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Measurement of liver volume and its clinical significance in cirrhotic portal hypertensive patients

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INTRODUCTION

Accurate assessment of hepatic reserve function in cirrhotic portal hypertensive patients is important for selection of surgical proc edure and evaluation of prognosis. The measurement of liver volume has been applied in clinic as widely as Child's class[1,2]. Limited by technical condition, measurement of liver volume *in vivo* has seldom been reported in China. Using double helix-spiral CT (Elscint CT Twin), the liver volume of 25 cirrhotic patients and 30 patients in controls was assessed, and a correlation analysis was made between the liver volume and preoperative natural shunting rate, portal vein flow, portal pressure and prognosis of cirrhotic patients.

MATERIALS AND METHODS

Patients

Twenty-five patients with post-hepatitis cirrhotic portal hypertension were included in this study (16 males and 9 females, aged 24-66 years, averaging 44.2 years ± 10.7 years, 1.58 m-1.76 m in hight and 47.5kg-70 .5kg in weight). All patients were HBsAg or HCV-antigen positive with no cardiac disease and hepatic space-occupying lesion.

Thirty patients with chronic cholelithiasis with no hepatic disease served as controls (13 males and 17 females, averaging 45.1 years ± 14.0 years, 1.58 m-1.82 m in hight and 48 kg - 85 kg in weight). All patients were HBsAg negative with no cardiac disease.

Methods

Measurement of liver volume The upper abdomen was scanned by double helix-spiral CT (Elscint CT Twin). The liver volume was measured by 3-dim ensional shaded surface display software[3].

Measurement of natural portal-systemic shunting rate ^{99m}Tc-MIBI750mBq (20mci) was given intrarectally to cirrhotic portal hypertensive patients who lied supine under the detector of Techneca 438H/560γ camera to image heart, liver and spleen. The region of interest (ROI) with equal area was set up over the surface of heart and liver, portal-systemic shunting index (SI) = ROI (heart)/ROI (heart) +ROI (liver).

Measurement of portal flow and portal pressure During breath holding after inspiration, the bore and average/maximal blood flow rate of portal vein were measured from 2-dimensional real-time ultrasonographic image with AC USON 128P/10 color Doppler ultrasound system. The portal flow was measured according to the formula (flow volume = sectional area × flow rate). Portal pressure was measured by gastroepiploic venous centesis.

RESULTS

According to double helix-spiral CT, the average liver volume in the control group was 1070.68cm^3± 227.52cm^3, and was positively correlated with height, the correlation coefficient ($\gamma = 0.42$, $P < 0.05$) was not correlated with that ($\gamma = 0.17$, $P > 0.05$) of body weight.

According to double helix-spiral CT, the average liver volume of portal hypertensive patients was 797.02cm^3±135.11cm^3, which was significantly smaller than that in the controls ($P<0.05$).

The liver volume of cirrhotic portal hypertensive patients was correlative with Child's class, the liver volume and liver volume/height of patients who were Child B were significantly greater than that of patients who were Child C ($P < 0.05$). There was no significant correlation between liver volume and natural portal-systemic shunting index (SI) (correlation coefficient $\gamma = -0.27$, $P > 0.05$) and portal flow (correlation coefficient $\gamma = 0.17$, $P>0.05$)(Table 1).

Among the 24 cirrhotic portal hypertensive patients who received H-graft portal -caval shunt (the bore of the artificial vessel was 8 mm), the morbidity of postoperative encephalopathy and the one-year mortality in patients with their liver volume lower than 750 cm^3 were found to be higher than those in patients with their liver volume higher than 750 cm^3. Significant difference was found in the morbidity of postoperative encephalopathy (Table 2).

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Table 1 Comparison of liver volume in different hepatic function class ($\bar{x}\pm s$)

Hepatic function class	Case(*n*)	Liver volume (cm^3)	Liver volume / height (cm^3 / m)
Child A class	2	1133.0	645.6
Child B class	13	888.2±92.6[a]	533.1±50.1[a]
Child C class	10	672.4±91.1	393.8±48.2

[a]Compared with Child C class, $P<0.05$.

