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Revascularization by Percutaneous Transluminal Angioplasty for Chronic Mesenteric Ischemia: Results and One-Year Follow-up in a Single Center

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Abstract

Although the prevalence of mesenteric artery stenosis is high, symptomatic chronic mesenteric ischemia (CMI) is rare; the collateral network in the mesenteric circulation serves to prevent most cases of ischemia.

The number of affected vessels is the major determinant in CMI development and most subjects with single vessel mesenteric stenosis do not develop ischemic complaints.

Keywords: Angioplasty; Endovascular surgery; Ischemia; Artery stenosis; Abdominal pain; Angiography; Femoral artery

Introduction

The clinical presentation of CMI consists of postprandial pain, weight loss, and an adapted eating pattern caused by fear of eating. In end-stage disease more continuous pain, diarrhea or a dyspepsia-like presentation can be observed [1].

Both, open surgical revascularization (OR) and endovascular surgery (ES), have been proposed for the treatment of symptomatic CMI. OR was considered the gold standard but ES is being increasingly proposed as the first option.

OR of mesenteric arteries is known for its efficacy and its durability. Sustained improvement in symptoms is noted in 78% to 100% of patients, and 3-year patency rates of 76% to 100% have been reported. The operative mortality is moderate (0% to 13%), but post-operative complications can reach 12% to 45% [2-4].

ES, consisting of percutaneous transluminal angioplasty and stenting (PTA/stenting), has been first described in 1980 [5] and has been increasingly applied in other vascular beds in order to decrease the morbidity and mortality associated with OR.

Recent series demonstrated that PTA/stenting was associated with lower morbidity and mortality compared with OR and other studies also showed patency rates of 30% to 90% at 2 years and 40 to 88% at 3 years [3,4].

The purpose of this article is to report the results of PTA/stenting in the treatment of patients with CMI in a single center [6-10].

Materials and Methods

The authors performed a retrospective study in order to evaluate the results of PTA/stenting in patients who presented with symptoms and angiographic findings of CMI. The surgical procedures were performed in patients presenting at least two of the following digestive symptoms: chronic postprandial abdominal pain, weight loss, a fear of food and digestive troubles (diarrhea, nausea, or vomiting) with at least thrombosis or 70% stenosis in one or more digestive arteries confirmed by pre-operative computed tomography (CT-scan) angiography.

The hospital records of all patients undergoing treatment for CMI on the Service of Vascular and Thoracic Surgery of the CHR Auvelais, Sambreville, Belgium, were prospectively studied from 2013 to 2016.

Exclusion criteria were patients treated for acute mesenteric ischemia, no atherosclerotic causes of CMI and treatment of any digestive artery in combination with another aortic procedure.

Patient demographics, cardiovascular risk factor (diabetes, hypertension, dyslipidemia, tobacco and alcohol use), comorbid conditions, (cardiac, renal, neurological) and angiographic features were abstracted. The results of follow-up imaging study were recorded and the patency of the revascularization or the earliest date of symptom recurrence or mesenteric vascular disease recurrence was also recorded.

The primary end-points were in-hospital major morbidity and mortality and technical and primary clinical success. In-hospital major morbidity was defined as bowel infarction, myocardial infarction, stroke, acute renal failure, respiratory failure, or multisystem organ failure. Technical success was defined as successful completion of the procedure and <30% residual stenosis at the end of the procedure. Primary clinical success was defined as uninterrupted relief or improvement of presenting symptoms with a patent re-vascularized target vessel.

The secondary end-points were death after hospital discharge (overall mortality), symptomatic and radiographic recurrence and re-intervention. Radiographic recurrence was the finding of evidence of recurrent stenosis (70% or more) on the vessels previously undergoing treatment by any conventional imaging modality. Symptomatic recurrence was defined as the return of the original symptoms despite intervention.

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Clinical and radiographic follow-up was performed with duplex ultrasound (DUS) and CT-scan angiography at one, six and twelve months postoperatively.

Results

Patients features

From March 3, 2013, to June 26, 2016, 14 patients underwent ES for CMI at the CHR Auvelais, Sambreville, Belgium. In the cohort, there were 8 women and 6 men (mean age, 72, 7 years; range, 59 to 85 years).

Traditional cardiovascular risk factors were highly prevalent: hypertension 78.5% [11], dyslipidemia 64.2% [9], diabetes 28.5% [4], nicotine use 50% [7], and alcohol use 85.7%. Cardiac, renal, and cerebral comorbidities were present in 4 (28.5%), 2 (14.2%) and 1 (7.1%) patients, respectively. Patient's characteristics are summarized in Table 1.

Abdominal pain and weight loss was the most common presenting symptom: 14 patients (100%). Other common symptoms on presentation included diarrhea 50% [7], fear of eating 21.4% [3], and nausea 14.2% [2].

CT-scan was performed in all patients. In our cohort, eight patients (57.1%) had involvement of one vessel, six (42.9%) had two-vessel involvement, and 0 had involvement of all three mesenteric arteries with a mean number of 1.33 (Table 2).

