

중대뇌동맥 동맥류의 수술적 치료

임 만 빈 · 이 창 영

= Abstract =

Surgical Management of Middle Cerebral Artery Aneurysm

Man Bin Yim, M.D., Chang Young Lee, M.D.

Department of Neurosurgery, Keimyung University, School of Medicine, Taegu, Korea

Although the surgical technique of the management of an middle cerebral artery(MCA) aneurysm is not more difficult than that of an aneurysm in any other location, the surgical management outcome of this aneurysm is not better than that of other location aneurysms. This is probably due to occurrence of an intracerebral hemorrhage more frequently in an MCA aneurysm than other location aneurysms. This is required the proper surgical management of this aneurysm to be reviewed.

The key points of surgery for MCA aneurysm can be summarized as follows : gently wide dissection and splitting of the sylvian fissure without injury of main sylvian veins ; early adequate exposure of the M₁ sites for temporary clips applications ; avoid injuries of small branches of the MCA in sylvian fissure by using a low pressure suction during removing the intrasylvian hematoma ; avoid injury of lenticulostriate arteries and narrowing of the parent arteries during clipping of aneurysms ; and successful aneurysm obliteration with minimal brain retraction. Preoperative imagination of the configuration of aneurysm and the relationship between the aneurysm and surrounding vessels, such as M₁, M₂ and lenticulostriate arteries, from angiographic informations will decrease the incidence of premature aneurysmal rupture during surgery and improve the surgical management outcome of patients with MCA aneurysm.

From September 1982 to December 1998, the authors has surgically treated 1025 patients of the cerebral aneurysms. Among these patients, 274 patients(26.7%) had the MCA aneurysms. The surgical outcomes of these MCA aneurysm patients were good in 222 patients(81.0%) and death in 22 patients(8.0%).

The authors discusses surgical anatomy and techniques for the management of MCA aneurysms on the basis of the author's experiences and a review of the literatures in order to improve the surgical management outcomes of patients with MCA aneurysm in the future.

KEY WORDS : Cerebral aneurysm · Middle cerebral artery · Surgical anatomy · Surgical management · Outcome.

서 론

중대뇌동맥 동맥류의 수술적 치료에 있어서는, 다른 부위의 동맥류와 비교하여 수술적 치료의 결과가 더 좋지 않다는 보고가 있다. 이는 아마도 중대뇌동맥 동맥류의 경우 다른 부위의 동맥류에 비해 뇌내출혈이 더 자주 발생하기 때문이다. 따라서 중대뇌동맥 동맥류의 수술적 치료에 있어서는, 적절한 수술적 관리가 필요하다.

중대뇌동맥 동맥류 수술의 주요 포인트는 다음과 같이 요약할 수 있다 : Sylvian fissure의 넓은 절개와 분할을 Sylvian veins를 손상시키지 않고 ; M₁ 부위를 위한 임시 클립의 적절한 적용 ; Sylvian fissure의 작은 가지 동맥을 저압 흡인기를 사용하여 제거하는 동안 Sylvian hematoma를 제거하는 동안 ; lenticulostriate arteries를 손상시키지 않고 ; 동맥류 절제 시 부모 동맥의 협착을 방지 ; 그리고 최소한의 뇌 재traction을 통한 동맥류의 성공적인 절제이다. 동맥류의 형태와 주변 혈관, 즉 M₁, M₂ 및 lenticulostriate arteries와의 관계를 혈관조영학적 정보를 통해 수술 전 미리 상상해두면, 수술 중 동맥류의 조기 파열을 예방하고 중대뇌동맥 동맥류 환자의 수술적 치료 결과를 개선할 수 있다.

1982년 9월부터 1998년 12월까지, 저자들은 1025명의 뇌동맥류 환자를 수술적으로 치료하였다. 이들 환자 중 274명(26.7%)은 중대뇌동맥 동맥류였다. 이들 중대뇌동맥 동맥류 환자의 수술적 치료 결과는 222명(81.0%)이 양호하고 22명(8.0%)이 사망하였다.

