

Diagnostic Accuracy of Fine Needle Aspiration Cytology: Comparison of Results in Tabriz Imam Khomeini Hospital and Shiraz University of Medical Sciences

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Abstract

Introduction: It is more than 60 years that Fine Needle Aspiration (FNA) has been used for diagnosing palpable breast masses and has been known as an effective method for several years in Europe. In this study, we compared the diagnostic accuracy of FNA with open biopsy in Tabriz and Shiraz, Iran.

Material and Methods: We studied 100 patients with breast lesions in Tabriz Imam Khomeini Hospital from late September 2003 to late July 2004. FNA and open biopsy were done for all patients, FNA results were studied by pathologists in Tabriz imam Khomeini hospital and Shiraz University and pathological and cytological results were compared.

Results: According to cytology, 44% of samples were benign, 15% were suspicious, 33% were malignant and 8% were insufficient in Tabriz. These figures were 25%, 10%, 27% and 37%, respectively in Shiraz. Sensitivity of FNA was higher in Tabriz (89.79% vs. 69%) but specificity did not differ significantly in two groups (93.47% vs. 80.95%). Positive and negative predictive values were 97.77% and 89.36% in Tabriz and 100% and 60.6% in Shiraz, respectively. FNA accuracy was higher in Tabriz than in Shiraz (93.47% vs. 80.95%).

Conclusion: If done by experts, FNA can be a reliable replacement for open biopsy in palpable breast masses. Evaluation of FNA samples during aspiration can decrease insufficient samples. FNA (at least in deprived areas) can be the first line of diagnosis in women with breast masses and is helpful to increase health standards and clinical supervision of patients.

Keywords: palpable breast mass, needle aspiration, breast cancer, FNA

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IJCP 2009; 3: 133-136

Introduction

Breast cancer is one of most prevalent cancers in women worldwide. It is estimated that 192,370 women will be diagnosed with and 40,170 women will die of breast cancer in 2009 in United States. [1] In Iran, approximately 7500 new cases of breast cancer are diagnosed each year. In 2005, standardized incidence rate of breast cancer was 23.56 and 0.66 in females and males, respectively. Its standardized mortality rate was 3.31 in females which was the 4th leading cause of females' death due to cancer. [2] Various methods such as Mammography, needle biopsy and open biopsy are used for diagnosis; some combination of these tests has been studied and it has been distinguished that sensitivity and specificity of combining different tests are more than one single test. Each year, more than 500000 breast biopsies are done in USA and more than 80% of them are benign. Although open biopsy

is the standard method for diagnosing palpable breast masses, at present, fine needle aspiration (FNA) has more application and is an acceptable method in clinical centers and articles. In needle aspiration, in addition to separation of cysts from solid masses, cellular samples are collected for cytological study. A probable diagnosis of cancer is propounded by a positive cytological sample and since the probability of danger is low, biopsy and definite remedy can be done in one phase. If done by experts, FNA is more preferable than biopsy because of reduction of excision surgery in benign masses, lack of general anesthesia especially in old and weak people, low emotional stress in comparison to open surgery, being doable in wards and clinics, being quick and profitable and easy to perform, its high efficiency, low morbidity, and possibility of the quick study of samples in the operating room [3,4,5,6,7,8,9].

Table 1: Characteristics of 100 patients with breast mass undergone FNA and open biopsy in Imam Khomeini Hospital Tabriz.

Characteristic	% frequency	
age	<20	3
	21-39	47
	40-59	42
	≥60	8
Marital status	not married	20
	Married	80
Family history	positive	10
	negative	90
History of hormone therapy	positive	10
	negative	90
Location of mass	Right breast	52
	Left breast	48

The aim of this study was to compare diagnostic accuracy, sensitivity, specificity, and false positive and negative cases in FNA with excisional biopsy in patients with palpable breast masses in two different medical centers.

Patients and Methods

Between September 2003 and July 2004, all women with a breast mass who were referred to Tabriz imam Khomeini hospital for further evaluation were included in this study. Patients with a definitive diagnosis of the mass, any contraindication for FNA or excisional biopsy and patients who did not agree with the terms of study were excluded.

