

## ORIGINAL ARTICLE

# Use of 64-slice spiral CT examinations for hepatocellular carcinoma

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## Summary

**Purpose:** To evaluate the application value of conventional ultrasound (US) and 64-slice spiral computed tomography (CT) examinations in the clinical diagnosis of hepatocellular carcinoma (HCC) and focal nodular hyperplasia (FNH) of the liver.

**Methods:** A total of 85 patients diagnosed with space-occupying liver diseases via needle biopsy or pathological examination underwent conventional US and CT examinations. The detection of tumor in different sizes was compared, and imaging characteristics were analyzed.

**Results:** Under the CT enhancement scan, HCC lesions displayed the "fast-in and fast-out" features and the blood flow in the tumor could be clearly shown, while FNH displayed the low/uniform density and significant enhancement. The accuracy of conventional US and CT in the diagnosis of benign

liver lesion was 86.00% (43/50) and 94.00% (47/50), respectively, showing no significant difference ( $p > 0.05$ ). However, the accuracy of CT in the diagnosis of malignant HCC was 94.29% (33/35), which was higher than that of US [74.29% (26/35)]. The accuracy of CT in the diagnosis of lesion with a diameter  $\leq 1$  cm was 84.00% (21/25), which was higher than that of US [56.00% (14/25)].

**Conclusions:** The diagnosis and differential diagnosis of HCC and FNH via 64-slice spiral CT are superior to those of conventional US, and the diagnostic effect of CT on tiny lesions with a diameter  $\leq 1$  cm is significant.

**Key words:** hepatocellular carcinoma, focal nodular hyperplasia of the liver, 64-slice spiral CT, ultrasound, diagnostic value

## Introduction

Focal nodular hyperplasia (FNH) of the liver is a benign space-occupying lesion of liver cells, accounting for approximately 8% of primary liver tumors. With the development of imaging techniques in recent years, there have been increasingly more reports about FNH in the clinic [1]. The pathogenesis of FNH remains unclear, and patients mostly have no symptoms in the early stage, while a small number of patients may suffer from pain, discomfort or mass in the right upper abdomen, which are similar to early manifestations of hepatocellular carcinoma (HCC). In addition, there are a variety of FNH lesions, some of which lack spe-

cific imaging features in the early stage. Therefore, the clinical diagnosis of HCC and FNH is prone to missed diagnosis and misdiagnosis [2], which is not conducive to the timely and accurate guidance of clinical intervention. Ultrasound (US) is currently a conventional means of diagnosis of focal liver lesions, but its image resolution is low, and the diagnostic results still remain to be improved. Multi-slice spiral computed tomography (CT) is an imaging diagnostic technique gradually emerging in recent years, providing important image information for the diagnosis and differential diagnosis of HCC and FNH [3]. However, whether CT is

more advantageous in the diagnosis than conventional US still needs further studies. In this study, 85 patients diagnosed with space-occupying liver diseases underwent conventional US and CT examinations, so as to compare the application value of both imaging methods, and provide a reference basis for optimizing the early clinical diagnosis.

## Methods

### *General data*

A total of 85 patients with space-occupying liver diseases treated in the First Affiliated Hospital of Xinxiang Medical University from January 2017 to April 2018 were enrolled. Inclusion criteria: (1) patients diagnosed via needle biopsy of liver cells or pathological examination after operation; (2) patients who could actively cooperate to perform US and CT examinations without allergic history to contrast agent; (3) patients who and/or whose family members signed the informed consent. Patients with severe organic lesions in the heart, brain, kidney or lung or complicated with other malignant tumors were excluded. Among the 85 patients, there were 39 males and 46 females aged 31-70 years with an average of  $58.7 \pm 6.8$  years. Thirty five cases were pathologically diagnosed with HCC, including 24 cases of primary HCC and 11 cases of metastatic HCC, and 50 cases were diagnosed with benign tumor, including 21 cases of hepatitis-type pseudotumor, 18 cases of hepatic hemangioma and 11 cases of FNH of the liver. The diameter of lesions was 0.3-9 cm with an average of  $4.1 \pm 1.0$  cm. This study was submitted and approved by the Ethics Committee of the First Affiliated Hospital of Xinxiang Medical University.

