Original Article

Performance of Ultrasonography for Detection of Hepatocellular Carcinoma among Patients with Hepatic Mass

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Abstract

Background: *Hepatocellular carcinoma (HCC) is the prevailing form of primary liver cancer and is typically associated with chronic liver disease (CLD) and cirrhosis. The liver can develop various types of growths, noncancerous and cancerous, which can be identified through specific histopathological and ultrasonographic characteristics.*

Objective: *To assess the performance of ultrasonography for detection of hepatocellular carcinoma among patients reported with hepatic mass.*

Materials and Methods: *This cross-sectional study was designed to be carried out at the Department of Radiology and Imaging of Dhaka Medical College Hospital (DMCH) and Bangladesh Medical University (BMU), in collaboration with the Department of Hepatology of the university, during the period from May 2017 to October 2018. Fifty-two patients with hepatic masses were randomly selected irrespective of age and sex. Out of them, histopathology reports of two patients could not be collected and two patients refused FNAC examination and were excluded from this study. The patients with hepatic masses were diagnosed by the patient's history, clinical examination, routine laboratory examination and radiological investigations specially ultrasonography of the hepatobiliary system and CT scan in some cases. The results obtained from radiological investigations, specially ultrasonography, were correlated with histopathological findings.*

Results: *The maximum number of hepatic mass was found in age group 30-40 years (33.3%) and was more in males (70.8%) with a male to female ratio 2.43:1. Performance statistics of ultrasound in diagnosis of HCC were following- sensitivity 100%, specificity 96%, accuracy 97.9%, positive predictive value 95.8% and negative predictive value 100%. Performance statistics of ultrasound in diagnosis of hepatic abscess were following- sensitivity 94%, specificity 100%, accuracy 97.9%, positive predictive value 100% and negative predictive value 96.9%. Most hepatic masses were 11-20 cm^2 in size (45.8%). Out of 48 patients, 23 (47.9%) cases were hepatocellular carcinoma, 17 (35.4%) were abscess, 5 (10.4%) were secondaries, 2 (4.2%) were lymphoma and 1 (2.1%) was hepatocellular adenoma.*

Conclusion: *This study shows that the role of ultrasound in detecting hepatic masses is precise and sensitive. Moreover, this modality is cheap, noninvasive, radiation-free and allows real-time evaluation of the entire organ in any plane. However, in selective and doubtful cases, where ultrasound cannot give a proper evaluation, CT and MRI can give better evaluation of hepatic masses.*

Key words: *Hepatic mass, Ultrasonography, Modality, Histopathological*

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Introduction

Hepatic metastases are significantly more common in adults, occurring 20 times more frequently than primary liver malignancies.[1-4] Hepatic masses are also prevalent in Bangladesh, largely due to the high incidence of viral infections such as HAV, HBV and HCV. These masses can be classified into hepatic neoplasms, hepatic cystic diseases and hepatic infections. Hepatic neoplasms include both benign tumors, such as hemangioma, adenoma, lymphoma and focal nodular hyperplasia, and malignant tumors, including hepatocellular carcinoma (HCC), cholangiocarcinoma and secondary metastases. Hepatic cystic diseases primarily consist of polycystic liver disease and simple hepatic cysts. Hepatic infections encompass pyogenic liver abscess, amebic liver abscess, hydatid disease, tuberculosis and actinomycosis[1-10].

The age incidence varies by region, with cases occurring between 20 and 40 years in South Asia and Africa, while in the USA and Europe, it is more common in individuals over 60 years and in children. Males are predominantly affected, with the incidence being more than twice as high in men as in women. The condition typically develops in the presence of chronic hepatitis B or C infections, dietary exposure to aflatoxins, alcoholic liver disease and liver cirrhosis. In developing countries, viral infections such as HBV and HCV are the primary causes[6-14].

Various imaging techniques are utilized to detect hepatic masses in suspected patients, including ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI), angiography, and radionuclide scanning. While CT is more specific for identifying tumor nodules, its limited availability, high cost and radiation exposure restrict its use to complex cases that cannot be diagnosed through other methods. Similarly, MRI provides high specificity, but its high cost and limited accessibility make it less suitable as a primary diagnostic tool[8,9]. Ultrasound is an excellent screening modality for hepatic masses because of its relative accuracy, speed, lack of ionizing radiation and availability[15,16].

