Chapter 39
Interventional Radiology: Transjugular Retrograde Obliteration

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Abstract The method of transvenous retrograde obliteration is divided into two approaches. One is the transjugular approach and the other is the transfemoral approach. The former is called transjugular retrograde obliteration (TJO) and the latter balloon-occluded retrograde transvenous obliteration (B-RTO). TJO makes it easier than B-RTO to reach gastric varices with gastrorenal shunt (GRS) with either superselective or selective access. The gastric varices are successfully eradicated by TJO. However, TJO obliterates the GRS, which has an abundant blood flow and increased portal venous pressure. Partial splenic embolization (PSE) has the effect of decreasing splenic blood flow and portal venous pressure. The combined therapy using TJO and PSE for gastric varices is more effective than TJO only in the long-term prevention of esophageal varices after TJO.

Keywords Transjugular retrograde obliteration · Partial splenic embolization
Gastric varices · Gastrorenal shunt

39.1 Introduction

Transvenous retrograde obliteration has recently become the treatment of choice for gastric varices with gastrorenal shunt (GRS) at many institutions in Japan [1–4]. The method of transvenous retrograde obliteration is divided into two approaches. One is the transjugular approach and the other is the transfemoral approach. The former is called transjugular retrograde obliteration (TJO) [3] and the latter balloon-occluded retrograde transvenous obliteration (B-RTO) [4]. Here, we describe TJO and the combined therapy using partial splenic embolization (PSE).

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39.2 Merits

Olson et al. [5] reported a case of gastric varices treated with retrograde obliteration of esophagogastric varices with absolute ethanol and coils via the GRS through femoral vein. Kanagawa et al. [1] also reported variceal obliteration with 5% ethanolamine oleate with iopamidol (5% EOI) with the same route, but they used 40 mL of 5% EOI. Our method of TJO approaches the GRS through a jugular vein (Table 39.1). This route is easier than the femoral one to reach at the GRS with either superselective or selective access. Because absolute ethanol has stronger potency to obliterate the vein than 5% EOI, it was used to obliterate the communicating routes of GRS such as inferior phrenic and/or azygos veins. By using absolute ethanol, we could reduce the volume of 5% EOI as compared with the report of Kanagawa et al. [1]. However, the volume of absolute ethanol should be smaller, because it causes epigastric pain. Therefore, superselective access is more desirable than selective access because the required volume of absolute ethanol is smaller. The quantity of 5% EOI used should be less than 0.5 mL/kg because larger volumes can cause renal injury or lung congestion [6]. With our method, the volume is smaller than 0.3 mL/kg.

39.3 Treatment Procedure

Pentazocine 15 mg and hydroxyzine hydrochloride 25 mg are injected intramuscularly 30 min prior to the operation. Through the right internal jugular vein, we inserted an 8-French long cobra-shaped sheath into the left renal vein. We then inserted a 5- or 6-French angiographic catheter, with an occlusive balloon of 11 or 20 mm in diameter, into the GRS through a previously inserted sheath. The balloon is inflated with 0.7–4.0 mL of diluted contrast medium to stop the blood flow in the GRS (Fig. 39.1). The communicating routes of the GRS, such as the inferior phrenic and/or retroperitoneal veins, are obliterated with a microcoil when a 3-French microcatheter can be inserted into these veins and/or with absolute ethanol when the microcatheter cannot be inserted. After the procedure, gastric variceal blood flow is completely controlled, and we inject 5–20 mL of 5% EOI into the gastric varices

Table 39.1 Techniques of retrograde obliteration for gastric varices

Method	Author	Approach	Embolic material	Duration of Balloon inflation
Transrenal-vein reflux ethanol sclerosis	Olson (1984)	Femoral v.	Ethanol coil	None
Balloon-occluded retrograde transvenous obliteration (B-RTO)	Kanagawa (1991)	Femoral v.	5%EOI	30 min
Transjugular retrograde obliteration (TJO)	Chikamori (1992)	Jugular v.	Ethanol coil 5%EOI	24 h

