

허혈성뇌졸중의 수술치료시 동반되는 합병증과 관리*

가

김달수 · 유도성 · 허필우 · 조경석 · 강준기

= Abstract =

Surgical Complication and Its Management in Ischemic Stroke

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Recently various operative procedures including microsurgery or endovascular surgery have been increasing for the management of ischemic cerebrovascular diseases.

Carotid endarterectomy(CEA), extracranial - intracranial(EC - IC) arterial bypass, embolectomy, decompressive craniectomy, arterial transposition, intravascular thrombolysis, and percutaneous transarterial angioplasty and stenting (PTAS) are available surgical modalities for ischemic stroke.

This article focuses the complications and perioperative management of patients treated with CEA and carotid PTAS among various surgical managements for ischemic stroke.

KEY WORDS : Ischemic stroke · Complication · Management · CEA · PTAS.

서 론

경동맥내막절제술
(Carotid Endarterectomy, CEA)

50 가 가

30% , 10)

80% . 1998 가

가 가 34,355 (10 74) , 90,000 CEA가

가 17)54) ,

가 CEA가 13)43)46)

North American Symptomatic Carotid En-
darterectomy Trial(NASCET) 70%

(CEA), 2 26% , CEA

(PTAS) 9% , 2

13.1% 2.5%

50%

(HNP - 00 - CN - 01 - 0018).

3).
European Carotid Surgery Trial(ECST)¹⁸⁾, Veterans Affairs Cooperative Study¹¹⁾ Veterans Administration Asymptomatic Carotid Stenosis Study¹⁷⁾
39%, 60%

Asymptomatic Carotid Atherosclerosis Study (AC-AS) 60%
CEA가 1)

1)14)15)54)56)

Postoperative Complication and Management

1. Non-neurologic complications

1) Cardiac morbidity

0.7 7.1%
50% 가

가

2) Airway compromise

3) Wound hematoma

가 ,
12% 2.5 29)60)

4) Wound infection

1% 가

5) 재발성 경동맥 협착

6 1
1 2%

2. Neurologic complications

1) Cerebral thromboembolism

5%
1 3% 가 ,

2) Intracerebral hemorrhage

3) Seizure

CEA (hyperperfusion)

4) Nerve damage

12 20% 12)22)44) 가
bi -
polar coagulation ,

, superior recurrent laryngeal

1 2cm 가 , greater auricular superior cervical plexus,

가 NASCET CEA
가 7.6% ,
5.5%, 3.4%, 54)
0.9% 3.0%

CEA의 환자선택과 수술전 평가

Sundt 2-70) , 가
grade 가 grade

CEA 가 503 (96.2%)
 0%, 2.1%, 6.3%
 4 - 6)8)20)21)24)27)32 - 40)48 - 53)55)63 - 67)69)70) Theron 68)

가가 CEA, PTA 259
 CT , 136 0%
 가, 8% PTA 38 5%
 325mg 가 , 69
 warfarin 1 . Crawley 9) PTA 1
 12 6 PTA 47%
 28% , PTA rem -
혈관성형술(Percutaneous Transluminal Angioplasty, PTA)
스텐트 삽입

가 PTA “ Stent ” 1800 (im -
 가 1980 Kerber 30) pression material) Charles R.
 PTA Stent ,
 Mullan 47)

PTA 가 7)41)62)57)

Carotid and Vertebral Artery Transluminal Angioplasty Study(CA - VATAS) North American Cerebral Percutaneous Transluminal Angioplasty Registry(NACPTAR)가 48)58).
 1993 Ferguson 19) NACPTAR 가 (self -
 102 PTA expanding mesh ; Wallstent, Schneider),
 가 50% , 2 , 8 (Gianturco - Roubin, Cook) Slot -
 , 4 tedtube stent(Palmaz - Schatz, Johnson & Johnson) Wall -
 . Kachel 31) 245 (supra - stent Palmaz - Schatz, Gianturco - Roubin
 aortic) 74 PTA stent, Strecker stent
 69 1 가
 , 2 70 (carotid endarterectomy, CEA)
 . Higashida 23) (Percutaneous Transluminal
 325 P - TA PTA Angiopalsty and Stent, PTAS) Jordan 28)
 292 107 PTAS 166
 5%, 7%, 2% , CEA PTAS :
 PTA 33 30.3% CEA 5.6% : 1.2%, PTAS : CEA 6
 12%가 , 5% : 0.6%, PTAS : CEA가 3.7% : 3.6%
 21%, 9% PTAS가 CEA
 PTA 가 Wholey 71) PTAS
 523 PTA 2,048 98.6%

