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Original Article

Pathology Section

Usefulness of Image Guided Fine Needle Aspiration Cytology in the Assessment of Intra-abdominal Lesions

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ABSTRACT

Introduction: The appropriate diagnosis of intra-abdominal lesions is difficult and often requires histopathological confirmation. Image guided Fine Needle Aspiration Cytology (FNAC) is a simple, readily available, safe, inexpensive, time saving, rapid procedure which prevent unnecessary surgical interventions.

Aim: The study was conducted to determine the diagnostic efficacy of image guided FNAC in the assessment of intra-abdominal lesions and to determine age and sex distribution.

Materials and Methods: This cross-sectional study was conducted in Department of Pathology SN Medical College Agra (from September 2019 to September 2021. Two hundred and seven patients who were detected to have abdominal lesions by Ultrasonography (USG) or Computed Tomography (CT), image guided Fine Needle Aspiration (FNA) was performed under all aseptic condition. The sample was spread onto slides, air-dried and stained with Giemsa and was fixed in 95% ethanol and stained with Papanicolaou's stain. The cyto-histopathological association was done wherever possible, the overall accuracy, sensitivity, specificity, the Negative Predictive Value (NPV) and Positive Predictive Value (PPV) was calculated.

Results: Out of 207 patients, 110 were males and 97 were females with male to female ratio of 1.13:1. Out of 207 cases, the aspirate was satisfactory in 201 (97%) cases. Unsatisfactory aspirate was obtained in 06 (3.0%) of cases. Among 207 cases, most common lesions were malignant 170(82.1%) cases, followed by inflammatory 31 (14.9%) cases and unsatisfactory 06 (3.0%) cases. Most common age group for malignant lesions was 59-68 years with 45 (26.4%) cases followed by 49-58 years with 41 (24.1%) cases. The majority of aspirates were from liver 78 cases (38.2%), followed by 47 cases (22.71%) from gall bladder and 44 cases (21.30%) from the lymph nodes. The sensitivity was 92.3% while specificity was 100%. The Positive Predictive Value (PPV) and Negative Predictive Value (NPV) were 100% and 91.4%, respectively. The diagnostic accuracy of image guided FNAC was 95.8%.

Conclusion: FNA of abdominal lesions guided by ultrasound is a quick, low-cost, safe, highly accurate, and minimally invasive approach for getting a tissue diagnosis in solid localised lesions of the abdomen.

Keywords: Benign, Computed tomography, Liver, Malignant, Ultrasonography

INTRODUCTION

The histopathological confirmation is often required for definitive diagnosis of intra-abdominal lesions [1]. Image guided FNAC is a simple, readily available, safe, inexpensive, time saving, rapid procedure which prevent unnecessary surgical interventions as well as obtaining samples from very small lesions or inaccessible and deeper organs like liver, spleen, pancreas, retroperitoneum, ovary under radiological guidance [1-3]. Image guided FNAC is indicated in almost every mass where the aetiology is unclear. The preparation of cell blocks from aspirate and application of Immunohistochemistry (IHC) is equivalent to biopsies obtained [1]. Image guided FNAC can be utilized for practically any mass in the abdomen, pelvis, mediastinum, lung/pleura, thyroid, parathyroid, and the cervical nodes. Aspiraton cytology helps in determining and differentiating the benign versus malignant neoplasms, cystic versus solid lesions and abscess versus a neoplasm [2,3]. The study was conducted to determine the diagnostic efficacy of image guided FNAC in the assessment of intra-abdominal lesions. The objectives were to study cytomorphological features of intra-abdominal lesions, to determine age and sex distribution, categorise them as inflammatory and neoplastic and to establish an association between the cytological diagnosis with histopathology wherever possible.

MATERIALS AND METHODS

This cross-sectional study was hospital based, conducted in Department of Pathology, and Department of Radiodiagnosis SN Medical college, Agra, Uttar Pradesh from September 2019 to September 2021. All patients who fulfilled the inclusion and exclusion criteria and were detected to have abdominal lesions by USG or CT were included in the study. The approval was taken from Institutional Ethical Committee with ethical clearance number IEC/2022/114. The informed consent was taken from all patients.

Inclusion criteria: All patients referred to FNAC clinic with intra-abdominal organs swellings/lesions including liver, spleen, pancreas, stomach, gall bladder, small and large intestine, omentum, mesentery, retroperitonium, kidney, adrenals, lymph nodes, soft tissues and ovary were included in the study.

Exclusion criteria: All patients with parietal swellings arising from the skin and the abdominal wall, uterus, cervix, prostate and bone as well as those cases with severe bleeding diathesis were excluded from the study.

Procedure

A thorough clinical examination was done before the procedure was performed. Under aseptic precautions, a 22G needle fitted with a 20 ml syringe was inserted into lesion under continuous real- time imaging guidance and aspiration was done under negative pressure. On an average, two to three needle passes were made in each case to obtain adequate material. The sample was spread onto slides, air-dried and stained with Giemsa or was fixed in 95% ethanol and stained with Papanicolaou's stain. Special stains like Zeil-Nelson was used wherever required.

