Gastrointest Interv 2013; 2:118–120

Contents lists available at ScienceDirect

Gastrointestinal Intervention

journal homepage: www.gi-intervention.org

Case Report

Microcatheter looping technique for catheterization of the proper hepatic artery through pancreaticoduodenal arcades and gastroduodenal artery in celiac axis occlusion

Roh-Eul Yoo,[1,2,3] Hyo-Cheol Kim,[1,2,3,*] Jin Wook Chung[1,2,3]

A B S T R A C T

The present report describes a case of successful embolization of the hepatic artery pseudoaneurysm in a 61-year-old female patient with celiac axis occlusion. Because of celiac artery occlusion, the hepatic artery had to be catheterized through the pancreaticoduodenal arcades and the gastroduodenal artery (GDA) from the superior mesenteric artery (SMA). Despite coaxial catheterization using a torque guide wire, the proper hepatic artery (PHA) could not be catheterized because of the acute angle between the GDA and the PHA. The use of the microcatheter looping technique facilitated catheterization of the PHA and subsequent embolization of the right hepatic artery pseudoaneurysm.

Keywords: Celiac axis occlusion, Hepatic artery pseudoaneurysm, Microcatheter looping technique

Introduction

Celiac axis stenosis or occlusion is not an infrequently encountered condition in routine practice, although the majority does not cause clinically significant ischemic bowel disease due to rich collateral circulation from the superior mesenteric artery (SMA).[1] The condition, however, poses a considerable challenge to interventional radiologists, when catheterization of the hepatic artery is required for various therapeutic purposes—for example, chemoembolization of hepatocellular carcinomas (HCCs) or embolization for hemobilia, pseudoaneurysm, traumatic bleeding, and hepatic artery arteriovenous malformation.

When the celiac artery is occluded, superselective catheterization is performed from the SMA to the hepatic artery through dilated pancreaticoduodenal arcades and the gastroduodenal artery (GDA). We describe the microcatheter looping technique to assist hepatic artery catheterization, when direct catheterization of the proper hepatic artery (PHA) from the GDA is difficult due to an acute angle between the GDA and the PHA.[2,3] The loop technique is as follows: when the guide wire is passing into the common hepatic artery instead of passing into the PHA, the microcatheter is advanced into the common hepatic artery toward its occlusion. The tip of the microcatheter forms a loop and its tip will then enter the PHA.

Herein, we present a case of successful embolization of the hepatic artery pseudoaneurysm using the microcatheter looping

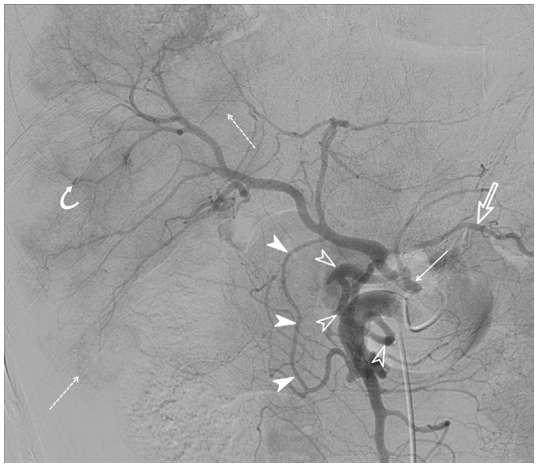

Fig. 1. On the initial superior mesenteric artery (SMA) angiography performed with a 5 French (5F catheter), the celiac axis (arrow) and its distal branches [mainly supplied via the dilated dorsal pancreatic artery (open arrowheads)] are visualized, suggesting celiac axis occlusion. The pancreaticoduodenal arcades and the gastroduodenal artery (GDA; arrowheads) are slightly dilated. The splenic artery is diminutive (open arrow). In addition to multinodular tumor stains (dotted arrows) in both hepatic lobes, a small pseudoaneurysm (curved arrow) was noted at a peripheral branch of the right hepatic artery in Segment 5.

[1] Department of Radiology, Seoul National University College of Medicine, Seoul, South Korea
[2] Institute of Radiation Medicine, Seoul National University Medical Research Center, Seoul, South Korea
[3] Clinical Research Institute, Seoul National University Hospital, Seoul, South Korea
Received 11 September 2013; Revised 3 October 2013; Accepted 5 October 2013
* Corresponding author. Department of Radiology, Seoul National University Hospital, Number 28 Yongon-dong, Chongno-gu, Seoul 110-744, South Korea.
E-mail address: angiointervention@gmail.com (H.C. Kim).

