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A Cyto-Histo Correlative Study of Image Guided Fine Needle Aspiration Cytology in Intra-Abdominal Lesions

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Abstract

Background: Image Guided Fine Needle Aspiration Cytology (Image Guided FNAC) has become routine procedure for any lesion which is deep seated or inaccessible by conventional FNAC. It is an established, simple, rapid, less-invasive and economical procedure for cytological diagnosis of various benign as well as malignant lesions. *Aims & Objectives:* To study the sensitivity, specificity and diagnostic accuracy of image guided FNAC and to correlate its diagnosis with histopathology (HP) in intra-abdominal lesions. *Materials & Methods:* Image guided Fine Needle Aspirations (FNA) were performed in 80 patients with various intra-abdominal lesions during May 2009 to December 2011. Among which, 73 were USG guided (91.3%) and 7 were CT guided (8.7%). Their cytological diagnosis was compared to HP diagnosis. True and false (positive and negative) data was analyzed to measure sensitivity, specificity and diagnostic accuracy of image guided FNAC. *Results:* Out of 80 cases, adequate material was aspirated in 75 cases (Sample adequacy 93.6 %.) so remaining 5 cases were excluded from study. Maximum cases were from Liver (24) followed by Ovary (19), Gall bladder (13), Gastro Intestinal Tract (GIT) (10), Lymph nodes (5) and Omentum (4). FNAC was diagnostic in all 75 cases which had adequate material. Among which, 55 (73.3 %) cases were malignant, 9 (12%) were benign and 11 (14.7%) were non-neoplastic. HP correlation was available in 58 (77.3%) cases. HP diagnosis was different from FNAC diagnosis in only 2 (3.4%) cases. Diagnostic accuracy of image guided FNAC was 96.6% with sensitivity of 95.9% and 100% specificity. *Conclusion:* Having high sensitivity, specificity and diagnostic accuracy**,** image guided FNAC is an OPD based rapid, reliable and accurate diagnostic procedure for various intra-abdominal lesions which are inaccessible by conventional FNAC. It is much economical to the patient as compared to costly surgical biopsies which have high morbidity.

Keywords: Image Guided FNAC; Intra-Abdominal; Ultrasonography; CT Scan, Histopathological Correlation.

Introduction

Now a days Fine Needle Aspiration Cytology (FNAC) is assuming increased importance in cytology and practiced today as an interpretative art with histopathology. Improvement in radiological imaging methods have made diagnostic process far more accurate and allow more precise localization of deep seated intra-abdominal lesions. Such few imaging modalities are Ultrasonography (USG), Computed Tomography (CT) Scan, Magnetic Resonance Imaging (MRI) Scan, Fluoroscopy etc [1]. But these imaging modalities alone cannot differentiate between benign, malignant or non-neoplastic lesions, therefore tissue diagnosis is mandatory [2]. So FNAC under USG or CT guidance can be regarded as the investigation of choice for diagnosis of abdominal masses [3]. It is now routinely possible to aspirate and yield adequate cellular material under image guidance from intra-abdominal sites which were previously inaccessible by conventional FNAC [4]. However, some associated risk and complications like hemorrhage, peritonitis, pneumothorax, needle tract tumor seedling etc. should be kept in mind [2]. USG is the most preferred modality due to its mobility, portability, rapidity, easy

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availability and zero radiation exposure, while CT is used when USG guidance failed to yield adequate material and in some lesions obscured by bone and gas [5]. Other modalities like MRI are costly, bulky, time consuming and not available at all centers, so not preferred much. Besides, close cooperation between radiology and cytology department allows maximum efficiency and accuracy. Presence of pathologist is most important as he can guide the radiologist to different areas of lesion, such as periphery instead of central necrotic area of solid lesions [5]. The main objectives of present study are: (1) To study the sensitivity, specificity and diagnostic accuracy of image guided FNAC and to correlate its diagnosis with histopathology (HP) in intra-abdominal lesions. (2) To diagnose inaccessible intra-abdominal lesions and to differentiate neoplastic from non-neoplastic ones. (3) To assist the surgeon in selection of patient for surgical or medical management or palliative therapy.

