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## Case Report

# Diagnosis and management of radiation cholecystitis as a complication of Y90 radioembolization for hepatocellular carcinoma <sup>☆</sup>

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## ABSTRACT

Radiation induced cholecystitis is a known but rare complication of Yttrium90 (Y90) radioembolization of hepatic tumors due to nontarget embolization. Many documented cases of radiation induced cholecystitis have been treated with cholecystectomy, which is significant given the typical patient population undergoing radioembolization tends to be of higher surgical risk. Here, we present a case of a 68 year old male who developed radiation induced cholecystitis status post hepatic radioembolization that resolved with conservative management alone. This case highlights that radiation induced cholecystitis may be successfully and safely treated conservatively.

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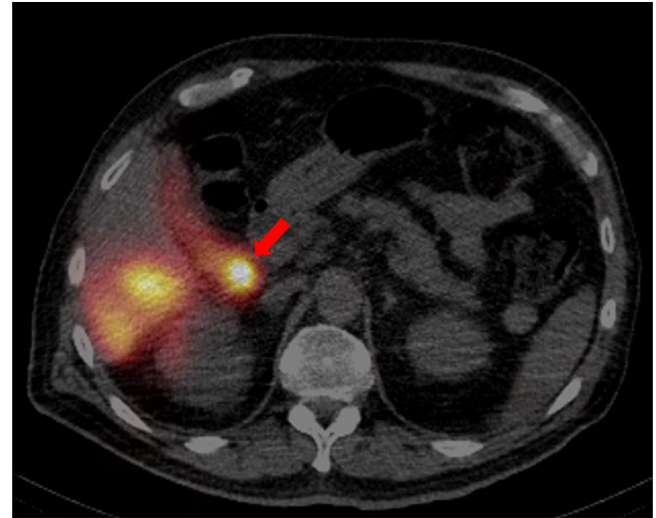
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## Introduction

Y90 radioembolization of hepatic tumors is a common and effective intervention [1]. Of the known post procedural complications, those affecting the gallbladder have low incidence and are not fully understood [2]. The incidence of radiation cholecystitis has been estimated to range from 0.8% to 10.1% of patients undergoing Y90 radioembolization, with the percentage of patients ultimately requiring a cholecystectomy being as low as 0.6% [2,3]. Diagnosis of radiation cholecystitis is typically performed clinically, as imaging may overestimate the number of clinically significant cases [4]. Usual symptoms of radiation cholecystitis include persistent right upper quadrant (RUQ) pain, fever, nausea, and vomiting [5]. Here, we present a case of radiation cholecystitis following Y90 radioembolization that resolved with conservative management alone.

