




Vascular Interventions Case Report

A novel method of mechanical thrombectomy utilizing a stent retriever device with continuous aspiration prior to intracranial vascular embolectomy technique for acute superior mesenteric artery occlusion: A case report

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ABSTRACT

Acute superior mesenteric artery (SMA) occlusion resulting from a thrombus formation carries a high mortality risk and therefore immediate diagnosis and treatment are warranted. In recent years, mechanical thrombectomy by interventional radiology has become a viable treatment option if the occlusion has not advanced to intestinal necrosis. We present a rare and interesting case involving a patient with acute SMA occlusion which was completely recanalized by mechanical thrombectomy utilizing a stent retriever device and the continuous aspiration prior to intracranial vascular embolectomy (CAPTIVE) technique. The CAPTIVE technique has become widely adopted in recent years to treat large vessel occlusions in the cerebrovascular region due to thrombi. First, a microcatheter with a microguidewire is advanced through the occlusive thrombus coaxially with an aspiration catheter. Next, a stent retriever is deployed in the thrombotic body and the aspiration catheter is advanced adjacently to the proximal part of the thrombus with strong aspiration until no backflow is present. After checking for backflow from the aspiration catheter, the microcatheter delivering the stent is removed to increase the aspiration force. Finally, the stent retriever and the aspiration catheter are retrieved as a single unit. An 87-year-old female patient with a history of atrial fibrillation (AF), chronic heart failure, aortic valve stenosis, hypertension, type 2 diabetes mellitus, and hyperlipidemia was admitted to our hospital complaining of sudden onset upper abdominal pain, vomiting, and watery diarrhea. On arrival, her body temperature was 36.0°C (96.8°F), blood pressure was 131/75 mmHg, heart rate was 115 beats/min with AF rhythm, and her white blood cell count was 18,100 cells/μL. A contrast-enhanced computed tomography revealed a contrast defect in the SMA which we later diagnosed as an acute occluding thrombus of the SMA. Initially, we attempted aspiration of the thrombus but were unsuccessful, so we transitioned to mechanical thrombectomy utilizing a stent retriever device with CAPTIVE technique which rapidly and completely recanalized the occluded SMA. After the procedure, the patient's abdominal pain immediately subsided. Normal stool was observed 2 days after the procedure and oral feeding was subsequently initiated. Twelve days after the procedure, the patient was discharged from the hospital in good health.

Keywords: Superior mesenteric artery, Thrombus, Interventional radiology, Mechanical thrombectomy, Stent retriever

INTRODUCTION

Acute superior mesenteric artery occlusion (ASMAO) is a high mortality disease.^[1] In the event that ASMAO advances to intestinal necrosis, the necrotic area must be surgically resected. However, in recent years, revascularization by interventional radiology (IVR) has emerged as a promising therapeutic option falling under a Class IIa recommendation under existing guidelines.^[2]

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Various IVR methods for revascularization are reported; however, even with this arsenal at our disposal, a fraction of cases will necessitate intestinal resection due to failures to achieve complete revascularization. Therefore, a more reliable and promptly deployable method is needed. In this context, the efficacy of mechanical thrombectomy with stent retriever (SRMT) for large vessel occlusion (LVO) in cerebral infarction is recommended under Class I in existing guidelines.^[3]

In the present, we report a case of ASMAO in which SRMT with continuous aspiration prior to intracranial vascular embolectomy (CAPTIVE) technique was performed, resulting in complete revascularization in a rapid manner and which prevented the need for more invasive surgical procedures. SRMT appears to be a viable option for thrombotic occlusions that fall outside of its intended scope of cerebrovascular applications.

CASE REPORT

An 87-year-old female patient presented with complaints of sudden onset upper abdominal pain, vomiting and watery diarrhea. Her medical history included atrial fibrillation (AF), chronic heart failure, aortic valve stenosis, hypertension, type 2 diabetes mellitus, and hyperlipidemia.

