

가

가

29

Gigantos(Siemens, Erlangen, Germany),
 Angiostar(Siemens, Erlangen, Germany), Multistar(Siemens,
 Erlangen, Germany)

(, ,),

1986 1997

가

29

가 4 , 가 25 1:6.25

12 72

51.4

4 , 1 ,

1

Barrow (7)

A -

B -

가 , C

가

D -

가 A

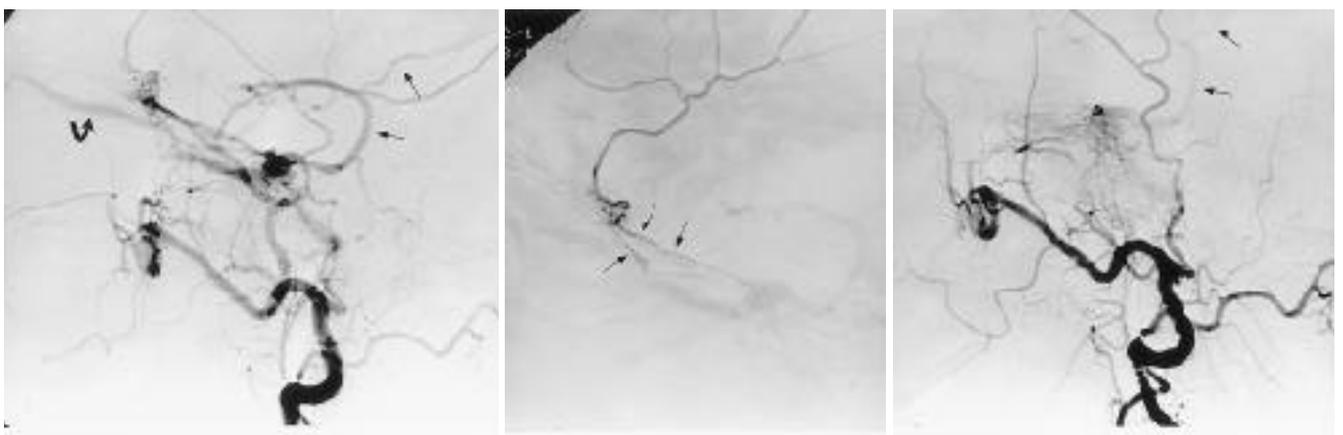
(12), (2),

(15)

Barrow B

, C . D

가



A

Fig. 1. Transarterial treatment(Case 11).

A. Lateral view of right external carotid angiogram shows a fistula in cavernous sinus. Multiple branches from internal maxillary artery feed a dural fistula with drainage into superior orbital vein(curved arrow) and cerebral cortical veins(arrows).

B. Lateral view of selective middle meningeal arteriogram demonstrates feeding vessel(arrows).

C. After embolization of middle meningeal and accessory meningeal arteries of external carotid artery, residual fistula is faintly noted but blood flow is markedly decreased(arrows).

7 , 가 5 , 5
 가 (intercavernous coronary sinus)
 19 , 3
 2
 5 (Table 2). 가 5 13
 2 (Table 3). 3 (Table 4). 1
 가 8 (28%)
 inferolat- 가 21 (72%)
 eral trunk meningohypophyseal trunk 19
 Barrow B 2 (65%), 8 (28%), 2 (7%)
 C 1 , D 26 가
 3 23 가
 가 1 6 , 1 1

