Endovascular Treatment In Cerebrovascular Diseases

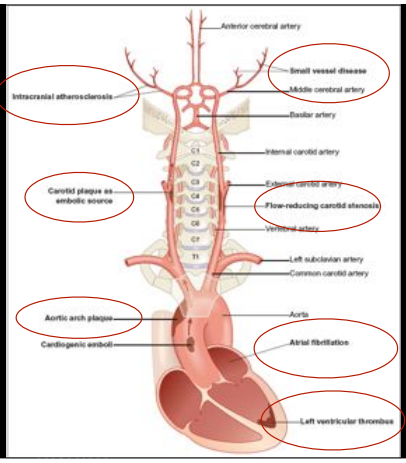
Thaweesak Aurboonyawat, M.D., M.Sc.
Neurosurgery & Interventional neuroradiology
Faculty of Medicine Siriraj Hospital, Mahidol University

Scope

- Ischemic stroke intervention- Embolic stroke, atherosclerotic stenosis
- Hemorrhagic stroke intervention- Aneurysms, AVM
- Hybrid cerebrovascular surgery

Ischemic Stroke intervention

Acute ischemic stroke patients



Clots

Acute ischemic stroke treatment

- Intravenous(IV) thrombolysis
- Intra-arterial(IA) approach
  - Intra-arterial(IA) thrombolysis
  - Bridging therapy (No benefit)
  - Mechanical thrombectomy
  - Intracranial angioplasty and/or stenting

Why IA approach?

- Contraindications for IV thrombolysis
- Out of IV thrombolysis therapeutic window
- Large burden clot

IA approach (Pro)

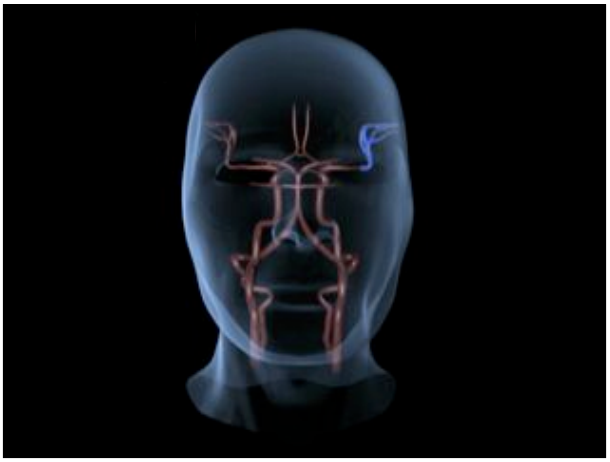
- Extend the treatment window beyond the limit of 6 – 8 hours
- Mechanically fragmenting a clot increases the surface area accessible to fibrinolytic agents

IA approach (Pro)

- Permits a smaller dose of fibrinolytic agent to reach a higher local concentration (lessen ICH risk)
- Clot-retrieval devices may provide faster recanalization

IA approach (Cons)

- Need experience team
- Need time to treat
- High cost



Case illustration

History

- A 63-year-old man
- Underlying cardiomegaly??? Treated at Thaksin hospital
- He presented with left side weakness and dysarthria for 1 hour

Physical Examination

BP 144/77 mmHg, pulse 120/min

E4V5M6, dysarthria

Language : comprehension, repetitive, fluency - good

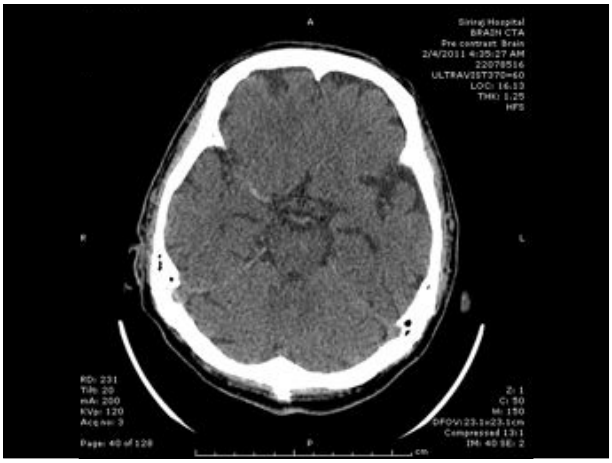
Motor power : Rt grade V, Lt grade II

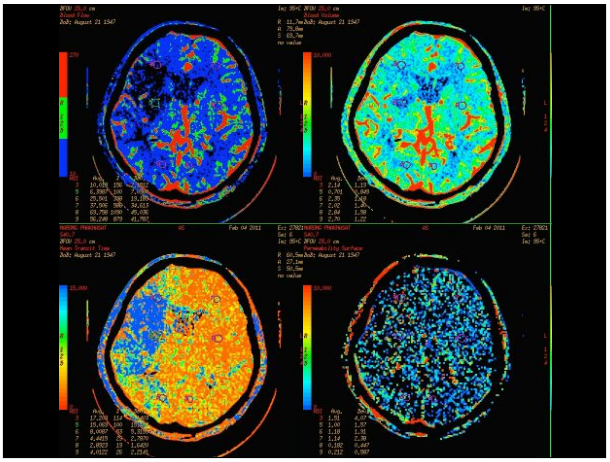
Lt facial palsy (UMN)

