Original Article

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Role of Triphasic MRI in the Evaluation of Focal Hepatic Lesions with Histopathological Correlation

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Abstract

Pathologies of hepatic lesions ranges from benign lesions like hemangioma, hepatic adenoma and cyst to malignant lesions like primary hepatocellular carcinoma and metastases. In the clinical context, focal hepatic lesions are a daily challenge. Non-invasive diagnosis of liver abnormalities is typically accomplished using contrast- enhanced Magnetic Resonance (MR) imaging. Due to its higher soft tissue resolution, multiplanar capability and lack of radiation triphasic MRI has recently proven to be the ideal approach for the evaluation of focal hepatic lesions. This study aimed to determine the role of triphasic MRI in the evaluation of focal hepatic lesions and their correlation with histopathological findings. This study was carried out in the Department of Radiology and Imaging, BSMMU, Dhaka. The study was conducted among patients with focal hepatic lesions during the period from the date of September 2021 to August 2023 on 48 patients. Triphasic MRI were done then findings compared with the histopathology findings. Sensitivity, specificity and accuracy were calculated for diagnostic validity of triphasic MRI. In this study observed that majority (27.1%) of the patients belonged to age 51-60 years. The mean age was found 49.7±13.8 years with range from 20 to 73 years. Almost two third (64.6%) of the patients were male and 17(35.4%) patients were female, male female ratio was 1.8:1. Malignant lesions were found 33(68.8%) patients and benign lesions were 15(31.3%). Most common malignant lesion was HCC followed by metastasis and benign lesion was hemangioma followed by hepatic adenoma, hepatic cyst. Triphasic MRI has high sensitivity and specificity in the evaluation of the focal hepatic lesions. Triphasic MRI detects and characterizes focal hepatic lesions by their characteristic appearance and specific contrast enhancement patterns. It has several advantages like multiplanar capability, higher soft tissue contrast and lack of ionizing radiation.

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Introduction

Liver lesions can be categorized into focal and diffuse liver lesions. Focal liver lesions have a broad spectrum of pathologies ranging from benign liver lesions such as hemangioma, cyst, adenoma, FNH to malignant lesions such as primary hepatocellular carcinoma and metastasis.[1] Evaluation of focal hepatic lesions are one of the diagnostic challenges in daily practice.[2] Imaging is a crucial step in diagnosing these conditions as liver enzymes can elevate in 8% of people in the U.S. A combination of medical history, serologic, and radiologic investigations can provide the diagnosis in most of

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these cases.[3] Diagnosis of focal liver lesions noninvasively is usually achieved with contrast material-enhanced computed tomography and Magnetic Resonance (MR) imaging. Dynamic three-dimensional gradient-recalled-echo MR imaging provides dynamic contrast-enhanced thin-section images with fat saturation and a high signal-to-noise ratio and is excellent for the evaluation of various focal hepatic lesions.[4] Dynamic contrast enhanced MRI demonstrates characteristics pattern of enhancement in various phases in the form of arterial, porto- venous and delayed phases that can be helpful in the diagnosis of benign and malignant focal hepatic lesions.[2] Detection and characterization of focal liver lesions accurately is paramount for appropriate treatment in a wide variety of clinical settings. It is a common diagnostic problem referred to radiologists for evaluation owing to its non-specific clinical presentation and marked inter-observer variation on clinical examination. Modern operative techniques and local therapies such as Radiofrequency (RF)/microwave ablation are effective methods to treat liver metastases or HCC. Therefore, the determination of liver lesions count, and the nature of the lesions are important.[4] For the detection of focal liver lesions optimal imaging modality has been robustly debated over the past two decades. Imaging modalities currently available to specifically evaluate focal liver lesions include transabdominal and intraoperative ultrasound, triphasic Computed Tomography (CT), Computed Tomographic Arterial portography (CTAP), and MRI enhanced with one or more types of contrast agent. These are often complementary and various combinations may be appropriate in different clinical settings. Dynamic three-dimensional gradient-recalled echoes MR imaging is a widely available non-invasive method of complete liver evaluation which provides dynamic contrast-enhanced thin-section images with fat saturation and a high signal-to-noise ratio. This is due to the high intrinsic soft-tissue contrast, improved biochemical and anatomic information, multiplanar capability, and lack of ionizing radiation that MRI has passed away all other liver imaging modalities.[5] It is the most sensitive and specific modality to show the focal liver lesions.[5,6] Sensitivity is required in the accurate diagnosis of focal liver lesions, whereas specificity prevents incorrect labeling of some inoperable tumors as being operable and thus unnecessary interventions in patients.[7] Its high intrinsic contrast allows the detection of small lesions, while the characteristics of the signal intensity on T1- and T2-weighted images allows the characterization of each lesion, with very high specificity in differentiating benign from malignant lesions.[8] The faster MRI scanning techniques presently available permit the dynamic assessment of contrast enhancement, which permits improved characterization of focal hepatic lesions, including regenerative nodules, dysplastic nodules, and hepatocellular carcinoma.[4] Correct identification of benign lesions (e.g., hemangioma) will prevent unnecessary invasive procedures and post procedural complications. Reliable detection and characterization of focal hepatic lesions are critical for appropriate patient management.[2] During initial staging, after treatment, and during follow-up, the status of the liver helps to predict patient outcome with many neoplasms, even those treated with only radiation or chemotherapy. Specific interventions rely on imaging for planning or guidance including cryoablation, laser photocoagulation, radiofrequency/ microwave ablation, percutaneous ethanol injection, surgical resection, and transplantation. In general, magnetic resonance imaging (MRI) has become the modality of choice for the characterization of focal

