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Original Article

Pathology Section

Role of Fine Needle Aspiration Cytology in the Assessment of Intra-Abdominal and Retroperitoneal Lesions-A Comparative Study

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ABSTRACT

Introduction: Fine needle aspiration cytology (FNAC) is a widely used valuable, accurate, and safe method which was initially applied only for readily palpable masses.But in recent years previously inaccessible lesions and deeper organs are safely aspirated using the fine needle under radiological guidance.

Aim: This study was conducted to evaluate and confirm the diagnostic utility of FNAC in intra-abdominal and retroperitoneal lesions.

Materials and Methods: This study was conducted on 660 patients with clinically suspected intra-abdominal and retroperitoneal lesions. Ultrasound guided (USG) or computed tomography (CT) guided FNACs were performed and the smears stained with Haematoxylin and eosin (H and E) and May Grunwald Giemsa (MGG) stains. A cyto-histopathological correlation was done where ever possible.

Results: Among the 660 patients studied, 65% were CT guided FNACs and 35% were USG guided. A cytopathological diagnosis was obtained in 477 cases (72%) of which 135(28.3%) werenon malignant (benign neoplasms and non neoplastic) lesions and 342 (71.7%) were malignant lesions. Liver was the most frequently aspirated organ. Pyogenic abscess of the liver and hepatic metastasis were the commonest non malignant and malignant lesions respectively. With the available cyto-histopathological correlation, the overall accuracy was 85%, the sensitivity for true positive results was 83%, the sensitivity for true negative results was 88%, the positive predictive value (PPV) was 94% and the negative predictive value (NPV) was 68%. No major complications were observed.

Conclusion: Guided FNAC was thus confirmed as a safe procedure that provides fairly accurate diagnosis with minimal complications in the diagnosis of intra-abdominal and retroperitoneal lesions.

Keywords: Computed tomography guided, Cytohistopathological, Ultrasonography guided

INTRODUCTION

As documented earlier, the correct diagnosis of abdominal lumps is difficult and often calls for a histopathological confirmation [1]. This also holds true in the diagnosis of lesions in other less accessible sites like the retroperitoneum Fine Needle Aspiration Cytology is a simple, safe, inexpensive and rapid procedure which renders surgical intervention and exploratory laprotomy unnecessary. In recent years previously inaccessible and deeper organs like liver, spleen, pancreas, retroperitoneum and ovary are safely sampled and routinely aspirated using the fine needle under radiological guidance [2]. Amongst the various imaging modalities, many prefer the speed of ultrasound guidance, while others are reassured by the greater resolution of computed tomography [2] .

Various studies have been performed to evaluate the accuracy of FNAC in the diagnosis of intra abdominal masses [1,3-8]. This study was conducted to further confirm the usefulness of FNAC as a diagnostic procedure in the management of intra-abdominal and retroperitoneal lesions. Our main objectives were to determine the anatomic site-wise distribution of the lesions, the age and sex distribution of patients with intra-abdominal and retroperitoneal lesions, to classify and study the prevalence of non malignant (benign and non neoplastic) and malignant lesions aspirated and to correlate the cytological diagnosis with histopathology wherever possible.

MATERIALS AND METHODS

It was a retrospective study which was conducted over a period of 8 years in the Department of Pathology in a tertiary care hospital from 2000 to 2007. It included analysis of 660 patients who presented clinically and radiologically with intra-abdominal and retroperitoneal lesions. A detailed workup of patients was carried out including complete patient history, review of records and clinical examination. Majority of the patients presented with an intra-abdominal mass or organomegaly. Others included patients who

presented with:– a) Symptoms of systemic involvement (e.g. dyspepsia, bleeding per rectum); b) Obstructive symptoms (e.g. obstructive jaundice) and c) Constitutional symptoms (e.g. abdominal pain, fever, weight loss etc). Intraabdominal and retroperitoneal masses detected by other radiological methods like MRI imaging were not included in this study.

An Informed consent was taken and the clotting time and bleeding time were confirmed to be in the normal range. FNAC under radiological guidance (USG/CT) was performed on an in-patient basis using a22G LP needle, 10ml disposable syringe and a modified comeco syringe piston holder. Smears were prepared and stained with H&E and MGG. Repeat aspirations were done in patients where the first attempt was inadequate or was inconclusive. A cytopathological opinion was made under light microscopy by correlating with clinical and radiological findings. Histopathological correlation was carried out in patients who underwent surgical excision/ biopsy of the lesion.