Pupil 3 mm BRTL, eye deviate to right side both eyes

NIHSS 14

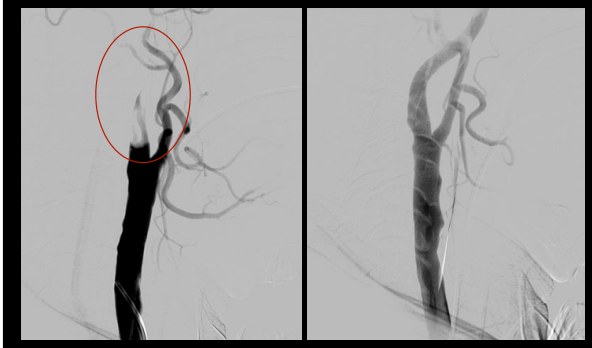
CT BRAIN 04.30 AM



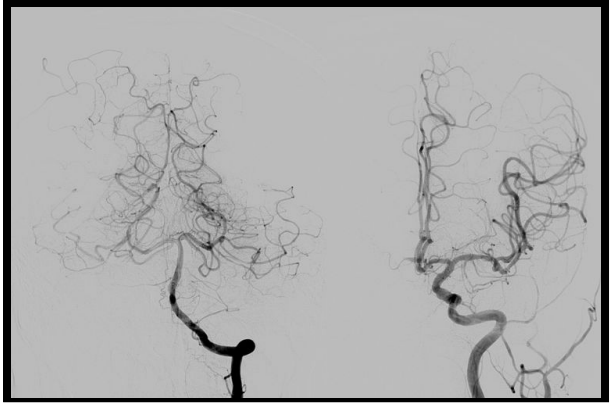


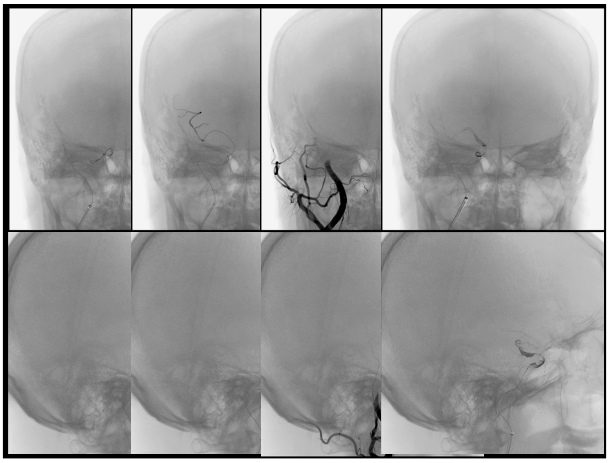
Angiogram 05.30 AM

RICA lateral LICA lateral

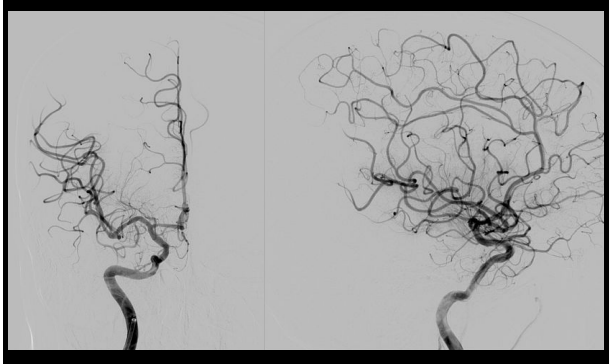


LVA LICA

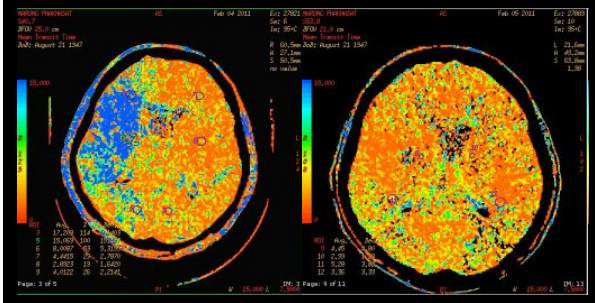




RICA post thrombectomy



CTP post procedure



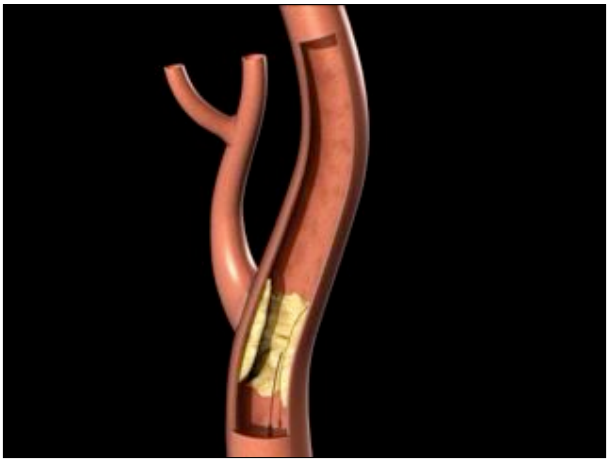
Pre Post

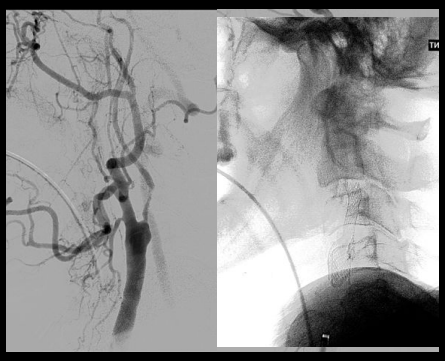
1 week post thrombectomy

3 months

Carotid artery stenting for carotid artery stenosis

Carotid endarterectomy (CEA)





Before After

Stenting versus Endarterectomy for Treatment of Carotid-Artery Stenosis

BACKGROUND—Carotid-artery stenting and carotid endarterectomy are both options for treating carotid-artery stenosis, an important cause of stroke.

