11-1-2019

A Current Review of Cerebral Aneurysm Treatment: Traditional and Novel Approaches

Max Kole

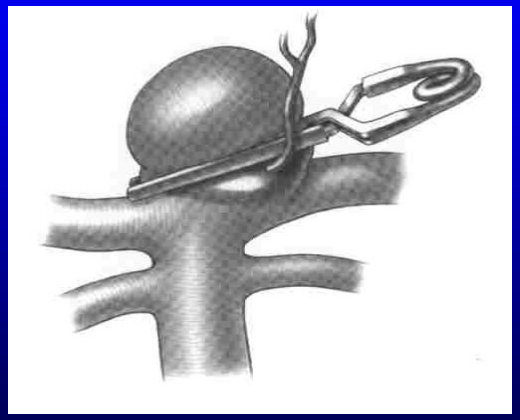
A CURRENT REVIEW OF CEREBRAL ANEURYSM TREATMENT: TRADITIONAL AND NOVEL APPROACHES

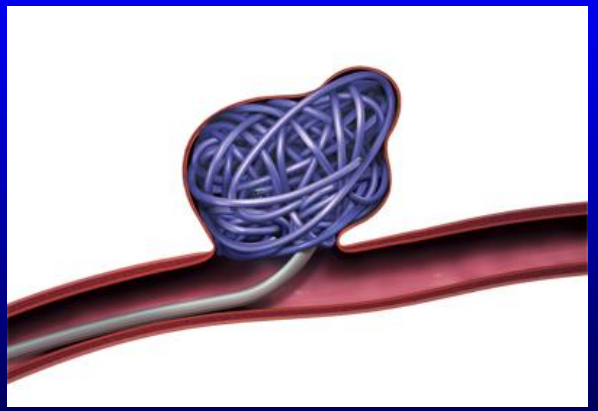
By Max Kole M.D.

Department of Neurosurgery and Diagnostic Radiology

CAST Neuroendovascular Fellowship Director

Henry Ford Hospital





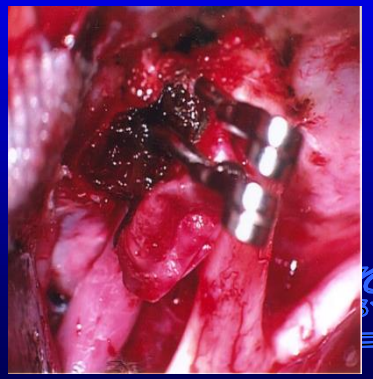
Henry Ford Health System

Historical Perspective

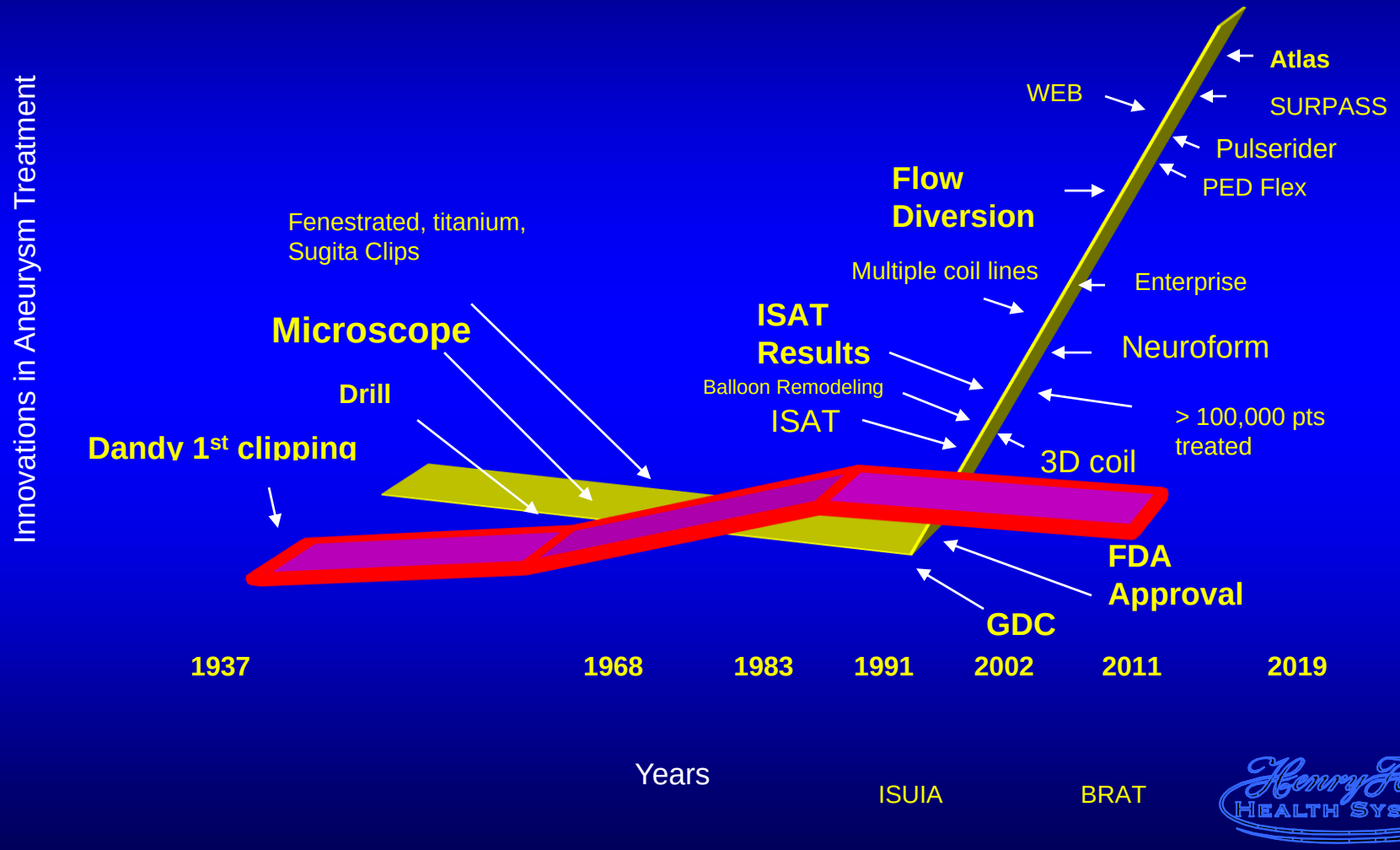
- 1923-Sir Charles Symonds established subarachnoid hemorrhage (SAH) as a distinct clinical entity

- 1927- Egas Moniz established cerebral angiography, an accurate test to diagnose intracranial aneurysms

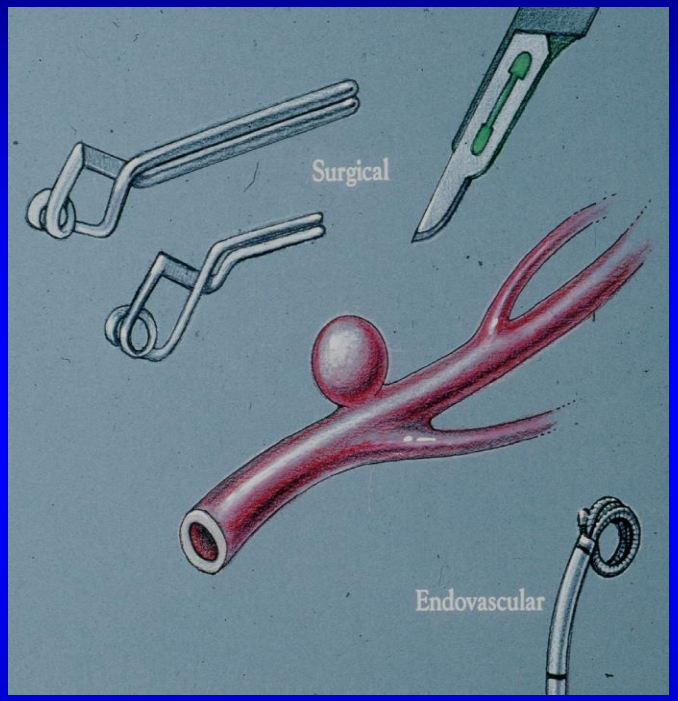
- 1937- Walter Dandy established the technique of aneurysm clipping

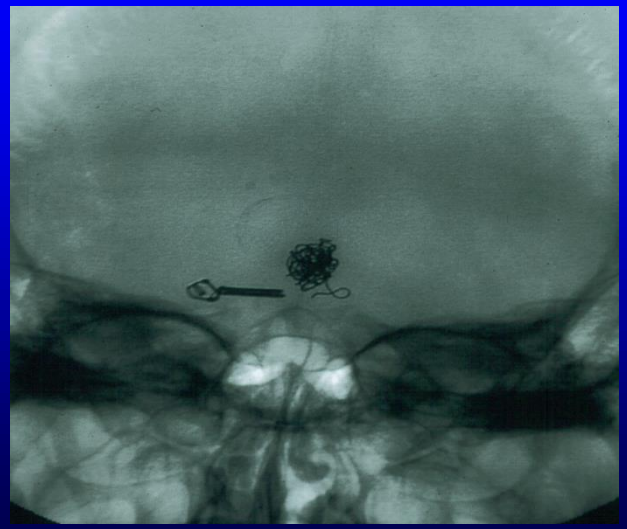


Intracranial Aneurysm Treatment Timeline



To Clip? To Coil?
or Flow Divert?





Henry Ford Health System

Optimal Aneurysm Treatment

Natural History

Indications, Risks and Benefits of Treatment

Durability and Efficacy of Treatment Modality

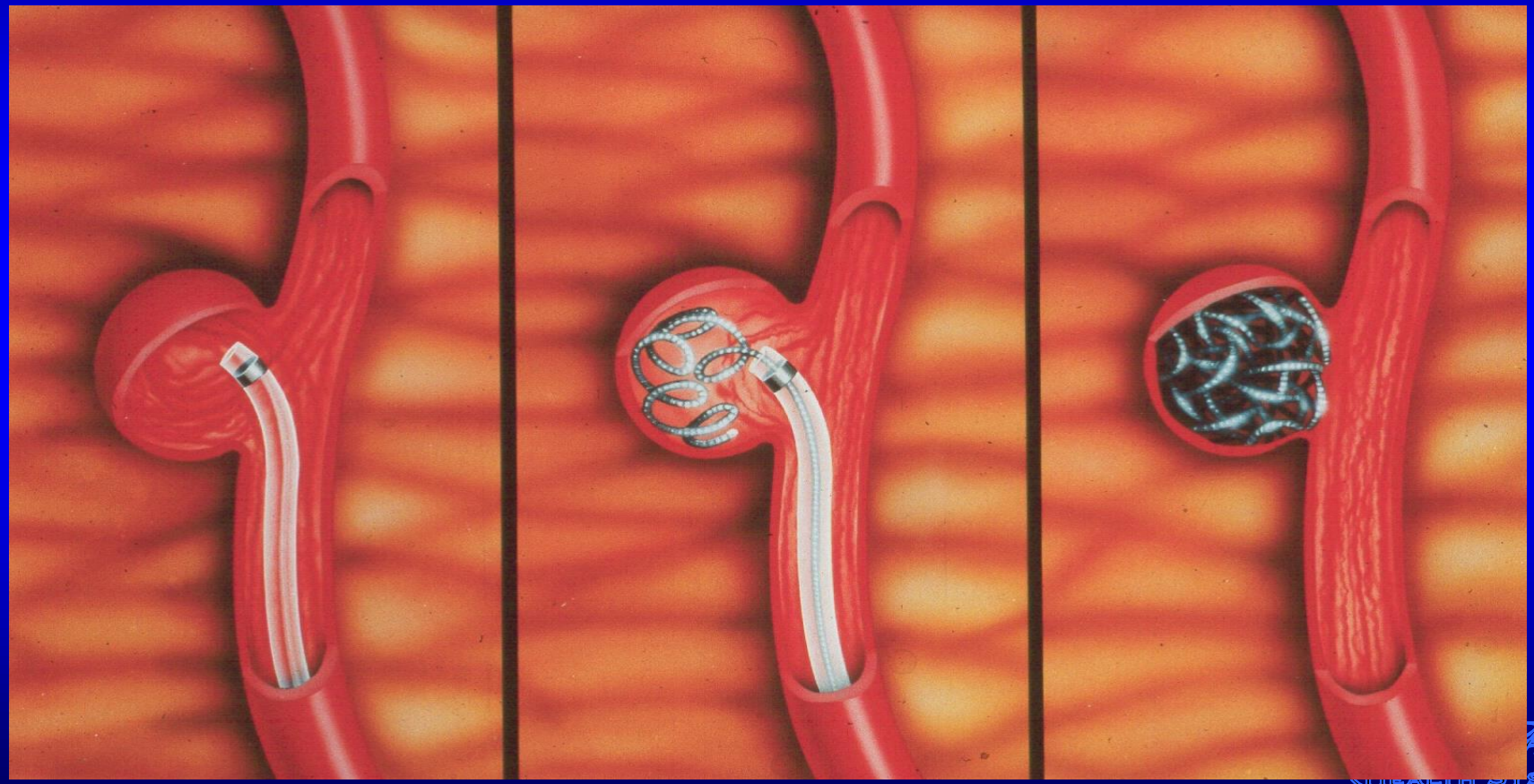
Aneurysm Characteristics,
Location, Size, Neck, Geometry

