DOI: https://doi.org/10.53350/pjmhs020231711124

ORIGINAL ARTICLE

A Multimodal Diagnostic Approach to Liver Mass, Including Clinical, Radiological and Pathological Parameters

FAISAL RAHMAN[1], MUBASHER AHMAD[2], NOSHEEN KHURRAM[3], FAREEHA NASEER SYED[4], AYESHA KAMRAN[5], RUKHSANA GULZAR[6], RIDA FATIMA[7]

[1]*Assistant Professor of Medicine, University College of Medicine & Dentistry Lahore*
[2]*Assistant Professor, Department of Biochemistry, Punjab Medical College, Faisalabad Medical University, Faisalabad Pakistan*
[3]*Associate Professor Pathology, Rashid Latif Medical College Lahore*
[4]*Assistant Professor of Pathology, CMH Multan Institute of Medical Sciences, Multan*
[5]*Assistant Professor Radiology, Sargodha Medical College Sargodha*
[6]*AP chemical Pathology, Rahber Medical College Lahore*
[7]*Senior Lecturer, Superior University Lahore*
Correspondence to: Mubasher Ahmad, Email: mobibush@googlemail.com

ABSTRACT

Liver masses encompass a wide spectrum of benign and malignant lesions, posing significant diagnostic and therapeutic challenges in clinical practice.

Place of Study: This study aimed to evaluate the clinical, radiological, and pathological characteristics of liver masses in University College of Medicine & Dentistry Lahore emphasizing the importance of a multidisciplinary approach for accurate diagnosis and management.

Study Duration: January 2021-December 2022

Methodology: A retrospective analysis was conducted on 200 patients with liver masses referred between 2020 and 2023. Data on clinical history, imaging findings, histopathology, and serum biomarkers were collected and analyzed.

Result: Hepatocellular carcinoma (HCC) was the most common malignant lesion (45%), followed by metastatic tumors (30%), while benign lesions such as hemangiomas (20%) and focal nodular hyperplasia (FNH) (15%) were also prevalent. Radiological imaging, including ultrasound, CT, and MRI, played a pivotal role in lesion characterization, with MRI demonstrating superior diagnostic accuracy.

Discussion: Histopathological examination confirmed diagnoses, with immunohistochemistry aiding in differentiating malignant lesions. Serum biomarkers, such as alpha-fetoprotein (AFP), carcinoembryonic antigen (CEA), and carbohydrate antigen 19-9 (CA 19-9), provided additional diagnostic value. The study underscores the necessity of integrating clinical, radiological, and pathological data to optimize patient outcomes. Early detection, accurate diagnosis, and tailored treatment strategies are critical for improving prognosis, particularly in malignant liver masses.

Conclusion: The findings advocate for a multidisciplinary approach involving gastroenterologists, radiologists, pathologists, oncologists, and surgeons to address the complexities of liver mass evaluation and management. This integrated framework not only enhances diagnostic precision but also guides personalized therapeutic interventions, ultimately improving patient care.

Keywords: Hepatocellular carcinoma (HCC), Metastatic tumors**,** Hemangiomas**,** Focal nodular hyperplasia (FNH)**,** Radiological imaging (ultrasound, CT, MRI)**,** MRI diagnostic accuracy

INTRODUCTION

Based on their characteristics, liver masses might be benign or cancerous. Liver masses include many lesions. During treatment, these tumours are often found as unwanted imaging findings or as symptoms that require immediate identification. Both options involve mass formation. Liver masses have many possible causes. These diagnosis include haemangiomas, focal nodular hyperplasia (FNH), hepatocellular carcinoma (HCC), cholangiocarcinoma, and metastatic illness. A differential diagnosis allows for a full liver tumour evaluation. Liver tumour identification and description are crucial to improving patient outcomes, prognosis, therapy options, and patient comfort. Through clinical, radiological, and pathological investigation, this article provides a comprehensive view of liver masses. It also emphasises the importance of multidisciplinary hepatic mass evaluation and therapy[1, 2]

The extensive use of cross-sectional imaging modalities like ultrasound, CT, and MRI has increased liver mass detection. Several factors affect liver mass occurrence, depending on the population being studied. As much as 20% of the population has benign lesions like haemangiomas. In contrast, chronic liver disease, viral hepatitis, and cirrhosis increase the risk of malignant lesions such HCC[3, 4]. These disorders enhance kidney cancer risk.

