CASE STUDY

Aneurysms and pseudoaneurysms of saphenous vein coronary artery bypass grafts

H Le Breton, D Pavin, T Langanay, Y Roland, C Leclercq, J M Beliard, M Bedossa, C Rioux, J C Pony

Abstract

Aneurysms of saphenous vein grafts to coronary arteries are unusual complications of coronary artery bypass graft (CABG) surgery. Three patients (men aged 47, 62, and 68 years) are presented with spontaneous chest pains 10, 21, and 17 years after CABG surgery. In one case, the saphenous vein graft had eroded into the right atrium and had established a fistula between the graft and the right atrium. Diagnosis of saphenous vein graft aneurysms was confirmed by echocardiography, computed tomography or magnetic resonance imaging, and by arteriography. Two patients were treated surgically, the third by percutaneous coil embolisation followed by balloon angioplasty of the right coronary artery.

(*Heart* 1998;**79**:505–508)

Keywords: aneurysm; pseudoaneurysm; saphenous vein grafts; coronary artery bypass graft

Department of Cardiology, CHRU Hotel Dieu, 2 rue de l'Hotel Dieu, 35033 Rennes Cedex, France
H Le Breton
D Pavin
C Leclercq
J M Beliard
M Bedossa
J C Pony

Department of Cardiovascular Surgery, CHRU Hotel Dieu
T Langanay
C Rioux

Department of Radiology, CHRU Hotel Dieu
Y Roland

Correspondence to:
Dr H Le Breton, Department of Cardiology, CHRU Pontchaillou, rue Henri Leguillou, 35033 Rennes Cedex, France.

Accepted for publication 28 January 1998

Aneurysms of saphenous vein grafts to coronary arteries were first reported in 1975,[1 2] but remain an unusual complication of coronary artery bypass graft (CABG) surgery. The most common treatment appears to be surgical but in two cases, percutaneous coil embolisation was attempted.[3 4] We report three cases of saphenous vein graft aneurysms. The first two patients were treated surgically, the third by coil embolisation. In one case, a fistula developed between the right atrium and the saphenous vein graft.

Case 1

A 47 year old man was investigated in 1974 because of angina despite medical treatment. Coronary angiography revealed a stenosis in the dominant right coronary artery (RCA) with normal left coronary artery and normal ventricular function. CABG surgery was done and a saphenous vein graft was applied to the right coronary artery without any complications. The patient did well and had no angina for almost eight years. In 1982 he reported atypical chest pains with normal clinical examination, chest radiography, electrocardiography, and exercise test. In September 1983 he was hospitalised because of an inferior myocardial infarction. In November 1984, 10 years after the CABG he was readmitted for spontaneous chest pains not resolved with nitroglycerin. A maximal exercise test was still negative. Chest radiography showed a right pericardiac mass. Cross sectional echocardiography revealed an oblong mass of low density adjacent to the right atrium. At left ventricular angiography, hypokinesia of the inferior segment and ectasia of the inferoapical segment were present with an ejection fraction of 52%. Coronary angiography showed a normal left coronary artery as before and complete occlusion of the mid-RCA. The saphenous vein graft was dilated (15 mm) and a large 40 mm diameter aneurysm involved the distal portion of the vein graft. The native RCA was not opacified. At cardiac surgery, careful dissection revealed an aneurysm (4×5 cm diameter) of the saphenous vein graft adjacent to the right atrium. The aneurysm was incised, was free from thrombus and in part excised. The proximal part of the saphenous vein graft was ligated. The patient's postoperative course was uncomplicated and he remains asymptomatic 12 years after surgery.

Case 2

A 62 year old man underwent single saphenous vein bypass grafting of the RCA in 1975. He was asymptomatic until 1993 when he underwent repeat coronary angiography because of recurrent angina. This angiographic study demonstrated multiple stenoses of the left anterior descending coronary artery (LAD) and a tight stenosis in the left circumflex coronary artery (LCx). There was a diffuse aneurysmal dilatation of the RCA bypass graft but it was still patent and provided flow to the distal bed of the occluded RCA. The patient underwent subsequent surgery with two new bypass grafts—the left mammary artery to the LAD and a saphenous vein graft to the LCx. The prior saphenous vein graft to the RCA was preserved. Postoperative ECG monitoring revealed a posteroinferior myocardial infarction. The patient remained asymptomatic until September 1996 when he had a road traffic accident with a thoracic trauma and a rib fracture. Three months later he was admitted to a community hospital and then transferred to our institution because of spontaneous constrictive chest pain. On admission, auscultation of the precordium revealed a continuous murmur, maximal at the right side of the sternum. The ECG showed changes of inferior

