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Percutaneous Transluminal Angioplasty Prior to Carotid Cavernous Fistula Embolization

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Detachable balloon embolization has become well established as the primary treatment for carotid cavernous fistulae, and numerous articles have been written on techniques for balloon placement in the cavernous sinus [1–3]. Recently, several case reports have described the use of angioplasty of the internal carotid artery for stenosis resulting from either fibromuscular dysplasia or arteriosclerosis [4]. We report a case in which percutaneous angioplasty of a stenotic internal carotid artery resulting from trauma was performed with subsequent embolization of a large carotid cavernous fistula. To the best of our knowledge this has not been previously described.

Case Report

A 24-year-old man sustained multiple injuries in a motor vehicle accident in April 1984. He developed exophthalmos with decreased vision in his left eye. The patient was admitted to another hospital where the diagnosis of a left carotid cavernous fistula was made. In addition, there was 90% stenosis of the vertical portion of the petrous segment of the left internal carotid artery. Two attempted embolization procedures of the fistula were unsuccessful owing to failure to pass the catheter through the stenosis. The patient was referred to us for further management 2 years after his initial injury.

A repeat left internal carotid arteriogram demonstrated a tight stenosis (90%) of the vertical portion of the petrous segment of the left internal carotid artery. There was good flow of contrast material through the internal carotid artery distal to the stenosis with subsequent filling of the left cavernous sinus and superior and inferior ophthalmic veins as well as the inferior petrosal vein (Fig. 1). The left anterior and middle cerebral arteries were filled from the right internal carotid artery. A selective vertebral artery injection showed retrograde flow through the left posterior communicating artery with filling of the left carotid cavernous fistula (Fig. 2). Subsequently, a 0.035 straight LLT (long, long tapered) wire was placed past the stenosis in the left internal carotid artery. Progressive dilatations with 5-French, 7-French, and 9-French catheters were performed. A 2-mm Becton-Dickinson self-sealing silicone balloon was then placed in the cavernous sinus. It was inflated with 0.8 ml iodipamide methyl glucamine and detached with occlusion of the fistula in a manner described by Ahn et al. [5]. A repeat arteriogram showed marked improvement in the caliber of the left internal carotid artery with occlusion of the fistula and excellent flow to the middle cerebral artery (Fig. 3). The patient remains clinically asymptomatic 6 months after the procedure.

Discussion

Percutaneous carotid cavernous sinus occlusion by detachable balloon was first described by Serbinenko in 1974 [6]. Since that time, numerous articles have documented the technical aspects of this procedure with an arterial approach remaining the most common and effective means for approaching the cavernous sinus prior to embolotherapy. Serbinenko [6] has stated that while the inferior petrosal vein approach is very safe, it is often unsuccessful and is much more difficult to perform. A recent article by Uflacker et al. [7] has described the superior ophthalmic vein approach in the treatment of carotid cavernous fistulae. This was successful in three of five patients and requires waiting at least 3 months for arterialization of the ophthalmic vein to occur. In addition, rupture of the superior ophthalmic is a very serious complication. Thus, the endoarterial approach remains the most common way to embolize carotid cavernous fistulae. Inability to use the arterial approach may be due to stenosis, prior ligation, or tortuosity of the common or internal carotid artery.

Recently, percutaneous transluminal angioplasty has been described in treating stenoses of the common carotid or internal carotid artery caused by arteriosclerosis or fibromuscular dysplasia [4]; however, no reports have described dilatation of an internal carotid artery stenosis caused by trauma. In our particular case, a previous attempt at an outside hospital to embolize the carotid cavernous fistulae by an arterial approach was unsuccessful because of the inability to pass the balloon through the stenosis of the internal carotid artery. We decided to attempt dilatation of the internal carotid artery prior to balloon embolization. A recent article by Sclafani et al. [8] states that luminal narrowing after blunt trauma could be the result of multiple causes including arterial wall contusion and hematoma or clot lining the vessel wall. In our case, angiography demonstrated narrowing of the internal carotid artery without evidence of intraluminal thrombus. Owing to the chronicity of the arterial injury in our patient, we supposed that any hematoma that might have dissected into the media of the vessel would have become fibrosed, and that dilatation could be done safely.

