Sonographic Findings of Hepatocellular Carcinoma Detected in Ultrasound Surveillance of Cirrhotic Patients

Nittaya Chamadol MD*, Kulyada Somsap MD*,
Vallop Laopaiboon MD*, Wattana Sukeepaisarnjaroen MD**

** Department of Radiology, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand*
*** Department of Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand*

Background: *Hepatocellular carcinoma (HCC) is associated with high mortality. Patients with hepatitis B or C viral cirrhosis have an increased risk of developing HCC. Ultrasound is the most widely used screening method, and is recommended by many guidelines.*
Objective: *To study the sonographic findings of HCC detected in ultrasound surveillance of cirrhotic patients.*
Material and Method: *Retrospective assessment of ultrasound findings of all nodules that were diagnosed HCC by either dynamic imaging (CT or MRI) or biopsy between October 2008 and July 2011. Nodules were classified based on echogenicity and other sonographic characteristics.*
Results: *Of 92 nodules, 42 (45.7%) were hyperechoic, 29 (31.5%) hypoechoic, 20 (21.7%) heterogeneous echoic and 1 (1.1%) isoechoic. Heteroechoic nodules were more common among nodules over 3.0 cm (p = 0.0037) while hypoechoic nodules tended to be the smaller ones. About half (48/92) of the nodules had a hypoechoic halo and occurred significantly more commonly among hyperechoic and heteroechoic nodules (p<0.001). Posterior enhancement was found in 54 nodules (58.7%), also more common in nodules >3.0 cm (p = 018). Lateral shadowing occurred in 40 nodules (43.5%).*
Conclusion: *The sonographic findings of HCC nodules in the present studies varied, but the prevalence of hyperechoic nodules was higher than in most of other studies. The authors emphasize the necessity of performing dynamic imaging for any nodule detected in a cirrhotic liver in order to exclude their neoplastic nature, no matter what it may look like.*

Keywords: *Sonographic finding, HCC surveillance*

J Med Assoc Thai 2013; 96 (7): 829-38
Full text. e-Journal: *http://jmat.mat.or.th*

Hepatocellular carcinoma (HCC) is one of the most common cancers globally (as well as in Thailand) associated with high mortality. Patients with hepatitis B or C viral cirrhosis have an increased risk of developing HCC, with a reported incidence of 1 to 6% per year[1]. As the stage of cancer affects therapeutic choices and outcomes, several strategies have been proposed in an attempt to detect cancer as early as possible.

Currently, tests that can be used for HCC surveillance fall into two categories, serology and imaging. Alfa-feto-protein (AFP)-the most commonly used serologic test for screening and diagnosis of HCCs-is no longer recommended because of lack of sensitivity and high rate of false positives[2]. Without a sensitive serological marker for surveillance, imaging tests have an even more important role. Among these, ultrasound surveillance in the population at risk has proven to be safe, cost-effective, widely available, and easy to perform. Furthermore, it is the main surveillance method recommended by many guidelines[1-5].

Using sonography as a surveillance tool has a sensitivity of between 31.6 to 80% and a specificity of between 59 to 94.7%[1,6,7]; depending on many factors including operator's experience, tumor size, echogenicity, and location[6-8]. Previous studies showed that the imaging features of HCC nodules in ultrasound could be varied[1,9-13]. The mosaic pattern with a star-shaped central hypoechoic area is due to the presence of fibrous septa. A hypoechoic rim is also a common characteristic, HCCs may present as single or multiple nodules and may be found anywhere in the liver. It is, therefore, important to emphasize that any nodule detected by ultrasound should be further investigated for HCC.

Based on the latest guideline from the American Association for Study of Liver Diseases (AASLD updated in 2010), a final diagnosis of HCC is reached by using either biopsies or dynamic imaging

Correspondence to:
Chamadol N, Department of Radiology, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand.
Phone & Fax: 043-348-389
E-mail: nittayachamadol@yahoo.com

(4-phase multidetector CT, MDCT or dynamic contrast magnetic resonance imaging, MRI of liver). A nodule larger than 1 cm-showing a typical vascular pattern-can be diagnosed and treated as HCC. If the nodule is not typical in the first imaging study, a second contrast-enhanced study with other imaging modalities should be performed. If the nodule is not typical in any of the studies, then biopsy should be done. For nodules less than 1 cm in size, it was recommended a follow-up ultrasound at three to six month intervals be performed. If a nodule is stable in size over a period of two years, one can revert to routine surveillance[2].

Even though ultrasound is not an ideal diagnostic test for HCC, it can serve as a good screening method. It also plays an important role in performing such intervention as biopsy or radiofrequency ablation. The purpose of the present study was to evaluate the ultrasound characteristics of HCCs in patients with cirrhosis under surveillance by the authors' hospital and benefit of its use for a surveillance program as well as diagnostic and therapeutic interventions. The secondary objective was to evaluate the role of AFP in the authors' HCC surveillance.

Material and Method

Patient population

The present retrospective study was approved by the Institute of Ethics Committee for Human Research (at Khon Kaen University No. HE541003). Enrolled in the present study were all cirrhotic patients (199) with liver nodules, detected in the ultrasound surveillance program and underwent subsequent dynamic contrast CT and/or MRI between October 2008 and July 2011. The medical charts, laboratory results, CT and ultrasound findings of all patients were reviewed by two experienced radiologists (NC, VL). Only patients finally diagnosed as HCC were included in the present study.

