Spectrum of Hepatic Lesions Diagnosed by Image-Guided Cytology and Core Needle Biopsy: A Retrospective Clinicopathological Study

*Quruni MO,[1] Hossain MS,[2] Afrin SS,[3] Saha MK,[4] Alam SN,[5] Nupur FP,[6] Jahan PA[7]

Abstract

Background: The liver is affected by a wide range of non-neoplastic and neoplastic lesions, requiring accurate diagnosis for appropriate management and prognostication. Image-guided cytology and biopsy are important diagnostic tools for evaluation of hepatic lesions.

Objective: To assess the spectrum of hepatic lesions diagnosed by ultrasonography-guided fine needle aspiration cytology (FNAC) and core biopsy, and to analyze their demographic and pathological distribution.

Methods: This retrospective descriptive cross-sectional study was conducted in a private laboratory in Tangail, Bangladesh, from March 2025 to March 2026. A total of 37 cases of radiologically detected hepatic lesions were included by consecutive sampling. Among them, 30 cases underwent USG-guided FNAC and 7 cases underwent USG-guided core needle biopsy. Clinical, radiological, cytological, and histopathological data were reviewed. Data were entered and analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage.

Results: The mean age of the patients was 54.95 ± 13.39 years, with most cases in the 41–60 years age group (54.1%). Male patients predominated (64.9%). Metastatic carcinoma was the most common lesion (62.2%), followed by non-neoplastic lesions (18.9%), hepatocellular carcinoma (13.5%), benign lesions (5.4%), and cholangiocarcinoma (2.7%). Metastatic adenocarcinoma was the most frequent malignant subtype. Radiological-pathological concordance was 83.8%.

Conclusion: Metastatic tumors were the predominant hepatic lesions, while hepatocellular carcinoma was the most common primary malignancy. Combined use of radiology, FNAC, and core biopsy remains valuable for accurate diagnosis and management of hepatic lesions.

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1. **Md Oyes Quruni, MD (Pathology), Assistant Professor and Head, Department of Pathology, Tangail Medical College, Tangail. oyesquruni@gmail.com. ORCID: https://orcid.org/0009-0004-9184-3173.*
2. *Dr. Md. Shahadat Hossain, MD (Pathology), Lecturer, Department of Pathology, Dhaka Medical College, Dhaka. ORCID: https://orcid.org/0009-0003-4384-4684.*
3. *Dr. Syeda Sadia Afrin, MD (Pathology) Assistant Professor, Department of Pathology, Dhaka Medical College, Dhaka. ORCID: https://orcid.org/0009-0005-7257-3583.*
4. *Dr. Mridul Kumar Saha, MD (Pathology), Assistant Professor, Department of Pathology. Manikganj Medical College, Manikganj. ORCID: https://orcid.org/0009-0007-2079-7757.*
5. *Dr. SM Nazmul Alam, MD (Pathology), Assistant Professor, Department of Pathology, Tangail medical College hospital, Tangail. ORCID: https://orcid.org/0009-0007-8847-7514.*
6. *Dr. Farjana Pervin Nupur, MD (Pathology), Assistant Professor, Department of Pathology, Dhaka Medical College, Dhaka. ORCID: https://orcid.org/0009-0009-5416-1073.*
7. *Dr. Pamia Arika Jahan, MBBS, Shaheed Monsur Ali Medical College, Dhaka ORCID: https://orcid.org/0009-0006-9103-4864.*

