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Chronic Mesenteric Ischemia: A Rare Cause of Chronic Abdominal Pain

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ABSTRACT

BACKGROUND: Chronic mesenteric ischemia is a rare disease with nonspecific clinical symptoms, such as chronic postprandial abdominal pain and weight loss. Diagnostic modalities and revascularization techniques have evolved during the past 20 years. The significance of stenosis in a single splanchnic vessel remains unclear. Our aims were to assess the outcomes of 2 revascularization techniques and report on the diagnostic modalities of splanchnic vessel stenoses.

METHODS: The demographic data, medical history, technical characteristics, and outcomes of the revascularization procedures were recorded for all of the patients admitted for endovascular revascularization or open surgical revascularization of the splanchnic vessels as treatment for chronic mesenteric ischemia in our tertiary referral center since 2000.

RESULTS: Fifty-four patients were included in this study: 43 received endovascular revascularization, and 11 had open surgical revascularization. The symptoms were abdominal pain, weight loss, and diarrhea in 98%, 53%, and 25% of the cases, respectively. Computed tomography angiography was the key diagnostic tool for 60% of the patients. A single-vessel stenosis was found in one-third of the patients. Endovascular and open revascularization had similar early and late outcomes, and no 30-day mortality was observed. However, we did observe higher morbidity in the open revascularization group (73% vs 19%, $P < .03$).

CONCLUSIONS: Chronic mesenteric ischemia may be diagnosed in the presence of a splanchnic syndrome and stenosis of a single splanchnic vessel, typically assessed using computed tomography angiography. In selected patients, endovascular revascularization had similar efficacy as, and lower complication rates than open revascularization.

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KEYWORDS: Abdominal angina; Chronic mesenteric ischemia; Splanchnic syndrome

INTRODUCTION

Chronic mesenteric ischemia develops from insufficient blood flow toward the gastrointestinal tract through the splanchnic vessels, mainly due to atherosclerotic stenosis. The symptoms are referred to as "splanchnic syndrome" and typically include postprandial pain, food fear, weight loss, and epigastric bruit.[1] Chronic mesenteric ischemia can develop from stenosis of a single vessel or multiple vessels: 17.5%-18% of elderly people are thought to have significant stenosis in one of their splanchnic vessels; only 1.3% have stenosis in two or more splanchnic vessels.[2] However, a large number of anastomoses exist between splanchnic vessels, and most of these patients do not display any symptoms. Therefore, the

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diagnosis of chronic mesenteric ischemia requires compatible clinical symptoms such as splanchnic syndrome, diarrhea and malabsorption, or vomiting from gastric ischemia, and significant stenosis (>70% narrowing of the contrast lumen) of the celiac artery, superior mesenteric artery, or inferior mesenteric artery. To better screen for patients who would benefit from revascularization, the CO_2 pressure gradient can be measured between the stomach lumen and arterial blood using gastric exercise tonometry[3,4]; however, this technique is invasive and not widely available.[5]

Various lifestyle changes are recommended for patients with chronic mesenteric ischemia. In addition to smoking cessation and treatment of risk factors for atherosclerosis, changes in the diet are recommended: small and more frequent meals, low protein and fat diet, and inhibition of gastric acid secretion and improvement of gastric mucosal blood flow through proton pump inhibitor therapy, which can decrease the gastrointestinal metabolic demand.[1,6] However, most patients will require an invasive treatment, either percutaneous endovascular revascularization or open surgical revascularization.

To determine the outcomes of each treatment approach in patients with chronic splanchnic syndrome, we conducted a retrospective study of all of the cases of chronic mesenteric ischemia managed in our tertiary referral center.

CLINICAL SIGNIFICANCE

- Computed tomography angiography has replaced Doppler ultrasound and conventional angiography for the diagnosis of chronic mesenteric ischemia.
- Endovascular revascularization appeared as effective as, and safer than, open surgery to treat this condition.
- Nonatherosclerotic splanchnic stenoses can be treated as effectively as atherosclerotic ones with endovascular approaches.

MATERIALS AND METHODS

This single-institution study was approved by our institutional review board and was compliant with the Health Insurance Portability and Accountability Act. All of the patients provided written informed consent before the revascularization procedures.