저자들은 저자의 경험과 문헌 고찰을 바탕으로 중대뇌동맥 동맥류의 수술적 치료에 있어서는, 저자의 경험과 문헌 고찰을 바탕으로 중대뇌동맥 동맥류 환자의 수술적 치료 결과를 개선할 수 있다.

키워드 : Cerebral aneurysm · Middle cerebral artery · Surgical anatomy · Surgical management · Outcome.

가 8% 3%
 (fissure)
 가
 (ara -
 chnoid membrane)
 mm²⁰⁾
 mm¹⁾,
 Yasargil²²⁾ Adin¹⁾
 A
 B
 (gyrus) 가 가
 가 가
 가 가
 가 A가 31%, B가 21%
 가 14% (Fig. 1B).
 A 가

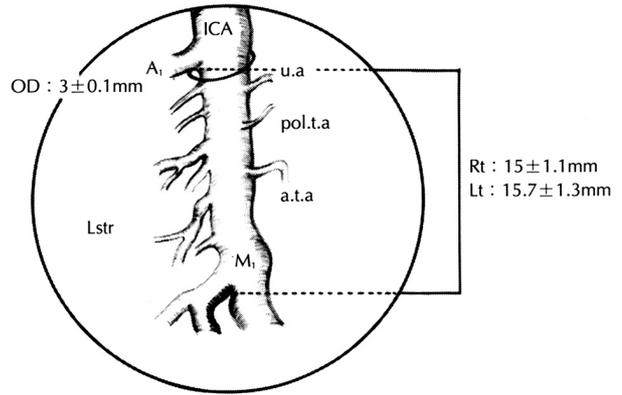


Fig. 2. The outer diameter(OD) and length of main trunk of the middle cerebral artery(M1). ICA = internal cerebral artery, A1 = horizontal segment of the anterior cerebral artery, u.a = uncal artery, pol.t.a = polar temporal artery, a.t.a = anterior temporal artery, Lstr = lenticulostriate artery (From Umansky F, Juarez SM, Dujovny M, et al : Microsurgical anatomy of the proximal segments of the middle cerebral artery. J Neurosurg 61 : 458-467, 1984).

2. 중대뇌동맥

M₁() , M₂(: insular) ,
 M₃(: opercular) M₄() 4
²⁾⁷⁾
 , M₁ 15 ± 1.1mm,
 15.7 ± 1.3mm, 3 ± 0.1mm¹⁸⁾.
 M₁
 (uncal artery), (polar)
¹⁸⁾²⁴⁾ (Fig. 2).
 Umansky¹⁸⁾
 6%, 2
 64%, 3 29% 4 1%
 가
 (Table 1). Gibo³⁾ 2 78%, 3
 12% 10% ,
 2 가 가 32%,
 가 가 28%, 가 18% .
 Umansky¹⁹⁾ M₁ ansky¹⁹⁾
 가 79%, M₂ 가 15.3%,
 가 5.7% , 21%

Table 1. Classification, diameter and length of main and secondary trunks of the middle cerebral artery*

Classification	Outer diameter(mm)	Length(mm)
Single trunk (6%)	2.9 ± 1.4	38.5 ± 19.3
Bifurcation (64%)		
Superior trunk	2.1 ± 0.1	11.8 ± 0.8
Inferior trunk	2.3 ± 0.1	11.7 ± 0.5
Trifurcation (29%)		
Superior trunk	1.4 ± 0.1	12.7 ± 0.9
Middle trunk	2.3 ± 0.3	13.6 ± 1.3
Inferior trunk	2.1 ± 0.2	12.2 ± 1.6
Quadrifurcation (1%)		
Superior trunk	1.4	8
Middle trunk 1	2.0	15
Middle trunk 2	1.8	13
Inferior trunk	2.1	7

*Umansky F, Juarez SM, Dujovny M, et al : Microsurgical anatomy of the proximal segments of the middle cerebral artery. J Neurosurg 61 : 458-467, 1984

1 21 10.4
 80% , 17%
 3% 가 Um -

수술적응증 및 시기

8)

