Role of Fine Needle Aspiration Cytology In Diagnosis of Chest Lesions

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Abstract

Objectives: Fine needle aspiration cytology and biopsy provides a highly accurate diagnostic method which can be performed rapidly with minimal risk. It provides a definitive diagnosis in most patients at low cost with minimal trauma. Aim of this study is to assess the value of fine needle aspiration cytology (FNAC) in the diagnosis of chest lesions.

Methods: FNA specimens from 57 patients with suspected pulmonary neoplasms were subjected to immediate cytology assessment. Direct smears were prepared in the radiology department and fixed in ethanol alcohol in four slides. The cellular content was assessed and, if possible, a provisional diagnosis offered. A second FNA was requested if the initial aspirate seemed of doubtful adequacy. The diagnostic accuracy was examined by review of clinical and radiological data in all patients.

Results: Satisfactory diagnostic material was obtained in 53 patients on a single aspirate and following a second FNA in 4 patients with inadequate specimens. Of the 57 aspirates, 37 were malignant. Most of tumors occurred in the age ranged between (50-59) years old. The male constitute the 2/3rd of malignant tumor. Adenocarcinoma constitute the majority of primary lung cancer 61.8%, this is indicated the benefit of FNAC for diagnosis of peripheral lesions of the chest, as this tumors tend to occur peripherally.

All malignant diagnoses were confirmed on clinical and/or pathological review. FNA accurately distinguished primary small cell and large cell carcinomas in those patients with pathological follow up. Complications were recorded in four (7%) patients, all of them were developed pneumothorax, a chest drain was required in one patient. The others managed conservatively.

Conclusions: Percutaneous FNA cytology provides safe, simple and accurate diagnosis in the investigation of chest lesions.

Keywords: Fine needle aspiration cytology, chest lesions.

Fine needle biopsy provides a highly accurate diagnostic method which can be performed rapidly with minimal risk. It provides a definitive diagnosis in most patients at low cost with minimal trauma. Patients at poor surgical risk are saved a thoracotomy in many instances. Patients who are clinically inoperable can receive appropriate chemotherapy and radiotherapy without major surgery done solely for diagnostic purposes [1-4].

In comparative studies, this technique has generally been reported to be superior to bronchoscopic biopsy and sputum cytology in the diagnosis of radiologically evident lung lesions.

In screening patients, sputum cytology remains the method of choice and is essentially the only method of diagnosing early lesions not seen radiologically. Bronchial brush and biopsy, another technique of great value, is particularly useful in the diagnosis of central bronchial lesions. Appropriate utilization of these cytologic sampling procedures provides for the highest degree of accuracy in the diagnosis of pulmonary disease with minimum risk to the patient. The transthoracic FNAC is now widely used in the diagnosis of suspicious peripheral lung lesion and it is routinely used in institute in United States [5].

Patients and Methods

A prospective and retrospective study of a total of 57 transthoracic lung FNAC cases were carried out and diagnosed in between 2007 and 2009 in Rizgary teaching

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Received: *1 - August -2022, Manuscript No. AAJPCR -22-001-PreQc-22;* ***Editor assigned:*** *3-August-2022, PreQC No. AAJPCR -22-001-PreQc-22 (PQ);* ***Reviewed:*** *17-August r-2022, QC No. AAJPCR -22-001-PreQc-22;* ***Revised:*** *22-August-2022, Manuscript No. AAJPCR -22-001-PreQc-22 (R);* ***Published:*** *29- August -2022,* ***DOI:*** *10.35841/aajpcr-001.5.4.1-5*

Citation: *Bashar Hanna Azar. Role of Fine Needle Aspiration Cytology In Diagnosis of Chest Lesions. J Pulmonol Clin Res. 2022; 5(4):1-5.*

hospital and Hawler Cardiac Center. There were 40 male and 17 female patients. The age range was from 31 to 72 years (mean age of 60), and the types of lesions are either lung mass (54 patients) or mediastinal mass (3 patients). Site of lesions was on the right side in (37 patients) and on the left side (20patients). There was history of smoking in 44 patients. The presenting symptoms was chest pain in 48 patients, cough in 39 patients, haemoptesis in 21 patients, dysphagia in 2 patients, hoarseness of voice 3 patients and fever in 2 patients [6] (Figure 1) (Table 1).

