Degenerative Venous Aneurysm of a Reverse Saphenous Vein Femoral Artery to Femoral Artery Cross over Graft: Case Report and Literature Review of Saphenous Vein Graft Aneurysm

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Abstract

A true aneurysm formation in an arterialized vein graft used for lower limb arterial occlusive disease is a rare complication. The saphenous vein is the preferred conduit for infrainguinal bypass. For extra-anatomical bypass-like femorofemoral crossover, a synthetic graft is preferred. A successful outcome of femorofemoral crossover bypass with autogenous vein is well described. This case report is regarding a 67-year-old male who underwent femorofemoral crossover bypass with reversed saphenous vein graft 15 years ago for arterial occlusive disease, who now presented with degenerative aneurysm of the graft with an incidental infrarenal Abdominal Aortic Aneurysm. He underwent aortobifemoral bypass with jump graft to right internal iliac artery and resection of aneurysms. Histopathology of venous aneurysmal wall showed graft wall calcification with fibrin and collagen deposits. The causes of saphenous vein graft aneurysm have been described to be mostly atherosclerotic but it may be a part of systemic dilating pathology.

Keywords: Aneurysms, degenerative, occlusive arterial disease, saphenous vein, vein graft

Introduction

A true aneurysm formation in infrainguinal reverse saphenous vein graft (RSVG) is an uncommon complication of lower extremity bypass, and the true incidence remains unknown.[1] Aneurysmal degeneration of RSVG commonly presents as a thin-walled pseudoaneurysm at the anastomotic site. Compliance and caliber mismatch between native vessel and vein graft, as well as anastomotic line stress contribute toward unnatural wall shear stress.[2]

In general aneurysmal dilation of RSVGs, following infrainguinal revascularization mostly represents false anastomotic aneurysms, with true aneurysms being an unusual complication.[3] Circumstantial evidence suggests that arterial aneurysms have a different cause than atherosclerosis and may form part of a generalized dilating diathesis. True aneurysms of RSVG can occur at any location. Several reports have observed that aneurysmal dilatation may complicate both coronary and infrainguinal vein grafts.[4] In 1992, Ward[5] observed that the mean diameters for all the peripheral arteries were significantly greater in the patients with aortic aneurysms than in the control groups and Baxter et al.[6] demonstrated that the extracellular matrix abnormalities that were present in the aneurysmal wall were also identifiable in the aortic tissue proximal to the aneurysmal site. Both of these studies suggested that localized aneurysmal disease might be a manifestation of a systemic dilating process. Interestingly, vein graft aneurysms are most common when the vein graft was originally implanted for lower extremity aneurysmal disease. In a study by Moore et al.,[7] it was found that saphenous vein grafts implanted to bypass popliteal artery aneurysm (PAA) are of significantly larger diameter than those implanted to treat peripheral arterial occlusive disease.

The great saphenous vein (GSV) is most widely used conduit for lower limb bypass procedures in arterial occlusive disease. The GSV is not a preferred conduit for extra-anatomical bypass. For extra-anatomical bypass, a synthetic graft is preferred. A successful outcome of femorofemoral crossover bypass with autogenous vein is well described. This case report is regarding a 67-year-old male who underwent femorofemoral crossover bypass with reversed saphenous vein graft 15 years ago for arterial occlusive disease, who now presented with degenerative aneurysm of the graft with an incidental infrarenal Abdominal Aortic Aneurysm. He underwent aortobifemoral bypass with jump graft to right internal iliac artery and resection of aneurysms. Histopathology of venous aneurysmal wall showed graft wall calcification with fibrin and collagen deposits. The causes of saphenous vein graft aneurysm have been described to be mostly atherosclerotic but it may be a part of systemic dilating pathology.

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bypass like a femorofemoral bypass. Successful outcomes of femoropopliteal vein (FPV) graft for such extra-anatomical bypass have been described.[8] Incidence of true venous degenerative aneurysm in femorofemoral saphenous vein bypass graft is unknown. Here, we describe a true venous degenerative aneurysm formation in the autologous vein graft used for femorofemoral bypass for arterial occlusive disease.

**Case Report**

A 67-year-old male, smoker, diabetic, hypertensive with chronic obstructive pulmonary disease and history of stroke. He had a history of acid-peptic disease 15 years ago, which was treated medically. In 2002, he underwent femorofemoral crossover, RSVG bypass for left lower limb disabling claudication. The GSV was harvested from right thigh. He was asymptomatic for 15 years, but he continued to smoke.

