ARCS 2019

ARTERIAL RECANALIZATION IN CEREBRAL STROKE

뇌졸중 재개통 심포지엄 및 대한뇌혈관내수술학회 2019 춘계보수교육

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분당서울대병원
헬스케어혁신파크 4층 미래홀

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대한뇌혈관내수술학회
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인사말

존경하는 대한뇌혈관내수술학회 회원 여러분, 그리고 우리나라 뇌혈관질환을 최 일선에서 담당하고 치료하고 계시는 각 분야 전문의선생님 여러분들에게 인사 드립니다.

뇌혈관질환은 오랜 기간 동안 국내 사망률 2위를 기록했을 정도로 예후가 불량했던 질환입니다. 그러나 최근 수년 전부터 사망률이 현저히 낮아지면서 현재는 심장질환에 이어 국내 사망률 3위의 질환으로 기록되고 있습니다. 이는 정부와 유관학회의 적극적인 예방 및 홍보의 효과일 수 도 있으나 일단 위중한 뇌졸중이 발생했을 당시 제일 먼저 환자를 보고 담당하면서 뇌혈관내수술치료나 미세혈관수술을 담당하는 신경외과 선생님들의 노고가 크다고 자부합니다. 특히 뇌졸중 초기 발병 시 적극적이고 전문적인 대처가 환자의 사망률을 줄이고 예후를 현저히 호전시킬 수 있는 대표적인 질환인 "대뇌혈관폐색에 의한 급성 허혈성 뇌졸중"에 대해 대한뇌혈관내수술학회 회원 여러분들이 동맥내 혈전제거술을 통해 국내 급성뇌졸중 재개통치료의 절반이상을 담당하고 있음이 건강보험심사평가원 데이터와 대한뇌혈관내수술학회 연보자료를 통해 확인되고 있습니다.

이에 이러한 우리 대한뇌혈관내수술학회의 역량을 되짚어보면서 향후 심뇌혈관질환 국가정책(national strategy)으로 시행되는 "국가 심뇌혈관질환 예방 및 관리에 관한 법령"에 대해 정보를 공유하고 전문가와 토론하는 "뇌졸중 재개통 심포지엄 및 2019 춘계보수교육"을 갖고자 하오니 이 분야를 담당하고 계시는 선생님들의 많은 참여와 격려를 부탁 드립니다. 뇌졸중치료의 최 일선에서 묵묵히 자신을 희생하고 계시는 회원여러분들의 치료 하나하나가 "Practice makes facility" 일 뿐만 아니라 "Practice makes facility and strategy"로 귀결될 수 있도록 우리 학회 회원 여러분들의 역량을 모아 주시길 간곡히 부탁 드립니다.

감사합니다.

대한뇌혈관내수술학회 회장 고준석

2018-2019 대한뇌혈관내수술학회 임원진

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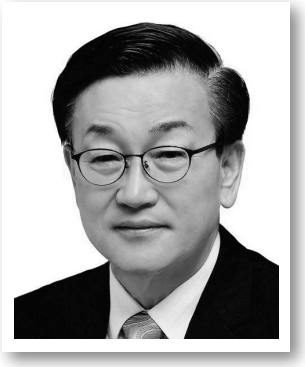

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ARCS 2019

ARTERIAL RECANALIZATION IN CEREBRAL STROKE

뇌졸중 재개통 심포지엄 및
대한뇌혈관내수술학회 2019
춘계보수교육

Session I. Literature review of recent stroke trial & ongoing study

좌장 : 가톨릭대 **성재훈**, 영남대 **장철훈**

Review of AIS treatment focused on IV thrombolysis: Past, present & future	연세대 **정준호**
Review of recent RCTs regarding IA thrombectomy from 2015's five trials to DAWN/DEFUSE-3	가톨릭대 **김영우**
Frontline stent retriever thrombectomy: Historical review and clinical implication	경희대 **신희섭**
Frontline contact aspiration thrombectomy: Historical review and clinical implication	경북대 **강동훈**

Acute ischemic stroke treatment focused on IV thrombolysis: Past, present and future

정 준 호

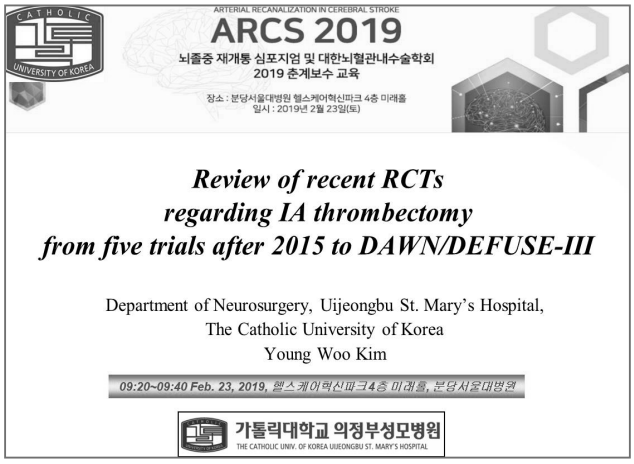
연세대 세브란스병원 신경외과

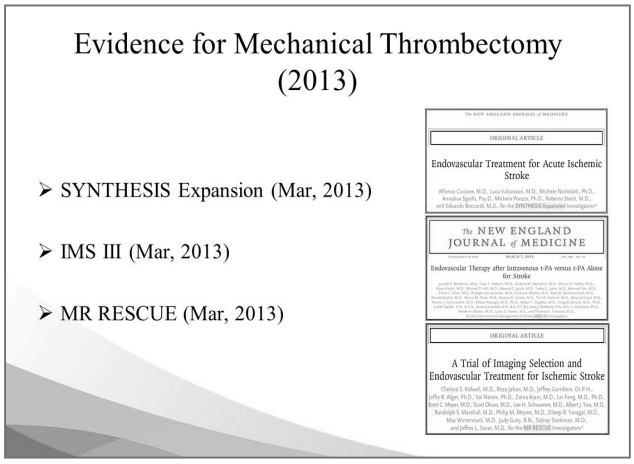
Thrombolysis offers the simplest and most direct treatment for acute ischemic stroke. The efficacy of intravenous (IV) thrombolysis using a recombinant tissue plasminogen activator (rt-PA) for acute ischemic stroke patients has been well established. However, a tight time window allows a minority of stroke patients to receive IV rt-PA, and low recanalization rates of large intracranial artery occlusions limit the efficacy of IV rt-PA. Shortening of the time of door to treatment plays a very important role to enhance the efficacy of acute reperfusion therapy including IV rt-PA and endovascular therapy, and as a consequence, it could contribute to improve the entire stroke outcomes due to an increase of acute reperfusion therapy-eligible patients. Here, the historical background of thrombolytic therapy in clinical trials and the different agents in previous as well as current use are reviewed. Additionally, the management protocol and future perspectives of IV thrombolysis are discussed.

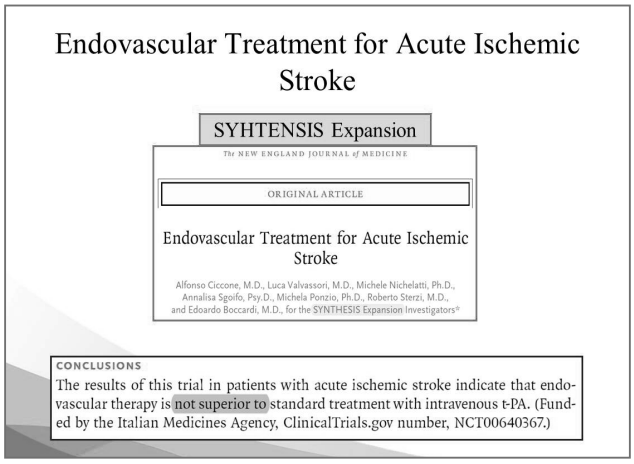
Review of recent RCTs regarding IA thrombectomy from 2015's five trials to DAWN/DEFUSE-3

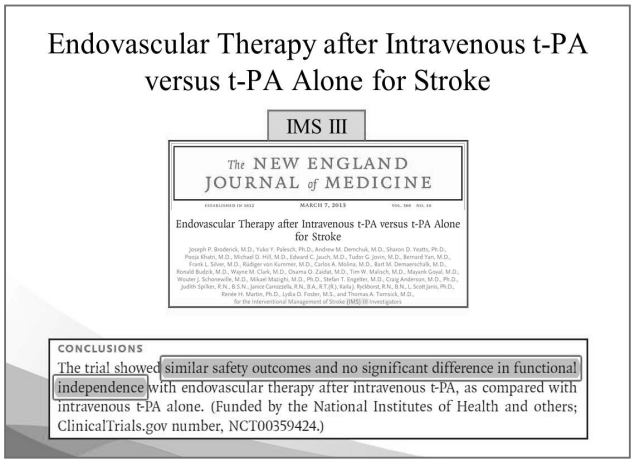
김 영 우

가톨릭대









A Trial of Imaging Selection and Endovascular Treatment for Ischemic Stroke

MR RESCUE

ORIGINAL ARTICLE

A Trial of Imaging Selection and Endovascular Treatment for Ischemic Stroke

Chelsea S. Kidwell, M.D., Reza Jahan, M.D., Jeffrey Gornbein, Dr.P.H., Jeffry R. Alger, Ph.D., Val Nenov, Ph.D., Zahra Ajani, M.D., Lei Feng, M.D., Ph.D., Brett C. Meyer, M.D., Scott Olson, M.D., Lee H. Schwamm, M.D., Albert J. Yoo, M.D., Randolph S. Marshall, M.D., Philip M. Meyers, M.D., Dileep R. Yavagal, M.D., Max Wintermark, M.D., Judy Guzy, R.N., Sidney Starkman, M.D., and Jeffrey L. Saver, M.D., for the MR RESCUE Investigators*

CONCLUSIONS

A favorable penumbral pattern on neuroimaging did not identify patients who would differentially benefit from endovascular therapy for acute ischemic stroke, nor was embolectomy shown to be superior to standard care. (Funded by the National Institute of Neurological Disorders and Stroke; MR RESCUE ClinicalTrials.gov number, NCT00389467.)

RCTs for mechanical thrombectomy in 2013

	SYNTHESIS expansion (n=362)	IMS III (n=629)	MR RESCUE (n=118)
Active vs. control	IA drug/any device/	2/3 standard-dose	Standard (±IVt-tPA)+MERCI or vs standard (±IV r-tPA)
	1. used thrombectomy devices of low efficacy		
Device deployment in active group	66% IA r-tPA alone 34% Device added	41% IA r-tPA 38% IA r-tPA+device	58% MERCI 22% Penumbra 16% both
	2. with insufficient imaging selection criteria		
Vascular imaging	3. long delays from hospital presentation to reperfusion		RA (Multimodal for Stratification)
Onset to IV r-tPA	165 (140-200)	122±34	Not reported
Time onset to groin puncture (min.)	225 (194-260)	208±47	381±74
Time to Reperfusion	Low rate successful recanalization → "Not superior"		Not reported
Successful Recanal. (TICI 2b/3)	Not reported	41%	27%
Good outcome (mRS 0-2)	No difference in risk profile compared to IV tPA		19%
Symptomatic ICH	6%	6.2%	5%
Death (90 days)	14.4%	19.1%	19%

Power WJ et al. Stroke 2015

Evidence for Mechanical Thrombectomy (2015)

- MR CLEAN (Jan. 2015)
- ESCAPE (Mar. 2015)
- EXTEND-IA (Mar. 2015)
- SWIFT PRIME (June. 2015)
- REVASCAT (June 2015)

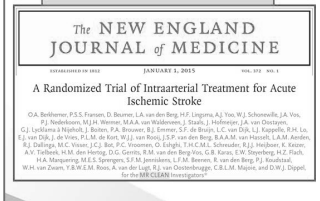
Evidence for Mechanical Thrombectomy (2015)

- Newer generation devices (mainly stent retrievers)
- More stringent imaging selection criteria
  - Confirmation of large vessel occlusion (CTA, MRA)
- More efficient workflow
- Minimize selection bias (done in interventional stroke centers)

→ Reduction in thrombectomy procedures times
→ Higher rates of successful recanalization

A Randomized Trial of Intraarterial Treatment for Acute Ischemic Stroke

MR CLEAN



- 16 centers in Netherlands
- N=500 (233 IAT vs. 267)
- Age ≥ 18
- NIHSS > 2
- ASPECTS: No
- Waiting period prior to endovascular Tx.
- Time: 6 hrs to IAT

MR CLEAN

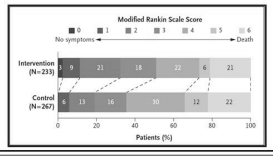


Table 2. Primary and Secondary Outcomes and Treatment Effects.*

Outcome	Intervention (N=233)	Control (N=267)	Effect Variable	Unadjusted Value (95% CI)	Adjusted Value (95% CI)†
Primary outcome: modified Rankin scale score at 90 days — median (interquartile range)	3 (2 to 5)	4 (3 to 5)	Common odds ratio	1.66 (1.21 to 2.28)	1.67 (1.21 to 2.30)
Secondary outcomes					
Clinical outcomes					
Modified Rankin score of 0 or 1 at 90 days — no. (%)	27 (11.6)	16 (6.0)	Odds ratio	2.06 (1.08 to 3.92)	2.07 (1.07 to 4.02)
Modified Rankin score of 0–2 at 90 days — no. (%)	76 (32.6)	51 (19.1)	Odds ratio	2.05 (1.36 to 3.09)	2.16 (1.39 to 3.38)

CONCLUSIONS

In patients with acute ischemic stroke caused by a proximal intracranial occlusion of the anterior circulation, intraarterial treatment administered within 6 hours after stroke onset was effective and safe. (Funded by the Dutch Heart Foundation and others; MR CLEAN Netherlands Trial Registry number, NTR1804, and Current Controlled Trials number, ISRCTN10888758.)

Randomized Assessment of Rapid Endovascular Treatment of Ischemic Stroke

ESCAPE


The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Randomized Assessment of Rapid Endovascular Treatment of Ischemic Stroke

M. Goyal, A.M. Demchuk, B.K. Menon, M. Eesa, J.L. Rempel, J. Thornton, D. Roy, T.G. Jovin, R.A. Willinsky, B.L. Sapkota, D. Dowlatshahi, D.F. Frei, N.R. Kamal, W.J. Montanera, A.Y. Poppe, K.J. Ryckborst, F.L. Silver, A. Shuaib, D. Tampieri, D. Williams, O.Y. Bang, B.W. Baxter, P.A. Burns, H. Choe, J.-H. Heo, C.A. Holmstedt, B. Jankowitz, M. Kelly, G. Linares, J.L. Mandzia, J. Shankar, S.-I. Sohn, R.H. Swartz, P.A. Barber, S.B. Coutts, E.E. Smith, W.F. Morrish, A. Weill, S. Subramaniam, A.P. Mitha, J.H. Wong, M.W. Lowerison, T.T. Sajobi, and M.D. Hill for the ESCAPE Trial Investigators*

- 22 centers in Canada, US, South Korea, Ireland, United Kingdom
- N=315 (165 IAT vs. 150)
- Age ≥ 18
- NIHSS > 5
- ASPECTS ≥ 6
- Time: 12 hrs to randomization

ESCAPE

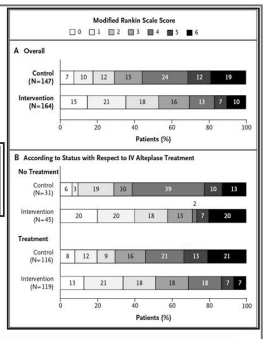


Table 2. Primary and Secondary Efficacy Outcomes.

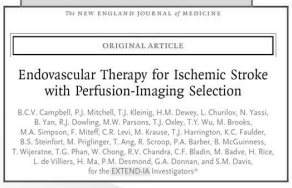
Outcome	Intervention (N=165)	Control (N=150)	Difference (95% CI)*	Effect Variable	Unadjusted Value (95% CI)	Adjusted Value (95% CI)†
Primary outcome: modified Rankin score at 90 days‡				Common odds ratio	2.6 (1.7–3.8)	3.1 (2.0–4.7)
Modified Rankin score of 0–2 at 90 days — no./total no. (%)§	87/164 (53.0)	43/147 (29.3)	23.8 (13.2–34.4)	Rate ratio	1.8 (1.4–2.4)	1.7 (1.3–2.2)

CONCLUSIONS

Among patients with acute ischemic stroke with a proximal vessel occlusion, a small infarct core, and moderate-to-good collateral circulation, rapid endovascular treatment improved functional outcomes and reduced mortality. (Funded by Covidien and others; ESCAPE ClinicalTrials.gov number, NCT01778335.)

Endovascular Therapy for Ischemic Stroke with Perfusion-Imaging Selection

EXTEND-IA


The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Endovascular Therapy for Ischemic Stroke with Perfusion-Imaging Selection

B.C.V. Campbell, P.J. Mitchell, T.J. Kleinig, H.M. Dewey, L. Churilov, N. Yassi, B. Yan, R.J. Dowling, M.W. Parsons, T.J. Oxley, T.Y. Wu, M. Brooks, M.A. Simpson, F. Miteff, C.R. Levi, M. Krause, T.J. Harrington, K.C. Faulder, B.S. Steinfort, M. Priglinger, T. Ang, R. Scroop, P.A. Barber, B. McGuinness, T. Wijeratne, T.G. Phan, W. Chong, R.V. Chandra, C.F. Bladin, M. Badve, H. Rice, L. de Villiers, H. Ma, P.M. Desmond, G.A. Donnan, and S.M. Davis, for the EXTEND-IA Investigators*

- 10 centers in Australia & New Zealand
- N=70 (35 IAT vs. 35)
- Age ≥ 18
- NIHSS: None
- ASPECTS: No
- RAPID software (ischemaView)
- Max. core volume: 70ml
- Time: 6 hrs to groin & complete in 8 hrs

EXTEND-IA

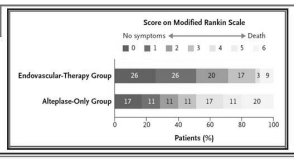


Table 3. Study Outcomes.*

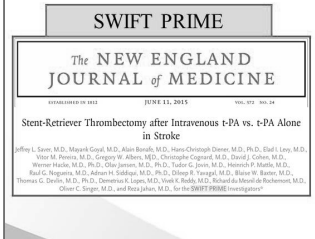
Outcome	Alteplase-Only Group (N=35)	Endovascular-Therapy Group (N=35)	Effect Size (95% CI)† Adjusted	P Value	Unadjusted	P Value
Primary outcomes						
Median reperfusion at 24 hr (IQR) — (%)‡	37 (−0.5 to 96)	100 (100 to 100)	4.7 (2.5 to 9.0)	<0.001	4.9 (2.5 to 9.5)	<0.001
Early neurologic improvement — no. (%)§	13 (37)	28 (80)	6.0 (2.0 to 18.0)	0.002	6.8 (2.3 to 20)	<0.001
Secondary outcomes						
Score on the modified Rankin scale at 90 days¶						
Median score (IQR) on ordinal analysis	3 (1 to 5)	1 (0 to 3)	2.0	0.02	2.1 (1.2 to 3.8)	0.006
Independent outcome — no. (%)	14 (40)	25 (71)	4.2 (1.4 to 12)	0.01	3.8 (1.4 to 10.0)	0.009
Excellent outcome — no. (%)	10 (29)	18 (51)	2.4 (0.87 to 6.6)	0.09	2.6 (1.0 to 7.1)	0.05

CONCLUSIONS

In patients with ischemic stroke with a proximal cerebral arterial occlusion and salvageable tissue on CT perfusion imaging, early thrombectomy with the Solitaire FR stent retriever, as compared with alteplase alone, improved reperfusion, early neurologic recovery, and functional outcome. (Funded by the Australian National Health and Medical Research Council and others; EXTEND-IA ClinicalTrials.gov number, NCT01492725, and Australian New Zealand Clinical Trials Registry number, ACTRN12611000969965.)

Stent-Retriever Thrombectomy after Intravenous t-PA vs. t-PA Alone in Stroke

SWIFT PRIME


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JUNE 11, 2015 VOL. 372 NO. 24

Stent-Retriever Thrombectomy after Intravenous t-PA vs. t-PA Alone in Stroke

Jeffrey L. Saver, M.D., Mayank Goyal, M.D., Alain Bonafe, M.D., Hans-Christoph Diener, M.D., Ph.D., Elad I. Levy, M.D., Vitor M. Pereira, M.D., Gregory W. Albers, M.D., Christophe Cognard, M.D., David J. Cohen, M.D., Werner Hacke, M.D., Ph.D., Olav Jansen, M.D., Ph.D., Tudor G. Jovin, M.D., Heinrich P. Mattle, M.D., Raul G. Nogueira, M.D., Adnan H. Siddiqui, M.D., Ph.D., Dileep R. Yavagal, M.D., Blaise W. Baxter, M.D., Thomas G. Devlin, M.D., Ph.D., Demetrius K. Lopes, M.D., Vivek K. Reddy, M.D., Richard du Mesnil de Rochemont, M.D., Oliver C. Singer, M.D., and Reza Jahan, M.D., for the SWIFT PRIME Investigators*

- 39 centers in US & Europe
- N=196 (98 IAT vs. 98)
- Age: 18-80
- NIHSS: 8-29
- ASPECTS ≥ 6
- RAPID software (ischemaView)
- Time: 6 hrs to groin

SWIFT PRIME

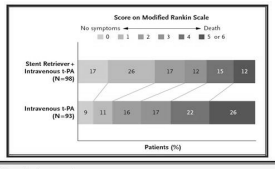


Table 2. Primary and Secondary Outcomes.*

Outcome	Intravenous t-PA Alone (N=98)	Stent Retriever plus Intravenous t-PA (N=98)	Risk Ratio (95% CI)	P Value
Primary outcome: score on modified Rankin scale at 90 days†				<0.001
No. of patients with data	93	98		
Median score	3	2		
Interquartile range	2–5	1–4		
Secondary outcomes				
Clinical efficacy outcome				
Functional independence at 90 days — no./total no. (%)‡	33/93 (35)	59/98 (60)	1.70 (1.23–2.33)	<0.001

CONCLUSIONS

In patients receiving intravenous t-PA for acute ischemic stroke due to occlusions in the proximal anterior intracranial circulation, thrombectomy with a stent retriever within 6 hours after onset improved functional outcomes at 90 days. (Funded by Covidien; SWIFT PRIME ClinicalTrials.gov number, NCT01657461.)

Thrombectomy within 8 Hours after Symptom Onset in Ischemic Stroke

REVASCAT

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Thrombectomy within 8 Hours after Symptom Onset in Ischemic Stroke

T.G. Jovin, A. Chamorro, E. Cobo, M.A. de Miquel, C.A. Molina, A. Rovira, L. San Román, J. Serena, S. Abilleira, M. Ribó, M. Millán, X. Urra, P. Cardona, E. López-Cancio, A. Tomasello, C. Castaño, J. Blasco, L. Aja, L. Dorado, H. Quesada, M. Rubiera, M. Hernández-Pérez, M. Goyal, A.M. Demchuk, R. von Kummer, M. Gallofré, and A. Dávalos, for the REVASCAT Trial Investigators*

- 4 centers in Spain
- N=206 (103 IAT vs. 103)
- Age 18-85
- NIHSS ≥ 6
- ASPECTS: ≥ 7 (NECT)
  ≥ 6 (MRI-DWI)
  ≥ 8 (age > 81–85 y)
- Waiting period prior to endovascular Tx.
- Time: 8 hrs to groin

REVASCAT

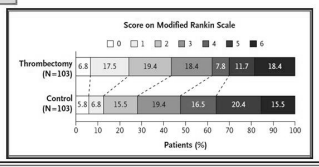


Table 2. Primary and Secondary Clinical and Imaging Outcomes.*

Outcome	Thrombectomy (N=103)	Control (N=103)	Effect Variable	Unadjusted Value (95% CI)	Adjusted Value (95% CI)
Primary outcome: score on modified Rankin scale at 90 days	NA	NA	Common odds ratio	1.7 (1.04 to 2.7)	1.7 (1.05 to 2.8)
Secondary outcome					
Score of 0 to 2 on modified Rankin scale at 90 days — no. (%) †	45 (43.7)	29 (28.2)	Odds ratio	2.0 (1.1 to 3.5)	2.1 (1.1 to 4.0)

CONCLUSIONS

Among patients with anterior circulation stroke who could be treated within 8 hours after symptom onset, stent retriever thrombectomy reduced the severity of post-stroke disability and increased the rate of functional independence. (Funded by Fundació Ictus Malaltia Vascular through an unrestricted grant from Covidien and others; REVASCAT ClinicalTrials.gov number, NCT01692379.)

	MR CLEAN	EXTEND-IA	ESCAPE	SWIFT PRIME	REVASCAT
Release date	January 1, 2015	February 11, 2015	February 11, 2015	June 11, 2015	June 11, 2015
No. of centers	16 (the Netherlands)	10 (Australia/ New Zealand)	22 (Canada, United States, South Korea, Ireland, United Kingdom)	39 (primarily United States and Europe)	4 in Spain
No. of patients	502	70	316	196	206
Imaging criteria	Anterior circulation proximal occlusion	ICA/MCA occlusion, penumbra, ischemic core < 70 mL	Anterior circulation proximal occlusion; small-to-moderate infarct core; good-to-moderate collateral flow	Intracranial ICA or M1 MCA; small-to-moderate core infarct strategy; first 71 patients with Rapid software	ASPECTS > 6 on CT or > 5 on diffusion-weighted MRI
Time criteria (h)	Intra-arterial treatment by 6 h	Intravenous alteplase by 4.5 h	Enrollment by 12 h	Within 6 h of onset/1.5 h of imaging	8 h of symptom onset
Median stroke to groin puncture (min)	260	210; stroke to reperfusion, 248	Stroke to CT, 134; CT to groin puncture, 53; stroke to reperfusion, 241	224; stroke to stent deployment, 252	260; stroke to revascularization, 355
Endovascular treatment	Mechanical (83.7%); retrievable stent (81.5%); intra-arterial thrombolysis (10.3%); intra-arterial thrombolytic alone (0.4%)	Solitaire FR stent retriever	Retrievable stent (86.1%)	Solitaire stent retriever	Retrievable stent
Outcomes (Treatment vs Control)					
mRS 0–2 at 90 days	32.6% vs 19.1% (P < .05)	71% vs 40% (P = .01)	53% vs 29.3% (P < .001)	60% vs 35% (P < .001)	44% vs 28% (odds ratio, 2.1; 95% confidence interval, 1.1–4)
Symptomatic ICH	7.7% vs 6.4% (P > .05)	11% vs 15% (P > .05)	3.6% vs 2.7% (P > .05)	0% vs 3% (P > .05)	1.9% vs 1.9% (P > .05)
Mortality	18.9% vs 18.4% (P > .05)	9% vs 20% (P > .05)	10.4% vs 19%	9% vs 12%	19% vs 16%

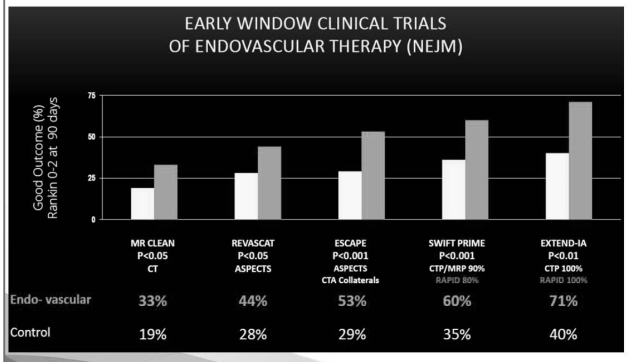
2018 Stroke - Late window paradox.pdf - Adobe

Vol. 15. NO. 2 Feb. 2016, Endovascular today

Summary of outcomes

	TICI 2b/3	mRS 0-2 at 90 days	Death
MR CLEAN	59%	**32.6%** vs. 19.1%	21% vs. 22%
ESCAPE	72%	**53%** vs. 29%	10% vs. 19%
EXTEND-IA	86%	**71%** vs. 40%	9% vs. 20%
SHIFT PRIME	88%	**60%** vs. 36%	9% vs. 12%
REVASCAT	66%	**44%** vs. 28%	18% vs. 16%

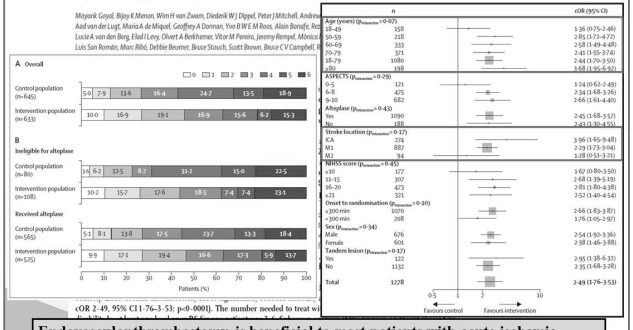
EARLY WINDOW CLINICAL TRIALS OF ENDOVASCULAR THERAPY (NEJM)



Albers GW. Stroke 2018

Endovascular thrombectomy after large-vessel ischaemic stroke: a meta-analysis of individual patient data from five randomised trials

al. Lancet 2016



Endovascular thrombectomy is beneficial to most patients with acute ischemic stroke caused by occlusion of the proximal anterior circulation, irrespective of patient characteristics or geographical location.

2015 AHA/ASA Guidelines

- Class I: Endovascular therapy
  - Pts should receive IAT if. (LOE A, new)
    - a. Prestroke mRS ≤ 1,

Since 2015,
IV-tPA + Endovascular Treatment
Stand of care for acute ischemic stroke due to large vessel occlusions

    - f. ASPECTS ≥ 6
    - g. Starting treatment ≤ 6 hrs
  - If considering IAT, vessel imaging recommended but should not delay IV tPA (LOE A, new)

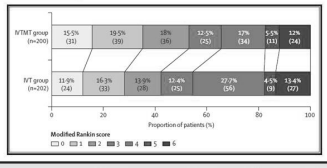
Mechanical thrombectomy after intravenous alteplase versus alteplase alone after stroke

THRACE (2016)

Mechanical thrombectomy after intravenous alteplase versus alteplase alone after stroke (THRACE): a randomised controlled trial

- 26 centers in France
- N=414 (204 IAT vs 208)
- Age: 18-80
- NIHSS: 10-25
- Time: 5 hrs to groin

THRACE

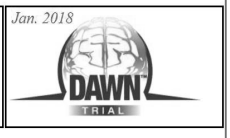


	IVT group	IVTMT group	Odds ratio (95% CI)	p value
Modified Rankin score of 0–2 at 3 months*	85/202 (42%)	106/200 (53%)	1·55 (1·05–2·30)	0·028
NIHSS score at 24 h†				
n	192	187	..	..
Median (IQR)	12 (6–19)	9 (4–18)	..	0·04
NIHSS score at discharge or 7 days†				
n	172	168	..	..
Median (IQR)	8 (2–16)	4 (1–14)	..	0·001
NIHSS score at 3 months†				
n	167	158	..	..
Median (IQR)	4 (0–10)	2 (0–8)	..	0·01

Interpretation Mechanical thrombectomy combined with standard intravenous thrombolysis improves functional independence in patients with acute cerebral ischaemia, with no evidence of increased mortality. Bridging therapy should be considered for patients with large-vessel occlusions of the anterior circulation.

Consider proper target of IAT for AIS : Salvageable brain

- **Time based**: Time is most critical factor
- **Tissue based**: Try to utilized advanced imaging (DWI, CTP…) to better identify core infarction/penumbra/collateral



Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct

DAWN

The NEW ENGLAND JOURNAL of MEDICINE

Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct

- 26 centers in US, Canada, Europe & Australia
- N=206 (107 IA vs. 99)
- Time: 6-24 hrs
- RAPID software (ischemaView)
- Max. core volume: 20ml, 30ml, or 50ml (based on age & NIHSS)
- Stopped early

DAWN

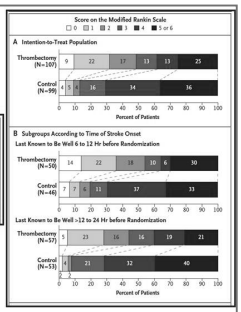


Table 2. Efficacy Outcomes.*

Outcome	Thrombectomy Group (N=107)	Control Group (N=99)	Absolute Difference (95% CI)†	Adjusted Difference (95% Credible Interval)‡	Posterior Probability of Superiority
Primary end points					
Score on utility-weighted modified Rankin scale at 90 days§	5.3±3.8	3.4±3.1	2.1 (1.2–3.1)	2.0 (1.1–3.0)	>0.999
Functional independence at 90 days — no. (%)¶	52 (49)	13 (13)	36 (24–47)	33 (21–44)	>0.999
			Risk Ratio (95% CI)		P Value

CONCLUSIONS

Among patients with acute stroke who had last been known to be well 6 to 24 hours earlier and who had a mismatch between clinical deficit and infarct, outcomes for disability at 90 days were better with thrombectomy plus standard care than with standard care alone. (Funded by Stryker Neurovascular; DAWN ClinicalTrials.gov number, NCT02142283.)

Thrombectomy for Stroke at 6 to 16 Hours with Selection by Perfusion Imaging

DEFUSE 3

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Thrombectomy for Stroke at 6 to 16 Hours with Selection by Perfusion Imaging

G.W. Albers, M.P. Marks, S. Kemp, S. Christensen, J.P. Tsai, S. Ortega-Gutierrez, R.A. McTaggart, M.T. Torbey, M. Kim-Tenser, T. Leslie-Mazwi, A. Sarraj, S.E. Kasner, S.A. Ansari, S.D. Yeatts, S. Hamilton, M. Mlynash, J.J. Heit, G. Zaharchuk, S. Kim, J. Carrozzella, Y.Y. Palesch, A.M. Demchuk, R. Bammer, P.W. Lavori, J.P. Broderick, and M.G. Lansberg, for the DEFUSE 3 Investigators*

- 38 centers in US
- N=182 (92 IA vs. 90)
- Time: 6-16 hrs.
- RAPID software (ischemaView)
- Max. core volume: 70ml
- Stopped early

DEFUSE 3

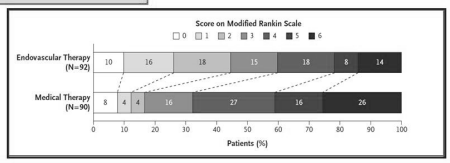


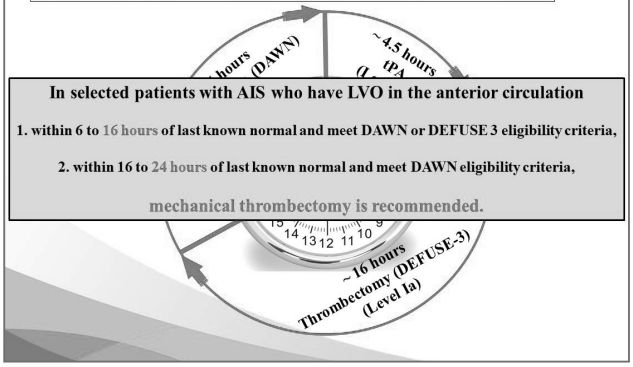
Table 2. Clinical and Imaging Outcomes.

Outcome	Endovascular Therapy (N=92)*	Medical Therapy (N=90)	Odds Ratio or Risk Ratio (95% CI)†	P Value
Primary efficacy outcome: median score on modified Rankin scale at 90 days (IQR)‡	3 (1–4)	4 (3–6)	2.77 (1.63–4.70)§	<0.001
Secondary efficacy outcome: functional independence at 90 days — no. (%)¶	41 (45)	15 (17)	2.67 (1.60–4.48)	<0.001

CONCLUSIONS

Endovascular thrombectomy for ischemic stroke 6 to 16 hours after a patient was last known to be well plus standard medical therapy resulted in better functional outcomes than standard medical therapy alone among patients with proximal middle-cerebral-artery or internal-carotid-artery occlusion and a region of tissue that was ischemic but not yet infarcted. (Funded by the National Institute of Neurological Disorders and Stroke; DEFUSE 3 ClinicalTrials.gov number, NCT02586415.)

2018 Stroke Guidelines extends the thrombectomy window to 24 hours !



In selected patients with AIS who have LVO in the anterior circulation

1. within 6 to 16 hours of last known normal and meet DAWN or DEFUSE 3 eligibility criteria,

2. within 16 to 24 hours of last known normal and meet DAWN eligibility criteria,

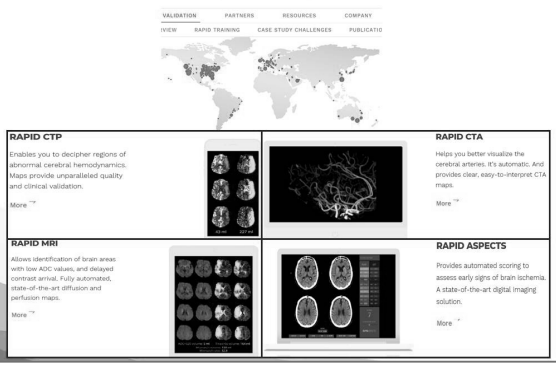
mechanical thrombectomy is recommended.

DEFUSE 3 Vs. DAWN

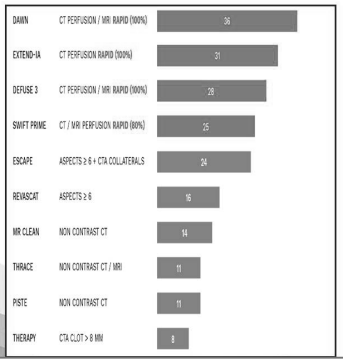
Criteria	DEFUSE 3	DAWN
Time	6 ~ 16 hrs. (LKW)	6 ~ 24 hrs. (LKW)
Age	18 ~ 90	≥ 18
Baseline NIHSS	≥ 6	≥ 10
Prestroke mRS	≤ 2	≤ 1
Imaging criteria	1. ICA or M1 2. Target mismatch on CTP or PWI - core < 70cc - mismatch ratio ≥ 1.8 - mismatch volume ≥ 15ml	1. ICA-T and/or M1 2. < 1/3 MCA territory 3. Clinical imaging mismatch (CIM) on DWI or CTP-rCBF maps) A. Age ≥ 80: <21ml core infarct & NIHSS ≥ 10 B. Age < 80: <31ml core infarct & NIHSS ≥ 10 C. Age < 80 <31-50ml core infarct & NIHSS ≥ 20

http://www.i-rapid.com

RAPID (ischemaView)

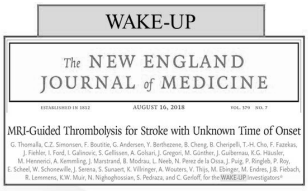


Absolute benefit: % increase in mRS ≤ 2 at 90 days



MRI-Guided Thrombolysis for Stroke with Unknown Time of Onset

WAKE-UP


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 AUGUST 16, 2018 VOL. 379 NO. 7

MRI-Guided Thrombolysis for Stroke with Unknown Time of Onset

G. Thomalla, C.Z. Simonsen, F. Boutitie, G. Andersen, Y. Berthezene, B. Cheng, B. Cheripelli, T.-H. Cho, F. Fazekas, J. Fiehler, I. Ford, I. Galinovic, S. Gellissen, A. Golsari, J. Gregori, M. Günther, J. Guibernau, K.G. Häusler, M. Hennerici, A. Kemmling, J. Marstrand, B. Modrau, L. Neeb, N. Perez de la Ossa, J. Puig, P. Ringleb, P. Roy, E. Scheel, W. Schonewille, J. Serena, S. Sunaert, K. Villringer, A. Wouters, V. Thijs, M. Ebinger, M. Endres, J.B. Fiebach, R. Lemmens, K.W. Muir, N. Nighoghossian, S. Pedraza, and C. Gerloff, for the WAKE-UP Investigators*

- N=503 (254 IV-PA vs. 249)
- 61 centers in 8 European countries
- Age 18-80 yrs
- <1/3 MCA territory
- NIHSS ≤ 25
- Time: < 4.5 hrs. of Recognition
- "DWI-FLAIR mismatch"
- Stopped early d/t cessation of funding

WAKE-UP

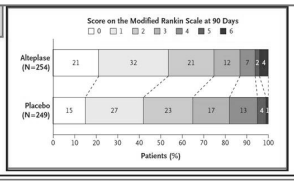


Table 2. Primary and Secondary Efficacy Outcomes (Intention-to-Treat Population).*

Outcome	Alteplase Group (N=254)	Placebo Group (N=249)	Effect Variable	Adjusted Value (95% CI)†	P Value
Primary efficacy end point					
Favorable outcome at 90 days — no./total no. (%)‡	131/246 (53.3)	102/244 (41.8)	Odds ratio	1.61 (1.09 to 2.36)	0.02
Secondary efficacy end points					
Median score on modified Rankin scale at 90 days (IQR)§	1 (1–3)	2 (1–3)	Common odds ratio	1.62 (1.17 to 2.23)	0.003¶

CONCLUSIONS

In patients with acute stroke with an unknown time of onset, intravenous alteplase guided by a mismatch between diffusion-weighted imaging and FLAIR in the region of ischemia resulted in a significantly better functional outcome and numerically more intracranial hemorrhages than placebo at 90 days. (Funded by the European Union Seventh Framework Program; WAKE-UP ClinicalTrials.gov number, NCT01525290; and EudraCT number, 2011-005906-32.)

