

## CASE REPORT

# Yttrium-90 Segmentectomy Flow Diversion Using Embozene™ Microspheres

BY PAUL O'CONNOR, MD; AARON M. FISCHMAN, MD; AND EDWARD KIM, MD;  
MOUNT SINAI HEALTH SYSTEM

A 62-year-old man with cirrhosis and active HIV and hepatitis C virus was found to have a 3.2-cm hepatocellular carcinoma (HCC) within Couinaud segment 6 on surveillance liver protocol MRI. The patient was referred for transplantation. A history and physical examination were performed without evidence of encephalopathy or abdominal ascites. The patient's performance status assessment indicated an ECOG (Eastern Cooperative Oncology Group) score of 0. Laboratory studies revealed mildly elevated transaminases, total bilirubin of 1 mg/dL, and an albumin level of 4.2 g/dL. Coagulation profile and platelet levels were unremarkable. Alpha fetoprotein level was 19 ng/mL. MRI demonstrated cirrhosis with evidence of portal hypertension and a segment 6 HCC without vascular invasion (Figure 1). The patient is Child-Pugh class A and BCLC (Barcelona Clinic Liver Class) stage A. The case was reviewed in multidisciplinary liver conference and the decision was made to proceed with yttrium-90 (Y-90) radioembolization with glass microspheres (TheraSphere, BTG International) as a bridge to liver transplantation.

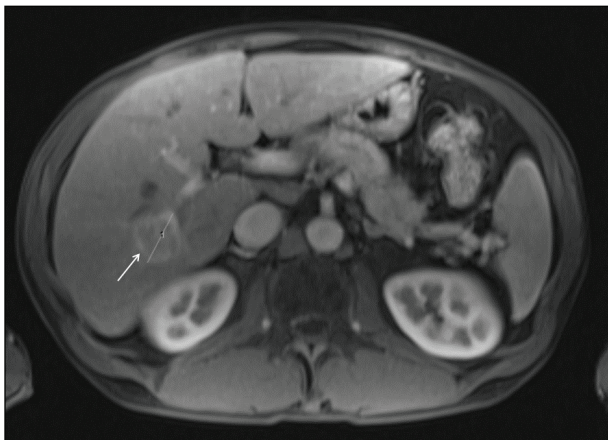


Figure 1. Postcontrast MRI performed during portal venous phase demonstrates a central segment 6 HCC.

## PROCEDURE DESCRIPTION

Prior to Y-90 therapy, planning angiography was performed to identify tumor vascular supply and determine the lung shunt fraction by administration of technetium-99m macroaggregated albumin in the proposed vessel of Y-90 treatment delivery. Initial angiography was performed with a 5-F CONTRA 2 Catheter (Boston Scientific Corporation), identifying a replaced right hepatic artery (RHA) arising from the superior mesenteric artery. Tumor blush was present within segment 6. The right hepatic artery and segmental branch arteries were selectively catheterized with a Direxion HI-FLO™ Microcatheter (Boston Scientific Corporation) over a Fathom®-16 Guidewire (Boston Scientific Corporation). Cone-beam CT (CBCT) was performed during segmental contrast injection to confirm tumor supply. CBCT performed during superselective contrast injection of the sixth segmental artery demonstrated tumor blush and extensive normal parenchymal enhancement (Figure 2). Two small ves-

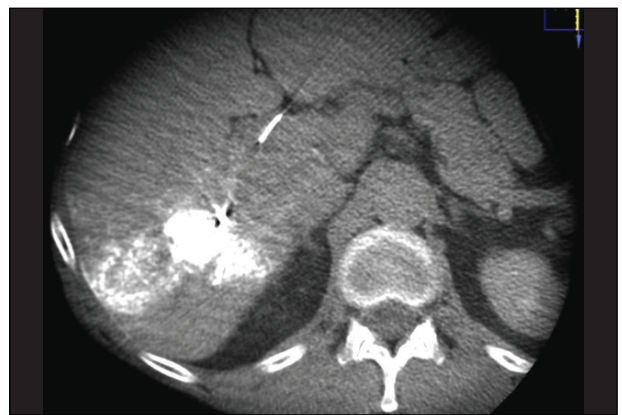
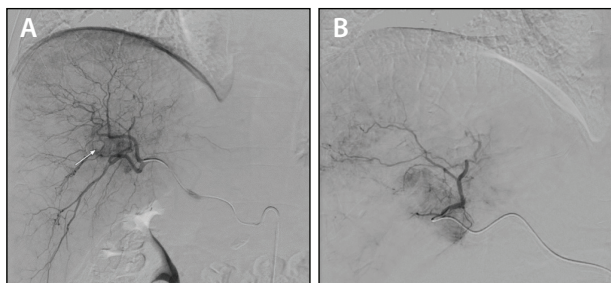
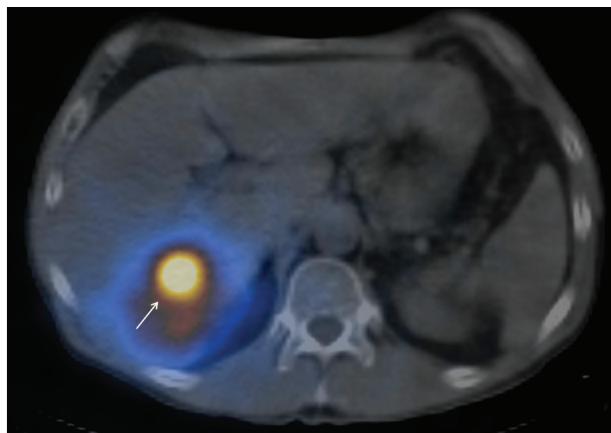


