Selective cerebral arteriography and the CAT scan in acoustic tumors

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Increasing experience with selective cerebral arteriography in the diagnostic evaluation of acoustic tumors has led to a more rational determination of the proper surgical approach to the lesion. It also predicts the necessity for staging the surgical procedure, reduces the potential for intraoperative complications and rules out other types of angle lesions and the possible necessity for performing a preoperative, concomitant or postoperative shunting procedure. The CAT scan has added an important screening procedure in predicting the presence of an angle lesion, determining the need for further diagnostic studies and evaluating the possible presence or absence of a recurrent tumor growth.

THE basic diagnostic workup in suspected cases of acoustic tumors at Harper Hospital, Detroit, now includes polytomography of the internal acoustic canals, computerized axial tomography (CAT scanning), posterior fossa myelography and, in all except the smallest tumors, selective cerebral arteriography. Neurological diagnosis using angiography has been made in 65 to 70 patients.

On the basis of suspicious otologic studies and polytomes, a posterior fossa myelogram using the technique of Wilner and other is performed except where a massive tumor is suspected on the basis of papilledema or lateralizing cerebellar signs. While the small amounts (1-2 cc) of contrast media used will not delineate the exact size of larger tumors it does confirm an angle tumor, rule out an arachnoiditis, eliminate the need for removing the contrast material and decrease the potential for spilling dye into the intracranial subarachnoid pathways, thereby affecting the accuracy of the arteriographic study.

Selective cerebral arteriography has become extremely important in determining the ultimate surgical approach for acoustic tumors. In contrast to the philosophy of some surgeons, we do not feel that there is any one surgical procedure appropriate for all acoustic tumors. The surgical approach must be tailored to the individual case and depends upon the size, vascularity and associated

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secondary effects of the mass. Selective arteriography gives important information in the diagnostic and prognostic workup:

1. More exact assessment of the size of the mass.
2. Intrinsic vascularity of the tumor.
3. Pattern of displacement of major vessels, arterial and/or venous.
4. Effect of the mass on the brain stem.
5. A more accurate cellular diagnosis, i.e., it may rule out angle lesions such as meningioma, aneurysm, and others.
6. Presence or absence of hydrocephalus.
7. Extension of the lesion into the middle cranial fossa.
8. Presence or absence of cerebellar tonsillar herniation.
9. Extent of cerebral vascular occlusive disease which might affect a decision on surgical intervention in the more elderly patient.
10. Baseline comparison for studying patients with suspected recurrent acoustic tumors.

The following examples illustrate many of these advantages when selective cerebral arteriography is used in the preoperative evaluation of acoustic tumors. The figures that follow illustrate some case reports.

Case reports

Case I. (A)
Mid-arterial phase of a conventional roentgenogram taken in the Towne projection. Curved cerebellar arteries surround the tumor capsule (arrows). The left anterior inferior cerebellar artery is depressed (arrow). No abnormal vascularity is observed.
Selective cerebral arteriography

Case I. (B and C)
Venous phase of the same injection series (with subtraction in C, figure below). Increased vascularity is noted in the left angle region (arrows) probably representing abnormal capsular branches. The left petrosal vein is displaced laterally (arrow).
Case II. (A)

Towne projection (3 times magnification) of a late arterial phase. The left anterior inferior cerebellar artery is depressed (arrow). A suggestion of dilated vessels in the superior portion of the tumor capsule (arrows) is seen.
Venous phase (with subtraction in C) of the same injection series. A “stain” or abnormal collection of vessels is noted (arrows) occurring most likely within the medial portion of the tumor capsule. The left petrosal vein (arrow) is deviated laterally.
Anteroposterior tomogram indicating the presence of a smooth left angle tumor (arrow) displacing the Pantopaque medially.

The advent of the CAT scan has added an important screening tool, noninvasive in character, for determining the presence of an angle mass and more importantly in evaluating the patient suspected of harboring a recurrent tumor growth. A positive CAT scan in the face of suspicious otologic studies and polytomes reinforces the decision to study the patient further. A negative CAT scan, however, does not rule out the presence of an acoustic tumor or other angle mass, sometimes even quite large ones.