RESULTS

This series of 660 patients revealed a male predominance that included 392 (59.39%) males and 268 (40.61%) females, giving a male to female ratio of 1.5:1. Cases from all age groups were analyzed and it was observed that the maximum number i.e. 153 (23.18%) cases were in the age group of 51-60 years [Table/Fig-1]. The youngest that underwent the procedure was aged 19 days and the oldest was 89 years.

Computed Tomography (CT) was the more common mode of radiological guidance used over ultrasonography with 427 cases (64.7%) being CT guided and 233 cases (35.3%) being USG guided FNAC. Amongst the various organs / sites aspirated, the maximum number of aspirates were of hepatic lesions (307) followed by intraabdominal lymphnodes all of which were retroperitoneal (70) [Table/Fig-2]. The aspirations were categorized as diagnostic aspirates (477 cases) and non-diagnostic/inconclusive aspirates (183 cases). The non-diagnostic/inconclusive category included: a) Aspirates with inadequate material (e.g. scanty cellular material or presence of normal cellular material and b) Those with atypical cells or where the possibility of malignancy could not be ruled out (e.g. differential diagnosis of low grade HCC and regenerating nodule).

Age Group (years)	Number of cases (N)	Percentage (%)
0 – 10	27	4.09
11 – 20	24	3.64
21 – 30	57	8.64
31 – 40	93	14.09
41 – 50	134	20.30
51 – 60	153	23.18
61 – 70	118	17.88
> 71	54	8.18

[Table/Fig-1]: Age-wise distribution of the intraabdominaland retroperitoneal lesions aspirated : (N=660).

Organ / Site	Number of Cases	Percentage of total (%)
Liver	307	46.52
Biliary System	6	0.9
Spleen	25	3.79
Pancreas	13	1.97
Adrenals	9	1.36
Kidney	60	9.09
Female Genital System		
Ovary	52	7.88
Uterus	13	1.97
Retro peritoneum		
Retroperitoneal Lymph nodes.	70	10.61
Retroperitoneal masses (not specified)	32	4.85
Others		
Gastriontestinal tract	46	6.97
Mesentry	09	1.36
Omentum	10	1.52
Psoas Region	3	0.45
Undescended Testis	4	0.61
Paravesical site	1	0.15

[Table/Fig-2]: Incidence of intra-abdominal and retroperitoneal lesions aspirated :(N=660).

Out of the 477 cases where a definite cytological interpretation was possible, cyto-diagnosis revealed 135 non-malignant lesions and 342 malignant lesions. The non malignant lesions comprised of 102 non-neoplastic and 33 benign neoplastic conditions while out of the 342 malignant lesions; 190 were primaries, 114 were metastatic and 38 were positive for malignancy. Cases positive for malignancy included those in which the smears revealed few hyperchromatic cells or clusters of poorly differentiated cells (poorly differentiated/ high grade malignancy).

Hepatic metastasis was the most common malignant lesion while pyogenic abscess was the commonest non malignant lesion aspirated [Table/Fig-3,4].

A cyto-histopathological correlation was available in 58 cases [Table/Fig-5]. A true positive diagnosis was made in 34 cases while a false positive diagnosis was made in only 2 cases. 15 cases were true negatives while 7 were false negative. Thus the accuracy was 85% while the sensitivity for true positive results was 83% and that for true negative results was 88%. The positive and negative predictive values were 94% and 68% respectively.

During the study period only minor complications were encountered with a complication rate of 0.76%.

