

XVII CURSO NACIONAL DE NEURORRADIOLOGÍA

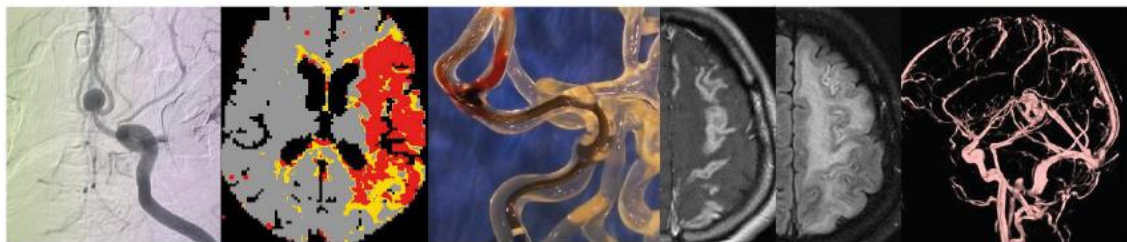
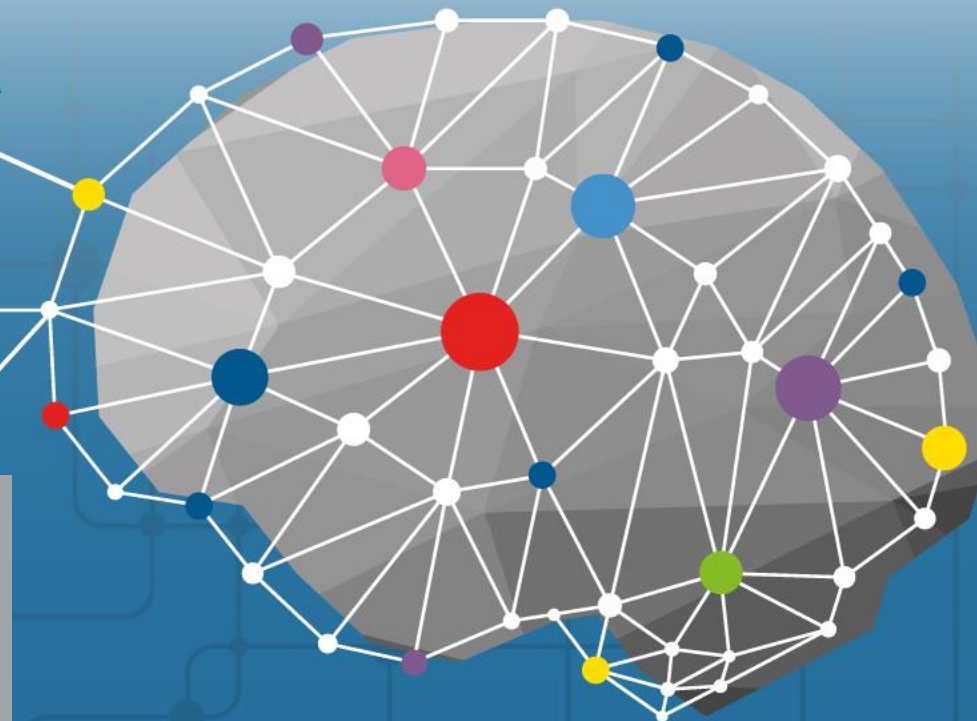
Neurorradiología en la Patología Vascular Cerebral

EDICIÓN VIRTUAL

22-26 febrero 2021

ANEURISMAS INTRACRANEALES.
TRATAMIENTO Y SEGUIMIENTO DE LOS
ANEURISMAS TRATADOS POR VÍA
INTRAVASCULAR

Dr. Juan Macho. Hospital Clínic. Barcelona



ANEURISMAS INTRACRANEALES

- **Presentaciones clínicas: Indicaciones de tratamiento**
- **Revisión Histórica del tratamiento**
- **Avances y técnicas combinadas en terapia endovascular**
- **Seguimiento por imagen de aneurismas tratados**



Epidemiología

1-2 % prevalencia aneurismas

Autopsias 1-5 %

Mujeres 3:1

Asociado a :

Enfermedad Poliquística renal

Síndrome de Marfan'S

Síndrome de Ehlers-Danlos tipo IV

10-30 % múltiples

Historia familiar (4%) hasta 8-10 %

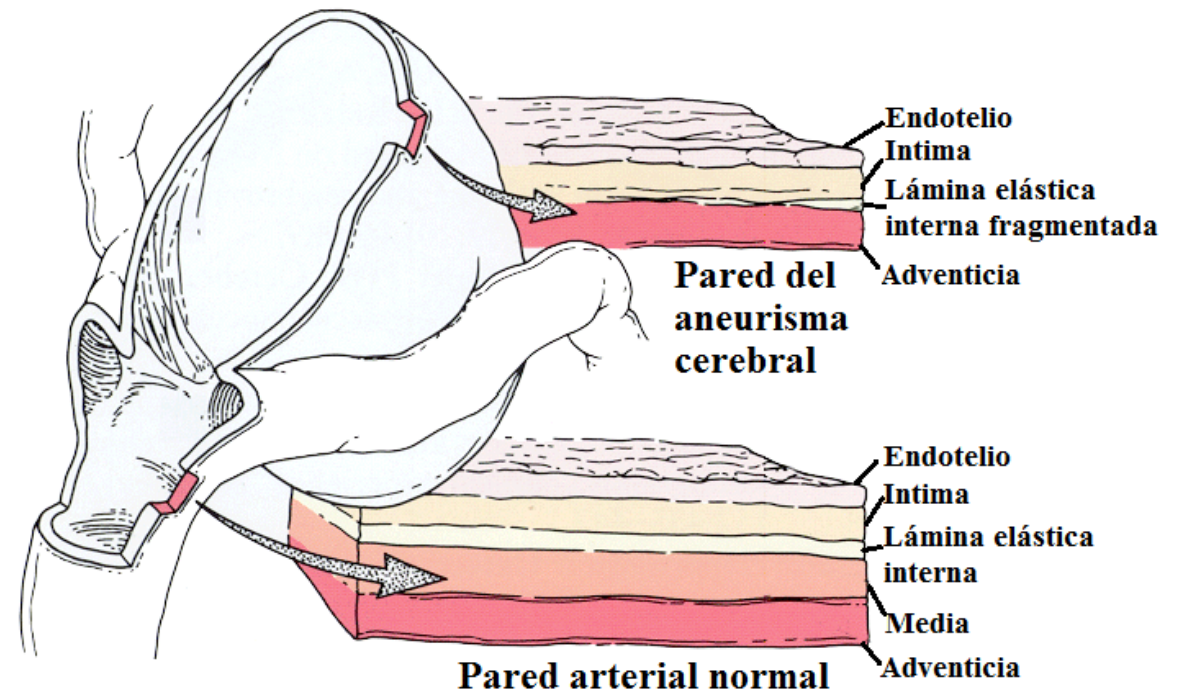
si 2 o + miembros afectados

Incidencia HSA 2-22 casos /100.000H/año

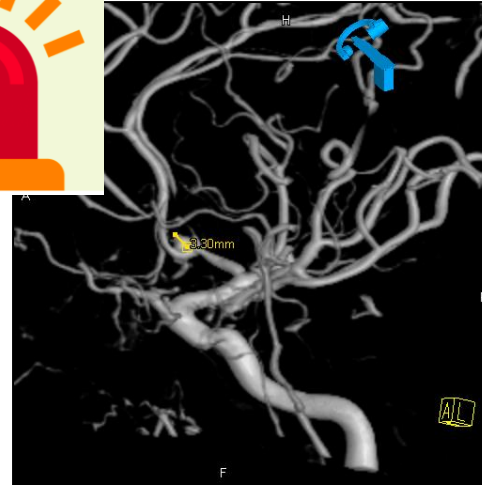
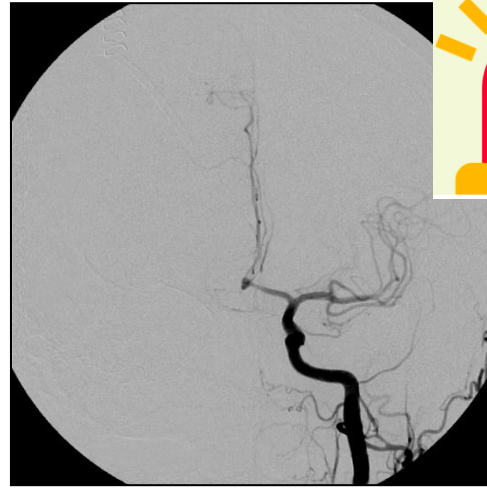
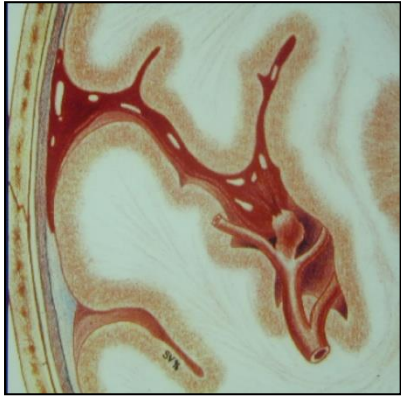
HTA

Tabaco

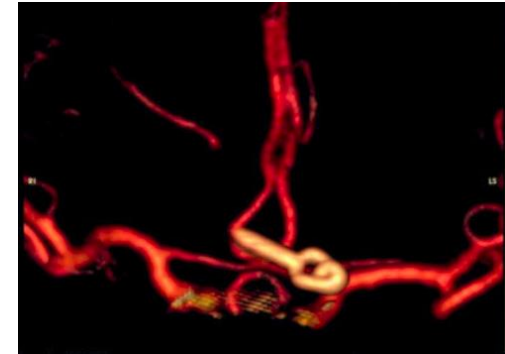
Alcohol



HSA aneurismática: Ruptura espontánea



Clipaje Q



Tto ev
embolización



Tratamiento Urgente

Opciones limitadas

Alta morbimortalidad

- mortalidad 32-67%

- Dependencia: 10-30%



Aneurisma No Roto ¿Indicación tratamiento?

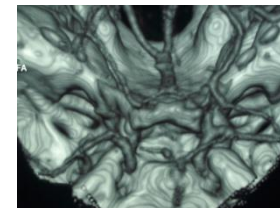
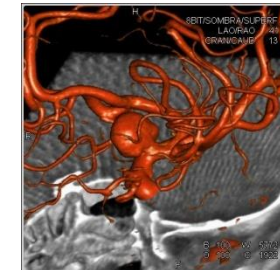
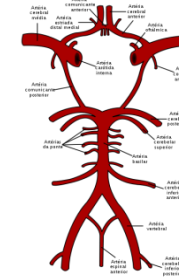


Prevalencia aneurisma no roto (ANR): 2% de población
Riesgo anual de ruptura espontanea (HSA)*: 0,6 – 1,3 %
Riesgos embolización ANR:
mortalidad: 0-1,7% (1,5%)
morbilidad permanente: 1-7,6% (3-6%)
re-embolización: 5-20%



FACTORES DE DECISIÓN TERAPÉUTICA

- Tamaño/Morfología
- Localización
- Factores de riesgo
- HTA
- Historia familiar
- Conectivopatías
- Dificultad del tratamiento
- Edad



REFERENCIAS

- 1) A Randomized Trial on the Safety and Efficacy of Endovascular Treatment of Unruptured Intracranial Aneurysms Is Feasible Raymond J et al. Interventional Neuroradiology - Volume 10 - Page 103 - June 2004
- 2) Neurological, neuropsychological, and psychosocial outcome following treatment of unruptured intracranial aneurysms: a review and commentary. Towgood K, et al. JINS 2004; 10, 114-134.
- 3) Unruptured intracranial aneurysms. A review. Weir B. J Neurosurg 2002; 96:3-42.
- 4) Procedur-related haemorrhage in embolisation of intracranial aneurysms with GDC coils. Kwon BJ and c. Neuroradiology (2003) 45:562-569
- 5) Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment. ISUIA investig. Lancet 2003; 362:103-110.
- 6) In-hospital morbidity and mortality after endovascular treatment of unruptured intracranial aneurysms in the US, 1996-2000: Effect of hospital and physician volume. BL Hoh et al. AJNR 2003; 24:1409-1420.
- 7) International Subarachnoid Aneurysm Trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised trial. Lancet 2002; 360:1267-74.

7) The ISAT: a position statement from the executive committee of the ASITN and the ASNR. AJNR 2003; 24:1409-1420.



Valoración personalizada de indicación y tipo de tratamiento

El riesgo de ruptura en los estudios de seguimiento es **1% por año**.

El **tamaño** es el factor de riesgo más importante con menor riesgo para aneurismas pequeños.

Otros factores de riesgo son:

Sitio : > riesgo en **fosa posterior**.

Edad : > riesgo en **menores de 50 años**.

Sexo femenino.

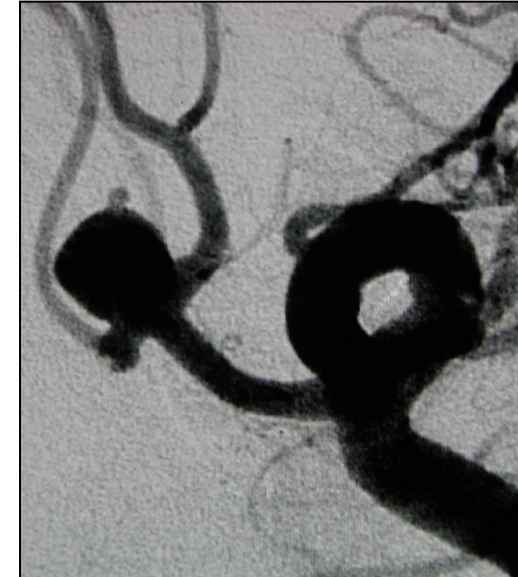
Población: **Finlandia , Japón**.

Tabaco

HTA

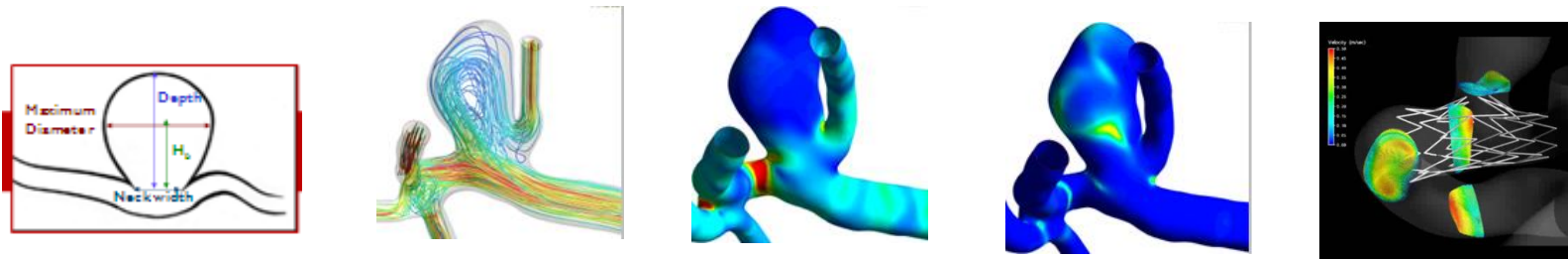
Para aneurismas de menos de 10 mm el tratamiento conlleva un riesgo de alrededor del **5%** de muerte o dependencia de ayuda para actividades de la vida cotidiana.