Classifications of true negative (TN; histopathological confirmed benign cytological diagnosis), true positive (TP; histological confirmed malignant cytological diagnosis), false negative (FN; Histological diagnosis: malignant and cytopathological diagnosis benign) and false positive (FP; histological diagnosis; benign and cytopathological diagnosis: benign and cytopathological diagnosis: malignant) were determined. The sensitivity (sensitivity: TP/TP+FNX100). Specificity (specificity: TN/TN+FPX100), accuracy (accuracy: TP+TN/TP+TN+FP+FN), PPV (PPV=TP/TP+FPX100) and NPV (NPV=TN/TN+FNX100) was calculated.

RESULTS

Out of 207 patients, 110 were males and 97 were females with male to female ratio of 1.13:1. The youngest patient in study was a nine-year-old girl and oldest was 88-year-old male. The lesions were classified on the basis of cytological features into inflammatory and malignant. Among 207 cases, most common lesions were malignant 170 (82.1%) cases, followed by inflammatory 31 (14.9%) cases and unsatisfactory 06 (3.0%) cases. Most common age group for malignant lesions was 59-68 years with 45 (26.4%) cases followed by 49-58 years with 41 (24.1%) cases. Malignant lesions were more common in males 52.9% (90/170) cases then females 47.1% (80/170) cases. Most common age group for inflammatory lesions was 49-58 years followed by 9-18 years. Inflammatory lesions were more common in males 58.1% (18/31) cases then females 41.9% (13/31) cases [Table/Fig-1].

Age (Years)	Inflammatory		T	Malignant		T	Unsatisfactory		T	Grand total
	F	M		F	M		F	M		
9-18	3	3	6	1	1	2		1	1	9
19-28	2	-	2	3	4	7				9
29-38	2	-	2	7	5	12		1	1	15
39-48	1	2	3	20	11	31	2		2	36
49-58	2	5	7	23	18	41	1		1	48
59-68	1	3	4	17	28	45	1		1	50
69-78	1	4	5	6	19	25				31
79-88	1	1	2	3	4	7				9
Total	13	18	31	80	90	170	4	2	6	207

[Table/Fig-1]: Age and sex wise distribution of intra-abdominal lesions.

The majority of aspirates were from liver 78 cases (37.68%), followed by 47 cases (22.71%) from gall bladder and 44 cases (21.30%) from the lymph nodes. Eight cases were aspirated, from pancreas, 02 from kidney, 01 from adrenal, 07 from omentum, 01 from stomach, 10 from ovary, 01 from aortic bifurcation, 01 from appendix and 07 from bowel [Table/Fig-2].

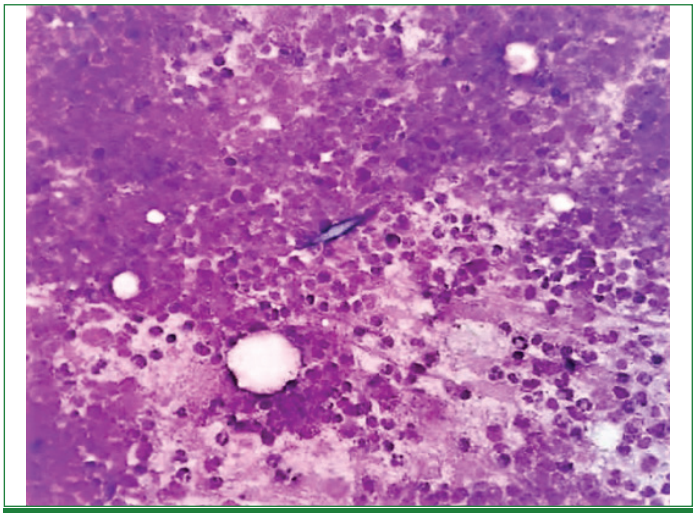
Organ	Number of cases	Total percentage
Liver	78	37.68%
Gallbladder	47	22.71%
Pancreas	08	3.86%
Kidney	02	0.97%
Adrenal	01	0.48%
Omentum	07	3.38%
Lymph node	44	
Iliac lymphnode	06	2.90%
Mesenteric lymphnode	16	7.73%
Periportal lymphnode	09	4.35%
Peripancreatic lymphnode	06	2.90%
Perigastric lymph node	02	0.97%
Retroperitoneal lymph node	05	2.42%
Stomach	01	0.48%
Ovary	10	4.83%
Aortic bifurcation	01	0.48%
Appendix	01	0.48%
Bowel	07	3.38%
Total	207	100%

[Table/Fig-2]: Organ wise distribution of intra-abdominal lesions.