(Table 2). Rosner¹²⁾

Table 2. Sites of origin of the perforating branches of the middle cerebral artery*

1. Main trunk	79.0%	79.0%
2. Secondary trunk	15.3%	15.3%
Superior division	56.0%	56.0%
Inferior division	39.0%	39.0%
Middle division	5.0%	5.0%
3. Early branches	5.7%	5.7%
Temporal	93.0%	93.0%
Frontal	7.0%	7.0%

*Umansky F, Gomes FB, Dujovny M, et al : The perforating branches of the middle cerebral artery. A microanatomical study. J Neurosurg 62 : 261-268, 1985

4 5

14)15)17)21)25) . Symon¹⁷⁾

4 5

가 가

. Solomon¹⁵⁾

가 (Fig. 3).

4 5

가

48

2. 접근방법

. Yasargil²⁵⁾

4 50%가

5

가

25),

15)20),

가

. Shimoda¹⁴⁾

가

(superior temporal gyrus)

5)10)

16)

25cc

가

M₁

M₁

7)10)

가

11),

5)21)

M₁

(Fig.

4)⁷⁾.

가

5).

수 술 방 법

1. 환자 자세

가

가

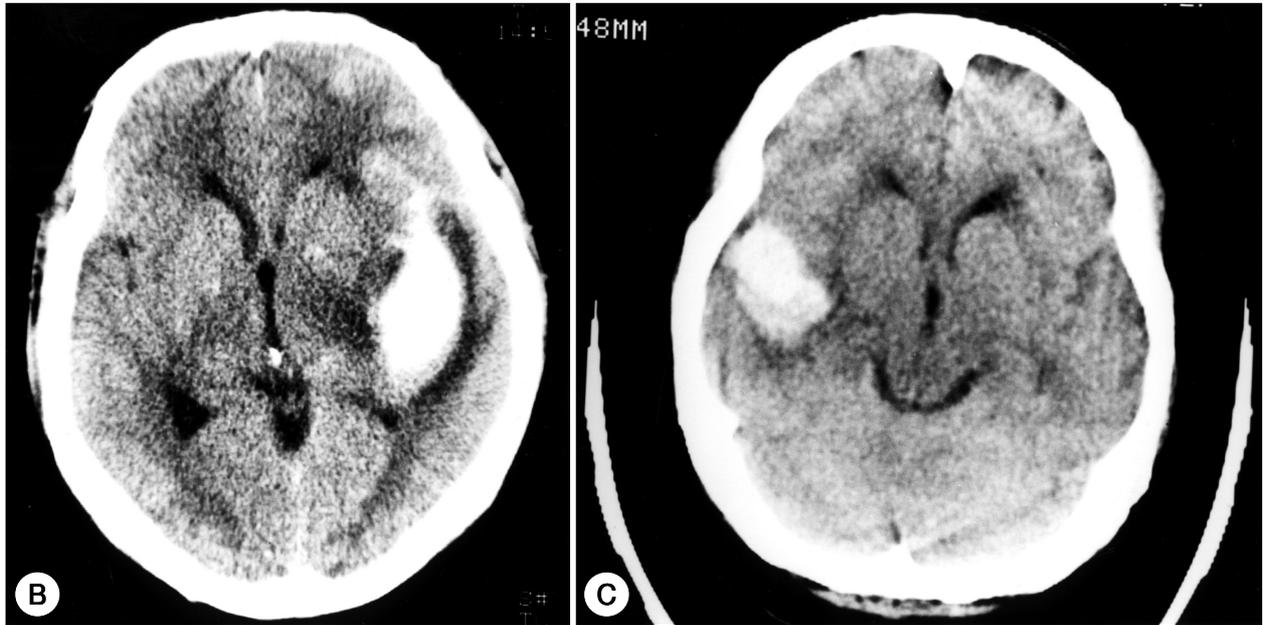
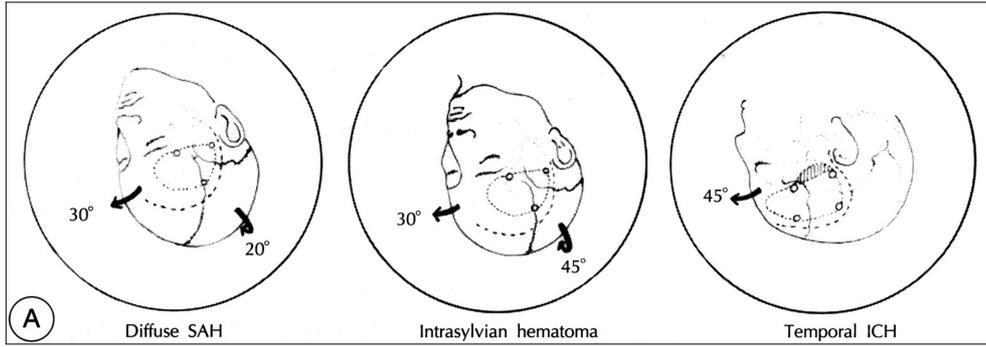


