Original Article

Diagnostic Impact of USG-Guided FNAC in Liver Lesions: A Retrospective Study

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Abstract

Background: Ultrasound-guided fine-needle aspiration cytology (FNAC) has emerged as a pivotal diagnostic tool in the evaluation of liver lesions, offering a minimally invasive, accurate, and efficient method for obtaining tissue samples. This article aims to provide a comprehensive overview of the spectrum of liver lesions diagnosed through USG-guided FNAC in our tertiary care facility, highlighting its diagnostic efficacy, clinical impact, and potential challenges.

Materials and Methods: This is a retrospective study conducted over a period of 18 months in Post Graduate Institute of Medical Sciences, Rohtak, a tertiary care hospital and medical institute. All the liver lesions undergoing USG-guided FNAC were included in the study.

Results: A total of 188 cases were included in the study. The age of patients ranged from 20–87 years, with a male-to-female ratio of 1.7:1. On cytological characterization, 72.9% were malignant, 0.5% were benign, 14.4% were reported as non-neoplastic, and 12.2% were inadequate or unsatisfactory for opinion. Among the malignant lesions, poorly differentiated carcinoma was the most commonly diagnosed malignant lesion.

Conclusion: In the complex clinical landscape of a tertiary care hospital, where patients present with a broad spectrum of hepatic pathologies, the utility of USG-guided FNAC cannot be overstated.

Keywords:

FNAC, liver, USG-guided, diagnosis

Introduction

Liver lesions encompass a wide array of pathological entities, ranging from benign conditions such as hepatic cysts and hemangiomas to malignant neoplasms including hepatocellular carcinoma (HCC) and metastatic carcinomas. Accurate diagnosis is crucial for the appropriate management and prognostication of these conditions [1]. Traditional diagnostic modalities like CT and MRI, while valuable, often necessitate confirmatory cytological or histological analysis, making FNAC a critical adjunct in the diagnostic algorithm. FNAC is a commonly used minimally invasive technique to assess superficial as well as deep-seated lesions. In this, a hollow needle of 20–22 gauge is inserted into the lesion and needling is done in the lesion by to-and-fro motion of the needle, and smear is prepared from the sample collected in the hub of the needle [2]. There are certain limitations to this

technique, as the sample collected is small and may not be adequate for diagnosis. Also, it is possible that the malignant cells are missed entirely while needling. Use of image-guided FNAC, such as X-ray, USG, CT, or MRI to guide the insertion of the needle and sample collection, overcomes these limitations and provides results with high accuracy [3].

In a tertiary care hospital, the integration of USG-guided FNAC into routine clinical practice has facilitated timely and precise diagnosis of liver lesions. This article reviews our institutional experience, detailing the various types of liver lesions encountered, the cytological features observed, and the demographic aspects of liver lesions. Additionally, we discuss the procedural aspects, including technique and use of cell blocks to identify the primary lesion, which helps to avoid unnecessary invasive diagnostic procedures.

Through this comprehensive analysis, we aim to underscore the significance of USG-guided FNAC in the diagnostic workup of liver lesions, advocating for its broader adoption in similar healthcare settings.

Materials and Methods

The present study was a retrospective analysis of USG-guided FNAC of liver lesions performed under the guidance of a pathologist and radiologist in a tertiary care hospital, conducted over a period of 18 months, from 1 January 2023 to 30 June 2024.

After explaining the procedure to the patient, percutaneous FNAC of the mass was done under real-time USG guidance under complete aseptic conditions using a 20–22 gauge spinal needle and a 10 ml disposable plastic syringe. The needle was inserted into the lesion, and needling was done in the lesion by a to-and-fro motion of the needle. A smear was prepared from the sample collected in the hub of the needle. The aspirated material was used to make smears for Leishman or Giemsa staining. Whenever possible, cell blocks were prepared and were used for immunocytochemistry.

Statistical analysis was done using Microsoft Excel sheets. Qualitative data was expressed in percentages, and the effectiveness of the diagnostic method was calculated with the results obtained.