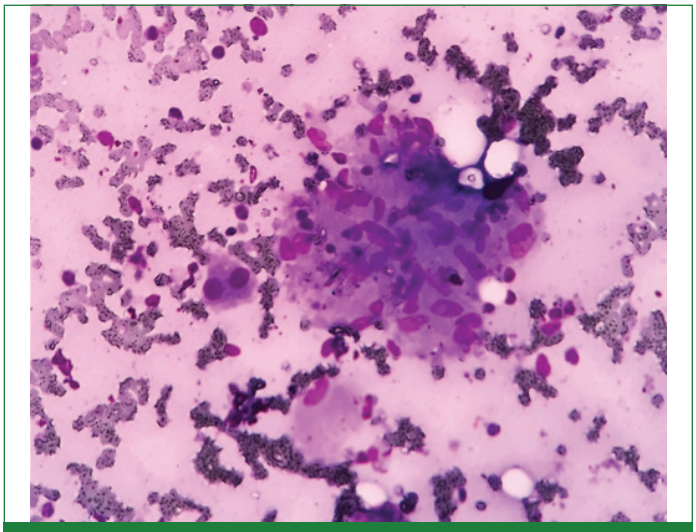
Granulomatous lesions (granulomatous as well as necrotising granulomatous) constituted the most common inflammatory lesion 12 cases (38.7%). Majority of granulomatous lesions were located in various lymph nodes. There were 08 cases of reactive lymphadenitis and 06 cases of necrotising lymphadenitis. Among 12 cases with granulomatous inflammation, eight were acid fast bacilli positive. Histopathological examination of lymph node specimen of cytologically diagnosed cases of granulomatous lesions showing granuloma comprising of epithelioid cells surrounded by lymphocyte with caseous necrosis [Table/Fig-3-6].

Inflammatory lesions	Male	Female	Total
Necrosis only	02	01	03
Necrotising granulomatous	01	00	01
Reactive lymph node	04	04	08
Granulomatous	03	08	11
Necrotising lymphadenitis	06	00	06
Charcot leyden crystals	02	00	02
Total	18	13	31

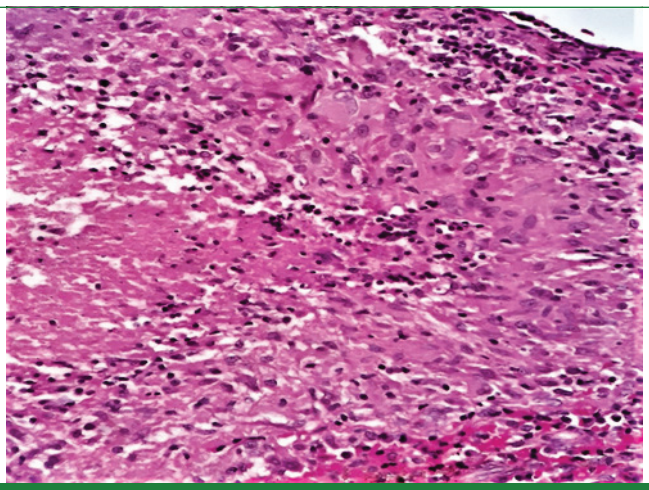
[Table/Fig-3]: Distribution of inflammatory lesions.



[Table/Fig-4]: Aspirate from liver abscess showing charcot -leyden crystal (May-Grunwald-Giemsa, 400X).



[Table/Fig-5]: Aspirate from liver showing granuloma (MGG, 400X).



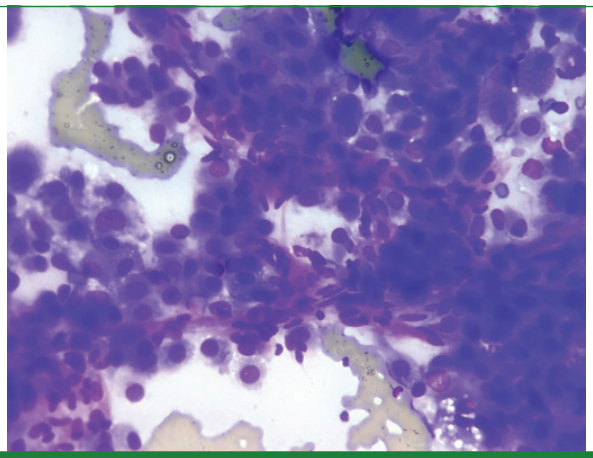
[Table/Fig-6]: Aspirate from lymph node showing caseous necrosis with granuloma (H & E, 400X).

Malignant lesions were more common as compared to inflammatory lesions in the present study. As liver was the most common organ to be aspirated the majority of malignant lesions were seen in liver followed by gall bladder. The most common malignant lesion in liver was adenocarcinoma (46), followed by hepatocellular carcinoma (14), 02 cases of adenosquamous carcinoma, 02 cases of metastasis and 01 case of carcinoid, non hodgkin lymphoma and small cell carcinoma. In three cases of liver aspirate a clear cut diagnosis was not made and were labelled as malignant neoplasms. The next most common site for malignant lesions was gall bladder, where most common malignant lesions were adenocarcinoma (38), 03 cases of adenosquamous carcinoma and 02 cases of squamous cell carcinoma [Table/Fig-7].