Table 4. Angiographic Findings of 29 Patients

Pt.No.	Sex	Age	Site	Feeding arteries	Draining veins	Type
1	F	58	R	EC(R)	CS-SOV	C
2	F	12	B	EC+ IC(RL)	CS(B)-SOV(B)+ IPS(B)+ CV	D
3	M	31	L	EC+ IC(RL)	CS-SOV+ IPS+ CV	D
4	F	44	L	EC+ IC(RL)	CS-SOV+ CV+ DV	D
5	F	27	L	EC+ IC(L)	CS-SOV+ CV	D
6	F	72	B	EC(R)+ IC(L)	CS(B)-SOV(R)+ IPS(R)	D
7	F	66	L	EC+ IC(RL)	CS-SOV+ IPS+ CV	D
8	F	62	L	EC+ IC(RL)	CS-SOV+ CV	D
9	F	53	B	EC(L)+ IC(RL)	CS(B)-SOV(L)+ CV(L)	D
10	F	59	L	EC+ IC(RL)	CS-SOV+ IPS+ PP	D
11	F	67	R	EC+ IC(RL)	CS-SOV+ IPS+ CV	D
12	F	49	L	EC+ IC(RL)	CS-SOV+ IPS+ CV	D
13	M	35	R	IC(R)	CS-SOV+ IPS+ CV	B
14	F	59	L	IC(L)	CS(L)-IPS(L), CS(L)-CS(R)-IPS(R)	B
15	F	47	L	EC(L)+ IC(L)	CS-SOV	D
16	F	64	L	EC+ IC(L)	CS-SOV+ IPS+ CV	D
17	F	52	R	EC+ IC(RL)	CS-SOV+ IPS, CS(R)-CS(L)-IPS(L)	D
18	F	56	L	EC+ IC(RL)	CS-SOV+ IPS+ CV+ DV	D
19	F	55	L	EC+ IC(RL)	CS(L)-CS(R)+ IPS(R)	D
20	M	36	L	EC+ IC(RL)	CS-SOV+ IPS+ CV+ DV	D
21	F	32	L	EC(L)+ IC(RL)	CS-IPS	D
22	F	66	L	EC+ IC(RL)	CS(L)-CS(R)-IPS(R)	D
23	M	39	L	EC+ IC(RL)	CS-SOV+ IPS	D
24	F	60	R	EC+ IC(RL)	CS-SOV+ IPS, CS(R)-CS(L)-IPS(L)	D
25	F	57	R	EC+ IC(RL)	CS-SOV+ IPS	D
26	F	59	B	EC+ IC(RL)	CS(B)-SOV(B)+ IPS(B)	D
27	F	60	B	EC+ IC(RL)	CS(B)-SOV(B)+ IPS(B)	D
28	F	57	L	EC+ IC(RL)	CS-SOV+ IPS	D
29	F	56	R	EC+ IC(RL)	CS-SOV+ IPS	D

DAVF : dural arteriovenous fistula
 EC : external carotid artery
 SOV : superior ophthalmic vein
 DV : deep vein

L : left R : right
 IC : internal carotid artery
 IPS : inferior petrosal sinus
 PP : pterygoid plexus