Results

Over a period of 18 months, a total of 188 USG-guided FNAC of liver lesions were performed, out of which 63.3% were male and 36.7% were female. The maximum number of cases were seen in the age group of 61–70 years (40.9%), followed by 51–60 years (18.6%) and 71–80 years (15.5%). The majority of the cases were malignant, comprising 72.9%, whereas only 0.5% of cases were benign, 14.4% of cases were reported as non-neoplastic, and 12.2% of cases were inadequate or unsatisfactory for opinion. The maximum number of primary as well as metastatic liver lesions were reported in the age group of 61–70 years, followed by 51–60 years of age.

Among the 27 non-neoplastic liver lesions, liver abscess was found to be the most common lesion, comprising 10 cases, followed by 8 cases of diffuse parenchymal disease. Other non-neoplastic liver lesions included 6 cases of fatty change, 2 cases of regenerating nodule, and 1 case of granulomatous hepatitis.

Out of all neoplastic liver lesions, there was a single reported case of benign category, i.e., hepatic nodule. Malignant liver lesions formed the majority of the cases, i.e., 72.9%. Among the malignant liver lesions, 7.5% of cases were of primary origin, i.e., hepatocellular carcinoma, whereas 65.4% of cases were metastatic in nature. The most common metastatic liver lesion diagnosed was poorly differentiated carcinoma, comprising 28.7% of cases, followed by adenocarcinoma (19.8%), undifferentiated neoplasm (8.0%), squamous cell carcinoma (2.8%), and metastatic small round cell neoplasm (2.1%). There were single reported cases of

metastatic amelanotic melanoma, renal cell carcinoma, colorectal carcinoma, gastrointestinal stromal tumor, cholangiocarcinoma, breast carcinoma, neuroendocrine tumor, and pancreatic carcinoma, comprising 0.5% each of all liver lesions, which were diagnosed using cell block and immunocytochemistry.

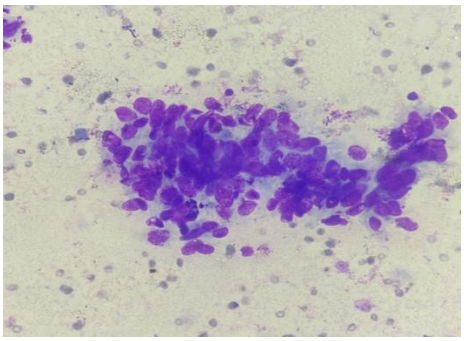

Figure 1: Leishman-stained smears at 40X – poorly differentiated carcinoma.

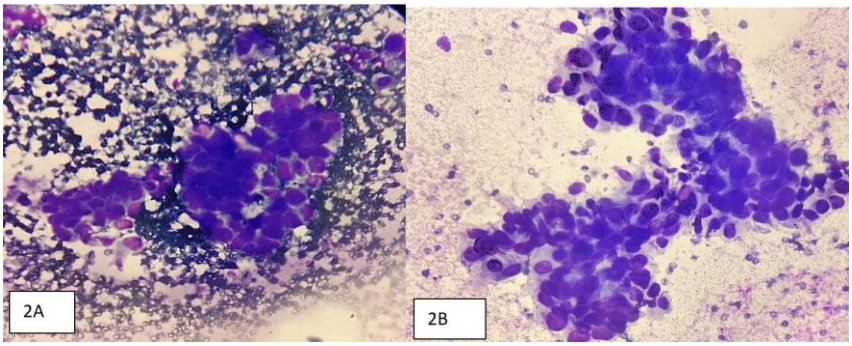

Figure 2: High power view of Leishman stained smears showing metastatic deposits of adenocarcinoma

