

Radiation Segmentectomy and Subsegmentectomy of Hepatocellular Carcinoma

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ABSTRACT: We present 2 cases of successful radiation segmentectomy and subsegmentectomy using yttrium-90 in 2 patients with biopsy-proven hepatocellular carcinoma. In the following clinical images report, we review the initial clinical presentation, diagnostic work-up, procedural planning, intervention, and postintervention follow-up imaging.

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KEY WORDS: hepatocellular carcinoma, radioembolization, segmentectomy, Y-90

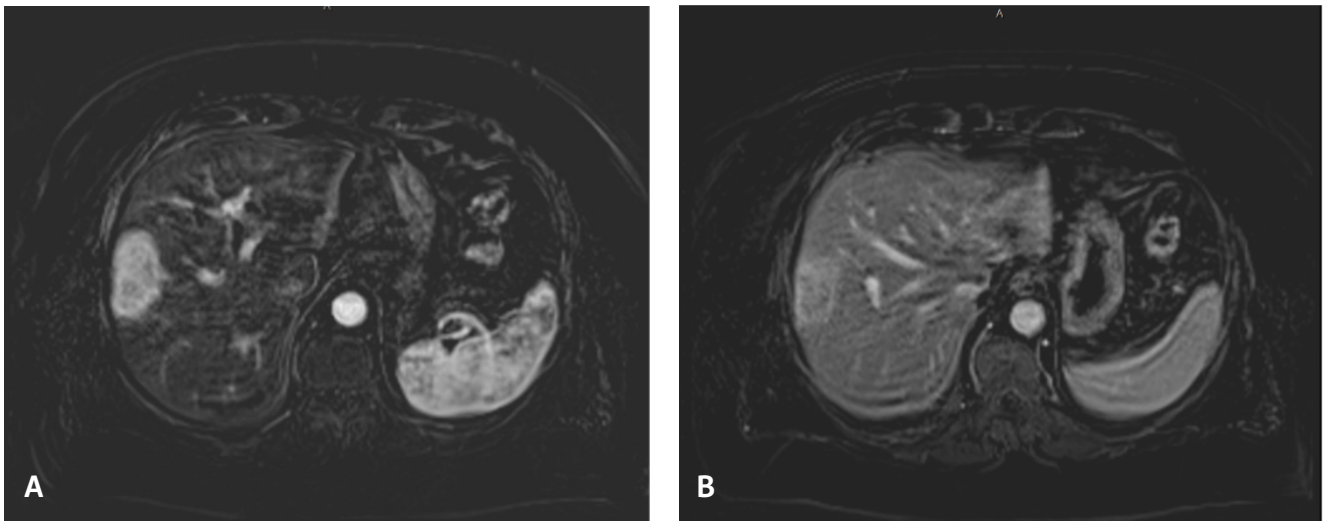


FIGURE 1. MRI of the abdomen with contrast. MRI images showed a right hepatic lesion in segments 5 and 8 with (A) enhancement on the arterial phase and (B) washout on the venous phase.

CASE 1

A 71-year-old man with history of type 2 diabetes mellitus and gastric adenocarcinoma, status post gastroesophageal junction endoscopic biopsy and resection, presented with weakness, lethargy, and abdominal pain. The patient was incidentally diagnosed with a 6.2 cm lesion in segments 5 and 8. Magnetic resonance imaging (MRI) revealed a LR-5 lesion (**Figure 1**). Biopsy and pathology confirmed the diagnosis of hepatocellular carcinoma. The patient was not a surgical candidate and locoregional therapy was planned for him. Alpha-fetoprotein level (AFP) was 249.7 ng/mL at the time of diagnosis. Angiogram of the right hepatic artery during yttrium-90 (Y-90) mapping/planning study showed tumor blush supplied by 2 separate arteries

from segments 5 and 8 (**Figure 2A**). After catheterization of segment 5 (**Figure 2B**) and segment 8 (**Figure 2C**) branches, a split dose of technetium (Tc-99m) macroaggregated albumin (MAA) was delivered. Post MAA delivery, single-photon emission computed tomography (SPECT) computed tomography (CT) scan showed localization of the MAA to the lesion in segments 5 and 8 (**Figure 3A**). Three days later, Y-90 therapy was administered from the same location, with follow-up SPECT-CT scan confirming successful delivery of Y-90 to the target area (**Figure 3B**). Three-month follow-up MRI showed a non-viable lesion in segments 5 and 8 (**Figure 4**), with the AFP decreased to 10.4 ng/mL. The patient had no immediate or long-term postoperative complications.