Mean age	72.7
Female	8
Male	6
Cardiovascular risks	
Hypertension	11 (78.5%)
Diabetes	4 (28.5%)
Dyslipidemia	9 (64.2%)
Smoking	7 (50%)
Alcohol use	12 (85.7%)
Comorbidities	
Cardiac	4 (28.5%)
Renal	2 (14.2%)
Cerebral	1 (7.1%)

Table 1: Demographics and clinical data.

Vessels involved	
SMA	6
CA	2
SMA + CA	6
Total	20
Vessels treated	
SMA	10
CA	2
SMA + CA	2
Total	16
Type of stent used	
4 mm	1
5 mm	11
6 mm	4
In-hospital mortality/morbidity	0
Technical and primary clinical success	14 (100%)
Overall mortality at 1-years	2 (14.2%)
Recurrence and re-intervention	1 (7.1%)

Table 2: Vessels involved, revascularization and outcomes.

Endovascular techniques

The ES cohort consisted of 14 patients in whom 16 vessels were re-vascularized.

Access was obtained through the femoral artery in all patients. Selective angiography of the celiac artery (CA) and superior mesenteric artery (SMA) was attempted using a 7 Fr Optitorque angiographic catheter (Terumo Europe NV).

The lesions were crossed using a 0.035' guidewire M standard type (Terumo Europe NV) and the stent was deployed at 12 ATM (stents used are summarized in Table 2 followed by post-dilatation if needed. No peri-procedural complications were reported.

A total of 16 vessels were treated, including 12 SMA and 4 CA.

Twelve patients (85.7%) had one vessel treated, two patients (14.3%) had two vessels treated and no patients had all three re-vascularized. Revascularizations characteristics are summarized in Table 2.

Post procedurally, all patients were treated with statin and acetylsalicylic acid 80 mg in the first year and clopidogrel 75 mg during the first three months.

Outcomes

Technical and primary clinical success rates were 100% with complete resolution of symptoms in all patients at 3 weeks. No immediate failures were reported. In hospital major complications and mortality rates were 0%. The hospital length of stay rate was 3 days [2-6].

Follow-up at 1 year was successful in 12 patients. The overall mortality was 14.2% (2 patients).

There were two non-post procedural deaths at 6 months: one patient died from myocardial infraction and one died due to suicide.

The recurrence and re-intervention rate was 7.1% (1 patient). At 10 months after the procedure, one patient showed symptomatic and radiographic recurrence and was retreated by PTA. Angiographic control showed no signs of restenosis but the patient remained symptomatic due, surely, to a secondary gastrointestinal disorder.

The remaining 11 patients (78.5%) showed no symptoms or recurrence in angiographic follow-ups.

There was no difference in patency, complication, or survival rates irrespective of the number and vessel treated.

Discussion

OR has been the standard treatment of CMI since the first successful repair reported by Shaw from the Massachusetts General Hospital in 1958 [6]. At present, OR is preferred in lower risk patients and ES is preferred in higher risk patients. This concept is based in some observational studies that prove that ES has lower mortality and morbidity, shorter length of stay and recovery time compared to OR, but more frequent recurrence of symptoms, restenosis and re-interventions. In general, ES is considered as a less durable treatment. However, in those series, patients undergoing ES were older and had more comorbidities than patients undergoing OR. So, more high-risk patients were treated with PMA/stenting, probably leading to reported outcomes that disadvantage PMA/Stenting [7-9]. In addition, mesenteric revascularization in the stent era (including the recent use of covered stents) might have different results. Some of the patients

in the first series were treated only with angioplasty without stenting [8,10]. This leads us to conclude that results of OR and ER are not comparable in some studies.

To our knowledge, no randomized trial exists in the literature comparing OR with PTA and the best available level of evidence is 2b. However, recent observational studies with good validity have shown similar patency at medium term follow-up, concluding that ES may be considered a first-line therapy in selected patients. A recent article published in 2016 describing the current insights into diagnosis and treatment of mesenteric ischemia, reach similar conclusions: PMA/Stenting should be the first choice treatment for CMI. Bypass surgery should only be used in low risk patients who have unfavorable mesenteric lesions, failed PMA/Stenting or Retrograde Open Mesenteric Stenting or multiple recurrences of in-stent stenosis/occlusion [7].

Our study confirmed the low incidence of complications as well as the good results at short term. However, it has several limitations. First, it is a retrospective study performed at a single institution. Second, the study population is small (14 patients) and the study period is short (1 year).

Nevertheless, based on the latest reports and on our initials results, we believe that ES could be the first choice treatment in patients with short stenosis of the involved vessels, in which angioplasty and stent placement would not compromise the landing site for a possible future open bypass graft. OS should still be the preferred approach in patients at low risk for aortic operations who present with complex occlusive disease of their mesenteric vessels (occlusion, long stenosis), or in patients in whom placement of a stent would compromise subsequent bypass grafting [11].

A large randomized study would then be required, but is a difficult task due to the low number of patients potentially suitable for both techniques.

Conclusions

The authors confirm that PTA/Stenting for patients with CMI is feasible and effective with a low incidence of complications and good results at short term, as others studies had previously concluded.

ES is preferred for high-risk patients and may be an alternative to OR in low-risk patients with ideally suited lesions. However, whether the use of ES in low risk patients should be the standard of practice is yet to be determined.

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