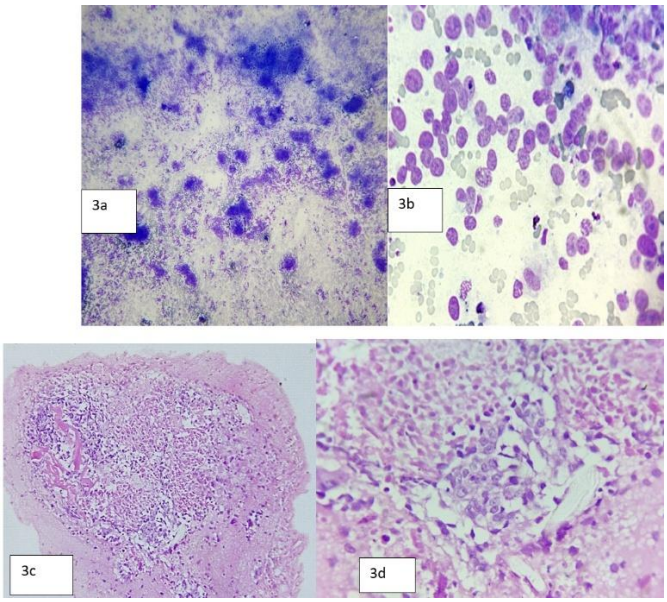

Figure 3a-b: low power and high power view of Leishman stained atypical cells arranged in groups and scattered singly. 3c, 3d: low power and high power view of H&E stained section of cell block respectively showing atypical cells with squamoid differentiation

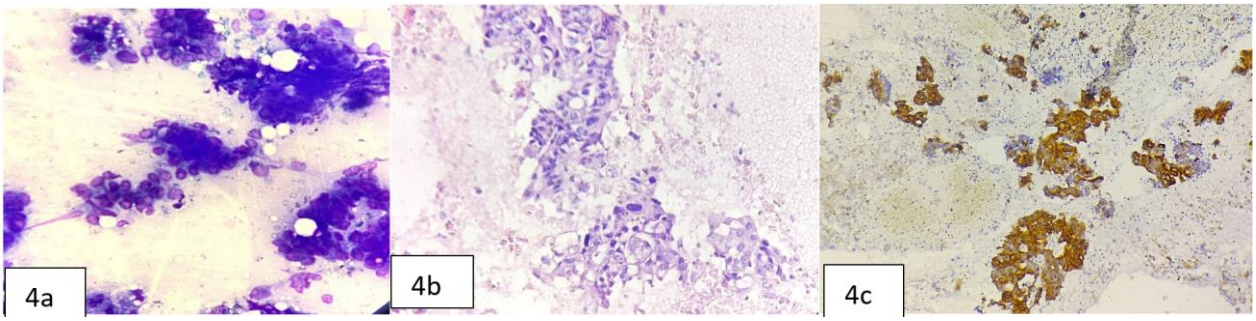

Figure 4: High power view of Leishman stained smear showing metastatic deposits of Colonic carcinoma. 4B) cell block – H&E stained section at high power showing atypical cells . 4C) ICC applied on cell block- CK 20- positive cytoplasmic staining in atypical cel

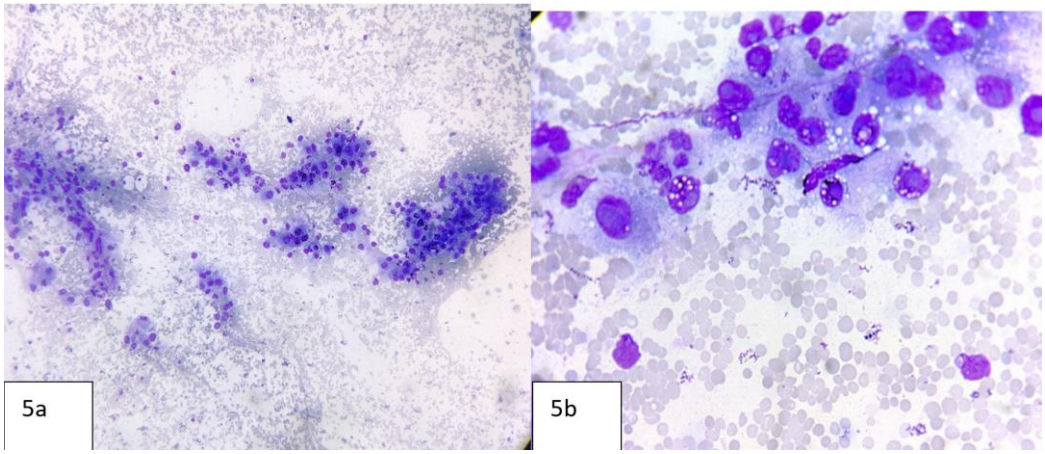

Figure 5: a: Hepatocellular carcinoma: low power view of Leishman stained smears showing atypical cells. 5b: High power view of atypical cells showing presence of macronucleoli and cytoplasmic vacuolations.

