



Clinical course of conservative management for isolated superior mesenteric arterial dissection

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ABSTRACT

Objectives: Isolated superior mesenteric arterial dissection (ISMAD) is an uncommon type of arterial dissection and treated with surgery, stenting, or conservative management. This study aimed to evaluate the criteria for conservative therapy for ISMAD patients based on imaging findings.

Methods: Eighteen consecutive ISMAD patients without peritoneal irritation at onset were retrospectively studied. The decision to perform stenting was based on the emergence of peritoneal irritation, aneurysm, or mesenteric ischemia. Clinical manifestations, follow-up contrast-enhanced computed tomography (CECT) findings, and patient outcome were evaluated.

Results: Most patients (16, 89%) were successfully treated conservatively; two patients (11%) required endovascular stenting because of an aneurysm or ulcer-like projection (ULP) sign. The median duration of fasting and hospital stays was 3 (range, 1–8) and 9 (range, 4–34) days, respectively. On CECT, the median distance from the superior mesenteric artery (SMA) origin to the entry site was 12 mm (range, 5–35 mm), and the median length of dissection was 87.5 mm (range, 20–150 mm). Among 16 patients treated conservatively, serial imaging was obtained in 11 patients (69%), and disappearance of the dissection within 4 months occurred in five patients. Two patients treated with endovascular stent underwent follow-up CECT 1 year after onset, and there were no complications.

Conclusions: ISMAD patients without peritoneal irritation can be treated conservatively if there are no signs of an aneurysm, ULP, or mesenteric ischemia. When an aneurysm or ULP sign exists, endovascular stenting was able to preserve SMA blood flow with the improvement of the dissection.

1. Introduction

Isolated superior mesenteric arterial dissection (ISMAD) is an uncommon arterial event first reported by Bauersfeld et al. in 1947 [1]. Foord et al. reported an ISMAD incidence of 0.06% in autopsy cases [2]. There are various treatment options for ISMAD including surgery, endovascular stenting, and conservative management. Although most cases with mild symptoms can be successfully managed with conservative regimens [3–6], endovascular stenting [7–12] and surgical intervention [13] may be required. Invasive treatment is highly recommended in patients with the following characteristics: abdominal

pain lasting for more than 5–7 days [7,8,12,13], true lumen occlusion greater than 80% [7], aneurysm dilatation more than 20 mm [7], signs of ruptured aneurysm [14] or mesenteric ischemia [13,14], and evidence of peritonitis [8,10].

Thus far, there has been no consensus on the optimal therapy for ISMAD, and its management is highly dependent on physician experience. The aim of this single-institution, retrospective study was to assess the border of conservative treatment and endovascular treatment. Herein, we report a consecutive series of 18 ISMAD cases and discuss therapeutic strategies based on clinical manifestations and contrast-enhanced computed tomography (CECT) findings.

Abbreviations: CECT, contrast-enhanced computed tomography; ISMAD, isolated superior mesenteric arterial dissection; SMA, superior mesenteric artery; ULP, ulcer-like projection

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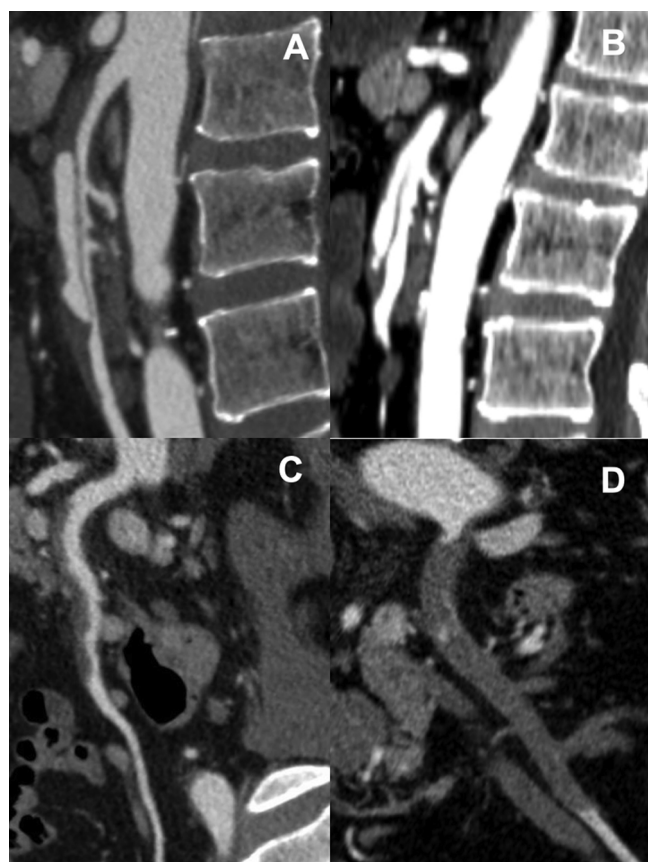