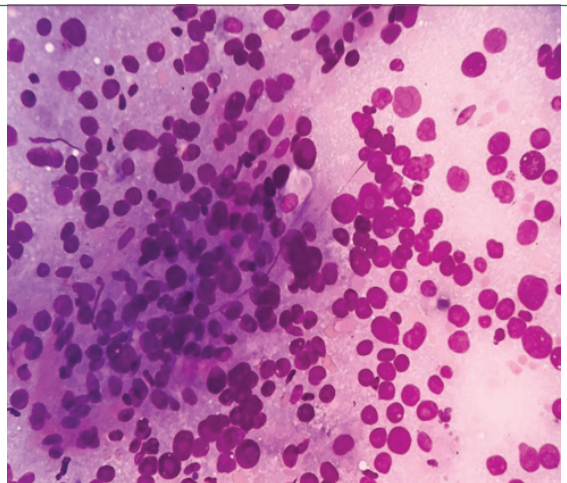
Organ	Malignant neoplasms	Total no. cases
1. Liver	Adenocarcinoma	46
	Hepatocellular carcinoma	14
	Small cell carcinoma	01
	Adenosquamous carcinoma	02
	Non-Hodgkins Lymphoma	01
	Malignant Neoplasm	03
	Carcinoid	03
	Metastasis	02
2. Gall bladder	Adenocarcinoma	38
	Adenosquamous carcinoma	03
	Squamous Cell Carcinoma	02
3. Pancreas	Adenocarcinoma	05
	Squamous Cell Carcinoma	02
	Neuroendocrine Tumour	01
4. Kidney	Clear cell rcc	01
5. Adrenal	Adenocarcinoma	01
	Malignant Neoplasm	01
6. Omentum	Adenocarcinoma	04
	Urothelial Papillary Carcinoma Malignant	01
7. Mesentric lymph node	Adencarcinoma	02
	Non-Hodgkins Lymphoma (NHL)	08
	Hodgkin's lymphoma	01
8. Retroperitoneal lymph node	Adenocarcinoma	02
9. Periportal lymph node	Adenocarcinoma	05
10. Peripancreatic lymph node	Adenocarcinoma	01
	NHL	02
11. Perigastric lymph node	Adenocarcinoma	02
12. Stomach	GIST	01
13. Ovary	Serous adenocarcinoma	07
	Metastasis	02
14. Appendix	Adenocarcinoma	01
15. Bowel	Adenocarcinoma	05
	NHL	02
Total		170

[Table/Fig-7]: Organ wise distribution of malignant lesions. Likewise tabulate the data.

Adenocarcinoma was diagnosed in 102 cases on FNAC. All the aspirates were cellular and composed of pleomorphic ductal cells with highly variable with or without inflammation necrosis and cellular debris. Sheets of neoplastic cells showed focal acinar pattern, few with mucinous background, cells have high nucleus to cytoplasmic ratio (N:C), open chromatin and prominent nucleoli, having amphophilic to basophilic cytoplasm. Hepatocellular carcinoma was diagnosed in 14 liver aspirates. Smears revealed high cellularity in all cases. Cells were seen in solid sheets. The nuclei of malignant hepatocytes were large with conspicuous nucleoli and granular cytoplasm with easily appreciated blood vessels. The histopathology of hepatocellular carcinoma shows trabeculae of malignant hepatocytes with hyperchromatic nuclei having prominent nucleoli. Smears of Adenosquamous carcinoma were highly cellular with highly variable background. All cases showed loose aggregates of cells with few singly scattered cells. Predominent ductal differentiation with subtle squamous differentiation was also present [Table/Fig-8-13].

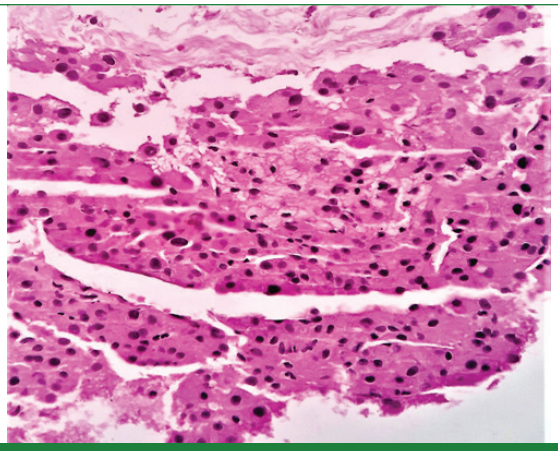


[Table/Fig-8]: FNAC of hepatocellular carcinoma showing malignant hepatocytes with fibrovascular core (MGG, 400X).

