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The Transsylvian Approach to Middle Cerebral Artery Bifurcation/Trifurcation Aneurysms

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A transsylvian approach to treat aneurysms located at the bifurcation/trifurcation of the middle cerebral artery (MCA) is described. This surgical route traces a distal MCA branch retrogradely into the Sylvian fissure whereupon a secondary MCA branch and the main stem of the MCA (M_1) are identified before aneurysm clipping. The advantages and disadvantages of this approach are discussed. The transsylvian route should be considered as an alternative to the traditional pterional approach, which utilizes proximal to distal dissection of the MCA, in situations when the M_1 is long or when the pterional approach is inadvisable.

KEY WORDS: Cerebral aneurysm; Middle cerebral artery; Subarachnoid hemorrhage; Surgical techniques; Transsylvian approach

Aneurysms located at the bifurcation or trifurcation of the middle cerebral artery (MCA) are most commonly approached via a pterional [10] or superior temporal gyrus [3] route. Although an approach that traces a superficial distal MCA branch retrogradely to reach such aneurysms has been described previously [1,2,5–8,10], certain features of this technique and its indications have not been enumerated. In this article, we report our use of the transsylvian approach in a select group of patients with MCA bifurcation/trifurcation aneurysms and describe the advantages and disadvantages of this technique as well as certain features of radiologic anatomy.

Clinical Methods and Materials

Although the transsylvian approach described in this report has been used in a number of patients, the present analysis was restricted to 13 patients who had a single MCA bifurcation/trifurcation aneurysm and who did not undergo emergency surgery prompted by a large intracerebral hematoma. Patients ranged in age from 23 to 67 years. Eight were women; five were men. Preoperatively, patients were in the following Hunt and Hess [4] grades: 0–2 patients; I–6 patients; III–3 patients; and IV–2 patients. Surgery after aneurysm rupture was performed within 3 days in two patients; from 4 to 14 days in five patients; and in greater than 14 days in four patients. Two patients had unruptured aneurysms. Maximal aneurysm diameter as measured from cerebral angiograms ranged from 2 to 18.5 mm. All aneurysms were clipped. Assessment of aneurysm obliteration was evaluated by postoperative angiography in all cases.

Surgical Technique

After induction of general anesthesia and placement of appropriate monitoring equipment and intravenous lines, the patient is placed supine and positioned as follows. The head is turned 80° to the opposite side, elevated above the heart, and secured by 3-point skull fixation. A curvilinear skin incision is made and the scalp is reflected in a single layer. A free bone plate is turned. The sphenoid wing is removed until flat. Standard microsurgical technique is used to identify a distal MCA branch on the cortical surface of either the temporal (more commonly used) or frontal lobe. The arachnoid over this vessel is then stripped and the vessel traced retrogradely into the depths of the Sylvian fissure until a secondary branch, inferior or superior trunk (M_2), is identified. Regardless of the severity of the subarachnoid hemorrhage or the amount of subarachnoid blood, a superficial cortical vessel will enter the Sylvian fissure and eventually will lead to a secondary MCA branch. Care is taken to preserve the Sylvian veins, although sometimes a small branch requires sacrifice. Retrograde dissection of this M_2 branch leads to the main stem of the MCA (M_1). Although the aneurysm is often seen before identification of the M_1, the aneurysm is left untouched until the M_1 is circumferentially dissected.

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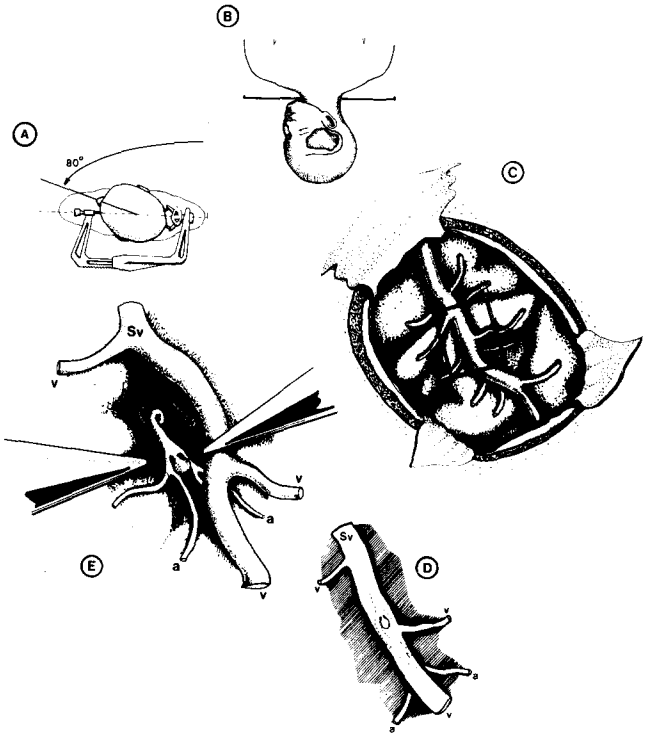