### *Methods*

Conventional US and CT examinations were performed for the 85 patients by radiologists with 3-year experience in imaging in the First Affiliated Hospital of Xinxiang Medical University.

### *US examination*

Conventional liver US scan was performed to observe the size, location and number of lesions, and color Doppler US was used to observe the blood flow spectrum signal in local lesions.

### *CT examination*

GE Discovery CT750 HD spiral CT scanner was used to scan (slice thickness: 5 mm, spiral pitch: 1.375) from the diaphragmatic dome to the inferior margin of liver of patients under a prone position after the breath became stable to observe the size, location and number of lesions in the liver. After plain scan, 80-100 mL iohexol was injected intravenously using a high-pressure injector at an injection rate of 3.0-3.5 mL/s. CT enhancement scan parameters: tube current: auto-milliampere, tube voltage: 120 KV, slice gap: 5 mm, slice thickness: 5 mm, matrix:  $512 \times 512$ , scanning speed: 0.5 s/r. At 12 s after injection of contrast agent, the scan started, and when

the CT value in the region of interest reached or exceeded 100 HU, the arterial-phase scan was automatically triggered after delayed scan for 6 s. Arterial phase scan lasted for 60 s and delayed scan lasted for 180 s for all cases. The images obtained were sent to the AW4.6 image processing workstation, read and diagnosed jointly by two experienced radiologists.

### *Observation indexes*

The imaging findings of conventional US and 64-slice spiral CT were compared, and their diagnostic effect on focal benign and malignant lesions in the liver was also compared. According to the gold pathological standards, the lesions in the liver were classified based on the diameter, and the detection of lesions in different sizes was compared between the two methods.

### *Statistics*

SPSS 20.0 software was used for data analysis in this study. Numerical data were expressed as  $n$  (%), and log rank test was used for the comparison of data. The test level was set as  $\alpha=0.05$ , and  $p<0.05$  suggested that the difference was statistically significant.

## Results

### *US and CT image analysis*

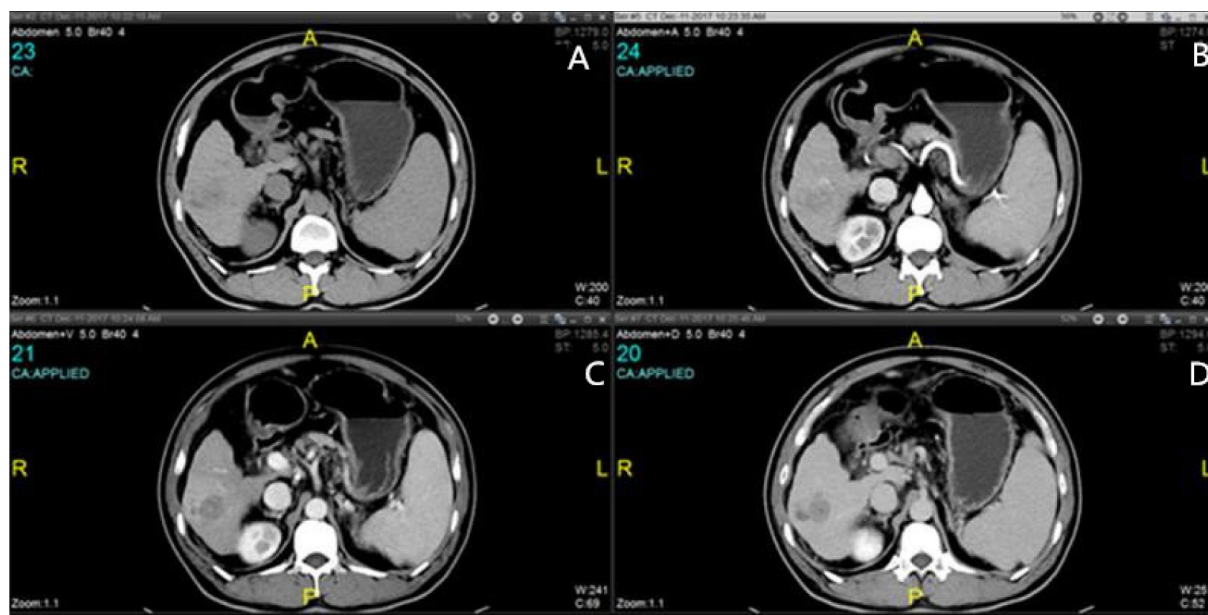
US and 64-slice spiral CT examinations were successfully performed. Conventional US could display the basic information of lesions in the liver, but the image resolution was low, and both of the two examiners said that it was difficult to identify the images of some patients. The 64-slice spiral CT image resolution was higher, the blood flow signal intensity was enhanced under enhancement scan, and the local blood supply and vascular morphology could be better displayed. HCC lesions showed low density, lesions with a smaller diameter ( $\leq 1$  cm) could also be clearly displayed, and HCC lesions displayed the "fast-in and fast-out" features under the CT enhancement scan (Figure 1). FNH mainly showed low or equal density in plain scan with significant enhancement after enhancement scan, and the local blood flow in lesions could be clearly displayed (Figure 2).