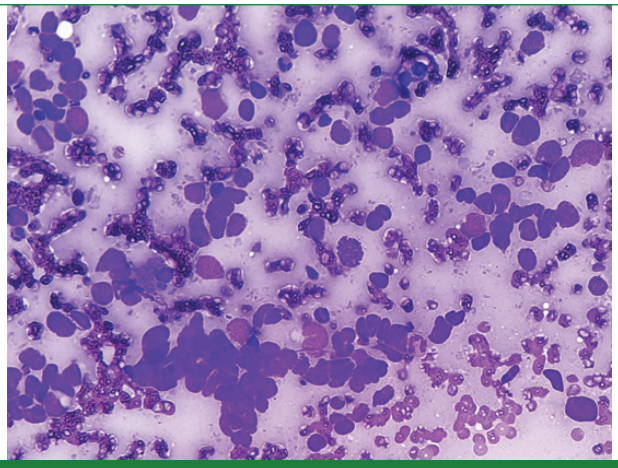


[Table/Fig-9]: FNAC of hepatocellular carcinoma showing malignant hepatocytes showing macro nucleoli (MGG, 400X).

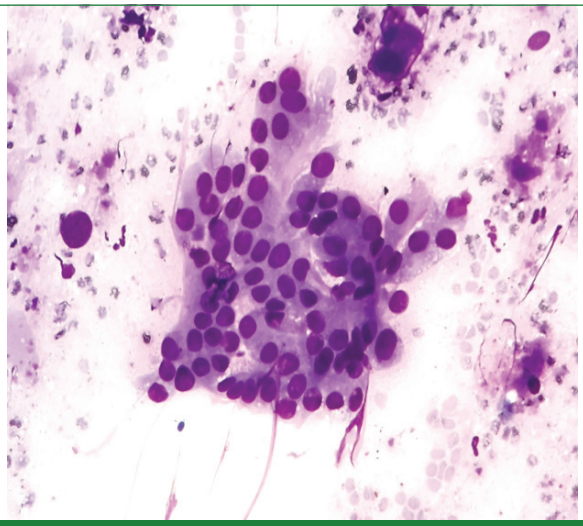
Among the total 170 malignant cases, adenocarcinomas were most common 60% (102), followed by hepatocellular carcinomas 8.2% (14) cases and non hodgkin's lymphoma 7.0% (12) cases. Out of



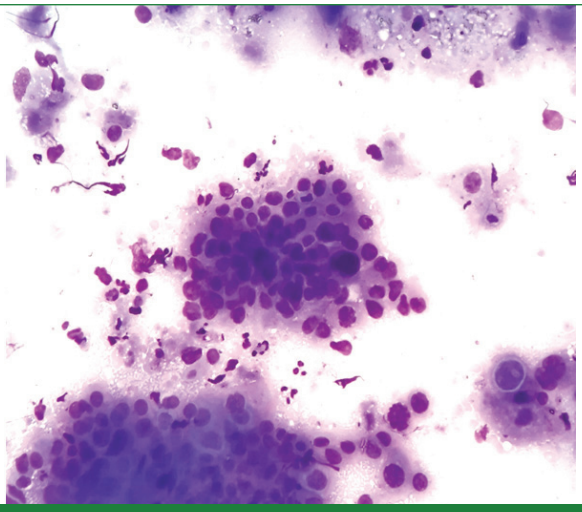
[Table/Fig-10]: Hepatocellular carcinoma of liver showing trabeculae of malignant hepatocytes with hyperchromatic nuclei having prominent nucleoli. (H& E, 400X).



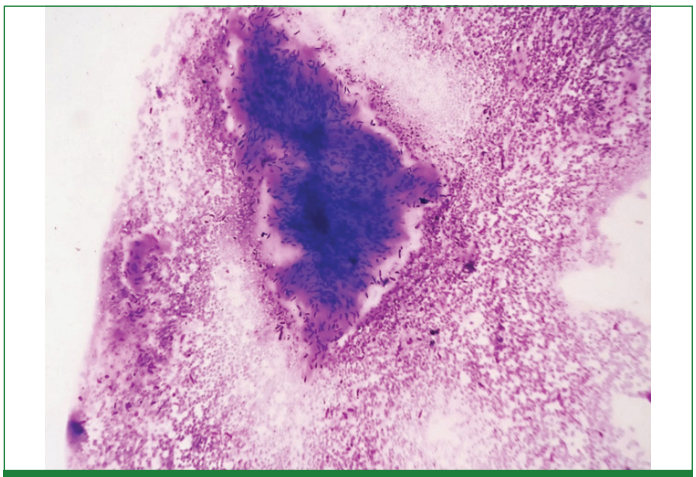
[Table/Fig-11]: Small cell carcinoma of liver. Aspirate from liver showing predominately singly scattered cells and few arranged in cluster cells have high N:C ratio, scant cytoplasm, round to oval nucleus with hyperchromasia. Nuclear moulding is also noted. (MGG, 400X).