Fig. 1. Contrast-enhanced computed tomography findings of isolated superior mesenteric arterial dissection. A. Type I, patent true and false lumen revealing entry and re-entry sites. B. Type IIa, patent true and false lumen without re-entry. C. Type IIb, patent true lumen but thrombosed false lumen. D. Type III, superior mesenteric artery occlusion.

2. Materials and methods

Ethical approval for the study was obtained from the institutional review board at our hospital (#TGE00991-012), and participants provided informed consent. From January 2009 to December 2017, 19 patients were diagnosed with ISMAD by CECT at Sapporo Higashi Tokushukai Hospital. One patient who was not hospitalized at our institution due to a lack of vacancy was excluded. Finally, we retrospectively reviewed 18 patients. All patients were treated conservatively following the diagnosis. Patient characteristics such as past and current medical history and manifestations were assessed.

In the analysis of CECT data, distance from the superior mesenteric artery (SMA) origin to the entry site and length of the dissection were measured on both axial and sagittal views. The presence of an aneurysm or ulcer-like projection (ULP) sign [9], which is defined as a small blood sac sticking out from the true lumen into the thrombosed false lumen, was determined using the sagittal view. ISMAD cases were categorized into four types according to Yun's classification (Fig. 1) [4], which consists of simple and commonly used criteria [15]. Three radiologists evaluated all CECT images.

Conservative treatment included bowel rest and fluid resuscitation but not antiplatelet or antithrombotic therapy. This is because many authors concluded that antiplatelet or antithrombotic therapy was not effective [4,7,13,16]. After the disappearance of abdominal pain, water intake was permitted. Antihypertensive treatment was administered to patients who had hypertension to reduce systolic blood pressure below 120 mmHg. Follow-up CECT (1 week, 2 weeks, 1 month, 6 months, and 1 year after onset) was planned for all 18 patients. In cases involving an

Table 1
Patient characteristics and clinical features.

Features (n = 18)	
Median age (range, years)	51 (42–66)
Male	18 (100%)
Coexisting medical conditions	
Smoking	13 (72.2%)
Hypertension	12 (66.7%)
Dyslipidemia	4 (22.2%)
Diabetes mellitus	1 (5.6%)
Symptoms	
Sudden onset	14 (77.8%)
Insidious onset	4 (22.2%)
Upper abdominal pain	18 (100%)
Back pain	6 (33.3%)
Other symptoms	
Vomiting	1 (5.6%)
Diarrhea	2 (11.1%)
Bloody stool	1 (5.6%)
Treatments	
Conservation only	16 (88.9%)
Conservation and stenting	2 (11.1%)
Median time	
Symptoms duration (range, hr)	29.5 (6–190)
Fasting time (range, day)	3 (1–8)
Length of stay (range, day)	9 (4–34)
ISMAD features on CECT (Yun's classification)	
I	3 (16.7%)
IIa	1 (5.6%)
IIb	10 (55.6%)
III	4 (22.2%)
Median distance from the SMA origin to the entry site (range, mm)	12 (5–35)
Median length of dissection (range, mm)	87.5 (20–150)

ISMAD, isolated superior mesenteric arterial dissection.

CECT, contrast-enhanced computed tomography.

SMA, superior mesenteric artery.

endovascular procedure, to prevent a stent stenosis, antiplatelet therapy with clopidogrel 75 mg per day for 1 month and aspirin 100 mg per day for 6 months postoperatively was prescribed.

