Chronic Mesenteric Ischemia Presenting as Exercise-induced Abdominal Pain

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Patients with a stenosis of the superior mesenteric artery and a widely patent celiac axis are often asymptomatic because of a rich network of collaterals between the two. Compression of the celiac axis by the diaphragm is, in patients without additional vascular disease, also frequently asymptomatic. Here, we describe an unusual case of exercise-induced abdominal pain caused by a combination of these two pathologies. In our patient with a previously occluded inferior mesenteric artery and a 90% superior mesenteric artery stenosis, celiac compression by the diaphragm, worsened with exercise, caused severe abdominal pain. This exercise-induced pain resolved completely with endovascular treatment of the superior mesenteric artery stenosis.

CASE REPORT

A 78-year-old male was referred to the outpatient vascular office by his gastroenterologist for a concern of chronic mesenteric ischemia. The patient complained of significant periumbilical abdominal pain that occurred reliably with ambulation at 1 block and improved with rest. He had no associated nausea, vomiting, changes in his bowel habits, postprandial symptoms, or recent weight loss. He did, however, have a significant past medical history for vascular disease, including a saccular abdominal aortic aneurysm (AAA) which was treated endovascularly 4 years before this presentation. Other pertinent past history included coronary artery disease with stent placement, atrial fibrillation with attempted cardioversion, and long-standing hypertension. Gastrointestinal work-up including endoscopy did not reveal a source for his pain.

Fasting duplex of the mesenteric vessels reveals a stenosis of the superior mesenteric artery (SMA) with a peak systolic velocity (PSV) of 466 cm/sec and end diastolic velocity of 88 cm/sec. The celiac artery had a PSV of 275 with deep inspiration and a PSV of 573 with deep expiration.

An outpatient computed tomography angiography was performed. This revealed a 90% stenosis of the SMA at its origin (Fig. 1). The suprarenal fixation stents from his endograft seemed to be very intimate with the orifice of the SMA. The celiac artery was patent but constrained by the median arcuate ligament, and his inferior mesenteric artery (IMA) was occluded. Given this history, it was postulated that celiac compression by the median arcuate ligament, occurring more frequently during deep respiratory cycles as during exercise, may exacerbate an ischemic episode because of his high-grade SMA stenosis. The patient’s particular anatomy, coupled with the lack of alternative diagnoses following a complete gastrointestinal work-up, supported this hypothesis.

After a long discussion with the patient including the unusual presentation of his symptoms and the possibility of treatment failure, we proceeded to angiogram. Ultrasound guidance was used to access the left axillary artery. From this location, an aortogram was performed, confirming a high-grade stenosis of the SMA at its origin (Fig. 2). A balloon-expandable stent was placed to correct this lesion, and completion angiogram revealed a widely patent SMA (Fig. 3).

After the procedure, the patient’s abdominal pain resolved completely. At both his 1-month and 6-month follow-up visits, he confirmed complete resolution of symptoms. Six-month follow-up duplex evaluation revealed a widely patent SMA stent.

DISCUSSION

Chronic mesenteric ischemia most often presents with postprandial abdominal pain and weight loss secondary to “food fear”. This pain is a type of angina, caused when the blood supply to the
viscera cannot meet the increased demand which occurs after eating. Although traditionally it was thought that at least 2-vessel disease was required for symptoms to present, it is now known that the quality of collateral vessels is a more important predictor.

In our patient, the IMA was occluded by a previous endovascular aneurysm repair. Although the SMA and celiac axis were both free of any obvious atherosclerotic disease, the proximal extent of the patient’s endograft fixation strut, over time, may have caused the stenosis at the ostium of the SMA.
thus creating a 2-vessel disease scenario. Fortunately, the patient’s robust celiac artery supplied adequate collateral flow to the SMA distribution to prevent ischemia. He never experienced postprandial abdominal pain and reported no weight loss.

The median arcuate ligament of the diaphragm can slide over the takeoff of the celiac axis, causing a temporary stenosis of the vessel during expiration. During exercise, the diaphragm experiences greater range of motion as the depth of both inhalation and exhalation increases. This increased motion may worsen compression of the celiac artery by the diaphragm. In our patient, where the celiac artery served as the main blood supply for the abdomen, a temporary compression of this vessel would have caused ischemic abdominal pain.

Unlike in the Median Arcuate Ligament Syndrome, where pain may not be completely related to celiac compression and the mechanism is incompletely understood, compression of the celiac artery in our patient would have led to typical intestinal angina, pain secondary to basic ischemia. Treatment of the SMA stenosis reestablished the blood supply to the viscera, and decreased the importance of the celiac artery’s continuous flow.

Patients with chronic mesenteric ischemia have been observed to have exercised-induced pain in addition to more traditional symptoms. In one case study, a patient has been observed to present with exercise-induced abdominal pain as his only symptom. This patient was found to have severe stenosis of both the celiac and superior mesenteric arteries. Stenting of both vessels was performed with resolution of symptoms. In our case, however, it was a unique combination of SMA stenosis and a dynamic stenosis of the celiac artery by the median arcuate ligament which explains the patient’s symptoms with exertion.

**CONCLUSIONS**

We report an unusual cause of exercise-induced abdominal pain in an adult. In our patient, a high-grade SMA stenosis was exacerbated during exercise when the median arcuate ligament would intermittently occlude the celiac artery. With a previously occluded IMA, the celiac artery acted as a major source of collateral blood flow to the viscera. When this collateral flow was impaired with heavy respiration, the patient experienced ischemic abdominal pain. After endovascular correction of the SMA stenosis, the patient’s symptoms resolved completely.

**REFERENCES**