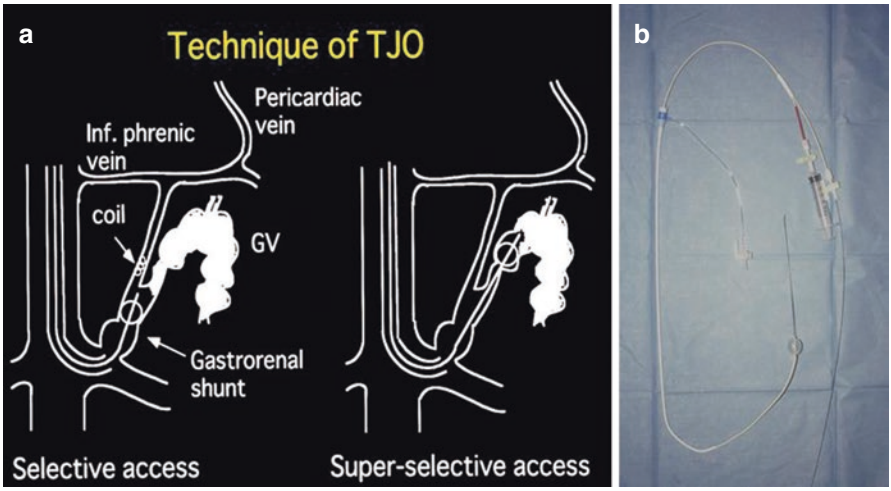

Fig. 39.1 (**a**) Schematic diagram of TJO. (**b**) Long, cobra-shaped sheath and angiographic catheter with an occlusive balloon

under fluoroscopy. After confirming the presence of thrombi in the gastric varices by retrograde shunt venography the next day, we remove the catheter. If retrograde shunt venography reveals no thrombi in the varices, we repeat the procedure. The catheter is left in the vein for 1 or more days, depending on how rapidly the thrombi form in the gastric varices [3].

39.4 Results

We reported on 8 years of experience with TJO performed on 54 patients with gastric varices [7]. The success of obliteration of the gastric varices was confirmed by enhanced computed tomography (CT) 1 week, 1 month, and 3 months after TJO. The gastric varices were successfully obliterated by TJO in all patients. Eradication of the gastric varices was diagnosed by endoscopic examination 1 week, 1 month, and 3 months after TJO. The gastric varices were successfully eradicated by TJO in all patients.

Minor complications observed were fever more than 38 °C in 20 patients, hemoglobinuria in 8, pleural effusion in 3, ascites which could be controlled with diuretics in 1, and hemorrhagic gastritis in 3. There was no deterioration in liver function.

There was no recurrence or bleeding of gastric varices in any patient after TJO.

The overall cumulative survival rate of patients after TJO was 92% at 1 year, 76% at 3 years, 61% at 5 years, and 47% at 8 years. The cumulative survival rate of patients without HCC after TJO was 88% at l year, 82% at 3 years, 73% at 5 years, and 60% at 8 years. The cumulative survival rate of patients with HCC after TJO

was 100% at 1 year, 64% at 3 years, and 21% at 5 years. Patient survival differed depending on whether or not HCC was present ($p < 0.05$).

The cumulative occurrence rate of esophageal varices in patients in whom the inferior phrenic vein was preserved after TJO was 30% at 1 year, 51% at 3 years, and 63% at 5 years. The cumulative occurrence rate of esophageal varices in patients in whom the inferior phrenic vein was not preserved after TJO was 36% at 1 year, 56% at 3 years, and 56% at 5 years (Fig. 39.4). The occurrence rate of esophageal varices after TJO was not affected by the preservation of the inferior phrenic vein. Esophageal varices that occurred after TJO were treated by EIS using the Takase method.

39.5 Effects on Portal Hemodynamics

We investigated the short-term effects on portal hemodynamics of TJO in 30 patients with gastric varices with GRS [8]. The portal blood flow was measured by an ultrasonic duplex Doppler system, and the wedged hepatic venous pressure was measured by hepatic venous catheterization, before and after TJO. The wedged hepatic venous pressure was significantly increased the day after TJO compared with that before therapy (257 ± 71 vs. 307 ± 73 mmH_2O, $p < 0.01$). The portal venous flow was significantly increased 1 week after TJO compared with that before therapy (744 ± 190 vs. 946 ± 166 mL/min, $p < 0.01$). The serum albumin levels before and after TJO were 3.0 ± 0.4 and 3.1 ± 0.5 g/dL, respectively, and the total bilirubin levels were 1.5 ± 0.7 and 1.5 ± 0.8 mg/dL, respectively, neither of these parameters changing significantly. The plasma ammonia levels before and after TJO were 109 ± 62 and 67 ± 31 μg/dL, and the indocyanine green retention rates at 15 min were 31 ± 13 and 24 ± 13%, both showing a significant change ($p < 0.01$ and $p < 0.05$, respectively). We conclude that TJO increases portal blood flow which contributes to the decrease in plasma ammonia levels and the indocyanine green retention rate but increases the wedged hepatic venous pressure.