At the time she was admitted to our hospital, 8 h had transpired since the onset of symptoms. Her blood pressure was 131/75 mm Hg, heart rate was 115 beats/min with AF rhythm, body temperature was 36.0°C (96.8°F), and oxygen saturation was 97% under room air. Physical examination revealed tenderness over the upper abdomen without any signs of peritonitis. Blood chemistry analyses revealed the following: White blood cell counts 18,100 cells/ μ L, creatine phosphokinase 54IU/L, lactate dehydrogenase 336IU/L, and C-reactive proteins 1.29mg/dL. Blood gas analysis revealed the following: pH 7.399, PaCO₂ 32.4 mmHg, PaO₂ 73.6 mmHg, HCO₃⁻ 19.6 mmol/L, base excess -4.4 mmol/L, anion gap 11.6, and lactate 1.31mmol/L. A contrast-enhanced computed tomography (CE-CT) revealed a contrast defect indicating a thrombotic occlusion in the SMA [Figure 1a-c] with no apparent ischemic changes documented in the intestinal tract. These findings suggested that the patient's disease state was early and had not advanced to intestinal necrosis and therefore we opted for emergency IVR.

Under local anesthesia, the right common femoral artery was punctured using the Seldinger technique and a 6Fr long sheath (Radifocus Introducer II; Terumo Corporation, Tokyo, Japan) was inserted. Angiography revealed a thrombus in the main trunk of the SMA [Figure 1d]. A 6Fr Hyperion guiding catheter (ASAHI INTECC Co., Ltd., Aichi, Japan) was inserted into the orifice of the SMA. At first, we tried

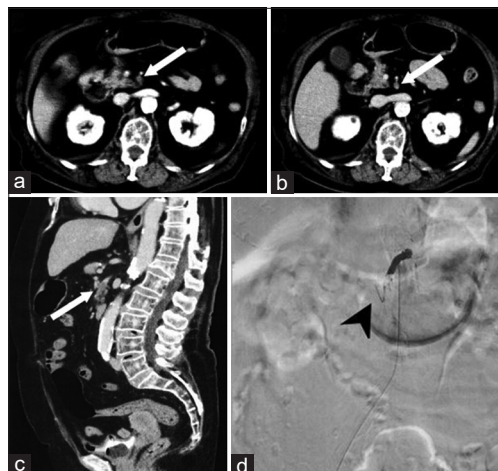


Figure 1: An 87-year-old woman with acute superior mesenteric artery occlusion who presented with complaints of sudden onset upper abdominal pain, vomiting, and watery diarrhea. (a) Contrast-enhanced computed tomography axial view in early phase (arrow), (b) axial view in late phase (arrow) and (c) sagittal view in late phase revealed a contrast defect suggestive of thrombus (arrows) in the superior mesenteric artery (SMA). (d) Abdominal angiography also revealed a contrast defect (arrow head) in the proximal SMA. Inferior pancreaticoduodenal artery, middle colic artery, jejunal artery, and right colic artery could not be visualized.

to aspirate the thrombus using a Thrombuster II (Kaneka Medix Corporation, Tokyo, Japan); however, the thrombotic body could not be evacuated. We then performed SRMT. The Solitaire Platinum (Medtronic, Dublin, Ireland), a stent retriever device, was deployed in the thrombotic body. The guiding catheter was advanced adjacently to the thrombus over the stent delivery wire and the thrombus was retrieved using the CAPTIVE technique.^[4] Massive thrombi were confirmed in the stent retriever device along with vacuumed blood [Figure 2a and b] and complete recanalization was achieved [Figure 2c].

After the procedure, the abdominal pain rapidly improved. Normal stool and bowel movements were observed 2 days after the procedure and oral feeding was initiated without issue. Twelve days after the procedure, the patient was discharged from the hospital in a good state of health.

DISCUSSION

ASMAO is documented as a poor prognostic disease carrying with it a high mortality rate of 70%.^[1] If the patient's condition had advanced to intestinal necrosis, a laparotomy for resection of the entire necrotic area would have been warranted. However, in recent years, revascularization through IVR (Class IIa recommendation) has emerged as an increasingly popular therapeutic option.^[2]

