Isolated dissections of the visceral arteries. Management and outcomes

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Abstract:

Background: The wide application of computer tomography angiography (CTA) in the diagnostic evaluation of abdominal pathologies identifies an increasing number of isolated dissections of mesenteric arteries (IMAD). Despite the recent ESVS guidelines, IMAD management is still controversial. The aim of this retrospective study was to assess all cases diagnosed with IMAD, symptomatic and asymptomatic, in two tertiary vascular centers and present the therapeutic strategies used.

Methods: This is a two-center retrospective analysis of patients who presented IMAD from 2013-2019. All patients were assessed with CTA at presentation and follow up. Patients received conservative treatment initially, while some of them who remained symptomatic underwent a subsequent endovascular intervention.

Results: Fourteen patients presented with IMAD; 11 symptomatic and 3 asymptomatic. CTA revealed a dissection of the celiac trunk (2 symptomatic) or the superior mesenteric artery (SMA) (12 patients; 9 symptomatic). All symptomatic patients were initially treated conservatively with food restriction and antithrombotic therapy. Two patients with SMA dissection, who clinically deteriorated, underwent endovascular intervention using stents. One patient suffered a mild ischemic colitis that was managed conservatively with a complete recovery. The rest of the symptomatic patients were discharged showing clinical improvement. A short-term anticoagulant therapy was prescribed (1 month) with a long-term single antiplatelet therapy thereafter. Asymptomatic patients initiated single antiplatelet therapy and remained under close surveillance. During follow-up (range 6-60 months), all patients remained asymptomatic and serial imaging confirmed the stabilization or improvement of the dissection.

Conclusion: IMAD should be considered in the differential diagnosis of acute abdominal pain. CTA is the preferred method for diagnosis and follow-up. Conservative treatment seems to be a safe and efficient option, while an endovascular procedure could be attempted in persistent symptomatology.

INTRODUCTION

Isolated mesenteric artery dissections (IMAD), including the superior mesenteric artery and celiac trunk, are uncommon arterial lesions, with low incidence in the general population.[1,2] It may be asymptomatic or associated with acute abdominal pain, which is the commonest symptom, and/or mesenteric ischemia.[1,2] During the last decades, the widespread use of new imaging modalities as computed tomography and magnetic resonance imaging has permitted the immediate diagnosis of the disease in symptomatic patients, while asymptomatic dissections have been detected incidentally during investigation of other pathologies.[1]

Different management approaches have been described for the treatment of IMAD, including open surgery, stenting and conservative management.[2] Asymptomatic and patients with mild symptoms may be successfully treated with conservative measures while persistent or worsen abdominal pain may require an interventional approach.[2] However, and despite the quite recent ESVS guidelines, at the moment, there is no consensus on the optimal therapy for IMAD, as all existing evidence stems from case series studies.[1]

The aim of this retrospective study was to assess all cases diagnosed with IMAD, symptomatic and asymptomatic, in two tertiary vascular centers and present the therapeutic strategies used.

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ISSN 1106-7237/ 2019 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications

METHODS

Patients' characteristics and imaging

Between September 2013 and August 2019, 14 patients were diagnosed with IMAD in two tertiary centers and were analyzed retrospectively. Demographics, clinical evaluation, anatomical characteristics, location of the dissection (SMA or CT), medical management, and patients' outcomes were recorded prospectively. Patients divided in symptomatic and asymptomatic according to the presence of clinical symptoms and signs at the time of evaluation. All patients were assessed with computed tomography angiography (CTA) of the abdominal aorta down to the femoral arteries at presentation and follow-up in order to verify the diagnosis and course of the lesion. All patients underwent food restriction until symptoms' relief and clinical stabilization. In case of symptoms' deterioration, despite the conservative management, endovascular treatment was attempted as the first treatment option, keeping as back-up treatment the conventional open surgery. Sizing and planning for any endovascular procedures were performed using a workstation with 3Mensio dedicated reconstruction software (Medical Imaging B.V., Bilthoven, Netherlands).

Medical management

In patients with asymptomatic IMAD, conservative management was the initial and definitive approach. In all patients, where dissection was diagnosed through medical imaging and referenced no present symptoms (considered as chronic dissections), antiplatelet treatment with aspirin 100mg per day initiated along with antihypertensive control medication and statin therapy. In cases were symptoms were present at diagnosis, treatment with low molecular weight heparin (LMWH) or unfractionated heparin (UFH) initiated, according to the severity of symptoms and the possible need for further intervention. Conservative treatment continued until symptoms were resolved. Patients with deterioration of symptoms that were not responding to medical treatment were considered for endovascular intervention.

