Fine Needle Aspiration Cytology of 108 Breast Lesions with Histopathologic Correlation: A Retrospective Study

Nasar Yousuf Alwahaibi[1*], Hafsah Ahmed Alfahdi[1] and Usha Rani Bai[1]

[1]*Department of Pathology, College of Medicine and Health Sciences, Sultan Qaboos University, P.O. Box 35 Postal Code 123 Muscat, Oman.*

Authors' contributions

This work was carried out in collaboration between all authors. Author NYA designed the experiment and wrote the manuscript. Authors HAA and URB carried out the comparison processes and analyzed data. All authors read and approved the final manuscript.

ABSTRACT

Aims: The aim of this study was to evaluate and compare the accuracy of fine needle aspiration cytology (FNAC) in the diagnosis of breast lesions with relevant histopathologic report.
Methodology: A retrospective study was performed over 11 year period at Sultan Qaboos University Hospital, Sultanate of Oman. The records of all patients who had undergone FNAC and histopathologic diagnosis of breast lesions were included. Cytological and histopathological diagnosis were classified into four categories: inadequate, benign, suspicious and malignant.
Results: A total of 108 reports were found. Only one case (0.9%) in each of FNAC and histopathologic specimens was reported inadequate. The diagnosis of FNAC in the remaining 107 cases were: 47 benign, 25 suspicious and 35 malignant. Subsequent histopathologic examination showed 41 benign, 3 suspicious and 63 malignant. FNAC showed a sensitivity, specificity, accuracy, positive predictive valve and negative predictive value of 70%, 65%, 68%, 77% and 57%, respectively.
Conclusion: The findings of this study showed that FNAC is a reliable method for the diagnosis of breast lesion.

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Corresponding author: Email: nasar@squ.edu.om;

1. INTRODUCTION

Fine needle aspiration cytology (FNAC) is considered to be safe, painless, rapid, simple and inexpensive with variable sensitivity and specificity [1]. It can be used for palpable and non-palpable lesions [2]. In addition, FNAC is more suitable for lesions close to the skin, chest wall and vessels. Especially, for palpable lesions, FNAC is straightforward and therefore it can be performed in outpatient clinic without anesthesia [3]. In fact, FNAC is one of the important component of triple test used for the diagnosis of breast lesion [4]. However, interpretation of FNAC is difficult and requires vast experience [3]. Breast cancer is the most common cancer affecting women in Oman and worldwide [5]. According to the Oman National Registry about 100 new cases are yearly diagnosed. FNAC is a common practice in the developing countries [6,7]. In Oman, FNAC of the breast lesion is a routine test along with the mammographic and physical examinations. The sensitivity and specificity of FNAC differs from one cytology laboratory to another. The aim of this study was to evaluate and compare the accuracy of FNAC in the diagnosis of breast lesion with relevant histopathologic report.

2. MATERIALS AND METHODS

This study was conducted after an approval from the Medical Research Committee and Ethics Committee (MREC # 512) from the College of Medicine and Health Sciences, Sultan Qaboos University, Sultanate of Oman. A retrospective review over a period of 11 years from 2000 to 2010 in the department of Pathology, Sultan Qaboos University Hospital, Sultanate of Oman, was performed. The records of all patients who had undergone FNAC and histopathologic diagnosis of breast lesions were included. During the study period, 156 cases (154 females and 2 males) were found. Histopathologic specimens included either core needle biopsies or mastectomy. FNAC was obtained through a 21 or 23 gauge needle attached to a 10mL syringe, which was mounted on an aspiration gun. Minimum passes were made into the lesion with the needle. The samples were smeared onto labeled glass slides and fixed in 95% ethanol. Two to four slides were prepared per case. Papanicolaou and hematoxylin and eosin stains were usually performed. Sometimes an air dried slide was stained with Diff-Quik method. For histopathologic diagnosis, a core biopsy or pieces of mastectomy specimens were fixed in 10% neutral buffered formalin for 24 hours, histoprocessed, cut into 3µm thickness in diameter and stained with hematoxylin and eosin method. Cytological and histopathological diagnosis were classified into four categories: Inadequate, benign, suspicious and malignant. Cytological diagnosis was performed by different available cytopathologists over a period of 11 years.