Local Expertise

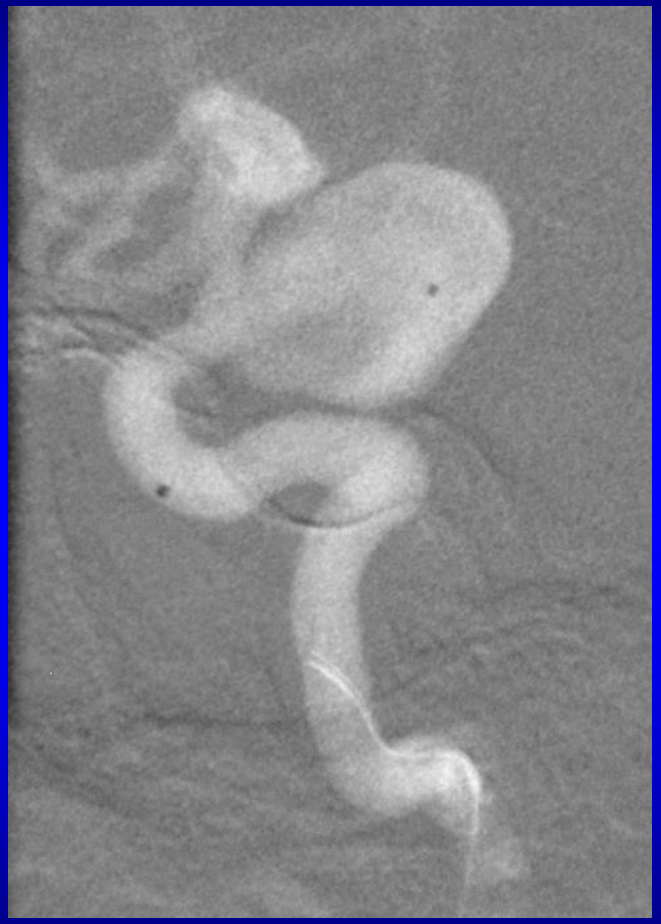
Find a team with comprehensive experience!

Henry Ford Health System

Endovascular Coiling of Aneurysms



Placement of Microcatheter in Aneurysm



Henry Ford Health System

Henry Ford Health System

The durability of endovascular coiling versus neurosurgical clipping of ruptured cerebral aneurysms: 18 year follow-up of the UK cohort of the International Subarachnoid Aneurysm Trial (ISAT)

Andrew J Molyneux, Jacqueline Birks, Alison Clarke, Mary Sneade, Richard S C Kerr

Summary

Background Previous analyses of the International Subarachnoid Aneurysm Trial (ISAT) risks of recurrent subarachnoid haemorrhage and death or dependency for a minim maximum of 14 years after treatment of a ruptured intracranial aneurysm with eithe endovascular coiling. At 1 year there was a 7% absolute and a 24% relative risk reduction the coiling group compared with the clipping group, but the medium-term results show treatment of the target aneurysm in the patients given coiling. We report the long-term UK cohort.

Methods In ISAT, patients were randomly allocated to either neurosurgical clipping or endovascular coiling after a subarachnoid haemorrhage, assuming treatment equipoise, between Sept 12, 1994, and May 1, 2002. We followed up 1644 patients in 22 UK neurosurgical centres for death and clinical outcomes for 10·0–18·5 years. We assessed dependency as self-reported modified Rankin scale score obtained through yearly questionnaires. Data for recurrent aneurysms and rebleeding events were collected from questionnaires and from hospital and general practitioner records. The Office for National Statistics supplied data on deaths. This study is registered, number ISRCTN49866681.

Findings At 10 years, 674 (83%) of 809 patients allocated endovascular coiling and 657 (79%) of 835 patients allocated neurosurgical clipping were alive (odds ratio [OR] 1·35, 95% CI 1·06–1·73). Of 1003 individuals who returned a questionnaire at 10 years, 435 (82%) patients treated with endovascular coiling and 370 (78%) patients treated with neurosurgical clipping were independent (modified Rankin scale score 0–2; OR 1·25; 95% CI 0·92–1·71). Patients in the endovascular treatment group were more likely to be alive and independent at 10 years than were patients in the neurosurgery group (OR 1·34, 95% CI 1·07–1·67). 33 patients had a recurrent subarachnoid haemorrhage more than 1 year after their initial haemorrhage (17 from the target aneurysm).

Interpretation Although rates of increased dependency alone did not differ between groups, the probability of death or dependency was significantly greater in the neurosurgical group than in the endovascular group. Rebleeding was more likely after endovascular coiling than after neurosurgical clipping, but the risk was small and the probability of disability-free survival was significantly greater in the endovascular group than in the neurosurgical group at 10 years.

version first appeared at thelancet.com on March 13, 2015

Oxford Neurovascular and Neuroradiology Research Unit, Nuffield Department of Surgical Sciences, University of Oxford, Oxford, UK (A J Molyneux FRCR, A Clarke BA, M Sneade BA); Centre for Statistics in Medicine, Oxford, UK (J Birks M.Sc); and Department of Neurosurgery, John Radcliffe Hospital, Oxford, UK (R S C Kerr FRCS)

Correspondence to: Dr A J Molyneux, Oxford Neurovascular and

	Rebleeding from target aneurysm* (deaths)	Rebleeding from aneurysm known at baseline† (deaths)	De-novo aneurysm‡ (deaths)	Aneurysm from unknown source (deaths)	Total
Endovascular coiling group (8351 patient-years)	13 (3)	4 (2)	3 (1)	1 (1)	21 (7)
Neurosurgical clipping group (8228 patient-years)	4 (2)	2 (2)§	6 (3)	0	12 (7)
Total	17 (5)	6 (4)	9 (4)	1 (1)	33 (14)

Numbers for UK patients as of May 31, 2012. Numbers in parentheses show deaths within 30 days of rebleeding. *Aneurysm identified at the time of enrolment in the trial (log-rank p=0·02; figure 1). †Other known aneurysm present on the first angiogram but not believed to have ruptured. ‡Aneurysms not shown on the first angiogram. §One patient died at 48 days from recurrent subarachnoid haemorrhage.

Table 2: Number of patients who had recurrent subarachnoid haemorrhage after 1 year

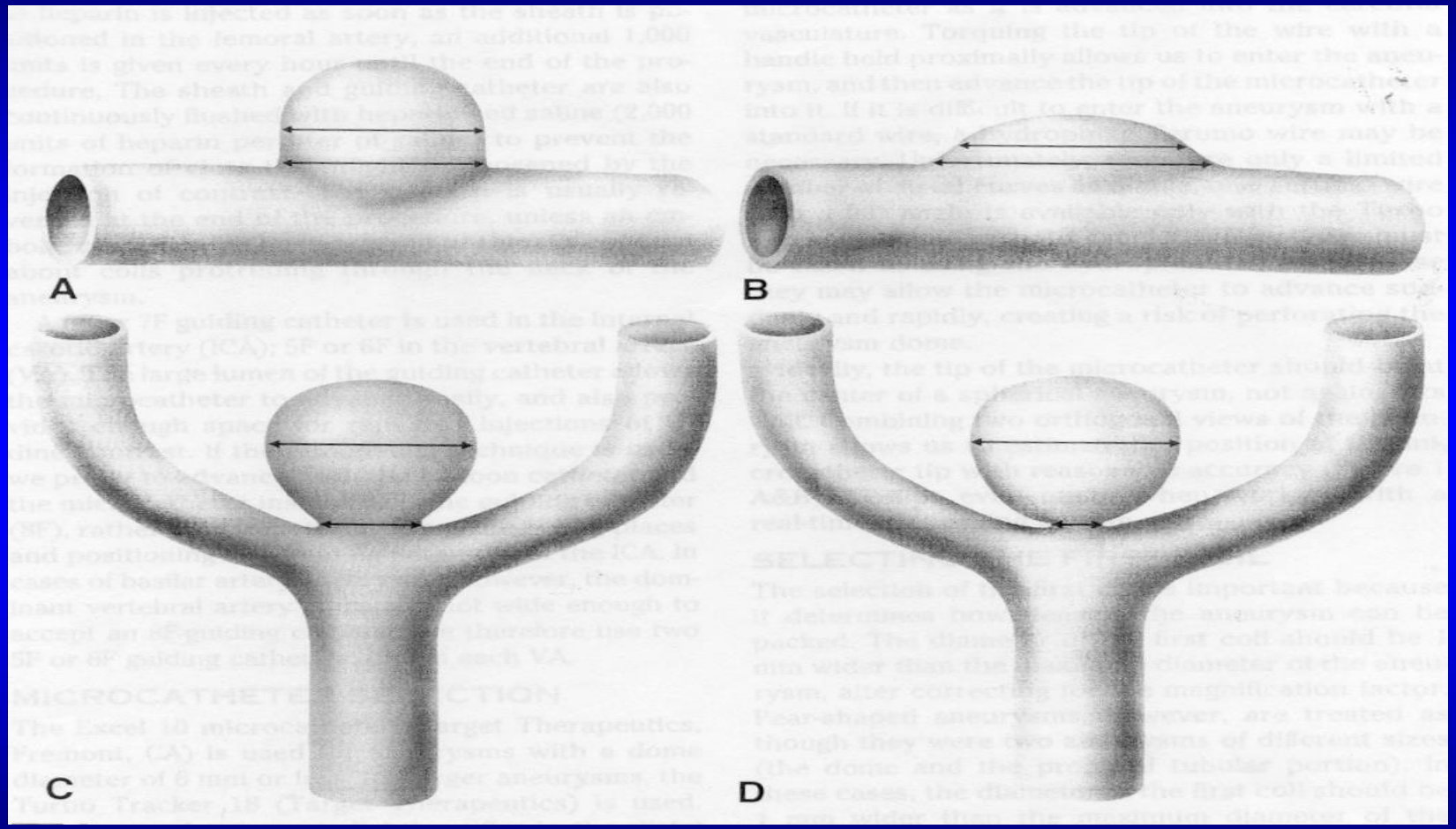
Introduction

Since the introduction of endovascular coiling of ruptured cerebral aneurysms in 1990 in the USA and in 1992 in Europe, concerns have been expressed about the

secondary objective was to assess differences between the two treatments in the prevention of rebleeding from the treated aneurysm. The tertiary objective, reported

