

Giant vein graft aneurysm complicated by Loeys-Dietz syndrome

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Loeys-Dietz syndrome (LDS) is a recently reported autosomal dominant aortic aneurysm syndrome with widespread systemic involvement. Although connective tissue diseases carry a theoretical risk of aneurysmal degeneration in vein grafts, there are no reports of vein graft aneurysm (VGA) in patients with connective tissue disease. We herein report the first case of a giant VGA that was manifested 5 years after the reconstruction of a popliteal artery aneurysm associated with LDS. A pathologic examination of the VGA revealed high proteoglycan deposition and medial degeneration of the diffuse type in the VGA; these findings conformed to LDS. (*J Vasc Surg Cases* 2015;1:123-6.)

Loeys-Dietz syndrome (LDS) was first reported in 2005 as an autosomal dominant aortic aneurysm syndrome with widespread systemic involvement, such as skeletal, craniofacial, and cutaneous symptoms, and most cases of arteriopathy are manifested in the ascending aorta.¹ Although aneurysmal degeneration has been noted in other locations within the thorax, abdomen, and neck, the combination of LDS with a peripheral artery aneurysm is extremely rare.^{1,2} Peripheral artery aneurysms are also rare in other connective tissue diseases (CTDs), such as Marfan syndrome (MFS).² Therefore, prosthetic grafts are usually used for reconstruction in cases of CTD, and only two cases of the use of vein grafts in the setting of CTD have been reported.^{3,4} Although vein grafts can carry a theoretical risk of aneurysmal degeneration due to CTD, it is unclear whether aneurysmal changes occur in practice, as vein graft aneurysm (VGA) complicated by CTD has not been previously documented according to a MEDLINE search. We herein report the first case of a giant VGA complicated by LDS that was manifested 5 years after the reconstruction of a popliteal artery aneurysm (PAA). The patient provided his written consent for the publication of this case report.

CASE REPORT

A 29-year-old man was admitted because of discomfort in his left knee. At 13 years of age, he underwent the Bentall procedure

and total arch replacement for annuloaortic ectasia. Thereafter, he underwent replacement of the descending aorta at 21 years of age, replacement of the thoracoabdominal aorta at 23 years of age, and replacement of the brachiocephalic artery at 29 years of age for aneurysms. At 24 years of age, he complained of severe intermittent claudication on his left calf and underwent popliteal reconstruction with a great saphenous vein graft for an occluded PAA. During the subsequent follow-up, VGA was detected at 26 years of age. He had no relevant family or smoking history. He also displayed the clinical features of patients with LDS, including hypertelorism, strabismus, bifid uvula, arachnodactyly, talipes equinovarus, and joint laxity. Pulsatile masses in the left above-knee and below-knee portions were evident on inspection and palpation, and the bilateral dorsal pedal arteries were palpable. Multidetector computed tomography demonstrated a VGA in the shape of a dumbbell, measuring 41 mm and containing an area of massive mural thrombosis in the below-knee portion (Fig 1). Multidetector computed tomography also showed marked tortuosity of the bilateral vertebral arteries and aneurysmal dilation of the left subclavian, bilateral carotid, right common iliac, and right popliteal arteries.

Because the VGA was symptomatic and carried a high risk of rupture or distal embolism, elective surgery was performed 1 month after brachiocephalic reconstruction. The distal superficial femoral artery and vein graft were dissected at the above-knee and below-knee levels through the medial approach and controlled with silicone tape. After systemic heparinization, the vein graft was ligated and transected at the below-knee portion to avoid peripheral embolism while manipulating the sac. The distal portion of the VGA was also dissected on an incline, after which the below-knee popliteal artery was clamped and the aneurysm was explanted. Distal anastomosis was performed in an end-to-end manner using an 8-mm heparin-bonded polytetrafluoroethylene Propaten graft (W. L. Gore & Associates, Flagstaff, Ariz). In the same manner, the proximal portion of the VGA was excised, and proximal anastomosis was performed (Fig 2). The operative time was 193 minutes. The patient resumed anticoagulant therapy immediately after undergoing surgery for a previous replacement of an aortic valve. His postoperative course was uneventful. On pathologic examination of the VGA, the wall of the aneurysms showed severe diffuse fragmentation and loss of elastic fibers, with an increase