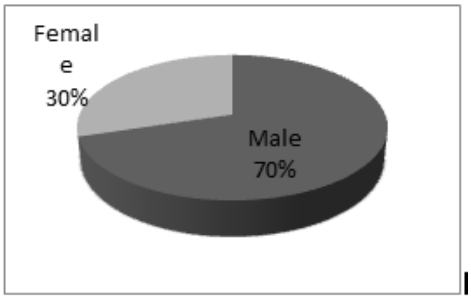

Figure 1: Male to female ratio

Table 1: Presenting symptoms of the patients

Symptoms	Sex		No. of patients
	Male %	Female %	42(73.7%)
Chest pain	34(59.6)	8(14.0)	
Cough	31(54.4)	8(14.0)	39(68.4%)
Breathlessness	22(38.6)	4(7.0)	26(45.6%)
Haemoptysis	18(31.6)	3(5.3)	21(36.9%)
Dysphagia	2(3.5)	0(00.0)	2(3.5%)
Hoarseness of voice	2(3.5)	1(1.7)	3(5.2%)
Fever	2(3.5)	1(1.7)	3(5.2%)

A general investigation with CXR and CT scan done for all patients with biochemical and haematological examinations. The result were peripheral lesions in 54 patients and mediatinal lesions in 3 patients, all underwent FNAC .The bronchoscopy done for 42 patients, the mass detected by bronchoscopy only in one patient and bronchial wash was positive for only 4 patients [7] (Figure 2) (Table 2-3).

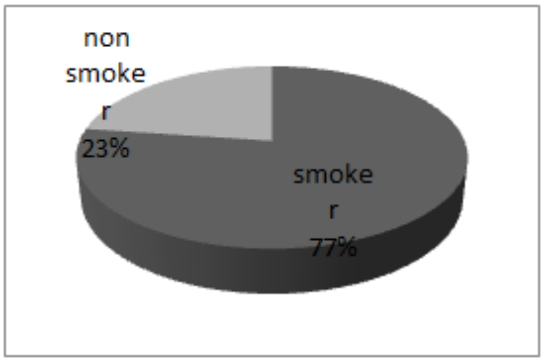

Figure 2: Percentage of smoking in the study

Table 2: Demographic description of the study

Subject	Subheadings	Total No.	Percentage
Age	Bellow 40 years	2	3.5
	40-59 years	5	17.5
	50-59 years	15	28
	60-69 years	26	45.6
	Above 70 years	9	15.8
Sex	Male	40	94.8
	Female	17	5.2
Types of lesions	Lung mass	55	94.8
	Mediastinal mass	3	5.2
Side of lesions	Right	37	65
	Left	20	35
History of smoking	Smoker	44	77.2
	Nonsmoker	13	22.8
Provisional diagnosis	Malignant	35	61.4
	Benign	22	38.6
Cytological finding	Malignant	37	65
	Benign	20	35
Sampling	Adequate	53	93
	Inadequate	4	7

Table 3: Age wise distribution of malignancy.

Age	Sex	No. of patient	Sampling
	Male (%)	Female (%)	(%)
30-40	0(00.0)	0(00.0)	0(00.0)
41-50	5(13.5)	2(5.4)	7(18.9)
51-60	13(35.1)	6(16.2)	19(51.3)
61-70	7(18.9)	2(5.4)	9(24.3)
Bellow 80	1(2.7)	1(2.7)	2(5.4)
Total	26(70.3)	11(29.7)	37(100.00)

The cytological finding reveal malignancy in 37 patients and benign in 20 patients. Sampling was adequate in 53 patients. For the other 4 patients we did another try for adequate sample and we sent it again for cytological examination. The transthoracic FNAC were done by using 22G biopsy (spinal needle). Most of our patients (45 patients) done under direct ultrasound guide by the supervision of ultrasonographer, and the others done blindly depending on CXR and CT scan of them.