The diagnosis of HCC was based on dynamic imaging studies and/or tissue pathology. A nodule with a typical vascular pattern in at least one dynamic (contrast-enhanced) study was considered to be HCC. Any nodules <1 cm in size or nodules with an atypical vascular pattern considered tobe non-HCC were excluded from the present study. The authors also omitted nodules for which the ultrasound location did not correspond with the CT (Fig. 1).

Of 199 cirrhotic patients who met the inclusion criteria, 118 were excluded, leaving 81 patients with 92 liver nodules eligible for analysis.

The demographic data

Including patient age, sex, important clinical and laboratory data (i.e., liver function, serum AFP, Child Pugh classification, and causes of cirrhosis) was corrected.

CT and MRI technique

Triple-phase or quadruple-phase contrast-enhanced CT examinations were performed by using a 4- or 128-slice MDCT scanner. Unenhanced CT was performed first followed by a contrast-enhanced scan in the arterial and portovenous phase. Delayed images at five minutes were also occasionally obtained.

The MRI was performed using a 1.5 T or 3.0 T MRI machine. The following sequences were obtained (a) in- and out of phase, gradient-recalled based T1W sequences (b) T2W fast-spin echo with fat saturation (c) heavily T2W and (d) contrast-enhanced dynamic 3D T1W MR-images.

The CT and MR images were reviewed in axial planes with multiplanar reconstruction (MPR) using the picture archiving and communicating system (PACs). The location, size, number, and enhancement pattern of liver nodules were recorded. The diagnosis of HCC in contrast-enhanced studies was made by a radiologist experienced in gastrointestinal imaging (NC).

Ultrasonography

All of the liver ultrasound studies were performed by or under the supervision of a board-certified radiologist during surveillance screening. Two experienced radiologists (NC and VL) separately performed the retrospective assessment of ultrasound characteristics of HCC nodules under the PACS system. Data collection included echo pattern of liver parenchyma, number, size, location, echopattern of

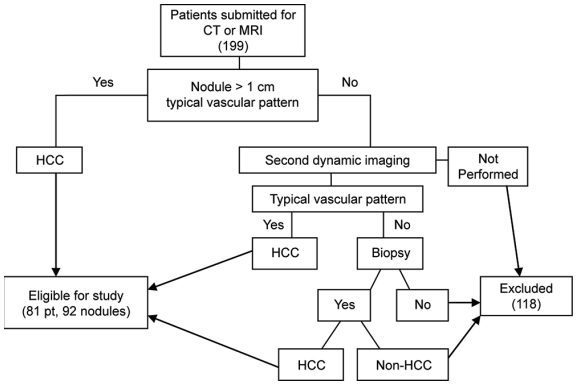

Fig. 1 Patient enrollment workflow.

the mass, and other characteristics as described by Choi et al[14] such as, presence of a hypoechoic halo, mosaic appearance, posterior acoustic features, and lateral shadowing.

A third review was conducted by consensus of two radiologists together (NC and VL) only when there was disagreement between the two reviewers. All reviewers were masked vis-à-vis the laboratory data and the patients' clinical information. They were, however, aware of the diagnosis of HCC.

Evaluation and statistical analysis

The mean ± SD, median, paired Student's t-test and one-way ANOVA were used for descriptive univariate analysis of the continuous data. The proportion and Chi-square tests were the statistics used for the categorized data. A p-value of ≤0.05 was considered statistically significant.

Results

Eighty-one patients with 92 liver nodules were included in the study. The characteristics of the study population are presented in Table 1. Fifty-six patients (69.2%) had a baseline AFP <200 ng/mL while 24 (29.6%) had >200 ng/mL. When 20 ng/mL was used as the cut-off point.

Most of the patients (n = 59, 72.9%) had single HCC and 22 patients had two or more (Fig. 2), altogether yielding 92 nodules. Twenty-one nodules (22.5%), 25 (27.2%), 28 (30.4%), and 17 (18.5%) were 1.0 to 2.0, 2.1 to 3.0, 3.1 to 5.0, and >5.0 cm in diameter, respectively. The majority of these nodules were located in the right hepatic lobe. Fig. 3 demonstrated the location of liver nodules in relation to the segmental anatomy based on Cauinaud's classification.

Dynamic imaging detected more lesions than ultrasound in 15 cases (19.0%) and the same number of lesions in 63 cases (77.7%). Ultrasound detected more nodules than CT in one case. In that case, it was revealed by MRI that the lesion was more likely to be a dysplastic nodule. Statistically, CT and/or MRI were able to detect more lesions than ultrasound (p = 0.001).

