Percutaneous transluminal carotid angioplasty in fibromuscular dysplasia

Case report

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A patient with fibromuscular dysplasia (FMD) of the internal carotid artery was treated by balloon percutaneous transluminal angioplasty (PTA). This is the sixth reported case of FMD stenotic disease which was dilated by PTA. All previous cases including the current example were treated successfully with resolution of symptoms. This procedure is associated with a relatively low morbidity and is an alternative method of treatment to operative endarterectomy for this disorder.

KEY WORDS • fibromuscular dysplasia • percutaneous transluminal angioplasty • carotid artery

Fibromuscular dysplasia (FMD) is a vascular disease of unknown etiology, affecting primarily the renal arteries (85% of cases) of young females.10 The distal internal carotid artery (ICA) at the C1–2 vertebral level is the second most commonly affected site.10 The natural history of the disease is variable and largely unknown, but may progress to transient neurological deficits or even to completed stroke.4,5,10 Symptomatic lesions have been managed by surgical endarterectomy, excision and arterial reconstruction, patch angioplasty, bougie dilatation, and more recently endarterectomy with balloon dilatation.1,14,19

This case is the sixth known published instance of FMD treated by percutaneous transluminal angioplasty (PTA), and is presented to emphasize the advantages of the PTA technique.2,9,18

Case Report

This 30-year-old Caucasian woman presented with a chief complaint of a “noise in her right head” that was synchronous with her heart beat. This noise had been troubling her for 2 years; it had become progressively louder with time, and was exacerbated by physical exercise. She also complained of an intermittent right-sided headache and occasional numbness and tingling of the third through fifth fingers of her right hand, the latter being worse when the hand was elevated above her head. No left-sided motor or sensory difficulties were detected.

Examination. The neurological examination was normal except for a high-pitched holosystolic bruit heard over the right orbit and carotid artery. A cerebral angiogram 4 months prior to admission had revealed a thin web-like stenosis of the right ICA at the level of the C-1 vertebral body, suggestive of FMD. Angiographic cross-filling from side to side of the circle of Willis was demonstrated.

A repeat right ICA angiogram via a No. 5 French cerebral polyethylene catheter showed some progression of the stenotic segment of the right carotid artery with a beaded appearance typical of FMD (Fig. 1). The stenotic FMD lesion was marked by a lead skin marker, and a repeat angiogram confirmed the location of the marker at the level of FMD.

Procedure. The No. 5 French cerebral catheter was then exchanged for a 260-cm 0.035-in. guidewire. A No. 5 French Grünzig balloon catheter,* with a balloon...
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Discussion

In 1974, Grünzig and Hopff developed a balloon dilatation technique (PTA) for atheromatous vascular disease, a modification of PTA as originally described in 1964 by Dotter and Judkins. Since then, a number of authors have described balloon PTA for the treatment of atheromatous disease of coronary, renal, iliac, and femoral arteries. Motarjeme, et al., recently published their experience with PTA in 20 cases of atheromatous disease of the brachiocephalic arteries, including one external and one common carotid artery. Vitic and Morawetz also recently reported their experience with PTA of the external carotid arteries. Kerber, et al., recently published their experience with PTA in 20 cases of atheromatous disease of the brachiocephalic arteries, including one external and one common carotid artery. Vitic and Morawetz also recently reported their experience with PTA of the external carotid arteries.

Kerber, et al., described the successful balloon dilatation of a proximal carotid atheromatous plaque via surgical endarterectomy. Martin, et al., presented their experience in 1980 with PTA of nonatherosclerotic, non-carotid vascular lesions, including FMD.

The main objection to PTA of atheromatous disease of the carotid artery is the possibility of showering embolic material into the brain. Fibromuscular lesions may be accompanied by clot deposition in the affected vessel, and therefore if intraluminal thrombi are detected by angiography before PTA, the latter technique should not be used, and endarterectomy balloon removal of clot and dilatation of the FMD rings as described by Balaji and DeWeese should be used instead. However, scattered reports of successful PTA in cases of FMD in the absence of thrombi have been described. Mullan, et al., reported the successful Grünzig PTA of the ICA of a patient with FMD in 1980. Hasso, et al., presented three additional cases of FMD of the ICA in 1981 treated by Grünzig balloon PTA. In all three of these individuals the signs and symptoms of the disease eventually cleared by the 3-month follow-up review. These authors also stressed the importance of systemic heparinization to guard against PTA-produced emboli. Belán, et al., recently reported one case of FMD of the ICA, treated successfully by PTA using a Schneider Medintay AG coronary balloon catheter. All these cases are summarized in Table 1.