liver disease (Kotnis *et al.* 2021).[4] Benign lesions such as cyst, hemangioma, abscesses, focal nodular hyperplasia (FNH) or adenoma, can be distinguished from malignant lesions. In a non-cirrhotic liver, the most common malignant lesions are metastases. In the cirrhotic liver hepatocellular carcinoma is of considerable importance.[9] The radiologist's primary task is to maximize tumor detection, because missing the diagnosis of HCC may preclude potentially curative therapies (Galia *et al.* 2014).[10] DCE enables MRI of the liver with high temporal and spatial resolution improves evaluation of focal liver lesions by arterial, porto- venous and equilibrium phases. DCE MRI has potential benefits in terms of detection and characterization of focal hepatic lesions and in monitoring therapy.[11] It should be the modality of choice for hepatic lesions which are undetected or doubtful on ultrasound and CT examinations.[4]

Objectives

General objective:

- To assess the role of triphasic MRI in the evaluation of focal hepatic lesions.

Specific objectives:

- To diagnose and characterize focal hepatic lesions by triphasic MRI.
- To diagnose focal hepatic lesions by histopathology.
- To compare MRI findings with histopathological diagnosis of focal hepatic lesions.
- To calculate the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of triphasic MRI in the evaluation of focal hepatic lesions.

Methods

This was a cross-sectional study carried out in the Department of Radiology and Imaging, BSMMU, Dhaka, Bangladesh. Duration of study: This study was conducted from September 2021 to August 2023. People with focal hepatic lesions, irrespective of age and sex after fulfilling the inclusion and exclusion criteria.

Inclusion criteria:

- USG showed focal hepatic lesions.
- CT scan showed focal hepatic lesions.

Exclusion criteria:

- Patient who had one or more of the absolute or relative MRI contraindications like having MRI incompatible implants, cardiac pacemakers, cochlear implants, renal failure etc.
- Patients who already underwent biopsy
- Pregnant patients.
- Patients who had known hypersensitivity to contrast media.

Sampling technique: Purposive sampling. Patients who had focal hepatic lesions diagnosed at ultrasonography/CT scan was taken as study sample. Informed written consent was taken. Triphasic MRI was performed and finding was compared with the histopathological findings.