ICH (type 2): 4.0% vs 0.4% (P=0.03)

Frontline stent retriever thrombectomy: Historical review and clinical implication

신 희 섭

강동경희대학교병원 신경외과

Endovascular thrombectomy for large vessel occlusion (LVO) has been regarded as one of precious treatment in acute ischemic stroke. In early 2000s, mechanical thrombecomy of clot disruption and/or intra-arterial thrombolysis had been performed to patients with acute ischemic stroke. Despite of their improving results, clinicians still wanted to get better recanalization and clinical results. Since late 2000s, retrievable stent has been used for acute stroke and the Solitaire With the Intention For Thrombectomy (SWIFT) trial showed successful result. Until now, through the encouraging result of several large randomized trials, many clinicians have used the retrievable stent in mechanical thrombectomy as the first line choice.

Clinicians have put their great efforts for 1) successful recanalization of TICI grade IIb and III, 2) reducing the procedure time to successful recanalization, 3) preventing clot migration to the artery of distal segment or new territory. Flow arrest and suction aspiration through balloon guiding catheter are effective for improving recanalization of occluded vessel and preventing distal migration of captured clot. Especially in large clot amount on internal carotid artery, suction aspiration through balloon guiding catheter can reduce the clot burden and, thereby, one can reduce the procedure time and achieve good recanalization.

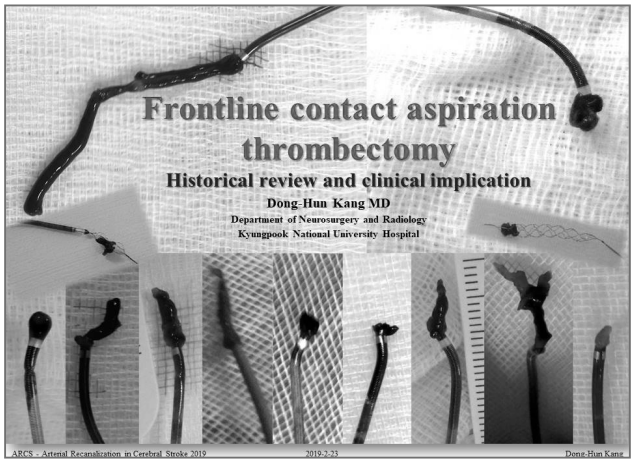
Sometimes, it is difficult to situate the balloon guiding catheter to appropriate position because of tortuous vasculature or atherosclerotic vessels. Fail to place the balloon guiding catheter on appropriate position can cause less effective treatment result. Technical improvement enables intermediate catheter and large bore aspiration catheter to advance to internal carotid artery terminus and even to M1 segment of middle cerebral artery. Several combined techniques using stent retriever and suction aspiration are introduced as the first line treatment or rescue treatment after FAST (ADAPT) procedure. Recent clinical reports showed improved results of 1st pass recanalization and complete recanalization.

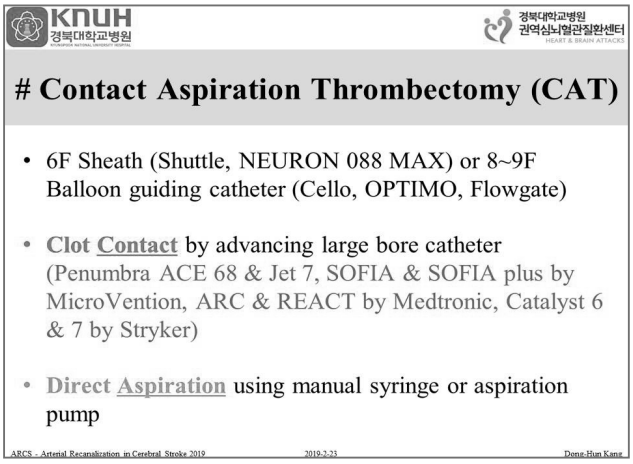
Stent retriever thrombectomy is familiar to many clinicians, and the treatment results are enhancing with evolution of procedure techniques and devices. This treatment are expected to provide valuable treatment option to clinicians as one of the frontline manner.

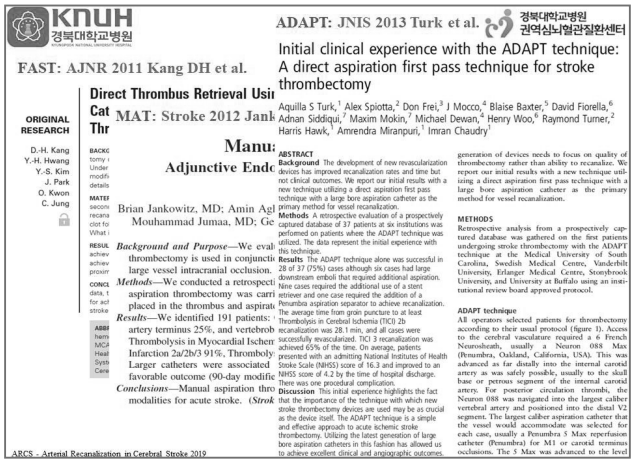
Frontline contact aspiration thrombectomy: Historical review and clinical implication

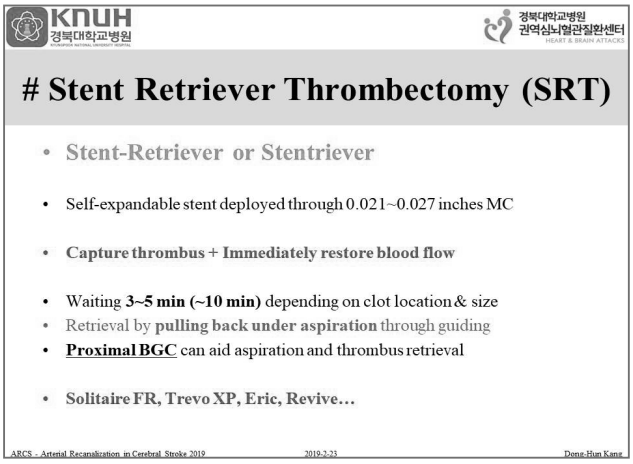
강동훈

경북대









KNUH 경북대학교병원 KYUNGPOOK NATIONAL UNIVERSITY HOSPITAL | 경북대학교병원 권역심뇌혈관질환센터 HEART & BRAIN ATTACKS

SRT: Solitaire FR: SWIFT trial

Solitaire flow restoration device versus the Merci Retriever in patients with acute ischaemic stroke (SWIFT): a randomised, parallel-group, non-inferiority trial

Jeffrey L Saver, Reza Jahan, Elad I Levy, Tudor G Jovin, Blaise Baxter, Raul G Nogueira, Wayne Clark, Ronald Budzik, Osama O Zaidat, for the SWIFT Trialists

Summary
Background The Solitaire Flow Restoration Device is a novel, self-expanding stent retriever designed to yield rapid flow restoration in acute cerebral ischaemia. We compared the efficacy and safety of Solitaire with the standard, predicate mechanical thrombectomy device, the Merci Retrieval System.

Methods In this randomised, parallel-group, non-inferiority trial, we enrolled patients from 18 sites (17 in the USA and one in France). Patients were eligible for inclusion if they had acute ischaemic stroke with moderate to severe neurological deficits and were treatable by thrombectomy within 8 h of stroke symptom onset. We used a computer-generated randomisation sequence to randomly allocate patients to receive thrombectomy treatment with either Solitaire or Merci (1:1; block sizes of four and stratified by centre and stroke severity). The primary endpoint was Thrombolysis In Myocardial Ischemia (TIMI) scale 2 or 3 flow in all treatable vessels without symptomatic intracranial haemorrhage, after up to three passes of the assigned device, as assessed by an independent core laboratory, which was masked to study assignment. Primary analysis was done by intention to treat. A prespecified efficacy stopping rule triggered an early halt to the trial. The study is registered with ClinicalTrials.gov, number NCT 01054560.

Results Between February, 2010, and February, 2011, we randomly allocated 58 patients to the Solitaire group and 55 patients to the Merci group. The primary efficacy outcome was achieved more often in the Solitaire group than it was in the Merci group (61% vs 24%; difference 37% [95% CI 19–53], odds ratio [OR] 4·87 [95% CI 2·14–11·10]; $p_{non-inferiority}$<0·0001, $p_{superiority}$=0·0001). More patients had good 3-month neurological outcome with Solitaire than with Merci (58% vs 33%; difference 25% [6–43], OR 2·78 [1·25–6·22]; $p_{non-inferiority}$=0·0001, $p_{superiority}$=0·02). 90-day mortality was lower in the Solitaire group than it was in the Merci group (17 vs 38; difference −21% [−39 to −3], OR 0·34 [0·14–0·81]; $p_{non-inferiority}$=0·0001, $p_{superiority}$=0·02).

Interpretation The Solitaire Flow Restoration Device achieved substantially better angiographic, safety, and clinical outcomes than did the Merci Retrieval System. The Solitaire device might be a future treatment of choice for endovascular recanalisation in acute ischaemic stroke.

Funding Covidien/ev3.

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SRT: TREVO XP: TREVO 2 trial

Trevo versus Merci retrievers for thrombectomy revascularisation of large vessel occlusions in acute ischaemic stroke (TREVO 2): a randomised trial

Raul G Nogueira, Helmi L Lutsep, Rishi Gupta, Tudor G Jovin, Gregory W Albers, Gary A Walker, David S Liebeskind, Wade S Smith, for the TREVO 2 Trialists

Summary
Background Present mechanical devices are unable to achieve recanalisation in up to 20–40% of large vessel occlusion strokes. We compared efficacy and safety of the Trevo Retriever, a new stent-like device, with its US Food and Drug Administration-cleared predecessor, the Merci Retriever.

Methods In this open-label randomised controlled trial, we recruited patients at 26 sites in the USA and one in Spain. We included adults aged 18–85 years with angiographically confirmed large vessel occlusion strokes and US National Institutes of Health Stroke Scale (NIHSS) scores of 8–29 within 8 h of symptom onset. We randomly assigned patients (1:1) with sequentially numbered sealed envelopes to thrombectomy with Trevo or Merci devices. Randomisation was stratified by age (≤68 years vs 69–85 years) and NIHSS scores (≤18 vs 19–29) with alternating blocks of various sizes. The primary efficacy endpoint, assessed by an unmasked core laboratory, was thrombolysis in cerebral infarction (TICI) scores of 2 or greater reperfusion with the assigned device alone. The primary safety endpoint was a composite of procedure-related adverse events. Analyses were done by intention to treat. This study is registered with ClinicalTrials.gov, number NCT01270867.

Findings Between Feb 3, 2011, and Dec 1, 2011, we randomly assigned 88 patients to the Trevo Retriever group and 90 patients to Merci Retriever group. 76 (86%) patients in the Trevo group and 54 (60%) in the Merci group met the primary endpoint after the assigned device was used (odds ratio 4·22, 95% CI 1·92–9·69; $p_{superiority}$<0·0001). Incidence of the primary safety endpoint did not differ between groups (13 [15%] patients in the Trevo group vs 21 [23%] in the Merci group; p=0·1826).

Interpretation Patients who have had large vessel occlusion strokes but are ineligible for (or refractory to) intravenous tissue plasminogen activator should be treated with the Trevo Retriever in preference to the Merci Retriever.

Funding Stryker Neurovascular.

Efficacy of SRT ???

Confirmed from MR-CLEAN to THRACE

SYNTHESIS Expansion (2013)	IA drug or any approved device vs IV rt-PA	6 hrs to IAT	con[illegible] only				NR	42% vs 46% (p=not reported)	6% vs 6% (p=0.99)	8% vs 6% (p=0.53)
MR RESCUE (2013)	IV rt-PA + IA mechanical (Merci or Penumbra System) vs IV rt-PA	8 hrs to IAT (stop by 9 hrs)	[illegible]	64/5[illegible]			[illegible]27%	Used mean mRS comparison 3.9 vs 3.9 (p=0.99)	5% vs 4% (p=0.24)	19% vs 24% (p=0.75)
MR CLEAN (2015)	IV rt-PA + IA any approved device (82% stent retriever) vs IV rt-PA	6 hrs to IAT	CT CTA MRA	233/267	66	260 [210-313]	**58.7%**	33% vs 19% (RR 1.7, 1.2-2.3)	7.7% vs 6.4% (p=NA)	21% vs 22% (RR 1.0, 0.7-1.3)
ESCAPE (2015)	IV rt-PA + IA any approved device (79% stent retriever) vs IV rt-PA	12 hrs to randomization	CT CTA	165/150	71	Onset to CT 134 [77-247] CT to groin 51 [39-68]	**72.4%**	53% vs 29% (RR 1.8, 1.4-2.4)	3.6% vs 2.7% (p=0.75)	10% vs 19% (RR 0.5, 0.3-0.8)
SWIFT PRIME (2015)	IV rt-PA + IA stent retriever vs IV rt-PA	6 hrs to IAT	CT CTA ± CTP or MRI	98/98	65	224 [165-275]	**88%**	60% vs 35% (RR 1.7, 1.2-2.3)	0% vs 3.1% (p=0.12)	9% vs 12% (RR 0.7, 0.3-1.7)
EXTEND-1A (2015)	IV rt-PA + IA stent retriever vs IV rt-PA	6 hrs to IAT	CT CTA CTP	35/35	69	224 [165-275]	**86%**	71 vs 40% (RR 1.8, 1.1-2.8)	0% vs 5.7% (p=0.49)	9% vs 20% (RR 0.4, 0.1-1.5)
REVASCAT (2015)	IV rt-PA + IA stent retriever vs IV rt-PA	8 hrs to IAT	CT CTA ± CTP or MRI	103/103	66	269 [201-340]	**66%**	44% vs 28% (RR 1.6, 1.1-2.3)	1.9% vs 1.9% (p=1.00)	18% vs 16% (RR 1.2, 0.6-2.2)

2015

Efficacy of CAT ???

THERAPY trial

Aspiration Thrombectomy After Intravenous Alteplase Versus Intravenous Alteplase Alone

J Mocco, MD; Osama O. Zaidat, MD; Rüdiger von Kummer, MD; Albert J. Yoo, MD; Rishi Gupta, MD; Demetrius Lopes, MD; Don Frei, MD; Harish Shownkeen, MD; Ron Budzik, MD; Zahra A. Ajani, MD; Aaron Grossman, MD; Dorethea Altschul, MD; Cameron McDougall, MD; Lindsey Blake, MD; Brian-Fred Fitzsimmons, MD; Dileep Yavagal, MD; John Terry, MD; Jeffrey Farkas, MD; Seon Kyu Lee, MD; Blaise Baxter, MD; Martin Wiesmann, MD; Michael Knauth, MD; Donald Heck, MD; Syed Hussain, MD; David Chiu, MD; Michael J. Alexander, MD; Timothy Malisch, MD; Jawad Kirmani, MD; Laszlo Miskolczi, MD; Pooja Khatri, MD; for the THERAPY Trial Investigators*

Background and Purpose—Thrombectomy, primarily with stent retrievers with or without adjunctive aspiration, provided clinical benefit across multiple prospective randomized trials. Whether this benefit is exclusive to stent retrievers is unclear.
Methods—THERAPY (The Randomized, Concurrent Controlled Trial to Assess the Penumbra System's Safety and Effectiveness in the Treatment of Acute Stroke; NCT01429350) was an international, multicenter, prospective, randomized (1:1), open label, blinded end point evaluation, concurrent controlled clinical trial of aspiration thrombectomy after intravenous alteplase (IAT) administration compared with intravenous-alteplase alone in patients with large vessel ischemic stroke because of a thrombus length of ≥8 mm. The primary efficacy end point was the percent of patients achieving independence at 90 days (modified Rankin Scale score, 0–2; intention-to-treat analysis). The primary safety end point was the rate of severe adverse events (SAEs) by 90 days (as treated analysis). Patients were randomized 1:1 across 36 centers in 2 countries (United States and Germany).
Results—Enrollment was halted after 108 (55 IAT and 53 intravenous) patients (of 692 planned) because of external evidence of the added benefit of endovascular therapy to intravenous-alteplase alone. Functional independence was achieved in 38% IAT and 30% intravenous intention-to-treat groups (*P*=0.52). Intention-to-treat ordinal modified Rankin Scale odds ratio was 1.76 (95% confidence interval, 0.86–3.59; *P*=0.12) in favor of IAT. Secondary efficacy analyses all demonstrated a consistent direction of effect toward benefit of IAT. No differences in symptomatic intracranial hemorrhage rates (9.3% IAT versus 9.7% intravenous, *P*=1.0) or 90-day mortality (IAT: 12% versus intravenous: 23.9%, *P*=0.18) were observed.
Conclusions—THERAPY did not achieve its primary end point in this underpowered sample. Directions of effect for all prespecified outcomes were both internally and externally consistent toward benefit. It is possible that an alternate method of thrombectomy, primary aspiration, will benefit selected patients harboring large vessel occlusions. Further study on this topic is indicated.
Clinical Trial Registration—URL: http://www.clinicaltrials.gov. Unique identifier: NCT01429350.
(*Stroke*. 2016;47:2331-2338. DOI: 10.1161/STROKEAHA.116.013372.)

- **CAT + IV rtPA vs. IV rtPA only**
- Focused on large thrombus (≥8 mm)
- Enrollment early stopped d/t external evidence reported
- **Failed to achieve primary endpoint**

However, in real practice…

A recent survey in US, 2017 JNIS

A survey of neurointerventionalists on thrombectomy practices for emergent large vessel occlusions

Kyle M Fargen,[1] Adam S Arthur,[2] Alejandro M Spiotta,[1] Jonathan Lena,[1] Imran Chaudry,[3] Raymond D Turner,[1] Aquilla S Turk[3]

16. When considering patients for mechanical thrombectomy, which of the following best summarizes your current practice patterns	Patients are only candidates if they present within 6 h from onset 9.0%	We may perform thrombectomy in rare cases when time is >6 h 35.9%	We frequently perform thrombectomy when time is >6 h 14.1%		We perform thrombectomy regardless of time course if imaging is favorable 41.0%
17. For an intracranial ELVO, our practice patterns are to begin thrombectomy with	Retrievable stent without balloon guide or aspiration 5.1%	Retrievable stent with balloon guide or aspiration 23.1%	Retrievable stent with aspiration at clot (Solumbra) 28.2%	ADAPT technique 39.7%	Intra-arterial thrombolytic or other 3.8%
18. What is your predominant type of anesthesia you use during acute thrombectomy procedures?	General anesthesia 20.5%		Conscious sedation 56.4%	None or minimal sedation 23.1%	

We Encounter A Few Basic Questions…

What is the final goal of EVT ?

Which is better frontline EVT between CAT and SRT ?

What we have to consider to answer these questions ?

What is the final goal of EVT?

Review
Cerebrovascular Diseases
Cerebrovasc Dis 2016;42:170–177
DOI: 10.1159/000445449

Abstract
Background: In the last 12 months, treatment of acute ischaemic stroke secondary to large vessel occlusion has undergone a paradigm shift. The success of endovascular surgery,

aging-based selection, those assessing collateral blood flow or ischaemic penumbra appear to be associated with better outcomes and possibly fewer complications. The importance of achieving effective, quality reperfusion is also demonstrated, in a remarkably linear fashion, across the 5 published trials. This may emerge as the single most important determinant of functional outcomes. While reperfusion may succeed time as the preeminent modifiable variable, it remains clear that achieving quality reperfusion in a timely manner should remain the goal of all acute stroke programs.

"mRS 0-2 at 3 months"

Quality reperfusion in a timely manner

What can we do?

mRS 0-2 of at 3 months

Timely reperfusion

Quality reperfusion

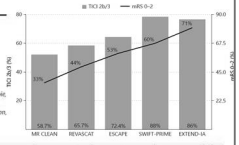
Which is better as a frontline? CAT vs SRT ?

SRT: From MR CLEAN to THRACE

- **HERMES study**: Meta-analysis of 2015's 5 RCTs
- TICI 2b/3 ranged **58.7%** in MR CLEAN to **88%** in SWIFT-PRIME
- 90-day mRS 0-2 ranged **33%** in MR CLEAN to **71%** in EXTEND-IA

→ **Validated SR based EVT's effectiveness for large vessel occlusion**

Endovascular thrombectomy after large-vessel ischaemic stroke: a meta-analysis of individual patient data from five randomised trials



Interpretation **Endovascular thrombectomy is of benefit to most patients with acute ischaemic stroke caused by occlusion of the proximal anterior circulation, irrespective of patient characteristics or geographical location. These**

→ **These are not the answer of better frontline EVT**

CAT: THERAPY (RCT) was failed

A meta-analysis of CAT (Wei et al. AJNR 2017)

The Use and Utility of Aspiration Thrombectomy in Acute Ischemic Stroke: A Systematic Review and Meta-Analysis

D. Wei, J.R. Mascitelli, D.A. Nistal, C.P. Kellner, J.T. Fifi, J.D. Mocco, and R.A. De Leacy

➢ DATA SYNTHESIS:
- The rate of TICI 2b/3 recanalization was **89.3%** (95% CI, 85.4%–92.3%)
- The rate of good clinical outcome (3 month mRS 0-2) was **52.7%** (95% CI, 48.0%–57.4%)

➢ CONCLUSIONS:
ADAPT and aspiration thrombectomy are effective EVT approaches with high recanalization rates and good clinical outcomes in the literatures

Table 1: Treatment times and clinical outcomes by study

Study	Treatment	No. of Patients	OTP (min)	PTR (min)	Final TICI 2b/3 (%)	90-Day mRS ≤2 (%)	90-Day Mortality (%)
Mocco et al.[37] 2016	Asp only	50	227	NA	70 (30/43)	38	12
Park et al.[38] 2016	Asp only	32	234	33	84	78	3
Eom et al.[7] 2014	Asp only	32	281	76	88	NA	25
Hwang et al.[9] 2013	Asp only	20	274	63	65	45	0
Kang et al.[39] 2013 (period 1)	Asp only	61	292	60	74	49	NA
Delgado Almandoz et al.[5] 2016	ADAPT	45	224	50	89	56	18
Hungerford et al.[36] 2016	ADAPT	154	454	40	95	53	10
Kabbasch et al.[28] 2016	ADAPT	30	189	26	90	43	20
Kim et al.[29] 2016	ADAPT	25	236	53	72	84	0
Kowoll et al.[31] 2016	ADAPT	54	179	41	93	NA	NA
Lapergue et al.[32] 2016	ADAPT	124	247	45	82	53	23
Mascitelli et al.[33] 2016	ADAPT	76	295	NA	92	NA	NA
Romano et al.[35] 2016	ADAPT	152	227	58	76	51	8
Vargas et al.[40] 2016	ADAPT	191	468	37	94	54	15
Jankowitz et al.[30] 2015	ADAPT	112	267	70	86	46	31
Kim et al.[8] 2015	ADAPT	70	238	34	91	60	3
Turk et al.[34] 2014a	ADAPT	98	507	37	95	39	19
Turk et al.[27] 2014b	ADAPT	64	NA	NA	95	47	NA
Turk et al.[17] 2014c	ADAPT	37	342	28	97	NA	NA
Kang et al.[6] 2013 (period 2)	ADAPT	74	233	68	85	68	NA
Kang et al.[41] 2011	ADAPT	22	318	40	82	46	14

→ **These are not the answer of better frontline EVT**

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Any comparison data ?

Frontline EVT

CAT

SRT

Retrospective study focused on the frontline EVT (1)

A Direct Aspiration, First Pass Technique (ADAPT) versus Stent Retrievers for Acute Stroke Therapy: An Observational Comparative Study

- Lapergue B et al. 2016 AJNR 37:1860-1865
- **119 with SR (Solitaire) and 124 with ADAPT (Penumbra catheters)**
- **They actively utilized the advantage of ADAPT in case of failure with the frontline ADAPT:** They used the aspiration catheter as a conduit for introducing a stent retriever
- **mTICI 2b/3 was higher in ADAPT then SR (82.3% vs. 68.9%, *P=0* .022)**
- **However, such difference did not reach to a better clinical outcomes (mRS 0-2 at 3 months: 53% in ADAPT vs. 54.8% in SR, *P*=0.79)**

A Direct Aspiration, First Pass Technique (ADAPT) versus Stent Retrievers for Acute Stroke Therapy: An Observational Comparative Study

Discussion points

1) mTICI 2b/3: 82.3% in ADAPT vs. 68.9% in SR (P=0 .022)
→ Successful recanalization by only ADAPT was only 50.8% (63/124), but rescue SR witching was finished with successful in 69.6% (39/56)

CAT to rescue vs SRT to rescue (not CAT only vs SRT only)

Importance of active switching to rescue therapy (CAT → SRT)

Retrospective study focused on the first-line EVT (2)

A direct aspiration first-pass technique vs stentriever thrombectomy in emergent large vessel intracranial occlusions

- Stapleton CJ et al. 2018 JNS 128(2): 567-574

- 70 with SR and 47 with CA (ADAPT)
- They typically attempted a single pass with the aspiration catheter
  → if adequate recanalization is not achieved, deploy SR through the catheter to use CASPER (Combined ASPiration and stent-rievER) as a rescue

- Single pass TICI 2b/3 of ADAPT: 57%
- Mean no. of ADAPT attempt: 1.3 → 20/47 (42.5%) in CA required rescue SR
- Procedure time (54.0 vs. 77.1 mins, P<0.01) and a time to TICI 2b/3 (294.3 vs. 346.7 mins, P<0.01) were significantly shorter in the frontline CA group

A direct aspiration first-pass technique vs stentriever thrombectomy in emergent large vessel intracranial occlusions

Discussion points

- However, the rates of final TICI 2b/3 recanalization (82.9% vs. 71.4%, P=0.19) and good functional outcome at 90 days (48.9% vs. 41.4%, P=0.45) were similar between the two groups.
- They carefully concluded that a frontline CA may be warranted prior to SR, based on the higher rate of single pass TICI 2b/3 reperfusion
- Additionally, active switching to SR is crucial to the benefit of a frontline CA

Importance of active switching to rescue therapy (CAT → CASPER)

First-pass recanalization: 57% in CAT

RCT regarding frontline EVT
ASTER

JAMA | Original Investigation

Effect of Endovascular Contact Aspiration vs Stent Retriever on Revascularization in Patients With Acute Ischemic Stroke and Large Vessel Occlusion
The ASTER Randomized Clinical Trial

Revascularization (ASTER) study was a randomized, open-label, blinded end-point clinical

days, change in National Institutes of Health Stroke Scale (NIHSS) score at 24 hours, all-cause mortality at 90 days, and procedure-related serious adverse events.

RESULTS Among 381 patients randomized (mean age, 69.9 years; 174 women [45.7%]), 363 (95.3%) completed the trial. Median time from symptom onset to arterial puncture was 227 minutes (interquartile range, 180-280 minutes). For the primary outcome, the proportion of patients with successful revascularization was 85.4% (n = 164) in the contact aspiration group vs 83.1% (n = 157) in the stent retriever group (odds ratio, 1.20 [95% CI, 0.68-2.10]; P = .53; difference, 2.4% [95% CI, −5.4% to 9.7%]). For the clinical efficacy outcomes (change in NIHSS score at 24 hours, mRS score at 90 days) and adverse events, there were no significant differences between groups.

CONCLUSIONS AND RELEVANCE Among patients with ischemic stroke in the anterior circulation undergoing thrombectomy, first-line thrombectomy with contact aspiration compared with stent retriever did not result in an increased successful revascularization rate at the end of the procedure.

- 1:1 randomization of CAT vs SRT

First RCT to compare frontline CAT vs SRT
→ CAT and SRT were similarly effective as a frontline

Importance of active switching to rescue therapy

- Although the differences were not statistically significant, median reperfusion times were shorter in the CA cohort (38min vs. 45min, P=0.10) and rescue therapy was more common in the CA cohort (32% vs. 23.8%, OR 1.57, P=0.05)

Re-visit to THERAPY trial

Why THERAPY failed?

Aspiration Thrombectomy After Intravenous Alteplase Versus Intravenous Alteplase Alone

J Mocco, MD; Osama O. Zaidat, MD; Rüdiger von Kummer, MD; Albert J. Yoo, MD; Rishi Gupta, MD; Demetrius Lopes, MD; Don Frei, MD; Harish Shownkeen, MD; Ron Budzik, MD; Zahra A. Ajani, MD; Aaron Grossman, MD; Dorethea Altschul, MD; Cameron McDougall, MD; Lindsey Blake, MD; Brian-Fred Fitzsimmons, MD; Dileep Yavagal, MD; John Terry, MD; Jeffrey Farkas, MD; Seon Kyu Lee, MD; Blaise Baxter, MD; Martin Wiesmann, MD; Michael Knauth, MD; Donald Heck, MD; Syed Hussain, MD; David Chiu, MD; Michael J. Alexander, MD; Timothy Malisch, MD; Jawad Kirmani, MD; Laszlo Miskolczi, MD; Pooja Khatri, MD; for the THERAPY Trial Investigators*

Background and Purpose—Thrombectomy, primarily with stent retrievers with or without adjunctive aspiration, provided clinical benefit across multiple prospective randomized trials. Whether this benefit is exclusive to stent retrievers is unclear.
Methods—THERAPY (The Randomized, Concurrent Controlled Trial to Assess the Penumbra System's Safety and Effectiveness in the Treatment of Acute Stroke; NCT01429350) was an international, multicenter, prospective, randomized (1:1), open label, blinded end point evaluation, concurrent controlled clinical trial of aspiration thrombectomy after intravenous alteplase (IAT) administration compared with intravenous-alteplase alone in patients with large vessel ischemic stroke because of a thrombus length of ≥8 mm. The primary efficacy end point was the percent of patients achieving independence at 90 days (modified Rankin Scale score, 0–2; intention-to-treat analysis). The primary safety end point was the rate of severe adverse events (SAEs) by 90 days (as treated analysis). Patients were randomized 1:1 across 36 centers in 2 countries (United States and Germany).
Results—Enrollment was halted after 108 (55 IAT and 53 intravenous) patients (of 692 planned) because of external evidence of the added benefit of endovascular therapy to intravenous-alteplase alone. Functional independence was achieved in 38% IAT and 30% intravenous intention-to-treat groups (P=0.52). Intention-to-treat ordinal modified Rankin Scale odds ratio was 1.76 (95% confidence interval, 0.86–3.59; P=0.12) in favor of IAT. Secondary efficacy analyses all demonstrated a consistent direction of effect toward benefit of IAT. No differences in symptomatic intracranial hemorrhage rates (9.3% ... P=0.18) were observed.
Conclusions—THERAPY did not achieve its primary end point in this underpowered sample. Directions of effect for all prespecified outcomes were both internally and externally consistent toward benefit. It is possible that an alternate method of thrombectomy, primary aspiration, will benefit selected patients harboring large vessel occlusions. Further study on this topic is indicated.
Clinical Trial Registration—URL: http://www.clinicaltrials.gov. Unique identifier: NCT01429350.
(*Stroke*. 2016;47:2331-2338. DOI: 10.1161/STROKEAHA.116.013372.)

- Focused on large thrombus (≥8 mm)
- Enrollment early stopped due to external evidence of MT benefit (2015's 5 trials)
- Failed to achieve primary endpoint (mRS 0-2 at 3 mo: 38% in CAT vs 30% in rt-PA)

➢ Possible causes !!

1. Older technology involved: Traditional PS 54%, Separator 3D 25%, ACE 27%
2. Switching to SRT was not actively used in the failed cases with CAT: SRT was used in only 7%
3. TICI 2b/3 after Penumbra: 70% but TICI 2b/3 final: 73%

Why THERAPY and other trials showed different conclusion?

- Two retrospective studies: CAT was better
- ASTER: CAT and SRT were similar
- THERAPY: CAT was not superior to rt-PA

➢ **Answer of this question may be closely related to the factors to be considered when deciding frontline EVT**

➢ **My answer is FPE (First Pass Effect) and active switching to rescue therapy**

What is F-P-E ?
-- first report --

- FPE = Complete recanalization with a single device pass
- The North American Solitaire Acute Stroke (NASA) Registry database was used
- FPE was achieved in 25.1% (89/354)
- FPE was more in MCA occlusions (64% vs 52.5%) and fewer in ICA occlusions (10.1% vs 27.7%)
- BGC usage were related with FPE (64.0% vs 34.7%)
- FPE was related with shorter time to recanalization and good clinical outcome

First Pass Effect
A New Measure for Stroke Thrombectomy Devices

Osama O. Zaidat, MD; Alicia C. Castonguay, PhD; Italo Linfante, MD; Rishi Gupta, MD; Coleman O. Martin, MD; William E. Holloway, MD; Nils Mueller-Kronast, MD; Joey D. English, MD, PhD; Guilherme Dabus, MD; Tim W. Malisch, MD; Franklin A. Marden, MD; Hormozd Bozorgchami, MD; Andrew Xavier, MD; Ansaar T. Rai, MD; Michael T. Froehler, MD, PhD; Aamir Badruddin, MD; Thanh N. Nguyen, MD; M. Asif Taqi, MD; Michael G. Abraham, MD; Albert J. Yoo, MD, PhD; Vallabh Janardhan, MD; Hashem Shaltoni, MD; Roberta Novakovic, MD; Alex Abou-Chebl, MD; Peng R. Chen, MD; Gavin W. Britz, MD; Chung-Huan J. Sun, MD; Vibhav Bansal, MD; Ritesh Kaushal, MD; Ashish Nanda, MD; Raul G. Nogueira, MD

Background and Purpose—In acute ischemic stroke, fast and complete recanalization of the occluded vessel is associated with improved outcomes. We describe a novel measure for newer generation devices: the first pass effect (FPE). FPE is defined as achieving a complete recanalization with a single thrombectomy device pass.
Methods—The North American Solitaire Acute Stroke Registry database was used to identify a FPE subgroup. Their baseline features and clinical outcomes were compared with non-FPE patients. Clinical outcome measures included 90-days modified Rankin Scale score, National Institutes of Health Stroke Scale score, mortality, and symptomatic intracranial hemorrhage. Multivariate analyses were performed to determine whether FPE independently resulted in improved outcomes and to identify predictors of FPE.
Results—A total of 354 acute ischemic stroke patients underwent thrombectomy in the North American Solitaire Acute Stroke registry. FPE was achieved in 89 out of 354 (25.1%). More middle cerebral artery occlusions (64% versus 52.5%) and fewer internal carotid artery occlusions (10.1% versus 27.7%) were present in the FPE group. Balloon guide catheters were used more frequently with FPE (64.0% versus 34.7%). Median time to revascularization was significantly faster in the FPE group (median 34 versus 60 minutes; P=0.0003). FPE was an independent predictor of good clinical outcome (modified Rankin Scale score ≤2 was seen in 61.3% in FPE versus 35.3% in non-FPE cohort; P=0.013; odds ratio, 1.7; 95% confidence interval, 1.1–2.7). The independent predictors of achieving FPE were use of balloon guide catheters and non-internal carotid artery terminus occlusion.
Conclusions—The achievement of complete revascularization from a single Solitaire thrombectomy device pass (FPE) is associated with significantly higher rates of good clinical outcome. The FPE is more frequently associated with the use of balloon guide catheters and less likely to be achieved with internal carotid artery terminus occlusion. (*Stroke*. 2018;49:660-666. DOI: 10.1161/STROKEAHA.117.020315.)

Active switching to recue EVT ?

-- first report --

- Retrospective comparison study
- **Period 1: CAT only (n=61) Period 2: CAT to SRT switching (n=74)**
- Better TICI 2b/3 in period 2 (73.8% vs 85.1%, P=0.10)
- They concluded that **switching strategy may related to better angiographic outcome than one technique only strategy**

Stroke
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association | American Stroke Association

Switching Strategy for Mechanical Thrombectomy of Acute Large Vessel Occlusion in the Anterior Circulation

Dong-Hun Kang, MD; Yong-Won Kim, MD; Yang-Ha Hwang, MD; Jaechan Park, MD; Jeong-Hyun Hwang, MD; Yong-Sun Kim, MD

Background and Purpose—We introduce the concept of a switching strategy for mechanical thrombectomy with period-to-period analysis. In period 1, forced arterial suction thrombectomy with a Penumbra reperfusion catheter was performed, even in difficult cases; in period 2, forced arterial suction thrombectomy was initially performed, with switching to Solitaire in difficult cases.
Methods—We analyzed 135 consecutive patients treated with mechanical thrombectomy with acute large vessel occlusion in the anterior circulation, 61 from period 1 and 74 from period 2. We defined difficult case for both periods as ≥3 failed attempts at recanalization.
Results—Period 2 showed a trend for better angiographic outcome of Thrombolysis in Cerebral Infarction 2b-3 (73.8%, period 1 versus 85.1%, period 2; *P*=0.10). In interperiod subgroup analysis of difficult cases, switching significantly outperformed nonswitching in Thrombolysis in Cerebral Infarction 2b-3 recanalization (52.7% versus 82.9%; *P*=0.030). Differences in puncture-to-recanalization time, symptomatic intracranial hemorrhage incidence, and procedure-related complications were not statistically significant.
Conclusions—A switching strategy using 2 mechanical thrombectomy techniques (forced arterial suction thrombectomy to Solitaire) may harbor better angiographic outcomes than a 1 technique only strategy (forced arterial suction thrombectomy). (***Stroke*. 2013;44:3577-3579.**)

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Additional consideration for frontline EVT: Cost effectiveness

- 3 EVT groups: Traditional PS, stent retriever with local aspiration (SRLA), and ADAPT
- TICI 2b/3: 79% in PS, 83% in SRLA, and 95% in ADAPT group
- **Average total cost: $51599 with PS, $54700 with SRLA, and $33611 with ADAPT (p<0.0001)**
- **Average times to recanalization: 88 min with PS, 47 min with SRLA, and 37 min with ADAPT (p<0.0001)**
- Similar rates of good functional outcomes (PS 36% vs SRLA 43% vs ADAPT 47%; p=0.4)
- Conclusions: **The ADAPT technique represents the most technically successful yet cost-effective approach to revascularization of large vessel intracranial occlusions**

ORIGINAL RESEARCH

Comparison of endovascular treatment approaches for acute ischemic stroke: cost effectiveness, technical success, and clinical outcomes

Aquilla S Turk,[1] Raymond Turner,[2] Alejandro Spiotta,[2] Jan Vargas,[2]

Results 222 patients (45% men) underwent mechanical thrombectomy. Successful revascularization was defined as Thrombolysis In Cerebral Infarction (TICI) 2b/3 flow, which was achieved in 79% of cases with PS, 83% of cases with SRLA, and 95% of cases with ADAPT. The average total cost of hospitalization for patients was $51 599 with PS, $54 700 with SRLA, and $33 611 with ADAPT (p<0.0001). Average times to recanalization were 88 min with PS, 47 min with SRLA, and 37 min with ADAPT (p<0.0001). Similar rates of good functional outcomes were seen in the three groups (PS 36% vs SRLA 43% vs ADAPT 47%; p=0.4).

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COMPASS trial

- a randomized, blinded, concurrent, controlled trial
- **The purpose of COMPASS is to evaluate efficacy of CA vs SR as the first-line**
- Primary efficacy endpoint: mRS 0-2 at 3 months
- Secondary efficacy endpoints: TICI 2b/3, time to TICI 2b/3, and etcs
- Just completed to enroll the patients
- **Seems to have notable answers to the questions regarding better first-line EVT**

Ischemic Stroke

ORIGINAL RESEARCH

A comparison of direct aspiration versus stent retriever as a first approach ('COMPASS'): protocol

Aquilla S Turk,[1] Adnan H Siddiqui,[2] J Mocco[3]

J NeuroIntervent Surg 2018;**10**:953–957. doi:10.1136/neurintsurg-2017-013722

Secondary efficacy outcomes

Secondary efficacy outcomes will evaluate:
- TICI 2b or greater revascularization within 45 min of access.
- Occurrence of emboli to a new territory.
- Presence of vasospasm involving the accessed vascular tree.
- 90 day global disability assessed via the overall distribution of the utility weighted mRS.
- Reduction in stroke severity (NIHSS) at 24 hours post treatment.
- Reduction in stroke severity (NIHSS) at 7 days post treatment or discharge (whichever occurs first).
- Stroke Impact Score.[13]
- First pass TICI 2b or greater efficacy.

Cost outcomes

Cost outcomes will evaluate:
- Device related costs for the procedure.

