammogram and discovered NPBLs at the Breast Diagnostic Center, Faculty of Medicine, King Abdulaziz Medical Center, Jeddah, Saudi Arabia enrolled in this study. Clinical, mammographic, imaging, and histopathological findings of these cases were retrospectively collected from patient's sheet.

Mammograms read independently by two radiologists with breast imaging of 2 and 10 years experience. The radiologists examined each mammogram independently and made a diagnosis based on the American College of Radiology BI-RADS lexicon[1]. Mammograms were reviewed for the presence of masses (shape, margin, density, size, and location),

morphologic characteristics, distribution of calcifications, and associated findings such as skin, nipple, or pectoralis muscle involvement. Discordant mammographic interpretations were subsequently resolved by consensus of the 2 radiologists. BI-RADS 1, 2, and 3 were negative, benign, and probably benign, respectively. BI-RADS 4 and 5 were suspicious and highly suggestive of malignancy, respectively (Fig. 1 and 2).

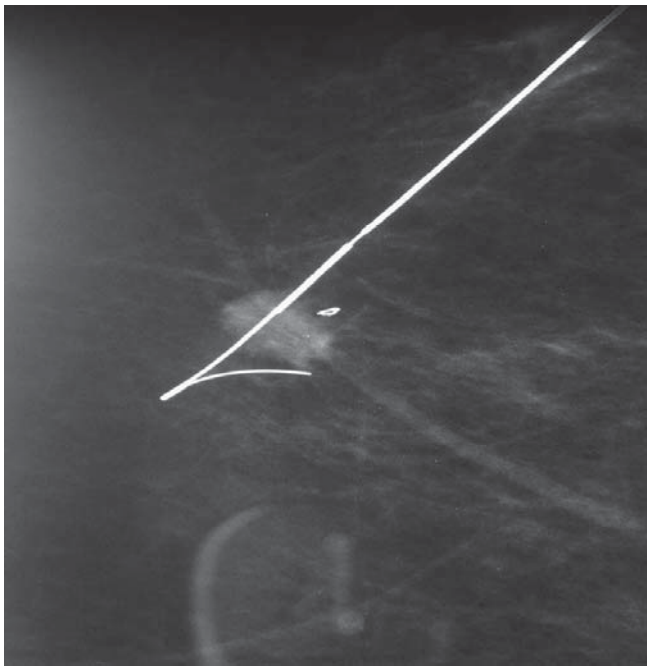

Fig. 1. Mammogram shows a speculated mass to be transfixed by the guide wire.

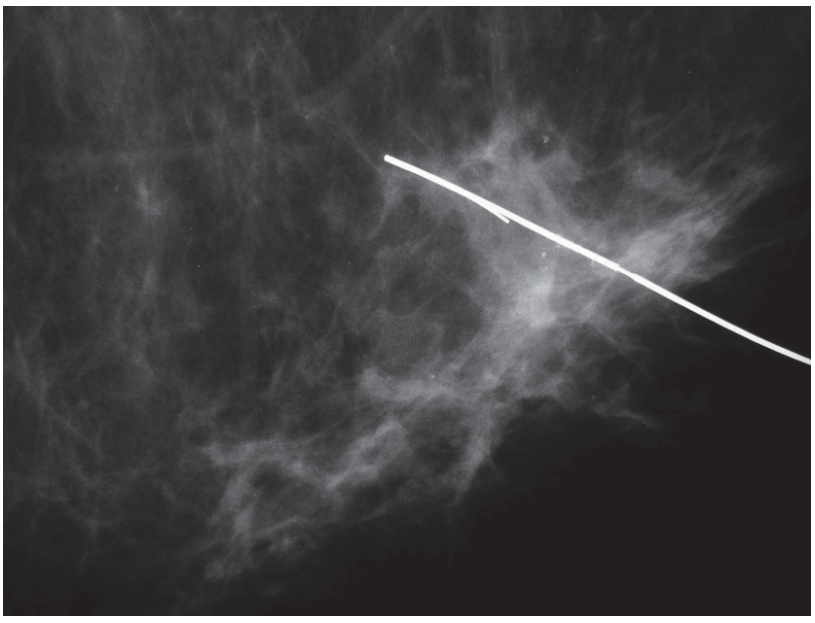

Fig. 2. Mediolateral projection confirms the position of the needle placed beyond the cluster of microcalcification.