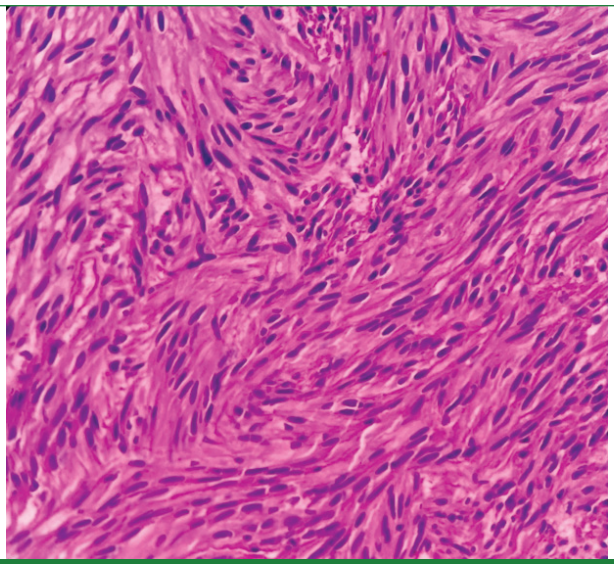
[Table/Fig-12]: Aspirate from gall bladder adenocarcinoma showing cells arranged in loose cluster. Cells have moderate amount of basophilic cytoplasm with round hyperchromatic nucleus (MGG, 400X).



[Table/Fig-13]: Aspirate of adenosquamous carcinoma of gall bladder showing cells predominately arranged in clusters with hyperchromatic nuclei along with few atypical singly scattered cells with high N:C ratio and individual cell keratinisation. (MGG, 400X).



[Table/Fig-14]: Aspirate from left hypochondrium, showing cells in loose cohesive cluster of bland looking spindle cells with tapered cytoplasm, having mild anisonucleosis, Gastrinestinal Tumour (GIST) (MGG, 100X).



[Table/Fig-15]: Aspirate from left hypochondrium, bland looking spindle cells with tapered cytoplasm, having mild anisonucleosis, Gastro-intestinal tumour (GIST) (H & E, 40X10).

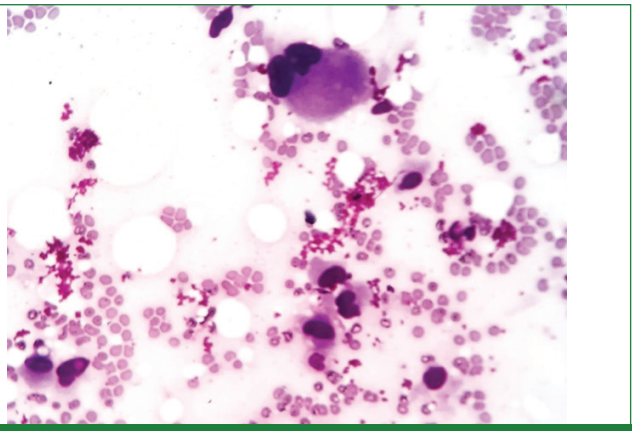
102 cases of adenocarcinomas, 59 cases were seen in females and 43 in males. However, hepatocellular carcinomas were more common in males (10/14 cases) then females (04/14).

Among the diagnostic pancreatic aspirates, majority were adenocarcinoma (5 cases), followed by squamous cell carcinoma (2 cases) and neuro-endocrine tumour (1 case). Only one case of clear cell RCC was detected in the diagnostic renal aspirate. A solitary case of GIST was found in the left hypochondrium [Table/Fig-14,15].

The majority of malignant nodal lesions were adenocarcinoma (12 cases), followed by non hodgkin's lymphoma (10 cases) and one case each of hodgkins lymphoma and paraganglioma was seen [Table/Fig-16].

Among the malignant ovarian neoplasms, 7 cases of surface epithelial tumours were aspirated and two case of metastatic adenocarcinoma was aspirated.

The cytopathological diagnosis was divided into categories of



[Table/Fig-16]: Aspirate from retroperitoneal lymph node showing cells with moderate nuclear pleomorphism, occasional binucleation with eosinophilic finely granular cytoplasm, Paraganglioma (MGG, 400X).

malignant, inflammatory and unsatisfactory, compared with histopathological diagnosis wherever possible. Among 170 cases of malignancy detected on FNAC, 39 specimen were received for histopathological examination and all were confirmed as malignancy on microscopy [Table/Fig-17]. Among 31 cases of inflammatory lesions diagnosed on cytology, histopathology was available for 29 patients, 28 were inflammatory and 01 had microscopic features of malignant lesion. Six cases with insufficient cellular yield, 02 cases were malignant and 04 cases were inflammatory on follow-up. The sensitivity, specificity, PPV, NPV and accuracy of image guided FNAC was 92.3%, 100%, 100%, 91.4% and 95.8%, respectively [Table/Fig-18].

Malignant Lesions	Number of cases FNAC	Histopathological Examination (HPE)
Adenocarcinoma	102	23
Mucinous adenocarcinoma	16	00
Adenosquamous carcinoma	05	00
Hepatic Cell Carcinoma (HCC)	14	04
Non-Hodgkins Lymphoma (NHL)	12	06
Squamous cell carcinoma	04	01
Small cell carcinoma	01	00
Haematolymphoid neoplasm	01	
Metastasis	03	
Renal Cell Carcinoma (RCC)	01	
Neuroendocrine Tumors (NET)	01	01
Gastrointestinal Stromal Tumor (GIST)	01	01
Omental carcinoma	02	
Adrenal malignant neoplasm	01	
Liver malignant neoplasm	03	
Serous cystadenocarcinoma	01	01
Mucinious epithelial neoplasm ovary	01	01
Hodgkins lymphoma	01	01
Total	170	39

[Table/Fig-17]: Distribution of malignant lesion with histopathological concordance.