3. Results

Clinical characteristics of the 18 patients are summarized in Table 1. All patients were men, with a median age of 51 years (range, 42–66 years). The rates of smoking history (13 patients, 72%) and hypertension (12 patients, 67%) were high. All patients complained of abdominal pain without peritoneal irritation symptoms such as muscular defense or rebound tenderness, and six patients (33%) had back pain. The patients were classified into four types according to Yun's classification [4]: type I (3, 17%), IIa (1, 6%), IIb (10, 56%), and III (4, 22%). The median distance from the SMA origin to the entry site was 12 mm (range, 5–35 mm), and the median length of dissection was 87.5 mm (range, 20–150 mm).

The median duration of abdominal pain was 29.5 (range, 6–190) hours. The median durations of fasting and hospital stay were 3 (range, 1–8) and 9 (range, 4–34) days, respectively. Among 16 cases treated conservatively, serial imaging was obtained in 11 cases (69%) during 4–116 months of follow-up, and complete disappearance of the dissection was observed in 5 cases, all type IIb, within 4 months (Fig. 2, Table 2).

Two patients (11%) newly developed an aneurysm or ULP sign and consequently underwent endovascular stenting. One patient had type IIa ISMAD associated with a newly developed 15 mm × 9 mm aneurysm at day 11. The aneurysm increased in size, reaching 21 mm × 14 mm at day 23. Considering the risk of rupture [9,17], we performed

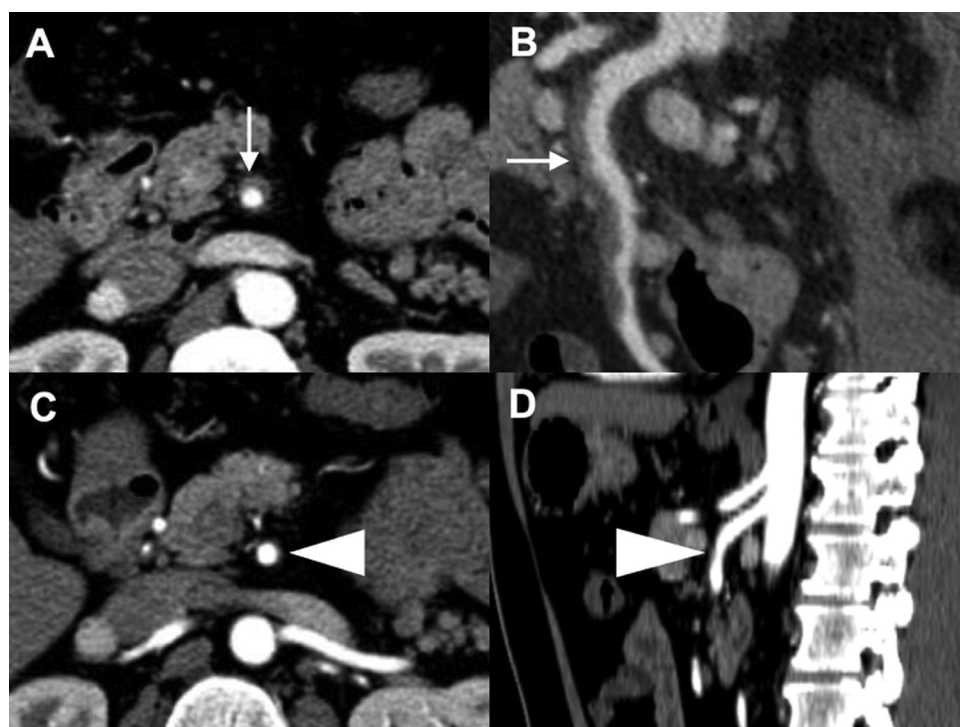


Fig. 2. (Case no. 12) Type IIb isolated superior mesenteric arterial dissection (ISMAD). A & B. Contrast-enhanced computed tomography showing ISMAD with patent true lumen and thrombosed false lumen at the time of onset (white arrows). C & D. The thrombosed false lumen had completely disappeared 82 days later (white arrowheads).

Table 2
Follow-up CECT results of 11 patients after conservative treatment.

Yun's classification	Before treatment (n = 11)	Complete disappearance (n = 5)
I	2	NA
IIa	0	NA
IIb	7	5
III	2	NA

CECT, contrast-enhanced computed tomography.

NA, not available.

