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Case Report / Olgu Sunumu

Successful recanalization of a superior mesenteric artery thrombotic occlusion via a percutaneous rotational thrombectomy

Süperior mezenter arter trombotik tıkanıklığının perkütan rotasyonel trombektomi ile başarılı rekanalizasyonu

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ABSTRACT

Acute mesenteric ischemia is a serious abdominal emergency characterized by sudden interruption of intestinal blood flow that commonly leads to bowel infarction. Prompt diagnosis and treatment of superior mesenteric artery (SMA) embolism before extensive irreversible gangrene develops in intestine is important. A 63-year-old male patient was admitted to our hospital's emergency department with complaint of a sudden onset and worsening abdominal pain. The patient was promptly performed contrast-enhanced computed tomography, which showed an embolus within the SMA. As there was no evidence of intestinal necrosis, rotational thrombectomy was started immediately. Thrombus aspiration was performed using a 6 French gauge Aspirex® S catheter. Reperfusion of the mesenteric flow was established within 20 minutes. Nine months after the procedure, Doppler ultrasound showed that SMA was patent. Percutaneous revascularization with Aspirex® S catheter may be a rapid, safe and promising alternative to surgery for acute SMA occlusion in selected patients who have no signs of advanced bowel ischemia.

Keywords: Aspiration thrombectomy; bowel ischemia; superior mesenteric artery occlusion.

ÖZ

Akut mezenterik iskemi, bağırsak kan akımının ani kesilmesine bağlı, sıklıkla bağırsak enfarktüsüne yol açan ciddi bir abdominal acilidir. Bağırsakta yaygın, geri dönüşsüz kangren gelişmeden önce süperior mezenterik arter (SMA) embolisinin erken tanı ve tedavisi önemlidir. Altmış üç yaşında bir erkek hasta hastanemiz acil servisine ani başlangıçlı ve gittikçe kötüleşen karın ağrısı şikayeti ile başvurdu. Hastaya acil olarak uygulanan kontrastlı bilgisayarlı tomografide SMA'da emboli gözlendi. İntestinal nekroz bulgusu olmadığından, derhal rotasyonel trombektomiye başlandı. Trombüs aspirasyonu 6 French gauge Aspirex® S kateteri kullanılarak uygulandı. Mezenterik akımın reperfüzyonu 20 dakika içerisinde sağlandı. İşlemden dokuz ay sonra, Doppler ultrasonda SMA'nın patent olduğu gözlendi. İleri bağırsak iskemisi bulguları olmayan seçilmiş hastalarda akut SMA tıkanıklığı için Aspirex® S kateteri ile perkütan revaskülarizasyon, cerrahiye karşı hızlı, güvenilir ve umut verici bir alternatif olabilir.

Anahtar sözcükler: Aspirasyon trombektomisi; bağırsak iskemisi; süperior mezenterik arter tıkanıklığı.

A superior mesenteric artery (SMA) embolism is a life-threatening vascular emergency that requires the rapid revascularization of mesenteric blood flow as well as an early diagnosis. It is the most frequent cause of acute mesenteric ischemia (AMI), which is associated with a high mortality rate.[1] An SMA embolism is relatively rare, accounting for 0.1% of all hospital admissions.[2] Despite considerable improvements in diagnostics and the treatment of AMI over the last few decades, the prognosis for those with this type of embolism is still poor with an in-hospital mortality rate of between 59 and 93%.[3] Early recognition and treatment are crucial for a successful outcome, with the main treatment choices being a surgical laparotomy

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in conjunction with a thrombectomy or percutaneous treatment options.[4] Although previous reports have described the successful use of thrombolysis with local thrombolytic infusion to the SMA, the prolonged infusion times and increased total drug dosage have the potential to produce continued intestinal ischemia and bleeding complications.[5,6]

In this report, we present a case of acute SMA occlusion diagnosed early after onset that was successfully treated via a percutaneous aspiration thrombectomy combined with an angiographic evaluation of the patient's blood flow, which thereby avoided the need for an intestinal resection.

