Three-Dimensional Reconstruction of a Large Venous Bypass Graft Aneurysm Supplying 2 Coronary Arteries

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This 33-year-old patient had had emergency surgery 11 years earlier, at age 22 years, for acute dissection of the ascending aorta involving the main stem of the left coronary artery with grade 4 regurgitation of the aortic valve. The aortic valve and the ascending aorta were replaced with a conduit consisting of a biological prosthetic aortic valve and an aortic prosthesis (Bentall’s technique). Because the dissection involved both coronary ostia, the native coronary arteries were not reimplanted. Instead, 2 saphenous vein segments were used for CABG to the left circumflex artery (LCx) and right coronary artery (RCA). The patient recovered from surgery and remained free of symptoms.

He presented at the age of 33 years with chest pain and shortness of breath during light exercise. Echocardiography showed severe left ventricular hypertrophy as well as intense degeneration and calcification of the grade 4 stenotic aortic valvular bioprosthesis. In addition, reduced myocardial wall motion of the anterolateral region of the left ventricle was noted. The ejection fraction was reduced to 45%.

Aortic angiography showed an aneurysmatic formation in the region of the ascending aorta from which both venous bypass grafts were supplied (Figure 1). Electron beam tomography (EBT) revealed a large aneurysmatic formation in the region of the proximal anastomosis of the aortic prosthesis \( \approx 5.0 \) cm in diameter. After 3D reconstruction of the EBT scans, the pathological condition was better appreciated. It revealed a large aneurysm of the venous bypass graft to the LCx from which the CABG to the RCA was supplied (Figure 2).

EBT images were performed from scans 3.0 mm thick, increment 2.0 mm, scan duration 0.1 second, 40 slices after intravenous injection of contrast media (3 mL/s; 120 mL total volume). Scans were triggered to late diastole for every heartbeat. The EBT shaded surface was created with Virtuoso software (Siemens Medical Systems). The chest wall was subtracted from the source images before 3D reconstruction.

The patient underwent reoperation. During surgery, the pathological anatomy was similar to what was identified by 3D reconstruction of the EBT. The degenerated aortic valve and the aortic prosthesis were replaced with a mechanical bileaflet valve and an aortic prosthesis as a conduit (Bentall’s technique). The length of the aortic vascular prosthesis was extended to the aortic arch because of the significant atherosclerotic degeneration of the native aorta; the distal anastomosis was performed under hypothermic circulatory arrest. The venous bypass grafts were ligated. Both internal thoracic arteries were used as arterial grafts for the LCx and RCA. Because of a dominant circumflex coronary artery system, a venous CABG was used to supply a large posterolateral branch of the LCx. The patient’s postoperative recovery was prolonged; he required catecholamines and intensive care for 9 days. He was discharged with improved myocardial performance 21 days after surgery.
Figure 1. Left anterior oblique view of left ventricle and ascending aorta. Large aneurysmatic formation is visualized (arrows). Aortic vascular prosthesis is marked by arrowheads. LV indicates left ventricle; Ao, native aorta.
Figure 2. Shaded-surface 3D reconstruction of ascending aorta. Large venous bypass graft aneurysm supplying both bypass grafts is shown by EBT. GA indicates graft aneurysm; Ao, aorta; PA, pulmonary artery; and CX, LCx. A, anterior view; B, left superior oblique view; and C, right lateral view.
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