

**TOSHIBA
MEDICAL**

Case Study

***Infinix-i* Sky**
Interventional Radiology

Yttrium-90
Radioembolization



HISTORY

A 68-year-old male with colorectal cancer underwent a hemi-colectomy with an ileostomy. The patient was treated with three rounds of chemotherapy, with each round consisting of six sessions. The patient was being considered for a resection of the liver and underwent embolization of the right portal vein with embolization coils (Figure 1). A PET/CT scan was performed at the conclusion of his chemotherapy treatment and discovered two metastatic lesions in the liver. The patient was then referred to Dr. Geoffrey Hill, an interventional radiologist, for Yttrium-90 (Y-90) radioembolization.

WORKFLOW

Y-90 radioembolization is a type of selective internal radiation therapy (SIRT), which is delivered with a minimally invasive procedure. Careful planning is required prior to the radioembolization with Y-90 to prevent damage of neighboring healthy organs and tissue. Planning involves the injection of Tc-99m MAA into the feeder vessel. A planar scintigraphy scan maps the distribution of the Tc-99m MAA and is used by the clinician for the calculation of the required Y-90 dose.

a. Tc-99m MAA injection

The patient underwent an initial digital subtraction angiography (DSA) of the celiac artery (Figure 2) to check the vascular anatomy. Next a DSA of the hepatic artery was performed with fluoroscopy guidance (Figure 3).

The micro catheter was advanced under fluoroscopy guidance to the section of the hepatic artery that allowed for optimal imaging of the branches surrounding the metastatic tumor. A cone beam computed tomography (CBCT) acquisition was performed with the C-arm to visualize the vessels that surrounded the outer edges of the tumor (Figure 4).

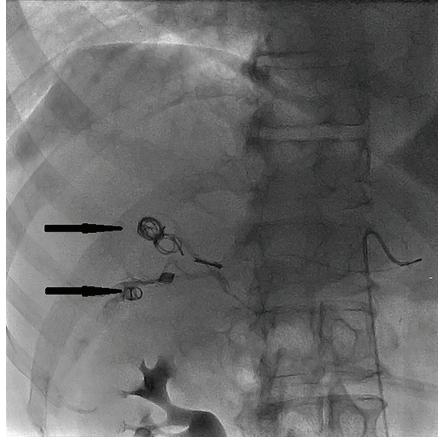


Figure 1. Arrows point to coils that were placed in the portal vein for possible liver resection.



Figure 2. DSA of the celiac artery.

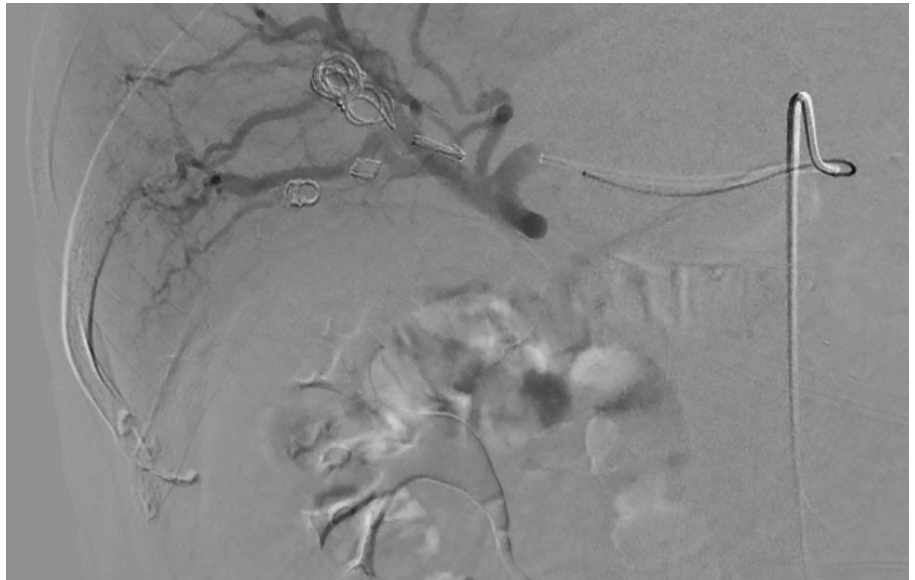


Figure 3. DSA of the hepatic artery.

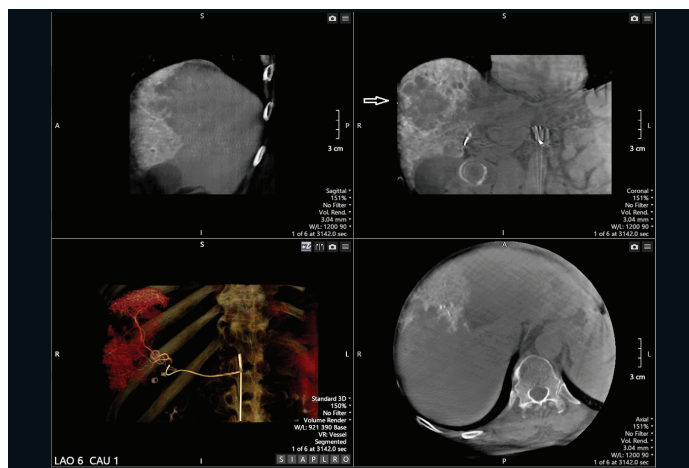


Figure 4. LCI Images on Vitrea of sub-selected hepatic artery. Arrow is pointing to the hypo-vascular metastatic tumor.