The type of tumor was based on histopathological reports, which was obtained from specimen of FWLB. Institutional review board-approved this retrospective study. The patients' ages range from 19 to 71 years old. Radiology and surgery techniques for wire placement and surgical excision were uniform throughout the study period. All patients underwent FWLB with single or multiple wire localization. The indication of usage FWLB, as a diagnostic procedure in our cases, were due to suspicious of malignancy while doing stereotactic large-core needle biopsy (SLCNB) (n = 30); vacuum-assisted biopsy (n = 10); insufficiency of SLCNB; vacuum-assisted biopsy for diagnosis (n = 20) or in technical problems with SLCNB vacuum-assisted biopsy in cases of small breast mass (n = 25). In the remaining cases (n = 35), FWLB was used for therapeutic purpose cases of positive SLCNB, or vacuum-assisted biopsy for cancer to complete resection of malignancy and to performed the sentinel node biopsy (SNB). Wire localization was performed under mammographic or sonographic based on the method that best visualized the targeted lesion (Fig. 3 and 4). Multiple wires were used for large lesions or eccentric in three dimensions to be successfully excised with one wire. All wire placements in this study were performed in a single breast imaging department by trained breast radiologists, who were blinded to patients' histopathological diagnoses. They categorized the patients' lesions by use of fourth edition of BI-RADS[1].

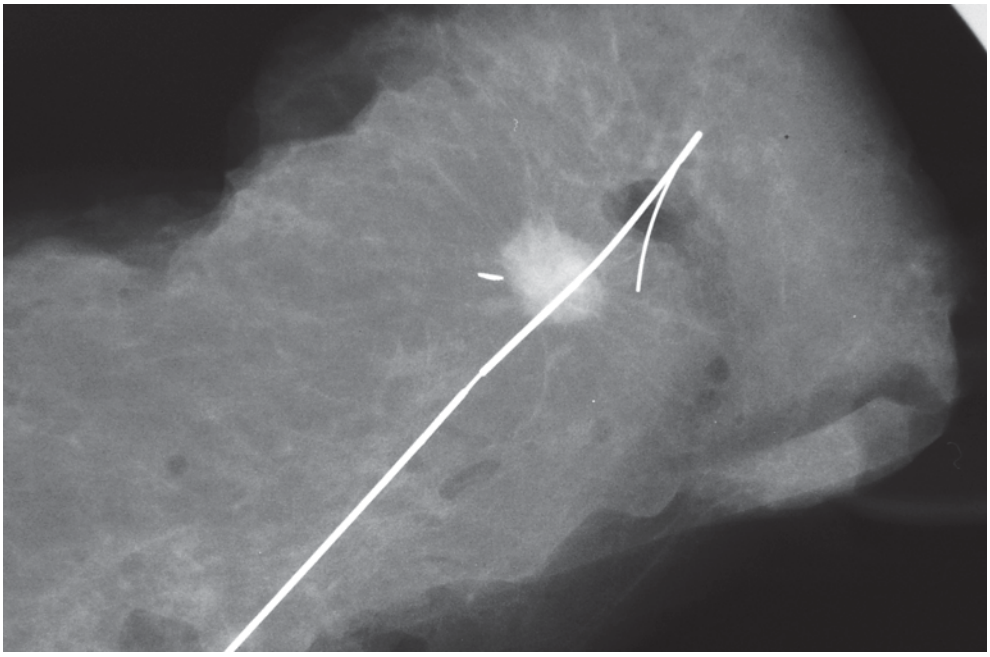

Fig. 3. Specimen radiograph shows the wire and the localized speculated mass in situ, with a good excision margin.