### *Comparison of diagnosis of focal benign and malignant lesions in the liver*

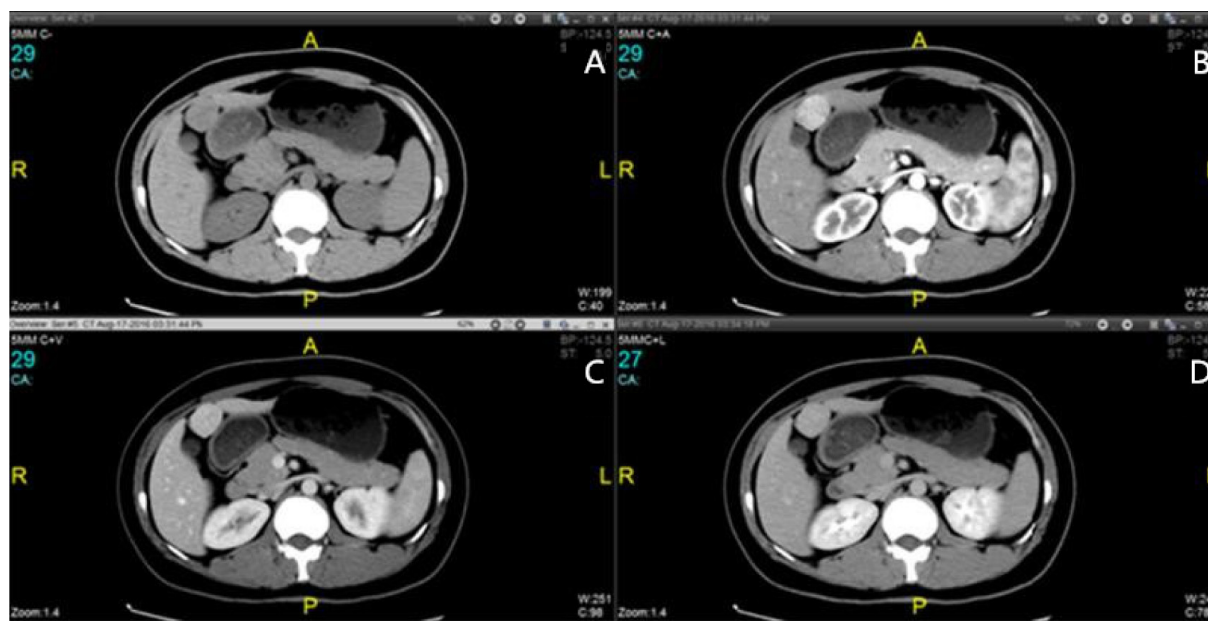
The diagnostic accuracy of conventional US was 81.18% (69/85), in which it was 74.29% (26/35) for malignant tumors, including 17 cases of primary HCC and 9 cases of metastatic HCC. In benign tumors it was 86.00% (43/50), including 18 cases of hepatitis-type pseudotumor, 16 cases of hepatic hemangioma and 9 cases of FNH of the liver. The diagnostic accuracy of 64-slice spiral CT was 94.12% (80/85), in which it was 94.29% (33/35)

