

6-7-8 NOVEMBRE 2017

San Benedetto del Tronto (AP)

33,6 crediti ECM

LA NEUROSONOLOGIA

NELLE PATOLOGIE  
DEGENERATIVE E  
VASCOLARI CEREBRALI

UNITÀ OPERATIVA DI NEUROLOGIA

Il neuroradiologo:  
imaging delle vene  
cerebrali, pseudotumor  
cerebri, seno cavernoso

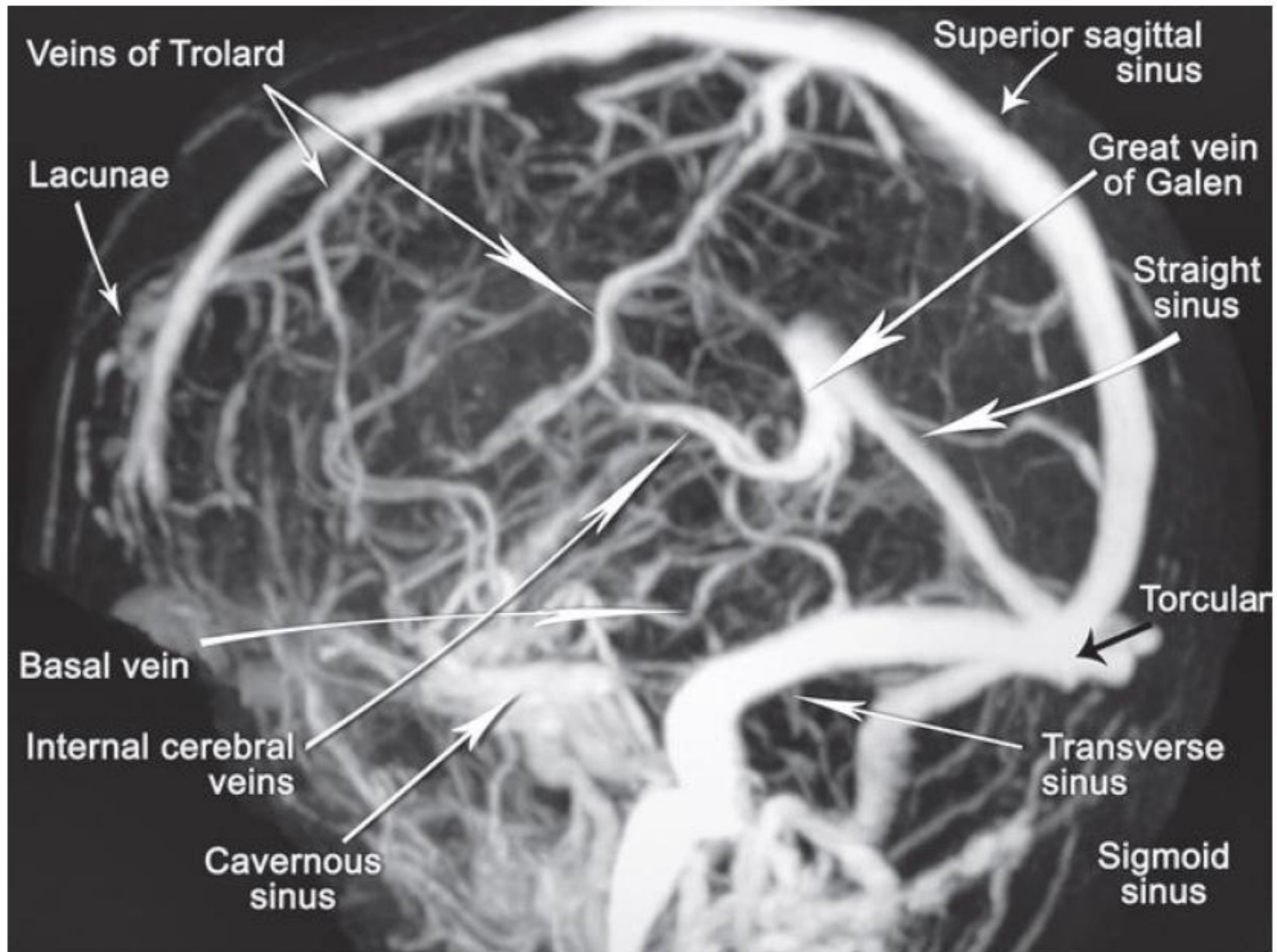
Nicola Limbucci

*SOD Interventistica Neurovascolare  
AOU Careggi - Firenze*

[nicolalimb@gmail.com](mailto:nicolalimb@gmail.com)