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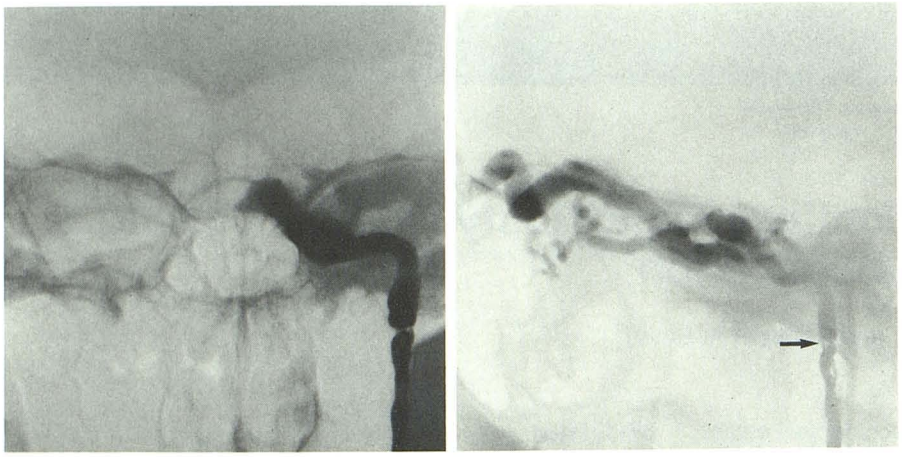
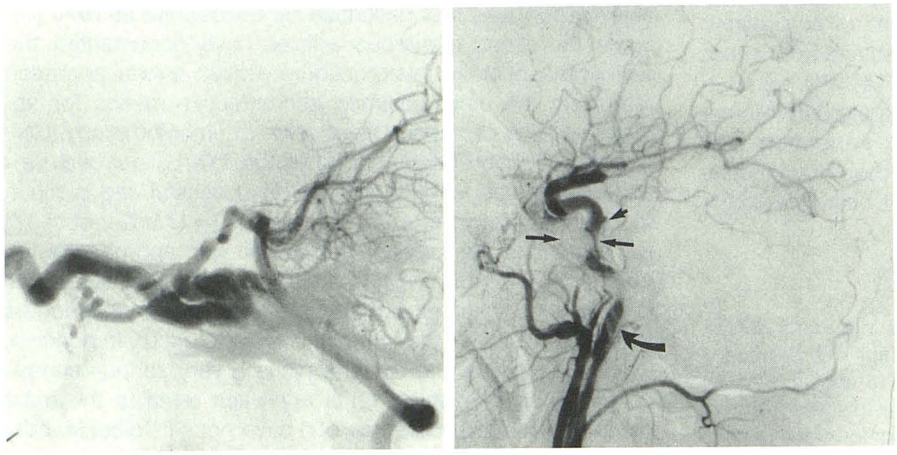


A B

Fig. 1.—*A* and *B*, Anteroposterior (*A*) and lateral (*B*) selective internal carotid arteriograms. Tight stenosis of petrous segment of left internal carotid artery (*arrow* in *B*) and a large carotid cavernous fistula.



2 3

Fig. 2.—Selective vertebral arteriogram. Retrograde flow into carotid cavernous fistula. Communication is via precavernous part of left internal carotid artery.

Fig. 3.—Postangioplasty and embolization arteriogram. Dilatation of stenotic left internal carotid artery (*curved arrow*). Detached balloon (between *long straight arrows*) in cavernous sinus with occlusion of carotid cavernous fistula and preservation of carotid flow. Note that small traumatic aneurysm of precavernous part of left internal carotid artery projects posteriorly (*short straight arrow*).

The amount of time it takes from initial injury to vessel fibrosis is unknown, but an article by Tsai et al. [9] suggests that fibrosis can occur within 1 month. A Dotter dilatation was performed rather than a balloon dilatation because of the higher radial forces generated on the arterial wall by a balloon dilatation catheter. While one can speculate that fibrosis should make dilatation of stenotic vessels caused by trauma safe, a Dotter dilatation generating less radial force would have less risk of vessel wall rupture [10]. In our patient, all the flow of the internal carotid artery was into the fistula. A Dotter dilatation with progressively larger catheters increased the risk of dislodging embolic debris because of the increased shear effect, but embolic material flowed into the cavernous sinus without clinical importance. Subsequent embolization with a detachable balloon was uneventful.

By extending the use of percutaneous transluminal angioplasty to the internal carotid artery, the need to approach the cavernous sinus through either the inferior petrosal vein or superior ophthalmic vein is unnecessary. In addition, flow through the affected internal carotid artery can be reestablished.

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