Sensitivity, specificity, accuracy, positive and negative predictive values were calculated with the assumption that suspicious cases were malignant. This approach is useful to achieve high sensitivity [8].

3. RESULTS

The patients ranged in age from 20 to 80 years with mean age of 46.3 years. Histopathological diagnosis of breast tissue was found in total of 108 cases. The FNAC report was correlated with the final histopathologic report in 108 cases.

Only one case (0.9%) in each of FNAC and histopathologic specimens was reported inadequate to make the final pathologic diagnosis. A diagnosis of malignant was made for 35 of the 108 FNAC cases (32.4%). Only 5 cases were false positive results when read as malignant. These five cases showed to be benign cases. A diagnosis of suspicious was made for 25 of the 108 FNAC cases (23.1%). Of these, 1 was suspicious, 15 were malignant and 9 cases were benign. A total of 47 of the 108 FNAC cases were read as benign (43.5%). Of these, 26 were benign, 2 were suspicious, 18 were malignant and one was inadequate based in histopathologic examination (Table 1). This represents a false negative rate of 19% for the 108 cases.

Table 1. Correlation of FNA cytology with histopathology diagnosis

	Cytology diagnosis	Suspicious	Malignant	Benign	Inadequate	Total
Histopathology diagnosis	Suspicious	1	0	2	0	3
	Malignant	15	30	18	0	63
	Benign	9	5	26	1	41
	Inadequate	0	0	1	0	1
	Total	25	35	47	1	108

With the assumption that suspicious cases were considered malignant, FNAC revealed 70 % sensitivity, 65% specificity, 68% accuracy, 77% positive predictive value and 57% negative predictive value (Table 2).

Table 2. Calculations based on the entire readings with the assumption that the suspicious was positive for malignancy

Parameter	Value (%)
Inadequate	1 (0.9%)
True positive	46 (43%)
True negative	26 (24%)
False positive	14 (13%)
False negative	20 (19%)
Sensitivity	70%
Specificity	65%
Accuracy	68%
Positive predictive value	77%
Negative predictive value	57%

4. DISCUSSION

Worldwide, recent review showed that the incidence of breast cancer increases at a rate of 3.1% [9]. Oman like other developing countries, where breast cancer represents a major health concern. Recent world health survey in Oman showed that more than 90% of women aged between 40 and 90 had never had a mammography or breast examination [10].

The results of this study showed that the ability of FNAC to detect the presence of breast cancer was high. This finding is inline with other studies [8,11]. However, the specificity is low (65%). This is due to the combination of both suspicious and malignant cases. If

malignant cases were alone calculated, then the specificity would be 84%. The majority of false positive specimens were classified as suspicious but not malignant. In fact, the combination approach of suspicious and malignant categories would minimize the rate of missing malignant cases. The present study showed that breast cancer is high in the age group of 30 – 50 years of age, this finding is inline with other study [2].

Cytologists and cytopathologists use suspicious category in cases where definite diagnosis cannot be made. This is due to either the cytologic features for malignancy are not fully met or due to technical problems such as inadequate fixation, thick smears or improperly stained [8].

The percentages of false positive and false negative values were 13% and 19%, respectively. These values are high when compared with the UK target values of false positive and false negative values, which are less than 5% and 1%, respectively [12]. However, a Japanese study showed a slight high false positive value of 10.8% [13]. Similarly, another study reported a range of 3% to 18% for the false negative diagnosis [1]. It is noteworthy that most pathologists worldwide are better trained in histopathologic examination rather in cytologic interpretation. In addition, tissue interpretation is easier than cytologic preparations [13].

