Case Report

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# Complete antegrade splanchnic revascularization

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**ABSTRACT**

In this article, we present two cases with mesenteric ischemia. Both patients had three occluded splanchnic arteries. Superior mesenteric artery and celiac artery were revascularized antegradely by using bifurcated Dacron® grafts. The main body of the bifurcated graft (7/14) was anastomosed to the supraceliac abdominal aorta. Then, the small branch of the grafts was anastomosed to the common hepatic artery or celiac artery. Superior mesenteric artery part of the Dacron® grafts was passed behind the pancreas and anastomosed to the superior mesenteric artery in an end-to-side fashion by using the Taylor patch technique. Inferior mesenteric artery was mobilized in both patients and anastomosed to the left iliac artery in an end-to-side fashion.

***Keywords:*** Antegrade revascularization, celiac artery, inferior mesenteric artery, intestinal ischemia, superior mesenteric artery.

Chronic mesenteric ischemia (CMI) is a disease consisting of stenosis or occlusion of one or more vessels of the three main intestinal arteries. It presents with postprandial abdominal pain, nausea, vomiting, diarrhea, fear of eat and weight loss. Atherosclerosis is the most common cause, with fibromuscular dysplasia, polyarteritis nodosa, and Takayasu's arteritis representing rare causes.[1-4] Untreated CMI can ultimately progress to acute ischemia, resulting in bowel necrosis. Percutaneous endovascular repair (ER) has been an alternative for treatment of CMI.[5,6] However, the most optimal management strategy for CMI has not been well established, yet. Open surgical treatment is still the best treatment procedure for young patients.

In this article, we present two cases who underwent antegrade surgical revascularization for three splanchnic arteries.

## CASE REPORT

***Case 1-*** A 65-year-old, heavy smoker female patient was admitted to our department with a complaint of postprandial pain and fear of food. She lost 33 kg within the last six months. Coronary angiography was done two months ago and revealed normal coronary anatomy. She had severe abdominal pain just after percutaneous ER of celiac artery. The urgent surgical revascularization decision was made due to severe abdominal pain. Nasogastric tube was inserted after general anesthesia. Midline abdominal incision was done from the inferior border of sternum to pubis. Triangular ligament of left lobe of liver was transected. The left lobe of liver was mobilized and retracted to the right side. Esophagus was easily found by palpating the nasogastric tube. Esophagus was mobilized and retracted to left side by using a silastic tape. Diaphragmatic crura were transected.

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Supraceliac aorta was taped. There was serious dissection in the proximal part of celiac artery. Blood was accumulated around the celiac artery. There was ischemic appearance on spleen. Spleenectomy was performed in usual fashion. Common hepatic artery was found and mobilized/taped. Superior mesenteric artery (SMA) was found below the transverse colon. Heparin (100 IU/kg) was administrated. A partial clamp was placed to the supraceliac aorta and a tailored, main bifurcated Dacron® (Medox Medical, Newark, NJ, USA) graft (7/14 size) was anastomosed to aorta in an end-to-side fashion. Aortic partial clamp was removed (Figure 1a). Small right branch of the bifurcated graft was anastomosed to common hepatic artery in an end-to-side fashion. The other branch of the graft was passed from behind the pancreatic body with extreme care for splenic vein. The SMA was clamped and 3-cm arteriotomy was done. A Taylor patch with the saphenous vein was done on SMA (Figure 3a). Then, the left branch of the Dacron® graft was anastomosed to SMA in an end-to-side fashion. Inferior mesenteric artery (IMA) was found and mobilized/taped. The proximal part of the IMA was ligated and then resected until the atherosclerosis-free part of the IMA was found, and a bulldog clamp was placed. The left iliac artery mobilized and taped. The IMA was anastomosed to the left iliac artery in an end-to-side fashion. The drain was placed in the Douglas cavity. Postoperative course was uneventful. We allowed oral intake in the postoperative second day. Clopidogrel (75 mg/day) and acetylsalicylic acid (100 mg/day) were administrated. The Douglas drain was removed on postoperative Day 11 due to excessive amount of lymphatic drainage. The patient was discharged on postoperative Day 15. We could not perform postoperative control tomography due to reduced renal function. Doppler ultrasonography revealed both SMA and common hepatic artery graft patency. Antegrade blood flow was also detected on IMA at Doppler ultrasound examination.