Technical details

Patients that underwent an endovascular intervention were treated in an adequately equipped operating room using a mobile digital angiographic system (Philips BV Pulsera, Philips Medical Systems, Netherlands) or an angiographic suite (Allura Xper FD 20, Philips, Netherlands). Access was achieved with open exposure or ultrasound-guided percutaneous puncture according to surgeon's preference and patient's anatomical characteristics. An upper access site from the left brachial artery or a standard femoral access was decided according to patient's anatomy.

A hydrophilic 0.035'' or/and 0.014'' and 0.018'' guidewire was inserted to the true lumen of the dissected vessel and it was exchanged with a standard PTFE-coated guidewire after access. After the insertion of a 7mm x 45 or 65cm sheath (Arrow, Teleflex, USA) into the artery, a diagnostic arteriography was accomplished. A covered stent graft (Be-Graft, Bentley, Innomed, Germany or Viabahn, Gore, USA) was, then, adjusted and deployed into the true lumen over a stiff guidewire. Covered stents were preferred to prevent distal embolization while balloon expandable stents were chosen in cases were a strict adjustment to the lesion was demanded. In case of long dissection, self-expanding bare metal stents were used to preserve patency. Final angiography was used to confirm adequate placement and patency intra-operatively.

Follow-up and post-operative imaging surveillance

In symptomatic patients, a LMWH was continued for the 1st month of follow-up, exchanged to single antiplatelet therapy with aspirin 100mg once per day as a long-term antithrombotic regimen. Patients treated with endovascular means underwent double antiplatelet therapy for 3 months and continued with single antiplatelet agent thereafter. All patients underwent clinical evaluation and CTA as the standard imaging method for the 30-day, 6-month and 1st-year of follow-up. Duplex ultrasonography was additionally used to evaluate the flow and any stent-graft malformation in patients treated endovascularly.

RESULTS

Fourteen patients were presented with IMAD; thirteen were males with a mean age 60.5 years (range 54-72 years). Patients' pre-operative comorbidities are presented in Table I. All patients had hypertension under treatment and were previous smokers. In the only female patient, a concomitant isolated dissection of the right common iliac artery was detected in CTA. Pulses were present in both femoral arteries and patient did not present symptoms of limb ischemia or intermittent claudication. Twelve patients were symptomatic and two asymptomatic. All patients underwent CTA which revealed a dissection of the mesenteric arteries. Two patients suffered from celiac trunk dissection and were both symptomatic (Figure 1) and the remaining, from superior mesenteric artery dissection (Figure 2). In this group, 9 presented symptoms at diagnosis and 3 were asymptomatic. The clinical presentation was acute diffused abdominal pain, with post-prandial exertion. In symptomatic cases, patients avoided food consumption while 2 patients referred excessive weight loss in a short time period. Clinical evaluation revealed abdominal tenderness and decreased bowel bruits. Episodes of vomits, nausea and diarrhea associated with episodes of constipation were also recorded (Table I).

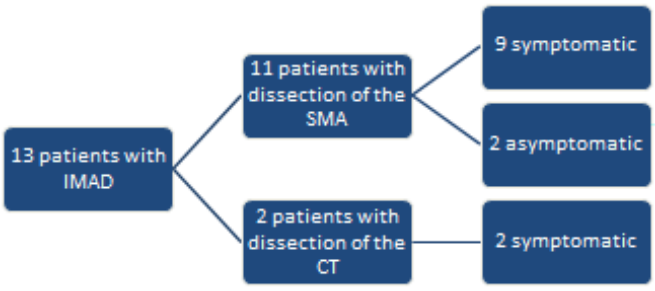

Figure 1. Distribution of isolated mesenteric artery dissection (IMAD) among patients. All dissections of the celiac trunk (CT) were symptomatic while 10 out of 12 patients with superior mesenteric artery (SMA) dissection presented symptoms.

As recorded previously, asymptomatic patients initiated single antithrombotic treatment with aspirin and statin therapy. A close control of blood pressure was also demanded. All asymptomatic patients remained under close surveillance. In symptomatic patients, food restriction was the initial measure along with subcutaneous LMWH or even UFH when clinical or laboratory deterioration was remarked. Statin therapy and hypertension control were also included in the standard conservative approach. Symptomatic patients were discharged showing clinical improvement. Hospitalization of symptomatic patients, that were conservatively treated, ranged between 5 to 9 days. A short-term anticoagulant therapy was prescribed (1 month) with a long-term single antiplatelet therapy (aspirin 100mg per day) to be continued thereafter.