CASE REPORT

A 63-year-old man was admitted to our emergency department complaining of acute and worsening abdominal pain. His past medical history revealed arterial hypertension, congestive heart failure, and peripheral vascular disease. A physical examination showed the following: blood pressure of 140/80, a heart rate of 77 bpm, an oxygen saturation rate of 93% (room air), and a body temperature of 37.2 °C. Furthermore, the laboratory data on admission yielded the following results: an elevated white blood cell (WBC) count and mildly elevated hepatic enzyme values (WBC 16,300/mm^3, C-reactive protein (CRP) 0.17 mg/dL, lactate dehydrogenase (LDH) 580 IU/L, aspartate aminotransferase (AST) 44 IU/L, alanine transaminase (ALT) 25 IU/L, and creatine phosphokinase (CPK) 146 IU/L).

No signs of peritonitis were found on the physical examination. The patient underwent emergency contrast-enhanced computed tomography angiography (CTA) which showed an embolus within the SMA (Figure 1). Furthermore, mesenteric angiography showed a filling defect at the middle and distal portion of the SMA (Figure 2a), but no signs of irreversible bowel wall ischemia were found. In addition, the CTA revealed circumferential wall thickening of the cecum with normal along with an enhanced homogenous wall. After explaining the purpose and the risk of the treatment fully, we obtained written informed consent to treat the SMA occlusion from the patient and his family.

As there was no evidence of intestinal necrosis, a rotational thrombectomy was immediately performed. Thrombus aspiration was carried out using the 6 French (F) Aspirex® S catheter (Straub Medical AG, Wangs, Switzerland) system, which is designed for the aspiration of emboli in smaller vessels. Heparin (5,000 IU) was infused intra-arterially prior to the procedure. The transfemoral approach was used under local anesthesia, and no additional techniques, such as fibrinolysis or catheter aspiration, were utilized. The patient's symptoms improved immediately after the procedure.

The Aspirex® S catheter is an over-the-wire, single-use 6F catheter that is compatible with a 0.035-inch guidewire (Figure 3), and the Aspirex® system offers the following three functions: *(i)* permanent suction via aspiration with the specially designed catheter that features 40,000 rotations/minute and 45 mL/minute suction capacity, *(ii)* fragmentation into extremely small particles when the materials enter the L-slit at the top of the catheter, and *(iii)* continuous transport of the debris out of the vessel into a waste bag.

Following the treatment, a control angiogram was performed, and after several passes of the thrombectomy catheter, a reperfusion of the mesenteric flow was established within 20 minutes (Figure 2c). Nine months after the procedure, Doppler ultrasound confirmed that the SMA was patent and that the patient was symptom-free.

DISCUSSION

Mesenteric ischemia can be classified as either AMI or chronic mesenteric ischemia based on the rapidity and degree to which the blood flow is compromised. An acute thromboembolic occlusion of the SMA leads to

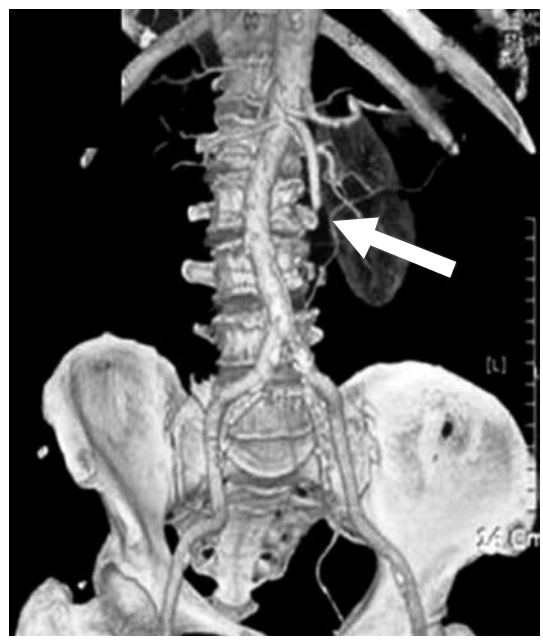

Figure 1. Computed tomography angiography showing the filling defect at the middle and distal portion of the superior mesenteric artery (arrow).