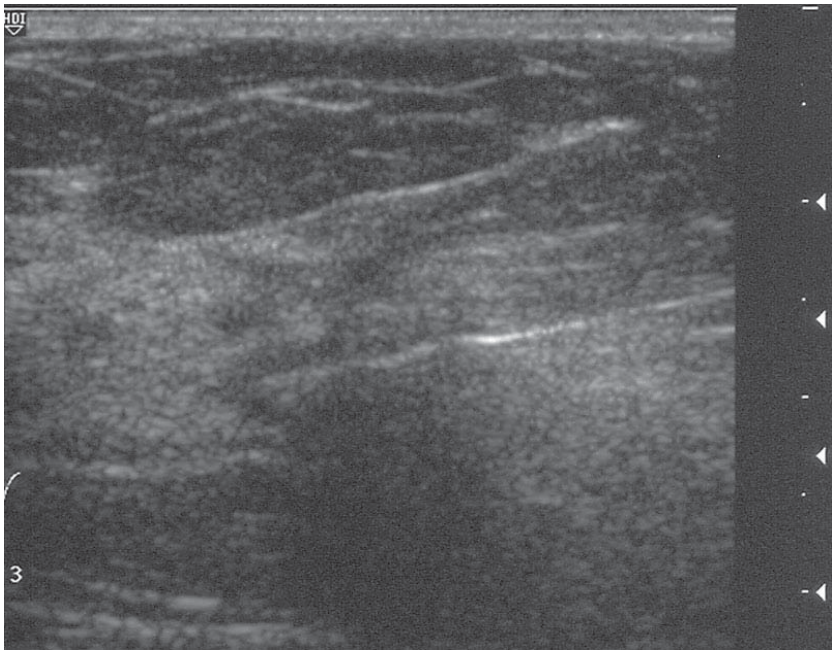

Fig. 4. It shows a poorly attenuating lesion being transfixed with a hook wire under ultrasonographic guidance.

Skin incision was centered over wire tip rather than its entry site, and a skin flap was elevated using diathermy. Dissection plane was subcutaneous fat above the breast parenchyma; 2-cm disc of breast tissue, surrounding wire tip was removed. The specimen included pectorals major fascia and the muscle was exposed in all cases. The specimen was orientated using stitches and metal clips before dispatching to radiology department for specimen mammogram. After complete removal of index lesion, the specimen was fixed with formalin and sent for paraffin section. If the initial mammogram did not confirm presence of index lesion or the margins were inadequate, further excision was performed. Following excision, the tumor bed was marked with metal clips for future identification, and the wound was closed in layers with absorbable sutures.

Histopathological results of FWLB were used as the gold standard to calculate the PPV of malignancy. Patients who had no histopathological records were excluded from the present study. A management plan for surgery and adjuvant therapy was proposed based on the clinical and histopathological assessment of the lesion. Surgical management included; local excision for benign lesions, wide local excision, and quadrantectomy or mastectomy for malignant lesions. Surgical procedures were performed by breast surgeons throughout the study

period duration. Specimen mammography was performed to document complete visible lesions removal. All cases with BI-RADS category 4 and 5 were biopsied.

Statistical Analysis

Continuous variables were summarized as mean (standard deviation) and range. Categorical variables were summarized as counts and percentages. Association between histological findings of malignancy and BI-RADS category was determined. For all examinations, calculation on the PPV (the number of breast cancers divided by the total number of examinations per category × 100) of the 4 and 5 BI-RADS assessment category. The positive predictive values were calculated using the following formula: PPV=TP/TP+FP. TP is the number of true positives; FP is the number of false positives. Statistical significance was defined as a p-value of 0.05 or less. All statistical analyses were performed using SPSS version 15 (Chicago, USA).

Results

There was no significant difference in demographic and clinical characteristics between patients with benign and malignant tumors. Wound infection occurred in 2.30% of patients with malignant breast masses and none of the patients with benign breast masses, with no significance difference between them ($p < 0.379$) (Table 1).