Patient no	Age (years)	Sex	Abdominal symptoms	Accompanying symptoms	Comorbidities
1	50	M	Sudden severe periumbilical pain	Nausea	Hypertension Solitary kidney Smoking
2	67	M	Sudden moderate epigastric	Nausea Vomiting Anorexia	Hypertension Dyslipidemia Obesity Smoking
3	54	M	Sudden moderate periumbilical pain	Anorexia	Hypertension Dyslipidemia Smoking
4	56	M	Sudden moderate periumbilical pain	Nausea	Hypertension Dyslipidemia Smoking
5	69	M	Moderate diffused abdominal pain	Nausea	Hypertension Obesity Smoking
6	67	M	Sudden diffused pain	Nausea	Hypertension Smoking
7	52	M	None	None	Hypertension Diabetes Smoking
8	50	M	Post-prandial epigastric pain	Weight loss	Hypertension Smoking
9	69	M	None	None	Hypertension Smoking
10	63	M	Sudden abdominal pain with back irradiation	Anorexia	Hypertension Smoking
11	72	M	Sudden peri-umbilical pain Hematochezia	Diarrhea	Hypertension Smoking Abdominal aortic aneurysm
12	55	F	Mild sudden peri-umbilical pain	None	Hypertension Smoking
13	70	M	Mild diffused abdominal pain	Anorexia	Hypertension Dyslipidemia Smoking
14	54	M	Moderate post-prandial peri-umbilical pain	Weight loss	Hypertension Smoking

Table I. Patients' demographic characteristics and clinical presentation

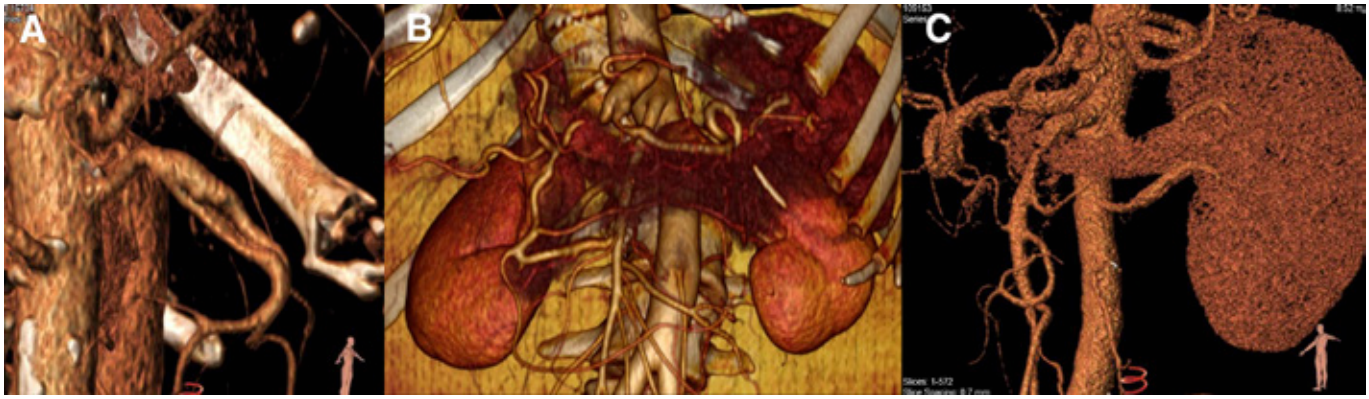

Figure 2. In Panel A, a dissection of the SMA was detected in the diagnostic CTA. This patient remained asymptomatic. In Panel B, a dissection of the CT was diagnosed. Both patients that suffered a CT dissection were symptomatic. In Panel C, another case of dissected SMA in a symptomatic patient was revealed. The patient suffered from hematochezia but recovered completely with conservative management.

Three patients deteriorated during hospitalization. In the first case, a 72-year old male patient presented ischemic colitis with episodes of hematochezia. UFH was preferred to this patient for a better control of anticoagulation and the flexibility of the medication in case of operation. The patient remained under close monitoring for 4 days when symptoms relief was achieved. He was discharged the 8th day, in a good general condition under anticoagulant treatment with LMWH. We should refer that this patient suffered also from an abdominal aortic aneurysm which was treated electively 3 months after the episode of dissection. No sign of dissection of the aorta was recorded in the CTA.

