

Aneurysmal tumors of the basifrontal region

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✓ The authors report the cases of three men who presented for evaluation of a rapidly progressing dementia. All were found to have a giant aneurysmal mass in the basifrontal region, and all were successfully treated by surgical excision of the mass. The presenting syndrome included rapidly progressive and severe loss of recent memory associated with confusion, chronic headache, wide-based staggering gait disturbance, urinary urgency, frequency, and incontinence, and a fine tremor of the hands exacerbated by purposeful movements. The clinical presentation, radiological assessment, and surgical treatment are discussed.

KEY WORDS • giant aneurysm • surgical excision • basifrontal syndrome

MOST patients with aneurysms of the intracranial circulation seek medical attention because of symptoms associated with subarachnoid hemorrhage. An occasional aneurysm enlarges without rupturing and produces a mass effect with symptoms and signs consistent with its location and pressure effects on adjacent neural and vascular elements. Giant intracranial aneurysms are usually defined as those measuring 2.5 cm or greater in diameter. The most common location for giant aneurysms is the intracavernous portion of the internal carotid artery where they produce such ophthalmological signs and symptoms as loss of visual acuity, visual field deficits, optic atrophy, exophthalmos, oculomotor deficits, and retro-orbital pain.^{9,16} Large intracavernous aneurysms may rupture into the cavernous sinus and produce spontaneous carotid cavernous fistulas with pulsating exophthalmos, bruits, chemosis, scleral injection, and associated retinal findings.⁶ Dandy¹⁰ and Jefferson¹⁶ also found loss of vision and optic atrophy in patients with diffuse dilation of the

carotid trunk. Periodic headache, sometimes unilateral, in association with ophthalmoplegia, has been described in patients with intracranial aneurysms.^{2,13} These attacks are presumably due to the abnormal relationship of the internal carotid artery aneurysm to the oculomotor nerves with secondary tissue distortion.^{2,7} Aneurysms of the internal carotid artery may also impinge upon the pituitary gland or the hypophyseal trunk causing an endocrinopathy.^{5,12,29} Giant aneurysms of the middle cerebral artery have also been reported. They often present with lateralizing findings consistent with their location.^{8,19,24,25,28} Giant aneurysms of the vertebrobasilar vessels can cause symptoms and signs similar to those that are caused by posterior fossa tumors^{4,11,14,18,22}

This report concerns three men of similar age who were admitted for evaluation of a rapidly progressing dementia. All were found to have a giant aneurysmal mass in the basifrontal region and all were successfully treated by direct surgical excision of the mass.

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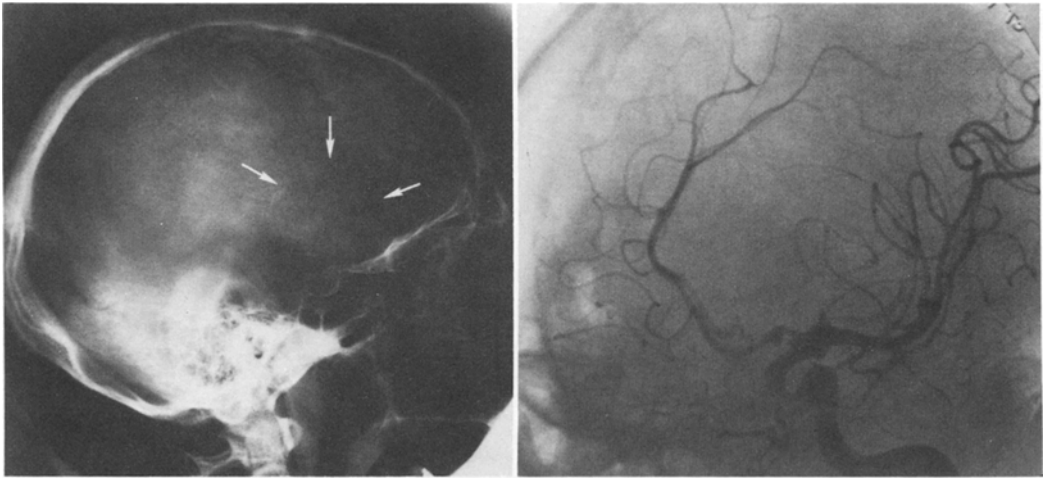