Fig. 3. Patient position and craniotomy according to the type of hemorrhage(A). Examples of intrasylvian hematoma(B) and temporal intracerebral hematoma(C). SAH = subarachnoid hemorrhage, ICH = intracerebral hematoma.

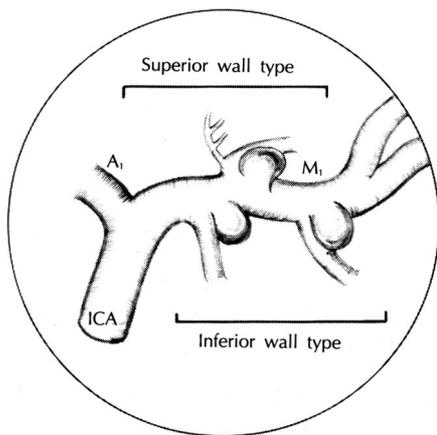


Fig. 4. Classification of aneurysms of the proximal(M₁) segment of the middle cerebral artery. A₁ = horizontal segment of the anterior cerebral artery, M₁ = horizontal segment of the middle cerebral artery, ICA = internal cerebral artery(From Hosoda K, Fujita S, Kawaguchi T, et al : Saccular aneurysms of the proximal (M₁) segment of the middle cerebral artery. Neurosurgery 36 : 441-446, 1995).

Fig. 5A

1a

Fig. 5B 1a

Fig. 5 C D

1a

가

가

가

가

, M₁,

A

(oblique)

20)