Study procedure: This study was carried out in the Department of Radiology and Imaging, BSMMU. The study was conducted among patients with focal hepatic lesions during the period from the date of September 2021 to August 2023. Formal ethical clearance from the Institutional Review Board of Bangabandhu Sheikh Mujib Medical University (BSMMU) was obtained prior to the study. Target sample size was 48. Patients having focal hepatic lesions diagnosed by USG/CT scan were briefed regarding the study purpose, method, benefit and hazard of the study. Inform written consent was taken from each of the selected patients or their legal guardians. Patients were examined by triphasic MRI. The interpretation of triphasic MRI was done by senior radiologists. Biopsy was done by USG guided then sample was sent to pathology department for histopathology examination. Then findings of triphasic MRI were compared with histopathology findings. The data were collected by a data collection sheet which

includes history, triphasic MRI findings and histopathology findings by the researcher himself. The data capturing master sheet was maintained throughout.

Statistical analysis of data: All the relevant collected data were compiled on the master chart first and statistical analyses were carried out by using the Statistical Package for Social Sciences version 25.0 for Windows (SPSS Inc., Chicago, Illinois, USA). A descriptive analysis was performed for all data. The qualitative/categorical variables were described as frequencies and percentages. All the continuous variables were summarized using measures of central tendency and dispersion such as mean, median, percentiles and standard deviation.

Ethical consideration: Prior to the commencement of this study, the research protocol was approved by the ethical committee of Institutional Review Board and department of Radiology and Imaging, BSMMU, Shahbagh, Dhaka (BSMMU/2022/5157). The aims and objective of the study along with its procedure, alternative diagnostic methods, risk and benefits was explained to the patients in easily understandable local language and then informed consent was taken from each patient. It was assured that all information and records would be kept confidential, unauthorized persons didn't have any access to the data. It was assured that he/she was having the right of refusal to join the study and withdrawal from the study at any time. If any respondent withdraw himself/ herself from the study that was not interfere with his/her treatment. The participants didn't gain financial benefit from this study. The procedure was helpful for both the physician and patients in making rational approach regarding management of the case. To avoid biasedness, MRI reports were done by several senior radiologists.

Results

This cross-sectional study was conducted in the Department of Radiology & Imaging, BSMMU, Dhaka, Bangladesh in collaboration with Department of Pathology. After careful history taking, examination and fulfilling inclusion & exclusion criteria, total 48 patients with focal hepatic lesions were included in this study. The findings derived from data analysis are furnished below:

Table 1: Distribution of the study patients by age (n=48)

Age (Years)	Number of patients	Percentage
≤30	6	12.5
31-40	7	14.6
41-50	11	22.9
51-60	13	27.1
61-70	10	20.8
>70	1	2.1
Mean±SD	49.7±13.8	
Range (min-max)	20.0-73.0	

Table 1 shows that majority (27.1%) of the patients belonged to age 51-60 years. The mean age was found 49.7±13.8 years with range from 20 to 73 years.

Table 2: Distribution of the study patients according to presenting complaints (n=48)

Clinical presentation	Number of patients	Percentage
Abdominal pain	46	95.8
Jaundice	19	39.6
Others	10	21.0

*Multiple response shows

Table 2 shows that 46(95.8%) patients had abdominal pain, 19(39.6%) had jaundice and 10(21.0%) had other complaints.

Table 3: Distribution of the study patients according to multiplicity of lesions (n=48)

Number of lesions	Number of patients	Percentage
Single	27	56.3
Multiple	21	43.8

Table 3 shows that 27(56.3%) patients had single lesion and 21(43.8%) had multiple lesions.

Table 4: Distribution of the study patients according to site of lesions (n=48)

Site of lesions	Number of patients	Percentage
Right lobe	29	60.4
Left lobe	6	12.5
Both	13	27.1

Table 4 shows that majority 29(60.4%) patients had right lobe involvement.

Table 5: Distribution of the study patients according to triphasic MRI diagnosis (n=48)

MRI findings	Number of patients	Percentage
HCC	25	52.1
Metastasis	9	18.8
Hemangioma	11	22.9
Hepatic adenoma	1	2.1
Hepatic cyst	2	4.2

In triphasic MRI diagnosis, 25(52.1%) patients were diagnosed as HCC followed by 11 (22.9%) hemangioma, 9 (18.8%) metastasis, 1 (2.1%) hepatic adenoma and 2 (4.2%) hepatic cyst.

Table 6: Distribution of the study patients according to nature of the lesion

MRI diagnosis	Number of patients	Percentage
Malignant	34	70.8
Benign	14	29.2

Table 6 shows majority 34(70.8%) patients were diagnosed as malignant and 14(29.2%) benign lesions.