FIG. 1. Case 1. *Left:* Lateral skull x-ray film shows a calcified rim in the basifrontal region. *Right:* Oblique view of a left carotid angiogram shows an irregular collection of contrast material at the bifurcation of the internal carotid artery with lateral and posterior displacement of the lenticulostriate arteries by a large avascular mass.

Case Reports

Case 1

This 52-year-old man was admitted in September, 1974, because of progressive dementia and chronic headache. For 2 years the patient had suffered major motor seizures, which had increased in frequency to three or four each week during the month before hospitalization despite anticonvulsant medication. He also gave a history of gait disturbance of recent onset and urinary urgency and frequency of many months' duration.

Examination. He was an alert but poorly oriented man, who could not remember place names for 10 minutes and demonstrated poor logic and proverb understanding. He walked with a wide-based, staggering gait, and had a fine tremor of both hands exacerbated by purposeful movements. Skull x-ray films showed a calcified rim in the deep left frontal region consistent with a giant aneurysm or an echinococcal cyst (Fig. 1 *left*). An electroencephalogram (EEG) was moderately abnormal and focal to the left frontal and midtemporal regions. Bilateral carotid angiography showed an irregular collection of contrast material at the bifurcation of the internal carotid artery (Fig. 1 *right*). There was lateral and posterior displacement of the lenticulostriate arteries and a proximal, left-to-right

shift of the anterior cerebral artery on the anteroposterior and oblique views.

Operation. A left frontal craniotomy was performed under general anesthesia with controlled ventilation. Upon opening the anterior Sylvian fissure, a very large, yellow-green mass with a smooth capsule was encountered underlying the frontal lobe. A No. 25 needle was introduced into the mass, but yielded no blood or cystic fluid. The fibrous capsule was incised and a lamellated, organized, blood clot was gradually and carefully removed in a piecemeal fashion. As the mass was reduced from inside, the capsule was dissected free of surrounding brain tissue without forced brain retraction. The mass was situated at the bifurcation of the internal carotid artery and extended laterally along the middle cerebral artery, which was intimately adherent to the mass. Medially the mass was close to the anterior cerebral artery, but not firmly attached to it. A pulsatile area 1 cm in diameter was found at the base of the organized clot. The neck of the sac was large and broad-based, and a clip could not be applied without risk to perforating vessels. The aneurysm was coated with an adhesive polymer. The largest diameter of the entire mass was 7.5 cm.

Postoperative Course. After surgery there was a transient dysphasia and mild right hemiparesis. Examination 6 months and 1 year later revealed that the headaches and