20%

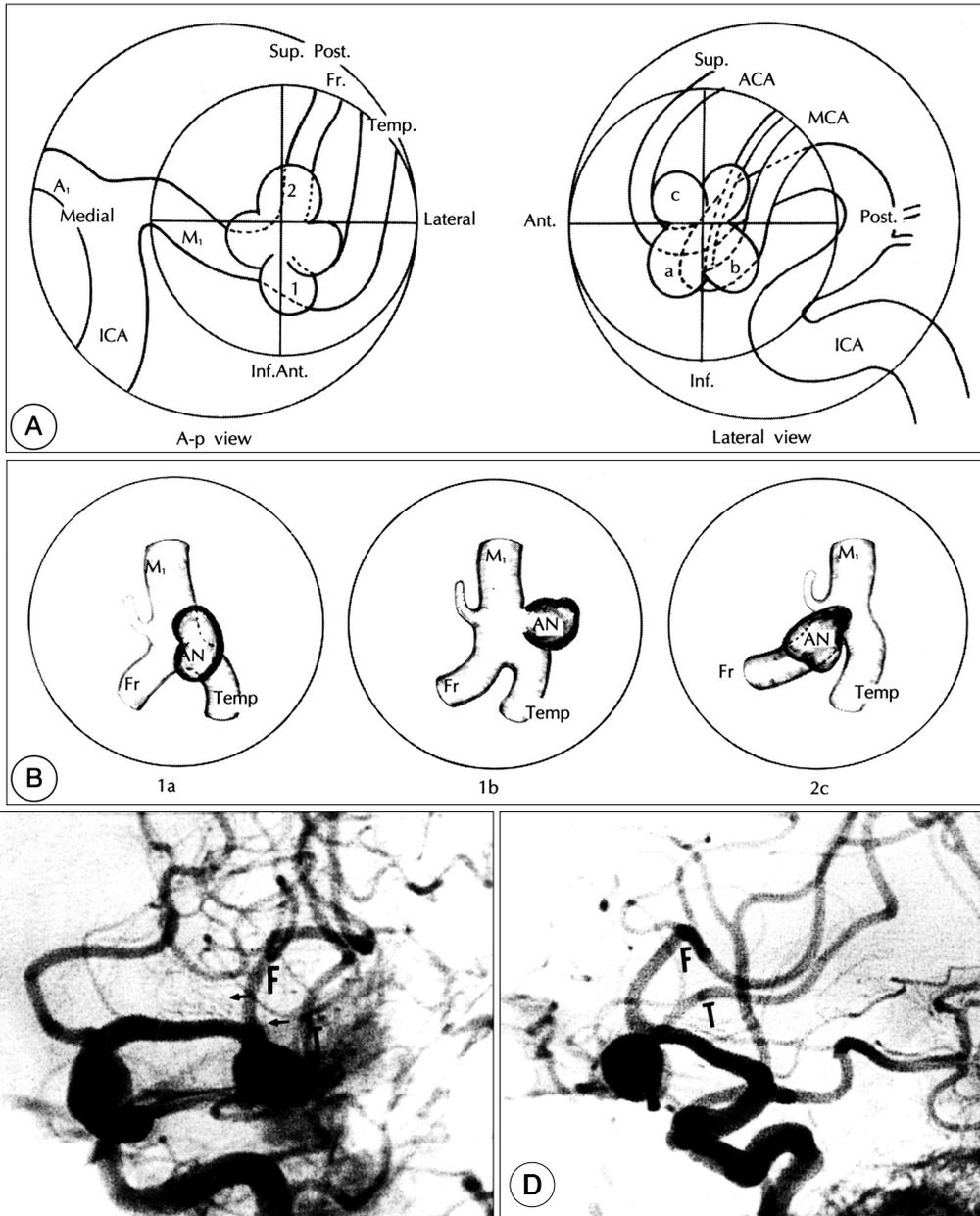


Fig. 5. Classification of the directions of the middle cerebral artery aneurysm in the carotid angiogram(A). Estimation of the operation findings according to the classification of the direction of middle cerebral artery aneurysm(B). Example of angiography of 1a type of aneurysm(C & D). Arrows indicate the lenticulostriate arteries originating from the M₁ near the neck of aneurysm. ICA=internal carotid artery, A₁=horizontal segment of the anterior cerebral artery, M₁=horizontal segment of the middle cerebral artery, ACA=anterior cerebral artery, MCA=middle cerebral artery, Fr=frontal division, Temp=temporal division, Sup=superior, Inf=inferior, Ant=anterior, Post=posterior, A-p=anterior posterior, An=aneurysm, F=frontal division, T=temporal division.