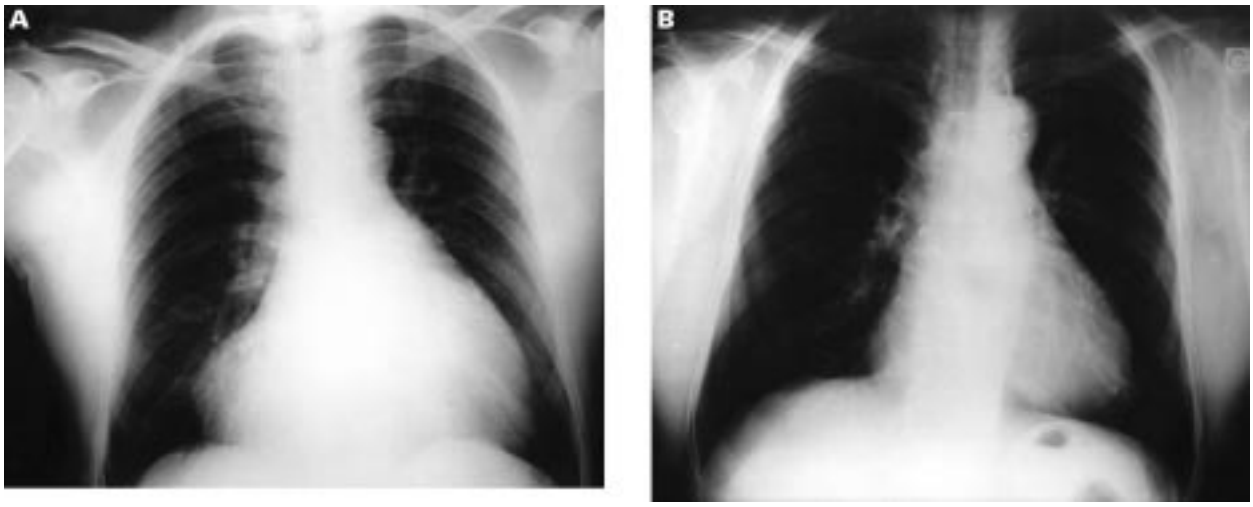

Figure 1 (A) Admission chest x ray of case 2 with a widened mediastinum and a right paracardiac mass; (B) chest x ray three years earlier.

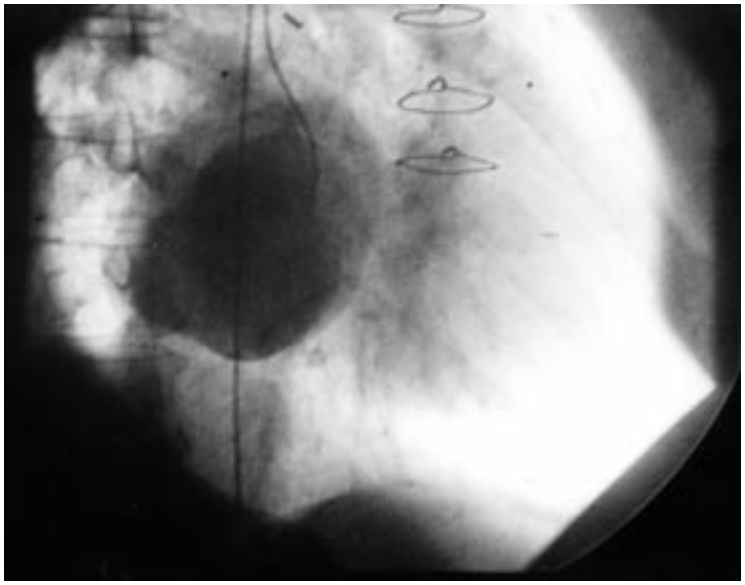

Figure 2 Case 2: Large pseudoaneurysm of the saphenous vein graft to the RCA (30° right anterior oblique view).

