

후방순환계 뇌동맥류의 혈관내 치료

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Endovascular Treatment of Posterior Circulation Aneurysms

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ABSTRACT

Posterior circulation aneurysm is difficult to treat because surgical approach is time consuming procedure and the risk of postoperative morbidity is still high due to the infarction as the result of the vascular injuries and direct injury to the brain stem and low cranial nerves. Endovascular occlusion is another treatment option for these aneurysms because the postoperative mortality and morbidity are lower than the direct neck clipping. Recently, treatment strategy is advanced, like combined treatment, emergency endovascular occlusion of the sac and direct neck clipping when the patient condition improves or vice versa. Technical and material developments are also noted, balloon assisted neck plasty, stent with coil are also available and 3D coil is recently innovated. Our 3 year experiences of endovascular treatment for posterior circulation aneurysms will be presented. More long-term follow-up is necessary to evaluate the final results, but technological development can reduce the procedure-related complications and newly designed coil and catheters can improve the results and more patients will be helped by this method. (Kor J Cerebrovascular Disease 1:53-5, 1999)

KEY WORDS : Aneurysm · Posterior circulation · Endovascular · Coil.

서 론

Posterior circulation aneurysm은 그 위치에 따라 수술적 접근이 어렵고, direct neck clipping 시 주위 주요구조물의 혈행 차단에 의한 infarction과 직접손상에 의한 합병증의 발생이 높다. 1995년 9월 FDA 공인을 받은 GDC를 이용한 endovascular treatment는 치료후 합병증의 발생이 5% 정도로 낮아 향후의 posterior fossa aneurysm의 치료대안이 될것으로 생각된다.

Fundamental Concepts

Hemodynamic stress at bifurcation points : Hyper-

논문접수일 : 1999년 7월 15일

심사완료일 : 1999년 8월 23일

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tension increased the wall shear stress, and acquired intimal and medial arterial degeneration over time all probably contribute to the growth and potential rupture of aneurysm.

Tensile strength contributes to aneurysmal rupture, whereas shear stress contributes more toward aneurysmal growth.

Aneurysmal rupture is primarily dependent on wall thickness and aneurysmal diameter, in addition to the tensile stress derived from the Law of Laplace. As the diameter of an aneurysm increases and the wall thickness decreases, the propensity for aneurysm rupture increases. If the aneurysm is filled with a tight coil mass, its effective diameter is decreased, as fibrosis ensues, the likelihood of rupture should be decreased. When the aneurysm is occluded with GDC's, it no longer receives the same

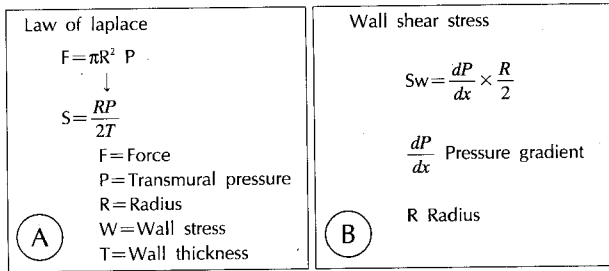


Fig. 1. A : The law of Laplace probably best describes forces that may be involved in aneurysm rupture. B : Wall shear stress equation that may be involved in aneurysm growth (Neurosurgery Quarterly, 1998).

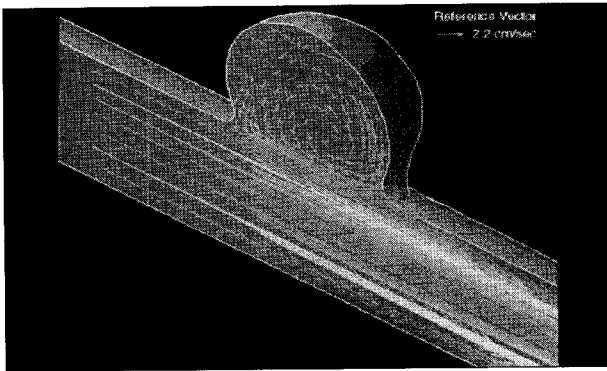


Fig. 2. Flow velocity vectors in a side-wall aneurysm calculated using computational fluid dynamics software. Notice the high wall shear stress at the distal and proximal aneurysm lip, corresponding to inflow and outflow zones of the aneurysm. There are two small intrasaccular flow vortices.

wall shear stress, which was previously promoting aneurysm growth. The area of maximal wall shear stress in a experimental side wall aneurysm model is located at the inflow tract, the distal lip of aneurysm orifice.

GDC는 1990년대초 Guglielmi가 개발한 detachable coil로 platinum으로 만들어졌으며, electric current를 통한 electrolysis와 electrothrombosis가 동시에 일어난다. 그러나 최근의 보고에 의하면 electrothrombosis의 역할보다는 compact packing으로 인한 혈행차단 효과가 더욱 큰 것으로 보고된다.

