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Clinical Article

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Clipping of the Anterior Communicating Artery Aneurysm without Sylvian Fissure Dissection

Objective : The focus of aneurysm surgery is eliminating unnecessary operative manipulations and preparing the surgeon for any crises that might arise. With this concept in mind, we have tried resection of the gyrus rectus without routine sylvian fissure dissection in selected patients with anterior communicating artery (ACom) aneurysms, and compared these results with those from the conventional transsylvian approach.

Methods : This retrospective study included 231 surgically treated patients with ACom aneurysms from March, 1997 to May, 2005. The patients were divided into two groups : Group A (96 with sylvian fissure dissection, March, 1997-December, 2000) and Group B (135 without sylvian fissure dissection, January, 2001-May, 2005). Overall surgical outcomes were compared, and operative times have been prospectively recorded since January, 04 to evaluate how this maneuver affected the length of surgical procedures.

Results : All aneurysms were satisfactorily clipped, and there was no evidence of increased number of procedure-related retraction injuries in group B. Overall outcome was good in 186 (80.5%); 76 (79.2%) in group A, and 110 (81.5%) in group B (x^2 test, p=0.79). In good clinical grade of group A, good outcome was observed in 60 patients (89.6%) and in group B, 97 patients (94.2%) (Fisher's exact test, p=0.38) (Fig. 2).

Conclusion : In this study, eliminating the step of sylvian fissure dissection by gentle lateral basal-frontal retraction to the side of the sylvian fissure did not increase morbidity and mortality. However, we do not intend to modify the standard approach to the ACom aneurysm that is familiar to and has been mastered by many others. Rather, we report our experience on the basis of our anatomic understanding of the technique and its results.

KEY WORDS : Anterior communicating artery · Aneurysm · Sylvian fissure · Dissection.

INTRODUCTION

The transsylvian apporach has been used in vascular neurosurgery for the treatment of cerebral aneurysms arising from the major structures of circle of Willis without significant brain retraction. During the treatment of cerebral aneurysm, opening of the sylvian fissure allows a more comfortable exposure of the internal carotid artery (ICA), the anterior communicating artery (Acom) complex, and the middle cerebral artery (MCA).

Recently, modern technology including contemporary microscope and newly designed surgical instruments has pushed neurosurgery toward less invasive surgery. Also, the focus of aneurysm surgery is minimizing unnecessary operative manipulation and preparing the surgeon for any crises that might arises. With this concept in mind, we have tried resection of the gyrus rectus without routine sylvian fissure dissections in selected patients with ACom aneurysms, and compare these results with those obtained during an earlier period in which conventional transsylvian approach was used.

MATERIALS AND METHODS

This retrospective study included 231 patients (unruptured, 13) with ACom aneurysms out of surgically treated patients during from March, 1997 to May, 2005. The patients were divided into two groups : Group A (96 with sylvian fissure dissection, March, 1997-December, 2000) and Group B (135 without sylvian fissure dissection, January, 2001-May, 2005). All patients underwent the conventional pterional approach. However, in the later period, the sylvian fissure was opened in patients with severe brain swelling, highly positioned aneurysms, and difficult aneurysms to clip such as large sized aneurysms and complex or inferiorly projecting

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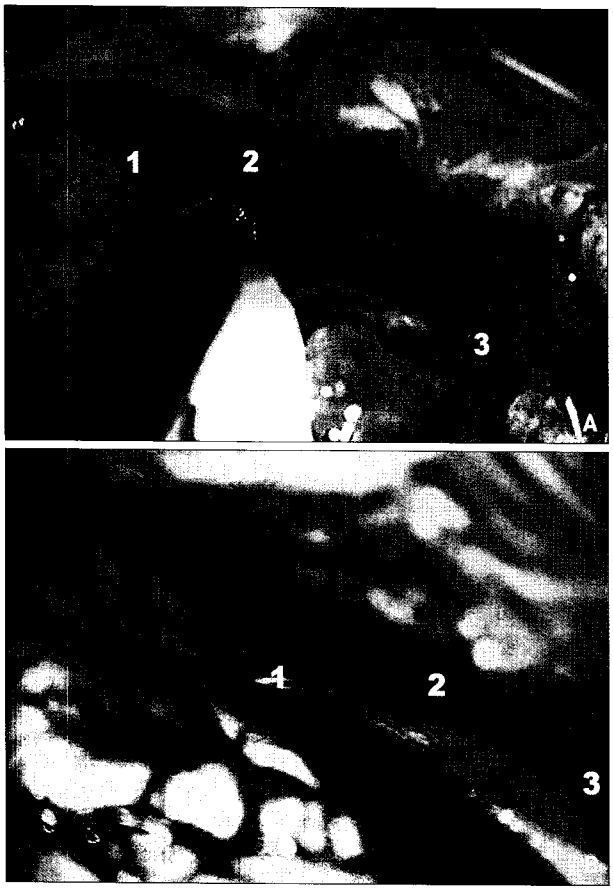

Fig. 1. After exposure of the proximal carotid artery, the basal-frontal lobe is retracted more laterally to the side of spacious sylvian fissure for minimizing direct trauma to brain tissue (B), compared to conventional approach (A). 1 : olfactory nerve, 2 : optic nerve, 3 : sylvian fissure.

