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Long-Term Results of Endovascular Treatment of Atherosclerotic Stenoses or Occlusions of the Coeliac and Superior Mesenteric Artery in Patients With Mesenteric Ischaemia

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WHAT THIS PAPER ADDS

Excellent long-term secondary patencies are described after percutaneous mesenteric artery stenting in a well defined cohort of patients with acute and chronic mesenteric ischaemia. This study underscores the evolving role for endovascular treatment in mesenteric ischaemia, from "bridge to surgery" to first choice treatment and "bridge to repeat endovascular treatment" in most patients with acute and chronic mesenteric ischaemia.

Introduction: Over the past decade, primary percutaneous mesenteric artery stenting (PMAS) has become an alternative to open revascularisation for treatment of mesenteric ischaemia. Institutes have presented favourable short-term outcomes after PMAS, but there is a lack of data on long-term stent patency.

Methods: One hundred and forty-one patients treated by PMAS for acute and chronic mesenteric ischaemia over an 8 year period were studied. Anatomical success was assessed by duplex ultrasound and/or CT angiography. A stenosis $\geq$70% was considered to be a failure.

Results: Eighty-six coeliac arteries (CA) and 99 superior mesenteric arteries (SMA) were treated with PMAS in 141 patients. Nine CAs (10%) and 30 SMAs (30%) were occluded at the time of treatment. Median follow-up was 32 months (IQR 20–46). The overall primary patency rate at 12 and 60 months was 77.0% and 45.0%. The overall primary assisted patency rate was 90.3% and 69.8%. Overall secondary patency was 98.3% and 93.6%.

Conclusion: This study shows excellent long-term secondary patencies after PMAS, comparable with published data on long-term patencies after open surgical revascularisation.

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INTRODUCTION

Acute and chronic mesenteric ischaemia are uncommon diseases. Chronic mesenteric ischaemia (CMI) is defined as longstanding abdominal symptoms caused by inadequate blood supply to the intestine.[1] Symptoms are non-specific and may include abdominal pain and weight loss. Acute (AMI) and acute on chronic mesenteric ischaemia (A-CMI) can progress to intestinal infarction in hours-days, with a high mortality rate.[2,3]

Open surgical revascularisation (OSR) was the gold standard for many years,[4–8] but percutaneous mesenteric artery stenting (PMAS) has become a valuable, less invasive alternative. The use of PMAS has been shown to lead to favourable short-term outcomes.[9–17]

Van Petersen et al.[18] compared the literature concerning the clinical and anatomical outcome after OSR and PMAS in case of CMI. They concluded that the short-term results were comparable, but there was a lack of robust data on mid- and long-term outcome after PMAS.

The main objective of the present study was to determine the long-term patency of PMAS of the CA and the SMA in a well defined cohort of patients with AMI and CMI.

METHODS

This study was performed with patients from a prospective database, including all patients with mesenteric ischaemia who were referred to Medisch Spectrum Twente, Enschede,

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The Netherlands, a nationwide referral centre for mesenteric ischaemia. For the current study all consecutive patients who underwent PMAS for acute (including acute on chronic) and chronic mesenteric ischaemia in the period between November 2004 and November 2012 were included. According to institutional regulations, additional IRB approval was required for this retrospective analysis. Patient data were analysed anonymously.

All patients were analysed and treated according to a strict protocol, which included a structured medical history, assessment of vessel anatomy, and ischaemia function test as published previously.[19]

Patients with coeliac artery compression syndrome were excluded. Patients with previous revascularisation of the mesenteric arteries (PMAS or OSR) or patients who had had retrograde operative mesenteric stenting (ROMS) were also excluded. Data on cohort patients with ROMS have been published previously.[20] Patients lost to follow-up or those with inadequate documentation of vessel patency were also excluded from analysis. During the study period, no drug eluting stents or covered stents were used for PMAS.

Follow-up was performed at 3 months and yearly thereafter, or whenever recurring abdominal complaints suggested re-stenosis. To assess vessel patency, Doppler ultrasound of the mesenteric arteries was used as standard,[21] occasionally followed by CT angiography.