Table 7: Distribution of the study patients according to histopathological diagnosis (n=48)

Histopathological findings	Number of patients	Percentage
HCC	25	52.1
Metastasis	8	16.7
Hemangioma	11	22.9
Hepatic adenoma	2	4.2
Hepatic cyst	2	4.2

In histopathological diagnosis, HCC were found in 25(52.1%) patients followed by hemangioma in 11(22.9%), metastasis in 8(16.7%), hepatic adenoma in 2(4.2%) and hepatic cyst in 2(4.2%).

Table 8: Distribution of the study patients according to nature of the lesion diagnosed at histopathology (n=48)

Histopathological diagnosis	Number of patients	Percentage
Malignant	33	68.8
Benign	15	31.3

In histopathological diagnosis, 33(68.8%) patients were diagnosed as malignant and 15(31.3%) were benign lesions.

Table 9: Comparison between triphasic MRI findings with histopathological diagnosis in evaluation of HCC (n=48)

MRI diagnosis	Histopathological diagnosis		Total
	Present	Absent	
Present	23 (True positive)	2 (False positive)	**25**
Absent	2 (False negative)	21 (True negative)	**23**
Total	**25**	**23**	**48**

P= 0.001

Table 9 shows that triphasic MRI diagnosis in evaluation of HCC, true positive cases were 23, false positive cases were 2, false negative cases were 2 and true negative cases were 21 in comparison to histopathology.

Table 10: Comparison between triphasic MRI findings with histopathological diagnosis in evaluation of metastases (n=48)

MRI diagnosis	Histopathological diagnosis		Total
	Present	Absent	
Present	7 (True positive)	2 (False positive)	**9**
Absent	1 (False negative)	38 (True negative)	**39**
Total	**8**	**40**	**48**

Table 10 shows that triphasic MRI diagnosis in evaluation of metastasis, true positive cases were 7, false positive case were 2, false negative case was 1 and 38 true negative cases were identified in comparison to histopathology.

Table 11: Comparison between triphasic MRI findings with histopathological diagnosis in evaluation of hemangioma (n=48)

MRI diagnosis	Histopathological diagnosis		Total
	Present	Absent	
Present	11 (True positive)	0 (False positive)	**11**
Absent	0 (False negative)	37 (True negative)	**37**
Total	**11**	**37**	**48**

P= 0.001

Table 11 shows that triphasic MRI diagnosis in evaluation of hemangioma, true positive cases were 11 and 37 true negative cases were identified in comparison to histopathology.

Table 12: Comparison between triphasic MRI findings with histopathological diagnosis in evaluation of hepatic adenoma (n=48)

MRI diagnosis	Histopathological diagnosis		Total
	Present	Absent	
Present	1 (True positive)	0 (False positive)	**1**
Absent	1 (False negative)	46 (True negative)	**47**
Total	**2**	**46**	**48**

Table 12 shows that triphasic MRI diagnosis in evaluation of hepatic adenoma, true positive case was 1, false negative case was 1 and 46 true negative cases were identified in comparison to histopathology.

Table 13: Comparison between triphasic MRI findings with histopathological diagnosis in evaluation of hepatic cyst (n=48)

MRI diagnosis	Histopathological diagnosis		Total
	Present	Absent	
Present	2 (True positive)	0 (False positive)	**2**
Absent	0 (False negative)	46 (True negative)	**46**
Total	**2**	**46**	**48**

Table 13 shows that triphasic MRI diagnosis in evaluation of hepatic cyst, true positive cases were 2 and 46 true negative cases were identified in comparison to histopathology.

