Supplementary data

The difference between type 2 gastroesophageal varices and isolated fundic varices in clinical profiles and portosystemic collaterals

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Materials and methods

Diagnostic Criteria

The diagnosis of liver cirrhosis was established with histological evidences; or was based on a compatible clinical history, specifically a history of chronic liver disease, physical exam, and/or laboratory abnormalities, and importantly, the presence of signs of liver cirrhosis and/or portal hypertension on imaging studies (nodular liver, splenomegaly, and/or collaterals) [1-4]. Diagnostic criteria of HBV/HCV-related liver cirrhosis were: 1) chronic HBV/HCV infection; 2) clinical or pathological evidences of liver cirrhosis; 3) the exclusion of other etiologies of liver cirrhosis. Diagnostic criteria of Schistosomiasis-related liver cirrhosis were: 1) the history of Schistosomiasis infection and/or the evidence of Schistosomiasis infection; 2) clinical or pathological evidences of liver cirrhosis; 3) the exclusion of other etiologies of liver cirrhosis. Diagnostic criteria of NASH liver cirrhosis were: 1) current or previous evidence of steatosis or steatohepatitis; 2) clinical or pathological evidences of liver cirrhosis; 3) the exclusion of other etiologies of liver cirrhosis [5]. Diagnostic criteria of alcohol-induced liver cirrhosis: 1) a history of significant alcohol intake; 2） clinical or pathological evidences of liver cirrhosis; 3) the exclusion of other etiologies of liver cirrhosis[6]. The diagnosis of PBC can be established when two of the following three criteria are met: 1) biochemical evidence of cholestasis based on ALP elevation; 2) presence of AMA, or other PBC-specific auto antibodies, including sp100 or gp210; if AMA is negative, histologic evidence of nonsuppurative destructive cholangitis and destruction of interlobular bile ducts[7]. The diagnosis of AIH requires compatible histological findings and is further supported by the following features: (1) elevated serum aminotransaminase levels; (2)

elevated serum IgG level and/or positive serological marker(s); (3) exclusion of viral, hereditary, metabolic, cholestatic, and drug-induced diseases that may resemble AIH[8]. Paris criteria for AIH-PBC overlapping syndrome require the presence of two of the following three diagnostic criteria: 1) alanine aminotransferase activity greater than 5 times the upper limit of normal; 2) IgG at least 2 times the upper limit of normal and/or positive anti-smooth muscle antibody; 3) Liver biopsy with moderate or severe interface hepatitis[7]. Left-sided portal hypertension can be caused by pancreatic diseases containing pancreatitis, pancreas malignancies, pancreatic pseudocysts, pancreatic abscess, etc [9]. Budd-Chiari syndrome is defined as hepatic venous outflow obstruction at any level from the small hepatic veins (HVs) to the junction of the inferior vena cava (IVC) and the right atrium, regardless of the cause of obstruction. The diagnosis of BCS was confirmed by clinical manifestations, by laboratory tests, by imaging modalities (ultrasonography, CT, MRI, or angiography)[10, 11].

Imaging technique

Images were acquired from one of the following CT scanners (Siemens Somatom Definition AS+, Siemens Somatom Definition, and Toshiba Aquilion ONE). Multi-detector row CT portal venography (CTPV) was performed after intravenous administration of high-iodine-concentration contrast medium (Iodixanol) (320 mg/mL) [Hengrui Medicine Co. Ltd, China] in a dose of 600 mg of iodine per kilogram of body weight at a rate of 2-4 ml/sec by an automatic power injector. CT examinations were performed 70-80 s after the start of the IV injection, and the images between 2-3 cm above the diaphragm and the ischial tuberosity were collected in our study. After scanning, the data were reconstructed at 0.75 mm slice

thickness and transferred into an advanced workstation (Syngovia Vb20, Siemens) for post-processing and analysis. All patients were investigated with axial images, multiplanar reconstruction (MPR), maximum intensity projection (MIP), and volume rendering images [12].

Imaging analysis

All images were retrospectively and independently reviewed by two radiologists with 5 or 10 years of experience in the field of abdominal imaging, who were blind to the patients' clinical data. A final consensus was obtained when any discrepant evaluation occurred. Firstly, radiological signs of liver cirrhosis were evaluated. We assessed the following signs: the volume of esophageal/gastric varices using regional growth method [13], the diameter of main portal vein (1cm distal to the junction of the splenic vein and superior mesenteric vein), splenic vein and superior mesenteric vein (1cm proximal to the junction), portal vein thrombosis, cavernous transformation of the portal vein, gallbladder wall thickening (>3 mm)[14-16], the longest dimension of spleen on an axial or coronal view and the presence of ascites. Secondly, afferent veins and efferent veins of gastric fundal varices were determined. Afferent veins of gastric varices contained the left gastric vein (LGV), short gastric vein (SGV) and posterior gastric vein (PGV), efferent veins contained splenorenal shunt (SRS), gastrorenal shunt (GRS) and spleno-gastroomental-superior mesenteric shunt (>3 mm). Thirdly, we also assessed the presence of other PSCVs, such as paraumbilical vein, intrahepatic portosystemic shunt (>3 mm), and retroperitoneal shunt.

