# $^{18}$F-Fluorodeoxyglucose Positron Emission Tomography-Computed Tomography Imaging of Inferior Vena Cava Tumor Thrombus Extending into the Right Atrium in a Patient with Cholangiocarcinoma Treated with $^{90}$Y-Microspheres


## Abstract

We present a case of a 42-year-old male patient affected by unresectable, chemorefractory cholangiocarcinoma, with prior placement of biliary stent. Because of the absence of extrahepatic metastases, he was submitted to liver-direct therapy with $^{90}$Y-microspheres. $^{18}$F-fluorodeoxyglucose positron emission tomography-computed tomography (FDG PET-CT) performed before the procedure showed intense tracer uptake in the hepatic lesion and along the biliary stent. The patient underwent radioembolization with $^{90}$Y-resin spheres (1.1 GBq). $^{18}$F-FDG PET-CT, acquired 6 weeks after the procedure, showed no response of the hepatic lesion and the appearance of an area of markedly increased uptake extending through the inferior vena cava into the right atrium, confirmed as extensive tumor thrombus at the enhanced multislice CT subsequently performed. $^{18}$F-FDG PET-CT proved to be a useful imaging tool not only for the evaluation of metabolic response but also for the early detection of extrahepatic progression after 90Y-radioembolization.


**Keywords:** *$^{18}$F-fluorodeoxyglucose, 90Y-microspheres, positron emission tomography-computed tomography, radioembolization, tumor thrombus*


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A 42-year-old male patient without any significant medical past history presented with jaundice and abdominal pain on his right side in July 2017. Ultrasound and computed tomography (CT) scan demonstrated a large tumor in the central part of the liver without any abdominal lymph nodes or extrahepatic localizations. Fine-needle biopsy and histological examination diagnosed an intrahepatic cholangiocarcinoma (ICC). In order to reduce the bilirubin levels, a biliary stent was implanted. Subsequently, the patient was submitted to chemotherapy. After 1 month due the appearance of toxicity, chemotherapy was stopped.

Since tumor was exclusively localized to the liver, a locoregional therapy with $^{90}$Y-microspheres was considered. $^{99m}$Tc-macroaggregated albumin scan performed before the radioembolization procedure did not reveal any lung shunting of extrahepatic uptake.

$^{18}$F-fluorodeoxyglucose positron emission tomography-computed tomography (FGD PET-CT), performed before the treatment with $^{90}$Y-microspheres [Figure 1], showed an area of focal tracer uptake in the IV segment of the liver, with a maximum standardized uptake value (SUV max) of 12.8. Furthermore, an area of $^{18}$F-FDG accumulation was detected along the hepatobiliary stent, most likely due to inflammation. Radioembolization was performed through the injection of 1.1 Gbq of $^{90}$Y-resin microspheres (SIRS-Spheres®, Sirtex Medical, Lane Cove, Australia). No side effects were registered. The patient was submitted to $^{90}$Y-PET scan to assess the microspheres' distribution pattern.[1] the images demonstrated poor tumor uptake with the majority of the dosage distributing to nontarget areas of the left lobe [Figure 2]. No significant toxicity or relevant symptomatology was registered in the weeks following the procedure.

$^{18}$F-FDG PET-CT, acquired 6 weeks after the radioembolization [Figure 3], showed no response of the hepatic lesion, also detecting an elongated area of intense



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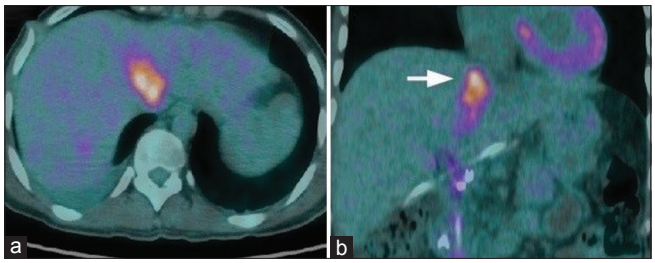

**Figure 1: $^{18}$F-fluorodeoxyglucose positron emission tomography-computed tomography performed before the treatment with 90Y-microspheres showed an area of focal tracer uptake in the IV segment of the liver, with a maximum standardized uptake value (SUV max) of 12.8, as well shown in the axial (a) and coronal (b, white arrow) slices. Furthermore, mild tracer uptake is evident along the hepatobiliary stent, most likely due to inflammatory processes**

