Ultrasound Guided Aspiration Cytology of Abdominal Masses with Histopathological Corroboration- A Prospective Study

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Abstract
Introduction
Abdominal cavity masses are often non palpable, deep seated and margins of these lesions are often undetached which makes it difficult to assess their size and shape. Ultrasound guided fine needle aspiration is a technique which is safe, rapid, accurate and simple which can be used for cyto-histologic diagnosis in abdominal masses and also for the confirmation of the suspected malignant masses in various intra abdominal locations. we present a study on ultrasound guided aspiration cytology of abdominal masses, the objective being to study the abdominal masses according to age and sex, analyze the usefulness of ultrasound guided aspiration cytology in diagnosing abdominal masses, classification of lesions according to organ involved and to evaluate the accuracy of aspiration cytology in comparison to a histological diagnosis in available cases.
Material And Method
This study involved 106 cases with clinically and ultrasonographically diagnosed abdominal mass. Patient subjected to fine needle aspiration by a 20 guage needle and smears were made which were stained by H & E and papanicolaou stain.
Result
In our study we found most of the patients were in age group of 4th and 6th decade with the mean age of 48.4 ± 15.7 years, malignant and benign neoplasm were in 6th decade but non neoplastic lesions were in 5th decade. And also there were 55.9% of female patient and 44.1% of male patient in our study. . 69 cases (67.7%) were malignant, 23 cases (22.5%) were non neoplastic and 10 cases (9.8%) were benign lesions. Most common organ involved was liver (34.3%) followed by ovary (14.7%), metastatic adenocarcinoma liver (15.6%) is the most common diagnosed mass lesion followed by Gall Bladder adenocarcinoma(11.6%). In our study the diagnostic accuracy rate was 95.83%. The sensitivity and the specificity of this study were 95% and 100% respectively
Conclusion
USG guided FNAC is a rapid, accurate, cost effective and a safe procedure which can be used as investigation of choice for early confirmation. These procedures help in decreasing use of hospital resources, reduces patient discomfort and morbidity. We have seen that FNAC done by pathologist increase the diagnostic accuracy and satisfactory aspiration rate when done under ultrasound guidance in the presence of radiologist.
Keywords:- ultrasound guided FNAC, Abdominal masses, benign, malignant

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I. Introduction

Aspiration cytology is defined as a study of cells, obtained by a fine needle puncture of the mass. Maryin and Ellis in 1930 first describe the use of narrow gauged needle for tumor sampling[1]. But the technique was ignored for several years though it was assessed In Scandinavia[2]. One of the main reason for this delay in acceptance of this technique is that only few pathologists are skilled in cytologic interpretations, while most pathologists believed that diagnosis could be made by tissue samples as intercellular relationship can be determined by pathologists[3].

Abdominal cavity masses are often non palpable, deep seated and margins of these lesions are often undetached which makes it difficult to assess their size and shape. Ultrasound guided fine needle aspiration is a rapidly growing, readily accepted and an important technique which is safe, rapid, accurate and simple technique which can be used for cyto-histologic diagnosis in abdominal masses and also for the confirmation of the suspected malignant masses in various intra abdominal locations. The greatest advantage of this procedure is that it allows visualization of needle tip as it moves in the tissue and also we can guide the needle into lesions which are at critical anatomical sites.

Abdominal mass commonly present in surgical and gynecological department with wide range of presentation. Different imaging modalities like radiography, fluoroscopy, ultrasound, computed tomography and magnetic resonance imaging along with clinical presentation play an important role in diagnosis of abdominal masses. Among them ultrasonography is a very important diagnostic tool. It can detect as small as one cm lesions in critical anatomic areas, thus making sonography the first choice among guided interventional diagnostic procedures. Fine needle aspiration cytology commonly used procedure since it can have a major impact on the management of patients, obviate diagnostic surgical procedures or expedite planning for therapy. Ultrasound guided aspiration can be used for any masses in abdomen, mediastinum, thyroid, pelvis cervical nodes, parathyroid and lung/pleura[4].

Here we present a study on ultrasound guided aspiration cytology of abdominal masses performed at a tertiary care hospital, the objective being to study the abdominal masses according to age and sex, analyze the usefulness of ultrasound guided aspiration cytology in diagnosing abdominal masses, classification of lesions according to organ involved and to evaluate the accuracy of aspiration cytology in comparison to a histological diagnosis in available cases.