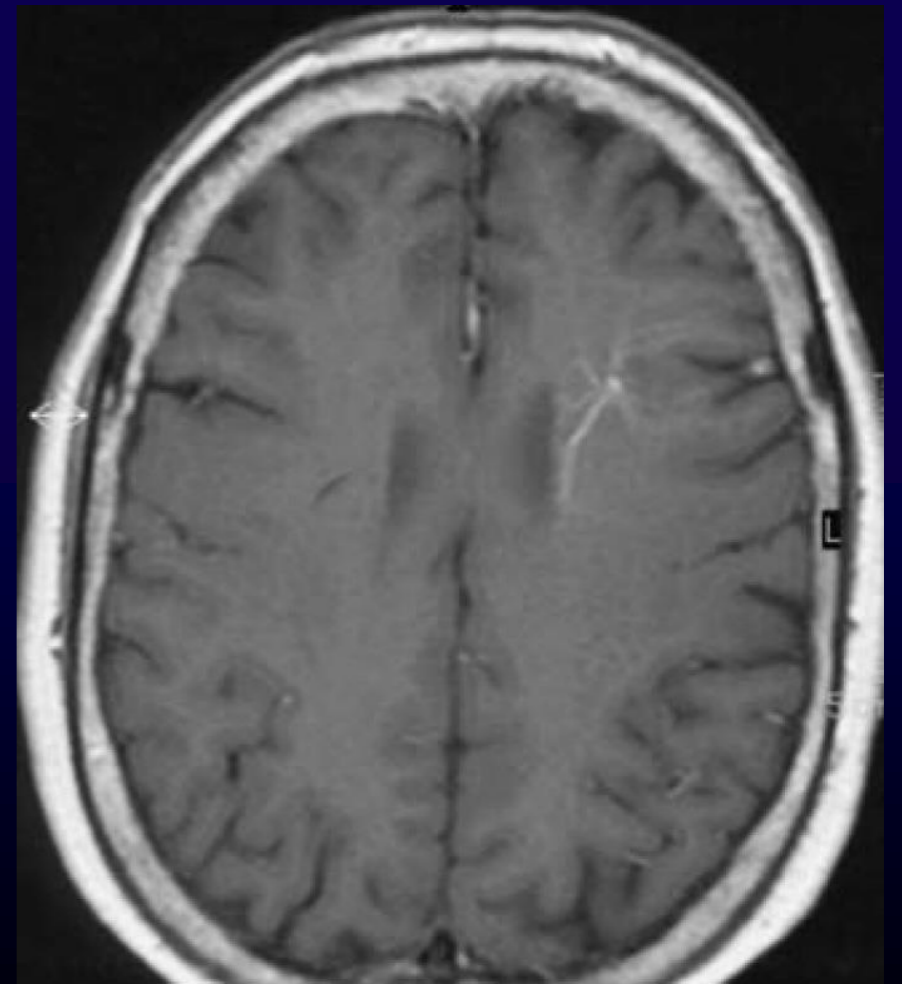


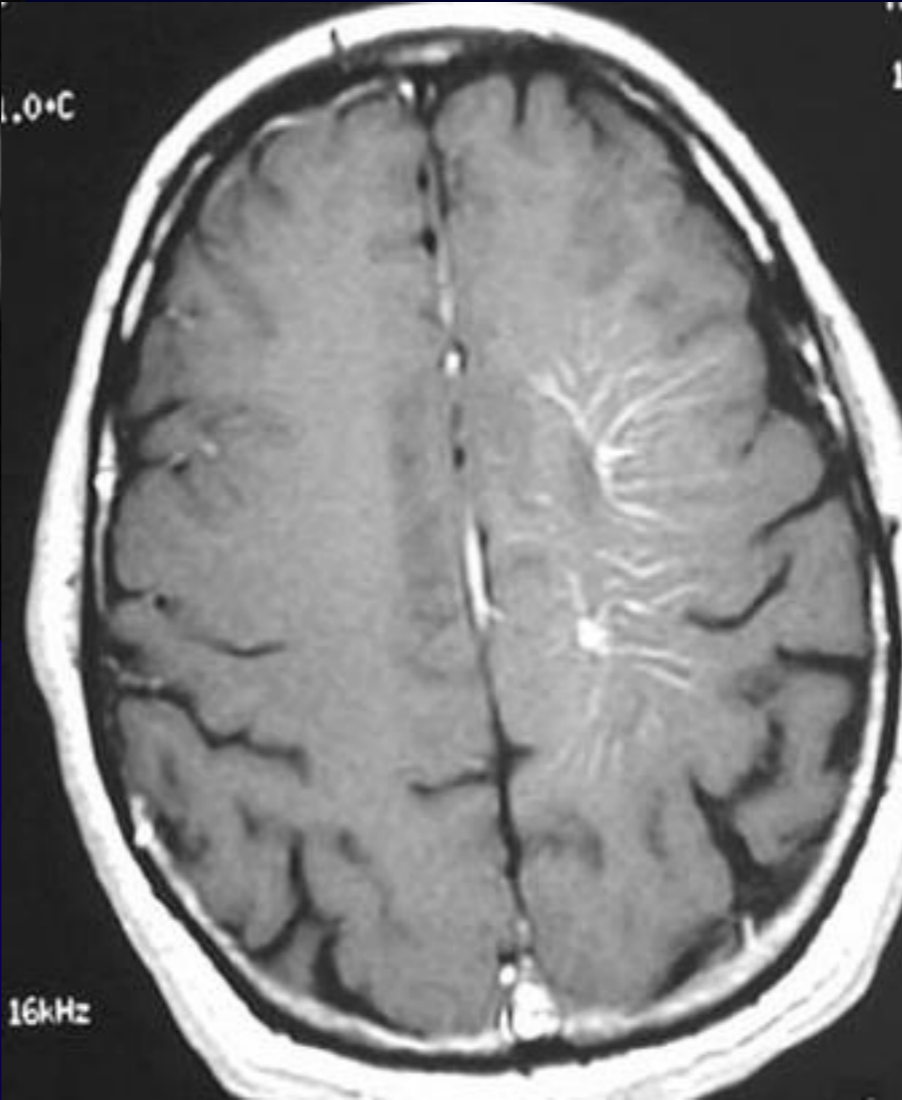
# VENE CEREBRALI



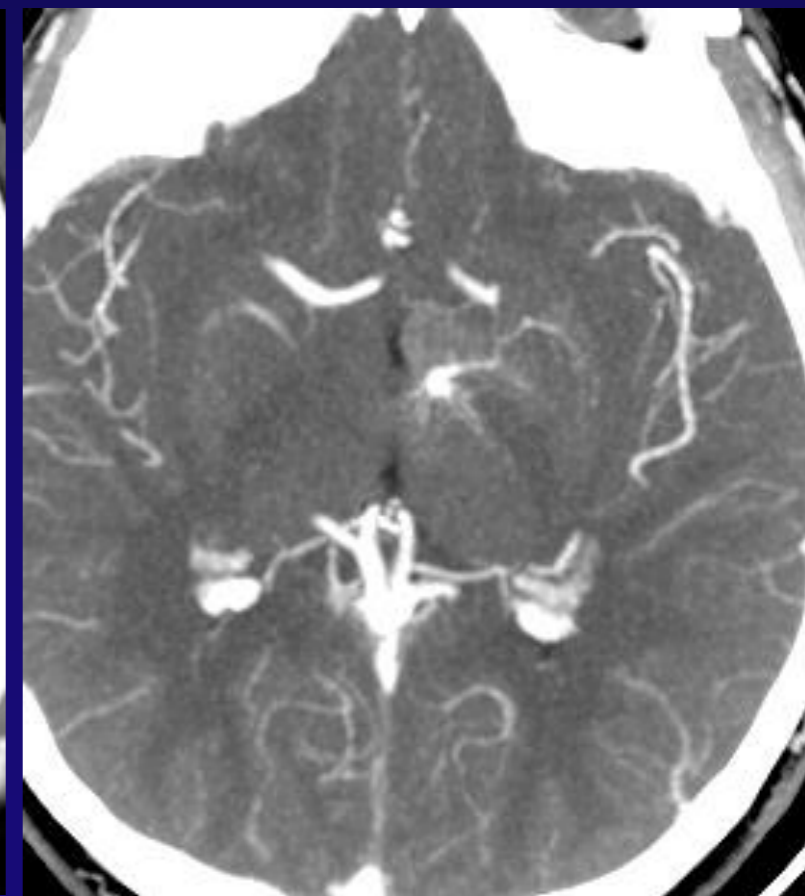
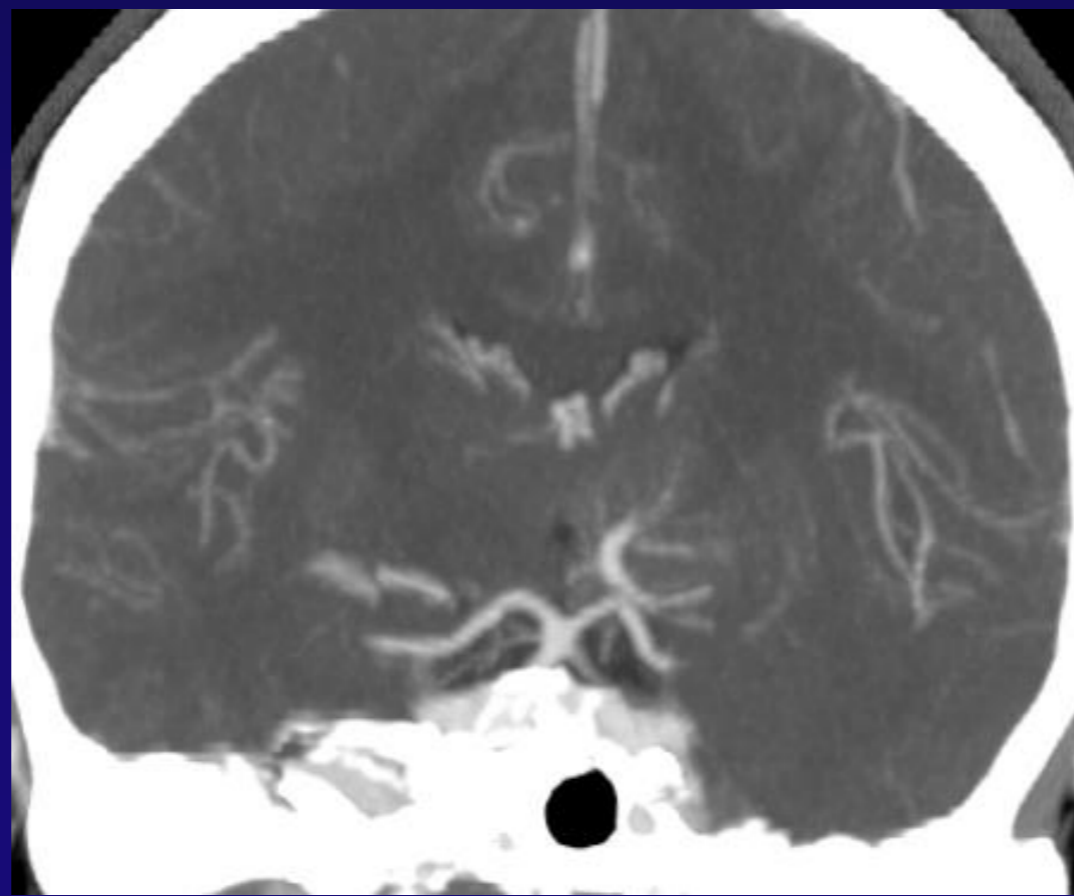
