Endovascular and surgical management of splenic artery aneurysms

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ABSTRACT

BACKGROUND: Although true splenic artery aneurysms (SAA) are rare, due to advancements in imaging techniques, they are seen more frequently. The aim of this study is to present our strategy of managing patients with SAA.

METHODS: Retrospectively, 13 patients who were treated in a tertiary university care center between 2012 and 2020 were included. Their demographic, clinical information, and post-operative complications were analyzed.

RESULTS: Seven male and six female patients were evaluated between the ages of 27 and 73. The mean age was 49.8±13.2. The diameter of the aneurysm was between 17 and 80 mm with a mean range of 31.5±16 mm. Seven patients were treated with endovascular interventions (EV). Two patients were referred to surgery with failed attempt of EV, but patients refused surgery and were followed up consequently. Patients who had larger aneurysms with an increased risk of rupture underwent aneurysmectomy and splenectomy. Conservative management was decided on two patients initially: A patient who was previously operated on for a sigmoid colon tumor, and had an aneurysm size of 15 mm and another patient with a surgical history of thoracic aortic dissection with an aneurysm size of 18 mm. One patient who underwent surgery had post-operative pancreatic fistula and was treated with percutaneous drainage. The treatment of the remaining 12 patients was completed without any further complications.

CONCLUSION: Splenic artery aneurysm treatment should be individualized. Endovascular treatment can be considered for patients with stable aneurysms larger than 2 cm in the elective setting. Open surgical treatment should be considered in patients with ruptured SAA or hemodynamically unstable, complicated patients.

Keywords: Endovascular treatment; management; open surgery; splenic artery aneurysm.

INTRODUCTION

Visceral artery aneurysms (VAA) are uncommon pathologies, with incidence ranging from 0.1 to 2% in general.[1] About 25% of patients with VAA are admitted to emergency departments with rupture, and the mortality rate is 8.5%. The most common VAA is a splenic artery aneurysm (SAA), which constitutes 60% of VAA and is commonly observed in the sixth decade.[1,3] The pathophysiology is not exactly known but several findings such as loss of elastic fibers and smooth muscle, and defects in tunica media are detected in patients with SAA.[2]

The majority of patients with SAA are asymptomatic.[1] Sudden abdominal pain in the left upper quadrant with hemodynamic instability and gastrointestinal bleeding is usually seen in patients with SAA rupture. Although SAA is 4 times more frequent in female patients, the risk of rupture is 3 times higher in male patients.[1] The risk of rupture is associated with sex, size of the aneurysm, rate of growth, underlying disease, history of liver transplant, portal hypertension, and pregnancy.[3-6] Mortality rates are reported up to 25% (and up to 75% in pregnancy) therefore the patients with high risk factors for rupture should be treated promptly.[7]

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SAAs are mostly single, saccular shaped, located in bifurcation zones 74–87% in the distal third, 20–22% in the mid-third, and <6% in the proximal third of the splenic artery. Visceral artery pseudoaneurysms should also be considered in the differential diagnosis which could occur due to iatrogenic injury, abdominal trauma, infection, pancreatitis, and, more uncommonly, peptic ulcer disease.

With the improvement of imaging techniques, SAAs are being diagnosed even more frequently. Contrast-enhanced computer tomography (CT) or CT angiography is the most commonly used method for diagnosing SAAs although USG and magnetic resonance imaging can be used in pregnant patients or patients with contrast allergy. Conventional angiography remains the gold standard that can be used for both diagnosis and treatment.

In this paper, we present our experience treating 13 patients with SAAs in a tertiary care setting.

MATERIALS AND METHODS

The study procedure has been approved by the institutional review board (2023/873). Patients diagnosed with true SAA in a tertiary care center were retrospectively analyzed between January 2012 and January 2020. The patients with pseudoaneurysm of the splenic artery were excluded. A total of 13 patients were included. Demographic data of the patients including age, gender, size of the aneurysm, localization, etiological factors, comorbidities, clinical signs and symptoms, treatment choice, complications, morbidity, and mortality rates were analyzed.

