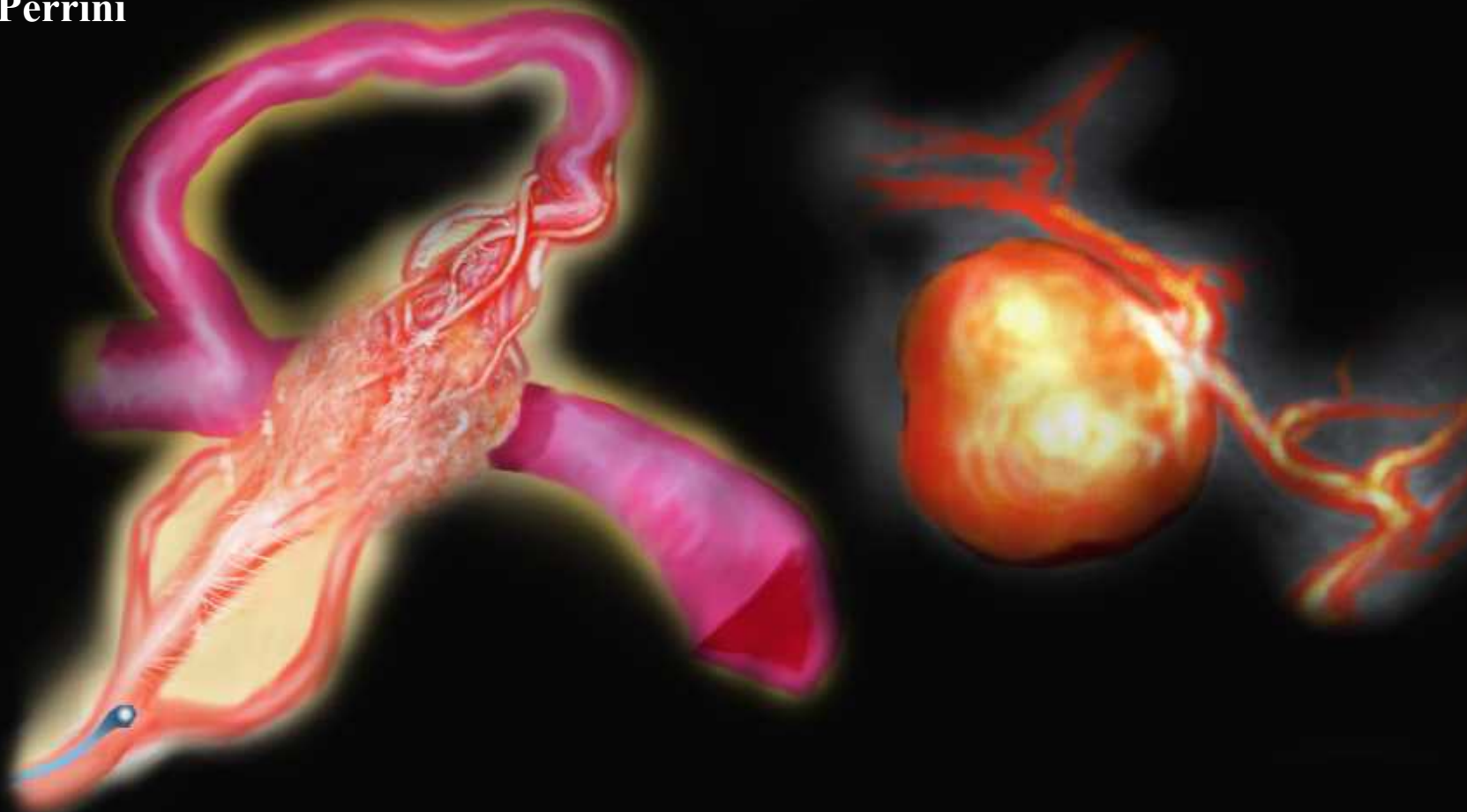


Le Patologie Vascolari di interesse Neurochirurgico



Clinica Neurochirurgica Azienda Ospedaliera Universitaria Careggi

Paolo Perrini



Gli aneurismi cerebrali: dalla diagnosi al trattamento

Epidemiologia

Diagnostica

Clinica

Trattamento



Epidemiologia

Età con maggiore incidenza: 55-60 anni

Incidenza annuale di ESA da rottura di aneurisma: 10-28 casi per 100 000 (28 000 casi/anno in USA)

Decessi prima della valutazione in Ospedale: 10%

Rischio di risanguinamento: 15-20% nelle prime due settimane

Il vasospasmo porta a decesso il 7% dei pazienti e causa deficit neurologici importanti in 7% dei pazienti

Complessivamente la metà dei pazienti decede entro il primo mese



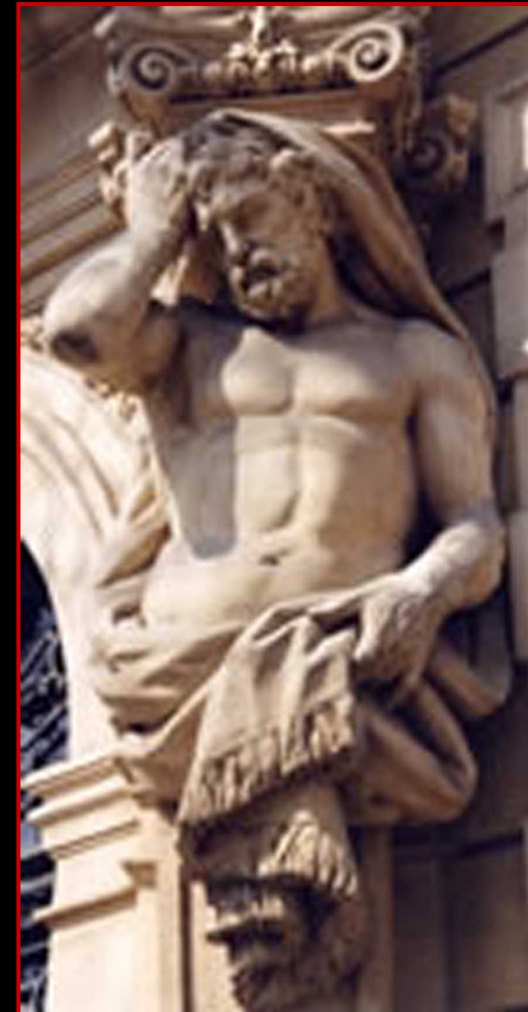
Clinica dell'ESA

Cefalea

Solitamente il paziente la descrive come “la peggiore cefalea della mia vita”

Nel 30-60% dei casi: “sentinel hemorrhage or warning headache”

La “warning headache” può conseguire ad accrescimento dell'aneurisma

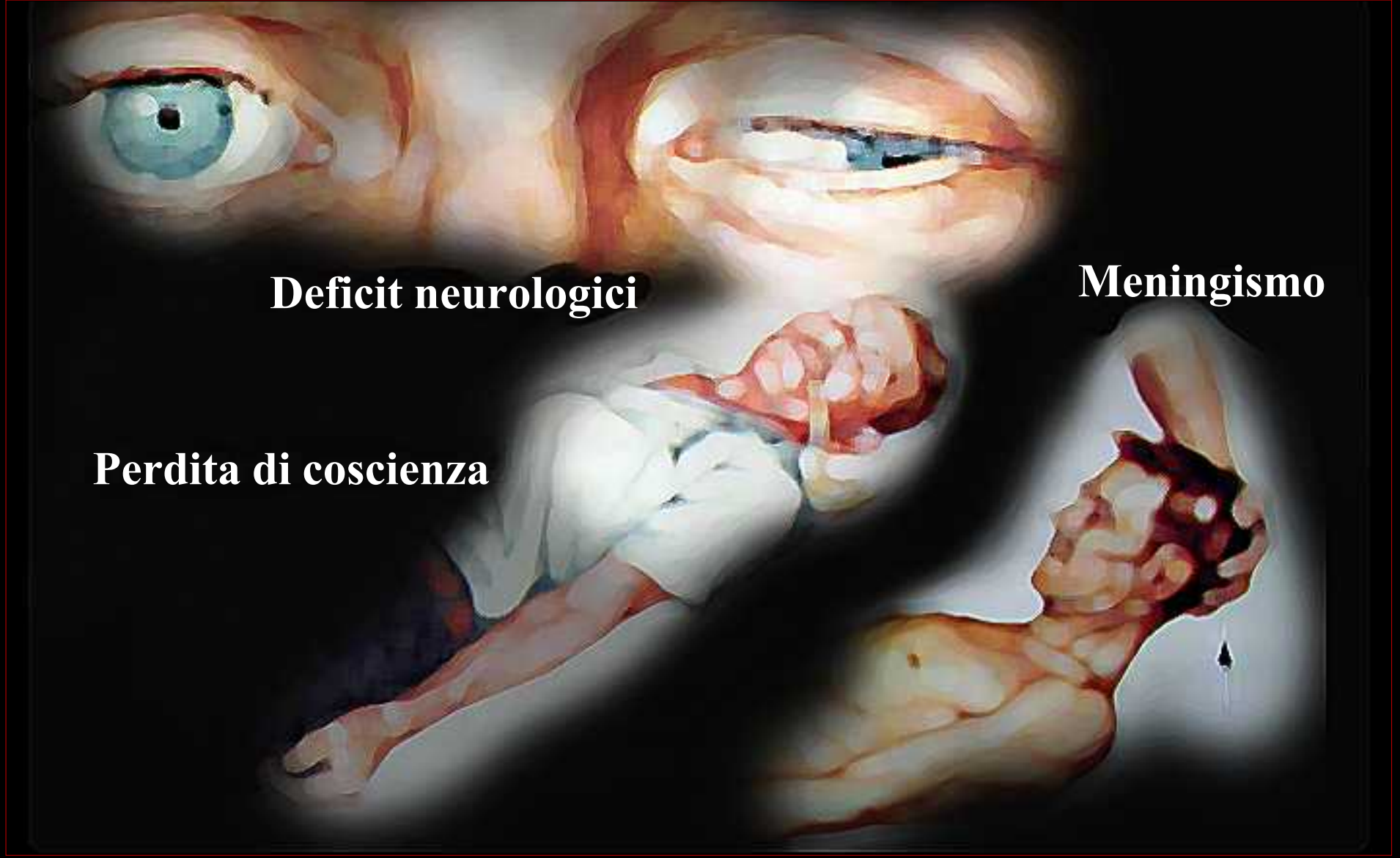


Segni dell'ESA

Deficit neurologici

Meningismo

Perdita di coscienza

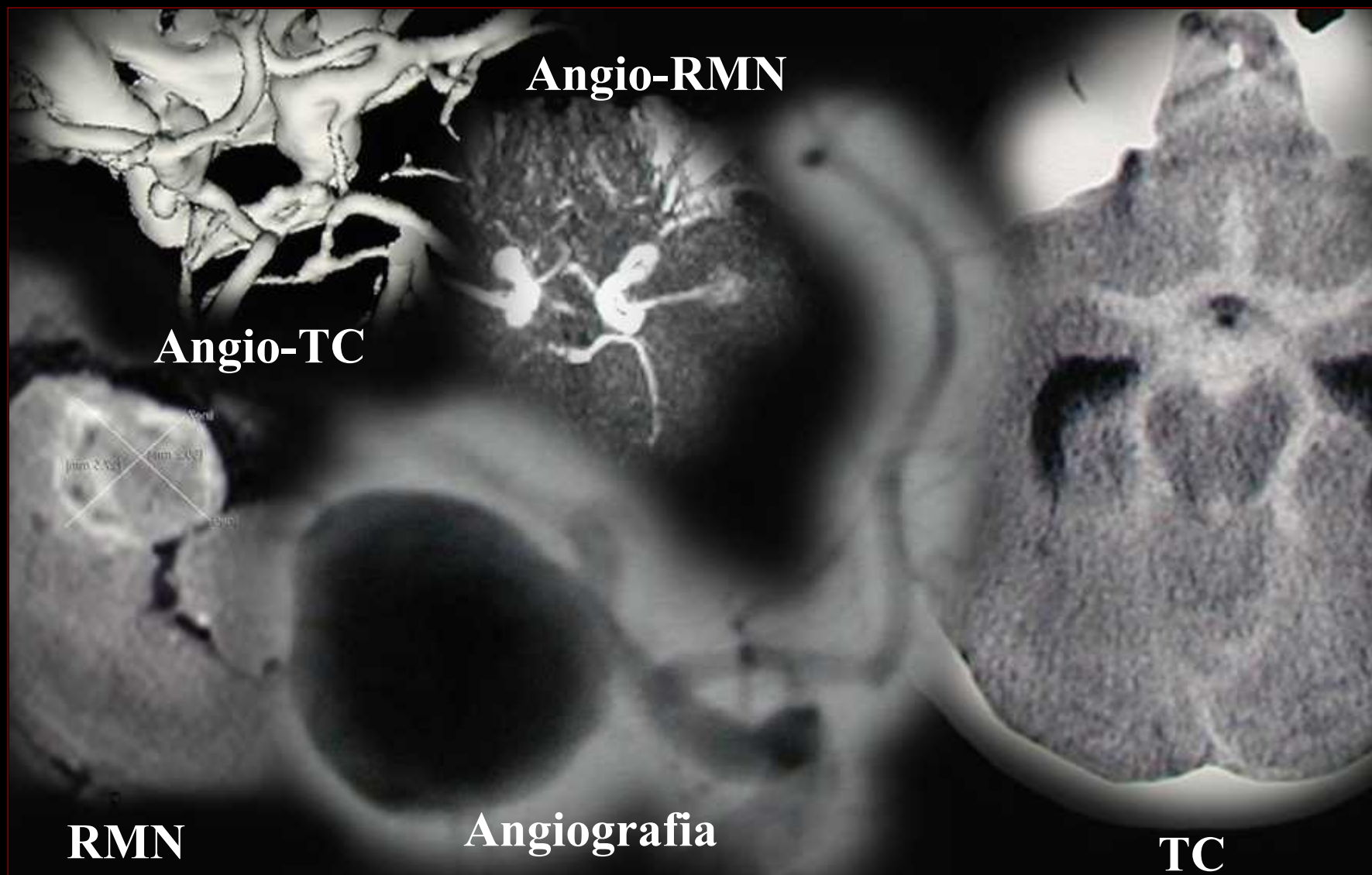


Classificazione di Hunt e Hess

Grado	Descrizione
0	Aneurisma intatto
1	Asintomatico o lieve cefalea con sfumata rigidità nucale
2	Paralisi di un nervo cranico (III, VI), cefalea moderata/severa, rigidità nucale
3	Deficit neurologico focale sfumato, letargia o confusione
4	Stupor, emiparesi moderata/severa, iniziale rigidità in decerebrazione
5	Coma profondo, rigidità decerebrata

Aggiungi un grado per concomitanza di importanti malattie sistemiche (Ipertensione, diabete, severa aterosclerosi) o importante vasospasmo all'angiografia.

Diagnostica



RMN

Angiografia

TC

Angio-TC

Angio-RMN

TC: Fisher Grade



Diagnostica TC

A) Permette di valutare la presenza di ESA in $> 95\%$ dei casi se eseguita entro 48 ore

B) In presenza di aneurismi multipli permette di identificare quale aneurisma ha sanguinato

C) Può predire la sede dell'aneurisma



Angiografia



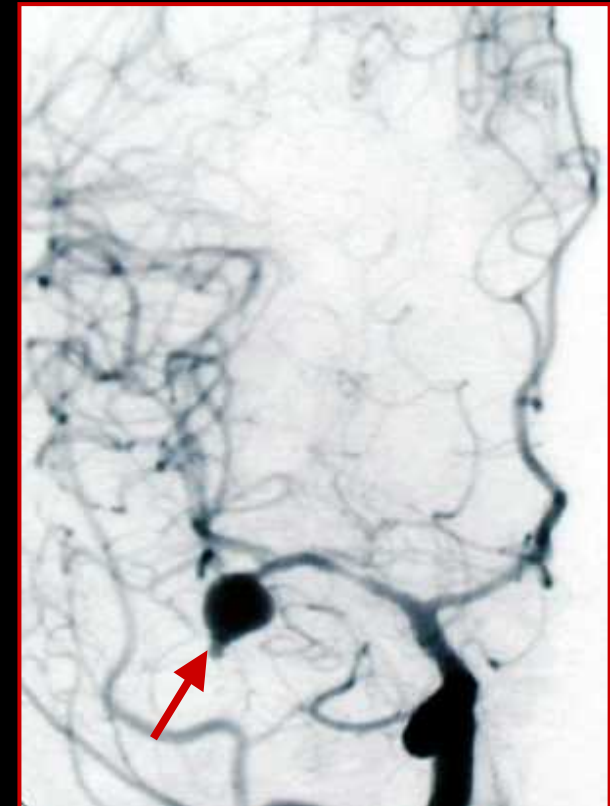
Uno studio angiografico completo e di buona qualità permette di diagnosticare la causa dell'emorragia in > 90% dei casi.



**Aneurisma della
Comunicante anteriore
(30% dei casi)**



**Aneurisma della
Comunicante posteriore
(25% dei casi)**



**Aneurisma della Cerebrale
media
(20% dei casi)**

ESA con angiografia negativa



La causa più frequente di ESA con angiografia negativa è la scarsa qualità dell'esame angiografico.

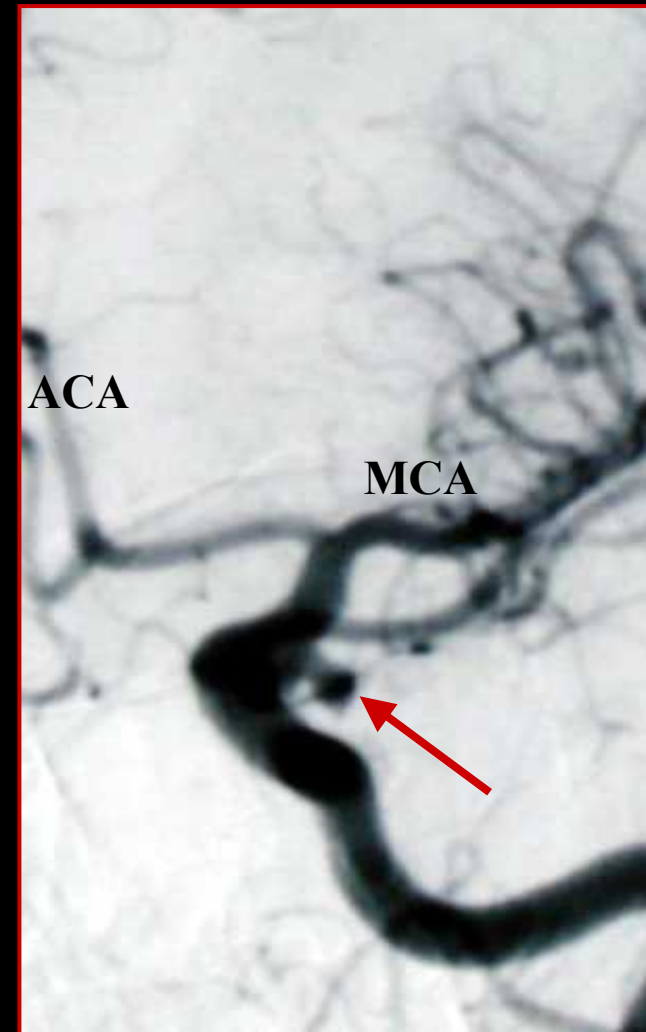
Talora l'aneurisma può non essere visualizzato per trombosi intra-aneurismatica o vasospasmo del vaso afferente.



Angio-TC



L'angio-TC ha una sensibilità del 95% e una specificità superiore all'80% nel rilevare aneurismi superiori a 2 mm di diametro. Permette una visione 3D e visualizza i rapporti con le strutture ossee.



