

Early Endovascular Treatment of Superior Mesenteric Occlusion Secondary to Thromboemboli

Z. Jia ^a, G. Jiang ^{a,*}, F. Tian ^a, J. Zhao ^a, S. Li ^a, K. Wang ^a, Y. Wang ^a, L. Jiang ^a, W. Wang ^b

^a Department of Interventional Radiography, The Second Hospital of Changzhou Affiliated to Nanjing Medical University, Jiangsu Province, China

^b Imaging Institute, Section of Interventional Radiology, Cleveland Clinic, Cleveland, OH, USA

WHAT THIS PAPER ADDS

Acute thromboembolic occlusion of the superior mesenteric artery (SMA) is a life-threatening disease. Despite advances in surgical technique, mortality remains high. The results of our study indicate that percutaneous revascularization is a promising alternative to surgical reconstruction in selected patients who present with acute occlusion of the SMA.

Objective: To evaluate our early experience with endovascular revascularization in patients with acute thromboembolic occlusion of the superior mesenteric artery (SMA).

Methods: A retrospective review was conducted of all patients who underwent endovascular revascularization for acute thromboembolic SMA occlusion from May 2005 to May 2012. Endovascular revascularization was performed using aspiration, intra-arterial thrombolysis, and adjunctive stent-placement techniques. Laparotomy was performed if the patient developed clinical signs of advanced bowel ischemia after endovascular procedure.

Results: Twenty-one patients underwent endovascular revascularization for acute thromboembolic SMA occlusion. All presented with acute-onset abdominal pain. Three patients had rebound tenderness before the procedure. Computed tomography angiography revealed complete occlusion in seven cases and incomplete occlusion in 14 cases, with no evidence of free gas or bowel necrosis. The median duration from onset of symptoms to revascularization was 8.7 ± 4.1 hours (range, 2–18 hours). Completely successful endovascular revascularization occurred in six cases (aspiration alone, 3 cases; combined aspiration and urokinase, 3 cases); partial success was achieved in 15 cases (aspiration alone, 4 cases; combined aspiration and urokinase, 10 cases; and combined aspiration, urokinase, and stent placement, 1 case). Laparotomy was required in five patients, all of whom had SMA main trunk complete occlusion and required small bowel resection. The 30-day mortality for all patients was 9.5%. During a median follow-up of 26 months, 15 patients remained asymptomatic, three patients reported occasional abdominal pain, and one patient had temporary short-bowel syndrome.

Conclusions: Percutaneous revascularization is a promising alternative to surgery for acute SMA occlusion in selected patients who have no signs of advanced bowel ischemia. Early diagnosis followed by prompt endovascular intervention with close postprocedural monitoring is key. Laparotomy is indicated in patients who develop new or worsening signs of peritonism after endovascular procedure, particularly in those who had complete occlusion of the main trunk of the SMA.

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INTRODUCTION

Acute superior mesenteric artery (SMA) ischemia from thromboembolic occlusion is a life-threatening condition.

* Corresponding author. G. Jiang, Department of Interventional Radiography, The Second Hospital of Changzhou Affiliated to Nanjing Medical University, Xing Long Road 29#, Chang Zhou, Jiangsu Province 213003, China.

E-mail address: 747094035@qq.com (G. Jiang).

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Early diagnosis and prompt treatment are necessary to prevent bowel ischemia and subsequent bowel infarction, necrosis, or perforation.^{1–5} Surgery is associated with a high rate of morbidity and mortality.^{1,6,7} Endovascular techniques may be a better treatment option, as they carry a lower risk of morbidity; however, data supporting the use of these techniques are currently lacking.

The purpose of this study was to evaluate our early experience with an endovascular technique to re-establish perfusion to the bowel in patients who suffered from acute thromboembolic occlusion of the SMA.

MATERIALS AND METHODS

Study design

This retrospective study was approved by our institutional review board. All patients who underwent endovascular revascularization for the treatment of acute thromboembolic occlusion of the SMA at our institution from May 2005 to May 2012 were included. Cases were identified through our departmental procedural log. Patient demographics, clinical information, and procedural data were gathered from patients' medical records.

Diagnostic workup

When acute SMA occlusion was suspected, patients underwent computed tomography angiography (CTA). Digital subtraction angiography (DSA) was then performed in those patients who were considered candidates for endovascular intervention. The findings of the CTA and DSA were used to assess the number and location of embolic occlusions.

