Stenting of a Large Thrombus-Containing Subclavian Artery Stenosis Using a Distal Protection Device

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Atheromatous obstructive lesions of the arch vessels that contain thrombi are at high risk for distal embolization during angioplasty. This can lead to catastrophic neurological complications. We report a case of acute-on-chronic ischemia of the left upper limb due to thrombus-containing subclavian artery stenosis. After placement of an intravascular filter device, angioplasty and stent implantation successfully relieved the stenosis without any complications. (Indian Heart J 2003; 55: 262–264)

Key Words: Endovascular therapy, Angioplasty, Distal protection

Percutaneous transluminal angioplasty and/or stenting has emerged as an alternative to surgery for patients with extracranial arch vessel obstruction. However, atherosclerotic debris or a thrombus released during angioplasty or stenting may lead to distal embolization and periprocedural brain ischemia or infarction. Experimental studies utilizing human carotid plaques have shown that embolic particles are released from them. In addition, transcranial Doppler studies have confirmed that multiple emboli are released during carotid, subclavian, and vertebral artery angioplasty. The risk of distal embolization would be much more in stenotic lesions containing a large thrombus. Over the past few years, distal protection devices have been used to capture and retrieve atherosclerotic material in carotid and coronary lesions (saphenous grafts and native). However, there is a scarcity of data on the use of distal protection devices in the stenting of subclavian artery stenosis containing a thrombus. Such devices protect against distal embolization. We report a case with severe subclavian artery stenosis containing a large thrombus, which necessitated the use of a distal protection device. Angioplasty and stent implantation could be performed successfully without any complications.

Case Report

A 65-year-old male, chronic smoker, nonhypertensive, and nondiabetic presented with a history of pain in the left upper limb after exercise for the past 6 months. The pain increased in severity, and the patient had developed rest pain for the past 15 days. He also developed a bluish discoloration of the fingertips of the left hand. The other limbs were not affected, and there was no history suggestive of coronary artery disease. On physical examination, the left upper limb was cooler, the left brachial and radial pulses were absent, and the fingertips were cyanotic. The other peripheral pulses were normal. Systemic examination was unremarkable. Routine biochemical, hematological, and lipid profile parameters were within normal limits. He underwent an arch aortogram and a selective angiogram of the left subclavian artery, which showed 90% stenosis in the first part with a large thrombus just distal to the obstruction (Fig. 1). The carotid and vertebral arteries were normal.

The patient was given a bolus of heparin 5000 units intravenously. The left subclavian artery was hooked with a 7 F Shuttle sheath (Cook Inc, Bloomington, IN, USA). The stenotic lesion was crossed with a Filter Wire Ex™ (Boston Scientific, Natick, MA, USA) along with its retrieval sheath. The distal part of the wire along with the filter was positioned in the vertebral artery on the left side, and the retrieval sheath removed (Fig. 2). Optimal positioning and apposition of the filter were confirmed in two orthogonal views by the injection of contrast. The lesion was predilated with a 3×15 mm coronary angioplasty balloon. Subsequently, a balloon-expandable Corinthian stent (Cordis Corp, FL, USA) measuring 7×15 mm was deployed at a pressure of 14 atm.

Check angiogram showed an optimal result with excellent dilatation of the stented segment (Fig. 3). A retrieval catheter was then passed over the filter wire into the vertebral artery to collapse the filter. Leaving 1 mm of the filter open, the system, i.e. the filter wire and the...
On follow-up of 18 months, the patient continues to be asymptomatic. The arterial pulsations in the left arm are well palpable. The blood pressure in both arms continues to be the same.

Discussion

Occlusion of the subclavian or brachiocephalic artery accounts for approximately 17% of symptomatic extracranial cerebrovascular disease. Patients who have subclavian artery stenosis with thrombi need to be diagnosed early so that therapy can be started for disabling upper extremity ischemia and gangrene. The traditional therapy for subclavian arterial occlusive disease is a surgical bypass. A variety of surgical techniques have been used, including transthoracic procedures, carotid–subclavian bypass, and axillo-axillary bypass. However, even with less invasive, extra-anatomic, extrathoracic reconstruction, the morbidity and mortality are considerable. An analysis of published results shows that it is associated with a mortality rate of 2%±2% (0%–11%), stroke rate of 3%±4% (0%–14%), and an overall complication rate of 16%±11% (0%–43%).

Subclavian angioplasty has become the preferred mode of treatment for stenotic lesions. However, it has certain limitations, such as dissection in 10%–15% of cases, thrombosis in 2%–8%, and technical failure in 5%–12%. Distal embolization of plaque material or a thrombus into the vertebral artery resulting in neurological deficit has been reported in 1% of procedures. In the presence of a thrombus, the risk of distal embolization and stroke is greater.
Stents are increasingly being used in arch vessel angioplasty, and have been found to overcome some of the limitations of balloon angioplasty, thereby improving the acute and long-term outcomes. The use of stents may limit distal embolization by trapping debris between the stent and arterial wall. However, microembolization still occurs. Transcranial Doppler studies have shown evidence of multiple embolization during almost all carotid stenting procedures. Carotid angioplasty and stenting is associated with a perioperative stroke rate of 3%–6% in most series, largely due to distal embolization. It has been shown in various studies that capturing these materials with a distal protection device leads to a reduction in neurological events. In a recent review of studies, the stroke and death rate within 30 days was found to be 1.8% in patients treated with a cerebral protection device compared with 5.5% in patients treated without a cerebral protection device. In the present case, there was a big thrombus in the proximal portion of the subclavian artery. Distal embolization into the vertebrobasilar territory could have led to disastrous consequences. The filter device retrieved thrombotic material, thereby avoiding neurological complications. Thrombolytic therapy to lyse the thrombus followed by angioplasty may be an option in such a case, but may be complicated by embolization of the thrombus or hemorrhage. Protected angioplasty and stenting, as used in this case, would seem to be a safer option.

There are three approaches to cerebral protection: distal balloon occlusion devices, distal filter devices, and proximal occlusion devices. Each approach has its inherent advantages and disadvantages. The FilterWire Ex (Boston Scientific, Natick, MA, USA) used in this patient is a new filter device currently under clinical investigation. The FilterWire is unique in that it has an off-center filter mounted on a 0.014" guidewire. Because of the unique design of the fish-mouth filter opening, it is extremely flexible, and also has a low crossing profile (<3.5 F). The filter has bare holes of 80 µm that permit antegrade flow while providing distal protection. In addition, the nitinol framework, which supports the filter, provides circumferential contact with the arterial wall, thereby assuring complete apposition of the filter, even in diseased and tortuous vessels. Finally, this filter can be recaptured (collapsed) and retrieved using any standard peripheral balloon that is used for post dilatation. Recently, a multicenter experience using this filter in patients undergoing carotid artery stenting has been reported by Grube et al. Embolic material was retrieved in 74% of 36 procedures, with only 2 (5.7%) transient periprocedural neurological events, and 0% 30-day major adverse cardiac events. Flow reversal also could provide protection from atheroembolization during subclavian angioplasty to some extent. However, some cases do develop neurological complications following angioplasty. Transcranial Doppler studies have also shown microembolization during and immediately after subclavian angioplasty. Techniques to make the procedure safer need to be employed.

The present case demonstrates the innovative use of a distal filter protection device in the presence of a large thrombus in the subclavian artery to protect the posterior circulation from embolization during angioplasty. Reduction of embolization by the use of a distal protection device during carotid angioplasty, and our experience with this case, suggest that the use of a protection device should be considered for proximal subclavian artery interventions, especially those with a thrombus.

References