

Case Report

Enlightenment and lesson from the successful treatment of acute superior mesenteric artery embolism

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Received November 29, 2016; Accepted November 1, 2017; Published November 30, 2017

Doi: <http://dx.doi.org/10.14715/cmb/2017.63.11.5>

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Abstract: Despite recent advances, treatment of acute superior mesenteric artery embolism (SMAE) in emergency is still very difficult. The comparative rarity, the difficulty of early diagnosis, and the extremely high mortality of SMAE give us the sufficient reasons to report our successful experience in curing a patient with acute SMAE. In the present case, the patient was diagnosed early without evidence of intestinal necrosis. The diagnosis of SMAE was verified by computed tomography angiography (CTA). A comprehensive treatment was immediately employed including a combination of intra-arterial thrombolysis and embolectomy operation with emergent laparotomy. We summarize that the successful treatment of superior mesenteric artery embolism depends on early diagnosis and timely reestablishment of arterial flow under the support of general treatments such as prevention of sepsis and control of organic insufficiencies. Through a combined treatment, patient's life could be saved without complications.

Key words: Superior mesenteric artery embolism; Acute mesenteric ischemia; Computed tomography angiography; Laparotomy.

Introduction

Its subsequent intestinal perforation and necrosis are major causes of the high mortality of this condition. Despite recent advances in thrombolysis and embolectomy, the improvement of the survival rate of the superior mesenteric artery embolism is still not significant. So far, the mortality of SMAE remains as high as about 40-70% (1-3). The patients with SMAE often die without prompt recognition of the condition, and without immediately initiating the therapy. The most of deaths are caused by sepsis, septic shock, multiple organ failure, and later stage of short-bowel syndrome (2-3). We have successfully rescued a case of atypical patient with superior mesenteric artery embolism by thrombolytic drug administration, thrombus aspiration, surgical embolectomy, and surgical removal of the necrotic bowel. The keys to successful treatment are early diagnosis, prompt thrombolysis, emergent surgical removal of clots and necrotic bowel, and prevention and treatment of complications.

Case report

A 68-year-old male patient was admitted to our hospital with a 9-hour history of mainly complaining abdominal pain, diarrhea, and vomit. The abdominal pain was intense cramps. The vomiting contained light brown stomach contents. And the diarrhea was like watery. Physical examination exhibited that abdomen was soft without palpable mass. There was only mild tenderness in the right lower quadrant without abdominal muscles tenderness and rebound tenderness. The bowel sound was weak (three times / min). The shifting dull-

ness was negative. Before the admission, the patient was misdiagnosed as acute gastroenteritis in another hospital. He was transferred to our hospital because the abdominal pain was not relieved after treatment. The patient previously had a 10-year history of hypertension and hyperlipidemia, but without a history of coronary heart disease, atrium fibrillation and diabetes. B Ultrasound and X-ray displayed no abnormalities in the abdominal examination. Biochemical analysis showed no significant positive results. Blood leukocytes were extremely high (total white blood cells: $15.4 \times 10^9/L$, neutrophils: 93.4%). Blood clotting tests were abnormal, D-dimer was high. Electrocardiogram indicated no atrium fibrillation. Echocardiography exhibited no atrium thrombus. Rectal examination did not provide evidence of bleeding. Selected computed tomography the patient was applied an emergency contrast-enhanced CTA, which confirmed that presence of the occlusions in the distal part of the main trunk of the superior mesenteric artery. Because there was no clinical or CTA evidence of intestinal necrosis, the patient was immediately taken for emergency thrombolysis and thrombectomy treatment. During the operation of thrombolysis and thrombectomy, the patient was given sufficient fluid resuscitation, wide-spectrum anti-biotics, and anti-inflammatory treatment to protect important organs and maintain the vital signs and their homeostasis.