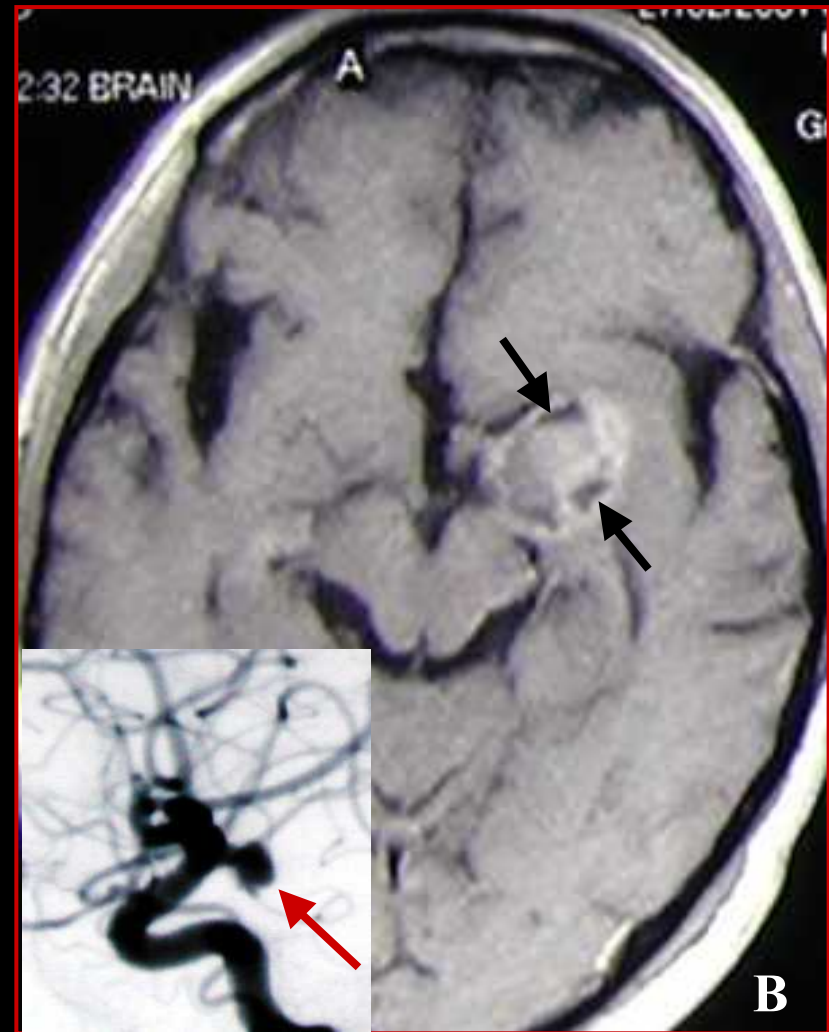
RMN



Bassa sensibilità nella diagnosi di ESA nelle prime 24-48 ore per la scarsità di meta-Hb

Esame di prima scelta nello screening di aneurismi intatti (A)

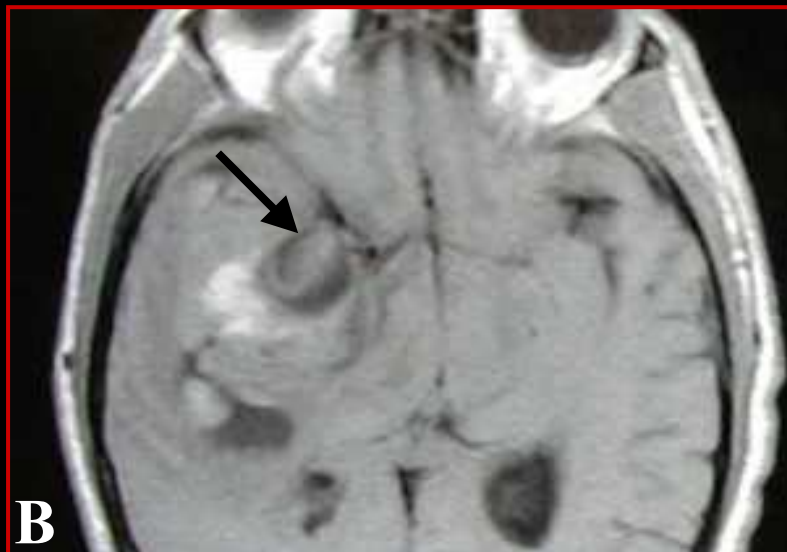
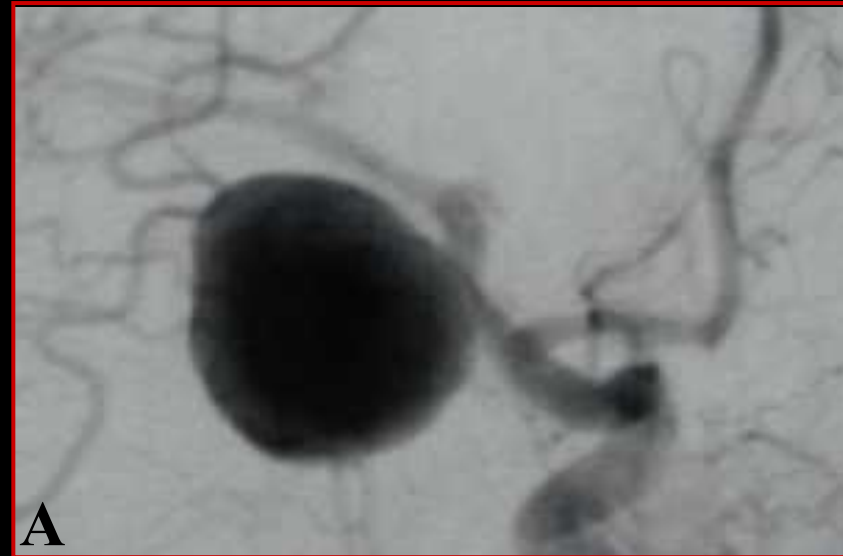
Utile negli aneurismi giganti perché visualizza bene la trombosi intraluminale (B)



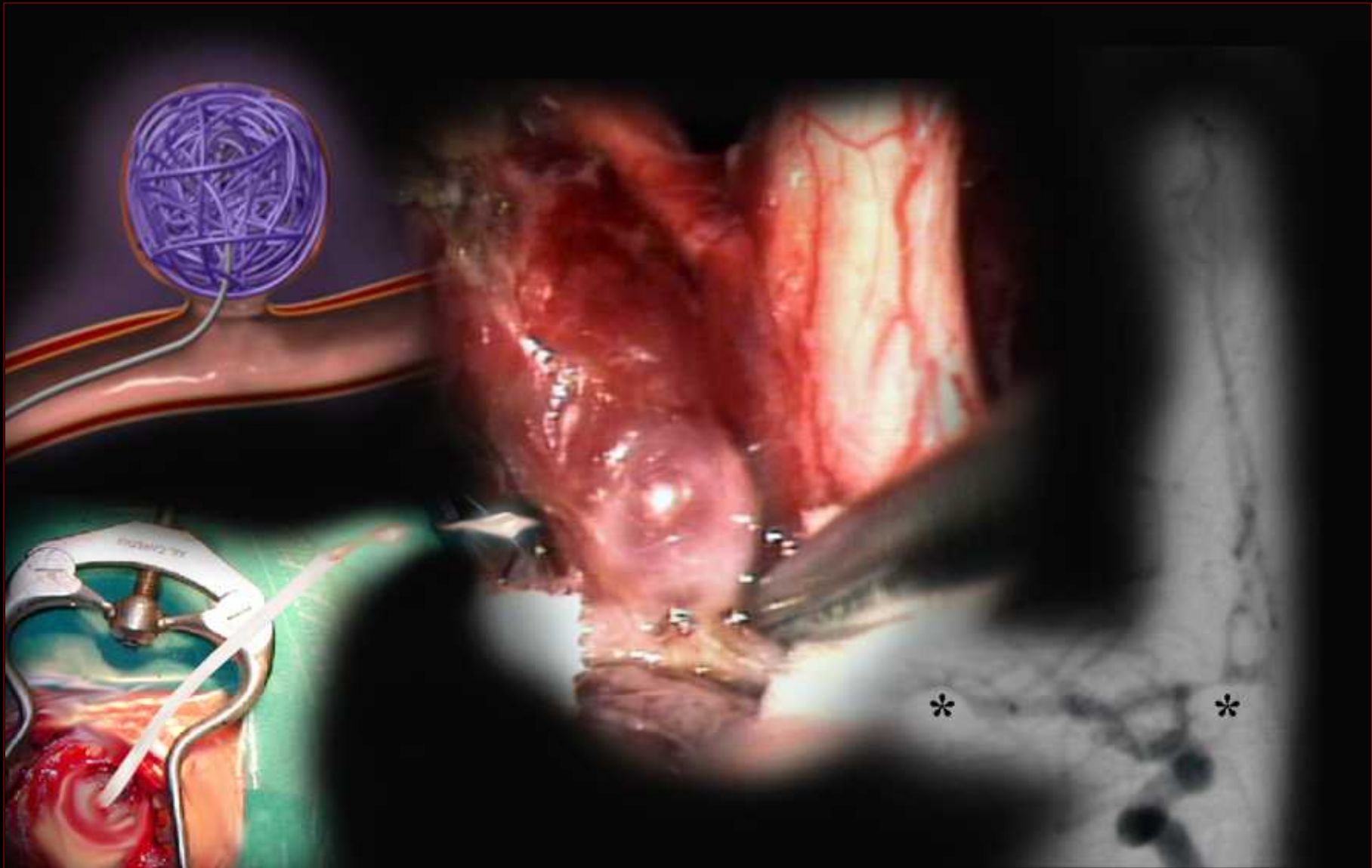
RMN



All'interno degli aneurismi giganti (A) aree con lento flusso presentano un segnale di intensità aumentata (*paradoxical enhancement*) alla RMN (B), difficilmente distinguibile dalla trombosi intraluminale. Lo stravasamento ematico peri-aneurismatico determina l'accrescimento di tali aneurismi (C).



Trattamento



Il trattamento globale deve essere marcatamente individualizzato:

Esclusione

Dell'aneurisma

**Trattamento
dell'idrocefalo**

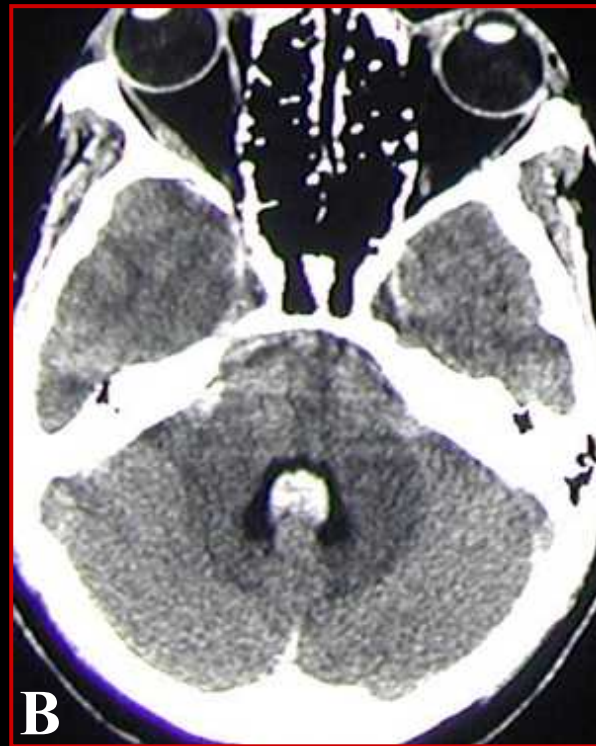
**Trattamento
dell'ematoma**



Idrocefalo acuto Post-ESA

L'idrocefalo acuto post-ESA può conseguire ad emorragia intraventricolare (A, B) o ad alterazione della dinamica liquorale per tamponamento dello spazio subaracnoideo (C).

L'idrocefalo acuto deve essere urgentemente trattato con la ventricolostomia.



Ematoma con effetto massa



Controllo della pressione intracranica

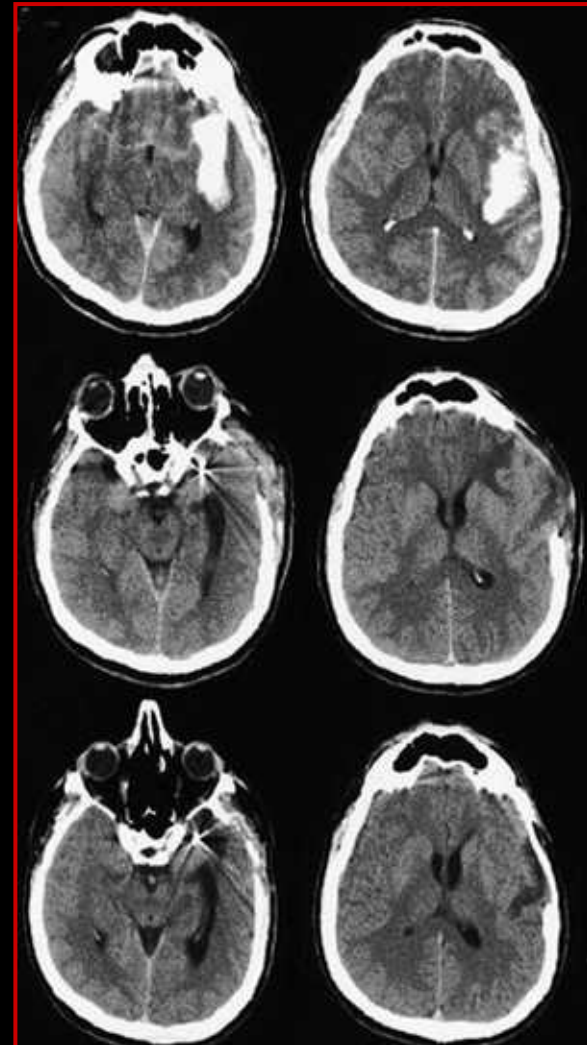
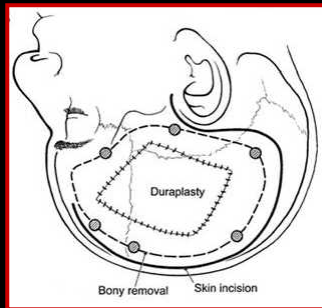
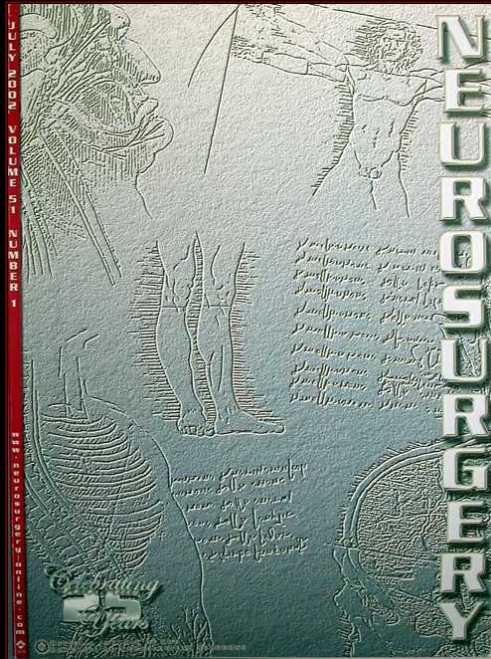
July 2002, Volume 51, Number 1
Page 117

Technique Applications

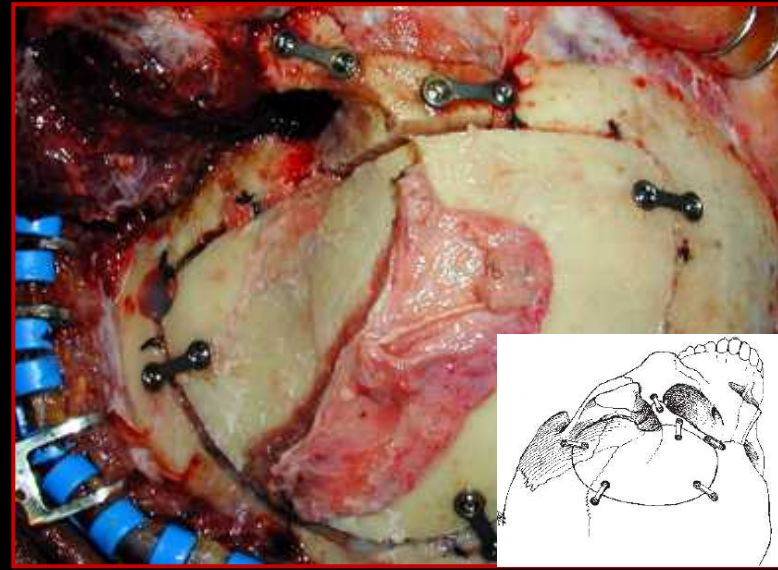
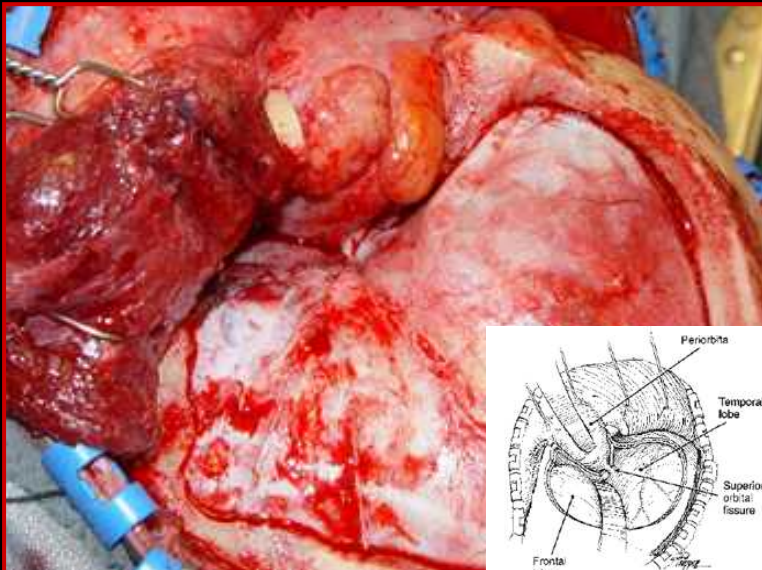
Proposed Use of Prophylactic Decompressive Craniectomy in Poor-grade Aneurysmal Subarachnoid Hemorrhage Patients Presenting with Associated Large Sylvian Hematomas

Edward R. Smith, M.D.; Bob S. Carter, M.D., Ph.D.; Christopher S. Ogilvy, M.D.

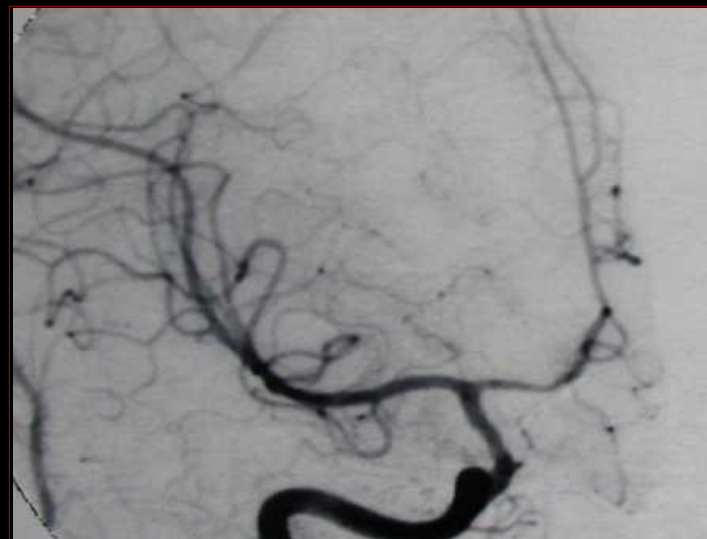
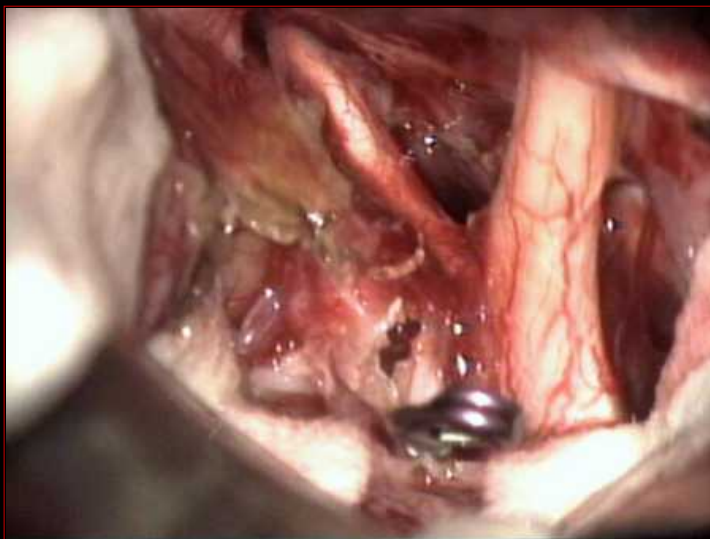
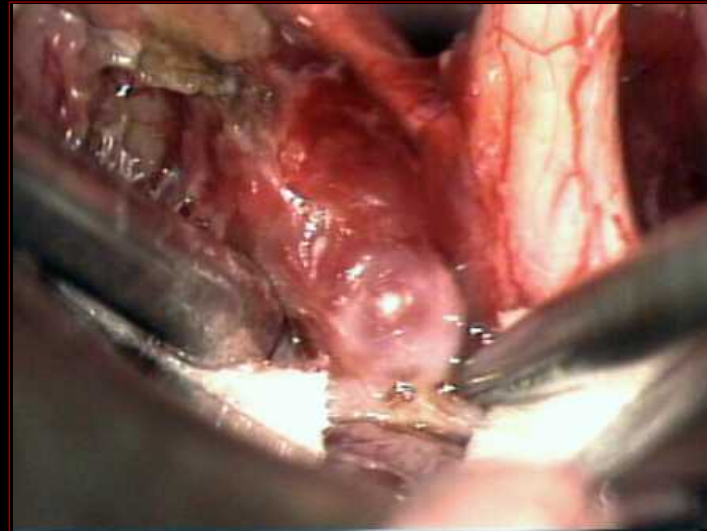
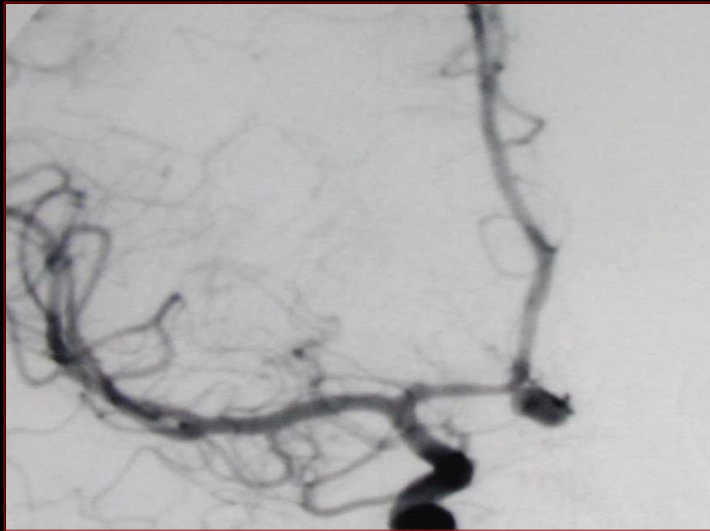
Cerebrovascular Surgery, Neurosurgical Service, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts



