

## Paraumbilical Vein Embolization with Amplatzer Vascular Plug Via the Paraumbilical Vein Approach in A Patient with Hepatic Encephalopathy

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### Abstract

Paraumbilical veins in patients with portal hypertension due to liver cirrhosis sometimes dilate. If a portosystemic shunt from the dilated paraumbilical vein to the femoral vein is the main cause of refractory hepatic encephalopathy, embolization of the paraumbilical vein is a suitable indication. The paraumbilical vein approach thru a percutaneous puncture to the paraumbilical vein under ultrasound guidance is not only simple, but also safe. However, embolization of the dilated paraumbilical vein using this approach is still uncommon. We report a case of successful shunt embolization with an Amplatzer vascular plug using the paraumbilical vein approach in a patient with hepatic encephalopathy due to a portosystemic shunt from the paraumbilical vein to the right femoral vein.

**Keywords:** Hepatic Encephalopathy, Paraumbilical Vein, Shunt Embolization

**Abbreviations:** HE: Hepatic Encephalopathy; CT: Computed Tomography; AVP: Amplatzer Vascular Plug

### Introduction

Hepatic Encephalopathy (HE) is a serious complication in patients with liver cirrhosis. HE is currently classified into three types according to underlying disease by the American Association for the Study of Liver Disease: type A is caused by acute liver failure, type B is due to a portosystemic shunt without intrinsic liver disease, and type C is caused by cirrhosis [1]. HE with liver cirrhosis accompanied with either portal hypertension or a portosystemic shunt is categorized as Type C. The frequency of type C HE is 30-40% [2]. In patients with persistently recurrent Type C HE, despite acceptable liver function, embolization for a large spontaneous portosystemic shunt has been proven effective [3]. The presence of a long dilated spontaneous shunt from the paraumbilical vein to the femoral vein in the HE patients has an

indication of embolization similar to other portosystemic shunts such as a renal-splenic shunt. There are three main approaches for embolization of a spontaneous shunt: transhepatic, transfemoral and paraumbilical vein. The paraumbilical vein approach by percutaneous puncture under ultrasound guidance was reported two decades ago. However, this approach is still uncommon today. We present a successful case of embolization for a spontaneous shunt with an Amplatzer Vascular Plug using a paraumbilical vein approach.

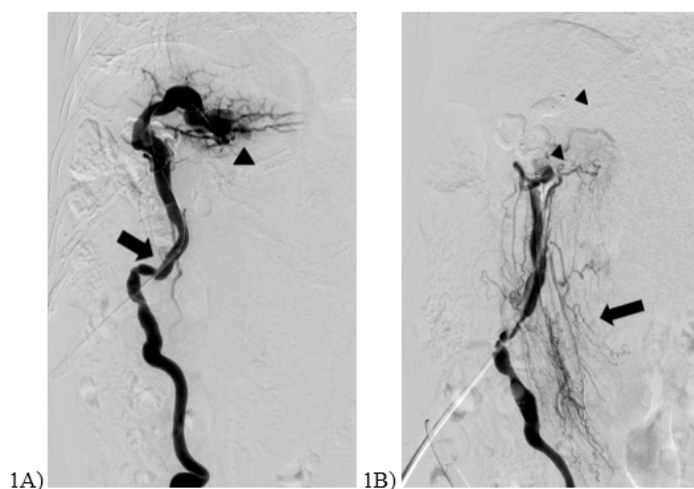
### Case Report

A 74-year-old female presented unconsciousness (Glasgow Coma Scale score E4V5M6) due to hyperammonemia and was admitted to our emergency department. Five years previous, she had been diagnosed with autoimmune hepatitis based on laboratory data, imaging studies and liver biopsy. She had multiple episodes of hospitalization for delirium and abnormal behavior despite optimal medical management for hyperammonemia since the diagnosis of autoimmune hepatitis. Additionally, she underwent endoscopic injection sclerotherapy three times for esophageal varices.