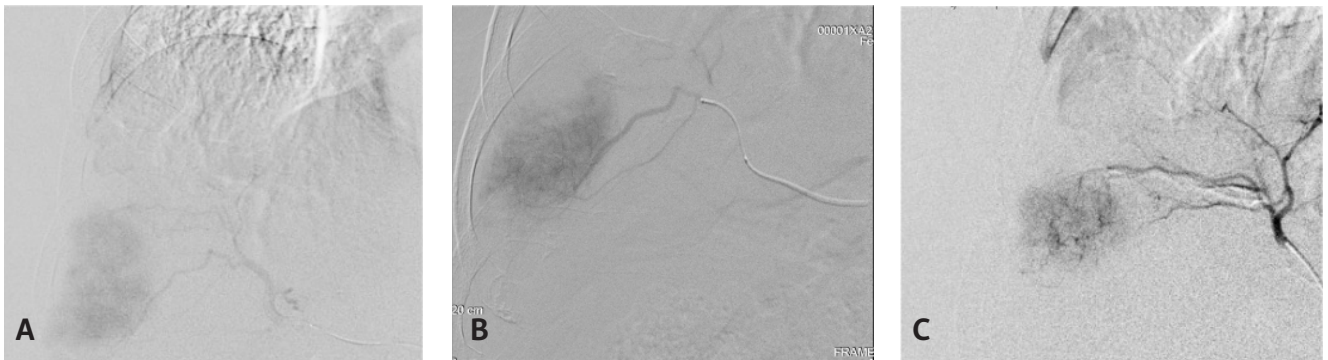


FIGURE 2. (A) Selective angiogram of the right hepatic artery shows 2 major supplying arteries. Subselective catheterization and angiography of (B) segment 5 and (C) segment 8 hepatic arteries revealed 2 major supplying branches.

