

 **Original Article** 

Selection and Determination of Treatment for the Spontaneous Isolated Dissection of the Superior Mesenteric Artery

Zaiqiang Yu, MD, PhD, Norihiro Kondo, MD, PhD, Mari Chiyoya, MD, Yasuyuki Suzuki, MD, PhD, and Ikuo Fukuda, MD, PhD

Objective: This study aimed to clarify the selection and determination of appropriate treatment for acute symptomatic spontaneous isolated dissection of the superior mesenteric artery (SIDSMA).

Methods: Data from 10 consecutive patients, who were diagnosed with symptomatic SIDSMA using computed tomography angiography and were managed in our hospital from January 2010 to October 2015, were retrospectively collected and analyzed.

Results: There were nine males and one female; mean patient age was 50.3 (range, 35–64) years. All patients experienced acute abdominal pain, and three patients experienced concomitant vomiting. Only one patient exhibited symptoms of suspected peritonitis and intestinal ischemia. Three patients showed improved abdominal pain before admission to our hospital. One patient experienced severe abdominal pain that could not be managed using morphine; he underwent right external iliac to superior mesenteric artery bypass with a great saphenous vein graft. No patient presented with intestinal necrosis. All patients survived, and no patient developed complications during the follow-up period of up to 42 (24.5±16.5) months.

Conclusion: Conservative management appears to be the most feasible treatment for SIDSMA. However, open surgery can be performed in patients presenting with any symptoms of intestinal ischemia.

Keywords: spontaneous isolated dissection of the superior mesenteric artery, open surgery, conservative treatment

Introduction


Spontaneous isolated dissection of the superior mesenteric artery (SIDSMA) is a rare condition.¹⁾ Although several cases have recently been reported because of the widespread use of computed tomography (CT), there has been no comprehensive report regarding the surgical indications and treatment modality for SIDSMA onset.²⁾ Thus, accumulating more data regarding this condition is important for determining the appropriate therapeutic strategies. This study aimed to clarify the selection and determination of the appropriate treatment for acute symptomatic SIDSMA.

Materials and Methods

Between January 2010 and October 2015, 10 patients were diagnosed with isolated SIDSMA at the Hirosaki University Hospital; these 10 patients were enrolled in this study. All patients were symptomatic with a diagnosis of SIDSMA using computed tomography angiography (CTA). Conservative treatment or surgical revascularization treatment was recommended on the basis of peritoneal irritation signs and persistent symptoms. If a patient's abdominal pain had improved or resolved by the administration of analgesics and antihypertensive agents, without the advancement of acidosis, conservative treatment with fasting and careful observation were conducted. If a patient showed "morphine-resistant" pain and peritoneal irritation signs, increase in lactic acid levels with the advancement of acidosis, sudden rise in lactate dehydrogenase and creatine kinase (CK) levels, CTA-based diameter reduction of the superior mesenteric vein (SMV) than the superior mesenteric artery (SMA), and contrast failure of the intestines, exploratory laparotomy and/or urgent angiography were performed for further intervention. Aspirin

Department of Thoracic and Cardiovascular Surgery, Hirosaki University Graduate School of Medicine, Aomori, Japan

Received: November 20, 2017; Accepted: December 23, 2017
Corresponding author: Norihiro Kondo, MD, PhD. Department of Thoracic and Cardiovascular Surgery, Hirosaki University Graduate School of Medicine, 5 Zaifu-cho, Hirosaki, Aomori 036-8562, Japan
Tel: +81-172-39-5074, Fax: +81-172-37-8340
E-mail: kondo18@hirosaki-u.ac.jp

 ©2018 The Editorial Committee of Annals of Vascular Diseases. This article is distributed under the terms of the Creative Commons Attribution License, which permits use, distribution, and reproduction in any medium, provided the credit of the original work, a link to the license, and indication of any change are properly given, and the original work is not used for commercial purposes. Remixed or transformed contributions must be distributed under the same license as the original.

was administered to patients with stenosis or high-risk occlusion of the SMA trunk to maintain intestinal perfusion. The patients' laboratory data, comorbidities, treatment, and midterm results were collected and analyzed retrospectively.