Table 1. Patient's demographic and clinical data.

Parameters	Benign (N = 72, 62.07%)	Malignant (N = 44, 37.93%)	Total (N = 116, 100%)	*P*-Value
Age Range	48.57 ± 10.42 (20.00-70.00)	50.59 ± 12.31 (19.00-71.00)	49.34 ± 11.16 (19.00-71.00)	0.431
Hormonal replacement therapy	8 (11.10%)	4 (9.10%)	12 (10.30%)	0.495
Taking contraceptive pills	15 (20.80%)	4 (9.10%)	19 (16.40%)	0.078
Positive family history	21 (29.20%)	12 (27.30%)	33 (28.40%)	0.500
Previous breast mass	11(14.47%)	6 (13.60%)	17 (14.66%)	0.564
Histopathology of cancer in previous operation	8 (11.10%)	6 (13.60%)	14 (14.10%)	0.449
Breast pain	19 (25.00%)	13 (26.40%)	32 (27.60%)	0.435
Nipple discharge	4 (5.60%)	5 (11.40%)	9 (7.80%)	0.216
Wound infection	-	1 (2.30%)	1 (0.9%)	0.379

The most common type of benign lesion was fibrocystic changes (40.52%, n = 47), while the most common type of malignancy was invasive ductal carcinoma (24.14%, n = 28). In BI-RADS 4, the benign cases were significantly more than malignant cases ($p < 0.0001$), while in BI-RADS 5, the malignant cases were significantly higher than benign cases ($p < 0.034$) (Table 2).

In BI-RADS 4, 70.80% (n = 64) of cases were benign and 28.10% (n = 25) were malignant which given a positive predictive value 28.09%. In BI-RADS 5, 29.60% (n = 8) of cases were benign and 70.10% (n = 19) were malignant given a positive predictive value 70.73% (Table 3).

Table 2. Cross tabulation between the Breast Imaging Reporting and Data System (BI-RADS) category and histopathology.

Parameters	BI-RADS 4 (n = 89, 76.72%)	BI-RADS 5 (n = 27, 23.28%)	Total (n = 116, 100.00%)
Benign	64 (70.60%)	8 (29.60%)	72 (62.07%)
Fibrocystic changes	44 (49.40%)	3 (11.10%)	47 (40.52%)
Others	20 (22.47%)	5 (18.25%)	25 (21.55%)
Fibroadenoma	11 (12.36%)	-	11 (9.48%)
Radial scar	2 (2.25%)	1 (3.70%)	3 (2.59%)
Fat necrosis	1 (1.12%)	1 (3.70%)	3 (2.59%)
Chronic mastitis	3 (3.37%)	1 (3.70%)	4 (3.45%)
Fibrosis	1 (1.12%)	-	1 (0.86%)
Duct papiloma	1 (1.12%)	-	1 (0.86%)
Adenosis	-	1 (3.70%)	1 (0.86%)
Papillomatosis	-	1 (3.70%)	1 (0.86%)
Malignancy	25 (28.10%)	19 (70.10%)	44 (37.93%)
Invasive ductal	15 (16.90%)	13 (48.10%)	28 (24.14%)
Ductal carcinoma insitue	9 (10.10%)	5 (18.50%)	15 (12.93%)
Invasive lobular carcinoma	-	1 (3.70%)	1 (0.86%)
Lobular carcinoma insitue	1 (1.10%)	-	1 (0.86%)
Significance	**p < 0.0001**	**p < 0.034**	**p < 0.0001**

Data are represented as number (%). P, significance benign versus malignancy of each category.

Table 3. Mammographic and pathologic correlations of the patients.

Mammography	Histopathology		All Cases	Positive Predictive Value (%)
	Malignant	Benign		
BIRADS 4	25	64	89	28.09%
BIRADS 5	19	8	27	70.34%

Data are expressed as number of cases.