Table 14: Validity of triphasic MRI in the evaluation of focal hepatic lesions (Separately for each lesion)

Validity test	HCC	Metastasis	Hemangioma	Hepatic adenoma	Hepatic cyst
Sensitivity	92.0	87.5	100.0	50.0	100.0
Specificity	91.3	95.0	100.0	100.0	100.0
Accuracy	91.7	93.8	100.0	97.9	100.0
PPV	92.0	77.8	100.0	100.0	100.0
NPV	91.3	97.4	100.0	97.9	100.0

Table 14 shows the validity of triphasic MRI in evaluation of focal hepatic lesions which was represented by calculating sensitivity, specificity, accuracy, positive and negative predictive values taken into account histopathology as gold standard. In case of HCC sensitivity was found 92.0%, specificity 91.3%, accuracy 91.7%, PPV 92.0% and

NPV 91.3%. In metastasis sensitivity was found 87.5%, specificity 95.0%, accuracy 93.8%, PPV 77.8% and NPV 97.4%. In Hepatic adenoma sensitivity was found 50.0%, specificity 100.0%, accuracy 97.9%, PPV 100.0% and NPV 97.9%. In hemangioma and hepatic cyst sensitivity, specificity, accuracy, PPV and NPV were found 100.0% respectively.

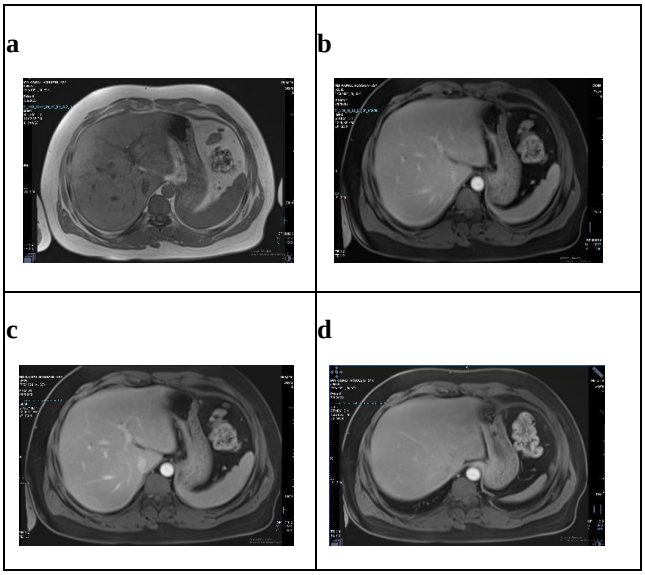

Figure 1: Shows precontract T1W (a) image, arterial (b), porto-venous (c) and equilibrium (d) phase. (Photo taken from radiology and imaging department of BMU).

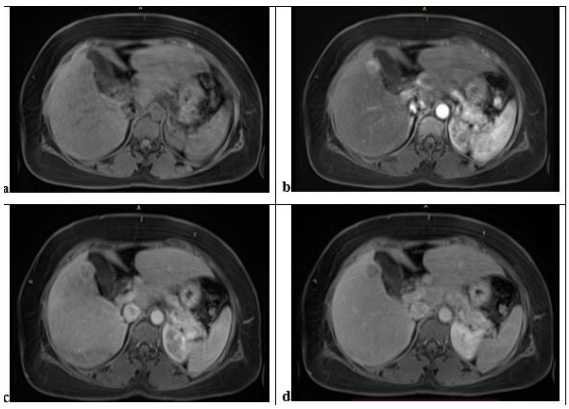

Figure 2: Case of Hepatocellular. Small hepatic lesion shows following features: hypointense on precontrast T1W (a) image, moderate enhancement noted at arterial (b) phase, washout noted at porto-venous (c) and equilibrium (d) phases. (Photo taken from radiology and imaging department of BSMMU)

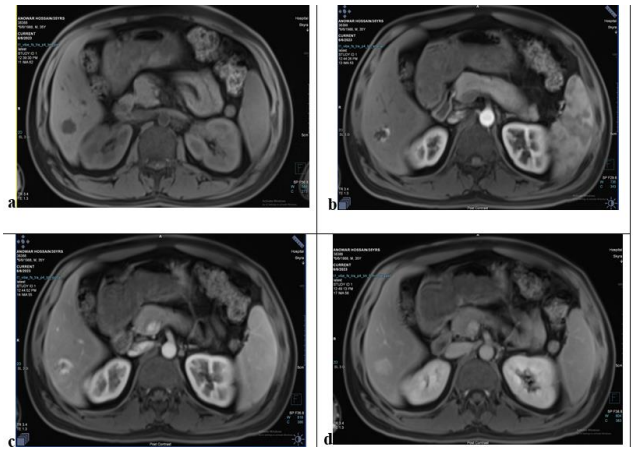

Figure 3: Case of Hepatic Metastases . Hepatic lesion show following features: hypointense on precontrast T1W (a) image, peripheral nodular discontinuous enhancement noted at arterial (b) phase, centripetal fill in noted at porto-venous (c) and equilibrium (d) phases. (Photo taken from radiology and imaging department of BSMMU)