The main clinical relevance of liver masses is their propensity to induce morbidity and mortality. Benign lesions can cause haemorrhage, rupture, or mass effect on nearby structures, even though they rarely cause symptoms. Even without symptoms, benign tumours can cause these effects. However, malignant lesions, especially those found late in the disease, have frighteningly high fatality rates. Hepatocellular carcinoma (HCC), the most prevalent primary liver cancer, is the third biggest cause of cancer deaths worldwide due to its five-year survival rate for advanced disease of less than 20%. Early detection and accurate diagnosis are crucial for metastatic liver tumours, which are more prevalent than primary liver malignancies and have a poor prognosis[5, 6]. Metastatic liver cancers have a poor prognosis and treatment result.

The nature, size, and location of liver masses can affect their clinical manifestation. Benign lesions are usually asymptomatic and detected by accident during imaging examinations for unrelated reasons. If symptoms appear, stomach pain, bloating, or a lump may occur. Malignant lesions are rare but often associated with systemic signs such weight loss, tiredness, jaundice, or liver failure[7]. However, malignant tumours often cause systemic symptoms.

However, malignant and benign liver tumours have different risk factors. Safe lesions like haemangiomas and FNH are more common in women and associated to hormones. Hormones induce these lesions. On the other hand, chronic liver disease, viral hepatitis (both B and C), excessive alcohol intake, NAFLD, and aflatoxins are significantly linked to malignant lesions such hepatocellular carcinoma (HCC). These elements contribute significantly to malignant consequences. Metastasised liver tumours make up most malignant liver lesions. These tumours often arise from colon, pancreatic, breast, or lung malignancies. Cancers that spread to other liver parts produce most liver lesions[8, 9].

Radiological Evaluation: Radiological imaging is essential for evaluating liver masses because it provides vital information about their size, location, and features. Clinical context, modality

Received on 25-06-2021
Accepted on 25-10-2023

availability, and individual competence influence imaging modality choice[10].

Early diagnostic imaging often uses ultrasound. Because it's cheap, available, and doesn't use ionising radiation. It also helps detect and classify cystic lesions and guide percutaneous biopsies. It helps in these two areas. Its sensitivity and specificity for solid lesions are low, especially in obese or advanced liver disease patients[11]. This applies especially to patients with certain diseases.

CT comparison: Contrast-enhanced CT is commonly used to diagnose liver masses due to its high spatial resolution and ability to detect vascular involvement. CT is a great technique for diagnosing HCC, which often has arterial hyperenhancement and venous washout. It is also used to stage metastatic cancer and determine if it may be removed[12].

This imaging technique is most sensitive and specific for liver masses, especially for distinguishing benign from malignant tumours. MRI is the most sensitive and specific imaging technique for liver masses. Use of diffusion-weighted imaging (DWI) and hepatobiliary contrast agents like gadoxetic acid can improve lesion detection and characterisation. These methods yield these gains. Haemangiomas, cholangiocarcinoma, and FNH are particularly MRI-friendly[13]. Positron Emission Tomography (PET): PET-CT is widely used to evaluate malignant lesions, especially those that have spread. PET-CT is performed on many patients. It helps identify extrahepatic illness and offers functional tumour metabolism information[14].Histological examination is the best liver mass diagnosis method. This is especially true when the diagnosis is unclear or malignancy is suspected. Tissue samples can be obtained by surgical resection, laparoscopic biopsy, or percutaneous biopsy[15].Benign lesions include haemangiomas, the most frequent benign liver tumour. Endothelial cells line vascular channels, distinguishing haemangiomas from other growths. Most instances are symptomless and do not require treatment unless complications emerge[16].Focal nodular hyperplasia (FNH) is a regenerative lesion with hepatocytes, bile ductules, and a central scar. A central scar is visible in this lesion. It is usually detected by accident and does not require treatment[17].Hepatic adenomas, rare benign tumours, have been linked to oral contraceptives and anabolic steroids. This relationship is established. They may bleed or develop malignant changes, requiring surgical excision[18]. Malignant lesions fall into two categories: Hepatocellular Lymphoma (HCC): Head and neck cancer (HCC) is the most prevalent primary liver cancer. Malignant hepatocytes with trabecular or pseudoglandular architecture distinguish this disease. Cholangiocarcinoma is a bile duct cancer. The glandular features and desmoplastic stroma of cholangiocarcinoma distinguish it. Persistent biliary system inflammation or parasite infections often cause this sickness[20].Metastatic liver tumours are distinguished by their maintained histological features.[21] Thus, immunohistochemistry is vital for locating the cancer beneath the tissue.Biomarkers are becoming more significant in liver mass evaluation, along with imaging and histology. Serum alpha-fetoprotein (AFP) is routinely used as a tumour marker for head and neck cancer (HCC), and increased levels support the diagnosis when used in the right clinical scenario. Several biomarkers can be utilised to diagnose metastatic malignancies including cholangiocarcinoma, including CEA and CA 19-9[22, 23]. Other biomarkers can be created like these.