Cytological Diagnosis of Non-Malignant Lesions	N	%
Benign Neoplastic		
LIVER		
Haemangioma	2	1.5
Hemangioendothelioma	2	1.5
ADRENAL GLAND		
Pheochromocytoma	1	0.75
OVARY		
Serous cyst adenoma	8	6
Mature cystic teratoma	3	2.2
Mucinous cyst adenoma	1	0.75
UTERUS		
Leiomyoma	13	9.6
RETROPERITONEAL MASSES (Not specified)		
Neurofibroma	1	0.75
MESENTRY		
Benign Gastrointestinal stromal tumour (GIST)	1	0.75
Non Neoplastic		
LIVER		
Pyogenic abscess	31	23
Tuberculous abscess	8	6
Amoebic abscess	3	2.21
Cyst	3	2.21
Granulomatous Inflammation	3	2.21
Cirrhosis	2	1.5
Focal Nodular Hyperplasia	1	0.75
Inflammatory Lesions(not specified)	1	0.75
SPLEEN		
Pyogenic abscess	10	7.4
Granulomatous inflammation	2	1.5
Reactive Hyperplasia of white pulp	2	1.5
Tuberculosis	1	0.75
Inflammatory Lesion(not specified)	1	0.75
PANCREAS :Tuberculosis	1	0.75
KIDNEY		
Cysts	4	3
Pyogenic Abscess	2	1.5
Tuberculous Abscess	2	1.5
Inflammatory Lesion	2	1.5
Xanthogranulomatous Pyelonephritis	1	0.75
RETROPERITONEAL LYMPHNODES		
Tuberculous Lymphadenitis	5	4
Reactive Hyperplasia	1	0.75
RETROPERITONEAL MASSES (not specified)		
Tuberculous abscess	3	2.21
Pyogenic abscess	2	1.5
Cyst	1	0.75
Chronic granulomatous inflammation	1	0.75
MESENTRY : Cyst	4	3
OMENTUM : Tuberculosis	1	0.75
PSOAS REGION		
Pyogenic abscess	3	2.21
Tuberculous abscess	1	0.75

[Table/Fig-3]: Cytopathological diagnosis of the non-malignant intra-abdominal lesions aspirated (N=135).

Cytological Diagnosis of Malignant Lesions	N	%
LIVER		
Hepatocellular carcinoma(HCC)	54	16
Hepatoblastoma	3	0.8
Lymphoma	2	0.5
Solid papillary epithelial neoplasm(SPEN)	1	0.3
Metastasis	83	24.3
Positive for malignancy	17	5
GALL BLADDER		
Adenocarcinoma	2	0.5
Positive for malignancy	1	0.3
COMMON BILE DUCT		
Cholangiocarcinoma	2	0.5
SPLEEN		
Lymphoma	2	0.5
Metastasis	1	0.3
PANCREAS		
Adenocarcinoma	8	2.3
Solid papillary epithelial neoplasm	1	0.3
KIDNEY		
Renal Cell Carcinoma	14	4.1
Wilms tumour	6	1.7
Squamous cell carcinoma	3	0.8
Renal oncocytoma	1	0.3
Metastasis	5	1.5
Positive for malignancy	1	0.3
ADRENAL GLAND		
Neuroblastoma	5	1.5
Metastasis	1	0.3
Positive for malignancy	1	0.3
UTERUS		
Positive for malignancy	1	0.3
OVARY		
Papillary adenocarcinoma	14	4.1
Immature teratoma	1	0.3
Positive for malignancy	3	0.8
RETROPERITONEAL LYMPHNODES : Lymphoma	29	8.6
Plasmacytoma	1	0.3
Metastasis	19	5.6
Positive for malignancy	1	0.3
RETROPERITONEAL MASSES (not specified)		
Sarcoma	16	4.7
Positive for malignancy	2	0.5
GIT		
Adenocarcinoma	20	6
Malignant Gastrointestinal stromal tumour	1	0.3
Leiomyosarcoma	1	0.3
Poorly Differentiated Carcinoma	11	3.2
OMENTUM		
Metastasis	5	1.5
UNDESCENDED TESTIS		
Malignant Germ Cell tumour	3	0.8

[Table/Fig-4]: Cytopathological diagnosis of the malignant intraabdominal lesions aspirated (N=342).