30
 27 (1.32%), 28 (1.37%), 6
 4.8%, CEA
 가 PTAS가

• :
 480 - 130 65 - 1
 가
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합 병 증

PTAS
 , ,
 , PTA
 low - profile balloon
 filter²⁾¹⁶⁾²⁶⁾
 , 가
 PTA
 (bradycardia)
 9
 90%
 가
 (hyperperfusion injury)
 (2)
 aque)
 (atheromatous pl -
 10%
 31)59)68)72)73)
 PTA 가
 CREST(Carotid Revascularization : Endarter-
 ectomy versus Stent Trial)²⁵⁾
 가 PTAS
 PTAS
 (vital
 sign), (ACT),
 가 (hyperperfusion)

References

- 1) Ackerman LV : *The pathology of radiation effect on normal and neoplastic tissue. AJR 114 : 447-459, 1972*
- 2) Asymptomatic Carotid Atherosclerosis Study Executive Committee. Endarterectomy for asymptomatic carotid artery stenosis. *JAMA 273 : 1421-1428, 1995*
- 3) Barnett HJ, Taylor DW, Eliasziw M, et al : *Benefit of carotid endarterectomy in patients with symptomatic moderate or severe stenosis. N Engl J Med 339 : 1468-1471, 1998*
- 4) Becker GJ, Palmaz JC, Röss CR, et al : *Angioplasty-induced dissections in human iliac arteries : management with Palmaz balloon-expandable intraluminal stents. Radiology 176 : 31-38, 1990*
- 5) Belloni G : *Angioplasty of carotid arteries. Rays 15 : 281-299, 1990*
- 6) Bergeron P, Rudondy P, Benichou H, et al : *Transluminal angioplasty for recurrent stenosis after carotid endarterectomy. Prognostic factors and indications. Int Angiol 12 : 256-259, 1993*
- 7) Brown NM, Butler P, Gibbs J, et al : *Feasibility of percutaneous transluminal angioplasty for carotid artery stenosis. J Neurol Neurosurg Psychiatry 53 : 238-243, 1990*
- 8) Courtheoux P, Tournade A, Theron J : *Transcutaneous angioplasty of vertebral artery atheromatous stricture. Neuroradiology 27 : 259-264, 1985*
- 9) Crawley F, Clifton A, Markus H, Brown MM : *Delayed improvement in carotid artery diameter after carotid angioplasty. Stroke 28 : 574-579, 1997*
- 10) da Silva AF, McCollum P, Szymanska T, et al : *Prospective study of carotid endarterectomy and contralateral carotid occlusion. Br J Surg 83 : 1370-1372, 1996*
- 11) Dehn TCB, Taylor GW : *Cranial and cervical nerve damage associated with carotid endarterectomy. Br J Surg 70 : 365-368, 1983*
- 12) Deruty R, Mottolese C, Pelissou-Guyotat I, et al : *The carotid endarterectomy : Experience with 260 cases and discussion of the indications. Acta Neurochir (Wien) 112 : 1-7, 1991*
- 13) ECIC Bypass Study Group : *Failure of extracranial-intracranial arterial bypass to reduce the risk of ischemic stroke : Results of an international randomized trial. N Engl J Med 313 : 1191-1200, 1985*
- 14) Espinoza FI, MacGregor FB, Doughty JC, et al : *Vocal cord paralysis following carotid endarterectomy. J Laryngol Otol 113 : 439-441, 1999*