Tratamientos que requieren gran inversión tecnológica y materiales costosos (**coste/eficiencia**)



PATOLOGÍA DE ALTO COSTE SOCIOSANITARIO

NUEVAS HERRAMIENTAS



REFERENCIAS:

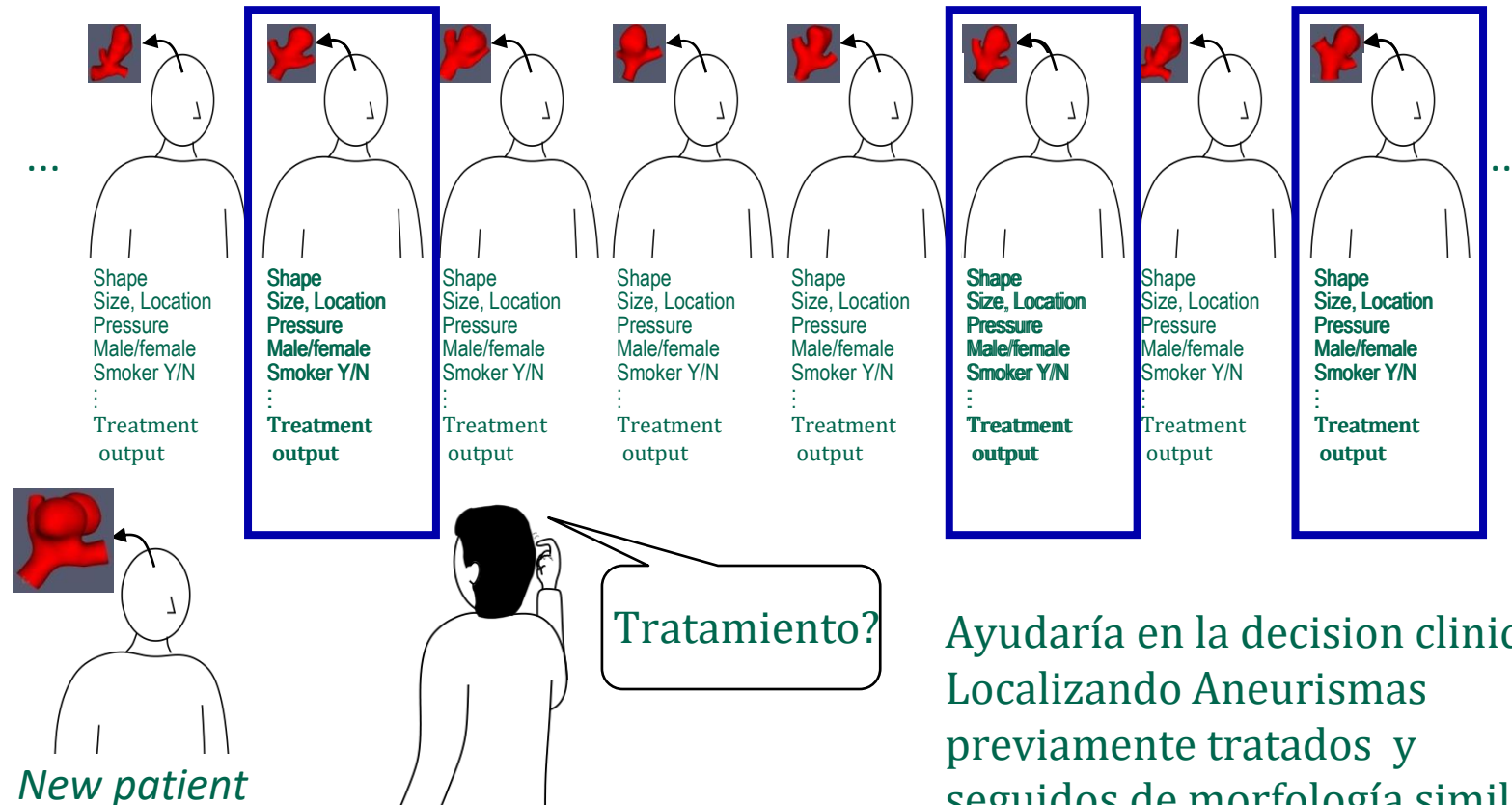
- [1] J. Brisman, J. Song, D. Newell, Medical progress: cerebral aneurysms, New Engl. J. Med. 355 (9) (2006) 928–939.
- [2] H. Meng, Z. Wang, Y. Hoi, L. Gao, E. Metaxa, D. Swartz, J. Kolega, Complex hemodynamics at the apex of an arterial bifurcation induces vascular remodeling resembling cerebral aneurysm initiation, Stroke 38 (2007) 1924–1931.
- [3] M. L. Raghavan, B. Ma, R. E. Harbaugh, Quantified aneurysm shape and aneurysm rupture, J. Neurosurg. 102 (2) (2005) 355–362.
- [4] J. R. Cebral, M. A. Castro, S. Appanaboyina, C. M. Putman, D. Millan, A. F. Frangi, Efficient pipeline for image-based patient-specific analysis of cerebral aneurysm hemodynamics: technique and sensitivity, IEEE Trans. Med. Imag. 24 (4) (2005) 457–467.



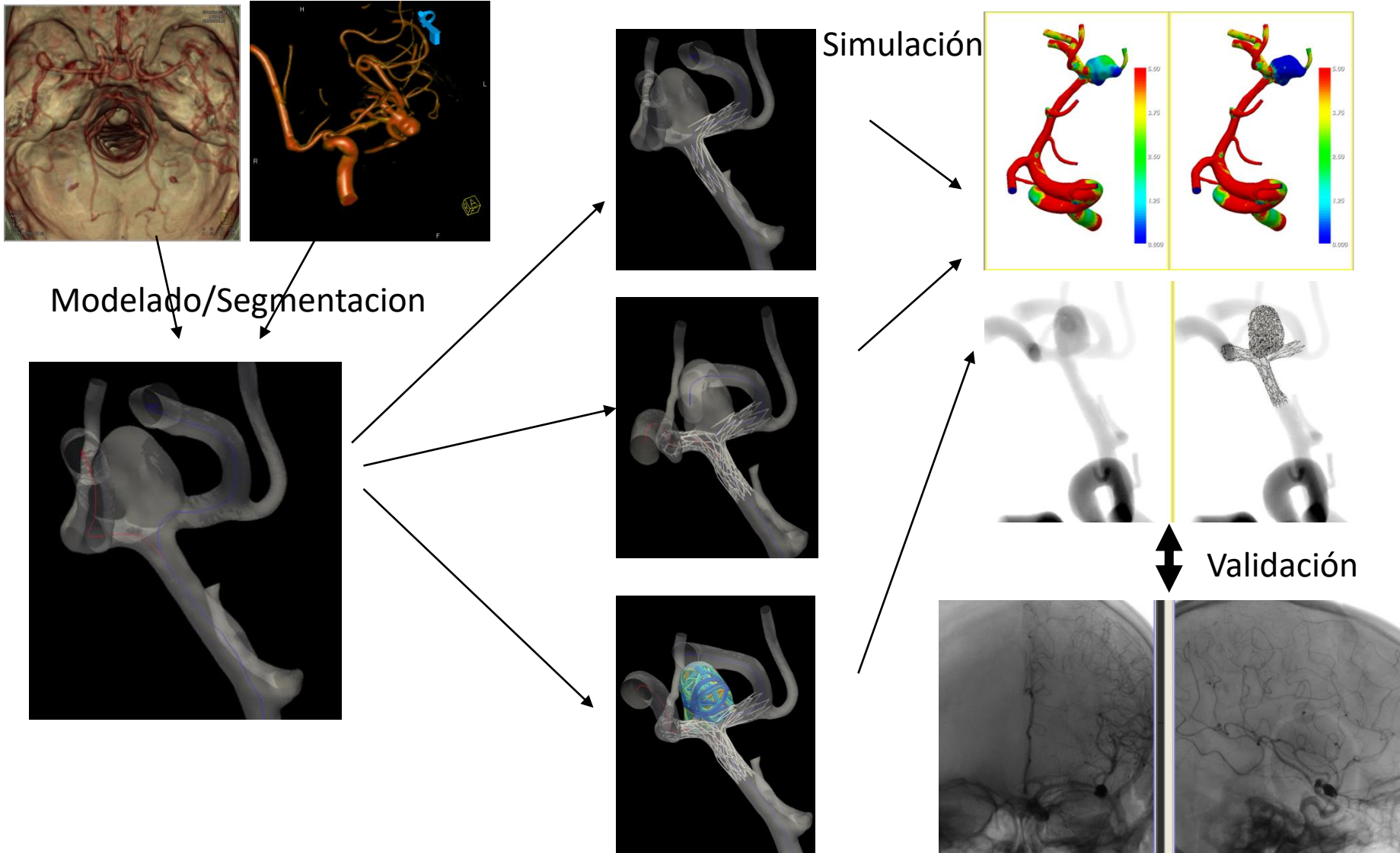
ANEURISMAS CEREBRALES INCIDENTALALES

Una caracterización completamente automática 3D de los aneurismas y la morfología vascular permitiría construir un sistema de búsqueda de aneurismas similares

Caracterización Automática

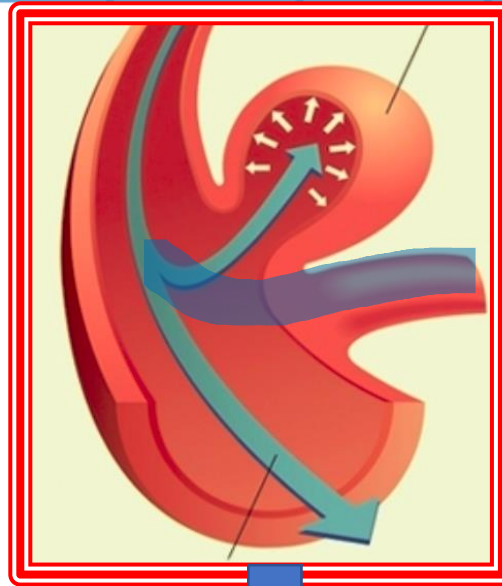
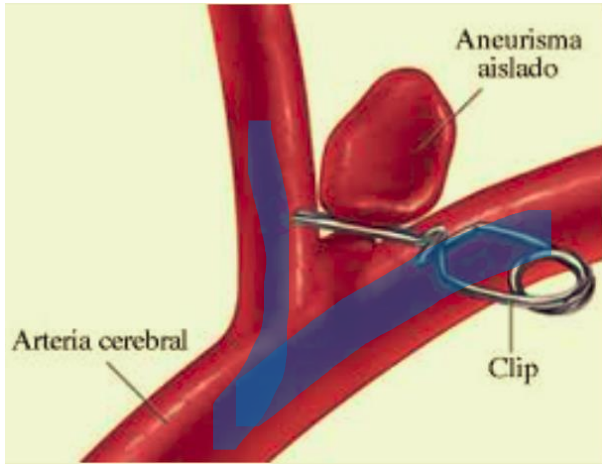


Simulación Personalizada Del Tratamiento

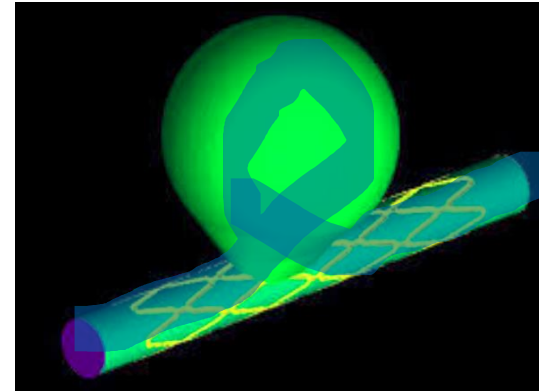


Opciones de Tratamiento y su evolución

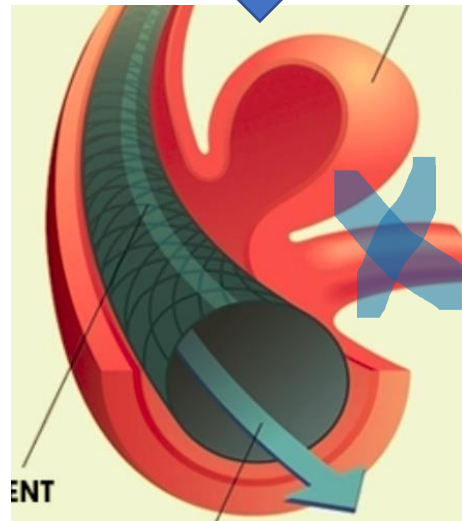
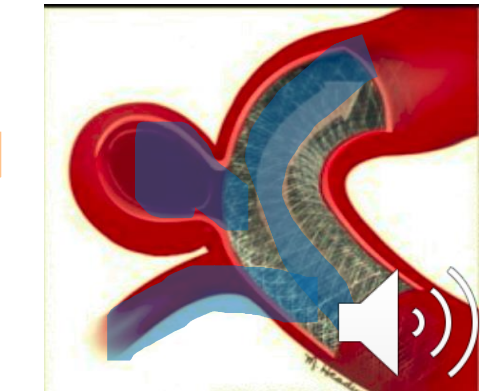
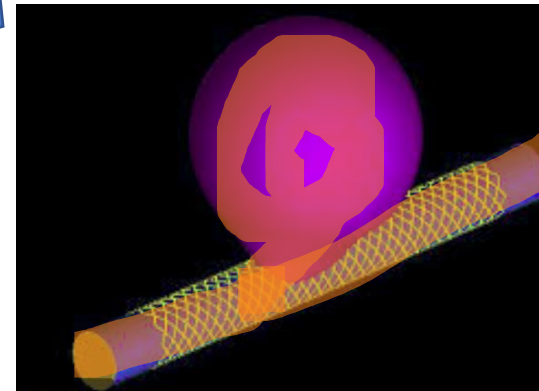




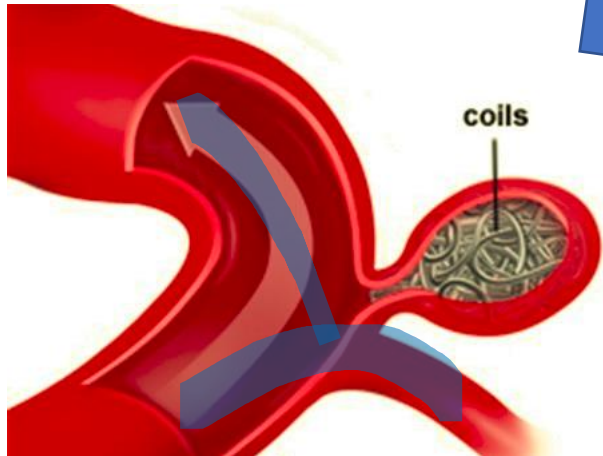
BARE STENT

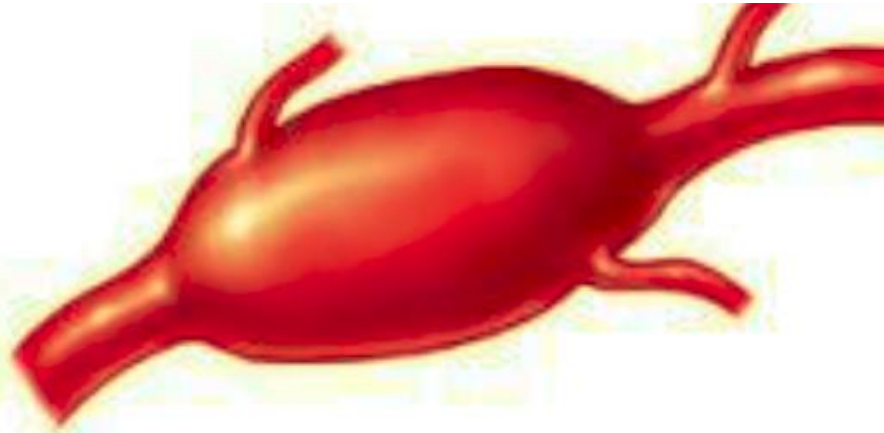


FLOW DIV. STENT

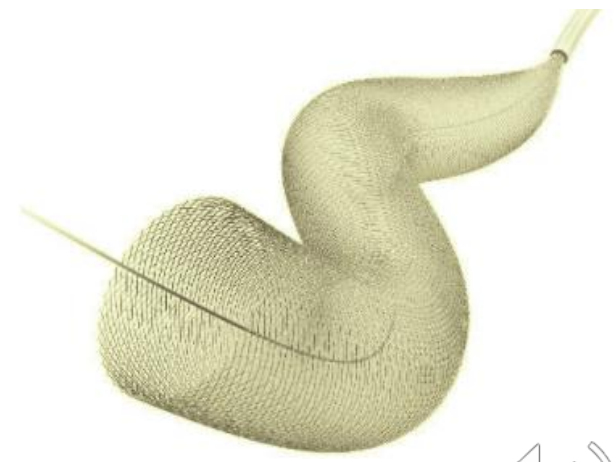
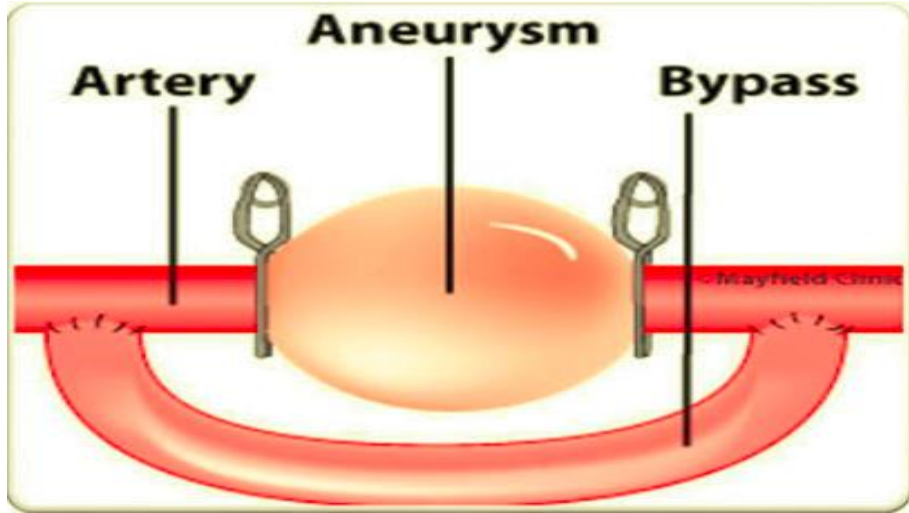
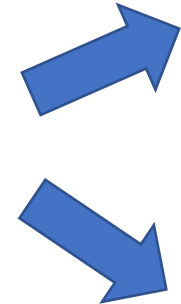


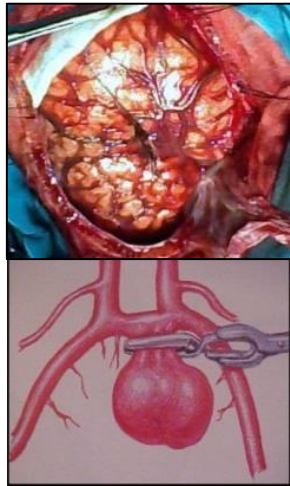
COVERED STENT





Aneurisma fusiforme

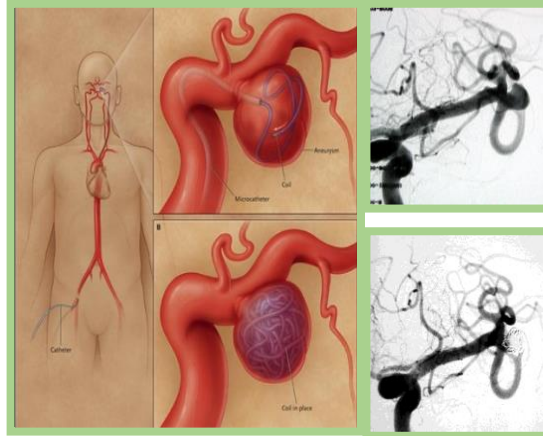




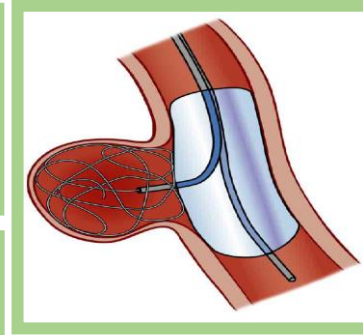
CLIPAJE QUIRURGICO
 1933 — 1960 (MICRO)



