Transcatheter Chemoembolization of a Hepatocellular Carcinoma Utilizing Lipiodol through the Pancreaticoduodenal Arcade: A Case Report

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Abstract

This case report describes the chemoembolization of a small hepatocellular carcinoma employing a lipiodol drug delivery system utilizing a novel arterial pathway. Because the target lesion was precariously located adjacent to the inferior heart border and the diaphragm, it was unsuitable for imaging-guided microwave ablation. To achieve chemoembolization, several intraprocedural adaptations were necessary, given the variant anatomy encountered and difficulty accessing the left gastric artery through a celiac artery approach. The left gastric artery was selected from a superior mesenteric artery approach through the pancreaticoduodenal arcade (Rio Branco's arcade). This case illustrates the importance of a mastery of the vascular anatomy and variants of hepatic arterial flow.

Keywords: Chemoembolization, Cirrhosis, Hepatocellular carcinoma, Lipiodol, Pancreaticoduodenal arcade

INTRODUCTION

Despite recent advances in imaging directed microwave ablation and its demonstrated efficacy in treating inoperable small hepatocellular carcinomas, some hepatic lesions remain unsuitable for microwave ablation due to their proximity to adjacent vital structures.[1] This subset of patients is typically referred for treatment with transarterial chemoembolization with drug-eluting beads or radioembolization with embospheres.[2] Due to its long-lasting staining of hepatocellular carcinomas (HCCs), a lipiodol-based drug delivery system is considered the gold standard among other transcatheter arterial chemoembolization procedures.[3] The successful endovascular treatment of liver tumors requires interventional radiologists to have a thorough understanding of both the normal anatomy and anatomic variants of the hepatic arterial supply.[4]

This report describes the successful transcatheter chemoembolization ablation of a 9 mm hepatocellular carcinoma utilizing a lipiodol-based drug delivery. This case delineates the variant anatomy encountered and the path pursued through the pancreaticoduodenal arcade to reach the left hepatic artery originating from the left gastric artery.

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CASE REPORT

A 68-year-old male presented with a history of cirrhosis due to hepatitis C. He underwent triphasic computed tomography (CT) imaging of the liver at an outside institution which revealed a 9 mm hypervasular lesion in the lateral segment of the left lobe of the liver (Figure 1).

He was referred to our interventional radiology department for potential image-guided ablation of the lesion. On reviewing the CT images, it was determined that the lesion was unsuitable for microwave ablation, due to its cephalad location in the liver, adjacent to the inferior heart border (Figure 1b). A diagnostic angiogram was performed for pre-chemoembolization planning to map the vessels supplying the lesion. In addition, lipiodol was injected to mark and further confirm that the lesion was an HCC.

Initially, a cobra catheter was used to select the superior mesenteric artery. A superior mesenteric digital subtraction angiography (DSA) arteriogram was performed, revealing filling of the hepatic artery through the pancreaticoduodenal arcade (Figure 2a). Selection of the celiac artery with the cobra catheter was difficult, and ultimately a Simmons-2 catheter was used. Celiac arteriogram revealed opacification of an enlarged splenic artery and left gastric artery (Figure 2b). The hepatic artery did not opacify from this access point. An angled Glidewire was then advanced into the hepatic artery. A common hepatic arteriogram again revealed a lack of opacification of the hepatic artery with hepatofugal flow filling the splenic artery. Over an exchange length wire, a 5-French straight glide catheter was used to select the proper hepatic artery near the hilum of the liver, illustrating the supply of the right lobe through the proper hepatic artery (Figure 2c). A left hepatic branch was identified originating from the left gastric artery which supplied the left lobe of the liver. The catheter was withdrawn and attempts to select the left gastric artery were not successful from the celiac artery approach. The cobra catheter was used to select the superior mesenteric artery (Figure 3a). An angled microcatheter and microwire were navigated through the pancreaticoduodenal arcade and the gastroduodenal artery to select the left gastric artery (Figure 3b). The microcatheter was then used to select the left hepatic artery from the left gastric artery (Figure 3c). Selective arteriography revealed that the left hepatic artery supplied the left lobe of the liver.

Due to the difficulty in selecting the left hepatic artery through the markedly tortuous pathway, the decision was made to proceed with a standard chemoembolization, deploying a mixture of 3–4 cc Lipidol mixed with chemotherapeutic agents. Chemoembolization was performed with the intention to occlude the left hepatic artery with n-butyl cyanoacrylate (N-BCA) glue mixed with lipiodol. 10 mg of mitomycin was reconstituted in 50 mg of Adriamycin in addition to contrast material (35 cc volume). In 5 cc aliquots, this chemotherapy