Table 1. Patient's characteristics (81 patients, 92 nodules)

	Value	Child-pugh classification			
		A	B	C	Total (%)
Gender					
Male		40	16	8	64 (79.0)
Female		4	7	6	17 (21.0)
Total		44	23	14	81.00
Age					
Minimum	20				
Maximum	84				
Mean		57.9	60.10	59.90	58.80
Causes of cirrhosis					
HCV		17	11	5	33 (40.7)
HBV		19	8	5	32 (39.5)
Alcoholic + HCV		2	0	1	3 (3.7)
HBV + HCV		2	1	0	3 (3.7)
Alcoholic		0	1	1	2 (2.5)
Alcoholic + HBV		0	0	1	1 (1.2)
Other		4	2	1	7 (8.6)
Total		44	23	14	81.00
Alpha-fetoprotein (AFP)					
0-200		33	15	8	56 (69.2)
More than 200		11	7	6	24 (29.6)
Not available		0	1	0	1 (1.2)
Total		44	23	14	81.00
Minimum	1.34				
Maximum	>400,000				
Median		30.36	35.44	45.87	30.36
Mean		1,541.86	415.07	1,455.24	1,212.72

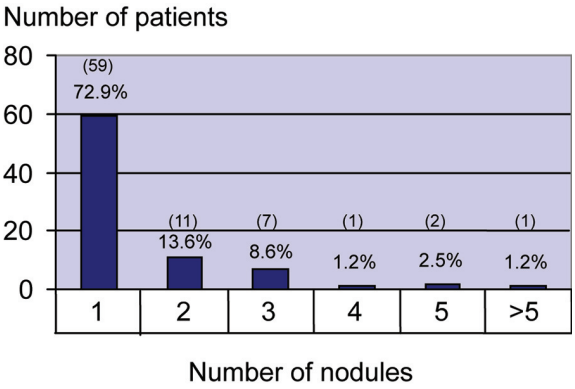

Fig. 2 Number of liver nodules in each patient.

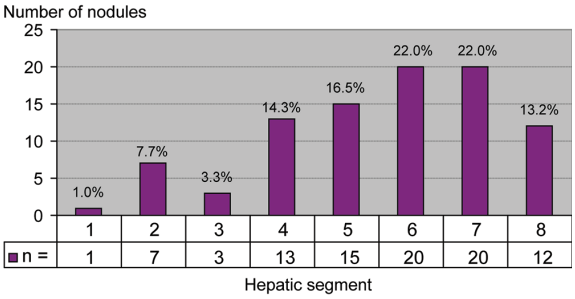

Fig. 3 Location of liver nodules based on Couinaud's classification.

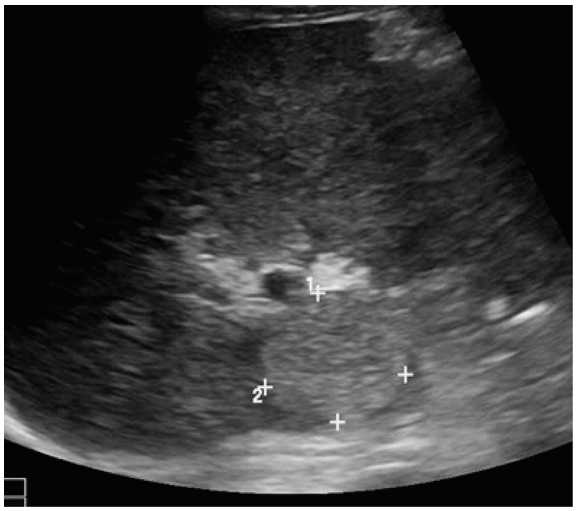

Fig. 4 Hyperechoic nodule: a nodule that appears mainly hyperechoic.

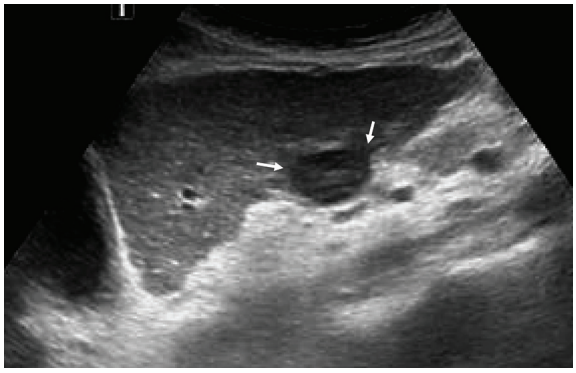

Fig. 5 Hypoechoic nodule: a nodule that appears mainly hypoechoic.

Analysis of the ultrasound appearance of the nodules showed that 29 nodules (31.5%) were hypoechoic (Fig. 5), one (1.1%) was isoechoic (Fig. 6), 42 (45.7%) were hyperechoic, and (Fig. 4) 20 (21.7%) were heterogeneous echoic (Fig. 7) when compared to the surrounding liver tissue. Nodule echogenicity differed significantly between nodules smaller and larger than 3.0 cm ($p<0.001$). Heterogeneous echoic nodules occurred more frequently in the nodules >3.0 cm ($p = 0.0037$). The percentage of hypoechoic nodules occurring in nodules <3.0 cm in diameter was higher than that of nodules >3.0 cm (38.5% vs. 22.5%, respectively), but the difference did not reach statistical significance. There was no difference in patient's age or serum AFP level between subgroups of different echogenicity. However, the only difference between echogenicity was nodule size ($p = 0.003$, Table 2). The average size of hypoechoic nodules was significantly smaller than that of heteroechoic nodules ($p<0.001$).

Of the 24 nodules (26.1%) with a mosaic appearance, most of them (21/24, 87.5%) were found in nodules >3.0 cm in size ($p<0.001$).