Material and Methods

The study was carried out after approval from institutional ethics committee and with prior informed consent from each patient referred to Pathology Department of Smt. NHL Municipal Medical College and its attached hospitals in Ahmedabad, Gujarat, India between May 2009 to December 2011. Total 80 image guided FNAC were performed (73 USG & 7 CT guided) in patients with various intra-abdominal lesions taking proper history and other relevant details. Prior clinical and radiological examination were done and patients found to have intra-abdominal masses were subjected to image guided FNAC under strict aseptic precautions by a 22-23 gauge needle attached to a 10 or 20 ml syringe for superficial lesions and by a long spinal needle of same gauge for deep seated lesions. Needle was introduced under imaging guidance and multiple needle passes were made in each case to obtain adequate material. After aspirating under negative pressure, smears were prepared, fixed in 95% ethyl alcohol and stained with Haematoxylin & Eosin (H & E) and Papanicolaou stains. For Histopathological Examination (post-surgical), specimens were fixed in 10% formalin, appropriate sections were taken, processed in Yorco's automatic tissue processor, cut by microtome and slides were prepared.

Slides were stained by routine H & E stain and mounted with DPX. Finally, FNAC and HP diagnosis were compared, analyzed and results were interpreted accordingly.

Results

We have performed 73 USG guided and 7 CT guided fine needle aspirations from various intra-abdominal lesions from total 80 patients including 37 males (46.3%) and 43 females (53.7%) in the age range of 12 to 85 years in Smt. NHL Municipal Medical College and its attached hospitals in Ahmedabad, Gujarat, India from May 2009 to December 2011. The study was followed by Histopathological Examination (HPE) in 58 cases. Various intra-abdominal organs studied were Liver, Ovary, Gall bladder, Gastro Intestinal Tract (GIT) Lymphnode and Omentum. Out of these 80 aspirations, adequate material was aspirated in 75 cases, while 5 aspirations were inadequate (acellular or blood only), so they were excluded from the study. FNAC was diagnostic in all 75 cases which had adequate material. Among which, 55 were malignant, 9 were benign and 11 were non-neoplastic.

Various parameters are displayed in Table 1.

Table 1: Various Parameters in Image Guided FNAC

Parameters	Number of Cases	%
Total Cases	80	100
Male	37	46.3
Female	43	53.7
USG Guided FNAC	73	91.3
CT Guided FNAC	07	8.7
Adequate	75	93.6
Inadequate (so, excluded from study)	05	6.4
Cytological Diagnosis (n=75)	**75**	**100**
Non Neoplastic	*11*	14.7
Benign	*09*	12.0
Malignant	*55*	73.3
Histopathological Diagnosis(n=75)	**58**	**77.3**
Non Neoplastic	*03*	4.0
Benign	*06*	8.0
Malignant	*49*	65.3

Malignant neoplasms diagnosed were Hepatocellular carcinoma, Cholangiocarcinoma, Primary and Metastatic adenocarcinoma of different organs, Metastatic squamous cell carcinoma, Serous and Mucinous cystadenocarcinoma of Ovary and Non-Hodgkin's Lymphoma. *Benign neoplasms* were Adenoma of liver, Serous & Mucinous cystadenoma and Benign cystic teratoma of ovary. *Non-neoplastic* lesions were Tuberculosis, Abscess, Cyst and Reactive lymphadenitis. FNAC diagnosis of all intra-abdominal lesions with their histopathological correlation is tabulated in Table 2 and photomicrographs of some lesions are shown in Figures 1 to 6.

66 patients did not have any complications during and after the procedure, while 14 patients complained of pain which was relieved by symptomatic treatment. HP correlation was available in 58 (77.3%) cases while not available in 17 (22.7%) cases. Out of 58 cases, HP diagnosis was different from FNAC diagnosis in 2 (3.4%) cases; one from intra-abdominal lymph node and the other from ovary. Both are diagnosed as non-neoplastic and benign on FNAC (Reactive lymphadenitis & Serous cystadenoma) while malignant on HPE (Non-Hodgkin's lymphoma & Serous cystadenocarcinoma of low malignant potential) respectively. With regard to malignancy from definitive cytological diagnosis along with histopathological correlation, the following was observed. True Positives (TP)-47 cases, True Negative (TN)-9 cases, False Positive (FP)-0 cases and False Negative (FN)-2 cases (Table 3).