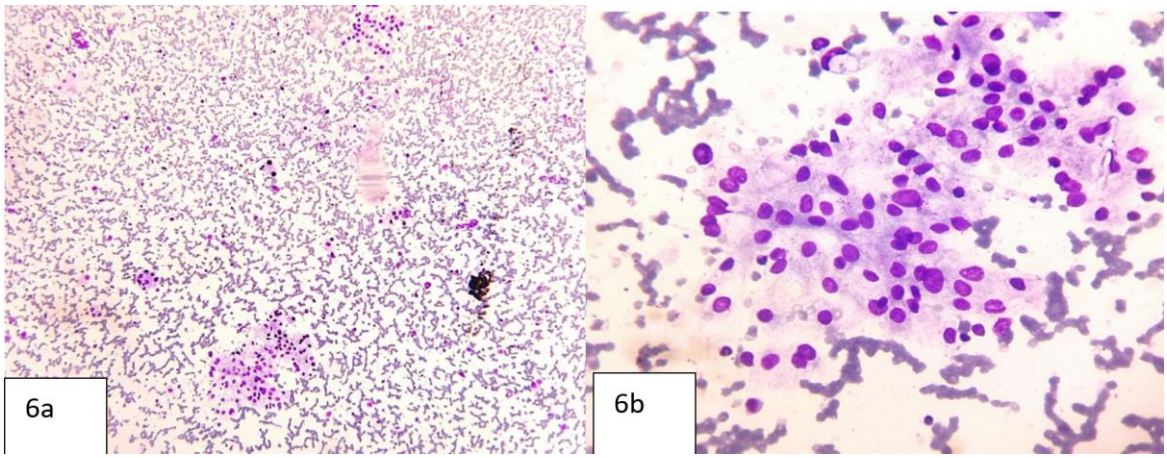

Figure 6: 6a,6b- Low power and High Power view of Leishman stained smears showing atypical cells in groups and scattered singly admixed with benign hepatocytes and RBCs- metastatic deposits from renal cell carcinoma

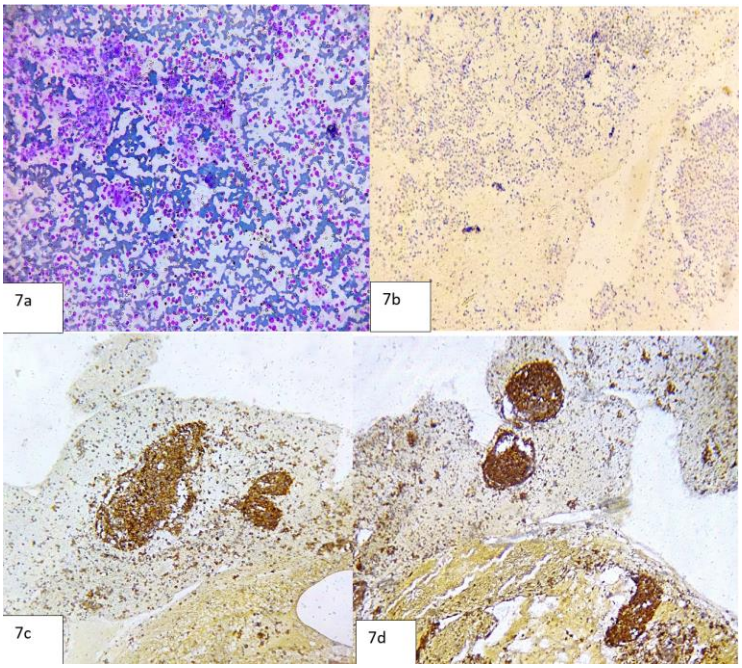

Figure 7: 7a: Leishman stained low power and high power view of metastasis of GIST to liver, 7b : cell block showing atypical cells and benign hepatocytes, 7c- ICC- CD117 showing cytoplasmic staining in atypical cells 7d: ICC- DOG-1 showing cytoplasmic and membranous staining in atypical cells