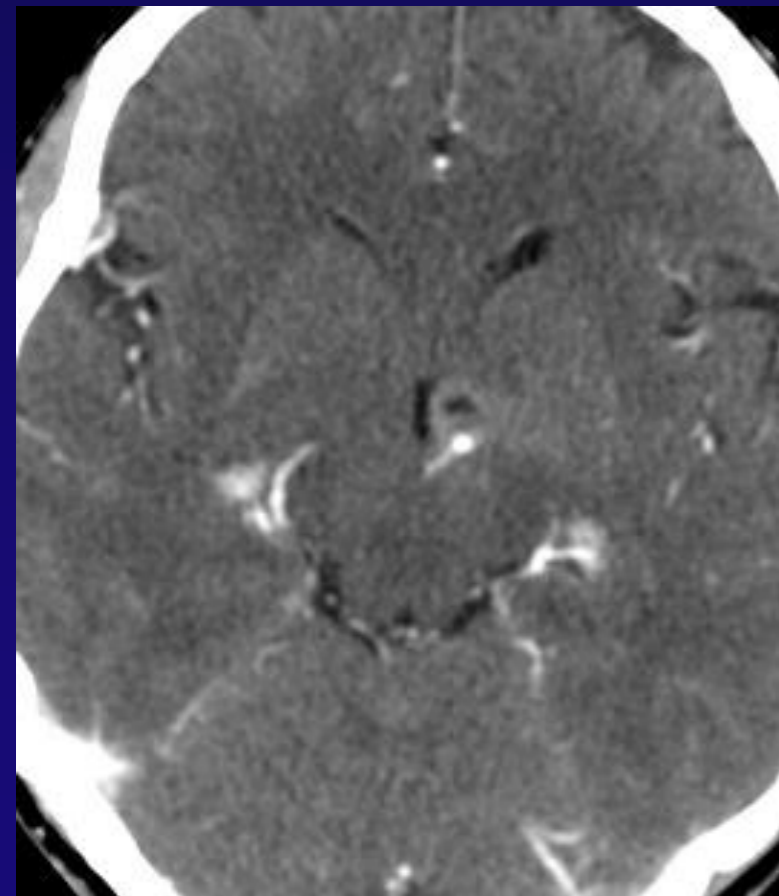
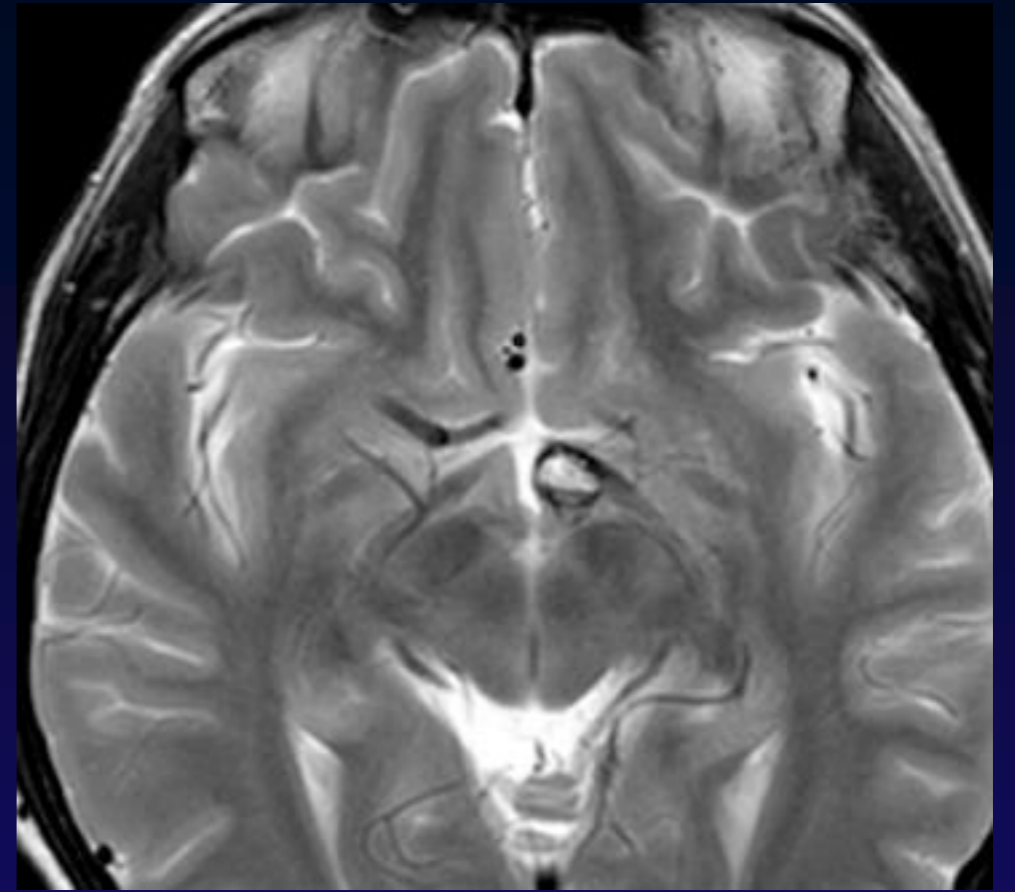
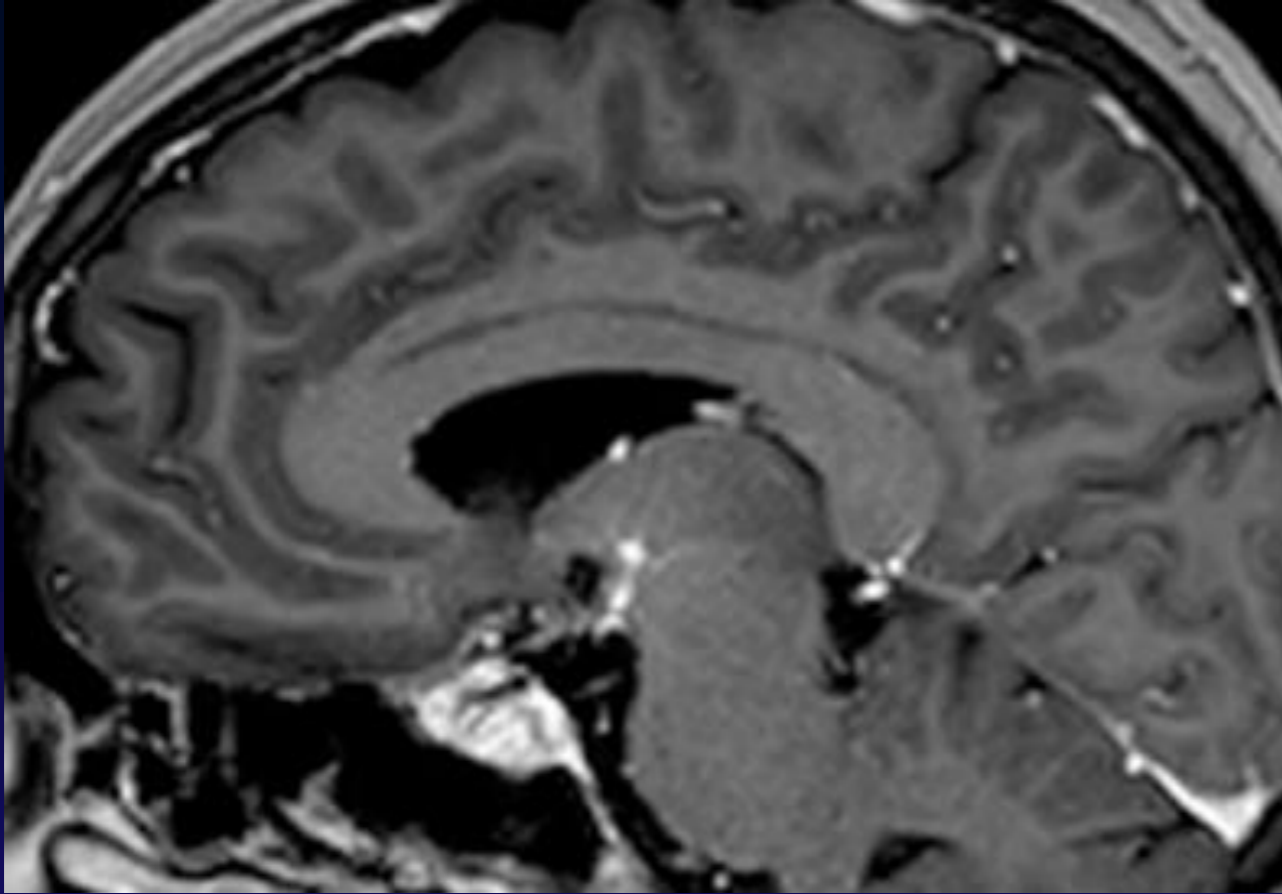
## ANOMALIE DI SVILUPPO VENOSO (DVA)