myocardial infarction. Serum creatine kinase peaked at 435 IU/l with raised MB fraction to 27. The admission chest radiograph demonstrated a widened mediastinum with a right paracardiac mass that was present but smaller on chest films taken three years earlier (fig 1A and B). A transoesophageal echocardiogram revealed a spherical 6 × 6 cm mass adjacent to the right atrium. This cavity, which appeared to be an aneurysmal dilatation of the saphenous vein CABG to the RCA, had established a fistulous communication between the graft and the right atrium. The left ventricle was dilated with moderate hypokinesia. The fistula was confirmed by right side heart catheterisation with oximetry. Angiography showed an aneurysmal dilatation of the proximal 2 cm of the saphenous vein CABG to the RCA with leakage forming a large pseudoaneurysm (fig 2) with a fistulous communication to the right atrium. The bypass grafts to the LAD and LCx were patent with no stenosis. Surgical management, which was considered a more appropriate treatment option than coil embolisation, was successful in occluding the proximal part of the aneurysmal RCA graft. The atrial wall was repaired by one suture of 5.0 polypropylene reinforced by pledgets. After operation, the continuous murmur was no longer audible. The patient was discharged 10 days after surgery.

Case 3

A 68 year old man with a history of limited anterior myocardial infarction and severe chronic obstructive pulmonary disease presented 17 years after CABG (saphenous vein graft to the LAD) with sustained acute chest pain; he had been free from angina since the bypass. On admission, ECG showed a persistent anterior lead ST elevation. Serial ECGs and enzyme estimations showed no evidence of acute myocardial infarction. Admission chest radiography showed a left perihilar mass. Transthoracic and transoesophageal echocardiographic studies revealed left ventricular anterior hypokinesia and an oval mass adjacent to the anterior wall (7 × 5 cm). Computed tomography and magnetic resonance imaging (fig 3)

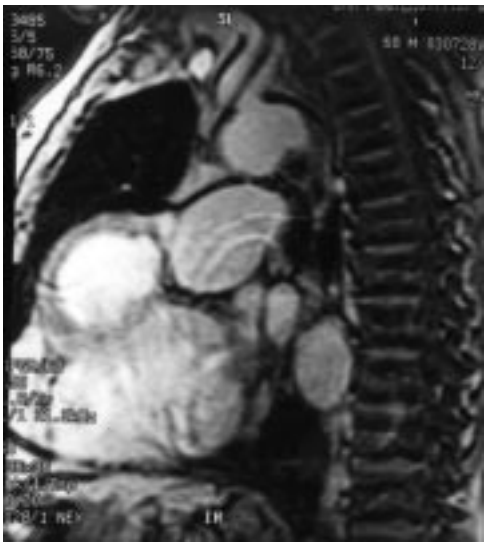

Figure 3 Magnetic resonance image of case 3 showing a 7 × 5 cm mass in the left mediastinum adjacent to the pulmonary artery trunk.