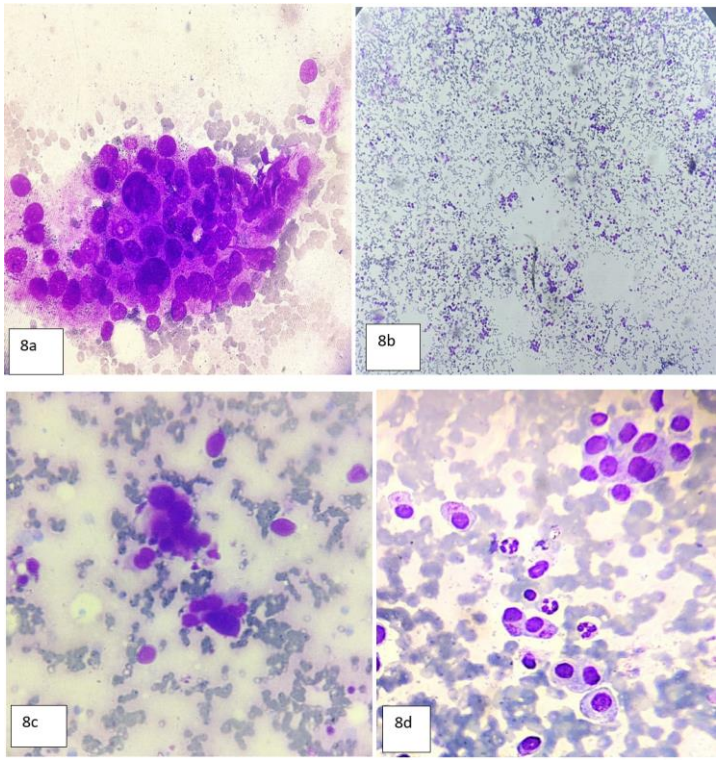

Figure 8: Leishman stained smears showing liver metastatic deposits from cholangiocarcinoma, small cell carcinoma, pancreatic carcinoma and neuroendocrine tumor respectively.

Table 1: Distribution of liver lessions

Lesion	No. Of Cases	Percentage
Inadequate/ Unsatisfactory	23	12.2
Non Neoplastic	27	14.4
Liver Abscess	10	5.3
Diffuse Parenchymal Disease	08	4.3
Fatty Change	06	3.2
Granulomatous Hepatritis	01	0.5
Regenerating Nodule	02	1.1
Neoplastic	138	73.4
Benign		
Hepatic Nodule	01	0.5
Malignant	137	72.9
Primary		
Hepatocellular Carcinoma	14	7.5
Metastatic		
Undifferentiated	15	8.0
Poorly Differentiated Carcinoma	54	28.7
Adenocarcinoma	37	19.8
Squamous Cell Carcinoma	5	2.8
Metastatic Small Round Cell Neoplasm	4	2.1
Metastatic Amelanotic Melanoma	1	0.5
Metastatic Renal Cell Carcinoma	1	0.5
Metastatic Colorectal Carcinoma	1	0.5
Metastatic Cholangiocarcinoma	1	0.5
Metastatic GIST	1	0.5
Metastatic Breast Carcinoma	1	0.5
Metastatic Neuroendocrine Tumor	1	0.5
Metastatic Pancreatic Carcinoma	1	0.5
Total	188	100

Table 2: Distribution of liver lesions according to age

AGE GROUP	NO. OF CASES	PERCENTAGE
11-20	1	0.5
21-30	5	2.7
31-40	12	6.4
41-50	25	13.3
51-60	35	18.6
61-70	77	40.9
71-80	29	15.5
81-90	4	2.1
TOTAL	188	100

Discussion

Liver lesions refer to any abnormal growth or localized area of liver tissue that differs in appearance from the surrounding tissue. These lesions can be classified into different types: non-neoplastic, neoplastic, including benign lesions like hepatic adenoma, focal nodular hyperplasia, and malignant neoplastic lesions, which can be further categorized as hepatocellular carcinomas and metastatic liver tumors. The identification and characterization of these lesions are crucial for appropriate treatment planning and patient management [4].

Table 3: Distribution of liver lesions according to sex

Lesion	Male	Percentage	Female	Percentage	Total
Inadequate	18	78.3	5	21.7	23
Non Neoplastic	16	59.3	11	40.7	27
Neoplastic					
Benign	01	100	00	00	01
Malignant					
Primary Malignancy – HCC	12	86	2	14	14
Metastatic					
Undifferentiated	7	47	8	53	15
PDC	33	61.1	21	38.9	54
Adenocarcinoma	22	59.5	15	40.5	37
SCC	5	100	0	0	5
Others	5	42	7	58	12
Total	119	63.3	69	36.7	188