II. Material And Method

This study involved 106 cases with clinically and ultrasonographically diagnosed abdominal masses, which were referred for fine needle aspiration cytology in Department Of Pathology in our tertiary care hospital during the period of February 2012 to January 2013. Detailed clinical history which includes history, physical examination finding and reports of relevant investigations were recorded. The coagulation profile was routinely done in all the patients and only those patients with normal coagulation profile were included in this study.

Before posting the patient for procedure, patient and the party was informed about the procedure and consent was taken. Ultrasonography was performed by a radiologist and different features of the mass were assessed such as depth, echogenicity, vascularity, extent, etc. Prior to the procedure bleeding time, clotting time, platelet count and prothrombin time were checked to be within normal limits. A percutaneous FNAC of the mass was done under USG- guidance while taking all aseptic precautions and by the shortest route as suggested by the radiologist. A 20 ml disposable plastic syringe and a 22 gauge needle were used. Each aspirate was smeared on an average of three to four slides, half of which were immediately wet fixed in 95% alcohol fixative to be stained with Papanicolaou & H&E and half were kept for air dry to be stained with May Grunwald Giemsa and Ziehl Neelsen Stain (In case of purulent material). Only those cases which had adequate material to be studied were taken for study and those with histopathological correlation were considered for statistical analyses. Statistical analyses were done by appropriate statistical method using 'SPSS software for windows.

III. Result

In the present study, USG guided FNAC was performed in 106 patients with intra abdominal mass lesions of different etiology in the Department of Pathology, of a tertiary care hospital from February 2012 to January 2013.

The patient and the party had been explained about the procedure and consent was obtained. A detailed clinical history was obtained. Physical examination, radiological examination and routine blood investigations including coagulation profile was performed in all cases. Guided FNAC was carried out in 106 cases. Among them aspiration material was satisfactory in 102 cases and unsatisfactory in 4 cases, so statistical analysis was done in 102 cases only. Histopathological correlation was done in 48 cases.

In our study we found most of the patients were in age group of 4th and 6th decade with the mean age of 48.4 $\pm$ 15.7 years, malignant and benign neoplasm were in 6th decade but non neoplastic lesions were in 5th decade. And also there were 55.9% of female patient and 44.1% of male patient in our study (**Table 1**).

Specific diagnosis formed on cytologic evaluation of smear was analyzed. 69 cases (67.7%) were malignant, 23 cases (22.5%) were non neoplastic and 10 cases (9.8%) were benign lesions.

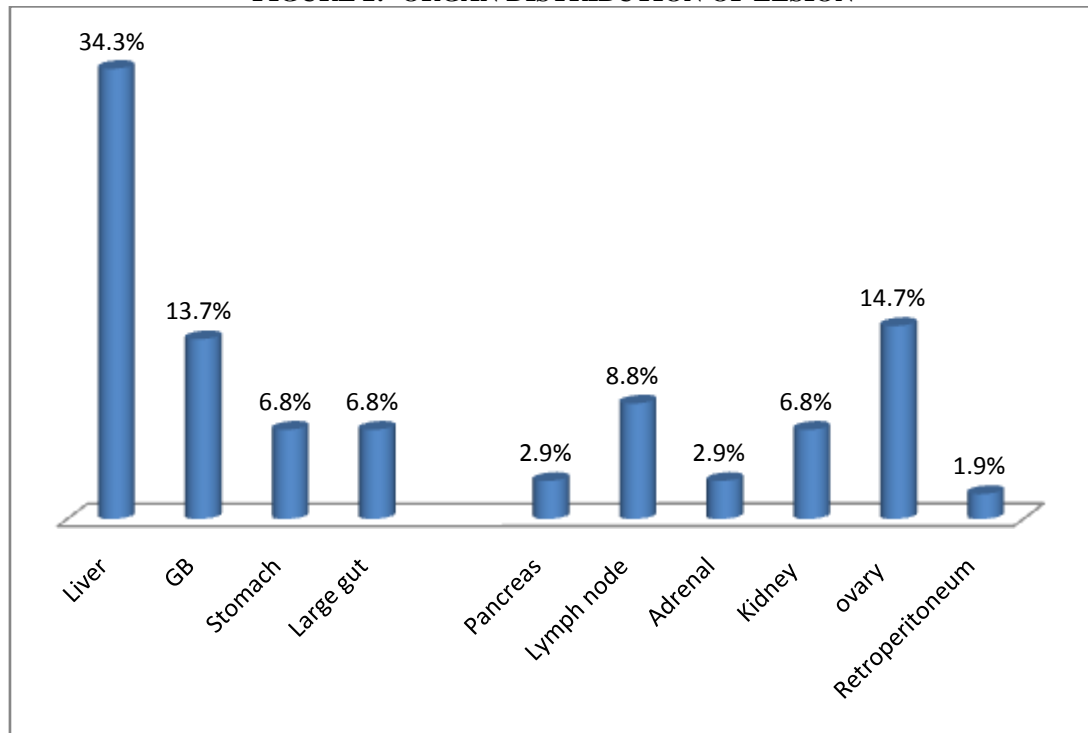**TABLE 1:- DISTRIBUTION OF CASES ACCORDING TO SEX**