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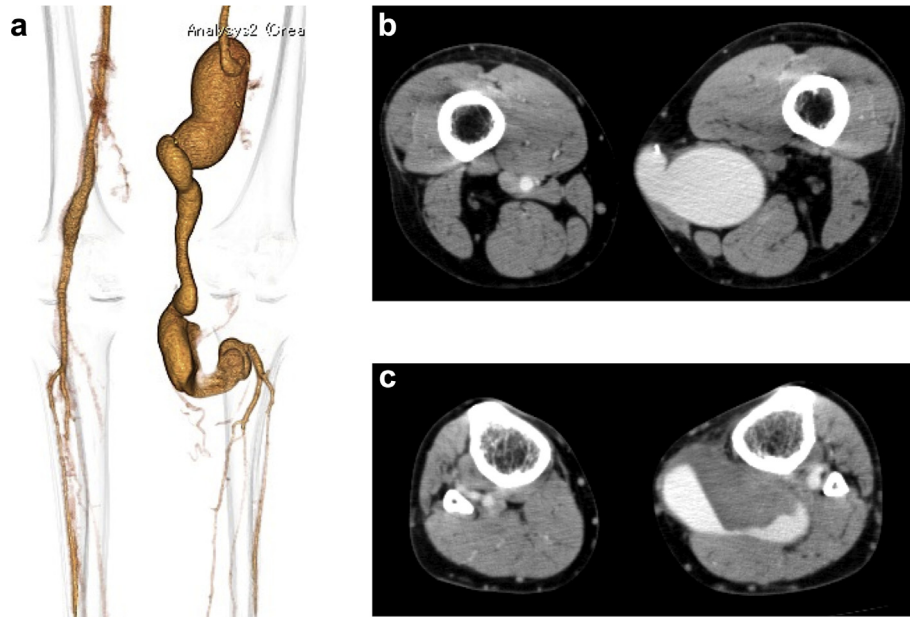


Fig 1. Computed tomography images obtained on admission. **a**, Computed tomography angiography showing a vein graft aneurysm (VGA) with an origin at the above-knee popliteal artery and termination at the below-knee popliteal artery. The VGA was tortuous. **b**, Axial image showing the VGA in the above-knee portion. **c**, Axial image showing the VGA in the below-knee portion, containing an area of massive mural thrombosis.

in proteoglycan material that formed pools between the remaining elastic lamellae, although atherosclerotic changes were absent (Fig 3).

DISCUSSION

LDS is characterized by the triad of arterial tortuosity and aneurysm formation, hypertelorism, and a bifid uvula or cleft palate and is caused by heterozygous mutations in the genes encoding transforming growth factor β receptors.^{1,2} Approximately 75% of LDS patients have both severe craniofacial features and aortic aneurysms (LDS type I); the rest (LDS type II) have less severe craniofacial features but cutaneous features (eg, velvety and translucent skin, easy bruising) resembling vascular Ehlers-Danlos syndrome.¹ LDS patients exhibit a high risk of aortic dissection or rupture at an early age and display an average life expectancy of 23 years in LDS type I and 27 years in LDS type II as a result of aortic dissection or cerebral bleeding.¹ MFS patients resemble LDS patients in the skeletal findings and aortic root dilation; however, they do not typically exhibit hypertelorism, bifid uvula or cleft palate, and arterial tortuosity.² In vascular Ehlers-Danlos syndrome patients, rupture or dissection of the arteries often occurs in medium-sized vessels, and surgical management is a formidable challenge because of tissue fragility.² Our patient was clinically diagnosed with LDS because he demonstrated the triad of LDS and underwent repeated aortic operations when younger, although mutations of the *TGFBR* gene were not assessed.

PAAs are the most frequently encountered peripheral artery aneurysms. Although most surgeons prefer to use saphenous vein grafts for PAA reconstruction because of their good patency,⁵ some prefer to routinely apply prosthetic grafts based on the match between the diameter and the popliteal artery and the acceptable results.⁶ It is rare for LDS to occur in combination with PAA, occurring in only 3% of cases,² with only one case having been reported in the English literature to our knowledge.⁷ That case underwent revascularization with synthetic grafts to avoid the theoretical risk of aneurysmal degeneration of the vein graft due to CTD. In contrast, our patient underwent popliteal vein grafting for an occluded PAA, and the VGA was detected 2 years later, following which a repeated operation was required after 5 years. We used a prosthetic graft in the current case because the VGA appeared to be caused by LDS. The application of endovascular therapy (EVT) was recently introduced to treat PAA, with outcomes similar to those of open repair.⁸ Although EVT may be a potential therapeutic option as initial PAA repair in LDS patients, whose life span is limited, EVT was not suitable in VGA of the present case because of the patient's anatomic condition, ie, the proximal and distal neck was angulated, the distal landing zone was too short, and the VGA was tortuous. Whereas arterial reconstruction is usually the best alternative for arterial occlusion, nonoperative medication should be considered a potential therapeutic option if revascularization requires repeated operation, retrospectively.