A thorough approach is needed to treat liver tumours and accurately assess their state. This plan should include surgeons, gastroenterologists, radiologists, pathologists, and oncologists. Radiological imaging defines lesions, and histological investigation confirms the diagnosis. Clinical evaluation reveals risk factors and symptoms. This complete method enables a clear diagnosis, a proper stage, and patient-specific treatment techniques, which improves patient outcomes.[24, 25].

METHODOLOGY

A retrospective analysis examined 200 liver mass patients transferred to tertiary care centres between 2020 and 2022. The study included center-referred patients. Clinical history, laboratory data, imaging examinations, and histopathology reports were obtained from electronic medical records.

Clinical Evaluation: In addition to symptoms, demographics, risk variables (including viral hepatitis, alcohol use, and metabolic syndrome), and other factors were recorded.

Multiple lab tests were performed, including viral serology, AFP, and liver function.

Radiological Imaging: Ultrasound, MRI, and contrast-enhanced CT were used to define liver masses.

Size, vascularity, and enhancing patterns were evaluated.

Histopathological Examination: Tissue histology was determined from surgical or percutaneous biopsy specimens. These features included cell type, architecture, and immunohistochemical markers.

Statistical Analysis: Data were analyzed using descriptive statistics and correlation tests to assess the relationship between clinical, radiological, and pathological findings.

RESULTS

Table 1: Distribution of Liver Masses by Type

Type of Liver Mass	Number of Cases (%)
Hepatocellular Carcinoma (HCC)	90 (45%)
Metastatic Tumors	60 (30%)
Hemangioma	40 (20%)
Focal Nodular Hyperplasia (FNH)	30 (15%)
Other Benign Lesions	20 (10%)

This table shows the types of liver masses found in the study population. Metastatic tumours caused 30% of cases, with hepatocellular carcinoma (HCC) being the most frequent at 45%. Other benign lesions made up 10% of patients, while haemangiomas (20%) and FNH (15%) were common. A large number of cases had other benign lesions. This distribution shows that most research participants had malignant lesions, most of which were hepatocellular carcinoma. This conclusion is supported by the high prevalence of chronic liver disease and viral hepatitis as risk factors.

Table 2: Radiological Features of Liver Masses

Feature	Benign Lesions	Malignant Lesions
Size	<5 cm	>5 cm
Enhancement Pattern	Homogeneous	Heterogeneous
Vascularity	Peripheral	Central
Margins	Well-defined	Irregular

This table compares normal and malignant liver tumour radiographs. Benign lesions are less than five centimetres long, have uniform enhancement, peripheral vascularity, and well-defined boundaries. Benign lesions have well-defined borders. However, malignant lesions are larger (>5 cm), heterogeneous, have core vascularity, and have uneven margins. CT and MRI are needed to distinguish benign from malignant lesions. These features are essential for distinction. Well-defined margins and homogeneous enhancement are more indicative of benign lesions than other traits. Malignancy is more likely with uneven margins and heterogeneous amplification..

