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Original Article

Sandwich transjugular intrahepatic portosystemic stent-shunt in esophageal variceal hemorrhage at end stage of hepatocellular carcinoma with wide portal vein embolism

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Abstract: *Background:* Transjugular intrahepatic portosystemic stent-shunt (TIPSS) is an effective treatment method for esophageal variceal hemorrhage caused by portal hypertension. This study aimed to investigate the efficacy and safety of sandwich TIPSS in treating esophageal variceal hemorrhage at end stage of hepatocellular carcinoma (HCC) with wide portal vein embolism. *Methods:* Twenty patients diagnosed with esophageal variceal hemorrhage at end stage of HCC with wide portal vein embolism were enrolled and TIPSS was performed. Before and 1 week after surgery, the portal vein pressure, serum levels of bilirubin indexes (total bilirubin, direct bilirubin), and liver function indexes (gamma glutamyl transferase, GGT; alanine aminotransferase, ALT; aspartate aminotransferase, AST) were determined and were compared. *Results:* The puncture was successfully performed in 20 patients. The hemorrhage was successfully stopped. The portal vein pressure before and after surgery was 27.36±3.11 mmHg and 17.36±4.32 mmHg, respectively, with significant difference between them ($P < 0.05$). There was no significant difference of serum total bilirubin, direct bilirubin, GGT, ALT, or AST before and 1 week after surgery ($P > 0.05$). During follow-up, the esophageal variceal hemorrhage did not occur again, and the ascites and edema of the lower limbs were obviously alleviated. *Conclusion:* For patients with esophageal variceal hemorrhage due to HCC with wide portal vein embolism, sandwich TIPSS can break the indication restriction and make patients to live longer in emergency situations. Vascular embolism is not a contraindication when considering the TIPSS operation, even when the patient is at end stage of HCC with wide vein embolism.

Keywords: Transjugular intrahepatic portosystemic stent-shunt, hepatocellular carcinoma, hemorrhage, embolism

Introduction

Transjugular intrahepatic portosystemic stent-shunt (TIPSS) is an effective treatment method for esophageal variceal hemorrhage caused by portal hypertension [1]. It has been demonstrated that, compared with medical treatment and treatment based upon gastroscopy, TIPSS is the favored rescue procedure for uncontrolled variceal hemorrhage [2]. With TIPSS developing, some authors have defined its indications and contraindications. The contraindications of TIPSS include the presence of hepatocellular carcinoma (HCC) or multicystic liver disease engoring or infiltrating the vascular structures or the parenchyma of the liver neighboring the proposed shunt tract [3-5]. When esophageal variceal hemorrhage at end stage of HCC with wide portal vein embolism occurs, it is usually one of the absolute contraindications. The reasons include invisible portal vein images, unmanageable embolisms, difficult operation process and bad prognostics [6]. If these problems can be solved, the patients will benefit from the TIPSS and survive longer with higher life quality. This study investigated the efficacy and safety of sandwich TIPSS in treating esophageal variceal hemorrhage at end stage of HCC with wide portal vein embolism. The objective was to provide a reference for the further clinical application of this technique.

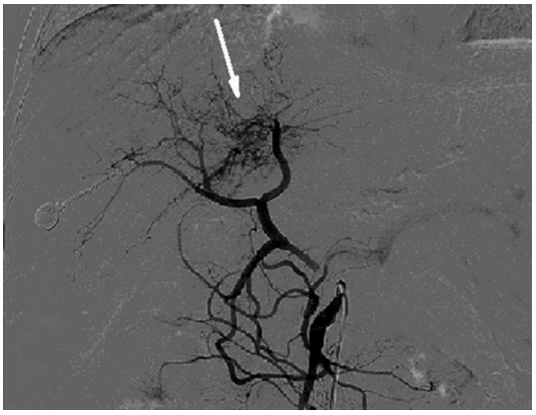

Figure 1. Indirect portography through superior mesenteric artery. The main portal vein and superior mesenteric vein were not developed, and there were large communicating branches between superior mesenteric artery and hepatic artery. The deep staining area in the liver was considered as the portal area of the left branch of portal vein, and this was the puncture target.