He presented to us with gradually increasing bilateral groin swelling of 2 years’ duration without any lower limb symptoms. On physical examination, bilateral groin pulsatile swelling [Figure 1] with bruit was present. Duplex scan reported bilateral groin pseudoaneurysm arising from common femoral artery (CFA) Anastomotic site, but computed tomography (CT) angiogram revealed true aneurysms of the vein graft in both groins – right measuring 75 mm × 60 mm × 55 mm and left 98 mm × 66 mm × 60 mm [Figure 2]. An incidental finding was an infra-renal abdominal aortic aneurysm (AAA) of 43 mm × 37 mm in diameter, 4 cm from lowest renal artery [Figure 2]. Right common iliac artery (CIA) had aneurysmal dilatation till its bifurcation and left iliac system was completely occluded, including left internal iliac artery (IIA).

He underwent AAA repair with Aortobifemoral bypass with jump graft to right IIA as right CIA was aneurysmal with the involvement of external iliac artery origin. Intraoperative bilateral CFA anastomosis suture line was intact. Perioperative period was uneventful and the patient was discharged on 7th postoperative day. The histopathological examination of vein wall revealed degenerative changes with calcification, fibrin, and collagen deposition.

**Discussion**

Venous degenerative aneurysm etiology also shares the factors associated with atherosclerosis such as smoking, hyperlipidemia, uncontrolled diabetes, hypertension, or an aneurysm elsewhere in the body also a proposed etiology. Studies have described nonatherosclerotic dilatation of vein graft in infrainguinal bypass but etiological factors should be considered, as atherosclerosis is not universally observed.[9] The removal of the GSV from its bed for the reversed vein technique leads to disruption of the vasa vasorum of the vein and a temporary preservation in an ischemic environment is necessary, which may cause endothelial damage. Other proposed mechanisms leading to venous graft aneurysms are weakness of vein valve site, blowout of side branches, mycotic aneurysm following low-grade infection, poststenotic dilatation, and varicosities of the vein itself.[1,2]

The literature reported aneurysmal dilatation of saphenous vein used for bypass surgery includes infrainguinal bypass, aortorenal, Iliac-femoral, or carotid–carotid.[10] Saphenous vein graft used for popliteal artery aneurysm repair has higher chances of developing degenerative aneurysm as compared to infrainguinal vein bypass for atherosclerotic arterial occlusive disease, which is well documented.[10] The femorofemoral crossover bypass can complicate with pseudoaneurysm at anastomotic site when FPV or saphenous vein used.[9]

Degenerative changes of the saphenous vein grafts include endothelial desquamation followed by fibrin deposition or platelet adhesion, mural edema and extensive medial and adventitial degeneration.[5] Arterialized autologous veins are subjected to degenerative changes due to its structural difference to arteries, but true aneurysmal vein graft dilatation pathogenesis still remains speculative. The tunica media is the layer of concentrically arranged smooth muscle, the autonomic
control of which can alter the diameter of the vessel and affect the blood pressure. In arteries, it is larger than that of veins of similar size and makes the veins more susceptible to aneurysmal degeneration.

We performed a search of published literature in April 2017 using PubMed, Cochrane library, Medline and Medscape research databases. The following search terms were used: true aneurysms, degenerative, vein graft, autologous, occlusive arterial disease, and femorofemoral. Table 1 summarizes literature on true aneurysm of autologous saphenous vein grafts. The listed publications are those that have mentioned that the indication for original surgery was atherosclerotic occlusive disease and not other causes such as popliteal arterial aneurysm and posttraumatic aneurysm. Some publications have not mentioned whether the saphenous vein was used in a reversed or in situ fashion.

Development of degenerative true aneurysm in vein graft was first reported by Davidson and DePalma12 in 1972. In 1973, Szilagyi and al.13 reported the fate of saphenous vein grafts in 260 patients and found 3.8% instances of aneurysms, most of them attributed to trauma during vein preparation. In 1973, De la Rocha and al.14 reported a case of aneurysmal dilatation in a saphenous vein graft 5 years after implantation for lower extremity occlusive disease and histopathological analysis revealed extensive atherosclerosis with subintimal fibrosis, giant cell formation, and cholesterol deposition. In 2004, Majeski15 reported his personal series of 207 in situ saphenous femoral popliteal bypasses, identifying only 3 (1.4%) true vein graft aneurysms. A long latency period from graft implantation to aneurysmal degeneration was seen in the reported cases, ranging from 3 to 22 years. Darling and al.16 found no aneurysmal dilatation of saphenous vein conduit at 10-year follow-up of 295 cases for infrainguinal saphenous vein graft bypass. Loftus and al.17 reported their 5-year experience with vein grafts involving 221 revascularization procedures for arterial occlusive disease and 24 procedures for popliteal aneurysms. This study revealed spontaneous aneurysm formation in 10 (42%) of the 24 bypass grafts for popliteal aneurysms. However, vein graft aneurysms were only detected in 2% of the 221 bypass procedures performed for arterial occlusive disease.