- Gruppo di vene ectasiche, disposte radialmente con drenaggio in un singolo collettore venoso a sua volta diretto verso vene normali
  - Sono varianti del normale drenaggio venoso; no shunt AV
  - Tessuto cerebrale interposto normale - Pareti venose normali
  - Molto comuni (> 60% delle MV) - Possibile associazione con cavernomi e TA
  - Clinicamente silenti, reperti incidentali; in rarissimi casi epilettogene
  - Emorragie rarissime (associazione con altre MV)
- 
- CT neg (potenzialmente collettore post mdc)
  - RM: collettore ipo in T1 e T2
  - RM e TC MDC: potenziamento vene con
  - Morfologia a caput medusae
  - DSA non necessaria





# DVA diencefalicata associata a cavernoma

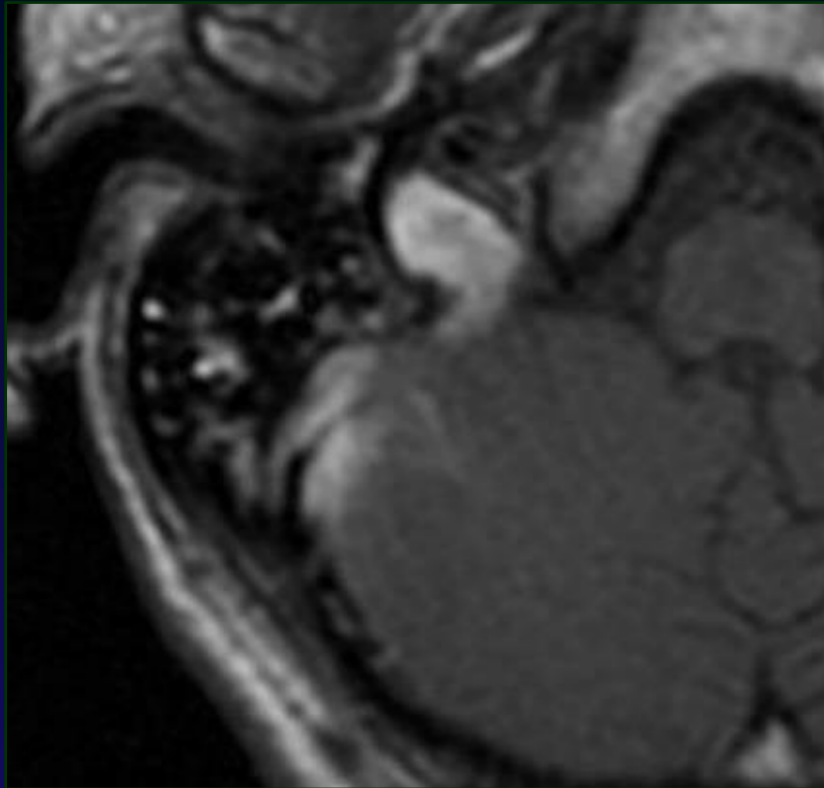


# TROMBOSI VENOSA CEREBRALE

- Occlusione venosa
  - Infezioni
  - Coagulopatie
  - Traumi
  - Tumori
  - Farmaci
  - Disidratazione
- Reperti neuroRX
  - Territori variabili
  - Spesso emorragia in sede atipica
  - Interessamento giunzione cortico-sottocorticale
  - Nuclei basali e talami
  - Identificazione del coagulo (diretta o indiretta)