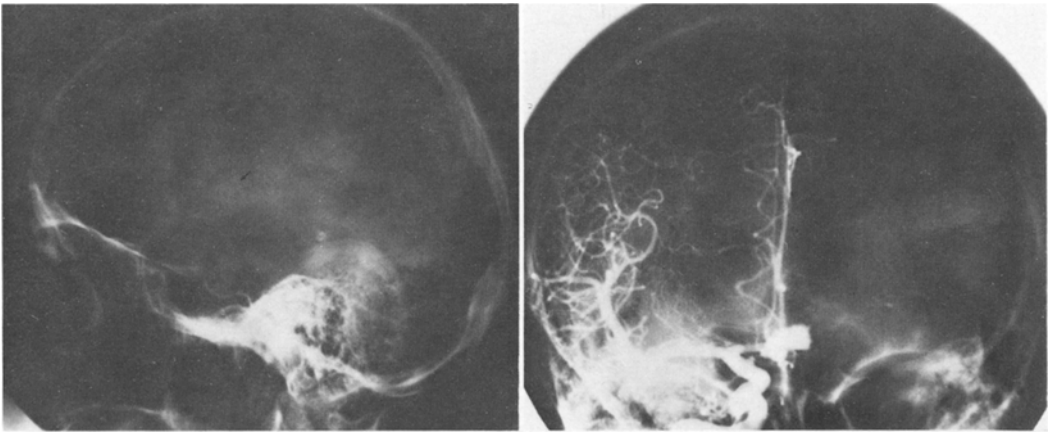


FIG. 2. Case 2. *Left:* Lateral skull x-ray film shows a small fleck of curvilinear calcification in the suprasellar region (*arrow*). *Right:* Right carotid angiogram, anteroposterior view, shows an anterior communicating artery aneurysm with irregular walls directed superiorly and to the left.

seizures had completely resolved, though the patient was still taking Dilantin (phenytoin sodium). The patient no longer had urinary urgency or frequency and his gait was normal. According to the patient's family, his mental function was much improved, except for recent memory, which was still poor.

Case 2

This 52-year-old man was admitted in April, 1974, complaining of an intractable, generalized headache of 2 months' duration. The patient's wife reported a rapid mental deterioration over the previous month, characterized chiefly by a severe disturbance of recent memory and somnolence. She had also noted a progressive staggering gait disturbance for several weeks, and urinary urgency and frequency for several months.

Examination. The patient was confused and depressed, with a severe memory deficit. He walked in a hesitant, apractic manner and had a fine tremor of the hands. There was a Babinski sign on the left and a prominent snout reflex. Skull x-ray films and a brain scan were initially read as normal, but subsequent review of the lateral skull films showed a small fleck of curvilinear calcification in the suprasellar region (Fig. 2 *left*). The EEG was consistent with a deep-seated frontal lesion. Angiographic studies showed a large, slightly lobulated aneurysm in the region of the anterior communicating artery,

the dome of which was directed superiorly and to the left (Fig. 2 *right*). The aneurysm had irregular walls with numerous small excrescences; dilatation of the lateral ventricles was evident.

Operation. A right transfrontal craniotomy was performed and a small anteromedial wedge of the right frontal lobe removed, exposing the dome of a large, dark green mass. The right anterior cerebral artery was dissected off the wall of this mass. The large sac was then opened and dark, bloody fluid mixed with clot and well organized, lamellated thrombus was found within the mass. As pituitary rongeurs were used to remove the clot, the wall could be enfolded and excised, and in this way the aneurysmal sac was totally removed. The sac was estimated to be 5.5 cm in its greatest diameter. While delineating the neck of the aneurysm, a temporary clip was applied across the right anterior cerebral artery and the blood pressure was deliberately reduced to 70 mm Hg while a Heifetz clip was applied to the neck of the sac.

Postoperative Course. During the immediate postoperative period, the patient was considerably confused, but his condition rapidly improved over 3 weeks. He was discharged 11 days after surgery. Within 2 months, the urinary symptoms and gait difficulty improved dramatically. He was also free of headaches. The mild bilateral tremor of the hands persisted. Although the patient's

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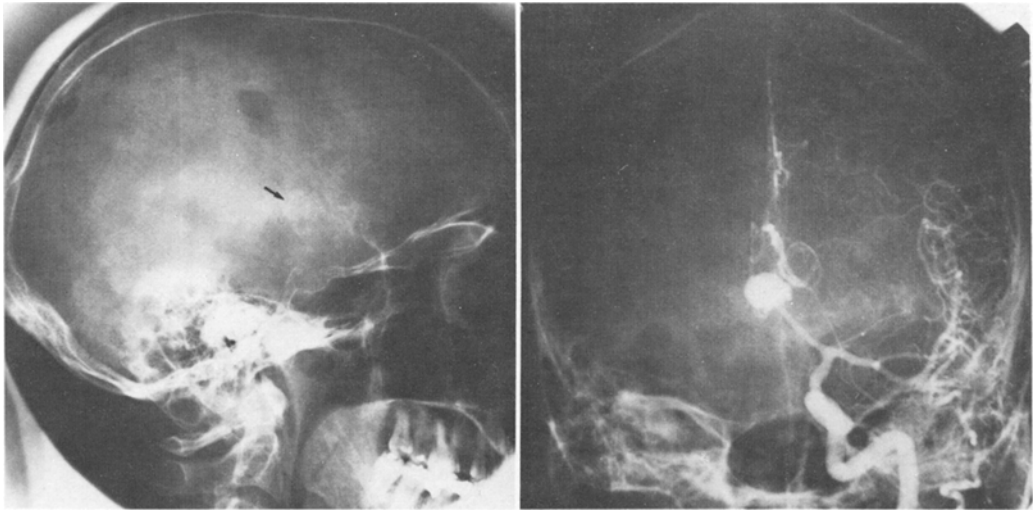