2213-1795/$ – see front matter
http://dx.doi.org/10.1016/j.gii.2013.10.001

technique, in a 61-year-old female patient with celiac axis occlusion.

Case report

A 61-year-old female patient with lung adenocarcinoma underwent ultrasound-guided, core-needle biopsy for a suspected metastatic mass in the liver. After the biopsy, right upper quadrant pain developed with a drop in systolic blood pressure to 79 mmHg and an increase in the heart rate to 105 beats per minute. Laboratory work-up revealed a decrease in the blood hemoglobin level from 9.8 g/dL to 6.9 g/dL after the biopsy. Under a strong suspicion of postbiopsy bleeding, the patient was referred to our vascular intervention section for diagnostic angiography and therapeutic embolization, without performing a diagnostic ultrasonography or computed tomography (CT) imaging.

Superior mesenteric angiography performed using a 5-French (5F) catheter (Rosch hepatic; Cook, Bloomington, IN, USA) demonstrated that the celiac axis and its distal branches were mainly supplied via the dilated dorsal pancreatic artery, suggesting that the celiac axis was occluded. The pancreaticoduodenal arcades and the GDA were mildly dilated. The splenic artery was diminutive. The PHA was short and it gave rise to the left and the right hepatic arteries. There was an acute angle between the GDA and the PHA. A small pseudoaneurysm was noted at a peripheral branch of the right hepatic artery in Segment 5. Additionally, multinodular tumor staining was noted in both hepatic lobes (Fig. 1).

Initial attempts to directly catheterize the celiac axis using the 5F catheter failed. Alternatively, a microcatheter (Progreat 2.0;