***Case 2*-** A 57-year-old male patient was admitted to our department with a complaint of severe postprandial abdominal pain. He lost 21 kg within the last four months. Tomographic angiography and coronary angiography were done (Figure 2a). Percutaneous coronary stenting was done due to severe right coronary artery (>70%) lesion. The elective surgical revascularization decision was made. A nasogastric tube was inserted after general anesthesia. A midline abdominal incision was done from the inferior border of sternum to pubis. Triangular ligament of left lobe

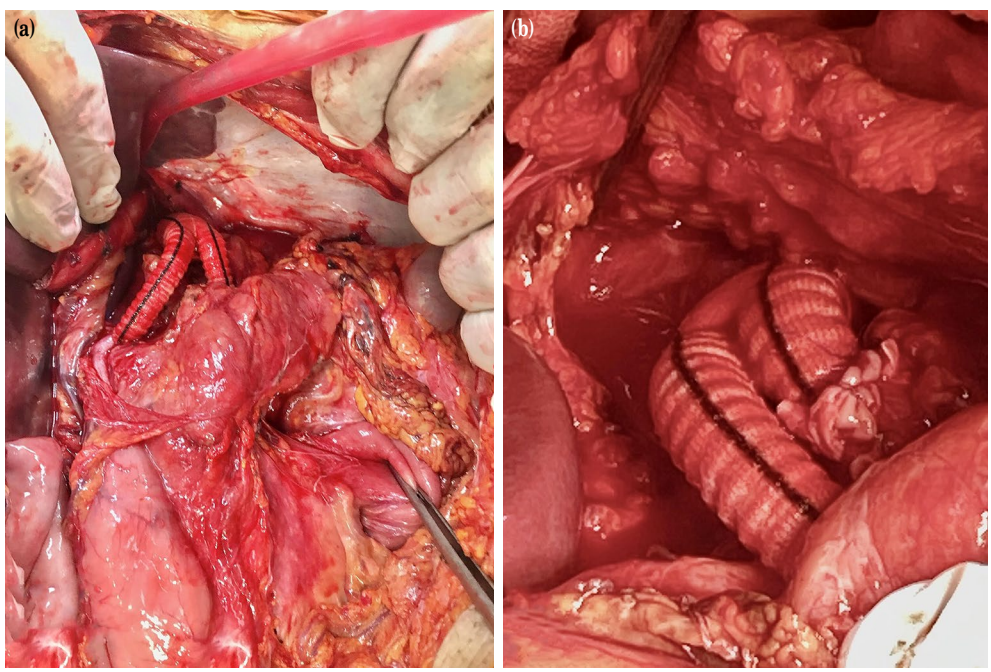


**Figure 1.** **(a)** Main body of (7-14) bifurcated graft anastomosed to supraceliac abdominal aorta. Right limb of bifurcated graft was anastomosed to common hepatic artery in end-to-side fashion. Left limb of bifurcated graft was passed from behind pancreas and anastomosed to superior mesenteric artery. **(b)** Main body of (7-14) bifurcated graft anastomosed to supraceliac abdominal aorta. Left limb of bifurcated graft was anastomosed to celiac artery in an end-to-end fashion. Right limb of bifurcated graft was passed from behind pancreas and anastomosed to superior mesenteric artery.


**Figure 2.** **(a)** Preoperative tomographic angiogram showing complete obstruction both celiac and superior mesenteric artery (Case 2). **(b)** Anterior view of postoperative tomographic angiogram showing both celiac and superior mesenteric artery limbs perfectly patency (Case 2). **(c)** Lateral view of postoperative tomographic angiogram showing patent both celiac and superior mesenteric artery limbs. Taylor patch bulge is easily noticed at the superior mesenteric artery anastomosis (Case 2).