Most patients required three or fewer passes for an adequate specimen. The aspirate was smeared on to glass slides directly fixed by ethanol alcohol 80%. (Usually in four slides) and then the samples sent into two different cytological analyzing labs(to get more accurate result about the diagnosis). They were sent for examination in the department of pathology by the Pathologist [8].

Follow-up biopsy and cytology records of the cases as well as clinical-radiological data were taken from case-sheets, hospital computer database in (Rizgary teaching hospital, Hawler cardiac center) and private clinical labs. This information constituted the final clinical-pathological diagnoses with which the FNAC diagnoses for all cases were correlated. A total of 17 cases that had original negative, unsatisfactory, non-specified malignancy and other lesions that had discordant clinical outcome, were reviewed in other pathologist labs [9-11].

The general results of pathological finding revealed malignancy in 37 patients, inflammatory result (4 patients), necrosis (2 patients) , abscess in 2 patients, benign lesions in 3 patients, negative result in 5 patients and unsatisfactory result in 4 patients. Among these 37 malignant pathology, the pathological result of these malignant tumor reveal 21 adenocarcinoma, 7 squamous cell carcinoma, 4 small cell lung carcinoma, 2 large cell carcinoma, 3 metastatic lesions from primary malignant sites(breast cancer, hepatoma, and carcinoma of esophagus. Data was compiled and statistical analysis was done by using statistical (SPSS) version 11 for windows (Figure 3).

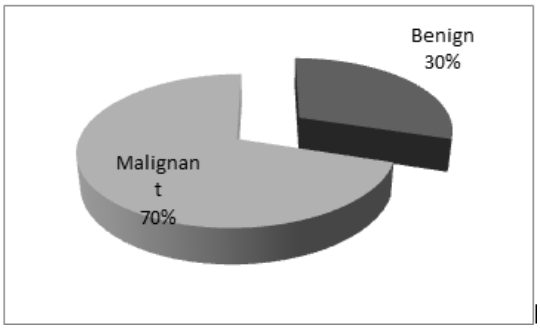

Figure 3: Benign and malignant ratio.

Result

The results of 57 cases were included in the study having peripheral chest lesions, they underwent FNAC , their clinical data are summarized in Table V and table , and the results of FNAC are shown in table . The results of cytological examination revealed 37 cases with malignancy and the tumor classification of the 37 malignant diagnoses is presented in Table. The metastatic carcinoma diagnosed in 3 patients who were from breast, liver and esophagus. Ten cases (29.4%) of the 34 primary lung malignancies shown in table occurred in female patients; females constituted 7 (33.3%) of the 21 patients with primary lung adenocarcinomas. The age wise distribution between male and female of occurrence of different types of malignancies are shown in table (Figure 4).

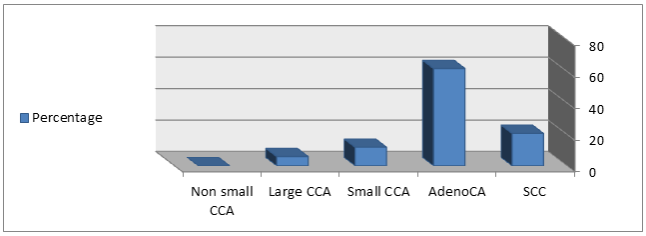

Figure 4: types of primary lung carcinoma

Nine cases (24.3 %) out of the 37 cases (65%) malignant FNAC diagnoses had follow-up lung biopsies that confirmed the diagnosis (ie post-surgical histopathological result). These comprised 21cases (56.8%) primary adenocarcinomas, , 7 cases (18.9%) primary squamous lung carcinomas, 4 cases (10.8%) primary small cell carcinoma, 3 cases (8.1%) was definitively classified as metastatic carcinoma with histopathology. There were difference between age and type of malignancy for distribution of the malignancy. Most of malignant distribution of disease was in age range between 51-60 years, in which 19 cases (51.4%) out of 37 malignant tumours of the lung occur in this age group, in maximum range of adenocarcinoma and Squamous cell carcinoma was detected. In the age range between 41-50years 6 primary lung carcinoma detected and one case (2.7%) metastatic breast cancer detected, and the same result detected in the age range between 61-70years. While in the age range between 31-40years no malignant lesion was detected. It show that all the result in this age group was benign, while bellow the age of 80 only two malignant lesion detected (one metastatic and one adenocarcinoma).