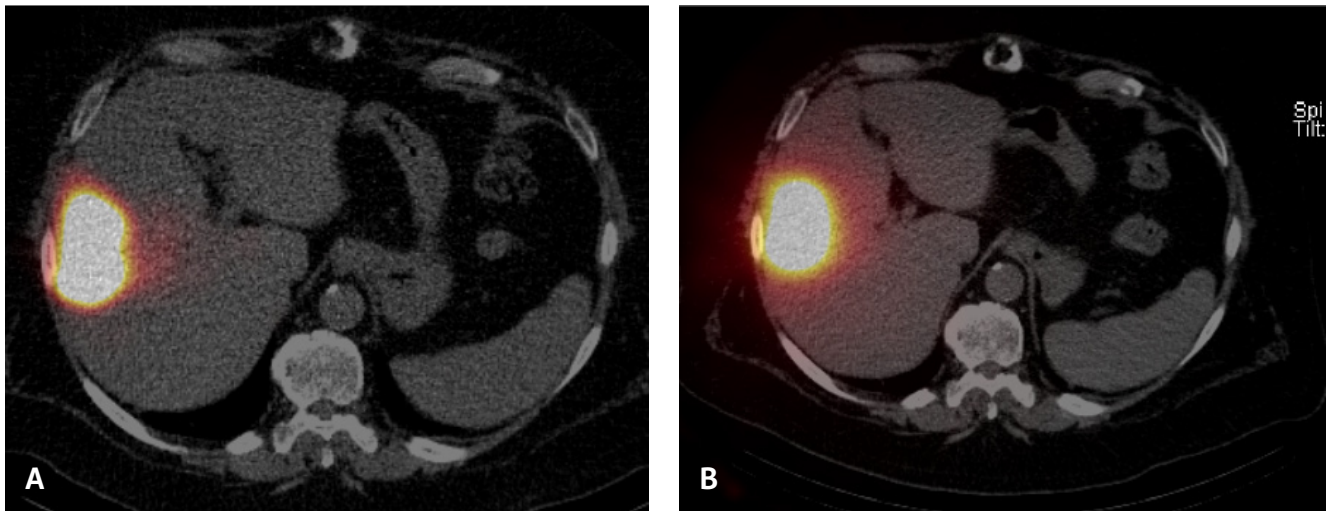


FIGURE 3. Post MAA shunt study, (A) SPECT-CT study showed localization of MAA to the expected right hepatic segment 5 and 8 regions with 5.53% lung shunt. Post Y-90 radioembolization, (B) SPECT-CT demonstrated localization of Y-90 glass beads to the expected right hepatic segment 5 and 8 areas without extrahepatic distribution.

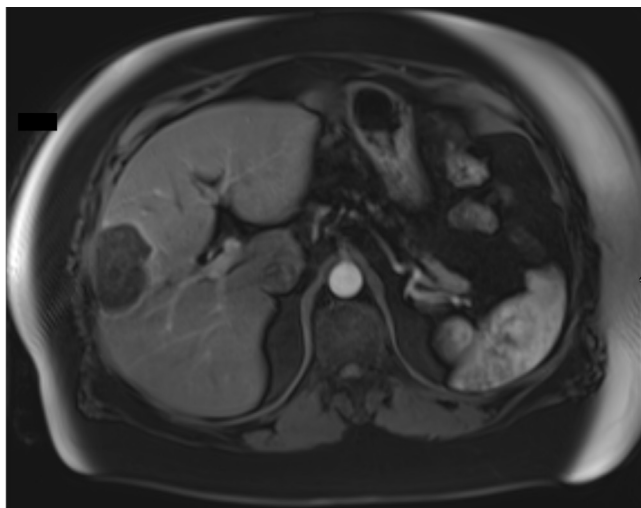


FIGURE 4. Follow-up MRI of abdomen after 3 months showed post-radioembolization changes in the right hepatic lobe without residual or recurrent tumor, compatible with treated non-viable lesion.