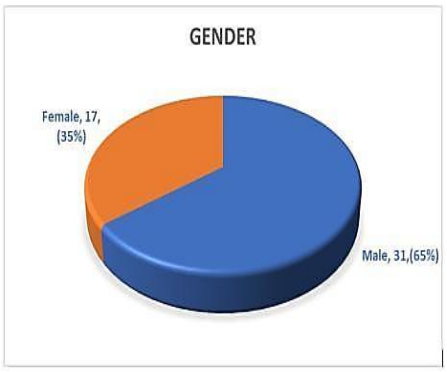

Figure 4: Distribution of the study patients according to Gender (n=48)

Figure 4 shows that almost two third (64.6%) of the patients were male and 17(35.4%) patients were female. Male female ratio was 1.8:1.

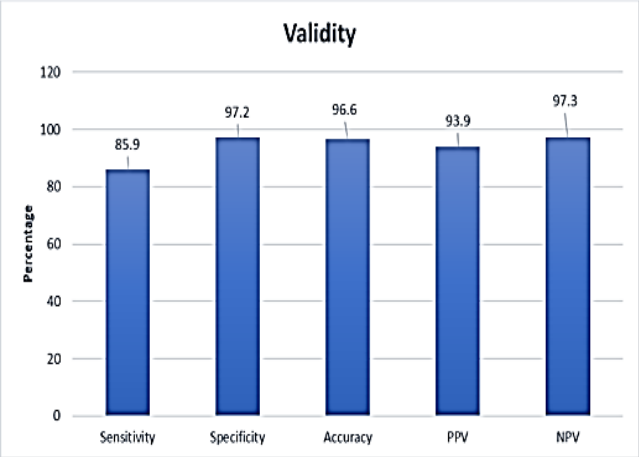

Figure 5: Average validity of triphasic MRI in the evaluation of focal hepatic lesions

Discussion

Triphasic MRI is currently considered to be the most accurate noninvasive technique in the evaluation of focal hepatic lesions. It is essential to distinguish between benign and malignant hepatic lesions because of their clinical implications. In this study we investigated the usefulness of triphasic MRI in the evaluation of focal hepatic lesions. In this study observed that majority (27.1%) of the patients belonged to age 51-60 years. The mean age was found 49.7±13.8 years with range from 20 to 73 years. Kotnis *et al.* (2021)[4] reported age group of 15 to 84 years with a mean age of 48 years. Youssef *et al.* (2021)[12] observed age ranged from 30 to 67 years with mean 48.8 years. Aziz *et al.* (2018)[13] reported maximum percentage of patients were in age ≤50 years (60%). Mean age of patients in the study was 47.7 years. Yeli *et al.* (2020)[1] observed ages varies between 30 to 71 years, with a mean age group of 54 years. Derkar, *et al.* (2022)[2] most common in the age-group of 71-80 years seen in 7 cases (23%), followed by 61- 70 years seen in 6 cases (20%), while benign lesions were 3 (10%) in number each in the age group of 41-50 years, 51-60 years & 61-70 years. Ali *et al.* (2017)[14] observed age ranged from 30 to 71 years with a mean age of 52 years. Previous studies demonstrated a relatively higher patient age range compared to this study which may be caused due to the differences in the patient demography. In this study observed that almost two third 31(64.6%) of the patients were male and 17(35.4%) patients were female. Male female ratio was 1.8:1. Kotnis *et al.* (2021)[4] reported 25 males and 17 female patients with male predominance were included in this study. Yeli *et al.* (2020)[1] reported 38 were male and 12 were female. Ali *et al.* (2017)[14] reported 28 were male and 12 were female. Derkar and Bagga, (2022)[2] reported majority of the focal hepatic lesions were found in males comprising of 19 patients (63%) & females about 11 patients (37%). Hasan *et al.* (2016)[15] showed focal hepatic lesion in 26 (64%) male patients and 14 (36%) female patients out of 40 patients. Previous studies demonstrated similar findings. In this study, single lesion was found 27(56.3%) patients and multiple lesions were found 21(43.8%) patients. Aziz Ali *et al.* (2018)[13] reported that single lesion was found 22(73.3%) patients and multiple lesions were found 8(26.7%) patients. Previous study demonstrated a relatively higher single lesion compared to this study due to the BSMMU is a tertiary level hospital. People came this hospital lately. In this study right lobe of liver involved in 29(60.4%) patients, left lobe involved in 6(12.5%) patients, both lobes involved in 13(27.1%) patients. Kotnis *et al.* (2021)[4] reported that right lobe involved in 27(64%) patients, left lobe involved in 4(9%) patients, both lobes involved in 11(26%) patients. According to Youssef *et al.* (2021)[12], 40.5% of patients had lesions on their right lobe where as 22.5% had lesions on their HCC left lobe and 7.5% both lobes. Previous studies demonstrated similar findings. In this study, 25 (52.1%) patients were