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Conclusions

- **Which is better frontline EVT???**

~~CAT only vs SRT only~~

CAT to rescue EVT vs SRT to rescue EVT

- **COMPASS will provide some information regarding this question**

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Key references

Review Article

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Endovascular Stroke Therapy Focused on Stent Retriever Thrombectomy and Direct Clot Aspiration : Historical Review and Modern Application

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Intravenous recombinant tissue plasminogen activator had been the only approved treatment for acute ischemic stroke since its approval in 1995. However, the restrictive time window, numerous contraindications, and its low recanalization rate were all limitations of this modality. Under those circumstances, endovascular stroke therapy went through a great evolution during the past two decades of intravenous thrombolysis. The results of the 2013 randomized trials for endovascular stroke therapy were neutral, although they were limited by insufficient imaging screening at enrollment, early-generation devices with less efficacy, and treatment delays. Huge progress was made in 2015, as there were five randomized clinical trials which all demonstrated the safety and efficacy of endovascular stroke treatment. Despite differences in detail patient enrollment criteria, all 5 trials employed key factors for good functional recovery; (1) screening with non-invasive imaging to identify the proximal occlusion and exclude a large infarct core, (2) using highly effective modern thrombectomy devices mainly with stent retriever, and (3) establishment of a fast workflow to achieve effective reperfusion. The results of those trials indicate that modern thrombectomy devices can allow for faster and more effective reperfusion, which can lead to improved clinical outcomes compared to intravenous thrombolysis alone. These advances in mechanical thrombectomy are promising in the global fight against ischemic stroke-related disability and mortality. Two current mainstreams among such mechanical thrombectomy techniques, "stent retriever thrombectomy" and "direct clot aspiration", are the topic of this review. Stent retriever thrombectomy using Solitaire and Trevo retriever will be firstly discussed. And, the commonalities and the differences between two major clot aspiration thrombectomy techniques; a direct aspiration first pass technique (ADAPT) and forced arterial suction thrombectomy (FAST), will be additionally explained. Finally, details regarding the combination of direct clot aspiration and stent retriever thrombectomy, the switching strategy and the Solumbra technique, will be described.

JoS JOURNAL OF STROKE

Journal of Stroke 2019;21(1):10-22
https://doi.org/10.5853/jos.2018.03076

Review

Frontline Contact Aspiration Treatment for Emergent Large Vessel Occlusion: A Review Focused on Practical Techniques

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Endovascular thrombectomy (EVT) as the standard care for acute stroke due to large vessel occlusion has recently been validated through several randomized controlled trials (RCTs). Contact aspiration (CA) and stent retriever (SR) are the two major EVT methods currently used. Because the RCTs have mostly evaluated SR devices, there was a demand to test CA in relation to SR as a frontline EVT treatment method. Recently, the Contact Aspiration vs Stent Retriever for Successful Recanalization (ASTER) study, the first RCT to compare CA and SR, demonstrated similar efficacy between them as a frontline EVT for patients with large vessel occlusions. This facilitates further investigation to confirm better frontline EVT for patients with acute stroke. In this review, we discuss past and recent developments in CA techniques, focusing on related literature. Additionally, we describe practical skills to overcome technical difficulties that can be encountered during the CA procedure. Finally, we review the evolution of device technologies, including a newer version of using a large-bore aspiration catheter.

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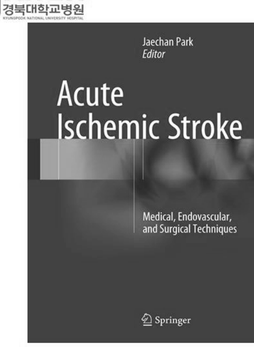

Thank you for your attention

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ARCS 2019

ARTERIAL RECANALIZATION IN CEREBRAL STROKE

뇌졸중 재개통 심포지엄 및
대한뇌혈관내수술학회 2019
춘계보수교육

Session II. Symposium on national strategy for CVD prevention & management

좌장 : 뉴고려병원 **백민우**, 순천향대 **김범태**

국내 응급 뇌졸중 재개통치료의 최근 경향 및 SKEN의 역할	대한뇌혈관내수술학회 대외협력이사 **윤석만**
국가 심뇌혈관질환 예방 및 관리에 관한 정책방향 I	순천향대학교 의과대학 예방의학교실 **박윤형**
국가 심뇌혈관질환 예방 및 관리에 관한 정책방향 II	질병관리본부 만성질환예방과 과장 **이동한**
국가 심뇌혈관질환 예방 및 관리에 관한 정책방향 III	국회의원, 국회보건복지위원회 **윤일규**

국내 응급 뇌졸중 재개통치료의 최근 경향 및 SKEN의 역할

윤 석 만

대한뇌혈관내수술학회 대외협력이사

국내 응급 뇌졸중 재개통 치료의 최근 경향

및 SKEN의 역할

윤석만

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ARCS 2019

뇌졸중의 발병 빈도

- 출혈성 뇌졸중: 15%,
  - 뇌동맥류파열, 고혈압성 뇌출혈, 모야모야병, 뇌혈관기형 출혈 등
  - 의료비는 발병률 대비 뇌경색에 비해 상대적으로 높다.
- 허혈성 뇌졸중: 85%
  - 심인성 (cardio-embolic), 혈전증 (thrombosis), 소와경색 (small vessel disease), undetermined

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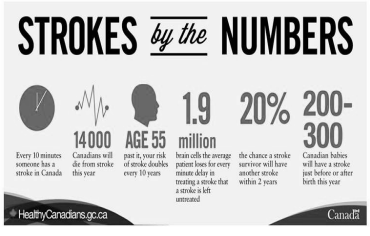
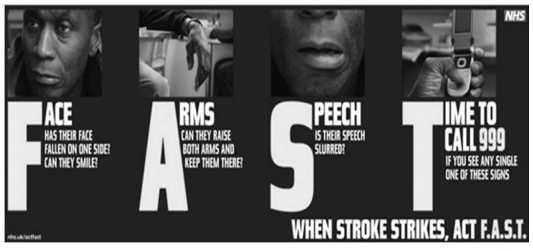
Time is brain

	Brain Cells Lost	Number of Years the Brain Ages
Per Stroke	1.2 billion	36 yrs
Per Hour	120 million	3.6 yrs
Per Minute	1.9 million	3.1 weeks
Per Second	32,000	8.7 hrs



- 영국 ACT FAST 캠페인

  대국민 홍보가 매우 중요



우리나라의 상황

- 대국민 홍보: 각 학회별, 병원별로 시행
- 심뇌혈관 예방 및 치료에 관한 법률 제정
- 급성기 뇌졸중 적정성 평가 가감지급 사업
- 뇌졸중 진료 관련 의사들의 노력 (신경외과, 신경과, 영상의학과, 재활의학과 등)
- 뇌졸중 환자 예후 지속적으로 호전

LVO의 IA 치료 역사

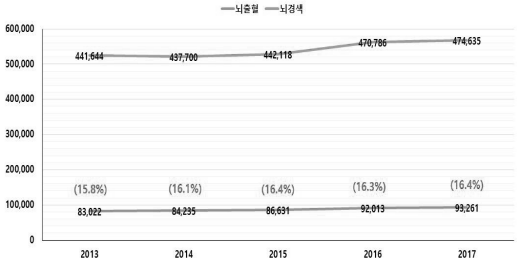
- 최초의 동맥내 혈전용해치료 (IAT)는 1982년 Zeumer 가 시도
- 1999년 첫번째 RCT인 PROACT II Study 결과 IAT군에서 재개통율이 높다는 것이 (67% vs 18%) 규명되었으나 출혈 합병증이 높아 FDA공인을 받지 못하였다.
- 그러나 ASITN멤버들은 계속 이러한 시도를 하였고 IAT 기술을 training 함.
- bridging thrombolysis 시도: IV tPA가 표준 치료로 인정받아 적용함에도 불구하고 ICA occlusion과 같은 경우 재개통이 잘 안되어 정맥과 동맥에 동시에 투여하는 됨. 그러나 결과는 만족스럽지 못함.

LVO의 IA 치료 역사

1. 약물 (Urokinase, tPA, Reopro, Tirofiban 등) 을 이용한 thrombolysis와 mechanical thrombolysis시행
   -→ 재개통되는 경우 많으나 약물 용량이 증가함에 따라 출혈 합병증 증가, 노력에 비해 예후가 좋지 않아 -→하려는 사람도 적었음(NS, Rad에서 시술)
2. Mechanical Thrombectomy (Aspiration, stent retriever)시대가 되면서 출혈 합병증 급격히 감소, 결과도 호전
3. 관심도가 증가하고 NR에서도 인터벤션 트레닝 받아 시술 하기 시작

뇌졸중 환자수 추이

출처: 건강보험통계

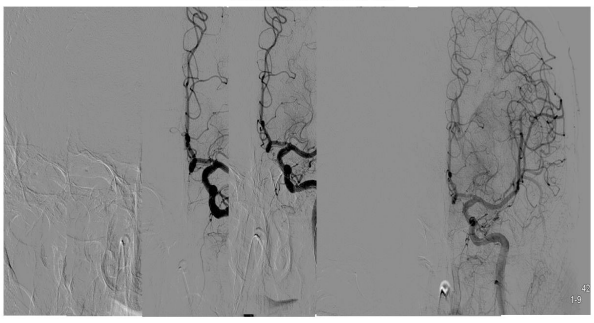


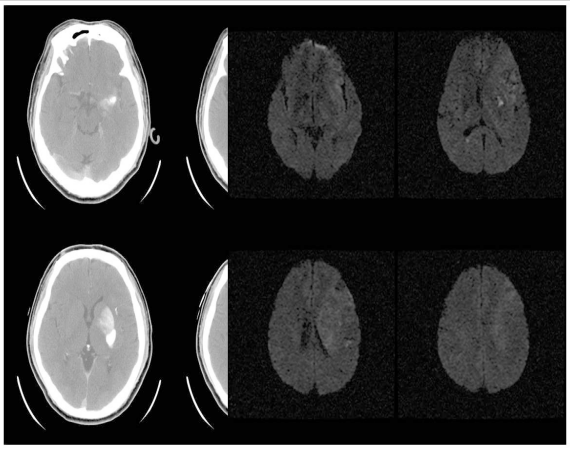
국내 의료비 변동 추이

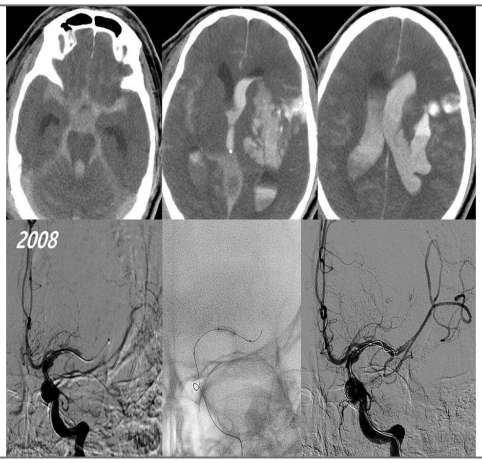
심사의료비는 건강보험,의료급여, 보훈급여,자동차보험에서 청구한 의료비 합계금액

2000년대 초반 증례

Left ICA occlusion
6F Guiding, Microcatheter & wire clot disruption
Urokinase infusion 0.68M unit







IV followed by IA thrombolysis

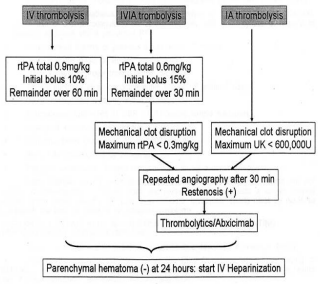
Combined Intravenous and Intra-Arterial r-TPA Ver
Intra-Arterial Therapy of Acute Ischemic Stroke
Emergency Management of Stroke (EMS) Bridging Trial

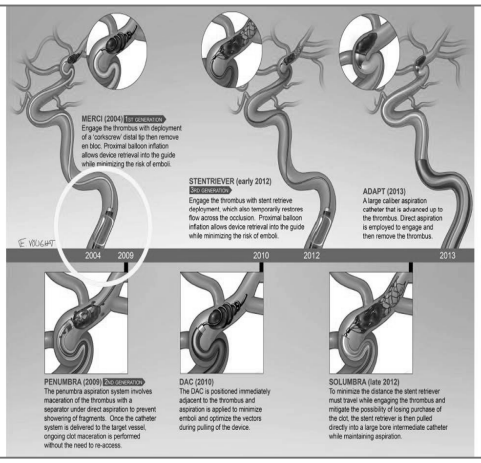
Christopher A. Lewandowski, MD; Michael Frankel, MD; Thomas A. Tomsick, MD; Joseph Broderick, MD; James Frey, MD; Wayne Clark, MD; Sidney Starkman, MD; James Grotta, MD; Judith Spilker, RN; Jane Khoury, MS; Thomas Brott, MD; and the EMS Bridging Trial Investigators

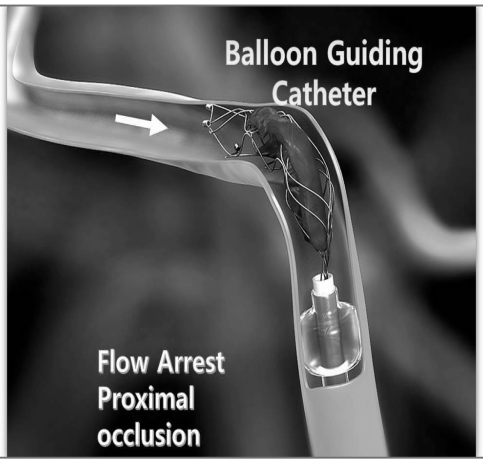
Arterial recanalization was better in the IV/IA group compared with the placebo/IA group, as measured by TIMI 3 flow at 2 hours (6 of 11 or 54% vs 1 of 10 or 10%),although this was not associated with an improved clinical outcome by prespecified measures. *Stroke*. 1999;30:2598-2605

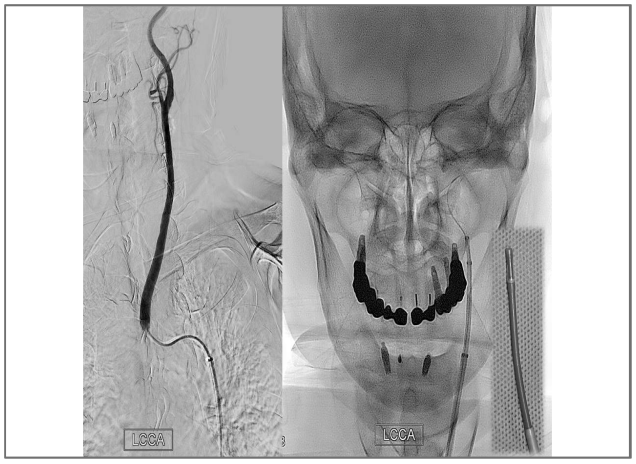
2000년대 SCHCH protocol

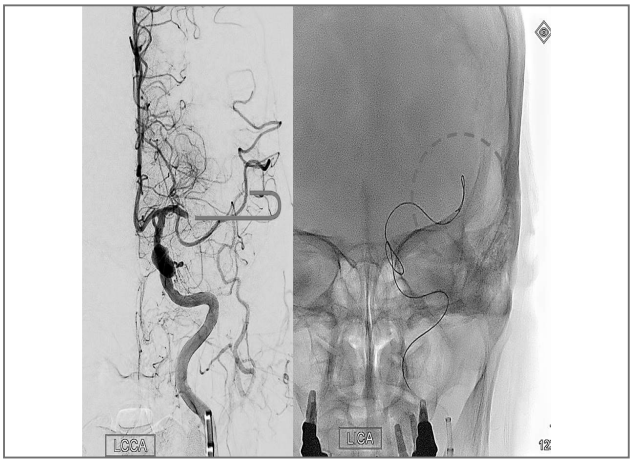
Dosage and technique

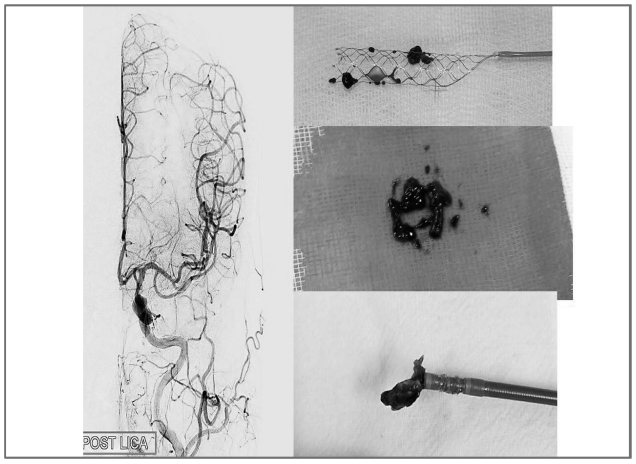


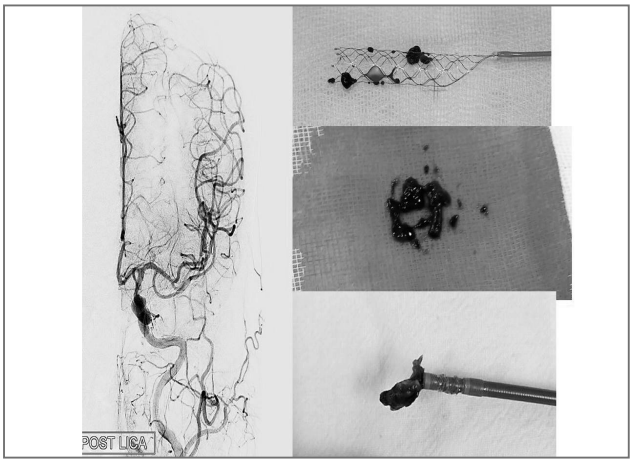




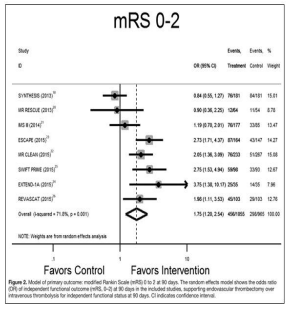






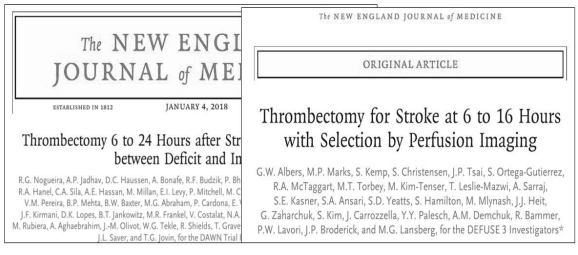


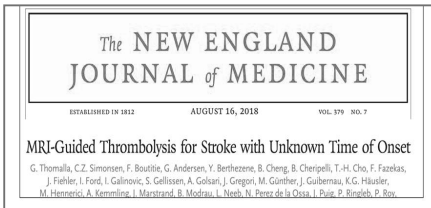
Mechanical Thrombectomy improves outcome



Dawn trial & Deffuse 3 trial이후

- 치료 대상 환자수 급증, 치료 결과 좋아짐





- MRI suggest less than 4.5hr of onset

  DWI (+), FLARE (-)

- Mortality higher (4.1% vs 1.2%, p=0.07)

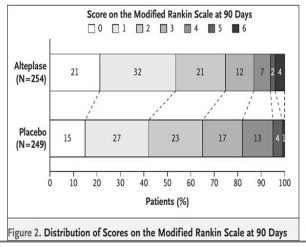


Figure 2. Distribution of Scores on the Modified Rankin Scale at 90 Days

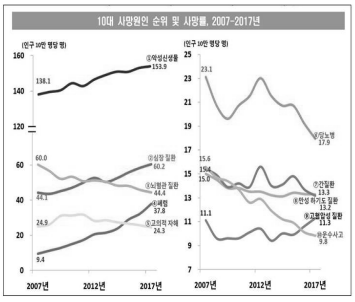
Recent LVO의 치료 전략

- 4.5시간 이내 iv tPA infusion하면서 mechanical thrombectomy (MT) 준비하여 바로 시작
- 4.5-8hr: IA MT
- 8-24hr: perfusion study 결과에 따라 가능하면 MT
- Unknown origin onset도 MR base로 치료하는 추세

--→ MT case 증가 추세

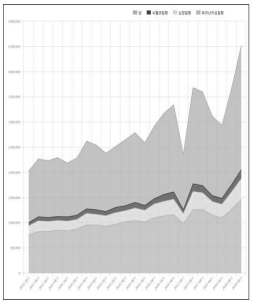
보건의료 빅데이터 개방시스템

10대 사망원인 순위 (2017)

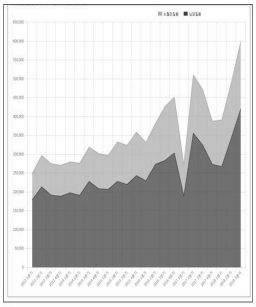


출처: 통계청. 2017년 사망원인 통계

4대 중증질환 의료비



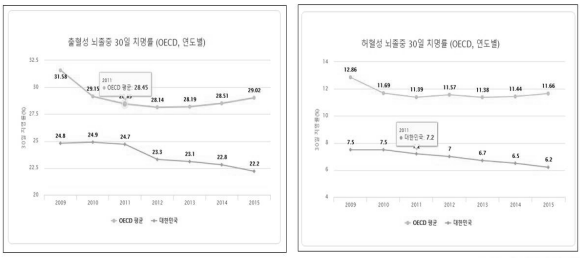
심뇌혈관 총의료비



뇌졸중 요양급여비용 총액

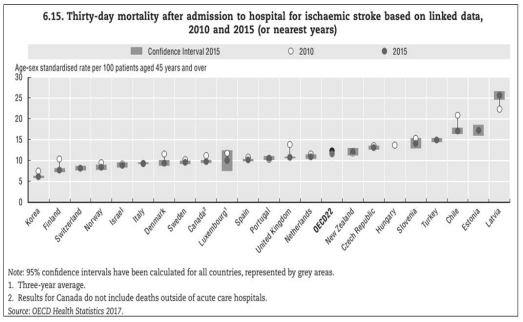
뇌졸중 30일 치명률

30일 치명률 = (입원시점 기준으로 30일 내 병원 내외에서 사망한 환자 수)/(주진단명이 허혈성 뇌졸중인 15세 이상 입원 환자 수)*100

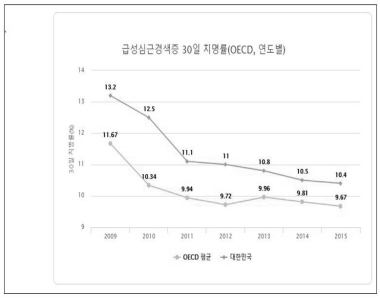


- HIRA 의료동향지표

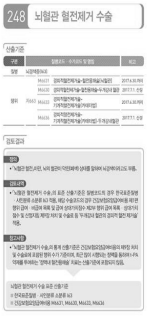
OECD 허혈성 뇌졸중 30일 사망률

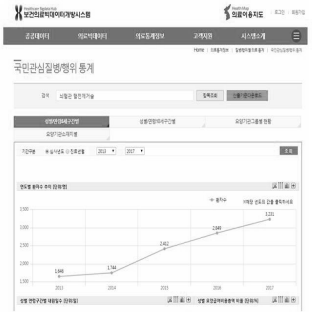


심근경색 30일 치명률

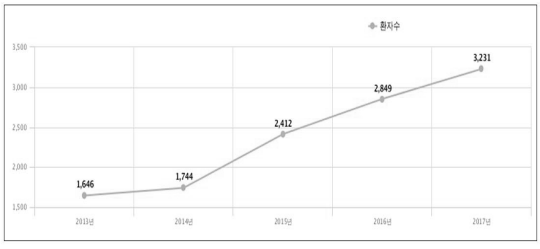


뇌혈관 혈전제거술

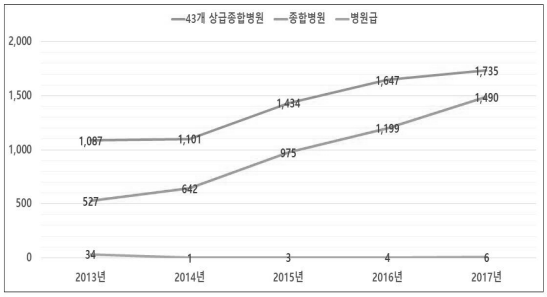




연도별 혈전제거술 환자수

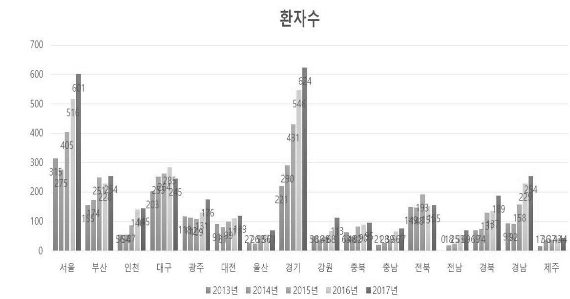


요양 기관별 환자수

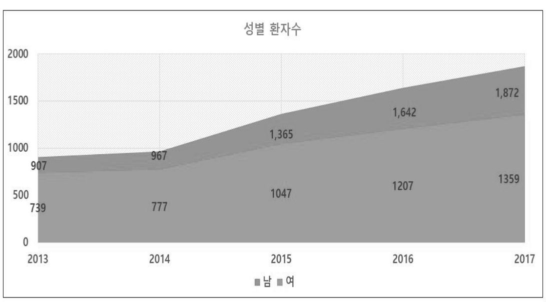


기계적 혈전제거술 요양 급여비 추이

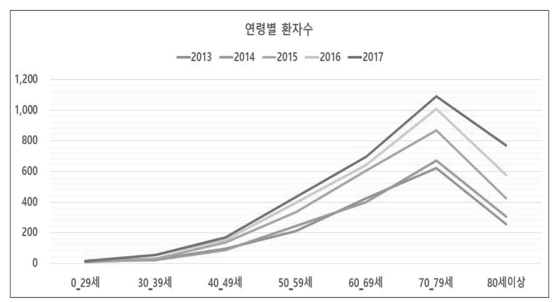
지역별 환자수 추이



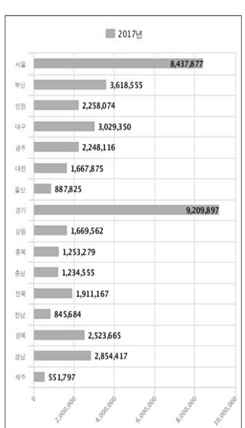
성별 MT환자수 추이



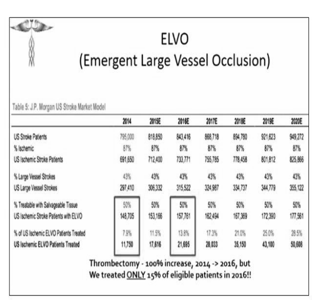
연령별 MT 환자 분포



지역별 요양급여비용

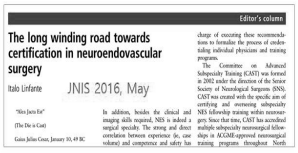


미국의 향후 뇌졸중 환자 예상치



- **JP Morgan분석모델**
- 미국의 stroke환자는 연간 약 70만명
- 이중 약 15%만이 MT로 치료 받는다.
- MT가 2014년에서 2016년 2년 사이 2배로 증가
- 2020년에는 약 30%의 환자가 MT로 치료, 이는 2016년 환자의 2배 이상

미국의 혈관내 치료(NES) 인증의



Editor's column

The long winding road towards certification in neuroendovascular surgery

Italo Linfante

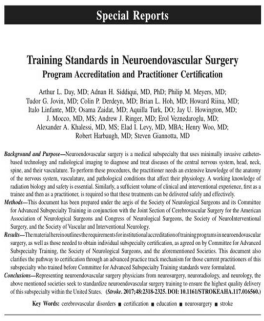
JNIS 2016, May

"Miss Jacta Est"
(The Die is Cast)
Gaius Julius Ceasr, January 30, 49 BC

In addition, besides the clinical and imaging skills required, NES is indeed a surgical specialty. The strong and direct correlation between experience (ie, case volume) and competence and safety has

charge of executing those recommendations to formalize the process of credentialing individual physicians and training programs.

The Committee on Advanced Subspecialty Training (CAST) was formed in 2002 under the direction of the Senior Society of Neurological Surgeons (SNS). CAST was created with the specific aim of certifying and overseeing subspecialty NES fellowship training within neurosurgery. Since that time, CAST has accredited multiple subspecialty neurosurgical fellowships in ACGME-approved neurosurgical training programs throughout North



Special Reports

Training Standards in Neuroendovascular Surgery
Program Accreditation and Practitioner Certification

Arthur L. Day, MD; Adnan H. Siddiqui, MD, PhD; Philip M. Meyers, MD; Tudor G. Jovin, MD; Colin P. Derdeyn, MD; Brian L. Hoh, MD; Howard Riina, MD; Italo Linfante, MD; Osama Zaidat, MD; Aquilla Turk, DO; Jay U. Howington, MD; J. Mocco, MD, MS; Andrew J. Ringer, MD; Erol Veznedaroglu, MD; Alexander A. Khalessi, MD, MS; Elad I. Levy, MD, MBA; Henry Woo, MD; Robert Harbaugh, MD; Steven Giannotta, MD

Background and Purpose—Neuroendovascular surgery is a medical subspecialty that uses minimally invasive catheter-based technology and radiological imaging to diagnose and treat diseases of the central nervous system, head, neck, spine, and their vasculature. To perform these procedures, the practitioner needs an extensive knowledge of the anatomy of the nervous system, vasculature, and pathological conditions that affect their physiology. A working knowledge of radiation biology and safety is essential. Similarly, a sufficient volume of clinical and interventional experience, first as a trainee and then as a practitioner, is required so that these treatments can be delivered safely and effectively.

Methods—This document has been prepared under the aegis of the Society of Neurological Surgeons and its Committee for Advanced Subspecialty Training in conjunction with the Joint Section of Cerebrovascular Surgery for the American Association of Neurological Surgeons and Congress of Neurological Surgeons, the Society of Neurointerventional Surgery, and the Society of Vascular and Interventional Neurology.

Results—The material herein outlines the requirements for institutional accreditation of training programs in neuroendovascular surgery, as well as those needed to obtain individual subspecialty certification, as agreed on by Committee for Advanced Subspecialty Training, the Society of Neurological Surgeons, and the aforementioned Societies. This document also clarifies the pathway to certification through an advanced practice track mechanism for those current practitioners of this subspecialty who trained before Committee for Advanced Subspecialty Training standards were formulated.

Conclusions—Representing neuroendovascular surgery physicians from neurosurgery, neuroradiology, and neurology, the above mentioned societies seek to standardize neuroendovascular surgery training to ensure the highest quality delivery of this subspecialty within the United States. (*Stroke.* 2017;48:2318-2325. DOI: 10.1161/STROKEAHA.117.016586.)

Key Words: cerebrovascular disorders ■ certification ■ education ■ neurosurgery ■ stroke

- 최소 100케이스까지는 fluoro time과 complication이 비례한다.
- 교육 기관에서 angio합병증이 더 많았다.
- Training standard 만들자 (NS, NR, Rad공동)
- On September 1, 2015 CAST announced immediate availability of **Practice Track Certification** of physicians who meet the 'grandfather' criteria for NES

미국의 혈관내 치료(NES) 인증의

NeuroEndovascular Practice Track
as of April 2018 Meeting

Certificates issued:

a. Neurosurgeons 77
b. Neurologists 45
c. Radiologists 54

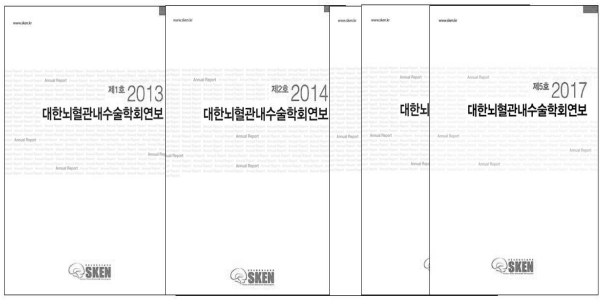
TOTAL 176

- 땅은 넓고 의사 수 부족
- MT를 다른 의사와 공유하자
  - Thrombectologist 육성, 1년간 교육시켜 MT만 하자는 안
  - Cardiologist, Body Rad 를 교육하여 공유안
- 24시간 365일 IA가 가능 하려면 high volume center에서는 인터벤션 인증의가 최소 4명은 있어야 한다.

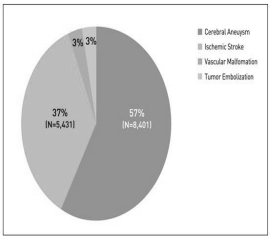
우리나라 혈관내 수술 인증의 (SKEN)

- 2013년에 국내 인증의 사업 시작
- 미국 보다 앞서 학회 차원에서 환자의 안전을 위한 질관리 사업 시작
- SKEN 학회 인증의 185명 모두 NS
- KSIN인증의 128 (Rad: 52, NR:13, NS: 60)
- 중복을 고려하더라도 국내 인증의 최소 270-300명 정도로 추정

대한뇌혈관내수술학회 연보 발간



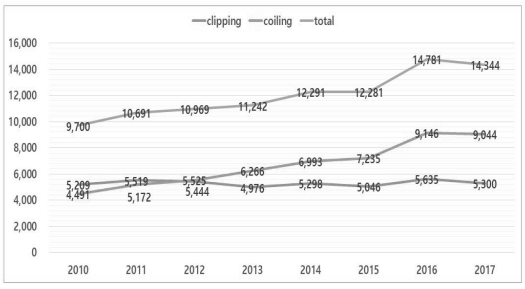
신경외과 혈관내시술 통계 (2017 SKEN연보)



뇌동맥류	비파열	5,563(66.2)
	파열	2,838(33.8)
	단순코일	4,935(58.7)
	보조코일	3,348(39.9)
허혈성질환	혈전제거술	2,666(49.1)
	CAS	1,820(33.5)
	Intracranial PTA/stent	719(13.2)
	CAS외 EC PTA/stent	226(4.2)

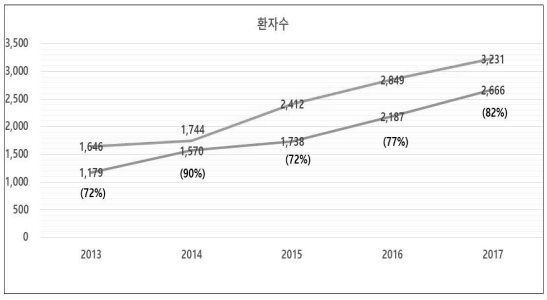
- 연간 45,000례의 진단적 뇌혈관조영술

뇌동맥류 치료 추세



건강보험심사평가원

국내 기계적 혈전제거술 현황



신경외과 의사의 역할

- 연간 93,000례에 이르는 Hemorrhagic stroke 치료
- Ischemic stroke 중 급성기 뇌졸중의 심한 형태인 LVO의 혈관내 MT시술 대부분 담당
- 연간 14,000례에 달하는 뇌동맥류 수술 및 시술의 84% 담당
- 경동맥 협착 수술 전체 및 스텐트 시술 64% 시행
- 두개강내 스텐트 시술 71% 시행
- 뇌경색 후 뇌부종이 심할 경우 감압개두술 시행

신경외과 의사의 역할

- 대부분 병원에서 응급 뇌혈관 수술 및 재개통 시술에 주도적 역할
- 재개통 시술 실패시 bypass수술 시행
- 뇌경색 환자가 빈도상으로 많지만 뇌경색 급성기 응급 치료는 대부분 신경외과에서 담당
- 치료비용 구조상 뇌출혈이 40% (6,150억) 차지, 빈도 대비 매우 높음
- 건보공단 통계 의사 수 - 신경과 1,734명, 신경외과 2,706명 (2017통계)
- 그러나 현행법상으로는 ???

심뇌혈관질환센터의 인력기준

가. 내과 전문의 3명 이상

나. 신경과 전문의 3명 이상

다. 신경외과 전문의 1명 이상

라. 흉부외과 전문의 2명 이상

마. 재활의학과 전문의 1명 이상

바. 예방의학과 전문의 1명 이상

심뇌혈관질환의 예방 및 관리에 관한 법률 시행규칙
보건복지부령 제495호, 2017. 5. 30., 제정

급성기 뇌졸중 치료시 응급 재개통 시술이 필수적

- IA를 24시간 365일 안정적으로 가능하도록 하려면 시술 가능 전문의가 최소 2-4인 필요
- 그러나 현행법상 신경외과 의사 수 1인 이상, 그렇다면 혼자서 365일 응급콜을 받아야 함.
- 대부분 병원에서 신경외과 의사들의 사명감으로 유지되고 있는 현실
- 적절한 수의 Endovascular neurosurgeon을 확보할 수 있도록 국가적인 지원이 필요

지역 심뇌혈관센터 지정 어떻게 할 것인가?

- Iv tPA만 가능한 일차 뇌졸중센터를 지역 심뇌혈관센터로 지정하는 데는 한계가 있음
- MT가 항시 가능한 것이 전제가 되어야 함
- 혈관내 시술 인증의가 최소 2인 이상 근무하고 인증기관으로 등록된 경우 지정하는 것이 바람직함
- 센터 지정 개념 보다는 센터 인증의 개념으로 접근하는 것이 바람직함
- 센터지정에서 배제되면 환자 치료기회가 없게 되며 비효율적으로 먼 거리의 센터로 환자를 후송하게 되어 예후 불량해질 것임
- 현재 혈관내 치료 SKEN 학회 인증기관이 66개임

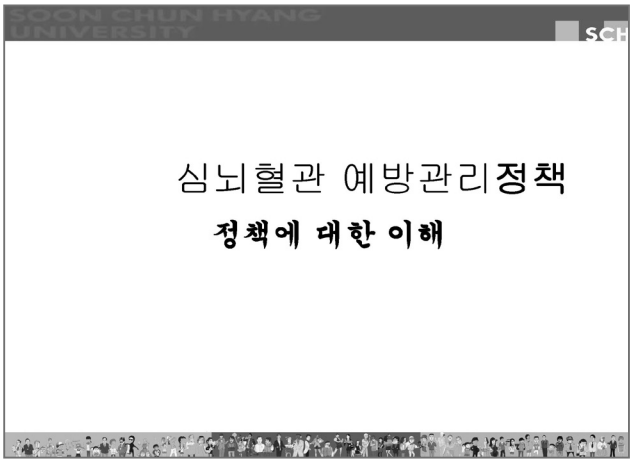
요약

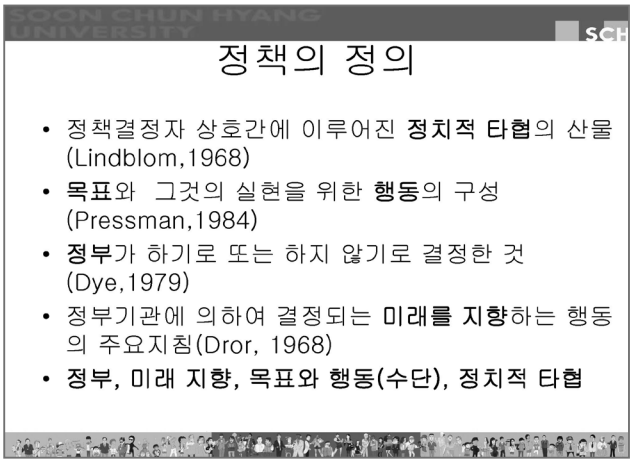
- LVO에 의한 stroke은 감염병과 마찬가지로 치료가 가능한 병이 되어가고 있다.
- 발병 직후 EMS를 통한 신속한 이송과 정맥내혈전용해술, 기계적 혈전제거술이 가능한 병원을 센터로 지정 할 수 있도록 의료 시스템을 정비하는 것이 필요하다.
- 24시간, 365일 기계적 혈전제거술이 안정적으로 시행될 수 있기 위해서는 혈관내 시술 인증의가 최소 2-4인 정도 확보되어야 하며 이를 위해 국가차원의 관심과 지원이 필요하다.