Thrombolysis and thrombectomy

The patient did not present evidence of intestinal necrosis. So, hydrodynamic thrombectomy was immediately started with a 6-F, 100-cm OASIS hydrodynamic thrombectomy system (Boston Scientific, Natick, MA,

USA). The OASIS system consists of two hollow tubes in addition to the 0.018-inch guide-wire. A selective angiography for the celiac artery and superior mesenteric artery by entering from Seldinger femoral artery was routinely used to demonstrate the existence of thrombosis, the precise locations and the extent of arterial obstruction, which confirmed acute occlusive thromboembolism in the mid-trunk of SMA and the origin of the jejunal and colic branches of SMA (arrows) (Figure 1A). The patient was initially given once an infusion of heparin 6250 units, then continuous infusion at 600 ~ 1000 units / h during the procedure. Papaverine was given by the arterial catheter at 30 ~ 60 mg / h, because angiography showed the spasm of the fine superior mesenteric artery. For the removal of initial thrombosis, we performed primary aspiration thrombectomy using a 6-French aspiration catheter (Cordis, Johnson and Johnson, San Diego, CA, USA) guided with a 0.018inch wire after intravenous infusion of 5000 IU heparin. After repeating the thrombectomy, angiography revealed the nearly complete removal of the thrombi from the main trunk and its branches of SMA, and residual focal severe stenosis in the mid-portion of the SMA main stem (arrow) (Figure 1B), which was considered as the major cause of thromboembolism. Although the occlusions within the trunk of SMA were able to be completely removed, angiography showed that the distal emboli of SMA still existed. Thus, a thrombolytic drug urokinase was administrated by continuous infusion at 125,000 units / h through the thrombi that may had been formed during the thrombectomy persisted within the distal portion of the SMA. And vasospasm was also observed. Thus, the therapy of local continuous infusion of alprostadil (PGE1, 20 mg / day) was added.

Surgical embolectomy and resection of necrotic bowel

The patient presented increased abdominal pain gain, and diarrhea with dark-red blood 20 hours after the procedures of thrombolysis and thrombectomy (at 14:00 on July 29, 2011). The brown liquid was withdrawn from the stomach. The patient started to appear apathy, low blood pressures 107/65mmHg, rapid heart rate 120 beats/min, and fast breathing 27 times/min, remarkable abdominal distension and tension, the whole

abdominal tenderness (+), rebound tenderness (+), especially obvious tenderness and significant rebound in the right lower quadrant, shifting dullness (+), disappeared bowel sound. The abdominal pain and distension were significantly increased. Blood oxygen saturation decreased 80%. Ultrasound examination indicated abdominal ascites, which was demonstrated as a bloody fluid by paracentesis, suggesting that there were peritonitis, intestinal necrosis and septic shock. Therefore, the patient was immediately treated with endotracheal intubation, mechanical ventilation, and the preoperative preparation. Emergent laparotomy, including arterial thrombosis incision surgery, small bowel resection with end-to-end anastomosis, and peritoneal lavage and drainage was performed under full body anesthesia.

Surgical procedures

The middle incision around the umbilical on the abdomen was taken by cutting the skin layer by layer into the abdominal cavity. Exploration of abdominal cavity showed a large amount of non-coagulated bloody fluid as well as the coagulated clot, totally about 2500 ml, which was cleaned. There was about 100 cm length of the small intestine at 40 cm from the cecum appearing like dark-red, which was resected with anastomosis. Multiple mesenteric rupture and hemorrhage were also noted, which were repaired, and their bleedings were stopped. There was about 90 cm length of the small bowel wall at ~60 cm from the Treitz ligament presenting being inflamed with a clear edge from the normal bowel tissue. The inflamed part was excised with cecum appeared the change of color to dark-red, suggesting the recurrence of intestinal necrosis. This 80 cm length of the necrotic intestine was resected with anastomosis again. After another 20-minute observation, the color of refixed small bowel restored to be normal. And active bleeding was no longer noted in the abdominal cavity. The remaining normal small bowel was about 200 cm length. A large amount of physiological saline solution had been used for washing the peritoneal cavity. A drainage tubes was placed from the surface of into the pelvic floor, and upper abdominal cavity respectively. The peritoneal cavity was closed post-operation. Operation was smooth. About total 2700 ml of blood was lost during the operation. Eight units of red blood cells and 200 ml of plasma were administrated. The patient was sent back to the ICU with tracheal intubation. Pathological report: chronic inflammation of intestinal mucus with acute infection, hyperemia of partial small bowel and associated with necrosis and demyelination of full-thickness mucus, and extensive visible mesenteric bleeding.