METHODS—We randomly assigned patients with symptomatic or asymptomatic carotid stenosis to undergo carotid-artery stenting or carotid endarterectomy. The primary composite end point was stroke, myocardial infarction, or death from any cause during the periprocedural period or any ipsilateral stroke within 4 years after randomization.

RESULTS—For 2502 patients over a median follow-up period of 2.5 years, there was no significant difference in the estimated 4-year rates of the primary end point between the stenting group and the endarterectomy group (7.2% and 6.8%, respectively; hazard ratio with stenting, 1.11; 95% confidence interval, 0.81 to 1.51; P = 0.51). There was no differential treatment effect with regard to the primary end point according to symptomatic status (P = 0.84) or sex (P = 0.34). The 4-year rate of stroke or death was 6.4% with stenting and 4.7% with endarterectomy (hazard ratio, 1.50; P = 0.03); the rates among symptomatic patients were 8.0% and 6.4% (hazard ratio, 1.37; P = 0.14), and the rates among asymptomatic patients were 4.5% and 2.7% (hazard ratio, 1.86; P = 0.07), respectively. Periprocedural rates of individual components of the end points differed between the stenting group and the endarterectomy group: for death (0.7% vs. 0.3%, P = 0.18), for stroke (4.1% vs. 2.3%, P = 0.01), and for myocardial infarction (1.1% vs. 2.3%, P = 0.03). After this period, the incidences of ipsilateral stroke with stenting and with endarterectomy were similarly low (2.0% and 2.4%, respectively; P = 0.85).

CONCLUSIONS—Among patients with symptomatic or asymptomatic carotid stenosis, the risk of the composite primary outcome of stroke, myocardial infarction, or death did not differ significantly in the group undergoing carotid-artery stenting and the group undergoing carotid endarterectomy. During the periprocedural period, there was a higher risk of stroke with stenting and a higher risk of myocardial infarction with endarterectomy. (ClinicalTrials.gov number, NCT00004732.)

N Engl J Med. 2010 July 1; 363(1): 11–23. doi:10.1056/NEJMoa0912321

Hemorrhagic Stroke intervention

Cerebral aneurysms

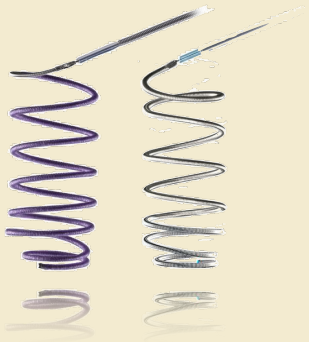
Treatment options

- Craniotomy with aneurysm clipping
- Endovascular treatment
  - Simple coiling
  - Coiling ± stent or balloon>>wide-necked aneurysms
  - Flow diversion>>Giant or fusiform aneurysms
  - Stent graft

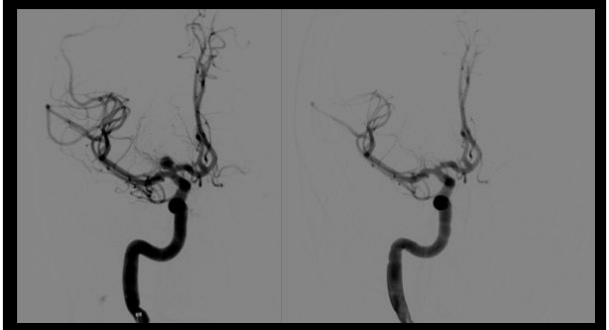
- Endovascular treatment compared with neurosurgical treatment was associated with *fewer adverse outcomes* (6.6% versus 13.2%), *decreased mortality* (0.9% versus 2.5%), *shorter lengths of stay* (4.5 versus 7.4 days), and *lower hospital charges* ($42,044 versus $47,567; combined P<0.05).

Higashida RT, Lahue BJ, Torbey MT, Hopkins LN, Leip E, Hanley DF. Treatment of unruptured intracranial aneurysms: a nationwide assessment of effectiveness. AJNR Am J Neuroradiol. 2007;28: 146 –151.

