Portal Embolization: Algerian Experience

Amine Habouchi
Diagnostic Radiology University. Hospital of Babeloued Algiers, Algeria

Kamel Hail
General Surgery University, Mustapha University Hospital of Algiers, Algeria

Radia Benyahia
Diagnostic Radiology University, CPMC Algiers, Algeria

Lounas Benghanem
Department of gynecology, University hospital of Algiers, Algeria

Chahira Mazouzi
Medical Oncology University, University Hospital of Béjaia, Algeria

Rachid Nemmar
Orthopedics University, Mustapha University Hospital of Algiers, Algeria

Abstract

Portal embolization is an interventional radiology technique aimed at occluding the right portal branches to induce hypertrophy of the remaining liver. In this article, we will discuss the experience of the radiology department at Bab el Oued University Hospital.

Introduction

Major hepatectomy carries a significant risk of mortality. In patients with normal livers, mortality after major hepatectomy ranges from 0.5 to 4% [1], but in patients with chronic liver disease, such as cholestatic or cirrhotic liver, mortality increases to 4 to 12% [2, 3]. The primary cause of postoperative mortality and morbidity after major hepatic resection is liver failure, often due to inadequate volume of the remnant liver [4, 5]. Today, percutaneous embolization is preferred over surgical ligation to avoid additional surgery. The goal of PVE is to preoperatively increase the volume of the future remnant liver to enable surgery and reduce postoperative morbidity when the only contraindication to surgery is an initially insufficient remnant liver [6-8].

Materials and Methods

Patient Selection: We report the results of a retrospective case study of patients referred for portal embolizations at the radiology department of Bab el Oued University Hospital from January 2022 to December 2023 after multidisciplinary consultations. All patients underwent blood tests such as coagulation profile and renal function assessment. The inclusion criteria were as follows: • Patients with tumors developing in a normal underlying liver parenchyma: PVE is recommended when the future remnant liver (FRL) to total liver volume ratio is between 25 and 30 [7, 10, 11]. PVE indication can be extended to an FRL ratio of 40% in patients receiving chemotherapy or exhibiting abnormal results in the indocyanine green retention test (or other abnormal liver function tests) [10, 12, 13]. • Patients with tumors developing in the context of chronic liver disease or cirrhosis: In these cases, the decision is based either on liver volume alone or on liver volume plus estimation of overall liver function using the indocyanine green retention at 15 minutes (ICG 15). An FRL ratio of 40% is recommended when ICG 15 is between 10 and 20%. When ICG 15 is [20%], an FRL ratio of 50% is recommended [12-14]. • Patients with tumors invading the bile duct associated with cholestasis: Biliary obstruction impairing liver regeneration and hypertrophy, the bile duct of the future remnant liver should be drained first, and PVE can be performed subsequently. The indication is an FRL ratio \40% [15]. It is recommended to drain the hepatic lobe intended for hypertrophy. Exclusion criteria were:[11]

PVE is contraindicated in the following patients:
1. Tumors invading the portal vein.
2. Portal hypertension (gradient exceeding 12mmHg).
3. Various coagulation abnormalities (PT < 60%, platelets < 50,000/μL). Even though chemoembolization may enhance PVE outcomes, a minimal delay of 3 weeks should separate the two procedures [16]. All patients should be informed during an interventional consultation that this procedure is not an antitumoral treatment but rather a procedure aimed at enhancing safety or enabling a surgical procedure. Minor complications occur in 20 to 25% of cases and are mainly associated with mild fever and abdominal discomfort and pain. Major complications are rare and mainly include infection and subcapsular hematoma (Figure 2), hemobilia, and portal vein thrombosis (2% of cases). Mortality directly related to PVE has not been reported. When tumors (usually small nodules) are present in the non-embolized lobe, it should be explained to the patient that these lesions may increase in size more rapidly due to PVE [17]. Patients should also be informed that the effectiveness of the procedure can be assessed approximately 4 weeks after the procedure by a contrast-enhanced CT scan and a second liver volumetry.