- 15) European Carotid Trialists Collaborative Group : *MRC European Carotid Surgery Trial : interim results for symptomatic patients with severe (70% to 99%) of with mild (0 to 29%) carotid stenosis. Lancet* 337 : 1235-1243, 1991
- 16) European Carotid Surgery Trialists Collaborative Group : *Randomized trial of endarterectomy for recently symptomatic carotid stenosis : final results of the MRC European Carotid Surgery Trial (ECST). Lancet* 351 : 1379-1387, 1998
- 17) Fearn SJ, Parry AD, Picton AJ, et al : *Should heparin be reversed after carotid endarterectomy? A randomised prospective trial. Eur J Vasc Endovasc Surg* 13 : 394-397, 1997
- 18) Ferguson R, Ferguson J, Schwarten D, et al : *Immediate angiographic results and in-hospital central nervous system complications of cerebral percutaneous transluminal angioplasty. Circulation Suppl* 88 : 1-393, 1993
- 19) Frawley JE, Hicks RG, Gray LJ, et al : *Carotid endarterectomy without a shunt for symptomatic lesions associated with contralateral severe stenosis or occlusion. J Vasc Surg* 23 : 421-427, 1996
- 20) Freitag G, Freitag J, Koch RD, et al : *Transluminal angioplasty for the treatment of carotid artery stenoses. Vasa* 16 : 67-71, 1987
- 21) Grzyska Z, Zeumer H : *Indikationen zur interventionellen neuroradiologie. arterielle lyse, angioplastie und embolsierende verfahren. Fortschr Med* 109 : 199-203, 1991
- 22) Hertzner NR, Feldman BJ, Beven EG, et al : *A prospective study of the incidence of injury to the cranial nerves during carotid endarterectomy. Surg Gynecol Obstet* 151 : 781-784, 1980
- 23) Higashida RT, Tsai FY, Halbach W, et al : *Cerebral percutaneous transluminal angioplasty. J Heart Dis Stroke* 2 : 497-502, 1993
- 24) Higashida RT, Tsai FY, Halbach W, et al : *Angioplasty for the brachiocephalic and intracranial arteries. In : Proceeding of the 10 th annual Endovascular Neurosurgical Society of Japan, pp1-9, 1994*
- 25) Hobson RW II, Brott T, Ferguson R, et al : *CREST : Carotid Revascularization Endarterectomy versus Stent Trial. [editorial] . Cardiovasc Surg* 5 : 457-458, 1997
- 26) Imparato AM, Riles, Ramariz AA, et al : *Early complications of carotid surgery. Int Surg* 69 : 223-229, 1984
- 27) Jooma R, Bradshaw JR, Griffith HB : *Intimal dissection following percutaneous transluminal angioplasty for fibromuscular dysplasia. Neuroradiology* 27 : 181-182, 1985
- 28) Jordan WD Jr, Schroeder PT, Fisher WS, McDowell HA : *A comparison of angioplasty with stenting versus endarterectomy for the treatment of carotid artery stenosis. Ann Vasc Surg* 11 (1) : 2-8, 1997
- 29) Kachel R, Endert G, ReiB-Zimmemann G, et al : *111 Indium-thrombozytenszinti-graphie und perkutane dilatation (angioplastik) von supraaortalen GefBstenoseine neue methode zur therapieentscheidung und verlaufskontrolle. Fortschr Rntgenstr* 145 : 336-339, 1986