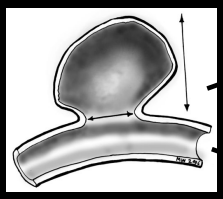
Coils

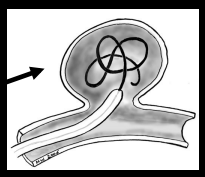


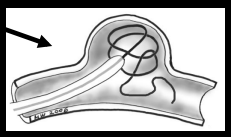
Simple coiling



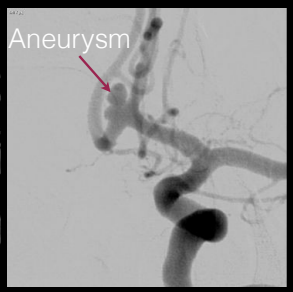
Wide-necked aneurysm







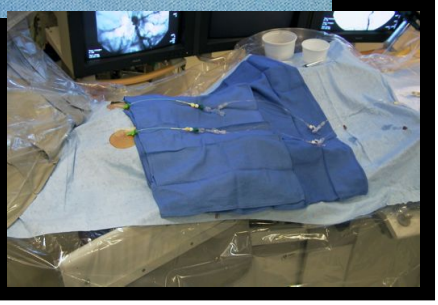
Balloon-assisted coiling



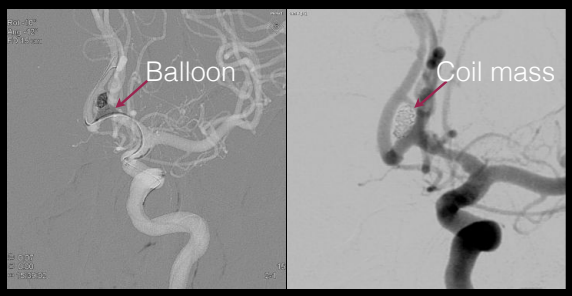
3DRA

Working projection

Low pressure balloon

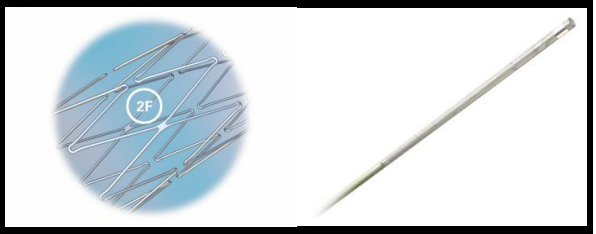


Balloon-assisted coiling



Intraoperative After procedure

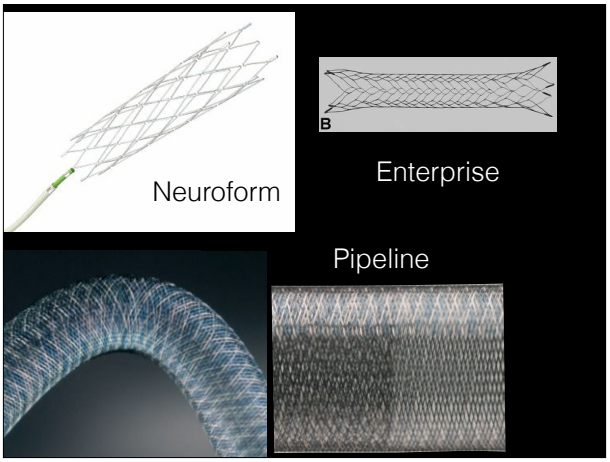
Stent-assisted coiling

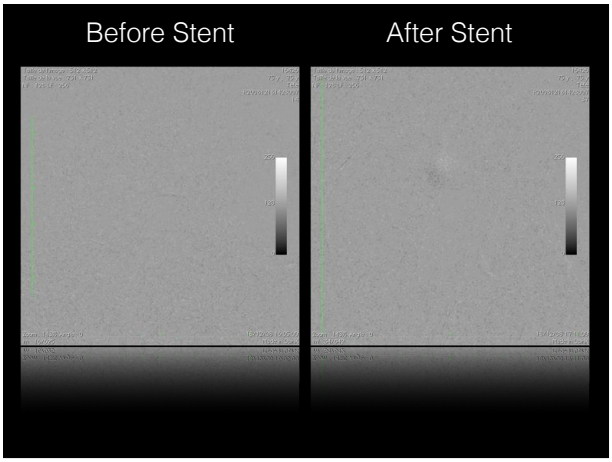


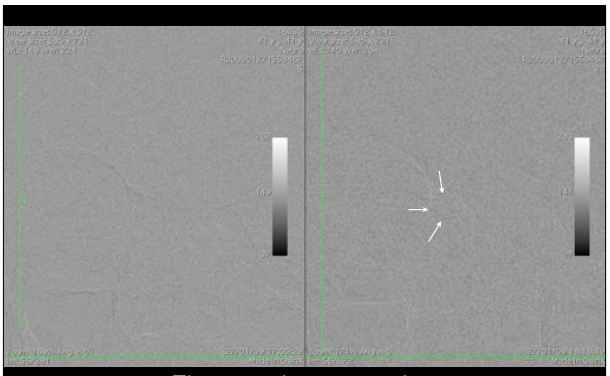
Wide-necked ophthalmic aneurysm

Wide-necked ophthalmic aneurysm

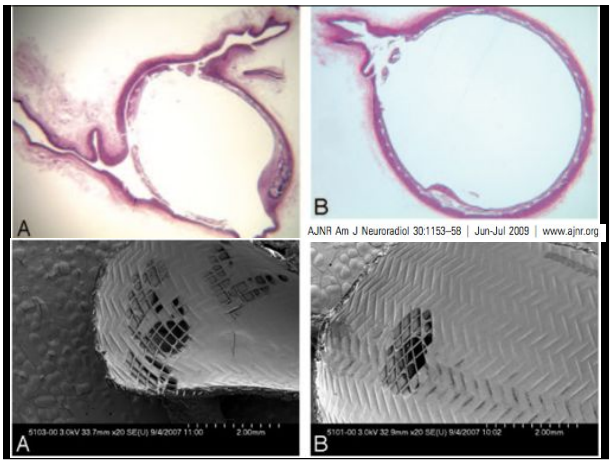
Flow diversion with stents







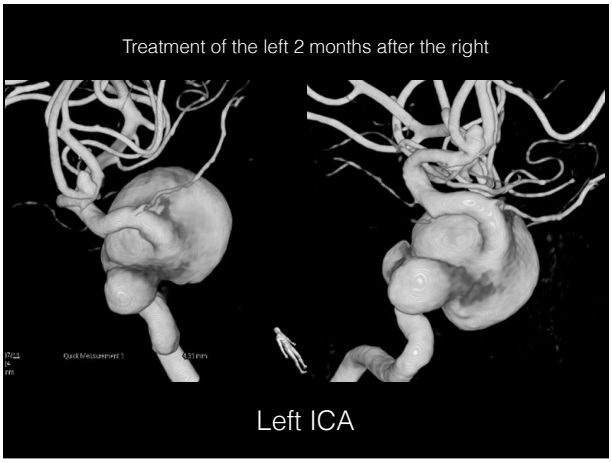
Flow study comparing
between Pre-&Post-stenting