Embolization Method: Access to the portal system was achieved under ultrasound guidance each time to puncture a peripheral branch [8]. Access can be obtained by a contralateral approach (i.e., puncturing the left portal branch and embolizing the left portal branch) or by an ipsilateral approach (puncturing the right portal branch to embolize the right portal branches). The advantage of the contralateral approach is to facilitate catheterization, but there is a risk of damaging the future liver remnant (FLR). A trans-splenic approach has also been described. Measurement of portal pressure was not systematically performed in patients with normal livers. In cirrhotic patients, measurement of portal and central venous pressures is useful to determine if the patient has a portosystemic gradient [12 mmHg], in which case the patient is at major risk of perioperative complications [18, 19]. A mixture of n-butyl cyanoacrylate (NBCA) and Lipiodol was used, with one part of NBCA and one or two parts of Lipiodol. Injection of small aliquots between two extensive flushes with a non-ionic liquid, such as dextran or 5% glucose, was the technique employed.

Patient Preparation:
PVE was performed on an outpatient basis under conscious sedation. Hospitalization for one or two days is recommended, as reported by most teams using either conscious sedation combined with local anesthesia or general anesthesia. There is no consensus on the use of antibiotics, and the type of antibiotics and duration of treatment vary from report to report [11], except in patients undergoing an associated biliary procedure.

---

**Figure 1:** 3D Hepatic Volumetry Performed on a Contrast-Enhanced CT Scan at Portal Venous Phase Acquisition
Results and Discussion

During this period, 26 patients were referred to our department for portal vein embolization, including 16 men and 10 women. We excluded 6 patients, and thus, 20 patients underwent this procedure. Of these, 12 patients were referred for cholangiocarcinoma treatment, 13 patients for secondary hepatic lesions (9 colorectal cancers and 4 breast cancers), and 1 patient for fibrolamellar carcinoma. The technical success rate was 100%. Few cases of failure or repeated procedures have been reported in the literature. In our series, out of 20 procedures performed in our unit, we had to redo only one patient due to inadequate embolization. We note a patient-operated ratio of less than 50%, mainly due to tumor progression (8 patients) or inadequate hypertrophy (3 patients). The resection rate should be approximately 85%. This rate can decrease to 70% in cirrhotic patients. Reasons for non-resection include tumor progression (N3), peritoneal metastases, or unsuspected metastases discovered during laparotomy [1]. Absence of hypertrophy is rare, less than 10% in metastatic liver disease in the literature, and not described in our series, but it can reach 20% in cirrhotic patients. In terms of complications, we noted their presence in 15% of cases, all minor. A rate of minor complications (20% to 25%) is considered acceptable [14, 23]. In case of major complications, this rate should be 5% and should not prevent continuation of hepatic resection. Except for accidental embolization, most complications will occur in the embolized lobe, which is an argument in favor of a homolateral intervention. However, complication rates for homolateral and contralateral approaches are the same. The literature reports that the only factor increasing complications is puncture of the posterior segment compared to puncture of the anterior segment [24], which argues for puncture of the anterior segment when compatible with the location of the PVE to be performed. In our experience, the rate of minor complications does not exceed 20%, with no major complications noted. However, some factors are correlated with the extent of liver regeneration, the most important of which is the FLR volume: the smaller it is pre-procedure, the greater the regeneration will be [25]. Several solutions
have been proposed to increase the rate and/or speed of hypertrophy after portal vein embolization. The combination of intra-arterial chemoembolization with portal vein embolization appears to increase the hypertrophy rate while preventing the risk of tumor progression [16]. In 2012, the Regensburg team proposed the technique of Associating Liver Partition and Portal Vein Ligation for Staged Hepatectomy (ALPPS), which involves performing portal embolization/ligation associated with parenchymal transection [25]. The results in terms of FLR volumetric hypertrophy are impressive but come with a morbidity and mortality rate of up to 20% [25]. Finally, it has been proposed to embolize the right hepatic vein in case of insufficient response to portal vein embolization [26]. Thus, a technique called vein deprivation has been developed, involving simultaneous embolization of the right suprahepatic vein (and the accessory right suprahepatic vein when present) and the right portal branch via a transthoracic route [26]. This technique is well tolerated and increases the growth rate of FLR volume compared to portal vein embolization. The preliminary results obtained in terms of FLR function enhancement are very promising but await a clinical research program.

![Figure 3: Global Portography on the Left Figure Following Contralateral Catheterization and on the Right Figure via Ipsilateral Approach](image-url)

**Conclusion**

Portal vein embolization (PVE) has a significant impact on therapeutic prospects for patients with malignant liver pathologies. The techniques require a thorough understanding of the anatomy, physiology, and pathophysiology of the portal vein.

**References**