Postoperative treatment

Aggressive treatments for postoperative respiratory failure, renal insufficiency, gastrointestinal bleeding, and acidosis correction were applied. In addition, anti-coagulant, anti-infection and nutritional supports were adequately employed. Parenteral nutrition as well as a small amount of enteral nutrition was provided. Other treatments included actively changing abdominal incision wound dressing and taking care of the drainage tubes of abdominal and pelvic cavities. Patient was discharged after 16 days of hospitalization in ICU. Discharge conditions: good spirit, stable signs of vital life,

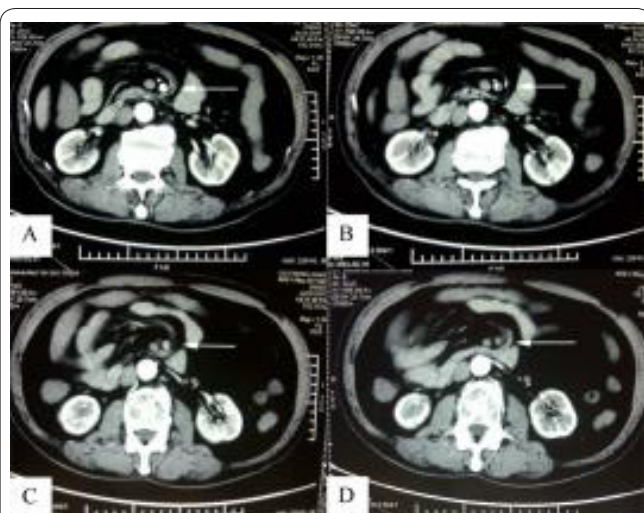


Figure 1. CTA displayed the filling defect and obstruction in the middle trunk and the distal end of the superior mesenteric artery.

no abdominal pain and bloating, no nausea and vomiting, eating well, normal defecation, good wound healing without local infection. Discharge instructions:

1. Pay attention to rest and nutrition; 2. Continue taking anticoagulant drugs; 3. Stabilize blood pressure and blood sugar. During the follow-up, the spirit of the patient was good. There was no recurrence of abdominal pain. The patient ate normally with normal urine. He regularly took anticoagulant and anti-cholesterol drugs, and appropriately used anti-hypertensive drugs to control blood pressure. Through these comprehensive treatments, the patient's life was saved without severe complications.

Discussion

Most of the superior mesenteric artery embolisms are due to thrombi entering into the superior mesenteric artery, which causes obstruction and leads to the development of the condition. By the anatomy, the superior mesenteric artery main trunk has a larger diameter, and shows a tilt angle with the abdominal aorta, and almost parallels down with the abdominal aorta, which is easily accessible by emboli. Because of this reason, SMAE accounts for most of the acute mesenteric ischemia (AMI), about 40-50%. Others, SMA thrombosis accounts for 20% -25% of AMI, non-occlusive mesenteric ischemia 20%, mesenteric vein thrombosis 5% (1-4). Thrombus and embolism that origin from heart are usually more common in patients with rheumatic heart disease, coronary heart disease with atrial fibrillation, infectious endocarditis, and early stage of myocardial infarction⁽⁵⁾. However, thrombus could also come from atherosclerotic plaque dropping off.

Diagnosis

The major clinical characterizations of SMAE are severe abdominal pain, and intense gastrointestinal emptying symptoms such as vomiting and diarrhea. Symptoms like abdominal pain may not be obvious at early onset of the condition. Moreover, patients may not realize they had a history of structural heart diseases such as coronary heart diseases and atrial fibrillation, or a history of rheumatic heart disease. These factors make the early diagnosis of this disease extremely difficult (6-8). Thus, SMAE is especially easy to be misdiagnosed as acute gastroenteritis at an early stage. In the present case, abdominal plain film and B Ultrasound examinations basically ruled out other acute abdomen symptoms. Considering the patient was an elderly man with a history of 20 years of hypertension and more than 10 years of hyperlipidemia, the diagnosis of SMAE was highly considered. Emergency CTA indicated filling insufficiency or not filling in the middle and distal end of the abdominal superior mesenteric artery, highly suggesting the occlusion of superior mesenteric artery. In combination with laboratory tests such as high white blood cells and neutrophils, high D dimer, and abnormal blood clotting test, the diagnosis of the SMEA was fully established (9,10).