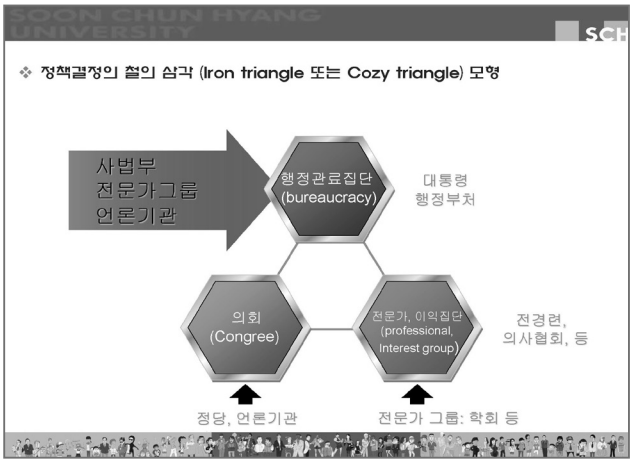
국가 심뇌혈관질환 예방 및 관리에 관한 정책방향 I

박 윤 형

순천향대학교 의과대학 예방의학교실

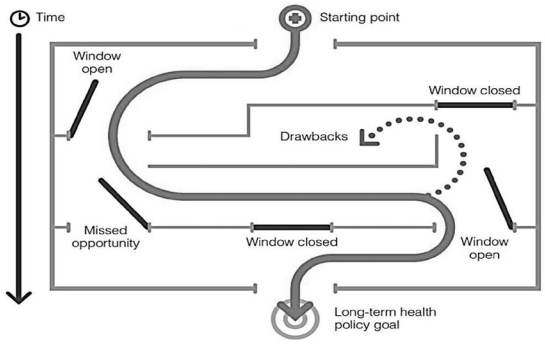






정책의 창(Policy Window, Window opportunity) 이론

- 정책의 장에는 정책의제, 정치, 대안이 떠돌아 다니고 있다.
- 정책의 창(policy window)이 열리는 순간에 3가지가 결합되어 정책의제로 선정:우연성(serendipity)
- 계속 노력하는 정책 커뮤니티(policy community), 정책선도자(policy entrepreneur)의 역할이 중요



정책 프레이밍(Framing)

- Framing refers to **how an issue is defined**, which can in turn influence **how the issue is viewed** (non-issue, problem, crisis, etc.), who is considered responsible and the cause and possible solutions. Policy **stakeholders can own or disown a public problem through the way they define it.**
- 목적이나 상황, 제약조건에 따라 정책의 부분적 특성을 선택하여 주목(**selective attention**)하여 이름을 부여하는 것 (**naming**): 정책초기에 가장 중요

✓ "코끼리는 생각하지마" : 코끼리를 계속 생각
✓ "영리병원은 의료영리화가 아니다" : 의료영리화 낙인

- 정책은 디테일(정책수단,시행방안)이 중요
  " 모든 정책의 악마는 디테일에 숨어 있다"

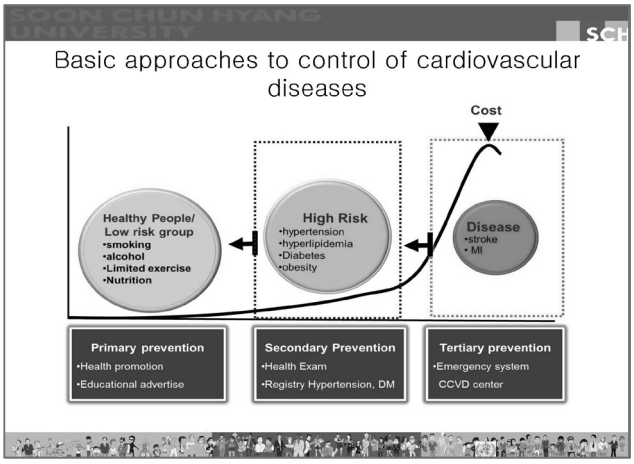
  * 숨은 규제
  경제적 효과
  파생 효과
  행동의 변화

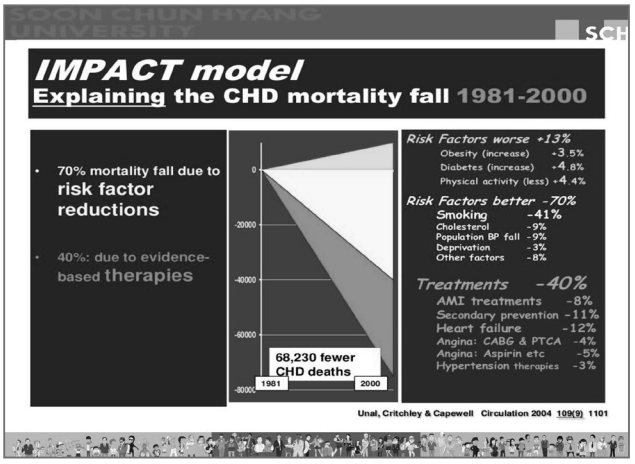
  – 디테일을 밝혀내어 개정, 수정, 항의(Negative action) 하게 하거나 디테일을 개발하여 정책에 포함시키는 노력 (Positive action) 하는 것이 협회, 학회,정책모임의 역할

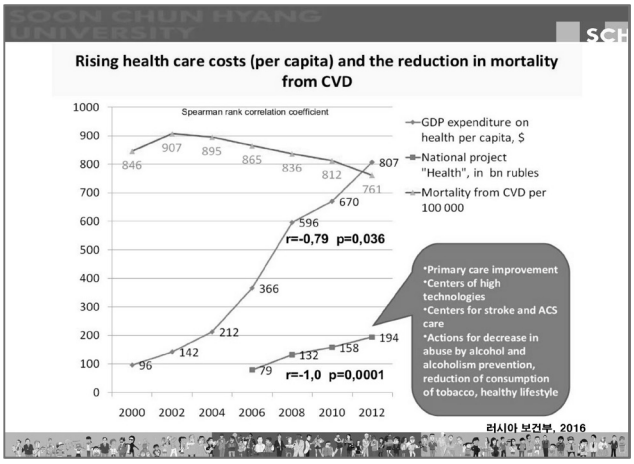
정책의 실행

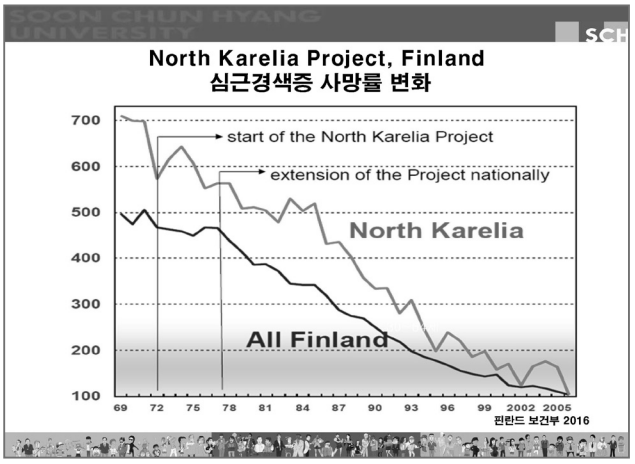
- 법과 시행령, 규칙, 지침, 고시 등으로 정함
  국민의 권리와 국가의 의무 등을 명시
- 국가의 예산(국민의 세금)을 사용
  세금을 납부하는 모든 국민을 대신하여 정부, 국회가 결정 및 집행 : SOC, 국가 R&D 투자 결정 등
  국민 모두 또는 보호해야 할 일부에게 지원

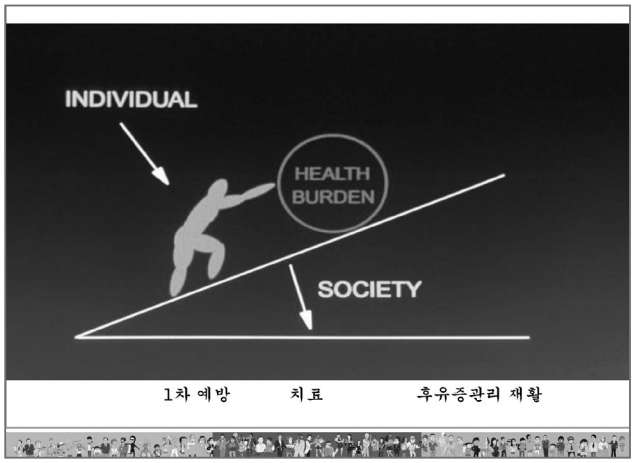
심뇌혈관질환 예방관리 접근방안







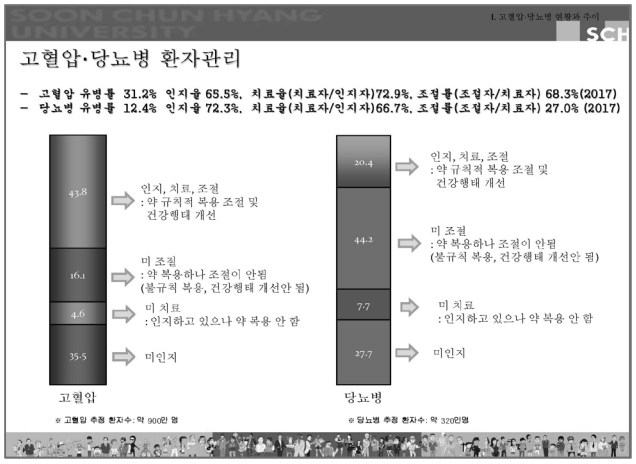


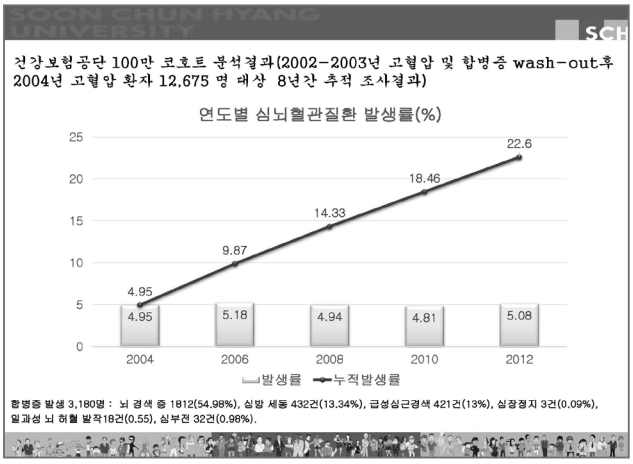


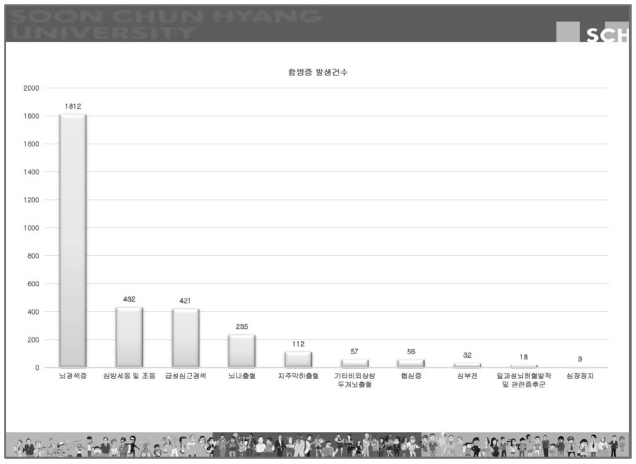
심뇌혈관질환 예방관리 접근방안

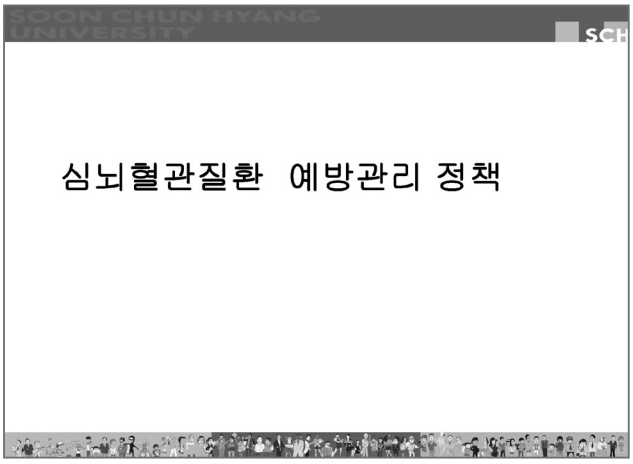
- 고혈압 환자 혈압관리 및 합병증 예방과 조기발견
- 고콜레스테롤 혈증 관리
- 당뇨병환자의 혈당관리 및 심뇌혈관 합병증 예방과 조기발견
- 환자의 금연교육 및 지원
  - 심뇌혈관질환 주요 위험요인

    고혈압(34%), 흡연(26%), 고 콜레스테롤혈증(5.1%), 당뇨병(2.5%)
- 환자의 건강증진활동 지원 : 비만, 운동, 영양, 음주 등
- 고혈압(65.5%) , 당뇨병(72.3%), 고콜레스테롤혈증(58.9%) 인지율 제고
- 초기 심뇌혈관질환의 증후에 대한 교육
- 골든 타임 내 접근 가능한 의료시설 확보 및 인력 양성 배치
- 응급 후송체계
- 재활 및 사회복귀 프로그램 구축









추진경위

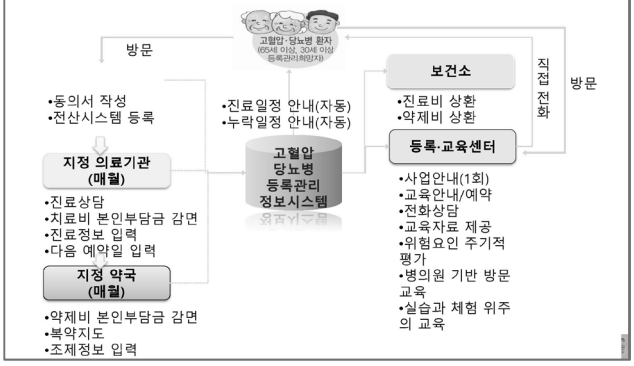
- 2006: 제1기(2006-2010) 심뇌혈관질환 종합대책 수립
- 2007: 2단계 균형발전정책 관계장관 회의에서 '보건의료분야 균형발전정책' 과제로 선정
- 2007: **대구광역시에서 의원과 보건소가 고혈압 당뇨병 등록관리 시범사업 시작**
- 2007: 심뇌혈관질환 예방 홍보사업 실시(Red Circle campaign)
- 2009-2011 : 경기도 광명시(2009), 경기도 하남, 남양주, 안산(2010) 에서 시범사업 확대
- 2012: **전국 19개 시 군 구에서 고혈압 당뇨병 등록관리사업 실시 (현재까지)**
- 2008-2017: **권역 심뇌혈관질환센터 설치(14개소)**
  - 2008~2010: 강원대, 경북대, 제주대, 충북대, 전남대, 경상대, 동아대, 원광대, 충남대
  - 2012-2016: 분당서울대, 인하대
  - 2017: 목포 한국병원, 안동병원, 울산 울산대 병원
- **2005- : 급성심근경색, 뇌졸중, 뇌졸중 재활환자 등 등록 및 코호트 연구**
- 2015 : **심뇌혈관질환 예방 및 관리에 관한 법률 제정 시행**
- 2017 : **심뇌혈관질환 예방관리 5개년 종합계획 발표**

고혈압·당뇨병 등록·관리 사업

- 참여기관
  - 지역사회 고혈압. 당뇨병 진료 의원(일부 병원 포함) 및 약국
  - 지역사회 전문가단체 및 주민자치단체(의사회, 약사회, 노인회 등)
- 등록관리 대상
  - 주민등록상 사업지역 거주 30세 이상 고혈압. 당뇨병 환자
- 등록관리 서비스
  - 65세 이상 환자 인센티브 42,000원/연(진료비, 약제비 등)
  - 병의원 치료일정(예약일) 안내, 누락일정 안내 등 지속 치료율 향상을 위한 recall/reminder 서비스 제공과 전화 및 대면상담
  - 고혈압·당뇨병 환자의 자가관리능력 향상을 위한 체계적 교육
  - 건강행태개선 인센티브 제공 등

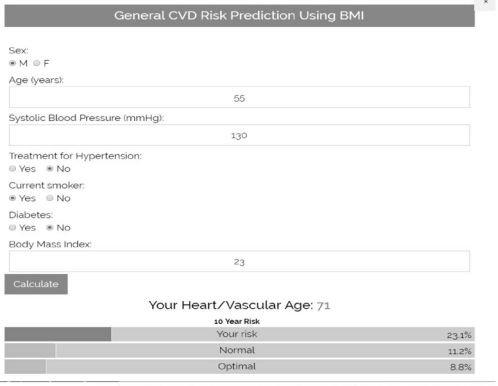
* 병의원 등록행정비용(65세 이상 1,000원/연, 30-64세 5,000원/연)

보건소 고혈압·당뇨병 등록·관리 사업 절차

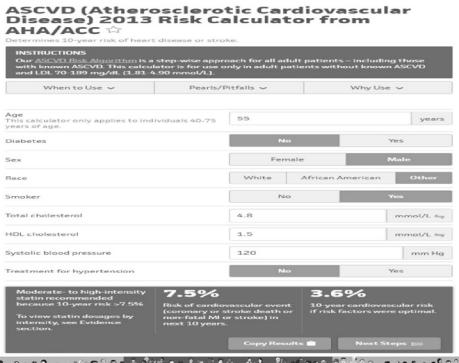


심뇌혈관질환 홍보사업

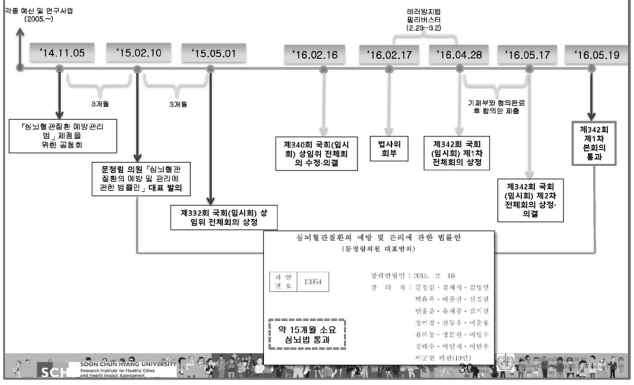
General CVD Risk Prediction Using BMI



ASCVD(Atherosclerotic Cardiovascular Disease)Risk



심뇌혈관질환 예방 및 관리에 관한 법률



○ 심뇌혈관질환예방관리법 상 관리 질병 규정

제2조(정의) 이 법에서 사용하는 용어의 뜻은 다음과 같다.
1. "심뇌혈관질환"이란 심장질환, 뇌혈관질환 또는 그 선행 질환으로서 다음 각 목의 어느 하나에 해당하는 질환을 말한다.
   가. 심근경색 등 허혈성 심장질환
   나. 심장정지
   다. 뇌졸중 등 뇌혈관질환
   라. 고혈압
   마. 당뇨병
   바. 그 밖에 보건복지부령으로 정하는 질환

➢ 보건복지부령으로 정하는 심뇌혈관질환 (안)

○ 보건복지부령으로 정하는 질병을 '심부전증', '부정맥', '뇌동맥 류'로 한다.

- 추가요구 : 고지질혈증, 비만<당뇨병학회>, 심장판막증<심장학회>, 대동맥류 <흉부외과>

• 추가 요구한 질병을 포함하여 필요한 경우는 종합계획에 포함하여 검토 추진

○ 심뇌혈관질환 관리 종합계획

제4조(심뇌혈관질환관리종합계획의 수립) ① 보건복지부장관은 심뇌혈관질환관리종합계획(이하 "종합계획"이라 한다)을 5년마다 수립하여야 한다.
② 종합계획에는 다음 각 호의 사항이 포함되어야 한다.
1. 심뇌혈관질환관리사업의 기본목표 및 방향
2. 심뇌혈관질환관리사업의 추진 계획 및 추진 방법
3. 심뇌혈관질환관리에 필요한 전문 의료인력의 양성에 관한 사항
4. 심뇌혈관질환에 관한 통계 및 정보의 관리 방안에 관한 사항
5. 그 밖에 심뇌혈관질환관리에 필요하다고 보건복지부령으로 정하는 사항

③-⑤ 생략
⑥ 그 밖에 종합계획 및 세부집행계획의 수립·시행에 필요한 사항은 대통령령으로 정한다.

❖ '심뇌혈관질환 관리위원회'를 구성하여 종합계획을 수립 및 심의
❖ 지역별 심뇌혈관질환 종합계획이 지역의료계획에 포함되도록 조치
❖ 계획수립에 필요한 자료 수집을 위해 다른 부처, 건강보험공단, 심사평가원, 의료기관의 자료 협조 방법과 개인정보의 보호
❖ 계획 실행방안과 예산 확보 방안 검토

○ 심뇌혈관질환 연구사업 규정 : 시행령 시행규칙 없음

제5조(심뇌혈관질환연구사업) ① 보건복지부장관은 심뇌혈관질환의 예방, 진료 및 재활 기술의 발전을 위한 연구·개발 사업(이하 "심뇌혈관질환연구사업"이라 한다)을 시행할 수 있다.
② 제1항에 따른 심뇌혈관질환연구사업은 다음 각 호의 사업을 포함한다.
1. 심뇌혈관질환연구사업의 국내외 추세 및 심뇌혈관질환연구사업의 수요에 대한 분석·예측
2. 연도별 심뇌혈관질환연구사업 과제의 공모·심의 및 선정
3. 심뇌혈관질환연구사업 결과의 평가 및 활용
4. 그 밖에 보건복지부장관이 심뇌혈관질환연구사업의 시행에 필요하다고 인정하는 사항

③ 보건복지부장관은 심뇌혈관질환 연구사업에 관한 국제협력의 증진을 위하여 노력하고 선진기술의 도입을 위하여 전문 인력의 국외 파견 및 국내 유치 등의 방안을 마련하도록 노력하여야 한다.

조사통계사업 : 시행령, 시행규칙 없음

제6조(심뇌혈관질환조사통계사업) ① 보건복지부장관은 **심뇌혈관질환 발생 위험 요인과 심뇌혈관질환의 발생, 진료 및 재활에 관한 자료를 지속적이고 체계적으로 수집·분석하여 심뇌혈관질환 발생률·재발률, 심뇌혈관질환에 따른 사망률 등 심뇌혈관질환 관련 통계를** 산출하기 위한 조사·통계사업(이하 "심뇌혈관질환조사통계사업"이라 한다)을 시행할 수 있다. 이 경우 **통계자료의 수집 및 통계의 작성 등에 관하여는 「통계법」을 준용하며,** 통계의 산출을 위하여 처리되는 개인정보는 「개인정보 보호법」 제58조제1항에 따라 같은 법이 적용되지 아니하는 개인정보로 본다.

② 제1항에 따른 심뇌혈관질환조사통계사업은 다음 각 호의 사업을 포함한다.
1. 심뇌혈관질환 등록통계사업
2. 심뇌혈관질환의 원인을 규명하기 위한 코호트 조사
3. 그 밖에 **심뇌혈관질환 관련 통계를** 산출하기 위하여 보건복지부장관이 필요하다고 인정하는 사업

③ 보건복지부장관은 심뇌혈관질환을 진단·치료하는 「의료법」에 따른 의료인 또는 의료기관, 「국민건강보험법」에 따른 국민건강보험공단 및 건강보험심사평가원, 그 밖에 심뇌혈관질환에 관한 사업을 하는 법인·기관·단체 등에 대하여 보건복지부령으로 정하는 바에 따라 심뇌혈관질환조사통계사업에 필요한 자료의 제출이나 의견의 진술 등을 요구할 수 있다. 이 경우 자료의 제출이나 의견의 진술을 요구받은 자는 정당한 사유가 없으면 이에 따라야 한다.

□ 한국인 급성심근경색증 등록연구

(Korea Acute Myocardial Infarction Registry; KAMIR, 2005~, KAMIR-NIH, 2011~)

○ 자료수집 : 55 주요 PCI 센터(Percutaneous Coronary Intervention-PCI) 내원하는 응급 환자 중 급성 심근경색증의 진단을 받은 모든 환자를 대상으로 온라인 등록, 약 5만명 등록

○ 조사 내용

급성 심근경색증의 위험요인 항목, 증상 발생 후 진료를 받는 행동을 개시하는 데 소요 시간, 전화 후 앰뷸런스 도착 시간, 환자 후송 시간 (앰뷸런스 병원 도착 시간), door to needle time (혈전용해제 투여 시), door to balloon time (primary or rescue PCI 시), 각 환자의 위험 인자, 그 외에 치료 약제 및 방법, 1개월 후 사망 여부 등을 웹 기반 등록

□ 한국뇌졸중환자등록(Korea Stroke Registy; KSR 1999~)

○ 전국 17개 의과대학 29개 대형병원이 참여하는 한국 뇌졸중 환자등록 시스템으로 대한뇌졸중학회 Korean Stroke Registry Task Force에서 운영

○ 급성기 뇌졸중 환자의 대규모 임상 자료를 전향적으로 인터넷기반 등록

○ 발병 및 입퇴원 상황, 뇌졸중의 아형분류 및 위험요인, 병변의 정보, 시행된 검사 및 결과, 입퇴원시 신경학적 결손상태 및 사인, 그리고 급성기 치료 표준화된 지침서에 따라 전향적으로 자료 수집

대분류	세부항목	대분류	세부항목
기본 인적사항	병록번호 성명 성별 나이	위험인자	고혈압 당뇨병 임파성허혈발작 및 뇌졸중의 과거력 고지혈증 흡연력 심인성 색전증의 원인질환
발병 및 입퇴원 상황	발병시각 입원시각 퇴원일 내원시까지 경과시간 내원경로 체중 및 키	시행된 검사 종류	시행된 검사 종류
		실험실 검사 결과	일반혈액 혈중 지질 및 혈당 혈액응고 심전도 급성기 수축기 및 확장기 혈압
뇌졸중의 분류 및 아형분류	임파성허혈발작 허혈성 뇌졸중 출혈성 뇌졸중	치료세부 내역	급성기 치료제 퇴원시 치료제 중재적 치료시술
병변의 위치와 특징	병변의 해부학적 위치 혈관 영역별 위치 침범된 혈관과 협착도		
		입퇴원시 신경학적 결손 상태	NIH 뇌졸중 점수 Modified Rankin 점수
		퇴원시 상태 및 사망원인	퇴원시 상태 및 사망원인

□ 한국 뇌졸중 재활 코호트 (Korea Stroke Cohort for Function and Rehabilitation; KOSCO)

○ 전국 10개 의과대학병원이 참여하는 한국 뇌졸중 환자등록 및 장기 추적시스템으로 질병관리본부 연구지원 하에 한국뇌졸중재활코호트 연구단에서 운영.

○ 2012년 8월 ~ 2015년 10월까지 9개 병원에 입원한 초발 급성 뇌졸중 환자 전수(10,636명)의 일반적 특성 및 초기 입원 임상 자료 취합 완료.

○ 추적 연구 참여동의자 8,010명을 대상으로 표준화된 지침 하에 2021년까지 지속적인 추적 조사를 시행하여 사망, 재발 여부와 함께 뇌졸중 환자의 다양한 기능, 장애정도 및 삶의 질에 대해 1:1 대면 평가를 통해 전향적으로 자료 수집 중.

○ 모든 자료는 web기반 E-CRF(http://cohort.epes.kr)에 등록하고 있음.

○ 주요 산출 지표 – 국내 초발 뇌졸중 환자
1) 임상 특성(나이, 성별, 뇌졸중 특성 등)
2) 초기 입원 치료 특성(급성기 치료 및 재활치료)
3) 생존률(생존곡선)
4) 재발률(재발곡선)
5) 장애 발생율 및 변화 양상
6) 운동, 이동, 인지, 언어, 삼킴 기능 변화 양상
7) 우울증 발생 및 변화 양상
8) 삶의 질 변화 양상
9) 급성기 및 만성기 의료기관 이용행태
10)보호자 부양 부담 및 삶의 질 변화 양상

지표의 예측 인자

○ 연구참여병원(10개 병원)
1) 수도권
: 삼성서울병원/세브란스병원/건국대병원/이화여대병원
2) 충청권: 충남대병원
3) 경상권: 경북대병원, 양산부산대병원
4) 전라권: 원광대병원, 전남대병원
5) 제주권: 제주대병원

■ 심뇌혈관질환 예방사업 규정: 시행령 시행규칙 없음

제7조(심뇌혈관질환예방사업) ① 보건복지부장관, 시·도지사 및 시장·군수·구청장은 심뇌혈관질환의 예방을 위하여 심뇌혈관질환에 관한 정보를 지속적이고 체계적으로 구축하고 심뇌혈관질환관리에 필요한 내용을 효율적으로 국민에게 제공하는 사업(이하 "심뇌혈관질환예방사업"이라 한다)을 시행할 수 있다.

② 제1항에 따른 심뇌혈관질환예방사업은 다음 각 호의 사업을 포함한다.

1. 심뇌혈관질환에 관한 각종 정보 수집, 데이터베이스 구축 및 관리
2. 국민에 대한 심뇌혈관질환 정보 제공 및 상담
3. 심뇌혈관질환에 관한 **교육자료 개발 및 교육·홍보**
4. **심뇌혈관질환 상담 인력의 교육 및 양성**
5. 그 밖에 심뇌혈관질환의 예방을 위하여 보건복지부장관이 필요하다고 인정하는 사업

③ 그 밖에 심뇌혈관질환예방사업의 시행에 필요한 사항은 보건복지부령으로 정한다.

○ 심뇌혈관센터의 지정과 관리

제9조(심뇌혈관질환센터의 지정 등) ① 보건복지부장관은 다음 각 호의 사업을 수행하기 위하여 「의료법」 제3조제2항제3호마목에 따른 종합병원을 심뇌혈관질환센터로 지정할 수 있다.

1. 심뇌혈관질환 환자의 **진료 및 재활**
2. 제4조에 따른 심뇌혈관질환종합계획 관련업무 지원
3. 심뇌혈관질환 관련 예방, 진료 및 재활 등에 대한 **조사 연구**
4. 심뇌혈관질환 조사통계 사업관련 **자료의 수집·분석 및 제공**
5. 심뇌혈관질환의 예방과 관리에 관한 **홍보 및 교육**
6. 그 밖에 심뇌혈관질환관리에 필요한 사업으로서 보건복지부령으로 정하는 사업

② 생략

③ 보건복지부장관은 심뇌혈관질환센터가 다음 각 호의 어느 하나에 해당하는 경우 그 지정을 취소할 수 있다.

1. 제1항에 따른 지정 기준에 미달한 경우
2. 제1항에 따른 사업을 수행하지 아니하거나 제2항에 따른 시정명령을 이행하지 아니한 경우
3. 제11조에 따른 지도·감독을 따르지 아니한 경우
4. 그 밖에 대통령령으로 정하는 사유에 해당한 경우

④ 심뇌혈관질환센터의 지정기준,방법,절차 및 지정 취소의 절차 등에 필요한 사항은 보건복지부령으로 정한다.

심뇌혈관센터

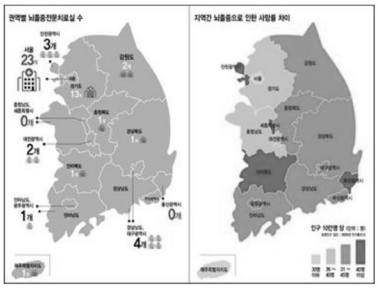
- 이법에서 심뇌혈관센터는 종전의 권역심뇌혈관센터를 지칭
  - 법안에는 중앙, 권역, 지역 심뇌센터로 안을 마련했으나 기재부가 예산투입 과다이유로 반대하여 권역센터만 심뇌혈관센터의 명칭으로 남았음
- 추가과제
  - 골든 타임 내에 국민이 치료받을 수 있는 심장, 뇌졸중 센터의 수와 분포, 규모, 조건은?
  - 급성기 환자에 대한 이송 대책은? 이송병원 지정대책은?
  - 응급의료체계와의 연계 구축방안 : 주요 응급환자는 심뇌혈관질환과 중증 외상환자이며 현재는 권역, 지역 응급의료센터, 권역외상센터, (권역)심뇌혈관센터가 주축이 되어 있으나 응급이송체계와의 연계가 미흡하고 지역센터가 없어 접근성 취약
  - 뇌졸중, 심장병치료 Unit 또는 지역센터의 지정 또는 육성 과제

전국 PCI 기관 분포

- PCI 센터(153개소)
- 지방 진료인력 문제
  - 응급시술 가능 인증의사는 280명, 기관당 평균 2-3 명
  - 해당지역 24시간 365일 응급환자 담당 가능하지 않음.
- 심장재활센터
  - 수도권 일부 병원, 권역심뇌혈관센터 일부에서만 시행

한국보건사회연구원,2017

뇌졸중 전문치료실과 사망률 비교



- 뇌졸중 사망률의 지역별 차이가 2.9배나 될 정도로, 수도권과 지방 간 편차가 심각함
- 병원 전 단계와 퇴원 후 단계의 지역간 차이에 대한 자료는 없음

한국보건사회연구원,2017

○ 역학조사

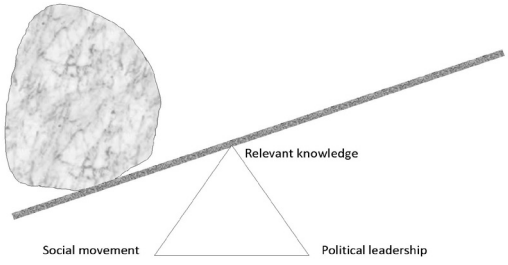
제8조(역학조사)

① 보건복지부장관은 심뇌혈관질환의 발생 및 재발의 원인 규명 등을 위하여 필요하다고 인정하는 경우 역학조사를 실시할 수 있다.

② 제1항에 따른 역학조사의 시기·방법 및 내용 등에 필요한 사항은 대통령령으로 정한다.

요약 및 결론

- ✓ 심뇌혈관질환의 유병과 사망을 줄이기 위해서는 고혈압, 고콜레스테롤증을 적극 관리하고 금연을 하도록 해야 함. 나아가 당뇨병, 비만을 관리하고 운동을 권장해야 함
- ✓ 심뇌혈관질환 예방관리는 치료와 생활습관 교정을 위해서 의원과 보건소 등 기관간 긴밀한 협조가 필요(intersectoral cooperation)
- ✓ 심뇌혈관질환에 대한 인식 제고를 위한 지식수단을 개발(국민들이 쉽게 접근할 수 있는 심뇌혈관 위험도 측정 등)하고 전파하여 국민의 자가관리능력을 키우고 (enabling) 전문가들은 홍보, 캠페인, TV 등 미디어 활용(advocacy)으로 사회적 이슈로 강조해야 한다.
- ✓ 심장병 뇌졸중 등 급성 심뇌혈관질환을 신속히 치료하는 응급이송 정보체계와 치료시스템이 구축되어야 한다.
- ✓ 심뇌혈관질환 예방관리법으로 기반은 구축되었으나 법의 집행에 필요한 시행령, 시행규칙은 거의 없어서 정책 초기에 해당하므로 지금부터 정책에 적극 참여가 필요
- ✓ 정부에 전체적으로 의존하는 것 보다 학회 등에서 자율적으로 시행하는 방안으로 추진하는 것이 효율적: 기술적 인증, 인력 훈련 및 수료증 등 (New Governance)



"만성질환(NCD)은 향후 국가의 지속가능성(Sustainability)의 가장 중요한 요소입니다" (반기문 UN 사무총장)

경청해 주셔서 감사합니다.

박윤형
parky@sch.ac.kr
www.prev-med.com

국가 심뇌혈관질환 예방 및 관리에 관한 정책방향 II

이 동 한

질병관리본부 만성질환예방과 과장

심뇌혈관질환 관리 종합대책
(2018-2022)

질병관리본부 만성질환예방과
이동한

보건복지부

현 황

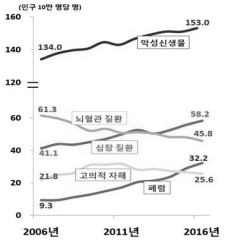
▣ 심뇌혈관질환, 높은 사회경제적 부담

⊙ 사망률
- 전체 사망원인의 24.3% 가 심뇌혈관질환
- 사망원인 1위 암, 2위 심장질환, 3위 뇌혈관질환

⊙ 의료비
- 진료 실인원 1,089만명, 진료비 9조6천억원
- 진료 실인원, 진료비 모두 증가 추세

⊙ 사회경제적 부담
- '15년 19조 6천억원
- '06 ~ 15년까지 연평균 6.5% 증가

< 1-5순위 사망원인 >



출처: 통계청, 2016년 사망원인통계

2

보건복지부

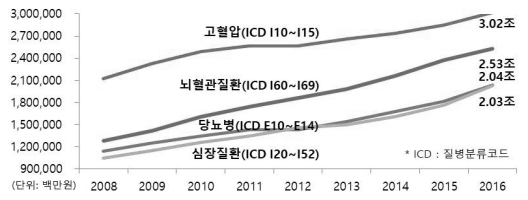
정책여건

▣ 고령화로 심뇌혈관질환 부담 증가

⊙ 65세 이상 인구에서 많이 발생하는 질환

⊙ 고령화 속도에 비해 심혈관질환 증가 속도 빠름
- ('10~'14) 노인인구 증가율(4.3%), 심혈관질환자 증가율(8.6%)

< 의료비 추이 >



출처: 건강보험통계

3

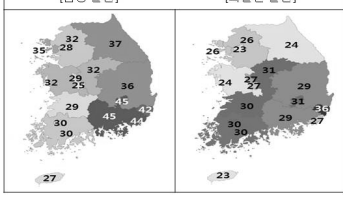
보건복지부

정책여건

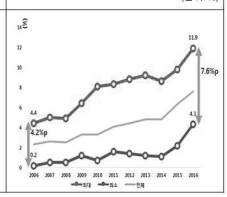
▣ 심뇌혈관질환 치료, 지역간 격차 지속

⊙ 심뇌혈관질환 사망률, 급성심장정지 생존율 등 지역간 격차 지속

연령표준화 사망률 (2016)
(단위: 명/표준인구 10만명)
[심장 질환] [뇌혈관 질환]



급성심장정지 생존율 지역격차 (2006-2016)
(단위: %)



자료 : 통계청, 2016년 사망원인통계 / 질병관리본부 보도자료(심장정지환자, 일상생활 복귀 10년간 7배 증가, 시도간 격차는 커져)

4

보건복지부

정책여건

▣ 심뇌혈관질환 관리법 제정 시행('17.5)

⊙ 대상질환
- 심장질환(심근경색 등 허혈성질환, 심장정지, 심부전, 부정맥)
- 뇌혈관질환(뇌졸중 등 뇌혈관질환, 뇌동맥류)
- 선행질환(고혈압, 당뇨병)

⊙ 주요조항
- 종합계획, 연구, 조사통계, 정보제공/교육홍보, 심뇌혈관센터

▣ 주요 심뇌혈관질환 예방관리사업

- 인식개선: 예방관리주간 운영(9월첫주), 레드써클 캠페인
- 국가건강검진사업
- 고혈압·당뇨병 등록관리사업, 지역사회 통합건강증진사업
- 권역심뇌혈관질환센터 지정·운영 등

5

보건복지부

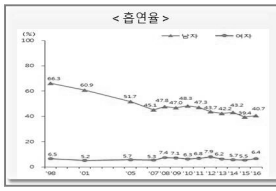
주요사업 성과

▣ 인식개선 : 건강행동 실천율 제고

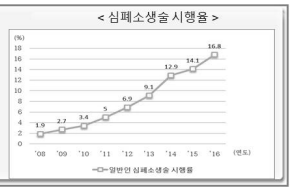
⊙ 추진내용
- 전문학회와 공동으로 심뇌혈관질환 예방·관리 생활수칙 제정
- 중앙-지자체 합동 전국 캠페인 및 홍보 실시

⊙ 성 과
- 금연, 절주 등 건강생활 실천율 제고
- 심장정지 초기대응 인식개선 : 목격자 심폐소생술 시행 10년간 9배 증가

< 흡연율 >



< 심폐소생술 시행율 >



6

보건복지부

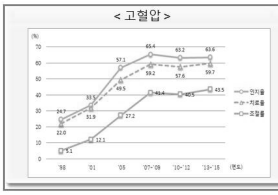
주요사업 성과

▣ 예방관리: 선행질환 조기발견 및 관리

⊙ 추진내용
- 국가 건강검진 도입('08)으로 고혈압,당뇨 위험군 조기발견
- 고혈압 당뇨병 등록관리사업 등 만성질환자 자가관리 지원

⊙ 성 과
- 고혈압, 당뇨병 등 선행질환 관리율 개선

< 고혈압 >



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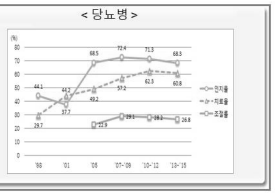

7

보건복지부

주요사업 성과

▣ 치료역량: 권역심뇌혈관센터 지정 운영

⊙ 추진내용
- 권역별 센터 지정으로 골든타임 내 집중 전문치료체계 구축
- 예방사업, 24시간 전문진료팀 운영, 재활연계 등 거점기관 육성

⊙ 성 과 : 급성기 진료 소요시간 단축 등 관리수준 향상
- 급성심근경색 : 응급실 도착~관상동맥중재술 69.3분('08)→53.3분('17)
- 뇌졸중 : 응급실 도착~뇌경색약제 투여 65.6분('08) → 28.8분('17)
- 뇌졸중 입원 후 30일 내 사망률 : 8.2% → 5.9%

8

보건복지부

개선 필요사항

▣ 예방 및 초기대응 – 인지도 향상

⊙ 질환과 증상에 대한 낮은 인지율
* 해당 질환을 모른다 20~30% 수준, 조기증상을 잘 안다 20% 미만

⊙ 필요한 정보를 찾기 어렵고, 이용자 불편

▣ 고위험군 관리 – 효율성 제고

⊙ 보건소-동네의원 기반 다양한 만성질환 관리사업간 연계 미흡
⊙ 대부분 시간 보내는 생활터(학교, 직장 등) 기반 정보제공과 관리 필요
⊙ 조절취약계층(젊은 환자, 독거노인 등) 집중관리 필요