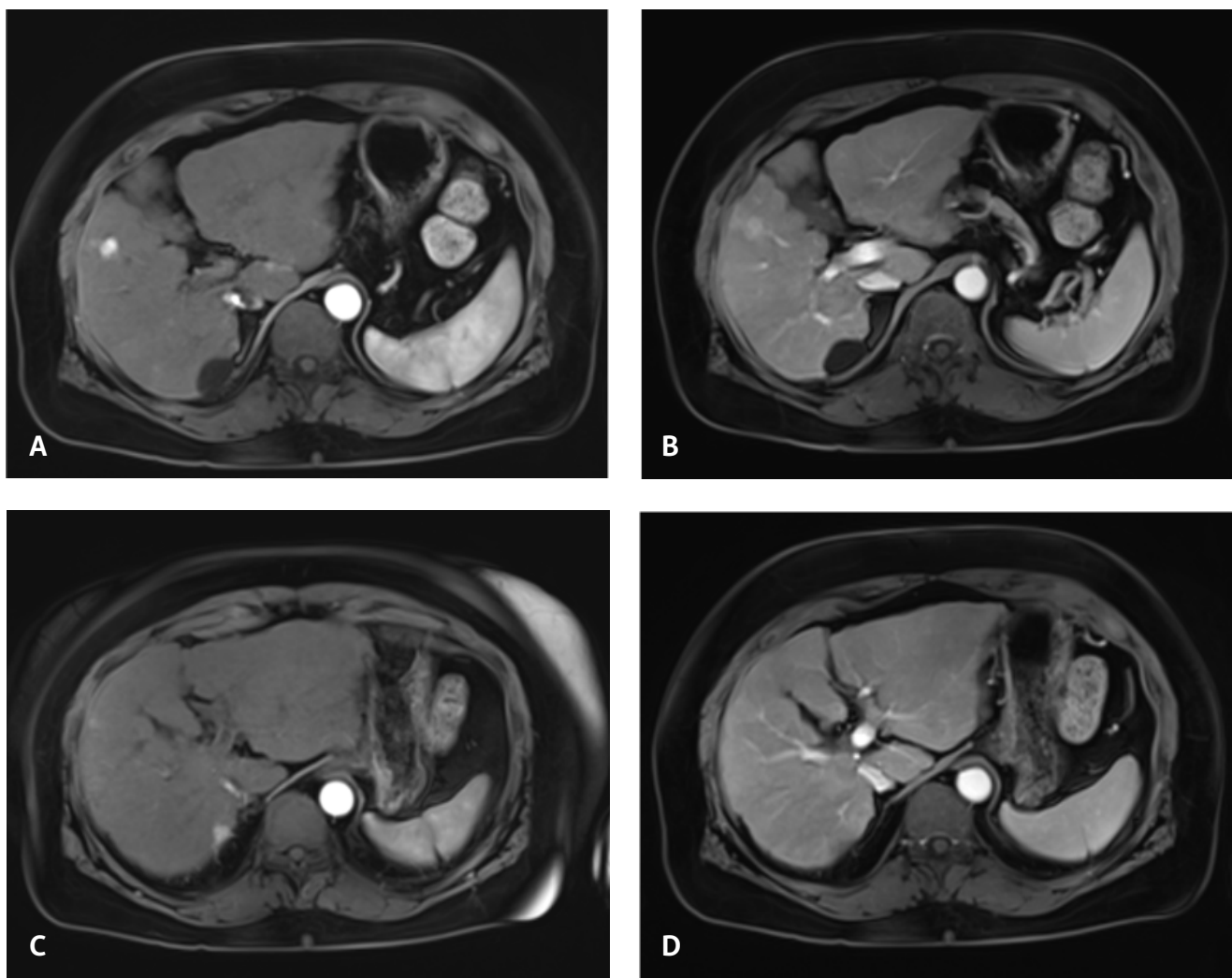


FIGURE 5. MRI of the abdomen with contrast characterized 2 hepatic lesions: a 1.5 x 1.0 cm segment 5 LR-5 lesion with (A) enhancement on the arterial phase and (B) washout on the venous phase; and a 1.2 x 0.8 cm segment 7 LR-5 lesion with (C) enhancement on the arterial phase and (D) washout on the venous phase.

CASE 2

A 74-year-old woman with history of chronic hepatitis B on concurrent tenofovir, hyperlipidemia, coronary artery disease with non-ST segment elevation myocardial infarction, and status post drug-eluting stent placement presented with chest pain and dyspnea on exertion to the emergency room. Her CT of the chest incompletely visualized nodular liver contours suggestive of liver cirrhosis. The patient had no sign or symptom of liver decompensation. Subsequent MRI (**Figure 5**) revealed 1.5 cm segment 5 and 1.2 cm segment 7 LR-5 lesions, concerning for hepatocellular carcinoma. The AFP level was 518.6 ng/mL. The biopsy confirmed hepatocellular carcinoma. The multidisciplinary tumor board discussion concluded that the patient was not a candidate

for resection or transplant, and the plan was set for locoregional therapy. Y-90 radioembolization mapping and shunt study showed a single-artery supply to the target lesions in the segment 5 and 7 lesions (**Figures 6A and 6B**), confirmed on cone-beam CT scans (**Figures 7A and 7B**). SPECT-CT scan following MAA injection confirmed on-target delivery of the MAA (**Figures 8A and 8B**). One month later, the patient underwent Y-90 radioembolization from the same locations with immediate postradioembolization SPECT-CT scan confirming delivery of Y-90 glass beads to the expected targets (**Figure 8C**). Follow-up MRI at 3 months demonstrated non-viable lesions in segments 5 and 7 (**Figure 9**), with AFP level down-trended to 4.5 ng/mL. The patient had no immediate or long-term postoperative complications.