Organ	Cytopathological Diagnosis	Number of Cases	Histopathological Diagnosis	Number of Cases	Correlation
Liver	Hepatocellular Carcinoma	1	Hepatocellular Carcinoma	1	True positive
Spleen	Inflammatory lesion (not specified)	1	Angiosarcorma of spleen	1	False negative
Pancreas	Solid papillary epithelial neoplasm	1	Solid papillary epithelial neoplasm	1	True positive
Kidney	Renal cell Carcinoma	12	Renal cell Carcimoma	12	True positive
	Wilms tumor	5	Wilms tumor	5	True positive
	Renal Oncocytoma	1	Renal oncocytoma	1	True positive
	Wall of an abscess	1	Renal Squamous cell Carcinoma	1	False negative
	Cystic lesion most probably benign	2	Renal cell Carcinoma	2	False negative
Adrenals	Pheochormocytoma	1	Pheochromocytoma	1	True negative
Ovary	Papillary adenocarcinoma	9	Papillary serous adenocarcinoma	9	True positive
	Benign Epithelial tumor .(probably serous cyst adenoma)	1	Granulosa cell tumour	1	Falsenegative
Uterus	Leiomyoma	13	Leiomyoma	13	True negative
Retroperitoneum	Spindle cell Sarcoma	2	Intermediate grade spindle cell Sarcoma	1	True positive
			Spindle cell tumor of uncertain malignant potential	1	False positive
	Benign spindle cell lesion ,most probably neurofibroma.	1	Retroperitoneal leiomyosaroma	1	False negative
	Neurogenic Sarcoma	1	Smooth muscle tumor of uncertain malignant potential	1	False positive
Mesentry	Benign Spindle cell tumor of smooth muscle origin most probably benign GIST.	1	Benign Gastrointestinal stromal tumour	1	True negative
	Inconclusive (Scanty aspirate). Probably Benign spindle cell lesion	1	Malignant Gastrointestinal stromal tumour	1	False negative
GIT	Adenocarcinoma	4	Adenocarcinoma	4	True positive
Total		58		58	

[Table/Fig-5]: Table demonstrating cyto-histopathological correlation
*True Positive – 34 True Negative – 15 False positive – 2 False Negative – 7

DISCUSSION

FNB is indicated in almost every mass where the etiology is unclear. It leads to a reduction in open biopsy and two stage surgical procedures by providing a definite diagnosis prior to primary surgical treatment [2]. This study further confirms its diagnostic accuracy in the assessment of intra abdominal and retroperitoneal lesions while assuring its safety as an interventional radiographic procedure.

The maximum number of patients in the present study belonged to the age group of 51-60 years (23.18%).A similar age range was observed by Zawar et al., [3] and Reddy S et al., [4].

A male predominance was observed with an incidence of 59%. These results tally with those of Zawar et al.,[3] Ennis and MacErlean [5], and Suman BS and Muniyappa B [9] who observed similar predominance of 65%,58%and 67.7% males respectively amongst patients who underwent FNAC of intra-abdominal lesions.

Amongst all the organs / sites in the present study, maximum number of aspirates were of hepatic lesions (46.52%). In the year 1980, Ennis and MacErlean [5] conducted a study where 38 patients with intra-abdominal masses underwent FNAC, 18 (47.37%) of which included patients with abnormal liver sonograms.These results also correspond to most of the Indian studies with Shanti Swaroop et al., [1], Khanna et al.,[10], Zawar et al.,[3] Reddy S et al., [4] and Suman BS and Muniyappa B [9] performing aspiration biopsies where hepatic lesions contributed to, 46.43%, 63.27%, 45%, 38% and 40% respectively of all the organs biopsied.

In the present study, of the 477 diagnostic aspirates, 72.7% were malignant lesions and 28.3% were non malignant (non neoplastic and benign neoplasms). Studies conducted in the

past by, Shanti Swaroop et al [1], Ennis and MacErlean [5] Zornoza et al., [6] and Goldstein et al., [7] as well as recent studies by Suman BS and Muniyappa B [9] and Al Hemalatha et al.,[11,12] revealed the predominance of malignant lesions among the total number of intra-abdominal organs / sites biopsied by FNAC.