Cases observed by serial CECT imaging over more than 4 months.

endovascular treatment followed by antiplatelet therapy. Following two stenting procedures on the SMA via femoral access, we performed coil embolization by inserting a micro-catheter from a gap of the stent into the aneurysm (Fig. 3 and Table 3). Another patient had type IIb ISMAD with a newly developed 4 mm × 2 mm ULP sign at day 10. At day 24, it increased to 8 mm × 4 mm in size. We therefore performed endovascular treatment on the SMA through a trans-femoral artery approach followed by antiplatelet therapy (Fig. 4 and Table 3). In both patients, endovascular treatment succeeded, and the aneurysm was thrombosed and ULP sign disappeared. Postoperatively, complications or recurrence did not occur during the 14- and 12-month follow-up periods. Mesenteric ischemia did not occur in any patients during the follow-up period.

4. Discussion

In our retrospective study, most patients (16, 89%) were successfully treated conservatively; two patients (11%) required endovascular stenting because of an aneurysm or ULP sign. All 18 patients were alive and had no complications during the follow-up period.

ISMAD may be complicated by aneurysms [7,12,14,16,18,19], ruptured aneurysms [9,16,20], mesenteric ischemia [9], and mesenteric necrosis [13,16]; therefore, several treatments may be considered. As the primary treatment for symptomatic ISMAD, some authors have recommended conservative treatment [3–6,21], while others

endovascular treatment [16,22–24]. However, there is no consensus regarding decision-making for the appropriate therapy.

In our series, with conservative management, abdominal pain disappeared within 8 days in all patients. Another study of 27 patients demonstrated that abdominal pain could be relieved by conservative therapy within 2 weeks [5]. Thus, these studies indicate that conservative treatment may be appropriate for 2 weeks in cases without an aneurysm or ULP sign, mesenteric ischemia, or peritoneal irritation. We therefore propose an algorithm for decision-making in patients with ISMAD based on symptoms and radiographic appearance (Fig. 5); patients without mesenteric ischemia or peritoneal irritation can be treated conservatively, whereas presence of aneurysm or ULP sign requires endovascular stenting. Invasive treatment may be useful in cases involving an aneurysm larger than 20 mm or ULP sign.

Even cases with true lumen occlusion exceeding 80% are not always candidates for invasive treatment. Kim et al. reported increased stenosis of the true lumen 1 week after the diagnosis of ISMAD in 16 patients including 9 with SMA occlusion, all of whom were treated conservatively [5]. Another study demonstrated that conservative treatment could be applied even in cases involving complete compression of the true lumen by the false lumen, as long as distal blood flow was preserved [6]. In our series, although the true lumen was completely occluded in four type III patients, the distal blood flow was maintained, and these patients were treated conservatively. Hence, conservative treatment may be possible as long as distal blood flow can be detected, even if stenosis of the true lumen is severe.

Luan et al. considered endovascular stenting the best option for ISMAD because it could provide immediate symptom relief with shorter fasting time and good long-term results [16]. A significant benefit of endovascular stenting was also demonstrated by several other reports (Table 4) [7,10,12]. However, negative effects of the interventional approach, such as failure to place the stent in the right position [8,10] and late restenosis [4,13,22], may emerge. Therefore, although stenting has a significant therapeutic effect, it requires long-term antiplatelet administration, resulting in a high medical cost [6].

Follow-up is necessary not only during the acute stage but also in the long term. There have been reports of dissection disappearance [8,9,13,25], which occurred more often in thrombosed false lumen than