Two patients that presented severe clinical deterioration despite conservative management as described above, with excessive abdominal pain, significant weight loss and inability to eat, probably due to insufficient collateral circulation, finally underwent endovascular intervention. Both cases were undertaken under local anesthesia with monitor assisted anesthesiological control. Systemic heparinization was administrated after sheath insertion (50-100IU/kg). In the first case, a left brachial artery access with open exposure was decided while an ultrasound guided percutaneous femoral access was chosen for the second patient. In the first case, a self-expanding covered stent 8mm x 50mm (Viabahn, Gore, USA) was deployed into the proximal SMA. A post-dilatation was performed using an 8mm balloon. Final angiography confirmed the false lumen occlusion and SMA patency (Figure 3). In the second patient, catheterization was challenging due to the total occlusion of the proximal SMA. A .018' guidewire was used to pass through the occluded segment, then carefully driven in the true lumen of the artery and finally, exchanged with a stiffer wire (Rosen, Cook, USA). A balloon expandable covered stent 8mm x 37mm (Be-Graft, Innomed, Germany) was deployed at the proximal part of the SMA. Angiography revealed a decreased lumen at the middle portion of the artery and a self-expanding bare metal stent 8mm x 60mm (E-luminexx, Bard, USA) had to be used to address this problem, while also preserving a large branch coming out from this part of the vessel (Figure 4). Completion angiography confirmed the adequate position of the stents and the patency of SMA. The operational time was 90 min while the mean contrast volume was 45ml. Overall technical success was 100%. Both patients were transferred post-operatively to the ward. Liquid consumption started the 1st post-operative day and a complete diet was initiated the 2nd one. Both patients were discharged the 4th post-operative day and remained asymptomatic after operation with an immediate weight gain. A double antiplatelet therapy was initiated after the procedure and up to 3rd month in order to preserve stent patency.

Figure 3. A patient with a symptomatic SMA dissection and persistent symptoms despite medical management underwent an endovascular approach, using a self-expanding stent. In panel A, diagnostic angiography confirmed the dissection intra-operatively while in panel B, the deployment of the stent graft was technically successful.

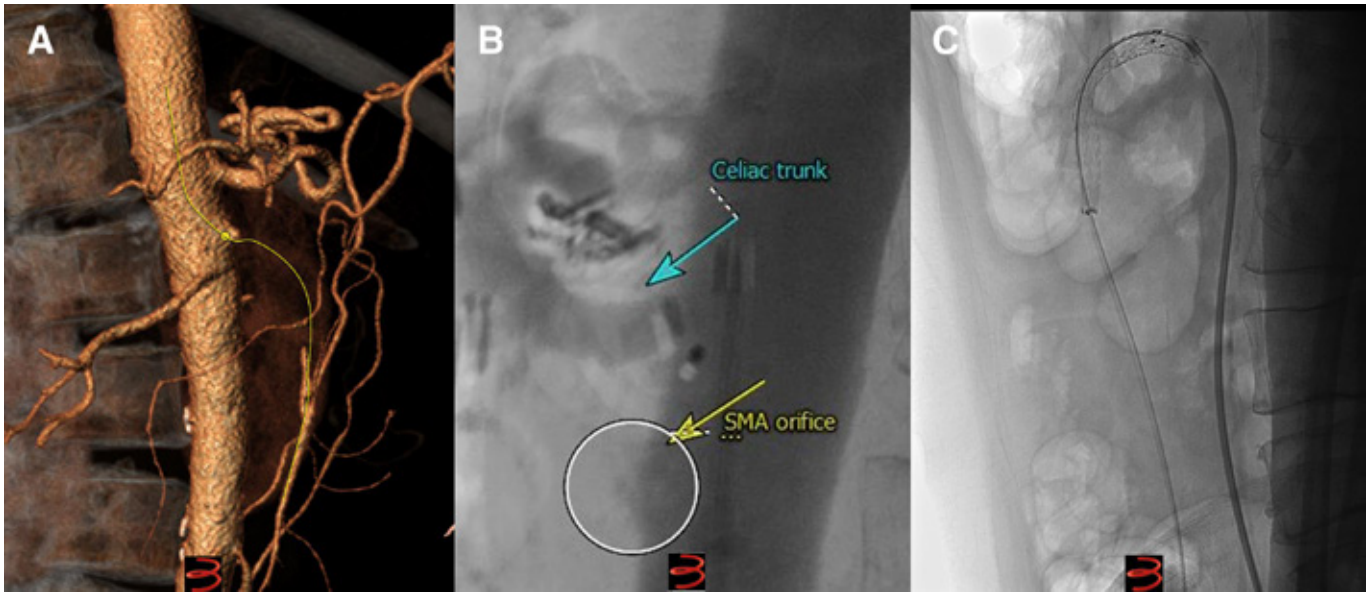

Figure 4. In the second case, technical issues were raised, as the SMA was completely occluded a few millimeters after its orifice (Panel A and B). The catheterization was achieved using a .018' guidewire. A balloon expandable stent was used proximally and a further stenting with a self-expanding stent was deployed in the middle portion of the SMA to preserve branch patency (Panel C)