B : both
 CS : cavernous sinus
 CV : cortical vein

가 4 , 1
가 2

가

29 16 (55%) 2

가

2-3

가

가

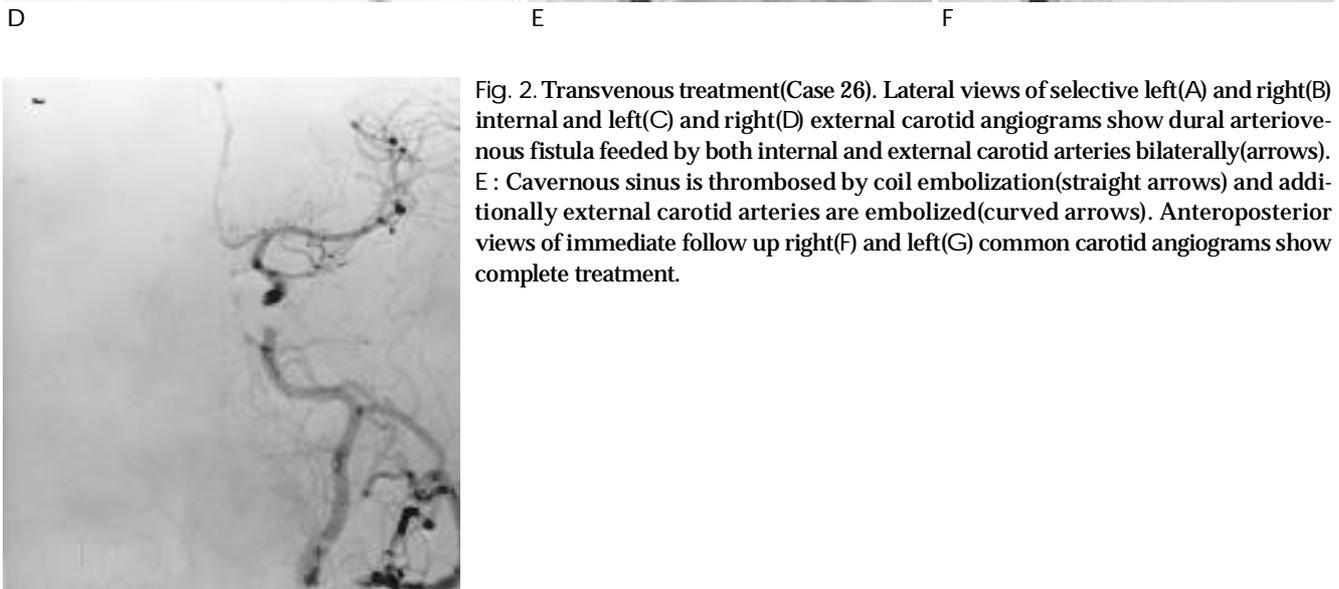
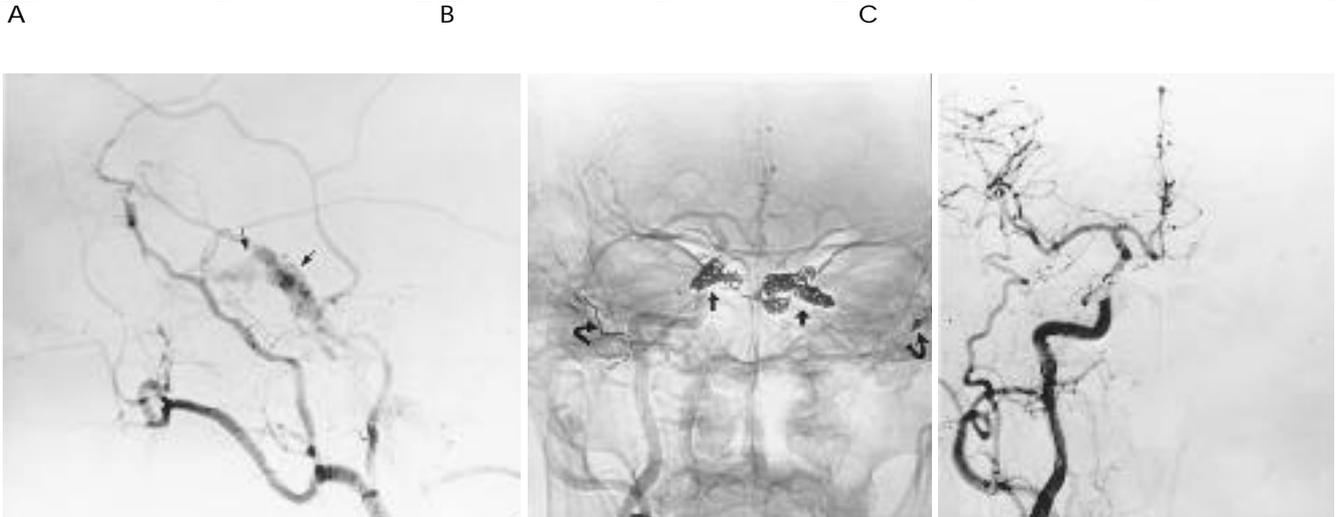
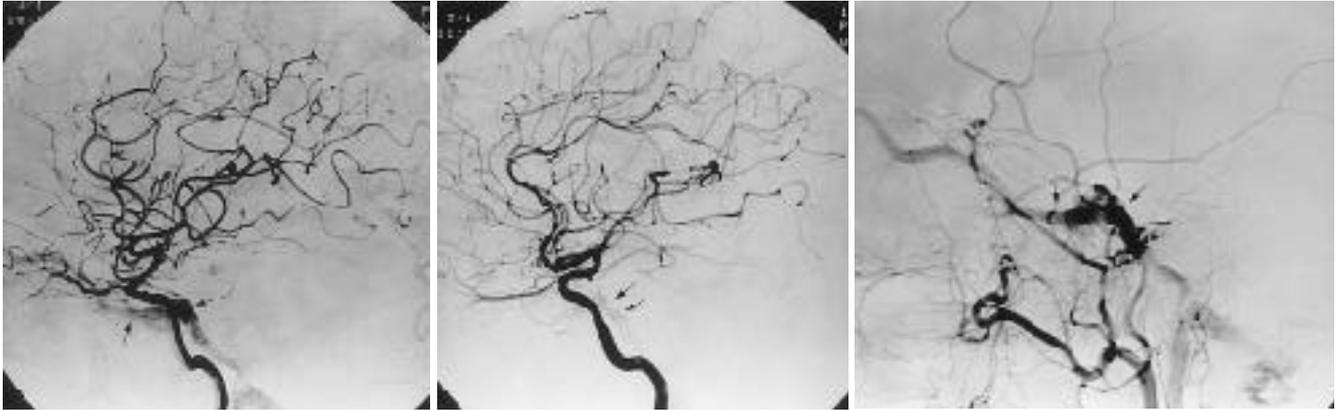


Fig. 2. Transvenous treatment(Case 26). Lateral views of selective left(A) and right(B) internal and left(C) and right(D) external carotid angiograms show dural arteriovenous fistula fed by both internal and external carotid arteries bilaterally(arrows). E : Cavernous sinus is thrombosed by coil embolization(straight arrows) and additionally external carotid arteries are embolized(curved arrows). Anteroposterior views of immediate follow up right(F) and left(G) common carotid angiograms show complete treatment.