OCCLUSION VASO PORTADOR
 1969



STANDARD COILLING
 1990 —



BALLON REMODELLING



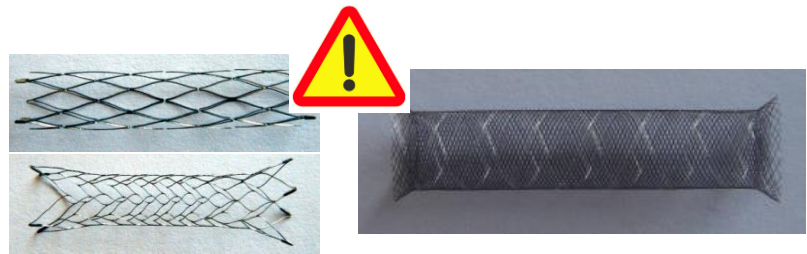
LIQUID SYSTEMS



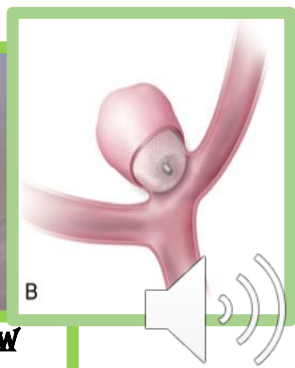
STENT + COIL

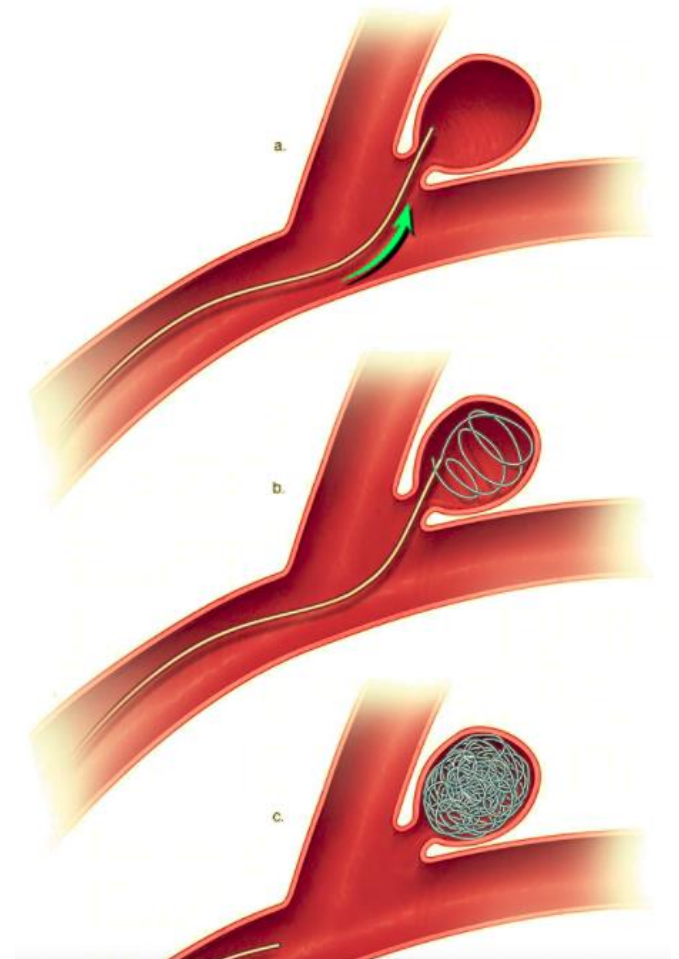
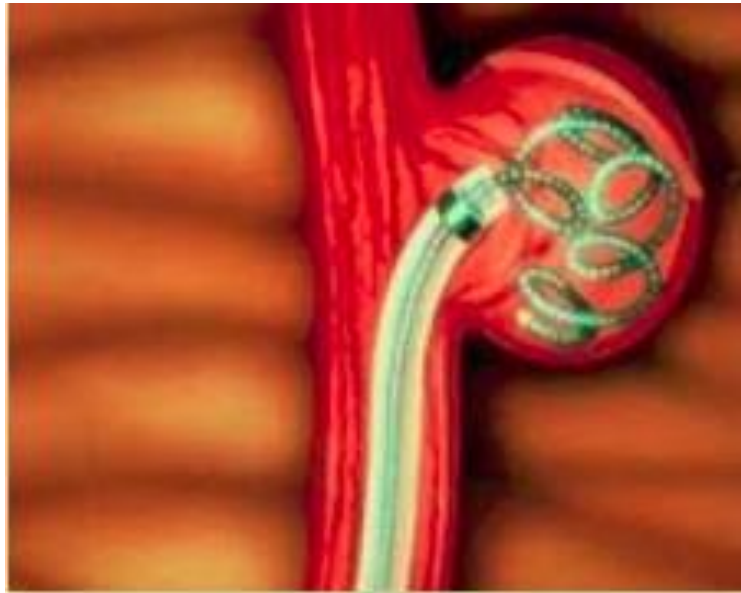
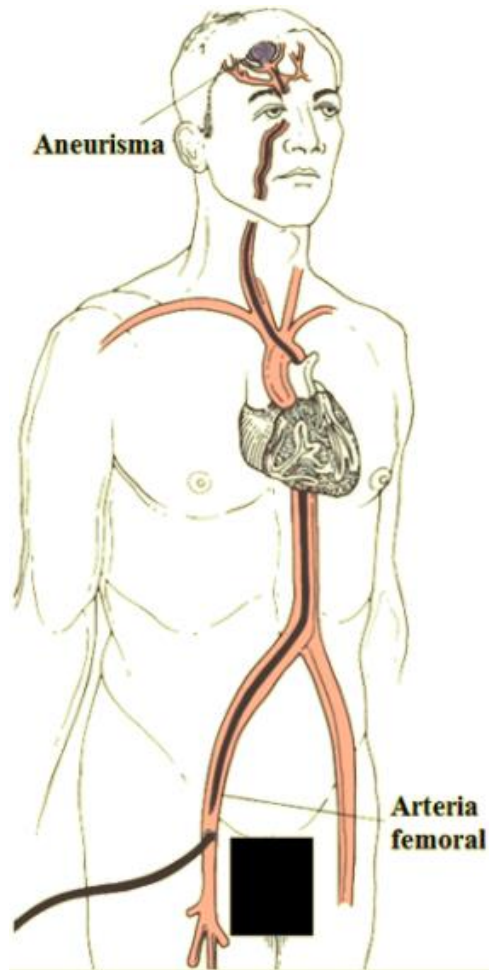
ASSISTED COILING OCCLUSION
 1996-2004

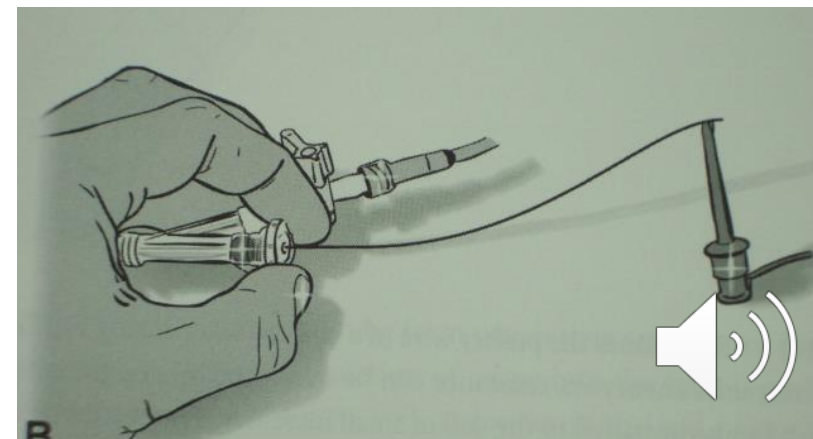
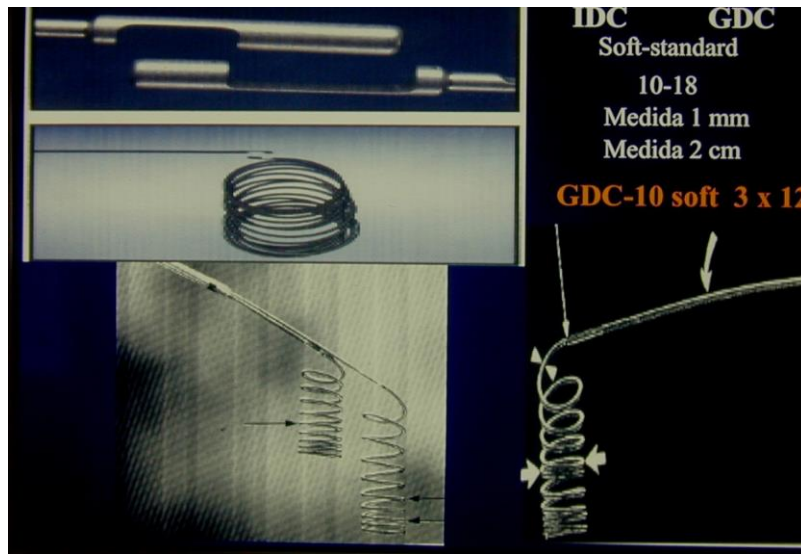
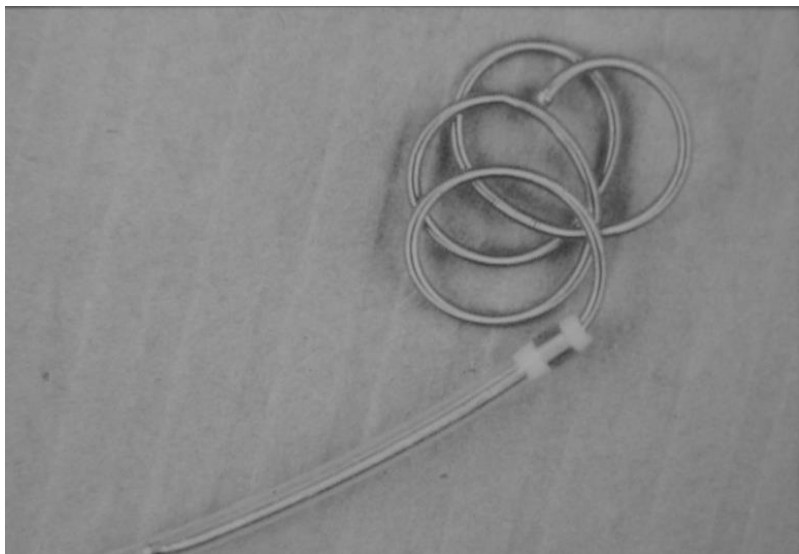
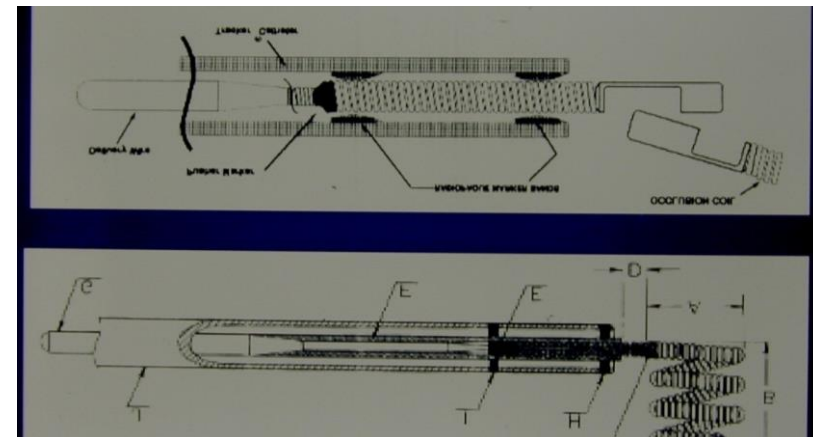
FLOW DIVERSION CONCEPT
 2006-....



INTRASACULAR FLOW DIVERSION
 2010-....







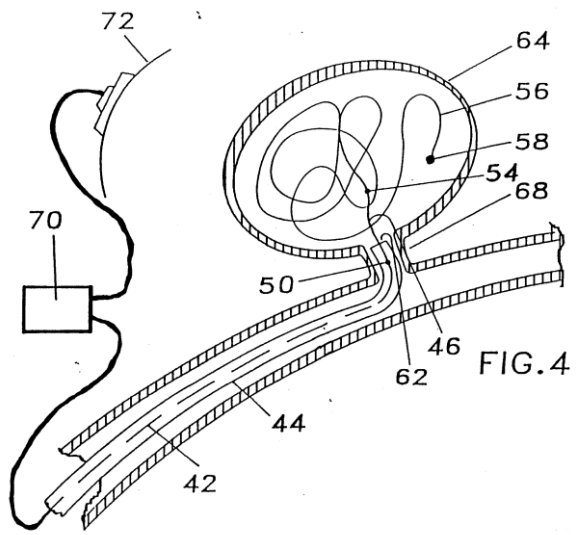


FIG. 4

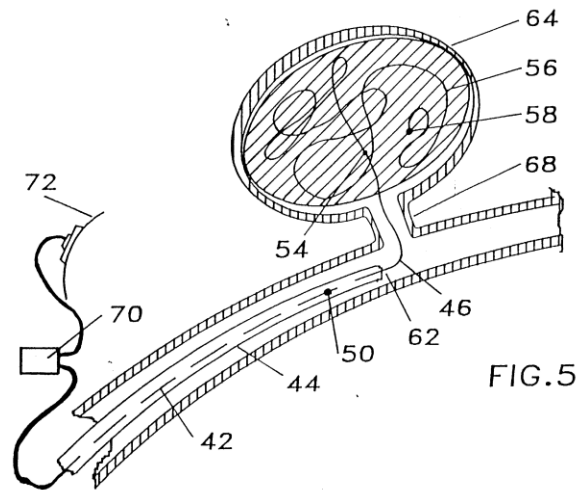
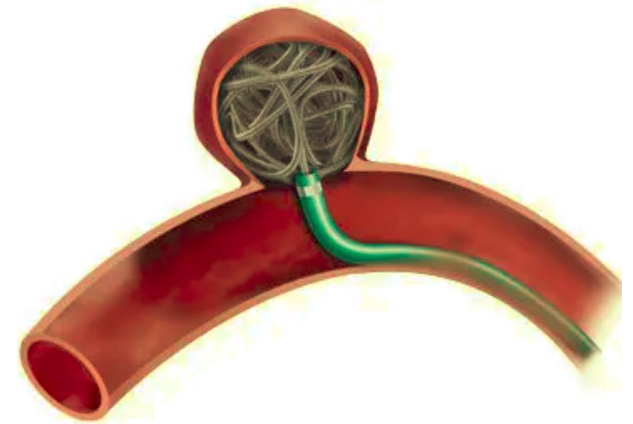
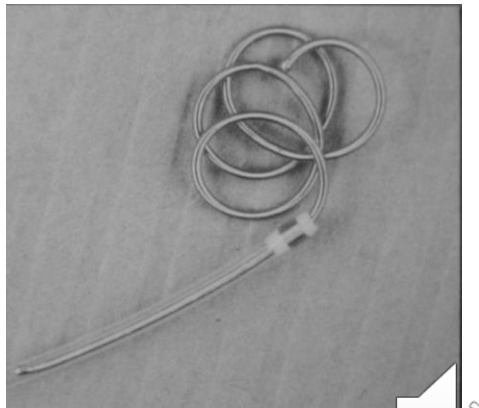
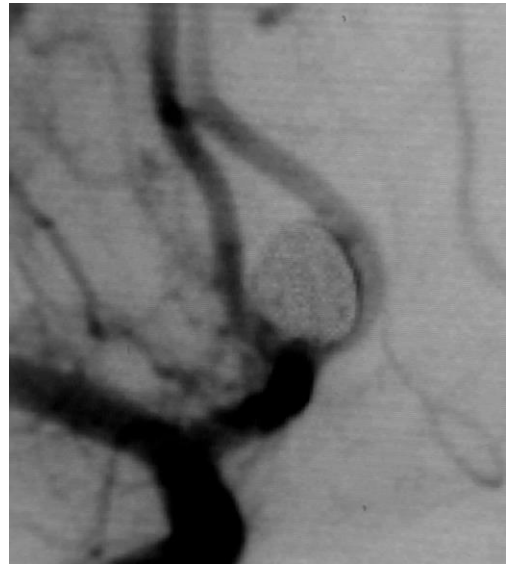
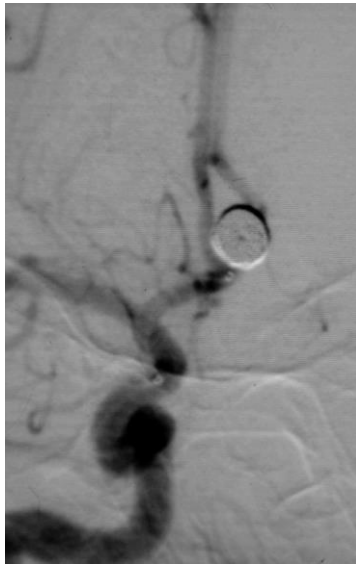
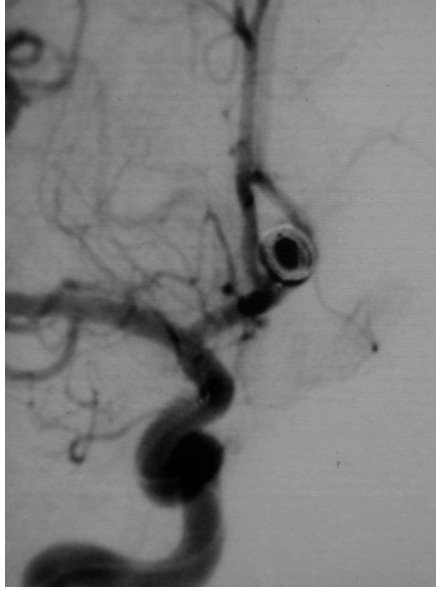


FIG. 5





- 6 de marzo 1990: 1er caso clínico en Humano (FAV-CC)
- 1995: Aprobación de la FDA del coil GDC
- 1998: Intracranial Aneurysms: A Review of Endovascular and Surgical Treatment in 248 Patients. K. A. Leber et al.
Minim Invasive Neurosurg 1998; 41(2): 81-85
- 1999: Regli et al. Endovascular coil placement compared with surgical clipping for the treatment of unruptured middle cerebral artery aneurysms: a consecutive series.
J Neurosurg. 1999 Jun;90(6):1025-30.

