Spontaneous Infrarenal Aortic Dissection in an Athlete Managed Emergently With Endovascular Stent Grafts, Occluders, and Femoral-Femoral Artery Bypass

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While competing in an obstacle course race, a 57-year-old male athlete developed left groin and leg pain. Several days later, infrarenal aortic dissection with clinically worsening left leg ischemia was diagnosed. An emergent repair was performed and consisted of an aorto-uni-iliac endovascular stent graft, an occluder in the left iliac artery, and a right-to-left femoral-femoral artery bypass. To the authors’ knowledge, the present report is the first case of a spontaneous infrarenal aortic dissection in a competitive athlete associated with participation in an extreme athletic event.

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Most spontaneous aortic dissections involve the thoracic aorta. Spontaneous infrarenal aortic dissections are rare events, comprising less than 1.9% of all aortic dissections.1 Endovascular techniques in vascular surgery are relatively new. The first endovascular management of spontaneous infrarenal abdominal aortic dissection (SIAAD) was reported in 1998 by Ferko et al,2 who reported 2 cases that involved an aorto-uni-iliac endovascular stent graft and a femoral-femoral crossover graft. Both patients were asymptomatic but had good results after the operation. We present a case of symptomatic infrarenal aortic dissection that likely developed while the patient was participating in an extreme athletic event. The aortic dissection was managed with endovascular repair.

Report of Case

In May 2016, a 57-year-old athlete and professional educator participated in a 4.5-mile run with 10 obstacles. After running an early portion of the race up and down a hill carrying large buckets filled with gravel, he felt that something was wrong. He completed the race, even finishing among the top competitors, but noted that his left leg felt more tired than usual, necessitating him to walk the last leg of the race, something he wouldn’t normally have done. Later that evening he began vomiting and had dry heaves and believed he had mild heat exhaustion due to being overheated and dehydrated. He tried running in subsequent days, which was a normal daily activity for him, but he could only run short distances before claudication in the left leg forced him to stop. The pain intensified each day to the point where walking was difficult. He presented to the emergency department in June 2016, 4 days after the athletic event. His initial vital signs were as follows:
temperature, 98.5°F; heart rate, 59/min; blood pressure, 144/84 mm Hg; respiratory rate, 18/min; and oxygen saturation, 98% while breathing room air. There was no hemodynamic instability. His medical history was notable for hypertension. He denied any collagen vascular disease. A cardiac catheterization performed in 2002 showed an occluded coronary artery with sufficient collaterals. No intervention was required during the catheterization. His home medications were metoprolol, losartan, isosorbide mononitrate, and aspirin.

Physical examination revealed that the left femoral pulse was barely palpable and the left popliteal and pedal pulses were absent. Continuous-wave Doppler ultrasonography flow findings of the left dorsalis pedis and posterior tibial arteries were markedly decreased but detectable. The left foot was cool but not mottled. Sensation and motor function in the left foot were present. Femoral, popliteal, and pedal pulses were easily palpable on the right. Complete blood cell count, comprehensive metabolic panel, cardiac enzymes, and coagulation findings were all within normal limits. An echocardiogram revealed normal sinus rhythm with nonspecific T-wave abnormality. An abdominal computed tomographic (CT) image with intravenous contrast revealed an infrarenal aortic dissection starting 2 cm below the renal arteries extending into the left iliac artery (Figure 1). The false lumen severely compromised arterial flow to the left leg.

After reviewing the abdominal CT image, a complete CT angiogram of the chest was obtained, but no thoracic dissection was present. The patient was then taken emergently to the hybrid operating room. An aorto-unii-iliac endovascular stent graft was placed starting just below the renal arteries and extending into the right common iliac. A 12-mm occluder was placed in the left iliac artery as proximally as possible. A right-to-left femoral-femoral artery bypass was then performed with an 8-mm polytetrafluoroethylene graft.

The patient’s postoperative course was uneventful. He tolerated regular diet the evening after the surgical procedure. He was discharged home 3 days after presentation with easily palpable lower extremity pulses bilaterally. A follow-up CT angiogram of the abdomen obtained 1 month after discharge showed patency of all grafts (Figure 2). The patient began running and biking 6 weeks after discharge. At that time, his only reported symptom was mild burning discomfort in his thighs, attributed to the groin incisions.

At the 4-month follow-up, results of repeated ultrasonography showed that the aorto-unii-iliac endovascular stent graft was widely patent; however, there was a hemodynamically significant stenosis at the modular extension limb attachment to the main limb with markedly elevated flow velocities. The femoral-femoral bypass graft was widely patent, and renal function was normal. The patient complained of extreme fatigue in both legs with exercise, with worse burning pain in the left leg, but denied pain at rest. These symptoms had worsened since his 1-month postoperative visit.

A CT angiogram obtained in November 2016, approximately 5 months after the patient’s surgical procedure, showed stenosis and possible thrombosis of the lower iliac limb of the endovascular stent graft. The graft was revised in December 2016 by balloon...
angioplasty of the stenotic area, and a second aorto-uni-iliac endovascular stent graft was placed over the lower part of the reconstruction to trap an apparent thrombus in the original limb. During the procedure, an embolus developed in the left popliteal artery and was removed with surgical thrombectomy.

After revision of the aorto-uni-iliac endovascular stent graft, the patient continued warfarin anticoagulation therapy. Approximately 1 year after the initial presentation, duplex ultrasonographic images showed the revised endovascular stent graft to be patent with no signs of stenosis or thrombus. The femoral-femoral bypass graft was widely patent, and there was no aneurysmal degeneration of the excluded left iliac artery. The patient now engages in moderate athletic activity with minimal symptoms of claudication in the left leg. He continues anticoagulant therapy and has been instructed to avoid participation in extreme athletic events.