Table 4: Distribution of malignant liver lesions according to age

Case	21-30	31-40	41-50	51-60	61-70	71-80	81-90	Total
HCC	-	-	3	3	5	3	-	14
Undifferentiated Metastatic Carcinoma	-	1	3	3	4	3	1	15
PDC	2	1	9	12	21	8	1	54
Metastatic Adenocarcinoma	-	3	6	8	11	8	1	37
Metastatic Squamous Cell Carcinoma	-	-	-	1	3	-	1	5
Metastatic Small Cell Neoplasm	-	-	-	1	2	1	-	4
Metastatic Cholangiocarcinoma	-	-	-	-	-	1	-	1
Metastatic Pancreatic Carcinoma	-	-	-	-	1	-	-	1
Metastatic Breast Carcinoma	-	-	-	1	-	-	-	1
Metastatic Colonic Carcinoma	-	-	-	-	1	-	-	1
Metastatic GIST	-	-	-	-	1	-	-	1
Metastatic Renal Carcinoma	-	-	-	1	-	-	-	1
Metastatic Amelanotic Melanoma	-	1	-	-	-	-	-	1
Metastatic Neuroendocrine Tumor	-	1	-	-	-	-	-	1

When it comes to diagnosing liver lesions, various approaches are available. FNAC, being a minimally invasive procedure, provides valuable diagnostic information and helps guide further management decisions. Furthermore, the use of USG in guiding FNAC enhances the accuracy and safety of the procedure. Ultrasonography allows real-time visualization of the liver and the targeted lesion, ensuring accurate needle placement and minimizing the risk of complications.

The findings of this study show a diverse spectrum of liver lesions diagnosed via USG-guided FNAC. The male: female ratio was found to be 1.7:1 in our study, which is comparable to similar studies conducted by Talukder SI et al. [5], Bohara et al. [6], and Nazir RT et al. [7], with male to female ratios of 1.7:1, 1.6:1, and 1.7:1 respectively, showing male predominance. The maximum number of cases were seen in the age group of 61–70 years, followed by 51–60 years, whereas in previous studies performed by Sudha P. Meena et al. [8] (2016) and Vyas et al. [9] (2022), 51–60 was the most commonly affected age group, followed by 61–70 years.

On cytological categorization of liver lesions, 14.4% of cases were non-neoplastic, 73.4% were neoplastic, whereas 12.2% were inadequate for definite opinion. Non-neoplastic lesions include cases of liver abscess, diffuse parenchymal disease, fatty change,

granulomatous hepatitis, and regenerative nodule. Similar findings were reported in a study conducted by Mishra et al. [10], in which out of 130 cases, 12 (9.2%) were non-neoplastic lesions and 118 (90.8%) were neoplastic lesions. Lekha M.B. et al. [11] reported that 6 (10%) cases out of 60 were non-neoplastic and 53 (88.3%) neoplastic. Agarwal A et al. [12] reported that 13 (8.9%) cases out of 146 were non-neoplastic and 133 (90.1%) neoplastic. Goel S et al. [13] (2014) reported that 7 (2%) cases out of 360 were non-neoplastic and 317 (88%) neoplastic.

In this study, the maximum number of neoplastic lesions were malignant, similar to the observations reported by Philipose et al. [14], Glaxon et al. [15], and Sidhalingreddy et al. [16], where malignant lesions constituted the most common diagnostic category. Among these, metastatic malignancies predominated over primary. Poorly differentiated metastatic carcinoma was the most frequently diagnosed metastatic liver lesion, followed by metastatic adenocarcinoma. This contrasts with the findings of Asghar et al. [17], who reported hepatocellular carcinoma as the most common hepatic lesion. Additionally, studies by Vyas et al. [9], Verma et al. [18], and Barbhuiya et al. [19] identified metastatic adenocarcinoma as the most prevalent liver lesion. Only 0.5% of cases were reported as benign, similar to a study conducted by Nasit et al., where 3.3% of cases were benign. Benign hepatocellular neoplasms such as hepatic adenoma, focal nodular hyperplasia, and hemangiomas can be difficult to diagnose on FNAC alone because of either inadequate sampling, cytologic similarities to normal liver, cirrhosis, well-differentiated HCC, or aspirate from necrotic areas. This may lead to inappropriate classification of benign lesions as inadequate/unsatisfactory or non-neoplastic lesions [20].