Indications for endovascular revascularization

Endovascular revascularization was indicated when there was CTA evidence of acute occlusion of the SMA (either the main trunk or branch) and when there was no clinical or imaging evidence of advanced bowel ischemia. Patients therefore did not undergo endovascular intervention if they had abdominal rigidity, marked abdominal distension with scarce bowel sounds, hypovolemic or septic shock, abdominal free air, pneumatosis intestinalis, or air bubbles in the mesenteric veins on CT scan.

Techniques of endovascular revascularization

Conventional mesenteric arteriography was performed before endovascular therapy. A 5-Fr sheath was introduced through a femoral approach. A bolus of 3,000 to 5,000 units of heparin was immediately administered through the sheath, followed by 1,000 units per hour continuously during the procedure, with control of activated clotting time (target: approximately 200 seconds). The SMA was cannulated with a 5-Fr Cobra catheter, and selective superior mesenteric arteriography was performed in posterior-anterior and lateral projections. Once SMA occlusion was confirmed, the 5-Fr sheath was exchanged for an 8-Fr sheath. An 8-Fr guiding catheter (Vista Brite Tip Guiding Catheter, Johnson & Johnson Co. Ltd., Miami, FL, USA) was advanced through the 8-Fr sheath, with the curved tip placed at the orifice of the SMA. A 0.035-inch hydrophilic guide wire was then passed beyond the mesenteric occlusion. With the wire in place, a 6-Fr guiding catheter (Envoy Guiding Catheter, Johnson & Johnson Co. Ltd., New Brunswick, NJ, USA) was co-axially advanced through the 8-Fr guiding catheter past the occlusion. The guide wire was then removed, and thrombectomy was performed by aspirating through the 6-Fr guiding catheter with a 50-mL syringe while gradually pulling the guiding catheter out. This process was repeated multiple times as needed until the embolus was completely removed or further removal of

the emboli was not possible. For disease in SMA branches, a 5-Fr catheter (Beacon Tip Torcon NB Advantage Catheter, Cook Co. Ltd., Bloomington, IN, USA) was used for aspiration.

Pharmacologic thrombolysis was indicated if there was inadequate contrast flow to the corresponding bowel because of residual thromboemboli. A 4-Fr infusion catheter (Uni*Fuse Infusion System, Angio Dynamics Co. Ltd., Latham, NY, USA) or a microcatheter (Progreat Microcatheter System, Terumo, Tokyo, Japan) was advanced just above the thromboembolic occlusion of the main trunk or branch, respectively, and a bolus of urokinase (e.g., 200,000 to 400,000 units) was slowly injected over 10 to 20 minutes. Direct intra-arterial administration of prostaglandin E1 was indicated when vascular spasm occurred. If residual luminal narrowing was greater than 75% because of underlying atherosclerosis, an adjunctive stent was placed.

Technical success of endovascular revascularization was defined as residual stenosis of the previously occluded artery of less than 30% in diameter, without migration of small thromboemboli to branches, along with prompt flow and visible contrast reaching the entire bowel. Partial success was defined as re-established or improved flow to the corresponding bowel but with residual luminal caliber greater than 30% or occurrence of small thromboemboli migration to distal vessels.^{8,9}

Postprocedure care

After the endovascular procedure, all patients were admitted to the intensive care unit for close monitoring of potential worsening of mesenteric ischemia or complications from the procedure. All cases were managed with bowel rest, nasogastric drainage, intravenous fluid therapy, and nutritional support. Laparotomy was indicated if abdominal pain worsened or if the patient developed new symptoms or signs suggestive of bowel perforation and/or gangrene. If bowel perforation or gangrene was found during laparotomy, a bowel resection was performed. Re-look laparotomy was performed if there was further clinical deterioration after bowel resection.

Subcutaneous low molecular weight heparin was administered routinely (low molecular weight heparin calcium injection, 0.1 mL/10 kg every 12 hours, GlaxoSmithKline Co. Ltd., London, UK) for 3 days. Warfarin was administered once the abdominal pain associated with bowel ischemia had resolved. Patients who had significant atherosclerotic disease (in the aorta and/or SMA) or who had received a metal stent were treated with antiplatelet therapy (oral clopidogrel 75 mg/day for 3 months and aspirin 100 mg/day for at least 1 year).

All patients who were treated with endovascular therapy underwent echocardiography to exclude a cardiac embolism.

Clinical follow-up

Outpatient clinic visits were offered at 1, 2, and 6 months during the first year and annually thereafter for follow-up of

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