Head Computed Tomography (CT) was within normal limits. Hematological findings were as follows: white blood cell count of 5600  $\mu\text{L}$ , red blood cell count of  $401 \times 10^4/\mu\text{L}$ , hemoglobin 12.8 g/dL, platelet count of  $14.4 \times 10^4/\mu\text{L}$  and prothrombin time 80.1%. Biochemical findings were: total bilirubin 2.3 mg/L, albumin 3.1 g/dl, aspartate aminotransferase 87 IU/L, alanine aminotransferase 30 IU/L, lactate dehydrogenase 275 IU/L, blood urea nitrogen 30 mg/dL, creatinine 0.59 mg/dL, and ammonia 177  $\mu\text{g}/\text{dL}$ . Her liver function was graded as Child-Pugh class B.

Enhanced CT during hospitalization revealed obvious shunt dilatation from the paraumbilical vein to the right femoral vein (porto onfalo femoral) and mild dilatation of the other portal vein collaterals. Endoscopy demonstrated mild esophageal varices without cherry red spot. Since the shunt was suspected as one of the important factors causing hepatic encephalopathy, shunt occlusion was scheduled. The straight segment of the paraumbilical vein was planned as the puncture site referring coronal images of a previous enhanced CT. The paraumbilical vein was punctured with a micro-puncture needle (Cook, Bloomington, Indiana, USA) under ultrasound guidance and a 5Fr sheath was inserted with marker tip by the Seldinger technique under fluoroscopy. A 5Fr balloon catheter (Selecon MP Catheter II, TERMO, Tokyo, Japan) was advanced into the left hepatic portal vein through the sheath. Portal venography from the left hepatic portal vein showed dilatation of the paraumbilical vein (Figure 1a).

Portal vein pressure with and without balloon occlusion of the paraumbilical vein was 35 mmHg and 28 mmHg, respectively. The 5Fr sheath was advanced into the intrahepatic paraumbilical vein. An Amplatzer Vascular Plug (AVP II; AGA Medical, Plymouth, MN, USA; 10 mm in diameter) was advanced and released at the intrahepatic portion of the paraumbilical vein measuring 7 mm in diameter. The paraumbilical vein still remained dilated right after the first plug embolization. Another vascular plug (14 mm in diameter) was deployed at the straight extrahepatic portion of the paraumbilical vein measuring 11 mm in the major axis near the first vascular plug. The paraumbilical vein collapsed on venography after the second embolization and the pressure in the paraumbilical vein decreased to 17 mmHg (Figure 1b). When the sheath was removed, a closure device was used at the puncture site to prevent bleeding. There were no complications related to the procedure.

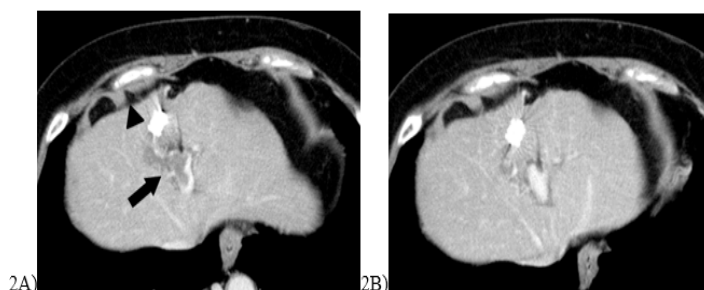


**Figure 1:** Left anterior oblique view of venography using a paraumbilical vein approach.

**(a)** Venography before embolization shows a dilated and kinking paraumbilical vein. The arrow indicates the puncture point and the arrowhead shows the left hepatic portal vein.

**(b)** Venography after embolization showed that the left hepatic portal vein was occluded and the paraumbilical vein became narrowed and developed multiple small branches (arrow). Arrowheads indicate AVPs.

Seven days after embolization, the blood ammonia concentration level decreased to 81  $\mu\text{g}/\text{dL}$  and her liver function improved to Child-Pugh class A. Enhanced CT 10 days after embolization showed the narrowed paraumbilical vein and thrombus in the left hepatic portal vein (Figure 2a). Anticoagulation therapy for portal vein thrombosis was performed. Enhanced CT nine days after the start of anticoagulation therapy showed a disappearance of portal vein thrombus (Figure 2b). The patient was discharged 25 days after embolization. The clinical course till two years of follow-up after embolization was uneventful and the blood ammonia concentration level stayed within a normal range. Endoscopy two and a half years after embolization revealed esophageal varices with cherry red spot, which underwent endoscopic injection sclerotherapy.