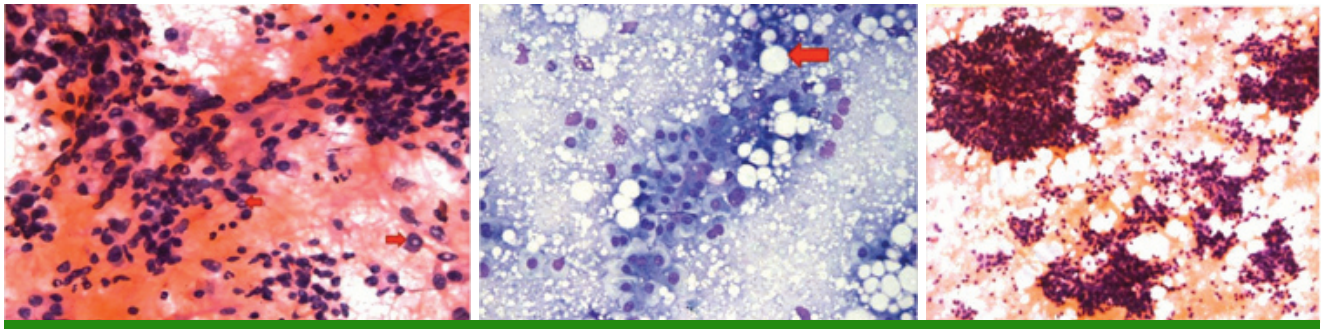
When analysis of specific organs was carried out, the percentage incidence of common non malignant and malignant lesions in these organs was comparable to results from previous studies.

Amongst the malignant hepatic lesions, metastatic lesions were the most frequent (51.88%) followed by hepatocellular carcinoma (33.8%). While this finding concurred with that reported by Khanna et al., [10], Gatphoh et al., [13], Barbhuiya et al., [14] and Fornari et al., [15], a higher incidence of primary Hepato cellular carcinoma was however observed by AL Hemlata et al., [11] and Suman BS and Muniyappa B [9]. Most of the smears from hepatocellular carcinoma were moderately cellular and revealed trabercullae of malignant hepatocytes with hyperchromatic nuclei having prominent nucleoli and intranuclear inclusions [Table/Fig-6,7]. The other hepatic malignancies included hepatoblastoma (1.87%) [Table/Fig-8], Lymphoma (1.25%), SPEN (0.62%) and positive for malignancy (10.63%).

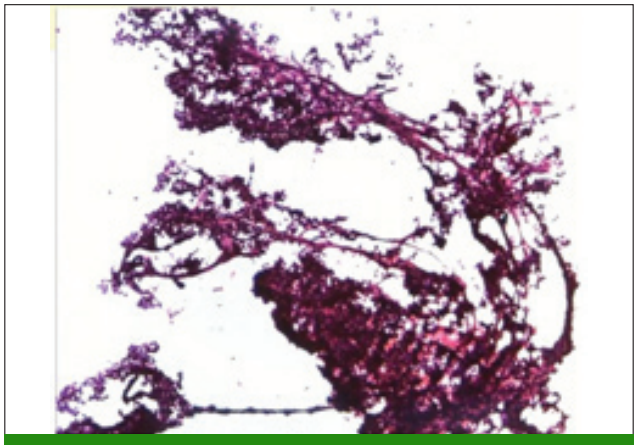
In the present series, of the total number of diagnostic splenic aspirates, 15.8% tested positive for malignancy and 84.2% were non-malignant lesions. Similar, findings of a higher incidence of non malignant lesions have been demonstrated by Zeppa et al., [16] and Siniluoto et al., [17].

Among the diagnostic pancreatic aspirates, a higher incidence of malignant pancreatic lesions was observed in this study (90%) of which 8 cases (88.89%) were adenocarcinomas and one was case of SPEN of pancreas [Table/Fig-9]. Goldstein et al., [7] conducted a study where 8 of the 14 cases having a correct or presumptive diagnosis were pancreatic carcinomas. These results were concurred upon by Jorda et al., [18]. Amongst the total number of pancreatic malignancies, the increased incidence of adenocarcinomas (88.89%) noted in this study was also similar to that depicted by Jorda et al.,[18]. Endoscopic ultrasound–guided fine needle aspiration cytology (EUS-FNAC) is currently the most commonly used procedure for obtaining cytologic specimens of the pancreas and studies have confirmed its diagnostic accuracy [19].