Table 2. Comparison of mean age, AFP and nodule size in subgroups divided by echogenicity

Parameters	Echogenicity			p-value
	Hypoechoic	Hyperechoic	Heterogeneous echoic	
Mean age	61.60	57.95	57.29	0.351
Serum AFP	373.12	134.04	139.58	0.092
Mean size in ultrasound	2.54	3.39	4.59	0.003

* Using one-way ANOVA

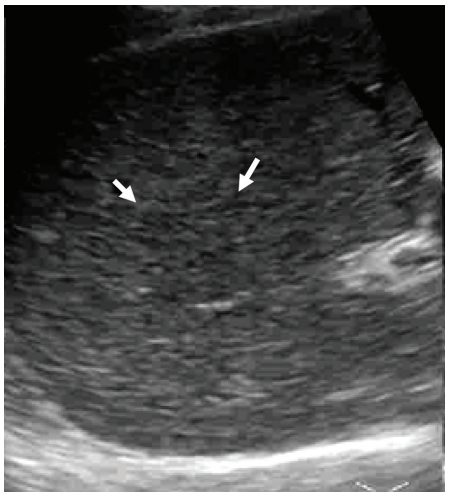

Fig. 6 Isoechoic nodule: a nodule isoechoic to adjacent liver parenchyma an isoechoic nodule at right lobe liver, CT (not shown) confirmed the presence of HCC.

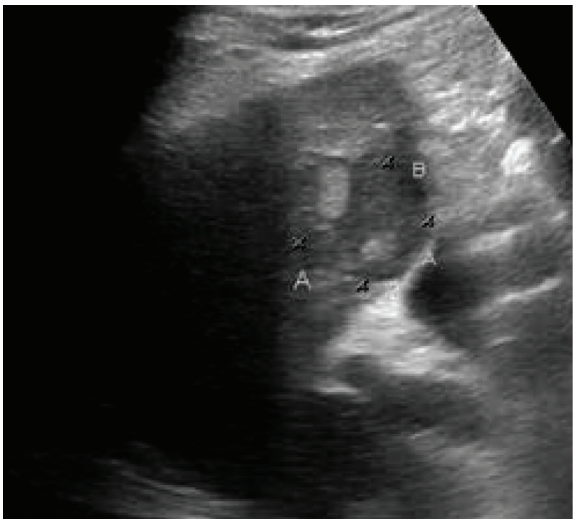

Fig. 7 A heterogeneous echoic nodule: a nodule containing mixed echogenicity and cannot be specified by single echogenicity.

About posterior acoustic features 54 nodules had posterior acoustic enhancement (58.7%) (Fig. 8-11) while 38 (41.3%) did not. None of the nodules had a posterior acoustic shadow. The posterior enhancement was found less frequent in nodules <3.0 cm ($p = 0.018$). No relationship was found between posterior enhancement and echogenicity of the nodule.

About one-half of the nodules (48/92; 52.2%) had a hypoechoic halo. The halos (Fig. 10) were more common in hyperechoic (28/42) and heterogeneous echoic nodules (14/20) than in hypoechoic nodules (6/29) ($p<0.001$). (No significant difference in the presence of halos between nodules with difference size was found). About 43% of nodule (40/92) showed lateral shadowing, 20 (50%) were found in nodules <3.0 cm. No statistical relationship of this characteristic

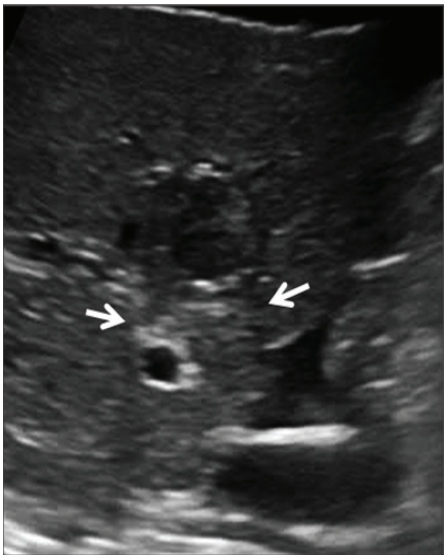

Fig. 8 Lateral shadowing: linear shadow casted at lateral margin of a nodule (arrows). A heterogeneousechoic nodule with lateral shadowing and posterior enhancement.

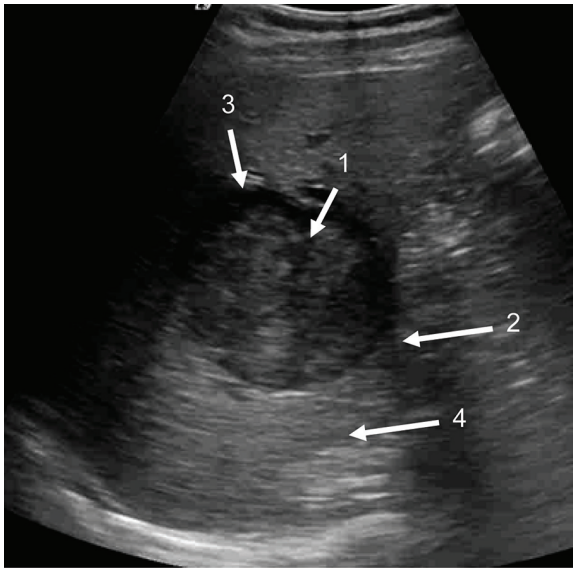

Fig. 9 A heterogeneous echoic nodule with mosaic appearance showing star-shape or linear hypo-echoic center (arrow 1). Also note the presence of lateral shadowing (arrow 2) peripheral halo (arrow 3) and posterior enhancement (arrow 4).

