Case Report

Three Case Report of Spontaneous Isolated Dissection of the Superior Mesenteric Artery—With an Algorithm Proposed for the Management

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Spontaneous isolated dissection of the superior mesenteric artery (SID-SMA) is a rare condition, and there is still no consensus on optimal management. Here, we present three cases of SID-SMA, that were treated by surgical revascularization with urgent iliomesenteric bypass surgery without intestine resection, endovascular therapy with stent placement, and conservative management. The purpose of this study is to review these three cases and propose an algorithm for optimal management of SID-SMA.

Key words: spontaneous isolated dissection of the superior mesenteric artery, endovascular therapy, surgical treatment

Introduction

Spontaneous isolated dissection of the superior mesenteric artery (SID-SMA) that does not involve the abdominal aorta is very rare. Three different therapeutic approaches are possible: conservative management, endovascular therapy, and surgical revascularization. However, optimal management has not yet been established. We report three cases of SID-SMA that were managed with conservative, endovascular and surgical approaches. Finally, we would like to propose an algorithm for the management of isolated dissection of the SMA.

Case Report

Case 1
A 47-year-old man presented at an emergency department complaining of severe abdominal pain with a sudden onset. He had no medical history, cardiovascular risk factors or recent trauma. He was pale and sweaty with hypertension. An examination of his abdomen showed epigastric mild tenderness without any signs of peritonitis. Laboratory tests were unremarkable. Contrast-enhanced computed tomography (CT) revealed SID-SMA with a thrombosed false lumen that began at the origin of the SMA and extended for 5 cm with no evidence of bowel ischemia. Initially, we chose conservative treatment with anticoagulation therapy and blood pressure control. However, his abdominal pain persisted and follow-up CT revealed progression of SMA dissection and little flow through the SMA because of compression of the true lumen by the false lumen (Fig. 1A and B). In addition, imaging indicated signs of bowel ischemia and partial necrosis; therefore, we decided to perform urgent surgery. Laparotomy revealed a pulseless small bowel without necrosis. We proceeded with a bypass operation between the jejunal branch of the SMA and the right common iliac artery using the left great saphenous vein as a free graft. His postoperative course was uneventful, and follow-up CT showed good general vascularization of the bowel and full patency of the graft, although the SMA was completely occluded (Fig. 1C). The patient was discharged on postoperative day 20 and was asymptomatic for 1 year after surgery with no disease progression.

Case 2
A 62-year-old man was admitted to an emergency department because of the sudden onset of severe abdominal pain. His medical history was remarkable for chronic atrial fibrillation and hypertension under treatment with olmesartan (20 mg/day), diltiazem (100 mg/day) and warfarin...
(5.25 mg/day). Physical examination revealed no abdominal tenderness or peritonitis. The results of laboratory tests were normal, and his PT-INR was 2.08. Contrast-enhanced CT showed SID-SMA without any signs of bowel ischemia. At first, we started anticoagulation with heparin, but his symptoms persisted. In addition, we performed selective angiography of the SMA using a 5 Fr transfemoral SELECON catheter (Terumo, Tokyo, Japan). It showed severe stenosis and local dissection of the SMA that occurred 1.5 cm from the aorta and extended for approximately 6 cm with a malperfusion area distal to the origin of the first jejunal artery. Therefore, we considered endovascular therapy in order to reverse bowel ischemia and not to aggravate the dissection. Using the same route, a 0.020 guiding wire (Terumo, Tokyo, Japan) was advanced via the true lumen under intravascular ultrasound guidance, and we performed just balloon angioplasty at first; however, the blood flow did not improve. After that, we deployed a self-expandable metallic endoprosthesis (SMART stent, 7 mm in diameter and 60 mm in length, Cordis, Miami, FL, U.S.A.) to cover the entrance of the false lumen and obstruct the intimal flap. The stent was delivered through a 6 Fr Mach 1 guiding catheter (Boston Scientific, Watertown, MA, U.S.A.) after measuring the diameter of the SMA using selective arteriography. During the procedure, we used the stent balloon to dilate the in-stent portion of the SMART stent. A final angiogram demonstrated a patent, true lumen with good blood flow in all branches of the SMA (Fig. 2B). After the procedure, long-term aspirin therapy (100 mg/day) was initiated and warfarin was continued. There were no symptoms during eating, bowel

![Fig. 1](computed-tomography-ct-in-case-1-a-b-preoperative-ct-revealed-the-true-lumen-of-the-sma-was-compressed-by-the-false-lumen-with-an-arrow-c-postoperative-ct-showed-good-general-vascularization-and-full-patency-of-the-graft-although-the-sma-was-completely-occluded)