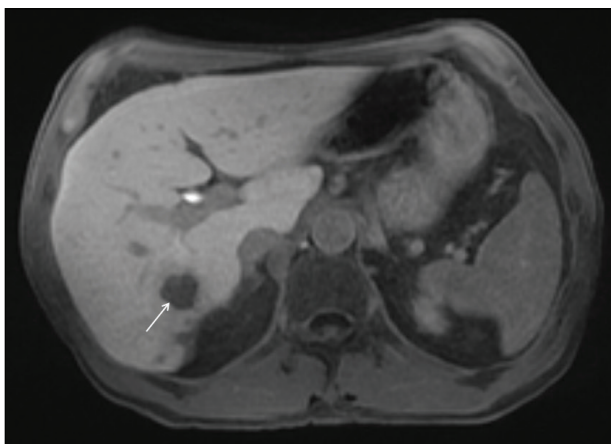
Figure 2. CBCT performed during superselective injection within the segment 6 artery demonstrated tumor enhancement as well as significant liver parenchymal enhancement. Arterial injection was performed at a rate of 0.5 mL/sec to mimic flow conditions during Y-90 therapy injection.



**Figure 3.** Selective angiography performed from the RHA demonstrating tumor blush corresponding to the segment 6 HCC found to be supplied from two small vessels arising from the proximal sixth segmental branch not accessible with a microcatheter (A). RHA after injection of 250-µm Embosphere particles within segment 6 branch just distal to the origin of the tumor-supplying vessels, resulting in significant vessel pruning (B).



**Figure 4.** SPECT/CT performed after Y-90 delivery demonstrating radioactive material primarily within the central aspect of segment 6 containing the HCC.



**Figure 5.** Contrast-enhanced MRI performed during hepatobiliary phase demonstrating complete necrosis of the segment 6 HCC without significant radiation changes to the surrounding liver parenchyma.

sels supplying the tumor originated from the proximal aspect of the sixth segmental branch. The microcatheter system was then placed just beyond the vessels supplying the tumor to perform bland embolization for the purposes of flow diversion prior to Y-90 therapy. Bland embolization was performed utilizing a quarter of a vial of 250-µm Embosphere™ Microspheres (Boston Scientific Corporation) suspended in 6 mL of iopamidol-300 contrast until stasis was achieved. Follow-up angiography demonstrated satisfactory pruning of the treated segmental vessel (Figures 3A and 3B).

Single-photon emission CT (SPECT)/CT performed during Y-90 therapy administration demonstrated radiation deposition primarily with the segment 6 HCC (Figure 4). A 6-week postprocedure liver MRI demonstrated 100% HCC necrosis with minimal radiation changes to the surrounding liver parenchyma (Figure 5). Follow-up laboratory studies were unremarkable and without treatment toxicity.

## DISCUSSION

Centrally located tumors or those supplied by small vessels may be problematic for catheter-directed therapy due to unfavorable flow dynamics, leading to suboptimal therapy delivery to the tumor and deposition within the functioning hepatic parenchyma and resulting in incomplete tumor response and liver toxicity. As demonstrated in this case, bland embolization of the hepatic artery distal to the tumor supplying vessels using properly sized particles can reduce competitive blood flow and is generally well tolerated. Microsphere embolization for blood flow diversion can improve Y-90 deposition within the tumor while minimizing adjacent parenchyma damage. ■

### Paul O'Connor, MD

Division of Interventional Radiology  
Mount Sinai Health System  
New York, New York

*Disclosures: None.*

### Aaron M. Fischman, MD

Division of Interventional Radiology  
Mount Sinai Health System  
New York, New York

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### Edward Kim, MD

Division of Interventional Radiology  
Mount Sinai Health System  
New York, New York

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