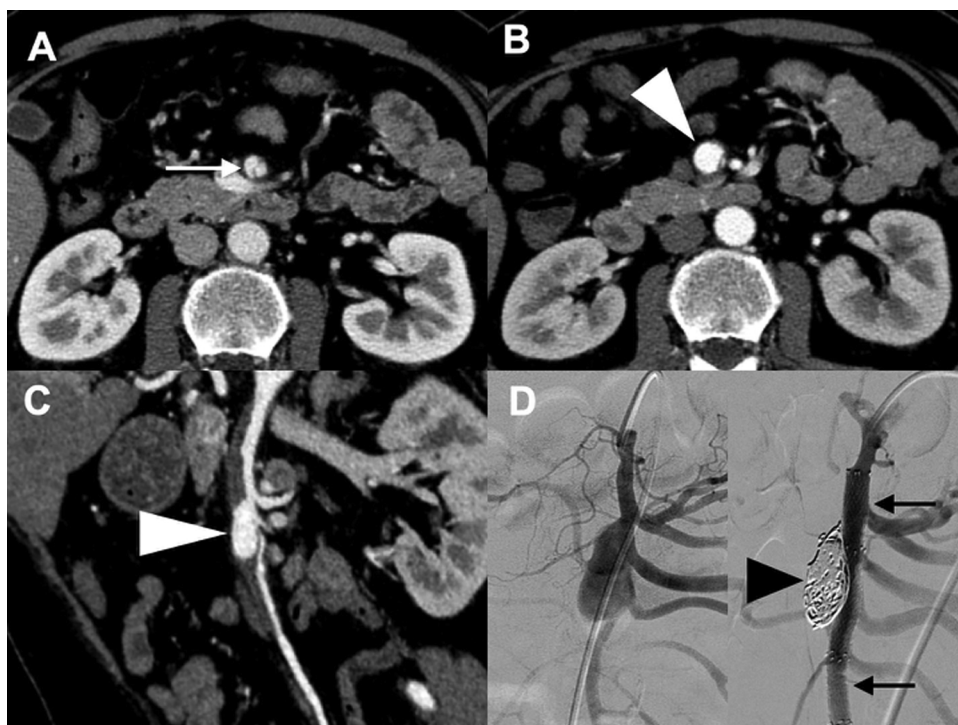


Fig. 3. (Case no. 17) Contrast-enhanced computed tomography and angiography images of a patient with type IIa isolated superior mesenteric arterial dissection. A. Axial view at day 1. The white arrow indicates patent false lumen. B. An aneurysm emerged at day 11 (white arrowhead). C. At day 23, the aneurysm size increased during conventional therapy (white arrowhead). D. Angiography image of the aneurysm before (left panel) and after treatment (right panel; black arrows indicate two stents and black arrowhead indicates the endovascular coil for embolization).

Table 3

Stents and coils used at the endovascular treatment.

Case	Stent	Coil
No.17	LIFE STENT ϕ 6 mm $\times$ 40 mm (1) SMART CONTROL STENT ϕ 6 mm $\times$ 60 mm (1)	Target coil 14 mm $\times$ 50 cm (1) Target coil 10 mm $\times$ 40 cm (1) Target coil 9 mm $\times$ 30 cm (2) Target coil 7 mm $\times$ 20 cm (1)
No.18	INNOVA STENT ϕ 8 mm $\times$ 40 mm	no coils