Follow-up was ranging between 6 and 72 months. All patients remained asymptomatic and serial imaging confirmed the stabilization or improvement of the dissection. Patients that underwent intervention were also stable while a complete thrombosis of the false lumen achieved in both cases. The first patient completed 5 years of uneventful follow-up (Figure 5) while the second patient, 6 months (Figure 6).No re-intervention, colonic ischemia event, major cardiovascular adverse event or death was recorded. No stent compression, restenosis or migration was revealed in follow-up CTAs.

Figure 5. The first patient that underwent endovascular treatment, completed 5 years of uneventful follow-up. CTA revealed adequate stent position, SMA patency and dissection disappearance.

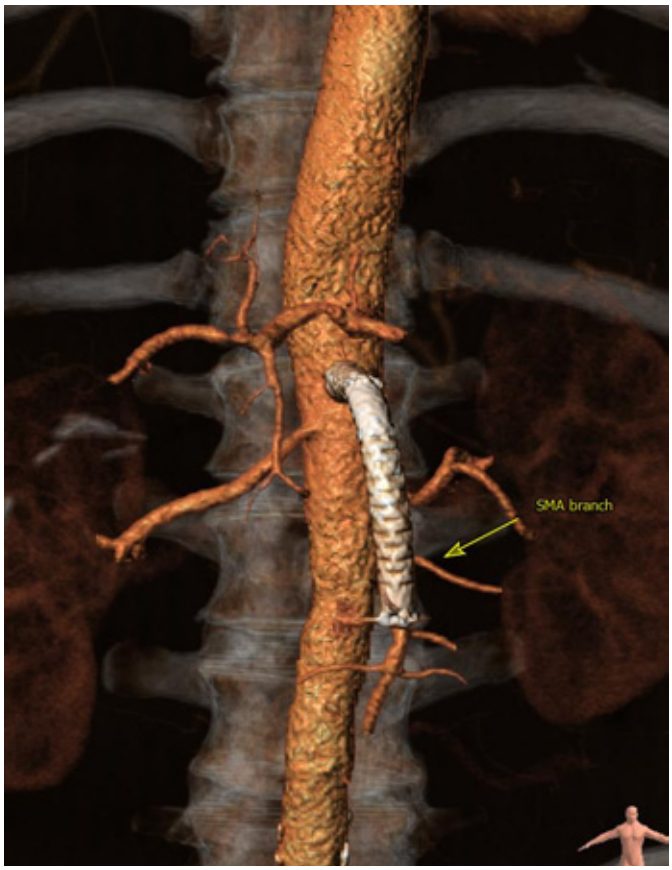

Figure 6. The second case that was treated using stent completed 6 months of follow-up. No complication was recorded. CTA revealed stent and SMA patency. The smaller branches of the SMA were successfully preserved (yellow arrow).

DISCUSSION

IMAD is a rare cause of acute abdominal pain. As in this study, the disease affects middle-age male patients.[1] In this analysis, mean age was estimated at 60.5 years ranging between 54-72 patients while 13 out of 14 patients were males. The incidence of the disease is estimated at 0.09% of all abdominal contrast-enhanced CTs and 0.68% of all CT scans accomplished for the evaluation of acute abdominal pain.[3] The prevalence of the disease is higher in Asian populations, especially from developed areas.[1,4] The majority of the literature is conducted in Far East countries, a fact reflecting the geographical distribution of the disease.[1,4] IMAD affects mainly middle age male patients while hypertension is the commonest comorbidity and the prevalence of diabetes may be lower in this group.[1,4] However, the specific etiology of the disease is not yet defined.[1] Acute abdominal pain is the commonest symptom and affects more than 90% of these patients.[4] In the European population, and furthermore in Greece, there no epidemiological data concerning IMAD and its specific characteristics.