▣ 응급대응과 치료역량 – 지역사회 내 역량 강화

⊙ 심뇌혈관센터 전 단계, 급성기 진료 후 지표개선 미흡
⊙ 심뇌혈관센터(14개)에서 진료가능환자는 심뇌혈관질환자의 20%

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보건복지부

개선 필요사항

▣ 급성기 치료 이후 – 환자 지속관리체계

⊙ 급성기 치료 후 재발 또는 후유 장애를 낮추기 위한 조기재활, 지역사회 내 지속 관리체계 필요

▣ 기초통계 및 정책근거 생산 등 기반 미흡

⊙ 발생률, 유병률 등 기초통계 생산체계 미흡
⊙ 국민건강과 의료비에 미치는 영향 대비 R&D 투자 저조

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보건복지부

비전 및 목표

비전 심뇌혈관질환 걱정 없는 건강한 사회

목표
- 심뇌혈관질환의 발생과 사망감소
- 심뇌혈관질환 충촘한 안전망 구축
- 심뇌혈관질환 발병 이후 삶의 질 향상
- 심뇌혈관질환관리 정책근거 생산 강화

추진전략
1. 대국민인식 개선과 건강 생활 실천
2. 고위험군 및 선행질환 관리 강화
3. 지역사회 응급대응 및 치료역량 강화
4. 환자 지속관리 체계 구축
5. 관리 인프라와 조사·R&D강화

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5대 추진전략, 14개 중점과제

추진전략		중점과제
1	대국민 인식개선과 건강생활 실천	1-1. 심뇌혈관질환 **위험요인 대국민 인식** 개선
		1-2. 급성심근경색증·뇌졸중 **증상 인지 및 대처능력** 향상
		1-3. 심뇌혈관질환 **종합정보포털사이트** 구축
2	고위험군 및 선행질환 관리 강화	2-1. 심뇌혈관질환 **고위험군 관리** 강화
		2-2. **고혈압·당뇨병** 관리 강화
3	지역사회 응급대응 및 치료역량 강화	3-1. **권역** 심뇌혈관질환센터 기능 정비 등 운영 활성화
		3-2. **지역** 생활권 중심 일차(지역) 심뇌혈관질환센터 지정, 운영
		3-3. 권역·일차(지역)심뇌혈관질환 기반 **조기재활**서비스 제공
4	환자 지속관리체계 구축	4-1. 급성심근경색증·뇌졸중환자 **퇴원 후 지역연계** 관리체계 구축
		4-2. 급성기 퇴원 후 회복기와 유지기 **재활서비스 제공체계** 구축
5	관리 인프라와 조사·R&D 강화	5-1. **국가통계** 생산체계 구축
		5-2. 심뇌혈관질환 **연구개발**(R&D) 강화
		5-3. **전문인력** 수요평가와 역량 강화
		5-4. 심뇌혈관질환 **적정 치료와 관리**를 위한 지원대책 마련

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보건복지부

(전략1) 대국민 인식개선과 건강생활실천

01 심뇌혈관질환 위험요인 대국민 인식개선

⊙ 예방관리 홍보사업 강화 - 레드써클(자기혈관숫자알기) 캠페인 강화
- 중장기 홍보계획 수립 등

⊙ 생활터 중심 위험요인 인식개선 - 학교, 직장교육 실시, 교육인력 양성
- 생활터 건강증진사업 강화 등

02 급성심근경색증/뇌졸중 증상 인지 및 대처능력 향상

⊙ 증상인지, 대처역량 강화 위한 전국단위 캠페인 - 질환 증상과 대처방법 정보제공 강화
- 증상 인지도 및 자가진단 컨텐츠 개발
- 심정정지 발생시 초기대응방법 교육 등

⊙ 권역심뇌센터와 지자체간 협업 강화 - 지역사회 내 가용자원 연계 강화

03 심뇌혈관질환 종합정보포털사이트 구축

⊙ 예방수칙, 증상, 대처법, 치료, 재활 등 필요정보 한 곳에서 제공

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보건복지부

(전략2) 고위험군 및 선행질환 관리 강화

01 심뇌혈관질환 고위험군 관리 강화

⊙ 한국형 고위험군 선별 및 관리 권고안 개발 보급 - 고위험군 정의, 선별도구 개발
- 고위험군 발견 및 관리지침 등

⊙ 보건소-일차의료 기반 고위험군 발굴, 관리 강화 - 보건소-의원급 협력체계 구축
- 보건소, 의료기관 고위험군 관리전략
- 1차의료기관 선행질환 임상진료지침

02 고혈압, 당뇨병 관리 강화

⊙ 동네의원 중심 고혈압 당뇨병 관리사업 통합모델 적용

⊙ 지역사회 고혈압 당뇨병 전문 교육인력 양성 - 인력개발원 등 전문기관에 교육과정 위탁

⊙ 고혈압, 당뇨병 관리사업 내 취약환자 관리 강화
- 최초 진단환자, 질환 조절 취약자(젊은 환자, 복거노인 등) 등 환자 맞춤형 사업 도입

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보건복지부

(전략3) 지역사회 응급대응,치료역량 강화

01 권역 심뇌혈관질환센터 기능정비 등 운영 활성화

⊙ 중앙심뇌혈관센터 지정 - 심뇌혈관질환 관리정책 지원, 평가, 국가 통계체계, 교육자료, 지침개발, 홍보 등

⊙ 권역심뇌혈관센터 기능 강화 - 지역사회기반 예방사업, 전문인력 교육 등 기존 사업 강화
- 지역센터 지원 및 네트워크, 권역별 특화사업 개발 수행 등

02 지역생활권 중심 지역 심뇌혈관센터 구축

⊙ 지역책임의료기관 등에 지역심뇌혈관센터 운영 - 중앙-권역-지역센터 안전망 구축

⊙ 센터별 역할, 기능, 지정기준 마련 후 단계적 확대

03 권역-지역 심뇌혈관질환센터 기반 조기재활 강화

⊙ 급성심근경색, 뇌졸중 조기재활 표준화 및 센터 내 조기재활 강화
- 조기재활 현황조사, 표준지침 개발 및 적용

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보건복지부

(전략4) 환자 지속관리체계 구축

01 급성심근경색증, 뇌졸중 환자 퇴원 후 지역연계관리체계 구축

⊙ 퇴원 후 환자,보호자 대상 종합지원체계 구축
- 체계적 정보제공, 상담, 지역사회 서비스 연계 등
- 심뇌혈관질환 관리기관(진료, 재활 등) 정보제공
- 뇌졸중 환자, 보호자 위한 상담창구 구축 및 서비스 연계

02 급성기 퇴원 후 회복기-유지기 재활서비스 제공체계 구축

⊙ 조기재활, 재활서비스 제공/연계 위한 프로토콜 개발
→ 병원 내, 기관간 연계 활성화
- 급성기 이후 재활서비스 이용 현황과 경로 파악
- 재활의료기관 등으로 적정진료 연계체계 구축 (재활의료기관 지정 운영 시범사업과 연계)

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(전략5) 관리 인프라, 조사 R&D 강화

01 국가통계 생산체계 구축

- ⊙ 심뇌혈관질환 국가 통계 생산체계 구축 - 심뇌혈관질환 통계 조사관리체계 - 국가 단위 통계 산출 생산
- ⊙ 심뇌혈관질환 등록사업과 조사 강화 - 등록관리사업 대상지표, 대상기관 확대 - 심뇌센터 중심 지역 내 대학병원 등 협조체계

02 심뇌혈관질환 R&D 강화

- ⊙ 심뇌혈관질환 극복 위한 R&D 5개년 계획 수립
- ⊙ 기 개발된 임상진료지침 등 중재연구의 현장적용 방안 마련

03 전문인력 수요평가 및 역량 강화

- ⊙ 필수전문인력 현황 및 수요파악, 전문인력 양성 프로그램 운영

04 심뇌혈관질환 적정치료와 관리 지원

- ⊙ 진료, 재활 등 난이도에 따른 적정보상, 환자부담 완화

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보건복지부

기대효과

▣ 예방-치료-재활 전 과정의 정책과제 발굴

- ⊙ 예방-초기대응 캠페인, 조기재활-지역사회 재활 연계

▣ 심뇌혈관질환 관리를 위한 촘촘한 안전망 구축

- ⊙ 중앙-권역-지역 심뇌혈관센터 체계 구축

▣ 근거중심 정책을 위한 기반 마련

- ⊙ 심근경색, 뇌졸중 등 등록관리사업 확대
- ⊙ 기초자료 수집, 통계작성체계 구축

→ 과제별 세부 시행계획 마련, 연도별 시행 성과 평가

국가 심뇌혈관질환 예방 및 관리에 관한 정책방향 III

윤 일 규

국회의원, 국회보건복지위원회

ARCS 2019

ARTERIAL RECANALIZATION IN CEREBRAL STROKE

뇌졸중 재개통 심포지엄 및
대한뇌혈관내수술학회 2019
춘계보수교육

Session III. Interdisciplinary luncheon seminar

좌장 : 경희대 **고준석**

Pathophysiology of cerebral ischemic stroke	분당서울대병원 신경외과 **권오기**
Update of stroke prevention therapy for patient with non-valvular atrial fibrillatio	서울대병원 순환기내과 **최의근**
Integrating approach to AF with stroke: Rehabilitation concerns	강동경희대병원 재활의학과 **유승돈**

Pathophysiology of cerebral ischemic stroke

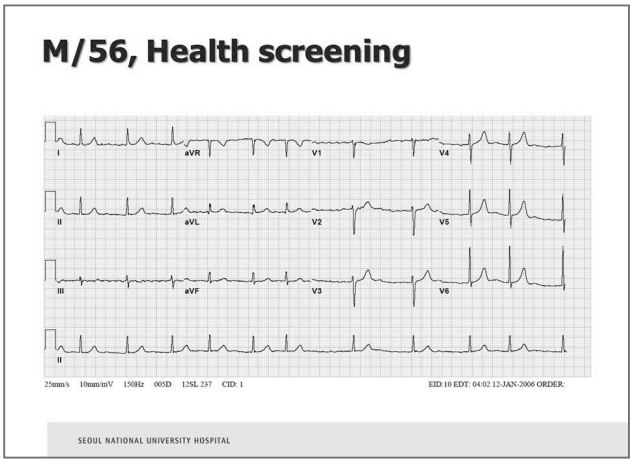
권 오 기

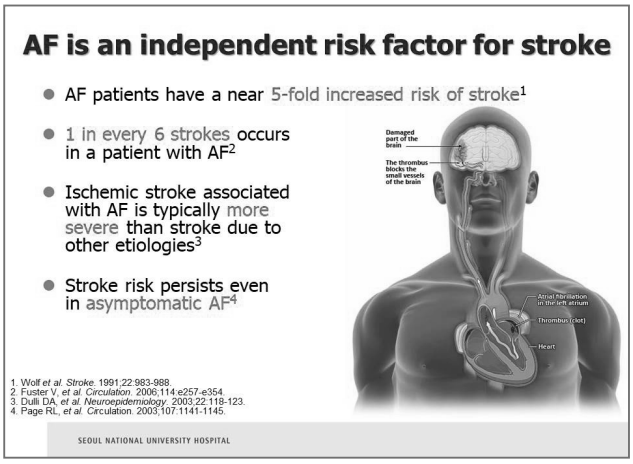
분당서울대병원 신경외과

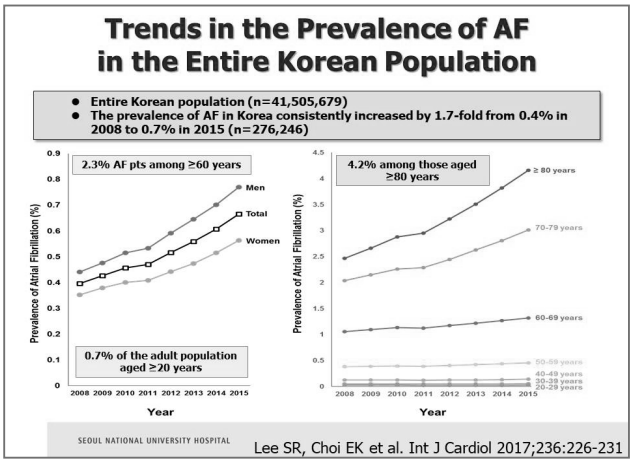
Update of stroke prevention therapy for patient with non-valvular atrial fibrillation

최 의 근

서울대병원 순환기내과

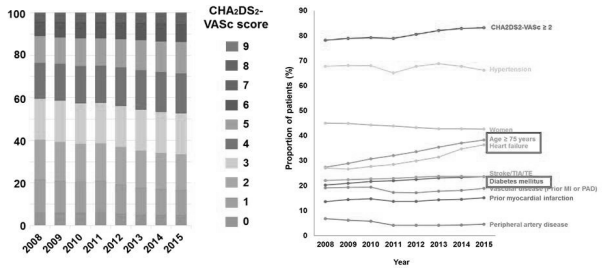






Lee SR, Choi EK et al. Int J Cardiol 2017;236:226-231

Distribution of CHA_2DS_2-VASc scores in Korean AF patients



SEOUL NATIONAL UNIVERSITY HOSPITAL

Lee SR, Choi EK et al. Int J Cardiol 2017;236:226-231

ESC 2010 guideline for stroke prevention : CHA_2DS_2-VASc

	Risk factor	Score
CHA_2DS_2	Congestive heart failure/LV dysfunction	1
	Hypertension	1
	Age ≥75	2
	Diabetes mellitus	1
	Stroke/TIA/thrombo-embolism	2
VASc	Vascular disease[a]	1
	Age 65–74	1
	Sex category (i.e. female sex)	1
	Maximum score	**9**

[a]Prior myocardial infarction, peripheral artery disease, aortic plaque

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ESC 2010 Guidelines for the management of atrial fibrillation

Validation of CHA_2DS_2-VASc score in Korean AF pts

Suggested **threshold of annual ischemic stroke risk for a favorable net clinical benefit from OAC** for patients with AF is **between 1% and 2%**[1]

The performance of **CHA_2DS_2-VASc score in Koreans was consistent with western** populations according to 2 Korea risk stratification studies[1]

CHA_2DS_2-VASc score	Adjusted stroke rate (%/year)[1,*]
0 (male) or 1 (female)	0.26
1 (male)	1.18
2	2.21
3	2.88
4	5.34
5	6.54
6	9.50
≥7	9.97
Total	3.79

*adjusted for Aspirin

CHA_2DS_2-VASc score	Adjusted stroke rate (%/year)[2]
0	0.61
1	0.92 *
2	2.10
3	3.49
4	5.14
5	9.53
6	17.35
7	41.44
8	37.48
9	48.17

*male 1.5%/year

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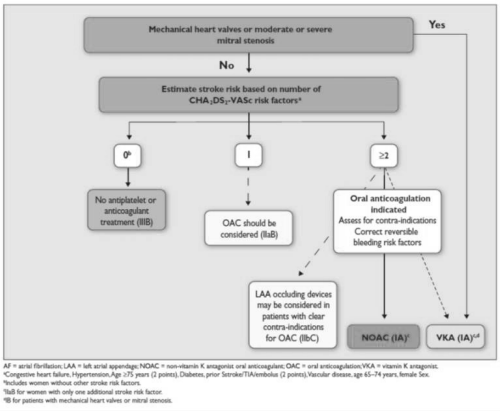
Ref. 1. Kim TH, Yang PS, Joung B, Lip GYH *et al.* Stroke 2017;48(6):1524-1530
2. Kang SH, Choi EK *et al.* Circ J 2017; 81: 1158–1164



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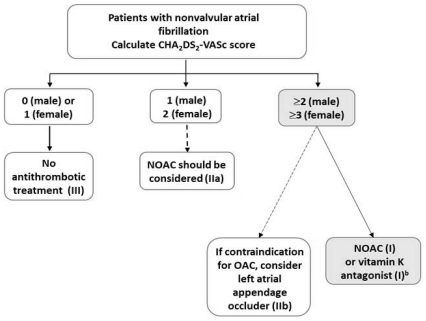
ESC 2016 Guidelines for the management of AF

2018 Korean Guideline of AF Management



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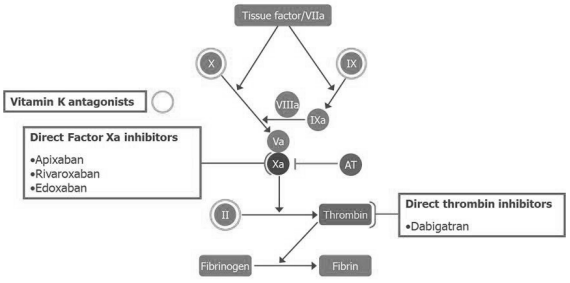
Korean Circ J 2018

Non-Vitamin K antagonist Oral Anticoagulants (NOAC)



SEOUL NATIONAL UNIVERSITY HOSPITAL

Weitz J, Bates S. J Thromb Haemost 2005;3:1843–53

Properties of NOACs

	Dabigatran	Apixaban	Rivaroxaban	Edoxaban
Action	Direct thrombin inhibitor	Activated factor Xa inhibitor	Activated factor Xa inhibitor	Activated factor Xa inhibitor
Dose	150 mg BID 110 mg BID (75 mg BID)	5 mg BID 2.5 mg BID	20 mg QD 15 mg QD	60 mg QD 30 mg QD
Phase III clinical trial	RE-LY	ARISTOTLE AVERROES	ROCEKT-AF	ENGAGE-AF
Elimination half-life	12-17 hr	12 h	11–13 h (elderly)	10-14hr
Renal clearance	80%	25%	33%	50%

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Heidbuchel H. Europace (2015) 17, 1467–1507

Summary of results from 4 RCTs

	Dabigatran 150 mg	Dabigatran 110 mg	Apixaban 5/2.5 mg	Rivaroxaban 20/15 mg	Edoxaban 60/30 mg
Dosing frequency	BID		BID	OD	OD
RCTs: major bleeding vs warfarin[1–4]	Not significant	20%	31%	Not significant	20%
RCTs: stroke/SE vs warfarin[1–4]	35%	Not significant	21%	Not significant	Not significant
RCTs: ischaemic stroke vs warfarin[3–4]	24%	Not significant	Not significant	Not significant	Not significant
RCTs: haemorrhagic stroke vs warfarin[1–5]	74%	69%	49%	41%	46%
Superior safety profile reinforced by comparative real-world data[7,8]	✓		✓	✗	✗
Specific reversal agent available	✓		✗	✗	✗

No head-to-head RCT comparison. Head-to-head data available from observational studies

SE, systemic embolism

1. Connolly et al. N Engl J Med 2014; **2.** Granger et al. N Engl J Med 2011; **3.** Patel et al. N Engl J Med 2011; **4.** Giugliano et al. N Engl J Med 2013; **5.** Pradaxa®. EU SPC, 2016; **6.** Lopes et al. Lancet 2012; **7.** Larsen et al. BMJ 2016; **8.** Lin et al. ESC 2015

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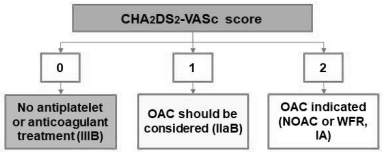
OAC therapy for stroke prevention in AF patients



Recommendations	Class	Level
In male or female AF patients **without additional stroke risk factors**, anticoagulant or antiplatelet therapy is not recommended stroke prevention	III (harm)	B
OAC to prevent TE should **be considered** in **male with a CHA_2DS_2-VASc = 1** and **female with a CHA_2DS_2-VASc = 2**, considering individual characteristics and patient preferences.	IIa	B
OAC to prevent TE **is recommended** for all **male with a CHA_2DS_2-VASc ≥ 2** and all **female with a CHA_2DS_2-VASc ≥ 3**.	I	A
When OAC is initiated in a patient with AF who is eligible for a NOAC, a **NOAC** is recommended in preference to a VKA.	I	A

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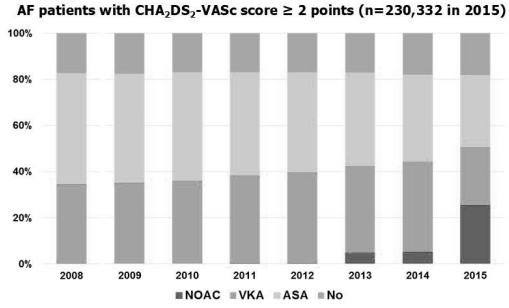
ESC AF guideline 2016

Underutilization of Antithrombotic therapy in the Entire Korean Population



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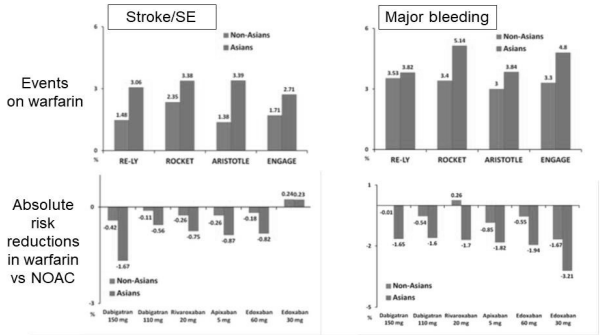
Lee SR, Choi EK et al. PLOS one 2017 Dec

Asian results from 4 RCTs



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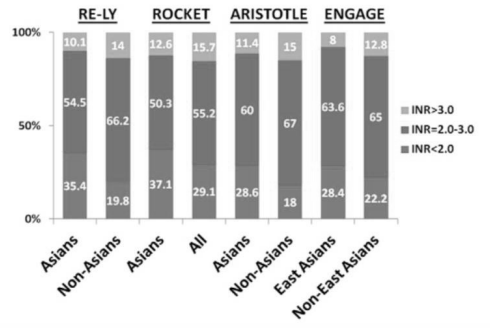
Lip GYP IJC 2015:180; 246–254

Data on warfarin in Asians



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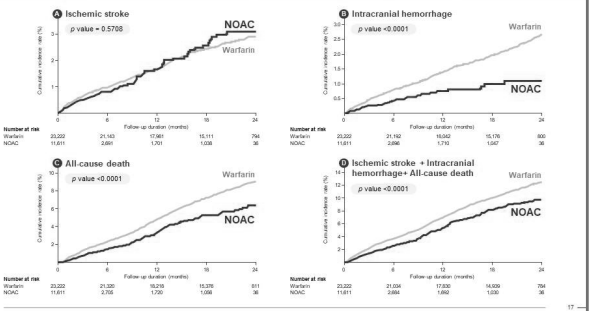
Lip GYP IJC 2015:180; 246–254

Risk of stroke, ICH and all-cause mortality

NOAC vs Warfarin

Crude cumulative incidence curves of ischemic stroke, intracranial hemorrhage, all-cause mortality, and combined outcome according to initiated treatment



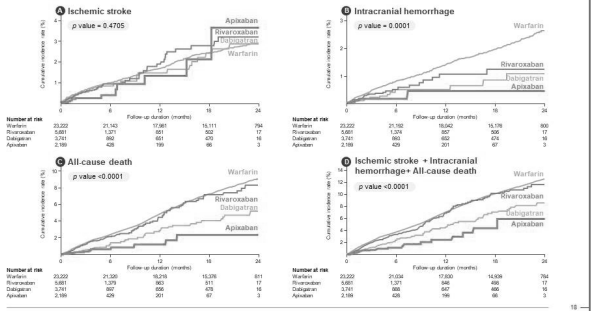
1. Cha MJ, Choi EK et al. Stroke. 2017;48:3040-3048.. DOI: 10.1161/STROKEAHA.117.018773.

17

Risk of stroke, ICH and all-cause mortality

Each NOAC vs Warfarin

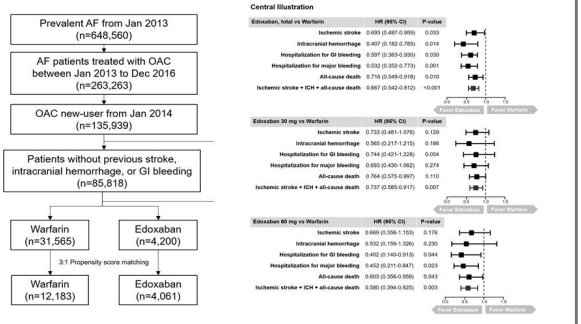
Crude cumulative incidence curves of ischemic stroke, intracranial hemorrhage, all-cause mortality, and combined outcome according to initiated treatment



1. Cha MJ, Choi EK et al. Stroke. 2017;48:3040-3048.. DOI: 10.1161/STROKEAHA.117.018773.

18

The first real world data in Edoxaban



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Lee SR, Choi EK et al. JACC 2018;72:838–53

Initiator of anticoagulant Tx

- Establishes indication for anticoagulation
- Checks baseline labs
  - Hb, renal and liver function, full coagulation panel
- Chooses anticoagulant and correct dose
- Check concomitant drugs : antiplts, NSAIDs, etc
- Provides education and hands out OAC card
- Organizes follow-up

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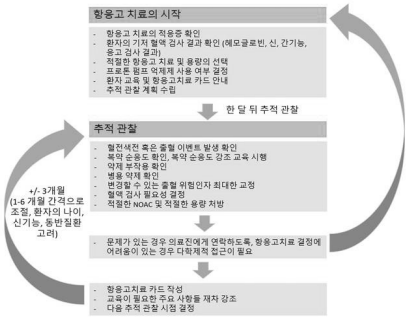
2018 EHRA practical guideline on NOAC use in AF

NOAC 환자의 약제 복용 시작 및 추적 관찰 계획



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2018 대한부정맥학회 심방세동 환자에서 비타민 K 비의존성 경구 항응고제 사용 지침
2018 EHRA AF management practical guideline

심방세동 환자에서 NOAC의 적응증과 금기증

동반 질환 및 상태	NOAC 사용의 적합성
기계판막치환술	금기
중등도 이상의 승모판 협착증	금기
경도 및 중등도의 다른 판막 질환 (경도 및 중등도의 대동맥판막 협착증, 역류증 또는 퇴행성 승모판 역류증)	적합
심한 대동맥판막 협착증	데이터 부족
조직대동맥판막 치환술 (수술 3개월 이후)	적합
조직승모판막 치환술 (수술 3개월 이후)	적합 (퇴행성 승모판 역류증의 경우)
	부적합 (승모판 협착증의 경우)
승모판 성형술 (수술 3개월 이후)	적합
PTAV and TAVI	데이터 부족
비후성 심근병증	적합할 수 있음

PTAV, percutaneous transluminal aortic valvuloplasty; TAVI, transcatheter aortic valve implantation

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Simplified schema to physician choice of anticoagulant

Recurrent stroke, systemic embolic event, or TIA despite good TTR (>70%)	D150
High risk of bleeding (HAS-BLED ≥3)	D110, A, E
High risk of GI bleeding	D110, A, (E)
Asian patients (consider drugs with reduced risk of ICH and major bleeding in Asian subgroups)	A, D, E
Once daily dosing or preference to have a lower pill burden	W, R, E
Gastrointestinal symptoms or dyspepsia	A, R, E
Moderate-to-severe renal dysfxn (CrCl 15-49)	A*, D, E30, R15

A, apixaban; D, dabigatran; E, edoxaban; R, rivaroxaban; W, warfarin

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Chest guideline and Expert Panel Report. Chest 2018

NOAC DOSING RECOMMENDATIONS

	Dabigatran	Rivaroxaban	Apixaban	Edoxaban
표준 용량	150mg bid	20mg qd	5mg bid	60mg qd
저용량	110mg bid	15mg qd	2.5mg bid	30mg qd
용량 감량 기준	- 기준 없음. 단, 고령 (80세 이상)시 110mg을 추천	CrCl ≤ 50ml/min	다음 중 두 가지 이상에 해당시 • 체중 60kg 이하 • 나이 80세 이상 • s-Cr 1.5 mg/dl 이상	다음 중 한 가지 이상에 해당시 • 체중 60kg 이하 • CrCl ≤ 50ml/min • P-Gp 억제제 병용

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2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS

Modifiable risk factors	Non-modifiable risk factors
Hypertension (especially when systolic blood pressure is >160 mmHg)	Age (>65 years) or (≥75 years)
Labile INR or time in therapeutic range <60%a in patients on vitamin K antagonists	History of major bleeding
Medication predisposing to bleeding, such as antiplatelet drugs and NSAIDs	Previous stroke
Excess alcohol (≥8 drinks/week)	Dialysis-dependent kidney disease or renal transplant
	Cirrhotic liver disease
	Malignancy
	Genetic factors

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2016 ESC Guidelines for the management of AF

Follow-up of anticoagulant Tx

- Check for thromboembolic and bleeding events
- Assess adherence & education
- Assess co-medication and OTC drugs
- Assess modifiable risk factors and minimize
- Blood sampling
  - hemoglobin, renal and liver function

Yearly	
6-monthly	≥ 75 years (especially if on dabigatran) or frail
X-monthly	If renal function CrCl ≤ 60ml/min: recheck interval = CrCl/10

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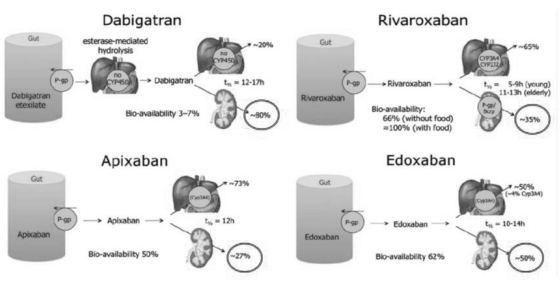
2018 EHRA practical guideline on NOAC use in AF

Absorption and metabolism of NOACs



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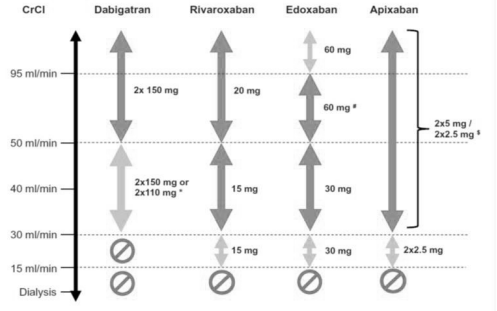
Heidbuchel H. Europace (2015) 17, 1467–1507

NOAC dose according to renal fxn



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2018 EHRA practical guideline on NOAC use in AF

Classification of elective surgical interventions according to bleeding risk

Interventions with minor bleeding risk	Interventions with low bleeding risk (i.e. infrequent or with low clinical impact)	Interventions with high bleeding risk (i.e. frequent and/or with high impact)
Dental interventions	Endoscopy with biopsy	Complex endoscopy (e.g. polypectomy, ERCP with sphincterotomy etc.)
Extraction of 1-3 teeth	Prostate or bladder biopsy	Spinal or epidural anaesthesia; lumbar diagnostic puncture
Parodontal surgery	Electrophysiological study or catheter ablation (except complex procedures, see below)	Thoracic surgery
Incision of abscess	Non-coronary angiography (for coronary angiography and ACS: see Patients undergoing a planned invasive procedure, surgery or ablation section)	Abdominal surgery
Implant positioning	Pacemaker or ICD implantation (unless complex anatomical setting, e.g. congenital heart disease)	Major orthopaedic surgery
Cataract or glaucoma intervention		Liver biopsy
Endoscopy without biopsy or resection		Transurethral prostate resection
Superficial surgery (e.g. abscess incision; small dermatologic excisions; …)		Kidney biopsy
		Extracorporeal shockwave lithotripsy (ESWL)

No interruption | 0.5-1 day | 2 days

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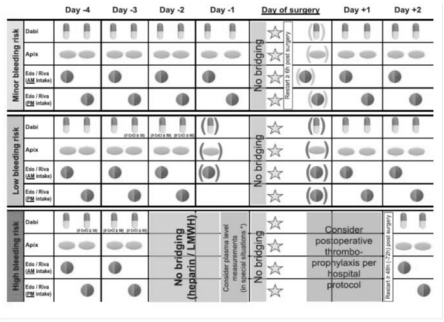
2018 EHRA practical guideline on NOAC use in AF

Management of NOAC in elective surgery



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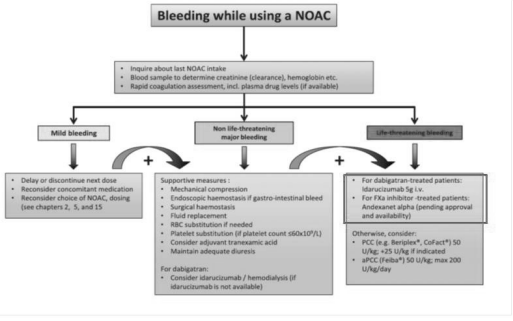
2018 EHRA practical guideline on NOAC use in AF

Management of bleeding in pts with NOAC



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2018 EHRA practical guideline on NOAC use in AF

Reversal Agents for NOAC

Reversal agent	Target	Mechanism of action
Idarucizumab	Dabigatran	Humanized Fab: specifically binds dabigatran with high affinity2
Andexanet alfa	FXa inhibitors	Recombinant modified FXa: competitive affinity for direct FXa inhibitors3
Ciraparantag	Universal	Synthetic small molecule: hydrogen bonds (NOACs); charge–charge interactions (heparin)4

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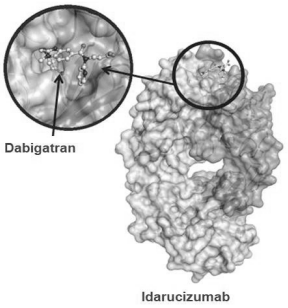
Idarucizumab



- Humanized Fab fragment
- Binding affinity for dabigatran **~350× higher** than dabigatran to thrombin
- IV administration, immediate onset of action
- Short half-life
- No intrinsic procoagulant or anticoagulant activity expected

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Adapted from Schiele F et al. Blood 2013; Stangier J et al. ISTH 2015, OR320

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Idarucizumab for Dabigatran Reversal — Full Cohort Analysis

Charles V. Pollack, Jr., M.D., Paul A. Reilly, Ph.D., Joanne van Ryn, Ph.D., John W. Eikelboom, M.B., B.S., Stephan Glund, Ph.D., Richard A. Bernstein, M.D., Ph.D., Robert Dubiel, Pharm.D., Menno V. Huisman, M.D., Ph.D., Elaine M. Hylek, M.D., Chak-Wah Kam, M.D., Pieter W. Kamphuisen, M.D., Ph.D., Jörg Kreuzer, M.D., Jerrold H. Levy, M.D., Gordon Royle, M.D., Frank W. Sellke, M.D., Joachim Stangier, Ph.D., Thorsten Steiner, M.D., Peter Verhamme, M.D., Bushi Wang, Ph.D., Laura Young, M.D., and Jeffrey I. Weitz, M.D.

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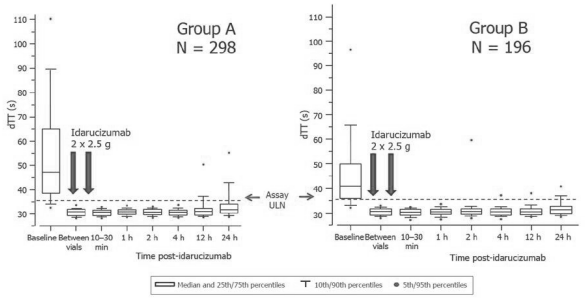
N Engl J Med. 2017 Aug 3;377(5):431-441

Diluted Thrombin Time (dTT) - Assessment of Reversal of Dabigatran Anticoagulation with Idarucizumab



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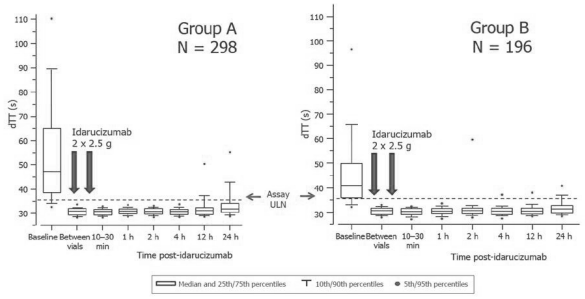
RE-VERSE AD™ N Engl J Med. 2017 Aug 3;377(5):431-441

Diluted Thrombin Time (dTT) - Assessment of Reversal of Dabigatran Anticoagulation with Idarucizumab



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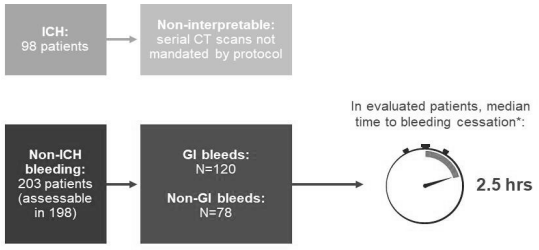
RE-VERSE AD™ N Engl J Med. 2017 Aug 3;377(5):431-441

Group A: Local Confirmation of Hemostasis



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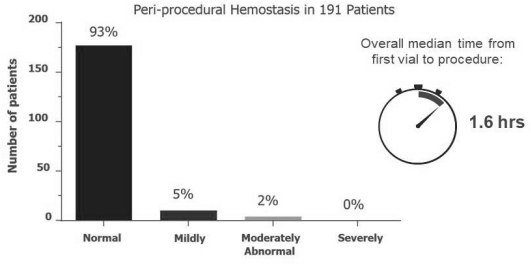
RE-VERSE AD™ N Engl J Med. 2017 Aug 3;377(5):431-441

Group B: Peri-procedural Hemostasis

- 191 of 196 (97.4%) patients underwent surgery/procedures



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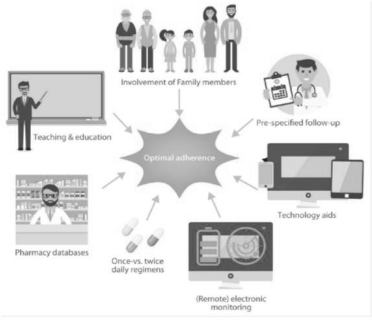
RE-VERSE AD™ N Engl J Med. 2017 Aug 3;377(5):431-441

Adherence to NOAC



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2018 EHRA practical guideline on NOAC use in AF

Summary

- The proportion of AF patients who were candidates for anticoagulation therapy also significantly increased owing to population aging and increasing comorbidities (i.e., heart failure and diabetes)
- All four NOACs demonstrated similar or lower risk of ischemic stroke and a lower risk of ICH compared to warfarin
- It would be more important to use appropriate dose in indicated patients, and adhere to current guideline
- Idarucizumab provides an additional option in the management of emergency surgery and life-threatening bleeding in dabigatran treated patients

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Youngjin Cho, MD
SMG-SNU Boramae
Medical Center EP lab
Woo-Hyun Lim, MD
Animal Lab
Moo-Kang Kim
Jee-Hee Chang
Clinical Research
Hyun-Joo Yu
Ji-Hee Min
Sein Hwang
Da-jung Hur
Bo-mi Yu
Soon Chun Hyang
University Hospital
Seoul
So-Ryoung Lee, MD
The Catholic
University of Korea
Kyung-Do Han, PhD
Thank you for your attention

Integrating approach to AF with stroke: Rehabilitation concerns

유승돈

강동경희대병원 재활의학과

ARCS 2019
ARTERIAL RECANALIZATION IN CEREBRAL STROKE
뇌졸중 재개통 심포지엄 및
대한뇌혈관내수술학회 2019
춘계보수교육

Integrating approach to AF with stroke: Rehabilitation concerns

유승돈
강동경희대병원 재활의학과
2019년 2월 23일

Contents

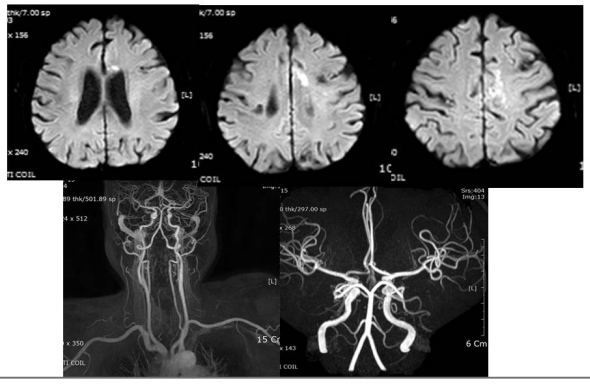
- Case
- Integrating approaches to atrial fibrillation management: **EHRA consensus**
- Integrating approaches to atrial fibrillation: **Rehabilitation concerns**

Case 1

- 73/f
- **Rt side weakness (2019.1.14) at Lt centrum semiovale, 2nd attack**
- Past Hx:
  - HTN/DM(7YA), RA(7YA), paroxysmal AF, cerebral inf at Rt inf frontal (2YA)

  -> UGI bleeding (Lixiana 중단), dual(aspirin+pletaal) 유지, tambocor(flexainide) 50mg bid, conbloc(bisoprolol) 1.25mg qd
- Previous state: walker gait
- Motor: u 5/4, low 5/4
- moderate assisted gait

MRI diffusion + MRA



1. 약제 변경

1) 항혈소판제 유지
2) 항응고제 재투여
3) Tambocor 50mg bid 유지
4) Tambocor 75mg bid 증량
5) Bisoprolol 1.25mg 유지 또는 증량

1. 약제 변경 결과

- Holter; short AF, frequent APCs, bradycardia 88%, min/max/ave HR 39/119/53 bpm
- 현재 약제; edoxaban 30mg, bisoprolol 1.25mg, tambocor 75mg bid, exforge 5/80mg
- 맥박이 느린 편이어서, bisoprolol 1.25mg qd 는 중단하시는 것이 좋겠습니다. 나머지 약은 현재와 같이 유지해 주십시오.