Table 1: True vein graft aneurysms published literature

| Author                  | Year of reporting | No. of cases | Time of presentation after bypass | Insitu/RSVG |
|-------------------------|-------------------|--------------|-----------------------------------|-------------|
| Davidson et al[12]      | 1972              | 1            | 3 yrs                             | RSVG        |
| Szilagyi et al[13]      | 1973              | 10           | over 10 years                     | NA          |
| De La Rocha et al[14]   | 1973              | 1            | 5 yrs                             | NA          |
| De Weese et al[16]      | 1973              | 3            | 5-6 yrs                           | RSVG        |
| Vantinnen et al[17]     | 1975              | 3            | NA                                | NA          |
| Friedman et al[18]      | 1975              | 1            | 6 yrs                             | NA          |
| Settembrini et al[19]   | 1980              | 1            | NA                                | NA          |
| Denton et al[20]        | 1983              | 1            | 5 yrs                             | RSVG        |
| Cloud et al[21]         | 1984              | 1            | 9 yrs                             | RSVG        |
| Walton et al[22]        | 1985              | 2            | 2.5 yrs and 9 yrs                 | NA          |
| Bevers et al[23]        | 1988              | 1            | 4 yrs                             | RSVG        |
| Sassouet et al[24]      | 1988              | 1            | 8 months                          | In-situ     |
| Peer et al[25]          | 1990              | 1            | 3 yrs                             | RSVG        |
| Kelly et al[26]         | 1990              | 1            | 22yrs                             | NA          |
| Almgreen et al[27]      | 1990              | 1            | 15yrs                             | NA          |
| Bedirhan et al[28]      | 1991              | 1            | 1yr                               | NA          |
| Straton et al[29]       | 1991              | 2            | 5 yrs and 2.6 yrs                 | RSVG        |
| Bastoumis[30]           | 1994              | 1            | 21 yrs                            | In-situ     |
| Barker et al[31]        | 1996              | 2            | 12 yrs and 19 yrs                 | RSVG        |
| Loftus et al[32]        | 1999              | 4            | over 5 yrs                        | NA          |
| Bohra et al[33]         | 2001              | 1            | 22 yrs                            | NA          |
| Majeski[34]             | 2004              | 3            | 3-22 yrs                          | In-situ     |
| Corriere et al[35]      | 2004              | 1            | 13 yrs                            | RSVG        |
| Bik et al[36]           | 2006              | 1            | 9 yrs                             | RSVG        |

No clear consensus for the management of such venous true aneurysms in groins but it should be managed like any other aneurysm. The differential diagnosis of groin swelling in previously operated bypass cases should include anastomotic false aneurysm before hernia. Physical examination usually reveals nonreducible and expansible groin swelling. The initial type of surgical intervention depends on the extent of aneurysmal dilatation, associated aneurysm elsewhere, and comorbidities. One option is complete graft replacement with prosthetic graft and aneurysm repair. Endovascular options are still unknown in view of lack of literature and rarity of such kind of aneurysm. Varicosities of saphenous vein usually also increase the risk of aneurysm formation. External reinforcement with Dacron prosthesis seems to allow the use of autologous saphenous veins without compromising graft patency and limb salvage. In conditions where prosthetic grafts are not suitable such as infected bed or below knee distal bypass, the use of cryopreserved saphenous vein allograft or human umbilical vein is an alternative option. With any aneurysm repair approach, excellent limb salvage can be expected and postoperative function should be achieved following venous graft aneurysm repairs.
CONCLUSION
The femorofemoral crossover bypass with saphenous vein is uncommon, and the development of a true venous aneurysm is rare. Etiology is still unknown with a possible explanation of the systemic dilating pathology like an aortic aneurysm and associated risk factor like progressive atherosclerotic disease, which we have found in our case.

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Conflicts of interest
There are no conflicts of interest.

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