Fig 2. Postoperative computed tomography angiography images showing the polytetrafluoroethylene graft in situ and three-vessel runoff.

VGA is an unusual complication after revascularization, occurring in 1.8% to 3.8% of patients,^{9,10} and histologic examinations of the VGA show advanced atherosclerotic changes with extensive intimal fibroplasia, subendothelial cholesterol deposits, and ulceration.¹⁰ Therefore, atherosclerosis may be considered to be the main cause of VGA, although additional etiologic factors are likely related (ie, smoking, popliteal aneurysm repair, or concomitant abdominal aortic aneurysm).^{9,10} Maleszewski et al¹¹ examined the aortic specimens of patients with both LDS and MFS in detail and showed that the presence of high collagen deposition and medial degeneration of the diffuse type with relatively little medial degeneration of the cystic type can be used to differentiate LDS from MFS. In the vein graft in the current case, the pathologic findings showed diffuse medial degeneration in addition to the fragmentation of elastic fibers without

atherosclerotic changes. These findings resembled those of the aortic specimen of LDS and support the hypothesis that the VGA was caused by LDS. Among patients with CTD, there are only two cases in which vein grafts have been used for arterial reconstruction.^{3,4} In these cases, no signs of VGA were noted during the 2-year and 18-month follow-up periods, although it is possible that VGA may occur in the future. The present case is the first case of a VGA complicated by CTD.

CONCLUSIONS

We herein presented the first case of a giant VGA that was manifested 5 years after the reconstruction of a PAA. The use of vein grafts should be avoided in patients with CTD to the extent possible and requires careful surveillance.

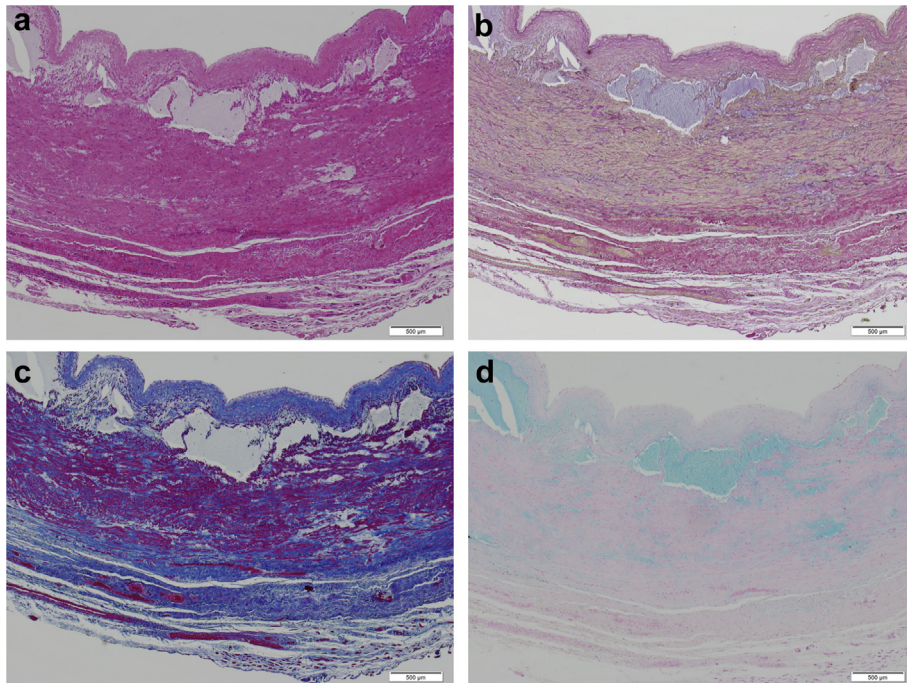


Fig 3. Pathologic findings of the vein graft aneurysm (VGA). Histologic sections showing marked loss of elastic fibers and focal extensive accumulation of pools of proteoglycan material in the media: (a) hematoxylin-eosin stain; (b) elastic van Gieson stain; (c) Masson trichrome stain; (d) alcian blue stain.

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