for malignant tumors, including 23 cases of primary HCC and 10 cases of metastatic HCC, while it was 94.00% (47/50) for benign tumors, including 19 cases of hepatitis-type pseudotumor, 18 cases of hepatic hemangioma and 10 cases of FNH of the liver. Statistical analysis showed that the diagnostic accuracy of conventional US and 64-slice

spiral CT examinations for benign liver lesions was similar, and there was no statistically significant difference ( $\chi^2=1.778$ ,  $p>0.05$ ). However, the diagnostic effect of 64-slice spiral CT was superior to that of conventional US in HCC, and the difference was statistically significant ( $\chi^2=5.285$ ,  $p<0.05$ ) (Table 1).



**Figure 1.** Male, 50 years old, primary hepatocellular carcinoma. **A:** An irregular slightly lower density tumor can be seen in liver S6. **B:** the mass is mildly unevenly enhanced in the arterial phase. **C:** In the portal venous phase, the lesion enhancement is lower than that in **A**. **D:** in the delayed phase, the degree of enhancement of the lesion is reduced, and the lesion showed a “fast-in and fast-out” change.



**Figure 2.** Female, 33 years old, hepatocellular carcinoma. **A:** a quasi-circular low-density focus can be seen in the liver S4. **B:** In the arterial phase, the mass shows obvious and uneven enhancement. **C:** In the portal venous phase, the lesion is further enhanced, and the enhancement is more even than that in **B**. **D:** in the delayed phase, the regress of enhancement of the lesion is reduced by an equal density.

**Table 1.** Comparison of diagnostic effect on focal benign and malignant lesions in the liver between conventional US and 64-slice spiral CT

Diagnosis of focal benign and malignant lesions in the liver	Gold standard	US		CT	
		+	-	+	-
Malignant tumor	35	26	9	33*	2
Primary HCC	24	17	7	23	1
Metastatic HCC	11	9	2	10	1
Benign tumor	50	43	7	47	3
Hepatitis-type pseudotumor	21	18	3	19	2
Hepatic hemangioma	18	16	2	18	0
FNH of the liver	11	9	2	10	1
Total	85	69	16	80	5

\*indicates  $p < 0.05$  in comparison with US**Table 2.** Comparison of diagnostic effect on lesions in different sizes between conventional US and 64-slice spiral CT

Diameter of lesion (cm)	Gold standard	US		CT	
		+	-	+	-
≤1	25	14	11	21*	4
1-3.5	27	23	4	25	2
3.5-6	19	17	2	18	1
6-9	14	14	0	14	0
Total	85	68	17	78	7

\*indicates  $p < 0.05$  in comparison with US

### Comparison of diagnostic effect on lesions in different sizes

According to the pathological examination, the diameter of tumor lesions was 0.3-9 cm. Based on the lesion size, lesions were divided into 4 groups: ≤1 cm (n=25), 1-3.5 cm (n=27), 3.5-6 cm (n=19) and 6-9 cm (n=14). Statistical analysis revealed that the diagnostic accuracy of conventional US and 64-slice spiral CT had no statistically significant difference for lesions in the 1-3.5 cm, 3.5-6 cm and 6-9 cm groups ( $\chi^2=0.750$ , 0.362 and 0.000, all  $p > 0.05$ ). However, the diagnostic accuracy of CT for tumor lesions ≤1 cm [84.00% (21/25)] was significantly superior to that of US [56.00% (14/25)], and the difference was statistically significant ( $\chi^2=4.667$ ,  $p < 0.05$ ) (Table 2).