Results

There were nine men and one woman in this study; their mean age was 50.3 (range, 35–64) years. All patients experienced acute abdominal pain at SIDSMA onset (Table 1). Three patients experienced concomitant vomiting. Three patients showed spontaneously improved abdominal pain before admission to our emergency room. No patients exhibited signs of peritoneal irritation. SIDSMA was diagnosed using contrast-enhanced CT with typical findings of intestinal ischemia in the SMA. SIDSMA subtypes were grouped according to the Sakamoto's classification²⁾ as follows: type I, patent false lumen with both entry and re-entry; type II, "cul-de-sac"-shaped false lumen without re-entry; type III, thrombosed false lumen with ulcer-like projection (ULP), defined as a localized blood-filled pouch protruding from the true lumen into the thrombosed false lumen; and type IV, completely thrombosed false lumen without ULP. In our study, type I was observed in two patients, type II was observed in one patient, type III was observed in four patients, and type IV was observed in three patients (Table 1). Blood examination revealed leukocytosis in two patients; however, the serum creatinine phosphokinase, lactate dehydrogenase, and C-reactive protein levels were normal. All patients had a history of hypertension, and three were current smokers. Conservative treatment was selected in eight patients with uneventful clinical outcomes. One patient (Case 1) with severe abdominal pain showed morphine resistance, increased leukocyte count (18,860/ μ L) without change in CK levels, SMA occlusion on CTA (Figs. 1A–1C) with contrast failure of the intestines, and signs of intestinal ischemia; he

underwent urgent external iliac artery (EIA)–SMA bypass surgery. In this patient, the SIDSMA morphology was unsuitable for endovascular therapy because of concerns regarding distal embolization and acute occlusion. Another patient (Case 2) with signs of intestinal ischemia underwent urgent angiography. Although there was stenosis in the main trunk of the SMA (Fig. 2A), distal perfusion was sufficiently maintained (Fig. 2B); therefore, conservative treatment was performed, and her abdominal pain was resolved. All patients were regularly followed up using CT at our clinic. To maintain intestinal perfusion, six patients were administered heparin and/or aspirin because the stenosis of the SMA trunk or ULP was detected. These patients were considered at a high risk of occlusion induced by thrombosis events. A bypass graft of saphenous vein graft (SVG) was used in one patient; aspirin was used to prevent the stenosis and occlusion of the graft.

Mean follow-up duration was 24.5 ± 16.5 months, and all patients remained healthy. Follow-up CT revealed that the false lumen was unchanged in six patients, disappeared (Fig. 2B) in three patients, and enlarged (Fig. 1D) in one patient. Anti-platelet therapy was discontinued if the false lumen had disappeared. Except in Case 1, there were no incidences the dilatation or new formation of aneurysm during the follow-up.

Discussion

Historically, SIDSMA has been considered a rare condition. However, recently, SIDSMA has been reported more frequently because of higher detection rates owing to the recent advances in diagnostic imaging technology.¹⁾ The entry point of an SMA dissection frequently starts at 3–4 cm from the point where the SMA branches off of the abdominal aorta because of the large local shear stress induced by the pancreas.³⁾ Hypertension, cigarette smoking, and arteriosclerosis have been considered the main risk factors for SIDSMA.⁴⁾ Several studies^{2,5–7)} have

Table 1 Patient characteristics

No.	Sex	Age (years)	Symptoms	WBC (cells/ μ L)	Type	Hypertension	Treatment
1	Male	60	Abdominal pain, vomiting	18,860	III	+	Open surgery
2	Female	47	Abdominal pain, vomiting	8,200	II	+	Conservative
3	Male	49	Abdominal pain	8,930	III	+	Conservative
4	Male	44	Abdominal pain	7,340	IV	+	Conservative
5	Male	52	Abdominal pain, vomiting	11,400	I	+	Conservative
6	Male	60	Abdominal pain	5,660	III	+	Conservative
7	Male	76	Abdominal pain	6,640	IV	+	Conservative
8	Male	75	Abdominal pain	4,950	III	+	Conservative
9	Male	78	Abdominal pain	4,860	I	+	Conservative
10	Male	75	Abdominal pain	5,040	IV	+	Conservative