Twin cavernous aneurysms

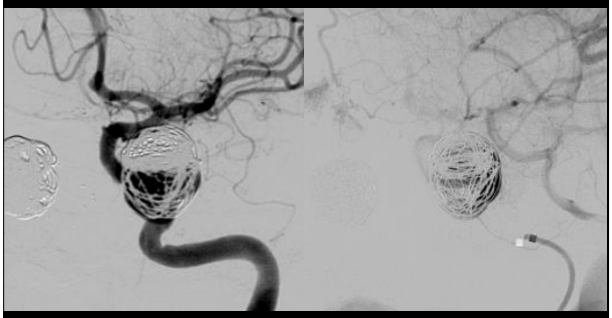
Previously treated with Neuroform stent
w coil on the right

scheduled for Pipeline w coil on the left

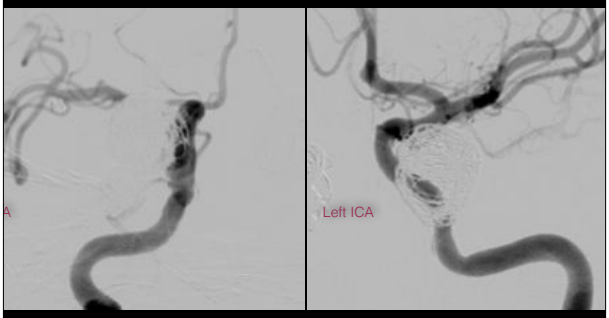


Stent deployment. Pipeline Stent

Final control after stenting and coils



Control at 5 months after left ICA treatment with stent

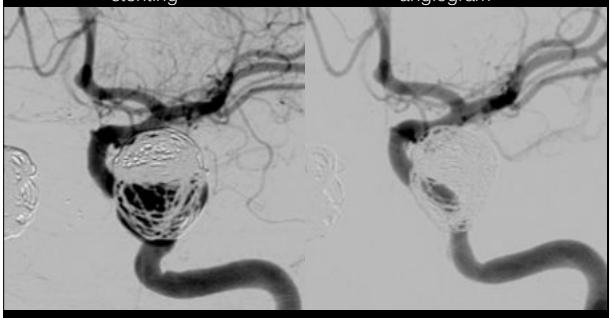


Neuroform w coil

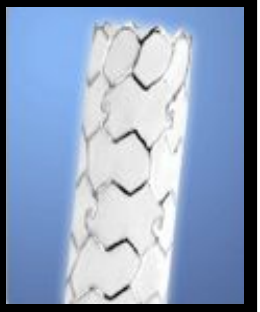
Pipeline w coil

Immediate post stenting

4 month control angiogram



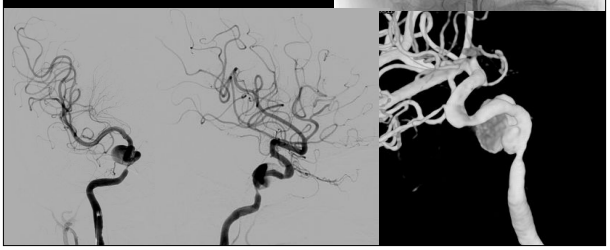
Stent graft for aneurysms

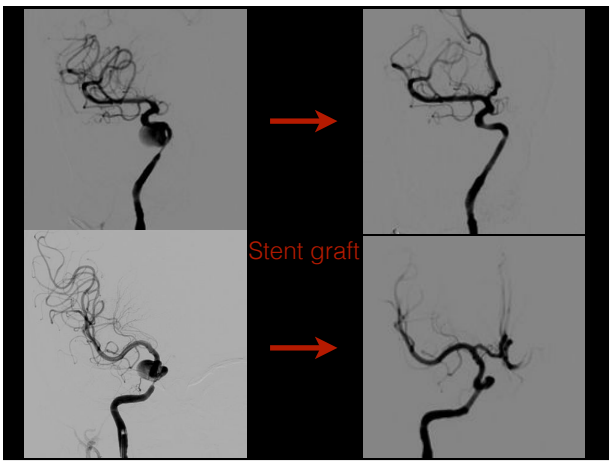


Indications

- Selected cervical or petrous aneurysms
- Traumatic aneurysms

A 70-year-old woman presented with acute right ophthalmoplegia

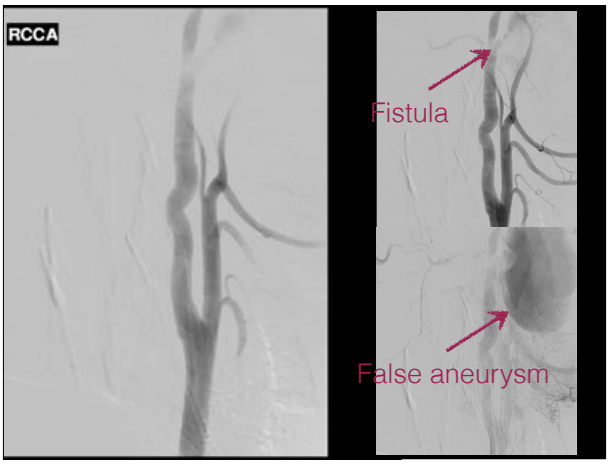




Head&neck vascular injuries

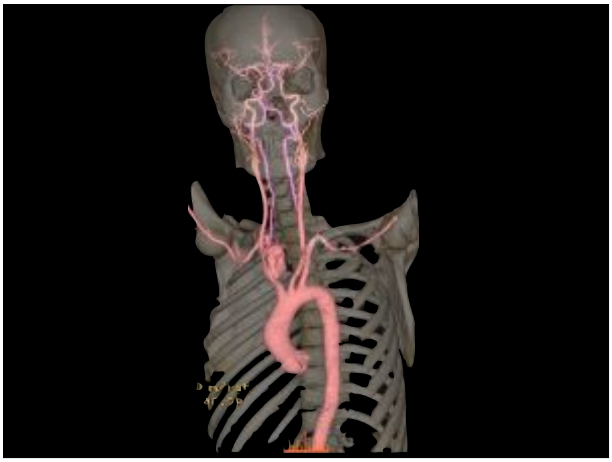
