

Antegrade coeliac axis reconstruction for Chronic Mesenteric Ischaemia: a case series

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Abstract

The management of chronic mesenteric ischaemia remains a compelling challenge for many vascular surgeons. Over the past four decades, several reports have demonstrated encouraging results following revascularisation of the splanchnic arteries. To this date, due to limited numbers, there have been no randomized trials on which we can base our current practise. In this series, we have demonstrated the benefits of a left thoraco-abdominal approach for performing an antegrade bypass graft to the coeliac axis, in patients with severe mesenteric angina. Its low complication rate and excellent aortic vessel exposure make it a procedure of choice in expert centres.

Keywords

Mesenteric vascular occlusion, revascularisation, thoracoabdominal

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Introduction

Chronic mesenteric ischaemia (CMI) remains one of the most eagerly discussed topics in vascular surgery. First described by Antonio Benivieni in the 15th Century, it was Mikkelsen¹ in 1957 who coined the term "Intestinal Angina." Today, various techniques of revascularisation have been employed, including reimplantation, angioplasty, trans-aortic endarterectomy and bypass grafting. Debate still revolves as to the advantages of antegrade over retrograde bypass, the use of supraceliac or distal thoracic aorta in antegrade bypass, the need for complete *vs* single vessel revascularisation and the optimum conduit material for the procedure.

CMI diagnoses is often delayed and usually presents with post-prandial abdominal pain, diarrhoea/constipation and "food fear" with weight loss. On the contrary, acute on CMI has a significant mortality with a figure of 71% reported in current literature. Due to a rich anastomosis, critical ischaemia is usually the result of blockage to two or three anterior aortic branches – coeliac, superior mesenteric or inferior mesenteric arteries. CMI is less frequently seen in patients with single vessel disease. Autopsy reports by Croft *et al*² however, concluded that no correlation between degrees of stenosis and previous gastrointestinal symptoms could be found, making the concept of mesenteric ischaemia even more contentious.

The purpose of this report is to describe three cases whereby patients diagnosed with CMI were successfully subjected to antegrade bypass procedures. We have used Dacron[®] grafts from the thoracic aorta in all our patients, gaining access via a left thoraco-abdominal approach. All patients were deemed unsuitable for endovascular procedures due to the extent of their atheromatous disease process.

Cases

Case 1

A 73 year old gentleman was investigated for recurrent abdominal pain associated with a poor appetite and weight loss. His past medical history was significant for hypertension, diverticular disease, hiatus hernia/gastritis, myocardial infarction, aortic reconstruction and bilateral above knee amputations. Interestingly, this patient's pain was constant in nature and although he restricted himself to small meals, he never suffered from pain exacerbations during or after meals. He did though, complain of occasional vomiting episodes. Plain CT of the abdomen and pelvis was unremarkable.



Figure 1: Sagittal view Magnetic Resonance Angiogram (MRA) of the descending aorta showing 70-80% stenosis of the coeliac artery (arrow) with an intact superior mesenteric artery entering the small bowel mesentery

Magnetic resonance angiogram of the abdominal aorta showed diffuse atheromatous disease. Significant atheroma was seen around the origin of the coeliac axis (CA) with severe 70-80% stenosis involving the proximal centimetre of the CA. Superior mesenteric artery (SMA) was normal (Figure 1).

After appropriate cardiovascular investigations, the patient underwent prompt coeliac axis reconstruction via a left thoraco-abdominal approach. There were no surgical complications. The patient required a period of CPAP post operatively but made a full recovery with resolution of symptoms and steady weight gain. The patient suffered residual neuropathic pain over the thoracic scar but was otherwise asymptomatic at fourteen months post operatively.

Case 2

A 69 year old gentleman originally presented as an acute admission with ischaemic colitis for which a Hartmann's procedure was performed. He had a reversal procedure one year later however he complained of persistent left upper quadrant pain/epigastric pain made worse after eating. His past medical history was significant for atrial fibrillation, myocardial infarction and prostatism.