Discussion

The BI-RADS lexicon offers a number of strengths, including the application of standardized common language to facilitate communication between radiologists, referring physicians, and patients. The system also clarifies reporting of mammography results, and will support the completion of quality improvement activities and clinical research[6]. Women whose mammograms are interpreted as "suspicious abnormality" (BI-RADS 4) or "highly suggestive of malignancy" (BI-RADS 5) should undergo lesion biopsy[7].

The sensitivity of mammography ranges from 74% to 95%, and specificity from 89.4% to 99.1%[8,9]. The diagnosis of subclinical breast lesions is very common due to easy access to standard mammography in most places. Many techniques such as core biopsy, fine needle aspiration, and vacuum-assisted are used for histological study of clinically occult breast lesions. Mammography is increasingly used as an investigation and screening tool. As such, an increasing number of abnormalities that are not associated with a palpable mass will be encountered. Although most lesions will be ultimately confirmed benign, further investigations are still necessary. Core biopsy/vacuum-assisted biopsy is a minimally invasive procedure used for this preoperative diagnosis. Wire-guided biopsy should be confined to therapeutic use. Nonetheless, in some situations as technical problems or insufficient biopsy or suspicious of malignancy, FWLB is still used as a diagnostic procedure. Sometimes it is necessary to excise all occult lesions in order to clear the margin and sentinel lymph node biopsy. However, the problems reported with this technique are evident: Wire trans-section, difficulties in wire repositioning in dense or fatty breasts, dislodgement, and interference with surgical approach. Patient discomfort during wire positioning and during patient transportation from radiological center to operating room[10,11]. Complications range from relatively common; hematoma formation, missed lesions, premature wire removal, localization failure, and vasovagal reactions, and to obscure (guide wire fragmentation, guide wire migration, pneumothorax, pleural migration, tumor seeding)[10,12]. The most common reason for carcinoma missing is erroneous placement of the needle guide wire[10]. If needle-localization procedures performed properly, problems should be infrequent. In this study, one patient (0.90%) encountered wound infection, but no other complications were noticed.

In this study, 116 non-palpable breast masses that underwent FWLB mammographic biopsy, 44 cases of them revealed cancers. Eighty nine cases (76.72%) were categorized as "BI-RADS 4". Histopathological examination revealed cancer in 25 cases (28.10%) and benign lesions in 64 cases (70.60%) with a PPV of this category to be 28.09%. In other words, the percentage of positively classified findings for which no carcinoma was subsequently found to be 28.10%. A study by Orel *et al.*[13] reports that of 1,312 lesions that underwent mammographically guided biopsy, 449 cases were carcinomas. There were 936 (71%) category 4 lesions; the PPV was 30% (279 of 936 lesions). Another study by Zonderland *et al.*[2] revealed a carcinoma in 52.7% (39 of 74 lesions) category 4 lesions. The PPV of BI-RADS category 4 lesions in most previous studies ranged from 6.2% - 52.7%[2,13]. In this study, twenty seven cases (22.28%) were categorized as "BI-RADS 5". Histopathological examination of these cases revealed carcinoma in 19 cases (70.10%), while 8 cases (29.60%) were benign with a PPV of this category 70.73%, so our results indicate that preoperative histopathologic diagnosis is necessary before definite treatment in category 5, although the probability of malignancy was very high. PPV for mammographic BI-RADS category 5 in published studies ranged from 80-97%[13]. Several studies have assessed accuracy and positive predictive value of the BI-RADS *lexicon*. It had been reported that, PPV of a biopsy positive for malignancy increases from 23%-30% for category 4 mammograms to 95% for category 5 mammograms[13]. ACR-BI-RADS, encourages the subdivision of final assessment category 4 into subcategory 4a, 4b, or 4c to communicate the level of suspicion to referring physicians and patients[1]. Lazarus *et al.*[14] reported that the PPVs of such sub-categorization (6% for 4a, 15% for 4b, and 53% for 4c) were good enough to predict the likelihood of malignancy, although, their study was limited by sample size. Further studies with a larger sample size are required.