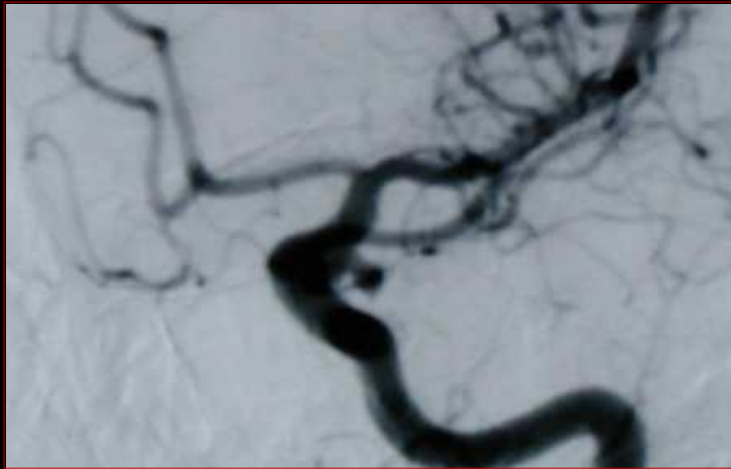
Trattamento chirurgico



Oggi i rischi chirurgici sono quasi nulli in
aneurismi “**common**”



Aneurismi multipli: approccio chirurgico in più steps



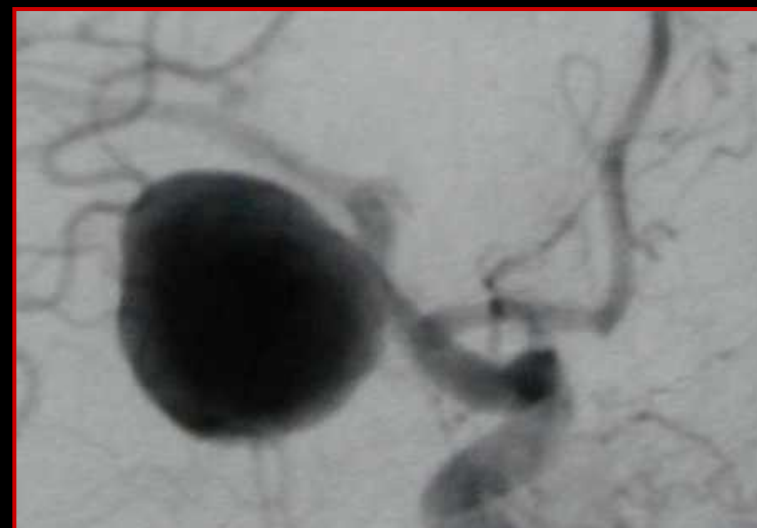
Carotide comune **sn**



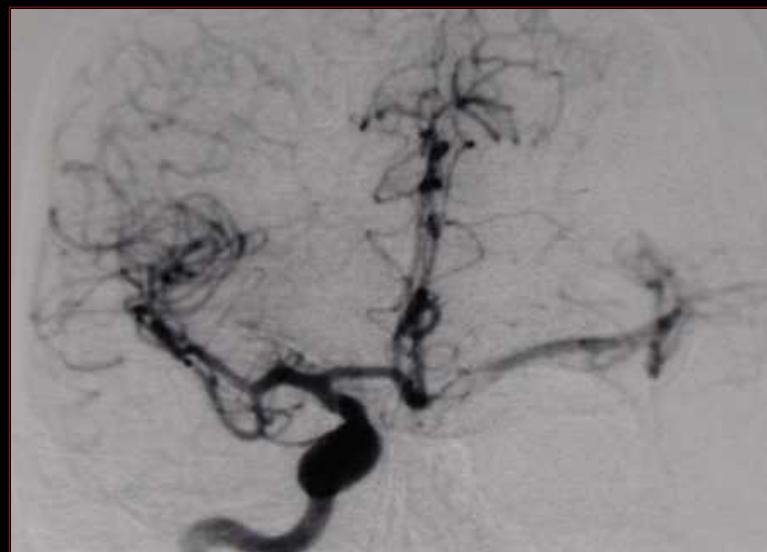
Carotide comune **dx**



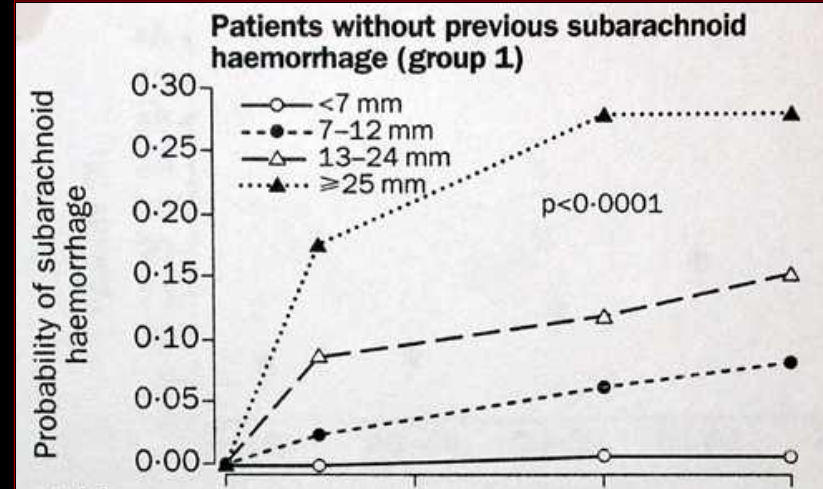
Aneurismi giganti: clipping progressivo



Aneurismi giganti: chiusura del vaso afferente



Aneurismi intatti



	<7 mm		7-12 mm	13-24 mm	≥25 mm
	Group 1	Group 2			
Cavernous carotid artery (n=210)	0	0	0	3.0%	6.4%
AC/MC/IC (n=1037)	0	1.5%	2.6%	14.5%	40%
Post-P comm (n=445)	2.5%	3.4%	14.5%	18.4%	50%

AC=anterior communicating or anterior cerebral artery. IC=internal carotid artery (not cavernous carotid artery). MC=middle cerebral artery. Post-P comm=vertebrobasilar, posterior cerebral arterial system, or the posterior communicating artery.

Table 4: 5-year cumulative rupture rates according to size and location of unruptured aneurysm

Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment

Lancet 2003; 362:103 -10



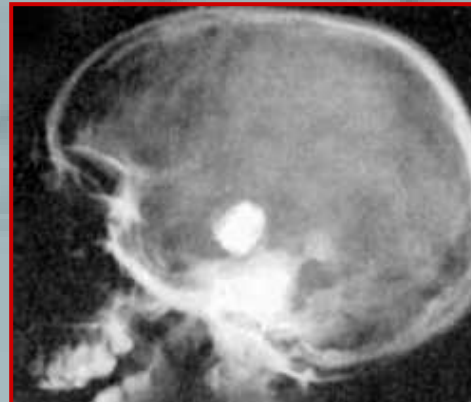
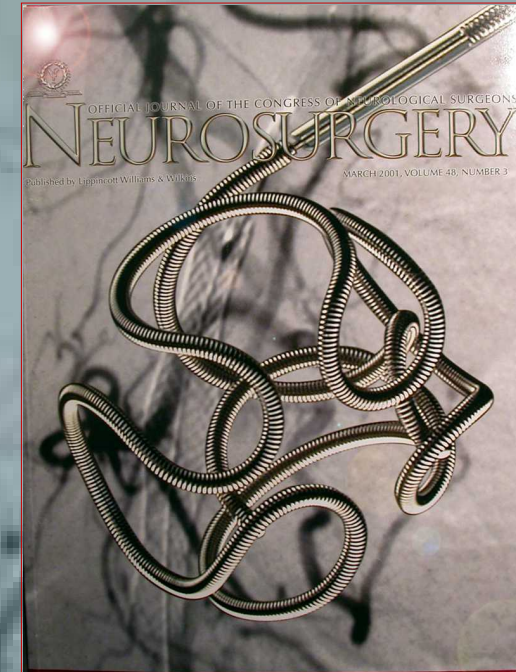
Trattamento endovascolare

PRINCIPAL'S EDITORIAL

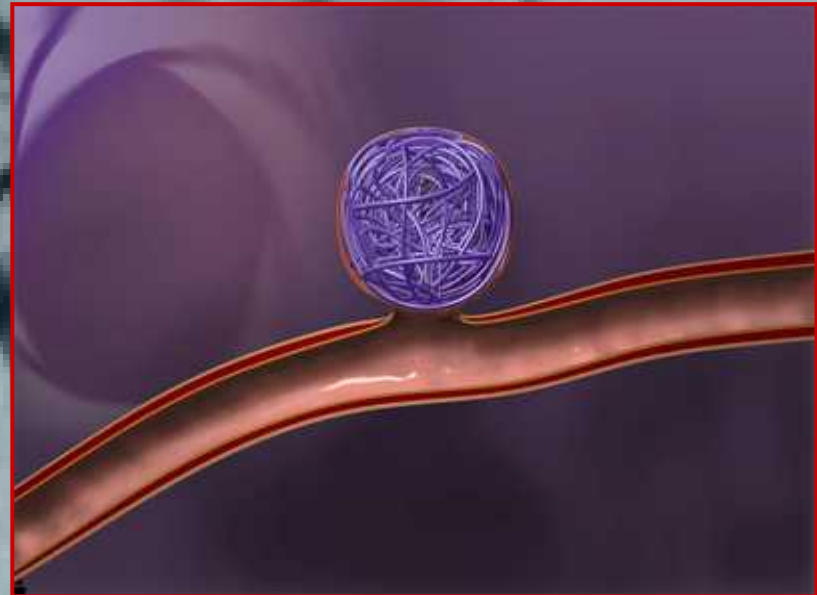
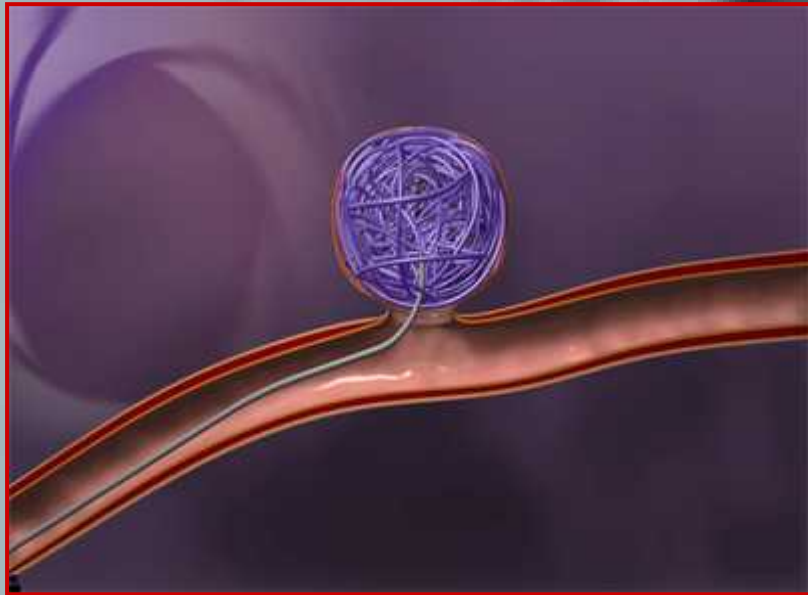
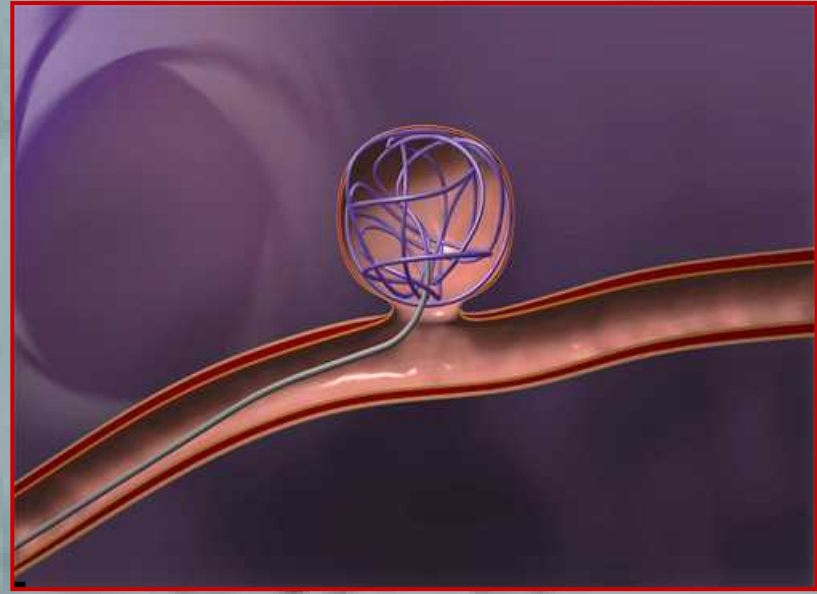
Treating Complex Nervous System Vascular Disorders through a "Needle Stick": Origins, Evolution, and Future of Neuroendovascular Therapy

L. Nelson Hopkins, M.D., Giuseppe Lanzino, M.D.,
Lee R. Guterman, Ph.D., M.D.

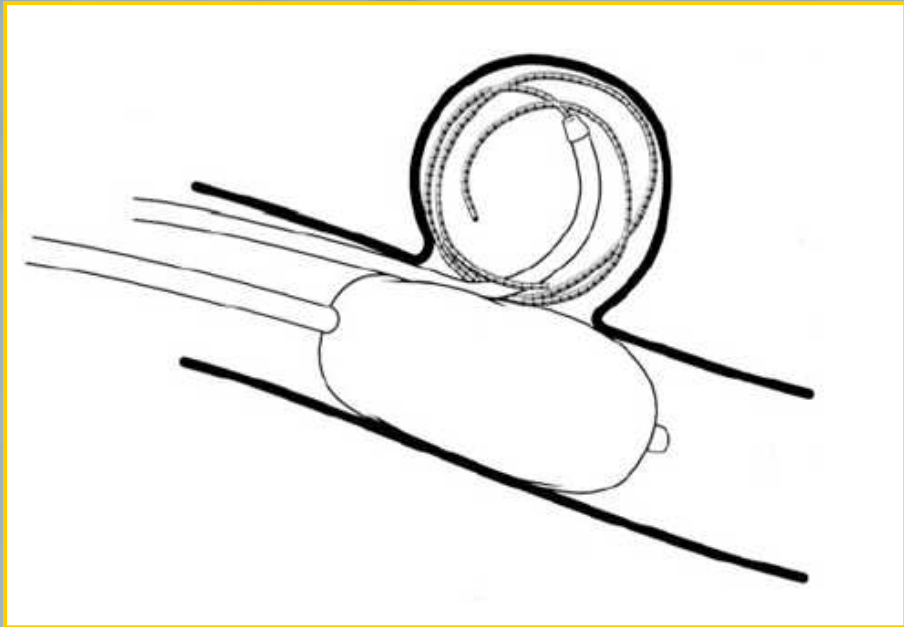
Department of Neurosurgery and Toshiba Stroke Research Center (LNH, GL, LRG),
State University of New York at Buffalo, Buffalo, New York, and Department of
Neurosurgery (GL), University of Virginia, Charlottesville, Virginia



“It was not until 1941 that Werner reported successful electrothermic thrombosis of an intracranial aneurysm after filling the aneurysm with silver wire inserted through the orbit.”



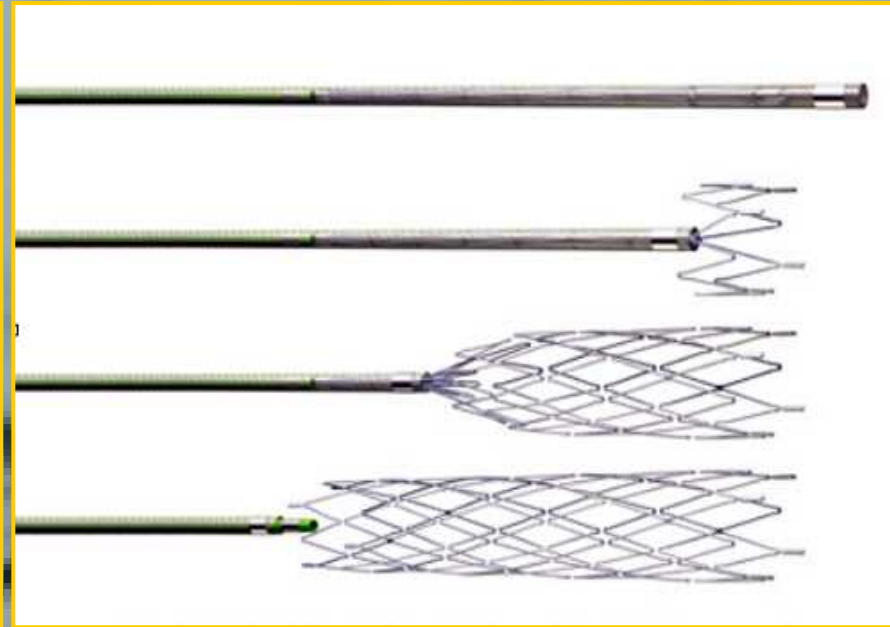
Trattamento endovascolare degli aneurismi con colletto largo



Balloon Remodeling

Il palloncino è gonfiato in modo intermittente durante il posizionamento dei coils in modo da prevenire il loro prolasso nel vaso afferente

Moret, 1997



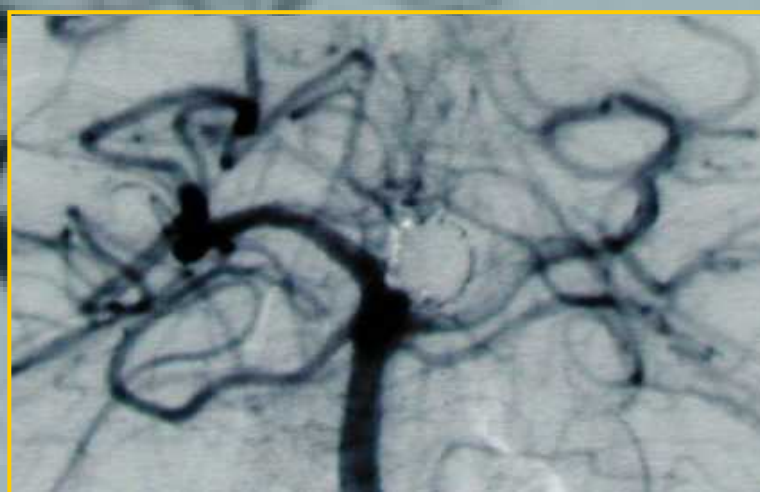
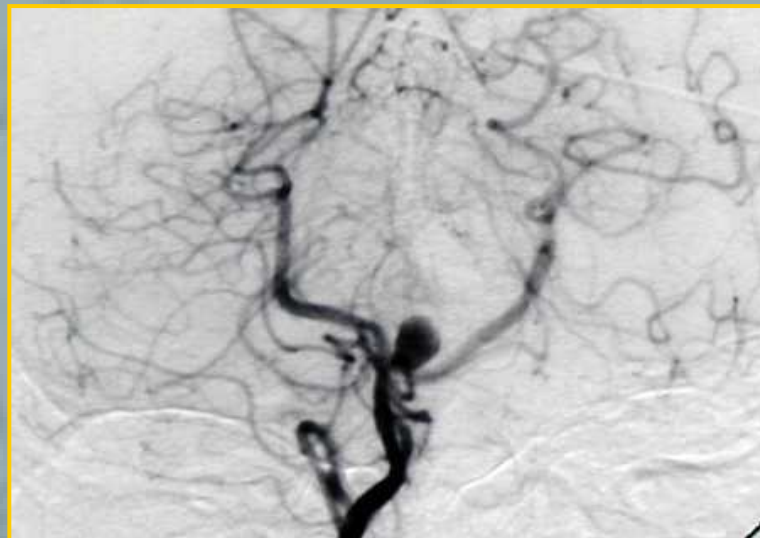
Stent-assisted coiling

The Neuroform stent, the first microcatheter-delivered stent for use in the intracranial circulation



Stent-assisted coiling

Per gli aneurismi dell'apice di basilare ed in casi selezionati, il trattamento endovascolare è una alternativa efficace