39.6 Combined Therapy Using PSE

Our previous study [8] showed that TJO obliterates the GRS, which has an abundant blood flow, and increases portal venous pressure. PSE has the effect of decreasing splenic blood flow and portal venous pressure [9]. Therefore, we recommend the combined therapy using PSE.

PSE was performed 7–14 days before TJO. Through the right femoral artery, a 5- French catheter was selectively advanced to the splenic artery. Through this catheter, a 3-French microcatheter was positioned into the peripheral splenic artery, distal to the great pancreatic artery. After selective splenic arteriography, more than

70% splenic arterial embolization was performed using platinum microcoils and/or gelatin sponge under fluoroscopy.

Between November 2002 and December 2006, 14 patients with gastric varices with GRS were treated by combining TJO and PSE (group 1) [10]. These patients were compared with 19 patients with gastric varices with GRS treated by only TJO (group 2) for the disappearance rate of gastric varices, the cumulative survival rate, and the occurrence rate of esophageal varices after TJO. The disappearance rate of gastric varices following TJO was 100% in both groups. The 3-year cumulative survival rate after TJO was 92% in group 1 and 95% in group 2. The 3-year cumulative occurrence rate of esophageal varices after TJO was 9% in group 1 and 45% in group 2, with a significant difference ($p < 0.05$). We conclude that the combination of TJO and PSE for gastric varices is more effective than TJO only in the long-term prevention of esophageal varices after TJO.

39.7 Case Report

A 54-year-old man with liver cirrhosis was admitted for the treatment of large gastric varices (Fig. 39.2a, b). The Child-Pugh score was grade B. Antibodies to hepatitis B was positive. This case was treated by PSE and TJO. Splenic arterial portography showed that the gastric varices were supplied by the posterior gastric vein and drained into the GRS (Fig. 39.3a). At first, PSE was performed using microcoils and gelatin sponge. Two weeks after PSE, TJO was performed. Retrograde shunt venography showed the inferior phrenic veins; however, gastric varices were unclear (Fig. 39.3b). After embolization of inferior phrenic vein with 5 mL of ethanol and 80 mL of 50% glucose, 10 mL of 5% EOI was injected into the gastric varices (Fig. 39.3c). CT 1 week after TJO revealed the gastric varices had

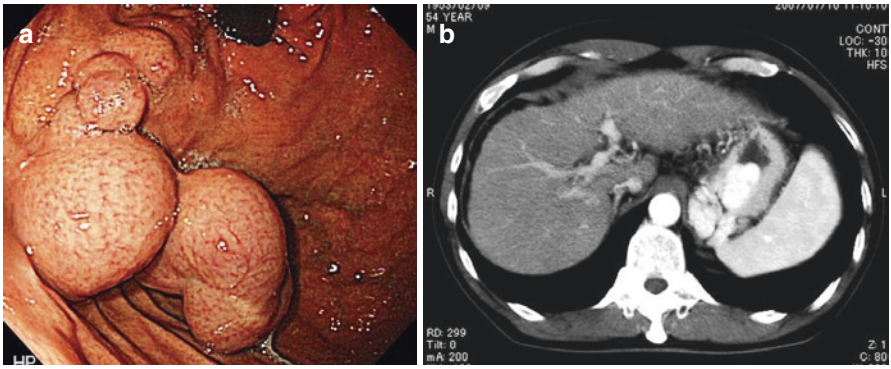

Fig. 39.2 (**a**) Endoscopic picture before TJO showing large gastric varices. (**b**) CT before PSE and TJO showing large gastric varices and mild splenomegaly