![Fig. 2](selective-angiography-in-case-2-a-the-superior-mesenteric-angiogram-showed-severe-stenosis-and-dissection-occurred-1-5-cm-from-the-aorta-and-extended-for-approximately-6-cm-with-a-malperfusion-area-distal-to-the-origin-of-the-first-jejunal-artery-b-final-angiography-showed-improved-blood-flow-to-the-distal-branches-no-major-branch-was-occluded-by-the-stents-the-arrow-indicates-the-ostium-of-the-sma)
arterial dissection, which is the most frequent site of isolated spontaneous dissection among peripheral arteries, antiplatelet drugs are the first line therapy, because they should prevent thrombosis of the true lumen, although this remains unproven. We suggest that anticoagulation therapy should be given when there is clot confinement (type IV of the classification by Sakamoto et al.) or when there is constriction of the true lumen. Because of severe stenosis of the true lumen, we gave antiplatelet therapy to all three of our cases, and it was successful in case 3. Recently, endovascular therapy has been used fairly widely and is very useful for inoperable cases. Stent placement is a good treatment strategy for dissection for three reasons. First, it improves flow through the true lumen when there is pressure in the false lumen. Endovascular therapy should be used because the risk of thrombosis increases when the true lumen is narrowed. The second reason is to prevent the diameter of the aneurysm from increasing with subsequent aneurysm rupture. The third reason is to prevent the dissection from progressing. Therefore, we suggest that stent placement should be the first choice for patients with transient or ongoing pain.

The standard approach is to place the stent over the entry site of the dissection (over the dissection fully if possible) to prevent flow into the false lumen when there is a short segment of dissection. If the stent does not fully cover the dissection, the stent should be placed over the entry site at first, and the false lumen of the remaining peripheral dissection should be reduced by balloon inflation. However, it is often difficult to find the entry site where the stent can be placed, and a more precise method is needed. A new algorithm for isolated superior mesenteric artery dissection is proposed in Fig. 3.

Discussion
SID-SMA is very rare condition; however, it has been reported frequently. Diagnostic capability has been improved with the development of imaging techniques. And, there are two classifications of SMA dissection based on radiological appearances by Sakamoto et al. and Yun et al. However, as for neither classification, a clear relationship has been found between radiological imagings and the clinical course.

Some treatment algorithms for the management of SID-SMA have been reported, including conservative management with or without anticoagulation, endovascular therapy and surgical revascularization. However, at the present time, there is no consensus regarding optimal management.

Some cases have been successfully treated by conservative therapy when imaging showed no signs of bowel ischemia or aneurysmal enlargement. However, Sparks et al. reported a case where the conservative approach failed, similar to our cases 1 and 2. Although conservative therapy has included anticoagulants, antiplatelet drugs, blood pressure control and pain control, there is no consensus on the optimal strategy for conservative management. Katsura et al. have reported that antiplatelet drugs are ideal to prevent thrombosis of the true lumen in patients with SMA dissection. As for carotid arterial dissection, which is the most frequent site of isolated spontaneous dissection among peripheral arteries, antiplatelet drugs are the first line therapy, because they should prevent thrombosis of the true lumen, although this remains unproven. We suggest that anticoagulation therapy should be given when there is clot confinement (type IV of the classification by Sakamoto et al.) or when there is constriction of the true lumen. Because of severe stenosis of the true lumen, we gave antiplatelet therapy to all three of our cases, and it was successful in case 3.

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be placed in cases of SMA dissection. In such cases, intravascular ultrasound could be very helpful to find the entry site and re-entry site. When the flow is not improved due to enlargement of the false lumen, especially a thrombosed false lumen, it may be possible to cut into the lesion and make an exit similar to a re-entry site using a cutting balloon. Furthermore, when the aneurysm has been enlarged, the covered stent may be useful to prevent further enlargement. However, there are still many problems with stent placement itself, such as the risk of re-occlusion and possible obstruction of side branches of the stented segment, rupture itself and anatomical problems. Kim et al. described three desirable characteristics for the SMA stent: shortening, good conformability and flexibility, and deviation despite enteric peristalsis. Favorable anatomy for stenting includes localized intimal flaps or short segments of dissection. In addition, there is the danger of an explosion when a stent is cramped, or a stent may move with bowel peristalsis.

Many operative methods for treating SID-SMA have been reported. All surgical approaches have resulted in good short-term follow-up, but long-term results are not clear. Emergency laparotomy should be undertaken when the patient has signs that are suspicious for bowel necrosis, as in our case 1, or aneurysm rupture. Otherwise, we recommend that surgery should be performed in difficult patients or in cases with failure of endovascular repair.

Finally, we would like to propose a new algorithm for the management of SID-SMA based on symptom presentation and image findings (Fig. 3). In the first place, emergency laparotomy is mandatory when bowel necrosis or artery rupture is suspected. Next, we differentiate between two modalities of clinical presentation in an asymptomatic patient whose dissection is an incidental finding: a patient with chronic relapsing pain (non-continuous pain), and a patient with acute transient pain or acute ongoing pain (continuous pain). For patients with symptoms (transient or ongoing pain), we should perform angiography and evaluate SMA flow and bowel ischemia. If there is low flow and bowel ischemia, endovascular stent placement should be feasible in patients without anatomical problems. On the other hand, asymptotic patients and symptomatic patients with no ischemia and good flow (based on angiography) should receive conservative therapy. Furthermore, endovascular treatment should be performed when symptoms recur and/or are persistent, or when follow-up CT demonstrates aneurysm increase or dissection progression.

Conclusions
The most important thing is whether the blood supply through the SMA is sufficient to prevent bowel ischemia. In many cases, conservative treatment is effective. However, endovascular therapy should be performed initially for symptomatic patients when there is suspicion of bowel ischemia.

Disclosure Statement
We declare that we have no conflict of interest in connection with this paper.

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