Table 2 Morbidity of post-shunting encephlopathy and post-shunting mortality in patients with different liver volume

	Case (*n*)	Encephalopathy (*n*)	Morbidity of encephalopathy	One-year death	Mortality
Liver volume>750cm^3	13	1	7.7%[a]	1	7.7%
Liver volume<750cm^3	11	4	36.4%	1	9.1%

[a]Compared with liver volume<750 cm^3 group,$P<0.05$.

DISCUSSION

Liver cirrhotic portal hypertension is a disease with considerable individual difference. The complicated liver function and other factors will influence portal pressure and the operational results. How to evaluate patients' tolerance to operation, how to select optimal operation for patients and how to predict the prognosis are challenges to surgeons. Age, nutritional condition and hepatic function class (Child's class) have often been regarded as the criteria. Liver volum e and amount of liver cells, which is an important index of the hepatic function, were overlooked, while the volume and weight of liver have been regarded as the factors as important as Child's class[3,4].

Liver is an irregular wedge-shaped organ, critical deformity is present during the course of cirrhosis, which has brought certain difficulty to the measurement of liver volume and its weight *in vivo*. With the help of double helix-spiral CT (Elscint CT Twin), scanning could be completed during the course of breath holding, thus reduced the error. Liver volume was measured by 3-dimensional integral software accurately. The result showed that liver volume in adult had a positive and linear correlation with height, but no close correlation with body weight, this will guide the selection of donor and receptor for liver transplantation. The liver volume of cirrhotic portal hypertensive patients decreased by 25.6% as against controls. The liver volume of patients in Child C class decreased obviously in contrast with patients in Child B class, indicating that hepatic reserve function was correlative with liver volume. If patients were divided into two groups according to liver volume of 750 cm^3, the morbidity of postoper ative encephalopathy in patients who received portal-caval shunt with their liver volume less than 750 cm^3, was 4.5 times that of patients with their liver volume higher than 750 cm^3. Owing to the poor hepatic reserve functi on, patients with lower liver volume were prone to enceplopathy, therefore it was not adequate to perform shunt operation on patients whose liver volume was too low. It played a role in objective evaluation of patients' tolerance to operation and selection of operational procedure[5,6]. Our study showed that although the extent of liver atrophy was negatively correlated with portal pressure, correlation coefficient was small. Statistical analysis showed no significant difference, and portal flow was not closely correlated with liver volume. These suggest that there are many factors that influence portal pressure, natural portal-systemic shunting index and portal flow. Liver volume is probably just one of them. At the same time, the relationship between liver volume and portal pressure, portal flow and portal-systemic shunting rate needs to be further studied.

REFERENCES

1 Galambos JT. Evaluation of patients with portal hypertension. Am J Surg, 1990;160:14-18
2 Zoli M, Cordiani MR, Marchesini G, Iervese T, Bonazzi C, Bianchi G, Pisi E. Prognostic indicators in compensated cirrhosis. *Am J Gastroenterol*,1991;86:1508-1513
3 Ogasawara K, Une Y, Nakajima Y, Fukumoto T, Sane S. The significance of measuring liver volume using computed tomographic images before and after hepatectomy. *Surg Today*, 1995;25:43-48
4 Ros PR, Eirahman MM, Barrda R, Somers G. Three dimensional imaging of liver masses: preliminary experience. *Appl Radiol*, 1990;19:28
5 Adler M, Van Laethem J, Gilbert A, Gelin M, Bourgeois N, Vereerstraeeten P, Cremer M. Factors influencing survival at one year in patients with nonbiliary hepatic parenchymal cirrhosis. *Dig Dis Sci*, 1990;35:1-5
6 Albers, Hartmann H, Bircher J, Creutzfeldt W. Superiority of the Child Pugh classification to quantitative liver function tests for assessing prognosis of liver cirrhosis. *Scand J Gastroenterol*, 1989; 24:269-276

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