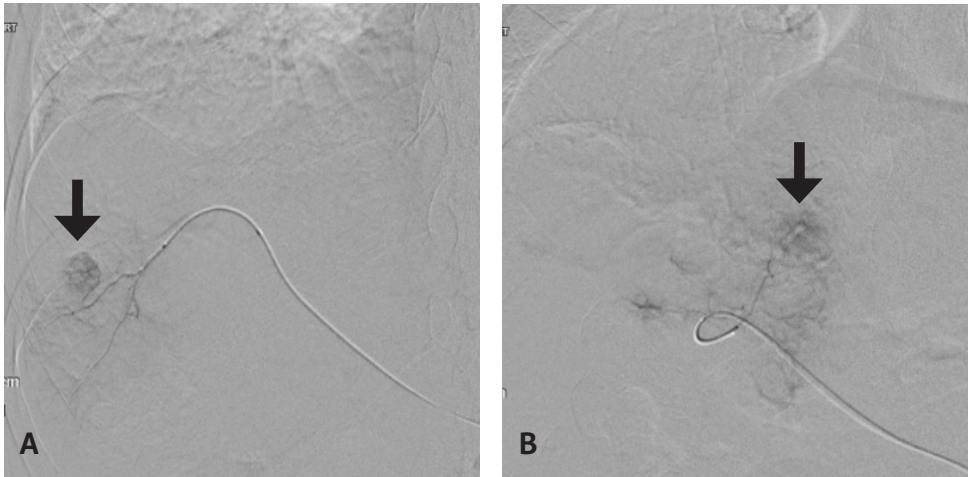


FIGURE 6. Selective catheterization and angiography of (A) segment 5 and (B) segment 7 hepatic arteries showed tumor blushes.

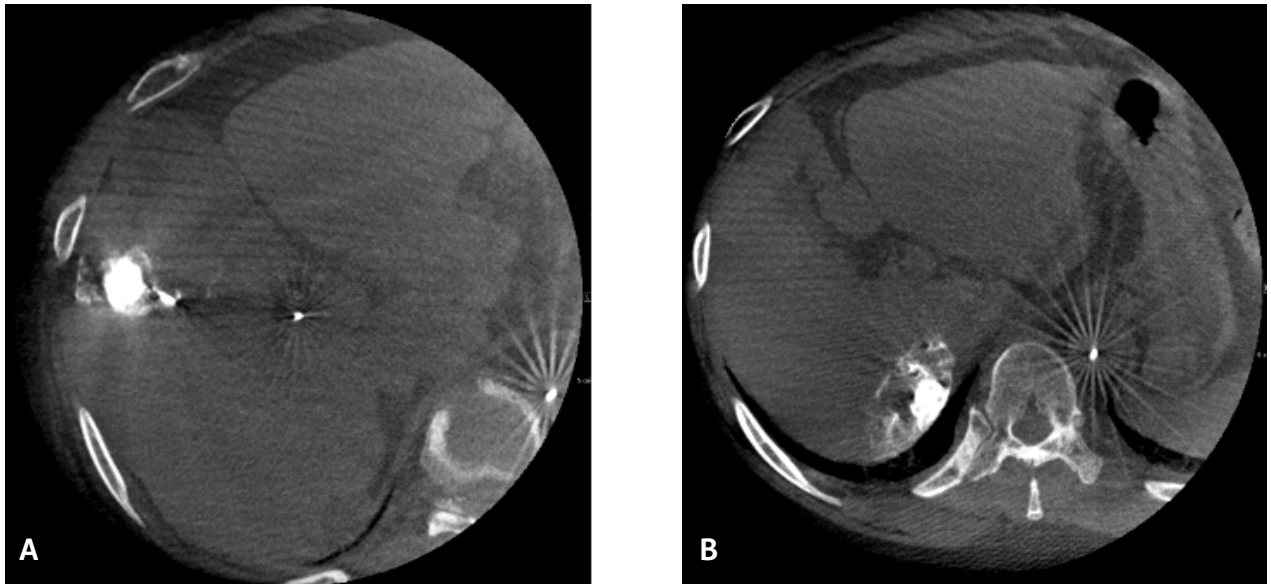


FIGURE 7. Intraoperative perfusion cone-beam CT confirms the location of microcatheter and proper supplying arteries to both (A) segment 5 and (B) segment 7 lesions.