ACom aneurysms.

Computed tomographic angiogram was done in all patients. Four-vessel angiogram was added to better define the aneurysmal neck in a few complex cases. Aneurysms were generally approached from the side of the dominant A1 segment to obtain the proximal control, with an exception of the presence of contralateral additional aneurysm or hematoma[5,8].

Overall surgical outcomes were compared between two groups. Outcome was assessed at last follow up intervals according to the Glasgow Outcome Scale with "good" or "moderate disability" classified as a good outcome and "severe disability", "vegetative" or "death" classified as a poor outcome[7]. Additionally, to evaluate how this maneuver affected the length of surgical procedures, operative times and complications have been prospectively recorded since January, 2004.

Two groups were evaluated for comparability of demographic and clinical variables including age, sex, Hunt-Hess grade, Fisher Grade, aneurysm size, and direction of aneurysm, at entry by a t-test, x^2, and Fisher's exact tests for categories. In the final analysis of the outcome at the last follow up period, the significance of observed differences in the outcome between the groups were assessed by Fisher's exact test. A p value 0.05 or less was considered significant.

Table 1. Clinical features of ACom aneurysms

	Group A	Group B
No. of Cases	96	135
Age (mean years)	55	59
Sex Ratio (m/f)	37/59	49/86
Fisher Grade		
Grade 1	2	4
Grade 2	36	51
Grade 3	45	62
Grade 4	8	10
Hunt/Hess Grade		
Grade 1	12	19
Grade 2	22	39
Grade 3	28	37
Grade 4/5	29	32
Aneurysm direction		
Superior	29	41
Anterior	16	21
Posterior	23	33
Inferior	12	15
Complex	16	25
Size (mm)	7.1×3.5	6.9×3.2

Group A : 96 with sylvian fissure dissection, March, 1997–December, 2000, Group B : 135 without sylvian fissure dissection, January, 2001–May, 2005

Surgical technique

A standard frontotemporal craniotomy was performed. An intraoperative ventriculostomy was done in most cases of ruptured aneurysms. Wide opening of the carotid-ophthalmic cisterns is essential for gaining the relaxation needed to observe the communicating complex. An incision in the arachnoid membrane was made over the ipsilateral optic nerve, and this opening was expanded to completely free the optic nerve from frontal lobe. After exposure of the proximal carotid artery, the basal-frontal lobe was retracted more laterally to the side of spacious sylvian fissure for minimizing direct trauma to brain tissue, compared to conventional approach (Fig. 1). Resection of the gyrus rectus parallel to and immediately medial to the olfactory nerve allows identification of the ipsilateral A2 or A1 for early proximal control[1,4,5,8]. After improving visualization of the ACom complex with resection of the gyrus rectus, the frontal lobe retractor was placed within the incision in a manner analogous to conventional approach. Before clip application, complete identification of all afferent and efferent vasculature, identification and preservation of perforating vessels, and dissection of aneurysm neck were done. A variety of clipping techniques and appropriate clips were used depending on the aneurysm anatomy, size, and projection.

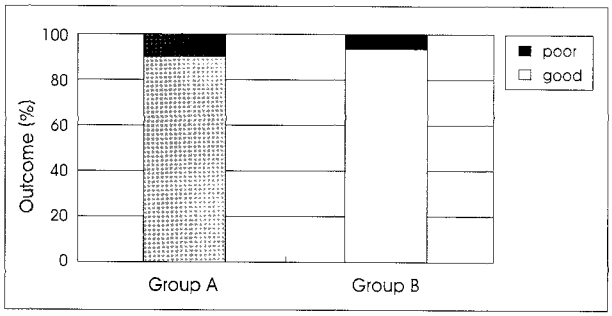

Fig. 2. Surgical outcome in good clinical grade after surgery. Group A : Pterional approach with sylvian fissure dissection. Group B : Pterional approach without sylvian fissure dissection.

RESULTS

Subjects in the two treatment groups were similar with regard to including age, sex, Hunt-Hess grade, Fisher Grade, aneurysm size, and direction of aneurysm (Table 1). All aneurysms were satisfactorily clipped, and there was no evidence of increase in incidence from procedure-related retraction injury in group B. There was few more patient suffering from anosmia in group B (4 patients, 2.96%) than those of in group A (2 patient, 2.08%), but with no statistical significance. Overall outcome was good in 186 (80.5%); 76 (79.2%) in group A, and 110 (81.5%) group B (x^2 test, p=0.79). In good clinical grade of group A, good outcome was observed in 60 patients (89.6%) and in group B, 97 patients (94.2%) (Fisher's exact test, p=0.38) (Fig. 2). Microsurgical times averaged 48.1 min (range 25-110 min).