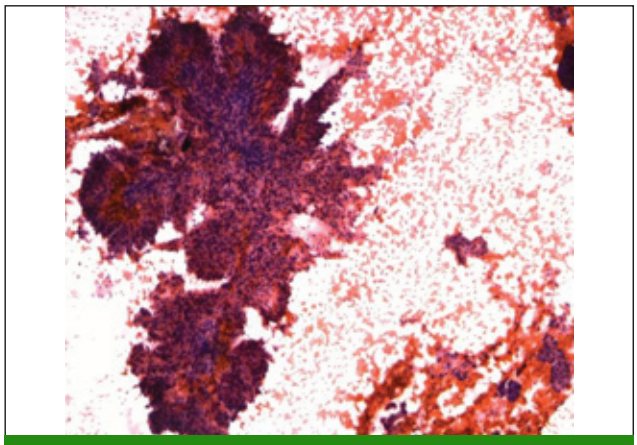
Out of the malignant renal and adrenal lesions aspirated, renal cell carcinoma was the commonest (37.84%) [Table/Fig-10] followed by Wilms tumor (16.22 %), metastasis



[Table/Fig-6]: FNAC of hepatocellular carcinoma showing malignant hepatocytes with prominent intranuclear inclusions (arrow). (H and E,x400).
[Table/Fig-7]: FNAC of hepato cellular carcinoma showing malignant hepatocytes exhibiting prominent fatty change (arrow). (MGG,X400).
[Table/Fig-8]: FNAC of hepatoblastoma showing atypical hepatocytes arranged in thick traberculae. (H and E, X200).



[Table/Fig-9]: FNAC of solid and papillary epithelial neoplasms (SPEN) showing pseudo papillary fragments lined by small tumor cells (H and E, X100).



[Table/Fig-10]: FNAC of renal cell carcinoma-papillary type showing papillary fragment of epithelial cells having a central fibrovascular core. (H and E,X100).

(16.22 %) and neuroblastoma (13.51%), renal squamous cell carcinoma (8.11%), positive for malignancy (5.40%) and renal oncocytoma (2.7%). Similar findings were demonstrated by Pilotti et al., [20] and Mangal N et al., [21]. Renal cysts showed a higher incidence (4 of 11 cases) among the benign non neoplastic conditions, as also shown earlier by Kristensen et al., [22] in their study. Ultrasound guided aspiration of the adrenal gland revealed a benign pheochromocytoma, 5 cases of neuroblastoma, and one case each of metastasis and positive for malignancy. It is thus highly safe and specific in the diagnosis of adrenal gland lesions which concurs with the findings of Mangal N et al., [21].

Lymphomas [Table/Fig-11] formed the majority of all the malignant retroperitoneal lesions followed by metastasis to lymphnodes and sarcomas [Table/Fig-12,13]. While sarcomas predominated in the series carried out by Al Hemlata et al., [11], lymphomas also formed the majority in the study conducted by Khanna et al., [10].

In the present study, all the conclusive aspirates from the female genital system (ovary and uterine corpus) were neoplastic in nature. Primary adenocarcinoma of ovary had the highest incidence (77.78 %) among the ovarian malignant neoplasms. These findings were concurred upon by Dey et al., [23] and Bandyopadhyay A et al., [24].

Similar to the results observed by Das et al., [25] most of the GIT lesions diagnosed on cytology were malignant, commonest being gastrointestinal adenocarcinoma.

In this study, cyto–histopathological correlation was available in 58 cases out of 660 cases. This may be due to fact that (1) 307 cases of the total 660 cases were aspirates from hepatic lesions. The patients diagnosed as having malignant hepatic disease are either referred to oncology institutes for specialized treatment or had convincing evidence of advanced malignancy and hence were not subjected to further histopathological diagnosis (2) Benign lesions were treated conservatively with antibiotics/ antituberculous treatment while, (3) rest of the cases were lost for follow-up.

With the available cyto-histopathological correlation, overall accuracy was 85%. Sensitivity for true positive results was 83% and that for true negative results was 88%. A positive predictive value of 94% was obtained while the negative predictive value was 68%. Similar findings with a high diagnostic accuracy have been observed by Shanti Swaroop et al.,[1], Zawar et al., [3], Reddy S et al., [4], Ennis and MacErlean [5] Zornoza et al., [6] Goldstein et al., [7] Shamshad et al., [8] and Khanna et al. [10]