가 10 , 가 6
 가 4
 가 1
 가 , 3
 가
 6
 10
 가 12 , 가
 가 17
 , 1 C
 가
 D (Fig. 1) 11
 가
 4 (36%) , 5 (46%)
 , 2 (18%) 가 (Table)
 5) 가 2 1
 가
 15 D (Fig. 2)
 가 6 , 가 9

Table 5. Results of Endovascular Treatment of 29 Patients

Pt.No.	Embolitic material		Angiographic result*	Follow up months	Clinical result#
	A	V			
1	Coil+ PVA		Complete	5	Cure
2	NBCA		Partial	5	Cure
3	PVA+ NBCA+ coil		Partial	74	Improve
4	PVA		Partial	45	Cure
5	PVA		Partial	122	Cure
6	PVA		Partial	106	Improve
7	PVA		Partial	52	Improve
8	PVA		Partial	95	Aggravation
9	PVA+ coil		Partial	54	Aggravation
10	PVA		Partial	48	Cure
11	PVA+ NBCA+ coil		Partial	10	Improve
12	PVA+ NBCA+ coil		Partial	9	Improve
13		Coil	Complete	74	Cure
14		Coil	Partial	5	Cure
15	PVA	Coil	Complete	95	Cure
16	PVA	Coil	Partial	96	Cure
17	PVA	Coil	Partial	61	Improve
18	PVA	Coil	Complete	74	Cure
19	PVA	Coil	Partial	25	Cure
20	PVA+ NBCA+ gelfoam	Coil	Complete	111	Cure
21	PVA+ coil	Coil	Complete	40	Cure
22	PVA+ coil	Coil	Partial	39	Cure
23	PVA+ NBCA+ coil	Coil	Complete	62	Cure
24	PVA+ coil+ silk	Coil	Partial	58	Improve
25	PVA+ coil	Coil	Partial	22	Improve
26	PVA+ coil	Coil	Complete	59	Cure
27	PVA+ NBCA+ coil	Coil	Partial	22	Cure
28	PVA+ NBCA+ coil	Coil	Partial	10	Cure
29	PVA	Coil	Partial	7	Cure

PVA: polyvinyl alcohol NBCA: N-butyl 2-cyanoacrylate

A: transarterial route embolization V: transvenous route embolization

*, # : Results are the final follow up results

(8,29-31).

arterial steal
가

(31).

3

3

4

(2,27).

가

가

(2,27,32,33).

(35)

가

가

가 13

1

29

Barrow

, D

가 26

29

27

B

C

, D

가

가

가

가

가

가

가

가

가

가

(3,34).