Indication of Endovascular Treatment

초기 GDC를 이용한 endovascular tx의 indication은

- 1) 수술적 접근이 어려운 부위의 뇌동맥류
- 2) 수술이 어려운 넓은 경부를 가진 거대 동맥류
- 3) Clipping 할 neck이 없는 ectatic aneurysm
- 4) 개두술을 시행하였으나 성공적으로 clip을 할 수 없었

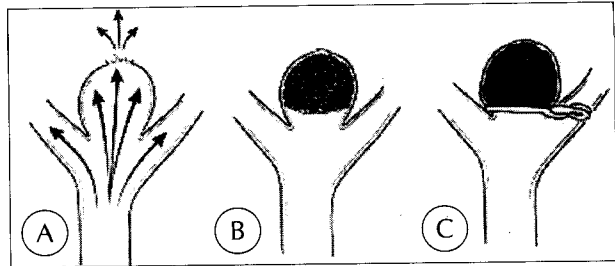


Fig. 3. A : Schematic showing ruptured aneurysm with subarachnoid hemorrhage. B : The aneurysm can be at least temporarily secured with microcoils if the patient has a poor Hunt-Hess grade. This allows aggressive medical or endovascular management of vasospasm without the high risk of repeated aneurysm rupture. Because the aneurysm has a very wide neck, filling the proximal neck region with coils will increase the risk of parent artery occlusion. C : After the patient improves neurologically, definitive surgical management with clipping of the wide neck can be performed.

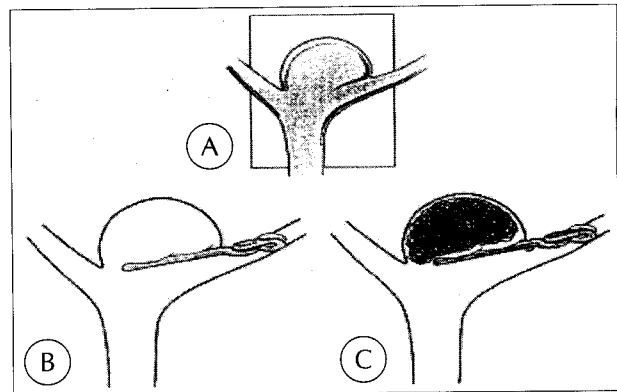


Fig. 4. Schematic of a combined approach that takes advantage of both techniques. A : This wide-necked, giant basilar tip aneurysm would be difficult to manage with either approach alone. The lesion was first approached surgically, but due to the aneurysm morphology the entire neck was not well visualized. B : Rather than aborting the procedure one option was to reconstruct the aneurysm neck with partial clipping to make endovascular treatment easier. C : Final result after coiling through the reconstructed neck.

던 경우

- 5) 전신 상태가 전신마취를 행하기에 부적합한 경우
- 6) 환자가 마취나 수술을 거부한 경우 등 이었으나 최근의 indication은

1) vasospasm 이 있으면서, 환자의 상태가 나쁜 Hunt-Hess IV-V인 환자로 delayed surgery가 필요 경우 ; recurrent hemorrhage를 방지하고 동시에 vasospasm을 intraarterial papaverine injection이나 angioplasty로 치료가능하므로 endovascular 치료가 대안이 된다.

2) Combined approach : partial treatment with GDC, then clipping or vise versa

- 3) Calcified neck
- 4) Mycotic aneurysm

Table 1. Technical controversy for aneurysm embolization

Anesthesia	Neuroleptic	General
Heparinization	Yes	No
Packing	Loose	Tight
Recanalization	Reembolization	Clipping
After embo		

5) Serpentine or fusiform aneurysm : with stent
 최근에는 여러 경험을 통하여 indication이 더욱 광범위하여져 surgically accessible aneurysm에 까지 넓혀가고 있다. 그러나 Table 1.처럼 techical controversy 아직 남아있다.

Endovascular treatment에서 가장 좋은 indication으로는 1) neck size가 4 mm 이하인 경우는 85%이상 complete packing이 될 가능성이 높으며 2) Neck to fundus ratio가 1 : 4이상이 되면 complete obliteration 될 가능성이 높다.

Basilar tip aneurysm의 surgical clipping vs Endovascular obliteration의 치료 결과

보고된 endovascular procedure related morbidity는 5%이며, mortality 는 3%로 surgical clipping의 morbidity 10%, mortality 5%보다는 그 결과가 양호하다. 그러나 incomplete occlusion 된 환자에서 regrowth 나 rebleeding rate 2% 로 더욱 오랜 추적 기간이 필요하다.

Recent technical development

- 1) Remodeling technique with balloon assisted neck plasty
- 2) Stent assisted coiling

3) 3D coil

Conclusion

Posterior circulation aneurysm 에 대한 가장 좋은 치료법은 각 aneurysm의 location, size, configuration 과 환자의 medical, neurological 상태에 따라 tailed treatment가 되어야 하며, 향후 coil 및 catheter의 새로운 design과 계속 발전하는 endovascular technique으로 치료 결과가 좋아짐으로 endovascular treatment의 치료 횟수가 더욱 증가 할 것으로 생각된다.

중심 단어 : 뇌동맥류 · 후행혈관 · 혈관내 · 코일.

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