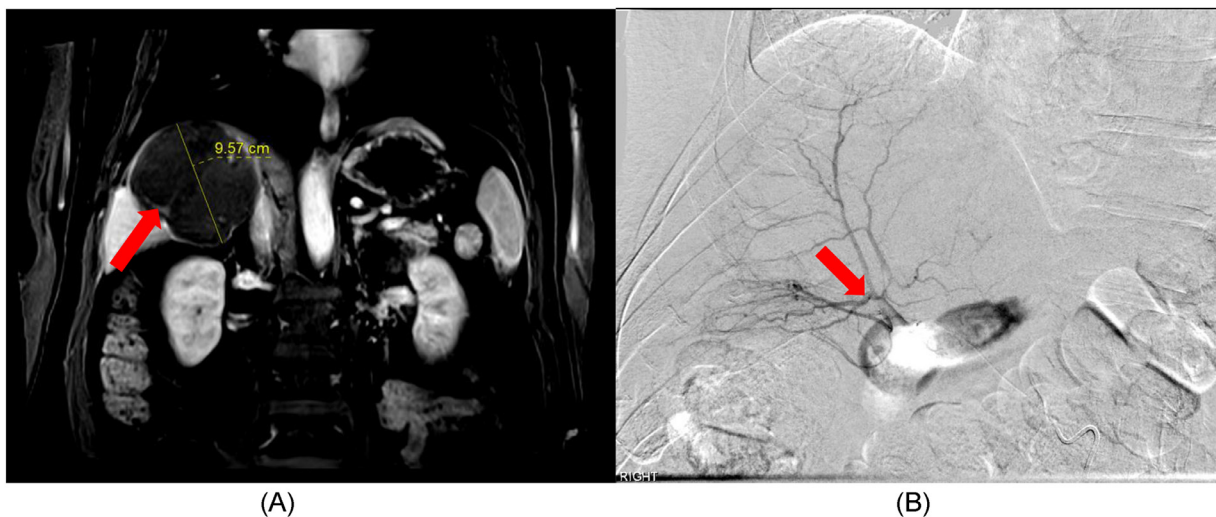
## Case report

A 68 year old male with a history of cirrhosis and a large right hepatic biopsy proven hepatocellular carcinoma (HCC) (Fig. 1A) status post Y90 radioembolization presented to the emergency department with RUQ pain 4 days post procedure. The patient received intravenous acetaminophen and ketorolac for the pain and was discharged home. Despite initial relief, the patient returned 2 days later with persistent abdominal pain. At this time, the patient was admitted to the hospital for hydration, pain control, and further workup. A CT of the abdomen and pelvis was performed with intravenous contrast, which demonstrated pericholecystic inflammatory changes consistent with cholecystitis. Given the history of recent radioembolization, a review of imaging demonstrated focal high

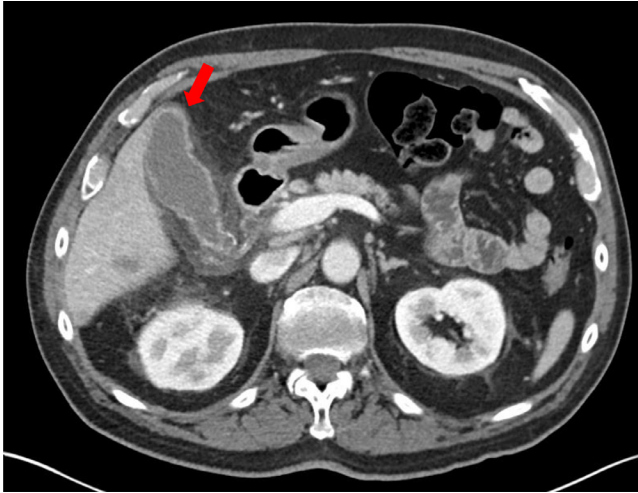


**Fig. 2 – Bremsstrahlung SPECT status post Y90 radioembolization in the right hepatic artery demonstrates uptake in the peripheral aspect of the mass, as well as high intensity focal deposition in the gallbladder neck (red arrow).**

intensity in the gallbladder neck on post Y90 Bremsstrahlung SPECT, which was consistent with nontarget radioembolization to the gallbladder causing radiation induced cholecystitis (Fig. 2). This was further corroborated on CT performed 1 month post Y90 radioembolization (Fig. 3). Discussion on management included potential cholecystectomy, cholecystostomy tube placement, or continued conservative management. The decision was made to pursue conservative management, including a low fat diet, NSAIDs, and steroids. The



**Fig. 1 – (A) Coronal contrast enhanced MRI demonstrates a large biopsy proven right HCC measuring 9.57 cm in diameter (red arrow). (B) Right hepatic arteriogram shows tumoral enhancement from anterior and posterior branches of the right hepatic artery, as well as the cystic artery origin from the anterior division (red arrow).**



**Fig. 3 – Axial contrast enhanced CT of the abdomen 1 month post Y90 radioembolization demonstrates gallbladder distension with a thickened, irregular wall and pericholecystic inflammation.**

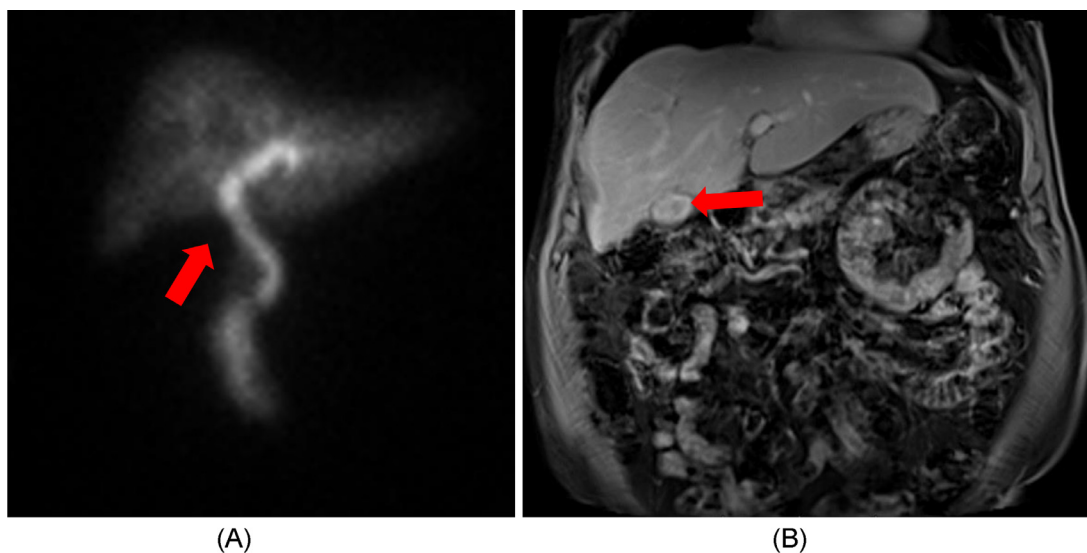
patient tolerated a normal diet the following morning and was discharged home. The patient continued to have intermittent postprandial pain for the next two months, which then completely resolved. After resolution of his postprandial pain, he returned to normal eating habits and regained the weight he had lost. Surveillance MRI of the abdomen with intravenous contrast demonstrated no further enhancement of the tumor and an overall decrease in size. Follow up biliary scintigraphy (HIDA scan) 2 months post procedure revealed chronic cystic duct obstruction (Fig. 4A) and a contracted