가

B

가

1. Newton TH, Cronqvist S: Involvement of the dural arteries in intracranial arteriovenous malformation. *Radiology* 1969 ; 93 : 1071-1078
2. Awad IA, Little JR, Akrawi WP, Ahl J: Intracranial dural arteriovenous malformations: Factors predisposing to an aggressive neurological course. *J Neurosurg* 1990 ; 72 : 839-850
3. Newton TH, Hoyt WF: Dural arteriovenous shunt in the region of the cavernous sinus. *Neuroradiology* 1970 ; 1 : 71-81
4. Halbach VV, Hieshima GB, Higashida RT, Reicher M: Carotid cavernous fistulae : indication for urgent treatment. *AJNR* 1987 ; 8 : 627-633
5. Barrow DL, Spector RH, Braun IF, Landman JA, Tindall SC, Tindall GT: Classification and treatment of spontaneous carotid-cavernous sinus fistulas. *J Neurosurg* 1985 ; 62 : 248-256
6. Bitoh S, Hasegawa H, Fujiwara H, Nakao K: Irradiation to spontaneous carotid cavernous sinus fistulas. *Surg Neurol* 1982 ; 17 : 282-286
7. Parkinson D: Carotid-cavernous fistula: direct repair with preservation of carotid artery. Technical note. *J Neurosurg* 1973 ; 38 : 99-106
8. Mullan S: Experiences with surgical thrombosis of intracranial berry aneurysms and carotid cavernous fistulas. *J Neurosurg* 1974 ; 41 : 657-670
9. Vinuela F, Fox AJ, Debrun GM, Peerless SJ, Drake CG: Spontaneous carotid-cavernous fistulae: clinical, radiological, and therapeutic consideration. *J Neurosurg* 1984 ; 60 : 976-984
10. Halbach VV, Higashida RT, Hieshima GB, Handin CW: Embolization of branches arising from the cavernous portion of the internal carotid artery. *AJNR* 1989 ; 10 : 43-150
11. Halbach VV, Higashida RT, Hieshima GB, Handin CW, Pribram H: Transvenous embolization of dural fistulas involving the cavernous sinus. *AJNR* 1989 ; 10 : 377-383
12. Monsein LH, Debrun GN, Miller NR, Nauta HJW, Chazaly JR: Treatment of dural carotid-cavernous fistulas via the superior ophthalmic vein. *AJNR* 1991 ; 12 : 435-439
13. Pugatch RD, Wolpert SM : Transfemoral embolization of an external carotid-cavernous fistula. case report. *J Neurosurg* 1975 ; 42 : 94-97
14. Debrun GM, Vinuela F, Fox AJ, Davis RR, Ahn HS: Indications for treatment and classification of 132 carotid cavernous fistulas. *Neurosurgery* 1988 ; 22 : 285-289
15. Manelfe C, Berenstein A: Treatment of carotid cavernous fistulas by venous approach. *J Neuroradiol* 1980 ; 7 : 13-21
16. Debrun GM, Lacour P, Vinuela F, Fox AJ, Drake CG, Caron JP: Treatment of 54 traumatic carotid-cavernous fistulas. *J Neurosurg* 1981 ; 55 : 678-692
17. Seeger JF, Gabrielsen TO, Gianotta S, Lotz P: Carotid cavernous sinus fistulae and venous thrombosis. *AJNR* 1982 ; 1: 141-148
18. Houser OW, Baker HL Jr., Rhoton AL Jr., Okazaki H: Intracranial dural arteriovenous malformation. *Radiology* 1972 ; 105 : 55-64
19. Halbach VV, Higashida RT, Hieshima GB, Reicher M, Norman D, Newton TH: Dural fistulas involving the cavernous sinus: Result of treatment in 30 patients. *Radiology* 1987 ; 163 : 437-442
20. Barnwell SL, O'neill OR: Endovascular therapy of carotid cavernous fistulas. *Radiol Clin North Am* 1994 ; 5 : 485-495
21. Teng MMH, Guo WY, Juang C, Wu CC, Chang T: Occlusion of ar-

Embolization of Dural Arteriovenous Fistulas Involving the Cavernous Sinus¹

YT Oh, M.D., DI Kim, M.D., PH Yoon, M.D., GC Lee, M.D.², SG Hur, M.D.²,
P Jeon, M.D., GJ HWang, M.D., JS Lim, M.D.

¹Department of Diagnostic Radiology, Research Institute of Radiological Science

²Department of Neurosurgery College of Medicine, Yonsei University

Purpose : To compare the results of endovascular treatment by using transarterial, transvenous, or a combined approach in cavernous dural arteriovenous fistulas(CDAVF).

Materials and Methods : Twenty-nine angiographically confirmed CDAVF patients underwent endovascular treatment. Initial presenting symptoms and the characteristics of CDAVF, as seen on angiograms, were investigated. Patients were divided according to Barrow's classification. Using embolic materials, endovascular treatment was performed transarterially or transvenously, and the clinical results were retrospectively evaluated during follow up ranging from 5 to 122(mean 48.8) months.

Results : All patients complained of ocular symptoms. Twenty six (90%) showed congestive symptoms related to superior ophthalmic vein drainage, but three presented with only ophthalmoplegia without congestion. According to Barrow's classification, patients were classified as follows : type B(n= 2), type C(n= 1), or type D(n= 26). Twenty-four patients had a unilateral CDAVF, and five a bilateral CDAVF. The results of angiographic treatment were as follows : completely treated in 8 cases(28%), partially treated in 21(72%). Clinical symptoms completely disappeared in 19 patients, for eight of these treatment was entirely angiographic, while for 11 it was partially angiographic. Clinical improvements were noted in eight patients, but in two, visual acuity progressively decreased. In 12 patients who underwent transarterial treatment, the clinical results were as follows : complete cure in five(42%), improvement in five(42%), and progressively decreasing visual acuity in two(16%). Among 17 patients who underwent transvenous or transvenous with transarterial treatment, complete cure was seen in 14(82%), and improvement in three(18%).

Conclusion : Twenty-seven of 29 CDAVF patients were completely cured or improved after endovascular treatment. For type-D patients, transvenous with transarterial treatment led to a higher cure rate than the transarterial approach alone.

Index words : Fistula, arteriovenous
Arteries, therapeutic blockade

Address reprint requests to : Prof. D.I. Kim, Dept. of Diagnostic radiology, Yonsei University Medical college,
#134 Sinchondong, Seodaemoon-Gu, Seoul, 120-752, Korea.
Tel. 82-2-361-5837 Fax. 82-2-393-3035