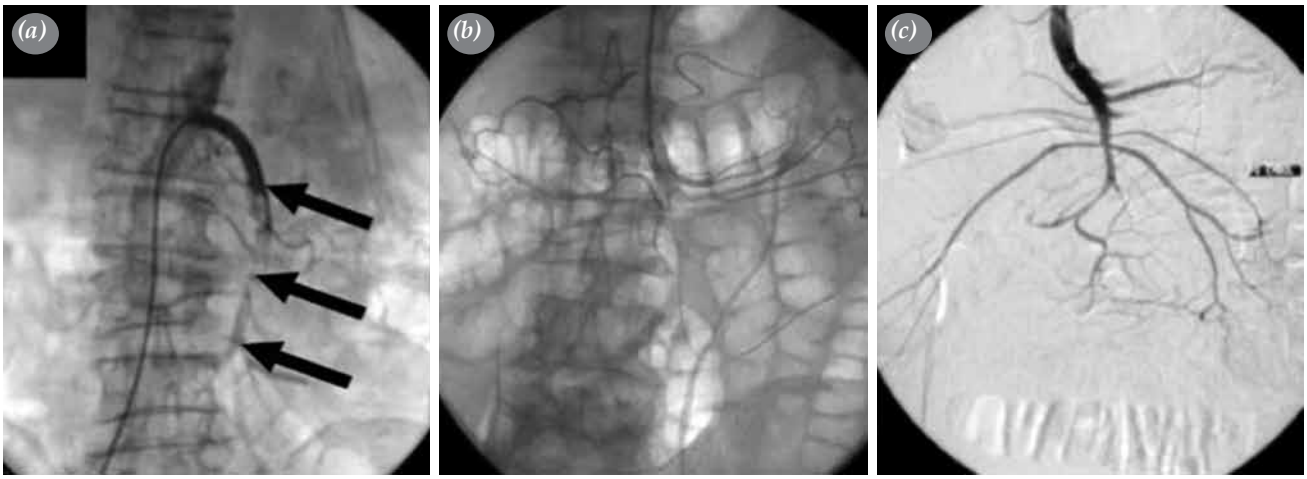

Figure 2. (a) Selective mesenteric angiography image of the superior mesenteric artery showing a thromboembolism in the trunk of the artery. **(b)** A percutaneous aspiration thrombectomy with the Aspirex® S catheter system were performed. **(c)** Postinterventional arteriography showing a patent superior mesenteric artery.

intestinal infarction and is associated with a mortality rate of approximately 65%.[1] Therefore, early diagnosis and appropriate treatment are required for a good prognosis. Patients with AMI classically present with abdominal pain out of proportion to their abdominal tenderness, and diagnosis depends upon a high clinical suspicion, especially in patients with known risk factors such as atrial fibrillation, congestive heart failure, peripheral vascular disease, or a history of hypercoagulability. An acute embolus to the SMA is the most common cause of AMI, making up 40-50% of all cases.[2]

An embolism in the mesenteric arteries is most frequently caused by a dislodged thrombus from the left atrium, left ventricle, or cardiac valves.[7] The SMA is anatomically most susceptible to an embolism because of its large diameter and narrow takeoff angle from the aorta. The inferior mesenteric arteries (IMAs) are rarely affected because of their small diameter.

Mesenteric angiography remains the gold standard for diagnostic study of acute arterial ischemia, and early and liberal implementation of this tool has been the major reason for the decline in mortality of patients with AMI over the past 30 years. With SMA occlusion, selective injection of the celiac artery and IMAs may be necessary to assess the adequacy of collateral circulation and age of the occlusion. Once AMI is suspected, selective mesenteric angiography or CTA should be performed immediately so that therapy can begin as soon as possible. If there are clinical or radiological signs of bowel necrosis, then emergency surgery is needed. However, if there is no clear evidence of this condition, endovascular treatment can be a promising alternative, as was confirmed in our patient.[8-10] Minimal bowel changes, such as circumferential wall thickening of the cecum with normal, homogenous wall enhancement, are not a contraindication for an endovascular procedure. As the follow-up of our patient showed, no additional surgery is usually needed since the changes are most often due to edema and not prolonged, irreversible acute intestinal ischemia.

