

# Laparoscopic Excision of Splenic Artery Aneurysm

Youngjin Kim, MD, Samir Johna, MD

## ABSTRACT

**Introduction:** Splenic artery aneurysm is more frequently diagnosed today with the advancement and liberal use of imaging modalities. A symptomatic aneurysm, an aneurysm of any diameter in a pregnant woman or a woman of childbearing age, and an aneurysm  $>2$  cm are all strong indications for surgery because of a significantly increased risk for splenic artery rupture.

**Case Description:** A 35-year-old, morbidly obese, African American woman presented with constant left flank pain for 4 weeks. Angiography confirmed a 2.5-cm splenic artery aneurysm near the splenic hilum. Because angioembolization was unlikely to succeed because of extensive collaterals and the aneurysm's proximity to the splenic hilum, laparoscopic excision of the aneurysm with splenectomy was performed.

**Discussion:** We report the successful laparoscopic surgical treatment of a 2.5-cm splenic artery aneurysm. Any splenic artery aneurysm with a significantly increased risk of rupture requires a prompt intervention. Although percutaneous embolization of the splenic artery is the most frequently applied therapy today, surgical repair is preferred for all symptomatic aneurysms because of the greater likelihood of success.

**Key Words:** Aneurysm, Laparoscopy, Splenic artery, Rupture.

## INTRODUCTION

Splenic artery aneurysm (SAA) is the most common splanchnic arterial aneurysm, accounting for approximately 60% of all visceral aneurysms, and is the third most common abdominal aneurysm, after aortic and iliac artery aneurysms.<sup>1,2</sup> The incidence of SAA has been reported to be between 0.02% and 10.4% in the general population, with a prominent occurrence in multiparous women.<sup>1</sup> The increase in the incidence of SAA in the past decade can be attributed to the technical advancement and more frequent use of imaging modalities. Most patients with SAAs are asymptomatic. However, a symptomatic aneurysm, an aneurysm of any diameter in a pregnant woman or a woman of childbearing age, and an aneurysm  $>2$  cm are all strong indications for surgery because of a significantly increased risk for splenic artery rupture.<sup>1</sup> Various treatment options for SAA include endovascular management, laparoscopic surgery, and open surgery.<sup>3</sup> We report the successful laparoscopic surgical treatment of a 2.5-cm SAA near the splenic hilum by en bloc resection of the SAA and the spleen.

## CASE REPORT

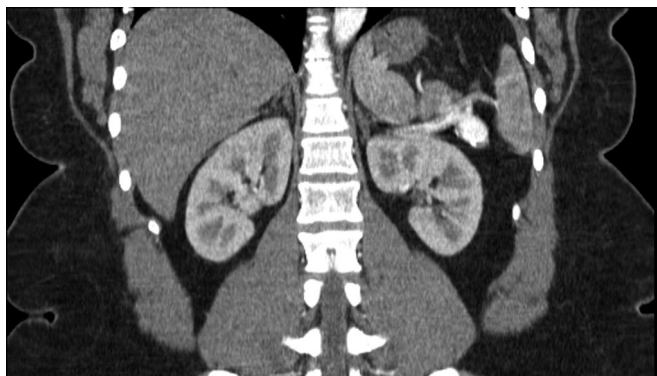
A 35-year-old, morbidly obese, African American woman presented with constant left flank pain, which she had had for 4 weeks. She had no significant medical history and no family history of aneurysm or connective tissue disorder. Physical examination was benign. Computed tomography showed no obvious disease processes except a questionable aneurysm of the splenic artery, and subsequent computed tomography angiography confirmed a 2.5-cm SAA near the splenic hilum (**Figure 1**). A multidisciplinary discussion among the primary admitting team, the vascular surgeon, the general surgeon, and the interventional radiologist resulted in a recommendation of angioembolization as the treatment of choice. However, after visceral angiography, the interventional radiologist believed that angioembolization was unlikely to succeed in this case because of extensive collaterals. Surgical options, including open aneurysm excision or laparoscopic en bloc resection with the spleen because of the hilar location of the aneurysm, were discussed with the patient. The laparoscopic approach was offered based on reports of success-

Department of General Surgery, Arrowhead Regional Medical Center/Kaiser Permanente Fontana Medical Center, Fontana, CA, USA (Drs. Kim, Johna).

Address correspondence to: Youngjin Kim, MD, Department of General Surgery, Kaiser Permanente Fontana Medical Center, 9985 Sierra Ave, Fontana, CA 92335, USA. Telephone: (909) 427-5626, Fax: (909) 427-4065, E-mail: y32kim@gmail.com

DOI: 10.4293/108680812X13517013317392

© 2013 by JSLS, *Journal of the Society of Laparoendoscopic Surgeons*. Published by the Society of Laparoendoscopic Surgeons, Inc.



