

Percutaneous Transluminal Angioplasty of an Innominate Artery Occlusion

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Abstract

A middle-aged woman presented with recent-onset left hemiparesis and right subclavian steal syndrome. She was found to have an obstructed innominate artery. We successfully performed balloon angioplasty of the occluded innominate artery and encountered no complications during follow-up of currently 8 months.

Key words: Angioplasty—Innominate artery—Subclavian artery

Percutaneous transluminal angioplasty (PTA) is an accepted and effective method for treatment of arterial stenoses [1–6]. The procedure has few complications [1–6]. The technique has also been applied successfully to recanalization of occluded vessels, including the subclavian artery [1–6]. However, we have found only one other report in the literature [7] of its use for the recanalization of an innominate artery occlusion. These lesions are comparatively rare and there may be a reluctance to perform the procedure in such cases for fear of cerebrovascular complications. We successfully applied PTA to recanalize an occluded innominate artery in a patient with a recent cerebrovascular accident and subclavian steal syndrome.

Case Report

A 49-year-old woman presented with a 3-week history of sudden onset right-sided headaches and pain in the right eye. She had a left hemiparesis and right subclavian steal syndrome, further limiting her daily activities. Her only known cardiovascular risk factor was that she smoked 20 cigarettes a day. On examination she was found to have a left hemiparesis. Her right carotid and radial pulses were absent. A clinical diagnosis of cerebral infarction following ischemia or stenosis of the innominate artery was made. A cerebral computed

tomography (CT) scan showed a mixed density lesion in the right insula and opercula with low density extending into the basal ganglia, in keeping with a vascular insult a few weeks old.

Aortic arch angiography showed occlusion of the right innominate artery near its origin (Fig. 1). Steal phenomenon was present with filling of the right subclavian artery by retrograde vertebral artery flow. Some contrast entered the distal innominate artery and the occluded segment was estimated to be 2 cm long (Fig. 2). There was retrograde filling of the right carotid artery in the neck via collaterals from the vertebral artery to the ascending pharyngeal artery.

Under systemic heparinization, angioplasty of the occluded innominate artery was performed in order to relieve her subclavian steal syndrome. A 0.035-inch-diameter Terumo wire (Terumo Corporation, Tokyo, Japan) and a Cook 5 Fr headhunter catheter (William Cook, Ejaeberskov, Denmark) were passed through the occluded segment without difficulty. The occlusion was relatively short (Fig. 2) and was dilated using an 8-mm, 4-cm Accent balloon catheter (Cook). Two dilatations were made, each being of 2 min duration, with a pressure of 6 atm. Continuous monitoring of the subclavian artery waveform was carried out and a clinical assessment was made of the patient's condition and neurological status after each minute of every inflation. Angiography performed after the procedure showed a widely patent innominate artery with good antegrade flow in the carotid, subclavian, and vertebral arteries (Fig. 3). The patient was not heparinized after the procedure.

The patient complained of paresthesia in the right hand for 12 hr after the procedure. There were no other complications. The right carotid pulse returned to normal immediately and the radial pulse was easily palpable after 24 hr. No complications have occurred during 8 months of follow-up and blood pressures in both arms have remained equal.

Discussion

The cause of the cerebral infarct in this patient could have been either hemodynamic or embolic, but in either case was likely to have been a result of the innominate artery occlusion. The indication for angioplasty was to relieve the subclavian steal syndrome. We considered very carefully whether to go ahead with the angioplasty but decided in favor of it on the grounds that reverse flow in the vertebral artery would protect this vessel from distal embolization, and considered that the relatively small risk of embolization into the carotid territory would be very unlikely to worsen her clinical condition given that she



Fig. 1. Initial arch aortogram showing occlusion of the innominate artery at its origin. By choosing a later frame as mask, the retrograde filling (white arteries) of the right vertebral artery is seen in **A** and retrograde filling continuing into the subclavian artery is seen in **B**.