Lancet 385 (9969): 691-7, 2015

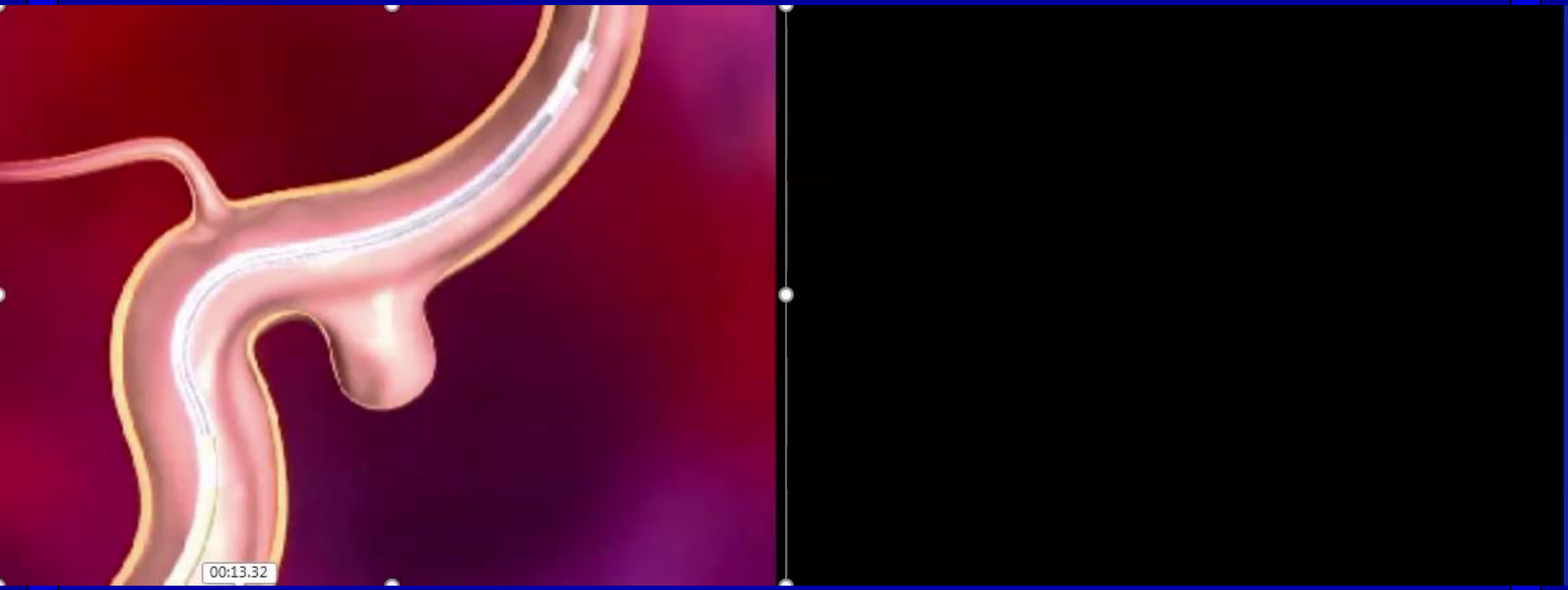
Aneurysm Geometry



Balloon Remodeling and Stents

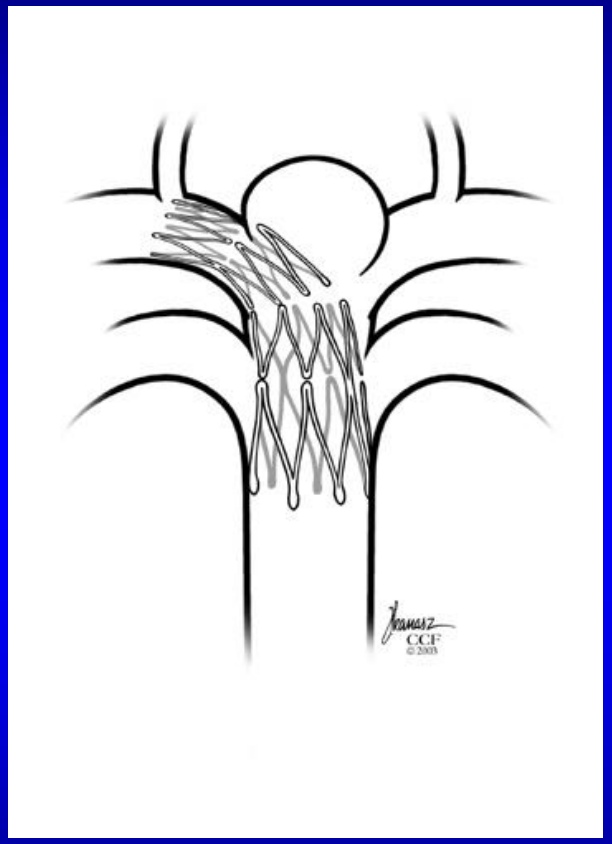
Henry Ford Health System

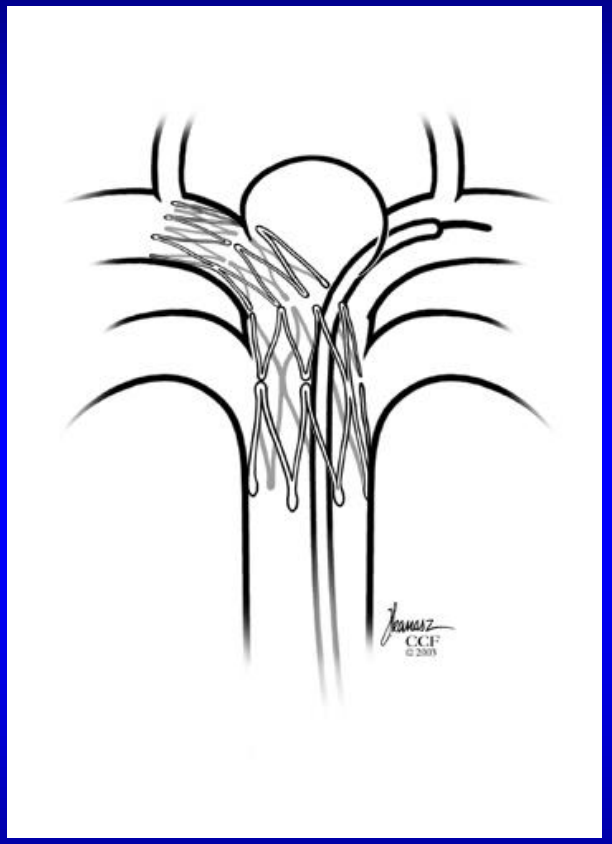
Stent Assisted Coiling

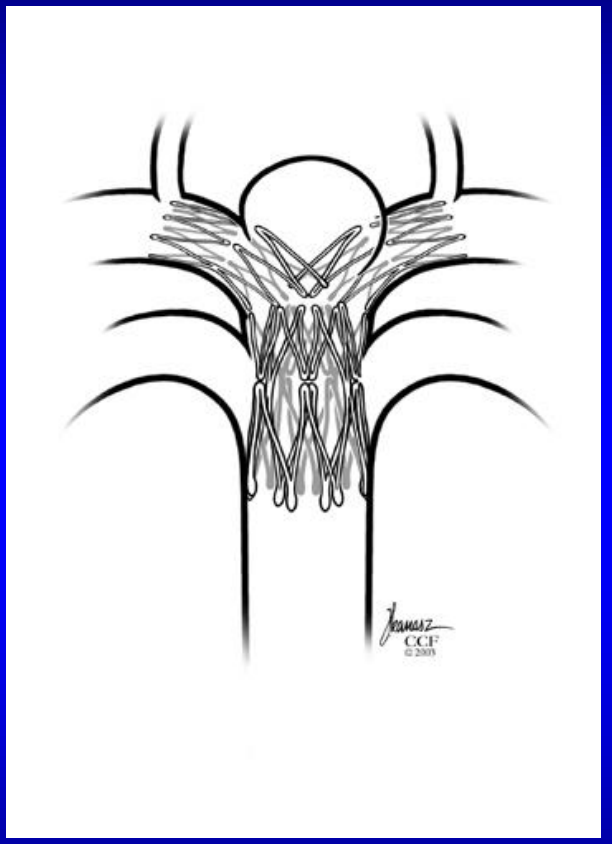


Henry Ford Health System

NEUROFORM Y-STENT CONFIGURATION for WIDE-NECKED BASILAR ANEURYSMS





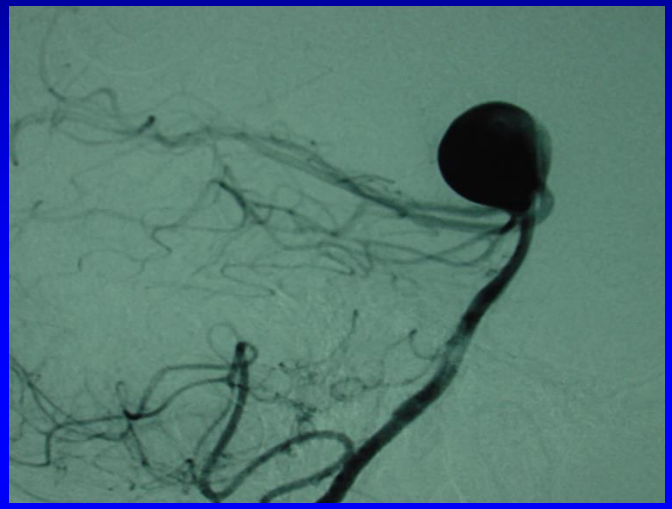


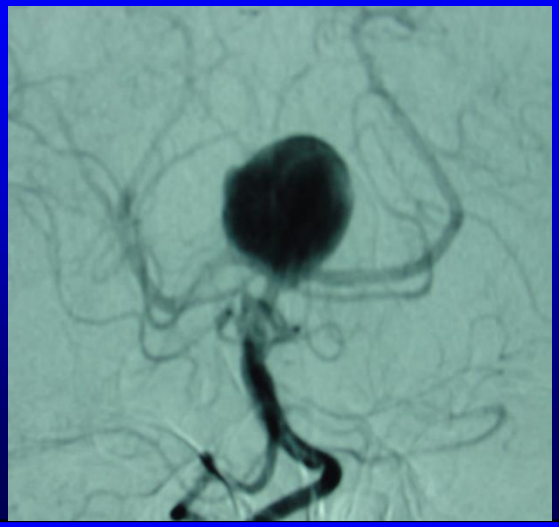
Henry Ford Health System

Henry Ford Health System

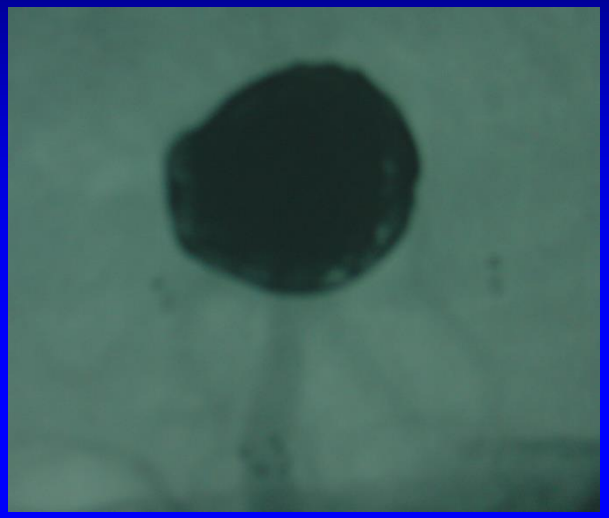
Henry Ford Health System

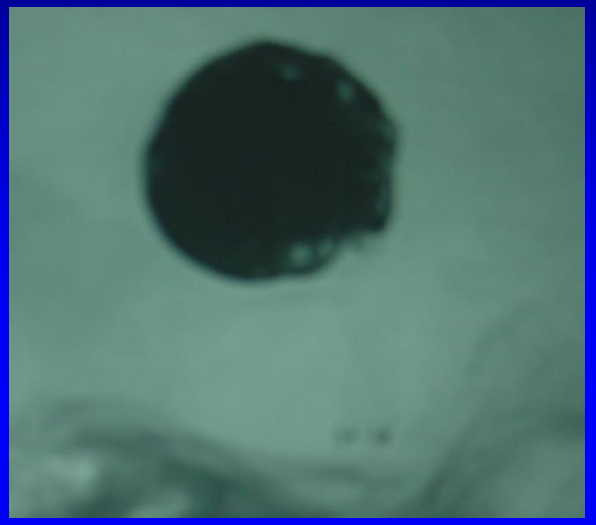
WIDE-NECKED BASILAR ANEURYSM



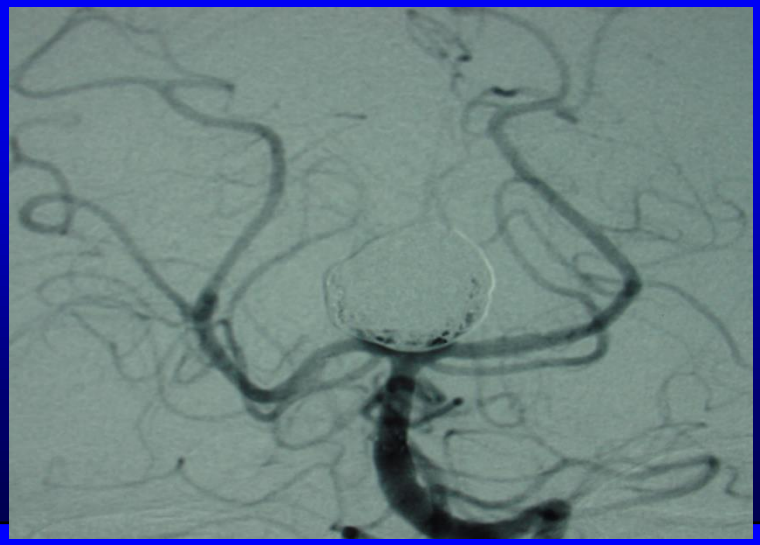


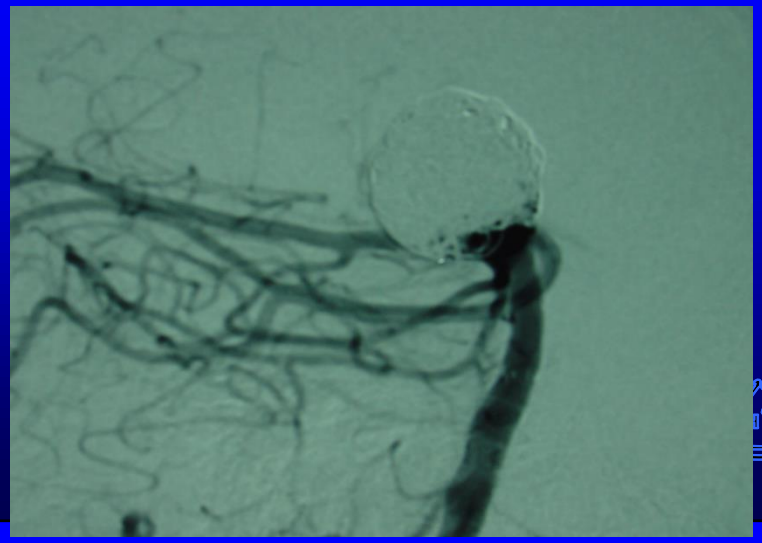
POST STENT ASSISTED COILING WITH Y-CONFIGURATION



