

Detecting isolated superior mesenteric artery dissection with computed tomography

İzole süperior mezenterik arter diseksiyonunun bilgisayarlı tomografi ile tespit edilmesi

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Abstract

Aim: Isolated superior mesenteric artery (SMA) dissection without associated aortic dissection is a rare entity. The aim of the study is to evaluate its incidence, and multidetector computed tomography (MDCT) and computed tomography angiography (CTA) findings, as well as show the clinical importance of this condition, which should be diagnosed and treated urgently.

Methods: Images of all patients who underwent contrast enhanced CTA or MDCT scan from July 2017 to July 2020 at our radiology department were examined retrospectively. A total of 600 CTA and 14000 contrast enhanced MDCT scans (14600 CT) were evaluated. Only the cases with isolated SMA dissections without aortic involvement, who had arterial phases on contrast enhanced MDCT images, were included. Aortic dissection cases with SMA involvement, and non-contrast MDCT images were excluded. Age, gender, symptoms, presence of thrombosis or bowel ischemia were noted. Average extension of dissection and distance from origin were measured.

Results: Ten patients (7 M, 3 F), aged between 48-66 years (mean: 57 years), had isolated SMA dissection. The mean distance of dissection from origin and mean extension were 1.9 cm and 3.4 cm, respectively. Patients were treated with conservative anticoagulation therapy. Follow-up CTA or MDCT showed normal SMA without evidence of dissection in 5 patients, decreased extension and length of dissection in 3 patients and no significant difference in 2 patients.

Conclusion: Isolated SMA dissection is a rare but important cause of abdominal pain. Early diagnosis allows correct treatment. CT is a useful noninvasive method for diagnosis and anticoagulation therapy is successful.

Keywords: Superior mesenteric artery, Dissection, Computed tomography, Mesenteric ischemia, İzole

Öz

Amaç: Aort diseksiyonu olmaksızın görülen izole süperior mezenterik arter (SMA) diseksiyonu nadir bir durumdur. Çalışmanın amacı, insidansı ve çok dedektörlü bilgisayarlı tomografi (ÇKBT) ve bilgisayarlı tomografi anjiyografi (BTA) bulgularını değerlendirmek ve acilen teşhis ve tedavi edilmesi gereken bu durumun klinik önemini ortaya koymaktır.

Yöntemler: Temmuz 2017'den Temmuz 2020'ye kadar radyoloji bölümümüzde kontrastlı BTA veya ÇKBT taraması yapılan tüm hastaların görüntüleri geriye dönük olarak incelendi. 600 BTA ve 14000 kontrastlı ÇKBT taraması değerlendirildi. Sadece, aort tutulumu olmayan izole SMA diseksiyonları dahil edildi. SMA tutulumu olan aort diseksiyonları dahil edilmedi. Arteriyel faza sahip kontrastlı ÇKBT görüntüleri dahil edildi. Yaş, cinsiyet, semptomlar, tromboz veya bağırsak iskemisi varlığı kaydedildi. Ortalama diseksiyon uzunluğu ve orijinden uzaklık ölçüldü.

Bulgular: 10 hastada (7 E, 3 K) izole SMA diseksiyonu vardı. Hastaların yaş aralığı 48 ile 66 (ortalama 57) arasındaydı. Diseksiyonun orijinden ortalama uzaklığı 1,9 cm ve ortalama uzunluğu 3,4 cm idi. Hastalar konservatif olarak antikoagulan ile tedavi edildi. Takip BTA veya ÇKBT'de 5 hastada diseksiyonda kaybolma, 3 hastada diseksiyon uzunluğunda azalma izlenirken 2 hastada anlamlı bir fark saptanmadı.

Sonuç: İzole SMA diseksiyonu nadir görülen önemli karın ağrısı nedenlerindedir. Erken teşhis doğru ve zamanında tedaviye izin verir. BT tanı için yararlı noninvasif bir yöntemdir ve antikoagulan tedavi başarılıdır.