Data Collection

The study was conducted in November 2014. All of the patients consecutively recorded with a diagnosis of chronic mesenteric ischemia between July 2000 and September 2014 were included in the study. All of the medical records, hospitalization, and clinical follow-up reports were reviewed by both MB and CM, and the following data were recorded: demographic data, such as patient anonymous identification number, sex, date of birth, and date of each procedure; patient medical history, such as history of diabetes, hypertension, current or past tobacco use and quantification in pack-years, dyslipidemia, coronaropathy, cardiac insufficiency, cardiac arrhythmia, peripheral arterial disease, history of stroke, chronic obstructive pulmonary disease, chronic kidney disease or renal insufficiency, anemia and hemoglobin level at the time of the first procedure, history of cancer, abdominal surgery, and current medications (at the time of the revascularization procedure); clinical symptoms leading to the diagnosis, such as weight at the time of the first procedure, usual body weight (defined as the body weight 6 months before the procedure), and height; diagnostic imaging and endoscopic modalities used and their findings, such as key diagnostic modality used for the diagnosis, splanchnic vessels affected, stenosis or complete occlusion, length of the stenosis, cause of the stenosis, and revascularization technique used; and procedure-related data for each revascularization, such as immediate technical success, complications (local and systemic, procedure or anesthesia related), duration of hospital stay, clinical outcome at the first follow-up visit (at 3 months), date and type of recurrence (clinical, angiographic, or both), total number of procedures, date of last contact with the patient and clinical status at that time, death during follow-up, and cause of death. Late outcomes were assessed with a phone interview in October 2014.

The main outcome measurement was the clinical success at the first follow-up at 3 months. The secondary outcomes were the technical success, length of hospital stay, death rate at day 30, and recurrence rate at the time of the follow-up.

Definitions

The diagnosis of chronic mesenteric ischemia was made when both clinical symptoms compatible with splanchnic syndrome (postprandial abdominal pain, food fear, or weight loss) and stenosis in at least one significant splanchnic vessel were present. Significant stenosis comprised a reduction of at least 70% of the vessel lumen, diagnosed with either duplex ultrasound, computed tomography angiography, or arteriography.[1,7,8] Patients with acute mesenteric ischemia were excluded.

Technical success was defined as the achievement of revascularization of the treated vessel immediately at the end of the procedure.

Recurrence was defined as the reappearance of symptoms compatible with splanchnic syndrome, associated with significant vascular restenosis (using duplex ultrasound, computed tomography angiography, or arteriography) in at least one of the splanchnic vessels previously treated.

Clinical success was defined as complete resolution of the postprandial abdominal pain previously experienced by the patient, and the absence of weight loss.