Statistical analysis

Continuous variables were expressed as mean and standard deviation or median (25^{th}-75^{th} percentiles). Categorical variables were presented as count (percentage). The interobserver agreement between the two radiologists for determining radiological feature was determined using kappa (κ) statistics [17-19]. Mann-Whitney U test and ANOVA test were performed for continuous variables. The Chi squared ($\chi 2$) test was run for qualitative variables. The correlations of categorical or continuous variables were analyzed by Spearman correlation test. P value less than 0.05 was considered to indicate statistical significance. Statistical analyses were performed using SPSS version 22.0 (SPSS Inc., Chicago, Illinois, USA).

Table S1： The etiology of enrolled patients with gastric fundic varices in our study

	Total(222)	Gastroesophageal varices 2(109)	Isolated gastric varices1 (113)
Liver cirrhosis	168/222(75.68%)	101/109(92.66%)	67/113(59.29%)
HBV/HCV	106/222(47.75%)	61/109(55.96%)	45/113(39.82%)
Schistosomiasis	9/222(4.05%)	6/109(5.50%)	3/113(2.65%)
Alcoholic	7/222(3.15%)	5/109(4.59%)	2/113(1.77%)
Autoimmune liver diseases	11/222(4.95%	9/109(8.26%)	2/113(1.77%)
Cardiac cirrhosis	1/222(0.45%	1/109(0.92%)	0
Wilson diseases	1/222(0.45%	1/109(0.92%)	0
Nonalcoholic fatty liver disease	1/222(0.45%)	0	1/113(0.89%)
Budd-Chiari syndrome	1/222(0.45%)	1/109(0.92%)	0
Cryptogenic cirrhosis	31/222(13.96%)	17/109(15.59%)	14/113(12.39%)
Caroli's disease	1/222(0.45%)	1/109(0.92%)	0
Pancreatic diseases	38/222(17.12%)	0	38/113(33.63%)
Others	15/222(6.76%)	7/109(6.42%)	8/113(7.08%)

Table S2: The correlations of portosystemic collateral vessels with clinical profiles in patients with GOV2

Variables		**Peripheral blood routine examination**			**Liver function**		**Clinical characteristics**				
		Erythrocytes	Leukocyte	Platelet	Child-Pugh	MELD	PHG	Ulcer	Ascites	Portal vein thrombosis	Cavernous transformation of PV
The volume of esophageal varices (ml)	Correlation coefficient	0.026	-0.092	-0.317	-0.134	-0.032	0.022	0.013	-0.086	0.115	0.151
	P	0.806	0.375	0.002	0.217	0.765	0.836	0.902	0.412	0.270	0.146
	N	94	94	94	87	88	93	94	94	94	94
The volume of gastric varices (ml)	Correlation coefficient	0.089	0.013	0.087	-0.003	-0.168	-0.229	0.159	-0.105	-0.079	0.029
	P	0.401	0.904	0.412	0.977	0.123	0.029	0.130	0.318	0.452	0.781
	N	92	92	92	85	86	91	92	92	92	92
Maximum diameter of LGV (mm)	Correlation coefficient	0.122	-0.068	-0.189	-0.114	0.041	-0.184	0.061	-0.009	0.101	0.181
	P	0.241	0.511	0.067	0.288	0.700	0.076	0.555	0.933	0.329	0.080
	N	95	95	95	89	90	94	95	95	95	95
Short gastric veins	Correlation coefficient	-0.186	-0.335	-0.319	-0.024	0.057	0.145	0.019	0.048	-0.034	-0.057
	P	0.068	0.001	0.001	0.823	0.593	0.160	0.852	0.639	0.738	0.578
	N	97	97	97	90	91	96	97	97	97	97
Posterior gastric vein	Correlation coefficient	-0.015	-0.04	-0.036	0.121	0.067	0.014	-0.070	0.045	-0.074	-0.028
	P	0.885	0.684	0.724	0.255	0.528	0.892	0.494	0.663	0.474	0.786

	N	97	97	97	90	91	96	97	97	97	97
Splenorenal shunt	Correlation coefficient	-0.010	-0.092	-0.113	-0.121	0.109	-0.202	0.162	-0.129	0.183	0.247
	P	0.924	0.372	0.272	0.257	0.305	0.049	0.113	0.208	0.073	0.015
	N	97	97	97	90	91	96	97	97	97	97
Gastrorenal shunt	Correlation coefficient	-0.001	0.062	-0.022	0.080	0.137	-0.061	0.031	-0.114	-0.135	-0.058
	P	0.993	0.545	0.831	0.453	0.195	0.556	0.766	0.265	0.187	0.574
	N	97	97	97	90	91	96	97	97	97	97
Intrahepatic portosystemic shunts	Correlation coefficient	-0.011	-0.093	-0.164	0.094	0.010	0.005	-0.078	-0.055	0.086	-0.099
	P	0.914	0.367	0.109	0.377	0.346	0.961	0.448	0.590	0.405	0.335
	N	97	97	97	90	91	96	97	97	97	97
Paraumbilical vein patency	Correlation coefficient	0.160	-0.004	0.034	-0.022	0.028	-0.194	-0.037	-0.012	-0.066	-0.211
	P	0.117	0.968	0.740	0.839	0.791	0.059	0.717	0.909	0.519	0.038
	N	97	97	97	90	91	96	97	97	97	97
Retroperitoneal shunt	Correlation coefficient	-0.013	-0.212	-0.054	0.113	0.131	-0.093	0.027	0.076	0.117	0.171
	P	0.897	0.037	0.598	0.289	0.217	0.365	0.791	0.459	0.252	0.094
	N	97	97	97	90	91	96	97	97	97	97