Anahtar kelimeler: Süperior mezenterik arter, Diseksiyon, Bilgisayarlı tomografi, Mezenterik iskemi, İzole

Introduction

Bauersfeld first described the dissection of superior mesenteric artery (SMA) in 1947, as accompanying a dissecting aneurysm of the aorta [1]. Isolated dissection without aortic involvement is a rare entity. To best of our knowledge, there have been only 147 reported cases in the literature from 1975 to 2020. With the improvement in the computed tomography (CT) techniques, isolated SMA dissections are diagnosed more commonly and much earlier. This explains the increased number of cases reported recently.

Dissection involves the SMA more frequently, when compared with other gastrointestinal arteries. Due to its rarity, clinical presentation, use of imaging studies, management, and outcomes of isolated SMA dissection have not been investigated in detail [2].

Acute mesenteric ischemia causes acute abdominal pain and isolated dissection of SMA rarely causes this condition [3,4]. SMA dissection can be classified into three types: Type I: A patent true lumen exists alongside a patent false lumen with re-entry, Type II: A patent true lumen exists alongside an either patent (Type IIa) or thrombosed (Type IIb) false lumen without re-entry, and Type III: Both lumens are thrombosed [5,6].

The goal of this study is to evaluate the incidence and CT Angiography (CTA) and contrast enhanced multidetector CT (MDCT) findings of this rare and important condition.

Materials and methods

The abdomen CTA and contrast enhanced MDCT images of all patients, obtained from July 2017 to July 2020 at our radiology department were evaluated retrospectively. A total of 600 CTA and 14000 contrast enhanced MDCT scans were examined. Only the cases with isolated SMA dissections without aortic involvement, who had arterial phases on contrast enhanced MDCT images, were included, while aortic dissection cases with SMA involvement, and non-contrast MDCT images were excluded.

Intravenous contrast enhanced CTA or MDCT (Toshiba Aquilion (80x2), Otawara, Japan) was performed. The patients were administered iodinated nonionic contrast agent (Omnipaque, Daiichi Pharmaceutical Co., Tokyo, Japan) with an iodine concentration of 300 mg/mL with mechanical injection at a flow rate of 3 mL. Postcontrast axial CTA images with 0.75 mm slice thickness were obtained, and coronal and sagittal maximum intensity projection (MIP) reconstructions were performed for CTA images. Contrast enhanced arterial phase MDCT images had the following parameters: Slice thickness: 2 mm, reconstruction index: 1 mm, tube voltage: 120 kVp, pitch: 0.75. Slices were extended from the diaphragmatic dome to the end of the pelvis. Optimal MIP reconstructions could not be performed from contrast enhanced MDCT images due to slice thickness and retrospective design of study.

Age, gender, symptoms of patients, presence of thrombosis or bowel ischemia were noted. Extensions of dissections, distance of dissection from origin, and SMA diameters were measured. Presence of follow-up CTA was determined, and their findings were evaluated.

Results

Ten (0.06%) patients (7 M, 3 F) aged between 48 to 66 years (mean age: 57 years), had isolated SMA dissection, three of which underwent CTA and 7 had contrast enhanced MDCT. All patients were admitted to the hospital with sudden onset abdominal or epigastric pain, which increased after meals in 5 patients. None of the patients had a history of trauma, while 2 had a history of hypertension. On physical examination, abdominal bruit was present in three patients and all patients had abdominal tenderness. Laboratory examinations were unremarkable.

The mean distance of dissection from SMA origin and the mean extension length were 1.9 cm (1.5-2.5) and 3.4 (2.6-4.3) cm, respectively. Only 3 patients had axial, coronal, and sagittal MIP images in thin slices, obtained via CTA. Seven patients were diagnosed with contrast enhanced arterial phase MDCT images with 2 mm slice thickness, and their MIP reconstructions could not be performed optimally. Dissection types were determined in only three patients with CTAs, among which 2 had Type IIa (Figures 1 and 2) and 1 had Type IIb SMA dissection (Figure 3). The other 7 patients had isolated SMA dissections but had no MIP images (Figure 4). None of the patients had any signs of bowel ischemia.