Ultrasonography is selected as the imaging modality in this study because of its wide acceptance as a safe investigation with no radiation at all. Ultrasound is also selected as because it is noninvasive and can be done repeatedly and rapidly with least expense but provides excellent result. Ultrasound have proven to be useful in the initial detection and evaluation of hepatic masses. This simple procedure provides essential information as to whether the mass is single or multiple and also readily distinguishes cystic from solid lesions[16-17]. Ultrasound is highly sensitive and can detect tiny masses. Ultrasound machine is portable equipment and can be supplied to Thana Health Complex level. Ultrasound-guided FNAC also can be done at Thana level. When a patient with previously diagnosed malignancy subsequently develops a liver mass, a Fine Needle Aspiration (FNA) is performed for cytopathological confirmation. Ultrasonographic guidance is usually preferred for its simplicity, capability of real-time monitoring and flexible needle tract placement. Histopathological confirmation is needed for diagnosis of hepatic masses.

The reported cross sectional descriptive study was carried out to assess the performance of ultrasonography for detecting hepatocellular carcinoma among patients reported with hepatic mass.

Materials and Methods

This cross-sectional descriptive study was carried out at the Department of Radiology and Imaging, Dhaka Medical College Hospital (DMCH). Total 52 cases of clinically suspected hepatic masses reported to Radiology and Imaging department of DMCH and BMU during a period of 6 months extending from May 2018 to October 2018 were initially included in this study. Ultrasonogram finding of all of them were recorded and all were advised for FNAC. Two of them refused FNAC and of two cases histopathological report could not be collected and hence finally 48 cases were included in this study.

Transabdominal scanning was performed with the patients lying supine. The distended bladder offers significant advantages in the imaging of the pelvic organs. Several glasses of water, 30-40 minutes prior to the examination, ensures adequate bladder distension. The moderately filled bladder displaces the small bowel loops out of the pelvis and serves as an acoustic

"window" for evaluation of adjacent structures. The distended bladder also alters the lie of the uterus, straightening it in its long axis. All the patients were prepared in that line. Adequate amount of scanning gel was applied over the scanning surface to ensure sufficient coupling of the transducer to the patients' skin. Care was taken so that the transducer didn't press upon the patient's abdomen. Adequate quantity of gel ensures excellent imaging applying only slightest pressure of the transducer onto the patient's abdomen. Excessive pressure is uncomfortable for the patient and squeezes the gel from beneath the transducer, thus reducing the coupling. Patients may be examined in decubitus position or in case of physically disabled patients, in a wheelchair in the sitting position, although pelvic examinations may not be satisfactory. Transvaginal scanning, a superior technique for visualization of the female pelvis, involves the introduction of appropriate probes into the vaginal canal with the patient in the lithotomy or left lateral decubitus position. Data were analyzed using Statistical Package for Social Science (SPSS) for Windows version 20.

Results

This study shows that the occurrence of hepatic mass was more common (33.3%) in 31–40-year age group (Table I). Out of total 48 patients of hepatic masses examined by ultrasonogram, 45.8% of patients had 11-20 sq cm in size of hepatic mass, 37.5% had 5-10 sq. cm in size and 16.6% had <20 sq.cm in size (Table II). According to ultrasonogram diagnosis, out of 48 patients of hepatic masses, 24 cases were hepatocellular carcinoma (HCC), and 16 cases were abscess. But, actually, 23 cases were HCC and 17 cases were abscess as confirmed by histopathological examination. One case diagnosed as Hepatocellular adenoma by ultrasonography was a healed abscess (Table III). According to histopathological diagnosis, 23 (47.9%), 17 (35.4%), 5 (10.4%), 2(4.2%) and 1(2.1%) were respectively HCC, abscess, secondary, lymphoma and hepatocellular adenoma cases (Table IV). Comparison between ultrasonographic and histological diagnosis, out of 48 patients of hepatic masses, hepatocellular carcinoma (HCC) was in 24 (50%) cases, hepatic abscess in 16 (33.3%) cases, secondaries in 5 (10.4%) cases, lymphoma in 2 (4.2%) cases and hepatocellular adenoma in 1 (2.1%) case (Table V). In this study, 24 cases were diagnosed as hepatocellular carcinoma (HCC). But, 23 cases were HCC as confirmed by histopathological examination. One case diagnosed as HCC by ultrasonography was a healed abscess (Table VI). Of the total, 16 cases were diagnosed as hepatic abscess. But, actually 17 cases were hepatic abscess. One case diagnosed by ultrasonography as HCC was a healed abscess as confirmed by histopathological examination (Table VII).