“ they concluded that endovascular surgery was not associated with a higher risk of morbidity and mortality than surgical clipping of aneurysms, but cautioned that the results have to be confirmed by longer follow-up.”



International Subarachnoid Aneurysm Trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised trial

International Subarachnoid Aneurysm Trial (ISAT) Collaborative Group*

THE LANCET • Vol 360 • October 26, 2002

Interpretation In patients with a ruptured intracranial aneurysm, for which endovascular coiling and neurosurgical clipping are therapeutic options, the outcome in terms of survival free of disability at 1 year is significantly better with endovascular coiling. The data available to date suggest that the long-term risks of further bleeding from the treated aneurysm are low with either therapy, although somewhat more frequent with endovascular coiling.

RANDOMIZATION
1994-1999

COILING SIMPLE
NO TECNICAS
ASISTIDAS

The ISAT showed that in patients with ruptured aneurysms suitable for neurosurgical clipping and endovascular coiling, **endovascular coiling was more likely to result in independent survival at 1 year (absolute risk reduction of 7.4%).**



International subarachnoid aneurysm trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised comparison of effects on survival, dependency, seizures, rebleeding, subgroups, and aneurysm occlusion

Andrew J Molyneux, Richard S C Kerr, Ly-Mee Yu, Mike Clarke, Mary Sneade, Julia A Yarnold, Peter Sandercock, for the International Subarachnoid Aneurysm Trial (ISAT) Collaborative Group*

Lancet 2005; 366: 809-17

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)

www.thelancet.com Published online October 28, 2014

Interpretation In patients with ruptured intracranial aneurysms suitable for both treatments, endovascular coiling is more likely to result in independent survival at 1 year than neurosurgical clipping; the survival benefit continues for at least 7 years. The risk of late rebleeding is low, but is more common after endovascular coiling than after neurosurgical clipping.

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.

Risk of recurrent subarachnoid haemorrhage, death, or dependence and standardised mortality ratios after clipping or coiling of an intracranial aneurysm in the International Subarachnoid Aneurysm Trial (ISAT): long-term follow-up

Andrew J Molyneux, Richard S C Kerr, Jacqueline Birks, Najib Ramzi, Julia Yarnold, Mary Sneade, Joan Rischmiller, for the ISAT collaborators

Lancet Neurol 2009; 8: 427-33



Guidelines for the Management of Aneurysmal Subarachnoid Hemorrhage : A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

E. Sander Connolly, Jr, Alejandro A. Rabinstein, J. Ricardo Carhuapoma, Colin P. Derdeyn, Jacques Dion, Randall T. Higashida, Brian L. Hoh, Catherine J. Kirkness, Andrew M. Naidech, Christopher S. Ogilvy, Aman B. Patel, B. Gregory Thompson and Paul Vespa
on behalf of the American Heart Association Stroke Council, Council on Cardiovascular Radiology and Intervention, Council on Cardiovascular Nursing, Council on Cardiovascular Surgery and Anesthesia, and Council on Clinical Cardiology

Stroke. published online May 3, 2012;

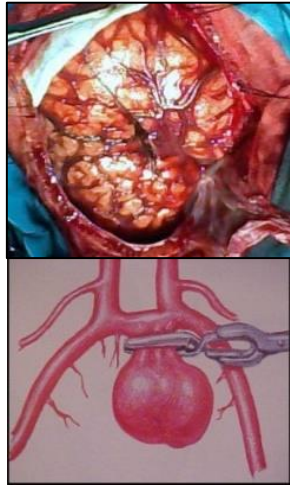
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

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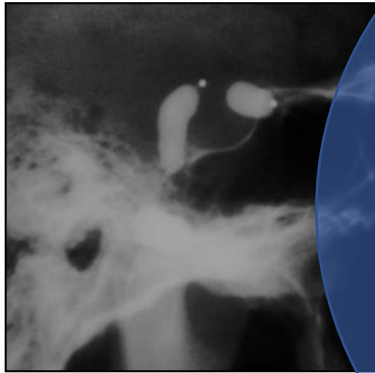
Print ISSN: 0039-2499. Online ISSN: 1524-4628

- 4. For patients with ruptured aneurysms judged to be technically amenable to both endovascular coiling and neurosurgical clipping, endovascular coiling should be considered (*Class I: Level of Evidence B*).**

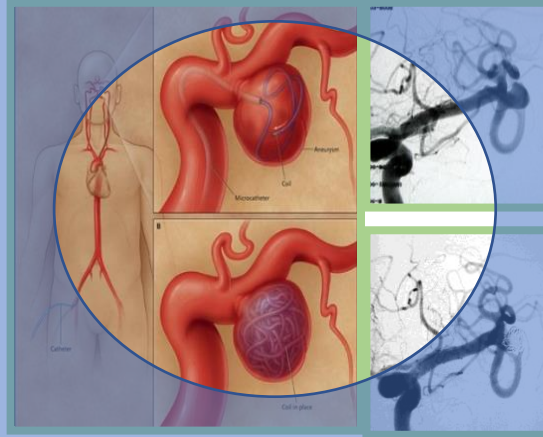




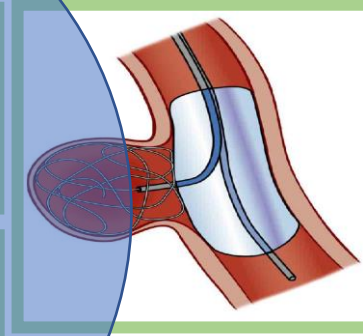
CLIPAJE QUIRURGICO
 1933 — 1960 (MICRO)



OCCLUSION VASO PORTADOR
 1969



STANDARD COILING
 1990 —



BALLON REMODELLING



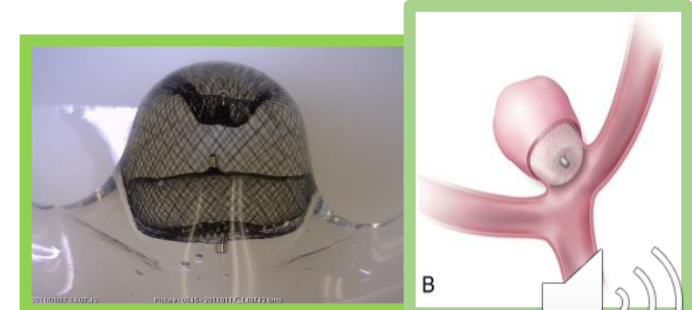
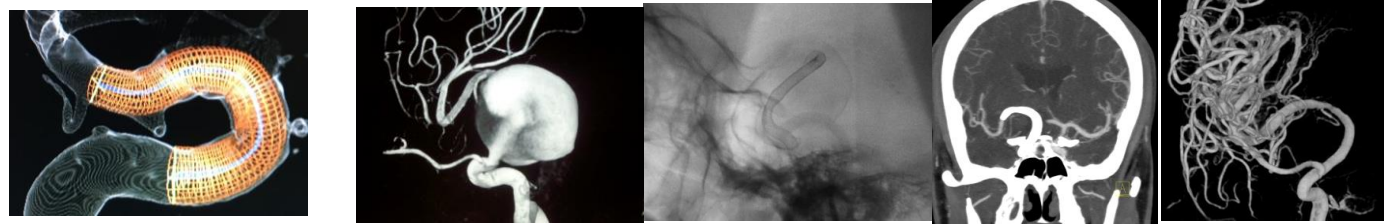
LIQUID SYSTEMS



STENT + COIL

ASSISTED COILING OCCLUSION
 1996-2004

FLOW DIVERSION CONCEPT
 2006-....



INTRASACULAR FLOW DIVERSION
 2010-....

AVANCES EN IMAGEN

ANGIOGRAFÍA 3D

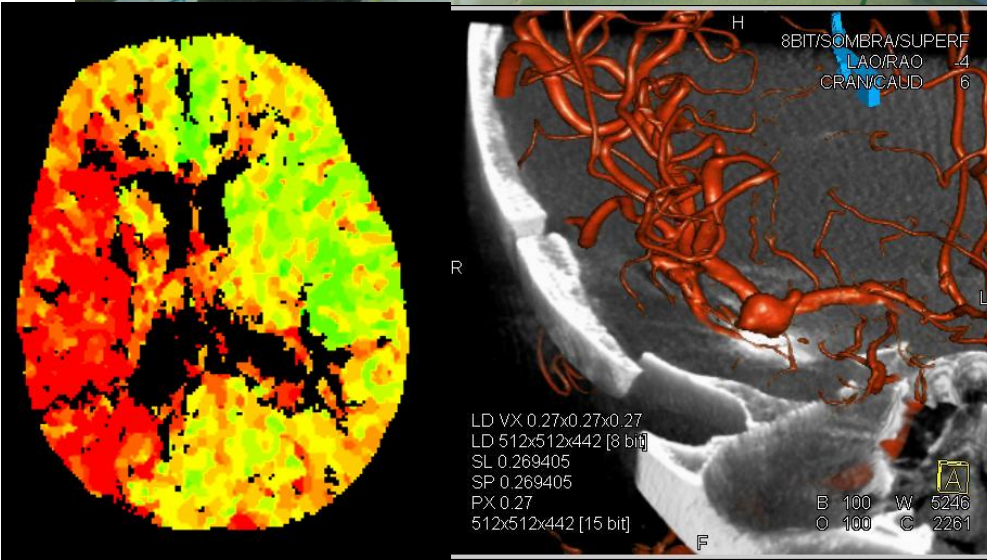
EQUIPAMIENTO BIPLANO

CONE BEAM CT

REDUCCIÓN DE DOSIS

INCREMENTO DE CALIDAD DE LA ESCOPIA







R



LAO/RAO 8BIT 0
CRAN/CAUD 0 0



B 39 W 21993
O 53 C 12815

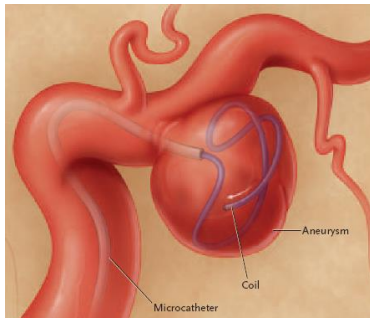
LIMITACIONES coiling simple

Aneurismas de cuello ancho.

Aneurismas fusiformes o disecantes

Aneurismas gigantes

Tasas de recanalización del 15 a 30 %



IRRUPCIÓN TECNICAS ASISTIDAS 2000-.....

- BALLOON REMODELLING
- STENT ASSISTED COILING
- FLOW DIVERTERS
- INTRASACULAR 2ND GENERATION DEVICES



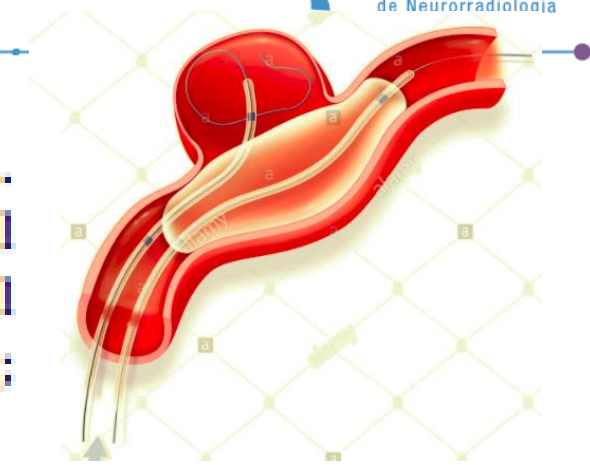
- TECNICAS ASISTIDAS CON BALÓN

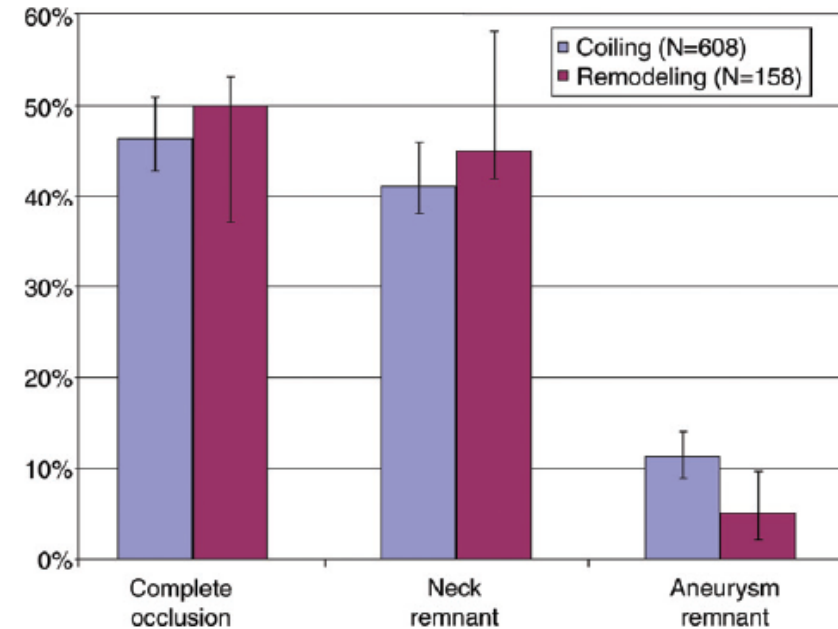
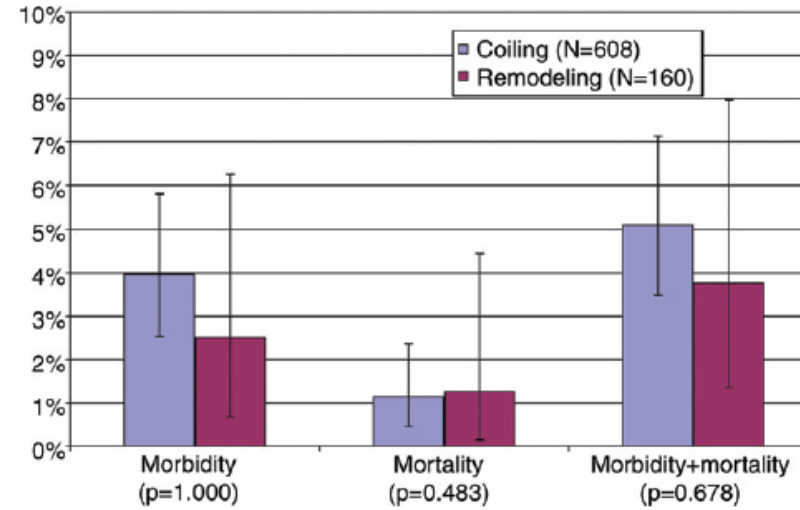
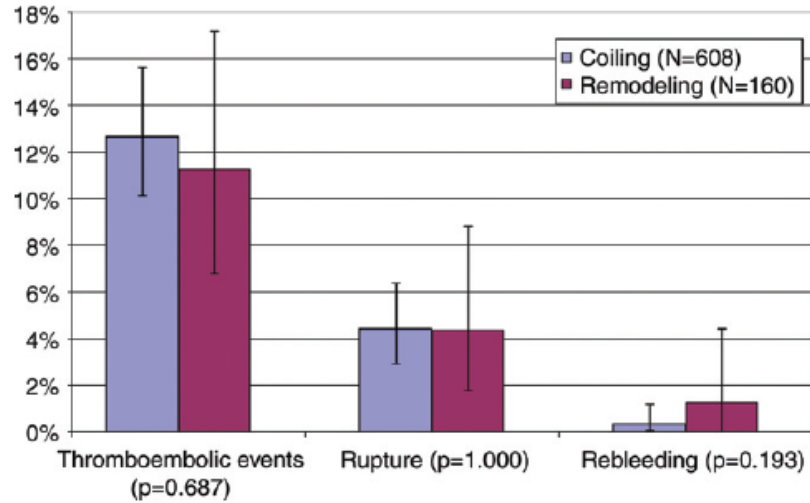
“REMODELLING”



Moret J, Pierot L, Boulin A, Castaings L. “Remodelling” technique of the arterial wall in the endovascular treatment of intracranial aneurysms [abstr]. *Neuroradiology* 1994; 36(suppl 1):S83.