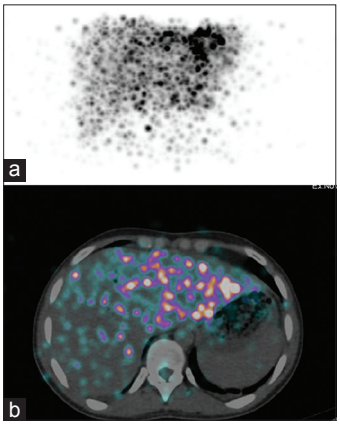

**Figure 2: $^{90}$Y-positron emission tomography-computed tomography following radioembolization procedure showed no sites of extrahepatic uptake of microspheres, as shown by the maximum intensity projection (a); axial slices (b) demonstrated poor tumor uptake with the majority of the dosage distributing to nontarget areas of the left lobe**

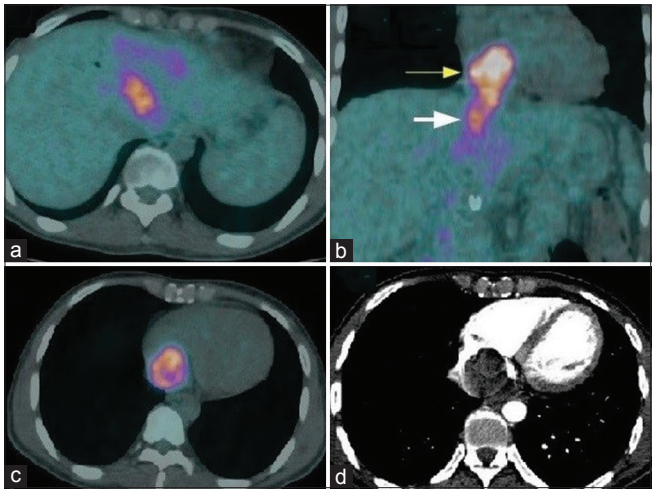

**Figure 3: Axial fused (a) and coronal fused (b, white arrow) positron emission tomography-computed tomography images, acquired 6 weeks after the radioembolization procedure, showed no response of the hepatic lesion, also detecting an elongated area of intense $^{18}$F-fluorodeoxyglucose uptake (SUV max 20.8) extending through the inferior vena cava to the right atrium, as well evident in the coronal (b, yellow arrow) and axial (c) slice. The subsequently performed enhanced multislice computed tomography axial slice (d) showed an arterial-phase gross-filling defect (dimensions 42 × 33 mm) in the right atrium, consistent with tumor thrombus**

$^{18}$F-FDG uptake (SUV max 20.8) extending through the inferior vena to right atrium. The subsequently performed enhanced multislice CT axial slice showed an arterial-phase gross filling defect (dimensions 42 mm × 33 mm) in the right atrium, consistent with tumor thrombus. Death occurred 3 months after the $^{90}$Y-radioembolization procedure.

Despite many advances in diagnosis and therapy, the management of ICC still remains a challenge for physicians. Surgery is the first choice but is often practicable due to advanced presentation.[2,3] Patients with unresectable ICC are often submitted to chemotherapy but with limited benefits on survival.[4] In this panorama, locoregional treatments such as transarterial chemoembolization and radioembolization with $^{90}$Y-loaded may be considered.[5] The median overall survival of ICC patients treated with $^{90}$Y-microspheres reported in previously published papers resulted of 15.2 months from the procedure,[6] which is the optimal imaging modality and the best time point for assessing response after $^{90}$Y RE has not been established yet. Identifying patients with poor clinical outcome is becoming of utmost importance in oncology to timely start as early as possible adjuvant or palliative treatments.[7,8] We present a rare and fatal complication in a nonresponder ICC patient after $^{90}$Y-radioembolization. This case points out the usefulness of metabolic imaging with $^{18}$F-FDG not only for monitoring the response of the hepatic lesion after $^{90}$Y-radioembolization but also for the early detection of extrahepatic progression.

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## Conflicts of interest

There are no conflicts of interest.

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