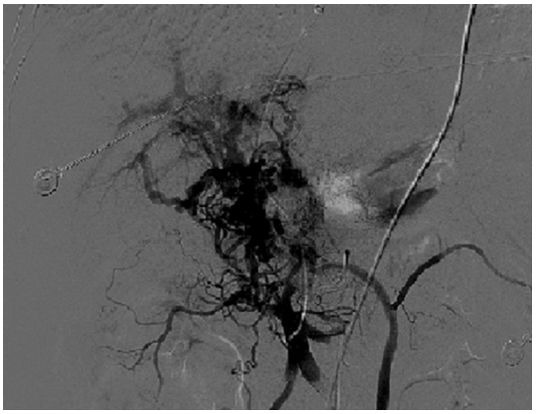

Figure 2. Direct portography through superior mesenteric vein. The main portal vein and splenic vein were not developed, but compensatory vessels of collateral branches and partial intrahepatic portal veins were developed.

Patients and methods

Patient recruitment

Twenty patients diagnosed with HCC combined with wide portal vein embolism were enrolled in this study. There were 12 males and 8 females. The average age of patients was 52.33±13.67 years. The patients vomited for a total of 63 times and the average vomit volume was 1565 ±20 mL for each person. Fourteen patients had total 70 times of blood feces, with average amount of 1500±30 g for each patient. Before TIPSS, all patients had enhanced CT scan and

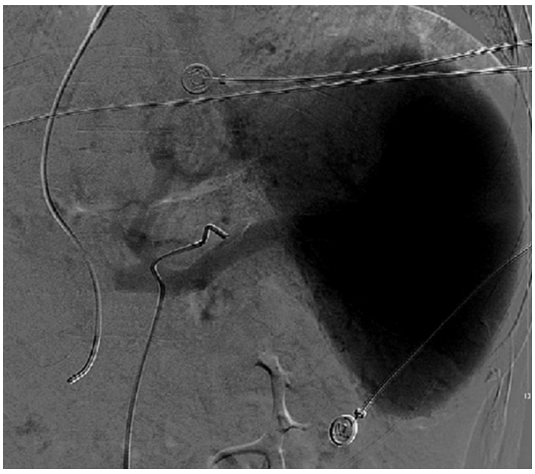

Figure 3. Splenic arteriography. The spleen vein embolism appeared, the gastric coronary vein was wider than normal, and the bleeding site appeared.

Figure 4. Direct portography after imbedding frame in main portal vein and splenic vein. The blood flow was unobstructed, and no gastric coronary vein was developed.

received gastroscopy examination and therapies. The different therapies were conducted for average 1.67±0.21 times for each patient based on gastroscopy.

Inclusion criteria and exclusion criteria

The inclusion criteria were as follows: i) the age of patients was 18-75 years old; ii) the preoperative B-ultrasound, CT or MRI examination indicated the HCC combined with portal vein embolism; iii) there was no distant metastasis. The exclusion criteria were as follows: i) the patients had the extrahepatic metastasis of tumor; ii) the patients had the previous history of TIPSS.

Table 1. General patient information

Index	
Age (years)	62.33±13.67
Gender [male, n (%)]	12 (60.00)
Combined hepatitis B [n (%)]	11 (55.00)
Combined esophageal varices bleeding [n (%)]	4 (20.00)
Combined electrolyte disturbance [n (%)]	3 (15.00)
Combined anemia [n (%)]	2 (10.00)
Portal vein diameter (cm)	1.40±0.20
Portal vein embolism diameter (cm)	1.35±0.20
CHILD score	B8
ECOG score	3

Obtaining of vascular images

The general indirect portography through superior mesenteric artery was conducted to obtain hepatic portal vein images (**Figure 1**). As a result, the main hepatic portal vein and superior mesenteric vein were not developed. This meant the embolisms jammed the hepatic portal vein and superior mesenteric vein. As a further step, direct portography through the superior mesenteric vein was conducted (**Figure 2**). It was found that the main portal vein and splenic vein were not developed, but the compensatory vessels of collateral branches and partial intrahepatic portal veins were developed. The hepatic portal vein distribution trend was determined by referring the abdominal contrast enhanced CT scan results. The right path to puncture was confirmed according to the CT scan results.