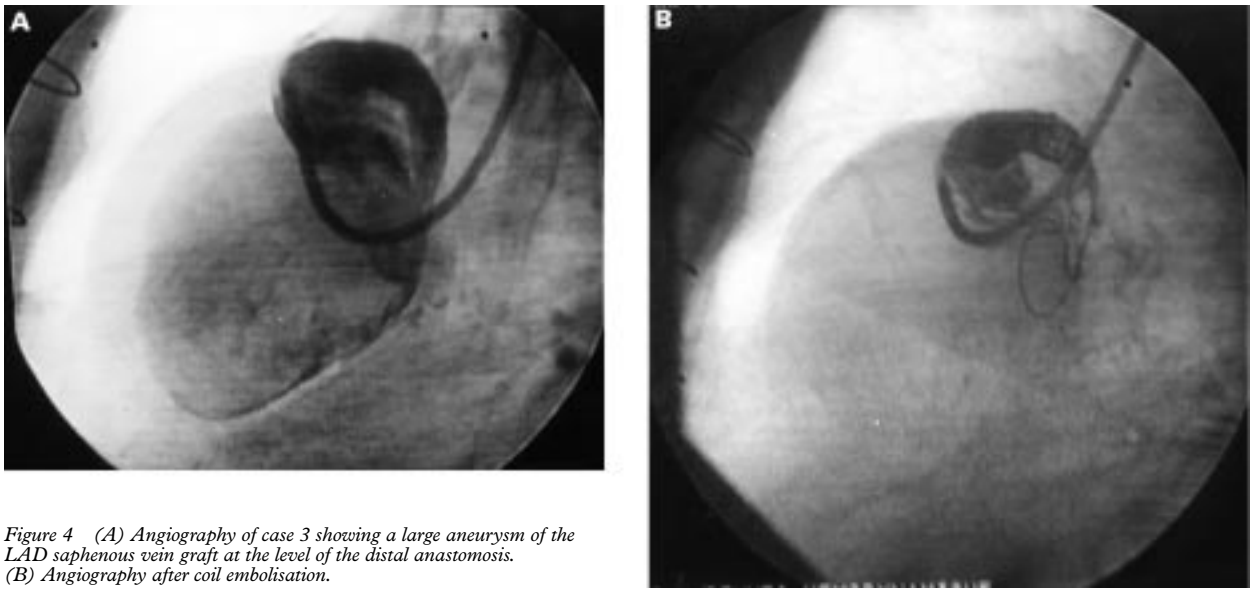

Figure 4 (A) Angiography of case 3 showing a large aneurysm of the LAD saphenous vein graft at the level of the distal anastomosis. (B) Angiography after coil embolisation.

showed a 7 × 5 cm mass in the left mediastinum, adjacent to the pulmonary artery trunk, filling with contrast. Angiography revealed a large aneurysm that arose from the left anterior descending saphenous vein graft at the level of the distal anastomosis (fig 4A). The native LAD beyond the graft anastomosis did not opacify. Coronary angiography showed complete occlusion of the mid-LAD that was opacified from the RCA. The RCA showed a very tight stenosis. Left ventricular ejection fraction was 50%.

The possibility of surgical grafting of the RCA was considered but thought to carry too high a risk because of the severe pulmonary disease. We decided on percutaneous embolisation of the LAD artery graft. A 5 F catheter was advanced through an 8 F multipurpose guiding catheter to the mouth of the aneurysm, and a 6 cm length 12 mm diameter coil (Cook Europe, Bjaeverskov, Denmark) was placed straddling the vein graft and the ostium of the aneurysm to provide a framework for the insertion of further five 5 cm length 10 mm diameter coils and one 15 cm length 15 mm diameter coil (fig 4B). These reduced flow and almost completely occluded the graft; however, unexpectedly delayed opacification of the native LAD beyond the distal anastomosis was observed.

No chest pain, no ECG change, and no cardiac enzyme increase occurred during the next 72 hours. On the fourth day after coil embolisation the patient reported new chest pain. The ECG showed increased ST elevation in anterior leads. We attributed these ECG change to the complete occlusion of the graft leading to recurrent anterior infarction. Serum creatine kinase peaked at 457 UI/l. Three days later, angiography confirmed complete occlusion of the graft with no more opacification of the aneurysm.

A few days later, the patient still reported spontaneous short chest pains with left arm irradiations resolved with nitroglycerin. Coronary angioplasty of the tight RCA stenosis was attempted with a good result and no complication. The patient was discharged three weeks after initial hospitalisation.

Discussion

There have been almost 50 published cases of saphenous vein graft aneurysms or pseudoaneurysms since 1975. The aneurysms have been of various sizes (1–13 cm diameter). The interval between operation and the occurrence of the aneurysm varied from 11 days to 21 years. A distinction should be made between a true aneurysm, usually a late complication of bypass surgery,[5] and a pseudoaneurysm. However, there appears to be some ambiguity in the literature in differentiating between the two. True aneurysms are atherosclerotic in nature and appear as a late postoperative complication more than five years after CABG. Pseudoaneurysms may occur early as well as late after initial surgery, at the anastomotic site in most cases. The exact mechanism for the development of such pseudoaneurysms is unclear. Imperfect surgical technique with sutural defects may play a role in some cases occurring relatively early in the postoperative course. Other mechanisms are thought to include damage to the graft wall during initial surgery or weakness in the veins themselves at branch sites or in the areas of the vein valves. One case of false aneurysm that appeared after coronary angioplasty and stenting of a saphenous vein CABG to the LAD suggested that stenting of aged vein grafts might be a cause of aneurysm formation. Infection has also been described as a cause in at least six observations.