Diagnosis	Sensitivity	Specificity	PPV	NPV	Accuracy
Adenocarcinoma	91.3	100	100	94.1	97.1
Hepatic Cell Carcinoma (HCC)	100	100	100	100	100
Non-Hodgkins Lymphoma	100	100	100	100	100
Granulomatous	85.71	100	100	97.18	88.89
Necrotising	85.71	100	100	98.4	98.6
Overall Study	92.3	100	100	91.4	95.8

[Table/Fig-18]: Diagnostic efficacy of image guided FNAC in intra-abdominal lesion.

DISCUSSION

Abdominal masses are always a conundrum for surgeons since they are a clinical enigma. To prevent an exploratory laparotomy, it's critical to distinguish between non malignant and malignant tumours, especially in advanced inoperable malignant instances [4,5]. This study further adds to the evidence that image guided FNAC is accurate and safe in detecting intra-abdominal and retroperitoneal lesions. Aspiration of representative material for precise cytological diagnosis is possible because to the use of USG or CT guidance for needle placement [6].

Out of 207 cases, 110 were males and 97 females, with a male to female ratio of 1.13:1. The male predominance was also reported in other studies conducted by Namshiker AAN et al., Madhav N and Meenai FJ; Ranjitha B et al., however, Hemrajani D and Upadhyay P; and Sidhalingreddy and Andola SK; had female predominance [1-4,7]. The most common type of lesion in the present analysis was malignant which was similar to the study conducted by Sidhalingreddy and Andola SK; Hemrajani D and Upadhyay P; and Namshiker AAN et al., [1-3]. Adenocarcinoma was the most common malignant cell 69.4% (118/170), followed by hepatocellular carcinoma 8.2% (14/170) which is consistent with prior research by Hemrajani D and Upadhyay P; and Madhav N and Meenai FJ while majority of cases were HCC followed by Adenocarcinoma in the study conducted by Ranjitha B et al., [2,4,7].

Most common age group for malignant lesions was 59-68 years with 45 (26.4%) cases followed by 49-58 years with 41 (24.1%) cases. Most common age group for inflammatory lesions was 49-58 years followed by 9-18 years. Both the inflammatory and malignant lesions were common in males as comparable to females which was comparable with study conducted by Namshiker AAN et al., Hemrajani D and Upadhyay P; and Sidhalingreddy and Andola SK [1-3].

Amongst all the organs/sites, maximum number of aspirates were of hepatic lesions 37.7% (78/207) followed by gall bladder 22.7% (47/207) which is similar to the study conducted by Swaroop VS et al., Khanna AK et al., Zawar MP et al., Reddy S and Andola SK and Suman BS and Muniyappa B, where hepatic lesions aspirated were 46.43%, 63.27%, 45%, 38% and 40% respectively of all the organs aspirated [8-12]. Many previous studies indicated that the routine and standard investigations diagnose hepatic metastatic malignancies correctly, still newer investigations are required to refine diagnostic capabilities [13,14]. Gallbladder was the second most prevalent location of aspiration 47 cases out of 207, which was similar to findings of Sidhalingreddy and Andola SK; Madhav N and Meenai FJ; Suva CM [3,4,15].

Among the diagnostic pancreatic aspirates, majority of aspirated samples were of adenocarcinoma (5 cases) which was similar to that observed by Namshiker AAN et al., and Jorda M et al., among the total number of pancreatic cancers [1,16]. Only one case of clear cell RCC was aspirated which is similar to study conducted by Mangal N et al., [17]. A solitary case of GIST was found in the left hypochondrium. The majority of malignant nodal lesions were metastatic adenocarcinoma, followed by lymphoma which was similar to study conducted by Mangal N et al., [17]. Lymphoma formed the majority of the nodal lesions in the study conducted by Namshiker AAN et al., and Ranjitha B et al., [1,7]. Among the malignant ovarian neoplasms in the present study, 7 cases of surface epithelial tumours were aspirated which were similar to findings of Namishker AAN et al., and Dey P et al., and one aspirate was acellular [1,18].

The sensitivity of USG guided FNAC ranged from 71.4% to 96.3%. In the present study, sensitivity was 92.3%, while specificity was 100%. The PPV and NPV were 100% and 91.4%, respectively which is similar to the study conducted by Namshiker AAN et al,; Hemrajani D and Upadhyay P; and Sidhalingreddy and Andola SK [1-3]. The diagnostic accuracy in various studies ranged from 83.9%

to 100%. The present study found a diagnostic accuracy of 95.8% which was comparable to most of the studies [Table/Fig-19]. These results were attributed to the thorough and accurate selection of cases and proper application of technique during aspiration and staining.