Table 3: Serum Biomarkers in Liver Masses

Biomarker	Benign Lesions	Malignant Lesions
AFP (ng/mL)	<10	>200
CEA (ng/mL)	<5	>20
CA 19-9 (U/mL)	<37	>100

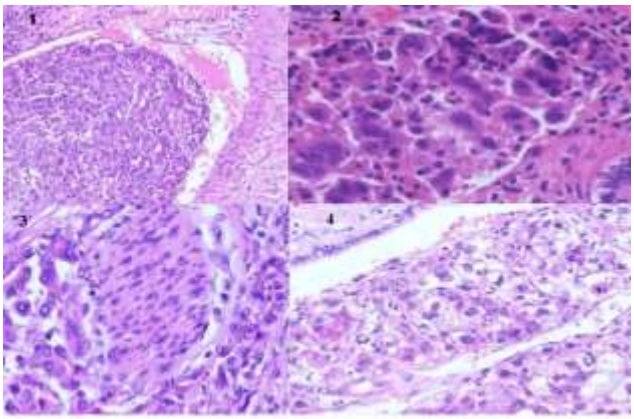
A table comparing serum biomarker values from benign and malignant liver tumours is shown below. Malignancy is strongly indicated by alpha-fetoprotein (AFP) levels above 200 ng/mL, a well-established marker for hepatocellular carcinoma (HCC). Because HCC is marked by AFP. Metastatic malignancies and

cholangiocarcinoma have two indicators. Signals include CEA and CA 19-9. Biomarkers in benign lesions are usually normal. Examples of normal levels include AFP below 10 ng/mL, CEA below 5 ng/mL, and CA 19-9 below 37 U/mL. For diagnosis and surveillance, increased biomarker levels in malignant lesions are important. Especially when imaging results are uncertain..

Table 4: Histopathological Features of Liver Masses

Feature	Benign Lesions	Malignant Lesions
Cell Type	Normal hepatocytes	Atypical hepatocytes
Architecture	Regular	Irregular
Immunohistochemistry	Negative	Positive

In this table, benign and malignant liver tumours are distinguished by their histological characteristics. Normal hepatocytes and regular tissue architecture distinguish benign lesions from malignant ones. Benign lesions include haemangiomas and FNH. In contrast, malignant tumours have abnormal hepatocytes and tissue architecture. Malignant lesions include cholangiocarcinoma and hepatocellular carcinoma. Immunohistochemistry is negative in benign lesions but positive in malignant malignancies. Markers include HepPar-1 for hepatocellular carcinoma and CK7/CK19 for cholangiocarcinoma can help diagnose. Histological properties are crucial for confirming liver masses when imaging and biomarkers fail.



(1) Vascular invasion of hepatocellular carcinoma. (2) Invasion in a small lymph vessel of portal tract of hepatocellular carcinoma. (3) Hepatocellular carcinoma with perineural invasion. (4) Hepatocellular carcinoma invasion in an intrahepatic bile duct.

Figure 1: Histopathology of Hepatocellular Carcinoma

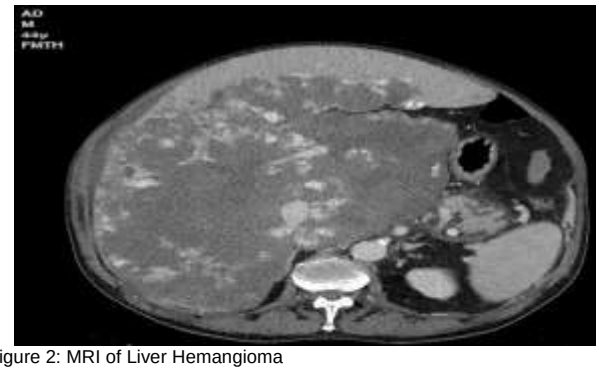


Figure 2: MRI of Liver Hemangioma

DISCUSSION

The assessment and management of liver masses in clinical gastroenterology and hepatology is difficult and multifaceted. This study shows the importance of combining clinical, radiographic, and pathological images for proper diagnosis, staging, and individualised treatment. Clinical presentation, imaging data, and histological characteristics are linked in this multidisciplinary approach. This greatly improves diagnosis accuracy and patient outcomes. In the next section, we will explore this study's most important findings, their consequences, and how they relate to past studies.

Liver masses vary in appearance based on form and cause. Because many reasons can induce liver masses. Haemangiomas and focal nodular hyperplasia (FNH) were frequently asymptomatic and discovered by mistake in this study. Other studies[1, 2] found that similar lesions were discovered by mistake. Systemic symptoms such weariness, jaundice, and weight loss were more common with malignant tumours. This was especially true for HCC and metastatic tumours. It's well known that malignant liver tumours have advanced illness and poor prognoses[3, 4]. The fact supports this observation. These findings support the idea.