These data indicate that when a cytological subclassification of type of bronchogenic carcinoma was attempted and a subsequent biopsy was available, a high concordance (94.4%) between both was obtained. Twenty five cytologically malignant cases (67.6%) had clinical-radiological courses that were consistent with the diagnoses, e.g. development of metastases, progression of radiological lesions, death due to the relevant malignancy or response to therapy. Histology of both these matched the primary cytological diagnosis. 12 cases (32.4%) of FNAC diagnosed malignancy died from there diseases. Notable, of the 4 cases (10.8%) of FNAC diagnosed small cell carcinoma, all but one of the patient have died of the disease at the time of writing, an observation consistent with the aggressive behaviour of these tumours. one case (2.7%) was lost to follow up.

In the benign category of FNAC diagnosis (including inflammatory, benign, and negative -16 cases). One inflammatory case (1.7%) had malignant clinical courses in the form of systemic metastases. One case (1.7%) died of unrelated malignancy (esophageal carcinoma and hepatoma) and one case 1.7) was lost to follow up. The rest of the cases had benign clinical courses.

The 4 unstatisfactory FNACs, 1(1.7%) case had subsequent malignancy on biopsy: eventual histology included adenocarcinoma. One other case 1.7%) had a benign follow up biopsy and one case (1.7%) had benign clinical courses. One case (1.7%) was lost to follow up.

The malignant and benign FNAC diagnoses were correlated with the final clinical-pathological diagnoses.

Review of cytology specimen

The cytological specimens of a total of 17 cases were available for review, including all those diagnosed as negative for malignancy (five cases), unsatisfactory (four cases), granulomatous inflammation (eight case). This blind review showed 96% concordance with the benign/ malignant diagnoses reported originally, as well as full concordance among the reviewers. None of the malignancies in this group allowed further sub-categorization on review. Some results of the review deserve highlighting and are shown in table.

Complications

Of the 4 patients who developed pneumothoraces (7%), all except one were small, and they were successfully managed conservatively. The other developed huge pneumothorax with dyspnoea so we managed him with chest tube insertion and underwater seal. The haemoptysis during biopsies was not recorded, but no episode of clinically significant haemoptysis occurred in any case during the post-biopsy inpatient stay.

Discussion

Comparing ours study to Gupta (Gupta et al, 2001) study which show that out of 98 patients, 53(54.1%) patients had malignant lesions, of these 7cases (13.2%) were seen in the age group of less than 40 years and the majority occurred above the age of 40 years. This is indicating that about 1/7th of the patients bellow 40 years of age group are affected with malignancy. The majority of cases were seen in 41-59 years age group 33(58.5%), while in our study out of 57 patients 37 (65%) had malignancies, no malignancy found bellow 40 years age group and majorities occurred in the same age group above 40 had also reported that the most common age group affected was between 40-60. The male to female ratio in our study is (2.5:1), while in Rajwanshi is (6.5:1) and in Nagrath (4:1).

Comparing our study with Gupta in our study, majority of patients 42(73.7%) presented with chest pain, 39(68.4%) patients with chronic productive cough, 26(45.6%) patients with breathlessness, 21(36.9%) patients with haemoptesis and 3 patients with fever (5.2%) , while in their study 68(69.3%), 53(54%) , 43(43.9%) and 1(32%) respectively. Dysphagia was seen in 2(3.5%) patients while in their study 8(8.2%), which indicating the compressing of esophagus with large LN, whereas hoarsens of voice was noticed in a total 3(5.2%), while in their study 11(11.2%) which indicating that involvement of recurrent laryngeal nerve. These changes were observed due to few considerable numbers of patients in our study comparing with Gupta study (57:98).

FOB was done in 42 patients and a mass detected in one patient (1.7%) and bronchioalveolar wash was helpful in detecting malignancy in 4(7%) patients while, comparing with Gupta study bronchoscopy was done in 65 patients bronchoalveolar wash detecting malignancy in 8 patients (8.2%), so it seems to be both result close to each other.