A 28-year-old man got a gun shot wound at right side of the neck.

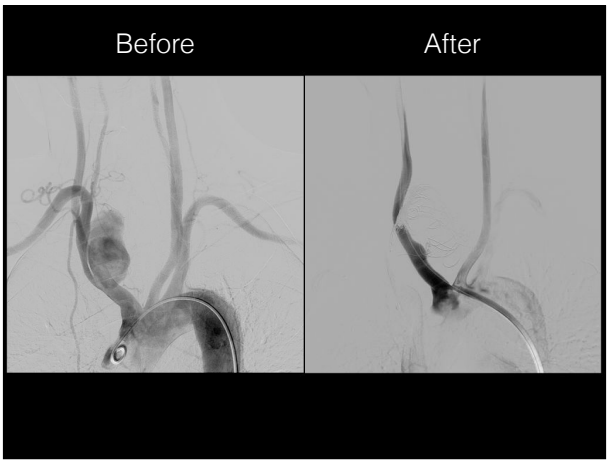
He had breathing difficulty after the accident.

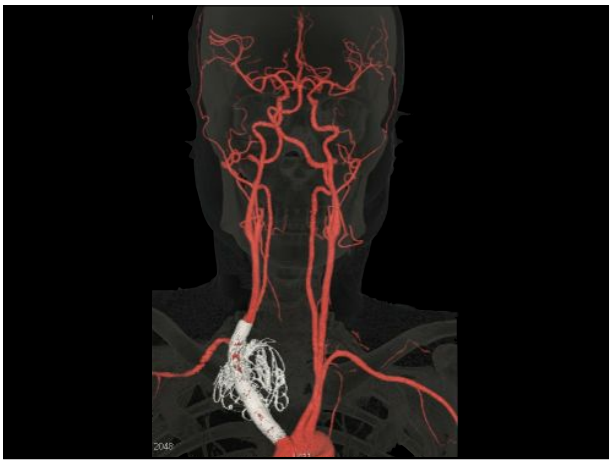


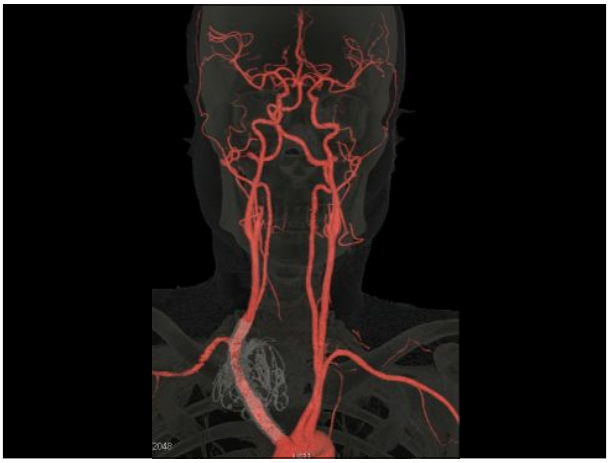
Blunt brachiocephalic artery injury

- A 35-year-old man with history of MCA and head injury 3 weeks ago.
- He developed horsiness and had secretion.
- His CXR reveals widening of mediastinum.
- His CT chest and neck study shows traumatic or false aneurysm at right brachiocephalic trunk.



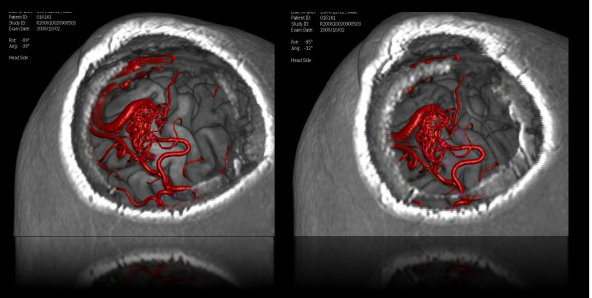






Brain Arteriovenous Malformations

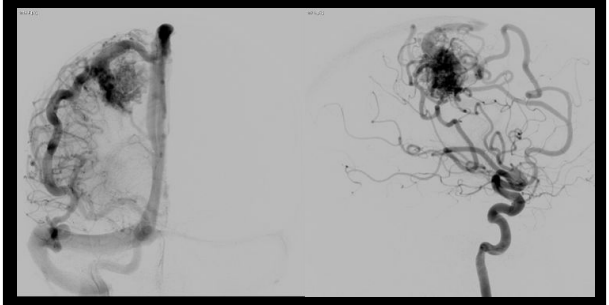
Brain AVM



Treatment options

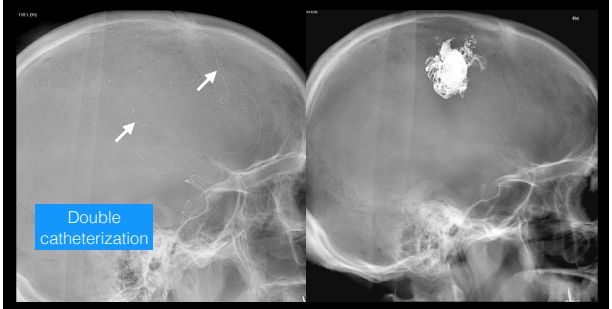
- Craniotomy with AVM resection- small (<3 cm), superficial non-eloquent location
- Radiosurgery- small (<3 cm), deep location
- Embolization