Il trattamento endovascolare non è privo di rischi

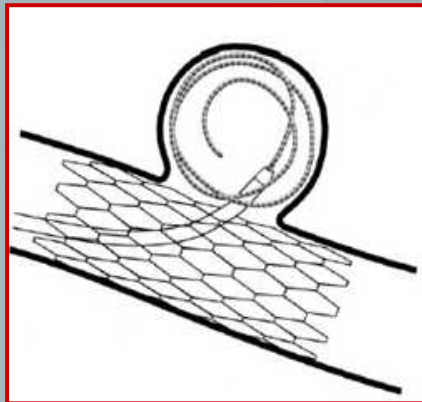
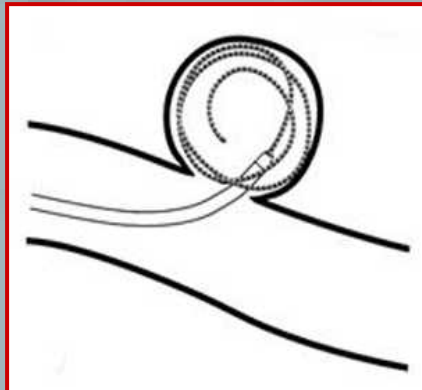
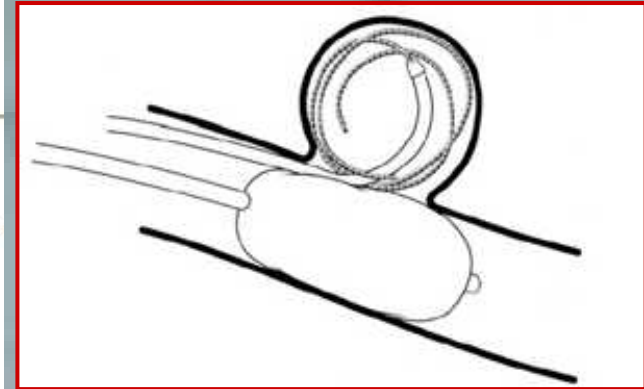


**Aneurisma BA-P1.
Rottura dell'aneurisma con idrocefalo
acuto e decesso della paziente durante
il micro-cateterismo pre-
embolizzazione.**

CLINICAL STUDIES

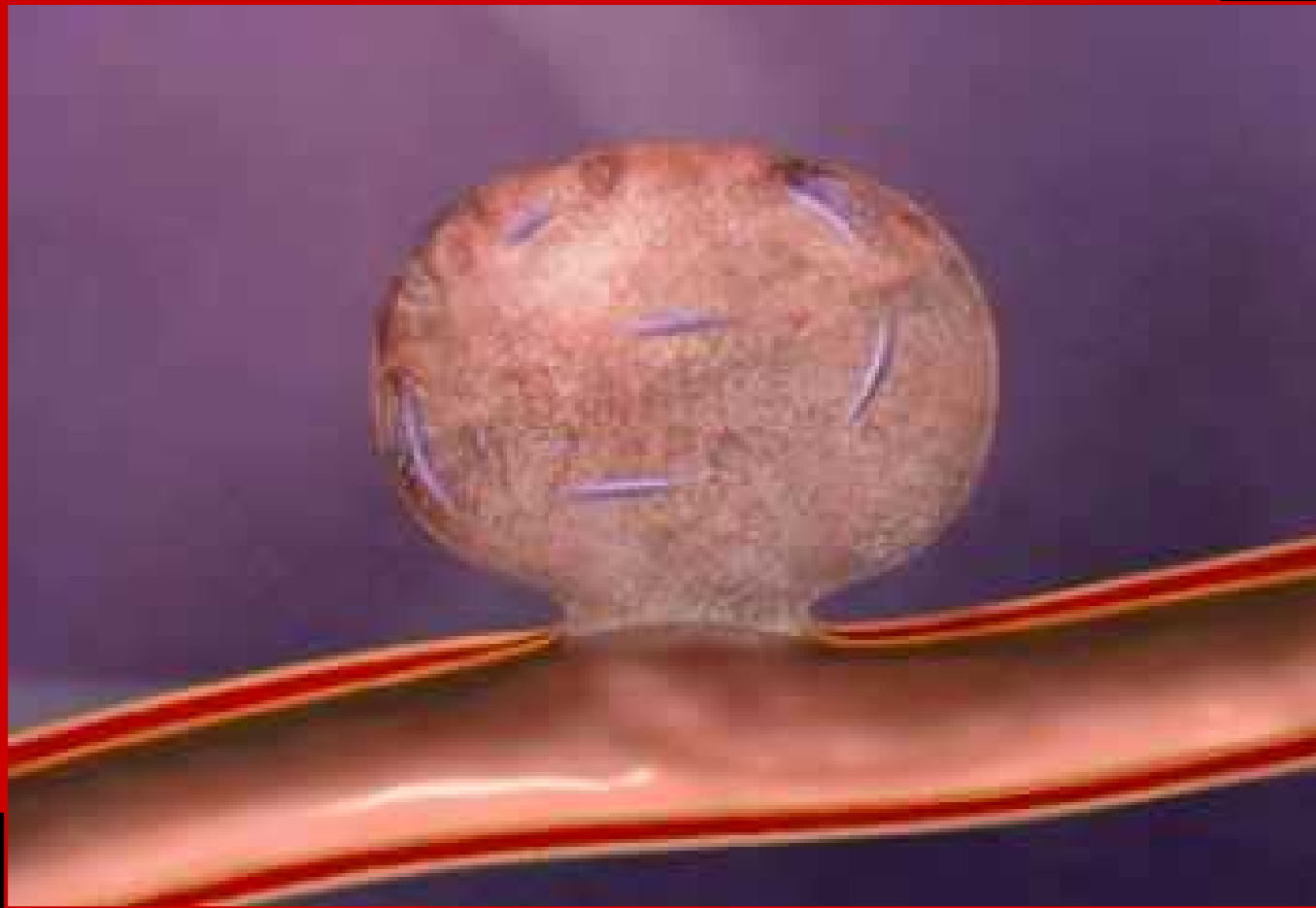
Endovascular Coil Occlusion of 1811 Intracranial Aneurysms: Early Angiographic and Clinical Results

Hans Henkes, M.D.; Sebastian Fischer, M.D.; Werner Weber, M.D.; Elina Miloslavski, M.D.; Stephan Felber, M.D.; Stefan Brew, M.B., Ch.B.; Dietmar Kuehne, M.D.



Complications encountered during the endovascular treatment of 1811 intracranial aneurysms

Complications	No. of patients (%)		
	Total	Unruptured (n = 777)	Ruptured (n = 1034)
None	1495 (82.6%)	630 (81.1%)	865 (83.7%)
<u>Aneurysm perforation</u>	57 (3.1%)	12 (1.5%)	45 (4.4%)
Aneurysm perforation and coil malposition	5 (0.3%)	2 (0.3%)	3 (0.3%)
Aneurysm perforation and thrombosis	4 (0.2%)	1 (0.1%)	3 (0.3%)
<u>Embolic event</u>	108 (6.0%)	62 (8.0%)	64 (4.5%)
<u>Thrombosis</u>	56 (3.1%)	25 (3.2%)	31 (3.0%)
Coil malposition	46 (2.5%)	21 (2.7%)	25 (2.4%)
Coil malposition and thrombosis	1 (0.1%)	0	1 (0.1%)
Thrombotic occlusion of the parent artery	4 (0.2%)	4 (0.5%)	0
Coil malposition and thrombotic occlusion of the parent artery	2 (0.1%)	1 (0.1%)	1 (0.1%)
Vessel dissection	1 (0.1%)	1 (0.1%)	0
Increased mass effect	8 (0.4%)	6 (0.8%)	2 (0.2%)
Toxic contrast medium reaction	7 (0.4%)	5 (0.6%)	2 (0.2%)
Increased vasospasm	13 (0.7%)	3 (0.4%)	10 (1.0%)
Stent malposition	1 (0.1%)	1 (0.1%)	0
Procedural but independent from coil procedure	3 (0.2%)	3 (0.4%)	0

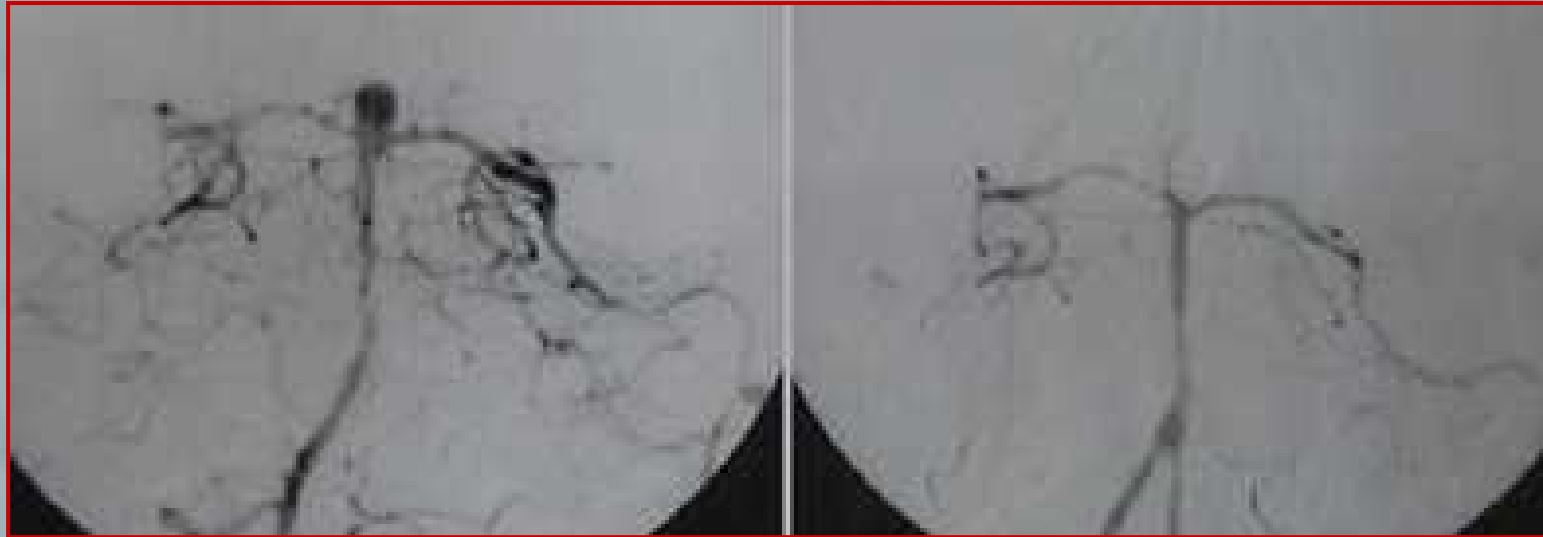


“Endothelization of the aneurysm orifice following placement of GDCs can occur; however, it appears to be the exception rather than the rule”

Gross and microscopic histopathological findings in aneurysms of the human brain treated with Guglielmi detachable coils

Bavinzki G et al.,

J Neurosurg 91:284-293, 1999



Bavinzki G et al., *J Neurosurg* 91:284-293, 1999

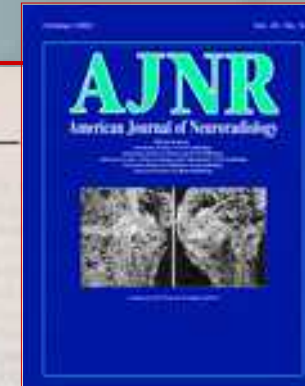
Technical Note

New Expandable Hydrogel-Platinum Coil Hybrid Device for Aneurysm Embolization

David F. Kallmes and Naomi H. Fujiwara

Summary: This study introduces a new, hybrid embolic device that in addition to offering all the important attributes of existing detachable platinum coils also shows an enhanced ability to fill aneurysm cavities. The device consists of a carrier platinum coil coupled to an expandable hydrogel material, which undergoes a ninefold increase in volume when placed into a physiological environment. Distinct from previous devices aimed at speeding the organization of thrombus, the new device has been designed to entirely fill the aneurysm cavity, with complete or near-complete exclusion of thrombus. Unlike thrombus, the hydrogel material is stable and unaffected by natural thrombolytic processes and thus may diminish observed rates of aneurysm recanalization. We report the angiographic and histologic findings of the new, hybrid device used to treat experimental aneurysms in rabbits.

tions of platinum coils that might enhance the organization of thrombus within aneurysms (8-15).



Matrix and Bioabsorbable Polymeric Coils Accelerate Healing of Intracranial Aneurysms Long-Term Experimental Study

Yuichi Murayama, MD; Satoshi Tateshima, MD; Nestor R. Gonzalez, MD; Fernando Vinuela, MD

Background and Purpose—Acceleration of intra-aneurysmal clot organization and fibrosis may be a solution to preventing aneurysm recanalization after endovascular treatment. The purpose of this study was to evaluate the short-term efficacy and long-term safety of the new Matrix coil system.

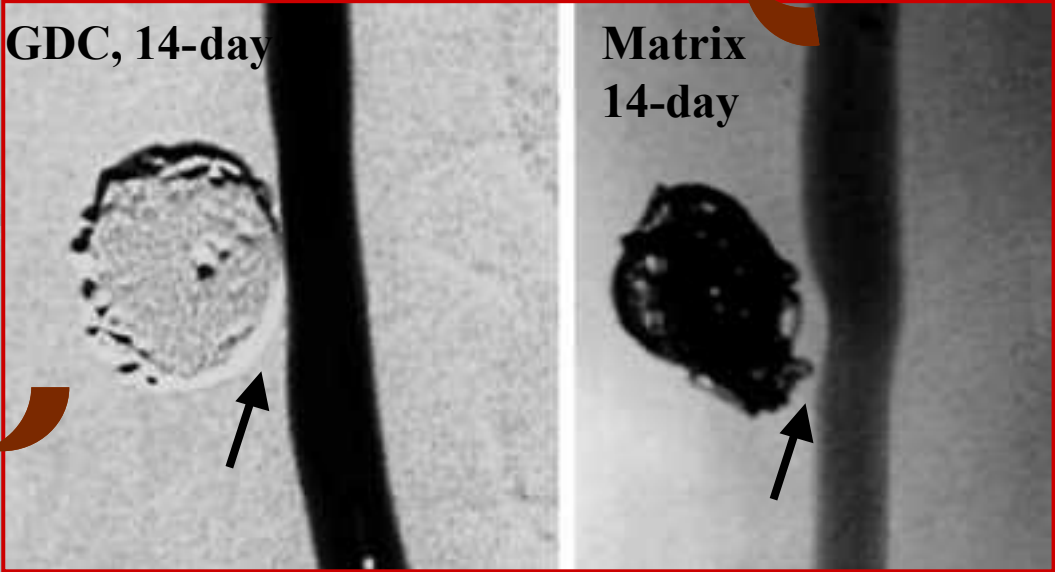
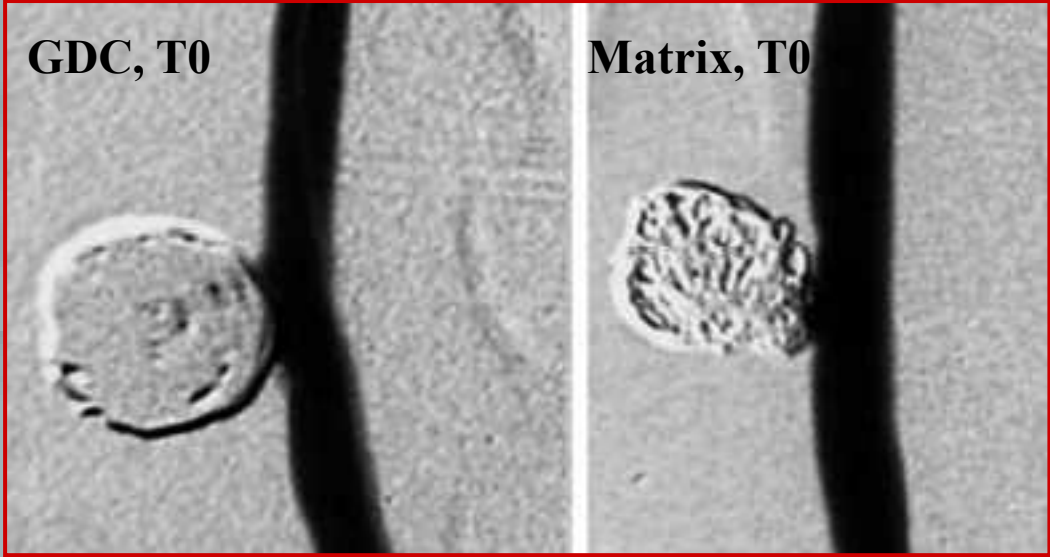
Methods—Matrix coils consist of thin platinum coils covered with a bioabsorbable, polymeric material (polyglycolic acid/lactide). Fifty-two experimental aneurysms were created in 26 swine. All of the aneurysms were tightly packed with Matrix or Guglielmi detachable coils (GDC). Comparative angiographic and histopathologic data were analyzed at 2 weeks (n=14), 3 months (n=6), and 6 months (n=6) after embolization.

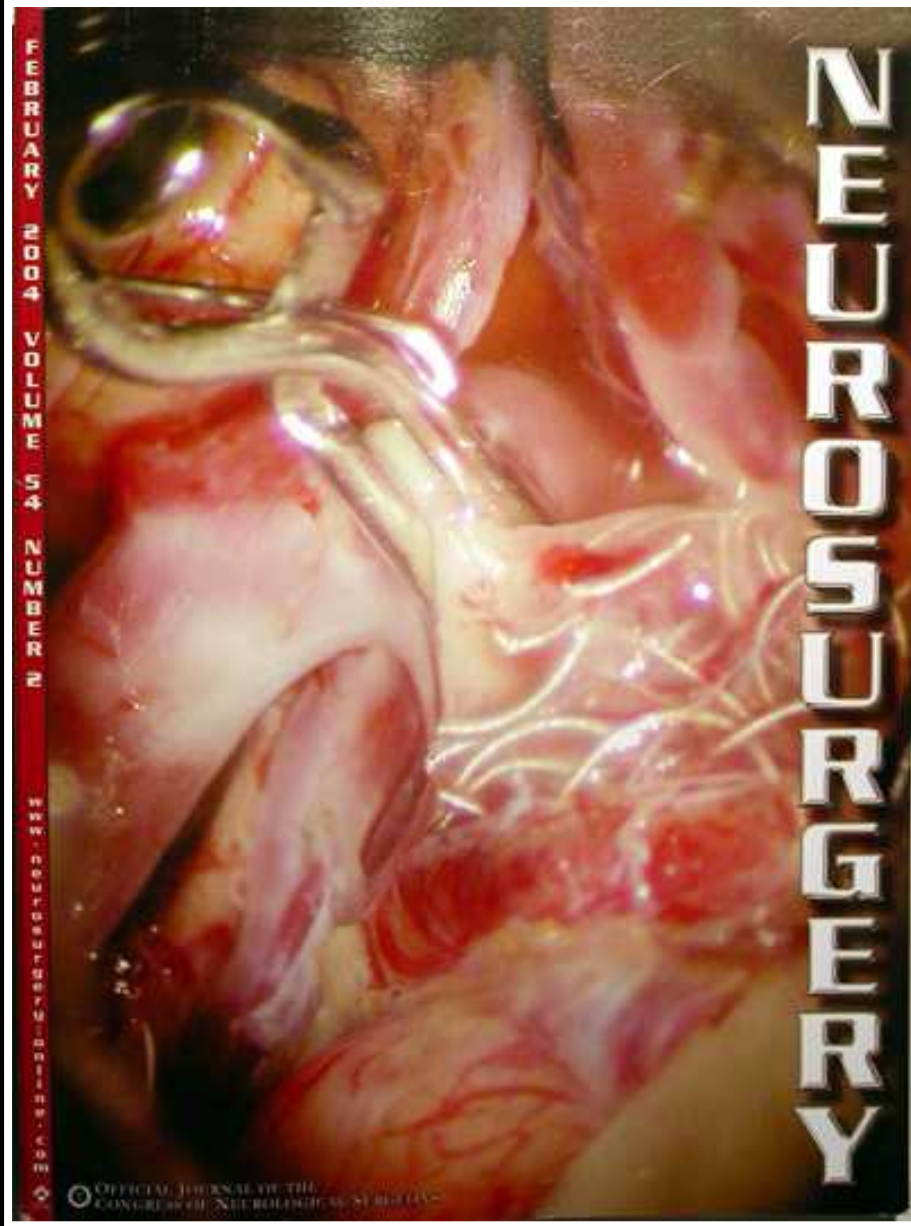
Results—Three aneurysms treated with GDC ruptured despite tight packing. No recanalization or rupturing was observed in the aneurysms embolized with Matrix coils. At 14 days after embolization, the aneurysms treated with Matrix coils exhibited a more extensive area of organized thrombus when compared with the aneurysms treated with GDC (87% versus 75%, $P=0.008$, n=11). At 3 months, both Matrix and GDC-treated aneurysms demonstrated complete clot organization. Neck tissue thickness was higher in Matrix-treated aneurysms at 14 days and 3 months, but not at 6 months. No untoward parent artery stenosis was observed in aneurysms treated with Matrix during follow-up. The angiographic cross-sectional area of the Matrix-treated aneurysms was smaller than those treated with GDC at the 3 months.

Conclusion—Matrix accelerated aneurysm fibrosis and neointima formation without parent artery stenosis. The Matrix system might prevent aneurysmal recanalization after endovascular treatment of cerebral aneurysms. (*Stroke*, 2003;34:2031-2037.)