**For correspondence*

Introduction

The liver is a vital organ responsible for metabolism, detoxification, bile secretion, protein synthesis, and immune regulation. It is affected by a wide spectrum of lesions ranging from inflammatory and infective conditions to benign and malignant neoplasms. Hepatic space-occupying lesions constitute an important diagnostic challenge in clinical practice, with primary and metastatic tumors forming a major proportion in tertiary care settings.[1,2] Accurate classification of these lesions is essential because treatment varies from conservative management for benign or inflammatory lesions to surgery, chemotherapy, or palliative care for malignant tumors.[3,4] The liver is also one of the most common sites of metastatic disease because of its dual blood supply and fenestrated sinusoidal vascular system.[5] Hepatocellular carcinoma (HCC), the most common primary liver cancer, remains a major global health burden and one of the leading causes of cancer-related mortality worldwide.[6] Radiological imaging plays an important role in lesion detection and localization; however, many hepatic lesions show overlapping imaging features, making tissue diagnosis necessary for definitive characterization.[3,7] Ultrasound- or CT-guided fine needle aspiration cytology (FNAC) has emerged as a simple, safe, rapid, and cost-effective diagnostic modality for hepatic lesions. It is particularly useful in differentiating hepatocellular carcinoma, metastatic tumors, and non-neoplastic lesions.[8,9] Several studies have shown that most aspirated liver masses are malignant, especially metastatic adenocarcinoma and HCC, while a smaller but clinically significant proportion are benign or inflammatory lesions.[8,10,11] Diagnostic accuracy for malignant lesions often exceeds 90% when combined with imaging guidance and clinicopathological correlation.[9] Aim of this study was to evaluate the spectrum of hepatic lesions diagnosed by ultrasonography-guided fine needle aspiration cytology and core biopsy, and to analyze their clinicopathological characteristics in a tertiary care setting. Local epidemiology, referral patterns, and technical expertise may influence the observed lesion spectrum; therefore, institution-based retrospective studies are valuable for evaluating local disease patterns and improving diagnostic strategies.

Methods

This retrospective descriptive cross-sectional study was conducted in several private pathology laboratory in Tangail, Bangladesh, from March 2025 to March 2026. The study included patients with radiologically detected hepatic focal or diffuse lesions who underwent image-guided tissue sampling for diagnostic evaluation. A total of 37 cases were included using a consecutive sampling technique. Of these, 30 cases underwent ultrasonography (USG)-guided fine needle aspiration cytology (FNAC) and 7 cases underwent USG-guided core needle biopsy.

Cases with inadequate material, poorly preserved smears, or incomplete clinical records were excluded. Demographic data, clinical presentation, relevant laboratory parameters, and radiological findings were collected from requisition forms and hospital records.

FNAC procedures were performed under aseptic precautions using a 22–23-gauge needle attached to a disposable syringe under real-time USG guidance. Smears were air-dried and alcohol-fixed, then stained with May-Grünwald-Giemsa and Papanicolaou stains. Core biopsy specimens were fixed in 10% neutral buffered formalin, routinely processed, paraffin embedded, sectioned at 4–5 μm thickness, and stained with hematoxylin and eosin. Special stains and

immunohistochemistry were performed in selected cases whenever indicated.

Final diagnoses were categorized as non-neoplastic, benign neoplastic, primary malignant, and metastatic lesions. Data were analyzed using SPSS version 26.0. Descriptive statistics were presented as frequency, percentage, mean ± standard deviation, and range. Ethical confidentiality and anonymity of all patients were strictly maintained.

Results

Demographic and Clinical Profile

The mean age of the patients was 54.95 ± 13.39 years (range: 28–78 years), with most cases occurring in the 41–60 years age group (54.1%)**.** A clear male predominance (64.9%) was observed.

Table I: Demographic and Clinical Profile

Variable	Category	Number (n=37)	Percentage (%)
Age group (years)	0–20	0	0
	21–40	5	13.5
	41–60	20	54.1
	>60	12	32.4
Age (years)	Mean ± SD	54.95 ± 13.39	—
	Range	28–78	—
Sex	Male	24	64.9
	Female	13	35.1

Spectrum by Modality: Cytology vs Core Biopsy

Metastatic lesions were the most common diagnosis in both modalities, accounting for **56.7%** of FNAC cases and **85.7%** of core biopsy cases. FNAC identified a wider range of non-neoplastic and benign lesions compared with core biopsy.

Table II: Spectrum by Modality: Cytology vs Core Biopsy

Modality	Total cases	Non-neoplastic n (%)	Benign neoplastic n (%)	Primary malignant n (%)	Metastatic n (%)
USG-guided FNAC (n=30)	30	7 (23.3)	2 (6.7)	4 (13.3)	17 (56.7)
Core biopsy (n=7)	7	0	0	1 (14.3)	6 (85.7)
Total (n=37)	37	7 (18.9)	2 (5.4)	5 (13.5)	23 (62.2)

Spectrum of Hepatic Lesions

Metastatic carcinoma was the most frequent hepatic lesion **(**62.2%**),** followed by non-neoplastic lesions (18.9%**)** and hepatocellular carcinoma **(**13.5%). Benign lesions were relatively uncommon.