RESULTS

A total of 13 patients met the inclusion criteria, true SAAs, three were male, and five were female. The age range between 27 and 73 years, and the mean age was 49.8±13.2 years. The diameter of the true SAA ranged from 17 mm to 80 mm, and the mean size was 31.5±16 mm. In these patients with SAA, management was evaluated under three main headings: endovascular intervention, surgery, and conservative follow-up. Table 1 summarizes management options for individual patients with SAA.

A total of seven patients underwent endovascular intervention (EV) treatment. Five of these patients were male, and two were female. The age range of patients who underwent EV treatment was 33–58 years, and the largest aneurysm diameters ranged from 21 mm to 34 mm. Two of these patients with SAA had known portal hypertension, and two had

| Table 1. Management of different individual splenic artery aneurysms |
|-----------------------|-------------------|----------------|----------------|----------------|-----------------|----------------|
| Patient | Age (years) | Gender | Size, mm (aneurysm) | Underlying etiology + comorbidities | Approach | Complication |
| 1 | 73 | Male | 17 | Operated sigmoid colon tumor | Conservative | No |
| 2 | 62 | Male | 18 | Thoracic aorta dissection | Conservative | No |
| 3 | 65 | Female | 24 | Failed EV → Declined surgery | No |
| 4 | 27 | Female | 26 | Declined surgery | No |
| 5 | 33 | Male | 34 | Idiopathic portal hypertension + tortuous multiple aneurysms | EV | No |
| 6 | 39 | Female | 21 | Diffuse atherosclerosis | EV | No |
| 7 | 58 | Male | 34 | Diffuse atherosclerosis | EV | No |
| 8 | 42 | Female | 30 | History of myocardial infarction | EV | No |
| 9 | 56 | Male | 25 | Portal hypertension | EV | No |
| 10 | 42 | Male | 30 | Blunt thoracic trauma | EV | No |
| 11 | 53 | Male | 31 | Surgery | Pancreatic fistulization and percutaneous drainage performed |
| 12 | 50 | Female | 80 | Surgery | No |
extensive atherosclerosis. SAA was detected in the control tomography of a patient with a previous history of blunt thoracic trauma and in the abdominal US of 2 patients who did not have a specific complaint. CT angiography was performed on all patients (Fig. 1). Following CT confirmation, patients underwent EV treatment, and the interventions were successful (Fig. 2a). Control CTs confirmed successful embolization (Fig. 2b). No complications were observed in the median 5-year follow-up.

Two patients who were presented to the clinic with slight left upper quadrant pain were diagnosed initially with US. After CT angiography, SAAs of 24 and 26 mm were confirmed. Endovascular coil embolization was the initial management plan but failed. Surgery was subsequently recommended; the patients did not consent therefore managed conservatively. No further complications were developed in the follow-up. Initial conservative management was preferred in two patients who had surgical management history for a sigmoid colon tumor and a thoracic aortic dissection with aneurysm sizes of 17 and 18 mm, respectively with no further complications during the follow-up.

Open surgery was preferred for two SAAs (80 mm and 40 mm in size) in two female patients aged 50 and 48 with past medical histories significant for severe hypertension and arrhythmia. Aneurysmectomy and splenectomy were performed in both patients (Fig. 3). Postoperatively a pancreatic fistula developed in one of the patients which was managed with percutaneous drainage. No further complications developed during the follow-up.