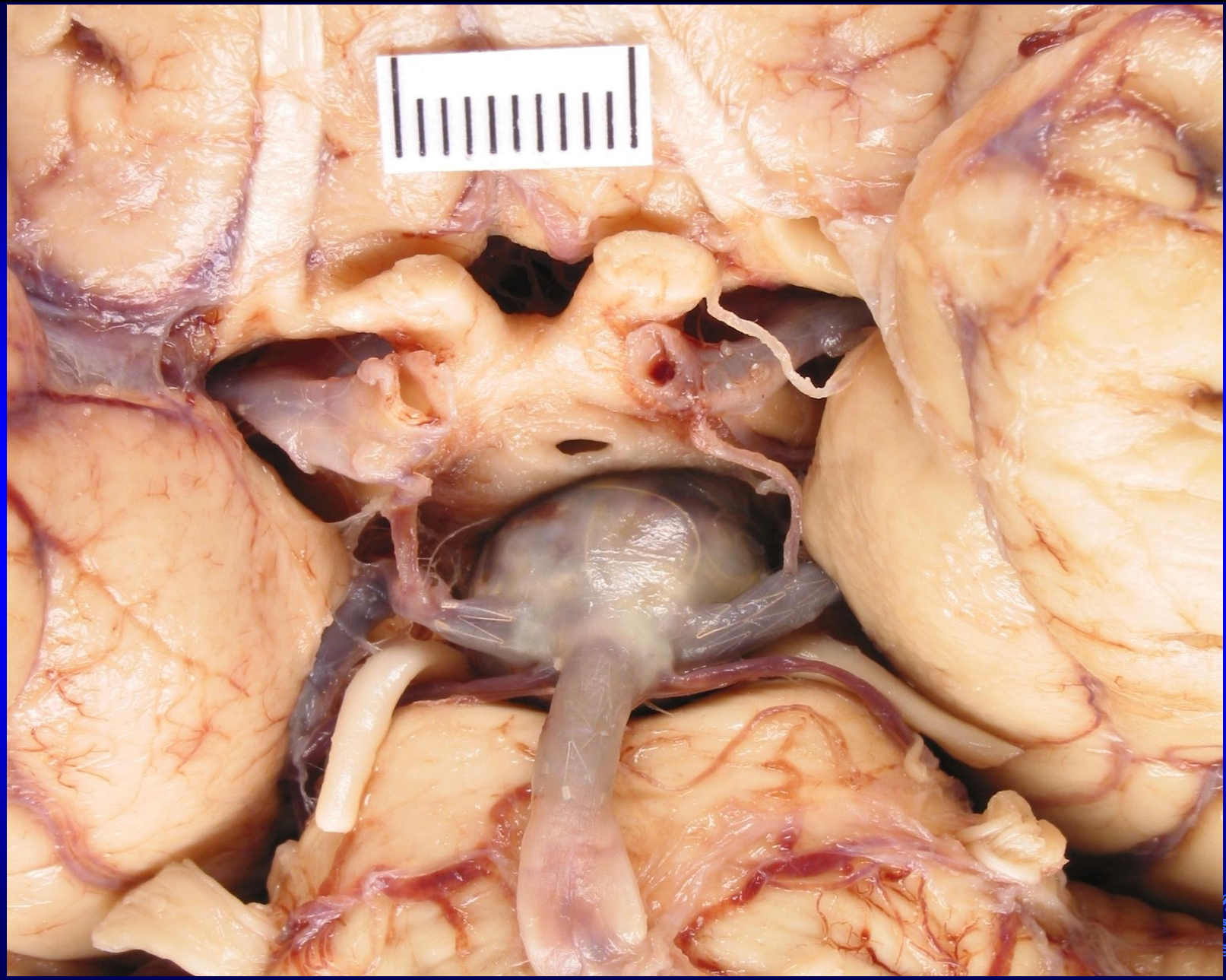


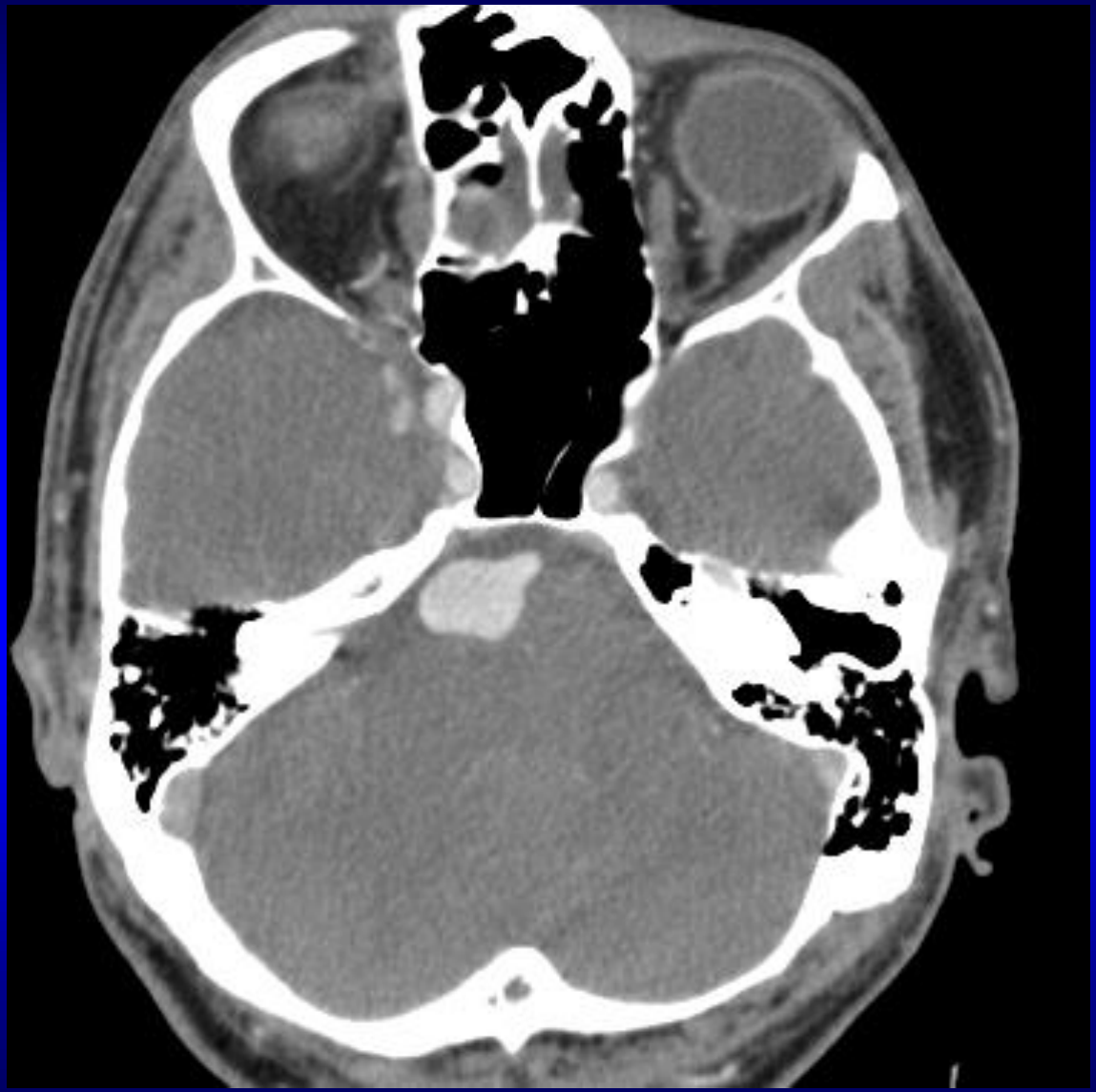
(2) 3.5 x 20 mm Neuroform stents



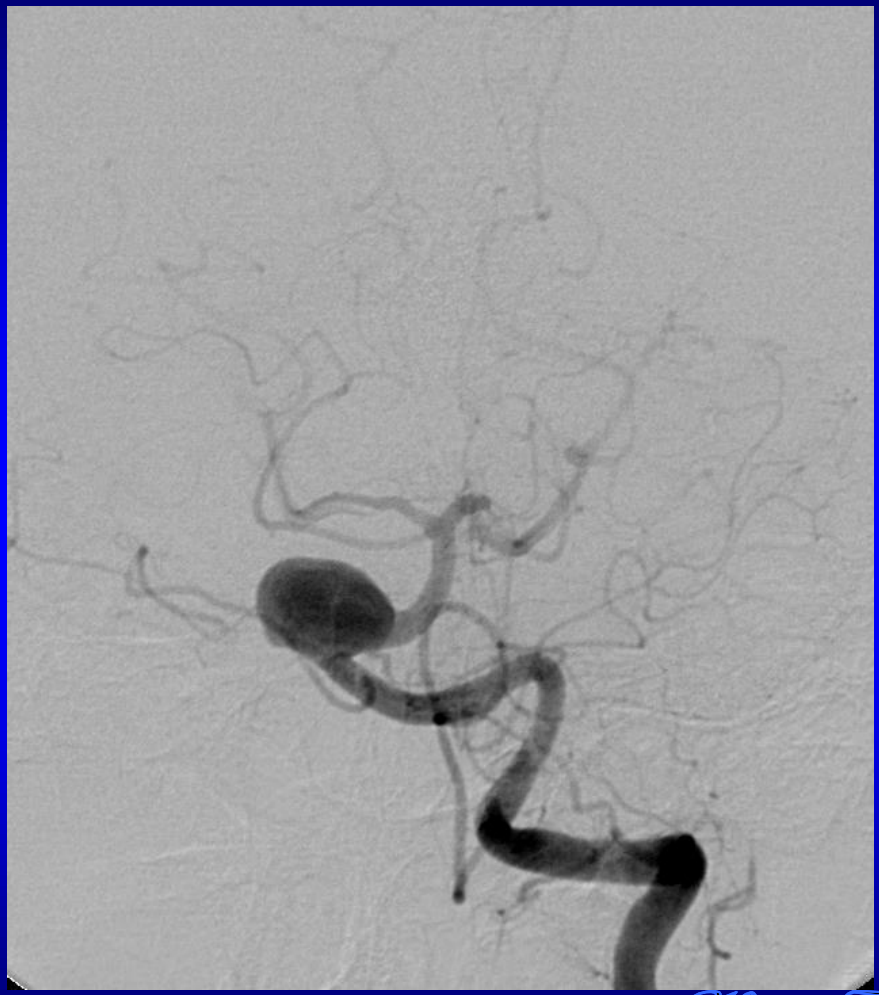


210 cm of coils



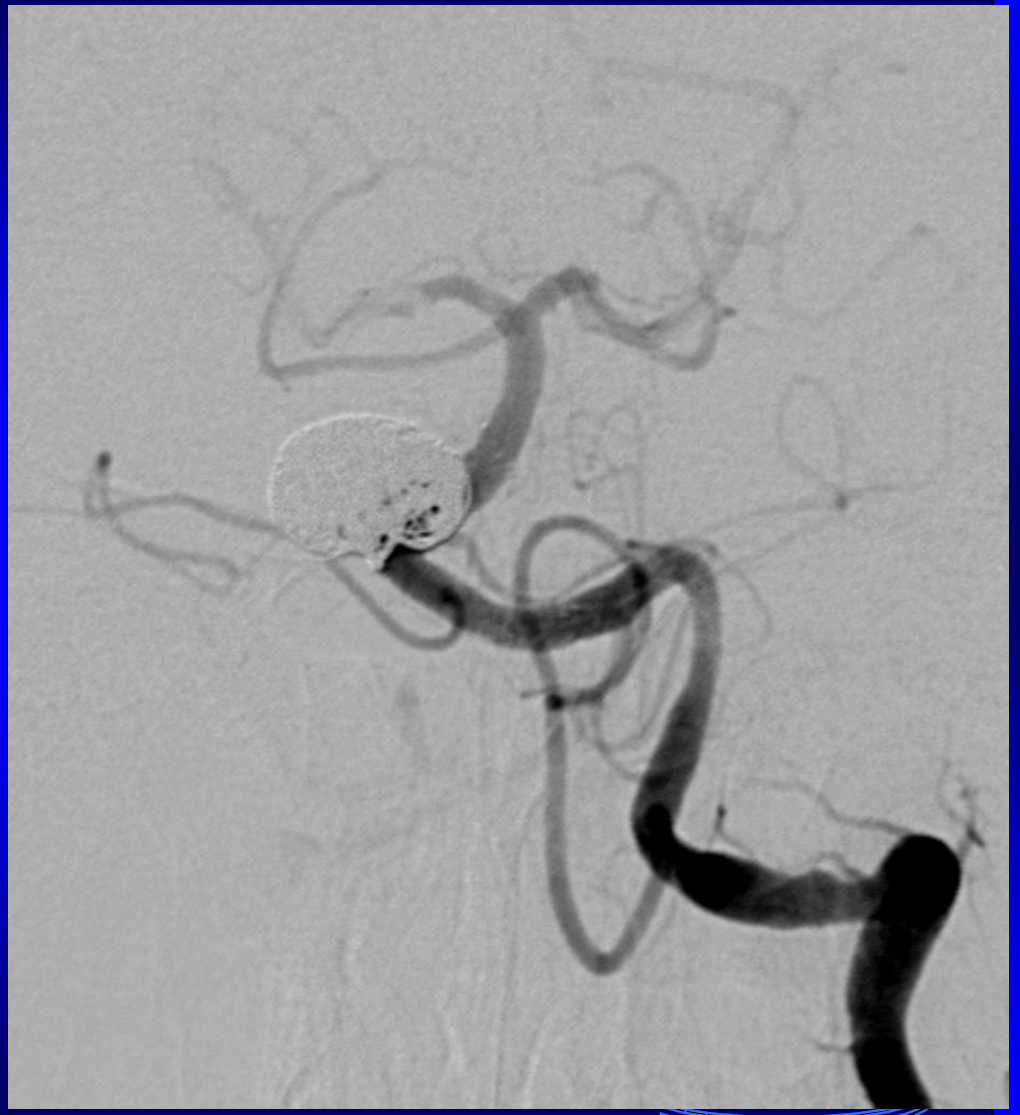


Henry Ford Health System



Henry Ford Health System

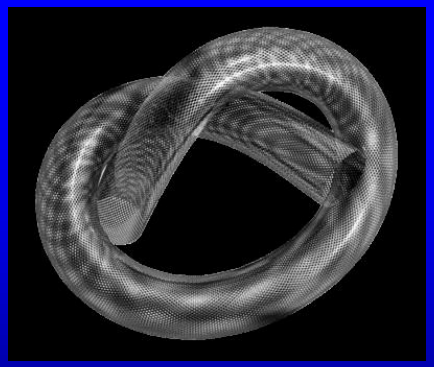
Henry Ford Health System



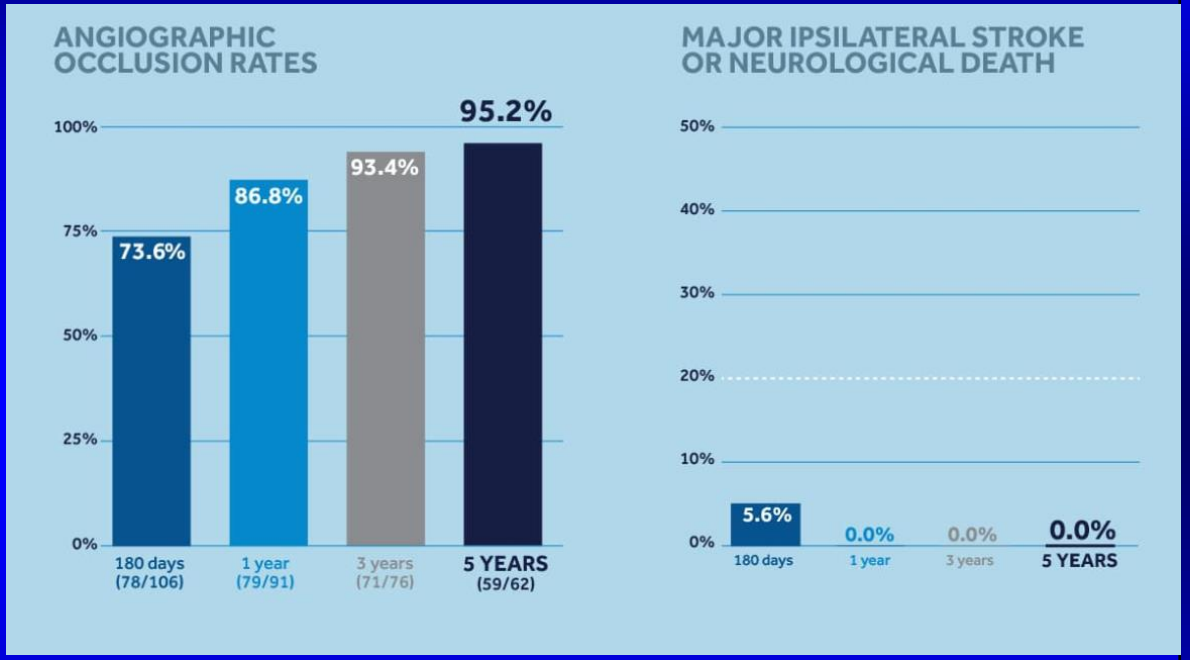
Flow Diversion