Figure 5. 3D overlay of the feeder vessels on live fluoro to aid in the positioning of the micro catheter prior to the delivery of Y-90.

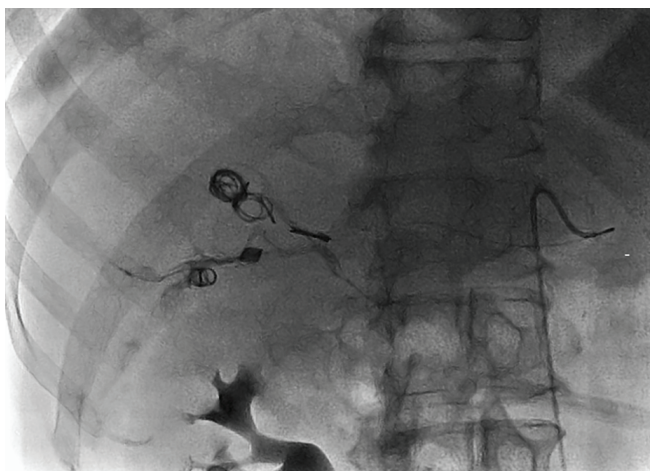


Figure 6. Fluoro record of Y-90 delivery to the inferior border of the tumor.

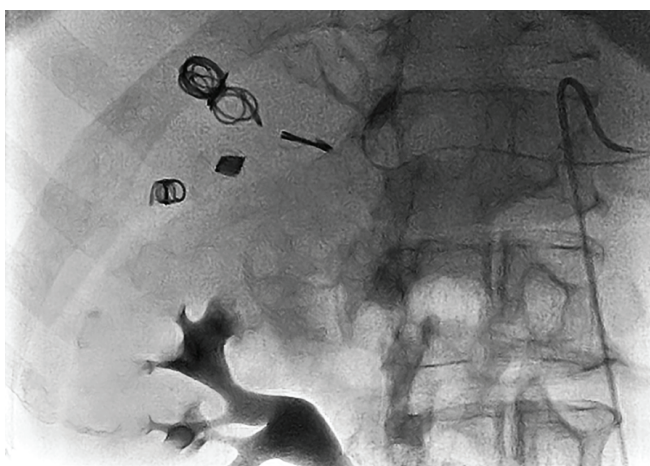


Figure 7. Fluoro record of Y-90 delivery to superior medial border of the tumor.

This acquisition protocol is enabled by Toshiba Medical's ImagingRite low contrast imaging (LCI) software and generates CT-like images. A power injector delivered iodinated contrast with 50 percent dilution during the CBCT rotation. The generated images were post-processed to create a 3D volume, and to segment the enhanced artery. The images identified two branches of the hepatic artery that would be utilized for the injection of Tc-99m MAA. Tc-99m MAA was injected into the sub-selected artery. A planar scintigraphy was performed two hours following the administration of the Tc-99m MAA to help the clinician map its distribution and calculate the required dose of Y-90 for the follow up radioembolization. The mapping aided the clinician in calculating the Y-90 dose to be injected through each vessel during the Y-90 radioembolization session.

b. Y-90 radioembolization

A week after the mapping study with Tc-99m MAA the radioembolization was performed. The Y-90 dose was calculated based on the volume of liver being treated and the volume of tumor within the treatment zone. One of the two arteries fed a greater volume of the liver and the tumor than the other. Consequently, each vessel received a different dose of Y-90. The vessel branches of interest were segmented from the 3D cone beam CT data set previously acquired during the Tc-99m MAA planning. Multi-modality fusion (MMF) enabled a 3D overlay of the segmented vessel branches on live fluoro, which aided the clinician in the positioning of the micro catheter for the delivery of Y-90 (Figure 5).

The 3D overlay was turned off prior to the infusion of the Y-90. Figure 6 shows the injection of the radioactive embolic material into the vessel that fed the inferior border of the metastatic tumor. A second injection into the vessel that fed the superior medial border of the tumor followed (Figure 7).

The patient was scheduled to undergo a follow up MRI or triphasic CT imaging study to evaluate the effect of the Y-90 treatment on the metastatic liver tumor a month after the treatment and at three month intervals following the first post-treatment imaging study.

CONCLUSION

"Cone beam CT and LCI were extremely helpful in assessing the volume of the liver that each of the two vessels perfused and therefore in calculating a more accurate dose of Y-90 to each vessel," Dr. Hill concluded. Toshiba Medical's Infinix-i vascular systems with ImagingRite can help clinicians to efficiently image difficult pathologies such as metastatic tumors in the liver. LCI and MMF can be utilized by the clinician to aid with the visualization of tumor feeder vessels as well as the planning and delivery of Y-90 radioembolization treatments, helping the clinician to potentially reduce their procedure time, increase accuracy of the delivery and thereby prioritize patient safety.

The clinical results described in this paper are the experience of the author.
Results may vary due to clinical setting, patient presentation and other factors.

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