The study populations included wide range of ages, and the application to women of ages 50-69 years as proposed for mammographic screening could result in less striking benefit, and limited to category 4 and 5. Further validation studies should employ different categories (from 1-5) of BI-RADS and report not only PPV, but also negative predictive value, sensitivity and specificity.

In conclusion, in this study the use of BI-RADS categories and FWLB for non-palpable breast lesions was safe, with acceptable surgical outcome. However, PPV of malignancy was low, especially for BI-RADS 4. Therefore, a liberal use of percutaneous biopsy for any suspicious NPBLs to avoid unnecessary open breast biopsy is recommended. Moreover, it limits open biopsy for therapeutic propose and for lesions which are non-amenable to percutaneous biopsy. Reliable and proven diagnostic approach will decrease the number of false-positive biopsies. Proper classification of BI-RADS final assessment will help referring surgeons, radiologists, and patients to understand their management options and implications.

References

[1] **Berg WA, Campassi C, Langenberg P, Sexton MJ.** Breast Imaging Reporting and Data System: Inter- and Intraobserver Variability in Feature Analysis and Final Assessment. *AJR* 2000; **174**(6): 1769-1777.

[2] **Zonderland HM, Pope TL Jr, Nieborg AJ.** The positive predictive value of the breast imaging reporting and data system (BI-RADS) as a method of quality assessment in breast imaging in a hospital population. *Eur Radiol* 2004; **14**(10): 1743-1750.

[3] **Costantini M, Belli P, Lombardi R, Franceschini G, Mule A, Bonomo L.** Characterization of solid breast masses: Use of the sonographic breast imaging reporting and data system lexicon. *J Ultrasound Med* 2006; **25**(5): 649-659.

[4] **Berg WA, Campassi C, Langenberg P, Sexton MJ.** Breast Imaging Reporting and Data System: interand intraobserver variability in feature analysis and final assessment. *AJR Am J Roentgenol* 2000; **174**(6): 1769-77.

[5] **Verkooijen HM, Peeters PH, Pijnappel RM, Koot VC, Schipper ME, Rinkes IH.** Diagnostic accuracy of needle-localized open breast biopsy for impalpable breast disease. *Br J Surg* 2000; **87**(8): 344-347.

[6] **Eberl MM, Fox CH, Edge SB, Carter CA, Mahoney MC.** BI-RADS Classification for Management of Abnormal Mammograms. *J Am Board Fam Med* 2006; **19**(2): 161-164.

[7] **Rotter K, Haentschel G, Koethe D, Goetz L, Bornhofen-Pöschke A, Lebrecht A, Kölbl H, Heywang-Koebrunner S**. Evaluation of mammographic and clinical follow-up after 755 stereotactic vacuum-assisted breast biopsies. *Am J Surg* 2003; **186**(2): 134-142.

[8] **Kerlikowske K, Carney PA, Geller B, Mandelson MT, Taplin SH, Malvin K, Ernster V, Urban N, Cutter G, Rosenberg R, Ballard-Barbash R.** Performance of screening mammography among women with and without a first-degree relative with breast cancer. *Ann Intern Med* 2000; **133**(11): 855-863.

[9] **Carney PA, Miglioretti DL, Yankaskas BC, Kerlikowske K, Rosenberg R, Rutter CM, Geller BM, Abraham LA, Taplin SH, Dignan M, Cutter G.** Individual and combined effects of age, breast density, and hormone replacement therapy use on the accuracy of screening mammography. *Ann Intern Med* 2003; **138**(3): 168-175.

[10] **Kopans DB.** Imaging-guided needle placement for biopsy and the preoperative localization of clinically occult lesions. In: *Breast Imaging*. Kopans DB, ed. Philadelphia, PA USA: Lippincott, Williams & Wilkins, 1997. 637-720.