After explaining the study terms, we checked CBC and Diff, did sonography and mammography, and complete a checklist including medical history, physical examination and laboratory and imaging results for all patients. FNA was performed for all patients and after that excisional biopsy of the lesion was done by the same team.

For FNA, after prepping the breast mass with alcohol or povidone-iodine and letting it dry in open air, we fixed the mass with one hand and aspirated it with a 22-gauge needle connected to a 10-cc syringe from the closest part of mass to skin. After FNA, to make sure of cytology results, 3-5 slides were fixed with 95% ethanol and prepared for each sample. Both pathology and cytology results were studied by the pathology department of Imam Khomeini hospital and the pathology department of Shiraz Medical University as control.

Negative and negative suspicious reports were considered as negative and positive and positive suspicious reports were considered as positive.

Mass biopsy was performed for all patients in Tabriz Imam Khomeini hospital with the same team and results were studied by pathologists and classified, similar to FNA.

We calculated positive and negative predictive values, sensitivity, specificity and accuracy of results in both centers.¹ Definitions are as follows:

TP (True Positive): positive cytological diagnosis that was positive in pathologic study.

FP (False Positive): positive cytological diagnosis that was negative in pathologic study.

TN (True Negative): negative cytological diagnosis that was negative in pathologic study.

FN (False Negative): negative cytological diagnosis that was positive in pathologic study.

Sensitivity = $\frac{TP}{TP + FN}$: cytological sensitivity in malignancy diagnosis

Specificity = $\frac{TN}{TN + FP}$: cytological Specificity in malignancy diagnosis

Accuracy = $\frac{TP + TN}{TP + TN + FP + FN}$: FNA diagnosis

Positive predictive value = $\frac{TP}{TP + FP}$: cytological predictive value in malignancy diagnosis

Negative predictive value = $\frac{TN}{TN + FN}$: cytological predictive value in no malignancy

Results

Total number of patients in this study was 100 with a mean age of 40.8 ± 12.4 years. Most patients were married and had a negative family history of breast cancer and a negative history of hormone therapy. As an incidental finding, the mass was located in the right breast in 52% of the patients (Table1).

Table 2 compares the results of FNA with open biopsy in Shiraz University and Tabriz Imam Khomeini Hospital. In Tabriz and Shiraz, 8% and 37% of the samples were insufficient and undesirable, respectively ($p < 0.05$). Positive results of FNA were significantly higher in Tabriz.

¹ -pathology results were considered as definite diagnosis.

Table 2: comparison of FNA results with Open Biopsy in Shiraz University and Tabriz Imam Khomeini Hospital.

Characteristics	Tabriz Imam Khomeini Hospital	Shiraz University	P -value	
Cytology results	benign	44	25	
	suspicious	15	10	
	malignant	33	27	
	Undesirable and insufficient.	8	37	
	total	100	100	
pathology	positive	49 (53.26%)	40(63.49)	
	negative	43(46.73%)	23(36.50%)	
	total	92	63	
Percentage of malignancy in suspicious cases	80%	10%	0.03	
Statistics	False positive results	5(5.43%)	0	0.97
	False negative results	1(1%)	12(19%)	0.004
	sensitivity	89.79%	69%	-----
	specificity	97.67%	100%	-----
	P.P.V ¹	97.77%	100%	-----
	N.P.V ²	89.36%	60.6%	-----
	Accuracy	93.47%	80.95%	-----

1- Positive Predictive Value.

2- Negative Predictive Value.

Number of false positive (FP) results did not differ in two groups while false negative (FN) results were mostly reported in Shiraz (5% vs. 25%, $p < 0.05$)

Sensitivity was lower in Shiraz rather than Tabriz (69% vs. 89.79%) while specificity did not differ significantly in the two groups. (97.67% vs. 100% in Tabriz and Shiraz, respectively)

Test accuracy was 93.47% and 72.82% in Tabriz and Shiraz, respectively.