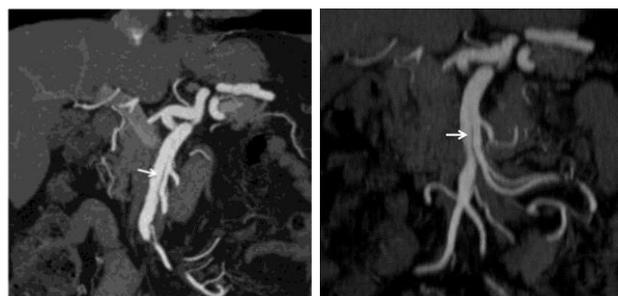


Figure 1: A 64-year-old man was admitted to the hospital with abdominal pain. On coronal maximum intensity projection (MIP) reconstruction CTA scan (a), an isolated SMA (Type IIa) dissection is observed (arrow). Follow up CTA (b) was performed 8 months later, which showed no progression in dissection (arrow).

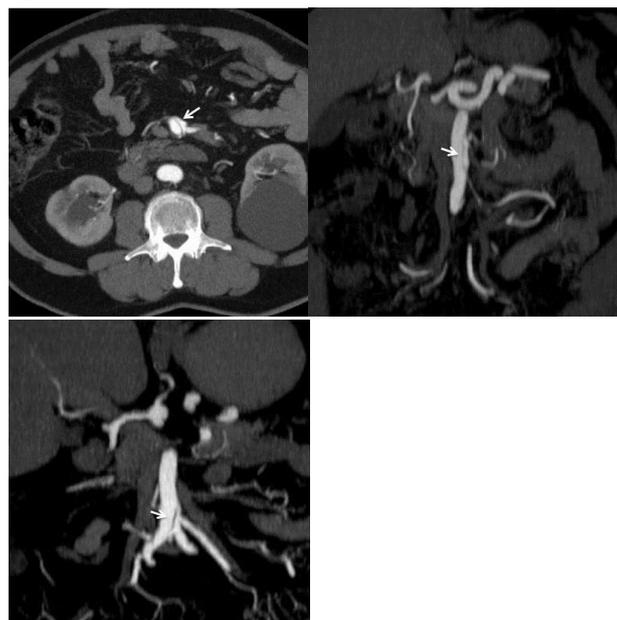


Figure 2: A 55-year-old woman with sudden onset abdominal pain. On axial (a) and coronal (b) MIP reconstruction CTA scans, a type IIa isolated SMA dissection is observed (arrow). After 10 months follow up, CTA (c) was performed, which showed decreased in extension of dissection (arrow).