FIG. 3. Case 3. *Left:* Lateral skull x-ray film shows a thin, curvilinear calcification in the basifrontal area (*arrow*). *Right:* Anteroposterior carotid angiogram shows a large anterior communicating artery aneurysm that fills from the left side. There is lateral displacement of the Sylvian point and widening of the distance between the anterior cerebral and lenticulostriate arteries because of a large mass extending into the deep frontal area on the left side.

wife feels his memory has improved, recent memory is still poor.

Case 3

This 48-year-old man was admitted to the Psychiatry Service because of a drastic deterioration of memory and intellectual function over the preceding month. The patient had been complaining of occipital headaches for 6 months and had consumed large amounts of aspirin. For several weeks, family and friends had been aware of personality changes, diminished sociability, and slovenly personal habits. The patient tended to sleep a great deal and had difficulty with his gait. He had been suffering from progressive urinary incontinence, urgency, and frequency for several months. On several occasions he had suddenly lost consciousness and slumped to the floor. Although the exact nature of these episodes was never well defined, he complained of stiff and aching muscles after these attacks and was started on Dilantin therapy. His wife stated that he also had brief periods during which he would just sit and stare.

Examination. The patient was a confused and demented man with a flat affect. He had a wide-based, unsteady gait and a fine tremor

of both hands. Glabellar and palmomental reflexes were easily elicited.

Skull x-rays showed a thin, curvilinear calcification in the suprasellar region (Fig. 3 *left*). An EEG was moderately abnormal due to frequent, bilaterally diffuse or left-right shifting, sharp and spike wave discharges, with greatest emphasis in the left frontal, temporal, and anterior midtemporal areas. A brain scan was read as normal. A computerized axial tomography scan, first performed without contrast enhancement, confirmed a large mass in the suprasellar area with small amounts of calcification posteriorly (Fig. 4 *left*). There was also marked ventricular dilatation. Following the intravenous injection of Renografin-60 for contrast enhancement, an additional area of density was seen adjacent to the posterior calcification. The larger portion of the mass did not fill with contrast, however (Fig. 4 *right*). Angiographic studies showed a large anterior communicating artery aneurysm that filled from the left side (Fig. 3 *right*). The anterior cerebral arteries were stretched around the mass and there was posterior displacement of the Sylvian triangle. The left carotid angiogram showed lateral displacement of the Sylvian point and widening of the distance between the anterior cerebral artery

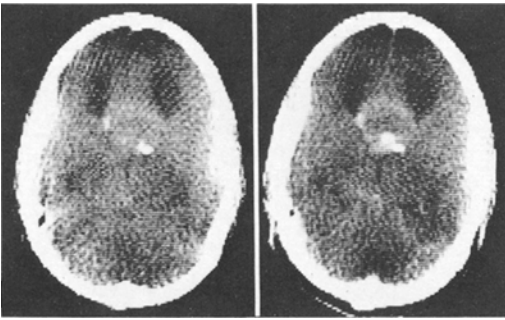


FIG. 4. Case 3. Computerized axial tomography scans. *Left:* Scan without contrast enhancement shows a large mass in the suprasellar area with a small amount of calcification in the periphery. Ventricular dilation is also present. *Right:* Scan following the intravenous injection of Renografin-60 for contrast enhancement shows an additional area of increased density adjacent to the posterior calcification.

and lenticulostriate arteries, suggesting that the mass extended into the deep frontal area on the left side.