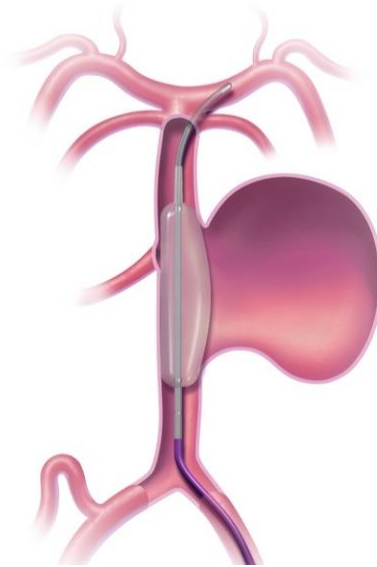
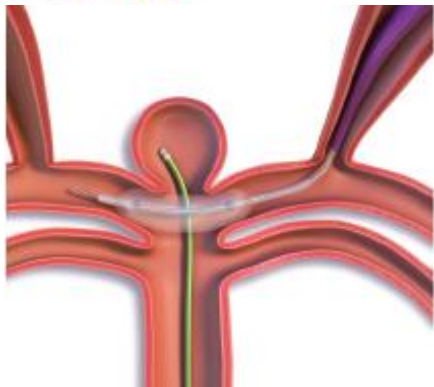
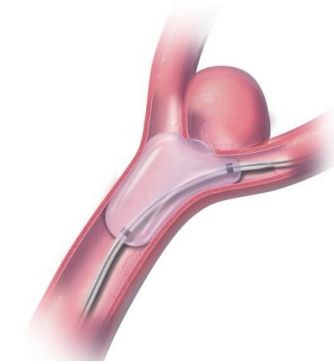
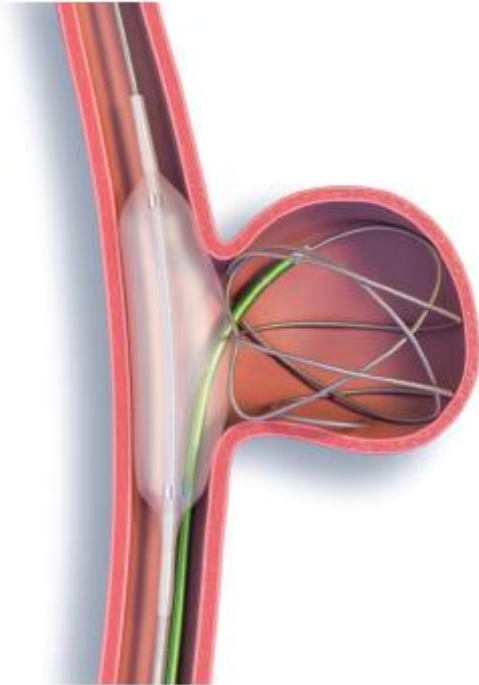
Moret J, Cognard C, Weill A, Castaings L, Rey A. The “remodelling technique” in the treatment of wide neck intracranial aneurysms. *Intervent Neuroradiol* 1997;3:21-35.

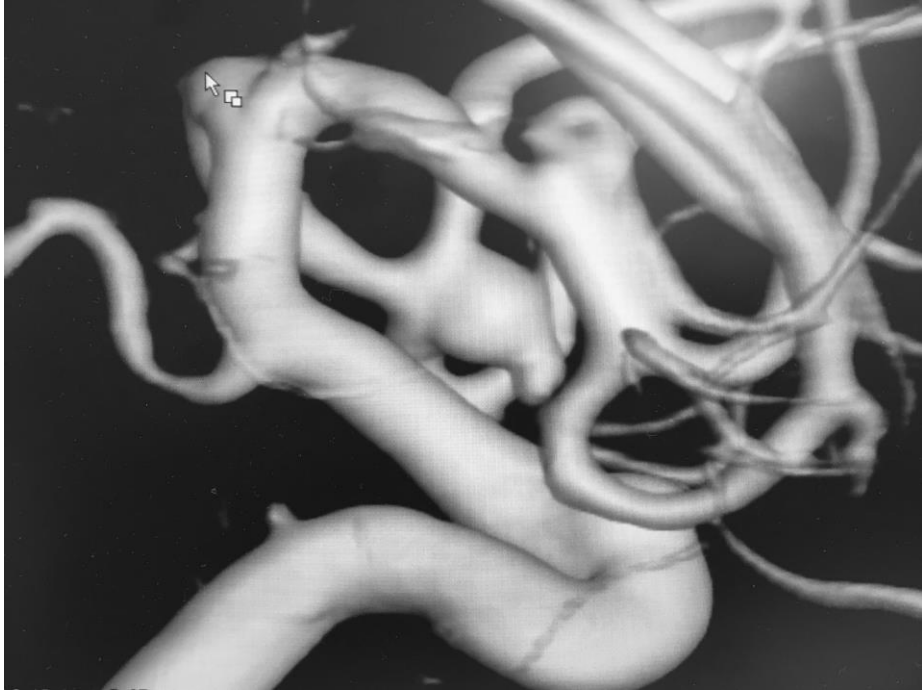




Pierot L, Cognard C, Anxionnat R, et al, for the **CLARITY** group.
The remodeling technique for endovascular treatment of ruptured intracranial aneurysms is **more efficacious than standard coiling with a similar safety.**
Radiology. Epub 2010 Dec. 3







ebri
DNV





The stent based medicine



INDICACIONES DE COLOCACION STENT EN TTO DE ANEURISMAS CEREBRALES

Aneurismas de cuello ancho (> 4 mm, relación saco-cuello > 2)

Aneurismas fusiformes.

Blisters

PREFERIBLEMENTE en no rotos o retratamientos.

En fase aguda de Hsa:

Alternativa a sacrificio del vaso.

Tratamiento parcial con coils y posteriormente stenting.

Primera intención si no requiere drenaje ventricular

En complicaciones para:

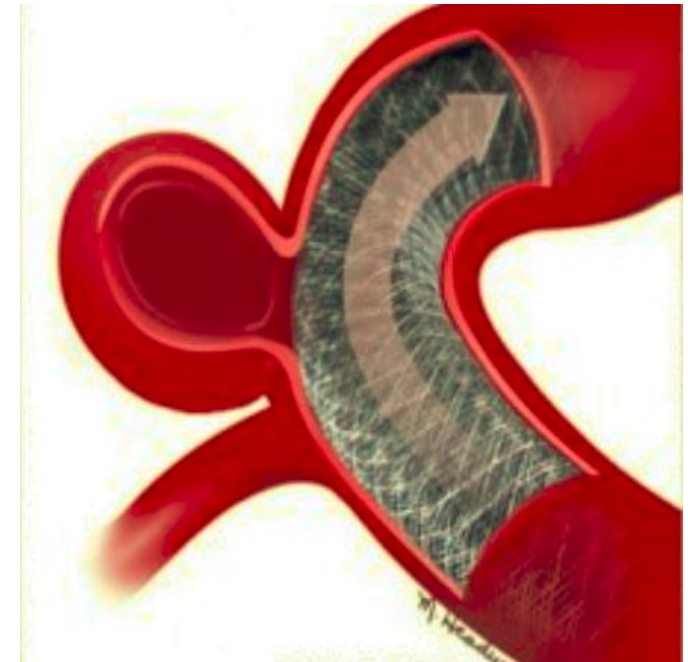
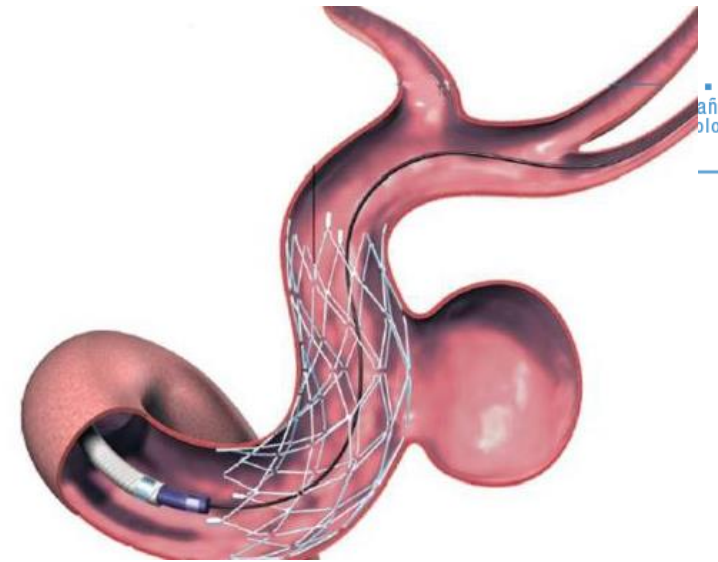
Recuperar el flujo

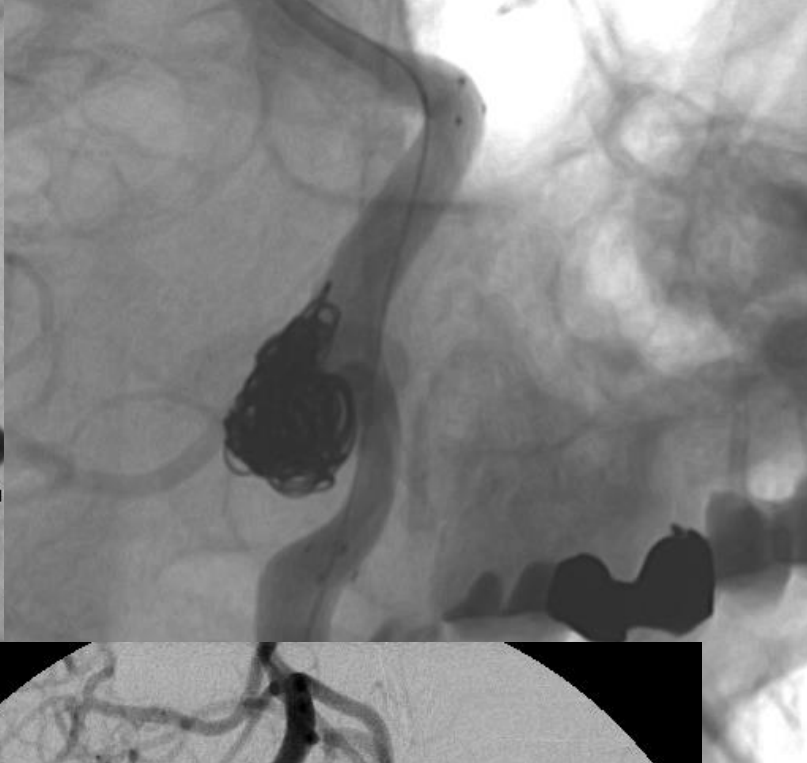
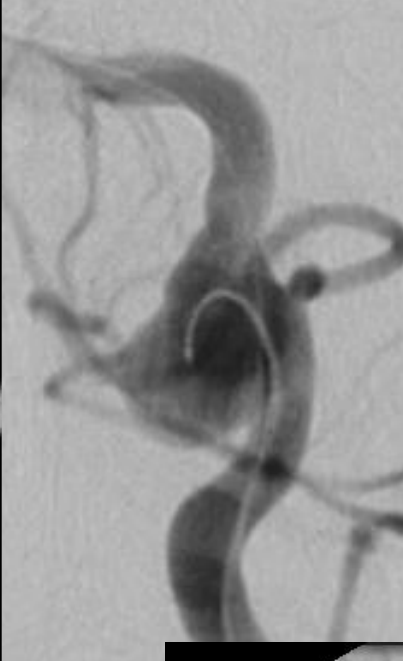
Estabilizar los coils

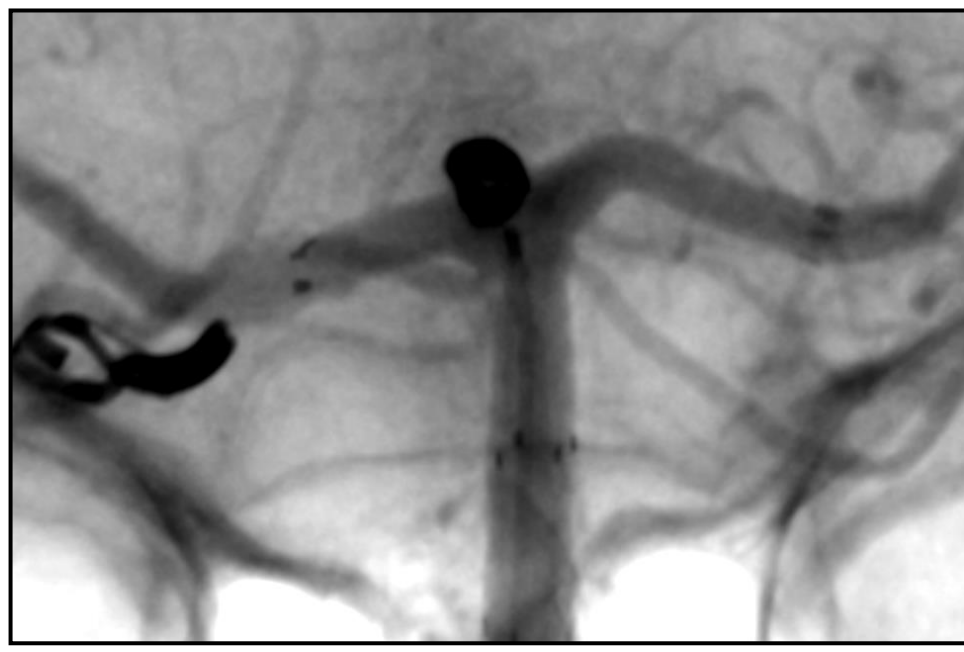
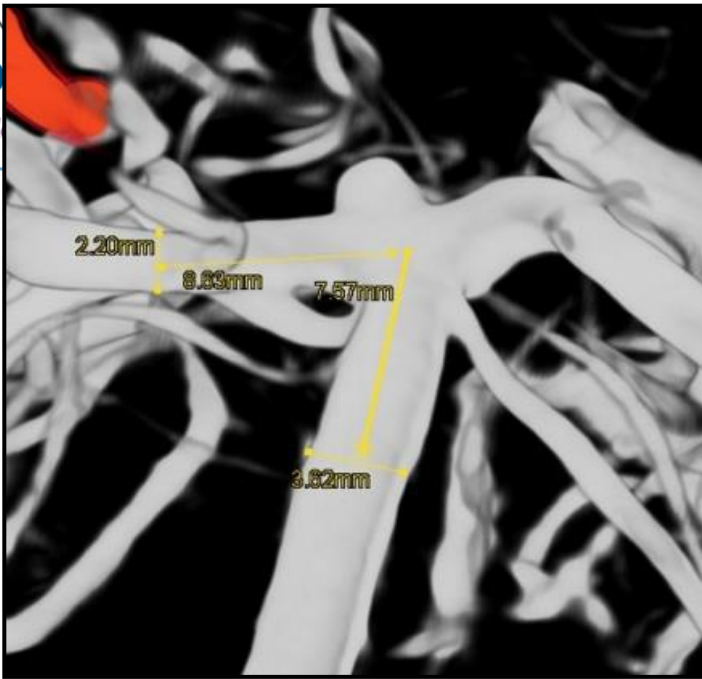
Tratamiento complementario tras la colocación de coils