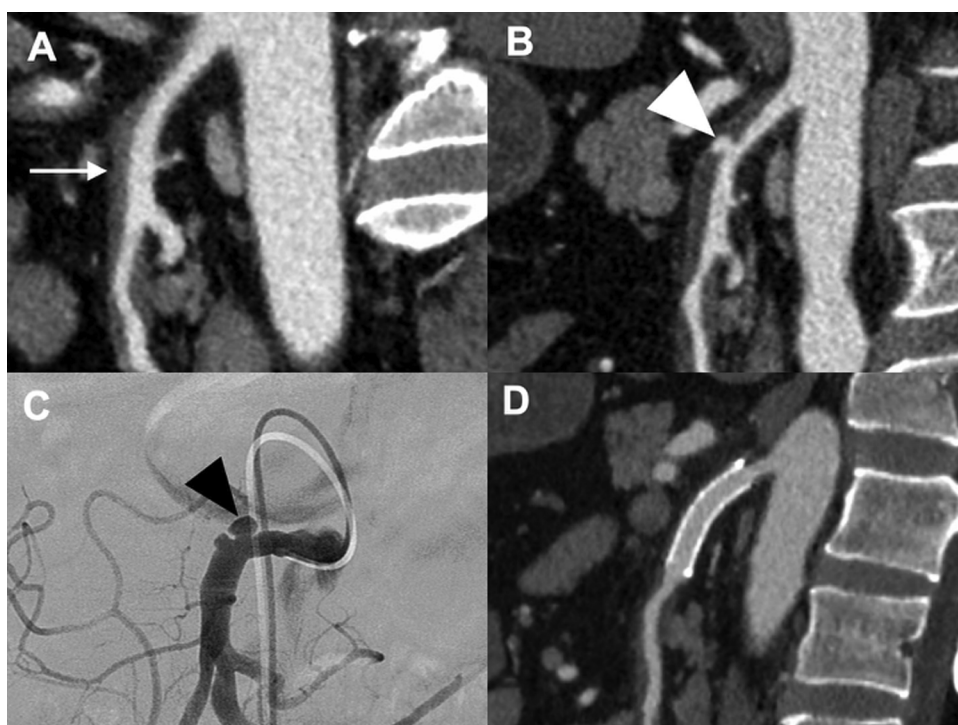


Fig. 4. (Case no. 18) Contrast-enhanced computed tomography (CECT) and angiography images of a patient with type IIb isolated superior mesenteric arterial dissection. A. Sagittal view at day 1. The white arrow indicates thrombosed false lumen. B. CECT indicated an ulcer-like projection (ULP) sign at day 24 (white arrowhead). C. Angiography showed ULP sign at day 28 (black arrowhead). D. CECT was performed 1 month later after endovascular stenting. The ULP sign had disappeared.

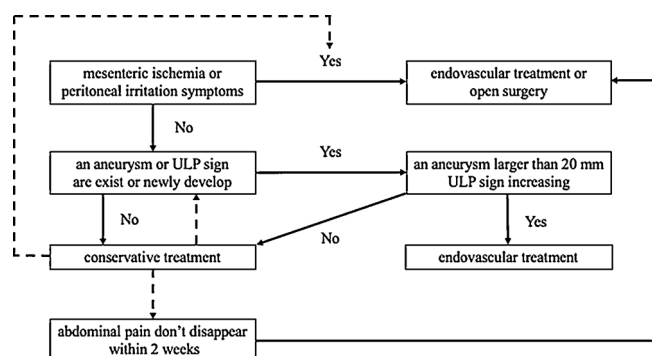


Fig. 5. Algorithm of the treatment for isolated superior mesenteric arterial dissection.

in patent false lumen [9,13,25]. Park et al. found that most dissection disappearance on CT occurred within 6 months [13]. In our series, ISMAD completely disappeared by conservative treatment in five type IIb patients within 4 months. On the contrary, there have been cases of new aneurysm development 4 months later [19] and of the development of bowel necrosis after 6 months that was treated with open surgery [13], suggesting a requirement of careful surveillance even after symptom relief.

This study has several limitations. First, it is a retrospective study in a single institution with a limited number of patients. Although we confirmed that all 18 patients were alive and had no complications during the follow-up period, data from blood tests and serial imaging of several patients were insufficient. Second, our series did not include severe cases with peritoneal irritation or mesenteric ischemia. Hence, we could not establish a definitive conclusion regarding the cases for which invasive treatment is highly recommended at the time of diagnosis. For future investigations, we intend to perform blood tests including lactate at the time of diagnosis and follow-up serial imaging in all ISMAD patients even at least for 1 year.

In conclusion, based on our 9-year single-institution experience with ISMAD, patients without peritoneal irritation can be treated conservatively when signs of an aneurysm, ULP, or mesenteric ischemia are not evident. However, endovascular stenting must be considered when radiographic signs of an aneurysm or ULP are observed to preserve SMA blood flow with the improvement of the dissection.

Author agreement

All authors agree submission of this article.

Competing financial interests

The authors declare no competing financial interests.

Table 4

Comparison of fasting time and length of hospital stay between conservative treatment and endovascular stenting.

Authors		Conservative treatment successful as a primary treatment	Endovascular stenting successful as a primary treatment
Min et al. [9]	n	7	4
	Median fasting time (range, days)	8.0 (2–18)	2.5 (1–4)
Pang et al. [12]	n	3	7
	Median fasting time (range, days)	9	3
	Median length of stay (range, days)	14	5.5
Jia et al. [14]	n	12	3
	Median fasting time (range, days)	8.5 (4–14)	3.5 (2–5)

n, number of patients.

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Guarantor

Tomoyuki Ohta, Director of Sapporo Higashi Tokushukai Hospital.

Conflict of interest

The authors of this manuscript declare no relationships with any companies, whose products or services may be related to the subject matter of the article.

Statistics and biometry

No complex statistical methods were necessary for this paper.

Informed consent

Ethical approval for the study was obtained from the institutional review board at our hospital (#TGE00991-012), and participants provided informed consent.

Ethical approval

Institutional Review Board approval was obtained.

Study subjects or cohorts overlap

Study subjects or cohorts have not been previously reported.

Methodology

- retrospective
- diagnostic or prognostic study / observational
- performed at one institution

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ejro.2019.05.004>.

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