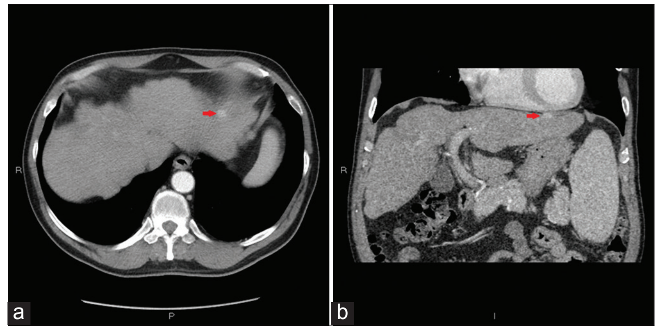

Figure 1: A 68-year-old male with a history of cirrhosis secondary to hepatitis C. Axial (a) and coronal (b) computed tomography images of the liver with contrast demonstrate a 9 mm hypervascular lesion (red arrow) in the lateral segment of the left lobe of the liver. The coronal image reveals the lesion's close proximity to the heart.

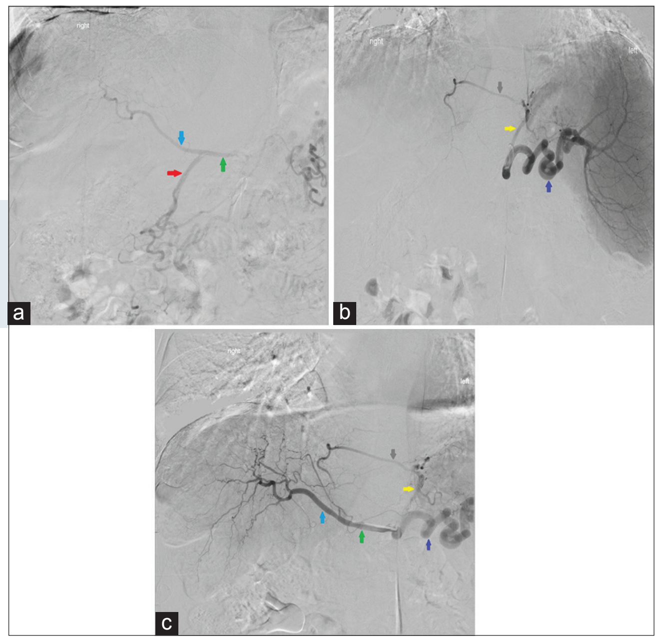

Figure 2: A 68-year-old male with a history of cirrhosis secondary to hepatitis C. (a) A superior mesenteric digital subtraction angiography (DSA) arteriogram was performed, revealing normal filling of the common hepatic (green arrow) and proper hepatic arteries (blue arrow) from the gastroduodenal artery (red arrow) through the pancreaticoduodenal arcade. (b) A celiac DSA arteriogram revealed opacification of the left hepatic artery (grey arrow) originating from the left gastric artery (yellow arrow). The common hepatic artery failed to opacify from this access point due to the enlarged splenic artery (purple arrow) and splenomegaly. (c) Selection of the proper hepatic artery (blue arrow) near the hilum of the liver, illustrates the supply of the right lobe through the proper hepatic artery. The left hepatic artery (yellow arrow) was identified originating from the left gastric artery (yellow arrow) supplying the left lateral lobe of the liver.

was injected into the left hepatic artery mixed with lipiodol. Subsequently, one vial of 300–500 μ Embosphere particles was injected slowly into the left hepatic artery to near contrast stasis. Although the intention was to occlude the left hepatic artery utilizing N-BCA glue, the catheter became kinked and the glue occluded the hub of the microcatheter. A guidewire could not be advanced through the microcatheter, and access was lost. Repeat attempts to select the left gastric artery and left hepatic artery through the superior mesenteric artery were unsuccessful.

Post-procedural CT images of the liver demonstrated successful lipiodol marking of the lesion, providing further confirmation that the lesion was a small HCC (Figure 4). Because the lesion was lipidol avid, a plan was established to repeat chemoembolization from the left brachial artery approach. The goal was to select the left hepatic artery from a celiac artery approach to repeat chemoembolization with Adriamycin-labeled drug-eluting beads and to occlude the left hepatic artery.