The diagnostic accuracy of USG-guided FNAC was found to be 85.7%, similar to studies done by Nautiyal S et al. [21], Vyas et al. [9], and Mahale et al. [22], in which the diagnostic yield was 93.06%, 84.4%, and 89.06% respectively.

In the present study, a few cases where relevant patient history was provided indicating a primary site of tumor for a metastatic tumor or where cell blocks were available and immunocytochemistry could be performed, a definite diagnosis for the primary origin of the metastatic lesion was given, further reducing the need for biopsy specimens. Two cases were reported as suggestive of metastatic deposits from renal cell carcinoma and cholangiocarcinoma respectively, based on clinical history and radiological findings.

In a 59-year-old female who complained of abdominal pain, USG revealed hepatomegaly with multiple well-defined hyperechoic space-occupying liver lesions. The patient was a known case of papillary renal carcinoma and had undergone radical nephrectomy. USG-guided FNAC revealed the presence of atypical cells arranged in groups, papillaroid clusters, overlapping sheets, and scattered singly against a background of benign hepatocytes and RBCs. These atypical cells showed moderate pleomorphism, moderate to abundant cytoplasm, large variable-sized nuclei, and inconspicuous nucleoli. Considering the patient history, a diagnosis of metastatic deposits from renal cell carcinoma was suggested.

In another case, a 75-year-old female presented with abdominal pain and distension. USG and CECT abdomen revealed the presence of a liver mass, likely metastatic in origin, infiltrating the wall of the gallbladder. FNAC from the liver lesion was performed under USG guidance. Smears prepared and examined showed low cellularity comprising atypical cells arranged in groups, clusters, and overlapping sheets against a background of a few benign hepatocytes and RBCs. These atypical cells had large pleomorphic nuclei, inconspicuous nucleoli, and scant to moderate cytoplasm. Cytological features were positive for malignancy, possibly cholangiocarcinoma.

A few cases were reported as metastatic deposits from amelanotic melanoma, colonic carcinoma, and GIST based on clinical history and immunocytochemistry applied on the cell block prepared at the time of FNAC. USG-guided FNAC of the liver lesion

was performed in a 30-year-old female who presented with a 3-month history of progressive abdominal distension, jaundice, and weight loss. USG abdomen and CT scan revealed hepatomegaly and multiple hypodense lesions in bilateral lobes suggestive of metastasis, mild splenomegaly, and metastatic bone lesions with pulmonary metastasis. The cytology smears showed atypical cells arranged in sheets, clusters, and scattered singly, admixed with benign hepatocytes and foamy macrophages against a hemorrhagic background. These atypical cells had a high N:C ratio, large pleomorphic nuclei, coarse nuclear chromatin, prominent 1–2 nucleoli, and moderate cytoplasm. An extensive panel of IHC markers was applied on the cell blocks prepared to identify the primary lesion. The atypical cells were found to be negative for CK, Hep-par 1, CDX2, PLAP, CD20, CA19.9, MUC-1 and positive for vimentin, S100, and HMB-45, establishing the diagnosis of metastatic amelanotic melanoma. The cell block was exhausted in the workup, and the primary lesion could not be ascertained. The patient was lost to follow-up.

Similarly, in a 63-year-old female, a known case of carcinoma rectum presenting with a liver lesion on CT abdomen, USG-guided FNAC was performed. Cytological features were suggestive of metastatic carcinoma. ICC applied on the cell block revealed CK20 positive and CK7 negative staining, suggestive of metastatic deposits from colonic carcinoma. A 63-year-old male presented with ascites, and on USG, an irregular cystic lesion measuring 9.5 × 7 cm was noted in the right lobe of the liver. The patient was a known case of gastrointestinal stromal tumor. USG-guided FNAC was performed from the liver lesion, and a cell block was prepared. Smears were positive for malignancy. On the cell block, these malignant cells were positive for CD117, CD34, and DOG-1, establishing the diagnosis of metastatic GIST.

Conclusion

Ultrasound-guided liver interventions play a unique role in providing diagnostic information on liver lesions, reducing the need for more invasive procedures like biopsy. It is a reliable, rapid, and sensitive method that can be used as an OPD procedure and can also be used in cases of local recurrence and metastasis in cases of post-radiation and post-operative follow-up.

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