Supplement

**Detailed methods of US**

Gray scale and color Doppler US were performed using a PVT-375 BT (center frequency, 3.75 MHz), 674 BT (center frequency, 6 MHz) and 704AT/BT (center frequency, 7.5 MHz) equipped with AplioTM XV/XG (Toshiba Medical Systems Corp., Otawara, Japan).

US was performed for the liver, gall bladder, spleen and abdominal cavity. Color Doppler imaging was performed for estimating hepatofugal flow of portal vein and recanalization of para-umbilical vein, obtained with color gain adjusted until disappearance of noise for maximization of the sensitivity. Color Doppler frequency was set from 3.3 to 7.2 MHz, pulse repetition frequency from 4.7 to 10.1 cm/sec, which was adjusted according to the type of probes and the depth of the target regions. Wall filter was set from 3 to 4.

Detailed parameters included in US-17 screening.

It was consisted of 17 parameters and maximum 19 points. Two parameters, amount of ascites and blood flow signal in PUV were weighed according to our previous analysis (data not shown).

1) Hepatomegaly is estimated in left lobe and right lobe (the value measured vertical diameter of pre-aortic and right anterior axillary line, not less than 70 mm and 110 mm, respectively).

2) Splenomegaly (maximum diameter, a value of not less than 110 mm),

3) Gall bladder wall thickening (not less than 6 mm),

4) Dilatation of main portal vein (not less than 12 mm).

5) Dilatation of para-umbilical vein (A hypoechoic lumen in the hyperechoic ligamentum teres measured not less than 2 mm of diameter),

6) Existence of ascites estimated in mainly 3 locations 1 (Douglas pouch, Morison’s pouch and periphery of spleen). A little amount of ascites: presented one or more of the locations as mentioned above. More than moderate amount of ascites: presented in all 3 locations and should be more than 1 cm thickening of ascites in 2 locations.

7) Hepatic vein narrowing (three hepatic veins diameter measured 2 cm from the inferior vena cava, less than 3 mm was considered as markedly reduced hepatic vein blood flow).

8) Decrease mean velocity of portal vein (less than or equal to 10 cm/sec), measured by pulse Doppler. Doppler angle should be maintain less than or equal to 60 degrees to avoid overestimation.

9) Hepatofugal flow in main portal vein by color Doppler, 0 indicates hepatopetal, 1 indicates congestion or hepatofugal flow of portal vein.

10) Appearance of blood flow signal in para-umbilical vein by color Doppler. To maximize sensitivity, try to employ high frequency probe (more than 6MHz), color Doppler frequency should be set at the lowest in the used US equipment, velocity range is recommended around 5 to 10 cm/s. 0 indicates none, 1 indicates appearance of blood flow signal in PUV.

11) Wave form planarization of 3 hepatic veins due to decrease blood flow (Normally triphasic, biphasic and monophasic waveform were considered decreased blood flow)

12) Increase resistive index (RI) of hepatic artery (not less than 0.75) 2. Resistive index (RI) was calculated by mathematical formula (maximum velocity minus minimum velocity over maximum velocity).

**Table S. US-17 screening**

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| --- | --- | --- | --- |
| US findings | Cut off value | points | Measurements details |
| Hepatomegaly in the left lobe | 70mm> | 0/1 | Vertical diameter of pre aorticplace |
| Hepatomegaly in the right lobe | 110mm> | 0/1 | Vertical diameter of right anterior axillary line |
| Splenomegaly | 110mm> | 0/1 | Maximum diameter |
| Portal vein diameter | 12mm> | 0/1 | Maximum diameter |
| Direction of portal vein flow | 0,1 | 0/1 | 0: hepatopetal, 1: congestion or hepatofugal flow |
| Portal vein mean velocity | 10cm/sec< | 0/1 | Measured by pulse Doppler in main portal vein trunk |
| PUV diameter | 2mm> | 0/1 | Maximum diameter |
| Appearance of  PUV blood flow signal | 0,1,2 | 0/2 | 0: none, 2: appearance is cknowledged by color Doppler |
| Gall bladder wall thickening | 6mm> | 0/1 | Maximum wall thickness |
| Amount of ascites | 0,1,2 | 0/1/2 | 0: none, 1: a little, 2: more than moderate amount |
| Hepatic vein diameter | Left 3mm> | 0/1 | Diameter measured 2 cm from the inferior vena cava |
| Middle 3mm> | 0/1 |
| Right 3mm> | 0/1 |
| Hepatic vein wave form | Left 0,1 | 0/1 | Measured 2 cm from the inferior vena cava by pulse Doppler, 0: triphasic, 1: biphasic or monophasic flow |
| Middle 0,1 | 0/1 |
| Right 0,1 | 0/1 |
| Hepatic artery resistive indexd | 0.75> | 0/1 | Measured in proper hepatic artery: Vmax-Vmin/Vmax |
| ***Total 17 parameters*** | | ***Maximum 19 points*** | |

Abbreviations; PUV = para-umbilical vein

1. Goodman LR, Aprahamian C. Changes in splenic size after abdominal trauma. *Radiology* 1990; **176**(3)**:** 629-632. doi: 10.1148/radiology.176.3.2389017

2. Herbetko J, Grigg AP, Buckley AR, Phillips GL. Venoocclusive liver disease after bone marrow transplantation: findings at duplex sonography. *AJR Am J Roentgenol* 1992; **158**(5)**:** 1001-1005. doi: 10.2214/ajr.158.5.1566656