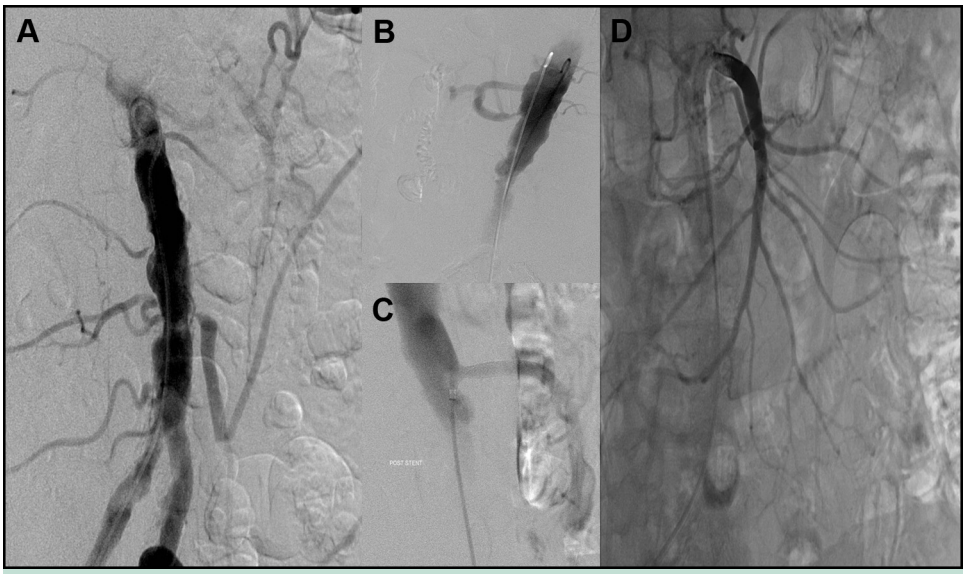

Figure 1 Abdominal angiography showing endovascular revascularization of a stenosis at the ostium of the inferior mesenteric artery (**A**) and of the celiac trunk (**B**). (**C** and **D**) Recanalization of the superior mesenteric artery after stent placement.

Revascularization Procedures

All of the endovascular procedures were performed in an angiography suite under local anesthesia and mild sedation with midazolam. Arterial access was through the right or left common femoral artery. The first target vessel for revascularization was always the superior mesenteric artery. For cases of stenoses, we performed a balloon angioplasty, followed, in case of recoiling or intimal dissection, by stenting. Four tablets of 75 mg clopidogrel were administered immediately after the procedure, and patients followed double antiplatelet therapy for at least 1 month.

Open revascularization procedures were performed under general anesthesia. The choice between a bypass, bifurcated graft, antegrade or retrograde positioning of the graft, or endarterectomy was made preoperatively by the surgeon. Antegrade revascularization of the superior mesenteric artery from the supraceliac aorta was generally preferred in patients fit for open surgery. Transaortic endarterectomy of the visceral artery ostia was performed in patients with extensive occlusive aortic lesions. Retrograde revascularization from the iliac artery was done in all other cases. Low-dose aspirin was administered immediately after the procedure and was recommended as a lifelong treatment for the patients.

Statistical Analysis

Continuous data are presented as means ± SD or median (range) as appropriate. Continuous variables were compared using a nonparametric Mann-Whitney *U* test. Categorical variables were compared using Fisher's exact test. Statistical analyses were performed using GraphPad Prism software (La Jolla, CA). A *P* value of $<.05$ was considered statistically significant.

Our main objective was to compare the outcomes of surgical and endovascular revascularization procedures. The secondary objectives were to assess the most frequent clinical presentation of chronic mesenteric ischemia and best diagnostic modality between computed tomography angiography, Doppler ultrasound, and conventional angiography.

RESULTS

Fifty-four patients with chronic mesenteric ischemia who had a revascularization procedure between February 2001 and June 2014 were included in the study. Representative pictures of the endovascular and open revascularization procedures are shown in **Figures 1** and **2**, respectively.

Forty-three patients underwent endovascular revascularization, and 11 underwent open revascularization. The patient characteristics, presented in **Table 1**, did not differ significantly between the groups. Most of the patients had one or more risk factors for atherosclerosis; therefore, the majority of patients had atherosclerotic vascular disease in multiple sites. The etiology of the arterial stenosis was atherosclerosis in 81.5% (44/54) of the cases. Visceral vasculitis and fibromuscular dysplasia were diagnosed in 7 patients, most of whom (6/7) were women <70 years old. Coagulation disorders, such as antiphospholipid syndrome and polycythemia vera, were diagnosed in 2 elderly men who also had concomitant risk factors for atherosclerosis.

The majority (98%) of patients presented with postprandial abdominal pain and food fear, and an average weight loss of 8.1 ± 6 kg over the past 6 months was observed in more than half of the patients. The mean body mass index was 21.6 ± 4 kg/m^2. Almost a quarter of the