Since the early signs and symptoms of acoustic tumors are mostly destroyed by surgical intervention, it is important to have a relatively safe screening study to rule out a recurrent lesion. The CAT scan fulfills that role in many instances. Adhesions in the operative area reduce significantly the efficacy of a posterior fossa myelogram study. Such adhesive alterations of the major vascular anatomy can also affect the value of selective arteriography. Arteriography also carries a risk not always justified in evaluating the relatively asymptomatic postoperative patient suspected of harboring a recurrent tumor. The CAT scan, in our limited experience, has already proved invaluable in determining the necessity for proceeding with more invasive studies. When a recurrent tumor is diagnosed, surgery can be carried out before the lesion has reached formidable size.

We have also found that a CAT scan may possibly be falsely negative. We have at least two patients who had subtotal tumor removals two years and five years ago respectively. Neither patient has any signs or
Case III. (B)
Towne projection (3 times magnification) of the arterial phase. Abnormal tumor capsular vessels (arrow) are noted. The left superior cerebellar artery is pushed medially and upwards (arrowhead).
symptoms of tumor regrowth but CAT scans are negative in both cases even though residual tumor mass presumably remains. Perhaps lack of vascularity is the explanation.

In some instances the amount of uptake on the CAT scan has been smaller than what is found at the time of operation. In other instances the uptake closely approximates the tumor size even though the angiographic studies suggested a much larger mass effect. Another advantage of the CAT scan is the preoperative assessment of ventricular size. This may eliminate the necessity for adding a preoperative carotid study to the cerebral arteriographic survey. It is also a simple followup method for determining progressive postoperative hydrocephalus.

The following cases illustrate our experience with the CAT scan to date.

Case I

A 30-year-old white female with right neurosensory hearing loss, numbness of the right side of the face and mild cerebellar ataxia had a 4.5-5 cm tumor mass removed in three stages and a shunting procedure for progressive hydrocephalus.

Case II

A 35-year-old white female with neurosensory hearing loss, decreased corneal sensation and headaches had arteriographic evidence of a large vascular acoustic tumor being fed by external carotid branches. Surgical intervention is still pending because of an episode of pulmonary embolism.
Case IV. (A)

Conventional Towne projection (1971) showing medial deviation of the right superior cerebellar artery (arrowhead). The right anterior inferior cerebellar artery is also elevated (arrow). No tumor vessels are noted. An extensive acoustic neuroma was partially removed.
Case IV. (B)

Conventional transfacial view (postoperative) taken three years later. The right superior cerebellar artery remains medially deviated (arrowhead). Postsurgical changes involve the right anterior inferior cerebellar artery (arrow). No stain is noted.
Case IV. (C)

Towne projection (subtraction film) utilizing three times magnification and taken immediately following B. This late phase demonstrates abnormal capsular vascularity in the area occupied by the residual tumor (arrows).
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Case V. (A)
Tomogram in the anteroposterior plane taken with Pantopaque. A large partially extracanalicular acoustic neuroma is demonstrated. The lack of any impression upon the superior portion of the contrast material is against involvement of the semi-lunar ganglion.

Case III
A 54-year-old white male with bilateral congenital hearing deficit had progressive hearing loss to total deafness in the left ear in recent years and a one-year history of progressive numbness of the left face. He also suffers from retinitis pigmentosa resulting in severe night blindness. A 2.5-3 cm tumor was removed surgically.

Case IV
In a 39-year-old white male with a 3-4 year history of unilateral hearing loss and decreased corneal sensitivity, a 4 cm tumor was found at surgery. A fragment was left adherent to the brain stem and two years later, without any new neurologic signs or symptoms, a CAT scan revealed a significant recurrence. Further surgery resulted in a successful total removal.
Conventional transfacial view. The left anterior inferior cerebellar artery (arrow) is poorly seen when compared to the right (arrows). No stain is noted.
Case V. (C)

Towne projection (three times magnification) of the early arterial phase, taken immediately following B. The basilar artery (arrowhead) and the two posterior inferior cerebellar arteries (arrows) are noted.
Case V. (D)

Towne projection (three times magnification) of the late arterial phase. The abnormal capsular vessels (arrow) and the circumscribed branches of the left posterior inferior cerebellar artery surrounding the tumor (arrows) are now apparent.
references