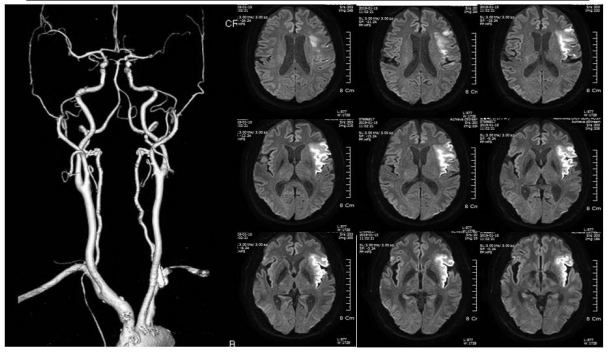
2. 재활치료

1) NIHSS 2
2) MMSE 28
3) RA and DM: toe amputation
4) Cardio: tambocor 75mg bid, edoxaban 30mg qd
5) HR: 54~56; Hb: 7.7 -> 10.7
6) Motor: 5/4, walker standing: no Sx

Case 2

- 71/m
- **Aphasie (2019.1.15) at Lt MCA territory infarction, 1st attack with M2 moderate stenosis**
- Past Hx:
  - DM(7YA), dyslipidemia
- Previous state: 일상생활 가능
- Initial NIHSS 10
- Motor: u 4/5, low 4/5
- Gait: supervision

MRI diffusion + CT angio



1. 약제 변경

Echo; possible early stage of apical cardiomyopathy
ECG: AF RVR, 71 bpm
Holter; paroxysmal AF 12%

-> 항응고치료가 필수적이며, sinus rhythm 으로 유지하기 위해 **amiodarone 200mg qd** 를 사용하시기 바랍니다.

aspirin 100mg -> 1.16 enoxaparin 60mg bid -> lixiana 60mg

HR: 55, aricept 5mg 투약

-> **amiodarone을 100mg qd 로 감량**해 주십시오. 일주일에 2-3회 심전도 찍어 주시기 바랍니다.

2. 재활치료

- 1.18 BBS 34
- 1.21
  k-WAB AQ 19.4, 12%ile, transcortical motor
  K-MBI 63, MFT 28/27; MMSE-K 1
- Independent gait

- 2019.1.6 71 bmp
- 2019.1.15 111 bpm
  -> 1/16 amiodarone 200mg, 1/18 edoxaban 60mg
- 2019.1.30 54 bpm
- 2019.2.1 50 bpm, sinus bradycardia
  -> 2019.2.1 amiodarone 100mg 감량

2019.1.30 운동 전후 BP, HR

- **1.30 step box, 20 repeat per minute**

	BP	HR
- resting :	131/65	60
- exercise:	130/65	61
- recovery:	130/62	60

- **2.13 Treadmill speed 2.0 km/h로 20분**

	BP	HR
- resting :	109/61	69
- exercise:	114/64	96
- recovery:	113/65	70

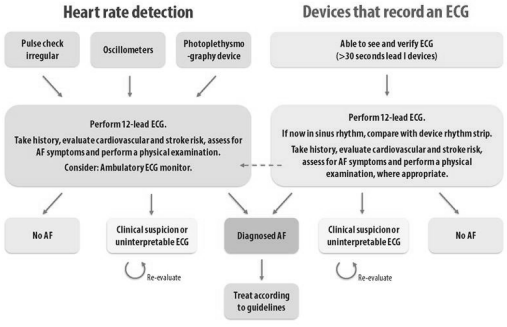
ESC European Society of Cardiology Europace (2018) 20, 395–407 doi:10.1093/europace/eux318 EHRA CONSENSUS STATEMENT

Integrating new approaches to atrial fibrillation management: the 6th AFNET/EHRA Consensus Conference

- **Diagnosis and screening**
  - Atrial fibrillation detection in an era of digital evolution
  - Self-initiated heart rhythm monitoring
  - Criteria for atrial fibrillation diagnosis and the impact of screening
  - The impact of atrial fibrillation detection and stroke risk

D. Kotecha et al. Europace (2018) 20, 395–407

Clinical methods to deal with self-initiated rhythm monitoring by the general public



D. Kotecha et al. Europace (2018) 20, 395–407

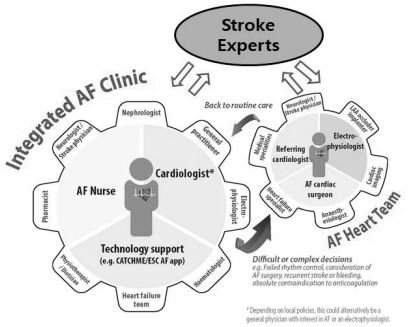
ESC European Society of Cardiology Europace (2018) 20, 395–407 doi:10.1093/europace/eux318 EHRA CONSENSUS STATEMENT

Integrating new approaches to atrial fibrillation management: the 6th AFNET/EHRA Consensus Conference

- **Integrated care of atrial fibrillation patients**
  - Definition of integrated care
  - Eligible patients and entry/exit criteria for integrated care
  - Technology tools to ensure the success of integrated care

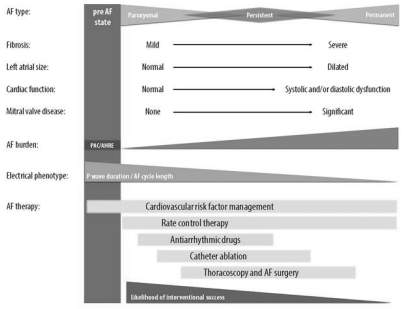
D. Kotecha et al. Europace (2018) 20, 395–407

Integrated AF care and the AF Heart Team



D. Kotecha et al. Europace (2018) 20, 395–407

Atrial cardiomyopathy



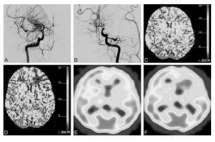
Pre-AF, atrial cardiomyopathy, and the spectrum of AF management. AHRE, atrial high rate episodes; PAC, premature atrial complex.

D. Kotecha et al. Europace (2018) 20, 395–407

Stroke prevention

- Safety of discontinuing anticoagulation in specific patient groups
- Anticoagulation after serious bleeding
- Left atrial appendage occlusion

D. Kotecha et al. Europace (2018) 20, 395–407

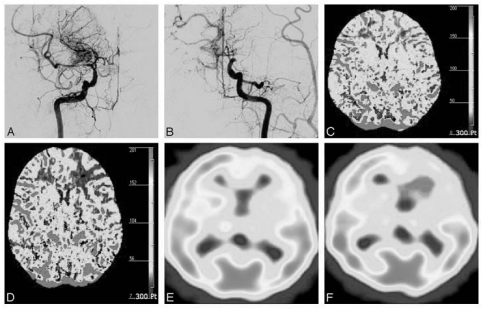


INTEGRATING APPROACH TO ATRIAL FIBRILLATION: REHABILITATION CONCERNS

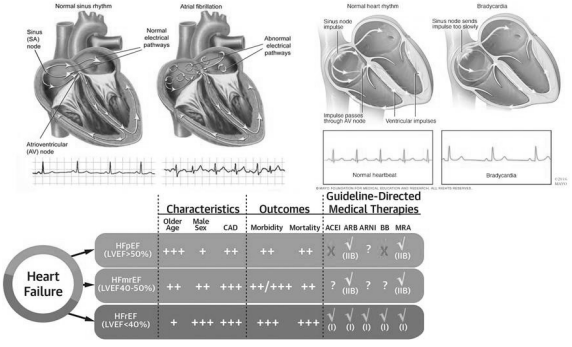
CONSIDERATION!!

- Cerebral hemodynamic reserve
  - Diamox SPECT, collateral
- Cardiac reserve
  - HR, EF, LA,
- Rehabilitation potential
  - Gait using any support vs bed rest
- Monitoring
  - teleECG, cardiac stress test, BP/HR monitoring before/after Rehabilitation

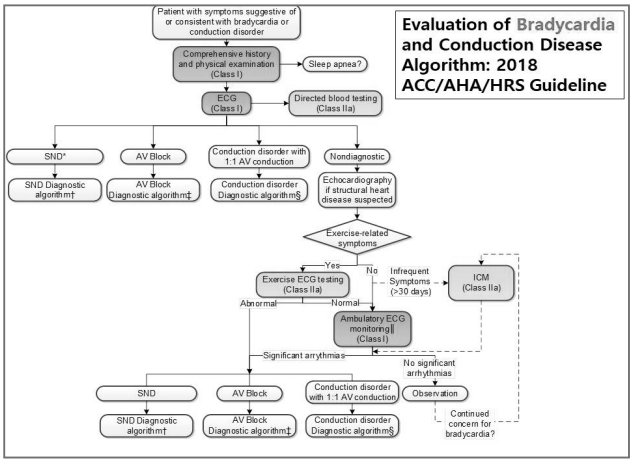
Cerebral hemodynamic reserve



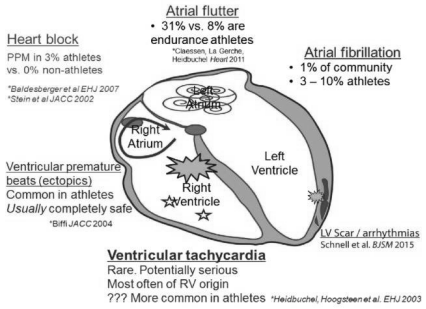
Cardiac reserve: rhythm & rate control?



Heart Failure With Mid-Range Ejection Fraction. Jeffrey J. Hsu JCHF 2017



The Potential Cardiotoxic Effects of Exercise



Risk stratification

- CHADS2 score
- CHA2DS2-VASc score
- HAS-BLED score
- Antiplatelet use
- anticoagulation use before

- Cardioembolic stroke severity among **BMI***
  - NIHSS on admission* (p.002)
  - mRS at discharge* (p.001)
  - Mortality (.13)
  - Period of hospitalization (days) (.51)

J. Hagii et al. Journal of Stroke and Cerebrovascular Diseases 2018

입원 운동 중단: 심장재활 준용

- 걷기 이상의 운동을 할 경우에는 운동 전, 운 동 중, 운동 후 혈압, 심박수, 심전도를 모니터링
- 운동 중에 협심증 및 중등도 이상의 호흡곤란을 호소
- 심박수가 운동 전에 비하여 분당 20회 이상 증가 또는 10회 이상 감소
- 새로운 부정맥
- 수축 기 혈압이 기저치보다 10 mmHg 이상 감소
- 혈압이 비정상적으로 상승(수축기 혈압 220 mmHg 이상, 이완기 혈압이 110 mmHg 이상)

입원 재활: Rehabilitation concerns

- 합병증이 없는 단순 심근경색 환자는 **발병 2-3일경부터** 의료진의 감시 하에 **낮은 강도**의 운동
- 누운 자세가 앉은 자세보다 심근산소요구량을 더 높이므로 침상에서도 가능한 **앉은 자세**
- 호흡운동, 이완운동, 소 근육을 이용한 동적운동으로 시작
- 점차 **대근육 운동**을 거쳐 서기, 걷기

-> Tele ECG monitoring, cardiac stress test, 운동자각지수

외래 재활?

경청 해 주셔서 감사합니다.

- 아직 뇌졸중을 동반한 심방세동/부정맥 환자의 재활치료 프로토콜은 마련 중입니다.
- 관련 과의 협진과 토의를 통한 **best practice decision**을 환자마다 결정하는 것이 좋습니다.
- 위험 요소가 있는 환자 **selection과 monitoring**으로 재발을 최소화하고 기능회복을 기대할 수 있습니다.

ARCS 2019

ARTERIAL RECANALIZATION IN CEREBRAL STROKE

뇌졸중 재개통 심포지엄 및
대한뇌혈관내수술학회 2019
춘계보수교육

Session IV. Debate session: beyond the scope of recent RCTs what we need to consider

좌장 : 분당제생병원 **신승훈**, 가톨릭대 **김성림**

Mechanical thrombectomy in IV rtPA in-eligible patients	충남대 **권현조**
Mechanical thrombectomy for patients with low NIHSS in ELVO	계명대 **김창현**
Mechanical thrombectomy in atherosclerotic ELVO	순천향대 **오재상**
Mechanical thrombectomy for patients with large DWI lesion	차의과학대 **김태곤**

Mechanical thrombectomy in IV r-tPA ineligible patients

권 현 조

충남대학교병원 신경외과

현재 임상적으로 사용되고 있는 급성 뇌경색 환자에서의 intravenous (i.v.) tPA주사요법 금기사항들은 대부분 주요 stroke trial들의 exclusion criteria로부터 만들어졌으며, NINDS (National Institute of Neurological Disorders and Stroke) trial의 expert consensus에서 기원한다. 이러한 i.v. tPA 금기사항들 중 일부는 지나치게 제한적이라는 비판이 있어왔고 2018년 개정된 guideline에서는 일부 완화되어 발표되었다. 증상 발생 후 3~4.5시간 이내의 경증 환자, MRI에서 cerebral microbleed가 10개 이하인 환자에서도 사용할 수 있도록 개정되었으며, i.v. tPA사용 후 24시간 이내에 항혈소판제나 항혈전제의 사용이 일부에서는 고려될 수 있다는 내용도 추가되었다. 반면에 Glycoprotein IIb/IIIa receptor inhibitor (Abciximab)와 동시 주입하는 것과 24시간 이내에 LMWH을 치료 용량으로 주사받은 경우에는 여전히 사용이 금지되고 있다. 또한, 18세 미만의 환자, 증상 발생 시점이 불분명한 경우나 4.5시간이 지난 경우, 급성 뇌출혈이 있는 경우, 3개월 이내에 허혈성 뇌졸중이 있었던 경우, 3개월 이내의 심한 두부 외상, 급성 외상 후 posttraumatic infarction이 있는 경우, 3개월 이내에 intracranial or intraspinal surgery를 받은 경우, 두개내출혈 병력이 있는 경우, 지주막하출혈의 증상과 증후가 있는 경우, GI malignancy나 21일 이내의 GI bleeding이 있었던 경우, Coagulopathy가 있는 경우, infective endocarditis가 있는 경우, aortic arch dissection이 있는 경우, intraaxial intracranial neoplasm이 있는 경우 등에서도 사용은 제한되고 있다.

최근에 이러한 제한 등으로 i.v. tPA를 사용하지 못하고 mechanical thrombectomy를 시행하는 경우와 함께 사용한 경우들의 결과를 비교한 보고가 이어지고 있는데, i.v. tPA를 미리 시행한 bridging therapy가 더 우수하다는 결과와 mechanical thrombectomy만 단독으로 사용한 경우와 큰 차이가 없다는 결과들이 모두 보고되고 있다. 따라서, 두 방법 간의 우월성 비교는 적절한 randomized controlled study가 나온 후에야 가능할 것이다.

이번 강의에서는 i.v. tPA의 적응증 및 금기 사항들과 i.v. tPA 사용 유무에 따른 결과 차이를 보고한 문헌들을 review하고, 실제 환자의 수술 증례들을 소개한다.

Mechanical thrombectomy for patients with low NIHSS in ELVO

김 창 현

계명대학교 동산의료원 신경외과

Introduction : Mechanical thrombectomy has been recently used as the standard therapy for patients with emergent large vessel occlusion (EVLO) and NIHSS score 〉 6. When patients with ELVO present with minor stroke (NIHSS 〈 5 or 〈 8), there were no consensus on the role of mechanical thrombectomy.

Methods : We reviewed systematic reviews and meta-analyses to describe the safety and efficacy of mechanical thrombectomy versus best medical treatment in patients with ELVO and low NIHSS score.

Result : In one paper, compared with best medical management-Mechanical thrombectomy, patients with immediate MT were younger, had more often atrial fibrillation, higher baseline NIHSS, higher ASPECT score, more middle cerebral artery-M1, and less middle cerebral artery-M2 occlusions. In another paper, when compared with medical therapy without iv tPA, mechanical thrombectomy and medical therapy with iv tPA, were associated with improved 90-day modified Rankin Scale (mRS) score. Among medical patients who were not eligible for iv tPA, those who underwent mechanical thrombectomy were more likely to experience good mRS at 3-month than who were not. There was no significant difference in functional outcome between mechanical thrombectomy and medical therapy with iv tPA.

Conclusion : In several papers on the patients for ELVO presented with low NIHSS, they suggest that mechanical thrombectomy with iv tPA resulted in good functional outcome at 3-month. Also, mechanical thrombectomy plays an important role in the patients who are not eligible for iv tPA. And, immediate mechanical thrombectomy in ELVO with low NIHSS may be safe and has the potential to result in good outcomes.

Mechanical thrombectomy in atherosclerotic ELVO

오 재 상

순천향대

Mechanical Thrombectomy in atherosclerotic ELVO

Jae-Sang Oh

Soonchunhyang University
Cheonan Hospital
Neurosurgery department

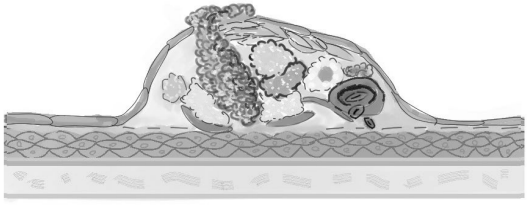
Etiology of LVO

- Embolic LVO
  - Cardio-embolic
  - Artery-to-artery embolic
- ***In-situ atherosclerotic LVO***

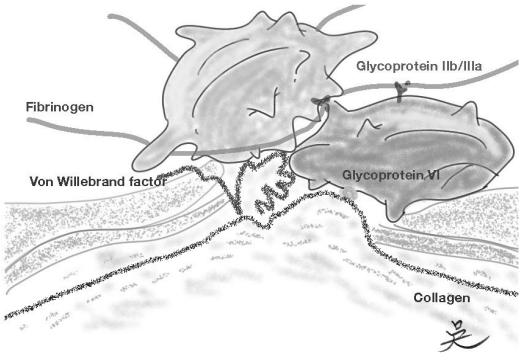
Pathogenesis of Atherosclerosis

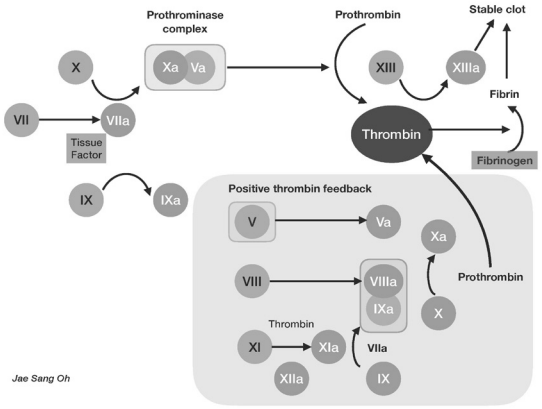
- Inflammatory pathogenesis
- Hemostatic pathogenesis

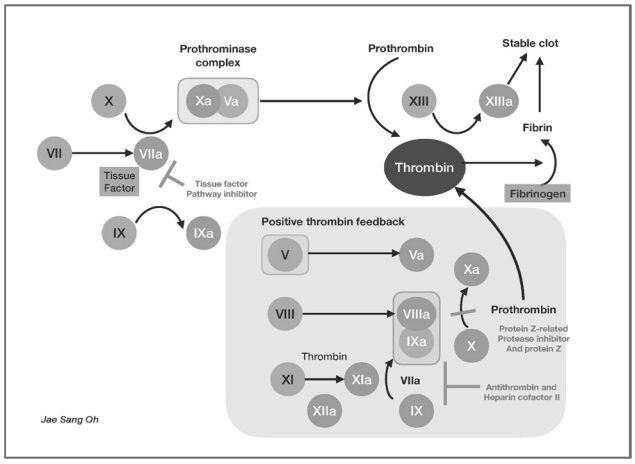
Inflammatory pathogenesis of ICAS



Hemostatic pathogenesis of ICAS







AIS with Atherosclerotic LVAO

- Incidence
- Diagnosis
- Management
- Prognosis

Incidence of ICAD

- Intracranial atherosclerotic disease (ICAD)
  - Systemic atherosclerosis
  - MCA (m/c) > BA > ICA > VA
  - African-American, Asia (CJKI), Hispanic

Incidence of ICAD

- Severe ICAD on autopsy
  - 43% (60-69yrs)
  - 65% (70-79yrs)
  - 80% (>80yrs)
- In non-valvular Af patients of Korean, ICAD>50% was 29.6% on angiogram.[1]

Incidence of atherosclerotic ELVO

- 20-40 per 100,000 related IS
- Atherosclerotic ELVO[2]
  - 5.5% in French
  - 15% on anterior circulation in Korean
  - 35% on vertebrobasilar in Korean

Incidence of atherosclerotic ELVO

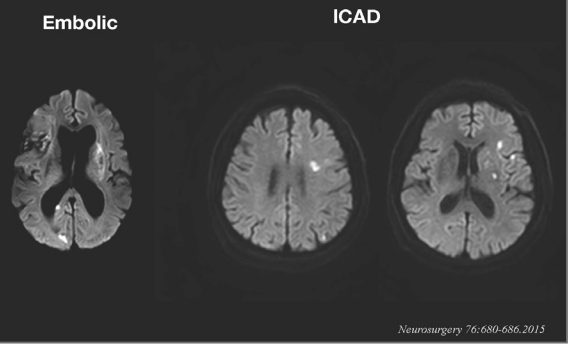
- Predictor
  - m/c: M1 or VB
  - Lower initial baseline NIHSS score than embolic ELVO
- Risk factors
  - Dyslipidemia
  - Smoking
  - Not AF, HTN

AIS with Atherosclerotic ELVO

- Incidence
- **Diagnosis**
- Management
- Prognosis

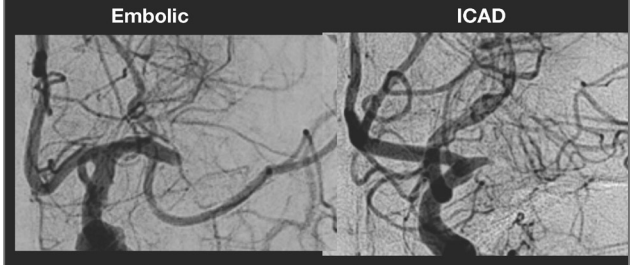
Diagnosis of atherosclerotic ELVO[4]

Two cases of Left M1 occlusion



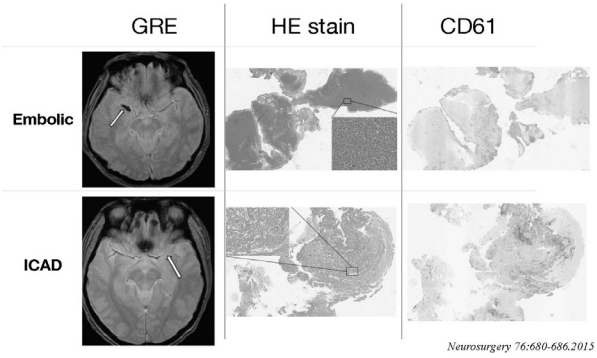
Neurosurgery 76:680-686,2015

Diagnosis of atherosclerotic ELVO



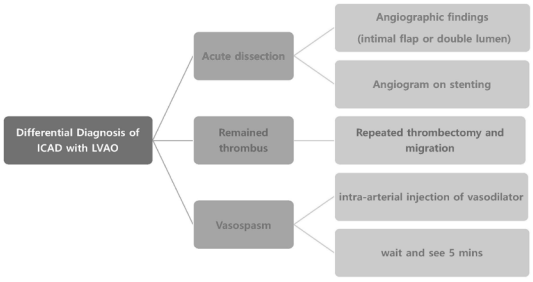
	Embolic	ICAD
Initial angiogram	contrast stagnation	sharp MVR sign
Collateral	+	+++
NIHSS score	Relatively high	Relatively low

Diagnosis of atherosclerotic ELVO[3]



Neurosurgery 76:680-686,2015

Differential diagnosis of Atherosclerotic ELVO



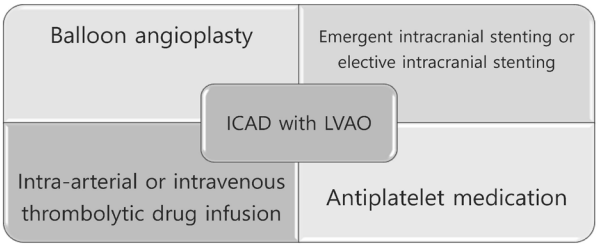
AIS with Atherosclerotic ELVO

- Incidence
- Diagnosis
- Management
- Prognosis

Treatment indication of Atherosclerotic ELVO

- Severe ICAS (≥70% stenosis of WASID)
- Bool flow impairment
- Re-occlusion on repeated angiogram
- Diffusion-perfusion mismatch

Management of Atherosclerotic ELVO



Balloon angioplasty

- Recanalization of stenotic portion > 50 %
- High re-occlusion risk
- Only PTA as acute management ?

Emergent intracranial stenting Elective intracranial stenting

- Recanalization of stenotic portion > 50 %
- High re-occlusion risk
- Only ICS as acute management without medication control?
- SAMPRIS study !!!

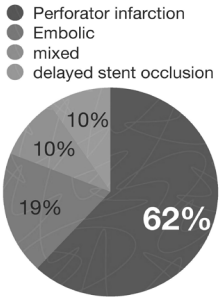
SAMPRIS study

- ☆ Stenting versus Aggressive Medical Therapy for Intracranial Arterial Stenosis
  - ☆ 451 patients
  - ☆ **30-day rate of stroke and death**
  - ☆ 14.7% in PTAS vs 5.8% medical group

Chimowitz et al ; SAMPRIS; NEJM 365;993-1003.2011

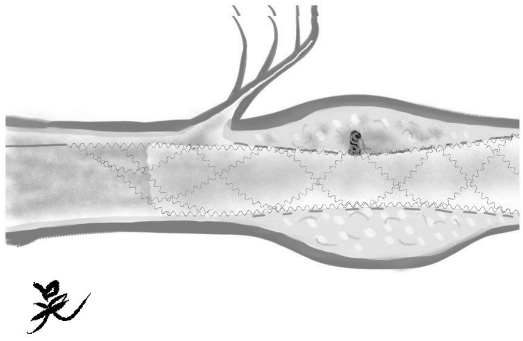
Detailed analysis of SAMPRIS

- ☆ **224 patients of PTAS**
- ☆ **208 stenting**
- ☆ **19 Ischemic stroke**
- ☆ **m/c is perforator infarction**

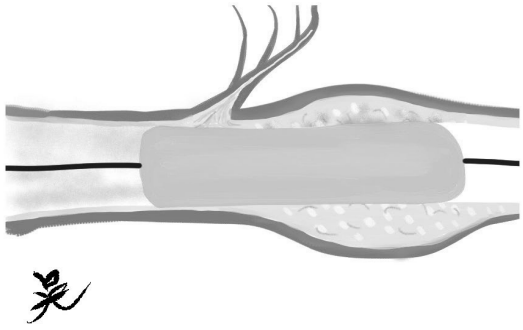


Fiorella, Stroke 43; 2682-2688,2012

Progression from ICAS to LVO



ICAS with perforator infarction



Treatment indication of Atherosclerotic ELVO

- •Severe ICAS (≥70% stenosis of WASID)
- •Bool flow impairment
- •Re-occlusion on repeated angiogram
- •Diffusion-perfusion mismatch

Not perforating infarction !!!
Hemodynamic impairment

Intra-arterial or intra-venous thrombolytic drug infusion

- ● Recanalization of stenotic portion > 50 %
- ●Urokinase injection (40,000-100,000 IU) on IA
- ●Tirofiban injection (0.5~1.0mg) on IA

- ● High re-occlusion risk
- ● Only drug infusion as acute management without PTAS control?

Glycoprotein IIb-IIIa inhibitors

	Abciximab	Tirofiban	Eptifibatide
Structure	Antibody Fab fragment	Non-peptide	Cyclic heptapeptide
Molecular weight	47615 Da	496 Da	832 Da
Cross reactivity with other	Yes	No	No
Plasma half life	10-30 min	2 h	2.5 h
Inhibition of platelet	>80%	>90%	>90%
Platelet recovery	<48 hr (>50% aggregation	< 4-8 hr (near baseline)	4 hr (>50% aggregation
Elimination route	Senescent	Mostly renal	50% renal
Reversal of effect	Platelet transfusion	Discontinuation of infusion	Discontinuation of infusion
Usual dosage	0.25 mg/kr + 0.125 ㎍/kg/min	*25 ㎍/kg (10㎍/kg) + 0.15 ㎍/kg/min	180 ㎍/kg/min + 2.0 ㎍/kg/min

Intra-arterial drug infusion on atherosclerotic ELVO

- Kang DH et al. Korea (2017)
  - **30.3%** of 168 patients with thrombectomy (Stent retrieval+Aspiration)
  - **Re-occlusion: 65% in ICAD vs 3.3% non-ICAD**
  - **0.5-1.0mg intra-arterial tirofiban intraprocedurally**
  - 85.7% TICI 2/3 **(no PTAS)**
  - **14.3% Rescue stenting**

***Cerebrovascular Diseases** 37: 350-355, 2014*

IA and IV drug infusion on atherosclerotic ELVO

- Zhao et al. China (2015)
  - **Seven patients with re-occlusion**
  - **IA and IV tirofiban 24 hrs (no PTAS)**
  - 71% (5/7) TICI≥ 2b
  - **No intracranial hemorrhage**

***Exp There Med 14**: 3314-3318, 2017*

PTAS on atherosclerotic ELVO

- Al Kasal et al. USA (2017)
  - 8.3% of 435 patients with thrombectomy (ADAPT)
  - Stent and balloon size under sized by 10-20% or sized to vessel caliber.
  - **Abciximab intraprocedurally** then received aspirin and clopidogrel after the procedure
  - 64.7% TICI≥ 2b
  - **4 patients had post procedural ICH**

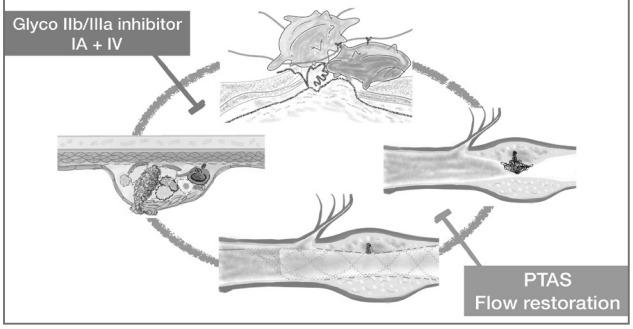
***JNIS 9**: 948-951, 2017*

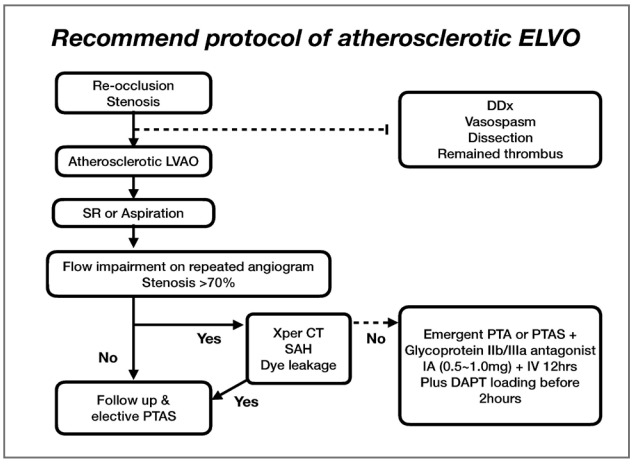
PTAS on atherosclerotic ELVO

- Jia B et al. China (2018)
  - 34% of 140 patients with thrombectomy (Solitaire)
  - Solitaire detachment, PTAS (Gateway, Wingspan)
  - **Intravenous IIb/IIIa inhibitor** + aspirin and clopidogrel after the procedure
  - 96.4% TICI≥ 2b

***JNIS 10**: 746-750, 2018*

Vicious circle of Atherosclerotic ELVO





Conclusion

- High percentage of atherosclerotic ELVO in Korea
- PTAS with IA or IV tirofiban as re-occlusion management in atherosclerotic ELVO leads better recanalization rates and better clinical outcomes.
- Flow restoration + medication intra and post-procedural period.

Mechanical thrombectomy for patients with large DWI lesion

김 태 곤

차의과학대학교 분당차병원 신경외과

From the past, it has been well known that the patient with large infarct volume had unfavorable outcome not only in the alteplase cases but also in the MT cases. Recently, mechanical thrombectomy(MT) has been considered as the firstline therapy for the patients with acute ischemic stroke due to the excellent achievement of the some positive randomized controlled trials (RCTs). In these positive MT trials, the inclusion criteria were mostly the lesions of small core infarcts.

However, there were constant questions about whether the proganosis of patients with large infarct volume was really unfavorable, and many studies have been tried. Recently, some research papers have been published on the MT for patients with large core infarcts. Although it still remains unclear whether MT should be withheld in patients with large core infarcts, I would like to get a little answer through a review of these papers.

ARCS 2019

ARTERIAL RECANALIZATION IN CEREBRAL STROKE

뇌졸중 재개통 심포지엄 및
대한뇌혈관내수술학회 2019
춘계보수교육

Session V. Video session with recorded case presentation

좌장 : 울산대 **권순찬**, 서울대 **강현승**

Case for contact aspiration	한림대 **전홍준**
Case for stent retriever	가톨릭관동대 **김소연**
Case for combined strategy (Solumbra or ARTS or TRAP)	영남대 **김종훈**
Complicated cases in mechanical thrombectomy (1)	가톨릭대 **문병후**
Complicated cases in mechanical thrombectomy (2)	원광대 **김대원**
Complicated cases in mechanical thrombectomy (3)	강원대 **이승진**
Complicated cases in mechanical thrombectomy (4)	에스포항병원 **이동우**
Complicated cases in mechanical thrombectomy (5)	진해연세에스병원 **정진영**
Complicated cases in mechanical thrombectomy (6)	청주효성병원 **김희섭**

Case for contact aspiration

전 홍 준

한림대

Main clinical trials of IA before New Era of Mechanical thrombectomy

	PROACT II	IMS III	SYNTHESIS	MR RESCUE
Study period	1996~1998	2006~2012	2008~2012	2004~2011
Subject number	180	656(early termination)	362	118
Intervention	IA r-proUK plus heparin vs. heparin	EVT plus IV rtPA vs IV rtPA	EVT vs. IV rtPA	EVT vs. standard care
Used devices	Non applicable	Merci, Penumbra, EKOS, Solitaire	Solitaire, Pneumbra, Trevo, Merci	Merci, Pneumbra
Patients included	Patients with occlusion of MCA<6h	Patients with IV rtPA<3h	Patients eligible of IV rtPA(<4.5h) and EVT(<6h)	Patients with LAO (anterior circulation) <8h
Imaging at baseline	CT	CT, CT angiography	CT	Multimodal CT/MR
Primary endpoint	mRS 0, 1, 2	mRS 0, 1, 2	mRS 0, 1, 2	Shift in mRS
Time to endovascular treatment	5.3h	249 min	3.45h	>6h
Recannalization rate	66% (TIMI 2,3)	40% (TICI2b/3)	Not reported	27% (TICI2b/3)
Clinical outcome	40% vs. 25% (p=0.04)	40.8% vs. 38.7%	30.4% vs. 34.8%	No difference
Symptomatic ICH	10% vs. 2%	6.2% vs. 5.9%	6% vs. 6%	9% vs. 6% (pneumbral pattern)

Design of the five RCT of IA thrombectomy

	MR CLEAN	ESCAPE	EXTEND IA	SWIFT PRIME	RECAVSCAT
Design	Medical care vs. Medical care + EVT	Medical care vs. Medical care + EVT	IV rtPA vs. IV rtPA+EVT	IV rtPA vs. IV rtPA+EVT	Medical care vs. Medical care + EVT
Phase	Phase 3	Phase 3	Phase 2	Phase 3	Phase 3
Time	≤6hr, expected puncture time	≤12hr, randomization	≤6hr, expected puncture time	≤6hr, expected puncture time	≤8hr, expected puncture time
EVT modality	Discretion of investigator	Recommended stent retriever	Exclusively Solitaire FR	Exclusively Solitaire FR	Exclusively Solitaire FR
Primary outcome	90 days mRS	90 days mRS	Median percentage reperfusion at 24 h NIHSS reduction≥ 8points or reaching 0-1 at 3days	90 days mRS	90 days mRS
Pretreatment Image	NCCT with CTA	NCCT with mCTA	NCCT with CTA and CTP	NCCT with CTA and CTP (or DWI with MRA and MRP)	NCCT with CTA
Image selection Criteria	Absent	Exclusion Large core (ASPECT<6) & Poor collateral	Target mismatch	Target mismatch Exclusion large core (CT or DWI ASPECTS <6)	Exclusion large core (CT ASPECT<7, DWI ASPECT<6)

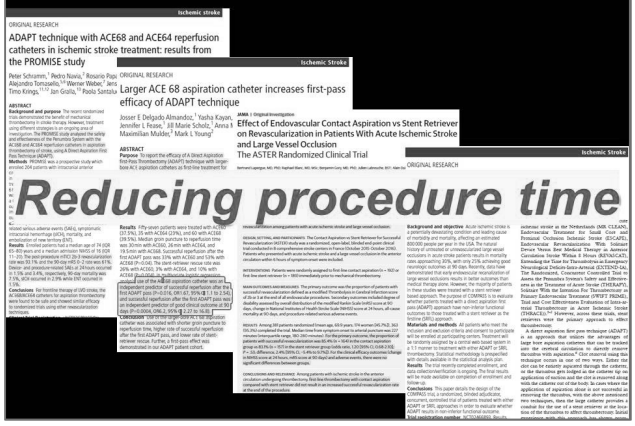
Target mismatch: Hypoperfused tissue / Core >1.2 and Hypoperfusesd tissue - Core >10 ml and Core <70 ml; Core (rCBF,30%); Hypoperfused tissue (Tmax > 6s)

Target mismatch: Hypoperfused tissue / Core 1.8 and Hypoperfused tissue - Core 15 ml and Core <50 ml and Severely hypoperfused tissue <100 ml; Core (DWI lesion or rCBF 30%); Hypoperfused tissue (Tmax >6 s); Severely hypoperfused tissue (Tmax>10 s)

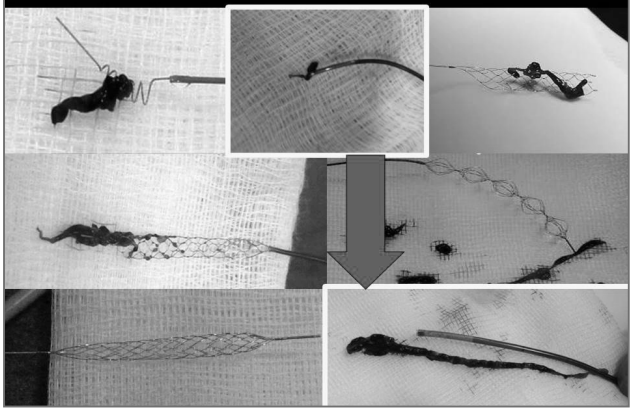
Onset to pucture~Recannalization time

- Onset to Door
- Door to CT
- Onset to tPA
- CT to Puncture
- Door to Puncture
- Onset to Puncture
- Puncture to Recannalization
- Onset to Recannalization

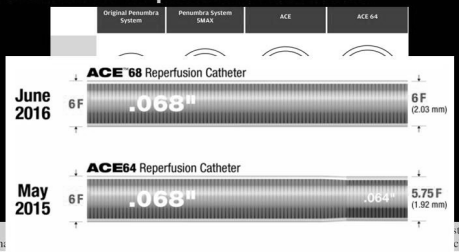
Non-inferior performance of direct aspiration by Large-bore catheter



Different characteristics to IA thrombectomy

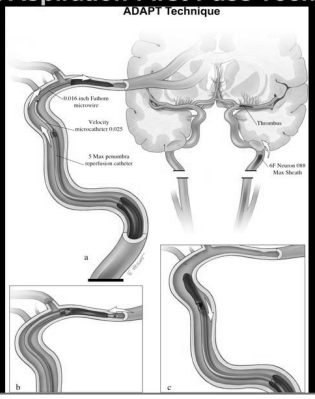


Advancement of Reperfusion Catheter

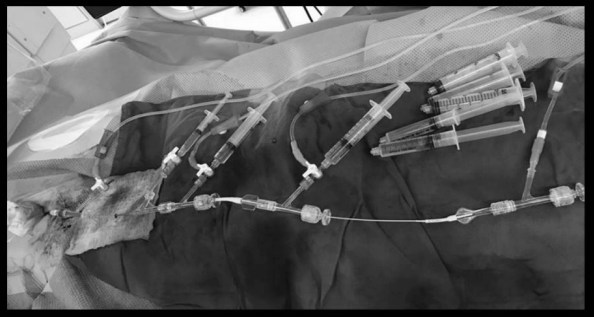


Product					
ACE 64 (I					64
Arc (Medi Neurovas					61
Catalyst (Neurovas					60
Sofia (MicroVention)	125	0.068	0.055	0.068	0.055
Sofia Plus (MicroVention)	125/131	0.083	0.070	0.082	0.070
Revive IC 044 (Codman Neurovascular)	136	0.053	0.044	0.053	0.044
Revive IC 056 (Codman Neurovascular)	121	0.065	0.056	0.065	0.056

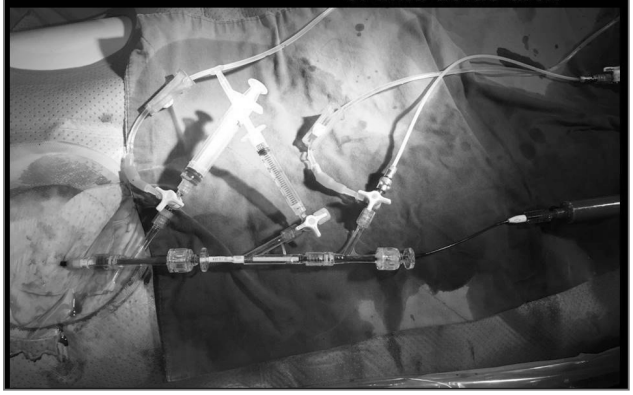
ADAPT = Contact aspiration (A Direct Aspiration First Pass Technique)



Accessing route: Tortuousity of supra or Infra-aortic arch



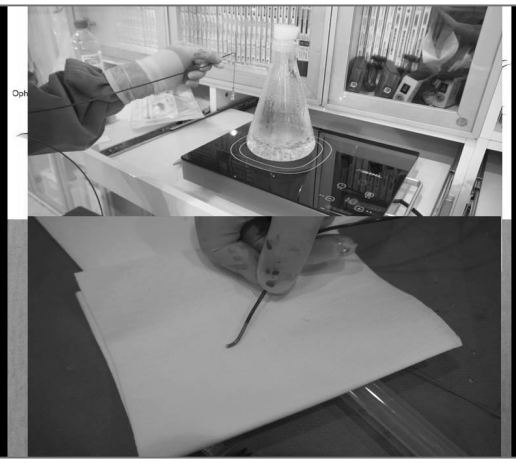
Accessing route: Tortuousity of supra or Infra-aortic arch



Accessing route: Neck dissection

Complicated anatomy of accessing route

- Narrow ICA siphon or Tortuous curve



How I do it?