**Figure 1.** Coronal computed tomography image showing large aneurysm of splenic artery.

ful treatment of SAA with the risk of rupture, which is difficult to treat with interventional radiology therapy.<sup>4</sup> On laparoscopy, the aneurysm was found to be partly embedded in the tail of the pancreas and the hilum of the spleen. The spleen appeared to be normal in size and texture. The aneurysm was excised en bloc with the spleen because the aneurysm was too close and tethered to the hilum, where isolation of the aneurysm would be dangerous and ultimately unnecessary. The SAA was identified and dissected *ex vivo* to confirm the removal of the aneurysm (**Figure 2**). The surgery was complicated by the patient's shortness of breath due to pulmonary atelectasis. She eventually recovered and was discharged home on postoperative day 5.

## DISCUSSION

SAA is the most frequently encountered type of splanchnic artery aneurysm and is the third most common abdominal aneurysm, after aortic and iliac artery aneurysms.<sup>1</sup> Female patients are 4 times more likely to have SAAs than male patients. An increased incidence of SAAs has been associated with several conditions, including pregnancy, degenerative atherosclerosis, portal hypertension, medial fibrodysplasia, arteritis, collagen vascular disease,  $\alpha$ 1-antitrypsin deficiency, and pancreatitis. Less common causes include idiopathic dissection, septic emboli, essential hypertension, polyarteritis nodosa, systemic lupus erythematosus, Ehlers-Danlos syndrome, and neurofibromatosis. Pseudoaneurysms of the splenic artery are most often caused by chronic pancreatitis or by trauma.<sup>5</sup>

More than two-thirds of aneurysms of the splenic artery are true aneurysms. They are usually saccular and occur at a bifurcation in the splenic hilum.<sup>6</sup> The true cause of SAA formation is unclear. However, an increase in splenic



**Figure 2.** Isolated SAA after en bloc resection of aneurysm and spleen.

blood flow may play a role in the development of SAA in patients with portal hypertension due to liver cirrhosis or transplantation. In addition, the increased prevalence in multiparous women may be related to increased splenic blood flow and the effects of estrogen on the elastic tissue of the tunica media.<sup>7</sup>

SAA rupture has been associated with aneurysm size  $>2$  cm, pregnancy, history of liver cirrhosis or transplantation, and  $\alpha$ 1-antitrypsin deficiency. The overall risk for rupture is 5%. Evidence in the literature indicates that pregnant patients are at high risk for rupture of SAAs, with a maternal mortality rate near 70% and an even more devastating fetal mortality rate of 90% to 95%.<sup>8</sup> SAA, once mostly found incidentally at autopsy, is more frequently diagnosed with the technical advancement of diagnostic imaging, prompting an earlier intervention for those at an increased risk for SAA rupture.

Traditionally, open laparotomy with either aneurysm ligation alone or splenectomy with ligation was the gold standard for the management of SAA. Today, various therapeutic options are available for SAA, including noninvasive endovascular management and laparoscopic or open surgery with or without splenectomy.<sup>9</sup> Percutaneous embolization of the splenic artery is the most frequently applied therapy. It may be performed for all SAAs except those located at the splenic hilum.<sup>10</sup> Aneurysm of the proximal splenic artery can be treated with simple ligation

or aneurysmectomy, but those involving the hilum require splenectomy.<sup>3</sup> Most recently, stent grafts and covered stents have been used with success, especially in the presence of portal hypertension, because the extensive collateral circulation that develops with portal hypertension makes surgery more difficult.<sup>11</sup> Surgical repair is preferred for all symptomatic aneurysms because of the greater likelihood of success.<sup>5</sup> Rarely, aneurysmectomy with end-to-end anastomosis may be used when the SAA is not intrasplenic or in the hilum.

Since the first successful laparoscopic-assisted SAA resection performed in 1993 by Saw et al.,<sup>12</sup> simple laparoscopic ligation of the artery proximal to the SAA and SAA resection with or without splenectomy have been conducted with increasing frequency. In experienced hands, laparoscopic surgery is a simple, safe, minimally invasive technique, with rapid recovery, decreased postoperative pain, and shorter hospital stay compared with the open technique.<sup>13</sup> Some authors have advocated a tangential stapler resection of sacciform aneurysms to preserve splenic flow, but others worry that this type of laparoscopic treatment leaves behind part of the aneurysmal artery and therefore might contribute to recurrence.<sup>14,15</sup> Ligation of the proximal and distal segment is considered safer in lesions of the medial third, because these are often adherent to the pancreas. However, the risk of pancreatic injury during the laparoscopic dissection of an SAA is more theoretical than real because the splenic artery runs separate from the pancreatic parenchyma and a plane can always be found between the two. Ligation is feasible in a mid-SAA by stapling or clipping the inflow and outflow.