- 30) Kachel R, Endert G, Basche S, et al : *Percutaneous transluminal angioplasty (dilatation) of carotid, vertebral and innominate artery stenosis. Cardiovasc Intervent Radiol* 10 : 142-146, 1987
- 31) Kachel R : *Angioplasty of neck and intracranial vessels, 1990. In : Kadir S, ed. Current Practice of Interventional Radiology. Philadelphia, Decker Inc, pp127-132, 1990*
- 32) Kachel R, Basche S, Heerklotz I, et al : *Percutaneous transluminal angioplasty (PTA) of supra-aortic arteries especially the internal carotid artery. Neuroradiology* 33 : 191-194, 1991
- 33) Kachel R : *Endovascular treatment of carotid and vertebral arteries. In : Bernstein E, Callow A, Nicolaidis E, et al, eds. Cerebral Revascularization. London, Med-Orion, pp663-672, 1993*
- 34) Kachel R : *Percutaneous transluminal angioplasty (PTA) of supraaortic arteries especially of the carotid and vertebral artery. An alternative to vascular surgery? J Mal Vasc* 18 : 254-257, 1993
- 35) Kachel R : *PTA of carotid, vertebral and subclavian artery stenosis. An alternative to vascular surgery? Int Angiol* 13 : 48-51, 1994
- 36) Kachel R : *Results of balloon angioplasty in the carotid arteries. J Endovasc Surg* 3 : 22-30, 1996
- 37) Karnik R, Valentin A, Ammerer HP, et al : *Perkutane und intraoperative angioplastie der supraaotalen GefBe. Vasa Suppl* 3 : 171-175, 1990
- 38) Kerber CW, Cromwell LD, Leohden OL : *Catheter dilatation of proximal carotid stenosis during distal bifurcation endarterectomy. AJNR* 1 : 348-349, 1980
- 39) Kovas J, Belan A, Bozovska J, et al : *Percutaneous transluminal angioplasty of branches of the aortic arch. Cesk Radiol* 43 : 218-225, 1989
- 40) Kunkel JM, Gomez ER, Spebar MJ, et al : *Wound hematomas after carotid endarterectomy. Am J Surg* 148 : 844-847, 1984
- 41) Kuntz RE, Baim DS : *Defining coronary restenosis. Newer clinical and angiographic paradigms. Circulation* 88 : 1310-1323, 1993
- 42) Lanska DJ, Kryscio RJ : *In-hospital mortality following carotid endarterectomy. Neurology* 51 : 440-447, 1998
- 43) Lau KW, Gunnes P, Williams M, et al : *Angiographic restenosis after successful Wallstent implantation : an analysis of risk predictors. Am Heart J* 124 : 1473-1477, 1992
- 44) Liapsis DC, Satiani B, Florance CL, et al : *Motor speech malfunction following carotid endarterectomy. Surgery* 89 : 56-59, 1981
- 45) Loftus IM, McCarthy MJ, Pau H, et al : *Carotid endarterectomy without angiography does not compromise operative outcome. Eur J Vasc Endovasc Surg* 16 : 489-493, 1998
- 46) Maemura E : *Percutaneous transluminal angioplasty for experimental carotid artery stenosis. Mechanism and long-term results. Neurol Med Chir Tokyo* 29 : 715-723, 1989
- 47) Mathias K : *Ein neues kathetersystem zurperkutanen transluminalangioplastie. Fortschr Rntgenstr* 145 : 336-339, 1986