DISCUSSION

Anatomical considerations of sylvian fissure

The extensive spectrum of the neural and vascular structures within the reach of the transylvian approach includes the insula, basal ganglia, lateral ventricle, middle cerebral artery, temporal operculum, uncus, orbit, anterior cranial fossa, optic nerve, internal carotid artery and its branches, lamina terminalis, and interpeduncular fossa[9]. From the neurosurgical viewpoint, the sylvian fissure can be considered a gateway connecting the surface to the depth of the anterior part of the brain base including A-ComA[9].

Care, during the procedure without sylvian fissure dissection, should be taken not to injure any vessels and the frontal or temporal cortex. The occurrence of a thick blood clot within the fissure makes the dissection even more difficult. Sylvian fissure has many anatomical variations depending on the citernal size and arachnoidal characteristics[10]. In some cases, the frontal and temporal lobe are closely approximated on the surface thereby covering the substance of the cistern[10]. Furthermore, deep within the sylvian fissure, the frontal lobe often protrudes laterally, indenting the temporal lobe[10]. Failure to recognize this anatomical variation may result in an inadvertent injury to the frontal lobe.

Surgical approach

Many surgeons have proposed different approaches in attempts to improve the surgical outcome. Operative approach of A-ComA can simply be classified into two categories that are lateral approach and anterior approach. The lateral approaches include pterional approach, orbitozygomatic approach, and orbitopterional approach. The anterior approaches consist of anterior interhemispheric approach and subfrontal approach[3]. Aneurysm location, direction, and size must be considered to select each operative approaches[3]. Yasargil[10] reported excellent surgical results by the pterional approach, and therefore, along with its technial easiness, his approach gained unanimous support and has been widely accepted as a standard procedure. When the aneurysm is positioned high from the anterior clinoid process and it is projected in a superior direction, interhemispheric approach is preferred[5]. If large AComA is directed superiorly, orbitozygomatic approach or subfrontal approach are preferred[1,3]. But, the choice of approach to AComA has depended largely on the surgeon's preference and experience[1].

Any maneuver that can prolong aneurysm surgery may be detrimental. Rapid clipping of the aneurysm may be the best interest of the patient. Also limiting a vascular manipulation may reduce the risk of spasm and potentially improve outcomes. Solomon[8] also commented that he routinely did not dissect sylvian fissure by performing a pterional craniotomy in patients with AComA. He thought that much of the injury associated with AComA surgery derived not from retraction but from small vessel injury. For resection of the gyrus rectus without sylvian fissure dissection, maximal brain relaxation is crucial to the successful exposure of aneurysm without sylvian fissure dissection. The surgeon can angle the microscope from a more oblique trajectory along the frontal lobe with more lateral retraction to the side of spacious sylvian fissure. It is unnecessary either temporal lobe retraction or sylvian fissure splitting. Although we could not compare operative times in patients with sylvian fissure dissection, we believe that eliminating the step of sylvian fissure dissection substantially by gentle lateral basal-frontal retraction to the side of the sylvian fissure may decrease operative times. On the contrary, this approach without sylvian dissection need more surgical experience not only to improve the response to intraoperative rupture but also to visualize anatomy under adverse conditions, and is limited in; 1) aneurysms associated with a large blood clot with mass effect, 2) subarachnoid hemorrhage associated

with brain swelling, 3) highly positioned aneurysms, and 4) difficult aneurysms to clip such as large sized aneurysms and complex or postero-inferiorly projecting ACom aneurysms.

In conventional approach with sylvian fissure dissection, there are three disadvantage including time consuming, longer retraction, risk of pial and microvascular injury during sylvian dissection. However, the limited access would in turn increase the tendency toward more significant brain retraction. Considering our surgical experience since 1990, it should be pointed out that an unavoidable prerequisite before trying to perform this approach is to have the precise anatomic knowledge and enough skills to dissect surrounding the aneurysm without using bulky brain retractors.

Complication

Being aware of the technical difficulties and potential morbidity of surgical adjuncts, many surgeons have proposed different approaches in attempts to decrease the surgical complication rates.

Hoeoek et al.[6] reported 0-3% of anosomia at the Acom-A surgery. Aydian et al.[2] observed 3% of the olfactory nerve dysfunction. In our series, there were no procedure-related complications except for olfactory dysfunction (2.96%), which was similar to conventional transsylvian approach. It is well known that the nerve can be pulled out from the cribriform plate when retraction exceeds a certain degree, and that even a moderate strain of compression on cranial nerves may result in temporary or permanent damage.

CONCLUSION

We believe that resection of the gyrus rectus without sylvian fissure splitting by gentle lateral basal-frontal retraction to the side of sylvian fissure permits rapid identification of the ipsilateral A1 and A2, and improve exposure of the aneurysm without inadvertant violation to the frontal or temporal lobe, especially in the cases of tightly adhered sylvian fissure.

In this study, we do not intend to modify the standard approach of the AComA that is familiar to and has been mastered by many others. Rather, we report our experience on the basis of our anatomic understanding of the technique and its results, and believe that good therapeutic results can be obtained by using this approach.

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