of liver was transected. The left lobe of liver was mobilized and retracted to the right side. Esophagus was easily found by palpating the nasogastric tube. Esophagus was mobilized and retracted to the right side by using a silastic tape. Diaphragmatic crura were transected. The supraceliac aorta was rounded/taped. Celiac artery was found and taped. The SMA was found below the transverse colon. Heparin (100 IU/kg) was administrated. A partial clamp was placed to the supraceliac aorta and a tailored, bifurcated Dacron® graft (7/14 size) was anastomosed to the aorta in an end-to-side fashion. The proximal part of the celiac artery was divided just after arising from the aorta and was ligated. The celiac artery wall was extremely thin. The saphenous vein was opened longitudinally and this saphenous vein was wrapped around the proximal

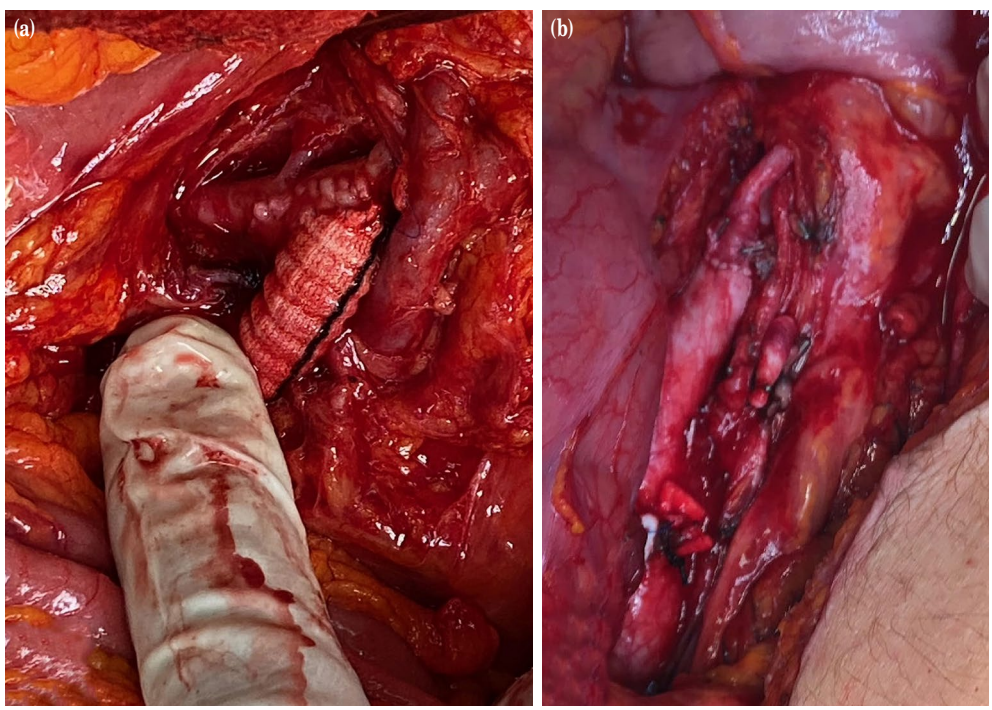


**Figure 3.** **(a)** Taylor patch is placed over the superior mesenteric artery and then superior mesenteric artery limb of bifurcated graft is anastomosed in an end-to-side fashion. **(b)** Inferior mesenteric artery is mobilized and transected from the origin of abdominal aorta and anastomosed to left iliac artery end-to-side fashion.

celiac artery to obtain good hemostasis. Small left branch of the bifurcated graft was anastomosed to the celiac artery in an end-to-end fashion (Figure 1b). The other branch of the graft was passed from behind the pancreatic body. The SMA was clamped and 3-cm arteriotomy was done. A Taylor patch with saphenous vein was done on SMA (Figure 3a). Then, the right branch of the Dacron® graft was anastomosed to SMA in an end-to-side fashion. The IMA was found and mobilized/taped. The proximal part of the IMA was ligated, the atherosclerosis-free part of the IMA was found, and a bulldog clamp was placed. Left iliac artery was mobilized and taped. The IMA was anastomosed to the left iliac artery in an end-to-side fashion and the clamps were, then, removed (Figure 3b). A drain was placed in the Douglas cavity. The postoperative course was uneventful. Oral intake was allowed in the postoperative second day. Clopidogrel (75 mg/day) and acetylsalicylic acid (100 mg/day) were administrated. The Douglas drain was removed on postoperative Day 7. The patient was discharged on postoperative Day 10. Postoperative control tomography was done which revealed patent SMA and celiac artery grafts (Figure 2b, c). The patency of the IMA was controlled by Doppler ultrasound and antegrade blood flow detected on IMA.