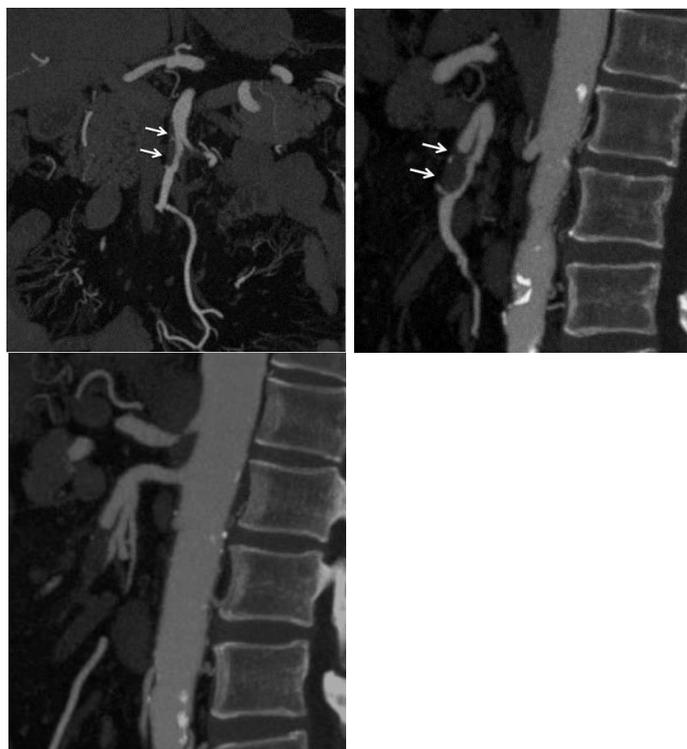


Figure 3: A 52-year-old man with abdominal pain. On coronal (a) and sagittal (b) MIP reconstruction CTA images, an isolated SMA dissection and thrombosis of false lumen (Type IIb) are observed (arrows). After 10 months, follow up CTA (c) was performed, which showed no significant difference in dissection (arrows).

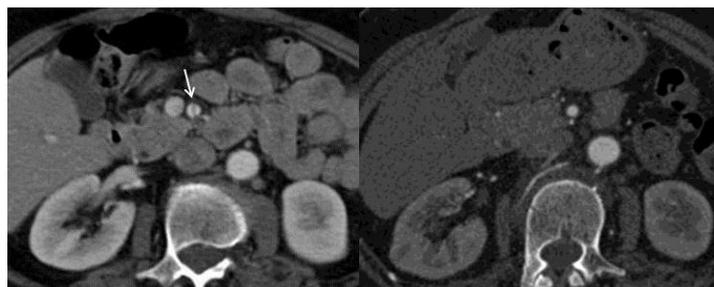


Figure 4: A 66-year-old woman was admitted with epigastric pain. The dissection is observed on axial (a) contrast enhanced MDCT images (arrow). After 9 months, follow up MDCT (b) was performed, which showed no evidence of dissection (arrow).

Two of the patients were started on an antihypertensive medical therapy for persistently elevated blood pressure. After hospitalization, patients were treated with unfractionated heparin (12,000 units/day) for 7-10 days. All patients were treated with Coumadin anticoagulation therapy for 9-12 months. Their symptoms resolved within 2-4 days of treatment. No surgical or endovascular intervention was deemed necessary because no bowel ischemia signs were present, and all patients responded well to medical treatment.

Follow-up CTA was performed after 8-10 (average: 9) months of medical therapy. Follow-up CTA or MDCT showed normal SMA without evidence of dissection in 5 patients, decreased extension and length of dissection in 3 patients and no significant difference in dissection in 2 patients.

Discussion

Visceral ischemia is divided into two subgroups, as occlusive and nonocclusive. Occlusive is further categorized into acute and chronic types and is caused by obstruction of major visceral arteries. Rarely, mesenteric ischemia occurs due to vasculitis, vasoconstriction and aortic or mesenteric dissection [3].

Isolated SMA dissection occurs predominantly in males (87%) at a mean age of 55 years. Its etiology is unclear because

of the scarcity of reported cases. Probable etiologic factors include fibromuscular dysplasia, arteriosclerosis, trauma, cystic medial necrosis, and hypertension [7-14]. Solis et al. [9] hypothesized that stress on the arterial wall at the inferior edge of pancreas cause SMA dissection.

Patients often present with acute epigastric pain [8, 14] and findings of intestinal obstruction or intestinal angina are caused by ischemia [13]. Abdominal or epigastric pain sometimes increases after meals [7]. Shock may occur after rupture of the dissection [8, 11], and epigastric bruit may be heard on physical examination [7, 8, 11].