[11] **Zgajnar J, Besic N, Frkovic-Grazio S, Hocevar M, Vidergar B, Rener M.** Radioguided excision of the nonpalpable breast cancer and simultaneous sentinel lymphnode biopsy using a single radiopharmaceutical: An original approach to accurate administration of the blue dye. *J Surg Oncol* 2003; **83**(1): 48-50.

[12] **Mandegar MH, Yousefnia MA, Rayatzadeh H, Roshanali F.** Intramyocardial sewing needle extracted one year after insertion. Interact *Cardiovasc Thorac Surg* 2006; **5**(6): 742-743.

[13] **Orel SG, Kay N, Reynolds C, Sullivan DC.** BI-RADS categorization as a predictor of malignancy. *Radiology* 1999; **211**(3): 845-50.

[14] **Lazarus E, Mainiero MB, Schepps B, Koelliker SL, Livingston LS.** BI-RADS lexicon for US and mammography: interobserver variability and positive predictive value. *Radiology* 2006; **239**(2): 385-391.

دور خزعة الثدي المحددة بالسلك الرقيق في تشخيص وعلاج أورام الثدي غير المحسوسة من الفئات ٤ و٥: تجربة بمستشفى جامعة الملك عبدالعزيز – المملكة العربية السعودية

زهور خضر الغيثي

قسم الجراحة، كلية الطب، جامعة الملك عبدالعزيز

جدة – المملكة العربية السعودية

المستخلص. أجريت هذه الدراسة لتحديد القيمة التنبؤية الإيجابية لمريضات تغيرات الثدي غير المحسوسة المصنفات مبدئيا حسب تقارير تصوير الثدي ونظام البيانات للفئات ٤ و٥ واللاتي خضعن لخزعة الأسلاك الرقيقة. تم استعراض مرجعي لعدد ١١٦ مريضة تم تصنيفهن حسب تقارير تصوير الثدي ونظامِ البياناتِ إلى الفئتين ٤ و٥، واللاتي خضعن لخزعة الأسلاك الرقيقة واستاصال جراحي في قسم الجراحة، مستشفى جامعة الملك عبدالعزيز، بجدة من ديسمبر ٢٠٠٧– نوفمبر ٢٠٠٩م. ثبت من فحص الخلايا المرضية النسيجية احتواء ٧٦ مريضة (٦٥,٥٢٪) على أورام حميدة ٤٤ مريضة (٣٧,٩٣٪) على أورام سرطانية. وفق تقارير تصوير الثديِ ونظامِ البياناتِ وجد ٨٩ مريضة (٧٦,٧٢٪) في الفئة الرابعة، ٢٧ (٢٣,٢٨٪) فى الفئة الخامسة. وجد في الفئة الرابعة ٨٠ مريضة (٧٠٪,٦٤) أورام حميدة، ٢٥ مريضة (٢٨٪,١٠) أورام سرطانية وكانت القيمة التنبؤية الايجابية ٢٨,٠٩٪ لدى الفئة الرابعة حسب نتائج تقاريرتصوير الثدي ونظامِ البياناتِ . لدي الفئة الخامسة حسب الفحص النسيجي للمرضي، وجد ٨ مريضات (٢٩,٦٠٪) أورام

حميدة، ١٩مريضة (٧٠,١٠٪) أورام سرطانية فكانت القيمة التنبؤية الإيجابية ٧٠,٧٣٪ لنتائج تقارير تصوير الثدي ونظامِ البياناتِ. نستنتج من هذه الدراسة أن المزج بين نتائج تقارير تصوير ونظامِ البياناتِ وخزعة الأسلاك الرقيقة لتشخيص تغيرات الثدي غير الواضحة آمن. القيمة التنبؤية الإيجابية لتقارير تصوير الثديِ ونظامِ البياناتِ منخفضة. لذا فإن أخذ الخزعة النسيجية من الجزء المشتبه ضرورة وأقتصار الجراحة على استكمال العلاج أوعند الفشل من أخذ العينة بطريقة غير جراحية.