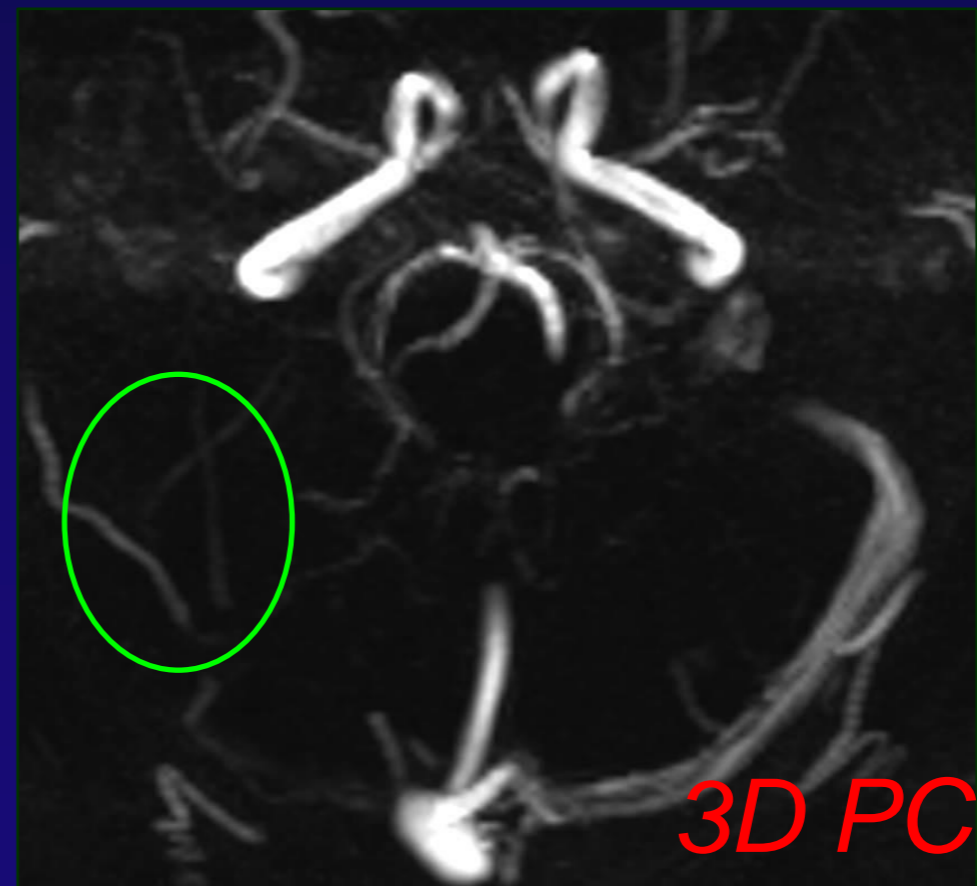
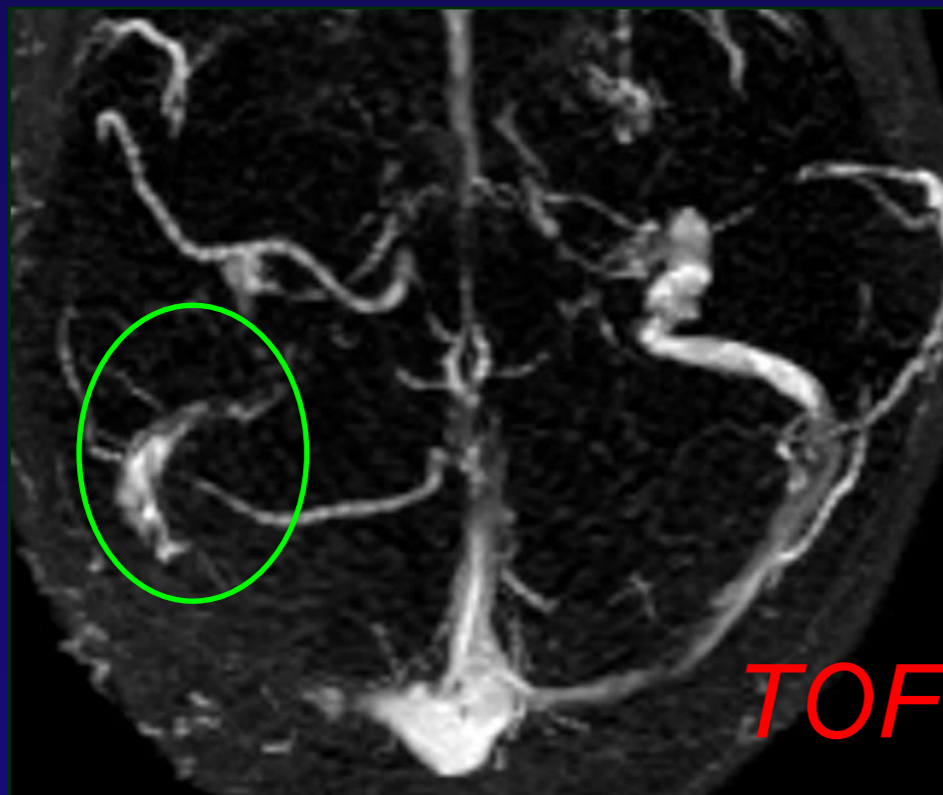
# TROMBOSI VENOSA SENI DURALI

Trombosi post-traumatica seni trasverso e sigmoideo



In fase subacuta il trombo può essere iperintenso nelle sequenze TOF (T1w) con rischio di falsi negativi

Utili le PC!