Discussion

In a collective review of 42 cases of SIAAD from 1953 through 2002, Mózez et al reported that half of the dissections were limited to the aorta and half extended distally into the iliac and femoral arteries. In this series, 14% of patients at presentation had aortic rupture, 48% had abdominal or back pain, 21% were asymptomatic, and 17% had lower extremity ischemia. The mean age was 58 years with a 3:1 male predominance. In this series, 64% of patients were treated with open repair with straight or bifurcated grafts. Two patients (5%) had endovascular repair.

A 2004 review by Farber et al identified 53 cases between 1953 and 2003. Of the patients in these cases, 19% presented with lower extremity ischemia, 19% were asymptomatic, and 58% had back or abdominal pain. Aortic, iliac, or femoral rupture occurred in 17%, with a 44% mortality rate. In this review, 73% had an open repair, 17% were observed, and 69% had an endovascular repair. This analysis found that the dissection entry site was usually between the renal arteries and the inferior mesenteric artery. Patients who presented with lower extremity ischemia were more likely to have a dissection extending distally into the iliac and femoral arteries than other presentations.

Some asymptomatic patients with SIAAD can be observed and treated with antihypertensive medications if indicated. Yearly imaging with CT or magnetic resonance imaging is recommended. Coexistence of the SIAAD and an abdominal aortic aneurysm is an indication for repair because of the clinically significant risk of aortic rupture. Symptomatic cases of SIAAD should be repaired by open or endovascular methods. Open surgical reconstruction using tube or bifurcated grafts had excellent results in both collected reviews. Considering the dates covered by the studies, it is not surprising that only a few cases were managed with endovascular methods. Some authors advocating an open approach have raised concerns that stenting or balloon dilation of the true lumen may lead to aortic rupture and thrombus migration.

Similar to our approach, Adam et al successfully treated a 90-year-old with SIAAD who presented with sudden onset of lower extremity ischemic pain at rest. Treatment consisted of an endovascular stent graft to
the right common iliac artery, an occluder in the left common iliac artery, and a right-to-left femoral-femoral artery bypass. Porcellini et al8 used a Talent bifurcated graft to successfully manage symptomatic SIAAD in a 71-year-old man. An occluding covered stent was placed in the right iliac artery, and a left-to-right femoral-femoral stent graft was placed. Treatments in both cases4,5 were successful.

In 2010, Pei et al9 reported 2 cases of SIAAD successfully treated by an endovascular method. They performed a literature search and found that at that time, only 16 cases of SIAAD were managed using endovascular methods. Of the 16 cases, 2 had aorto-uni-iliac grafts and femoral-femoral crossover, 5 had bifurcated endografts, and 9 had the entry and reentry sites covered by at least 1 stent graft. In total, Pei et al9 reported that the cases had a technical success rate of 93.8% (15 of 16), with no vascular complications or mortality in the 30 days after the procedure.

In the present report, the severity of our patient’s left leg ischemia demanded emergent treatment. Because most dissections involve the thoracic aorta, we obtained a CT angiogram of the chest before operating. This examination was negative for thoracic aortic dissection. Using a bifurcated graft would have been difficult because of the narrowing of the true lumen of the aorta caused by the dissection. Also, wire and sheath manipulation in the dissected left iliac artery could have caused vessel injury and rupture. Deployment of the aorto-uni-iliac endovascular stent graft covered the entry point of the dissection. The occluder in the left iliac artery prevented retrograde flow to the dissection site, and the femoral-femoral stent graft restored circulation to the ischemic left leg.

Athletic participation can involve risk. Harmon et al10 reviewed the cause of sudden cardiovascular death in the registry of National Collegiate Athletic Association athletes from 2004 to 2008. Forty-five sudden cardiovascular deaths were identified among more than 400,000 athletes, for an annual incidence of 1 in 43,770. A cause of death could be reasonably determined in 36 cases. Aortic dissection caused 3 deaths (8%). Autopsy indicated sudden unexplained death for 31% of deaths, followed by coronary artery abnormalities (19%). Cardiomyopathy, myocarditis, and left ventricular hypertrophy each accounted for 8%. In other studies cited by these authors examining athletes, the armed forces, and the general population, aortic dissection as a cause of sudden death ranged from 0% to 5%.10

Weightlifting has been associated with aortic and internal carotid artery dissection. Hatzaras et al11 documented 31 cases of acute aortic dissection following strenuous activity. Notably, weightlifting is associated with increased arterial blood pressure during the activity, possibly as high as 480/350 mm Hg.12 Our patient was lifting and carrying heavy objects over distances, which may have contributed to the dissection. Additionally, the vomiting and dry heaves he had could be implicated as a cause of the dissection due to increased intra-abdominal pressure. Because SIAAD is such a rare event, it is unlikely that any specific predisposing cause will be related to this problem.

Conclusion
Participation in extreme athletic events continues to grow worldwide; thus, the identification of this rare but potentially lethal problem can be life and limb saving. In osteopathic medical training, osteopathic medical students learn to consider the patient as a whole, which was essential in this case. The seemingly unrelated symptoms could have been easily disregarded and a critical illness would have been missed. We also accounted for the preoperative functional status of the patient when considering the emergent and minimally invasive intervention, allowing him to ultimately return to athletic activity.

Author Contributions
Both authors provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; both authors drafted the article or revised it critically for important intellectual content; both authors gave final approval of the version of the article to be published; and both authors
agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References


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