Mesenteric angiogram showed 90% stenosis of the CA with generalised stenosis of the aorta and Iliac vessels. The SMA showed atherosclerotic changes at the origin but no significant stenosis.

The patient underwent reconstructive surgery to the coeliac axis with excellent results. He experienced a left sided pleural effusion post operatively which persisted for several months. He remains well at sixteen months follow up with no residual symptoms.

Case 3

A 43 year old gentleman presented with acute epigastric pain, decreased appetite and marked cachexia. The pain was made worse after eating and he developed significant "food fear." Initial impressions were those of peptic ulcer or upper gastro-intestinal malignancy. Abdominal examination revealed minimal tenderness and no palpable masses. A bruit was heard in the epigastric region. Ultrasound followed by CT scan of the abdomen was normal.

The patient had a significant medical history which included a cerebro-vascular accident and two myocardial infarctions. This prompted immediate investigation of the mesenteric vascular tree. A descending aortogram revealed severe stenosis of the coeliac artery approximately 1cm from the origin. A Completely occluded SMA and patent IMA (Figure 2).

Reconstructive surgery was undertaken and the patient made an excellent post operative recovery with no surgical complications. He was completely pain free on re-introduction of meals in the hospital and was asymptomatic at nine months follow up.

Surgical technique

The patient is positioned in full right lateral decubitus position, with left side up. The hips are tilted to approximately 60 degrees. Proper protection from compression includes the use of an axillary roll and pillows between the legs. The left arm is supported on an arm holder or on a stack of folded blankets between the two arms in the "prayer position." The entire left chest and abdomen are then sterilely prepared and draped. A left thoraco-abdominal incision is performed through the ninth interspace extending down the linea alba in order to improve exposure to the lower thoracic and upper abdominal aorta. The peritoneum is mobilized from the under surface of the diaphragm and the diaphragm is then divided posterolaterally. Medial visceral rotation is performed. A splenectomy is performed if access to the coeliac and superior mesenteric arteries is compromised. The inferior pulmonary ligament and the left crus of the diaphragm are divided and care is taken to avoid damaging the left kidney and its vessels. The lower thoracic and upper abdominal aorta are identified, the coeliac axis is then visualised together with its branches and 5000 IU of unfractionated heparin is administered. The distal thoracic aorta is clamped without complete occlusion to maintain flow to the kidneys and spinal cord. A 6mm Dacron® interposition graft

is soaked in povidone-iodine solution and anastomosed end to side onto the aorta and CA after having passed through the aortic diaphragmatic hiatus. Haemostasis is ensured, a suction drain is placed in the left upper quadrant of the abdomen and a chest drain to the left thorax. The diaphragm is repaired with figure of eight interrupted sutures. The chest wall and abdomen are closed in two layers and clips are used for the skin.

Discussion

Chronic mesenteric ischaemia is an infrequent diagnosis due mostly to an excellent intestinal collateral circulation. The natural history is poorly defined and occlusive disease is due primarily to atherosclerosis, followed by fibromuscular dysplasias and the arteritides. Patients are usually subject to an array of tests e.g ultrasound, CT scan and endoscopy before the actual cause is identified.

Surgical revascularisation of the splanchnic arteries is an effective long term treatment for this disease, regardless of the operative technique adopted.³ Endarterectomy or transposition techniques are usually used for short lesions located at the origin of the diseased vessel. However, standard antegrade or retrograde bypass procedures are the most common and effective alternatives for more extensive lesions.

The bypass inflow site must be precisely chosen from a healthy inflow segment in order to avoid disease progression, thrombosis and obliteration of the graft's ostium with inevitable graft failure. It is recognised that the distal thoracic aorta is less heavily diseased when compared to the abdominal aorta, iliac and femoral arteries. In our series, all patients had a significantly atherosclerosed abdominal aorta, shedding doubt as to the eventual long term graft patency should the anastomosis be performed in this region.