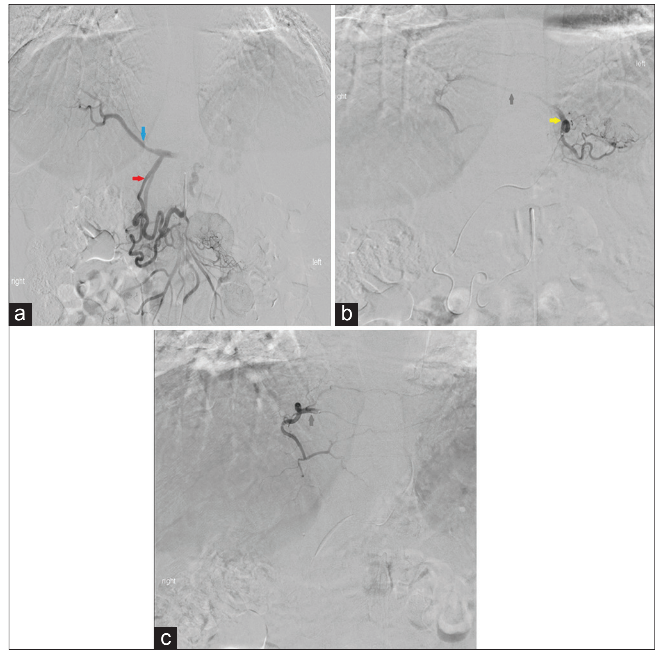

Figure 3: A 68-year-old male with a history of cirrhosis secondary to hepatitis C. (a) A superior mesenteric digital subtraction angiography arteriogram was performed, revealing normal filling of the proper hepatic artery (blue arrow) through the pancreaticoduodenal arcade (red arrow). (b) An angled "torque" microcatheter and fathom microwire were navigated through the pancreaticoduodenal arcade and the gastroduodenal artery to select the left gastric artery (yellow arrow). (c) The microcatheter was then used to select the left hepatic artery (grey arrow) from the left gastric artery.

DISCUSSION

Hepatocellular carcinoma is the fifth most common tumor worldwide and the third most common cause of tumor-related death.[5] The overall incidence of HCC in patients with cirrhosis is 29.7% (3.0%/year).[6] Due to the post-operative morbidity and mortality risk in patients with cirrhosis, these patients are typically managed non-operatively with image-guided therapeutic methods.[5,7]

At our institution, the patients with inoperable HCCs are typically treated with CT-guided microwave ablation. Smaller lesions which are more difficult to visualize on CT, undergo transarterial preprocedural marking with lipiodol.[8,9] Tumor size and location should be carefully considered before ablation therapy. In general, an ideal tumor for percutaneous ablation is smaller than 4 cm.[1] Despite the ideal size of the HCC in our case, its close proximity to the heart rendered it a poor candidate for microwave ablation. When adjacent vital structures such as the heart cannot be separated from the zone of ablation, and the risk of the thermal effects are significant, we typically proceed with selective angiography and transcatheter chemoembolization.[1] Angiography allows for selective catheterization, precise delivery of chemotherapeutic agents, and occlusion of the arterial supply.[2,3,5] Lipiodol was utilized as a drug delivery system. Lipiodol's tumor-seeking properties allow for higher tumor concentration of the chemotherapeutic agents, as well as plastic and transient embolization of the tumor microcirculation.[3,5,10]

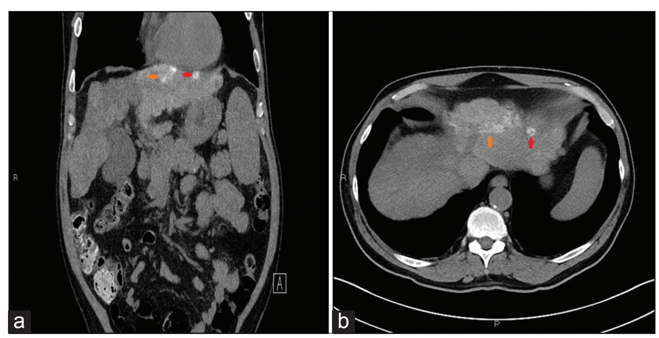

Figure 4: A 68-year-old male with a history of cirrhosis secondary to hepatitis C. Post-procedural axial (a) and coronal (b) computed tomography images of the liver demonstrated successful lipiodol marking of the lesion (red arrow), further confirmation that the lesion was a small hepatocellular carcinoma (HCC). The increased density in the left lobe of the liver (orange arrow) represents lipiodol deposited in hepatic tissue which is metabolized quickly by hepatocytes, while the lipiodol marking the HCC is retained for weeks to months. The radio-opacity of lipiodol helps to monitor treatment efficacy, with retention of lipiodol serving as an imaging biomarker for tumor response.

CONCLUSION

Performing angiography directed procedures require a consummate knowledge of the conventional anatomy of the hepatic arterial supply and the ability to adapt to any variant anatomy encountered. Heavy calcification, multiple plaques, and anatomic variations can complicate the process of accessing the left gastric artery from a celiac artery approach. After encountering difficulty in selecting the left gastric from a celiac artery approach, the left gastric artery was accessed through a superior mesenteric artery approach navigating through the pancreaticoduodenal arcade. The pancreaticoduodenal arcade is formed by the anastomosis of the superior pancreaticoduodenal artery, originating from the gastroduodenal artery and the inferior pancreaticoduodenal artery, originating from the superior mesenteric artery. Knowledge of this alternate approach allowed us to achieve selective catheterization of the left hepatic artery enabling subsequent successful chemoembolization of the targeted lesion.

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