SEX	NO. OF CASES	PERCENTAGE (%)
MALE	45	44.1
FEMALE	57	55.9
TOTAL	102	100

FIGURE 1:- SEX DISTRBUTION OF DIFFERENT TYPE OF LESION
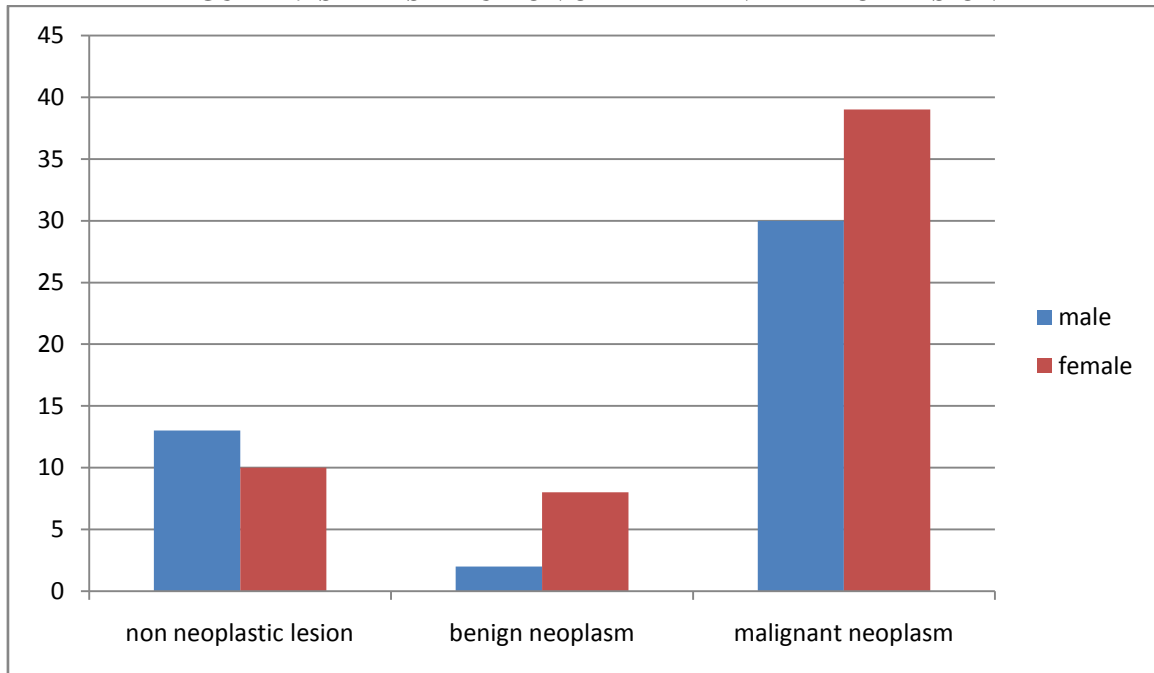
It was found that female had preponderance for both benign (7.8%) and malignant (38.4%) neoplasm, while male had preponderance for non neoplastic (12.7%) lesions.