Key Words: animal models ■ endovascular therapy ■ intracranial aneurysm ■ polymers ■ swine





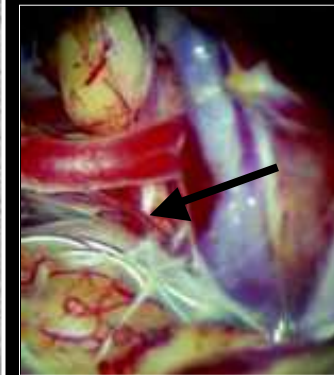
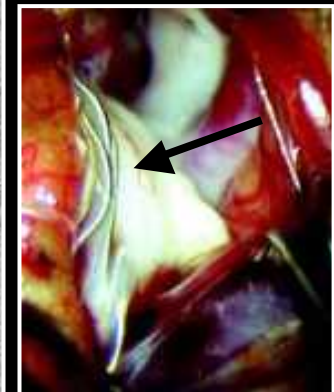


CLINICAL STUDIES

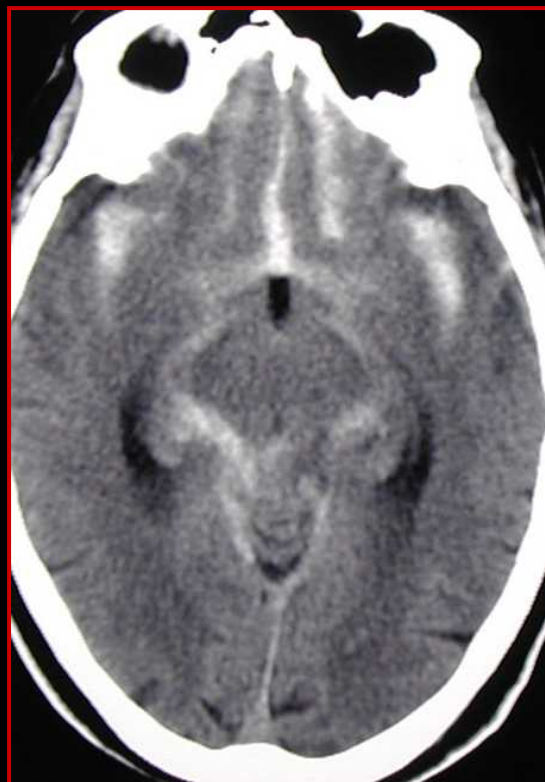
SURGICALLY TREATED ANEURYSMS PREVIOUSLY COILED: LESSONS LEARNED

Erol Veznedaroglu, M.D.; Ronald P. Benitez, M.D.; Robert H. Rosenwasser, M.D.

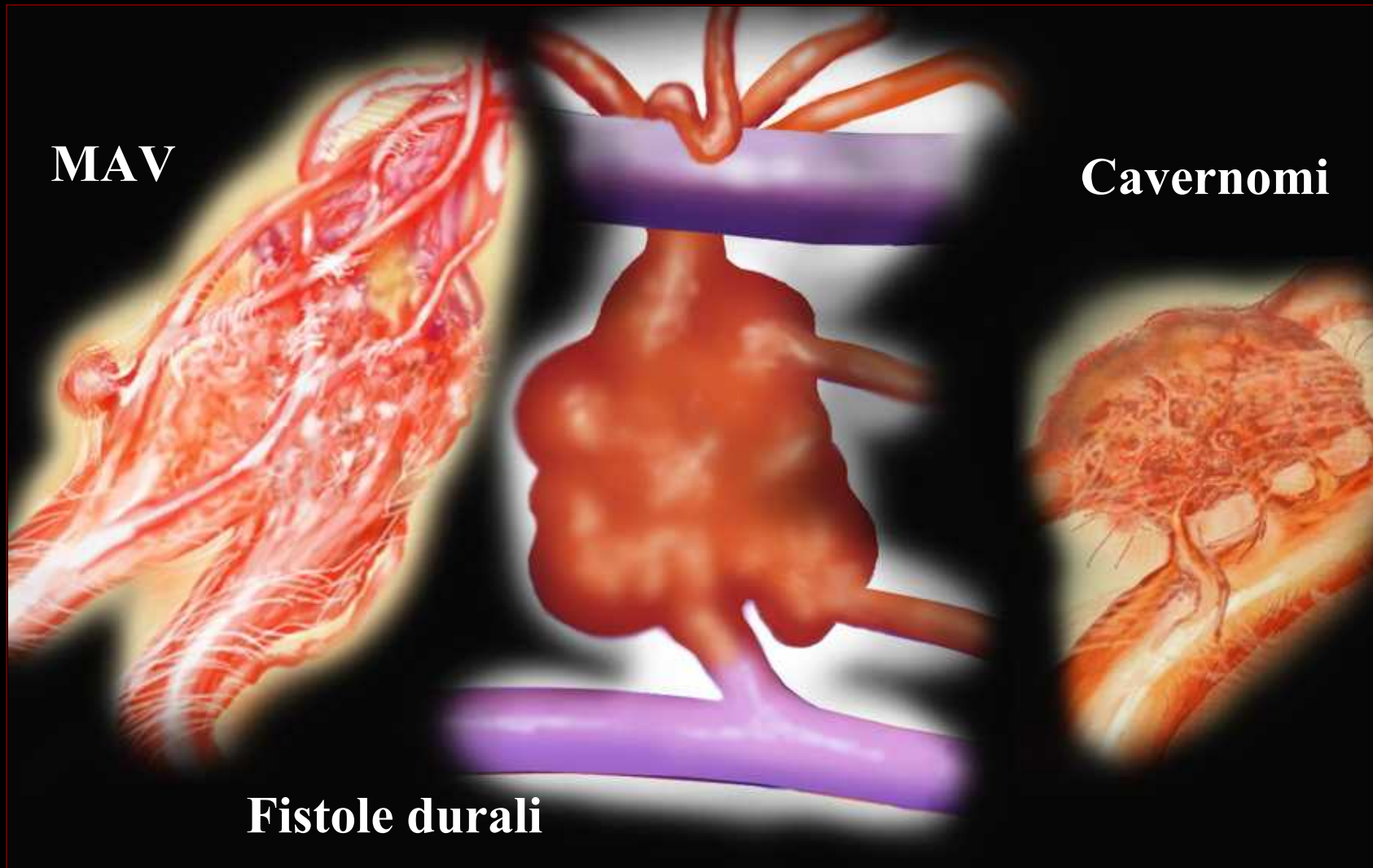
Division of Cerebrovascular and Endovascular Neurosurgery, Department of Neurosurgery, Thomas Jefferson University Hospital for Neuroscience, Philadelphia, Pennsylvania Division of Cerebrovascular and Endovascular Neurosurgery, Department of Neurosurgery, Thomas Jefferson University Hospital for Neuroscience, Philadelphia, Pennsylvania Division of Cerebrovascular and Endovascular Neurosurgery, Department of Neurosurgery, Thomas Jefferson University Hospital for Neuroscience, Philadelphia, Pennsylvania



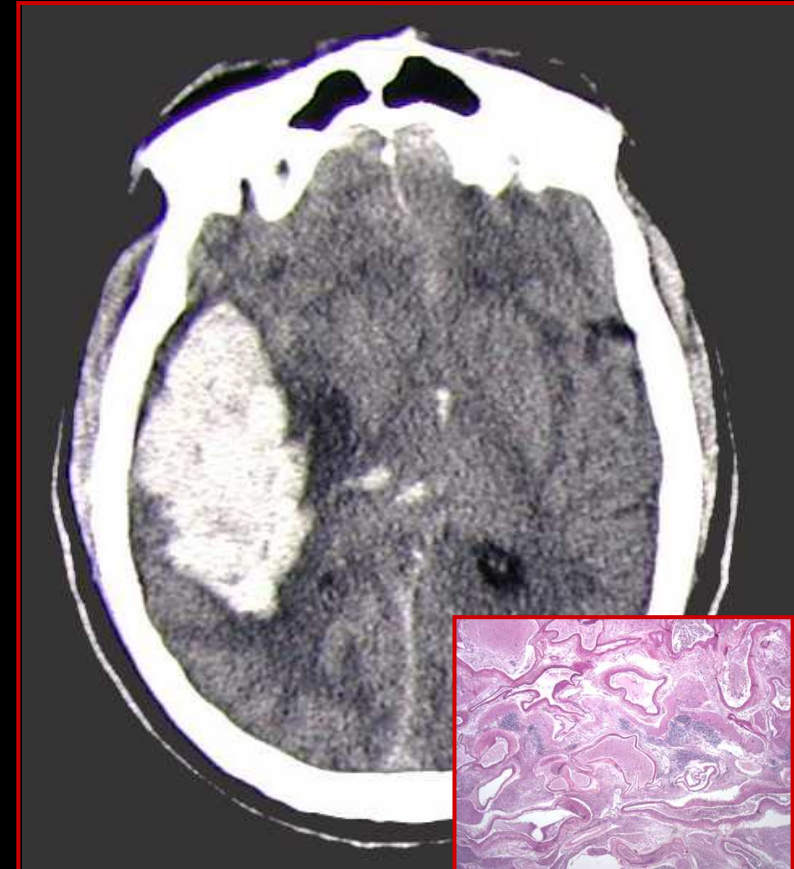
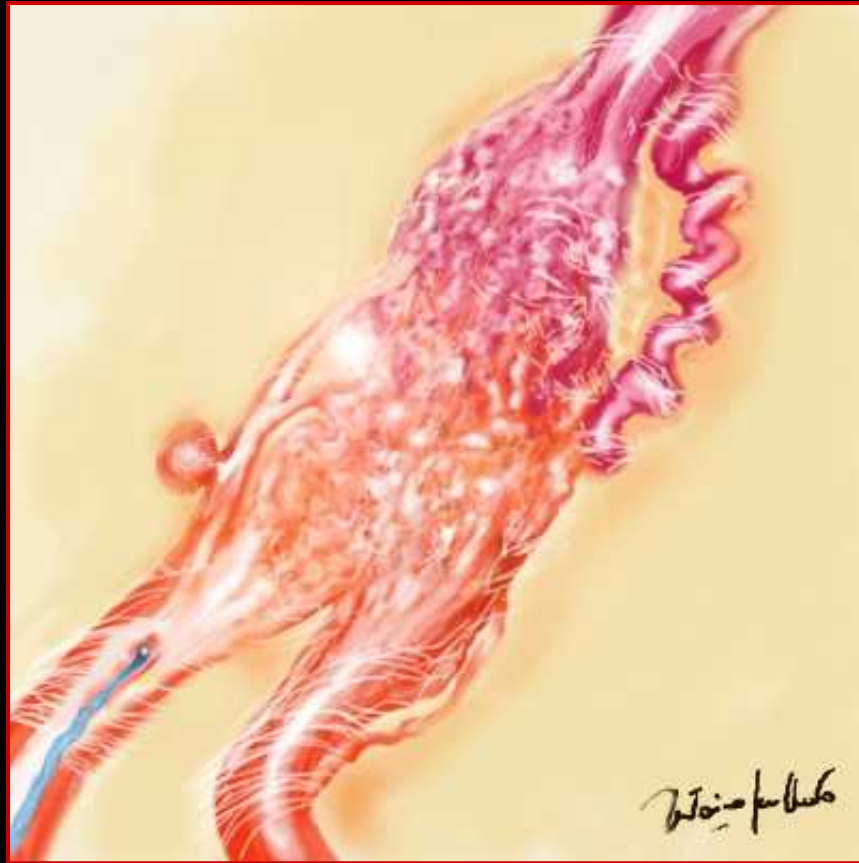
Il problema maggiore ed irrisolto è rappresentato dal vasospasmo



Le malformazioni vascolari cerebrali: una diagnosi difficile, un trattamento multidisciplinare



Malformazioni artero-venose



“Smaller AVMs tend to present more often with hemorrhage than do large AVM.”

Relationship of perfusion pressure and size to risk of hemorrhage from arteriovenous malformation .

J Neurosurg 76:918-923, 1992, Spetzler R.F. et al

Results of surgical and endovascular treatment of intracranial micro-arteriovenous malformations with emphasis on superselective angiography

P. Perrini et al.

Neurosurgical Department, Firenze, Italy

Published online June 14, 2004
© Springer-Verlag 2004

Keywords: Micro-arteriovenous malformation; intracranial haemorrhage; surgery; superselective angiography; endovascular treatment.