Diversificar el flujo

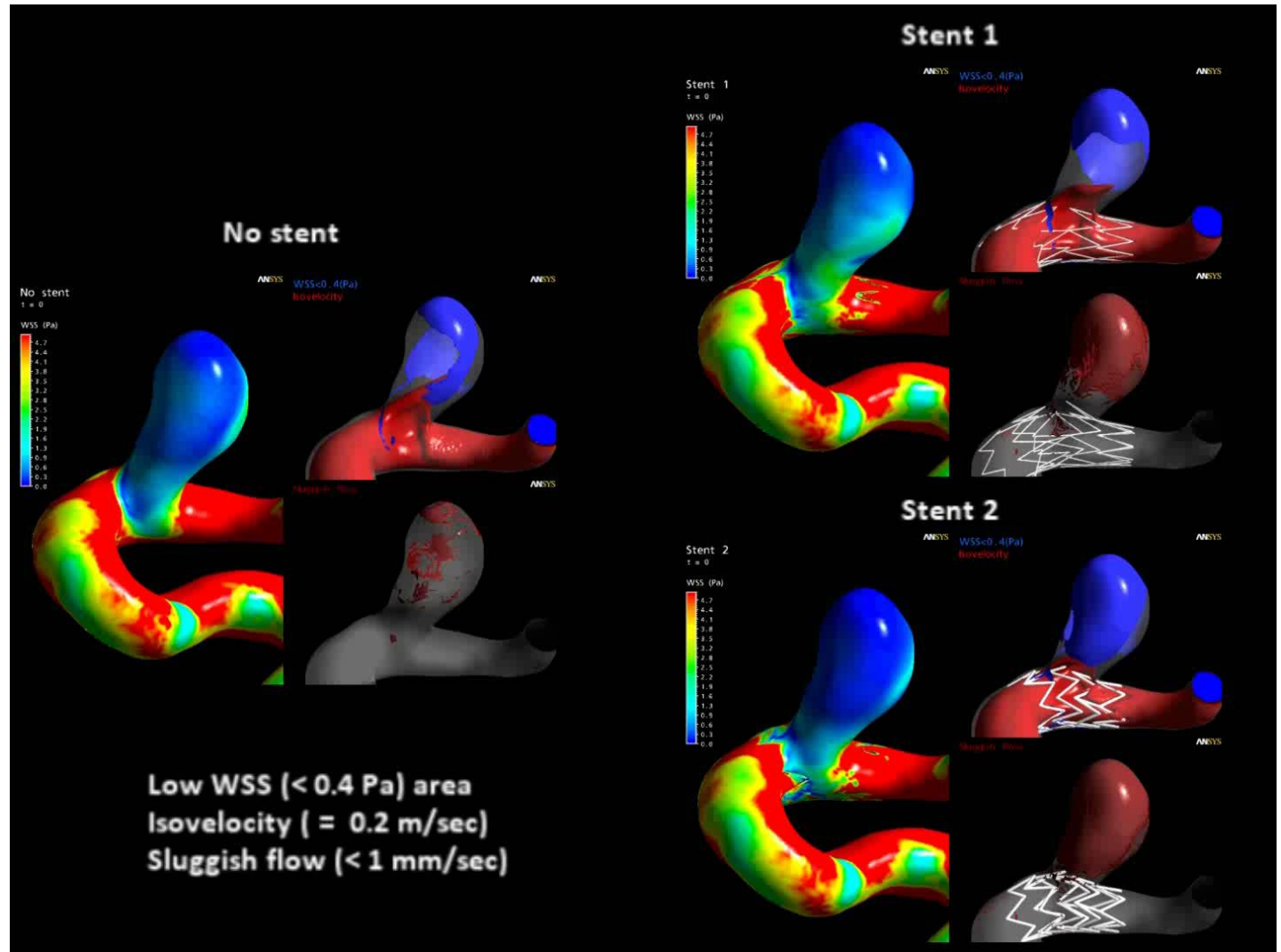
Reconstruir la pared



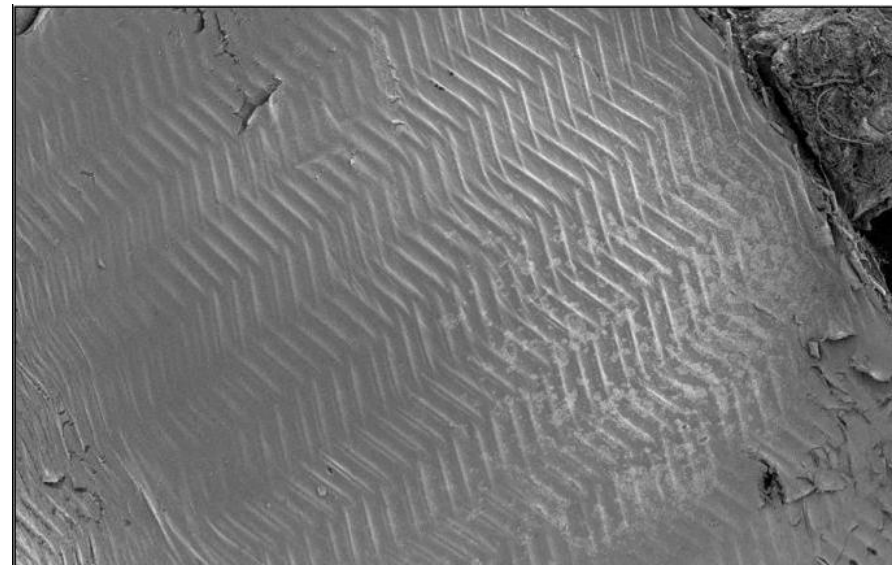
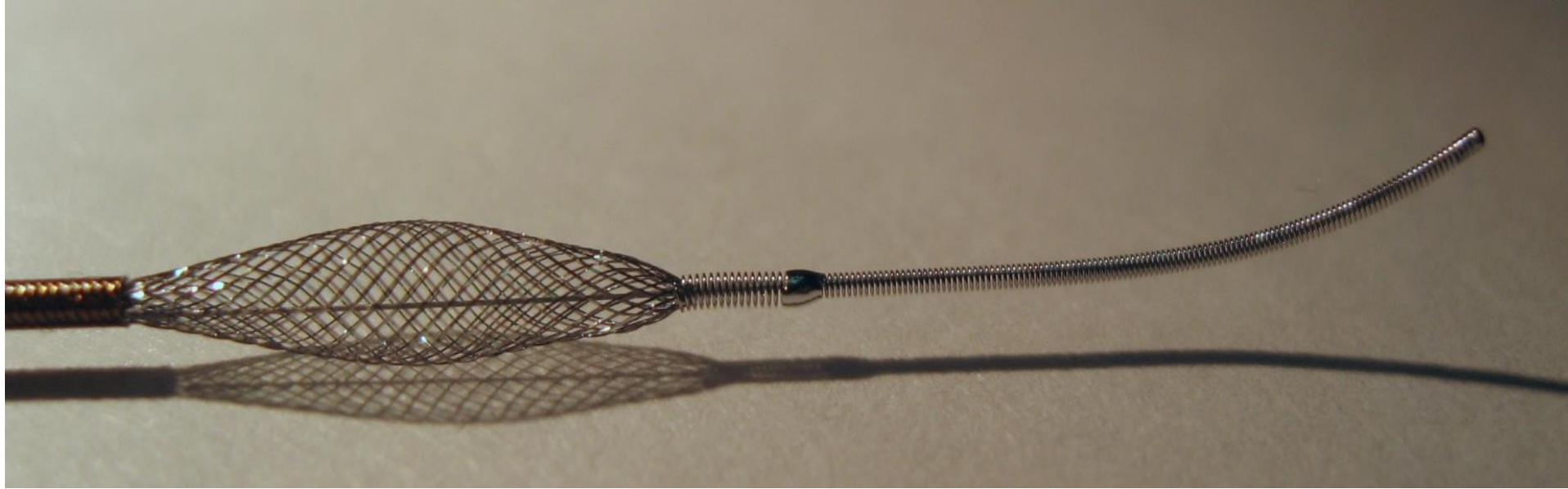




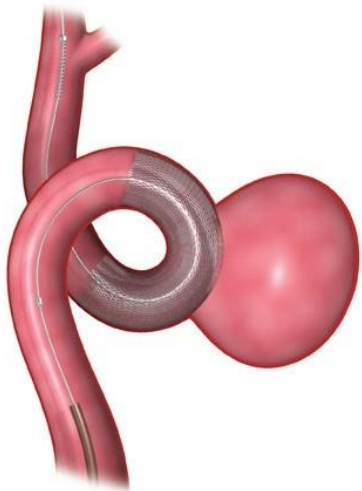
FLOW DIVERSION CONCEPT



Flow diverter stents



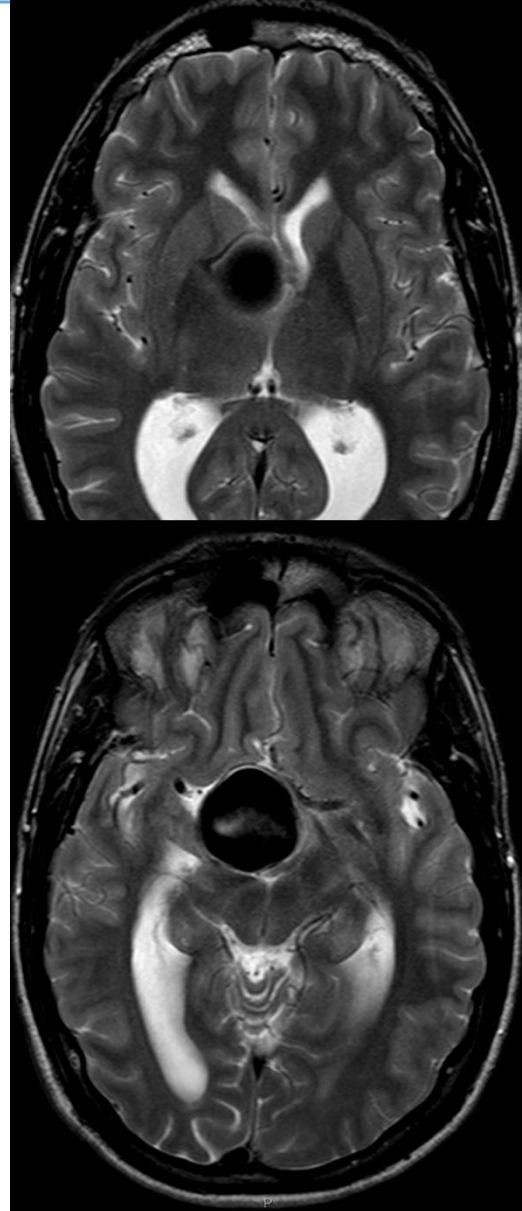
INDICACIONES ACTUALES DE LOS “STENTSFLOW DIVERTER”



- ANEURISMAS DE GRAN TAMAÑO, FUSIFORMES Y GIGANTES.
- ANEURISMAS DE CUELLO ANCHO.
- ANEURISMAS CON HISTORIA DE REPERMEABILIZACIONES.
- ANEURISMAS PEQUEÑOS INTRATABLES CON TECNICAS CONVENCIONALES.

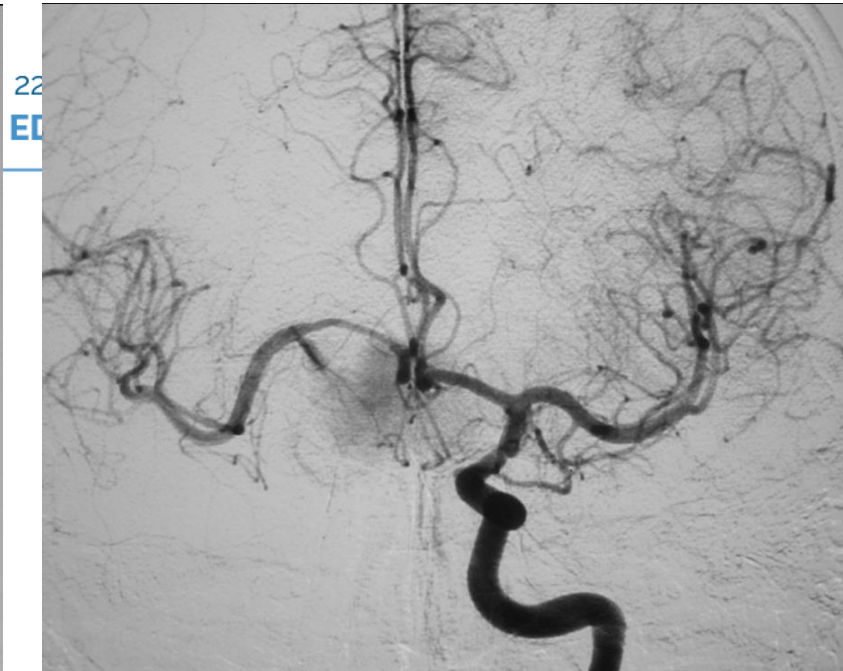
REQUIERE DOBLE ANTIAGREGACION LIMITANDO SU USO EN CASOS DE HSA





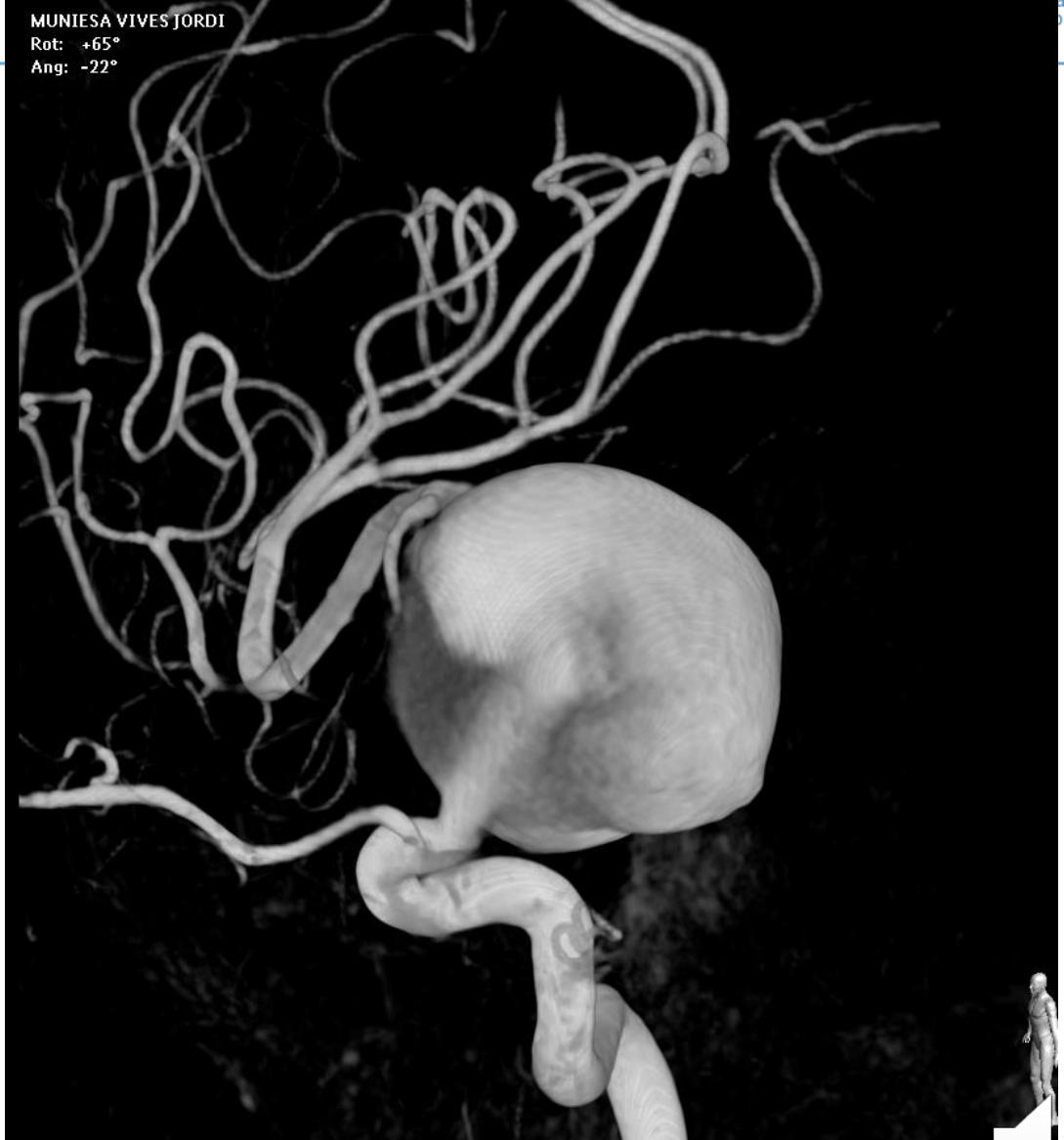
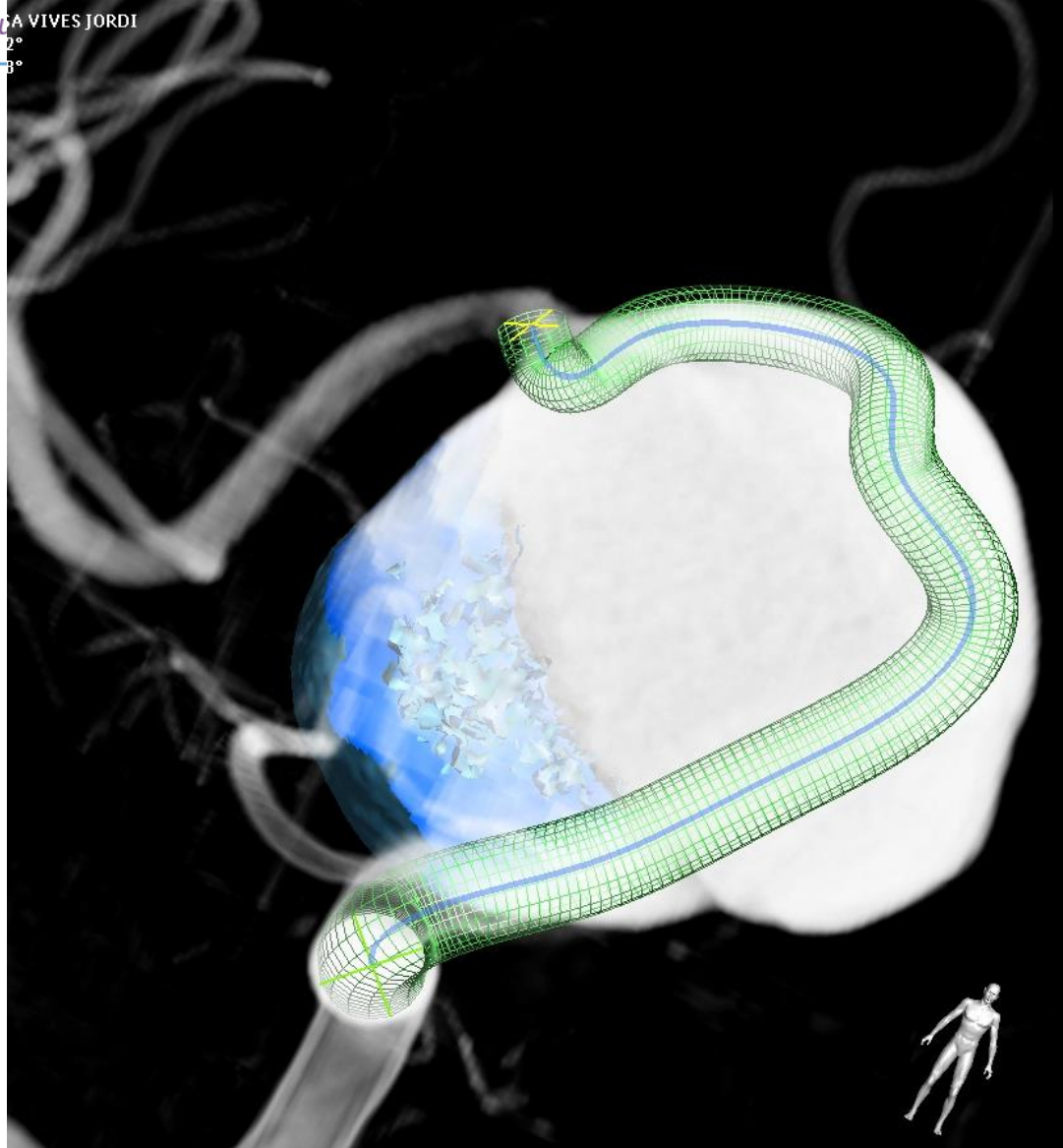
28 años
Síntomas de compresión quiasmática





