Cavernous sinus syndrome produced by communication between the external carotid artery and cavernous sinus

MICHAEL S. EDWARDS, M.D., AND EDWARD S. CONNOLLY, M.D.
Department of Neurosurgery, Ochsner Medical Institutions, New Orleans, Louisiana

The authors present two cases of cavernous sinus syndrome with spontaneous onset secondary to arteriovenous malformations and review the cases reported previously. These malformations enlarge slowly and produce symptoms only in adult life. Diagnosis may be difficult when there is no associated bruit. Adequate evaluation necessitates selective angiography of both the internal and external carotid artery circulation and the vertebral circulation. Conservative treatment is recommended unless symptoms worsen or there is progressive loss of vision.

KEY WORDS • angiography, selective • artery, external carotid • cavernous sinus

Cavernous sinus syndrome has commonly been associated with fistulous communications between the cavernous sinus and the internal carotid artery. Only 24 cases have been reported in which the major supply was through the external carotid artery 1-6,8,10,13,14,17-20 or the vertebral artery. 4 We wish to report two cases in which the major blood supply was through the external carotid artery with a main contribution from the vertebral artery in one case.

Case Reports

Case 1

A 42-year-old left-handed man developed a pulse-synchronous noise in his left ear in 1971, which he described as like the sound of whining dogs. He was examined by an otolaryngologist who found that compression of the left common carotid artery eliminated this noise. He underwent a carotid angiogram that was reported as normal.

In October, 1973, he noticed proptosis of his left eye, more pronounced on awakening, and a pulsatile vein below his left eye. He denied diplopia and headache at any time since the onset of symptoms.

Visual acuity was 20/20 in both eyes. He exhibited 2 mm of non-pulsatile exophthalmos and an intraocular pressure of 3.5 on the right and 7.5 on the left. Extraocular muscle strength was intact and the fundi appeared normal. A bruit, audible over both eyes, the left side of the face and head, and below the left ear, could also be heard over the left carotid artery but not over the right. It was abolished by carotid compression.

A left selective angiogram with external carotid injection revealed filling of the cavernous sinus through multiple dural branches of the left internal maxillary artery (anterior meningeal branches and the middle meningeal artery). Multiple tortuous vessels beneath the petrous bone in the cervical region were opacified with retrograde filling.

Cavernous sinus syndrome has commonly been associated with fistulous communications between the cavernous sinus and the internal carotid artery. Only 24 cases have been reported in which the major supply was through the external carotid artery 1-6,8,10,13,14,17-20 or the vertebral artery. 4 We wish to report two cases in which the major blood supply was through the external carotid artery with a main contribution from the vertebral artery in one case.

Case Reports

Case 1

A 42-year-old left-handed man developed a pulse-synchronous noise in his left ear in 1971, which he described as like the sound of whining dogs. He was examined by an otolaryngologist who found that compression of the left common carotid artery eliminated this noise. He underwent a carotid angiogram that was reported as normal.

In October, 1973, he noticed proptosis of his left eye, more pronounced on awakening, and a pulsatile vein below his left eye. He denied diplopia and headache at any time since the onset of symptoms.

Visual acuity was 20/20 in both eyes. He exhibited 2 mm of non-pulsatile exophthalmos and an intraocular pressure of 3.5 on the right and 7.5 on the left. Extraocular muscle strength was intact and the fundi appeared normal. A bruit, audible over both eyes, the left side of the face and head, and below the left ear, could also be heard over the left carotid artery but not over the right. It was abolished by carotid compression.

A left selective angiogram with external carotid injection revealed filling of the cavernous sinus through multiple dural branches of the left internal maxillary artery (anterior meningeal branches and the middle meningeal artery). Multiple tortuous vessels beneath the petrous bone in the cervical region were opacified with retrograde filling.
External carotid-cavernous sinus fistula

FIG. 1. Case 1. Left: Left common carotid injection shows early filling jugular system with retrograde flow into the cavernous sinus (upper arrow) and opacification of the arteriovenous malformation on the petrous bone (lower arrow). Right: Selective left vertebral injection shows filling of the left cavernous sinus through its anterior meningeal branch, and also opacifies tortuous vessels on the clivus and petrous bone.

of the cavernous sinus (Fig. 1 left). Drainage from the left cavernous sinus was in three directions: posteriorly into the petrosal-jugular system, anteriorly into the superior and inferior ophthalmic veins, and medially to a prominent vein on the margin of the tentorium, draining into the great vein of Galen and straight sinus. Injection into the right common carotid artery revealed filling of the left cavernous sinus from meningeal branches of the right internal maxillary artery. A left vertebral injection revealed filling of the left cavernous sinus through its anterior meningeal branch, and also opacified tortuous vessels on the clivus and petrous bone (Fig. 1 right). No treatment was instituted, and his clinical signs and symptoms were unchanged when he was last examined in 1976.

Case 2

A 58-year-old right-handed man noticed a pulse-synchronous “buzzing noise” in his head in 1971. In March, 1973, he complained of redness of both eyes and was treated with Blephamide ophthalmic ointment by a local ophthalmologist. Following treatment, there was slight improvement on the right; however, the left eye became more severely involved. He was evaluated again in July, 1973, at which time he exhibited marked conjunctival injection on the left with moderately dilated conjunctival veins.

Examination revealed a visual acuity of 20/25 on the right and 20/20 on the left. Exophthalmometer readings were 10 on the right and 22 on the left with applanation tensions of 12 on the right and 32 on the left. He exhibited mild left lateral rectus weakness. The fundi revealed sharp discs bilaterally and no evidence of venous congestion. On auscultation of the orbits, a bruit was heard bilaterally, louder on the left and loudest over the left mastoid and temporal area.