1. Pre-thrombectomy preparations /
   Evaluations & access
   Procedural performance

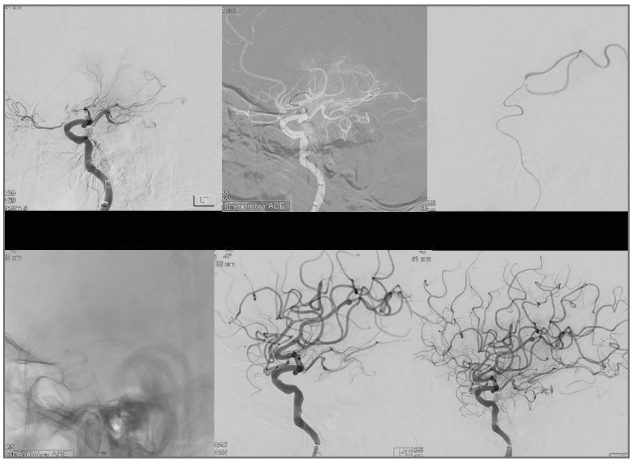
2. Case specific strategy
   - Typical case
   - Large volume clot
   - Underlying intracranial atherosclerosis
   - Rescue application of other procedure

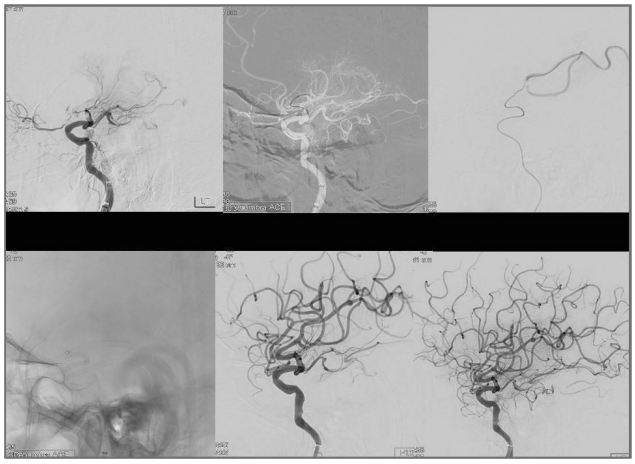
< Stepwise of penumbra reperfusion >

- **Microcatheter navigation beyond clot**
- **Gentle microcatheter angiogram with 1cc luer lock**
  => Check the contrast instillation
- **Suction device to contact the thrombus**
  - Notice the distal markers
  - Forward and backward slightly motion
- **Thrombus incubation about 1 min by penumbra Pump**
- **Consistency retrieval of suction system**

- **Check for clot**
  - Suction devices
  - Aspirated pump or syringes
  - Guiding or balloon system
- **DSA run**
- **Repeat contact aspiration, if necessary**

Typical cases





Typical cases

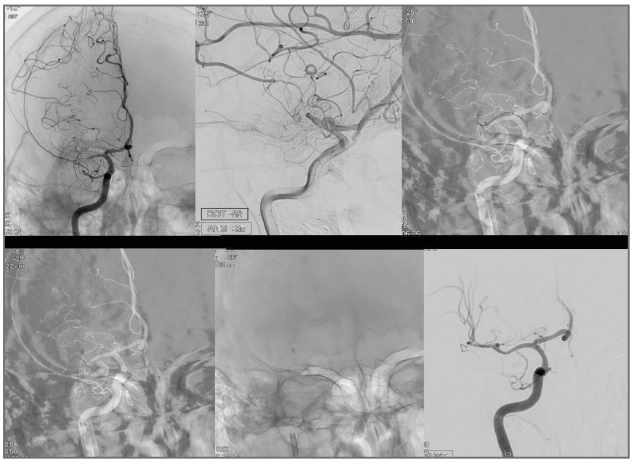
- **Large bore aspiration catheter**
  - Reliable performance to be first run TICI3
  - Reducing the procedure time
- If necessary, possible to change the Solumbra technique
- Large amount of clot ; Coaxial guiding support

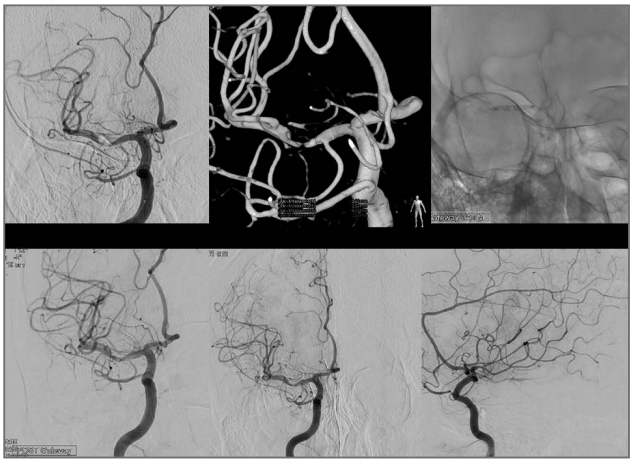
Shuttle 8~9Fr+ 8~9Fr BGC

+ Intermediate or Penumbra ACE Max 068 /

Neuron Max 088 90 cm+ Penumbra ACE Max 068

Intracranial atherosclerotic stenosis





Underlying intracranial atherosclerosis

- Suspect underlying intracranial atherosclorosis
- Goal; Baseline recanalization

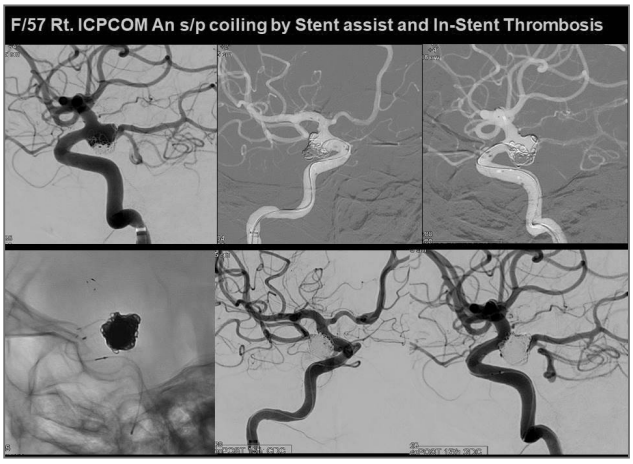
; Limit stent retrieval, possible iatrogenic dissection

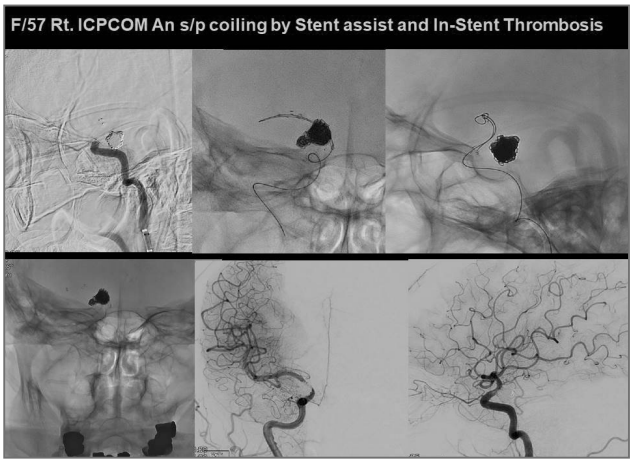
=> Suction or Intraarterial dethrombosis

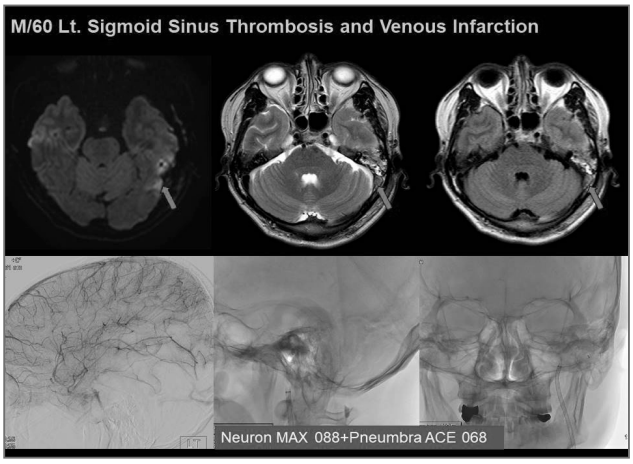
=> Emergency balloon angioplasty

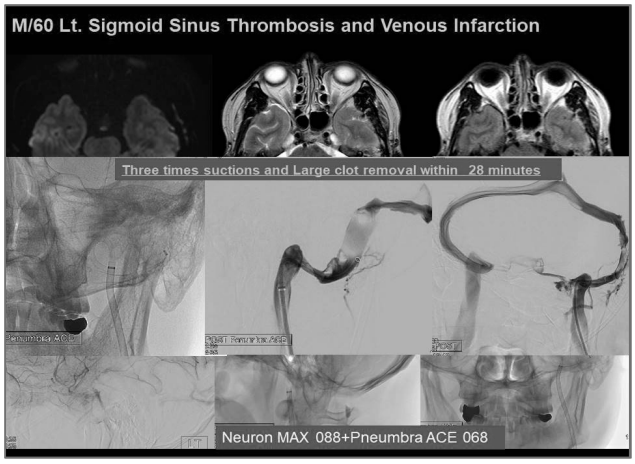
or stenting (Solitaire or Wingspan)

Rescue application of other procedure









Rescue application

- Lesser trauma for normal vessel or treated area
- Rapid response of the target like thrombus

Case for stent retriever

김 소 연

가톨릭관동대

Case for Stent Retriever

가톨릭관동대학교 국제성모병원
김소연

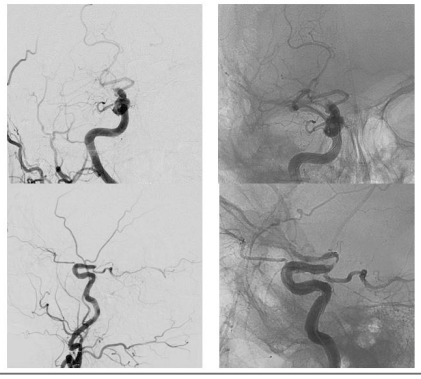
Guiding system

- 8F/9F long sheath or shuttle (90cm)
- Balloon guiding catheter
- Long HN1 catheter and 035 wire

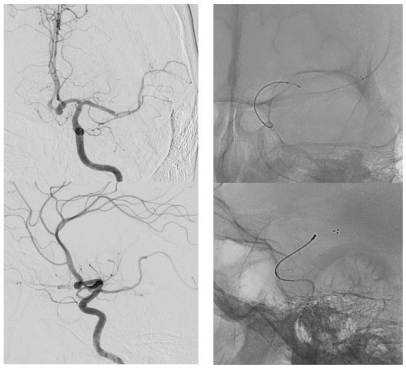
Selection of stent size

- Terminal ICA occlusion – 6/30, 6/40
- M1 or A1 occlusion – 4/20, 4/40
- M2~3 or A2~3 – 3/20

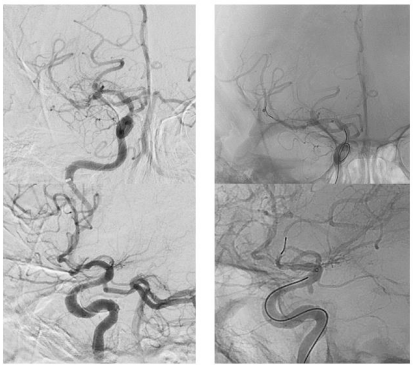
Case 1. distal ICA occlusion



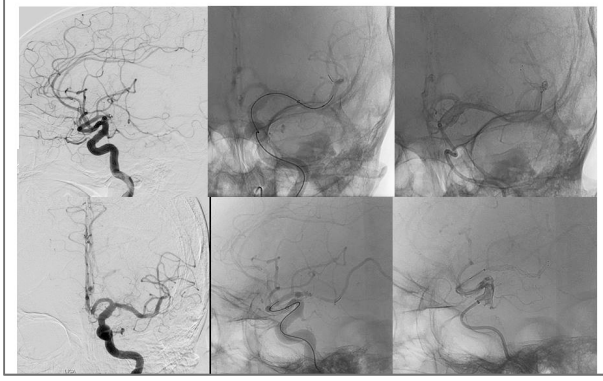
Case 2. M1 occlusion



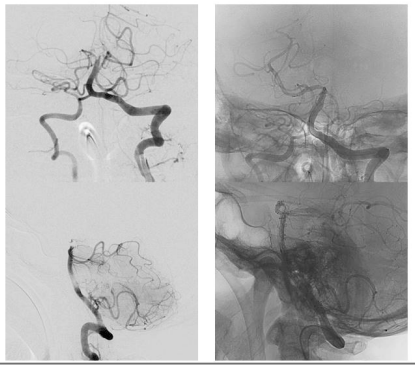
Case 3. M1 occlusion



Case 4. M2 occlusion



Case 54. Basilar top occlusion



Case for combined strategy (Solumbra or ARTS or TRAP)

김 종 훈, 정 영 진, 장 철 훈

영남대학교병원 신경외과

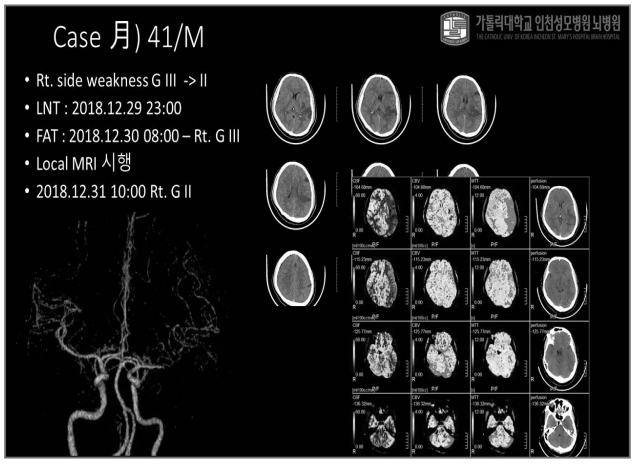
Extensive prospective clinical data have established mechanical thrombectomy by stentrievers as a critical treatment for acute cervical and cerebral large vessel occlusion since 2015. Improvements in thrombectomy devices and techniques have been made to achieve faster and more efficacious recanalization. In addition to stent retrievers and balloon guide catheters, large–bore intermediate catheters have been designed to advance easily through intracranial arteries to the clot for additional support and for direct aspiration. Using these trackable, large bore intermediate catheters, aspiration as a first pass technique has gained favor in many institutions.

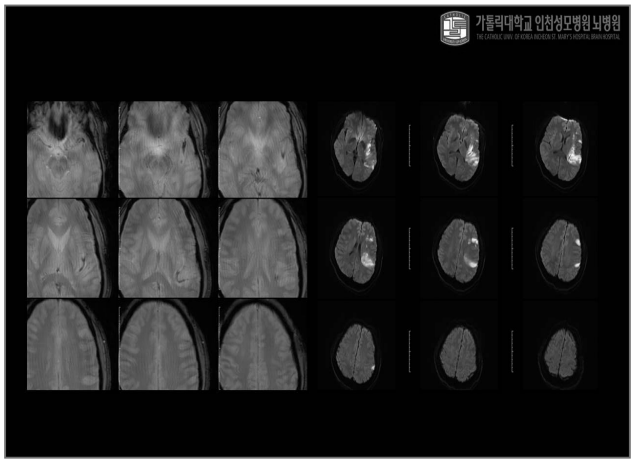
Recently, the combination of stentrievers and aspiration techniques was described in the treatment of large vessel occlusion and was applied to improve the rate of recanalization and decrease the procedure time. The combination of stentrievers and aspiration, which incorporates the benefits of both stentriever thrombectomy and aspiration, is thought to increase the efficacy of clot removal in comparison with each technique alone.

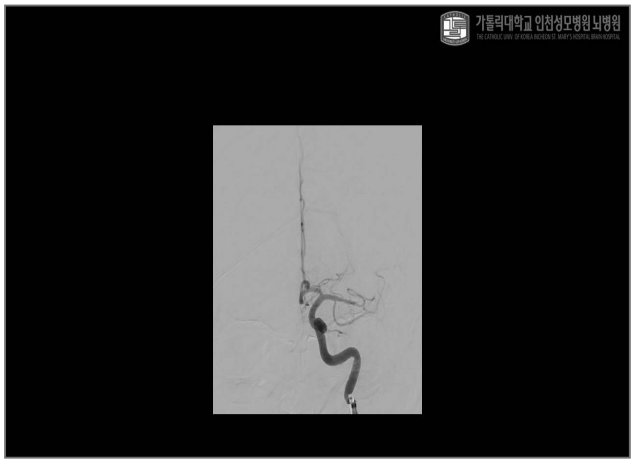
Complicated cases in mechanical thrombectomy (1)

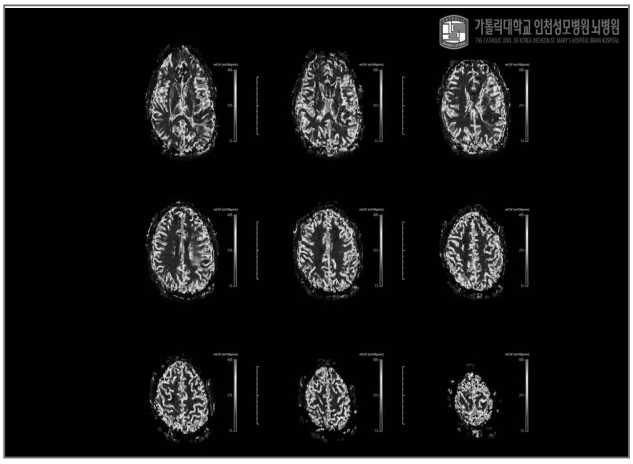
문 병 후

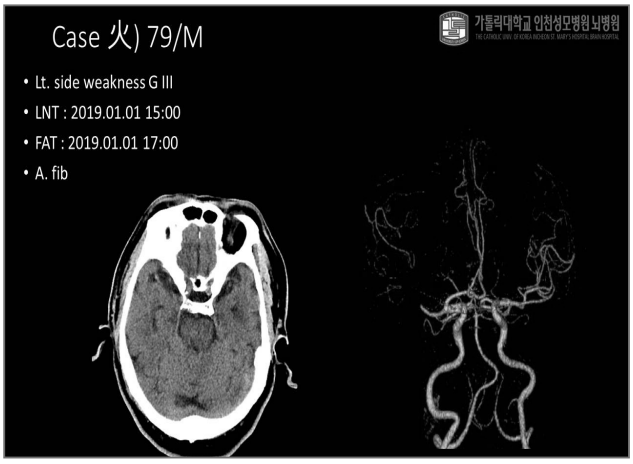
가톨릭대










Case 火) 79/M
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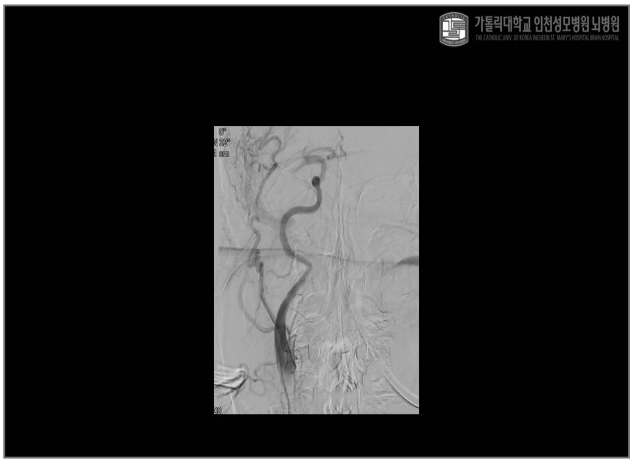
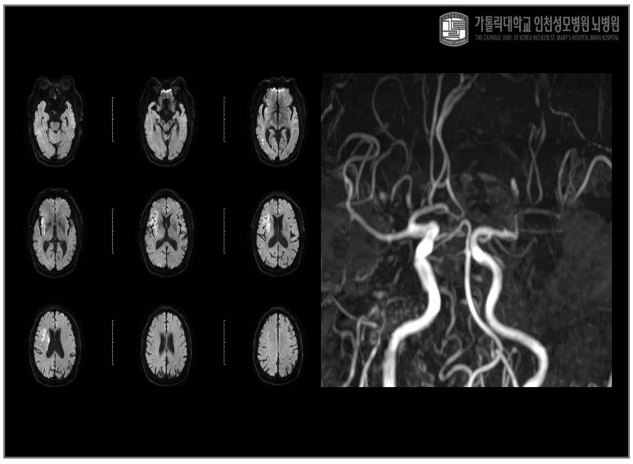
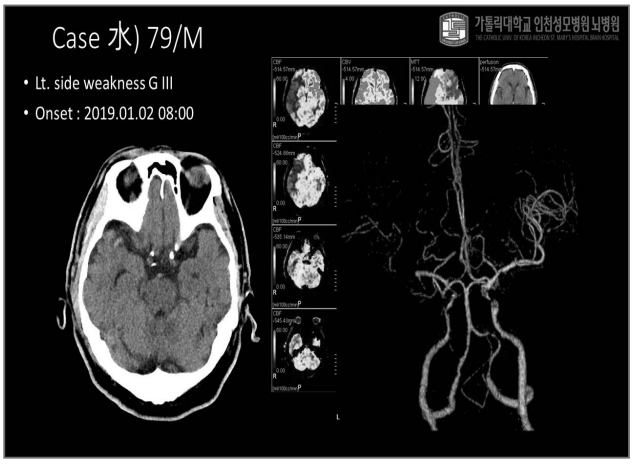
• LNT : 2019.01.01 15:00
• FAT : 2019.01.01 17:00
• A. fib



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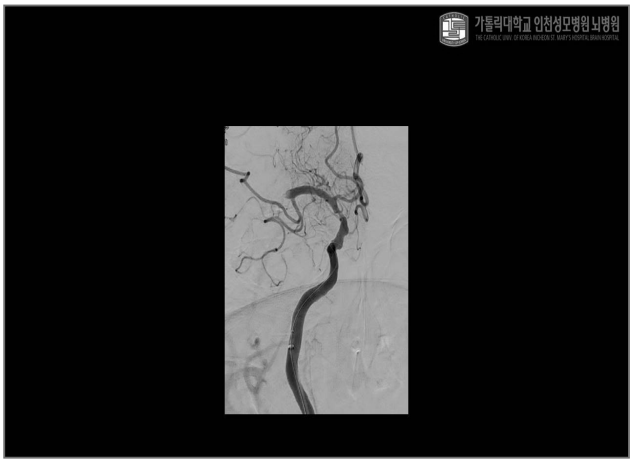
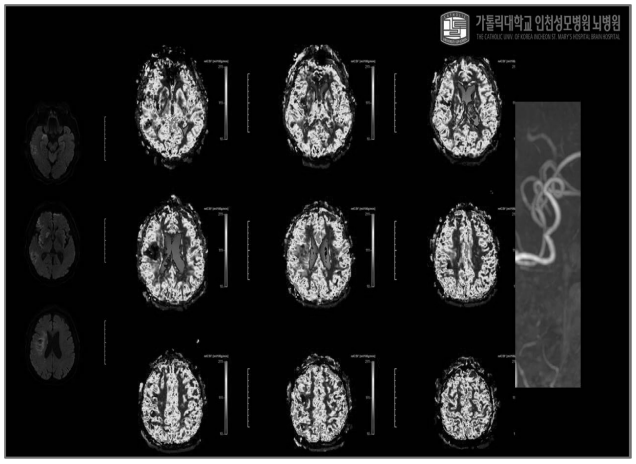
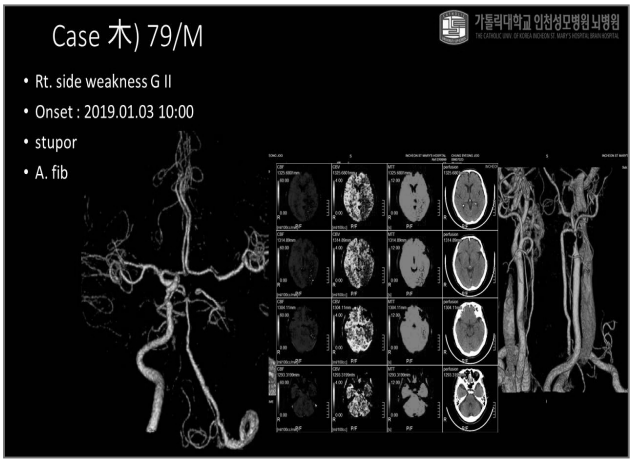
• Lt. side weakness G III
• Onset : 2019.01.02 08:00




가톨릭대학교 인천성모병원 뇌병원


Case 木) 79/M
• Rt. side weakness G II
• Onset : 2019.01.03 10:00
• stupor
• A. fib
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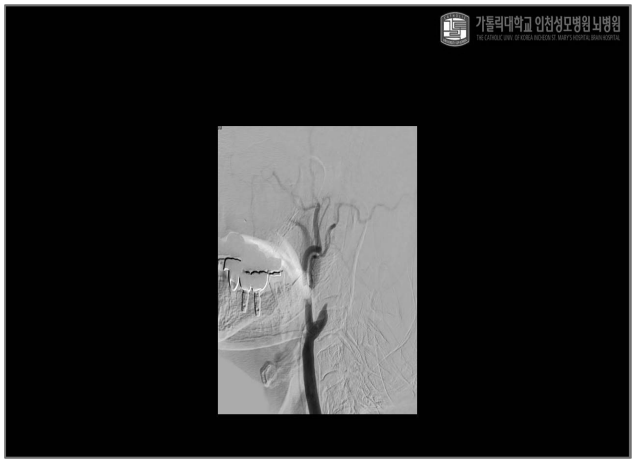
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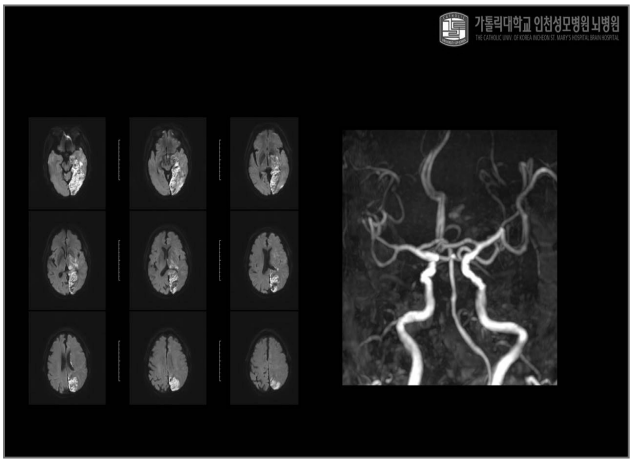
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가톨릭대학교 인천성모병원 뇌병원
Thank you for your attention!!!
뇌질환 정복을 위한 위대한 도약, 24시간 365일 잠들지 않는 병원!
뇌병원 개원!
가톨릭대학교 인천성모병원 뇌병원

Complicated cases in mechanical thrombectomy (2)

김 대 원

원광대

ARCS 2019

Arterial Recanalization in Cerebral Stroke

Complicated cases in mechanical thrombectomy

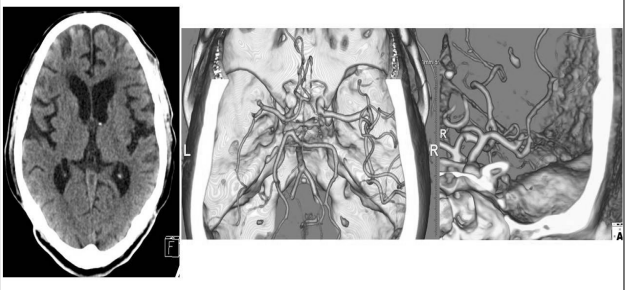
김 대 원

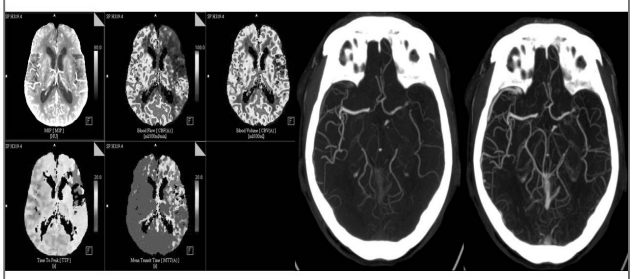
원광대학병원 신경외과

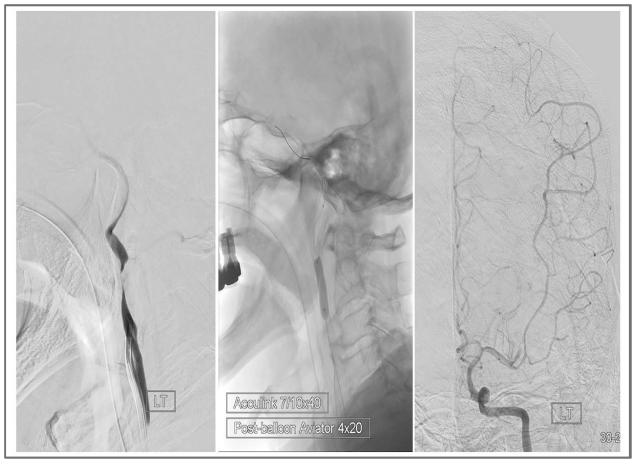
대한뇌혈관내수술학회
Society of Korean Endovascular Neurosurgeons

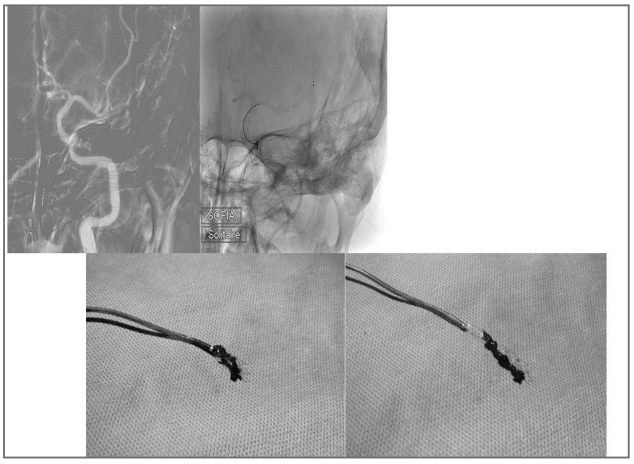
Case 1

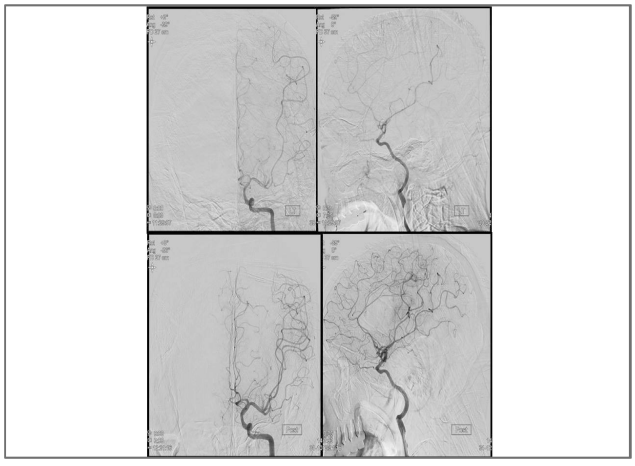
- M/78
- C/C Rt. Motor weakness
  Aphasia
  Last NR time: 03:00, First aNR time: 07:30, ER arrival time: 09:02
- P/Hx.
  HET with angina → coronary stent
  DM (+)
- N/Ex.
  M/S – alert with global aphasia
  CNF – LR(2+/2+)
  Motor – Rt. Hemiparesis G(3/3)
- NIHSS - 13

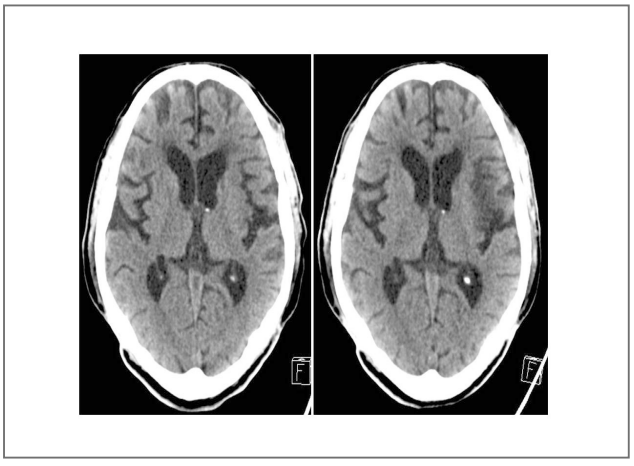












Case 1

- N/Ex. (**discharge**)
  M/S – alert with aphasia
  CNF – LR(2+/2+)
  Motor – Rt. Hemiparesis G(4-/4-)

Complicated cases in mechanical thrombectomy (3)

이 승 진

강원대학교병원 신경외과

Endovascular mechanical thrombectomy for acute ischemic stroke due to intracerebral artery occlusion is now a recommended treatment. Improved devices have made it possible to treat more acute ischemic stroke due to intracerebral artery occlusion. But mechanical thrombectomy is associated with a number of intra-procedural complications, which need to be minimized and effectively managed to maximize the benefits of thrombectomy. Complications are caused by a variety of causes. The tortousity of the cerebral artery is one of the causes of complications. Severe tortousity of the cerebral artery often causes the procedure to fail or cause injury to the device.

In older patients, the degree of tortousity of the cerebral artery is more severe than in younger patients. The percentage of the elderly population in Gangwon-do is higher than in other regions and is steadily increasing every year. I would like to announce on the complications experienced by severe tortousity of the cerebral artery through this session.