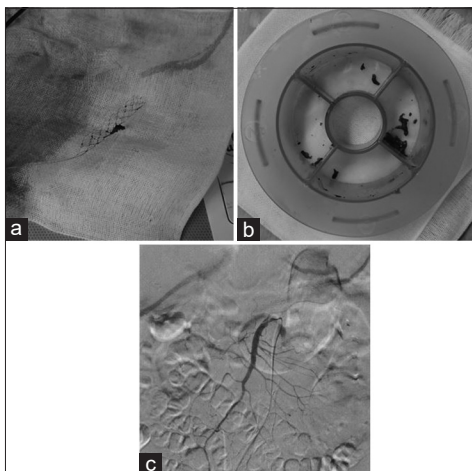


Figure 2: Post mechanical thrombectomy by stent retriever (SRMT) with continuous aspiration prior to intracranial vascular embolectomy (CAPTIVE) technique. (a) Massive thrombi are noted in the stent retriever device. (b) Blood recovered by CAPTIVE technique also contains massive thrombi. (c) Post-procedural angiography revealed complete recanalization in the superior mesenteric artery which extended to the peripheral arteries.

In general, the therapeutic window for treating ASMAO to avoid intestinal resection is considered within 10–12 h after onset of disease. However, this principle largely depends on the site and severity. Moteki *et al.* proposed to classify ASMAO into three types:^[5] Type A, where the occlusion is in the origin of the main trunk of the SMA or proximal to the middle or right colic artery; Type B, where the occlusion is between right colic artery and ileocolic arteries; and Type C, where the occlusion is distal to the ileocolic artery. Type A is not expected to establish collateral circulation and therefore the therapeutic window is generally considered to be within 5 h. The present case can be defined as a Type A ASMAO warranting a more invasive surgical operation if intestinal necrosis had already occurred. The white blood cell count was elevated over 18,000 cells/ μ L, but other biomarkers such as C-reactive proteins, creatine phosphokinase, lactate dehydrogenase, and base excess failed to indicate intestinal necrosis. Clinical symptoms such as irritation, shock, and melena were not observed. Abdominal CE-CT examination revealed no findings indicative of intestinal necrosis. Therefore, we decided to proceed with IVR.

Some IVR methods indicated for ASMAO include aspiration by suction catheter, intra-arterial infusion of urokinase, and thrombus disruption with PTA balloon dilatation.^[2] However, there are some cases in which recanalization cannot be attained by these methods. If the time to recanalization is short, intestinal resection can be avoided. Even if intestinal resection is warranted, the resection area would theoretically be minimal if shorter procedural time can be achieved. In the present case, we could not achieve recanalization through

conventional methods. Although UK intra-arterial infusion was also considered, the possibility of having to rapidly transition to laparotomy for intestinal resection made us reconsider this option as UK intra-arterial infusion could make hemostasis challenging.

We finally performed SRMT with CAPTIVE technique^[4] which was originally designed for the treatment of LVO in cerebrovascular applications. SRMT with CAPTIVE technique for ASMAO resulted in complete recanalization in a rapid manner without complications.

In the cerebrovascular realm, SRMT is expected to achieve a 2b (reperfusion more than 50% of the dominant territory of the occluded vessel) or 3 (reperfusion without contrast delay to the periphery of the occluded vessel) using the TIC1 (thrombolysis in cerebral infarction) scale. This translates to a high recanalization of 60–90% with a promising prognosis (modified Rankin Scale: mRS 0–2) at 90 days of approximately 30–70%, which is almost double that of rt-PA thrombolysis.^[6–10]

In recent years, various techniques have been developed which combine SRMT. The technique used in our case is called CAPTIVE.^[4] With CAPTIVE, the median time from puncture to recanalization was only 14 min and the effective recanalization rate for TIC1 2b or 3 was 100%. Also important to note is that the recanalization procedure was completed in 11 min without complications.

This experience suggests that the SRMT with CAPTIVE technique can be a safe and effective method for rapid recanalization of not only cerebrovascular LVOs but also for non-cerebrovascular occlusions such as ASMAO — in particular those falling under Type A classifications. In the future, indications for SRMT will be expanded to include blood vessel occlusions falling outside of the originally intended applications of cerebrovascular disease.

CONCLUSION

We experienced a case involving the use of SRMT with the CAPTIVE technique for ASMAO and achieved complete recanalization in a rapid and safe manner. SRMT with the CAPTIVE technique may be beneficial for revascularization of body vessel occlusions like ASMAO. Given its proposed utility outside of cerebrovascular applications, expanding the indications of the SRMT device could be beneficial in cases involving blood vessel occlusions in the abdomen and extremities.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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