Use of cavernous sinography to detect aneurysms or anomalies of the infraclinoid carotid artery

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Four cases are described to illustrate the ability of cavernous sinography to detect coincidental aneurysms or anomalies of the infraclinoid carotid artery. Sinography may be used as a preliminary step before a transsphenoidal operation, in order to identify the small proportion of cases in which arteriography should be performed.

KEY WORDS: carotid artery • cerebral aneurysm • hypophysectomy • pituitary tumor • cavernous sinus

An unrecognized aneurysm or other anomaly of the infraclinoid carotid artery poses a major hazard during a transsphenoidal operation. The need to consider a carotid aneurysm in the differential diagnosis of an intrasellar space-occupying lesion is well known. Careful analysis of plain films and computerized tomography (CT) scans will often suggest the diagnosis of an aneurysm and indicate the need for arteriography. On the other hand, carotid angiography carries a small risk of serious complications, and a carotid lesion may seem unlikely if a patient has biochemical evidence of pituitary overactivity. The need for routine preoperative arteriograms in such patients has been questioned; however, a patient with a pituitary adenoma may also harbor a coincidental aneurysm or an anomalous medial loop of the carotid artery.

Cavernous sinography is not associated with serious risks. We report four cases to illustrate that sinography can disclose coincidental abnormalities of the infraclinoid carotid artery, and we discuss the use of this procedure as a means of identifying the small number of patients in whom arteriography is advisable before a transsphenoidal operation.

Technique of Cavernous Sinography

The procedure is carried out on an outpatient basis. A forehead vein is cannulated; the frontal veins above the cannula tip and the supraorbital and facial veins are compressed, and contrast material is injected. The appearance of the cavernous sinuses is studied on subtraction films. Details of the application of the technique in a series of 500 cases were described by Macpherson. The examination has now been attempted on 725 patients and completed successfully in all but four of the last 500 cases. A normal study is illustrated in Fig. 1.

Fig. 1. Cavernous sinogram, basal view, showing a normal anatomical appearance. The vertical, then the anterior, and finally the anterolateral course of each internal carotid artery is shown by the areas with lack of filling in the cavernous sinus (filling defect).
Case Reports

Case 1

This 41-year-old woman sustained a subarachnoid hemorrhage (SAH) and underwent angiography. The source of bleeding was an aneurysm of the anterior communicating artery, but there was also an aneurysm projecting medially from the infraclinoid carotid artery (Fig. 2 left). Cavernous sinography was then performed and outlined the intracavernous carotid artery and the aneurysm arising from its wall (Fig. 2 right).

Case 2

This 51-year-old patient also had an SAH. Angiography demonstrated a right middle cerebral artery aneurysm and, in addition, an aneurysm projecting medially from the infraclinoid carotid artery (Fig. 3 upper left). Simultaneous angiography and cavernous sinography (Fig. 3 lower right) showed that the intracavernous aneurysm could be detected by the latter investigation alone (Fig. 3 right).

Case 3

This 32-year-old woman complained of secondary amenorrhea and infertility, and had hyperprolactinemia (the basal prolactin level was approximately 5000 mU/liter). The pattern of response to dynamic stimulation suggested a pituitary adenoma, and the left side of the pituitary fossa was enlarged. Cavernous sinography disclosed that the filling defects produced by the carotid arteries were relatively large and that the artery on the right side approached the midline (Fig. 4 left). Carotid angiography confirmed that the right internal carotid artery extended almost to the midline, whereas on the left the artery lay 10 mm laterally (Fig. 4 right). At operation, the dura of the fossa was opened only on the left of the midline, and a 4- to 6-mm microprolactinoma was removed without complication. The medial wall of the right cavernous sinus lay close to the midline.

Case 4

This 44-year-old man noticed deteriorating vision, and field testing showed a temporal defect. The pituitary fossa was enlarged but its floor was intact. Cavernous sinography showed that the anterior segments of the internal carotid arteries lay in an unusually medial position (Fig. 5 left). Arteriography confirmed that the internal carotid arteries looped medially at the level of the fossa, corresponding to filling defects in the sinogram (Fig. 5 right). Cisternography showed a partial intrasellar cisternal herniation.

Discussion

Damage to the carotid artery is a rare but potentially disastrous complication of transsphenoidal surgery. Large pituitary tumors push the carotid arteries laterally, and injury is likely only if the surgeon strays too far from the midline. The risk of injuring the carotid artery is also low during an operation on an intrasellar tumor or during ablation of a normal gland, unless the artery bears a coincidental aneurysm or lies in an abnormal medial position.

Silent intracranial aneurysms may be more frequent in patients with pituitary tumors. Jakubowski and Kendall discovered five patients with coincidental
infraclinoid aneurysms among 150 patients with pituitary adenoma, but two of these patients had been treated previously by a radioactive implant. These authors and also Nakstad and Skalpe\textsuperscript{11} recommended that carotid angiography should be a routine procedure before an operation on a pituitary tumor. By contrast, Richmond, \textit{et al.},\textsuperscript{14} found neither aneurysm nor vascular malformation in the radiograms of 100 patients with a prolactin-secreting pituitary adenoma, and considered that carotid angiography should be used sparingly and selectively in order to minimize management risks.

The normal variations in the position of the intracranial carotid arteries were described by Bergland, \textit{et al.},\textsuperscript{1} and by Renn and Rhoton.\textsuperscript{13} The distance of the medial wall of the artery from the midline of the pituitary fossa varied considerably. The mean distance...
was 12 mm, but in some specimens it was only 4 mm and in these it was noted to compress the pituitary gland. Hardy and Mohr encountered unexpected carotid loops in eight (2.8%) of 300 women with a prolactinoma.

Routine preoperative carotid angiography adds risk and expense to a method of treating pituitary tumors that is otherwise associated with minimal morbidity. Of the less invasive alternatives to carotid angiography, digital subtraction angiography is particularly promising. It can demonstrate the course of the internal carotid arteries in the sellar region. In the foreseeable future, however, it will be available in only a few centers; moreover, its value in demonstrating infracranial aneurysms has still to be determined. On the other hand, the demonstration of perisellar arteries by computerized tomography is often inadequate, and the infracranial artery cannot be distinguished from the cavernous sinus.

Cavernous sinography requires only standard radiographic equipment, and we have found it to be a safe and simple test. Although it will sometimes show lateral expansion of a pituitary tumor, we have found it less useful as an indicator of small intrasellar tumors than have others. The value of sinography lies in identifying patients who have an abnormality of the carotid artery and who therefore merit further investigation by arteriography before a transsphenoidal operation is undertaken.

Since we began to perform preoperative sinography as a routine procedure in 1976, we have operated on 150 patients with intrasellar tumors by a transsphenoidal approach. Carotid angiography has been utilized in only 10 patients in order to clarify abnormal venographic appearances. In none of these 10 was an aneurysm of the cavernous carotid artery found; anatomical arterial abnormalities similar to those illustrated in our Cases 3 and 4 were the usual finding, and led to appropriate modifications of the operative approach. No patient sustained carotid artery damage during surgery.

References

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Manuscript received December 17, 1981. Accepted in final form May 17, 1982.

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