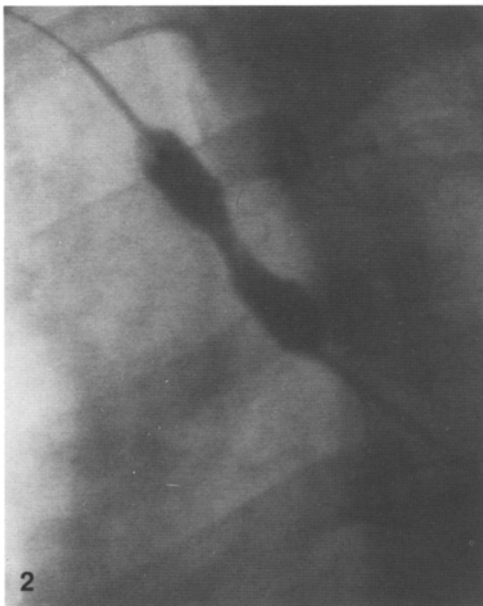


Fig. 2. Percutaneous transluminal angioplasty by 8-mm-diameter balloon. The occluded segment was estimated to be 2 cm long.

Fig. 3. Arch aortogram after percutaneous transluminal angioplasty shows complete patency of the innominate artery.

had a dense hemiplegia. We realized from the angiograms that the occlusion was short.

Corrective surgery has traditionally been the treatment for symptomatic subclavian or innominate artery stenoses or occlusions [8]. Surgical intervention has a high mortality and morbidity rate for the transthoracic approach with complications including chylothorax,

pneumothorax, pleural effusions, lymphatic fistulas, phrenic nerve palsy, and Horner's syndrome [9].

PTA of proximal or distal subclavian artery stenoses has been shown to be a safe and effective procedure with comparable efficacy to surgical intervention but with a lower complication rate [1–6]. It is recommended as the treatment of choice for subclavian steal

syndrome, arm claudication, or digital ischemia caused by such lesions [1].

Far fewer innominate or right subclavian artery lesions are featured in the published series [1–7, 10–12], possibly because right subclavian and innominate artery lesions are less common, or because there is some reservation over angioplasty at a site near the right common carotid origin [1]. The treatment of occlusions of the subclavian or innominate arteries using PTA is still contentious [3], although three recent studies suggest that such occlusions can be successfully corrected using this technique [1, 10, 13]. The largest series, by Mathias et al. [13], involved 348 patients with subclavian artery stenosis, 97% of whom were successfully dilated. In any vascular intervention in the great vessels, the potential benefits must be weighed against the possible serious risks. In this patient, the potential benefit of relieving the subclavian steal and increasing the cerebral blood flow was considered greater than the risk of distal thromboembolism and the additional potential risk to the carotid and vertebral arteries and their distributions.

Block et al. [14] demonstrated the release of wall debris during transluminal angioplasty, but only at a very minor degree which is clinically unimportant. Ringelstein and Zeumer [15] demonstrated that retrograde blood flow within the stealing vertebral artery does not reverse immediately following angioplasty, but takes 20 sec to 4 min, even though sufficient restoration of flow and blood pressure has occurred within the subclavian artery. This delay of flow reversal is thought to serve as a protective mechanism against cerebral embolism during and shortly after PTA [16]. These findings are supported by the results of clinical experience with PTA. Most studies have shown the rate of distal embolic episodes to be low [1–6].

It has also previously been assumed that angioplasty of stenotic or occlusive proximal subclavian artery lesions would lead to a higher rate of complications, particularly distal embolism or damage to the vertebral artery. This fear has not been borne out in subsequent reports [1, 2]. Vitek [2] reported on a series of 35 stenotic subclavian artery PTAs, 19 of which were proximal. The balloon was inflated at the origin of the subclavian artery with no resulting immediate complication. No complication occurred after 3 years of follow-up [2]. In one series, four out of five subclavian artery occlusions were recanalized successfully with no complications other than a groin hematoma in one patient [1]. Our experience lends support to the view that the procedure can also be safely carried out to achieve recanalization of occluded innominate arteries.

The long-term results of percutaneous transluminal angioplasty have also been studied [1, 6, 10]. Selby et al. [10] followed up all 29 patients in whom they had carried out PTA of subclavian, brachial, and innominate artery

stenoses. Follow-up ranged from 4 to 88 months (mean 36 months). Re-stenosis occurred in only one patient after 8 months. Life-table analysis projected a 7.5-year cumulative patency rate of 96.6% [10]. The results are favorable when compared with those of surgery [10]. Dorros et al. [11] successfully performed PTA in 27 patients at 33 sites without complication. Follow-up was obtained in 22 patients (82%) for a mean time of 28 months. The cumulative patency rate was 95% [11]. Other studies report similar results [1, 6].

We have applied PTA to recanalize an occluded innominate artery with no complications (to date) at 8-month follow-up.

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