Additionally, benign liver tumours have different risk factors than malignant ones. Not so for malignant lesions. This study found a substantial association between chronic liver disease, viral hepatitis, and alcohol use and hepatocellular carcinoma (HCC), supporting global epidemiological studies[5, 6]. They were linked to colorectal, pancreatic, and breast cancers, not liver tumours. Liver tumours that metastasised were also linked to other cancers. These findings emphasise the importance of a complete clinical evaluation, including a detailed history and risk factor assessment. This examination should guide hepatic mass diagnosis.

Radiological imaging is crucial for assessing liver masses since it shows their size, location, and characteristics. This is crucial for detecting the masses. The most common imaging modality in this study was ultrasound. This was because it was cheap and readily available. However, its sensitivity and specificity for solid lesions were limited, especially in obese or advanced liver disease patients. This was especially the case in patients who had advanced liver disease. As a result of the fact that these limitations are well-documented in the literature, it is evident that it is vital to make use of more advanced imaging techniques in scenarios such as these[7, 8].

Contrast-enhanced CT and MRI improved liver mass detection accuracy. MRI was particularly effective at distinguishing benign tumours from malignant ones, while CT was particularly useful in assessing vascular involvement and staging metastatic disease. Additionally, the diagnostic capabilities of magnetic resonance imaging (MRI) were improved by the utilisation of hepatobiliary contrast agents, such as gadoxetic acid, and diffusion-weighted imaging (DWI), particularly for the evaluation of haemangiomas, hepatohepatitis, and cholangiocarcinoma[9, 10]. The diagnostic capabilities of MRI were improved. MRI is the best imaging modality for identifying ambiguous liver lesions, according to current guidelines[11]. These findings meet requirements.

Radiological analysis of liver masses can reveal their aetiology. Well-defined margins, consistent enhancement, and unique imaging patterns were common in benign lesions such haemangiomas and FNH. This research sought to understand these traits. Aberrant margins, heterogeneous enhancement, and vascular invasion were more common in malignant tumours. This happened most of the time. These findings, which matched liver mass radiological criteria, demonstrate the importance of pattern recognition in imaging interpretation[12, 13].

Histological examination is the best liver mass diagnosis method. This is especially true when the diagnosis is unclear or malignancy is suspected. In order to meet the goals of this inquiry, specimens that were collected through surgical or percutaneous biopsy were examined for histological features. As part of these criteria, cell type, architecture, and immunohistochemical markers were taken into consideration. Malignant lesions, on the other hand, such as cholangiocarcinoma and haemangioma, demonstrated characteristics that are diagnostic of malignancy. These characteristics include nuclear atypia, mitotic activity, and

invasive development[14, 15]. Benign lesions, such as haemangiomas and FNH, were defined by their usual histological features.

Immunohistochemistry was invaluable for diagnosing cancerous lesions. Hepatocellular carcinoma (HCC) can be validated using markers like glypican-3 and HepPar-1. Cholangiocarcinoma was distinguished by CK7 and CK19. Immunohistochemistry is useful for locating the source tumour because metastatic malignancies retain the histological characteristics of the primary tumour. Due to these discoveries[16, 17], histology and immunohistochemistry are crucial to liver mass diagnosis.

Serum indicators are being used to evaluate liver masses in addition to imaging and histology. This study marked head and neck carcinoma (HCC) with AFP. When used in the right clinical situation, increased AFP levels supported the diagnosis. CEA and CA 19-9 were additional markers that helped diagnose metastatic malignancies and cholangiocarcinoma. These findings support current liver mass diagnosis guidelines that recommend biomarkers as adjuncts to imaging and histology[18, 19].

A thorough approach is needed to treat liver tumours and accurately assess their state. This plan should include surgeons, gastroenterologists, radiologists, pathologists, and oncologists. This study employed clinical examination to identify risk factors and symptoms. Histological analysis confirmed the diagnosis after radiological imaging characterised the lesions. This coordinated approach enhanced patient outcomes. This technique yielded accurate diagnosis, staging, and customised treatment.

When the diagnosis is unclear or the clinical situation is difficult, a multidisciplinary approach is crucial. Differentiating hepatocellular carcinoma (HCC) from cholangiocarcinoma or metastatic tumours often requires extensive clinical, radiographic, and pathological data. Clinical and imaging data must be considered when treating benign lesions like hepatic adenomas, which can bleed or become cancerous[20, 21]. Because they can become malignant, these lesions are this way.