Study	No. of FNAC	Sensitivity (%)	Specificity (%)	Diagnostic accuracy (%)
Talukder SI et al., [5] (2004) Bangladesh	-	-	-	93.5
Sidhalingreddy and Andola SK [3] (2011) Karnataka, India	234	94.1	100	96.5
Namshiker AAN et al., [1] (2016) Goa, India	660	83	88	85
Madhav N and Meenai FJ [4] (2019) Bhopal, India	164	-	-	96.4
Ranjitha B et al., [7] (2019), Banglore India	82	84	100	85.7
Present study, Agra India	207	92.3	100	95.8

[Table/Fig-19]: Compairing diagnostic accuracy with other studies [1,3-5,7].

Limitation(s)

Histopathological confirmation for all aspirated lesions was not available.

CONCLUSION(S)

Fine Needle Aspiration (FNA) of abdominal lesions guided by ultrasound is a quick, low-cost, safe, highly accurate, and minimally invasive approach for getting a tissue diagnosis in solid localised lesions of the abdomen. The accuracy of diagnosis in FNA and HPE is nearly same, implying that the simple and safe procedure of US guided FNA is somewhat superior to HPE and, when used in conjunction with serum indicators, could be a viable alternative to biopsy.

REFERENCES

[1] Namshiker AAN, Rocha PDS, Pinto RGW. Role of fine needle aspiration cytology in the assessment of intra-abdominal and retroperitoneal lesions-a comparative study. National Journal of Laboratory Medicine. 2016;5(7):31-32.

[2] Hemrajani D, Upadhyay P. Ultra-sonography guided fine needle aspiration cytology for the diagnosis of intra-abdominal lesions: an institutional study. SJPM. 2020;5(12):471-76.

[3] Sidhalingreddy, Andola SK. Fine Needle Aspiration cytology of intra-abdominal lesions. Journal of Clinical and Diagnostic Research. 2011;5(3):551-58.

[4] Madhav N, Meenai FJ. Role of USG guided FNAC in intra-abdominal masses- A study at tertiary care hospital Bhopa, Arch Cytol Histopathol Res 2019;4(1):19-25.

[5] Talukder SI, Huq MH, Haque MA, Rahman S, Islam SM, Hossain GA, et al. Ultrasound guided fine needle aspiration cytology for diagnosis of mass lesions of liver. Mymensingh Med J. 2004;13(1):25-29

[6] El-Naggar AAM, Wifi MNA, El-Nabwey W, Khattab H, Abdel-Azeem K, Mustafa A. Role of ultrasound guided fine needle biopsy, EUS and serum CA19-9 level in diagnosis of pancreatic Masses. Journal of American Science. 2012;8:58-62. https://www.researchgate.net/publication/256457650_Role_of_ultrasound_guided_fine_needle_biopsy_EUS_and_serum_CA19-9_level_in_diagnosis_of_pancreatic_Masses/citation/download.

[7] Ranjitha B, Hemalatha J, Murthy VS. Role of radiological-guided FNAC in intra-abdominal lesions. Int J Clin Diagn Pathol. 2019;2(1):247-53.

[8] Swaroop VS, Gupta SK, Dilawari JB. Fine needle aspiration cytology in the diagnosis of abdominal lumps. Indian J Med Res.1982;76:265-71. PMID: 7174016.

[9] Khanna AK, Misra MK, Khanna A, Misra VK, Khanna S. Fine needle aspiration cytology of abdominal masses. J Surg Oncl. 1990;44(1):15-19.

[10] Zawar MP, Bolde S, Shete SS. Correlative study of fine needle aspiration cytology and histology in intra-abdominal lumps. SMJ. 2007;4. https://statperson.com/uploads/4_4_1.pdf.

[11] Reddy S, Andola SK. Fine needle aspiration cytology of intra-abdominal lesions. JCDR. 2011;5(7):58-65.

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

[13] Centeno BA. Pathology of liver metastases. Cancer Control. 2006;13(1):13-24.

[14] Sheikh M, Sawhney S, Dey P, Ai-Saeed O, Behbehani A. Deep-seated thoracic and abdominal masses: Usefulness of ultrasound and computed tomography guidance in fine needle aspiration cytology diagnosis. Australas Radiol. 2000;44(2):155-60.

[15] Suva CM. Study of image guided fnac in intra-abdominal mass lesions at tertiary care hospital, Jamnagar, Gujarat, India. Ind J Basic Appl Med Res. 2016;6(1):40-51.

[16] Jorda M, Essenfeld H, Gracia E, Ganjei P. The value of fine needle aspiration cytology in the diagnosis of inflammatory pancreatic masses. Diagn Cytopathol. 1992;8(1):65-67.

[17] Mangal N, Sharma V, Verma N, Agarwal A, Sharma S, Aneja S. Ultrasound guided fine needle aspiration cytology in the diagnosis of retroperitoneal masses: A study of 85 cases. J Cytol. 2009;26(3):97.

[18] 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(5):698-701.

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