Unlike false positive rate, cytologic interpretation is not the main cause of misdiagnosis, however, sampling errors contribute greatly to false negative rate. With all the examined cases, conventional smearing of preparation and staining was used. During conventional smearing, drying artifacts, background materials, thick smears and inadequate fixations are frequently present. These drawbacks are important in cases of suspicious specimens. It has been reported that the conclusiveness rates (either benign or malignant) for conventional smearing of the breast lesion is 54% to 87% whereas using monolayer preparations, it ranges from 73% to 77% [14,15]. Monolayer preparations such as ThinPrep® processor, Auto Cyte PREP^{TM} System or other similar processor prevent air drying artifacts, have a minimum background material and the cellularity is increased [16]. In addition, aspirations were performed mainly by radiologists with a variable level of experience. It is noteworthy that the management of breast cancer patients does not rely only on cytologic interpretation. Combination of mammography, physical examination and FNAC with core biopsy is an ideal approach and would minimize any misdiagnosis.

Recent review showed that the sensitivity and specificity of FNAC range from 35 % to 95% and from 48% to 100%, respectively [3]. The findings of the current study are in line with these ranges.

Out of 35 cases were diagnosed as malignant by FNAC, five of them were diagnosed as benign. False positive finding is usually associated with benign condition like fibrocystic disease, pregnancy related changes, fibroadenoma, therapeutic changes, fat necrosis, and papillary lesions [13,17].

Out of 47 cases were diagnosed as benign by FNAC, 2 and 18 of them became suspicious and malignant, respectively. False negative of FNAC may lead to delaying the diagnosis and treatment. Diagnostic errors can be attributed to lack of training and miscorrelation with the patient's clinical and radiologic findings [13]. Sampling error is the major cause of the false negative result especially when benign lesions were located next to a carcinoma [17].

In this study, one case of each FNAC and breast biopsy was inadequate. Other studies reported higher frequencies of inadequate specimens [1,2,18]. The reasons for inadequate specimens could be due to the insufficient experience of the performer (physician, radiologist or pathologist), the nature of the lesion (lipoma, hypocellular or high content of connective tissue), and to a lesser extent, sampling error and inexperienced cytopathologist [19]. Other reasons for inadequate specimens may include in sufficient materials and obstacles by red blood cells or inflammatory cells. The criteria used at the current department for an adequate specimen are the inclusion of six to eight clumps and each clump should contain eight to ten cells of the FNAC smear.

In addition to the inability of FNAC to distinguish in situ from invasive lesions, several studies reported the presence of false negative and false positive interpretations [20,21,22]. In comparison, histopathologic core biopsy has minimum false positive and negative interpretations and can distinguish between invasive and in situ lesions [23]. Other advantage of core needle biopsy is the ability to analyze oestrogen and progesterone receptors and HER2 as well as molecular tests in breast lesions. Most cytologic samples, including cell blocks, are usually fixed in 95% alcohol. The recommendations of American Society of Clinical Oncology and the College of American Pathologist for the demonstration of these markers, in particular HER2, are that breast samples must be fixed for at least 6 hours in 10% neutral buffered formalin. A criteria which is difficult to perform with FNAC [24]. However, core biopsy, unlike FNAC, is painful, expensive, needs anesthesia, has a greater risk of tumour implantation of needle track and great risk for bleeding and the diagnosis is lengthy (1 – 3 days) [25,26]. Despite the above comparison of FNAC and histopathologic examination of breast lesion, the findings of this study support the use of FNAC as a reliable test for breast lesion. In the USA, core biopsy is preferred whereas in many European countries, FNAC is more practiced [19,27]. As a limitation of this study we should point out the absence of aspirators information and the various experience of cytopathologists involved in this study.

5. CONCLUSION

The findings of this study showed that FNAC is a reliable method for the diagnosis of breast lesion.

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COMPETING INTERESTS

No financial disclosure information related to this study and we declare that no competing interests exist.

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