Treatment

About 9 hours after the onset of the disease, physical signs of the abdomen indicated negative abdominal

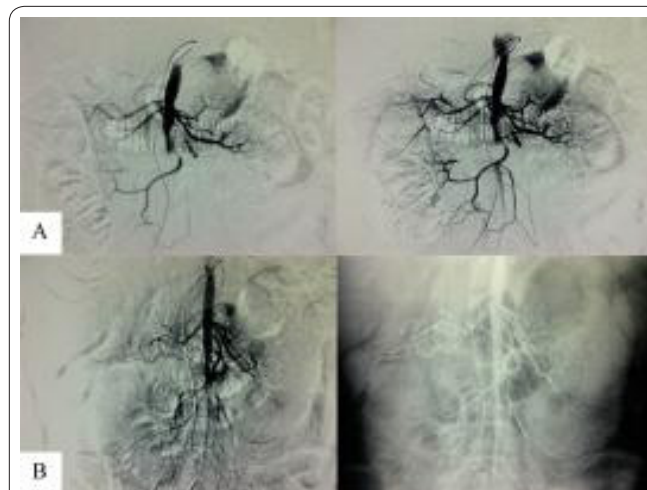


Figure 2. A. CTA showed distal occlusion of the superior mesenteric artery; B. After thrombolysis, CTA revealed the revascularization of the distal terminal of superior mesenteric artery trunk and main branches.

muscle tension. And the bowel sound was heard with auscultation, suggesting that mesenteric ischemia is reversible or no remarkable signs of intestinal necrosis. Therefore, the intra-arterial thrombolysis and embolectomy were processed under the support of general treatments like decompression of the gastrointestinal tract, maintaining the water and electrolyte balance by fluid infusion, and the application of broad-spectrum antibiotics(11). The revascularization can be observed in the middle of the superior mesenteric artery trunk after using thrombolytic drug urokinase. When most of thrombi were removed by the intra-arterial thrombolysis and embolectomy operation, CTA showed that thrombosis still existed in some distal parts of the branches of the superior mesenteric artery. Thus, the thrombolytic drugs were continuously used to maintain the therapeutic effect post-operation.

Unfortunately, the recurrence of condition took place 20 hours after the thrombolysis and thrombectomy operation. The patient presented progressively severed abdominal pain, and obvious physical abdominal signs such as significant muscle tension, tenderness, and positive rebound sign. The bowel sounds were gradually decreased until disappeared, highly suggesting the intestinal necrosis was occurring. As the patient started to present diarrhea with jam-like stools, dark-brown liquid extracted from the stomach tube, declining blood pressure, fast heart rate and other symptoms of septic shock, he was immediately treated with emergent endotracheal intubation, mechanical ventilation, and preparing for laparotomy. During the laparotomy, multiple mesenteric artery rupture and bleeding were noted. The thrombi in the superior mesenteric artery branches including the ileocolic artery and right colic artery were removed. Necrotic small bowel with deep dark color was excised about 180 cm length at 40 cm from the cecum, and about 90 cm length at 60 cm from Treitz ligament.