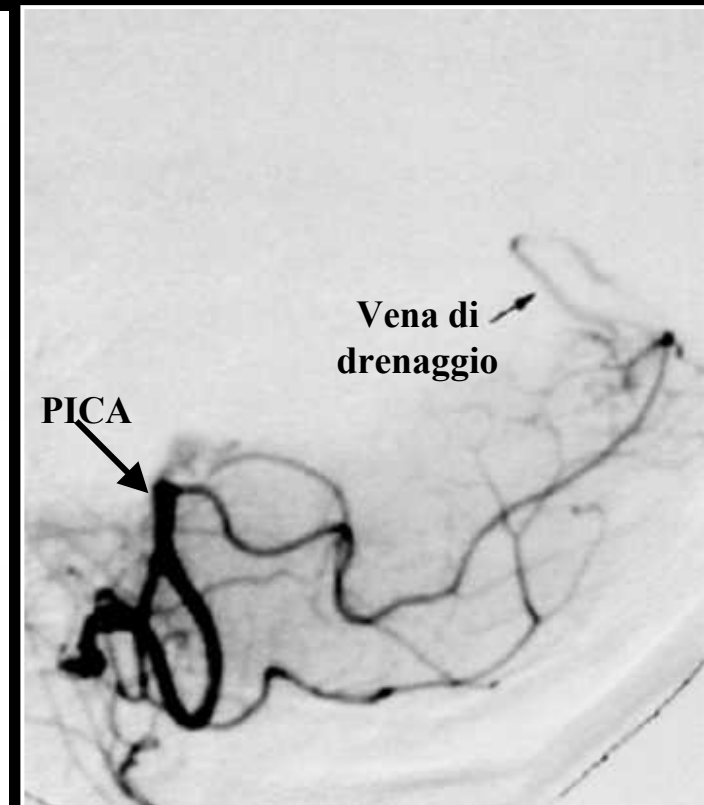
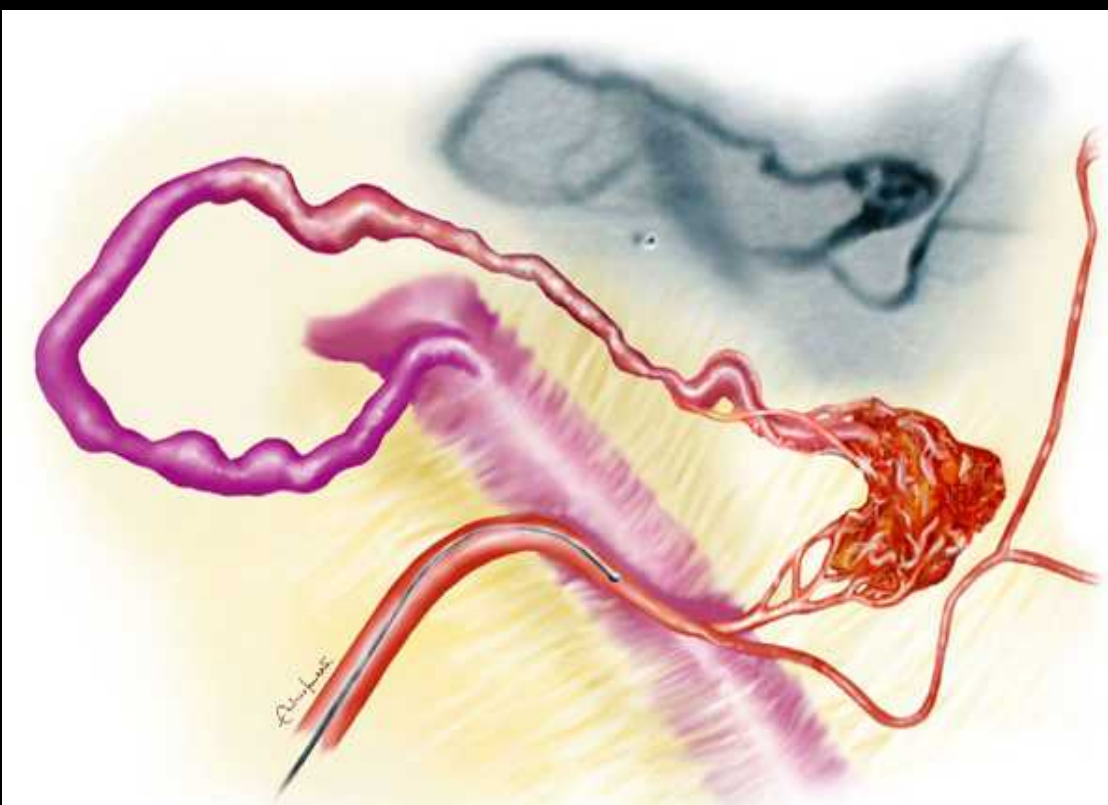
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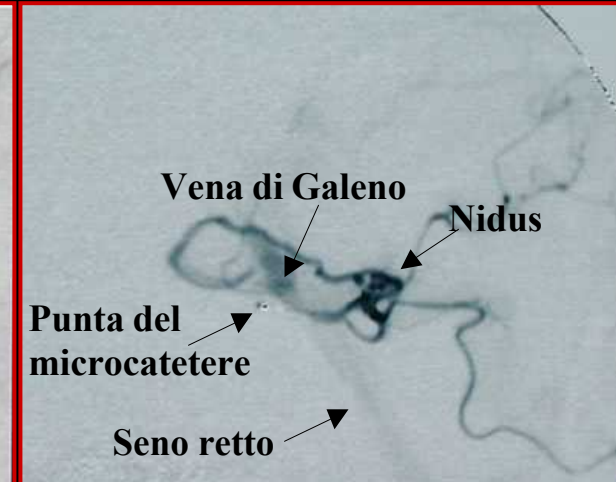
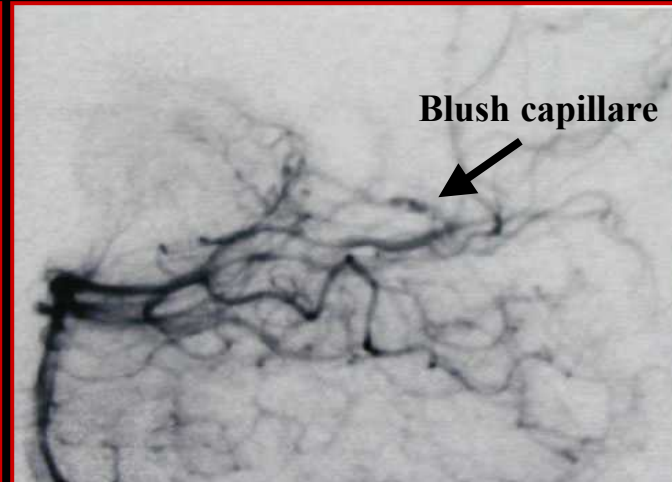
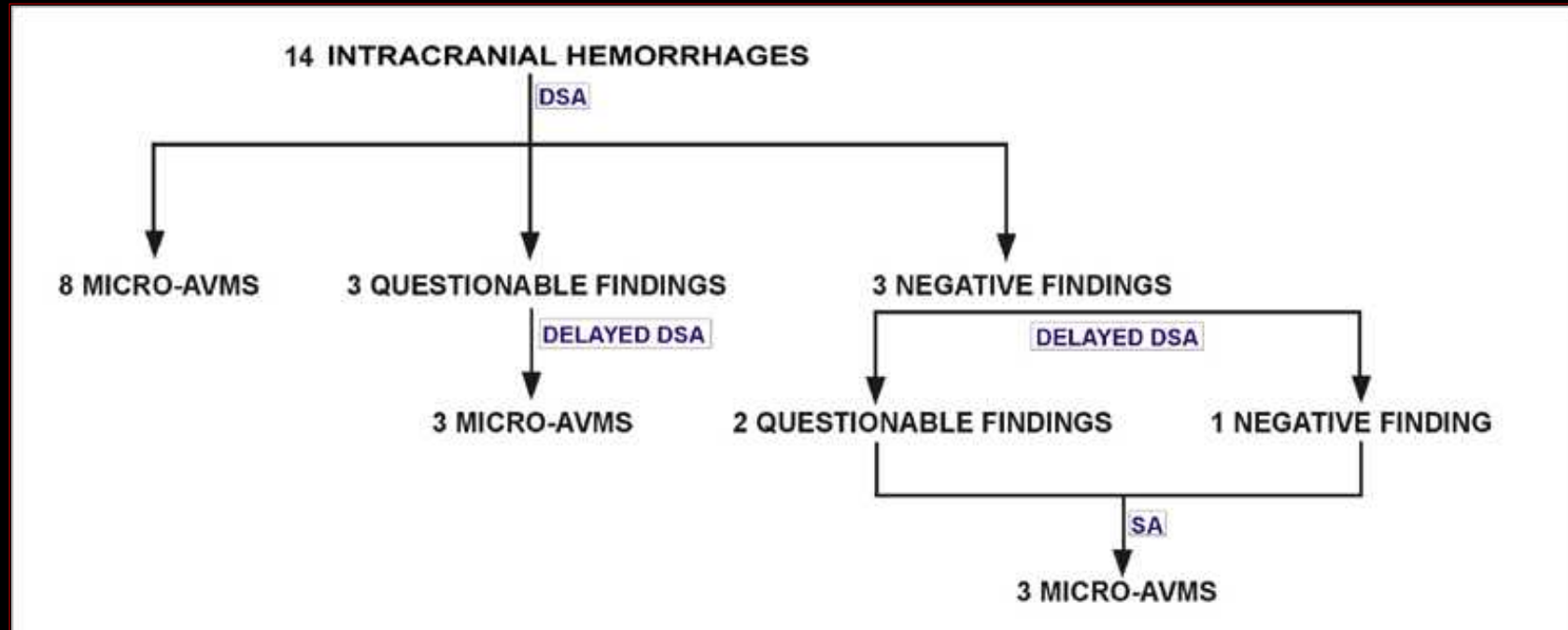
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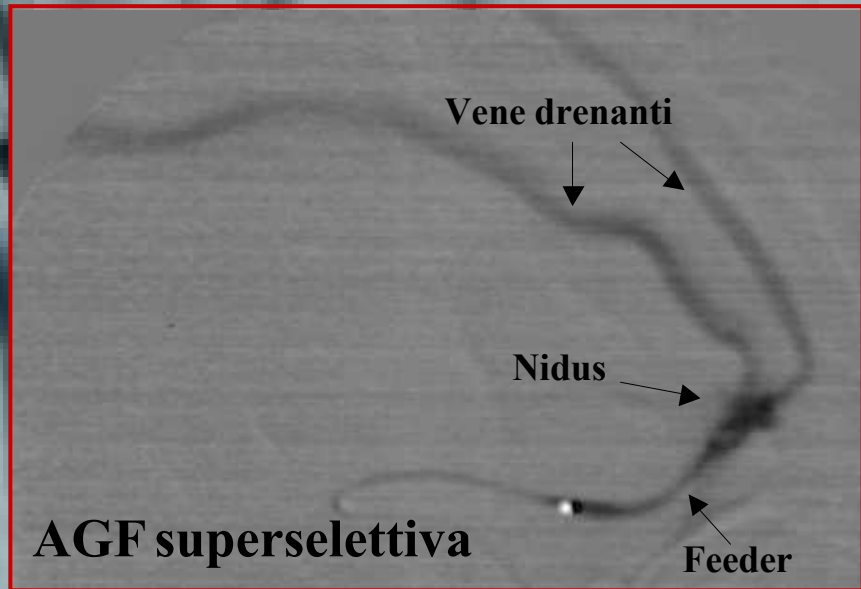
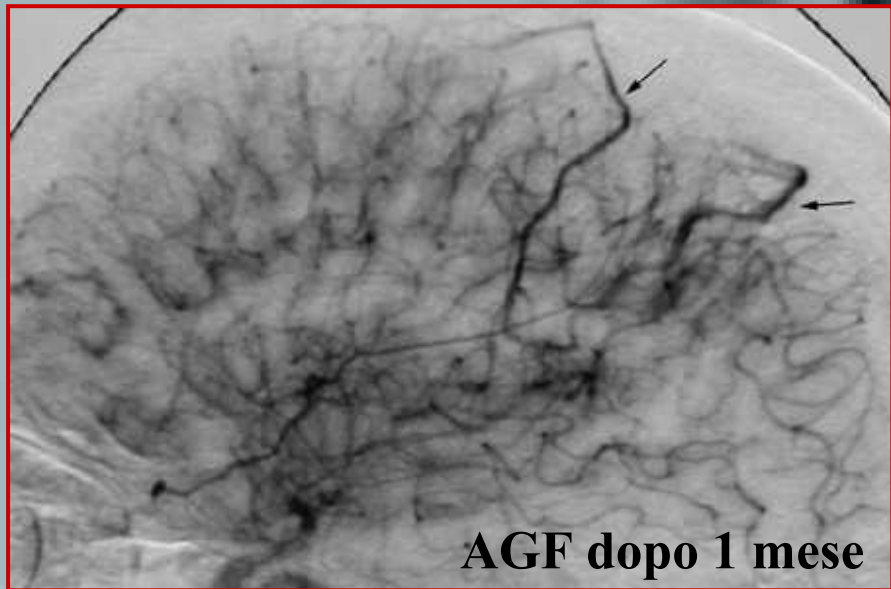
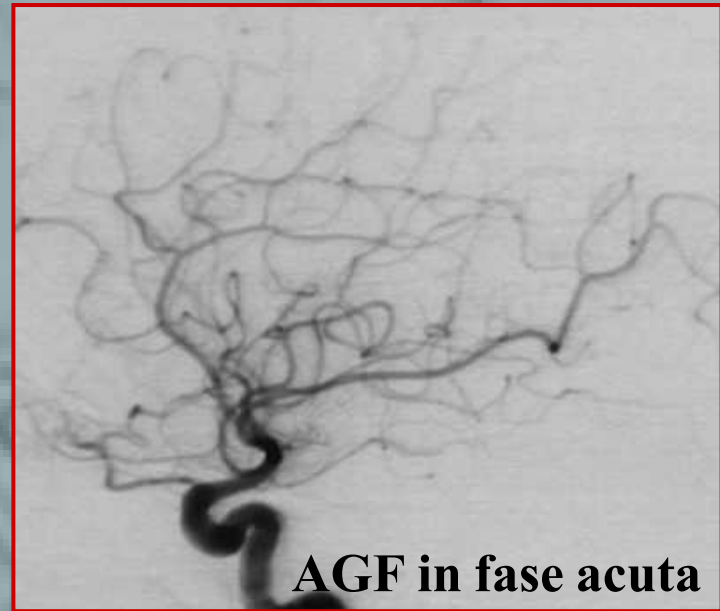
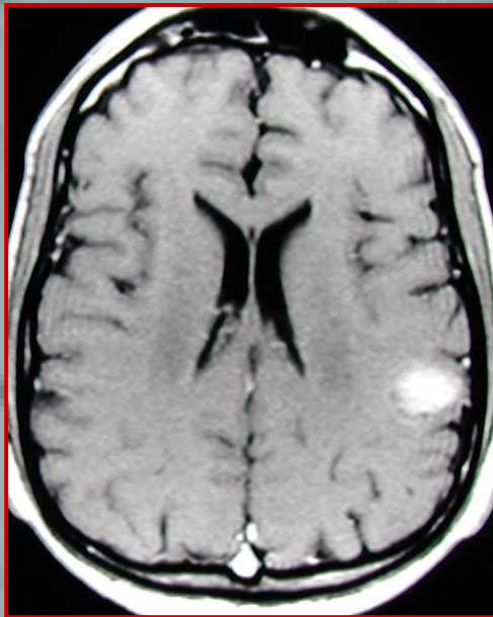
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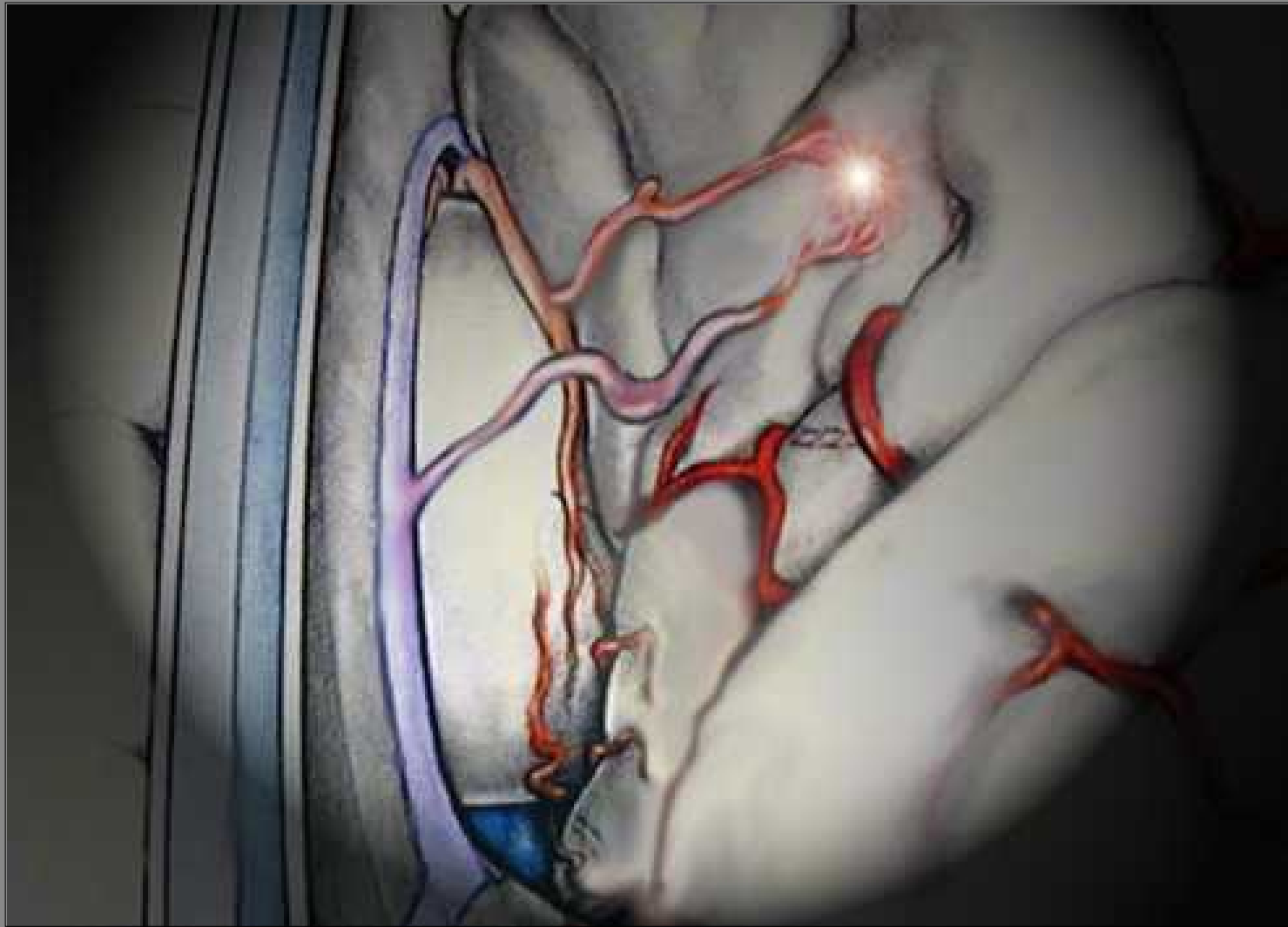


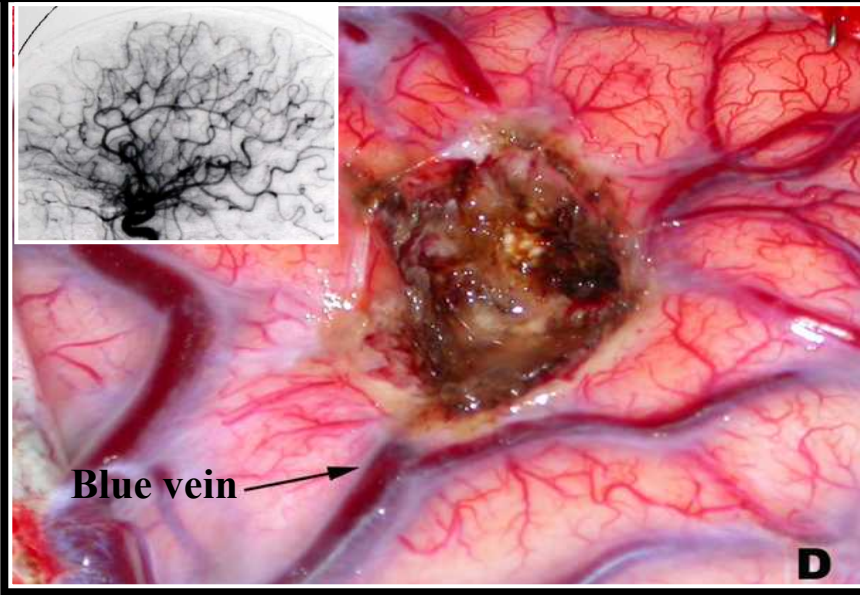
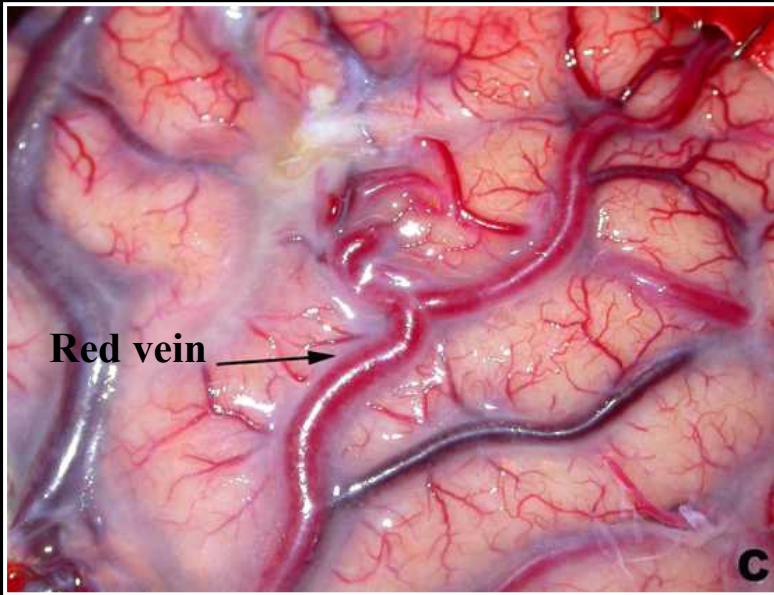
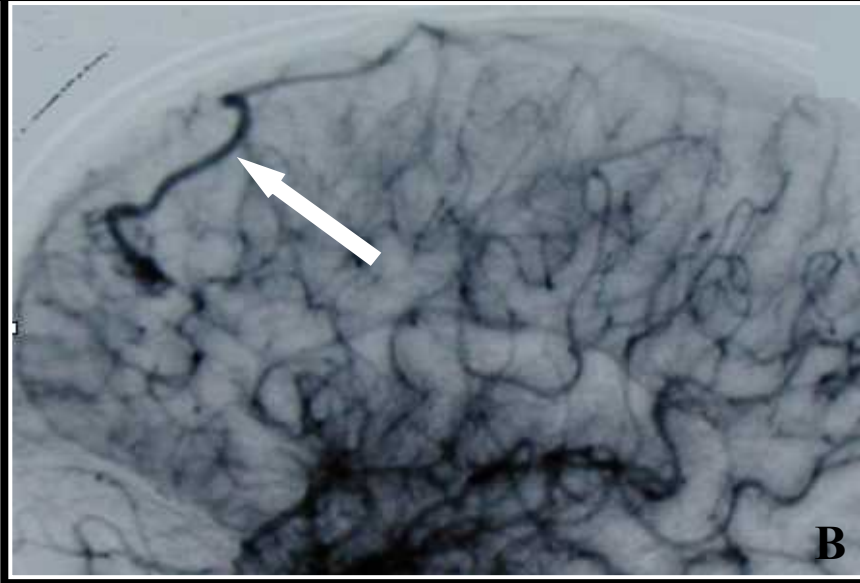
Iter diagnostico nel sospetto di micro-MAV

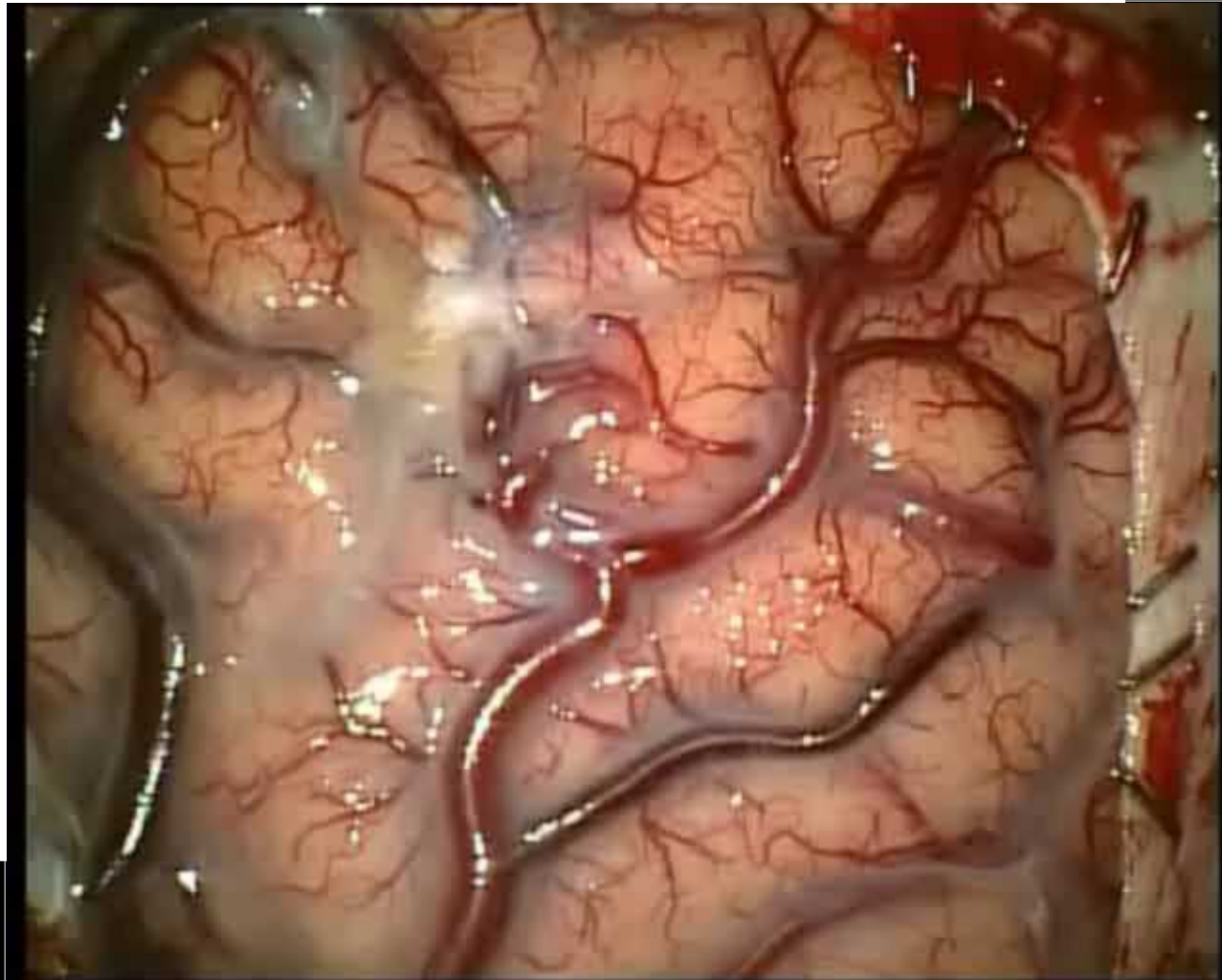




Trattamento Chirurgico delle Micro-MAV







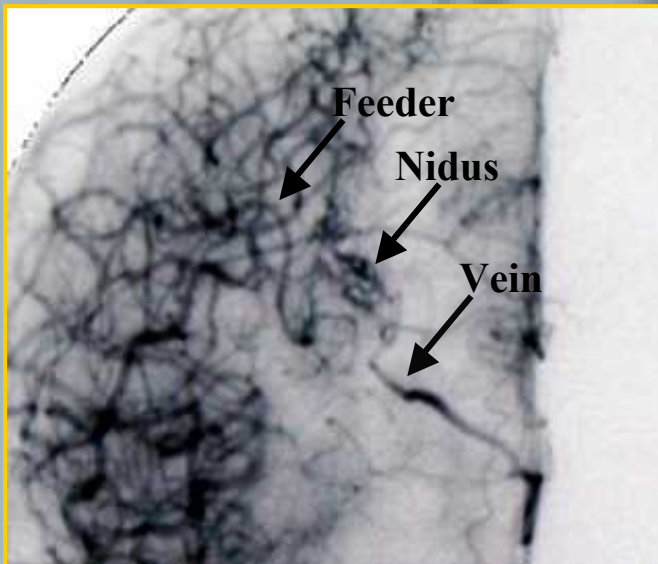
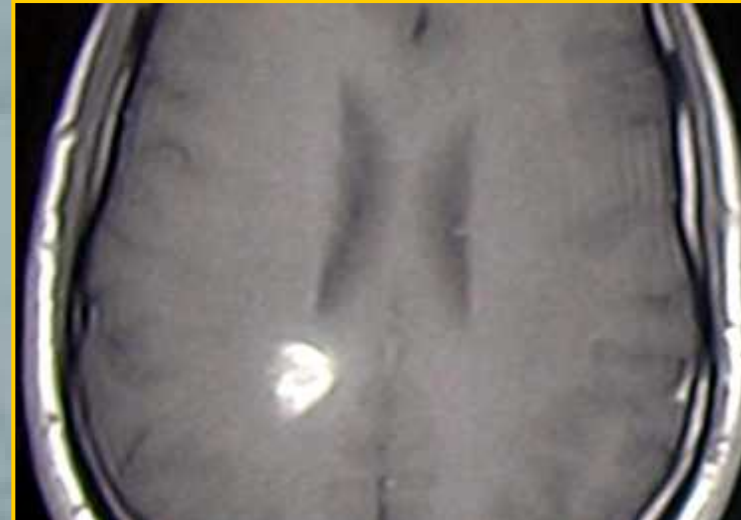
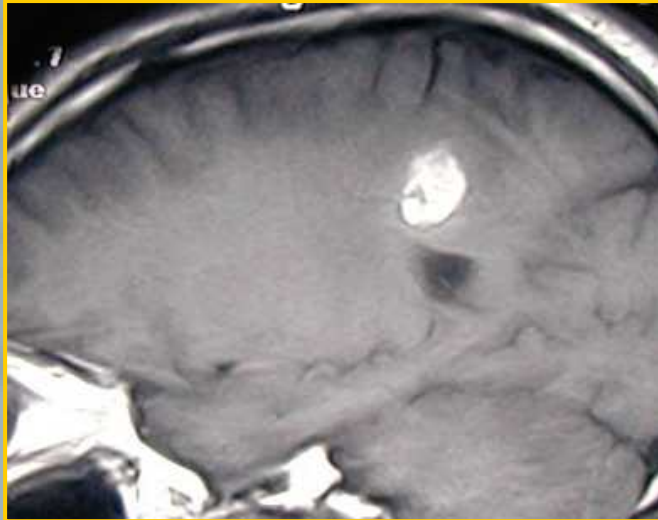
An anatomical illustration showing a complex network of blood vessels. A large, pinkish-red vessel is shown with a significant bulge or aneurysm. A smaller, blue vessel is shown branching off from the main vessel. The background is a warm, yellowish-orange gradient. The text 'Trattamento Endovascolare delle Micro-MAV' is overlaid on a dark green rectangular box on the right side of the image. In the bottom left corner, there is a signature 'V. J. - P. B. 2003'. In the bottom right corner, there is a date 'Spoleto, 5-8 maggio 2003'.