Figure 1. *Transsylvian approach to middle cerebral artery (MCA) bifurcation/trifurcation aneurysms. Stepwise surgical technique is illustrated. Patient position with the head turned 80° to the side opposite the aneurysm is shown in* (**A**). *The scalp incision and craniotomy are indicated in* (**B**). *The portion of Sylvian fissure exposure is demonstrated in* (**C**). *A higher magnification view of the framed area in* (**C**) *is shown in* (**D**). *In* (**E**), *retraction of the Sylvian vein (Sv) and Sylvian fissure with retrograde tracing of a distal MCA branch (a) leads to a secondary MCA branch which, in turn, allows identification of the main stem of MCA and the aneurysm. Similarly labeled distal MCA artery branches (a) and distal Sylvian veins (v) are marked for orientation purposes in* (**D**) *and* (**E**).

Then, M_2 branches of the MCA are completely freed before the aneurysm neck is identified (Figure 1). The aneurysm is then clipped. Temporary clipping was not used in these 13 cases. The total length of Sylvian fissure exposure is approximately 3 cm.

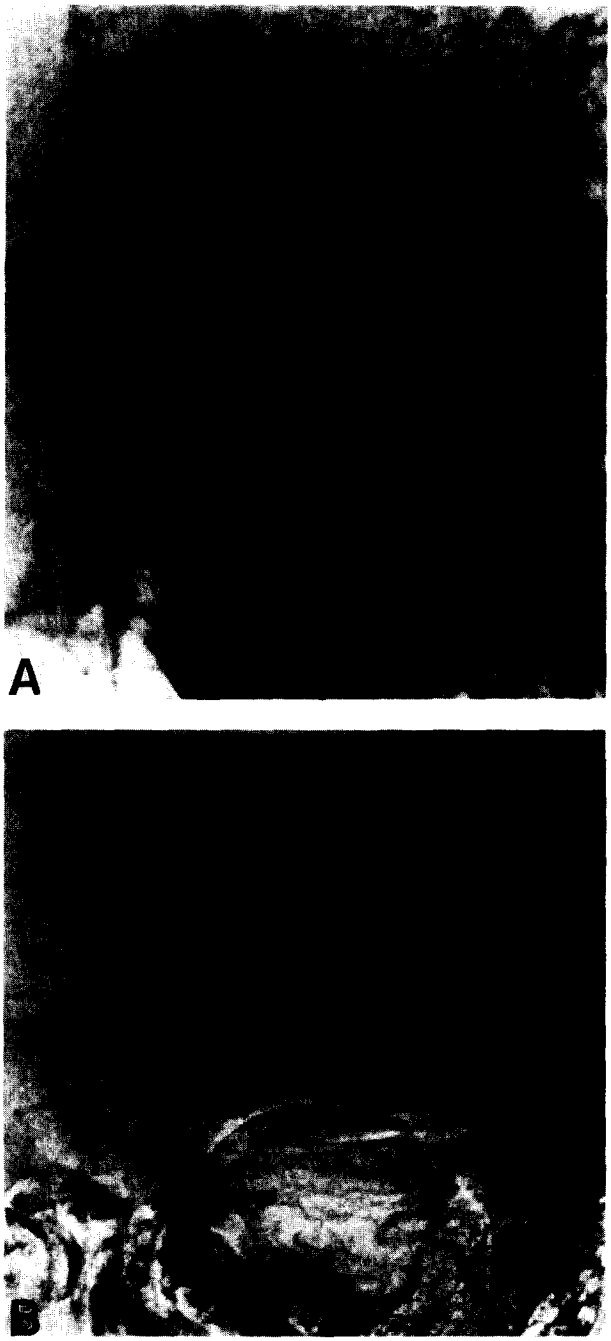
Results

All 13 aneurysms were able to be clipped directly. Confirmation of satisfactory aneurysm obliteration was documented by postoperative angiography. Premature aneurysm rupture did not occur. Postoperative status, utilizing an assessment criteria of others [9] was: excellent–9 patients; good–1 patient; fair–1 patient; and poor–1 patient. One patient was lost to follow-up. The single patient who did poorly sustained a stroke after a preoperative angiogram and the patient classified as fair postoperatively was grade IV [4] preoperatively. No patient was made worse by surgery.

Discussion

Utilizing the transsylvian approach, all patients did well (excellent or good) except for 2. The patient who did poorly suffered a stroke after the initial angiogram while

Figure 2. *Angiography of middle cerebral artery bifurcation aneurysms. Nonrotated anteroposterior (frontal) carotid arteriograms illustrate examples of a short* (**A**) *and a long* (**B**) *main stem of the middle cerebral artery. Arrowheads mark the mid-portion of the intracranial internal carotid artery bifurcation, whereas arrows indicate the end of the first branch of the main stem of the middle and anterior cerebral arteries respectively. Abbreviations: A-1, A_1 length; M-1, M_1 length.*



the patient classified as fair was in grade IV [4] preoperatively, and surgery did not affect his overall outcome. All aneurysms were able to be satisfactorily clipped using this technique. No premature aneurysm rupture occurred.