Table I

Demographic characteristics of patients with hepatic masses (n=48)

Age Group in years	Frequency	%
Below 20	01	02.1
21-30	04	08.3
31-40	16	33.3
41-50	13	27.1
51-60	08	16.7
61-70	06	12.5
Sex Group		
Male	34	70.8
Female	14	29.2

Table II

Distribution of the patients according to different size of hepatic masses (n=48)

Size in Sq. cm	Frequency	%
5-10	18	37.5
11-20	22	45.8
>20	08	16.6

Table III

Ultrasonographic diagnosis of hepatic masses (n=48)

Lesions	Frequency	%
Hepatocellular carcinoma (HCC)	24	50.0
Abscess	16	33.3
Secondaries	05	10.4
Lymphoma	02	04.2
Hepatocellular adenoma	01	02.1

Table IV

Histopathological diagnosis of hepatic masses (n=48)

Lesions	Frequency	%
Hepatocellular carcinoma (HCC)	23	47.9
Abscess	17	35.4
Secondaries	05	10.4
Lymphoma	02	04.2
Hepatocellular adenoma	01	02.1

Table V

Comparison between USG diagnosis and histological diagnosis of hepatic masses (n=48)

Lesions	Ultrasonogram diagnosis Frequency	Histological diagnosis %
Hepatocellular carcinoma (HCC)	24 (50.0%)	23 (47.9%)
Abscess	16 (33.3%)	17 (35.4%)
Secondaries	05 (10.4%)	05 (10.4%)
Lymphoma	02 (04.2%)	02 (04.2%)
Hepatocellular adenoma	01 (02.1%)	01 (02.1%)

Table VI

Sensitivity and specificity analysis of ultrasound in the diagnosis of hepatocellular carcinoma (HCC)

Ultrasonogram diagnosis	Histological diagnosis		Total
	Positive	Negative	
Positive (HCC)	23 (True positive)	1 (False positive)	24
Negative (Other than HCC)	0 (False negative)	24 (True negative)	24
Total	23	25	48
Sensitivity:	100%		
Specificity:	96%		
Accuracy:	97.9%		
Positive predictive value (PPV):	95.8%		
Negative predictive value (PPV):	100%		

Table VII

Sensitivity and specificity analysis of ultrasound in diagnosis of hepatic abscess

Ultrasonogram diagnosis	Histopathological diagnosis		Total
	Positive	Negative	
Positive (HCC)	16 (True positive)	0 (False positive)	16
Negative (Other than HCC)	1 (False negative)	31 (True negative)	32
Total	17	31	48
Sensitivity	94.1%		
Specificity	100%		
Accuracy	97.9%		
Positive predictive value (PPV)	100%		
Negative predictive value (PPV)	96.9%		

Discussion

Hepatic masses come to clinical attention when they are felt by the patient, discussed on clinical examination by the physician and diagnosed by radiological examination specially ultrasonography and CT scan in some cases. Technologic advances and expanded use of imaging technique have led to the increased documentation of hepatic masses. This study was undertaken by ultrasonogram, an important imaging modality, especially for the hepatic masses.

In this study, finally, 48 patients were included. According to ultrasonography, out of 48 patients, 24 (50%) were hepatocellular carcinoma (HCC), 16 (33.3%) were hepatic abscess, 5 (10.4%) were secondaries, 2 (4.2%) were lymphoma and 1 (2.1%) patient was hepatocellular adenoma. According to histopathological examination, 23 (47.9%) cases were hepatocellular carcinoma, 17 (35.4%) were abscess, 5(10.4%) were secondaries, 2 (4.2%) were lymphoma and 1 (2.1%) was hepatocellular adenoma. This finding consistent with other studies reviewed[9-17].

In this study, out of 48 cases of hepatic masses, 24 cases were HCC and 16 cases were abscess as diagnosed by ultrasonography. Actually, 23 cases were HCC and 17 cases were abscess as confirmed by histopathological examination. One case misdiagnosed as HCC by ultrasonography was confirmed as healed abscess. Similar study found 23 cases were HCC and 17 cases were abscesses diagnosed by ultrasonography. But, originally, 24 cases were HCC and 16 cases were abscesses diagnosed by histopathological examination[18].