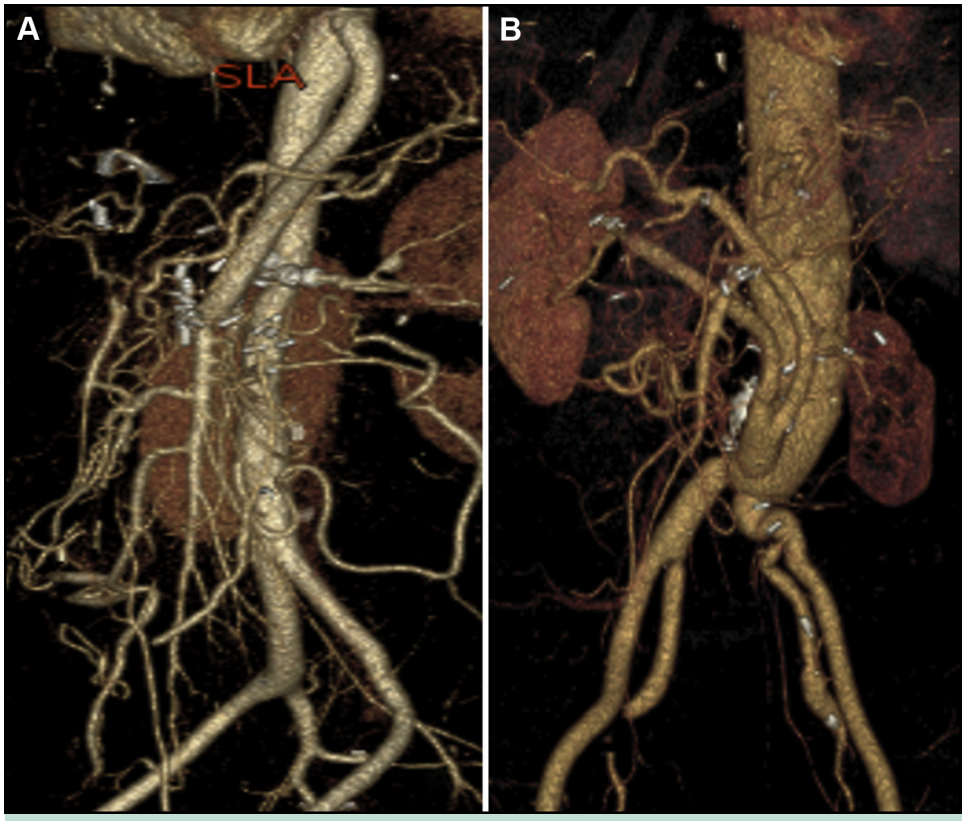

Figure 2 Abdominal computed tomographic images with 3-dimensional reformatting after open surgical revascularization of the superior mesenteric artery through bypass grafting. (**A**) Aortomesenteric antegrade bypass from the thoracic aorta to the superior mesenteric artery. (**B**) Aortomesenteric retrograde bypass using a bifurcated graft from the distal abdominal aorta to the superior mesenteric artery (as well as the hepatic and right renal artery).

Table 1 Patient Characteristics

	Endovascular Therapy* (n = 43)	Open Surgery† (n = 11)	*P*-Value	Total (N = 54)
Age (mean ± SD)	65.9 ± 18	68 ± 11	1	66.3 ± 16
Sex, n (% female)	25 (58.1)	8 (72.7)	.8	33 (61.1)
Diabetes mellitus, n (%)	7 (16.3)	3 (27.3)	.7	10 (18.5)
Hypertension, n (%)	30 (69.8)	6 (54.5)	.8	36 (66.7)
Current smoker, n (%)	16 (37.2)	4 (36.4)	1	20 (37)
Dyslipidemia, n (%)	15 (34.9)	5 (45.5)	.8	20 (37)
Chronic renal insufficiency, n (%)	10 (23.3)	4 (36.4)	.5	13 (24.1)
Coronary artery disease, n (%)	18 (41.9)	2 (18.2)	.5	20 (37)
History of stroke, n (%)	4 (9.3)	4 (36.4)	.09	8 (14.8)
History of peripheral arterial disease, n (%)	17 (39.5)	6 (54.5)	.6	23 (42.6)
COPD, n (%)	8 (18.6)	3 (27.3)	.7	11 (20.4)
Arrhythmia, n (%)	5 (11.6)	1 (9.1)	1	6 (11.1)
Previous abdominal surgery, n (%)	22 (51.2)	9 (81.8)	.4	31 (57.4)
Antiplatelet therapy, n (%)	30 (69.8)	9 (81.8)	.7	39 (63)
Aspirin alone	7 (16.3)	7 (63.6)	.004	14 (26)
Clopidogrel alone	12 (27.9)	1 (9.1)	.26	13 (24.1)
Bitherapy	11 (25.6)	1 (9.1)	.42	12 (22.2)
Anticoagulant therapy, n (%)	8 (18.6)	2 (18.2)	1	10 (18.5)

COPD = chronic obstructive pulmonary disease.
*Percutaneous angioplasty with or without stent placement.
†Bypass grafting or endarterectomy.