Placement of a low porosity stent across the aneurysmal neck redirects flow away from the aneurysm and back into the parent artery

Stroke. 2011;42: **2363-2368.**



Braided mesh cylinder
Platinum nickel-cobalt chromium alloy
Self-expanding, 35% metallic coverage
Variable diameter and
Pore size is 0.02 to 0.05 mm2



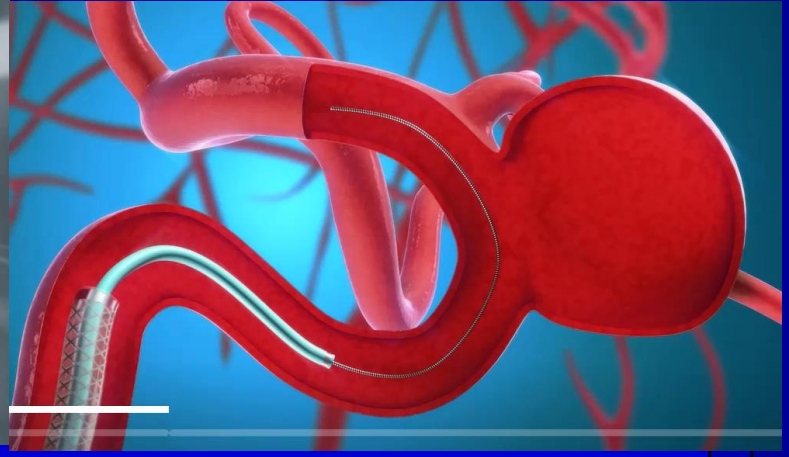
PIPELINE FOR UNCOILABLE OR FAILED ANEURYSMS PUFS TRIAL