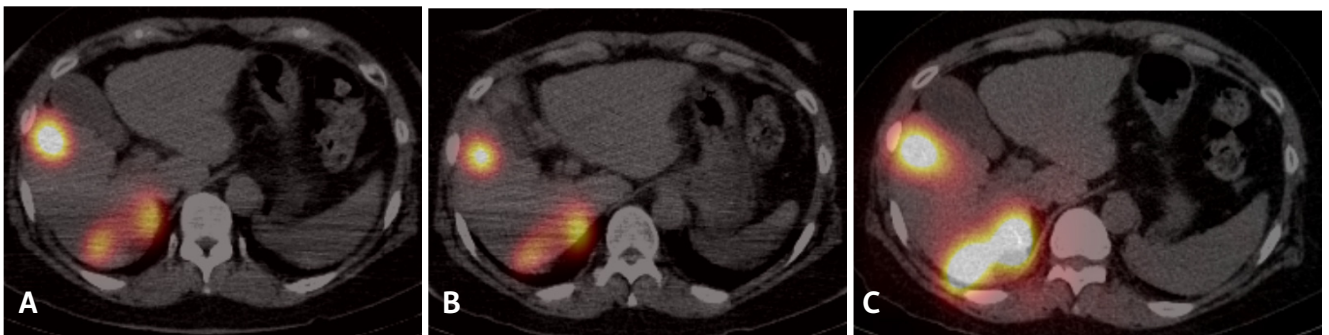


FIGURE 8. Post MAA delivery, SPECT-CT demonstrated localization of MAA to (A) the expected segment 5 and (B) segment 7 regions with 3.8% lung shunt. (C) Post Y-90 radioembolization SPECT-CT demonstrated localization of Y-90 glass beads to the expected segment 5 and 7 regions without extrahepatic distribution.

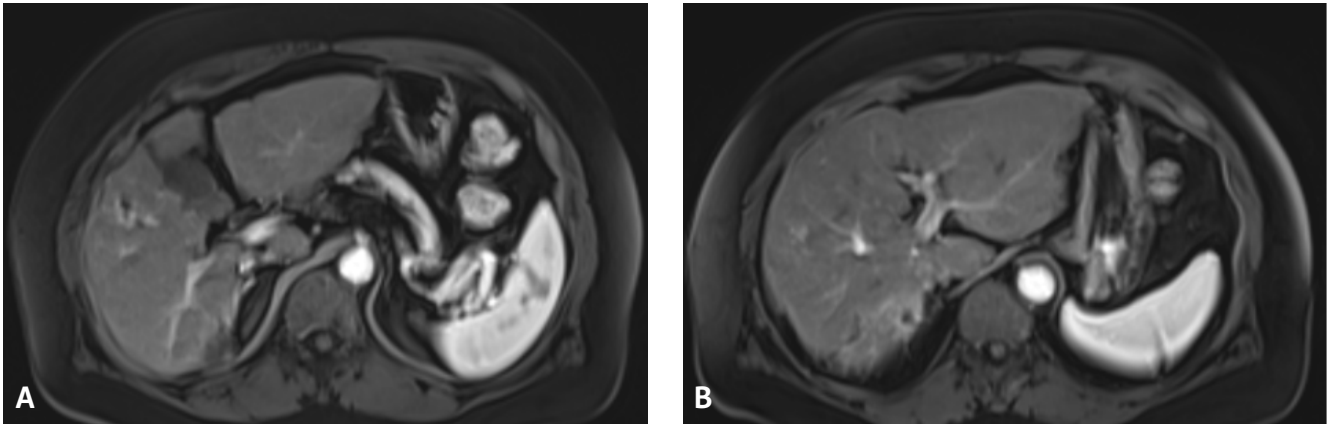


FIGURE 9. Three-month follow-up MRI post radioembolization demonstrated changes in the right hepatic lobe without residual or recurrent tumor at the location, compatible with treated non-viable lesions in (A) segment 5 and (B) segment 7.

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