Both spontaneous and iatrogenic dissection have been described in association with FMD, and may be particularly likely to happen if balloon overdistention occurs or if the balloon catheter is advanced without a floppy guidewire. Small fissures of the arterial wall that may be demonstrated after angioplasty are caused by splitting of both the intima and media, the latter accounting for an increased luminal diameter after PTA. It is suggested that PTA of the carotid artery affected by FMD will have long-term results similar to the successes demonstrated in PTA in cases of renal arterial disease.

In conclusion, PTA offers several advantages to surgical procedures for FMD, in the absence of thrombi on the pre-PTA angiogram. These advantages include continuous fluoroscopic control of the procedure, the

4 mm in inflated diameter and 2 cm in length, was placed over the guidewire, and the catheter was then withdrawn. Five thousand units of heparin was given intravenously, and a continuous drip infusion of heparin (10 units/cc) was maintained through the Grünzig catheter throughout the procedure. The guidewire was placed distal to the FMD lesion, and the Grünzig balloon was advanced so that the balloon itself was centered over the lesion. A 37-mm Hg mean pressure gradient was recorded across the carotid stenosis before PTA. The balloon was manually fully inflated for 5 to 10 seconds, and this procedure was repeated twice. A carotid angiogram after PTA obtained through the Grünzig catheter demonstrated a widely patent carotid lumen in the region of the previously detected FMD (Fig. 1). The pre-PTA pressure gradient was unchanged but, due to transient catheter-induced spasm, accurate post-PTA pressure readings were thought to be unreliable. A digital radiograph obtained from a 5-cc Conray-60 arterial injection through the Grünzig catheter in the abdominal aorta revealed no evidence of renal FMD.

After the procedure, the bruit had disappeared and the patient was still totally asymptomatic 4 months following angioplasty.

† Digital radiography equipment manufactured by ADAC Laboratories, Sunnyvale, California.
TABLE 1
Summary of six cases of fibromuscular dysplasia (FMD) treated with PTA*

<table>
<thead>
<tr>
<th>Authors, Year</th>
<th>Age (yrs), Sex</th>
<th>Presenting Signs &amp; Symptoms</th>
<th>Angiography Findings</th>
<th>Dilatation Procedure</th>
<th>Results of PTA</th>
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</thead>
<tbody>
<tr>
<td>Mullan, et al., 1980</td>
<td>35, F</td>
<td>diplopia, pain in eye, tingling in face, rt CCA surgically occluded; 3 mos later: pulsatile noise in rt ear with bruit in rt neck</td>
<td>rt ICA: web proximal; lt ECA: mild FMD</td>
<td>Grünzig balloon inflated 8 times for 5 sec each; no pressures recorded</td>
<td>faint bruit, patient asymptomatic</td>
</tr>
<tr>
<td>Hasso, et al., 1981</td>
<td>74, F</td>
<td>transient light-headedness, dizziness, rt carotid bruit</td>
<td>rt ICA: &quot;string of beads&quot;; lt ICA: mild FMD</td>
<td>No. 7 French Grünzig balloon; distal FMD carotid pressures: pre-PTA 45/30 mm Hg, post-PTA 117/55 mm Hg</td>
<td>no bruits or symptoms 3 mos post-PTA</td>
</tr>
<tr>
<td>Belán, et al., 1982</td>
<td>53, F</td>
<td>pulsatile ringing in rt ear, worse with exercise</td>
<td>lt ICA: web balloon type not stated; pre-PTA pressure 90/40 mm Hg, post-PTA pressure 108/45 mm Hg</td>
<td>No. 7 French Grünzig balloon; ophthalmic pressure pre-PTA 80/55 mm Hg, post-PTA 135/80 mm Hg</td>
<td>TIA's decreased until symptom-free 6 wks post-PTA</td>
</tr>
<tr>
<td>Dublin, et al., 1983</td>
<td>30, F</td>
<td>no bruits in rt ear, bruit in rt carotid artery &amp; eye</td>
<td>lt ICA: &quot;beading&quot;</td>
<td>Schneider Medintay AG coronary balloon inflated 5 times for 5 sec each; no pressure gradient given</td>
<td>symptom-free; neurologically normal 1 mo post-PTA</td>
</tr>
</tbody>
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*Abbreviations: PTA = percutaneous transluminal angioplasty; CCA = common carotid artery; ICA = internal carotid artery; ECA = external carotid artery; TIA = transient ischemic attack.

ability to treat multiple areas of FMD from a single transfemoral puncture approach, the lack of a large incision site, an awake patient with only local anesthetic control, and no suture material in the artery that might conceivably produce turbulent flow and possible subsequent thrombus formation.

References
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