Table III: Spectrum of Hepatic Lesions

Category of lesion	Lesion type	Number (n)	Percentage (%)
Non-neoplastic	Pyogenic liver abscess	3	8.1
	Negative for malignant cells	2	5.4
	Vascular lesion (non-neoplastic)	2	5.4
Benign neoplastic	Hemangioma	1	2.7
	Simple hepatic cyst	1	2.7
Neoplastic – malignant	Hepatocellular carcinoma	5	13.5
	Metastatic carcinoma	23	62.2
	Cholangiocarcinoma	1	2.7
Total		37	100

Subtypes of Malignant Hepatic Lesions

Among the 29 malignant hepatic lesions diagnosed by USG-guided FNAC, metastatic adenocarcinoma **(**65.5%) was the predominant cytological subtype, while hepatocellular carcinoma accounted for 17.2% of malignant cases. Poorly differentiated tumors represented a notable proportion.

Table IV Cytomorphological Subtypes of Malignant Hepatic Lesions Diagnosed by USG-Guided Fine-Needle Aspiration Cytology (FNAC) (n = 29)

Malignant lesion type	Number (n)	Percentage (%)
Hepatocellular carcinoma	5	17.2
Well differentiated	1	3.4
Poorly differentiated	4	13.8
Metastatic adenocarcinoma	19	65.5
Metastatic poorly differentiated carcinoma	4	13.8
Metastatic neuroendocrine carcinoma	1	3.4
Cholangiocarcinoma	1	3.4
Total malignant cases	29	100

Correlation Between Radiological Diagnosis and Final Diagnosis

Radiological findings showed good agreement with pathological diagnosis, with an overall concordance rate of 83.8%**.** Highest concordance was seen in gallbladder mass with liver lesion, benign lesions, and abscesses.

Table V: Correlation Between Radiological Diagnosis and Final Diagnosis

Radiological diagnosis	Number	Final pathological diagnosis	Concordant n (%)
HCC suspected	5	HCC (4), Metastatic (1)	4 (80.0)
Metastasis suspected	11	Metastatic (9), Abscess (1), Vascular (1)	9 (81.8)
GB mass with liver lesion	7	Metastatic adenocarcinoma	7 (100)
Benign lesion suspected	4	Hemangioma / cyst / vascular	4 (100)
Abscess suspected	2	Pyogenic abscess	2 (100)
Non-specific suspected	8	Mixed final diagnosis	5 (62.5)
Total	37		31 (83.8)

Summary Correlation

Cytology diagnosed most non-neoplastic and benign lesions, whereas biopsy was mainly utilized for confirmation of malignant lesions, especially metastatic tumors.

Table V: Summary Correlation (Diagnostic Categories)

Category	Cytology diagnosis (n)	Biopsy diagnosis (n)
Non-neoplastic	7	0
Benign neoplastic	2	0
Primary malignant	4	1
Metastatic	17	6

Lesion Spectrum by Age Group

Most hepatic lesions occurred in the **41–60 years age group,** where metastatic and primary malignant lesions were most frequent. Patients aged >60 years predominantly had metastatic lesions.

Table VII: Lesion Spectrum by Age Group

Age group (years)	Non-neoplastic (n)	Benign (n)	Primary malignant (n)	Metastatic (n)	Total (n)
0–20	0	0	0	0	0
21–40	2	1	0	2	5
41–60	5	1	4	10	20
>60	0	0	1	11	12

Lesion Spectrum by Sex

Metastatic and primary malignant lesions were more common in males, while benign lesions occurred exclusively in females. Overall, hepatic lesions were more frequent in men than women.

Table VIII: Lesion Spectrum by Sex

Lesion category	Male n (%)	Female n (%)	Total n (%)
Non-neoplastic	4	3	7 (18.9)
Benign neoplastic	0	2	2 (5.4)
Primary malignant	4	1	5 (13.5)
Metastatic	16	7	23 (62.2)