Neurosurgery. 2017 80 (1) : 40-48

Henry Ford Health System

PED FLEX, Medtronic

SURPASS, Stryker



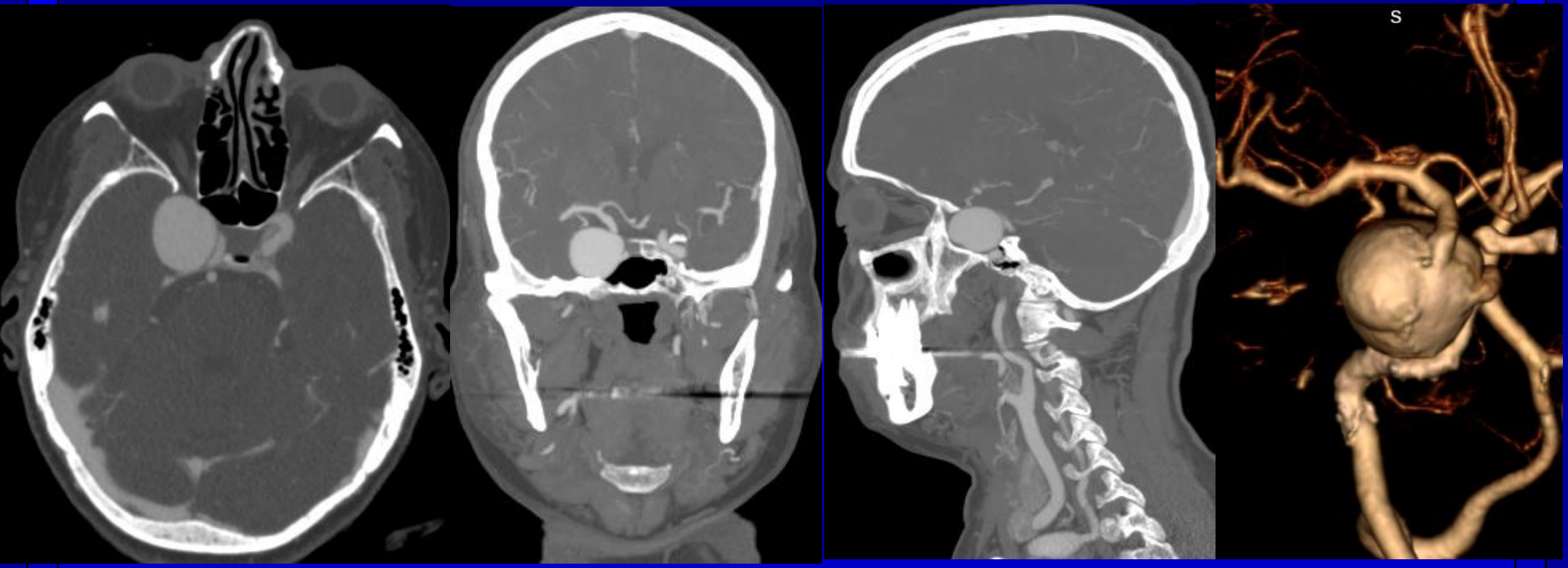
FRED, Microvention Terumo

P64 , phenox GmbH

SILK, Balt Extrusion

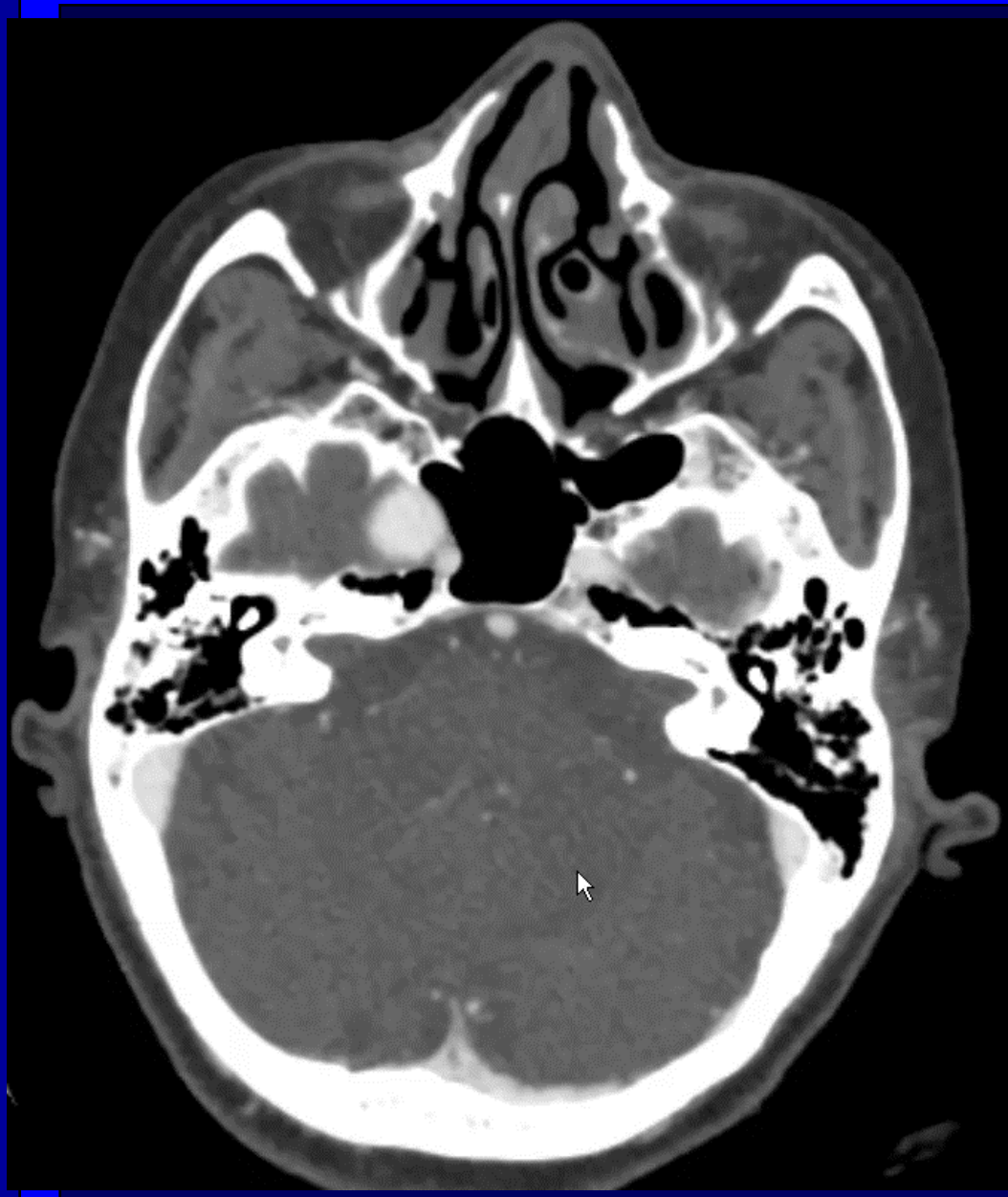
Henry Ford Health System

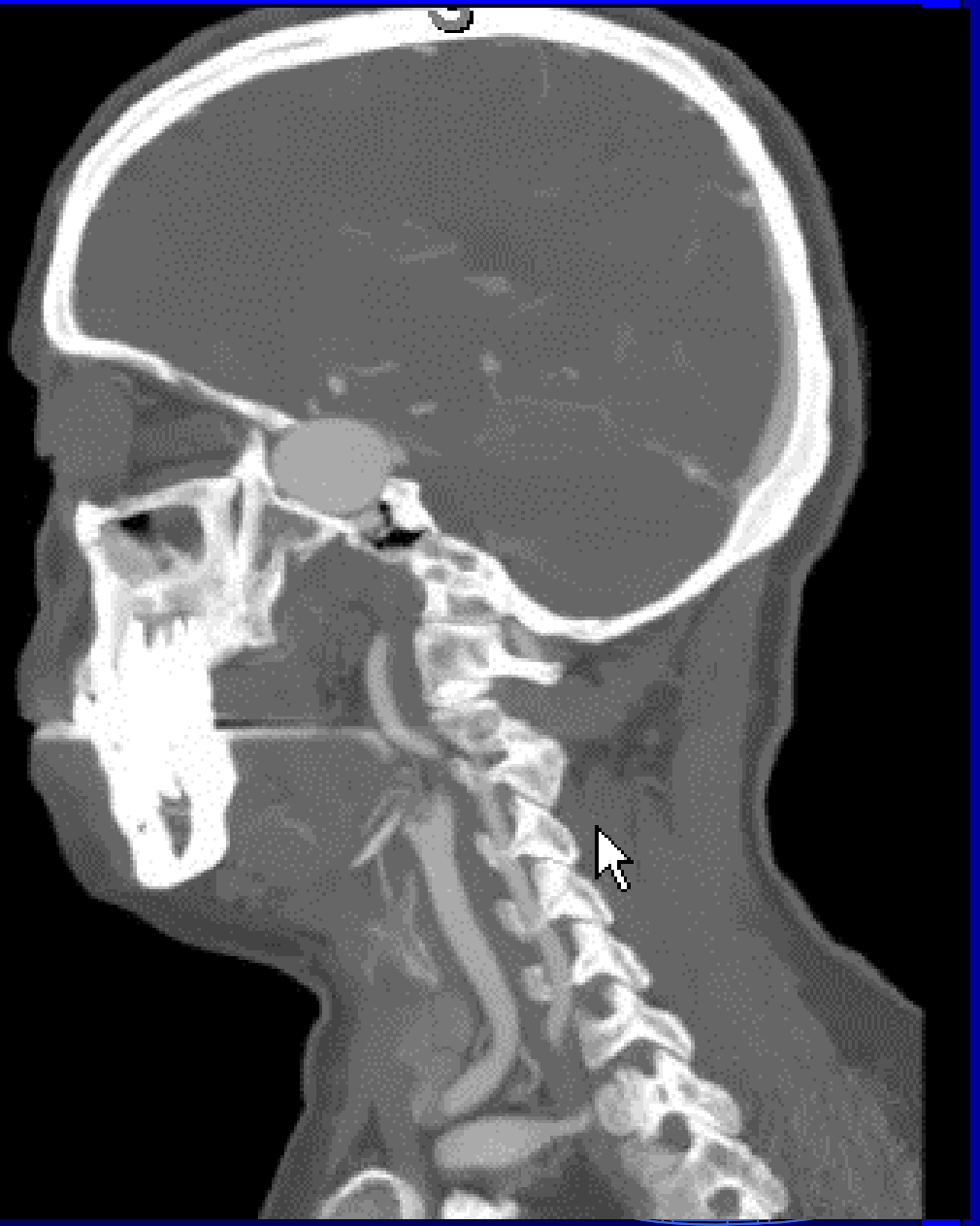
Flow Diversion for Large to Giant Aneurysms

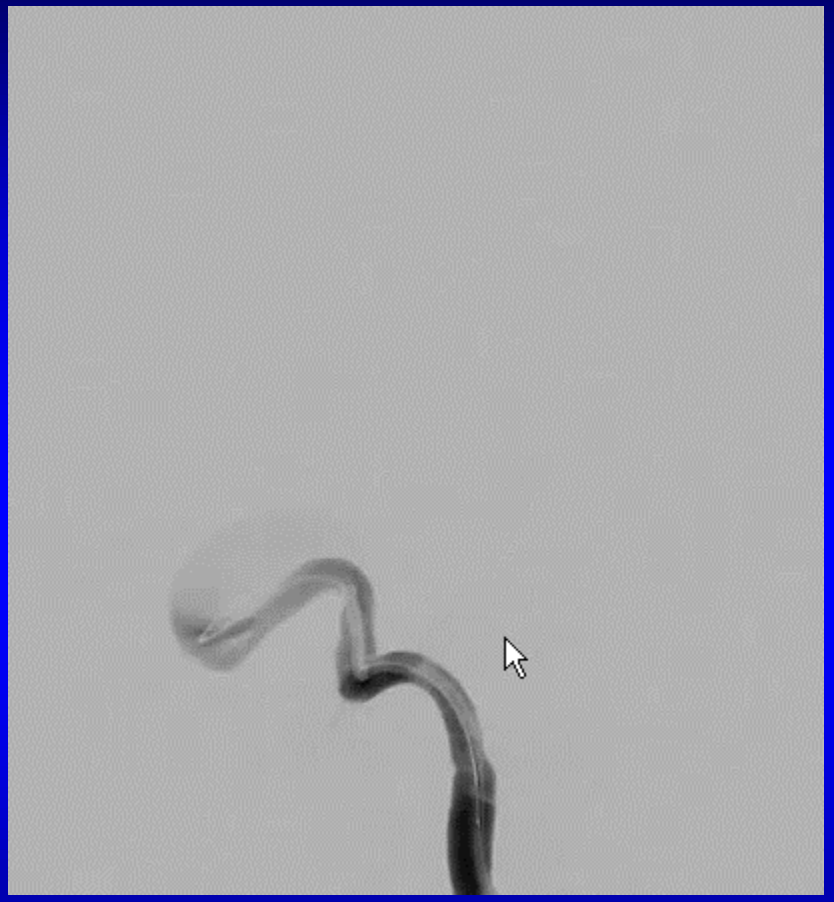


On label indications for PED: aneurysms >10 mm from petrous ICA to superior hypophyseal segment