Preservation of the spleen should be attempted unless the SAA is located deep within the splenic hilum.<sup>16</sup> Most recent reviews of laparoscopic surgery for SAAs show successful laparoscopic treatment of hilar SAAs with splenectomy and some even with distal pancreatectomy for SAAs too difficult to treat with interventional radiology therapy.<sup>4</sup> In case of splenic artery pseudoaneurysm, most often caused by chronic pancreatitis or trauma, SAA resection with splenectomy with or without distal pancreatectomy is recommended because of the higher risk of recurrence and complications.<sup>17</sup>

## CONCLUSION

SAA requires prompt attention for patients at increased risk for rupture. Endovascular management is the least invasive and most applied therapy. However, for more complicated cases, laparoscopic surgery should be considered as the next best option.

## References:

1. Abbas MA, Stone WM, Fowl RJ, et al. Splenic artery aneurysms: two decades experience at Mayo Clinic. *Ann Vasc Surg.* 2002;16(4):442–449.
2. Trastek VF, Pairolero PC, Joyce JW, Hollier LH, Bematz PE. Splenic artery aneurysms. *Surgery.* 1982;91(6):694–699.
3. Hashizume M, Ohta M, Ueno K, Okadome K, Sugimachi K. Laparoscopic ligation of splenic artery aneurysm. *Surgery.* 1993;113(3):352–354.
4. Obuchi T, Sasaki A, Nakajima J, Nitta H, Otsuka K, Wakabayashi G. Laparoscopic surgery for splenic artery aneurysm. *Surg Laparosc Endosc Percutan Tech.* 2009;19(4):338–340.
5. Pasha SF, Gloviczki P, Stanson AW, Kamath PS. Splenic artery aneurysm. *Mayo Clin Proc.* 2007;82(4):472–479.
6. Carr SC, Pearce WH, Vogelzang RL, McCarthy WJ, Nemcek AA Jr, Yao JS. Current management of visceral artery aneurysms. *Surgery.* 1996;120(4):627–633.
7. Hallett JW Jr. Splenic artery aneurysms. *Semin Vasc Surg.* 1995;8(4):321–326.
8. Cailouette JC, Merchant EB. Ruptured splenic artery aneurysm in pregnancy: twelfth reported case with maternal and fetal survival. *Am J Obstet Gynecol.* 1993;168(6 Pt 1):1810–1813.
9. Kokkalera U, Bhende S, Ghellai A. Laparoscopic management of splenic artery aneurysms. *J Laparoendosc Adv Surg Tech A.* 2006;16(6):604–608.
10. Reidy JF, Rowe PH, Ellis FG. Splenic artery aneurysm embolization—the preferred technique to surgery. *Clin Radiol.* 1990;41(4):281–282.
11. Arepally A, Dagli M, Hofmann LV, Kim HS, Cooper M, Klein A. Treatment of splenic artery aneurysm with use of a stent-graft. *J Vasc Interv Radiol.* 2002;13(6):631–633.
12. Saw EC, Ku W, Ramachandra S. Laparoscopic resection of a splenic artery aneurysm. *J Laparoendosc Surg.* 1993;3(2):167–171.
13. Ha JF, Sieunarine K. Laparoscopic splenic artery aneurysm resection: review of current trends in management. *Surg Laparosc Endosc Percutan Tech.* 2009;19(2):e67–e70.
14. Matsumoto K, Ohgami M, Shirasugi N, Nohga K, Kitajima M. A first case report of the successful laparoscopic repair of a splenic artery aneurysm. *Surgery.* 1997;121(4):462–464.
15. Lai PB, Leung KL, Lau WY. Laparoscopic repair of a splenic artery aneurysm. *Surgery.* 1998;123:247–248.
16. Pietrabissa A, Ferrari M, Berchiolli R, et al. Laparoscopic treatment of splenic artery aneurysms. *J Vasc Surg.* 2009;50(2):275–279.
17. Tessier DJ, Stone WM, Fowl RJ, et al. Clinical features and management of splenic artery pseudoaneurysm: case series and cumulative review of literature. *J Vasc Surg.* 2003;38(5):969–974.