Table 2 Presentation of Symptoms From Patients with Chronic Mesenteric Ischemia (N = 54)

Clinical symptoms, n (%)	
Postprandial abdominal pain	48/49 (98%)
Weight loss	26/49 (53.1%)
Diarrhea	12/49 (24.5%)
Nausea/vomiting	1/49 (2%)
Key diagnostic modality, n (%)	
Conventional angiography	6/47 (12.8%)
Duplex ultrasound	13/47 (27.7%)
CT angiography	28/47 (59.6%)
Hemoglobin level (g/dL)*	11.5 ± 2
Endoscopic gastric or colic erosion or ulcers, n (%)	10/19 (52.6%)
Diseased vessels, n (%)	
Celiac artery	3/54 (5.6%)
SMA	13/54 (24.1%)
Celiac artery + SMA	16/54 (29.6%)
SMA + IMA	4/54 (7.4%)
Celiac artery + IMA	2/54 (3.7%)
Celiac artery + SMA + IMA	16/54 (29.6%)

CT angiography = computed tomographic angiography; IMA = inferior mesenteric artery; SMA = superior mesenteric artery.
*Mean ± SD.

patients reported chronic diarrhea (24.5%), whereas nausea and vomiting were observed in only one patient (2%). Computed tomography angiography allowed a diagnosis of the vascular stenosis in 59.6% of the patients, compared with 27.7% who were diagnosed with transparietal Doppler ultrasonography. In the remaining cases, angiography was used to make a definitive diagnosis. Computed tomography examinations also revealed splenic infarction in one patient with celiac artery stenosis, and radiological signs of left-sided colitis in 3 patients (one only had inferior mesenteric artery stenosis). Stenosis was present in the celiac artery in 70.4% of the patients, in the superior mesenteric artery in 90.7%, and in the inferior mesenteric artery in 40.7%. Single-vessel involvement was observed in 29.6% of the cases, and bi- or tri-truncular lesions were seen in 40.7% and 29.6% of the patients, respectively. An endoscopic workup was performed in 19 patients, with 15 upper endoscopies and 6 colonoscopies. Erosions and stomach ulcers were observed in 6 of the patients: 3 took low-dose aspirin, and none had a *Helicobacter pylori* infection. Colonic erosions and ulcerations that were interpreted as mild-to-moderate ischemic colitis, despite nonspecific histological patterns, were seen in 5 patients. The main clinical and radiological findings are presented in Table 2.

Among the 43 patients who received endovascular revascularization, 10 underwent angioplasty alone, and 33 had an angioplasty followed by stent placement. Ten of the 11 patients who had an open surgical revascularization had bypass grafting, and the remaining patient underwent a transaortic endarterectomy. The technical success, complication rates, and length of hospital stay were 95% vs 100% (P = not significant [NS]), 18.6% vs 63.6% (P = .03), and 9.5 days ±10 vs 26.8 days ±14 (P = .002) for endovascular revascularization vs open revascularization, respectively. There were mild complications in the endovascular revascularization group in 5 cases (4 hematomas and one false aneurysm in the femoral puncture site) and severe complications in 3 cases (pulmonary edema, aspiration pneumonia, and pulmonary embolism). In the open revascularization group, 7 of 8 complications were severe (septic shock, ureteral compression, acute mesenteric ischemia, acute renal failure, aortic dissection, and distal lower limb ischemia). The severe complication rates were 7% and 63.6% (P = .004) in the endovascular and open revascularization groups, respectively. However, the 30-day mortality rates were 0% in both groups.