FIGURE 2:- ORGAN DISTRIBUTION OF LESION

In our study it was found that most common organ involved was liver (34.3%) followed by ovary (14.7%), gall bladder (13.7%), lymph nodes (8.8%). Stomach, large gut and kidney all involved 6.8% cases. Adrenals and pancreas both involved 2.9% cases. Retroperitoneum involved least cases (1.95%)

TABLE 2:- OVERALL DISTRIBUTION OF CASES ACCORDING TO CYTOLOGY

DIAGNOSIS	No of case	Percentage (%)
Hepatic cyst	3	2.94
Hydatid cyst liver	2	1.96
Liver abscess	8	7.84
Fatty liver	1	0.98
Hepatic adenoma	1	0.98
HCC	5	4.90
Secondaries in liver	16	15.6
Inflammatory lesion of GB	2	1.96
Adenocarcinoma GB	12	11.76
Adenocarcinoma stomach	5	4.90
GIST	2	1.96
Adenocarcinoma pancreas	2	1.96
Inflammatory pancreatic cyst of pancreas	1	0.98
Adenocarcinoma large gut	6	5.88
Lymphoproliferative disorder of large gut	1	0.98
Complex renal cyst	1	0.98
RCC	4	3.92
Wilms' tumor	1	0.98
Neuroblastoma	2	1.96
Pheochromocytoma	1	0.98
Reactive LN	3	2.94
Tubercular LN	2	1.96
Lymphoproliferative disorder of large gut	2	1.96
Metastatic LN	2	1.96
Benign ovarian lesion	7	6.86
Serous cystadenocarcinoma	5	4.90
Mucinous cystadenocarcinoma	2	1.96
Dysgerminoma	1	0.98
Retroperitoneal sarcoma	2	1.96
TOTAL	102	100

From the above table it is evident that metastatic adenocarcinoma liver (15.6%) is the most common diagnosed mass lesion followed by Gall Bladder adenocarcinoma(11.6%).

TABLE 3:- COMPARISION OF USG GUIDED FNAC AND HISTOPATHOLOGICAL DIAGNOSIS OF DIFFERENT ABDOMINAL MASS LESIONS

FNAC diagnosis	Histopathological diagnosis	
	non-neoplastic/benign	Malignant
Inflammatory lesion of GB (N=2)	1	1
GB adenocarcinoma (N=8)	-	8
Hydatid cyst (N=1)	1	-
Hepatocellular Carcinoma (N=1)	-	1
Liver secondaries (N=3)	-	3
Stomach adenocarcinoma (N=6)	-	6
Large gut adenocarcinoma(N=5)	-	5
Pancreatic adenocarcinoma (N=1)	-	1
Renal Cell Carcinoma (N=3)	-	3
Wilms tumor (N=1)	-	1
Neuroblastoma (N=1)	-	1
Pheochromocytoma (N=1)	1	-
Renal oncocytoma=1	1	
Retroperitoneal Sarcoma (N=1)	-	1
NHL of large gut (N=1)	-	1
Benign ovarian cyst (N=5)	4	1
Serous cystadenocarcinoma (N=4)	-	4
Mucinous cystadenocarcinoma (N=2)	-	2
Dysgerminoma (N=1)	-	1
TOTAL (N=48)	8	40

TABLE 4:-

FNAC Diagnosis	Histopathological diagnosis		
	Malignant	Benign	Total
Positive	38 (TP)	00 (FP)	38
Negative	02 (FN)	8 (TN)	10
Total	40	8	48

TP= True Positive
TN= True Negative
FP= False positive
FN= False Negative

The above table shows that in cases of abdominal mass lesions ,out of 38 positive (malignant) lesions diagnosed by FNAC , 38 cases are true positive and no false positive lesion were noted. Whereas, out of 10 negative cases (non neoplastic and benign) diagnosed by FNAC, 8 were true negative and 2 were falsely negative.

So, on the basis of the observation in the present study, we can find out various parameters for evaluation of FNAC diagnosis in cases of abdominal mass lesion (considering the histopathological diagnosis as the gold standard) which were as follows:

1. Sensitivity= TP/TP+FNx100 = 38/38+02x100 = 95%
2. Specificity =TN/TN+FP x100 = 08/08+00 x100 =100%
3. Predictive value of positive test = TP/TP+FPx100
     = 38/38+00x100= 100%
4. Predictive value of negative test= TN/TN+FNx100
     = 08/ 08+02 x100= 80%
5. Accuracy rate   =TP+TN/TP+TN+FP+FNx100
     = 38+08/38+08+00+02 x100= 95.83%