3. 동맥류 결찰

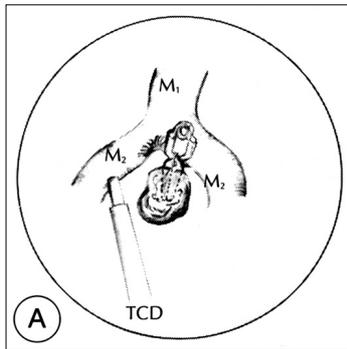
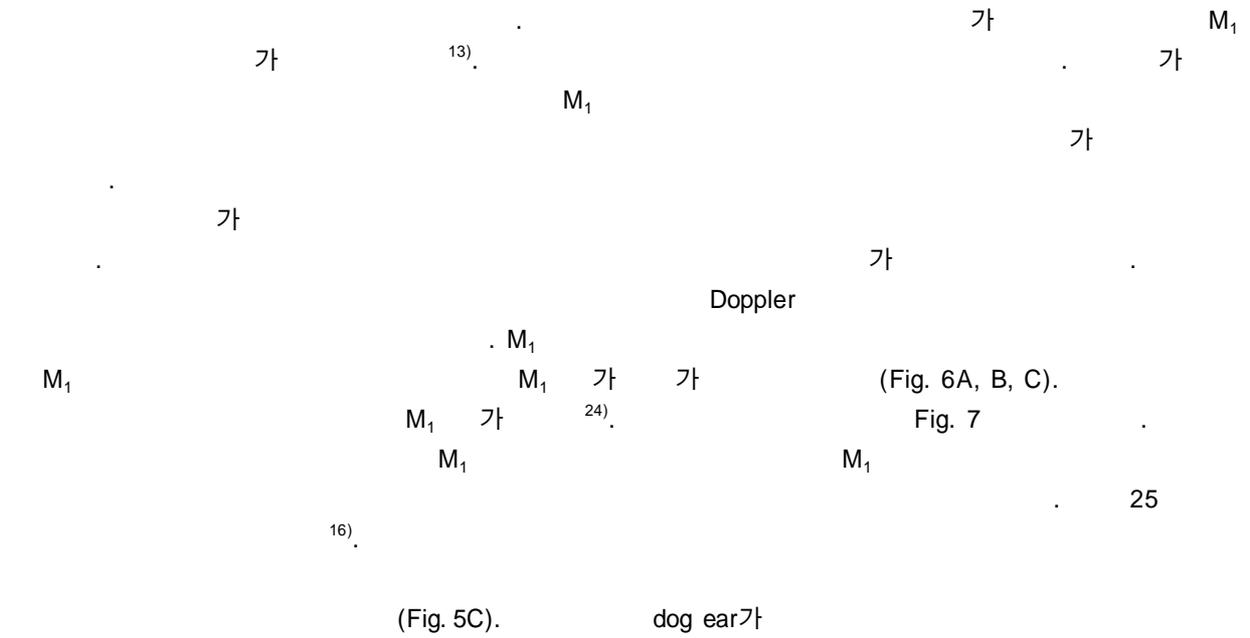
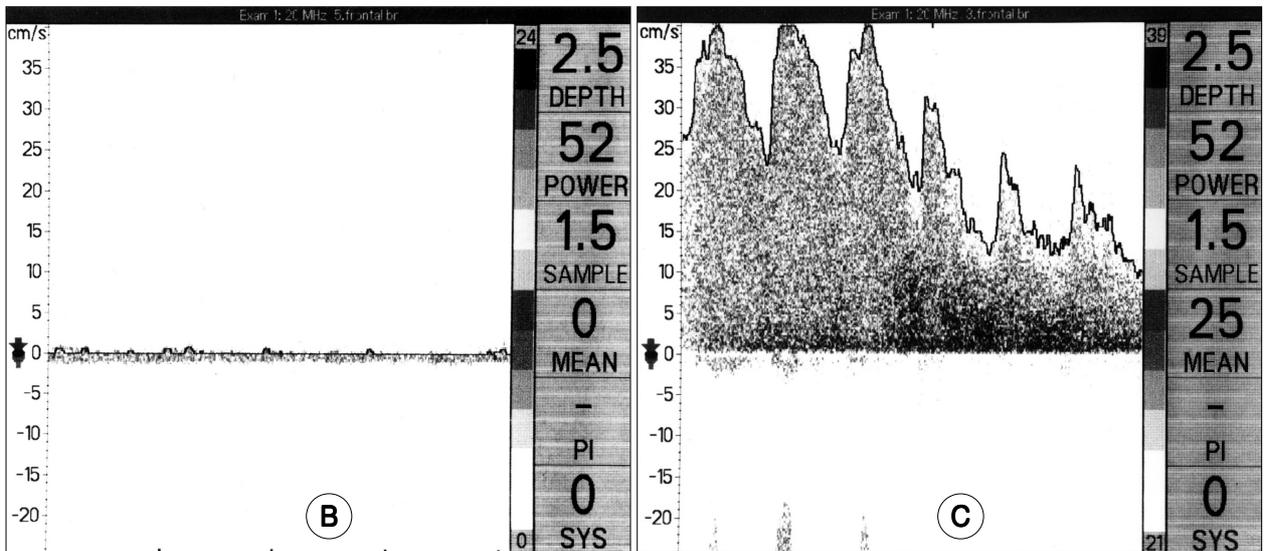