A selective left external carotid angiogram revealed a vascular malformation of both the petrous bone and the extracranial structures at the anterior-inferior margin of the petrous pyramid, that drained into the jugular system directly. There was filling of the cavernous sinus through the middle meningeal and anterior dural branches of the internal maxillary artery. Drainage occurred via the petrosal jugular system, anteriorly into the superior and inferior ophthalmic veins, and medially to a prominent vein in the margin of the tentorium that drained into the great vein of Galen/straight sinus (Fig. 2 left). There also appeared to be a contribution to the cavernous sinus via meningeal branches from
FIG. 2. Case 2. Left: Left selective external carotid injection shows filling of the cavernous sinus via multiple dural branches of the internal maxillary artery (anterior branches and middle meningeal artery) (upper arrow). Drainage into the petrosal jugular system can be seen (lower arrow) anteriorly into the superior and inferior ophthalmic veins, and medially to a prominent vein on the margin of the tentorium that drains via the great vein of Galen and straight sinus. Right: Left common carotid injection shows opacification of left cavernous sinus via meningeal branches of the internal maxillary artery.

Discussion

In a cooperative study of 545 cases of arteriovenous malformation (AVM's) Perret and Nishioka found 39 carotid-cavernous fistulas; four were extracranial angiomatous malformations and seven combined intra-extracranial malformations. Newton and Cronqvist reviewed 129 cases of AVM's and found 15 cases limited to the dura and supplied by meningeal arteries alone. Of their patients studied by external carotid angiography, 52% had dural contributions from one or both of the external carotid arteries.

In addition to our two cases, we found 36 reported cases of direct filling of the cavernous sinus from the external carotid arteries (Table 1). In 17 cases, the blood supply was solely through the external carotid artery; in nine cases, via the external and internal carotid artery; in seven cases by the external carotid artery and meningeal branches of the internal carotid; in two cases by the meningeal branches of the internal carotid artery; and in one case by the meningeal branches of the vertebral artery.

Lid postulated, and we agree, that cavernous sinus syndrome of spontaneous onset is the result of congenital dural AVM’s that enlarge slowly and present symptoms only in adult life. Almost all cases with blood supply chiefly from the external carotid artery were of spontaneous onset. These appear to be low pressure, low flow shunts that differ from the direct type of internal carotid-cavernous sinus fistula.

Eight of 22 patients with cavernous sinus syndrome of spontaneous onset had no bruit, which makes diagnosis difficult. These patients often seek treatment for ophthalmic disorders, but in many cases the dilatation of conjunctival veins is absent or mild; the proptosis is mild, and in only two cases was pulsatile proptosis present.

In assessing patients with a cavernous sinus syndrome, selective arteriography of the in-
External carotid-cavernous sinus fistula

TABLE 1

*Cavernous sinus syndrome produced by direct filling from external carotid arteries: summary of 38 cases

<table>
<thead>
<tr>
<th>Authors</th>
<th>Age, Sex</th>
<th>Bruit</th>
<th>Exophthalmos</th>
<th>Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Non-puls</td>
<td>Puls</td>
</tr>
<tr>
<td>Markham, 1961</td>
<td>31 F</td>
<td>+</td>
<td>+</td>
<td>?</td>
</tr>
<tr>
<td>Hayes, 1963</td>
<td>M</td>
<td>+</td>
<td>+</td>
<td>traumatic</td>
</tr>
<tr>
<td>Pakarinen,* 1965 (11</td>
<td>30-78</td>
<td>M</td>
<td>(8) proptosis</td>
<td>traumatic (1)</td>
</tr>
<tr>
<td>patients)</td>
<td></td>
<td></td>
<td>(3)</td>
<td>spontaneous (10)</td>
</tr>
<tr>
<td>Castaigne, et al., 1966</td>
<td>22 F</td>
<td>+</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td>Clemens &amp; Lodin, 1968</td>
<td>30 F</td>
<td>+</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td>Newton, 1968</td>
<td>67 F</td>
<td>0</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td>Rosenbaum &amp; Schechter, 1969</td>
<td>62 F</td>
<td>+</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td>Newton &amp; Hoyt, 1970</td>
<td>62 F</td>
<td>+</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td>Taniguchi, et al., 1971</td>
<td>49 F</td>
<td>+</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td>Katsiotis, et al., 1974</td>
<td></td>
<td></td>
<td>proptosis</td>
<td>spontaneous</td>
</tr>
<tr>
<td>(nine patients)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Koshik, et al., 1974</td>
<td>20 M</td>
<td>+</td>
<td>+</td>
<td>traumatic</td>
</tr>
<tr>
<td></td>
<td>45 F</td>
<td>+</td>
<td>bilateral</td>
<td>traumatic</td>
</tr>
<tr>
<td></td>
<td>23 M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>53 F</td>
<td>0</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td></td>
<td>64 M</td>
<td>0</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td>Waga, et al., 1974</td>
<td>28 F</td>
<td>+</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td>Edwards &amp; Connolly, 1977</td>
<td>42 M</td>
<td>+</td>
<td>+</td>
<td>spontaneous</td>
</tr>
<tr>
<td></td>
<td>58 M</td>
<td>+</td>
<td>+</td>
<td>spontaneous</td>
</tr>
</tbody>
</table>

*Individual case reports not given.

References


J. Neurosurg. / Volume 46 / January, 1977


---

Address reprint requests to: Edward S. Connolly, M.D., Ochsner Clinic, 1516 Jefferson Highway, New Orleans, Louisiana 70121.