Complicated cases in mechanical thrombectomy (4)

이 동 우

에스포항병원

뇌동맥류 코일 색전술중 이탈된 코일의 스텐트를 이용한 제거

신경외과 이 동 우

에스포항병원

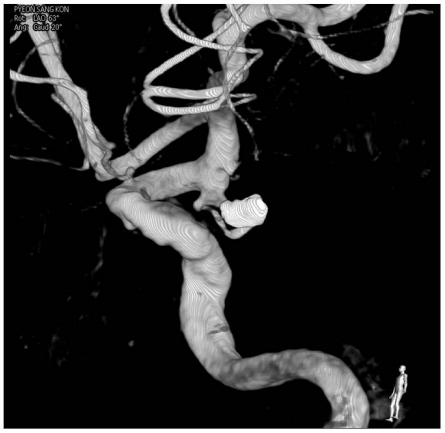
가치 있는 일을 좋은 사람들과 오랫동안 함께하는 병원

에스포항병원

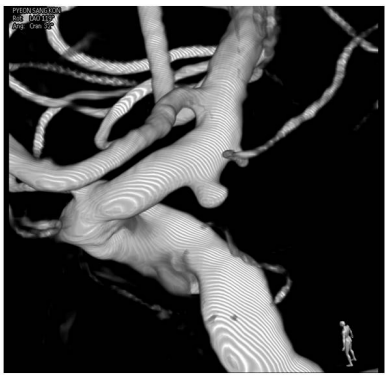
CASE. 1 (52. M)

1. 2017.3.4. SAH.P-com.Lt 로 coiling 치료 받으신 분(mRS 0)
   UIA.P-com.Rt. coiling 위해 내원
2. Both pICA stenosis combined
3. Stent assisted coiling
4. 과거력: DM

에스포항병원



에스포항병원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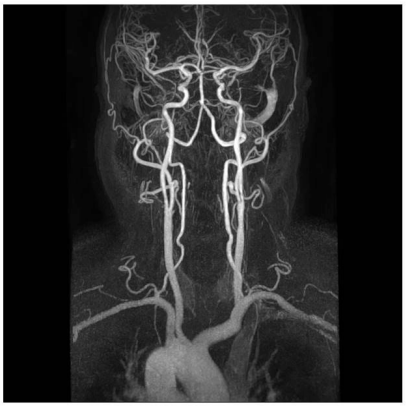
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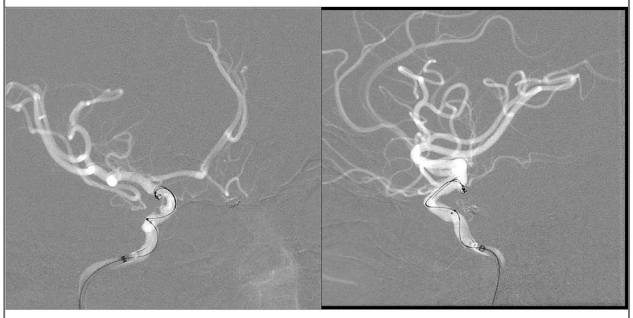
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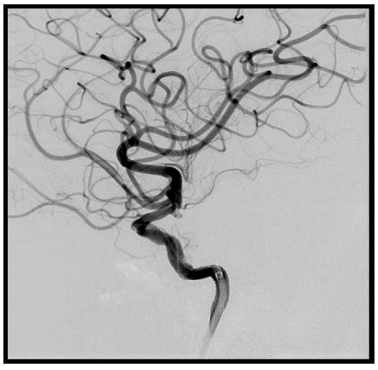
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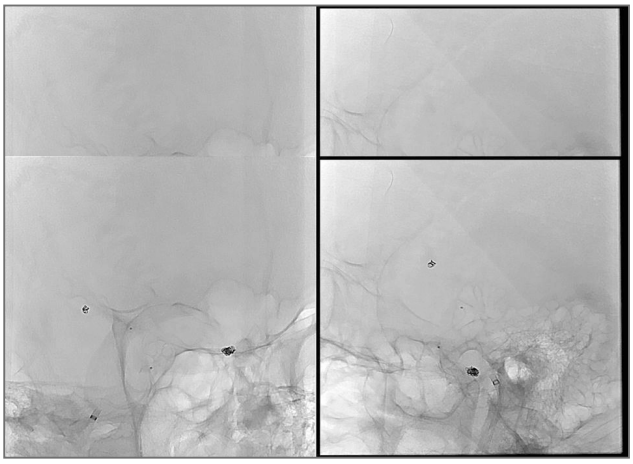

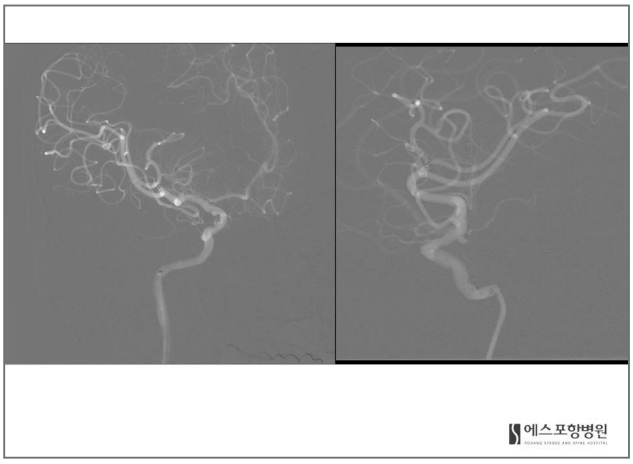
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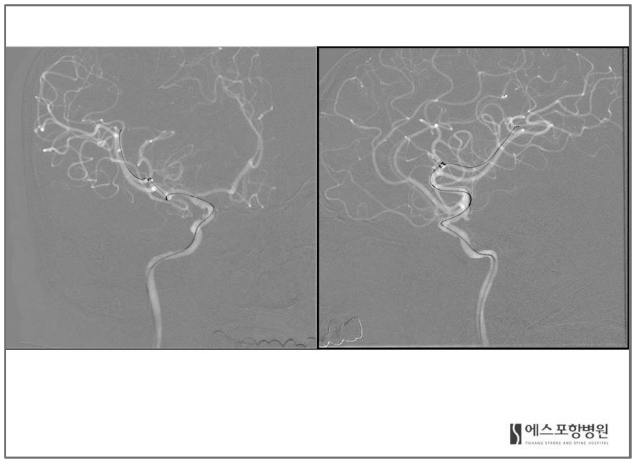
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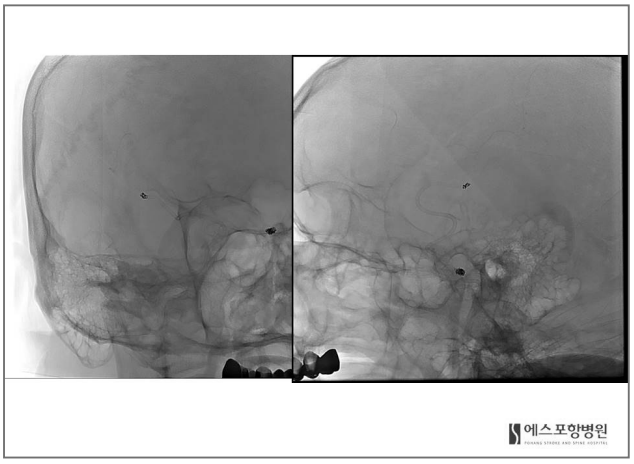
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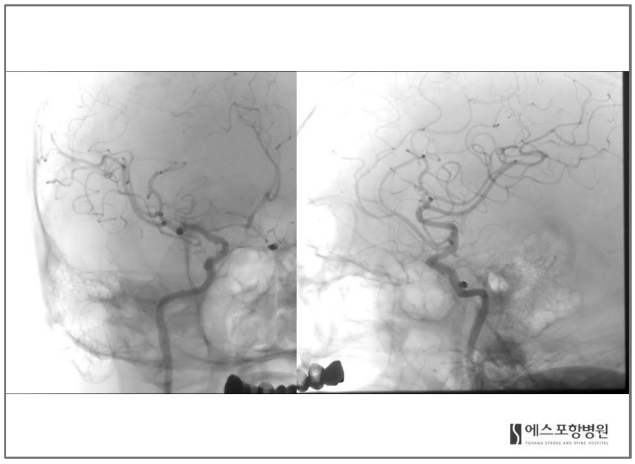
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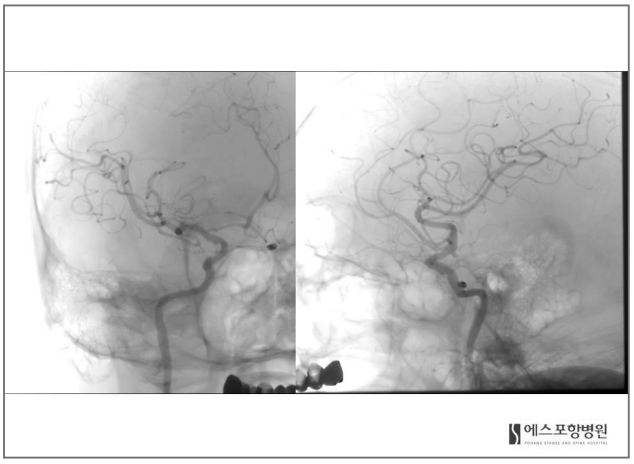
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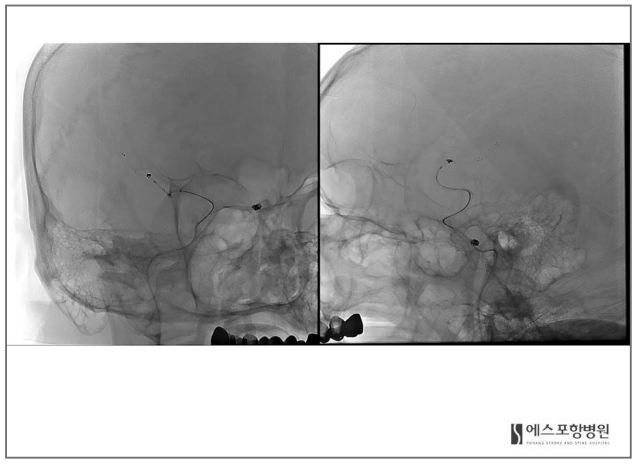
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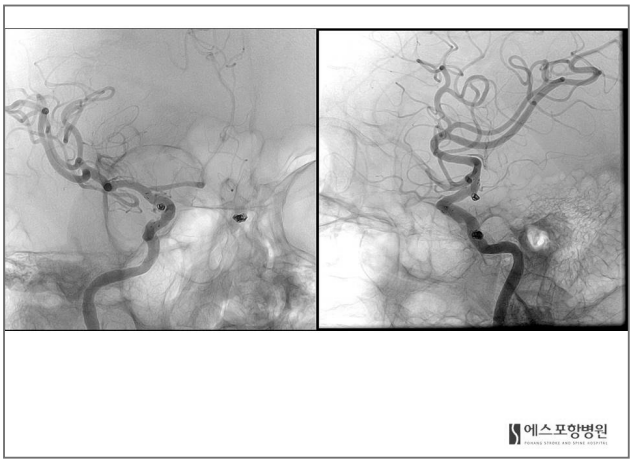
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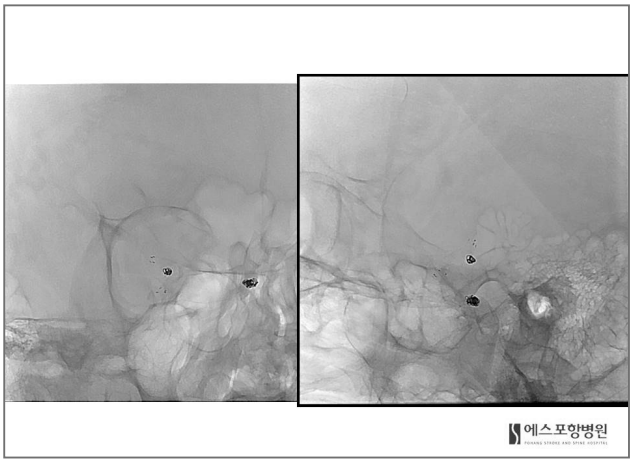
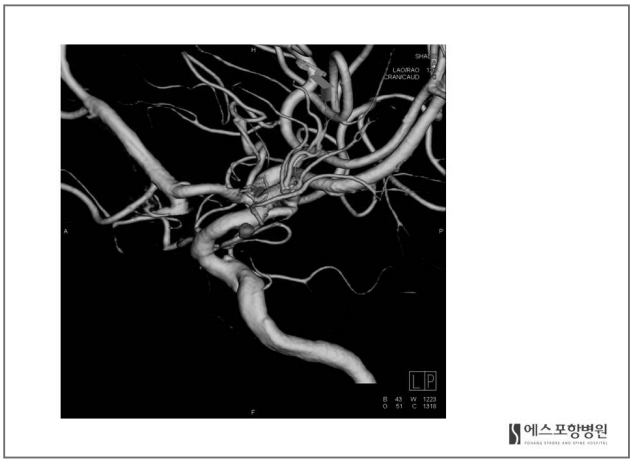
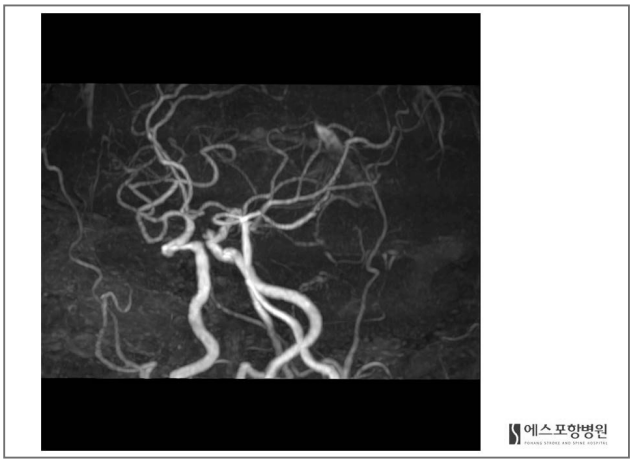
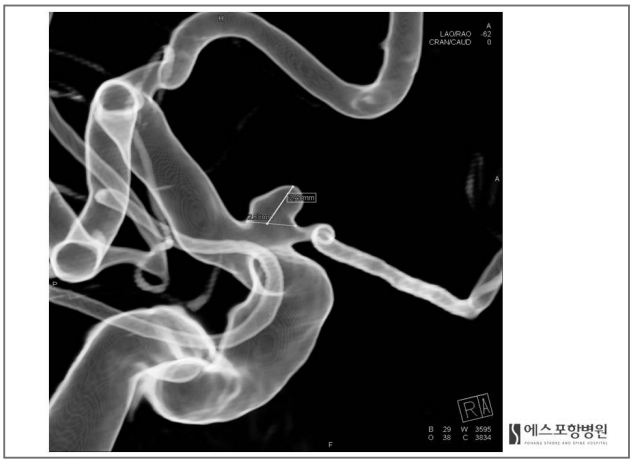


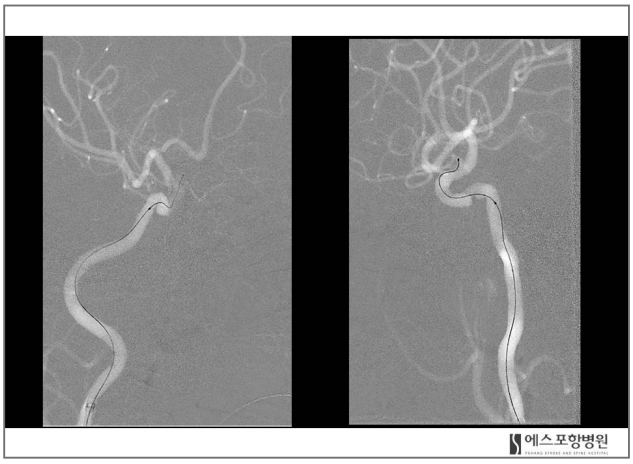


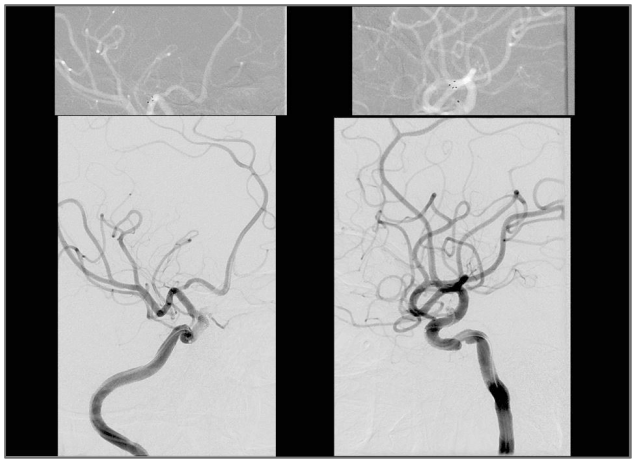
CASE. 2 (82. F)

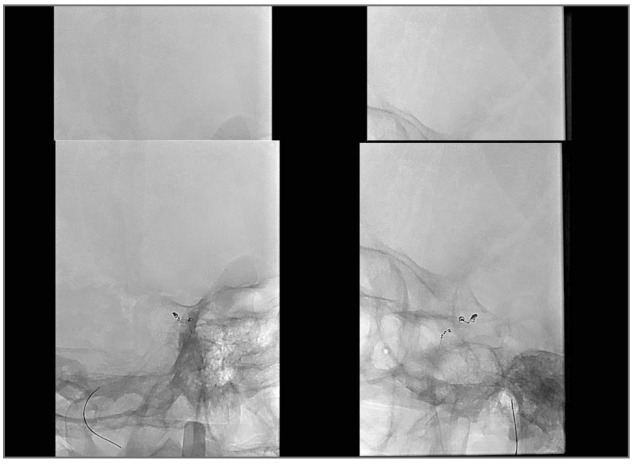
1. 2018.12.15 Bell's palsy 로 내원하여 시행한 두부 CT & MR 상 Rt. Ophthalmic UIA 소견 보임.
2. TFCA 시행 후 보호자 & 환자 면담 후 UIA 에 대한 치료원해 coiling 하기로 함.
3. 과거력: cervical spondylosis
4. Alert mentality

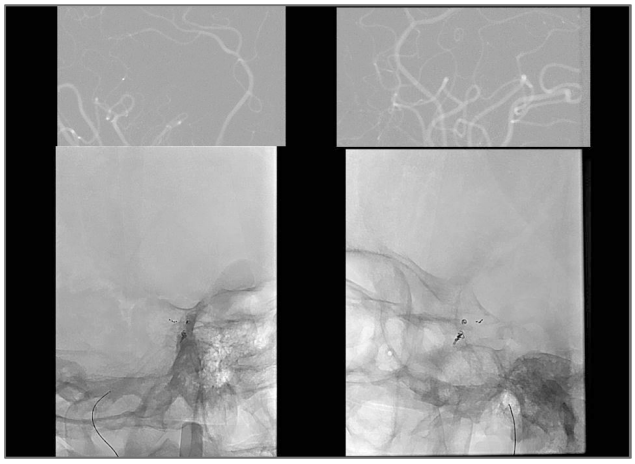


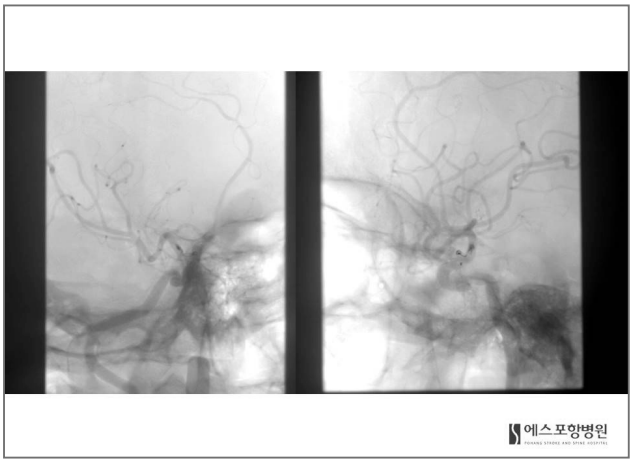








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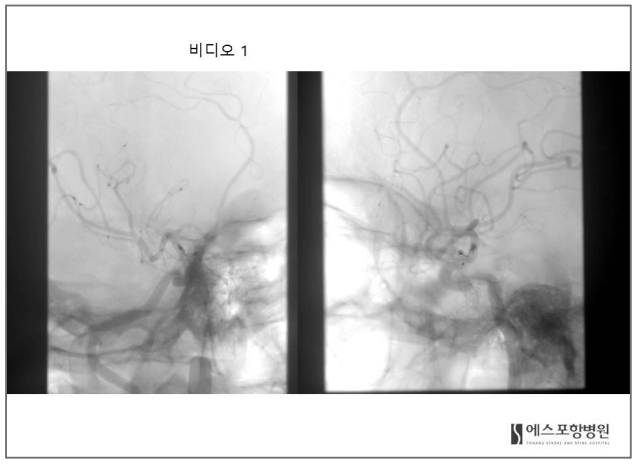
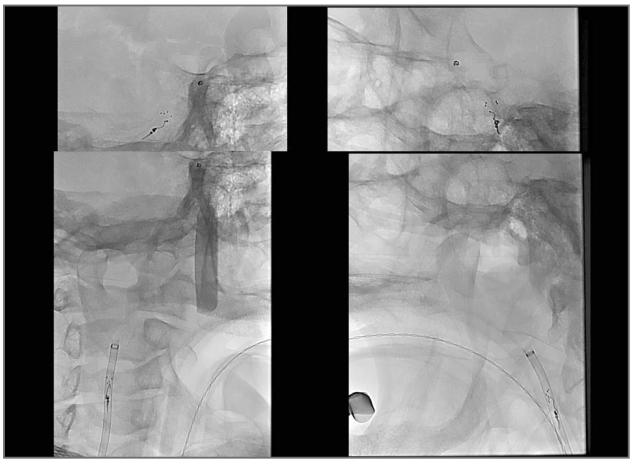
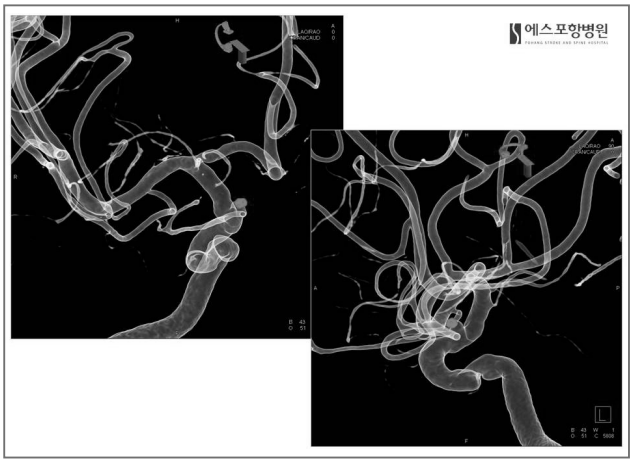

비디오 1
에스포항병원





경청해 주셔서
감사합니다

Q&A

에스포항병원

Complicated cases in mechanical thrombectomy (5)

정 진 영

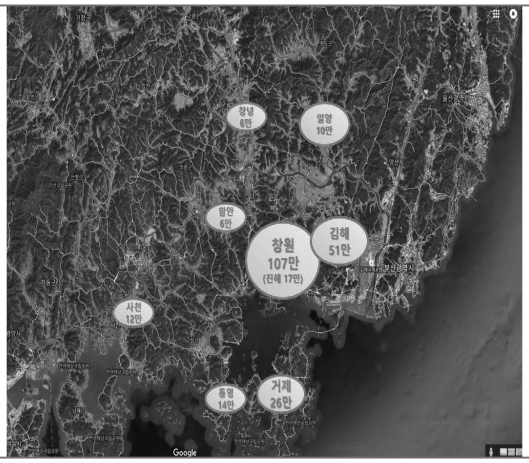
진해연세에스병원

Prehospital notification and Combined IAT

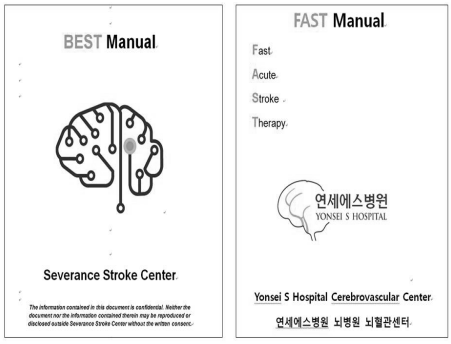
연세에스병원 신경외과

정진영 주상욱 김정훈 이형석

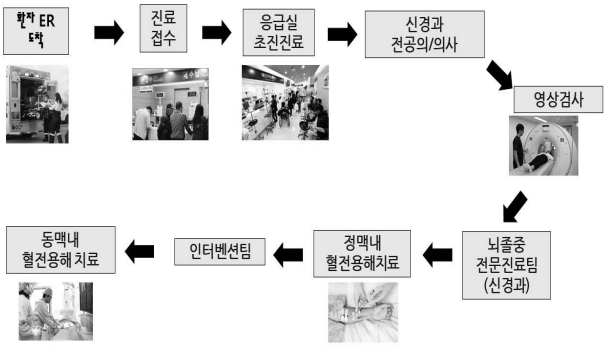
연세에스병원
YONSEI S HOSPITAL

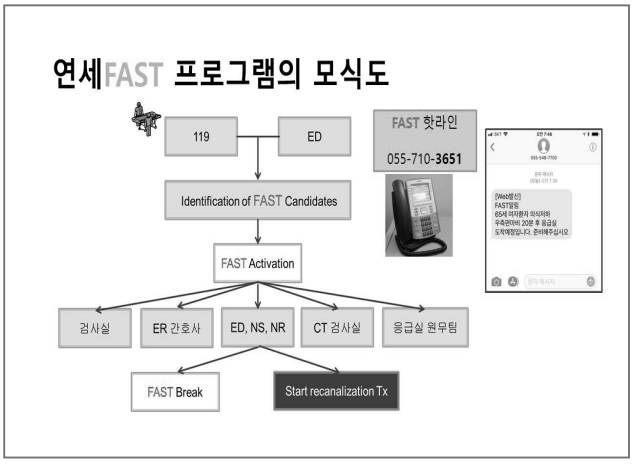


뇌졸중 프로그램



기존의 응급실 초진환자 진료 절차

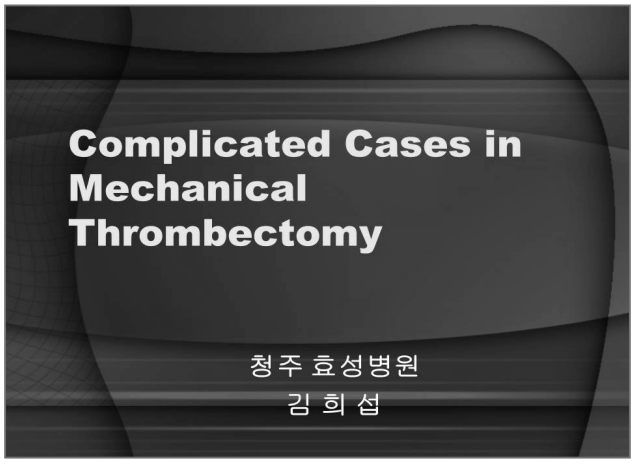


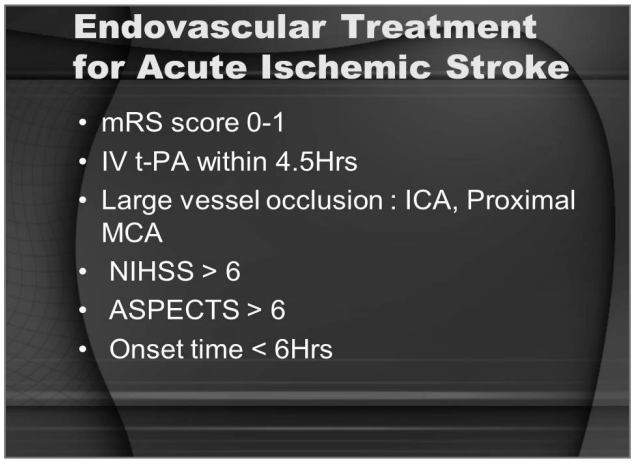

연세FAST 프로그램의 모식도
119
ED
FAST 핫라인
055-710-3651
Identification of FAST Candidates
FAST Activation
검사실
ER 간호사
ED, NS, NR
CT 검사실
응급실 원무팀
FAST Break
Start recanalization Tx

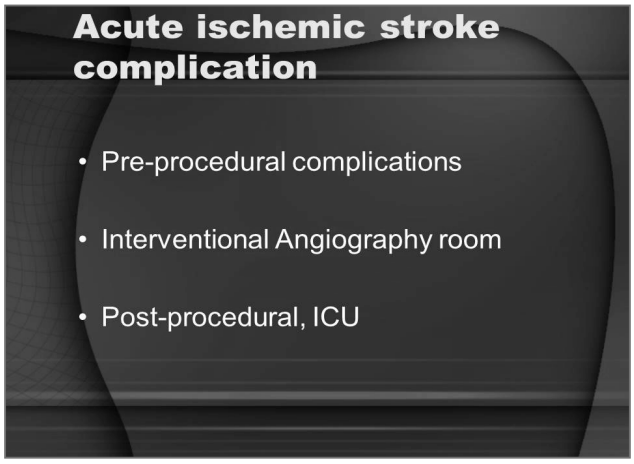
Complicated cases in mechanical thrombectomy (6)

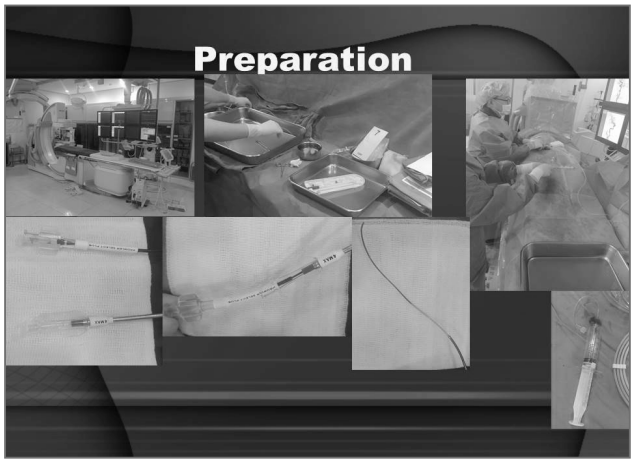
김 희 섭

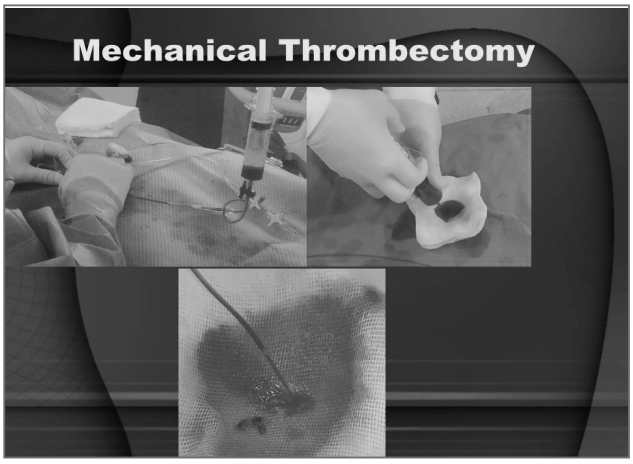
청주효성병원

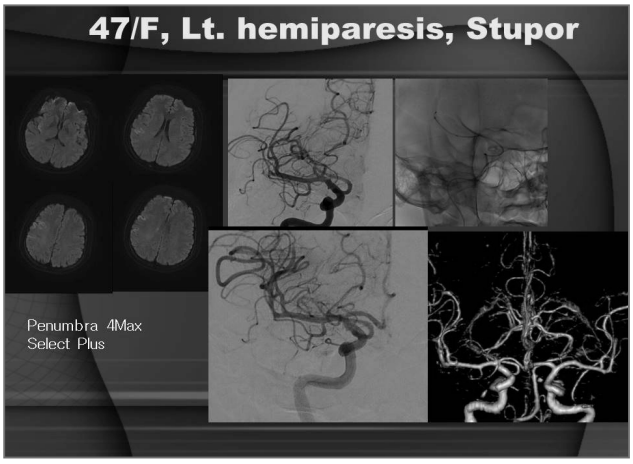


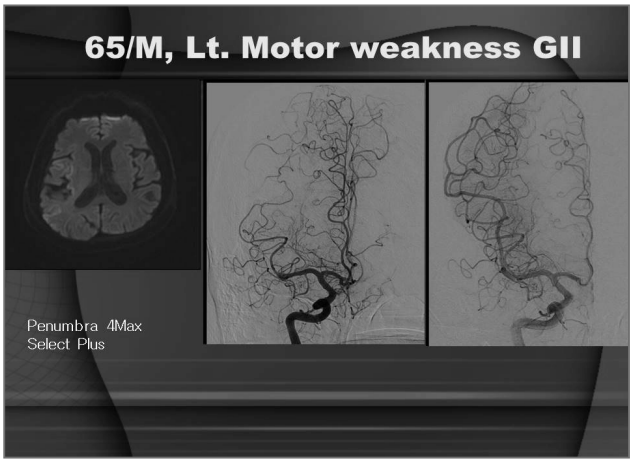


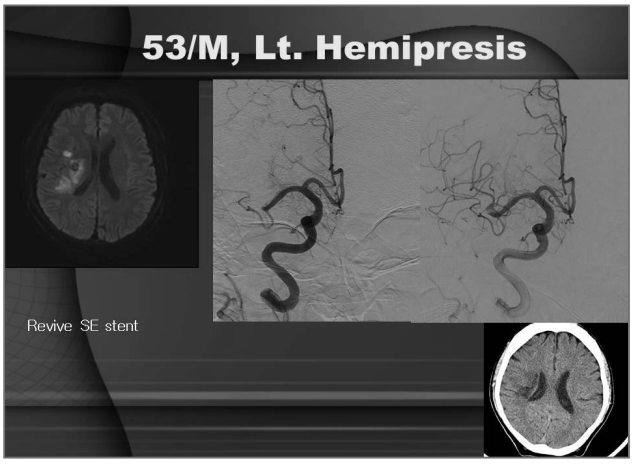


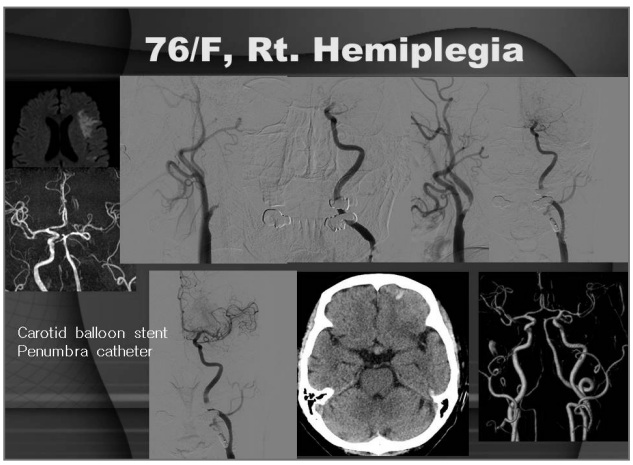


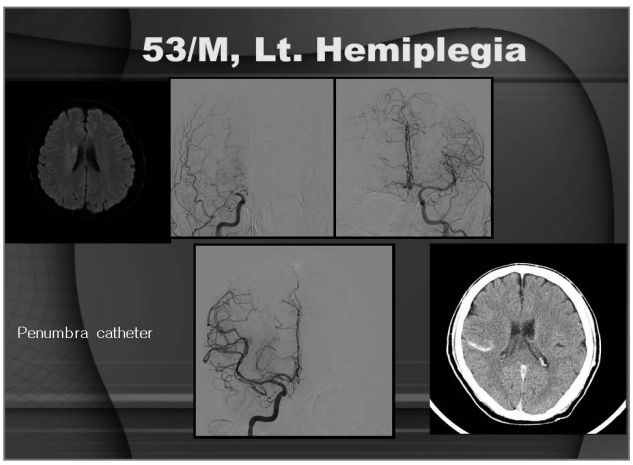

Mechanical Thrombectomy

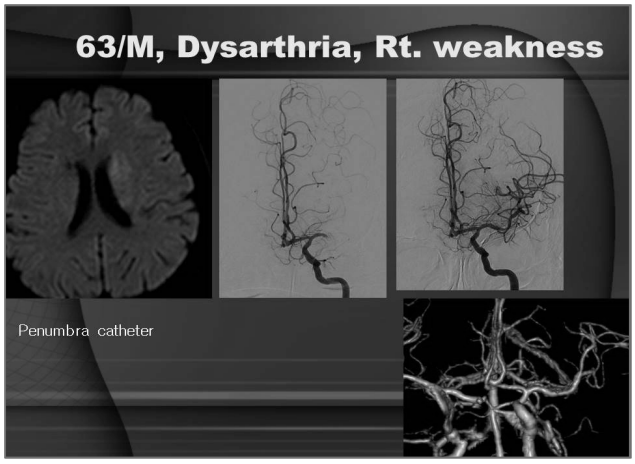

47/F, Lt. hemiparesis, Stupor
Penumbra 4Max
Select Plus

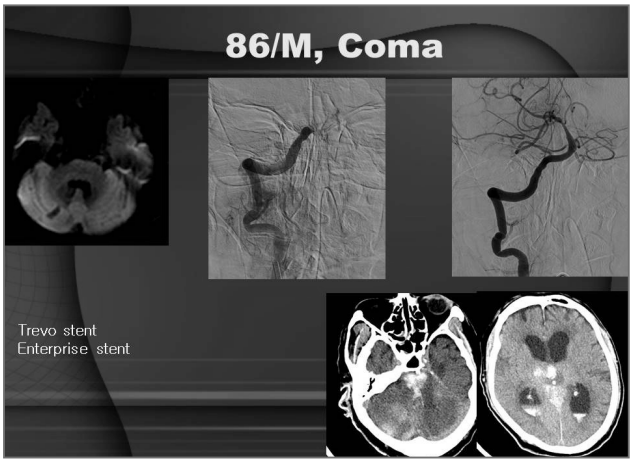

65/M, Lt. Motor weakness GII
Penumbra 4Max
Select Plus

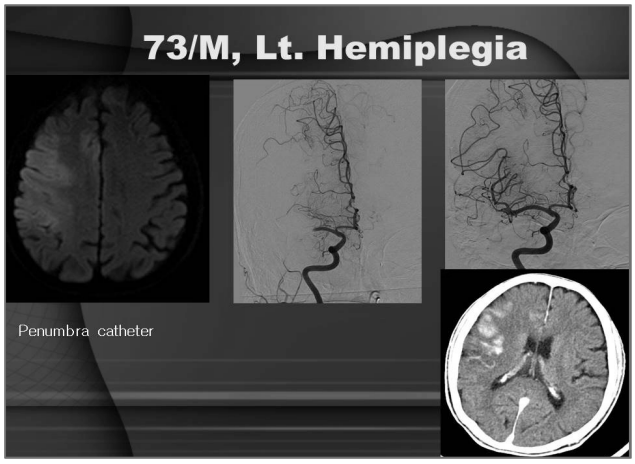

53/M, Lt. Hemipresis
Revive SE stent


76/F, Rt. Hemiplegia
Carotid balloon stent
Penumbra catheter


53/M, Lt. Hemiplegia
Penumbra catheter


63/M, Dysarthria, Rt. weakness
Penumbra catheter


86/M, Coma
Trevo stent
Enterprise stent


73/M, Lt. Hemiplegia
Penumbra catheter


58/M, Aphasia, Rt. Hemiplegia
Excelsior XT-27
Penumbra catheter

ARCS 2019 **A**RTERIAL **R**ECANALIZATION IN **C**EREBRAL **S**TROKE
뇌졸중 재개통 심포지엄 및 대한뇌혈관내수술학회 2019 춘계보수교육

인 쇄 2019년 2월 20일
발 행 2019년 2월 20일

발 행 처 대한뇌혈관내수술학회
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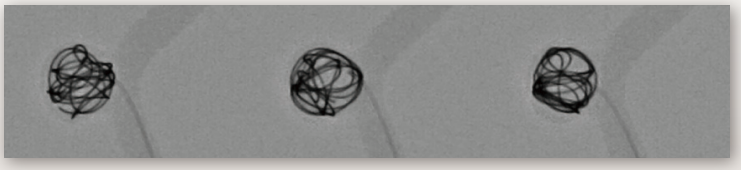
Random Break Deployment may ease coil repositioning during embolization[1]



Source: Fluoroscopic image of Orbit Galaxy 9mm x 25cm in 10mm x 8mm Aneurysm model, Tokyo Science Center, 2017

1) Ahmad Khaldi, The Orbit Galaxy XTEASOFT Coils: a Multicenter Study of Coil Safety and Efficacy in both Ruptured and Unruptured Cerebral Aneurysm, Journal of Vascular and Interventional Neurology, 2012
2) Juan A. Lorezo, XTRASOFT GALAXY Endovascular Finishing Coil, World Neurosurgery, 2011

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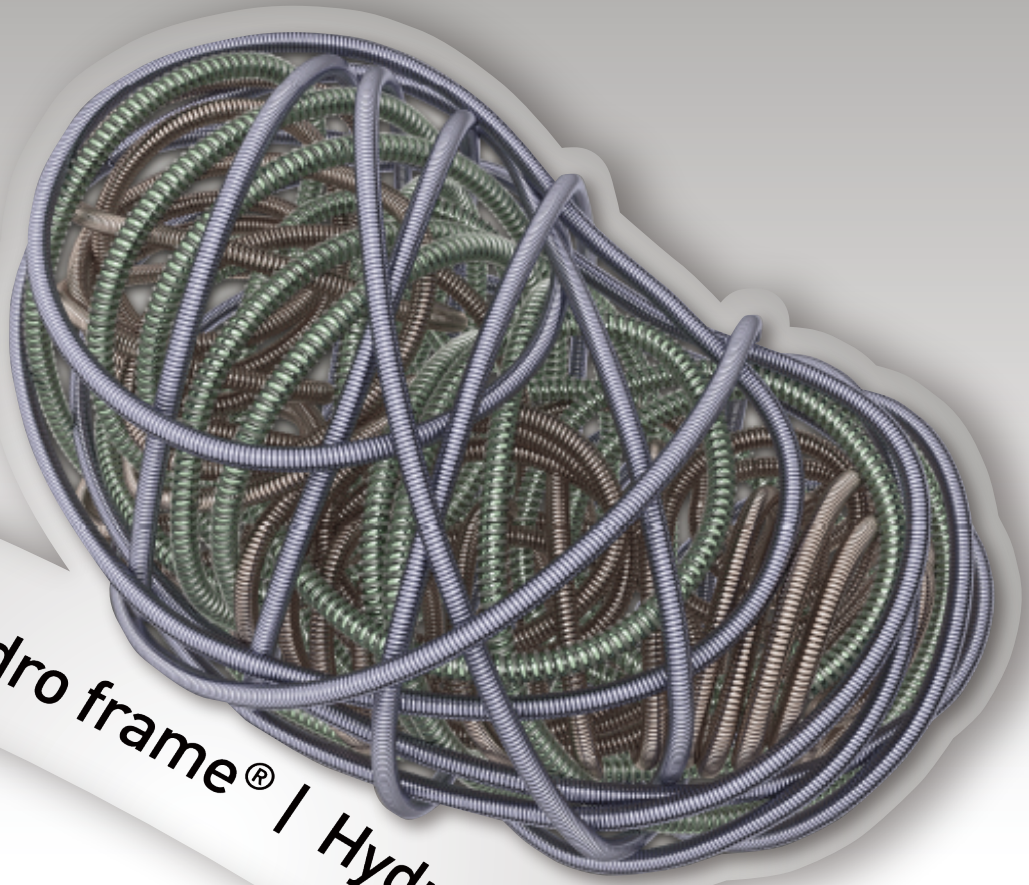

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Hydrosoft 3D

Catalog Reference No.	Coil Diameter (mm)	Length (cm)	Catalog Reference No.	Coil Diameter (mm)	Length (cm)
100102HFRM-V	1	2	100208HFRM-V	2	8
100103HFRM-V	1	3	100210HFRM-V	2	10
100152HFRM-V	1.5	2	100254HFRM-V	2.5	4
100153HFRM-V	1.5	3	100256HFRM-V	2.5	6
100154HFRM-V	1.5	4	100258HFRM-V	2.5	8
100202HFRM-V	2	2	100304HFRM-V	3	4
100203HFRM-V	2	3	100306HFRM-V	3	6
100204HFRM-V	2	4	100308HFRM-V	3	8
100206HFRM-V	2	6	100310HFRM-V	3	10

Hydroframe

Catalog Reference No.	Coil Diameter (mm)	Length (cm)	Catalog Reference No.	Coil Diameter (mm)	Length (cm)
100405HFRM-V	4	5	100715HFRM-V	7	15
100408HFRM-V	4	8	100728HFRM-V	7	28
100510HFRM-V	5	10	100817HFRM-V	8	17
100515HFRM-V	5	15	100833HFRM-V	8	33
100612HFRM-V	6	12	100931HFRM-V	9	31
100619HFRM-V	6	19	101036HFRM-V	10	36

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