Conservative: conservative treatment; WBC: white blood cell; Type: Sakamoto's classification

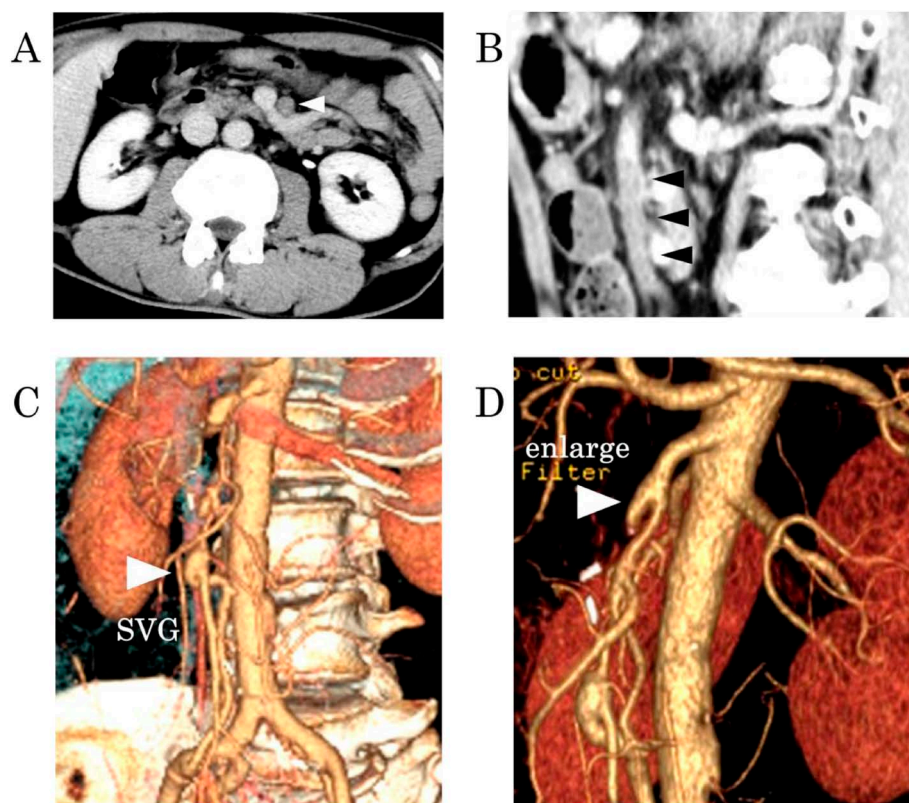


Fig. 1 (A) SMA occlusion (white arrowhead) was induced by the massive thrombosis of the false lumen with poor intestinal wall enhancement preoperatively. (B) SMA occlusion (black arrowheads) was confirmed. (C) SVG without stenosis and occlusion at 1 week postoperatively (white arrowhead). (D) Enlarged false lumen of the dissecting aneurysm confirmed 2 years postoperatively (white arrowhead).

demonstrated that mechanical stress and increasing blood pressure are the most important risk factors for SIDSMA. In acute SIDSMA, blood pressure control is most important because it may decrease the advancement of the dissection.⁸⁾ Well-controlled blood pressure is effective in reducing the risk of dissection progressing to the distal portion of the SMA and/or SMA rupture.

Sakamoto et al. classified SIDSMA into four types according to morphology.²⁾ Yun et al. expanded the classification system of Sakamoto et al. to include the complete occlusion of the SMA.⁹⁾ However, they did not provide sufficient evidence for treatment selection. There are several treatment strategies for SIDSMA, including conservative treatment, endovascular treatment, and open surgery. In 1998, Yasuhara et al. reported the first two patients with SIDSMA without a distal re-entry point, who were successfully managed with conservative treatment.¹⁰⁾ Kim et al. conservatively treated 27 consecutive patients; although some patients showed a ULP or a cul-de-sac-shaped false lumen, they obtained excellent clinical outcomes without any surgical intervention.¹⁾ These results suggest that conservative treatment is the most effective treatment option for SIDSMA patients without intestinal

ischemia. Morphological classification may not be able to guide the clinical treatment selection in the manner that the Stanford classification treatment selection does for aortic dissection.