Fig. 6. Intraoperative examination of the stenosis of parent artery with transcranial Doppler system(A). Example of case who shows no flow of blood through parent artery during clipping of aneurysm(B) and returning of blood flow after repositioning of clip(C).



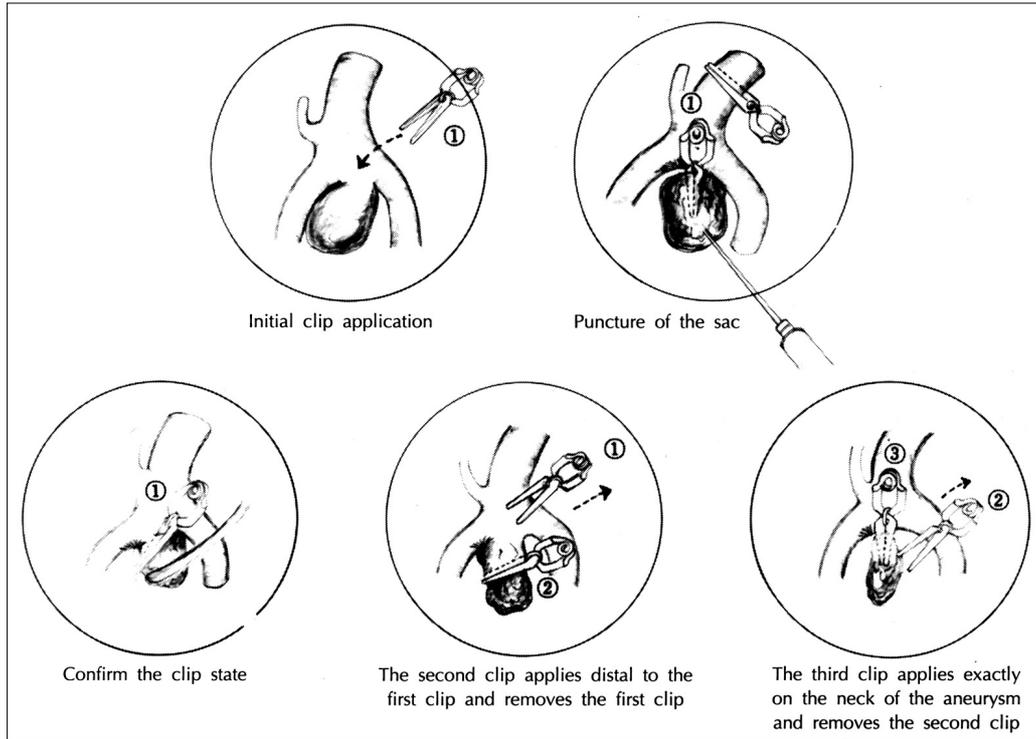


Fig. 7. The sequence of the clipping of the middle cerebral artery aneurysm.

가

(Fig. 7).

가

M₁ M₂ 10-0

가

가

(Fig. 8).

가 M₁ M₂

(Fig. 9).