Figure 3. The Aspirex® rotational thrombectomy catheter.

The traditional treatment for a mesenteric arterial embolism has been an early surgical laparotomy in combination with an embolectomy, which is accomplished by performing an arteriotomy distal to the embolism and then inserting a balloon-tipped embolectomy catheter. Palpation for SMA pulses is then performed, and the small bowel is carefully examined for areas of persistent ischemia, which, if found, are resected. Mesenteric arterial vasoconstriction often develops in association with an SMA embolus and may persist and compromise intestinal perfusion even after the removal of the arterial obstruction. However, the postoperative administration of papaverine can attenuate the associated vasospasms.

A less well-established approach is the local infusion of thrombolytic therapy or a percutaneous aspiration thrombectomy with or without balloon

dilation, both of which have proven to be successful.[8-10] Thrombolytic therapy has resulted in good outcomes during the early stages of SMA occlusion, although this therapy is not recommended after intestinal necrosis has developed,[11] causing an increased hemorrhage risk.[12] There are several techniques which require the infusion of a thrombolytic agent, with the most common being the McNamara protocol for peripheral arterial or graft occlusions, which involves a high-dose infusion.[13] Unfortunately, this thrombolytic therapy can require prolonged infusions during which the ischemia may continue, which can lead to intestinal necrosis. Lengthy infusion times are also associated with an increased risk of bleeding complications. While the endovascular approach may rapidly restore the blood flow to the bowel, the time needed for local lysis varies, meaning that if needed, the bowel viability cannot be assessed with a laparotomy afterwards.[14] In addition, numerous reports of complications after local thrombolysis have been reported which might compromise the outcome.[15,16]

An aspiration thromboembolectomy for an SMA embolism may be another minimally invasive therapy. The two main methods are a percutaneous aspiration thrombectomy in which the thrombus is removed by suction with the aid of a wide-bore catheter and a hydrodynamic mechanical thrombectomy in which a variety of automated devices are used to fragment or remove the thrombus. Moreover, different percutaneous devices are potentially useful or have been successfully used in the treatment of SMA embolisms.[10]

In our patient, we aspirated the obstructing thrombus via the Aspirex® 6F catheter, which is part of a catheter system that was specifically designed and developed for the percutaneous interventional treatment of small vessels. The central part of this over-the-wire catheter system is a high-speed rotational coil within the catheter body that creates negative pressure through an L-shaped aspiration port at the catheter tip. It then macerates the aspirated thrombus and removes it (Figure 3). The catheter is connected to a motor via an electromagnetic clutch, and a small control unit ensures a steady motor speed of 40,000 rpm. The aspiration capacity of the Aspirex® S catheter was adjusted so that it was possible to remove the thrombus from obstructed arteries and minimize the risk of vascular collapse and vessel wall entrapment. The design of this catheter does not allow for the recirculation of aspirated blood or the thrombus.

The percutaneous mechanical thrombectomy showed good results in our patient, and there was dramatic, immediate improvement in his symptoms. In addition, no postprocedural complications were present, which was probably due to the absence of any additional pharmacological lysis. The main advantages of this technique are that a large thrombus can be removed rapidly and effectively without the need for local thrombolysis and its minimal invasiveness, thereby avoiding the complications associated with this type of surgery. The seriousness of potential vessel damage should not be overlooked, and the risk most likely increases with smaller vessel diameters. However, if complications occur, they can be easily managed by simple coiling.

Conclusion

The emergency endovascular treatment of an SMA embolism is a safe and useful technique for restoring blood flow in selective patients with main trunk occlusion of the SMA, especially for those who are ineligible for an open surgical embolectomy. Prompt diagnosis and treatment before the presence of extensive irreversible gangrene is the primary objective in the treatment of SMA embolisms, and vascular surgeons should be aware that endovascular treatment for an SMA occlusion might need to be performed in selective cases. While the endovascular recanalization via a percutaneous aspiration thrombectomy had positive results in our patient, further well-designed clinical trials are needed to address the clinical effectiveness and long-term results regarding this technique.

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