As current information raise from case series and retrospective analyses, the best treatment option is not clear.1In the latest European Guidelines, the suggested management options have a level C of evidence.1 It has been proposed that asymptomatic patients should be treated conservatively with antiplatelet agent, statin and antihypertensive control.[1,5] These patients seem to have an uneventful follow-up with regression or stabilization of the dissection in 90% of them.[3] Conservative management may be successfully applied also in symptomatic patients, even without anticoagulation.[6,7,8] In this study, asymptomatic patients (21%) have been treated as indicated by the guidelines with single antiplatelet agent and statin. No development of symptoms or other complication has been recorded in this group. Along this line, the majority of symptomatic patients (10/13, 79%) had a regression of symptoms after the initiation of food restriction and anticoagulant regimen. Only one patient presented mild ischemic colitis with episodes of hematochezia. In this case, UFH was used, as an urgent colectomy could not be precluded initially. Finally, he responded to the medical management and was discharged a few days later. All symptomatic patients that did not undergo intervention were discharged with LMWH for the first month, which was then converted to single antiplatelet therapy.

In this study, two patients underwent endovascular treatment. Both patients had severe symptomatology and did not respond to the initial conservative management. Generally, the decision of endovascular intervention should evaluate the anatomic characteristics, patients' general status and symptomatology. Stenting of the diseased arteries may be challenging; however with satisfying results so far, affirming its safety and efficacy in highly symptomatic patients.[9] It is quite unusual to see any stent-related complications post-operatively after a successful intervention, while follow-up imaging in most cases revealed stent and artery patency with complete obliteration of the dissection.[9] Single or double antiplatelet therapy may be initiated after stent implantation in order to preserve patency.[9,10] In this study, double anti-platelet therapy was prescribed post-operatively. No hemorrhagic complication has been recorded in the literature so far.[10] In case of stent failure without signs of peritonitis or bowel ischemia, conservative medical treatment may be continued with acceptable outcomes and complete alleviation of symptoms.[11,12]

Access may be femoral or brachial.[13] In this study, one patient underwent femoral percutaneous access while the other brachial access with open exposure. Brachial artery access should be available in any case, as a failed catheterization via the femoral artery may be achieved through upper access.[13] Concerning the decision of stent type, the data are scarce. In the two patients treated with endovascular means, covered stents have been chosen in order to prevent distal embolization. Furthermore, no proximal branch was detected in CTAs, permitting the use of this type of stent. In the second patient, a decrease outflow due to the long dissected segment obligated the use of an additional stent. In this case, a bare metal stent was applied to preserve branch patency. Bare metal stents may have satisfying patency, even when more than one has to be used.[9] Thrombus protrusion into the bare metal stent cannot be precluded and may affect long-term patency.[13] There is no much information concerning the comparison of patency between balloon expandable and self-expanding stents. We have selected a balloon expandable stent in one case where the accurate position was mandatory to preserve branch patency. Self-expanding stents may be also reliable with good results as their conformability may better follow native vessels mobility.[12,14] Both balloon and self-expanding stent may be reliable in IMAD without difference in stent or false lumen patency, symptoms relief and progression of the disease.[15]

As endovascular management had satisfying results in this study, none of the patients underwent open surgical repair which may be an option in case of stent failure. Mesenteric bypass or patch-plasty may be an alternative when there is no stent availability or surgeon is not familiar with the endovascular procedures.[16] Conventional repair may be associated with good results affirming graft and artery patency while colonic ischemia events have not been recorded in the literature.[16] No late intervention or recurrences were noted.[16] All treatment approaches may have optimal results when patients' selection is careful. Successful dissection management may achieve 95-100% of complete recovery in this group of patients.[17]

Close follow-up may be mandatory in patients managed conservatively or not. The patients of this study had a follow-up ranging between 6 and 72 months. During surveillance, none of the patients presented recurrence of symptoms while CTAs revealed the complete resolution or stabilization of the lesion. No aneurysm formation or rupture has been recorded. Analogous data from the literature are in accordance to our results.[9,18] Among patients with IMAD, diameter enlargement may be recorded, reflecting the progression of the disease.[9] Routine surveillance may be important for re-evaluation of the status of dissection, as well as stent patency in operated patients.[9] Ultrasound may be used in appropriate cases in order to decrease radiation, contrast and cost during follow-up.[9]

CONCLUSION

IMAD should be considered in the differential diagnosis of acute abdominal pain. CTA is the preferred method for diagnosis and follow-up. Conservative treatment including adequate antithrombotic agents seems to be a safe and efficient option, while an endovascular procedure could be attempted in persistent symptomatology.

No conflict of interest.

Acknowledgements: None

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