Operation. The aneurysmal mass was approached through a right frontal craniotomy with a small wedge resection of the antero-

medial right frontal lobe. A brownish-green, encapsulated mass, 5 cm in diameter, was encountered and a plane developed between the mass and surrounding tissues. The mass was too large to attempt initial exposure of either the neck or the parent vessel of the aneurysm. The capsule was incised and a considerable amount of organized, lamellated hematoma was removed in pieces. The fibrotic capsule was gradually trimmed until the blood-filled, aneurysmal sac was defined where it originated from a wide-based neck at the junction of the left anterior cerebral and the anterior communicating arteries. A ligature was used to occlude the neck of the aneurysm.

Postoperative Course. After surgery the patient was disoriented but alert; he had moderate weakness of the left leg which gradually improved. Bilateral carotid angiography showed no mass effect and resolution of the hydrocephalus (Fig. 5). Subsequent evaluations revealed that the patient was less confused and recent memory was still poor, but definitely improved. No seizures occurred while he received Dilantin therapy, and he no longer was incontinent. He denied headache and his gait was improving.

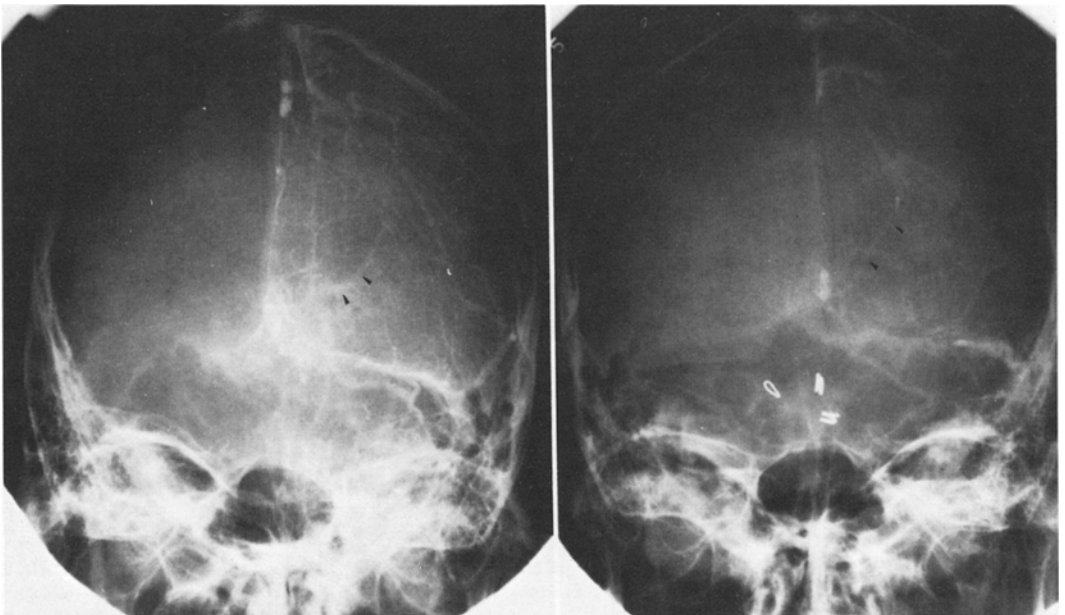


FIG. 5. Case 3. Anteroposterior view of venous phase of left carotid angiogram. *Left:* Before excision of aneurysmal tumor displacement of thalamostriate vein (*arrows*) is consistent with considerable hydrocephalus. *Right:* The thalamostriate vein (*arrows*) is less stretched after removal of the giant aneurysmal mass in the basifrontal region.