The median follow-up was 61 months (range: 4-152). The clinical success rates at 3 months were 86.1% and 100% (P = NS), and late recurrences rates were observed in 36.8% and 27.3% (P = NS) of patients treated with endovascular or open revascularization, respectively. Recurrence occurred with a mean time of 16 ± 19 months. Among the 14 late recurrences in the endovascular revascularization group, 5 were successfully treated with open revascularization, and the others underwent repeated angioplasty. Among the late recurrences in the open

Table 3 Outcomes in Patients with Chronic Mesenteric Ischemia After Endovascular or Open Revascularization Procedures

	Endovascular Revascularization (n = 43) Angioplasty Alone (n = 10) Angioplasty + Stenting (n = 33)	Open Revascularization (n = 11) Bypass Grafting (n = 10) Endarterectomy (n = 1)	*P*-Value	Total (N = 54)
Technical success, n (%)	41/43 (95.3%)	11/11 (100%)	1	52/54 (96.3%)
Complication, n (%)	8/43 (18.6%)	8/11 (72.7%)	.03	16/54 (29.6%)
Hospital stay (d) *	9.5 ± 10	26.8 ± 14	.0002	12.8 ± 13
30-day mortality, n (%)	0 (0%)	0 (0%)	1	0 (0%)
Clinical success at 3 mo, n (%)	31/36 (86.1%)	7/7 (100%)	1	38/43 (88.4%)
Follow-up† (mo)	63 (4-152)	59 (4-141)	.5	61 (4-152)
Recurrence rate, n (%)	14/38 (36.8%)	3/11 (27.3%)	1	17/49 (34.7%)

*Mean ± SD.
†Median (range).

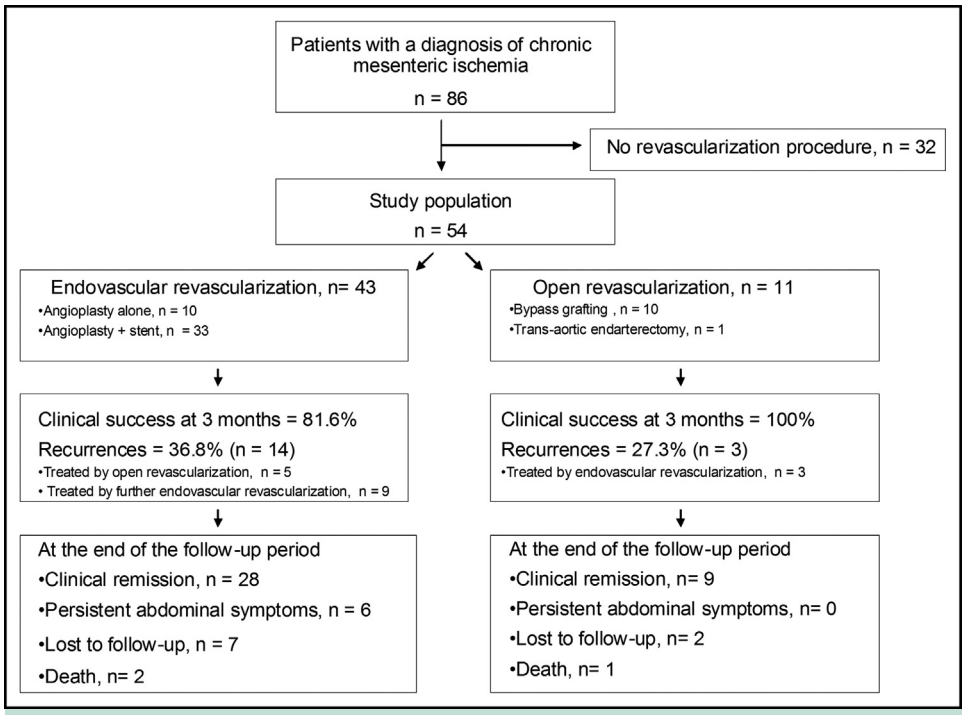

Figure 3 Flowchart of study patients.

revascularization group, the 3 restenoses were successfully treated with 1 or 2 sessions of percutaneous angioplasty and stenting. The patients had a mean number of 1.4 ± 0.6 revascularization procedures. The outcomes of the revascularization procedures are summarized in **Table 3**. Nine of the patients were lost to follow-up; they were unreachable by telephone. At the end of the study, 42 patients were alive and 3 had died (2 in the endovascular revascularization group, from septic shock related to an infection of the femoral puncture site during a further endovascular revascularization and from myocardial infarction, and 1 in the open revascularization group, from pancreatic cancer). A patient flowchart is presented in **Figure 3**.