TABLE 5:- OVERALL RESULT OF THE STUDY

INDICES	PERCENTAGE %
Sensitivity	95%
Specificity	100%
Diagnostic accuracy	95.83%
Positive Predictive value	100%
Negative Predictive value	80%

In our study the diagnostic accuracy rate was 95.83%. The sensitivity and the specificity of this study were 95% and 100% respectively. In the present study, no false positive diagnosis was encountered
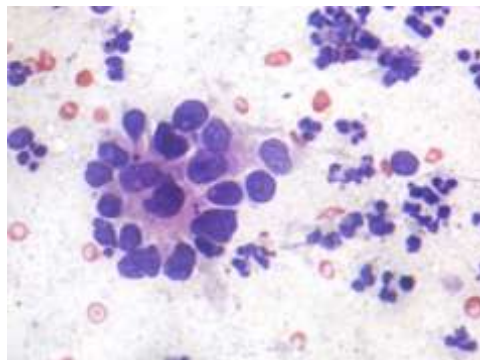

Figure 3:- showing FNAC smear acinar pattern of tumor Inflammatory background in adenocarcinoma of Gall bladder (H/E stain, 40X)
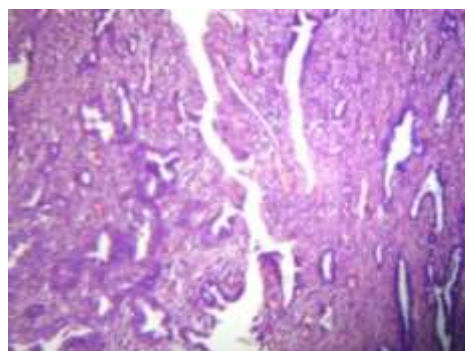

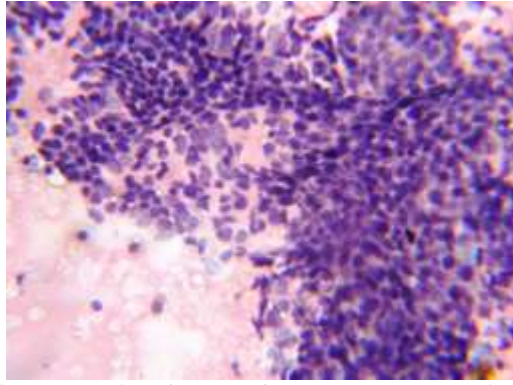**Figure 4:-** HP section showing adenocarcinoma of gall bladder (H&E stain, 10X)

Figure 5:- FNAC smear showing cytological feature of serous cystadenocarinoma of ovary . (H/E stain, 40X)
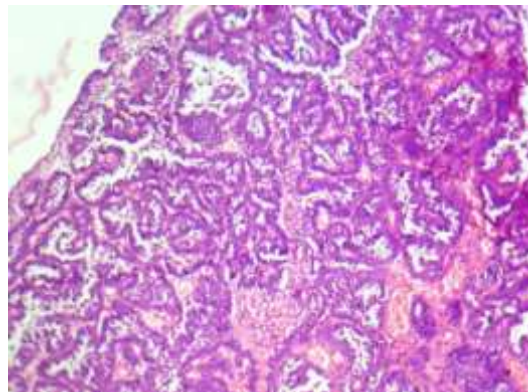

Figure 6:-HP section showing serous cystadenocarcinoma of ovary. (H/E stain, 10X)

IV. Discussion

FNAC of abdominal lesions reduces the incidence of exploratory laparotomy, minimizes the trauma for the patients undergoing invasive procedures, and reduces the risk of tumor spillage within the peritoneal cavity that can accompany surgical biopsy of tumors and also minimize the financial or working day loss of the patients because of hospitalization for long period.