Procedural details

A vessel-first approach and a two-vessel revascularisation were adapted, in which the PMAS preceded laparotomy. For an acute abdominal condition, such as gastrointestinal perforation, laparotomy preceded PMAS and retrograde revascularisation of the SMA was then the preferred option.

All PMAS procedures were performed by dedicated interventional radiologists. Under local anaesthesia, a sheath was introduced into the femoral or brachial artery, preferably under ultrasound guidance. Then a pigtail catheter was advanced into the abdominal aorta, just above the level of the coeliac artery, and antero-posterior and lateral angiography was obtained to identify the origin of the mesenteric vessels. This was performed with an injection of 25 mL at 15 mL/s (Visipaque 320).

The standard technique for selective mesenteric vessel angiography was obtained with a curved or angled Mach 1 (LIMA) guiding catheter (Boston Scientific Corporation, USA) after steady positioning at the desired vessel ostium. Before intended treatment of stenotic lesions 5.000 IU of heparin was administered intra-arterially to reduce thromboembolic events during the procedure. In most cases, the lesion could be passed by a 0.035 inch hydrophilic coated angled tip Terumo wire (Terumo Medical Corporation, USA). In a severe stenosis or occlusion a 0.014 (Journey, Boston Scientific, USA) or 0.018 inch (V-18, Boston Scientific, USA) guide wire was preferred. After obtaining stable wire position, the guiding catheter or sheath was placed into the ostium and the diagnostic catheter was advanced through the lesion, and whenever possible, the guiding catheter or sheath was also advanced through the lesion. If the guiding sheath could not pass the lesion, a pre-dilating 4 mm PTA was performed. Then, the guiding catheter was advanced over the balloon, while deflating it.

It is highly recommended to forward the guiding catheter through the lesion before deploying a balloon expandable stent, to avoid losing the stent when passing tight lesions.

Another angiogram was performed to prove adequate intraluminal post-stenotic position. The 0.035 inch hydrophilic coated wire was then, when necessary, replaced by a 0.014 or 0.018 inch wire depending on the type of stent used.

A crucial step in the procedure is to mark the ostium of the mesenteric vessel by selective lateral angiography. With ostial lesions, the stent should be placed 2—3 mm into the aorta to prevent ostial intima hyperplasia. The stent should not extend further into the aorta to prevent problematic re-intervention in the future.

Depending on the location of the lesion and the lesion's characteristics (calcified/non-calcified), different types of stents can be used to treat the stenosis. Ostial stenoses, which are often very calcified, were usually treated with balloon expandable stents. More distal stenoses, that are often long and curved, are better treated by self expanding stents. Self expandable stents keep the natural curved anatomy of the mesenteric vessels intact and are less affected by movements of respiration.

The diameter and length of the stents were determined by CT angiography or DSA by measuring the length of the stenosis to be covered. The stent diameter was tailored to the arterial diameter immediately distal to the target lesion. There was no oversizing, with stent size always according to the vessel's diameter. In most patients a 6 mm stent was used. When determining the stent length, the extent of the stent beyond the proximal and distal end of the lesion was taken into account.

After stent placement, selective angiography was performed to check the stent placement. The procedure was completed by antero-posterior and lateral angiography by a pigtail catheter to ensure restored vessel patency and outflow.

Since 2013, puncture sites in femoral arteries have been closed using MYNX closure devices (AccessClosure Inc, USA.), while brachial puncture sites are always manually compressed.

All patients with a pre-procedural indication for warfarin or NOAC therapy continued this therapy with an additional daily dose of 100 mg carbasalate calcium for 6 months. All other patients received double antiplatelet therapy: including lifelong treatment with a daily dose of 100 mg of carbasalate calcium, combined with a daily dose of 75 mg clopidogrel for 6 months.

Outcome measures

Demographics were collected from medical records. Primary, primary assisted, and secondary patencies are reported, as previously defined by the Society for Vascular

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