**Figure 2:** Enhanced CT after embolization.

**(a)** Enhanced CT 10 days after embolization showed thrombus (arrow) at the umbilical portion of the left hepatic portal vein. The arrowhead was AVP.

**(b)** The thrombus disappeared by treatment with anticoagulants 19 days after embolization.

## Discussion

Previous studies have reported that 46-70% of patients with medically refractory hepatic encephalopathy had large spontaneous portosystemic shunts [4-6]. In a spontaneous portosystemic shunt causing recurrent hepatic encephalopathy, the rate of paraumbilical vein as the main cause is 19% [7]. Additionally, the obvious expanding paraumbilical vein rarely has a risk of rupture [8]. The dilated paraumbilical vein on radiological images has been shown in 26% of patients with portal hypertension [9]. However, the rate of the dilated paraumbilical vein in each study might depend on the rate of etiology of liver disease. Dilated paraumbilical veins are more common in patients with alcoholic liver cirrhosis than in patients with viral liver cirrhosis [10]. Embolization for a large portosystemic shunt is an alternative treatment to surgical ligation. Lynn et al. reported that the durable benefit of embolization for variant portosystemic shunts causing refractory hepatic encephalopathy was effective at 100 % at 1-4 months and 92% at 6-12 months, respectively [11].

There are a few reports on paraumbilical vein occlusion for hepatic encephalopathy [12]. Paraumbilical vein occlusion had been performed by coil embolization using a percutaneous transhepatic approach, coil embolization or balloon retrograde transvenous obliteration using a femoral vein approach [8]. Clinical use of the paraumbilical vein has a long history. Portography via the umbilical or paraumbilical vein had been undertaken since half a century ago [13]. At that time, it was reported as an umbilical vein approach despite including cases of adult liver cirrhosis. In these previous studies, the dilated paraumbilical vein was mistaken as recanalized umbilical veins. Later in 1985, Lafortune et al.

histologically revealed that dilated veins in the falciform ligament in patients with portal hypertension were not umbilical veins, but paraumbilical veins [14].

Initially, direct puncture to the vein exposed from incision of the abdominal wall was performed as an approach method. Percutaneous puncture to the paraumbilical vein under ultrasound guidance as an access route of portography for transjugular intrahepatic portosystemic shunt was reported by Wenz et al. in 1992 [15]. Cho et al. reported on the usefulness of a paraumbilical vein approach for gastric variceal embolization [9]. Chin et al. reported that 22 patients underwent portal venography with paraumbilical access [16]. In this study, the puncture success rate was 64%. Puncture was successful when the paraumbilical vein measured a mean diameter of 0.75 cm at the skin and a mean diameter of 0.84 cm at the junction with the left hepatic portal vein. In comparison, reasons for a failed puncture were a small vein diameter (< 0.3 cm), moderate to severe vessel tortuosity, and distal thrombosis. Puncture of the paraumbilical vein in patients with HE due to a shunt from the paraumbilical vein to the femoral vein might be readily done because the enlarged paraumbilical vein is usually over 8 mm in diameter, which is similar to portosystemic shunts causing HE [17].

Various embolic materials for the paraumbilical vein occlusion have been used as well as other portosystemic shunts. Recently, reports of shunt occlusion with AVP have been increasing, however, there were few reports of embolization with AVP for the paraumbilical vein occlusion to date [17]. AVP has a strong embolic effect. In addition, it is safer than coils and liquid embolic materials such as n-butyl 2 cyanoacrylate because there is less risk of dislocation. In our case, the puncture tract after sheath removal was ligated using a vascular closure device. Chin et al. also used a vascular closure device for hemostasis of the puncture site after 6Fr sheath removal [16]. However, Cho et al. reported manual compression for 5 minutes achieved hemostasis at the puncture site after 5Fr sheath removal [9]. They mentioned that there was no risk of intraperitoneal hemorrhage because the paraumbilical vein was located in the extraperitoneal space. Manual compression might be sufficient to control hemostasis of the puncture tract.

## Conclusion

The paraumbilical vein approach was safe and useful. In a patient with HE caused by a shunt from the paraumbilical to the right femoral vein, puncture under ultrasound guidance was easy because of vessel dilatation. Additionally, AVP was effective for paraumbilical vein occlusion. The paraumbilical vein approach and embolization with AVP are recommended as a first choice.

## Conflict of Interest

None

## References

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