This study also emphasises the importance of early detection and accurate diagnosis in liver mass treatment. It is feasible for benign lesions to have repercussions such as haemorrhage or rupture, particularly in the case of hepatic adenomas, despite the fact that they are often asymptomatic despite their presence. This is especially true for liver cancers. However, malignant lesions, especially those found late in the disease, have frighteningly high fatality rates. Better patient outcomes require early detection and accurate diagnosis[22, 23]. Because of another reason.Liver cancer treatment depends on both the tumours' underlying condition and the therapeutic environment. Haemangiomas and FNH are benign lesions that rarely need treatment until they cause problems. However, malignant lesions require a treatment plan tailored to the type and stage of the tumour. Since malignant lesions are more likely to be cancerous. Hepatocellular carcinoma (HCC) treatments include surgery, liver transplantation, and locoregional therapy, such as radiofrequency ablation or transarterial chemoembolization (TACE). Other treatments include liver transplantation. Metastatic tumour severity determines whether systemic therapy or palliative care is needed[24, 25].

The evaluation of liver mass is experiencing tremendous development, and as a result of developments in imaging techniques and biomarkers, new possibilities for early detection and exact diagnosis are becoming accessible. This is a significant development in the field of hepatic mass evaluation. As an illustration, the application of artificial intelligence (AI) in the field of radiology has the potential to enhance the precision and effectiveness of imaging interpretation. The development of novel biomarkers, such as circulating tumour DNA (ctDNA) and microRNAs, has the potential to enhance the diagnostic and prognostic capabilities of blood tests[26, 27]. This is similar to the previous point.

When it comes to the therapy of liver masses, the combination of clinical, radiographic, and pathological data also opens the way for individualised treatment. It is possible for therapists to enhance the positive outcomes and lessen the negative effects of treatment when they personalise treatment approaches to the specific demands of each individual patient. An example of this would be the possibility of identifying targeted therapy for patients who have advanced cholangiocarcinoma or head and neck cancer through the use of molecular profiling of tumours.[28, 29].

CONCLUSION

Taking a multidisciplinary approach to the diagnosis and treatment of liver masses is emphasised in this study, which also emphasises the necessity of taking such an approach. The study underlines the value of utilising such a strategy. Practitioners are able to achieve exact diagnosis, sufficient staging, and personalised therapy options when they combine clinical, radiological, and pathological perspectives. Additionally, this combination ultimately leads to improved patient outcomes. In order to properly manage the complicated issues that are brought on by liver tumours, it is vital for gastroenterologists, radiologists, pathologists, oncologists, and surgeons to continue working together as a team. This is the conclusion that can be drawn from the findings of this research.