TIPSS operation

Polytetrafluoroethylene-covered stent and TUROM microcatheter (Cook Medical, Bloomington, IN, USA) were used for TIPSS. The puncture needle was controlled as it passed through the inferior cava vein to right hepatic vein. When the needle arrived at the accurate puncture point, it directly perforated into the left hepatic portal vein and successfully built a bridge to the right hepatic vein. It passed through the embolisms in the hepatic portal vein by normal TUROM guide wire. After another catheter was transposed, the hepatic portal vein was confirmed by direct hepatic portal portography. By conducting these examinations, it was found that two embolisms located in two different veins. To affirm that the lower veins were not obstructed, splenic arteriography was conducted (**Figure 3**). The images show that the spleen vein embolism appeared, the gastric coronary vein was wider than normal, and the bleeding site appeared.

Treatment of embolisms

The guide wire was extended to the spleen vein and exchanged the catheter. After that the spleen vein angiography was made, and the bleeding veins were found. Then, the gastric coronary vein was blocked with elasticity steel embolic agent to stop the gastrointestinal bleeding. When gastric coronary vein was blocked, the whole puncture path was expanded with balloon dilation balloon catheter. After that the stent was released beyond the embolisms to make the embolisms to form a "sandwich" in the middle of stent and vascular walls, which included the spleen vein, left hepatic portal and hepatic portal trunk (**Figure 4**).

Observation indexes

Before and 1 week after surgery, the portal vein pressure, serum levels of bilirubin indexes (total bilirubin, direct bilirubin) and liver function indexes (gamma glutamyl transferase, GGT; alanine aminotransferase, ALT; aspartate aminotransferase, AST) were determined and were compared.

Statistical analysis

SPSS13.0 software (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Data are presented as mean ± SD. Comparisons between two groups were performed using t test. $P < 0.05$ was considered as statistically significant.

Results

General information of patients

The general information of patients is shown in **Table 1**. In 20 HCC patients combined with wide portal vein embolism, there were 11 (55.00%) cases combined with hepatitis B, 4 (20.00%) cases combined with esophageal varices bleeding, 3 (15.00%) cases combined with electrolyte disturbances and 2 (10.00%) cases combined with anemia. The CHILD score was B8 and the ECOG score was 3.

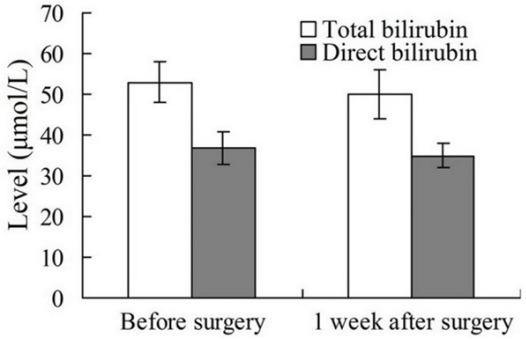

Figure 5. Comparison of serum bilirubin indexes before and after surgery.

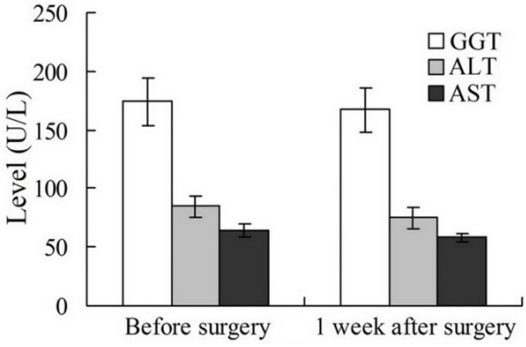

Figure 6. Comparison of liver function indexes before and after surgery. GGT, gamma glutamyl transferase; ALT, alanine aminotransferase; AST, aspartate aminotransferase.