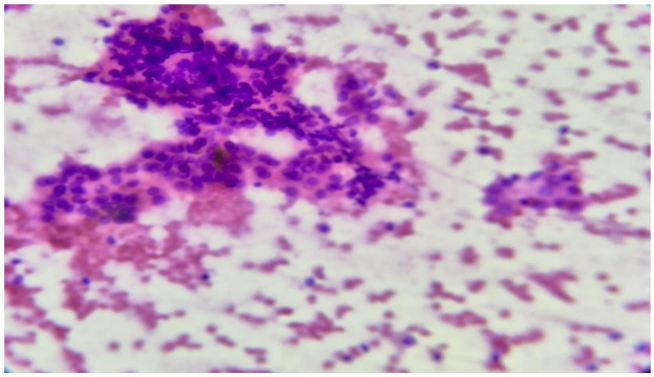

Figure 1. Hepatocellular carcinoma (H&E, 20X)

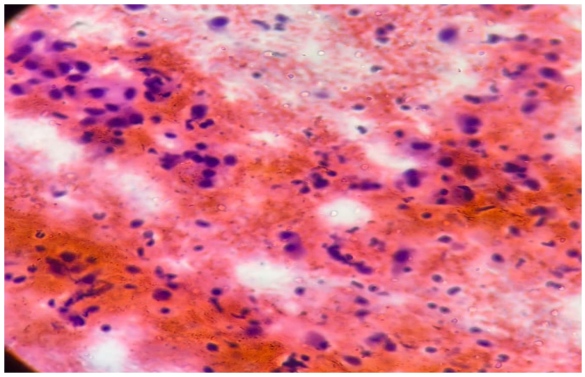

Figure 2. Metastatic adenocarcinoma (H&E , 20X)

Discussion

The present study demonstrated that hepatic lesions were predominantly encountered in middle-aged and elderly patients, with a mean age of 54.95 ± 13.39 years and maximum frequency in the 41–60 years age group (54.1%**).** A marked male predominance (**64.9%**) was observed, which is comparable to other FNAC-based hepatic studies reporting peak incidence in the fifth to sixth decades with male preponderance. [8,9,13] This demographic trend may reflect the higher

prevalence of chronic liver disease, alcohol exposure, and malignant disorders among adult males.[1,2]

Metastatic tumors constituted the largest diagnostic category (62.2%**),** confirming that the liver is one of the most common sites of secondary tumor spread because of its dual blood supply and fenestrated sinusoidal circulation.[4] Several studies have shown that metastatic lesions outnumber primary hepatic malignancies in cytology-based series, with metastatic adenocarcinoma being the commonest subtype.[8,9,15,16] In the present study, metastatic adenocarcinoma was also the predominant lesion, likely arising from gastrointestinal, gallbladder, pancreatic, breast, and colorectal primaries.

Among primary hepatic malignancies, hepatocellular carcinoma (13.5%) was the leading lesion, in agreement with global cancer statistics identifying HCC as the most common primary liver cancer worldwide. [5] Most HCC cases occurred in males within the middle-aged group, which is consistent with previous epidemiological observations.[1,5]

USG-guided FNAC identified a broad spectrum of lesions and was particularly useful for diagnosing metastatic tumors, whereas core biopsy provided architectural details and definitive histological confirmation. Similar studies have emphasized the rapidity, safety, and high diagnostic accuracy of image-guided FNAC in hepatic masses.[6,8,14] Radiological-pathological concordance was high **(83.8%),** supporting the importance of integrating imaging with tissue diagnosis.[7]

Non-neoplastic and benign lesions comprised a smaller but clinically relevant proportion of cases. Pyogenic abscess was the most common non-neoplastic lesion, while hemangioma and simple hepatic cyst were uncommon benign lesions. These findings reinforce the importance of clinico-radiological correlation to avoid unnecessary invasive procedures. Overall, the present study highlights that metastatic tumors form the major burden of hepatic lesions, while combined radiology, cytology, and histopathology significantly improve diagnostic accuracy.

Conclusion

This study demonstrated that metastatic tumors were the most common hepatic lesions, while hepatocellular carcinoma was the predominant primary liver malignancy. Hepatic lesions were more frequent in middle-aged to elderly patients with male predominance. USG-guided FNAC served as an effective initial diagnostic tool, whereas core biopsy provided definitive histopathological confirmation. A combined approach using radiology, cytology, and histopathology is essential for accurate diagnosis and appropriate management of hepatic lesions.

Recommendations

Larger multicenter studies are recommended. Combined use of imaging, cytology, and biopsy should be encouraged for accurate diagnosis.

Conflict of Interest

The authors declare no conflict of interest.

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