Postoperative treatment is also very crucial, which includes maintaining water and electrolyte balance and correcting acidosis, supplying sufficient parenteral nutrition, improving toxic symptoms by combined antibiotic therapy, prevention and treatment of DIC and multiple organ failure, and preventing the recurrence of

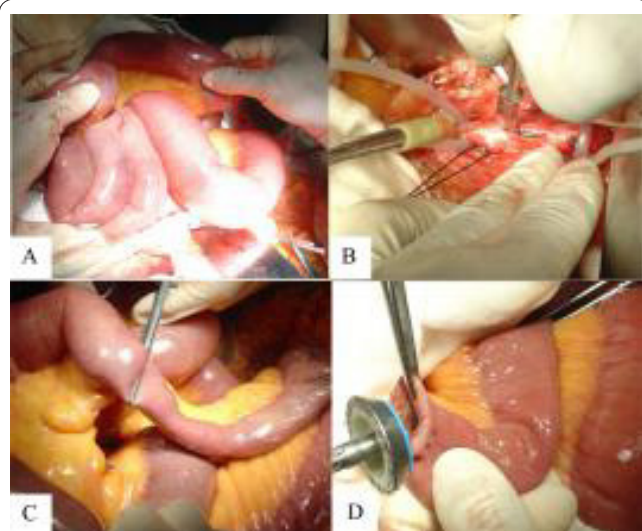


Figure 3. A. Gross photo exhibited that part of intestinal tract appeared dark red or pale, peristalsis disappeared, and ischemic necrosis presented; B. Mesenteric artery with embolization was open and removal of thrombus; C. Resection of part of the necrotic bowel.

embolization after surgery. The patient was discharged with full recovery after 16 days in the hospital. Follow-up after 6 months of oral anticoagulant treatment, the patient had no recurrence of abdominal pain, no recurrence of SMAE and short bowel syndrome *et al.*

After a review of the diagnosis and treatment of this case, we found that CTA can clearly display the occlusions of SMA, and the location and severity of the embolization (1,2,5,12). We think that CTA is still the gold standard for diagnosis of SMAE. However, the incidence of occult SMAE with nonspecific symptoms often leads to misdiagnosis and delayed treatment. This will directly impact on the prognosis, which is one of the reasons for the high mortality of SMAE. Therefore, such as careful taking of patient's history, inquiry of disease details, rigorous physical examination, rapid exclusion of other diseases, and early examination of CTA, all are the necessary measures for timely diagnosis of SMAE. Early diagnosis of SMAE can ensure maximum recanalization of the embolized artery, which leads to saving more ischemic intestines by reducing the intestinal necrosis, eventually improving the patient's outcome and reducing the mortality (13).

It is still controversial how to select thrombolytic drugs, and when to employ thrombectomy and surgical laparotomy during the process of the SMAE treatment. We believe that intra-arterial thrombolysis and embolectomy operation is one of the most effective non-surgical therapies for the treatment of SMAE. This approach can effectively dissolve the clots to ensure revascularization and reperfusion of the ischemic intestine, reduce intestinal ischemia, and avoid intestinal necrosis. However, there are many contraindications for using thrombolytic drugs, which limit their clinical applications. Thus, you should flexibly follow the indications and contraindications. During the process of drug thrombolysis in the current case, the patient presented agitation, increasing blood pressure, changes of heart rate and other changes, which indicated that the patient could not tolerate continuing the therapeutic process. This could result in an incomplete thrombolysis. As soon as a patient starts to

present signs of peritonitis and intestinal necrosis, he should be immediately treated with surgical laparotomy and embolectomy in order to save the patient's life (3,14,15).

Conclusions

Taken together, if SMAE can be diagnosed early and there is no sign of intestinal necrosis, the intra-arterial thrombolysis and embolectomy operation is undoubtedly the most effective approach for the treatment of the ischemic intestine and the removal of arterial obstruction. Once the symptoms of intestinal necrosis are noted, emergent laparotomy including embolectomy and removal of necrotic bowel should be immediately employed without any delay. Thrombolytic drugs and emergent laparotomy should be flexibly performed.

Acknowledgments

This work was supported in part by a grant from the National Natural Science Foundation of China (No:81272088). Key Scientific and Technological Cooperation Project of Hainan province (ZDYF2016203).

Interest conflict

None.

Author contributions Conception and design: Rongju Sun, Tanshi Li and Bei Wang; Analysis and interpretation: Rongju Sun and Bei Wang; Data collection: Wei Chen; Writing the article: Rongju Sun; Critical revision of the article: Tanshi Li; Final approval the article: Rongju Sun; Statistical analysis.

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