Our study shows diagnostic yield of 96.22% which is almost similar to studies done by Sumana BS and Muniyappa B[13] who reported a diagnostic yield of 96.77% in their study. The most common lesion was in our study was found to be secondary adenocarcinoma of liver probably because liver is the most common site of metastasis; the study was conducted in a tertiary hospital and patients approaching health care facilities lately which was similar with **Khanna et al**.[14](44.13%), **Hemlatha et al** [4](39.14%), **Whitlach et al**[16] **and wilson et al**[17]. The most common diagnostic problem which had to be solved by using an FNAC procedure in the liver was to distinguish a primary from a secondary tumour. Though hepatocellular carcinoma is a very vascular tumour and is prone for a spontaneous rupture causing haemoperitoneum, no such complication was encountered in the present study. Zargar et al[15] stated that common indication of FNAC is to confirm liver or gall bladder carcinomaFNAC of hepatic masses has proved to be a safe and an accurate method for diagnosing tumours in this site. We found two case (1.96%) inflammatory lesions of gall bladder one of them diagnosed as adenocarcinoma of the gall bladder on histopathology. The false negative diagnosis in this case could be attributed to a sampling error, wherein the needle might have missed the target lesion, as it was surrounded by an extensive inflammatory infiltrate. Histopathology confirmation was done in 48 cases so rest of the cases was not included in cytology and histopathological correlation.

Out of 38 positive (malignant) lesions diagnosed by FNAC, 38 cases were true positive and no false positive lesion were noted. Whereas out of 10 negative cases diagnosed by FNAC, 8 were true negative and 2 were falsely negative.

So from the above analysis following parameters were derived

Sensitivity- 95%

Specificity- 100%

Predictive value of positive test- 100%

Predictive value of negative test- 80%

Diagnostic accuracy- 95.83%

So from the above analysis it is evident that in diagnosis of abdominal mass lesion USG guided FNAC plays a very important and effective role. It shows high sensitivity and specificity and very low percentage of false negative and no false positive result. So cases where histopathology examination is not possible it can play an important decision making role.

We can evaluate and compare the sensitivity and specificity of various studies with our present study-

TABLE 6:- STATISTICAL RESULT COMPARATIVE ANALYSIS

STUDIES	SENSITIVITY (%)	SPECFICITY (%)	ACCURACY (%)
Joao Nobrega et al [5] (1994)	87	100	100
GovindKrishnaet al [6] (1993)	71.40	55.60	77.50
Aftab A.Khan et al [7] (1995)	94	100	94
Shamshadet al [8] (2006)	94.11	100	95.70
Andola et al [9] (2011)	94.10	100	96.50
Present Study (2013)	95	100	95.83

The sensitivity of USG guided FNAC ranged from 71.4% to 96.3% in various studies as shown by the table. In the present study, it was 95%, which was comparable to that of most of the studies [Table-5]. All the studies observed 100% specificity, as was found in the present study also except **Govinda Krisna et al** showed low specificity (55.60%). **Civardi et al** [18] reported sensitivity 95.6% and specificity of 100%. The diagnostic accuracy in various studies ranged from 77.5% to 100%. The present study was found a diagnostic accuracy of 95.83%, which was comparable to that of most of the studies.

No serious complication was encountered in the present study which was similar with the experience of other authors. A very few patients reported mild pain for 1-2 days at the site of operation, no other complication was noted. **Chaqnon S et al** showed low morbidity (0.8%) and no mortality [10]. **Azizi A et al** also showed no serious complication [11]. Complication rate was too low (0.9%) in the study of **RS Adhikari et al** [12]. Lumachi et al [19] also stated that ultrasound guided FNAC can be cost effecting in diagnosis and management of incidentally discovered tumors of adrenal gland. So from the above discussion it is clear that USG guided FNAC is a safe, minimally invasive procedure in diagnosis of abdominal mass lesion and when USG guided FNAC is used in conjunction with clinico-radiological parameters, is accurate and effective in diagnosing deep-seated mass lesions in the abdomen.

V. Conclusion

USG guided FNAC is a rapid, accurate, cost effective and a safe procedure which can be used as investigation of choice for early confirmation and exclusion of neoplastic diseases in cases which presents as abdominal masses thereby avoiding expensive, unnecessary and invasive procedure. However the cytopathologist needs to acquire manual skills before taking up this diagnostic procedure. He also has to keep in mind what they are looking under the microscope match with clinical picture or not. It is an accurate procedure which can be done in outpatient basis. It is not only useful in diagnosis of deep seated space occupying lesions but also helps in choosing the appropriate management. Moreover these procedures help in decreasing use of hospital resources, reduces patient discomfort and morbidiy. We have seen that FNAC done by pathologist increase the diagnostic accuracy and satisfactory aspiration rate when done under ultrasound guidance in the presence of radiologist.

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