Overall surgery outcome

The puncture was successfully performed in 20 patients, which success rate of 100%. The catheter was placed in the distal superior mesenteric vein for direct portography, with obvious shadow of distal superior mesenteric vein, but without shadow in the main portal vein. The distal superior mesenteric vein was connected with the trunk shunt branches around the main portal vein. There was a filling defect in the splenic vein in 15 cases. In 5 cases, due to no splenic vein angiography, splenic artery angiography was performed. It was found that, the parenchymal splenic vein and portal vein were blocked, and the gastric coronary vein was significantly thickened, with distal contrast diffusion. After embolization of gastric coronary vein, the stent was implanted in the splenic vein. The hemorrhage was successfully stopped. The other cases, the stent was implanted in the slightly distal superior mesenteric vein embolus, and the hemorrhage was successfully stopped. In 20 patients, the abdominal fullness and discomfort were alleviated obviously after 3-6 hours from surgery. The fecal occult blood became negative after 3-5 days from surgery.

Comparison portal vein pressure before and after surgery

Portal vein pressure was measured before and after the establishment of the shunt. It was 27.36±3.11 mmHg and 17.36±4.32 mmHg before and after surgery, respectively. There was significant difference before and after surgery ($P < 0.05$).

Comparison of serum bilirubin indexes and liver function indexes before and after surgery

Serum total bilirubin and direct bilirubin levels and liver function indexes including GGT, ALT and AST before and 1 week after surgery were compared. There was no significant difference of above indexes between before and 1 week after surgery ($P > 0.05$) (**Figures 5**, **6**).

Follow-up results

All 20 patients survived and were followed. 15 cases were followed for 4-6 weeks, and 5 cases were followed for 8 weeks. The esophageal variceal hemorrhage did not occur again. The ascites and edema of the lower limbs were obviously alleviated.

Discussion

When HCC with wide hepatic portal vein embolism occurs, the useful images of the hepatic portal vein and its branches could not be created. Because of the lead of image, the portal vein and inferior vena cava could not be connected and the embolism could not be handled well [7, 8]. For this reason TIPSS is very seldom reported in the end stage of HCC with wide hepatic portal vein embolism when it is combined with acute upper gastrointestinal bleeding. To solve this problem, a new way to obtain some images and sandwich TIPSS were utilized to handle the embolisms. For TIPSS operation, these difficulties were successfully conquered on patients at end stage of HCC with wide hepatic portal vein embolism combined with acute upper gastrointestinal bleeding. Results of this study show that, the puncture was successfully performed in 20 patients, which suc-

cess rate of 100%. This indicates that, the sandwich TIPSS is suitable for treating esophageal variceal hemorrhage at end stage of HCC with wide portal vein embolism.

Liver artery angiography examination is widely used in diagnosing many diseases [9-11]. However, it is seldom used to examine hepatic portal vein because of the special liver blood flow system [12, 13]. In this study, the liver artery angiography was applied to examine hepatic portal vein by accident during TIPSS operation when treating acute upper gastrointestinal bleeding in end stage of HCC with wide hepatic portal vein embolisms. This indicates that, the liver artery angiography can be performed for detecting esophageal variceal hemorrhage at end stage of HCC with wide portal vein embolism and guiding the treatment.

In this study, all 20 patients were found with HCC based on hepatic cirrhosis diagnosed many years ago, which had bad liver function and embolisms in the hepatic portal vein. We can freely pass through the embolisms in the hepatic portal vein by normal TUROM guide wire. After transposition with another catheter, the hepatic portal vein was confirmed by direct hepatic portal venography, so that RUPS-100 could be sent into the hepatic portal vein. For safety reasons anticoagulant pharmacy was not applied but directly drew back some blood with no embolisms in the vein by 20 mL syringe, considering that the embolism was old and the ectopic embolization could hardly occur. Furthermore, the embolisms are at the sandwich layer between stent and vascular, it is hard to drop.

In conclusion, for patients with esophageal variceal hemorrhage due to HCC with wide portal vein embolism, sandwich TIPSS can break the indication restrict and make patients live longer in emergency situations. Vascular embolism is not the contraindication when considering TIPSS operation even the patient is at end stage of HCC with wide vein embolism. However, the sample size of this study is relatively small. In future studies, the sample size should be further increased for obtaining more convincing results.

Disclosure of conflict of interest

None.

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