# TROMBOSI VENOSA CEREBRALE SUPERFICIALE E PROFONDA

F, 21 aa

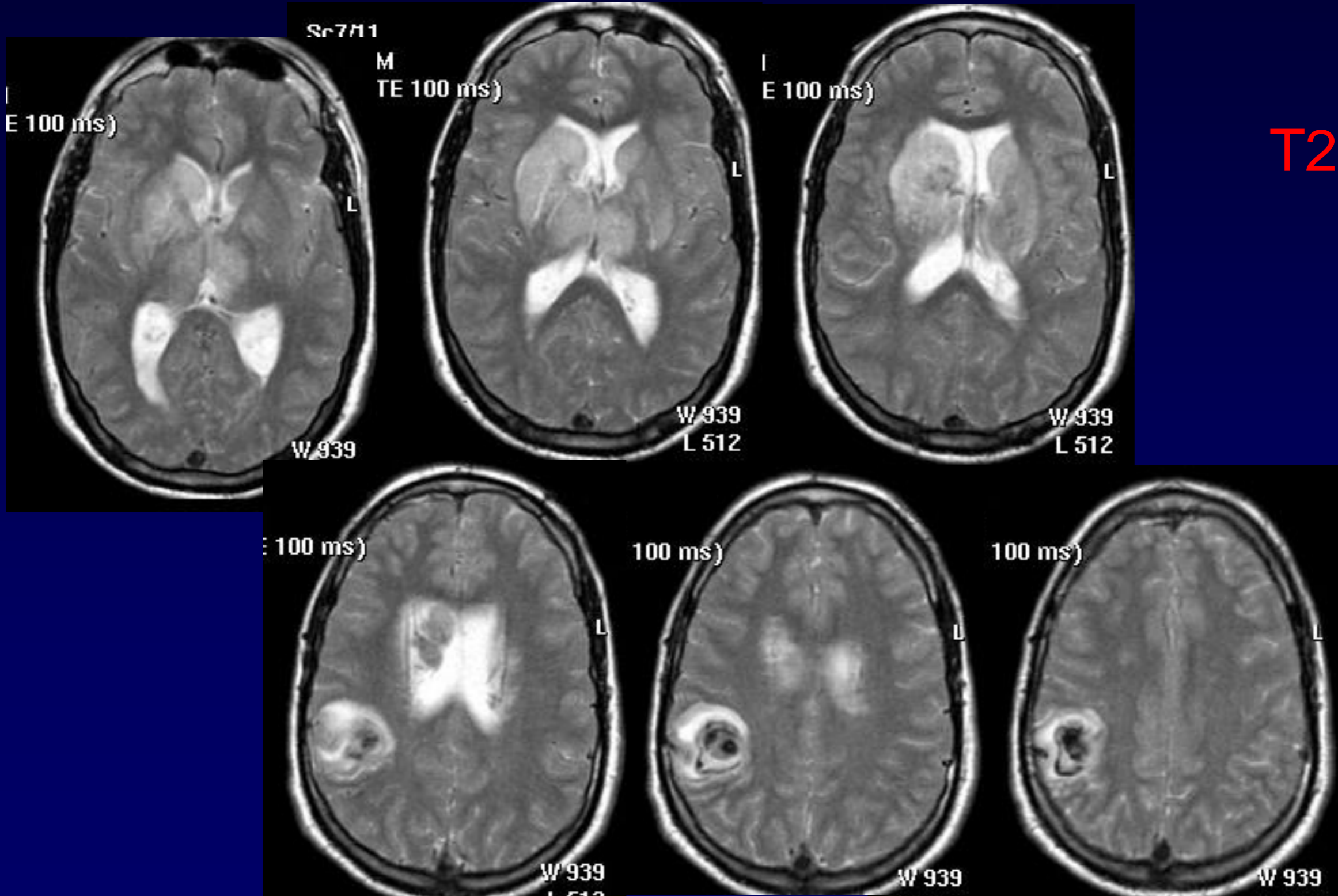
Cefalea per 3 gg

Poi agitazione e coma

Edema dei nuclei della base e dei talami

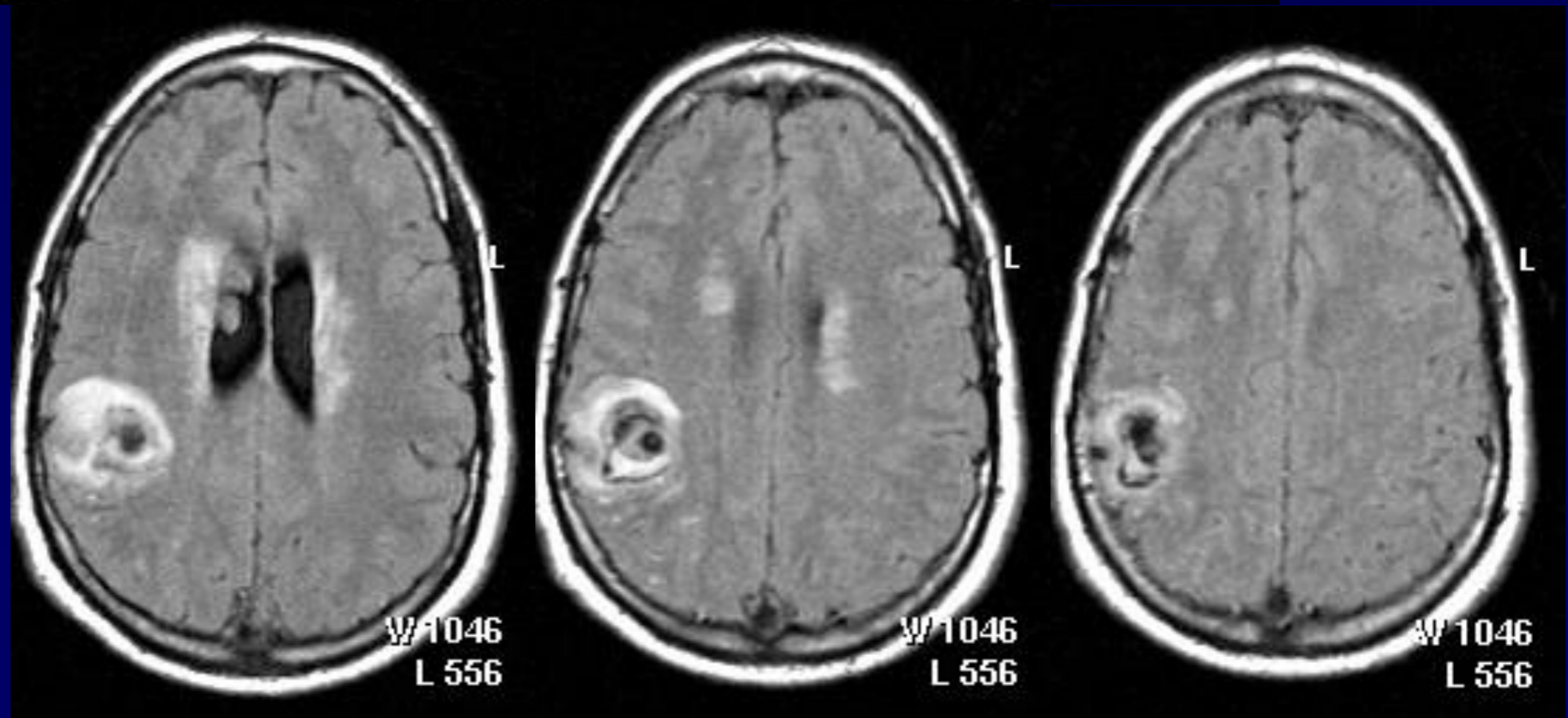
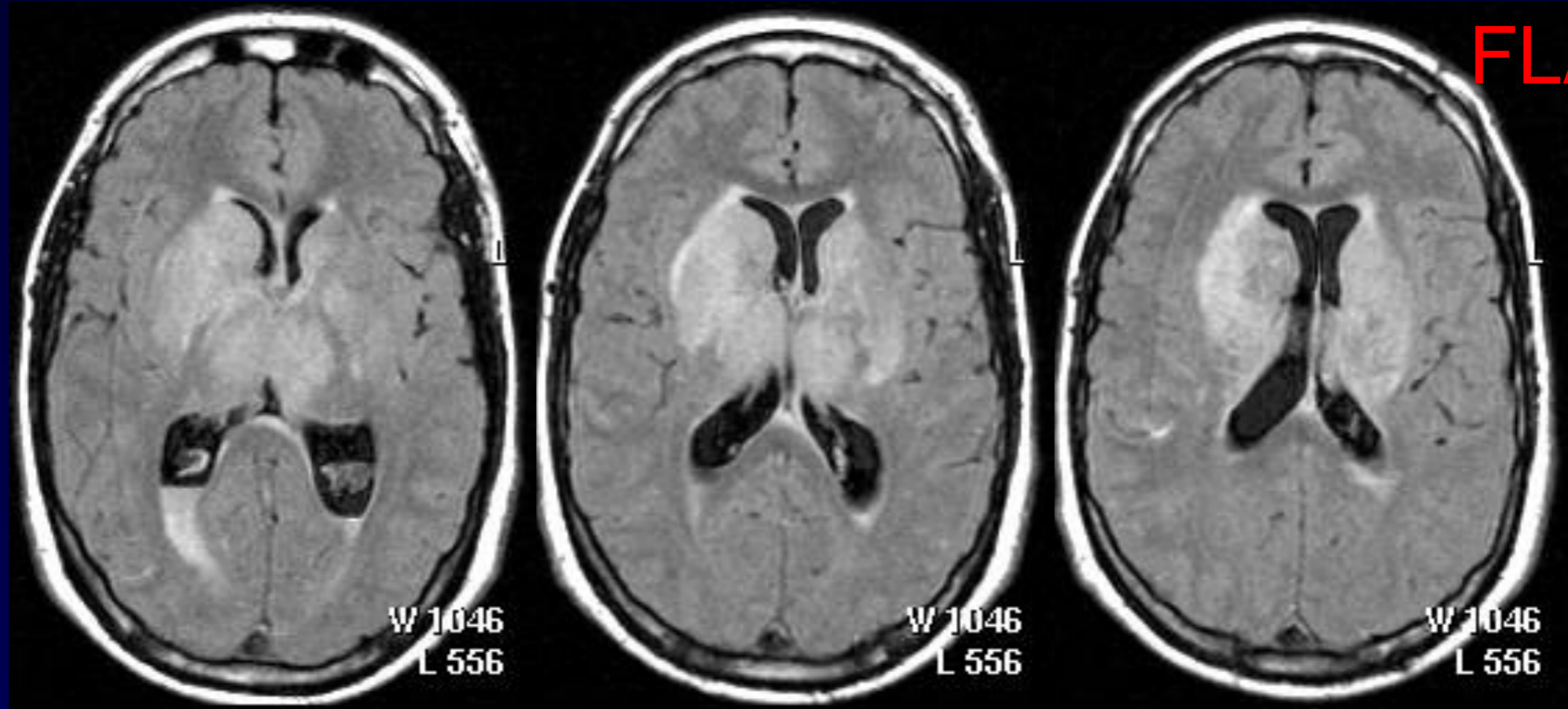
Ematoma sottocorticale in sede atipica