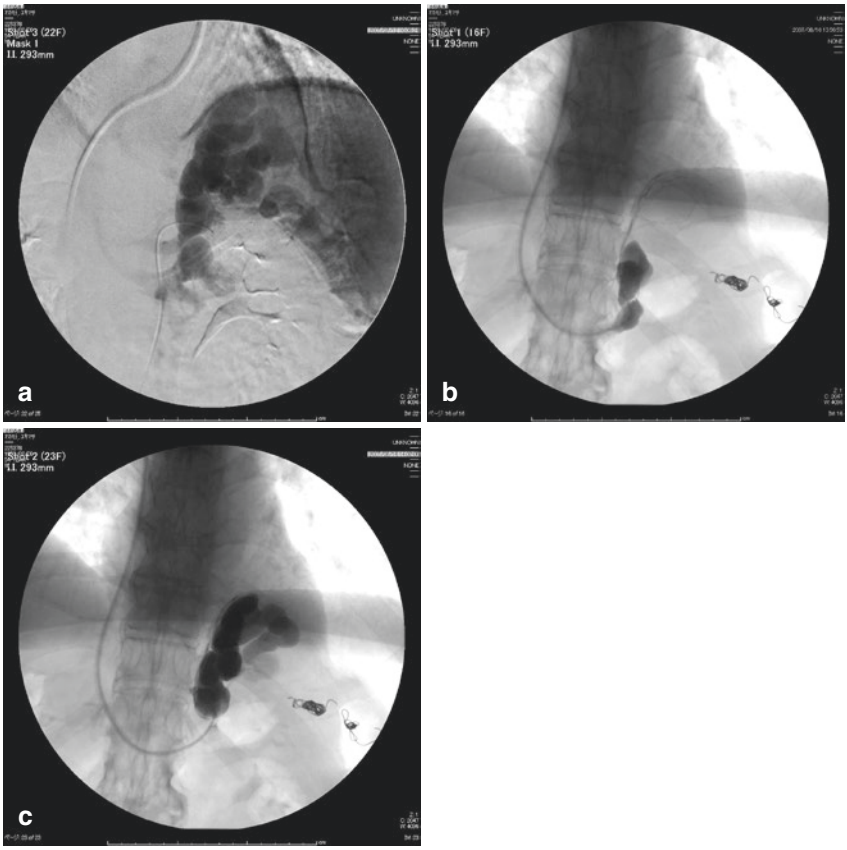

Fig. 39.3 (**a**) Splenic arterial portogram showing that the gastric varices are supplied by the posterior gastric vein and drained into the GRS. (**b**) Retrograde shunt venogram shows inferior phrenic vein; however, gastric varices are unclear. (**c**) After embolization of inferior phrenic vein with 5 mL of ethanol and 80 mL of 50% glucose, 10 mL of 5% EOI was injected into the gastric varices

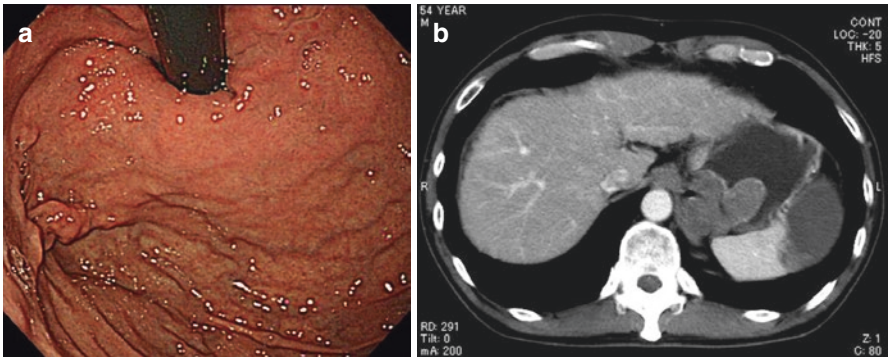

Fig. 39.4 (**a**) CT 1 week after TJO showing that the gastric varices are completely obliterated by the thrombi. (**b**) Endoscopic picture 3 months after PSE and TJO showing that the gastric varices are eradicated

been completely obliterated by thrombi (Fig. 39.4a). Endoscopy 3 months after TJO proved the gastric varices had been eradicated (Fig. 39.4b).

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