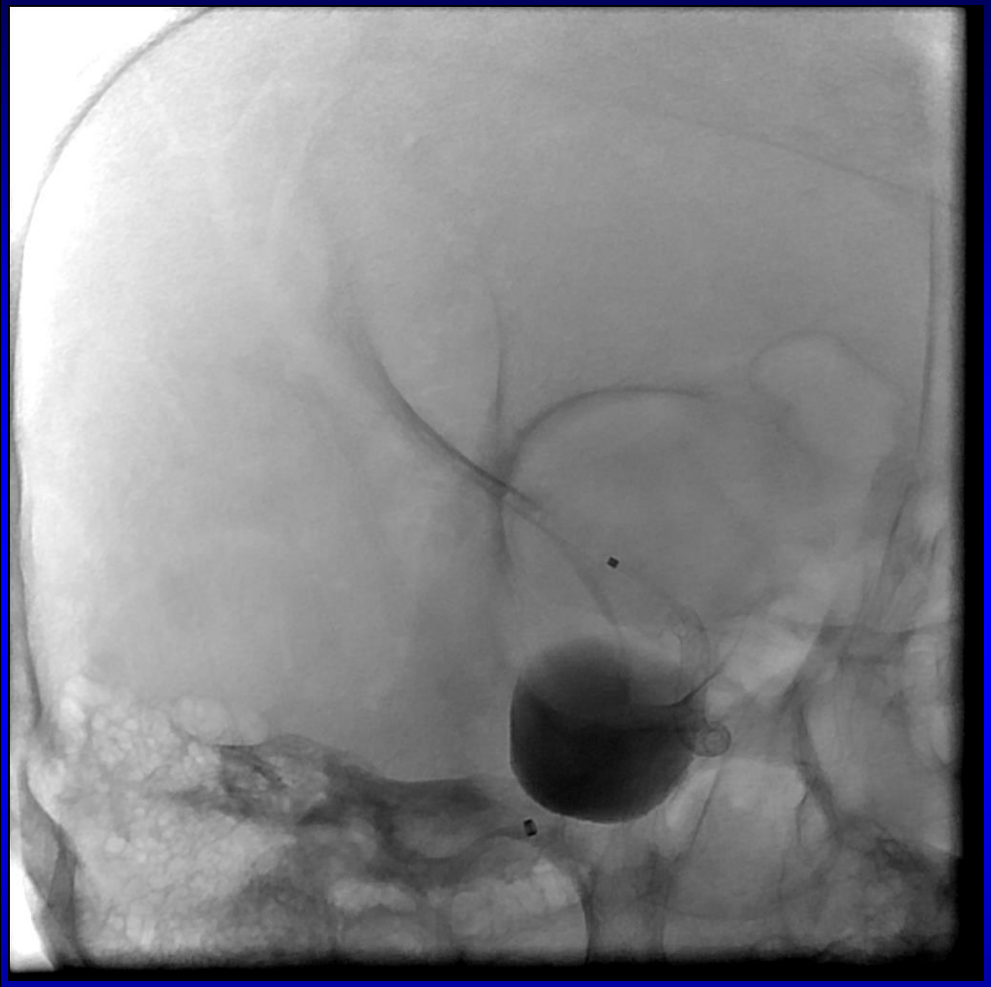
Henry Ford Health System





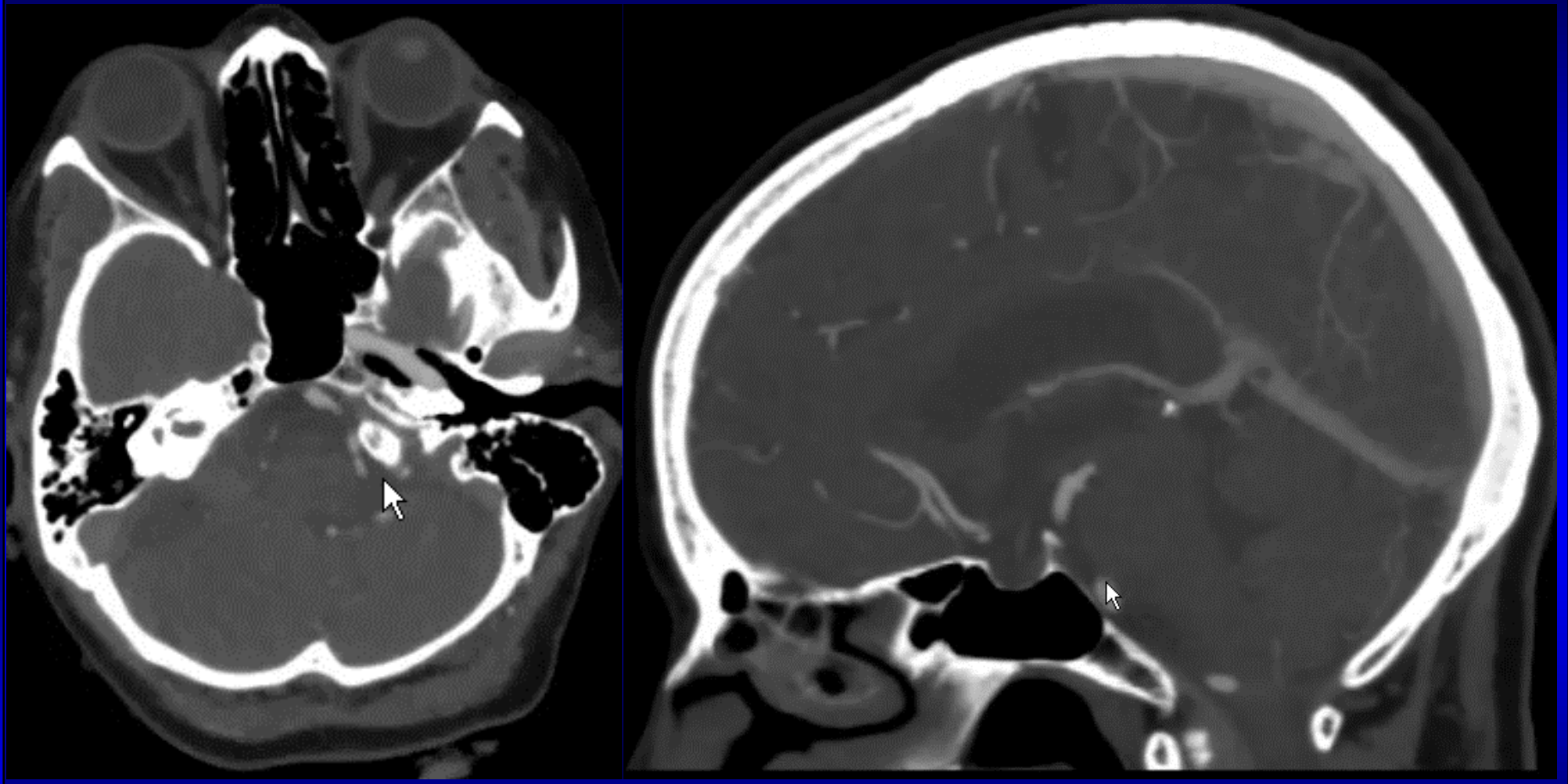


Henry Ford Health System



Henry Ford Health System

Henry Ford Health System

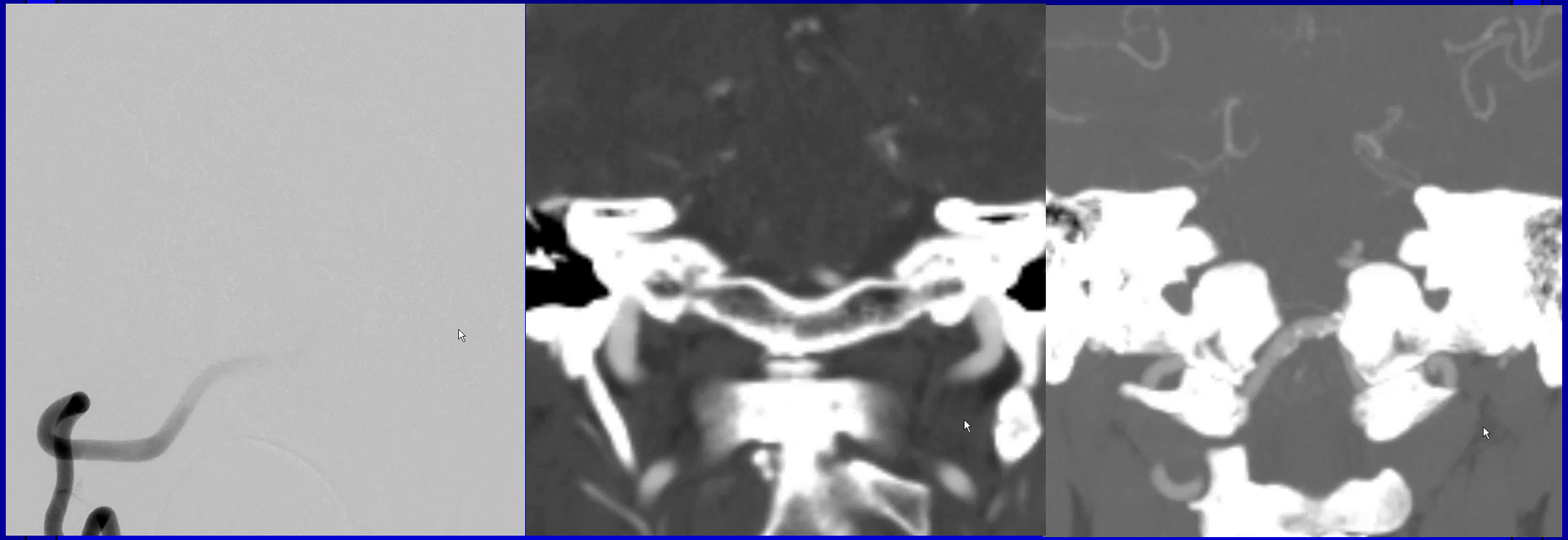


FLOW DIVERSION TRIALS FOR WIDER APPLICATIONS

- **FIAT TRIAL-** stopped prematurely, complete occlusion 60%, major stroke or death 16%
  - J Neurosurgery 127 : 454-462, 2017
- **PREMIER TRIAL-** complete occlusion 82%, major stroke and death 2.8%
  - J Neurointerv Surgery doi:10.1136- 2019
- **DIVERSION TRIAL-** complete occlusion 80%, major stroke and death 7.1%
  - Stroke 2019;50 2019

Henry Ford Health System

Flow Diversion for Large Vertebrobasilar Junction Aneurysm

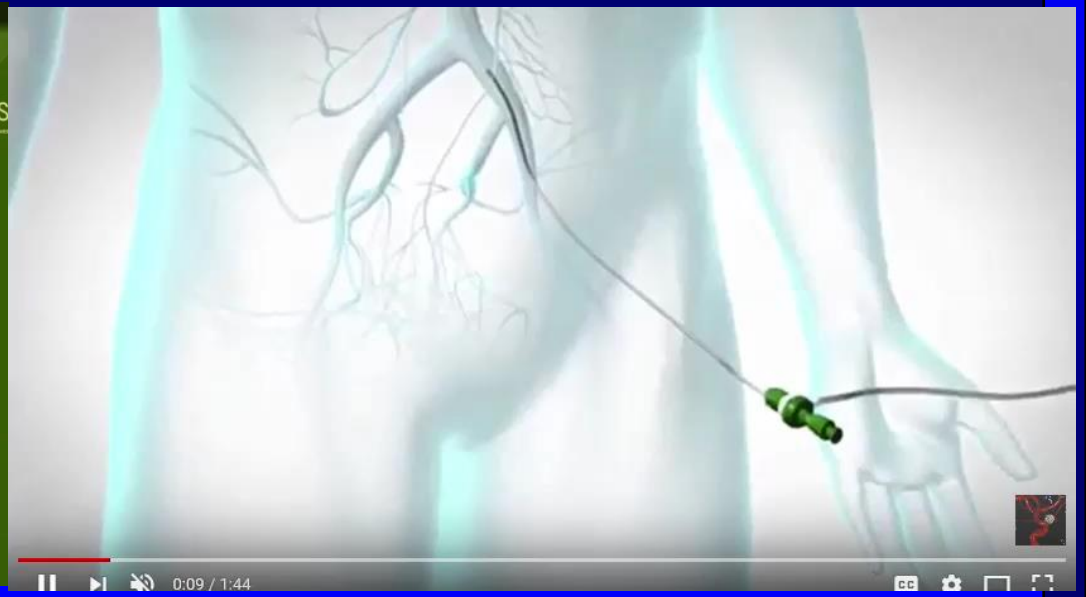


Complete Occlusion 4 months post

Henry Ford Health System

Neck Bridging Device

Intrasaccular Aneurysm Flow Diversion

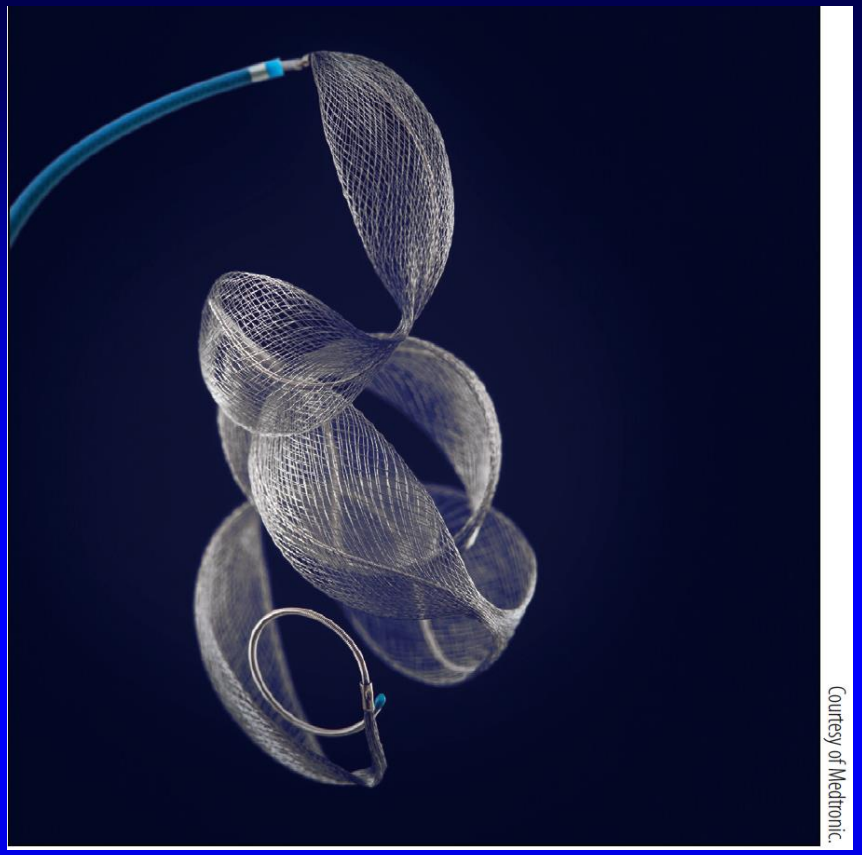


PulseRider

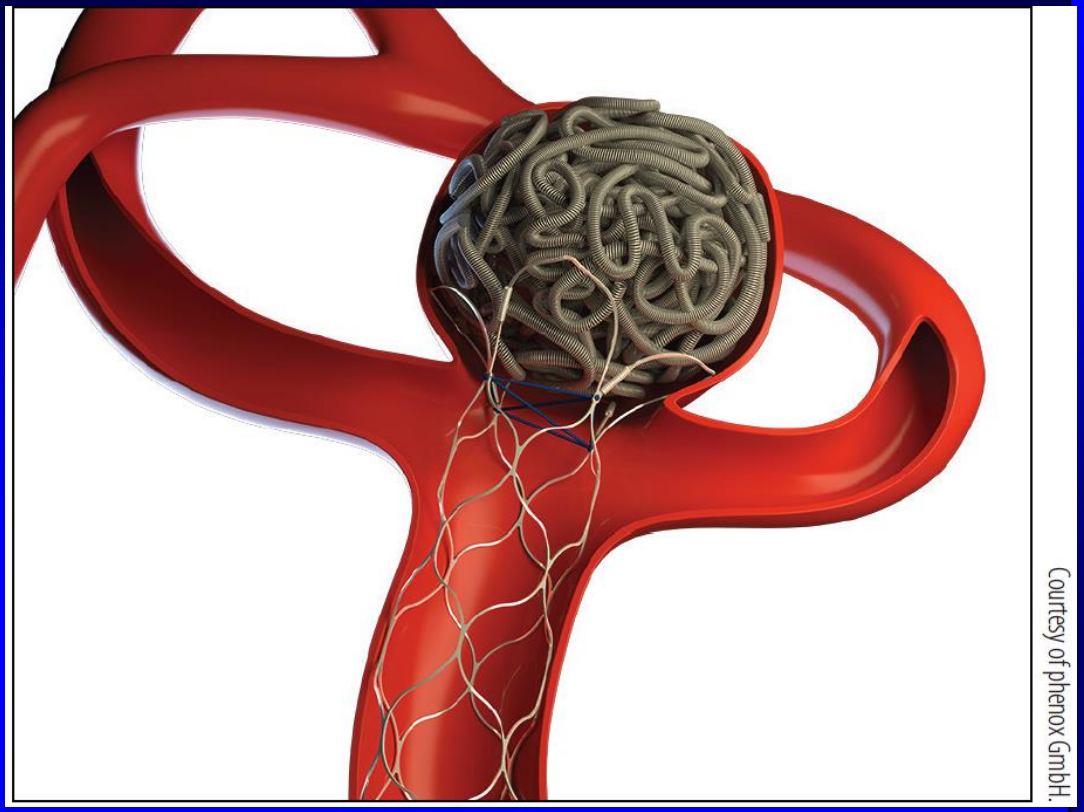
Web Device

- Intrasaccular
- Microcatheters 0.027 for device ≤ 7 mm to 0.032 compatible for device > 7 mm
- Two layers of Nitinol mesh (216 or 288 wires)
- 3 platinum markers
- Retrievable and detachable