gallbladder filled with sludge (Fig. 4B), indicative of chronic cholecystitis.

## Discussion

Although post procedural imaging findings of radiation induced cholecystitis may be more common, clinically significant cholecystitis requiring treatment is rare. The mechanism of injury to the gallbladder in cases after Y90 radioembolization is nontarget embolization of radioactive microspheres into the gallbladder and its capillaries [5]. In our case, the large right hepatic tumor received significant blood supply from both anterior and posterior divisions of the right hepatic artery; of significance, the patient's cystic artery was a branch of the anterior division of this artery. Radiation cholecystitis is typically a clinical diagnosis because imaging does not often correlate with the patient's clinical presentation. This case is unique due to the clear signs of focal radiotracer deposition in the gallbladder neck noted on Bremsstrahlung SPECT, accompanied by clear clinical signs and symptoms of cholecystitis.

Understanding each patient's vascular anatomy can help predict the migration of radioactive microspheres to unintended structures. Anatomical variations of the cystic artery occur with high frequency [6]. As in the case of our patient (Fig. 1B), up to 79.02% of patients have their cystic artery branch from the right hepatic artery. It must be noted that significant variants include the cystic artery originating from an aberrant right hepatic artery, the left hepatic artery, and the gastroduodenal artery [7]. The variation of the hepatogastric vasculature must be considered for each patient prior to radioembolization procedures in the area. Of interest to our patient, there can be drastic variations in how proximally



**Fig. 4 – (A) Hepatobiliary iminodiacetic acid (HIDA) scan 2 months post Y90 radioembolization shows no radiotracer uptake in the gallbladder (red arrow). (B) Coronal MRI of the abdomen demonstrates a contracted and sludge filled gallbladder (red arrow).**

or distally the cystic artery branches off of the right hepatic artery, such as closer to the bifurcation of the proper hepatic artery into the left and right hepatic arteries, or more distally approaching the inferior margin of the liver. Pre-procedural imaging is vital in identifying the patient's arterial anatomy, with care taken to inject microspheres distal to the origin of the artery, when possible, to reduce incidence of deposition in the gallbladder wall [8].

Conventional treatments including conservative management, cholecystostomy and cholecystectomy, are chosen based on several factors, including the patient's clinical findings, surgical risk, recurrence risk, and prognosis. A systematic review regarding the prevention, diagnosis, and management of complications from Y90 nontarget embolization attests to our team's decision and plan for our patient. Conservative therapy has been deemed safe and feasible, especially in patients with mild symptoms, and usually includes IV hydration, decreased dietary fat intake, and analgesics. Cholecystectomy is a safe and low-risk operative procedure in patients with mild acalculous cholecystitis, but can have higher complication rates in patients with medical comorbidities, while percutaneous cholecystostomy is reserved for severely ill and high-risk patients [8,9].

Due to the limited number of reported cases of post Y90 radiation cholecystitis, identifying the most appropriate course of management is challenging. While there are 4 documented cases of cholecystectomy following Y90 induced cholecystitis, there is only one previous case of conservative management leading to the resolution of symptoms [5]. Use of conservative versus invasive management is dependent on the patient's clinical presentation, comorbidities, and imaging. For example, patients with signs of rupture or wall necrosis on imaging should be considered for surgical therapy, while critically ill patients at high risk for surgical morbidity can be considered for cholecystostomy [9].

Our case provides credence to the recommendation of conservative management, when appropriate, of radiation induced radiation cholecystitis. In patients with mild cholecystitis and acute acalculous cholecystitis, conservative treatment is deemed safe, effective, and arguably advantageous to surgical options due to their risks for both short and long-term outcomes [10]. Further research studying the outcomes of surgical versus conservative management of radiation cholecystitis is warranted.

## Patient consent

The authors confirm that written, informed consent was obtained from the patient to publish this paper.

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