22
ED

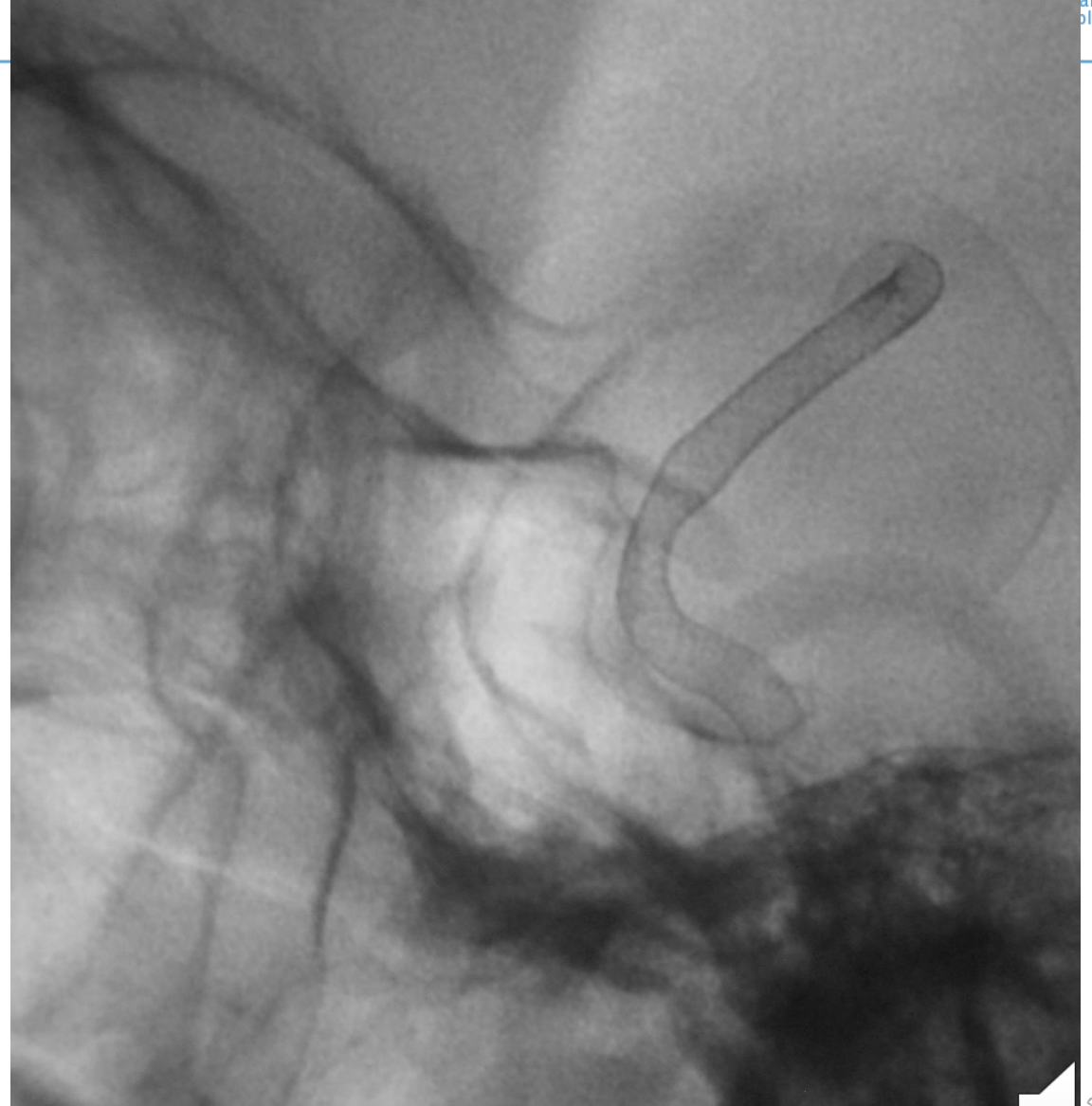
Neuroradiología



MUNIESA VIVES JORDI
Rot: +65°
Ang: -22°

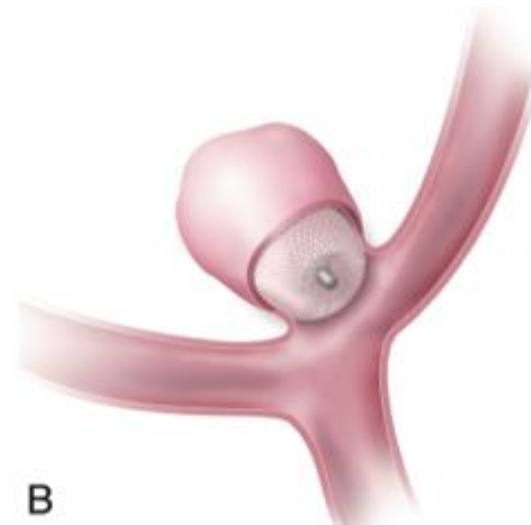
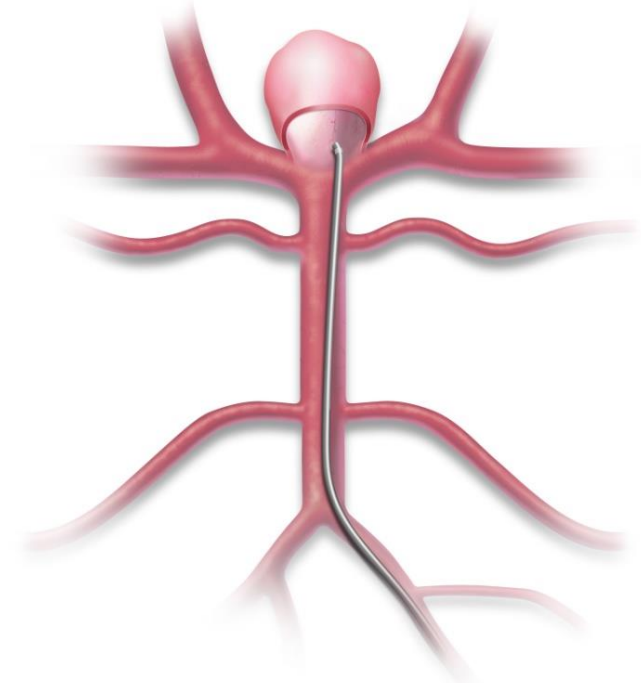
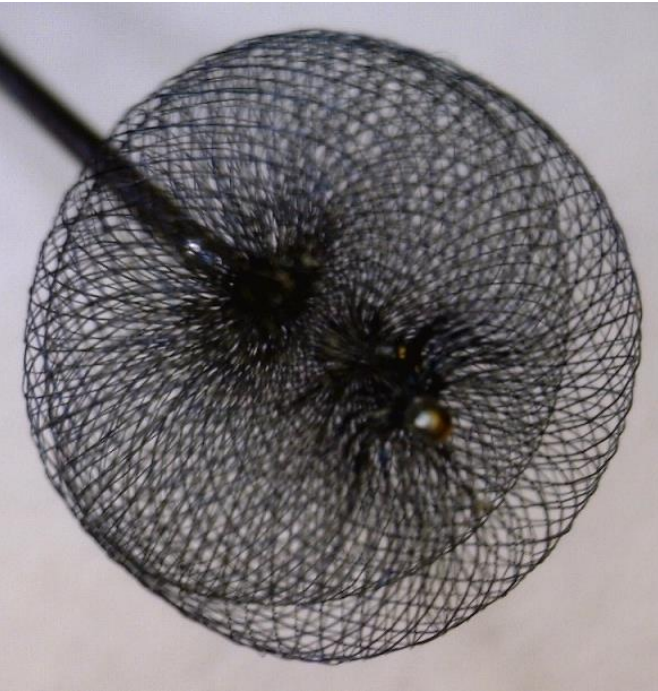


Neu



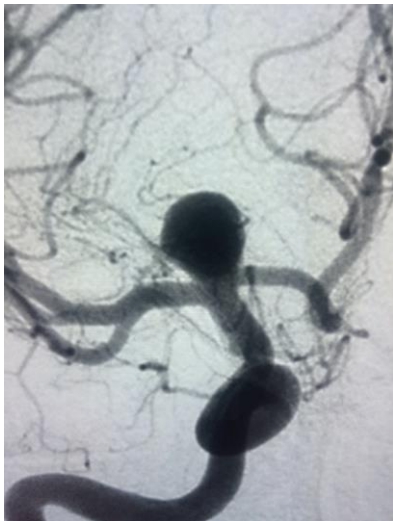
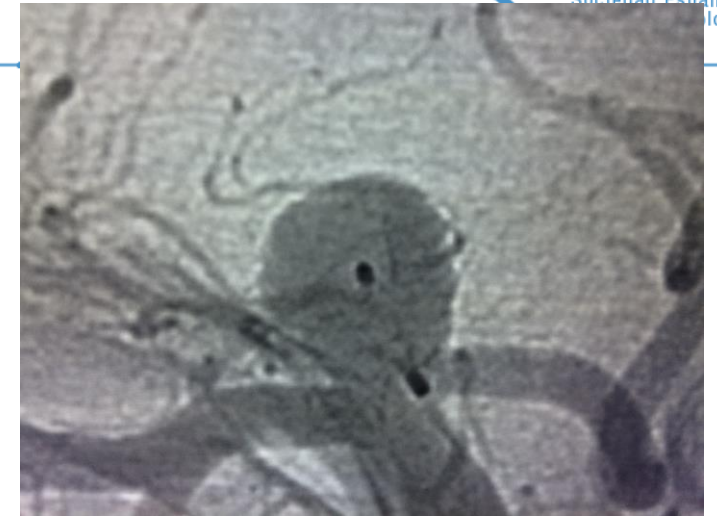
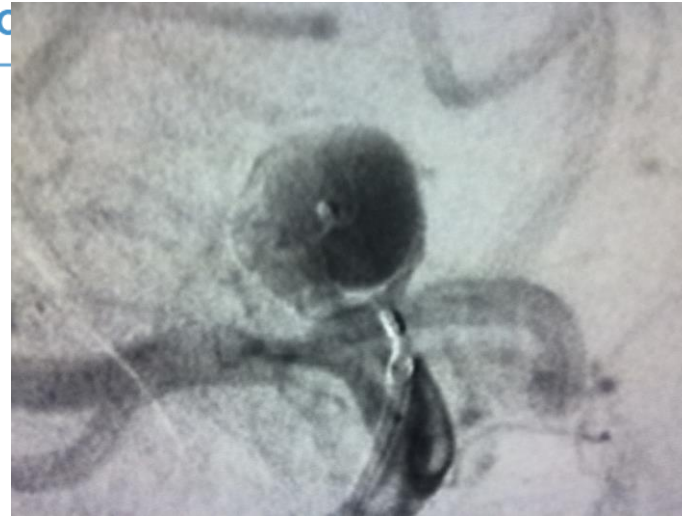


Aneurysm Embolization Device



OLD CONCEPT, NEW DEVICE





**TRATAMIENTO ENDOVASCULAR PATOLOGÍA
VASCULAR CEREBRAL HEMORRÁGICA**

**SEGUIMIENTO EVOLUTIVO CON
IMAGEN DE PACIENTES
TRATADOS DE ANEURISMAS
CEREBRALES**

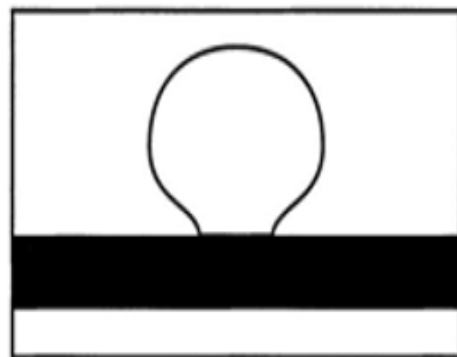


Clasificación de Resultados Angiográficos:

- Clase 1 de Raymond = Oclusión Completa.
- Clase 2 de Raymond = Cuello Residual.
- Clase 3 de Raymond = Aneurisma Residual.

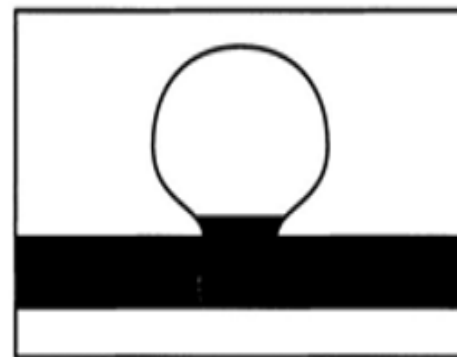
Conceptos a tener en cuenta:

- Compactación 3-6 meses
- Tasa Resangrado/1er año hasta 17% en cierre parcial
- Vinculados y dependientes de la calidad del cierre inicial
- Aneurismas de novo



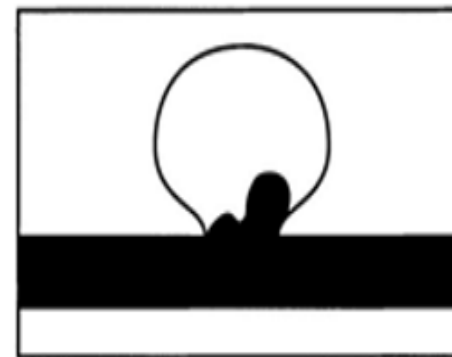
COMPLETE

Class 1



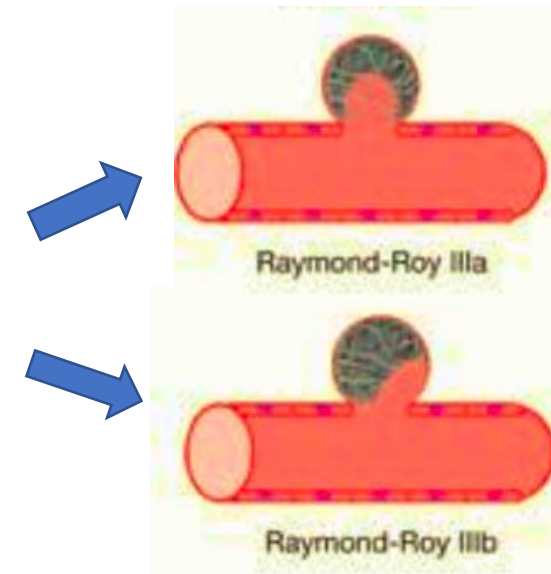
RESIDUAL NECK

Class 2



RESIDUAL ANEURYSM

Class 3



Resolución de técnicas de imagen

- angio-RM 0,6-1 mm
- angio-TC 0,4-0,7 mm
- **ASD 0,2 mm**
- **A3D 0,15 mm**

Variabilidad frente a diferentes tratamientos

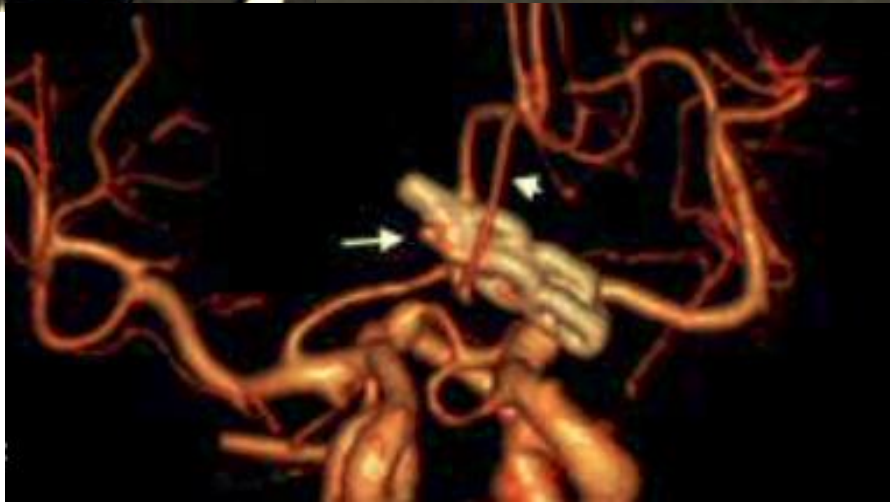
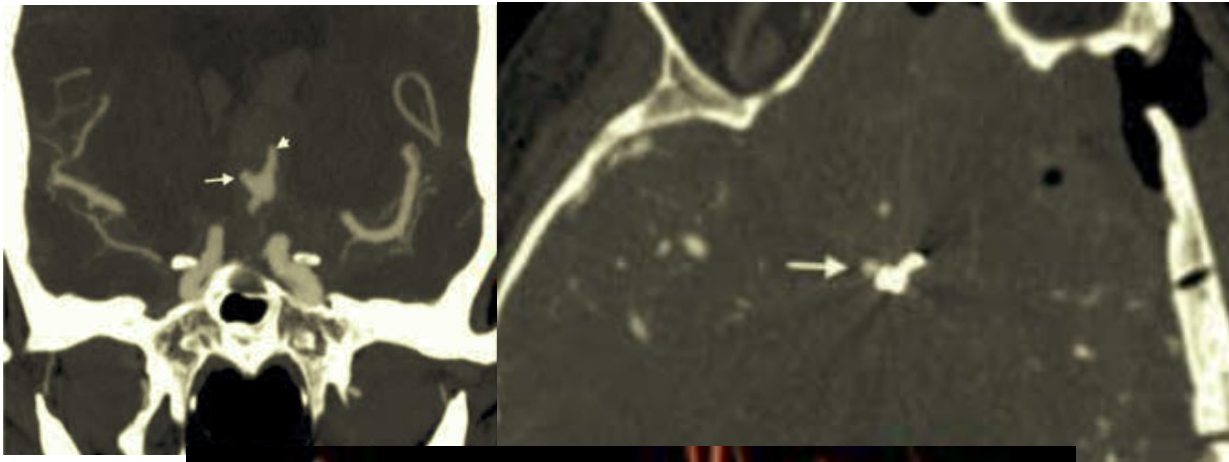
- **Clip** son de cobalto (más ferromagnético)
- **Coil** fundamentalmente Platino (artefacto en TC)
- **Stents** Nitinol o Cromocobalto (mas ferromagnético)
- **Web** Nitinol y marcador ? (ok visibilidad en TC y RM)