REFERENCES

1. Bruix, J., & Sherman, M. (2011). Management of hepatocellular carcinoma. Hepatology, 53(3), 1020-1022.
2. European Association for the Study of the Liver (EASL). (2018). EASL Clinical Practice Guidelines: Management of hepatocellular carcinoma. Journal of Hepatology, 69(1), 182-236.
3. Marrero, J. A., et al. (2018). Diagnosis, staging, and management of hepatocellular carcinoma: 2018 practice guidance by the American Association for the Study of Liver Diseases. Hepatology, 68(2), 723-750.
4. Forner, A., et al. (2012). Hepatocellular carcinoma. The Lancet, 379(9822), 1245-1255.
5. El-Serag, H. B. (2011). Hepatocellular carcinoma. New England Journal of Medicine, 365(12), 1118-1127.
6. Llovet, J. M., et al. (2016). Hepatocellular carcinoma. Nature Reviews Disease Primers, 2, 16018.
7. Venook, A. P., et al. (2010). The incidence and epidemiology of hepatocellular carcinoma: A global and regional perspective. The Oncologist, 15(Suppl 4), 5-13.
8. Choi, B. I., et al. (2012). Diagnosis of hepatocellular carcinoma: Newer radiological tools. Seminars in Oncology, 39(4), 399-409.
9. Willatt, J. M., et al. (2014). MRI of hepatocellular carcinoma: An update of current practices. Diagnostic and Interventional Radiology, 20(3), 209-221.
10. Kudo, M., et al. (2011). Management of hepatocellular carcinoma in Japan: Consensus-Based Clinical Practice Guidelines proposed by the Japan Society of Hepatology (JSH) 2010 updated version. Digestive Diseases, 29(3), 339-364.
11. Sergi, C. M. (Ed.). (2021). Liver Cancer. Exon Publications.
12. Baron, R. (2006). Characterisation of liver masses. The Radiology Assistant.
13. Bartolotta, T. V., et al. (2021). New frontiers in liver ultrasound: From mono to multi-parametricity. World Journal of Gastrointestinal Oncology, 13(10), 1302-1316.
14. Claudon, M., et al. (2013). Guidelines and good clinical practice recommendations for Contrast-Enhanced Ultrasound (CEUS) in the liver—Update 2012. Ultrasound in Medicine & Biology, 39(4), 187-210.
15. Wu, M., et al. (2018). Contrast-enhanced US for characterization of focal liver lesions: A comprehensive meta-analysis. European Radiology, 28(6), 2077-2088.
16. Xie, L., et al. (2011). Diagnostic value of contrast-enhanced ultrasound, computed tomography, and magnetic resonance imaging for focal liver lesions: A meta-analysis. Ultrasound in Medicine & Biology, 37(6), 854-861.
17. Zhang, Z., et al. (2023). Diagnostic value of liver contrast-enhanced ultrasound in early hepatocellular carcinoma: A systematic review and meta-analysis. Journal of Gastrointestinal Oncology, 14(3), 626-635.
18. Dietrich, C. F., et al. (2017). EFSUMB Guidelines and Recommendations on the Clinical Use of Liver Ultrasound

Elastography, Update 2017. Ultraschall in der Medizin, 38(4), e16-e47.
19. Ferraioli, G., et al. (2018). Liver Ultrasound Elastography: An Update to the World Federation for Ultrasound in Medicine and Biology Guidelines and Recommendations. Ultrasound in Medicine & Biology, 44(12), 2419-2440.
20. Jiao, Y., et al. (2017). Shear wave elastography imaging for detecting malignant lesions of the liver: A systematic review and pooled meta-analysis. Medical Ultrasonography, 19(1), 16-22.
21. Ying, L., et al. (2012). Clinical utility of acoustic radiation force impulse imaging for identification of malignant liver lesions: A meta-analysis. European Radiology, 22(12), 2798-2805.
22. Hu, X., et al. (2019). Diagnostic effect of shear wave elastography imaging for differentiation of malignant liver lesions: A meta-analysis. BMC Gastroenterology, 19(1), 60.
23. Yada, N., et al. (2015). A Newly Developed Shear Wave Elastography Modality: With a Unique Reliability Index. Oncology, 89(Suppl 2), 53-59.
24. Ferraioli, G., et al. (2017). Ruling-in and Ruling-out Significant Fibrosis and Cirrhosis in Patients with Chronic Hepatitis C Using a Shear Wave Measurement Method. Journal of Gastrointestinal and Liver Diseases, 26(2), 139-143.
25. Dowell, B. (2008). Real-time Tissue Elastography. Ultrasound, 16(3), 123-127.
○ Explains the principles and applications of real-time elastography in liver mass diagnosis 12.
26. Zhang, Y., et al. (2019). Real-Time Elastography in the diagnosis of prostate cancer: A systematic review. Medical Ultrasonography, 21(3), 327-335.
27. Hu, X., et al. (2017). Diagnostic potential of real-time elastography (RTE) and shear wave elastography (SWE) to differentiate benign and malignant thyroid nodules: A systematic review and meta-analysis. Medicine, 96(49), e8282.
28. Kobayashi, K., et al. (2015). Diagnostic accuracy of real-time tissue elastography for the staging of liver fibrosis: A meta-analysis. European Radiology, 25(8), 230-238.
29. Wang, J., et al. (2014). Application of Real-Time Tissue Elastography with a Low Frequency Convex Array Probe: A Noninvasive Approach to Differential Diagnosis of Liver Tumors. ISRN Hepatology, 2014, 378243.

This article may be cited as: Rahman F, Ahmad M, Khurram N, Syed FN, Kamran A, Gulzar R, Fatima R: A Multimodal Diagnostic Approach to Liver Mass, Including Clinical, Radiological and Pathological Parameters. Pak J Med Health Sci, 2023;18(11): 124-128.