Within the 43 endovascular revascularization procedures, the technical success, clinical success, and recurrence and complication rates were 80% vs 100% ($P = .05$), 75% vs 86.2% ($P = .6$), 60% vs 28.6% ($P = .1$), and 40% vs 12.1% ($P = .07$) for an angioplasty alone vs an angioplasty and stenting, respectively.

All of the patients with nonatherosclerotic stenoses (10/54) were treated with endovascular revascularization, along with stenting in 9/10 cases. Two of the patients developed hematomas at the puncture site, and the clinical success rate was 80%; however, 50% had recurrent symptoms and vascular stenosis within 5 years, requiring further endovascular revascularization (mean of 1.6 ± 0.7 treatment sessions). The recurrence rate and number of treatment sessions for this set of patients were not significantly different ($P = .33$ and $P = .4$, respectively) from the outcomes of patients with atherosclerotic stenoses of the splanchnic vessels.

DISCUSSION

In this work, we report the clinical presentation and diagnostic and therapeutic modalities in 54 patients with chronic mesenteric ischemia in a single tertiary referral center over 14 years. The major finding of our study is the comparable outcomes we observed between endovascular and open surgical treatment approaches for chronic mesenteric ischemia. Although the technical success was slightly higher in the open revascularization group, the lower complication rates, especially for severe complications, and resulting shorter hospital stays suggest that endovascular revascularization should be preferred to open revascularization for patients with chronic mesenteric ischemia.

The characteristics of our study participants are comparable with those from larger patient series[9,10]: the majority of patients were women in their 70s who had risk factors for atherosclerosis and at least one previous complication associated with atherosclerotic arterial disease. Almost all of the patients reported early postprandial abdominal pain, which led to food fear and major weight loss in more than half of the patients. Chronic diarrhea, possibly due to small bowel mucosal ischemia and subsequent villous atrophy and malabsorption, or chronic ischemic colitis was observed in 25% of the patients, which has been reported by others.[3] However, chronic diarrhea in the absence of coexisting abdominal pain was seen in only 1 of the 12 patients in that study.

The frequency of gastrointestinal mucosal lesions in chronic mesenteric ischemia is unknown. In our work, 52.6% of the patients who had an endoscopic workout had mucosal lesions of the stomach or colon that were attributable to the chronic mesenteric ischemia. Because the

mucosa is the first layer to suffer from ischemia, an endoscopic workout, including small bowel capsule endoscopy—provided no findings suggestive of small bowel stricture are seen on abdominal computed tomography—might be of interest whenever chronic mesenteric ischemia is suspected. These procedures should also be used for cases with recurrent symptoms after revascularization.

The optimal diagnostic modality for chronic mesenteric ischemia is controversial: previous data support abdominal angiography as the gold standard. However, this procedure is often reserved for therapeutic interventions and is becoming progressively replaced with noninvasive angiographic techniques, such as magnetic resonance angiography or computed tomography angiography.[11] Computed tomography angiography has a sensitivity of 96% and a specificity of 94% for the diagnosis of chronic mesenteric ischemia, and provides 3-dimensional reformatting to guide treatment. It also diagnoses potential complications, such as signs of critical or acute intestinal infarction, and enables a differential diagnosis, especially differentiating between chronic pancreatitis and retroperitoneal tumors. Therefore, the American College of Radiology currently recommends computed tomography angiography as the first-line exploration method for chronic mesenteric ischemia.[11]

Ultrasonography with B-mode and Doppler waveform analysis, called duplex ultrasound, has been extensively studied and its diagnostic criteria developed and validated.[12] Duplex ultrasound provides 80%-100% sensitivity and 42%-62% specificity for celiac or superior mesenteric artery stenosis.[12] However, this technique requires a high level of expertise, cannot visualize the inferior mesenteric artery, and may not visualize the celiac or superior mesenteric artery in 10%-90% of patients because of anatomical concerns or air interposition in the stomach.[1] In our study, computed tomography angiography was used as the key examination for the diagnosis of chronic mesenteric ischemia in 56.6% of the cases, progressively replacing Doppler ultrasound evaluation of splanchnic vessels. The use of diagnostic angiography remained stable throughout the study period. It should be noted that computed tomography often allowed the clinicians to bring up and confirm the diagnosis of chronic mesenteric ischemia. Because computed tomography is routinely performed in diagnostic workups of abdominal pain, specific attention should be given to the description and analysis of the splanchnic vessels.