LIMITATIONS

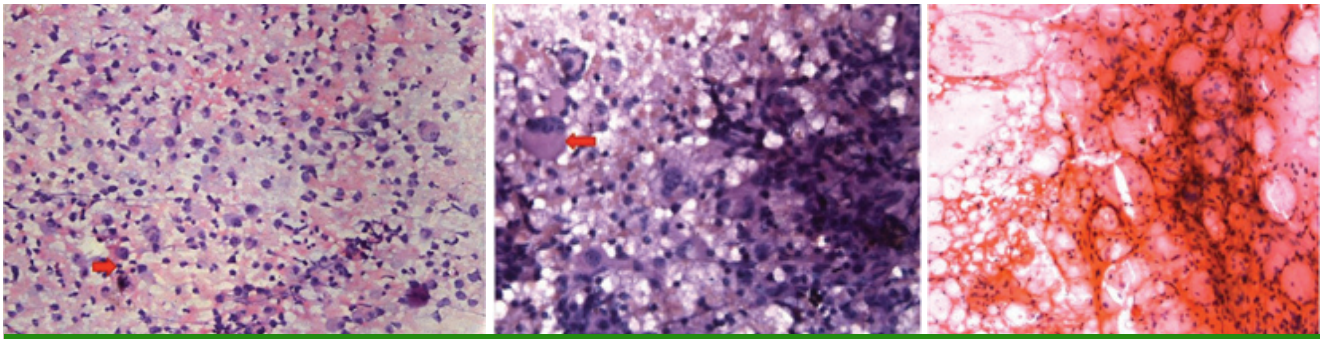
While only minimal complications occured, the high percentage (28%) of non diagnostic lesions was a drawback of this study. This can however be attributed to the fact that: 1) The cases with in adequate material (i.e. scanty aspirate, only blood aspirated, necrotic material only and normal epithelial cells); those with atypical cells as well as those where the benign or malignant nature of the lesion could not be ascertained were included under the category of nondiagnostic / inconclusive cases. 2) Lack of ancillary diagnostic techniques (immunocyto chemistry and cell block method). 3) Non – compliance of patients during repeat aspirations contributing to the number of cases with inadequate material.

CONCLUSION

The study conducted showed a high accuracy and a high sensitivity of FNAC in diagnosing intra–abdominal and retroperitoneal lesions under radiological guidance with minimal complications.

However, efforts are being made to reduce the number of false positive aspirates by considering the various criteria described in literature to differentiate between malignancies and benign conditions mimicking the same.

An attempt has to be made to decrease the percentage of non-diagnostic /inconclusive lesions by improving the modalities of radiological guidance using fine needles with radio opaque tips, performing further analysis of aspirates using ancillary techniques like immunocytochemistry and cell block methods and lastly and by honing the technical and diagnostic skills of cytopathologists.



[Table/Fig-11]: FNAC of large cell Non-Hodgkins Lymphoma showing large neoplastic lymphoid cells with prominent nucleoli (arrow). (H and E,X200), (MGG,X400). **[Table/Fig-12]:** FNAC of pleomorphic sarcoma showing malignant spindle shaped cells with scattered tumor giant cells (arrow). (H and E, X 400). **[Table/Fig-13]:** FNAC of well differentiated liposarcoma showing tissue fragment of fat and fibroblastic cells in a fibro myxoid stroma (H and E,X 200) (MGG,X400).

REFERENCES

[1] Swaroop VS, Gupta SK, Dilawari JB. Fine needle aspiration cytology in the diagnosis of abdominal lumps. *Indian J Med Res*.1982; 76:265-71.

[2] Langlois SP. Imaging methods for guidance of aspiration cytology. In: Orell SR, Sterret GF, Walters MN, Whitaker D, editors. Manual and atlas of fine needle aspiration cytology. 3rd ed. Edinburgh London:Churchill Livingstone; 1999.p.30.

[3] Zawar MP, Bolde S, Shete SS. Correlative study of fine needle aspiration cytology and histology in intra-abdominal lumps.*SMJ*. 2007; 4.

[4] Reddy S, Andola SK. Fine needle aspiration cytology of intra-abdominal lesions. *JCDR*. 2011; 5:758-65.

[5] Ennis MG, MacErlean DP. Percutaneous aspiration biopsy of abdomen and retroperitoneum. *Clinical Radiology*.1980; 31:611-16.

[6] Zornoza J, Jonsson K, Wallace S, Lukeman JM. Fine needle aspiration biopsy of retroperitoneal lymph nodes and abdominal masses: An updated report. *Radiology.* 1977; 125:87-88.

[7] Goldstein HM , Zornoza J, Wallace S, Anderson JH, Bree RL, Samuels BI et al. Percutaneous fine needle aspiration biopsy of pancreatic and other abdominal masses. *Radiology*. 1977;123:319-22.