Accumuli emosiderinici in vene striatali

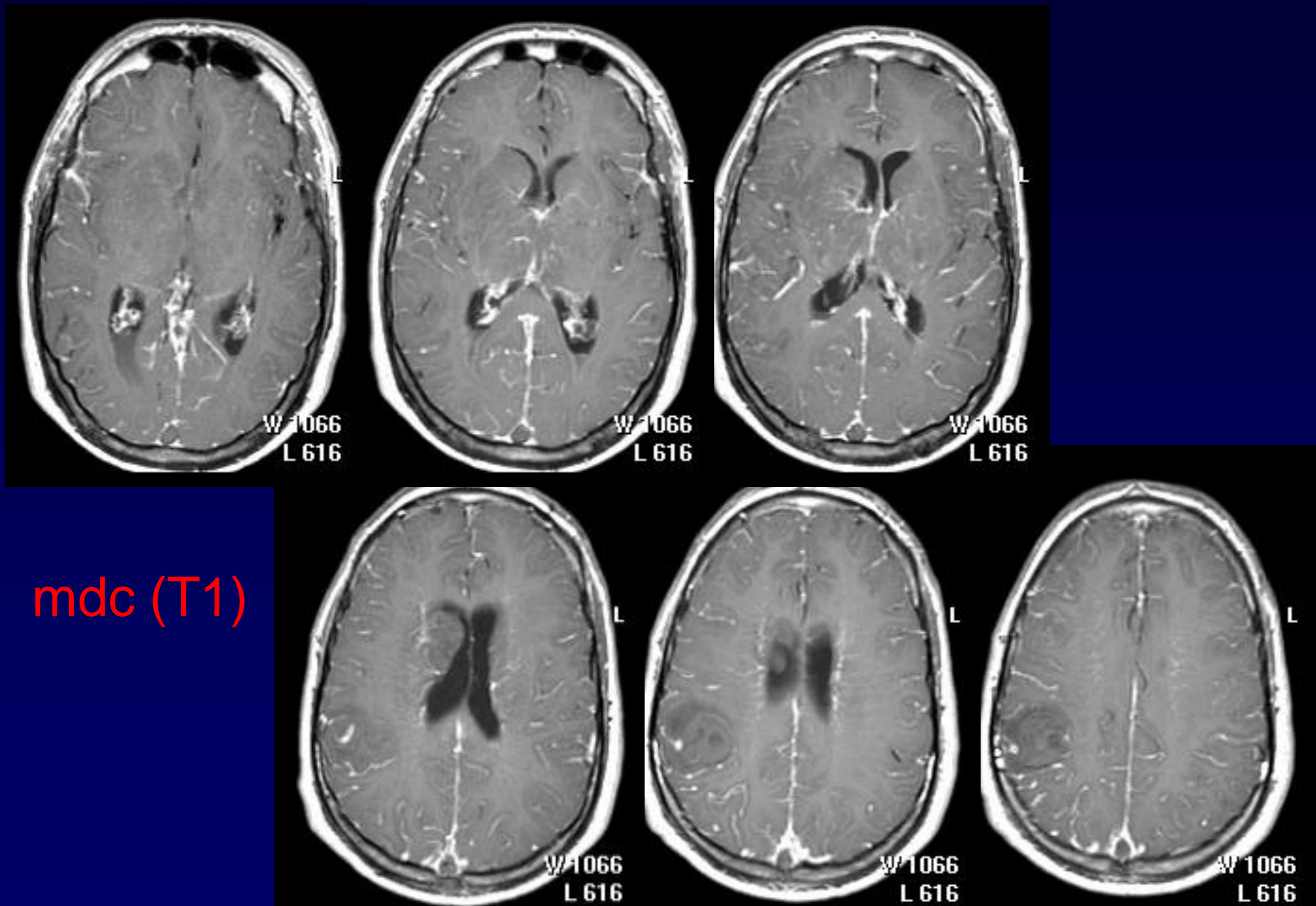




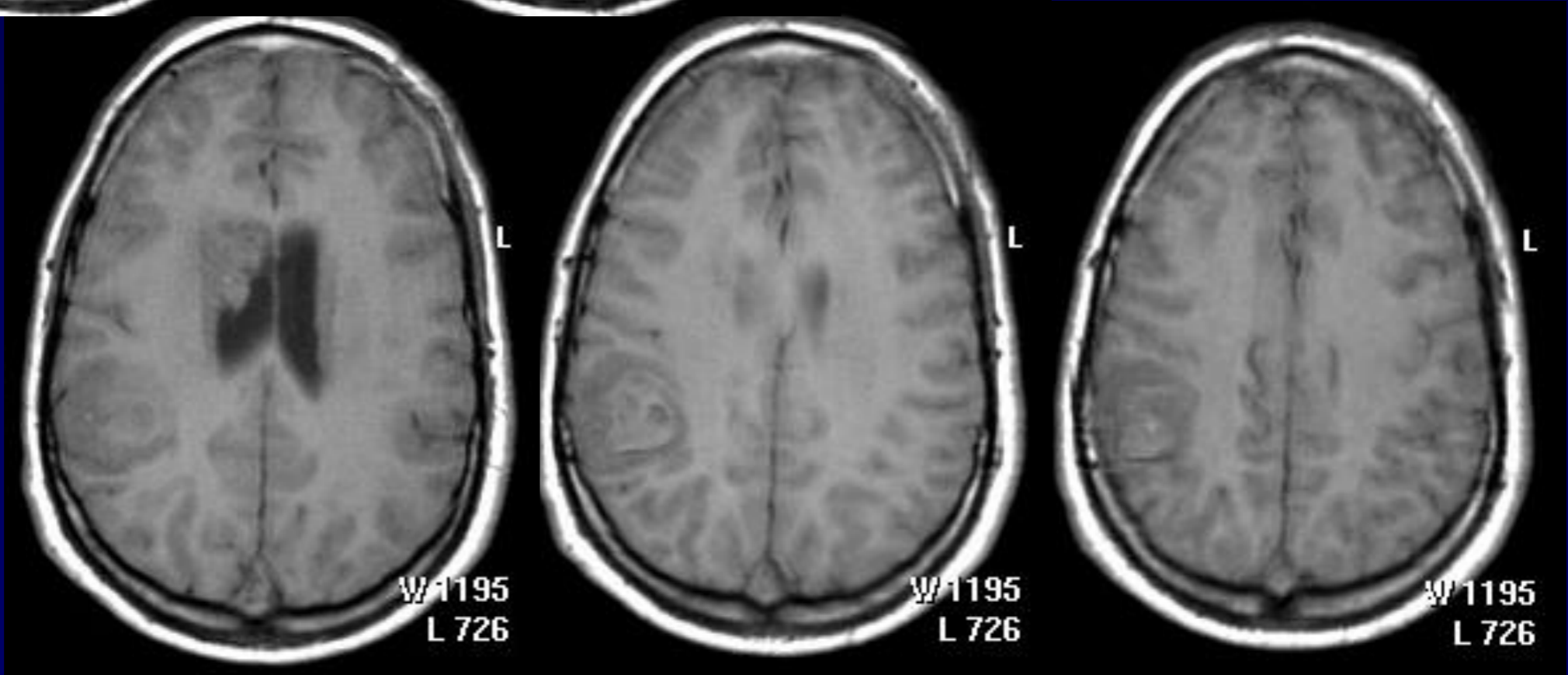
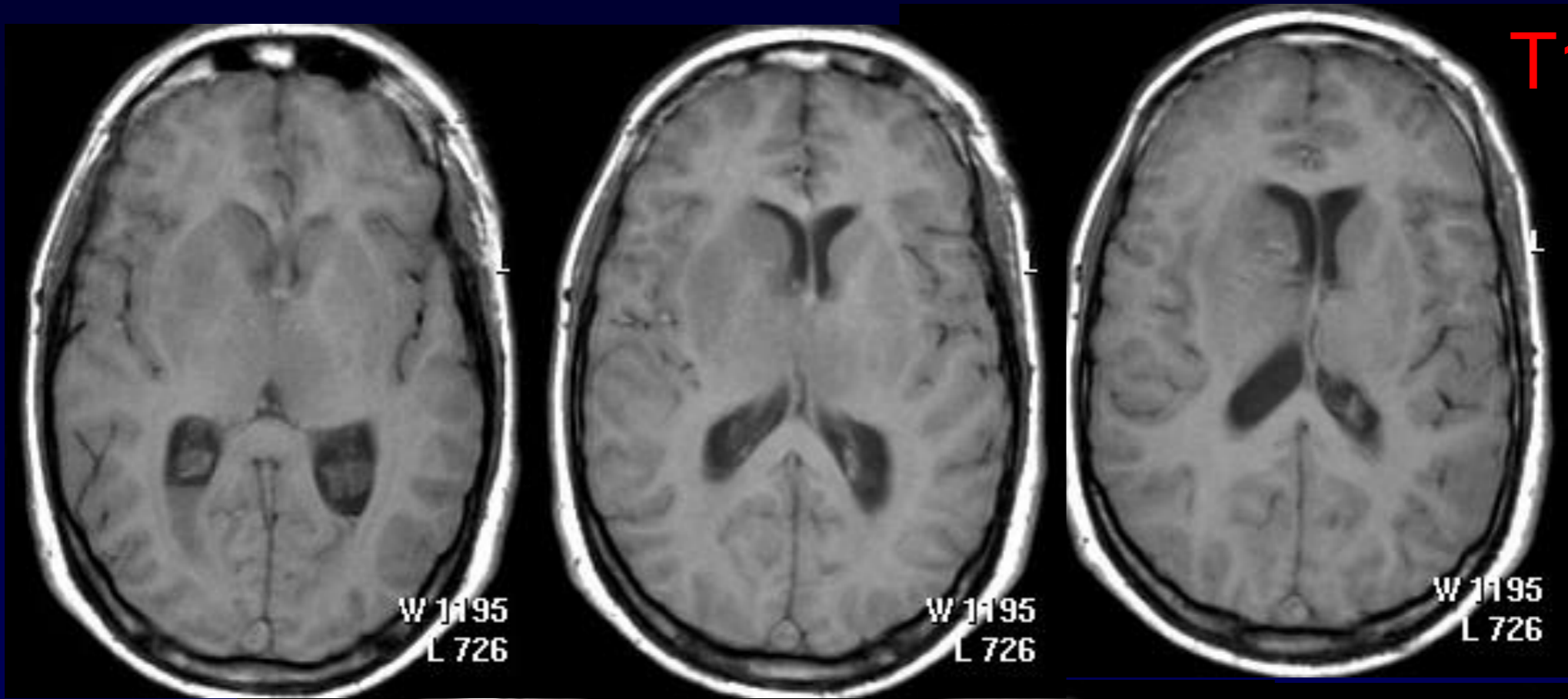
FLAIR