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Discussion

Clinical Presentation

The striking similarity in the clinical presentation of these three patients suggests a consistent syndrome: 1) the insidious and early onset of frequency, urgency, and incontinence of micturition, 2) chronic headache, 3) a fine tremor of the hands accentuated by purposeful movements, 4) a rapidly progressive, but relatively late-developing, dementia characterized by a severe loss of memory and confusion, and 5) a wide-based, staggering gait. The micturition symptoms and headaches presented early, persisted, and were tolerated for months until the late developing dementia and gait disturbance incapacitated the patient and forced his family or primary physician to seek neurological evaluation. In addition, two of the three patients had a generalized and progressive seizure disorder of less than 2 years' duration; pseudobulbar signs were also present in two of the three patients.

The clinical signs and symptoms associated with these basifrontal, aneurysmal masses might be confused with features described in normal pressure hydrocephalus^{1,21} except for the intractable headache and the fact that frequency of micturition, urgency, and incontinence of urine developed months before any signs of intellectual or social deterioration. In normal pressure hydrocephalus changes in mentation usually appear first, but at times gait disturbance is the earliest and most prominent symptom. Urinary incontinence is usually not present in the early stages and headache is not a prominent complaint in normal pressure hydrocephalus.²⁶

In 1964, Andrew and Nathan⁸ emphasized the occurrence of frequency and urgency of micturition, with occasional incontinence, that accompanies lesions of the frontal lobes. These urinary symptoms can occur in the absence of any signs of intellectual or behavioral deterioration,¹⁷ as was the case for some time in our three patients. The seizures that occurred in two of the patients were localized to the medial basifrontal region by EEG study and were of early onset. Eight of nine patients in Andrew and Nathan's series of frontal lobe tumors with micturition symptoms suffered seizures.⁸ The micturition symptoms cleared completely after excision of the aneurysmal mass in all three patients.

This is consistent with the experience of Maurice-Williams who noted remission of micturition symptoms in five patients after tumor resection in the frontal region.¹⁷ Andrew and Nathan⁸ proposed, on the basis of their studies of frontal lobe tumors, hematomas, penetrating injuries, and leucotomies, that a critical area involved in the control of micturition is located in the superomedial part of the frontal lobe, in the region of the anterior cingulate gyrus, the adjacent part of the superior frontal gyrus, and the underlying white matter, with fibers coursing to and from the genu of the corpus callosum. It seems probable that these giant aneurysmal masses resulted in a reversible disturbance of function in this region that responded to surgical decompression. The critical location of these masses resulted in the disturbances in micturition well before enlargement of the masses or hydrocephalus resulted in dementia and gait disturbance.

Radiological Assessment

Aneurysms of the internal carotid and anterior communicating arteries may produce roentgenologically detectable changes of the sella turcica that are typical for suprasellar tumors. The curvilinear calcification present in the wall of the aneurysmal masses is characteristic, but may be absent or so slight that it is missed, as in our second case (Fig. 2 *left*). The differential diagnosis of such suprasellar calcification includes craniopharyngioma and echinococcal cyst.

The brain scans were normal in these cases and are usually of little value in assessing aneurysmal masses. Computerized axial tomography may prove to be of value in distinguishing a giant aneurysmal mass from a neoplasm. An enhanced computer scan that shows a large mass enclosing a smaller, round mass of higher density, the latter of which disappears or is diminished without enhancement, supports the diagnosis of an aneurysmal mass (Fig. 4 *left*). This is of practical importance because it suggests the need for angiography as the subsequent procedure of choice rather than air contrast studies or surgical exploration. Angiography is indicated in practically all cases of suspected suprasellar tumor with atypical features; it is important to appreciate that on rare oc-