diagnosed as followed by 11(22.9%) hemangioma, 8(16.7%) metastasis, 2(4.2%) in hepatic adenoma and 2(4.2%) in hepatic cyst. Derkar and Bagga, (2022)[2] most common pathology detected was metastasis seen in 8 cases (27%) followed by HCC 7(23%), hemangioma 4(13%), hepatic abscess and hepatic cyst 3(10%), intrahepatic cholangiocarcinoma 2(7%). Youssef *et al.* (2021)[12] reported 23% had HCC, one fifth had hemorrhagic cyst and the same percentage had metastatic lesion, adenoma 7.5%. Yeli *et al.* (2020)[1] reported benign tumors (7 cases of hemangioma, 1 case of abscess, 4 cases of regeneration nodules, and 4 cases of simple hepatic cysts), malignant tumors (28 cases of HCC, 3 secondaries), 2 cases of dysplastic nodules, and 1 case of focal fat infiltration region. Ali *et al.* (2017)[14] observed 18(45%) HCC, 7(17.5%) hemangioma, 4(10%) cyst, regenerative nodule 4(10%), abscess 1(2.5%), metastasis 3(7.5%), focal fat infiltration 1(2.5%). Aziz Ali *et al.* (2018)[13] Hemangioma (36.7%), simple hepatic cyst (20.0%), abscess (13.3%), hydatid cyst (3.3%), adenoma (6.7%), and focal nodular hyperplasia (10%).Debees *et al*. (2016)[16] reported the benign lesions were 2 adenomas (5%), 2 cysts (5%), 5 hemangiomas (12%) and 6 regeneration nodules (14%). Among 27 malignant hepatic lesions 15 HCC (35%), 10 metastases (24%) and 2 cholangiocarcinoma (2%). In compared to previous study this study demonstrated more patients diagnosed were HCC due to most of the patients were cirrhotic. In this study, there were no lesions diagnosed as focal nodular hyperplasia, regenerative nodule, intrahepatic cholangiocarcinoma. In present study, most of the patients were diagnosed as malignant 33(68.8%) and 15(31.3%) were benign. Derkar and Bagga, (2022) [2] observed that among 30 patients 18 patients had malignant lesions whereas 12 patients had benign lesions. Kotnis *et al.* (2021)[4] reported among 42 patients, 14 (33.3%) had benign lesions, 22 (52%) had malignant lesions, 5 (11%) had infective lesions and 1 (2%) had a pseudolesion. Youssef *et al.* (2021)[12] reported, 52.5% had malignant growth while the remaining 47.5% had benign lesions. A. Ali *et al.* (2017)[14] reported that among 30 patients 18 focal lesions are benign and 21 are malignant, one focal fatty infiltration. Yeli *et al*. (2020)[1] observed that among 50 patients 18 focal lesions are benign and 31 are malignant. Previous study demonstrated similar findings. In this study observed that, triphasic MRI diagnosis in evaluation of HCC, true positive cases were 23, false positive cases were 2, false negative cases were 2 and 21 true negative cases were identified in comparison to histopathology. Use of these findings as diagnostic criteria for hepatocellular carcinoma has a sensitivity of 74 to 80% and a specificity of 89 to 97%. Debees *et al*. (2016)[16] reported after revising imaging results and histopathological examinations, dynamic MRI revealed 17 truly positive (benign and malignant) lesions, 3 false negative (radiological pattern of regeneration nodule proved to be HCC and one adenoma proved to be metastatic deposit), 8 true negative and 2 false positive (radiological pattern of HCC proved to be regeneration nodules), with sensitivity 85.0%, specificity 80.0% and 83.3% accuracy. Present study observed that triphasic MRI diagnosis in evaluation of metastasis, true positive cases were 7, false positive case were 2, false negative case was 1 and 38 true negative cases were identified in comparison to histopathology/ cytopathology. Present study observed that triphasic MRI diagnosis in evaluation of hemangioma, true positive cases were 11 and 37 true negative cases were identified in comparison to cytopathology. Present study observed that triphasic MRI diagnosis