Table 2: Image Guided FNAC Diagnosis in Various Intra-Abdominal Lesions with Histopathological Correlation

Organ	*Category*	*Cytological Diagnosis*	*No. of Cases*	*%*	*Histopathological Diagnosis*		
					Cyto-Histo Concordant Cases	*Cyto-Histo Discordant Cases*	*Cyto-Histo correlation Not Available*
LIVER (24 cases)	Malignant (17)	Hepatocellular Carcinoma	9	12.0	7	0	2
		Metastatic Adenocarcinoma	5	6.8	4	0	1
		Metastatic Squamous Cell Carcinoma	2	2.7	2	0	0
		Cholangiocarcinoma	1	1.3	1	0	0
	Benign (2)	Adenoma	2	2.7	2	0	0
	Non Neoplastic (5)	Tuberculosis	3	4.0	0	0	3
		Abscess	2	2.7	2	0	0
OVARY (19 cases)	Malignant (11)	Serous Cystadenocarcinoma	8	10.7	7	0	1
		Mucinous Cystadenocarcinoma	3	4.0	3	0	0
	Benign (7)	Serous Cystadenoma	4	5.3	2	1 (Cystadeno CA of LMP*)	1
		Mucinous Cystadenoma	2	2.7	1	0	1
		Benign Cystic Teratoma	1	1.3	1	0	0
	Non Neoplastic (1)	Follicular cyst	1	1.3	0	0	1
GALL BLADDER (13 cases)	Malignant (13)	Adenocarcinoma	13	17.3	11	0	2
	Benign & Non Neoplastic (0)		00	0	0	0	0
GIT (Gastro Intestinal Tract) (10 cases)	Malignant (7)	Adenocarcinoma	7	9.3	6	0	1
	Benign (0)	-----	0	0	0	0	0
	Non Neoplastic (3)	Tuberculosis	2	2.7	0	0	2
		Abscess	1	1.3	1	0	0
LYMPH-NODE (5cases)	Malignant (3)	Non-Hodgkin's Lymphoma	2	2.7	2	0	0
		Metastatic Adenocarcinoma	1	1.3	1	0	0
	Benign (0)	-----	0	0	0	0	0
	Non Neoplastic (2)	Tuberculous Lymphadenitis	1	1.3	0	0	1
		Reactive Lymphadenitis	1	1.3	0	1 ^(NHL)	0
OMENTUM (4 cases)	Malignant (4)	Metastatic Adenocarcinoma	4	5.3	3	0	1
	Benign & Non Neoplastic (0)		0	0	0	0	0
	TOTAL CASES		75	100	56	2	17

*Cystadeno CA of LMP- Serous Cystadenocarcinoma of low malignant potential, ^NHL- Non-Hodgkin's Lymphoma

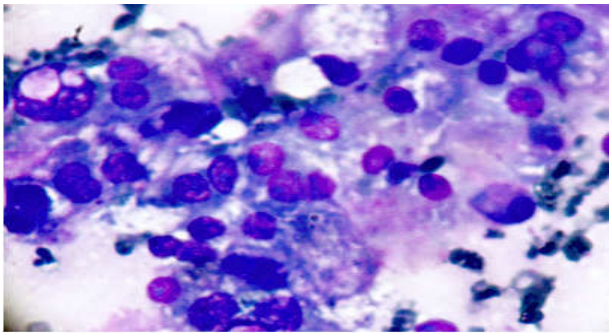

Fig. 1: Hepatocellular Carcinoma (H&E, × 400)

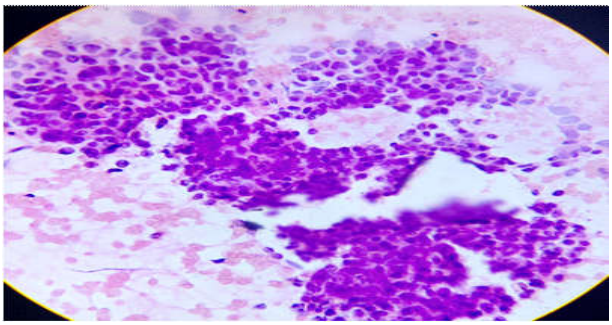

Fig. 2: Metastatic Adenocarcinoma, (H&E, × 100)