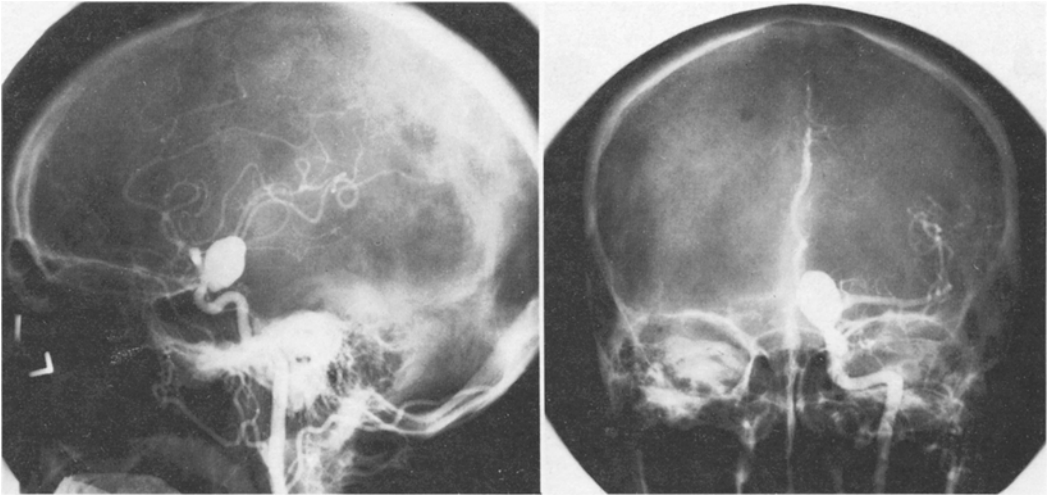


FIG. 6. Left carotid angiogram. *Left:* Lateral view shows giant aneurysm of internal carotid artery filled with circulating contrast medium. *Right:* Anteroposterior view shows this aneurysm has considerably less mass effect than those in our cases (Figs. 1-3), but technical problems may be greater because the mass cannot be reduced, as in our cases, before clipping or evacuating the sac filled with circulating blood.

casions a completely thrombosed aneurysm may not be definitively diagnosed even after contrast-enhanced computer scanning and angiography.

Surgical Treatment

The thick, dense, fibroconnective tissue capsule containing and surrounding well organized, lamellated clot, makes a subsequent catastrophic hemorrhage unlikely; therefore, surgery is not necessary in the asymptomatic patient or in the patient whose disability cannot be ascribed to the mass effect of the aneurysm. In those patients in whom a severe or progressive mental or neurological deterioration can be ascribed to the effects of local pressure due to an aneurysmal mass effect, removal of the mass is indicated to the extent that an internal decompression is achieved.

When the radiological studies and surgical findings indicate that the mass is solid, the fibroconnective tissue capsule and the organized, lamellated clot that it encloses should be removed piecemeal. Extensive brain retraction and manipulation of the mass in an attempt to first expose the neck or feeding vessels risks further neurological deficit by direct brain injury, tearing of the aneurysmal neck, or avulsion of an important

parent vessel. Reported cases where these masses have been removed *in toto* have resulted in a high mortality and morbidity.²⁸ If the entire giant aneurysmal sac is filled with circulating blood, however, it may be necessary to first achieve surgical control of either the parent vessel or the neck of the aneurysmal sac (Fig. 6). When the location of the aneurysm and the local hemodynamics permit temporary clipping or trapping of the parent vessel, the technical problems may be straightforward. Both controlled hypotension and hypothermia may be useful adjuncts. Carotid ligation may be the treatment of choice for certain of these aneurysms, but it has been estimated that a 20% to 50% reduction of late intra-arterial pressure is necessary to induce thrombosis in this type of aneurysm.^{20,27} Although this treatment may lessen the chance of intracranial hemorrhage, it does not necessarily reduce the mass effect of the aneurysm; Cuatico, *et al.*, reported two cases of enlargement of intracranial aneurysms following carotid ligation.⁹ It is their opinion that a process of mass enlargement by progressive lamination can occur even after carotid occlusion.

A shunting procedure is indicated when the clinical picture is totally consistent with communicating hydrocephalus due to a previous subarachnoid hemorrhage. A shunt is not en-

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tirely without risk, however, in the presence of a mass lesion where subsequent tissue shifts could conceivably occur.

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