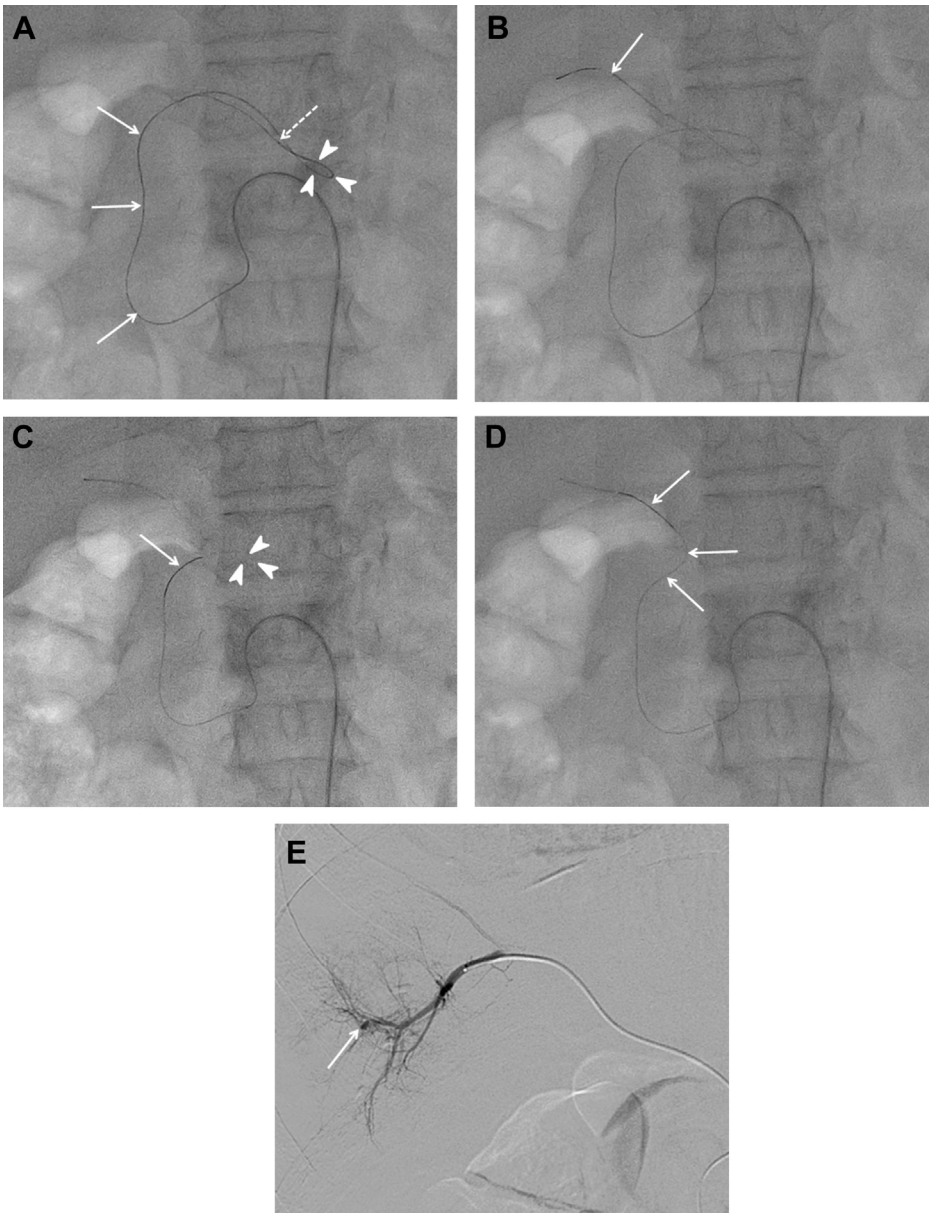

Fig. 2. (A) The microcatheter was advanced over a micro-guide wire through the pancreaticoduodenal arcade (arrows) toward the occluded celiac axis to form a loop (arrowheads) with its tip (dotted arrow) redirected to the proper hepatic artery (PHA). (B,C) After successfully advancing the microcatheter tip (arrow) over a micro-guide wire further into the PHA (B), the micro-guide wire (arrow) was drawn back into the microcatheter past the looped segment (arrowheads) (C). (D) The microcatheter (arrows) was unlooped by pulling it gently. (E) Subsequent selective angiography of the Segment 5 segmental hepatic artery reveals the tiny pseudoaneurysm (arrow).

Terumo, Tokyo, Japan) was advanced coaxially through the 5F catheter from the SMA into the pancreaticoduodenal artery and the GDA. The outer catheter was positioned in the inferior pancreaticoduodenal artery (Fig. 2A). An attempt to directly catheterize the PHA was unsuccessful, because the microcatheter had a propensity to course along the common hepatic artery or the left hepatic artery, rather than the PHA, which formed an acute angle with the GDA. Specifically, the left hepatic artery originated from the PHA, so the catheter had to pass through the PHA prior to entering the left hepatic artery. The decision was made to redirect the guide wire and the catheter entering the common hepatic artery using the microcatheter looping technique. Over a 0.014-inch micro-guide wire (Transcend; Boston Scientific, Natick, MA, USA), the microcatheter was advanced into the common hepatic artery. When the tip of the guide wire reached the occlusion, it buckled. As the micro-guide wire and microcatheter were advanced, a loop was formed (Fig. 2A), and with further advancing of the loop, the tip of the wire and catheter entered the PHA (Fig. 2B). After withdrawing the guide wire to the GDA (Fig. 2C), gentle retraction of the catheter unlooped the catheter (Fig. 2D), which was then advanced into the branch of the right hepatic artery supplying the pseudoaneurysm. After confirming the pseudoaneurysm with selective angiography (Fig 2E), embolization was performed with a glue (Histoacryl; B. Braun, Tuttlingen, Germany) and lipiodol (Lipiodol Ultrafluide; Laboratoire Guerbet, Aulnay-Sous-Bois, France) mixture (1:3 ratio). On completion, a superior mesenteric angiogram confirmed successful embolization of the pseudoaneurysm.

After the embolization, the blood hemoglobin level increased from 6.9 g/dL to 9.7 g/dL and the vital signs including the blood pressure and the heart rate were stabilized.

Discussion

Atherosclerosis and the median arcuate ligament sling are the two most well-known etiologies of the celiac axis stenosis or occlusion, although their exact incidences remain a subject of debate.[4–8] Relatively low incidence of clinically significant stenosis or occlusion has been attributed to the compensatory hypertrophy of various collateral pathways.[1,4,5,7,9,10] Of those, the pancreaticoduodenal arcades and the dorsal pancreatic artery are known to be the most pivotal and frequently encountered collateral vessels from the SMA in patients with celiac axis stenosis.[1]

In cases of celiac axis occlusion due to the extrinsic compression by the median arcuate ligament sling, the degree of stenosis has been found to be relieved by deep inspiration, because the celiac axis assumes a more caudal orientation as the lungs expand during inspiration.[11,12] Regarding cases with other underlying etiologies such as atherosclerosis, however, it is often necessary to make a detour via the pancreaticoduodenal arcades in order to access the hepatic arteries.