**DISCUSSION**

In this article, we shared our experience regarding the management of 13 patients with SAA. Although most SAAs are asymptomatic, the consequences of a ruptured SAA are dire.
Endovascular (EV) management should be the first treatment of choice unless contraindicated, especially in SAAs location proximal and mid splenic artery and in patients with high perioperative risk who are difficult to manage surgically. Coil embolization, covered stents, plug deployment, glue, endoluminal thrombin injection, polyvinyl alcohol, particles, and gel foam can be used in the EV approach. The choice of EV intervention, embolization, or stenting, depends on the SAA’s shape, size, and localization. The most common complication after EV repair is post-embolization syndrome (PES), which presents with fever, ileus, and abdominal pain. Pleural effusion and pancreatitis may also occur. PES was more common after treatment of SAAs, located in splenic hilus. In a meta-analysis by Hogendoorn et al. PES rate in patients who underwent EV repair was 25.1–30% in the literature. Other complications of EV procedures are coil migration, distal infarction, abscess development, and uncommon, only rupture of the aneurysm. Despite successful angioembolization, recanalization has been reported in 12.5% of the patients who require reintervention.

EV procedures are less invasive and preferable because of the shorter duration of hospital stay, lower risk of perioperative morbidity and mortality, and better quality of life in the perioperative period with reported success rates of 90–100%.[10-12] In a meta-analysis of 1,321 true SAA patients, it was found that 511 (38.7%) patients underwent open repair (resection of the aneurysm with splenectomy in most patients, and re- construction of the artery), 425 and 385 (29.1%) patients were treated with endovascular repair (embolization and stenting) showed better early outcomes for EV compared to open surgical repair. But open repair had fewer late complications and less need for reintervention.

For surgical repair, aneurysm resection with or without splenectomy, proximal and distal splenic artery ligation, and trans-aneurysmal arterial ligation can be considered.[7] If the SAA is proximally located resection, and end-to-end anastomosis can be done in most patients, preserving the spleen. In an aneurysm involving splenic hilum, splenectomy may be performed.[10] If the SAA is close to the pancreas, proximal and distal ligation is recommended. Conventional open surgical approaches should be performed in ruptured SAAs, hemodynamically unstable patients, and cases with complicated SAAs.

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Splenik arter anevrizmalarında endovasküler ve cerrahi tedavi
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AMAC: Gerçek splenik arter anevrizması (SAA) nadir görülmesine rağmen, görüntüleme tekniklerindeki gelişmeler sayesinde daha sık karşıma çıkmaktadır. Bu çalışmanın amacı kliniğimizde SAA tanısı alan hastalara tedavi yaklaşım stratejilerimizi sunmaktır.

GEREÇ VE YÖNTEM: Üçüncü basamak bir üniversite hastanesinde 2012-2020 yılları arasında gerçek SAA tanısı alan 13 hastanın özellikleri, tedavi yaklaşımları ve komplikasyonları retrospektif olarak değerlendirildi.

BULGULAR: Yaşları 27 ile 73 arasında değişen 7 erkek ve 6 kadın hasta değerlendirildi. Ortalama yaş 49.8±13.2 idi. Anevrizmaların çapları 17 mm ile 80 mm arasında idi ve ortalamada 53±16 mm idi. Yedi hasta endovasküler (EV) yöntemle tedavi edilirken, 2 hastaya EV tedavinin başarısız olması nedeniyle cerrahi planlandı. Ancak hastalar cerrahi tedavisi kabul etmedi ve takip altına alındı. 6 hastaya bir evden anevrizmanın olduğu tespit edildiği için, anevrizma 17 mm olan bir hastada cerrahi planlandı. Anevrizma boyutları büyük olan ve rüptüre riski yüksek olan iki hastaya anevrizmektomi ve silektomikti yapıldı. Sigmoid kolon tümörü nedeniyle ameliyat edilen ve anevrizma boyutu 18 mm olan bir hastanın konservatif olarak takip edilmesine karar verildi. Ameliyat edilen bir hasta pankreas fistülü gelişti ve perkütan drenaj ile tedavi edildi. Diğer 12 hastada takipleri sırasında herhangi bir komplikasyon gelmedi.


Anahtar sözcükler: Açık cerrahi; hasta yönetimi; endovasküler tedavi; splenik arter anevrizması.