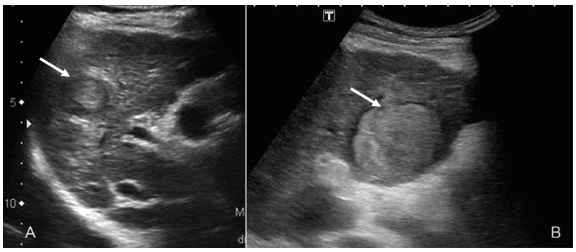

Fig. 10 Two patients with peripheral hypoechoic halo in (A) a small hyperechoic and (B) a larger hyperechoic nodule. Posterior enhancement is also present in both A and B.

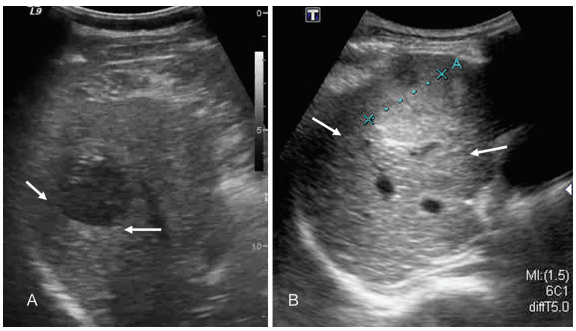

Fig. 11 Two patients, posterior enhancement in (A) a hypoechoic and (B) A hyperechoic HCC.

and the size of nodule was found (p = 0.295). There was also no relationship between any of the ultrasound findings and causes of cirrhosis or the Child Pugh classification. Table 3 presents the frequency of each ultrasound characteristic vis-à-vis the size range of nodules.

Three of the excluded patients had a dynamic imaging appearances typical for hemangiomas. These three hemangiomas appeared similar to hyperechoic HCC on the ultrasound hence it might not have been possible to distinguish between hemangioma and HCC using ultrasonography (Fig. 12).

Discussion

To date, most studies have shown that small HCCs are usually hypoechoic and less often hyperechoic[9,12,15-17]. Posterior enhancement is uncommon. The nodules become more heterogeneous and more hyperechoic as they grow. Nodular type HCCs with homogeneous, diffuse hyperechoic patterns are less common and usually surrounded by a hypoechoic halo[11,18,19]. Kanematsu et al studied the imaging findings of small hepatic nodules in cirrhosis and found that non-HCC nodules showed significantly higher echogenicity more often than HCCs. Less than one-third (4/15; 27%) of HCCs were hyperechoic[10]. Forner et al confirmed that the hypoechoic halo occurs significantly more frequently in HCC nodules[12].

In the current study, the number of hyperechoic nodules exceeded that of hypoechoic nodules (42; 45.7% vs. 29; 31.5%, respectively). This finding persisted even when only small nodules were analyzed (28; 50.9% vs. 20; 36.4%, respectively), which contrasts with most of the previous studies. However, the current study revealed that hypoechogenicity occurs more frequently in nodules <3.0 cm (not statistically significant) and the mean size of hypoechoic nodules was significantly smaller than that of the

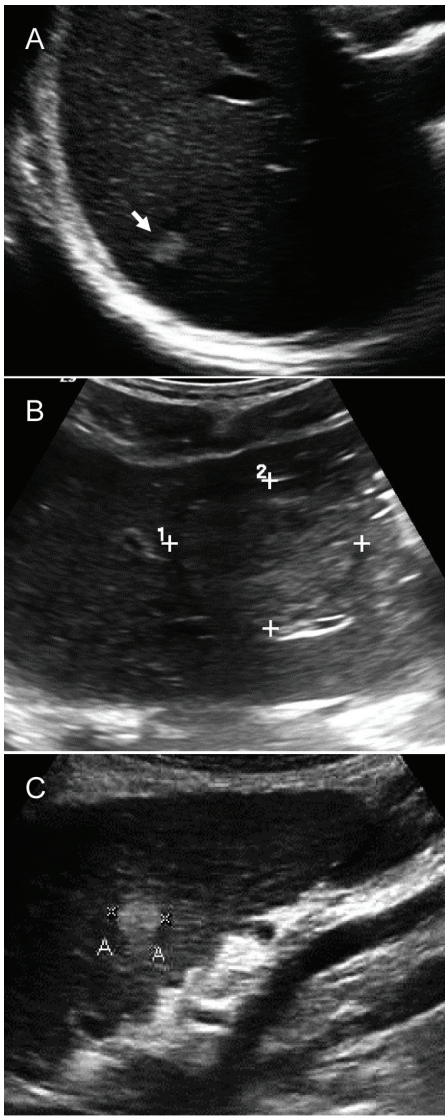

Fig. 12 A) small hemangioma, B) larger hemangioma, C) hyperechoic HCC.