수술후 결과

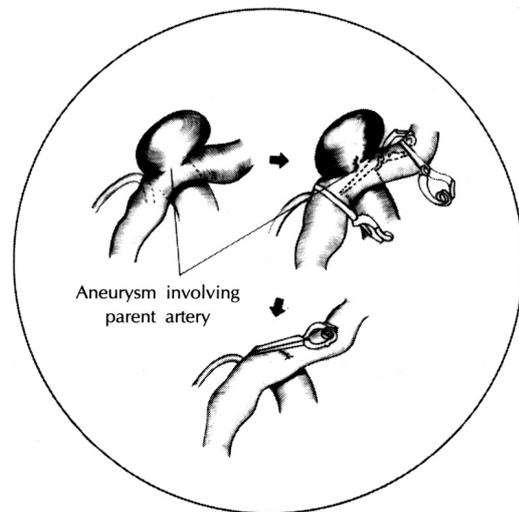


Fig. 8. One of methods which manages the aneurysm involving the parent artery. After application of temporary clips on M₁ and M₂, the aneurysm is clipped following reparation of the weak part of aneurysm involving the parent artery with 10-0 nylon silk suture.

가

가

가

. Symon¹⁷⁾ 181

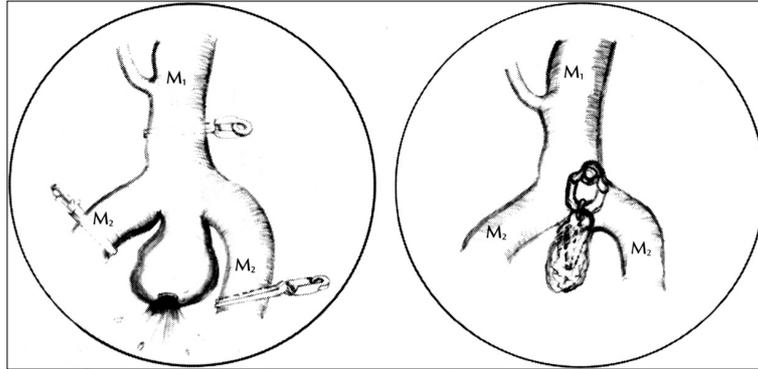


Fig. 9. Management of intraoperative rupture of the middle cerebral artery aneurysm. Temporary clips are placed on both the afferent M1 segment and the efferent M2 branches while the aneurysm neck is prepared and clipped

7.8% 가
 Sengupta McAllister¹³⁾
 99 6
 6%, Heros⁵⁾ 1 5
 7%, Yasargil²⁵⁾ 184
 4.9% , Solomon¹⁵⁾
 1 2.5%
 , Suzuki¹⁶⁾ 1975
 94%
 가 . Sym -
 on¹⁷⁾ , Heros⁵⁾가
 가 가 .
 Wheelock
 132
 43%가 9%
 Shimoda
 24 47
 53%
 38%가
 , 60
 25cc
 M₁
 Hosoda⁷⁾
 75%
 , 20% , 5%

Table 3. Sites of origin of the middle cerebral artery aneurysm

Sites	No of cases
• M ₁	10
• Multiple (M ₁ & other sites)	9
M ₁ & bifurcation	3
M ₁ & other	6
• Bifurcation	159
• Multiple (Bifurcation & other sites)	78
Bilateral bifurcation	12
Bifurcation & other	66
• M ₂	5
• Multiple (Bifurcation & other)	13
M ₂ & bifurcation	8
M ₂ & other	5
Total	274

저자 예들의 분석

1982 9 1998 12 1025
 274 가
 26.7%
 M₁ 10 , M₁ 가
 가 9 ,
 가 159 ,
 가 78 , M₂ 가 5 , M₂
 가 13 (Table 3).
 Hunt & Hess⁸⁾ 가 158
 57.7%, 50 18.3%, 가 66
 24.1% . 가 81.0%,
 8.0% (Table 4).

Table 4. Surgical outcome of the patients with middle cerebral artery aneurysm

Preoperative grade*	Surgical outcome			
	Good(%)	Fair	Poor	Dead(%)
& (N = 158)	146(92.4)	3	1	8(5.1)
(N = 50)	40(80.0)	4	2	4(8.0)
& (N = 66)	36(54.6)	10	10	10(15.2)
Total(N = 274)	222(81.0)	17	13	22(8.0)

* : Hunt & Hess clinical grade⁸⁾

결 론

가

M₁

가

가

700 - 712

194

: 053) 250 - 7332,

: 053) 250 - 7356

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