A 75-year-old woman with familial hypercholesterolemia was admitted with unstable angina. Thirteen years earlier, she had undergone coronary artery bypass grafting with a left internal mammary artery (LIMA) to the left anterior descending artery (LAD) and subsequently bilateral common carotid bypass surgery through a second sternotomy 3 years later. Physical examination revealed left brachial hypotension, a left subclavian bruit, and features of severe aortic stenosis. Transthoracic echocardiography demonstrated severe valvular and supravalvular aortic obstruction with an area of 0.50 cm². Noncontrast computed tomography showed complete calcification of the ascending aorta (porcelain aorta) and confirmed supravalvular obstruction with calcific plaque (Figure 1). She was subsequently offered placement of a left ventricular apex-descending aorta conduit through a left thoracotomy.

Preoperative diagnostic angiography revealed a critical ostial left subclavian artery stenosis, with flow reversal in the vertebral artery and preferential entering of contrast into the LIMA (steal phenomenon, Figure 2, Movie 1). The LIMA graft was widely patent, supplying the LAD, which itself collateralized the distal right and circumflex arteries. The native coronaries were occluded proximally. Of note, intubation of the left subclavian ostium with a 5F JR4 diagnostic catheter provoked immediate chest pain, profound hypotension, and severe ST depression on ECG. After a discussion with the patient and surgeons, the decision was made to proceed with endovascular subclavian intervention, with the goal of relieving myocardial ischemia and potentially reducing subsequent surgical risk.

A hybrid transradial-transfemoral approach was used to achieve the following 2 objectives: avoidance of catheter manipulation in the aortic arch and provision of myocardial perfusion during intervention (Figure 3). The lesion...
was crossed from the left radial with a 0.035-in Glidewire (Terumo). The wire was then snared and externalized through a 6F shuttle sheath (Cook) positioned in the descending aorta through the right femoral artery, with intervention being performed through the femoral route. After systemic heparinization, arterial blood was aspirated into a 50-mL syringe. During subsequent periods of subclavian occlusion by balloon angioplasty and stent placement, the pre-aspirated blood was manually injected into the LIMA graft through a left transradial guide catheter to provide myocardial perfusion. The final angiographic result was excellent, and, unlike the diagnostic study, there was no detectable procedure-related myocardial ischemia on this occasion. Moreover, a large area of resting ischemia in the LAD territory was resolved after stent placement. This is demonstrated (Figure 4, Movie 2) using body surface mapping (Prime ECG, Heartscape Technologies, Columbia, Md). The Prime ECG records electrocardiograms from 64 electrodes placed on the anterior and 16 on the posterior chest wall. Proprietary software creates a 360° map of the ST-segment deviation from the 80 leads, providing a sensitive tool for detecting and localizing ischemia.

Endovascular intervention for proximal subclavian stenosis is an effective strategy for the relief of myocardial ischemia in the presence of a mammary artery bypass graft. Although ischemia provoked during intervention is usually temporary and reversible, the critical importance of the LIMA graft together with severe aortic stenosis in the case presented raised concern of precipitating ischemia driven hemodynamic instability with even brief periods of occlusion. The adopted approach of maintaining some myocardial perfusion by manual transfusion of autologous arterial blood during periods of subclavian occlusion reduced procedural ischemia and may also have enabled longer periods of perfusion, had this been necessary. An approach such as this might additionally have value in the perfusion of cerebral, lower extremity, and other noncoronary circulations during selected interventions.

Disclosures

None.

Reference


Key Words: angioplasty  ■  catheterization  ■  perfusion  ■  peripheral vascular disease  ■  transradial
Figure 4. Eighty-channel Prime ECG body surface map of ST-segment shift at the J point, before and after subclavian intervention. Left, Blue zone represents a large area of resting ST-segment depression (ischemia) in the LAD territory before intervention. The red zone represents reciprocal ST-segment elevation. Right, Resolution of ischemia after stent placement.
Percutaneous Subclavian Artery Bypass for Myocardial Perfusion During Endovascular Intervention
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