Sakamoto et al. also recommended conservative treatment as the first-choice therapy for acute SIDSMA.²⁾ Their findings did not contradict the effectiveness of contrast-enhanced CT scan because CT scans can diagnose SIDSMA and differentiate it from other life-threatening acute abdominal conditions. Patients suspected to have a mesenteric vessel disorder should undergo CT with intravenous contrast enhancement, without the risk of contrast-induced renal failure, to improve their survival chances.¹¹⁾ Several authors have reported that after diagnosis, SIDSMA should be conservatively treated. The most important consideration is that the surgeon's "awareness" of the possibility of intestinal necrosis is the key factor that determines the potential success of further treatment.¹²⁾ We surgeons should be attentive to patients' symptoms in such clinical situations because no current plasma marker is sufficiently accurate as an early diagnostic aid.¹¹⁾ In this study, only 2 of the 10 patients experienced sustained abdominal pain after conservative treatment without

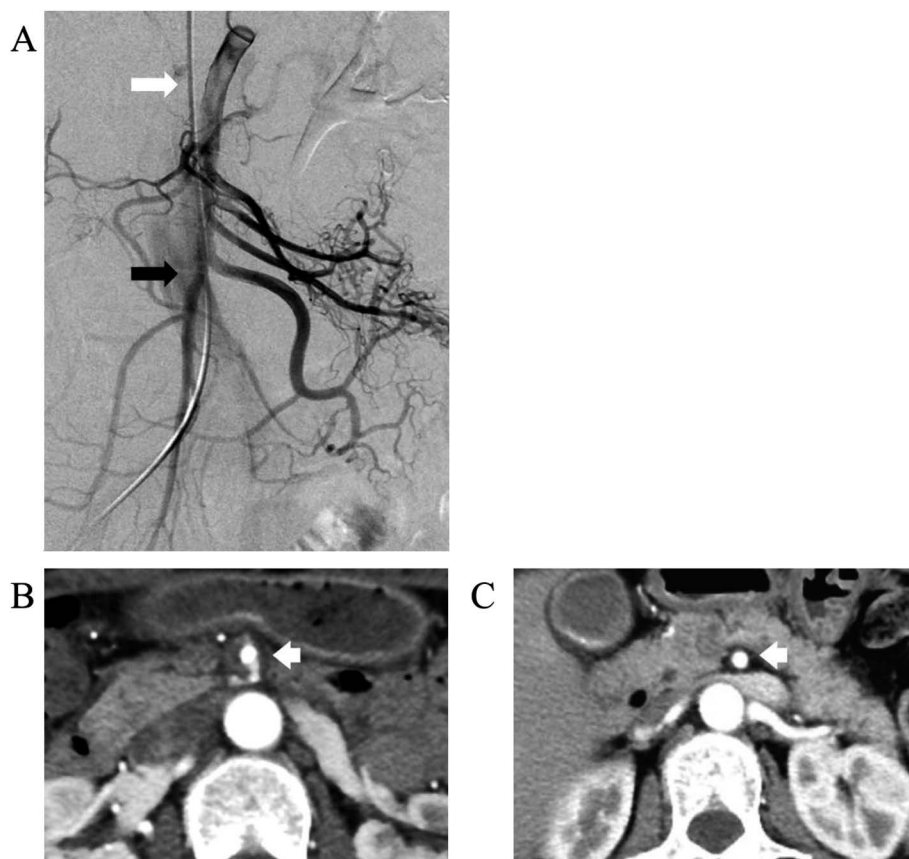


Fig. 2 (A) Angiography revealed no blood flow reduction to the distal portion (black arrow) in spite of SIDSMA (white arrow). (B) SIDSMA with thrombosis of the false lumen (white arrow), without stenosis of the SMA trunk. (C) The false lumen of SIDSMA had disappeared (white arrow).

changes in the clinical parameters. One patient experienced very severe and disproportionately high degree of morphine-resistant pain without any change in clinical parameters, including the advancement of acidosis; however, he underwent EIA–SMA bypass. After the operation, the pain disappeared. Therefore, we suspect that morphine-resistant pain may be a sign of intestinal ischemia before the advancement of acidosis.