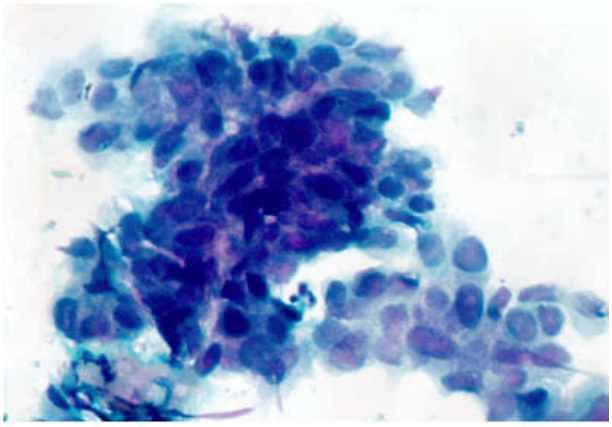

Fig. 3: Serous Cystadenocarcinoma (PAP, × 400)

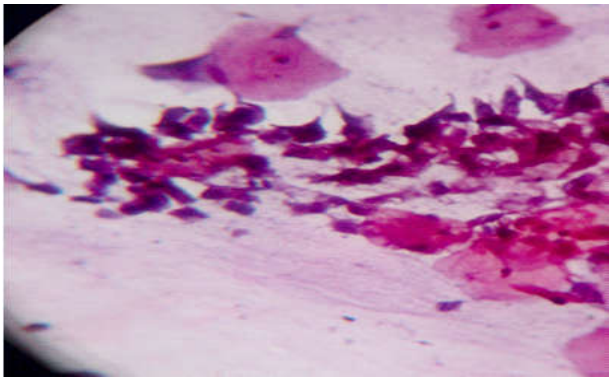

Fig. 4: Benign Cystic Teratoma (H&E, × 400)

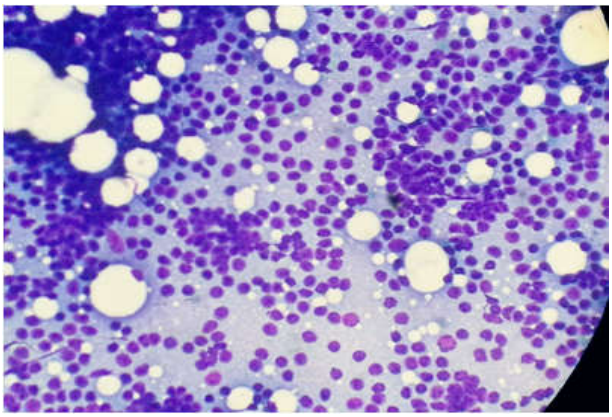

Fig. 5: Non-Hodgkin's Lymphoma (H&E, × 100)

Fig. 6: Tuberculous Lymphadenitis (H&E, × 100)

Table 3: Comparative Analysis between FNAC and Histopathology Diagnosis

FNAC Diagnosis		HISTOPATHOLOGY Diagnosis		
		Available		Not Available
Cytological Diagnosis	No. of Patients	*Non-Malignant**	*Malignant*	----
*Non-Malignant**	20	09 (TN)	02 (FN)	09
Malignant	55	00 (FP)	47 (TP)	08
		09	49	
TOTAL	**75**	**58**		**17**

*Non-Malignant = Benign + Non-neoplastic

Table 4: Comparison of Sensitivity, Specificity and Diagnostic Accuracy of Present Study to Other Studies [3, 9, 12-14]

Studies	Year of Publication	No. of Cases	Sensitivity %	Specificity %	Accuracy %
S.S Ahmad et al[3]	2006	200	94.1	100	95.7
S. Goel et al[9]	2010	78	85.0	100	93.8
Sidhaling Reddy et al[12]	2011	245	94.1	100	96.5
Hemalatha A.L et al [13]	2013	90	94.1	100	96.3
B.S.Sumana et al [14]	2015	62	95.3	100	96.4
Present Study		75	95.9	100	96.6

So, following are the overall Accuracy, Sensitivity and Specificity measurements.

Accuracy: It measures the *degree of veracity* of diagnostic test on a condition (Benign or Malignant).

= (TP+TN) ÷ Total × (100)

= (47+09) ÷ 58 × (100)

= **96.6** %

Sensitivity: The ability of a test to *detect* disease (here, Malignancy) when it is present.