- minalen angioplastie von karotisstenosen. *Forschr Med* 95 : 1007-1011, 1977
- 48) Mathias K : *Perkutane rekanalisation der supraartalen arterien*. In : Gonther RW, Thelen W, eds. *Interventionelle radiologie*. Stuttgart, Gonther RW, Thelen W, eds. *Interventionelle radiologie*. Stuttgart, Georg-Thieme-Verlag, pp73-87, 1988
 - 49) Mathias K : *Percutaneous transluminal angioplasty of the supraaortic arteries* In : Dondelinger PF, Rossi P, Kurdziel S, eds. *Interventional Radiology*. New York, Georg-Thime-Verlag, pp564-583, 1990
 - 50) Motarjeme A, Gordon GI : *Percutaneous transluminal angioplasty of the brachiocephalic vessels : Guidelines for therapy*. *Int Angiol* 12 : 260-269, 1993
 - 51) Mullan S, Duda EE, Patronas NJ : *Some examples of balloon technology in neurosurgery*. *J Neurosurg* 52 : 321-329, 1980
 - 52) Munari LM, Belloni G, Perretti A : *Carotid percutaneous angioplasty*. *Neurol Res* 14 : 156-158, 1992
 - 53) North American Symotomatic Carotid Endarterectomy Trial Collaborators : *Beneficial effect of carotid endarterectomy in symptomatic patients with high-grade carotid stenosis*. *N Engl J Med* 325 : 445-453, 1991
 - 54) Qi JP, Zeitler E : *Katheterdilatation der arteriellen stenosen supraaortaler Gefäße und sptergebnisse*. *Fortschr Geb Rntgenstr* 155 : 357-362, 1991
 - 55) Ress CR, Palmaz JC, Becker GJ, et al : *Palmaz stent in atherosclerotic stenoses involving the ostia of the renal arteries : preliminary report of a multicenter study*. *Radiology* 181 : 507-514, 1991
 - 56) Richter GM, Noeldge G, Troeren T, et al : *First longterm results of a randomized multicenter trial : iliac balloon-expandable stent placement versus regular percutaneous transluminal angioplasty*. *Radiology* 177 (P) : 152, 1990 (Abstract)
 - 57) Rockman CB, Riles TS, Lamparello PJ, Giangola G, Adelman MA : *Natural history and management of the asymptomatic, moderately stenotic internal carotid artery*. *J Vasc Surg* 25 : 423-431, 1997
 - 58) Roubin GS, Yaday S, Iyer SS, Vitek J : *Carotid stent-supported angioplasty : a neurovascular intervention to prevent stroke*. *Am J Cardiol* 78 : 8-12, 1996
 - 59) Self DD, Bryson GL, Sullivan PJ : *Risk factors for post carotid endarterectomy hematoma formation*. *Can J Anaesth* 46 : 635-640, 1999
 - 60) Strecker EPK, Hagen B, Liermann D, et al : *Iliac and femoropopliteal vascular occlusive disease treated with flexible tantalum stents*. *Cardiovasc Intervent Radiol* 16 : 158-164, 1993
 - 61) Sundt TM, Sandok BA, Whisnant JP : *Carotid endarterectomy. Complications and preoperative assessment of risk*. *Mayo Clin Proc* 50 : 301-306, 1975
 - 62) Theron JG : *Angioplasty of supra-aortic arteries*. *Sem Intervent Radiol* 4 : 331-342, 1987
 - 63) Theron J, Courtheoux P, Alachkar F, et al : *Techniques endovasculaires de revascularisation cerebral*. *J Mal Vasc* 15 : 245-256, 1990
 - 64) Theron JG, Payelle GG, Coskun O, Huet HF, Guimaraens L : *Carotid artery stenosis : Treatment with protected balloon angioplasty and stent placement*. *Radiology* 201 : 627-636, 1996
 - 65) Tsai FY, Higashida RT, Matovich V, et al : *Seven years experience with PTA of the carotid artery*. *Neuroradiology* 33 : 397-398, 1991
 - 66) Tsai FY, Matovich V, Hieshima G, et al : *Percutaneous transluminal angioplasty of the carotid artery*. *AJNR* 7 : 349-358, 1986
 - 67) Turnbull IW, Bannister CM, Armstrong G, et al : *An experimental model to assess the value of laser angioplasty in the management of atheromatous disease of the carotid bifurcation*. *Br J Neurosurg* 5 : 25-30, 1991
 - 68) Vitek JJ, Keller FS : *Angioplasty in neuroradiology*. In : Valk J, ed. *Neuroradiology*. Amsterdam, Elsevier, pp1008-1016, 1986
 - 69) Vitek JJ, Keller FS, Duvall ER : *Brachiocephalic artery dilatation by percutaneous transluminal angioplasty*. *Radiology* 158 : 779-785, 1986
 - 70) Wholey MH, Wholey M, Bergeron P, Diethrich EB, Henry M, Laborde JC, et al : *Current global status of carotid artery stent placement*. *Cathet Cardiovasc Diagn* 44 (1) : 1-6, 1998
 - 71) Yaday JS, Roubin GS, Iyer S, et al : *Elective stenting of the extracranial carotid arteries*. *Circulation* 95 : 376-381, 1997