Table 3. Frequency of each ultrasound characteristics based on size range

	Size range				Frequency	
	1.0-2.0	2.1-3.0	3.1-5.0	>5.0	Number	Percent
Nodules' echogenicity						
Hypoechoic	9	11	9	0	29	31.50
Isoechoic	0	1	0	0	1	1.10
Hyperechoic	13	15	9	5	42	45.70
Heterogeneous echoic	0	3	11	6	20	21.70
Hypoechoic halo						
Absence	14	14	12	4	44	47.80
Presence	8	16	17	7	48	52.20
Mosaic appearance						
Absence	22	27	14	5	68	73.90
Presence	0	3	15	6	24	26.10
Posterior enhancement						
Absence	15	12	7	4	38	41.30
Presence	7	18	22	7	54	58.70
Lateral shadow						
Absence	17	15	16	4	52	56.50
Presence	5	15	13	7	40	43.50
Total	22	30	29	11	92	100.00

heteroechoic ones. Heterogeneous nodules occurred more frequently in HCC nodules >3.0 cm. The prevalence of the mosaic pattern was only 26.1%, and when the pattern occurred, it was likely to be found in larger nodules. These findings corresponded with Choi et al[14] and the reviews by Gomaa et al, Yu et al and Saar et al[11,18,19]. Isoechoic nodules were found in only one patient: possible from an underestimated because isoechogenicity was reported to be one of the causes of false-negatives in ultrasound[7].

A hypoechoic halo presented in 52% of the nodules, which was lower than the study by Forner et al in which 76% of HCC nodules were found to have a hypoechoic halo but higher than other studies[12,17,20]. A hypoechoic halo occurred more frequently in hyperechoic and heteroechoic nodules than in hypoechoic nodules. This did not correlate with nodule size. To our knowledge, there was no study evaluating the relationship between hypoechoic halo and echogenicity of the nodules. Notwithstanding, due to less soft tissue contrast between hypoechoic nodules and hypoechoic halos, the prevalence of hypoechoic nodules with halos might be underestimated.

Posterior enhancement was observed frequently in the current study (58.7%). The prevalence of posterior enhancement was higher than reported by Choi et al and Katherine et al[14,21]. The authors found that posterior enhancement was detected more commonly in nodules >3.0 cm in size, contrary to the study by Choi et al[14]. Posterior enhancement in HCC is believed to correspond with structural characteristics that have yet to be identified[22].

Hyperechoic HCCs are believed to be due to fatty degeneration or coagulation necrosis, interstitial fibrosis, hemorrhage, fatty metamorphosis and sinusoidal dilatation within the tumor while hypoechoic HCCs are believed to contain pure, solid, carcinoma cells without any internal structure to serve as a reflective source for ultrasound[11,16]. The hypoechoic halo and lateral shadowing are thought to correspond with a thin fibrotic pseudocapsule or peripheral liver cell compression. The halos occurred in malignant nodules more often than in their benign counterparts[12,23]. In the current study-unlike other studies-the majority of the nodules were not hypoechoic. The authors found that hypoechoic halos occurred in more than half of the cases, which was significantly more frequently when the nodule was hyper or heteroechoic (than when the nodule was hypoechoic). Thus, in routine surveillance-apart from hypoechoic nodules-the practitioner might favor a diagnosis of HCC if a hyperechoic or heterogeneous echoic nodule with a hypoechoic halo was observed. By contrast, hyperechoic HCCs without halos may resemble hemangiomas, especially with posterior enhancement. A previous study mentioned that posterior enhancement could

occur equally in both benign and malignant nodules[24]. The current study confirmed a high prevalence of posterior enhancement in HCCs. Importantly, only three cirrhotic patients were excluded because the dynamic imaging proved that the nodules were hemangiomas. Thus, the likelihood of benign nodule(s) in the surveillance group would be low. The radiologist should not use either hyper- echogenicity or posterior enhancement to make the final decision of hemangioma.

Apart from ultrasound, the most commonly used serologic test is the level of serum AFP. Previously, the AASLD guideline for management of HCCs (2005) suggested that HCCs can be diagnosed if the value for AFP ≥200 ng/mL. The guideline cautions that although AFP has a role in the diagnosis of HCC, it has limited utility as a screening test. This is because a sensitivity of 60% is considered suboptimal since 40% of HCCs would be missed[1]. Many articles and studies support the argument that AFP alone is not optimal for HCC surveillance. It reported sensitivity was ~60% for AFP ≥20 ng/mL and about 22% for AFP ≥200 ng/mL[5,6,25,26]. Due to this inadequate sensitivity and the high rate of false-positives, this serologic marker was omitted from the recommended surveillance method as well as from the gold standard for the diagnosis of HCC in the 2010 version of this guideline.

In the current study, 56 (69.2%) patients had a baseline AFP ≤200 ng/mL and only 24 (29.2%) had a baseline AFP ≥200 ng/mL. This means that when using AFP alone for surveillance, 56 cases would be missed. Even when 20 ng/mL was used as the trigger, the detection rate would be only 59.5%. The detection rate of AFP at 20 ng/mL in the present study is comparable to other studies while the detection rate at 200 ng/mL is a little higher than other studies[2].

As with other studies[6,7,27], the current study confirmed the superiority of dynamic imaging to ultrasound for the detection of HCCs ($p = 0.001$). Dynamic imaging was able to detect more lesions in 15 cases (19%). In contrast, Teefey et al found that the sensitivity and specificity of CT and MRI were not as good as that of ultrasound[28].

The results of the current study emphasized the necessity of performing dynamic imaging for any nodule detected in a cirrhotic liver to exclude their neoplastic nature, no matter how benign it looks. When a patient is found to have a liver nodule on ultrasound, AFP should not be used for decision making whether to send the patient for further investigation.