Aneurismas tratados vía endovascular	Angio TC	Angio RM sin contraste (TOF)	Angio RM contrastada	Angiografía sustracción digital (ASD)
Coils	-	++	+++	+++
Stent	+	+	++	+++
Diversor de flujo	+	+	++	+++
Aneurismas tratados vía quirúrgica				
Clips	++	-	+	+++

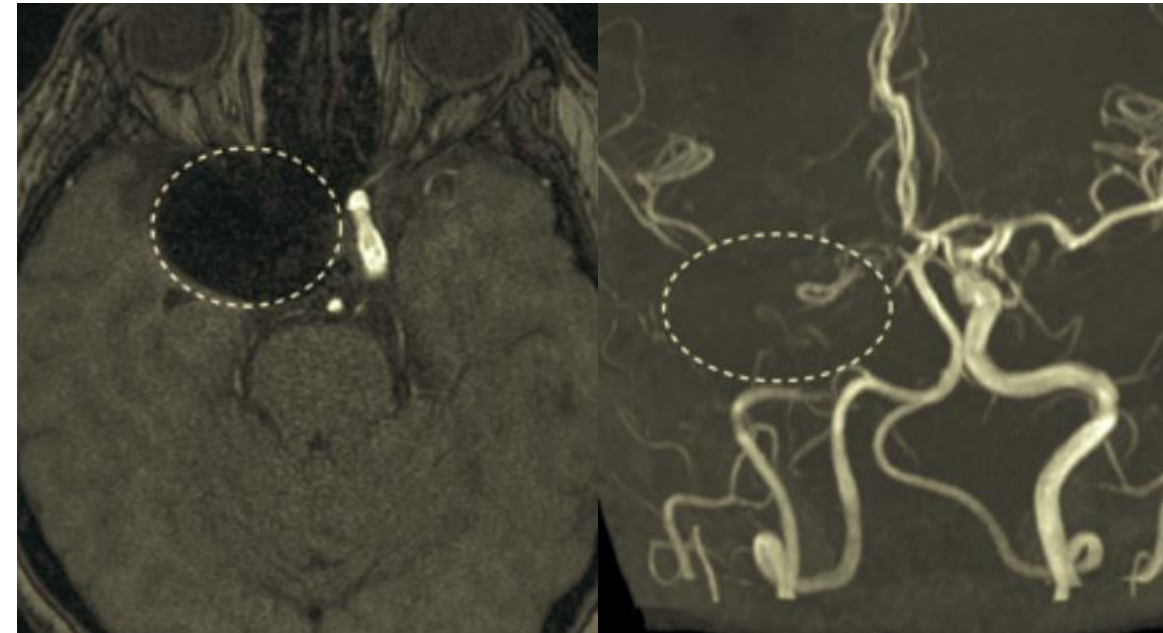
+++ *excelente exactitud.*
 ++ *exactitud moderada, puede ser usado en casos seleccionados.*
 + *baja exactitud, no recomendado rutinariamente.*
 - *nula utilidad.*
 TOF: "time of flight" o tiempo de vuelo.



Control clip quirurgico



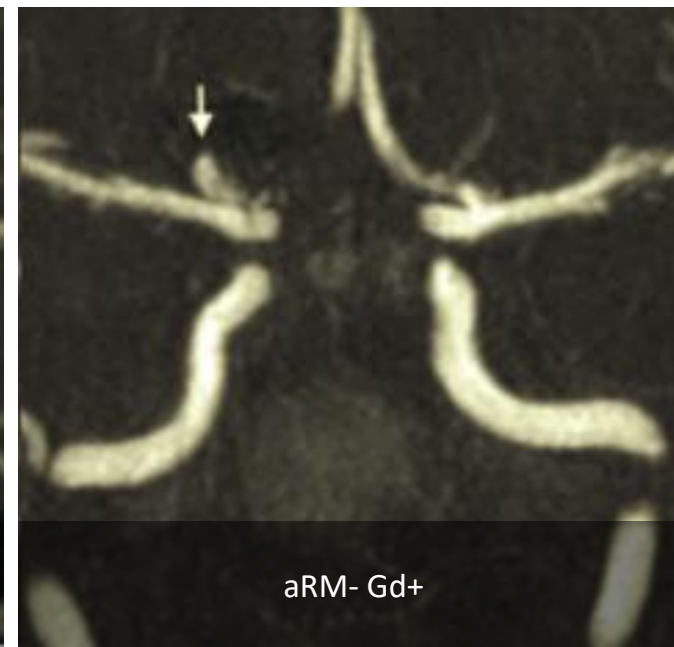
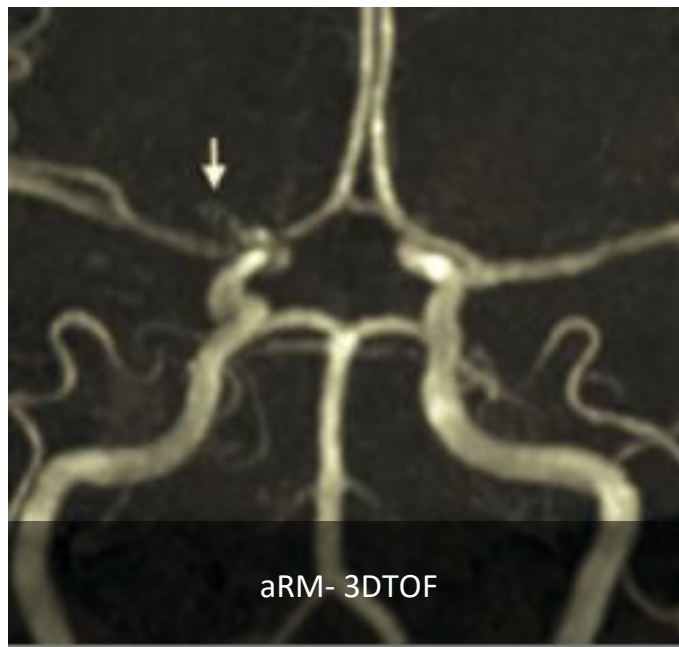
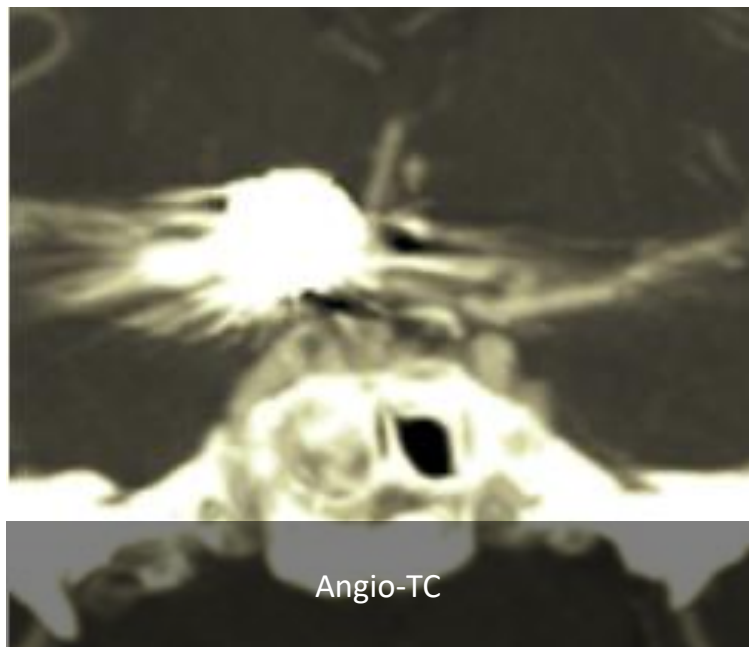
angio-TC



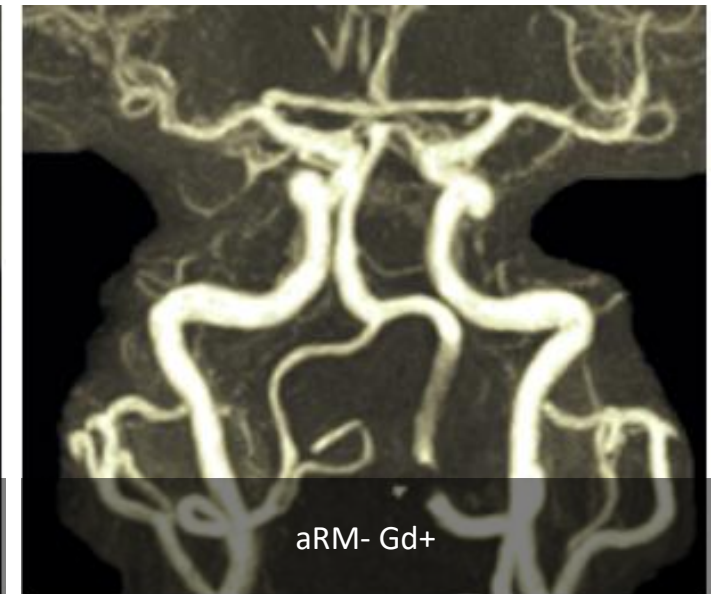
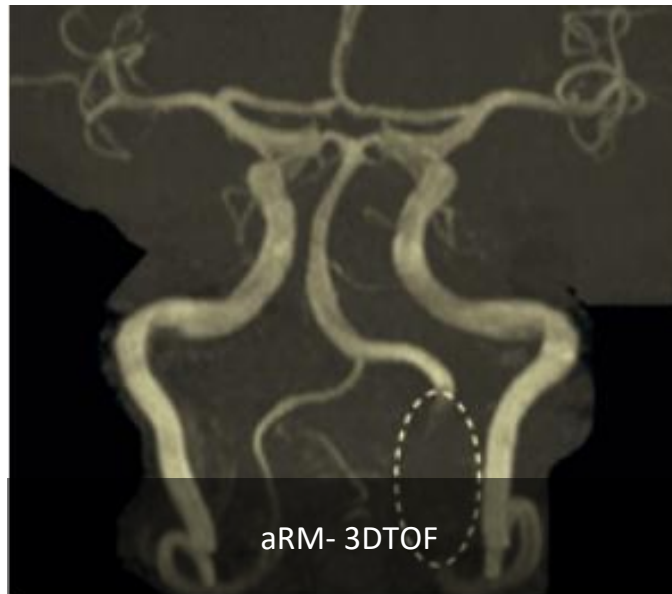
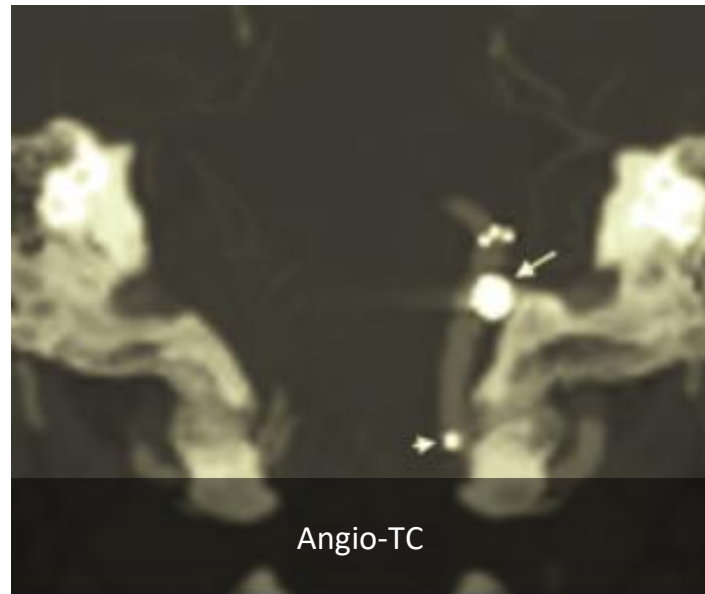
Angio-RM (TOF)

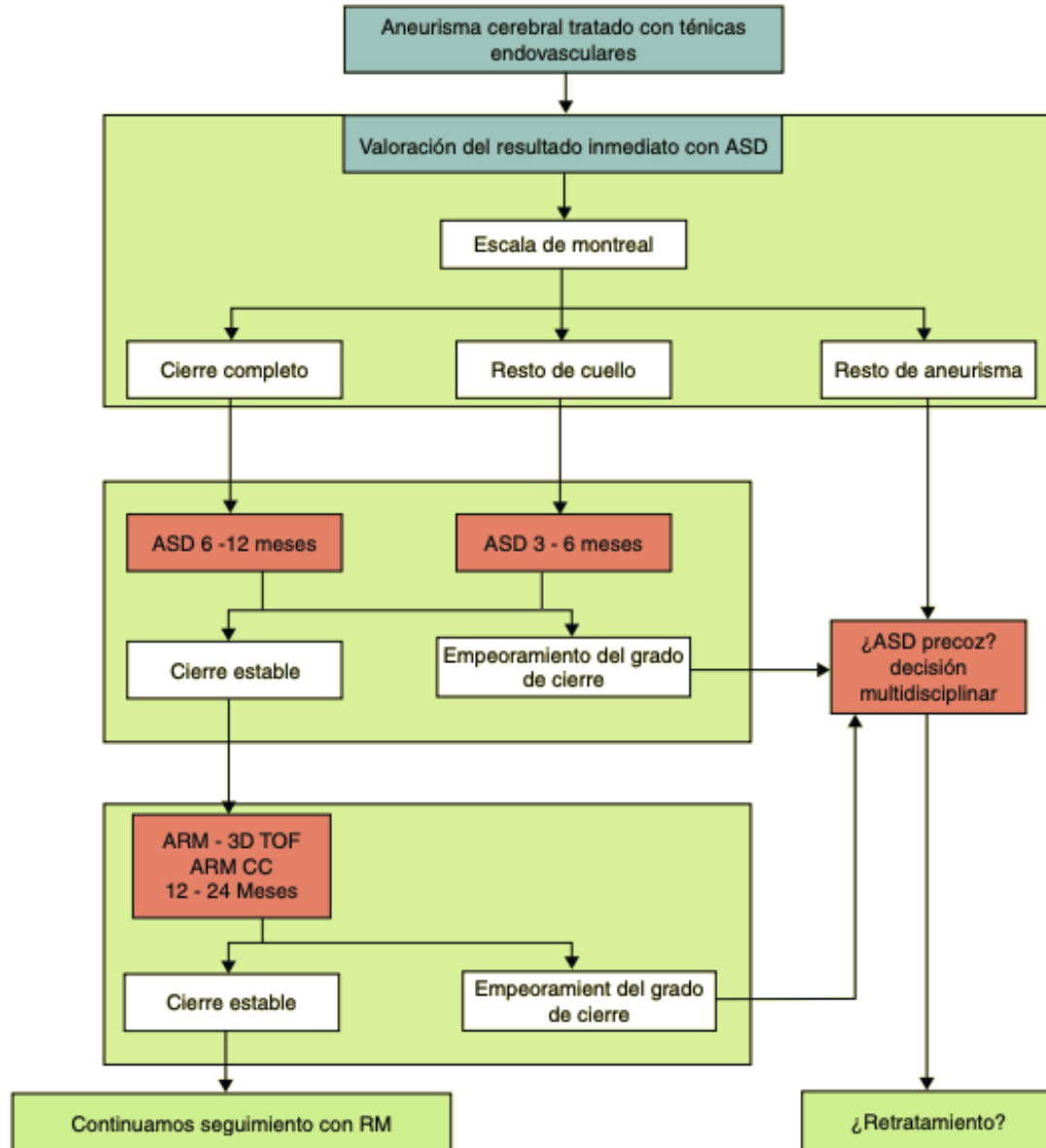


Control coil: comparativa



Control stent assisted coiling: comparativa





Cierre/Tipo Pres	ROTO	NO ROTO
Completo estable	ASD 6-12 M + aRM 12M X 3 -5A	aRM 12-18M X 3A
Cuello estable	ASD 3-6 M + aRM 12M X 3 -5A	Asd 12m? aRM 12-18M X 3A
incompleto	ASD 1-3 M retratar/reclasificar aRm 12 M de por vida?	ASD 6-12 M retratar/reclasificar? aRM 12 M De por vida?



Conclusiones

- 1.- En el abordaje clínico-radiológico actual de los aneurismas cerebrales es fundamental su clasificación primaria en cuanto ha si han producido un sangrado reciente o no.
- 2.- El tratamiento endovascular de los aneurismas cerebrales rotos es la primera opción terapéutica para estos pacientes con una evidencia 1B.
- 3.- Dicho estudio randomizado fue realizado hace más de 20 años y con la primera generación de dispositivos endovasculares. Hoy día los resultados parecen soportar esa realidad dada la vertiginosa evolución técnica y el conocimiento acumulado.
- 4.- Es fundamental el seguimiento evolutivo de los pacientes tratados, ante la posibilidad de reapertura, recrecimiento y aparición de otros aneurismas. En este papel, la aportación de aRM y angio-TC es relevante.





Muchas gracias por vuestra atención