Note: the correlations among variables were analyzed by Spearman correlation test. In determining the maximum diameter of a vessel, isolated saccular dilatation of a vessel in venous ectasia or venous aneurysm was excluded.

Table S3: The correlations of portosystemic collateral velssels with clinical profiles in patients with IGV1

Variable		Peripheral blood routin examination			Liver function		Clinical characteristics				
		Erythrocyte	Leukocyte	Platelet	Child-pugh	MELD	Portal hypertensive gastropathy	Ulcer	Ascites	Portal vein thrombosis	Cavernous transformation of portal vein
The volume of gastric varices (ml)	Correlation coefficient	-0.210	-0.390	-0.476	0.151	0.499	0.151	0.022	-0.003	-0.214	-0.054
	P	0.077	0.001	0.000	0.223	0.000	0.187	0.850	0.982	0.060	0.638
	N	72	72	72	67	67	78	78	78	78	78
Maximum diameter of LGV (mm)	Correlation coefficient	-0.009	-0.128	-0.282	0.039	0.061	0.173	-0.210	-0.148	-0.158	0.128
	P	0.950	0.348	0.035	0.786	0.670	0.178	0.101	0.252	0.221	0.321
	N	56	56	56	52	52	62	62	62	62	62
Short gastric vein	Correlation coefficient	-0.073	0.062	0.102	0.063	0.011	-0.063	0.080	-0.003	-0.063	0.013
	P	0.529	0.594	0.381	0.605	0.928	0.574	0.476	0.979	0.574	0.907
	N	76	76	76	71	71	82	82	82	82	82

Posterior gastric vein	Correlation coefficient	-0.078	-0.241	-0.019	-0.164	-0.082	0.142	-0.005	-0.136	0.028	0.089
	P	0.502	0.036	0.869	0.172	0.499	0.203	0.962	0.222	0.804	0.425
	N	76	76	76	71	71	82	82	82	82	82
Splenorenal shunt	Correlation coefficient	0.107	-0.161	-0.188	-0.066	0.061	0.102	-0.046	-0.008	-0.080	-0.068
	P	0.359	0.166	0.103	0.583	0.615	0.364	0.685	0.944	0.478	0.541
	N	76	76	76	71	71	82	82	82	82	82
Gastrorenal shunt	Correlation coefficient	0.130	-0.130	-0.218	0.044	0.129	0.205	0.293	0.091	-0.136	-0.215
	P	0.263	0.263	0.058	0.714	0.282	0.064	0.007	0.414	0.223	0.053
	N	76	76	76	71	71	82	82	82	82	82
Maximum diameter of gastrorenal shunt (mm)	Correlation coefficient	-0.042	-0.146	-0.467	0.236	0.594	0.075	0.113	0.068	-0.138	/
	P	0.795	0.369	0.002	0.154	0.000	0.630	0.466	0.659	0.371	/
	N	40	40	40	38	38	44	44	44	44	44
Spleno-gastro omental-super	Correlation	-0.056	0.039	0.238	0.028	-0.115	-0.111	-0.239	-0.197	0.174	0.232

ior mesenteric shunt	coefficient										
	P	0.628	0.740	0.038	0.819	0.339	0.319	0.031	0.075	0.117	0.036
	N	76	76	76	71	71	82	82	82	82	82
Intrahepatic portosystemic shunts	Correlation coefficient	-0.088	-0.199	-0.091	0.013	0.062	0.257	0.168	0.047	-0.044	-0.038
	P	0.451	0.085	0.435	0.915	0.606	0.020	0.133	0.675	0.694	0.735
	N	76	76	76	71	71	82	82	82	82	82
Paraumbilical vein patency	Correlation coefficient	-0.189	-0.194	-0.196	0.017	0.185	-0.069	0.004	0.143	-0.069	-0.060
	P	0.102	0.093	0.090	0.885	0.121	0.537	0.975	0.201	0.537	0.595
	N	76	76	76	71	71	82	82	82	82	82
Retroperitoneal shunt	Correlation coefficient	-0.002	0.138	0.068	0.052	-0.010	0.039	-0.015	-0.036	-0.107	0.076
	P	0.989	0.234	0.558	0.667	0.933	0.726	0.897	0.751	0.338	0.498
	N	76	76	76	71	71	82	82	82	82	82

Note: the correlations of categorical or continuous variables were analyzed by Spearman correlation test. In determining the maximum diameter of a vessel, isolated saccular dilatation of a vessel in venous ectasia or venous aneurysm was excluded.

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