Advancing a microcatheter from the GDA to the PHA is not too complicated, provided that the pancreaticoduodenal arcade has a large caliber and a straight course and the GDA forms an obtuse angle with the PHA.[3] By contrast, substantial technical challenges are encountered when the PHA divides from the GDA in an acute angle. The pursuit of easier ways to catheterize acutely angulated branches has led to the development of the microcatheter looping technique. Cho et al[2] reported the technique to be useful in coil embolization of wide-neck middle cerebral artery aneurysms incorporating origins of acutely angulated branches. Another study by Kwon et al[3] has demonstrated that transcatheter arterial chemoembolization (TACE) could be also performed via the dilated pancreaticoduodenal arcade in a patient with celiac axis occlusion, by employing the looping technique.

In the present case, the conventional method of preshaping a micro-guide wire was inefficient to counter the natural tendency of the wire to course along the left hepatic artery or the common hepatic artery, which formed a more obtuse angle with the GDA. Instead of fighting against it, the microcatheter looping technique was used to take advantage of the tendency, and the microcatheter was advanced toward the occluded celiac axis where it naturally formed a loop. The tip is redirected toward the PHA upon the loop formation, enabling successful catheterization of the hepatic artery thereafter.

In conclusion, the present case suggests that the microcatheter looping technique can facilitate catheterization of the PHA via the pancreaticoduodenal arcade in a patient with celiac axis occlusion, particularly when the PHA forms an acute angle with the GDA.

Conflict of interest

All contributing authors declare no conflicts of interest.

References

1. Song SY, Chung JW, Kwon JW, Joh JH, Shin SJ, Kim HB, et al. Collateral pathways in patients with celiac axis stenosis: angiographic-spiral CT correlation. *Radiographics*. 2002;22:881–93.
2. Cho YD, Kang HS, Kim JE, Son YJ, Lee JY, Lee SJ, et al. Microcatheter looping technique for coil embolization of complex configuration middle cerebral artery aneurysms. *Neurosurgery*. 2012;71:1185–91.
3. Kwon JW, Chung JW, Song SY, Lim HG, Myung JS, Choi YH, et al. Transcatheter arterial chemoembolization for hepatocellular carcinomas in patients with celiac axis occlusion. *J Vasc Interv Radiol*. 2002;13:689–94.
4. Lawson JD, Ochsner JL. Median arcuate ligament syndrome with severe two-vessel involvement. *Arch Surg*. 1984;119:226–7.
5. Mihas AA, Laws HL, Jander HP. Surgical treatment of the celiac axis compression syndrome. *Am J Surg*. 1977;133:688–91.
6. Park CM, Chung JW, Kim HB, Shin SJ, Park JH. Celiac axis stenosis: incidence and etiologies in asymptomatic individuals. *Korean J Radiol*. 2001;2:8–13.
7. Valentine RJ, Martin JD, Myers SI, Rossi MB, Clagett GP. Asymptomatic celiac and superior mesenteric artery stenoses are more prevalent among patients with unsuspected renal artery stenoses. *J Vasc Surg*. 1991;14:195–9.
8. Yoon DY, Park JH, Chung JW, Han JK, Han MC. Iatrogenic dissection of the celiac artery and its branches during transcatheter arterial embolization for hepatocellular carcinoma: outcome in 40 patients. *Cardiovasc Intervent Radiol*. 1995;18:16–9.
9. Derrick JR, Pollard HS, Moore RM. The pattern of arteriosclerotic narrowing of the celiac and superior mesenteric arteries. *Ann Surg*. 1959;149:684–9.
10. Roobottom CA, Dubbins PA. Significant disease of the celiac and superior mesenteric arteries in asymptomatic patients: predictive value of Doppler sonography. *Am J Roentgenol*. 1993;161:985–8.
11. Horton KM, Talamini MA, Fishman EK. Median arcuate ligament syndrome: evaluation with CT angiography. *Radiographics*. 2005;25:1177–82.
12. Lee VS, Morgan JN, Tan AG, Pandharipande PV, Krinsky GA, Barker JA, et al. Celiac artery compression by the median arcuate ligament: a pitfall of end-expiratory MR imaging. *Radiology*. 2003;228:437–42.