

identified only 14,810 revascularizations for CMI over a 13-year period (2000-2012) and this corresponded to roughly 800 endovascular and 400 open revascularizations per year.

The diagnosis of CMI requires the appropriate clinical presentation along with the presence of hemodynamically significant MAOD. The classic symptoms of CMI include postprandial abdominal pain, weight loss, and food fear. However, it is important to note that this triad is not always present, even at the time of revascularization, and patients can present with nonspecific intestinal complaints, including abdominal discomfort, nausea/vomiting, diarrhea, and constipation.^{6,31-34} The abdominal pain is described as mid-abdominal, crampy, or dull. It usually occurs within 30 minutes after eating and can persist for up to 6 hours as suggested by the time course of postprandial hemodynamic changes outlined elsewhere in this article. Certain foods may exacerbate the symptoms, and, accordingly, patients tend to avoid these foods by altering their eating habits.

The postprandial pain can lead to a decrease in oral intake and food fear with the end results that patients lose weight and can even become cachectic in the more extreme scenarios. In one series of patients undergoing mesenteric revascularization, abdominal pain was present in 96%, occurring after eating in only 74%, whereas weight loss occurred in 84% and food fear in 45%.⁶ Notably, there was a delay of 15 months from the onset of symptoms to the definitive diagnosis in this series. In another series from Europe, the typical postprandial abdominal pain was present in 85%, weight loss in 77%, and food fear in 63%, whereas diarrhea, nausea, or vomiting were noted in 56%.³⁵ Allain et al³⁶ examined the impact of malnutrition on outcome after revascularization for CMI (n = 54) using body mass index, percentage of weight loss and serum albumin. They found that 70% of the patients undergoing revascularization were malnourished and that it was associated with increased perioperative mortality and decreased longer term survival. Interestingly, not all patients are cachectic or malnourished at the time of presentation. Mansukhani et al³⁷ reported that 35% of the patients in their recent series undergoing revascularization for CMI were overweight or obese with a body mass index of greater than 25, a trend that they attributed to the obesity epidemic across the country. The common delays in diagnosis can often be explained by inconsistencies in the patient's symptoms, the extensive differential for chronic abdominal pain with weight loss, and the low prevalence of CMI in the population. These delays are usually attributed to the extensive diagnostic workups performed by the responsible primary care physician or gastroenterologist, before referral to the vascular specialist. In practice, many of the patients have completed their extensive evaluation and are referred to the specialist with a tentative diagnosis of CMI. Regardless of the explanations for the diagnostic

delay, an expeditious diagnosis can lead to timely treatment and avoid the sequelae of CMI, as well as the nutritional deficiencies that may affect the perioperative course.

Although patients with CMI present with abdominal pain and weight loss, the differential diagnosis for this presentation is quite extensive, with gastrointestinal malignancy being foremost among the potential causes. Unfortunately, there are no specific physical examination findings or laboratory studies to aid in the diagnosis. Endoscopy is an integral part of the diagnostic algorithm for abdominal pain and weight loss and, therefore, is often completed before considering CMI in the differential. Both esophagogastroduodenoscopy and a colonoscopy should likely be performed as a part of the diagnostic workup to exclude a malignancy, unless the diagnosis of CMI is clear. Although the findings of ischemic gastritis, duodenitis, and colitis are somewhat nonspecific, they can be suggestive of CMI.^{38,39} Notably, the presence of a gastric ulcer in the absence of a malignancy is highly suggestive of CMI.⁴⁰⁻⁴² A variety of adjunct functional studies have been described to aid in the diagnosis of CMI, including oxygen light spectroscopy^{43,44} and intestinal tonometry,⁴⁵ although their collective experience is limited and they have not achieved clinical usefulness. It is conceivable that the widespread availability of CT imaging may help to identify the culprit mesenteric stenoses sooner and expedite the diagnosis of CMI when compared with historic series when catheter-based arteriography was the primary diagnostic imaging modality.

Because there is no reliable functional test for the diagnosis of CMI, the diagnosis must rely on the appropriate clinical scenario and the presence of MAOD. Harki et al⁴⁶ have attempted to develop a predictive model based on the clinical presentation and anatomic findings to increase the diagnostic accuracy. They identified female sex, weight loss, presence of cardiovascular disease, duration of symptoms, and the presence of SMA/CA stenosis as diagnostic predictors. Van Dijk et al⁴⁷ have recently prospectively validated the predictive model (n = 666) and found that it discriminated well with the addition of a predictor for the cause of the CA stenosis. Notably, 94% of the high-risk patients had CMI based on durable symptom relief after revascularization, although the diagnosis was confirmed in only 8% of the low-risk patients.

Mesenteric DUS examination is an excellent screening tool for patients suspected of having CMI.⁴⁸ Although the test is technically demanding and requires an advanced skill set, it can yield consistent, reproducible results in experienced hands. Patients are routinely fasted for 6 to 8 hours to minimize the amount of bowel gas. Nevertheless, obesity can complicate the examination owing to the depth of the vessels. Comparison of mesenteric DUS findings with catheter-based arteriography