The primary limitation of the current study was its retrospective nature. There were nodules visible on the dynamic imaging but not visible on the ultrasound, which were excluded. Before July 2010, many of the patients with HCC were diagnosed if they had an elevated serum AFP, among whom many did not undergo second-imaging or biopsy. Consequently, nodules with atypical vascular pattern without second dynamic imaging or biopsy-proven diagnosis were also excluded. The authors, therefore, have no way of knowing if HCC with an atypical vascular pattern would appear similar to the present study's findings. To further evaluate this question, a prospective study with biopsy is needed.

Conclusion

The ultrasound findings of HCC nodules in the present study varied, but the prevalence of hyperechoic nodules was higher than most previous studies. The present study emphasized the necessity of performing dynamic imaging for any nodule detected in cirrhotic liver to exclude their neoplastic nature, no matter how they looked. The consulting radiologist should not depend upon AFP to make the decision whether or not to send the patient for further investigation.

Acknowledgement

The authors thank the Department of Radiology and the Faculty of Medicine, Khon Kaen University for their support and Mr. Bryan Roderick Hamman and Janice Loewen Hamman for assistance with the English-language presentation of the manuscript.

Potential conflicts of interest

None.

References

1. Bruix J, Sherman M. Management of hepatocellular carcinoma. Hepatology 2005; 42: 1208-36.
2. Bruix J, Sherman M. Management of hepatocellular carcinoma: an update. Hepatology 2011; 53: 1020-2.
3. Bruix J, Sherman M, Llovet JM, Beaugrand M, Lencioni R, Burroughs AK, et al. Clinical management of hepatocellular carcinoma. Conclusions of the Barcelona-2000 EASL conference. European Association for the Study of the Liver. J Hepatol 2001; 35: 421-30.
4. Cabibbo G, Craxi A. Hepatocellular cancer: optimal strategies for screening and surveillance. Dig Dis 2009; 27: 142-7.
5. Lencioni R. Surveillance and early diagnosis of

hepatocellular carcinoma. Dig Liver Dis 2010; 42 (Suppl 3): S223-7.
6. Paul SB, Gulati MS, Sreenivas V, Madan K, Gupta AK, Mukhopadhyay S, et al. Evaluating patients with cirrhosis for hepatocellular carcinoma: value of clinical symptomatology, imaging and alpha-fetoprotein. Oncology 2007; 72 (Suppl 1): 117-23.
7. Choi BI, Park JH, Kim BH, Kim SH, Han MC, Kim CW. Small hepatocellular carcinoma: detection with sonography, computed tomography (CT), angiography and Lipiodol-CT. Br J Radiol 1989; 62: 897-903.
8. Lee MW, Kim YJ, Park HS, Yu NC, Jung SI, Ko SY, et al. Targeted sonography for small hepatocellular carcinoma discovered by CT or MRI: factors affecting sonographic detection. AJR Am J Roentgenol 2010; 194: W396-400.
9. Rapaccini GL, Pompili M, Caturelli E, Covino M, Lippi ME, Beccaria S, et al. Hepatocellular carcinomas <2 cm in diameter complicating cirrhosis: ultrasound and clinical features in 153 consecutive patients. Liver Int 2004; 24: 124-30.
10. Kanematsu M, Hoshi H, Yamada T, Murakami T, Kim T, Kato M, et al. Small hepatic nodules in cirrhosis: ultrasonographic, CT, and MR imaging findings. Abdom Imaging 1999; 24: 47-55.
11. Gomaa AI, Khan SA, Leen EL, Waked I, Taylor-Robinson SD. Diagnosis of hepatocellular carcinoma. World J Gastroenterol 2009; 15: 1301-14.
12. Forner A, Vilana R, Ayuso C, Bianchi L, Sole M, Ayuso JR, et al. Diagnosis of hepatic nodules 20 mm or smaller in cirrhosis: prospective validation of the noninvasive diagnostic criteria for hepatocellular carcinoma. Hepatology 2008; 47: 97-104.
13. Eguchi A, Furuta T, Haraguchi M, Sugimachi K. Early stage hepatocellular carcinoma detected during intraoperative ultrasonography. Am J Gastroenterol 1994; 89: 595-8.
14. Choi BI, Kim CW, Han MC, Kim CY, Lee HS, Kim ST, et al. Sonographic characteristics of small hepatocellular carcinoma. Gastrointest Radiol 1989; 14: 255-61.
15. Ogata R, Majima Y, Tateishi Y, Kuromatsu R, Shimauchi Y, Torimyra T, et al. Bright loop appearance; a characteristic ultrasonography sign of early hepatocellular carcinoma. Oncol Rep 2000; 7: 1293-8.
16. Kim KA, Lee WJ, Lim HK, Park CM, Park CK, Cha IH, et al. Small hepatocellular carcinoma: ultrasonographic findings and histopathologic correlation. Clin Imaging 2003; 27: 340-5.
17. Shibata T, Sakahara H, Kawakami S, Konishi J. Sonographic characteristics of recurrent hepatocellular carcinoma. Eur Radiol 1996; 6: 443-7.
18. Yu SC, Yeung DT, So NM. Imaging features of hepatocellular carcinoma. Clin Radiol 2004; 59: 145-56.
19. Saar B, Kellner-Weldon F. Radiological diagnosis of hepatocellular carcinoma. Liver Int 2008; 28: 189-99.
20. Moribata K, Tamai H, Shingaki N, Mori Y, Enomoto S, Shiraki T, et al. Assessment of malignant potential of small hypervascular hepatocellular carcinoma using B-mode ultrasonography. Hepatol Res 2011; 41: 233-9.
21. Maturen KE, Wasnik AP, Bailey JE, Higgins EG, Rubin JM. Posterior acoustic enhancement in hepatocellular carcinoma. J Ultrasound Med 2011; 30: 495-9.
22. Livraghi T, Makuuchi M, Buscarini L. Diagnosis and treatment of hepatocellular carcinoma. New York: Cambridge University Press; 1997.
23. Wernecke K, Vassallo P, Bick U, Diederich S, Peters PE. The distinction between benign and malignant liver tumors on sonography: value of a hypoechoic halo. AJR Am J Roentgenol 1992; 159: 1005-9.
24. Minami Y, Kudo M. Hepatic malignancies: correlation between sonographic findings and pathological features. World J Radiol 2010; 2: 249-56.
25. Sherman M. Alphafetoprotein: an obituary. J Hepatol 2001; 34: 603-5.
26. Lok AS, Sterling RK, Everhart JE, Wright EC, Hoefs JC, Di Bisceglie AM, et al. Des-gamma-carboxy prothrombin and alpha-fetoprotein as biomarkers for the early detection of hepatocellular carcinoma. Gastroenterology 2010; 138: 493-502.
27. Chalasani N, Horlander JC Sr, Said A, Hoen H, Kopecky KK, Stockberger SM Jr, et al. Screening for hepatocellular carcinoma in patients with advanced cirrhosis. Am J Gastroenterol 1999; 94: 2988-93.
28. Teefey SA, Hildeboldt CC, Dehdashti F, Siegel BA, Peters MG, Heiken JP, et al. Detection of primary hepatic malignancy in liver transplant candidates: prospective comparison of CT, MR imaging, US, and PET. Radiology 2003; 226: 533-42.