## Discussion

There are no clear symptoms in the early stage of HCC, and most patients are treated in the late disease stage. The effects of surgery, radiotherapy and chemotherapy are unsatisfactory, and survival is often less than 1 year. Therefore, it is of great significance to find ways for early detection and early treatment to improve the prognosis of HCC

patients [4]. FNH is a benign liver tumor, second only to hepatic hemangioma. US is a major means of diagnosis in the clinic, which is characterized by convenient operation, cost-effectiveness, safety and repeatability, but it is difficult to qualitatively determine the tumor lesion [5]. Although the local blood flow spectrum information in the lesion can be observed combined with color Doppler US, there are few new vessels and lower blood flow velocity in the early stage of tumor, and the image is susceptible to the breath and heart beat of patients, so the image quality and resolution are poor, thus affecting the clinical diagnosis and leading to misdiagnosis and missed diagnosis. The rapid development of CT imaging techniques has facilitated the early detection of HCC and the identification of benign and malignant tumors, so it has been gradually recognized and valued in the clinic [6].

In this study, 85 patients diagnosed pathologically were subjected to conventional US and CT examinations. The results showed that the diagnostic accuracy of 64-slice spiral CT was 94.29% (33/35) for HCC and 94.00% (47/50) for benign tumors, so the overall diagnostic effect was satisfactory. Although the diagnostic effect of conventional US on benign tumors was similar to that



of CT, the diagnostic accuracy for malignant HCC was only 74.29% (26/35), significantly lower than that of 64-slice spiral CT, which is consistent with the study of Papanikolaou et al [7]. In this study, the contrast agent iohexol used in the CT examination contains a certain amount of microbubbles, the outer membrane is soft, and it is not easy to be destroyed after intravenous injection, which can not only expand the difference in density of lesion tissues and surrounding normal tissues and ensure the image resolution, but also enhance the blood flow signal intensity, accurately reflect the hemodynamic features of the tumor and determine the type of tumor vessel, providing important support in imaging for the early clinical diagnosis [8,9]. Zhou et al [10] studied and pointed out that CT is superior to B-mode ultrasound in the diagnosis of HCC, and the possible reason is that the liquefied and necrotic liver tissues of HCC patients are mistaken as the no-signal/no-echo normal liver tissues in B-mode ultrasound. It was also found in this study that the lesions of HCC patients displayed the “fast-in and fast-out” specific features under the CT enhancement scan, benefitting the identification of HCC and FNH. The authors analyzed the reason and believed that the supplying artery of HCC lesions is often accompanied with arteriovenous shunt, because it is often manifested as abundant blood supply. The changed hemodynamic images of three phases (arterial phase, portal venous phase and delayed phase) of the liver can be obtained within a short time by CT enhancement scan once. The contrast agent in the arterial phase rapidly enters the lesion and rapidly enhances, while the contrast agent in the portal venous phase and delayed phase rapidly disappears, showing low enhancement, thus displaying the “fast-in and fast-out” typical imaging feature of HCC [11,12].

In the present study, lesions in the 85 patients were divided into 4 groups:  $\leq 1$  cm, 1-3.5 cm, 3.5-6

cm and 6-9 cm according to their diameter. The results revealed that both conventional US and CT had better diagnostic accuracy for lesions with a diameter  $>1$  cm, but the diagnostic effect of US on lesions with a diameter  $\leq 1$  cm was inferior to that of 64-slice spiral CT, which is consistent with the literature report [13]. The weak signal in tiny tumor lesions and low image resolution are important causes of misdiagnosis and missed diagnosis in conventional US. 64-slice spiral CT can track microbubbles in real time and obtain the second-harmonic scattered signal under low-mechanical index gray imaging conditions, thus ensuring that the continuous and complete echo signals can be obtained in perfusion scan and realizing the real-time dynamic observation, which is beneficial for displaying and diagnosing tiny lesions [14]. In addition, one study [15] has also clarified the effects of diagnosis and differential diagnosis of focal lesions in the liver through measuring the time of CT enhancement of different lesions in different phases. The authors analyzed the principle and believed that it was possibly related to the significant difference in the hemodynamic force among different tumors, and further exploration was needed in subsequent research.

In conclusion, 64-slice spiral CT can provide more sufficient imaging evidence for the clinical diagnosis of HCC and FNH and effectively identify benign and malignant tumors compared with conventional US examination, which also has high sensitivity in the diagnosis of tiny lesions. With the improvement and popularization of CT technique, its clinical application value is higher than that of conventional US.

## Conflict of interests

The authors declare no conflict of interests.

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