Many bypass techniques utilise a transperitoneal midline abdominal incision. It is claimed, that this approach causes decreased morbidity in these frail, undernourished patients and allows for more straight forward access to the major vessels. Our centre has considerable experience in utilising the thoracic aorta and with advances in anaesthesia we have found minimal complication rates, even in patients with significant co-morbidities, particularly chronic airways disease. The benefit of using a side sitting clamp in this region is possible due to the limited presence of atherosclerosis. Also, our recommended technique allows for a short graft length with minimal bowel contact and a direct in-line flow.

Supraceliac grafts utilise an antegrade bypass procedure with a postulated decreased risk of graft kinking. In theory, the increased prevalence of atherosclerosis in this region of the aorta may actually contribute to increased graft failure rates. Stoney *et al*⁴ however, suggest transaortic endarterectomy or antegrade bypass grafting from the supraceliac aorta. They have achieved 86% 5-year patency rates. Chiche *et al*⁵ successfully utilised the ascending aorta in patients who had multiple exposures of the thoracic aorta or those who did not have adequate inflow for conventional bypass procedures. Taylor *et al*⁶ achieved a 5-year



Figure 2: Angiography of the descending aorta showing almost complete occlusion of the coeliac axis (arrowhead) and contrast cut off in the superior mesenteric artery (arrow). The inferior mesenteric artery is completely stenosed along its route whilst the right renal artery is clearly displayed

patency rate of 96% using retrograde bypass grafting. Many surgeons however, are still reluctant to undertake retrograde procedures for fear of kinking and a theoretical risk of increased graft failure due to non-physiological, reversed and turbulent blood flow.

The issue of optimal graft material is still controversial, although evidence seems to be pointing towards improved patency rates, with prosthetic grafts as opposed to autogenous saphenous vein. Most surgeons nowadays use prosthetic graft unless otherwise indicated.^{3,4,7} Several groups have noted a high failure rate with vein graft and have abandoned its use.⁸

Another widely debated issue in CMI concerns the more predominant vessel for revascularisation. Some authors believe that the coeliac trunk is the most vital vessel⁹ whilst others believe that the SMA is more critical.¹⁰ Still, others think that both these arteries or even all three should be bypassed in one procedure whenever possible.¹¹ Previous reports in the literature have shown that there was an increased mortality following single vessel revascularisation. This may occur because patients are thought to involute their collaterals after a certain period of time and if an acute graft occlusion occurs, the previously present collaterals are not there to protect the bowel.

Notably, the IMA alone is rarely responsible for causing symptoms of CMI, though there have been reports of isolated endovascular stenting to the IMA with symptomatic improvement.¹² As shown by various authors^{13,15} and from experience gathered in our centre, revascularisation of the coeliac trunk alone provides relief of symptoms, even when the SMA is not concomitantly revascularised.

In a series similar to the one we put forward, published by Geroulakos and colleagues¹⁴, antegrade visceral revascularisation was performed on a total of ten patients via a thoracoabdominal approach. There were no postoperative deaths and follow up at 40 months revealed 90% graft patency rates. Antegrade revascularisation was also performed by Randon CD *et al*¹⁵ who published a more recent series comprising 15 patients. An 84% graft patency rate was demonstrated at 24 months via a transperitoneal abdominal approach.

From the various reports presented, it can be seen that no single technique has proved to be superior and the choice of procedure therefore, should be individualized to the patient's condition and the skill of the surgeon. We recommend antegrade reconstruction if possible, for its theoretical advantages and its favourable results in experienced centres. In addition, for patients who's SMA is heavily diseased, we confirm that single vessel revascularisation to the CA alone results in resolution of symptoms in the early and intermediate post operative period. Prograde blood flow with reduced turbulence and decreased likelihood of graft kinking via a comparatively healthier thoracic aorta, contributes to improved patency rates in this subset of patients.

Erratum

The author of the stories of the detective Sherlock Holmes, should be Sir Arthur Conan Doyle, not Dr Oliver Wendell Holmes, as inadvertently mentioned in the first sentence of the article entitled "History of the development of general anaesthesia in Malta" which appeared in the Malta Medical Journal, 2009;21(3):42-8.

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