[8] Ahmad SS, Akhtar K, Akhtar SS, Alia Nasir AA, Khalid M, Mansoor T. Ultrasound guided fine needle aspiration biopsy of abdominal masses. *JK Science*. 2006; 8: 200-04.

[9] Suman BS, Muniyappa B. Ultrasonography guided fine needle aspiration cytology with preparation of cell blocks in the diagnosis of intraabdominal masses. *JCDR*. 2015;9(12):EC08-21.

[10] Khanna AK, Misra MK, Khanna A, Misra VK, Khanna S. Fine needle aspiration cytology of abdominal masses. *J SurgOncol*. 1990; 44:15-19.

[11] Hemalatha AL, Vidyadhar R, Kariappa TM. Retrospective study of hepatic and retroperitoneal masses. *Journal of Cytology*. 2004; 21: 85-90

[12] Hemlatha AL , Sindhuram VS, Sushma S et al. Ultrasound guided FNAC of abdominal–pelvic masses-the pathologists' perspective. *JCDR*. 2013;7(2):273-77.

[13] Gatphoh ED, Gaytri S, Babina S, Singh A M. Fine needle aspiration cytology of liver : a study of 202 cases. *Indian J Med Sci.* 2003;57:22.

[14] Barbhuiya M, Bhunia S, Kakkar M, Shrivastava B, Tiwari PK, Gupta S. Fine needle aspiration cytology of lesions of liver and gallbladder: An analysis of 400 consecutive aspirations. *Journal of Cytology*. 2014; 31(1):20-24.

[15] Fornari F, Civardi G, Cavanna L, Rossi S, Buscarini E, Stasi MD et al. Ultrasonically guided fine – needle aspiration biopsy: A highly diagnostic procedure for hepatic tumors. *Am J of Gastroenterol*.1990; 85:1009-13.

[16] Zeppa P, Vetrani A, Luciano L, Fulciniti F, Troncone G, Rotoli B et al. Fine needle aspiration biopsy of the spleen: A useful procedure in the diagnosis of splenomegaly. *Acta Cytol*. 1994; 38:299–309.

[17] Siniluoto T, Paivansalo M, Tikkakoski T, Apaja-Sarkkinen M. Ultrasound–guided aspiration cytology of the spleen. *Acta Radiologica.*1992; 33:137-39.

[18] Jorda M, Essenfeld H, Gracia E, Ganjei P. The value of fine needle aspiration cytology in the diagnosis of inflammatory pancreatic masses. *Diagn Cyto pathol*. 1992; 8:65-67.

[19] Baek HW, Park MJ, Rhee YY, Lee KB, Kim MA, Park IA. Diagnostic accuracy of endoscopic ultrasound-guided fine needle aspiration cytology of pancreatic lesions. *Journal of Pathology and Translational Medicine*. 2015;49(1):52-60.

[20] Pilotti S, Rilke F, Alasio L, Garbagnati F. The role of fine needle aspiration in the assessment of renal masses. *Acta Cytol*.1988; 32: 1-10.

[21] Mangal N, Sharma VK, Verma N, Agarwal AK, Sharma SP, Aneja S. Ultrasound guided fine needle aspiration cytology in the diagnosis of retroperitoneal masses: A study of 85 cases. *Journal of Cytology*. 2009; 26(3):97-101.

[22] Kristensen JK, Holan HH, Rasmussen SN, Barlebo H. Ultrasonically guided percutaneous puncture of renal masses. *Scand J Chrol Nephrol*.1972;6:49-56.

[23] Dey P, Dhar KK, Nijhawan R, Karmakar T, Khajuria A. Fine needle aspiration biopsy in gynecologic malignancies recurrent and metastatic lesions. *Acta Cytol*.1994; 38:698-701.

[24] Bandyopadhyay A, Chakraborty J, Chowdhury AR, Bhattacharya A, Bhattachrya P, Chowdhury M. Fine needle aspiration cytology of ovarian tumors with histological correlation. *Journal of Cytology*. 2012; 29(1):35-40.

[25] Das DK, Pant CS, Fine needle aspiration cytologic diagnosis of gastrointestinal tract lesions. a study of 78 cases. *Acta Cytol.*1994;38:723-29.

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