Rt.Parietal AVM

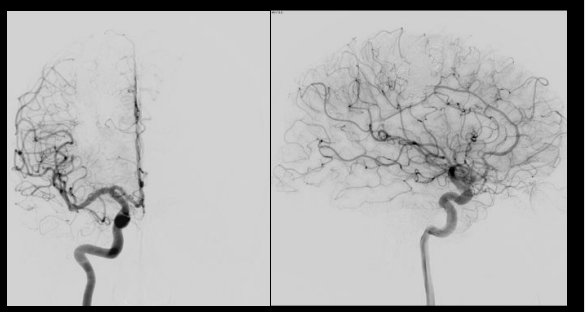


AP Lateral

Onyx embolization

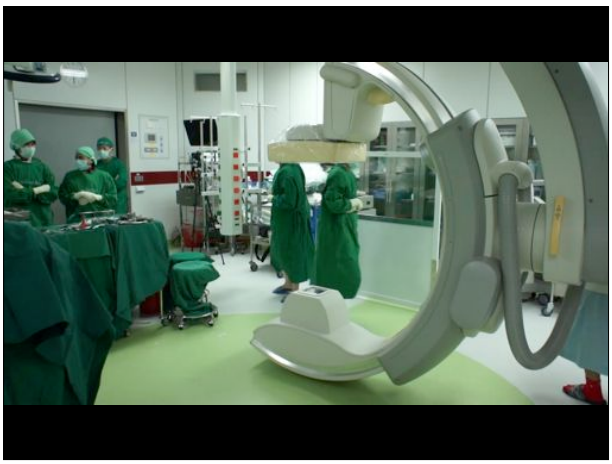


Post-embolization



AP Lateral

Hybrid cerebrovascular surgery



Indications of IOA

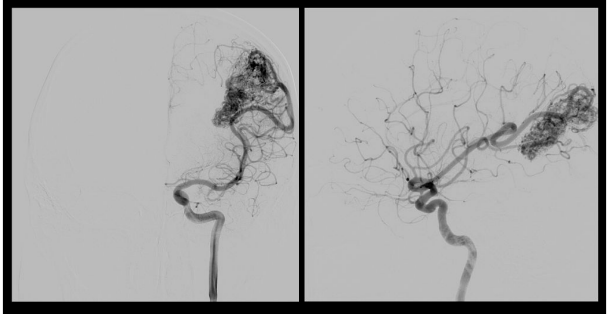
- Diagnostic cerebral angiography
- Therapeutic embolization
- Surgical treatment assistant

Diagnostic cerebral angiography

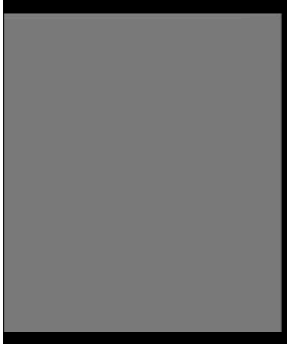
↓

Brain AVM resection

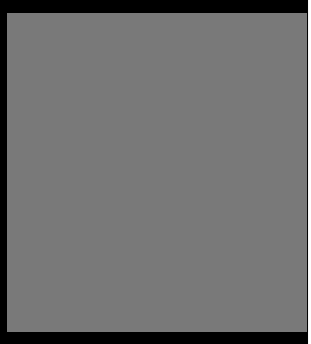
Left parieto-occipital AVM



During surgery

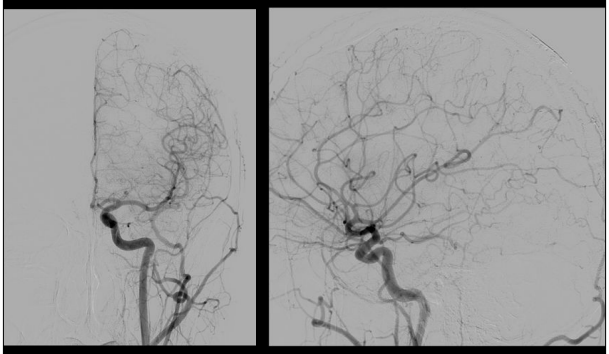


Before Resection



After Resection

3 months after surgery



Utility, Safety, and Accuracy of Intraoperative Angiography in the Surgical Treatment of Aneurysms and Arteriovenous Malformations

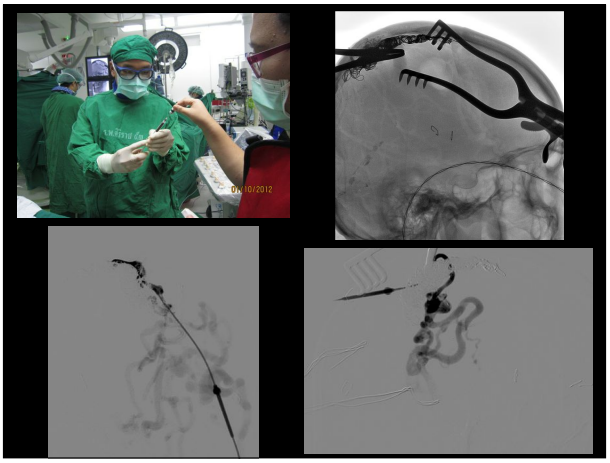
- Evaluation of the initial angiographic results showed that the lesion was eliminated in 66 cases (67%)
- Surgical procedure was modified with further surgical exploration and resection in 28 cases (29%)
- Three or more intraoperative angiograms were obtained in 10 cases (10%)