= TP ÷ (TP+FN) × (100)

= 47 ÷ (47+2) × (100)

= **95.9** %

Specificity: The ability of a test to *exclude* disease (here, Malignancy) when it is not present.

= TN ÷ (TN+FP) × (100)

= 9 ÷ (9+0) × (100)

= 100 %

Discussion

The main purpose of this study is to access the role of Image Guided FNAC in various intra-abdominal lesions and correlate Cytological findings with Histopathological (HP) findings. 73 USG guided and 7 CT guided FNAC were performed in all 80 patients. USG guidance was preferred to CT guidance because it is comparatively cheap, easy, rapid and has no radiation exposure. So first, USG guided aspirations were tried in all patients and yielded adequate material in 68 patients. From the remaining 12 patients with inadequate material, total 7 FNAC were repeated under CT guidance [liver(3), ovary(2) and gall bladder(2)] which finally obtained adequate material. 5 patients with inadequate material didn't give consent for CT guided FNAC, so were excluded from the study. So finally image guided FNAC yielded adequate material in 75 patients (Sample adequacy 93.6%). Maximum 17 malignant cases (22.6%) were reported from Liver followed by 13 from Gall bladder (17.3%) and 11 from Ovary (14.7%). From GIT, Lymphnode and Omentum, 7, 3 and 4 malignant cases were reported respectively. The commonest malignancy reported in all intra-abdominal organs was adenocarcinoma (primary & secondary) with 37 cases (49.3%) while the commonest benign neoplasm was adenoma with 8 cases (10.7%) and the commonest non-neoplastic lesion was tuberculosis with 6 cases (8%). Among malignant liver lesions, Hepatocellular carcinoma was most common malignancy comprising 52.9% of cases (9/17) followed by Metastatic adenocarcinoma with 29.4% cases (5/17) which are comparable to studies done by *Swamy et al* and *Rasania et al* [6,7]. Benign liver lesions include adenoma, tuberculosis and abscess.

Among malignant lesions of ovary, Serous cystadenocarcinoma was the commonest malignancy having 72.7% of cases (8/11) followed by mucinous adenocarcinoma. While, mucinous cystadenoma is the commonest benign ovarian lesion comprising of 57.1% of cases (4/7). Other benign lesions were mucinous cystadenoma and benign cystic teratoma. These findings are comparable to study done by Mehdi et al and *Goel et al* [8,9].

13 Out of 13 gallbladder lesions were diagnosed as Adenocarcinoma comparable to study done by *Das et al* [10].

Among GIT lesions, commonest malignancy is adenocarcinoma while benign lesions include tuberculosis and abscess comparable to study done by *Ahmad SS et al* [11].

Non hodgkin's lymphoma was the commonest malignancy in abdominal lymphnodes and metastatic carcinoma in omentum. All above results are also comparable to results of many other national and international studies [2-4, 12-16].

In 17 cases, HP correlation was not available mainly because, some benign or non-neoplastic lesions like tuberculosis were treatable by medical management, so surgery was not advised. In some malignant lesions, either the patients didn't come for follow up or they have been referred to higher center for advance treatment. In 2 cases, HP diagnosis was different from the FNAC diagnosis. One case from lymphnode was diagnosed as 'Reactive lymphadenitis' (Non neoplastic) on FNAC due to technically suboptimal smears while proved to be 'Non-Hodgkin's lymphoma' (Malignant) on HPE. The other one from ovary was diagnosed as 'Serous cystadenoma' (Benign) on FNAC due to unrepresentative aspiration and attached benign component, while proved to be a 'Serous cystadenocarcinoma with low malignant potential' (Malignant) on HPE. The present study showed the diagnostic accuracy of image guided FNAC was 96.6% with sensitivity of 95.9% and 100% specificity which is comparable to other studies as shown in Table 4.

Conclusion

Image Guided Fine Needle Aspiration Cytology is reliable, diagnostic and accurate in 96.6% of cases with 95.8% sensitivity and 100% specificity in present study. It plays an important role in diagnosing various benign, malignant and non-neoplastic intra-abdominal lesions and to assist the surgeon in deciding further management. It is much economical to the patient as compared to costly surgical biopsies which have high morbidity. Therefore, Image Guided FNAC should be used as a routine procedure for diagnosis of intra-abdominal lesions due to high sensitivity and specificity and very low complication rate.

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