Trattamento Endovascolare delle Micro-MAV

V. J. - P. B. 2003

Spoleto, 5-8 maggio 2003

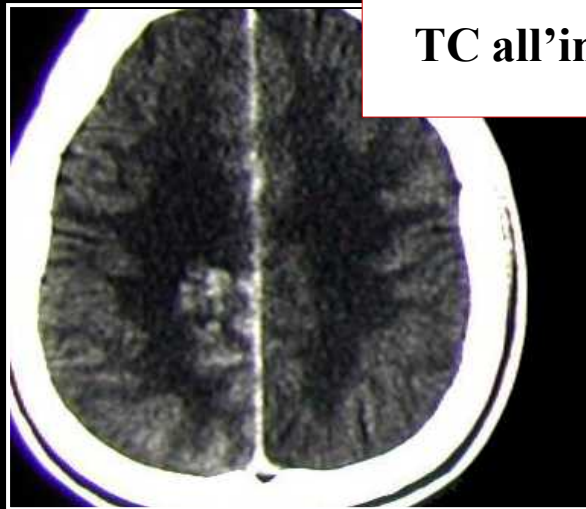
Micro-MAV in area critica



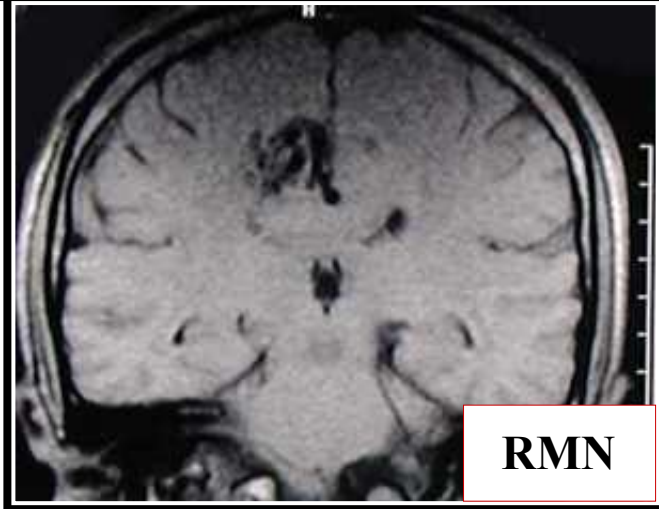
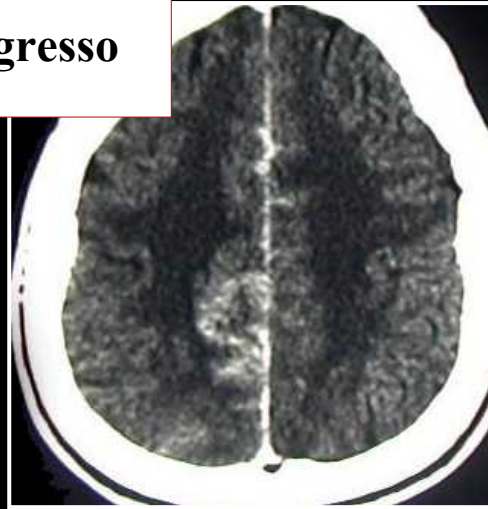
Trattamento multidisciplinare delle MAV



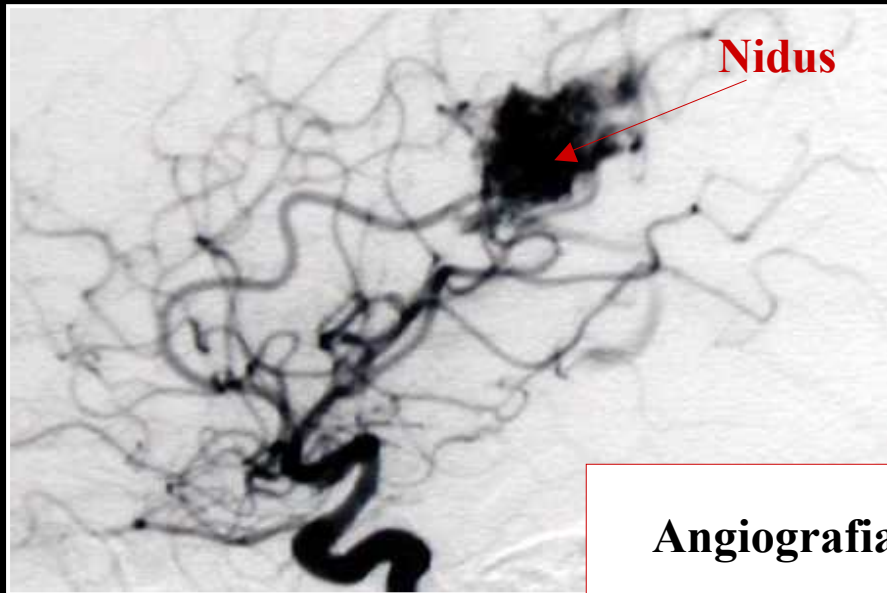
Embolizzazione e successiva chirurgia



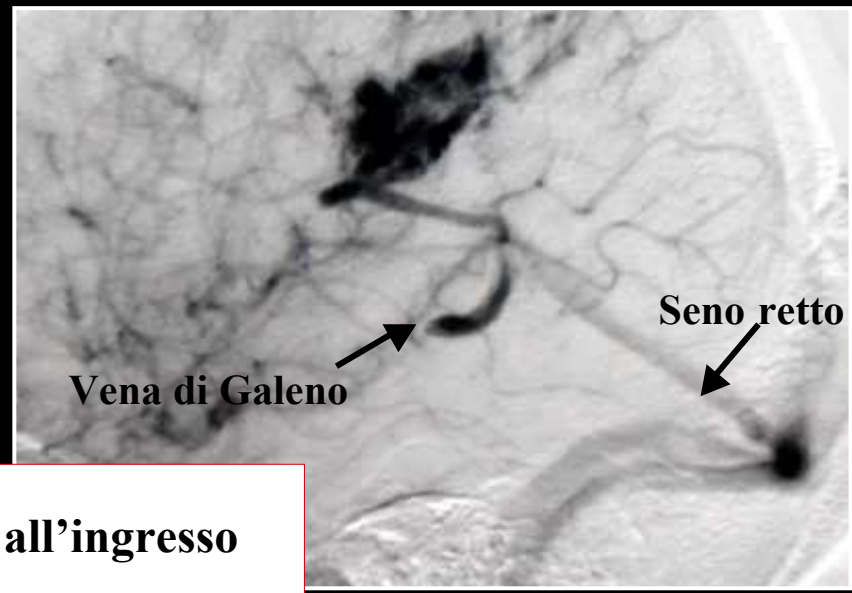
TC all'ingresso



RMN



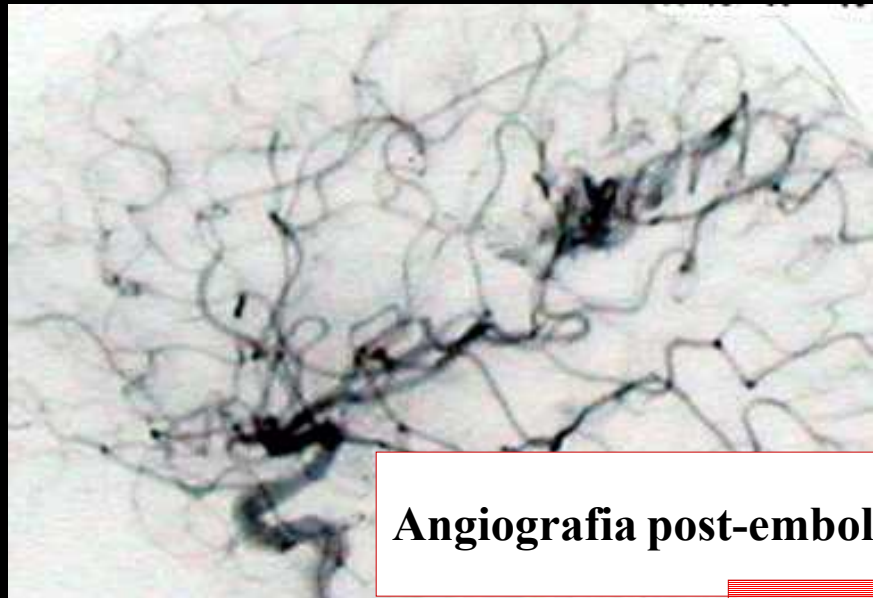
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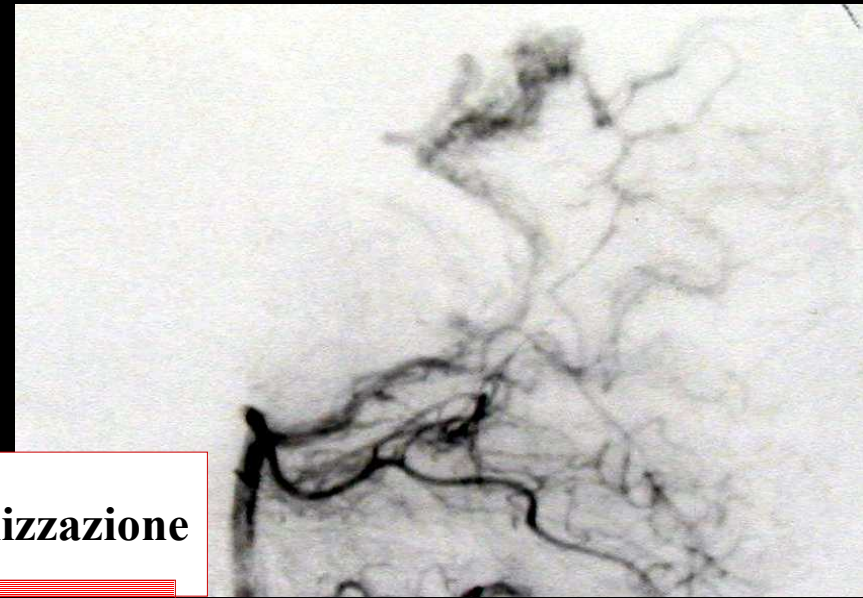
Vena di Galeno

Seno retto

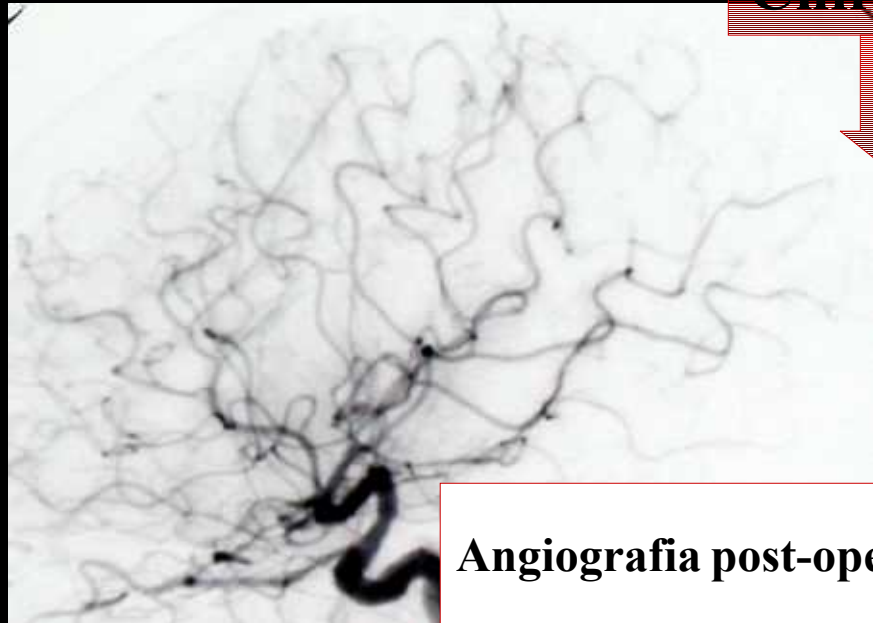
Angiografia all'ingresso



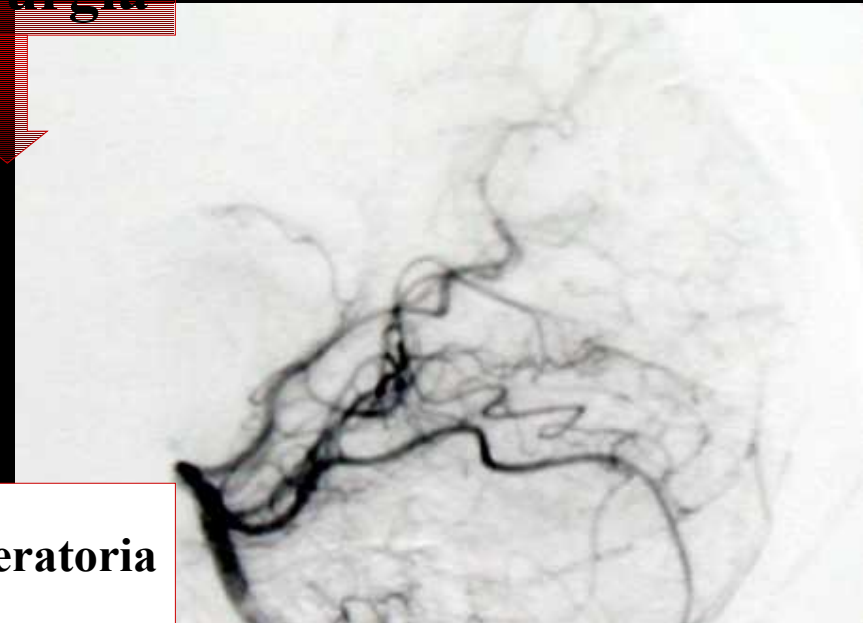
Angiografia post-embolizzazione



Chirurgia

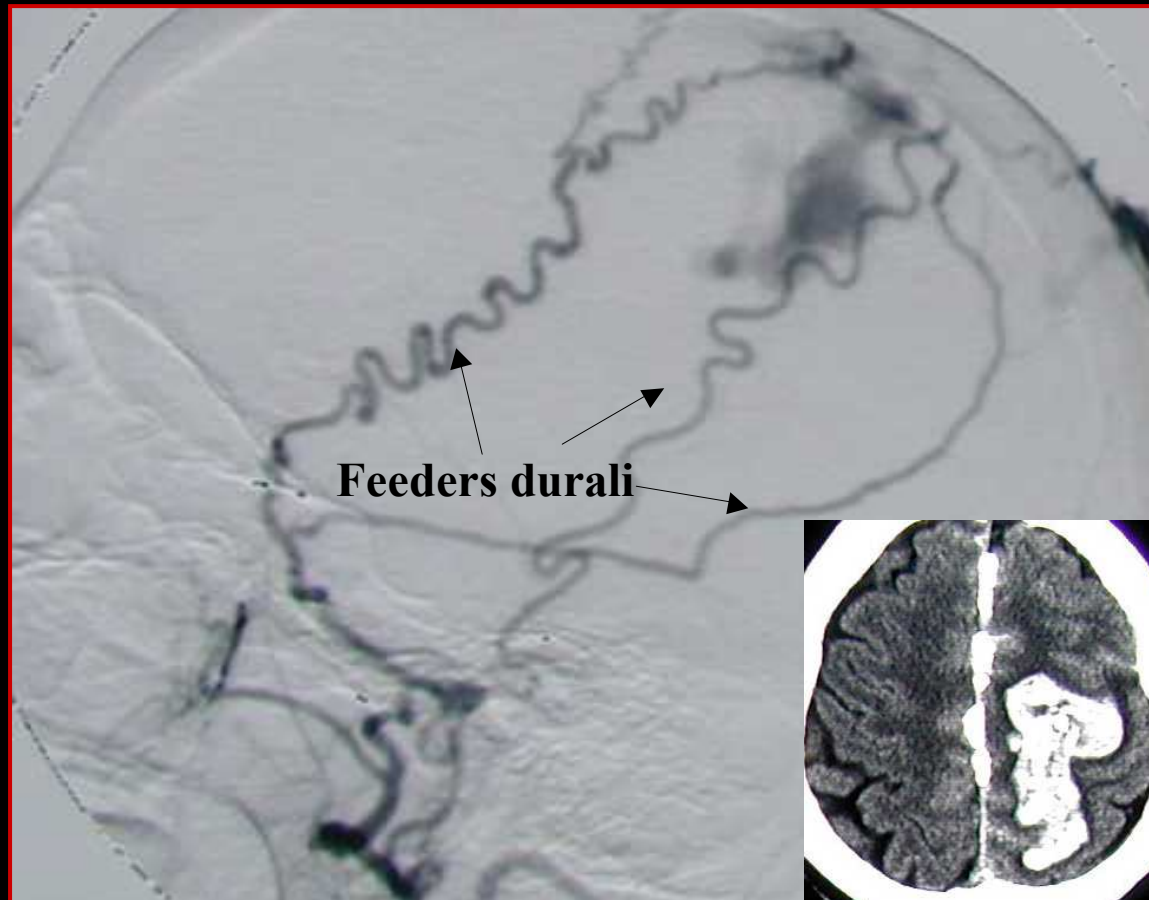


Angiografia post-operatoria



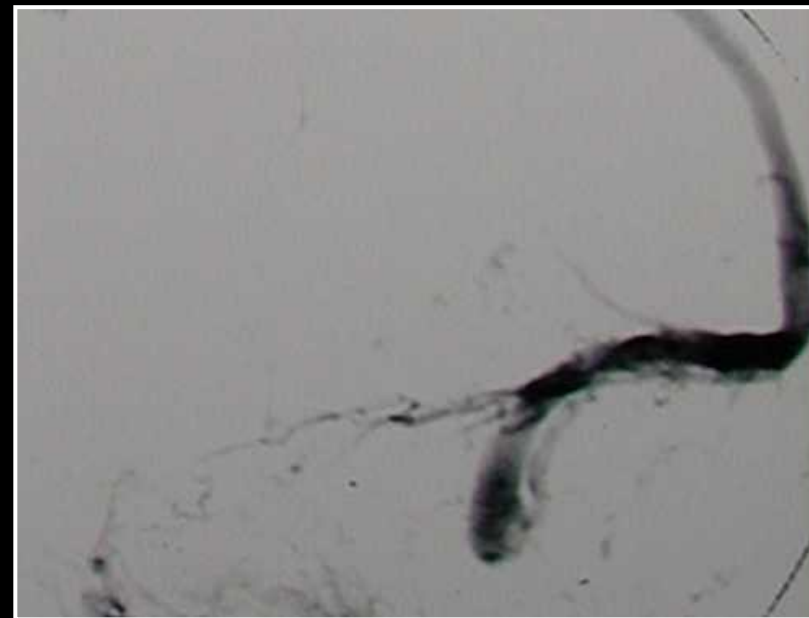
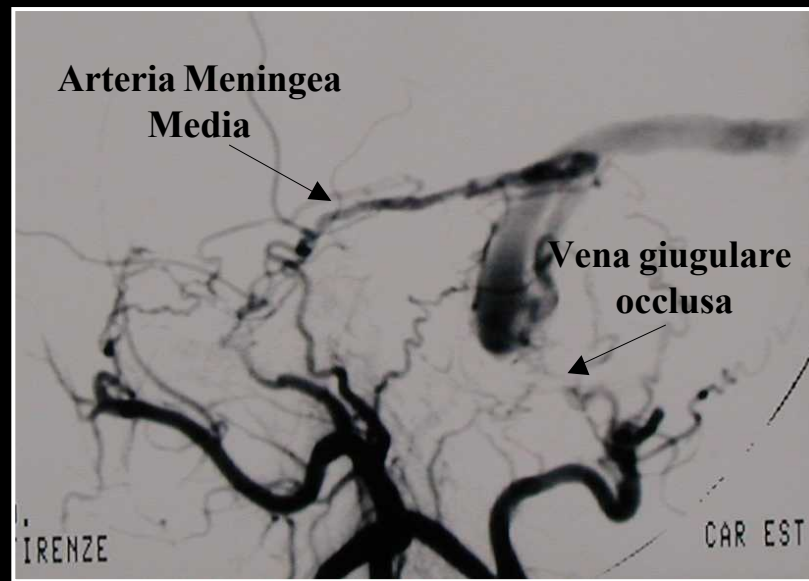
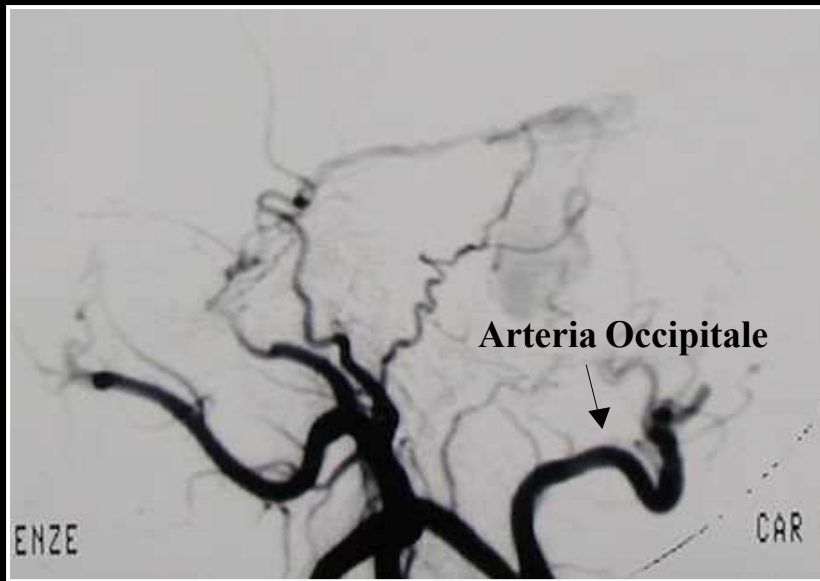
Fistole Durali

Le fistole arterovenose durali (FAVd) sono costituite da uno shunt artero-venoso diretto localizzato nello strato durale, in associazione ad un seno durale (sinus parent).