Sensitivity and specificity analysis of ultrasound in the diagnosis of HCC was following: sensitivity 100%, specificity 96%, accuracy 97.9%, positive predictive value 95.8% and negative predictive value 100%. Sensitivity and specificity analysis of ultrasound in diagnosis of hepatic abscess was as follows- sensitivity 94%, specificity 100%, accuracy 97.9%, positive predictive value 100% and negative predictive value 96.9%. These findings coincide well with other studies[8-19].

About 80% of primary malignant tumors of the liver are hepatocellular carcinoma. More than 80% of cases occur in Asia and Africa. The highest prevalence is encountered in South East Asia, Africa, China and also in USA and Europe. Age incidence was higher in South Asia and Africa in 20–40-year age group, whereas in USA and Europe that was higher above 60 years of age and in children. Male are predominantly affected and it is more than twice as high in men as in women. According to Bangladesh Journal of radiology and Imaging (BJRI), in United States and Western Europe, hepatocellular carcinoma (HCC) were seldom encountered before the age of 60 years with male to female ratio of about 3:1 to 8:1[4]. The incidence of this tumor was observed to be 20 fold to 30 fold greater in Sub Saharan Africa and South East Asia than the United States and Europe. In Africa and Asia this type of cancer occurs in younger individuals often in 20-40 year of age group with a male and female ratio of about 3:1 to 4:1[8]. In this study, age of the patients varied from below 20 years to above 70 years. Most of the patients were found between 31-40 years with a male to female ratio of about 2.43:1.

The peak occurrence of HCC in this study was in 31–40-year age group, which is much earlier than the Western country, where HCC is seldom seen before 60 years of age[4]. The age incidence of HCC in this study almost coincided with the age incidence of HCC in Africa and Asian people. As regarding to the sex incidence of hepatic masses in this study, 34 (70.8%) patients were males and 14 (29.2%) patients were females, with male to female ratio was 2.43:1, which almost coincided with ratio of male female of Asian people where male to female ratio was 3:1 to 4:1.

Metastatic hepatic lesions are the commonest hepatic malignancy. About 20 times more common than primary malignancy. But in this study, out of 48 cases of hepatic mass lesion, 5 cases were metastatic lesions and 24 cases were primary hepatic malignancy (HCC). These may be due to chronic liver disease (CLD) or cirrhosis, which is very common in Bangladesh. Among 5 cases of secondaries, cases were multiple and one case was a solitary hepatic lesion. Metastasis was commonly from lung, breast, colon, stomach & pelvic organ malignancy. Besides these 2 cases (4.2%) were lymphoma & one case (2.1%) was hepatocellular adenomas. The patient of hepatocellular adenoma was a woman and an oral contraceptive user.

Liver abscess is also a common disorder with 6.99% more common in males. Abscesses are most common in immune-compromised patients, older patients from biliary tract obstruction and young patients' consequences on suppurative appendicitis. Abscesses occur

due to amoebic, pyogenic as degenerative malignant lesions. According to Rubin RA et al.,[20] amoebic liver abscesses are more common in tropical climate. They are usually solitary and located in the right lobe of the liver and present with spiking fever. Abdominal pain, anorexia and tender hepatomegaly are frequently appreciated in contrast to pyogenic abscess; diagnostic aspiration of an amoebic abscess typically reveals culture-negative necrotic materials. Pyogenic liver abscess can develop via five routes- biliary tree, portal vein, hepatic artery, traumatic and direct extension from the contiguous organ. Pyogenic liver abscess is a secondary complication of localized or systemic bacterial infection. In up to 25% of cases, no specific cause for pyogenic abscess is identified. Imaging studies are essential for identifying the location & multiplicity of hepatic abscess.

In this study, 17 out of 48 patients (35.4%) were diagnosed with liver abscesses. Among those cases, 12 were located in the right lobe, 2 in the left lobe, and 2 involved both lobes. Of the 16 patients with abscesses, 12 were male and 4 were female. Ultrasound-guided FNAC revealed only inflammatory cells and necrotic tissue, with no identifiable causative organisms or microbial growth. The findings suggest that amoebic liver abscess is common in Bangladesh, likely due to its tropical climate and the high prevalence of amoebiasis, even though no organisms were detected through FNAC. This observation aligns with the studies conducted by Rubin RA et al.[20] and Marten et al[21].