Our results support previous reports that recommend conservative treatment for SIDSMA. Further, a morphological classification might be more important for predicting chronic morphological changes that could influence long-term results. To maintain intestinal perfusion, six patients with a high risk of a thrombosis event were administered heparin and/or aspirin. However, there was no sufficient evidence to warrant a recommendation of anticoagulation^{13,14}; thus, further clinical trials are required. Further investigation with more evidence should be conducted to clarify the optimal treatment selection.

Conclusion

Conservative treatment is the most effective solution for the majority of the patients with SIDSMA. Open surgery should be performed in patients with any signs of intestinal ischemia. Long-term follow-up is required to clarify the natural history of SIDSMA, including appropriate medication.

Disclosure Statement

There are no conflicts of interest to disclose. This study received no funding.

Author Contributions

Study conception: ZY, NK

Data collection: ZY, NK

Investigation: ZY, NK

Writing: ZY, NK

Funding acquisition: none

Critical review and revision: all authors

Final approval of the article: all authors

Accountability for all aspects of the work: all authors

References

- 1) Kim HK, Jung HK, Cho J, et al. Clinical and radiologic course of symptomatic spontaneous isolated dissection of the superior mesenteric artery treated with conservative management. *J Vasc Surg* 2014; **59**: 465-72.
- 2) Sakamoto I, Ogawa Y, Sueyoshi E, et al. Imaging appearances and management of isolated spontaneous dissection of the superior mesenteric artery. *Eur J Radiol* 2007; **64**: 103-10.
- 3) Sparks SR, Vasquez JC, Bergan JJ, et al. Failure of nonoperative management of isolated superior mesenteric artery dissection. *Ann Vasc Surg* 2000; **14**: 105-9.
- 4) Jia ZZ, Zhao JW, Tian F, et al. Initial and middle-term results of treatment for symptomatic spontaneous isolated dissection of superior mesenteric artery. *Eur J Vasc Endovasc Surg* 2013; **45**: 502-8.
- 5) Mousa AY, Coyle BW, Affuso J, et al. Nonoperative management of isolated celiac and superior mesenteric artery dissection: case report and review of the literature. *Vascular* 2009; **17**: 359-64.
- 6) Park YJ, Park KB, Kim DI, et al. Natural history of spontaneous isolated superior mesenteric artery dissection derived from follow-up after conservative treatment. *J Vasc Surg* 2011; **54**: 1727-33.
- 7) Katsura M, Mototake H, Takara H, et al. Management of spontaneous isolated dissection of the superior mesenteric artery: case report and literature review. *World J Emerg Surg* 2011; **6**: 16.
- 8) Li Z, Ding H, Shan Z, et al. Initial and middle-term outcome of treatment for spontaneous isolated dissection of superior mesenteric artery. *Medicine* 2015; **94**: e2058.
- 9) Yun WS, Kim YW, Park KB, et al. Clinical and angiographic follow-up of spontaneous isolated superior mesenteric artery dissection. *Eur J Vasc Endovasc Surg* 2009; **37**: 572-7.
- 10) Yasuhara H, Shigematsu H, Muto T. Self-limited spontaneous dissection of the main trunk of the superior mesenteric artery. *J Vasc Surg* 1998; **27**: 776-9.
- 11) Acosta S, Björck M. Modern treatment of acute mesenteric ischaemia. *Br J Surg* 2014; **101**: e100-8.
- 12) Renner P, Kienle K, Dahlke MH, et al. Intestinal ischemia: current treatment concepts. *Langenbecks Arch Surg* 2011; **396**: 3-11.
- 13) Gobble RM, Brill ER, Rockman CB, et al. Endovascular treatment of spontaneous dissections of the superior mesenteric artery. *J Vasc Surg* 2009; **50**: 1326-32.
- 14) Satokawa H, Takase S, Seto Y, et al. Management strategy of isolated spontaneous dissection of the superior mesenteric artery. *Ann Vasc Dis* 2014; **7**: 232-8.