Il comportamento aggressivo delle FAVd (emorragia cerebrale, comparsa di deficit neurologici progressivi, ipertensione endocranica) dipende dal pattern di drenaggio venoso ed in particolare dalla presenza di vene leptomeningeae arterializzate.

Fistole arterovenose durali aggressive: Sinus Fistulae

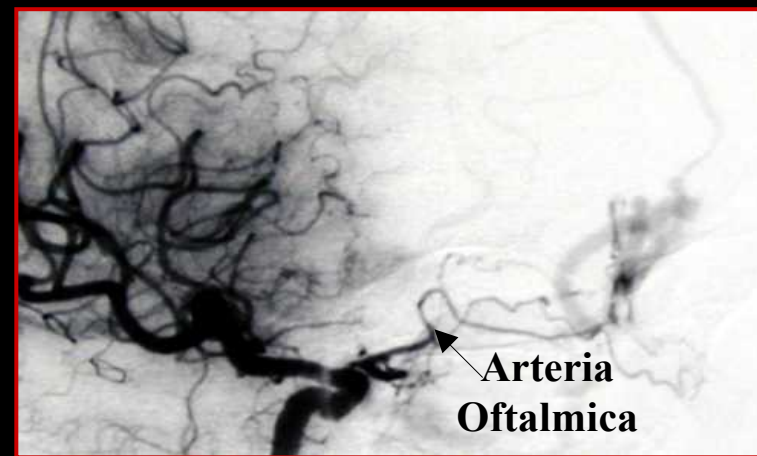
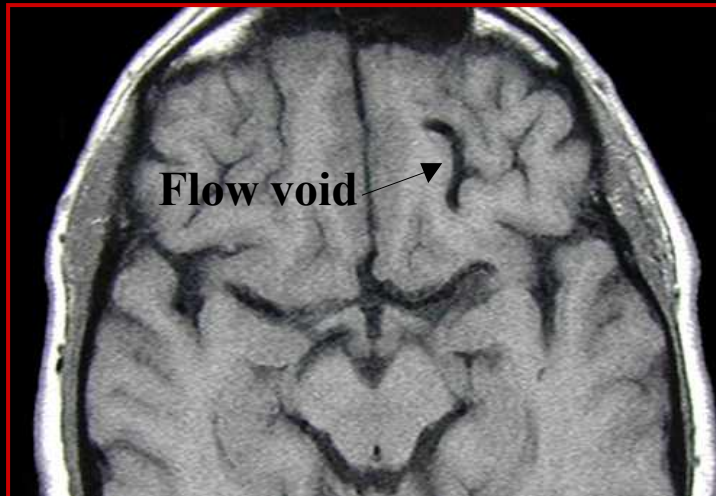


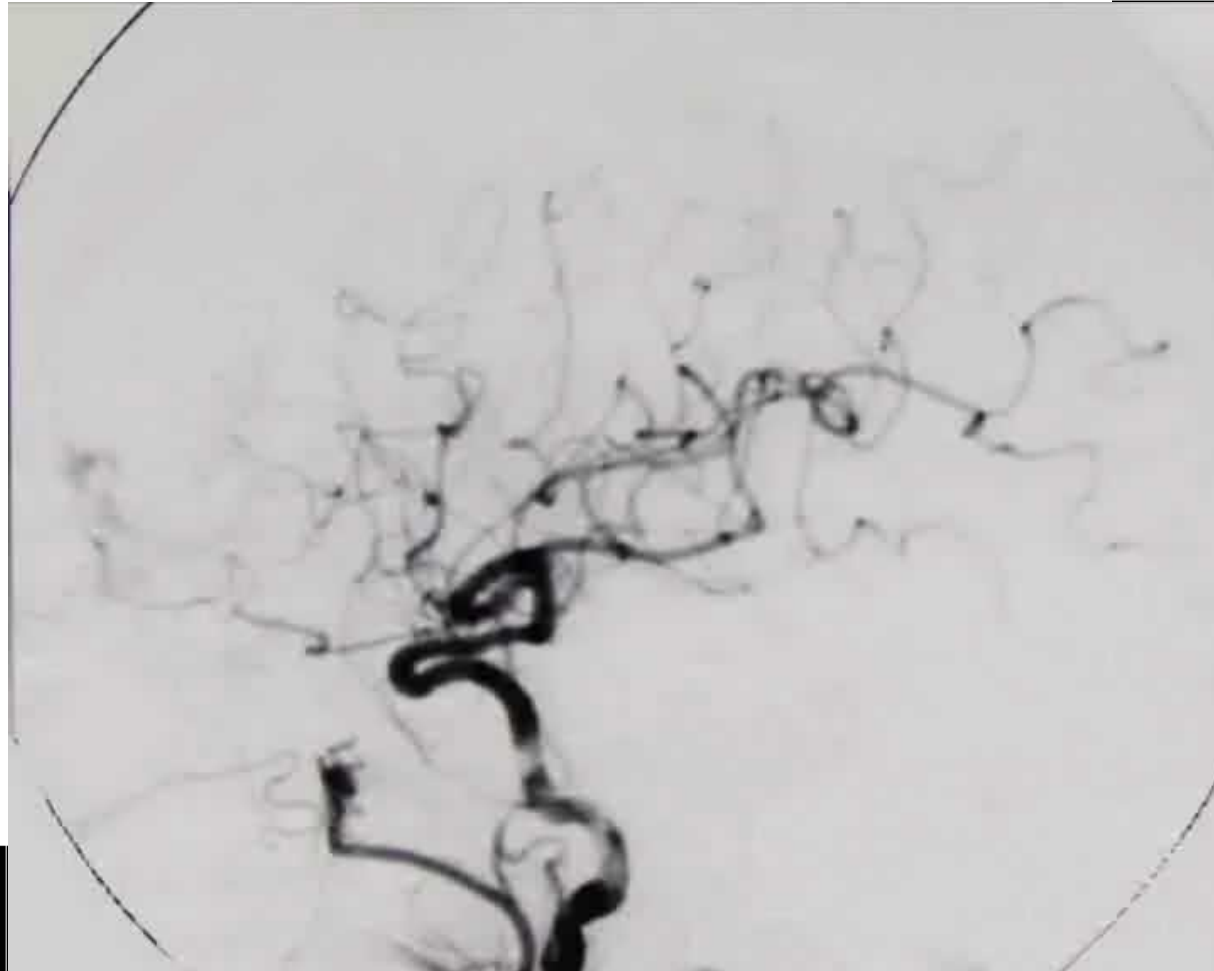
Fistole arterovenose durali aggressive: non Sinus Fistulae



Trattamento chirurgico

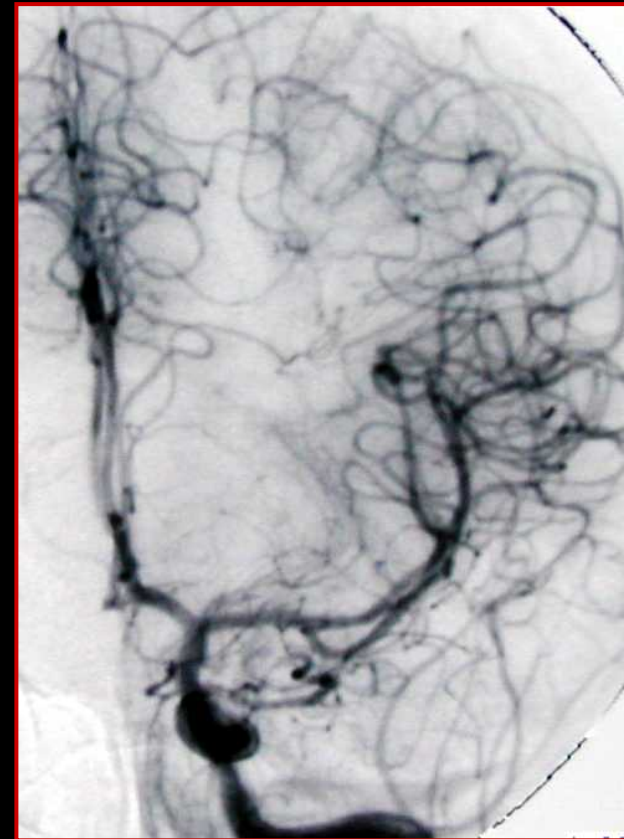
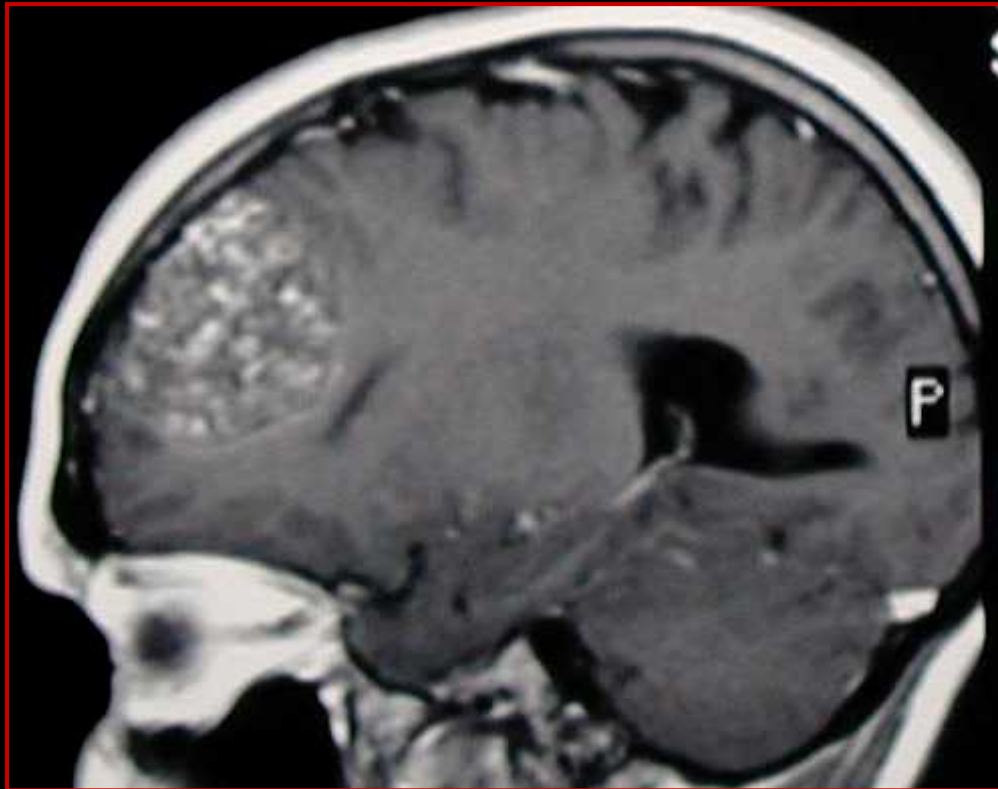
Nelle fistole non sinus la semplice interruzione della vena di drenaggio comporta la guarigione della malformazione ed è una metodica semplice e sicura.



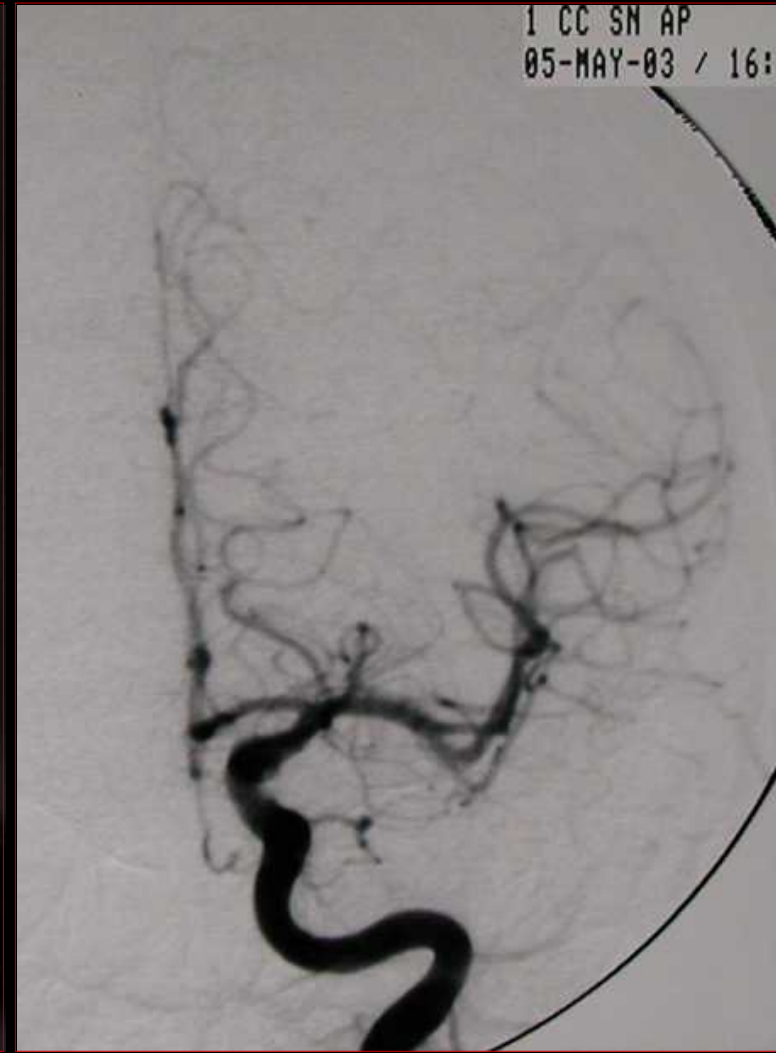


Cavernomi cerebrali

I cavernomi costituiscono il 5-13% delle malformazioni vascolari cerebrali, sono prevalentemente sopratentoriali e tendono a manifestarsi con crisi (60%), deficit neurologici progressivi (50%) o emorragia (20%). Con la diffusione dell'imaging sono spesso diagnosticati in modo incidentale. Non sono visualizzabili all'esame angiografico.



I cavernomi possono essere nascosti dall'ematoma

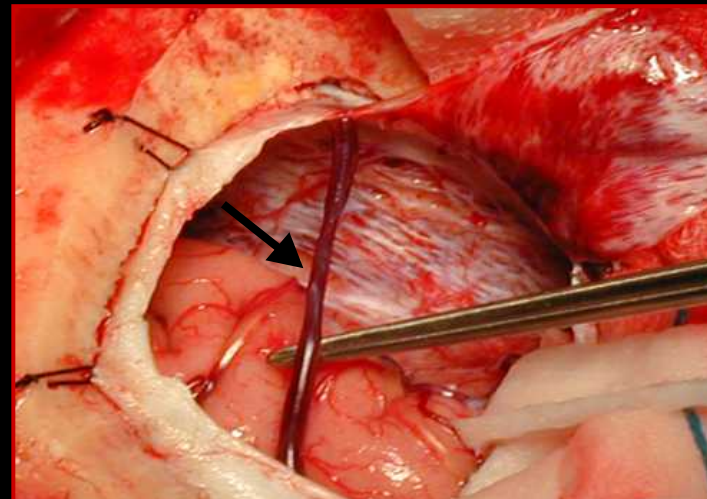
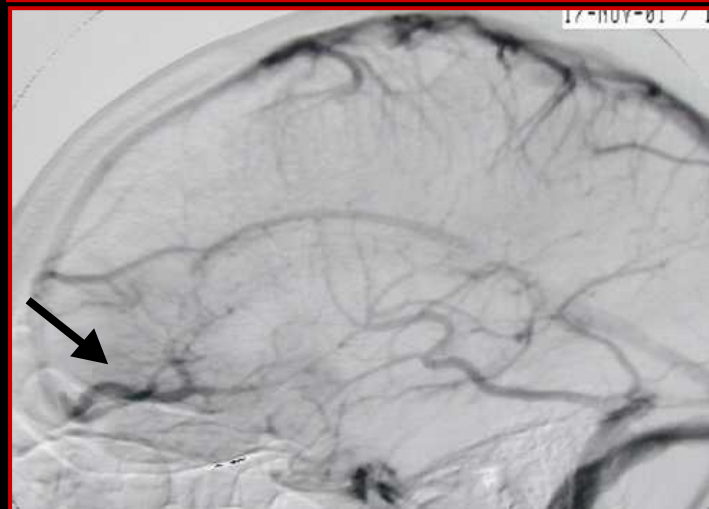
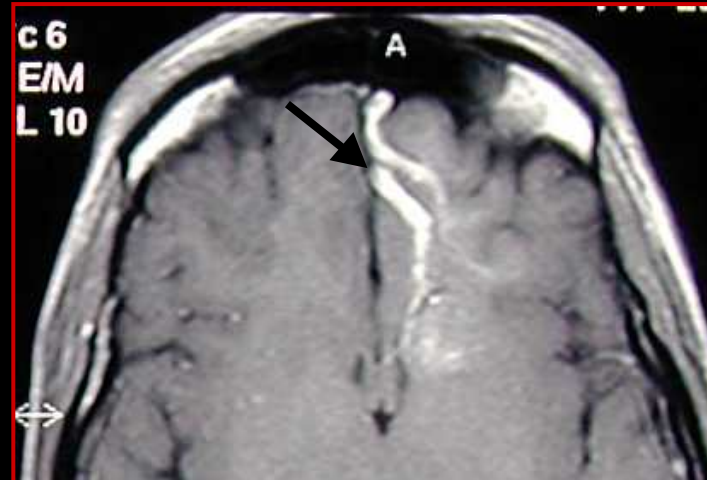


La TC (A) può non rilevare piccoli cavernomi e solitamente non fornisce informazioni dirimenti ai fini diagnostici. La RMN (B) è l'esame di scelta specialmente tramite le sequenze T2 pesate che permettono di valutare l'emosiderina.



Trattamento

Il trattamento dei cavernomi è l'exeresi chirurgica che appare indicata anche nei cavernomi non emorragici se chirurgicamente aggressibili, dato il loro rischio emorragico e di focus epilettogeno.



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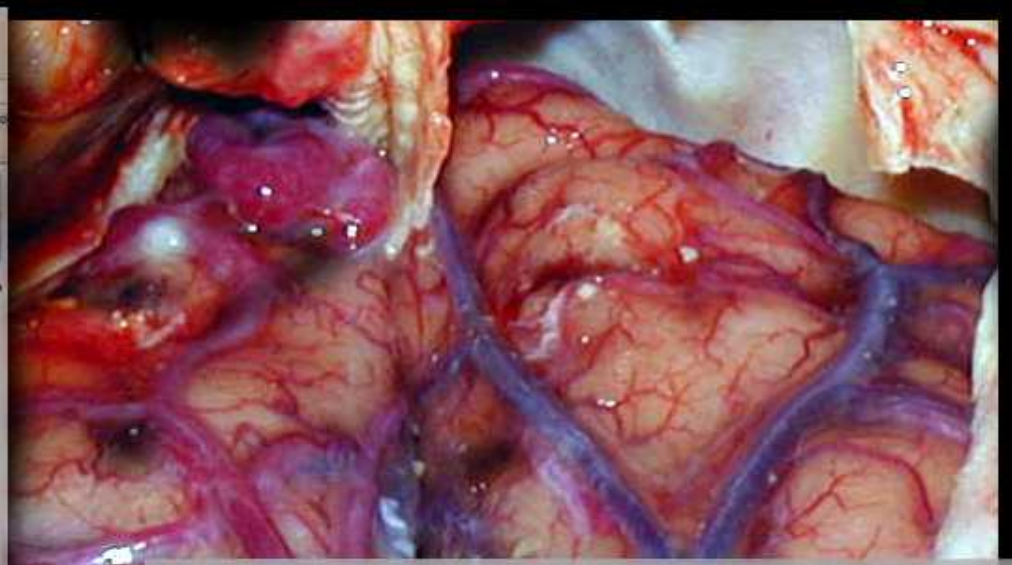
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