AJNR Am J Neuroradiol 20:1457–1461, September 1999

Angiography and embolization

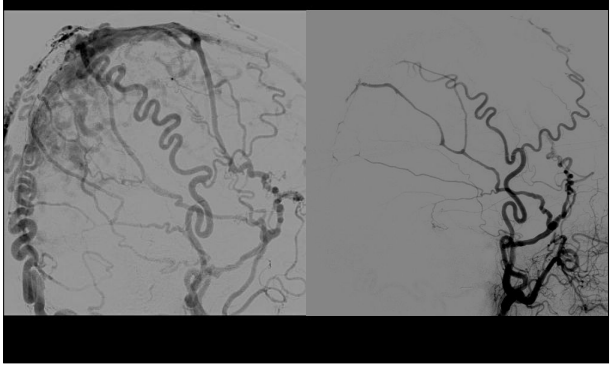
↓

Dural AVF



Pre embolization

Post embolization

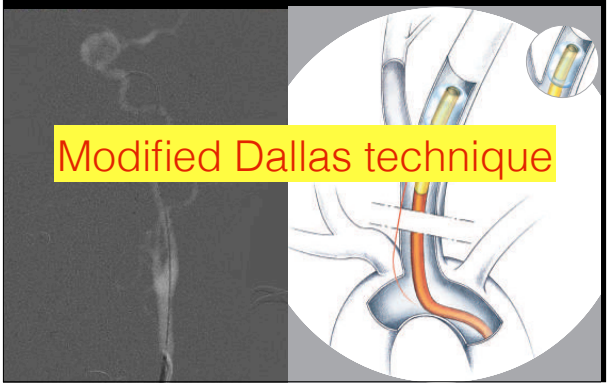


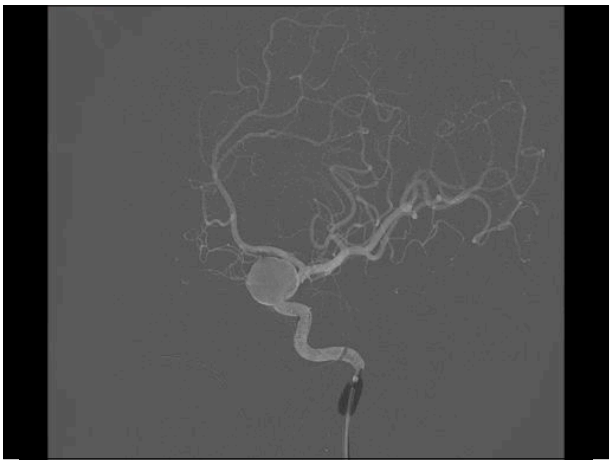
Angiography assisted surgical treatment

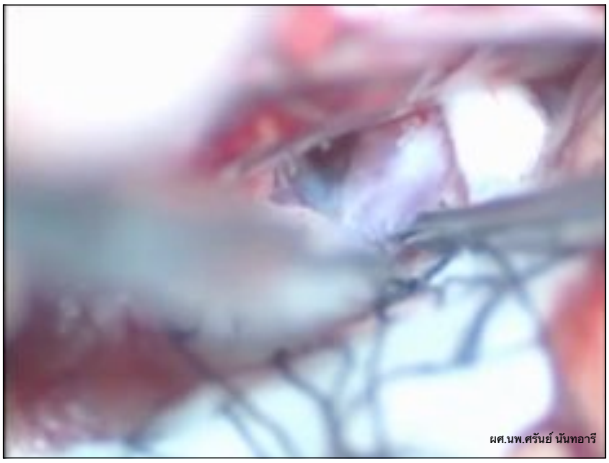
↓

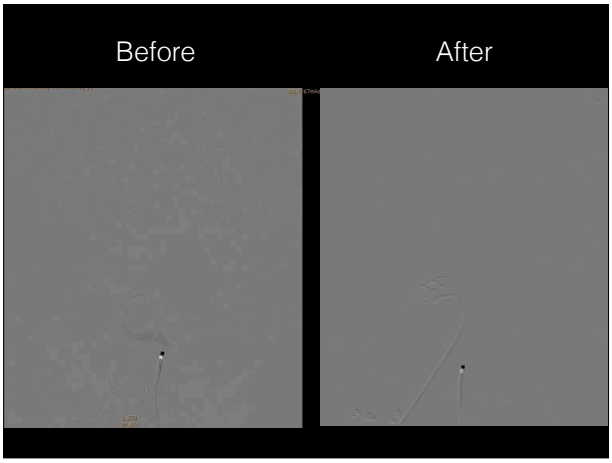
Giant or large aneurysm clipping

Double lumen balloon guiding catheter

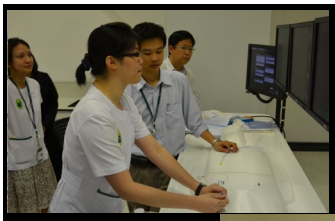








Endovascular training
and
neurosurgeons



Endovascular
training

Thank you