## DISCUSSION

Mesenteric ischemia requiring revascularization is associated with high mortality in both chronic and acute forms. Open surgical treatment with bypass, endarterectomy, or embolectomy has been the standard for many years. Given the rarity of the disease, there are few reported series with large numbers of patients undergoing surgery for CMI. Relatively high-volume centers have reduced operative mortality to 12%.[1-6] Mortality with revascularization for acute mesenteric ischemia (AMI) is typically more than 50%.[4-7] Schermerhorn et al.[4] reported that the surgical revascularization mortality rate was the highest with embolectomy and the lowest with bypass in AMI states. This is likely due to the lack of an established collateral circulation with embolization. Bypass surgery has been performed for CMI to obtain good results. Antegrade revascularization from supraceliac or descending aorta has favorable results due to the relatively short graft requirement, less turbulence, and kinking avoidance. Retrograde revascularization refers to inflow from abdominal aorta and iliac arteries.[2-6] We used supraceliac aorta for arterial inflow in our both cases. Mobilization of the left lobe of the liver and diaphragmatic crura are surgically demanding, particularly in obese and hemodynamically instable patients and, therefore, some surgeons can bypass only SMA. Foley et al.[8] advocated that isolated alone SMA revascularization can achieve satisfactory results. The proximal part of the duodenum and gastric blood flow are mainly originated from celiac artery. Isolated SMA revascularization may cause ischemic symptoms due to the reduced blood flow of the celiac artery. If there is a stenosed celiac artery, when SMA graft is occluded, severe ischemic symptoms and even bowel necrosis may develop at the time of diagnosis. Some surgeons perform all three splanchnic artery revascularization to obtain good results. We also performed all three splanchnic artery revascularization, celiac artery, and SMA and revascularization was done firstly and IMA was implanted later in our both cases. In the current practice, IMA revascularization was done mainly, if there was an unattainable SMA condition. Despite enhanced mesenteric collateral circulation, colonic ischemia may develop in some cases. We believe that if there is a good-caliber IMA, it should be revascularized.[9-11] McAfee et al.[12] performed complete splanchnic revascularization in their study. They advocated that complete splanchnic revascularization also increased the graft patency rate. They reported a three-vessel graft patency rate as 90%, a two-vessel patency rate as 54%, and a single-vessel patency rate 0% at three years. We previously demonstrated that IMA revascularization during abdominal aorta aneurysm surgery might cause rapid bowel movements in the postoperative period.[13] Graft choice is a serious issue in the current practice. Enough-size saphenous vein may obtain adequate blood flow. However, relatively small size saphenous vein may not have satisfactory blood flow in SMA, particularly after meals. We used Dacron® grafts for CMI. However, if there was bowel infarction and perforation, we routinely prefer saphenous vein to avoid graft infection. Intimal hyperplasia may usually cause early prosthetic graft stenosis. The same phenomenon may also cause early prosthetic graft stenosis. We utilized the Taylor patch technique by the using saphenous vein in our cases. Percutaneous ER has been a minimally invasive alternative for treatment of CMI.[5,6] The ER has good result for ostial lesions. However, dissection of the splanchnic arteries has been reported. Extensive dissection of the SMA have fatal results and makes surgical treatment impossible. The ER was firstly performed in Case 1, but celiac artery dissection during ER intervention caused AMI. Endovascular repair is recommended in patients with short life expectancy, high cardiopulmonary risk,

cachexia, or hostile abdomen. Open repair is the preferred option for patients who are relatively young, with age 50 years and, otherwise, fit for surgical repair.[5]

In conclusion, mesenteric artery revascularization should be done antegradely to all three mesenteric arteries. The Taylor patch technique (to avoid/reduce intimal hyperplasia) for end-to-side fashion anastomoses may be used to increase both early- and late-term patency rates for SMA.

**Patient Consent for Publication:** A written informed consent was obtained from the both patient.

**Data Sharing Statement:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

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