Before 1972, the prognosis of SMA dissection was extremely poor, and all 10 reported patients died [1, 8, 10, 15]. Diagnosis was made at autopsy. Four of them died of unrelated causes, such as renal infarction, myocardial infarction, subarachnoid hemorrhage, and uremic coma. The other six patients died of SMA infarction or rupture of the SMA [15]. To the best of our knowledge, since 1975, only one of the reported isolated SMA dissection cases died [16]. Drop in mortality rates is probably due to early diagnosis with improvement of imaging methods.

Early diagnosis improves the prognosis. Abdominal Doppler ultrasound, CTA, or selective digital subtraction angiography (DSA) may be performed for diagnosis. CTA reveals the type of dissection, intimal flap, thrombosis of false lumen and enlarged SMA diameter. Selective DSA is gold standard and has a double benefit, as it gives better information about dissection and offers endovascular treatment [12].

Isolated dissection of SMA begins around 1.5-3 cm from the origin [11], just as in our study. The mean distance of dissection from SMA origin was 1.9 cm (range: 1.5-2.5 cm), which indicated the fixed, retropancreatic portion of SMA. More distally, the SMA is relatively mobile, and it may transmit a shear force to the fixed retropancreatic portion [9,11].

Isolated SMA dissection may be treated with conservative or invasive (surgical or endovascular intervention) techniques. There is no consensus in the literature concerning which treatment is superior to other, however, the disease extent, bowel ischemia, clinical status of the patient and the response to the medical treatment are all factors effecting the choice of treatment. For a patient who initially begins anticoagulant therapy, surgery should be performed at a later stage, when the clinical status (bowel ischemia, sepsis, etc.) worsens. There is no standard treatment regimen for isolated SMA dissection, each case should be evaluated separately.

Indications for surgery include increasing size of aneurysmal dilatation of SMA, total thrombosis of the SMA lumen, and persisting symptoms despite anticoagulation [15]. Several surgical methods have been reported in the literature including reimplantation of SMA on the aorta [9], resection of affected arterial segment with graft interposition [17, 18], simple arteriotomy with thrombectomy [19], intimestomy [20], right gastroepiploic artery bypass [21], obtaining revascularization using arterial conduits [22], endoaneurysmorrhaphy [23], and superficial femoral artery transposition repair [24]. According to literature, there are 43 reported cases who underwent endovascular repair, out of which 38 were treated with percutaneous stent placement [2].

Another approach for treatment is the conservative therapy (i.e., bowel rest, anticoagulants, antihypertensives, antiplatelets, anticholesterol agents). In the literature, sixty-one reported cases were treated conservatively [2, 25]. Anticoagulation may prevent clot formation or emboli in the true lumen [7]. Hemodynamically stable patients with no clinical or imaging evidence of ruptured SMA dissection may be treated conservatively. Reported cases in literature treated with anticoagulation therapy had successful resolution of symptoms during their follow with no mortality [2]. Patients treated with anticoagulation therapy require close follow-up and it may not always prevent progression of disease [15]. There is no consensus on the optimal anticoagulant and the duration of treatment against SMA dissection [7]. All our cases were treated with anticoagulation therapy and their symptoms resolved within 2-4 days. Follow-up CTA revealed normalization of SMA in most patients.

Limitations

Repeat CT scans should be performed on follow up in all patients to evaluate the resolution or progression of dissection in cases of conservatively treated patients. Due to the retrospective design of the study, regular CTA or contrast enhanced MDCT follow-up was not performed, and the type of dissection could not be determined in all patients due to the lack of MIP images of some. Patients could not be followed up for more than 1 year and course of the SMA dissection after 1 year is incomplete in this study.

Conclusion

Isolated SMA dissection is a rare condition. It may remain unrecognized if the examining physician does not suspect this entity, which makes it essential to highlight it as an important cause of acute or chronic abdominal pain. Timely and accurate diagnosis allows correct treatment. Abdominal CTA is a useful noninvasive method revealing isolated SMA dissection findings clearly, and anticoagulation therapy is usually successful.

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