Conclusion

This study shows that the role of ultrasound in detecting hepatic masses is precise and sensitive. Moreover, this modality is cheap, non-invasive, radiation-free and allows real-time evaluation of the entire organ in any plane. However, in selective and doubtful cases, where ultrasound can't give proper evaluation, CT and MRI can give better evaluation of hepatic masses.

References

1. Ahirwar CP, Patil A, Soni N. Role of ultrasonography to evaluate hepatic lesions. Sch. J. App. Med. Sci. 2016; 4(7B): 2450-2459.
2. Sultana F, Al-Azad S, Sattar A, Hossain MZ, Deepa ZS, Chatterjee S. Ultrasonographic evaluation of hepatic metastases of malignant diseases with cytopathological correlation. Journal of Dhaka Medical College. 2014; 23(2): 239-244.
3. Kumar M, Khanna P, Kollu R, Bansal RP. Ultrasonography and computed tomography evaluation International Medical Journal. March 2017; 4(3): 351-356.
4. Dick R, Watkinson A. The Liver and Spleen. In: Sutton D, (editor). Text Book of Radiology and Imaging, 7th ed. Elsevier: Churchill Livingstone, 2003: pp.737-738.
5. Ahmed F. Sonogram Analysis of 1500 HBS patients. BJRl. 1996; 4(2): 58-61.
6. Atterbury, Colin. Liver & biliary disease'. 2nd ed. Baltimore: Williams and Wilkins. 1 996: pp. 317-26.
7. Cotton EM. Ultrasound in the screening of patients with sclerosis with varices. British Medical Journal, 1983: 533.
8. Byung IC. 'Small hepatocellular carcinoma, detection with sonography', Computed tomography (CT), Angiography and Lipoidal CT. BJR. 1989; 62: 897-903.
9. Bailey and Love's Short practice of Surgery. 25th ed. 2008: 718.
10. Edwards CRW, Bouchier IAD, Haslett C. 'Davidson's Principles & Practice of Medicine'. 17th edition, Churchill Livingstone, 1995 pp. 553-38.
11. Kumar PB, Hegde P, Kumar BNK, Kumar MLH, Manjunatha YC. A comparative study of ultrasound and CT findings in focal liver lesions. Int Biol Med Res. 2014; 5(3): 4362-69.
12. Jeffrey D. McTavish, Ros PR. Hepatic Mass Lesions. In: Haaga JR, Lanjieri CF, Gilkeson RC (editors) CT and MR of whole Body- Haaga. vol. 2, ed. 4, St. Louis. Mosby, 2003 pp. 1296-97.
13. Paulson EK. Evaluation of the Liver for Metastatic Disease. Semin Liver Dis. 2001; 2.1(2): 225-36.
14. Finlayson NDC, Hayes PC, Simpson RJ. Diseases of the Liver & Biliary System. In: Haslett C, Chilvers ER, Hunter JAA, Boon NA (editors) Davidson's Principles and Practice of Medicine, 18th ed., Edinburgh, Churchill Livingstone. 1999: pp.724-25.

15. Withers CE, Wilson SR. The liver. In: Rumack CM, Wilson SR, Charboneau JW (editors). Diagnostic Ultrasound, 2nd ed, St Louis; Mosby, 1998: pp.134-35.

16. Tsui NM, Cheng F, Lee Y, Fine needle Aspiration cytology of liver tumors (English version of an article in Chinese published) Annuals of Contemporary Diagnostic Pathology. 1998; 2: 79-93.

17. Baker ME, Pelley R. Hepatic Metastases: Basic Principles and implications for Radiologists. Radiology. 1995; 197: 329-37.

18. Reinhold C, Hammers L, Taylor CR, Quedens-Cas C, Holland CK, Taylor KJW. Characterization of Focal Hepatic lesions with Duplex Sonography: Findings in 198 patients. AJR. 1995; 164: 1131-35.

19. Minami Y, Kudo M. Hepatic malignancies: Correlation between sonographic findings and pathological features. World J Radiol. 2010; 2 (7): 249-56.

20. Rubin RA. Evaluation of the Solid Hepatic Masse. Med Clin North Am. 1996; 80(5): 907-28.

21. Lantinga MA, Gevers TJG, Drenth JPH. Evaluation of hepatic cystic lesions World J Gastroenterol. 2013; 19(23): 3543–3554.