in evaluation of hepatic adenoma, true positive case was 1, false negative case was 1 and 46 true negative cases were identified in comparison to histopathology/cytopathology. Present study observed that triphasic MRI diagnosis in evaluation of hepatic cyst, true positive cases were 2 and 46 true negative cases were identified. Current study observed the average validity of MRI in the evaluation of focal hepatic lesions which was represented by calculating sensitivity was 85.9%, specificity was 97.2%, accuracy was 96.6%, positive predictive value was 93.9 and negative predictive value was 97.3% taken into account histopathology as gold standard. In case of HCC 92.0% sensitivity, 91.3% specificity, 91.7% accuracy, 92.0% PPV and 91.3% NPV. In case of metastasis 87.5% sensitivity, 95.0% specificity,93.8% accuracy, 77.8% PPV and 97.4% NPV. In case of hepatic adenoma 50.0% sensitivity, 100.0% specificity, 97.9% accuracy, 100.0% PPV and 97.9% NPV. Hemangioma and hepatic cyst have 100.0% sensitivity, specificity, accuracy, PPV and NPV respectively. Kotnis *et al.* (2021)[4] showed specificity (90.4%) in characterizing the focal liver lesions with gadolinium enhanced MRI. Specificity for HCC was 96.7%, sensitivity was 89% and metastases was 97%, sensitivity was 100% for hemangioma. Youssef *et al.* (2021)[12] reported, sensitivity was 100%, specificity 90.5%, positive predictive value 90.5%, negative predictive value 100% and accuracy 95%. Maurea *et al.* (2014)[17] reported that for MR imaging, diagnostic accuracy, sensitivity, specificity, positive (PPV) and negative (NPV) predictive values were 83%, 79%, 85%, 68% and 91% respectively. Albiin, (2012)[9] reported that sensitivity of MRI in case of HCC was 87% and specificity 79%. Huppertz *et al.* (2004)[7] observed that, sensitivity was 79.9% and specificity was 86.5%.

The result of this study demonstrates that triphasic MRI has high sensitivity and specificity in the diagnosis of focal hepatic lesions which helps in the early management of patients.

Conclusion

The result of this study suggests that triphasic MRI showed a strong correlation with histopathological findings in the evaluation of the focal hepatic lesions. Triphasic MRI detects and characterizes focal hepatic lesions by their characteristic appearance and specific contrast enhancement patterns. Making triphasic MRI is the choice of modality for evaluation of the focal hepatic lesions which are undetected or doubtful on ultrasound and CT examinations. 6.2

Limitations

- To reduce motion artifact pediatric patient needs anesthetic support, for this reason pediatric patients were not included in this study.
- Only one center (BSMMU) was enrolled in this study.
- Sample size was small.

Recommendation

Based on findings and analysis of the present study the following recommendations are put forward:

- Triphasic MRI may be recommended as the preferred imaging method for better characterization of focal hepatic lesions with IN PHASE, OUT OF PHASE, T2WI, DWI and ADC sequences.
- A large-scale study with large sample size and greater logistic support is hereby recommended.

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