Henry Ford Health System



Medina



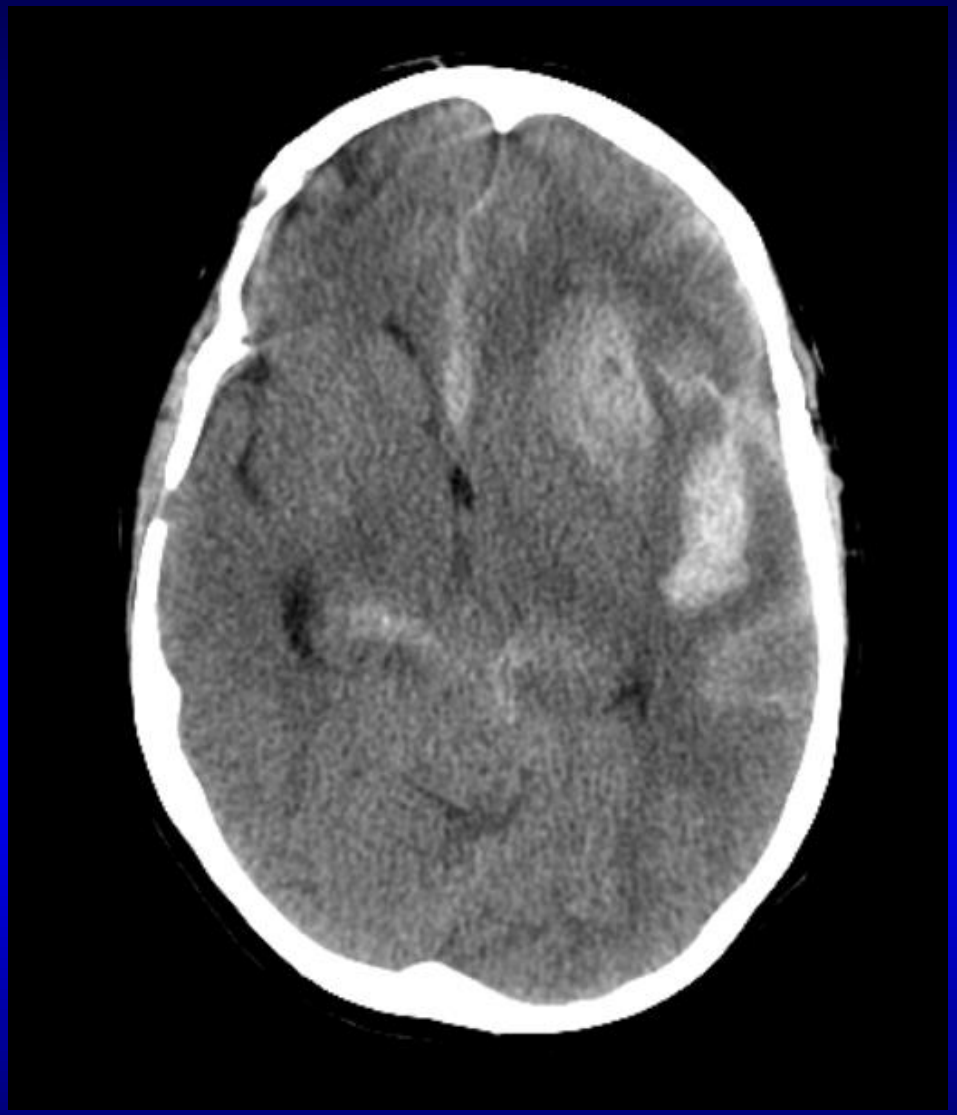
pCONus

Henry Ford Health System

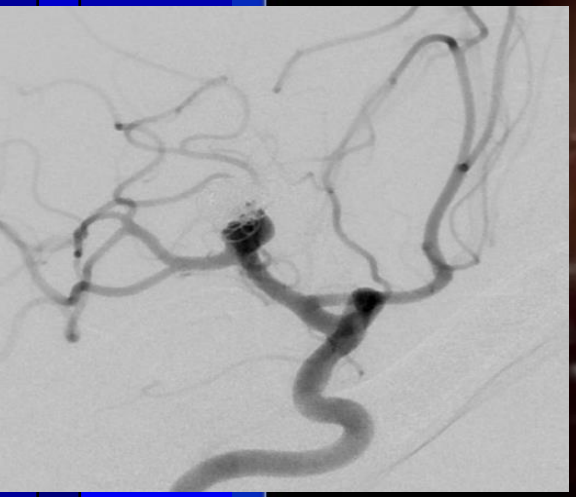
Direct Microsurgical Treatment: Indications and Clinical Considerations

- Relieve mass effect from hematoma, CN compression, brain edema
- Direct visualization of side branches and perforators
- Unfavorable aneurysm geometry or size
- Retreatment after failed endovascular attempts
- Need for combined treatment modalities

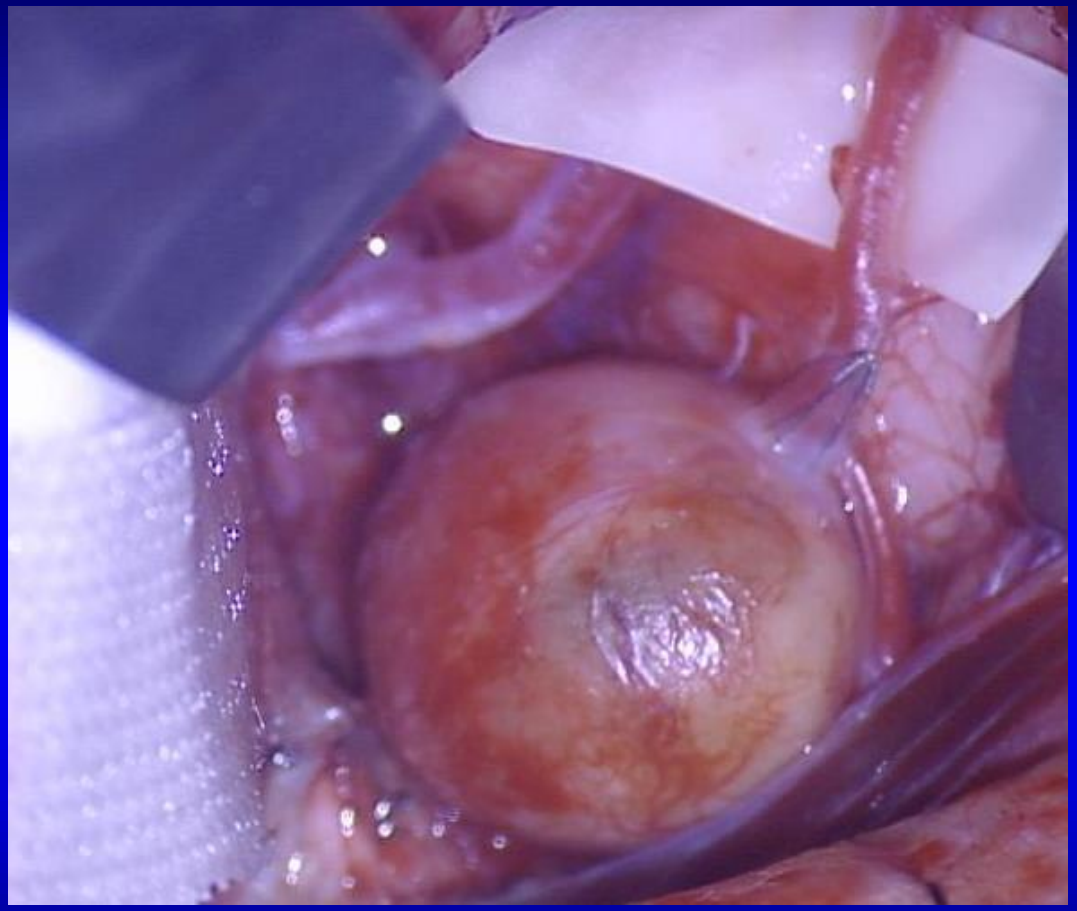
Henry Ford Health System



Henry Ford Health System

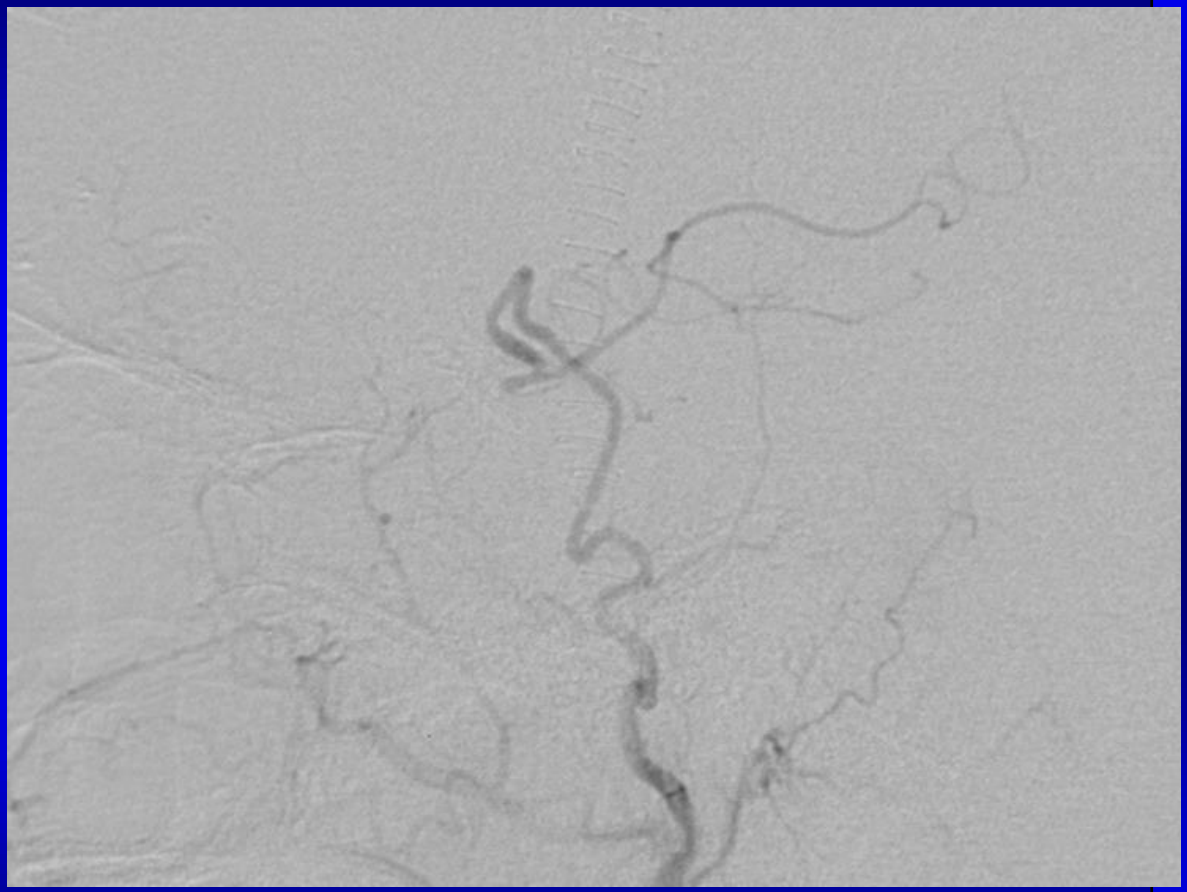


HEALTH SYSTEM



Henry Ford Health System


00:01.71



Henry Ford Health System

Henry Ford Health System