Discussion

FNA cytology is a practical protocol for diagnosing the nature of masses, particularly breast masses. The accuracy of this diagnostic method is highly dependent upon the expertise of the surgeon and the pathologist with an accuracy rate of 60-97%.

The value of each diagnostic test is depended upon its ability in diagnosing the disease (sensitivity) and distinguishing the healthy population (specificity). In this study, we compared cytology and pathology results of 100 samples from breast masses in Tabriz and Shiraz medical schools. The results showed a

significant difference between the two groups in both cytology and pathology results. The number of undesirable samples in Shiraz was significantly higher than Tabriz and false negative results were significantly higher in Shiraz.

The sensitivity and specificity of FNA were 89.79% and 97.67% in Tabriz and 69% and 100% in Shiraz, respectively. Positive Predictive Value (PPV) was almost similar in the two groups (97.77% vs. 100%) but negative predictive value was higher in Tabriz in comparison with Shiraz (89.36% vs. 60.6%). Accuracy of FNA was also higher in Tabriz rather than Shiraz (93.47% vs. 80.95%).

Many studies have reported the efficacy of FNA worldwide. In a study by Choi et al 1297 cases of FNA were evaluated and compared to histological diagnoses. About 29.7% of the cases were benign, 73.7% were suspicious, 68.1% were malignant and 14.6% were unsatisfactory. Sensitivity, specificity, positive and negative predictive values were 77.7%, 99.2%, 98.4%, and 88% respectively. Two cases were false positives and 35 were reported false negatives. Accuracy was 91.1%. They concluded that

FNA should be used together with other diagnostic modalities such as physical examination and imaging in evaluating breast lesions [10].

Mansoor et al have studied the diagnostic efficacy of FNA in breast lesions of 72 patients. Sensitivity, specificity, PPV, and NPV were 98.4%, 60%, 93.9%, and 93%, respectively. False positive and false negative fractions were 6% and 14.2%. They concluded that FNA is an efficient diagnostic method in breast [11].

Kim et al evaluated the accuracy of FNA with pathologic confirmation in 246 cases with breast lesions in an outpatient clinic. Likelihood ratio for malignant, suspicious, atypical, benign and unsatisfactory samples were 98.71, 5.48, 1.09, 0.07, and 0.55, respectively with a sensitivity of 90.3%, specificity of 71.9%, PPV of 98.4%, false positive of 4.3% and false negative of 0.7% [12].

Sheikh et al studied over 2623 samples of FNA in 3 years. Of them, 323 cases were malignant with a sensitivity of 80%, specificity of 98%, PPV of 100%, false positive of 0% and false negative of 9%. They concluded that FNA was accurate in evaluating breast masses breast surgery is indicated when the findings are positive [13].

Sneige reviewed 1995 cases of FNA in palpable breast masses. About 60.2% of the cases were malignant, 4.3% were suspicious, 29.9% were benign and 3.1% were insufficient, 28 cases were false negative and 2 cases were false positive. Sensitivity, specificity, PPV, NPV and overall efficiency were 96%, 99%, 99%, 94% and 97%, respectively [14].

Oneil et al evaluated the accuracy of FNA with histopathologic confirmation in 697 patients. About 0.7% of the samples were inadequate, 401 (57.53%) were malignant and 166 (23.81%) were benign. There were 3 false positives and 84 false negatives. Sensitivity, specificity, PPV, and NPV were 97%, 78%, 92% and 92%, respectively. They concluded that FNA was sensitive enough to be used for diagnosing breast cancer, but suspicious lesions needed further evaluation [15].

Number of unsatisfactory cases in Tabriz was acceptable in comparison to other studies but it was very high in Shiraz. Sensitivity, specificity and accuracy of FNA were acceptable in Tabriz. In Shiraz, despite higher specificity and PPV, sensitivity was low which could be due to higher number of insufficient and suspicious samples and experts' errors and can be decreased by the evaluation of the samples during aspiration.

In conclusion, FNA is a reliable method for evaluating breast masses if performed by experts who are familiar with FNA as a team.

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