In most symptomatic cases, patients with saphenous vein graft aneurysms presented with recurrence of thoracic chest pains, which may be related to angina, myocardial infarction, or rupture. In some cases a mediastinal mass on chest radiography or on echocardiography, a superior caval venous obstruction or worsening dyspnoea led to the diagnosis. Plain chest radiographs, computed tomography, echocardiography, transoesophageal echocardiography,

and magnetic resonance imaging have been used for diagnosis, which is confirmed by coronary arteriography. The natural history of aneurysms includes thrombosis, embolisation, and rupture. There are two reports of rupture of saphenous vein graft aneurysm. These ruptures may cause haemothorax or haemoptysis when the ruptured aneurysm communicates with a bronchus. In most cases, rupture occurred spontaneously. Murphy *et al* suggested that rupture of an aneurysm might have been the result of cardiopulmonary resuscitation.[6] Another complication is the occurrence of myocardial infarction. Intraluminal thrombus formation is common and can result in myocardial damage either by embolisation or by complete occlusion. The abnormal cavity may also cause myocardial infarction by mass effect.

Three cases of fistulous communication between a saphenous vein graft aneurysm or pseudoaneurysm and a heart cavity have been published.[7–9] Riahi *et al* reported a case of saphenous vein graft to an LAD aneurysm that had eroded into the anterior wall of the right ventricle.[7] Two cases of fistula between a saphenous vein graft aneurysm and an atrium have been published.[8 9]

Recommendations for treatment of saphenous vein graft aneurysms are not well established. Nevertheless the potentially life threatening complications suggest a role for early aneurysm correction. Treatment of these lesions includes excision or ideally resection of the aneurysm with replacement of the diseased graft when the native coronary artery requires further revascularisation. The risk of reintervention may be high. Thus, non-surgical embolisation of these aneurysms according to the method of Gianturco and colleagues[10] may be an alternative, particularly in patients considered not to be operative candidates who have the distal anastomosis of the saphenous vein graft already occluded. The coils have to be placed well within the graft to prevent embolisation to the aorta. The Gianturco steel coils are considered to be suitable because of their appropriate size, ease of placement, permanence, and effectiveness of occlusion. The first report of percutaneous transcatheter embolisation was in 1983[3]; since then, only one other case has been reported.[4] In these two cases no additional coronary revascularisation was performed.

Although aneurysm or pseudoaneurysm formation is an unusual complication of saphenous vein graft surgery, the diagnosis must be suspected particularly in the face of a mediastinal mass on chest radiography in patients who have had CABG, and be confirmed by echocardiography, computed tomography or magnetic resonance imaging. Coronary angiography should be performed to opacify the aneurysm and detect other lesions in the native coronary circulation that might require bypass grafting. The primary treatment remains surgical but transcatheter embolisation is an alternative in high risk or inoperable patients.

1 Riahi M, Vasu CN, Tomatis LA, *et al*. Aneurysm of saphenous vein bypass graft to coronary artery. *J Thorac Cardiovasc Surg* 1975;**70**:358–9.
2 Benchimol A, Harris CL, Desser KB, *et al*. Aneurysms of an aorto-coronary artery saphenous vein bypass graft—a case report. *Vasc Surgery* 1975;**9**:261–4.
3 Kim D, Guthaner DF, Wexler L. Transcatheter embolization of a leaking pseudoaneurysm of a saphenous vein aortocoronary bypass graft. *Cathet Cardiovasc Diagn* 1983;**9**: 591–4.
4 Dimitri WR, Reid AW, Dunn FG. Leaking false aneurysm of right coronary saphenous vein graft: successful treatment by percutaneous coil embolisation. *Br Heart J* 1992;**68**: 619–20.
5 Liang BT, Antman EM, Taus R, *et al*. Atherosclerotic aneurysms of aortocoronary vein grafts. *Am J Cardiol* 1988;**61**: 185–8.
6 Murphy JP, Shabb B, Nishikawa A, *et al*. Rupture of an aortocoronary saphenous vein graft aneurysm. *Am J Cardiol* 1986;**58**:555–7.
7 Riahi M, Stone KS, Hanni CL, *et al*. Right ventricular-saphenous vein graft fistula. Unusual complication of aortacoronary bypass grafting. *J Thorac Cardiovasc Surg* 1984;**87**:626–8.
8 Jukema JW, van Dijkman PRM, van der Wall EE. Pseudoaneurysm of a saphenous vein coronary artery bypass graft with a fistula draining into the right atrium. *Am Heart J* 1992;**124**:1397–9.
9 Zely P, Delarche N, Estrade G, *et al*. Double aneurysm of a venous aorto-coronary bypass graft. *Arch Mal Coeur* 1996; **89**:1213–16.
10 Gianturco G, Anderson JH, Wallace S. Mechanical devices for arterial occlusion. *Am J Radiol* 1975;**124**:428–35.