The outcome of this review of the lung FNAC service at our department shows that the relative percentages of the general benign and malignant diagnoses are comparable with those in other studies. Of particular note, however, is the relatively larger percentage of primary adenocarcinomas (56.8%) compared to other studies.

In studies by primary squamous cell carcinoma of the lung was the commonest diagnosis. They also had relatively larger percentages of large cell carcinomas, undifferentiated/ not otherwise specified. However, this may just reflect the overall difference in the frequency of specific lung cancer types. International figures have shown comparable incidences of primary lung adenocarcinoma and squamous cell carcinoma in the population, while the Singapore figures show relatively more adenocarcinomas, showed that adenocarcinoma constituted 39.7% of lung cancers while squamous cell carcinomas made up 27.0% of lung cancers. Compared with this, our FNAC study shows an even higher proportion of adenocarcinomas (56.8%) than in the reported Singaporean population. This could be explained by the fact that adenocarcinomas are more often peripherally located and thus more amenable to diagnosis by transthoracic FNAC.

Our study also found a high percentage of FNAC-diagnosed adenocarcinomas patients were female (33.3%). This is higher than the overall female proportion of all FNAC-diagnosed primary lung cancers (29.4%) in this study as well as the female proportion of all lung cancers in Singapore. This is in keeping with the fact that adenocarcinoma is the commonest lung cancer in females and that it tends to be peripherally located.

Adequacy of Samples

Adequacy of samples obtained by lung FNAC has been reported to be between 80%-95% (6, 10). Immediate assessment of the FNAC specimen by a cytotechnologist, with further passes made when necessary, has been shown to improve the adequacy rate of the technique, the figure remarkably reaching 100% in a prospective study by Santambrogio and coworkers. We routinely practice immediate assessment of smears by a trained cytotechnologist, which explains our high adequacy rate of 93%.

Diagnostic accuracy and follow-up

All the follow-ups available on the cases considered generally showed good correlation between the original cytological diagnoses and the final clinical-pathological diagnoses; furthermore, in all except two benign cases, review of the cytology material available concurred with the original diagnoses. A few cases illustrate the importance of good characterization of unsatisfactory and negative diagnoses.

Four cases originally considered being unsatisfactory at FNAC one of them turned out to be malignant when clinic-pathological follow-up was available, and four other cases diagnosed originally to be inflammatory but one of them turned out to be malignant. These cases underline the importance of minimizing unsatisfactory (inadequate) smears with the use of immediate assessment, the need to be able to recognize unsatisfactory smears and the carrying out of close follow-up/re-biopsy in such cases. In the FNAC-diagnosed malignancies that had histological follow-up, the concordance of the tumour type diagnoses was 94.4%. Although our figures were small, we compare favorably with other published results. Overall, our sensitivity, specificity and accuracy for diagnosing malignancy are comparable with those of other published results.

It is frequent presentation as a peripherally located solitary lesion and its cytological similarities to bronchioalveolar carcinoma, papillary carcinoma and carcinoid tumours require attention.

Transthoracic core needle biopsy of lung nodules has become more popular over the last five years, particularly at sites where immediate cytologic specimen evaluation is not readily available. The availability of inexpensive, disposable spring-loaded needles that cut in place rather than firing forwards has increased the popularity of such biopsies, as this style of core needle has a lower risk of producing pulmonary haemorrhage or pneumothorax. We did not perform any biopsies using this type of needle in our study.

More recently, many Department of Radiology continues to use fine needle cytology in the first instance and whenever feasible, and performs core needle biopsies only if fine needle biopsy consistently fails to deliver an adequate specimen.

Conclusion

Transthoracic FNAC is an accurate and safe method for the diagnosis of localized lung lesions. It can accurately sub-classify the type of bronchogenic carcinoma and suggest a possible primary site for those tumours metastasising to the lung.

The vast majority of lung malignancies can be confidently diagnosed with cytomorphological characterization in the right clinical context. Unsatisfactory and other non-malignant smears, in particular, need clinical correlation and close follow-up; re- biopsy may be necessary.

Acknowledgements

The author would like to acknowledge Ambo University for their encouragement.

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