ภาพอัลตราซาวด์ของมะเร็งตับ ชนิด hepatocellular carcinoma (HCC) ซึ่งตรวจพบในการเฝ้าระวังผู้ป่วยตับแข็ง

นิตยา ฉมาดล, กุลญาดา สมทรัพย์, วัลลภ เหล่าไพบูลย์, วัฒนา สุขีไพศาลเจริญ

ภูมิหลัง: มะเร็งตับชนิด hepatocellular carcinoma (HCC) เป็นมะเร็งที่มีอัตราการเสียชีวิตสูง ผู้ป่วยที่มีอัตราเสี่ยงต่อมะเร็งชนิดนี้คือ ไวรัสตับอักเสบชนิดบี ซี และตับแข็ง อัลตราซาวด์เป็นเครื่องมือที่ได้รับการยอมรับให้ใช้เป็นเครื่องมือในการเฝ้าระวังโรคนี้

วัตถุประสงค์: เพื่อศึกษาลักษณะภาพอัลตราซาวด์ที่พบของมะเร็งชนิดนี้ในขบวนการเฝ้าระวังโรค

วัสดุและวิธีการ: ทำการศึกษาย้อนหลังของภาพอัลตราซาวด์ที่พบในมะเร็งตับชนิดนี้ ซึ่งได้รับการวินิจฉัยโดยการเปลี่ยนแปลงในภาพเอกซเรย์คอมพิวเตอร์หรือคลื่นแม่เหล็ก ร่วมกับการฉีดสารทึบแสงหรือการเจาะชิ้นเนื้อตรวจตั้งแต่ เดือนตุลาคม พ.ศ. 2551 ถึง เดือนกรกฎาคม พ.ศ. 2554

ผลการศึกษา: พบก้อนมะเร็ง 92 ก้อน แบ่งลักษณะของการตรวจพบด้วยอัลตราซาวด์ดังนี้ คือ เป็นความเข้มเสียงมากกว่าเนื้อตับ (hyperechoic nodules) 45.7% ความเข้มเสียงน้อยกว่าเนื้อตับ (hypoechoic nodules) 31.5% ความเข้มเสียงผสมกันทั้งมากกว่าและน้อยกว่าเนื้อตับ (heteroechoic nodules) 21.7% ความเข้มเสียงเท่ากับเนื้อตับ (Isoechoic nodule) 1.1% ความเข้มเสียงผสมกันทั้งมากกว่าและน้อยกว่าเนื้อตับ (heteroechoic nodule) พบมากในมะเร็งขนาดใหญ่กว่า 3 ซม. พบลักษณะมีวงสีดำล้อมรอบก้อน (hypoechoic hal) พบ 52% ส่วนใหญ่พบในความเข้มเสียงมากกว่าเนื้อตับ (hyperechoic nodules) พบความเข้มเสียงมากขึ้นด้านล่างของก้อน (posterior wall enhancement) 58.7% และพบมากในก้อนขนาดใหญ่กว่า 3 ซม. และเงาด้านข้าง (lateral shadowing) พบ 43.5%

สรุป: การศึกษานี้พบว่าลักษณะของภาพอัลตราซาวด์ของมะเร็งตับชนิด HCC มีลักษณะหลากหลาย โดยมีลักษณะความเข้มเสียงมากกว่าเนื้อตับ (hyperechoic nodules) เป็นลักษณะเด่น การตรวจด้วยเอกซเรย์คอมพิวเตอร์และคลื่นแม่เหล็ก โดยดูการเปลี่ยนแปลงหลังการฉีดสารทึบแสง มีความสำคัญในการให้การวินิจฉัยมะเร็งชนิดนี้