This approach is best suited for those individuals in whom the M_1 is long. Because determination of overall M_1 length can sometimes be difficult for a variety of reasons, we assessed this value by comparing the length of the M_1 (M-1) to the length of the horizontal anterior cerebral artery (A-1) on nonrotated frontal angiograms (Figure 2). Ordinarily, the transsylvian approach was reserved for patients in whom the M_1 length was long $\left(\frac{M\text{-}1}{A\text{-}1} > 1\right)$ while the pterional approach, whereby the M_1 is traced distally to the bifurcation/trifurcation of the MCA, was used for patients whose M_1 was short $\left(\frac{M\text{-}1}{A\text{-}1} < 1\right)$. Nevertheless, the transsylvian approach has been used without difficulty in patients whose M_1 length was quite short (Figure 2 *A*).

A theoretical drawback to the transsylvian approach is the potential lack of early proximal control of the M_1. However, from a practical standpoint identification and control of the M_1 is obtained well before aneurysm dissection proceeds. This is confirmed by the lack of premature aneurysm rupture in the present series of patients.

The advantages of this technique are several. First, the length of Sylvian fissure opening is commonly about 3 cm so that brain retraction is minimal. Second, brain tissue is neither intentionally traversed nor removed. Third, although patients with large intracerebral hematomas who underwent aneurysm clipping utilizing this transsylvian approach were not included in this account, this technique provided excellent access to such clots. Fourth, the view provided by this approach avoids the lenticulostriate vessels. Our experience and that of others [1,7,8] suggest that the transsylvian technique described in this account should be considered as an alternative to the pterional approach, particularly when a long M_1 is present or when the pterional route is inadvisable.

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Editorial

The paper by Pritz and Chandler, "The Transsylvian Approach to Middle Cerebral Artery Bifurcation/Trifurcation Aneurysms," represents one of three approaches to middle cerebral aneurysms.

Generally, a major principle of all cerebral aneurysm surgery is to obtain proximal and distal control before dissection of the aneurysm is begun. The reasons for the principles are: (1) to eliminate the chance of intraoperative rupture that will worsen the outcome if it occurs; (2) also, proximal and distal control will allow temporary clipping; and (3) adequate dissection time for proper application of a clip to the aneurysm neck. If this principle is accepted, the Sylvian and superior temporal gyrus approaches do not qualify as acceptable surgical techniques.

In this report the authors indicate the Sylvian approach is restricted to those patients with long M_1 segments. If you view Figure 2 of the paper, you can see that a long M_1 allows the surgeon to follow the Sylvian branches to the M_1 behind the aneurysm, so proximal control may be gained before aneurysm dissection. Thus, this method will work in these cases; I have done this