Multiple-vessel involvement in mesenteric ischemia was found in 70.4% of the patients. However, in 29.6% of the patients, we observed splanchnic syndrome with stenosis in only a single splanchnic vessel. It was previously thought that the presence of stenoses in at least 2 splanchnic vessels was required for symptoms of chronic mesenteric ischemia to occur. Nevertheless, the team at the Medisch Spectrum Twente has demonstrated that a single-vessel stenosis could cause symptoms and require treatment using a functional in vivo assessment of tissue ischemia with gastric exercise and 24-hour tonometry.[1,3,4,8]

We found a nonstatistically significant advantage for open surgery over endovascular revascularization in terms of technical success, early clinical evaluation, and late vascular patency. Among the endovascular revascularization techniques, stenting was associated with higher clinical success at 3 months and less late recurrence than angioplasty alone, although the differences were not statistically significant. In a previous paper, Van Petersen et al[5] studied the outcomes of endovascular and open surgical revascularization in 8 recently published trials and found similar results for technical success. However, after mean follow-ups of 20 and 35 months, recurrence treatments were almost 3 times more frequent in the endovascular compared with the open revascularization group (30% vs 13%, $P < .001$).[5] These results were confirmed in a recent meta-analysis.[13] It is likely that our open revascularization group was too small to observe these differences. Postoperative complications were significantly less frequent in the endovascular revascularization group, and resulted in longer hospital stays in the open revascularization group. However, 30-day mortality was not observed in this group, despite the severity of the complications. Our figures are different from those reported in larger studies: when comparing endovascular and open revascularization procedures, major morbidity ranged from 11% to 20% and 32% to 39.7%, hospital stay from 5 and 11-15 days, and 30-day mortality from 3.7% to 5% and 6% to 15%, respectively.[5,10] It is possible that our patient numbers were too small or that our data reflect recent progress in revascularization techniques and postoperative care.

There are several limitations to our study. Some limitations are inherent to a retrospective monocentric study on a rare condition, such as recruitment bias and patients lost to follow-up. The small sample size might explain why we did not record rare complications such as mortality after endovascular revascularization. Furthermore, the size of the open revascularization group and possible selection bias toward this group (patients in better general condition with more severe or numerous lesions) prevents us from drawing definitive conclusions about the optimal therapeutic modality for patients with chronic mesenteric ischemia.

Of the patients with 3-vessel involvement in the disease, 1.5% develop fatal acute mesenteric ischemia within 2.6 years of diagnosis, and 20%-50% of the patients admitted for acute mesenteric infarction previously reported chronic splanchnic syndrome before their admission.[14,15] This stresses the importance of recognition of chronic mesenteric ischemia to provide timely and effective revascularization to the patients. Aside from the typical splanchnic syndrome with postprandial abdominal pain and weight loss that often occur in an elderly woman with multiple risk factors for atherosclerosis, more unusual presentations should be kept in mind by physicians: patients might present with dyspepsia-like symptoms from gastroparesis or gastric ulcers attributable to gastric ischemia, chronic diarrhea, bloating, and abdominal pain. In these patients, the arterial phase of the abdominal computed tomography should be carefully examined to diagnose any stenoses of the

splanchnic vessels. Depending on the patient's general health status, age, abdominal surgical history, and body mass index, as well as a multidisciplinary discussion, open surgical or percutaneous endovascular revascularization should be offered to the patient.

Our study confirmed that chronic mesenteric ischemia can occur in patients with a single splanchnic vessel stenosis and that the most relevant diagnostic modality for chronic mesenteric ischemia is computed tomography angiography. In our work, endovascular revascularization was the best therapeutic modality, with significantly fewer severe complications and similar late outcomes compared with open revascularization.

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