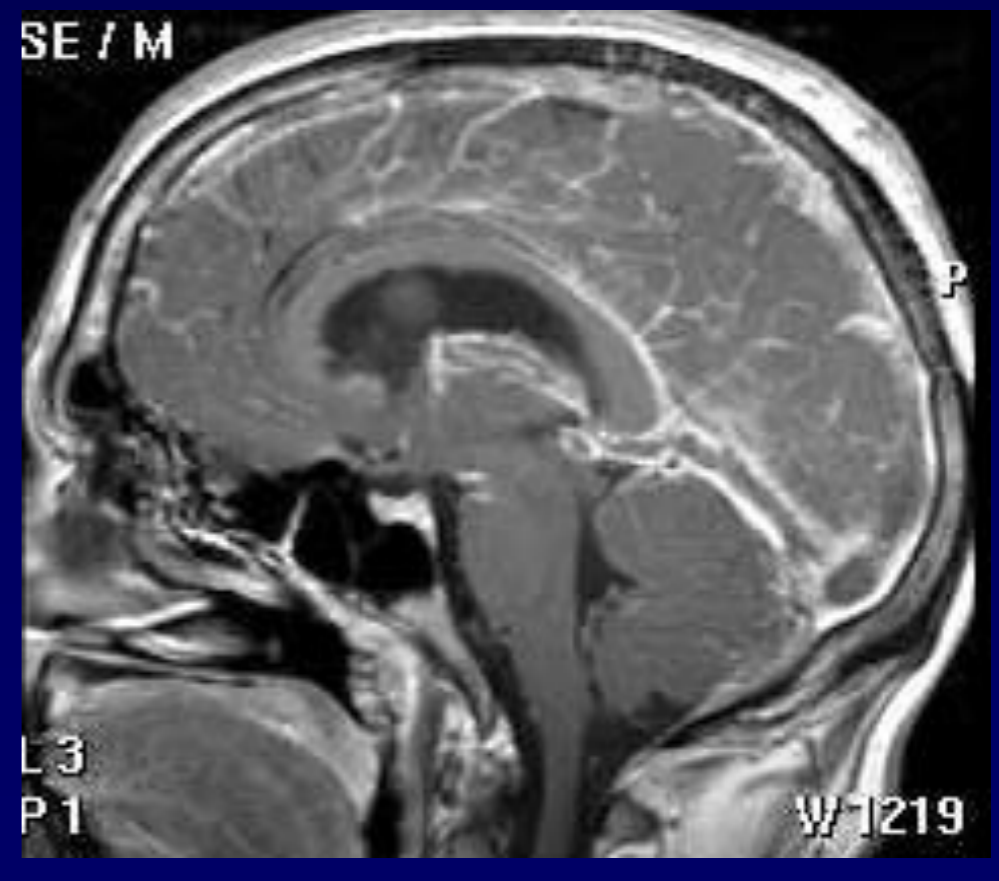
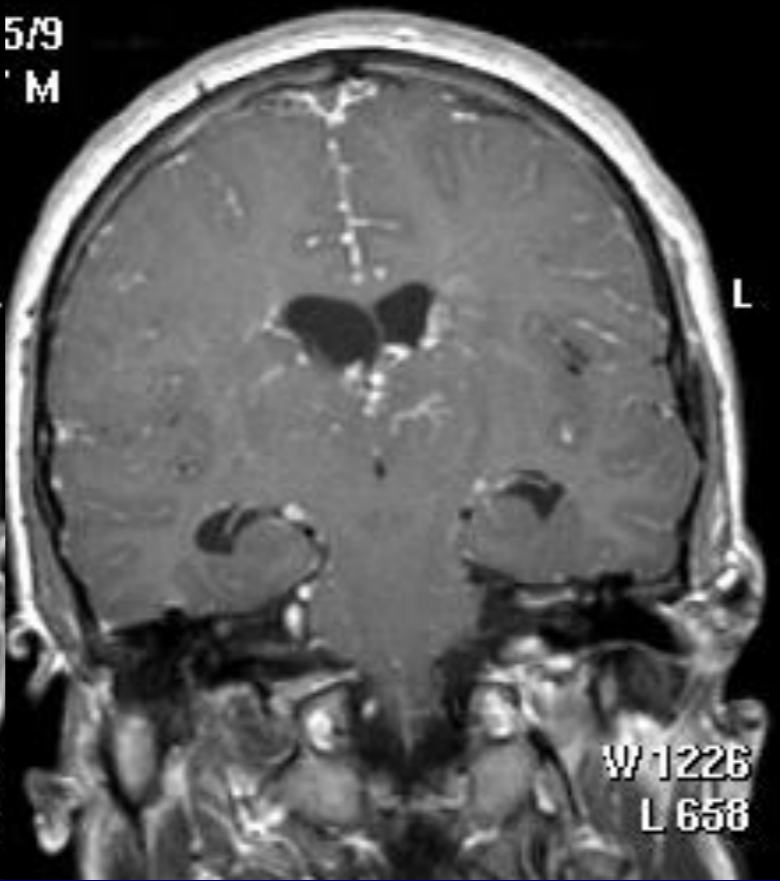
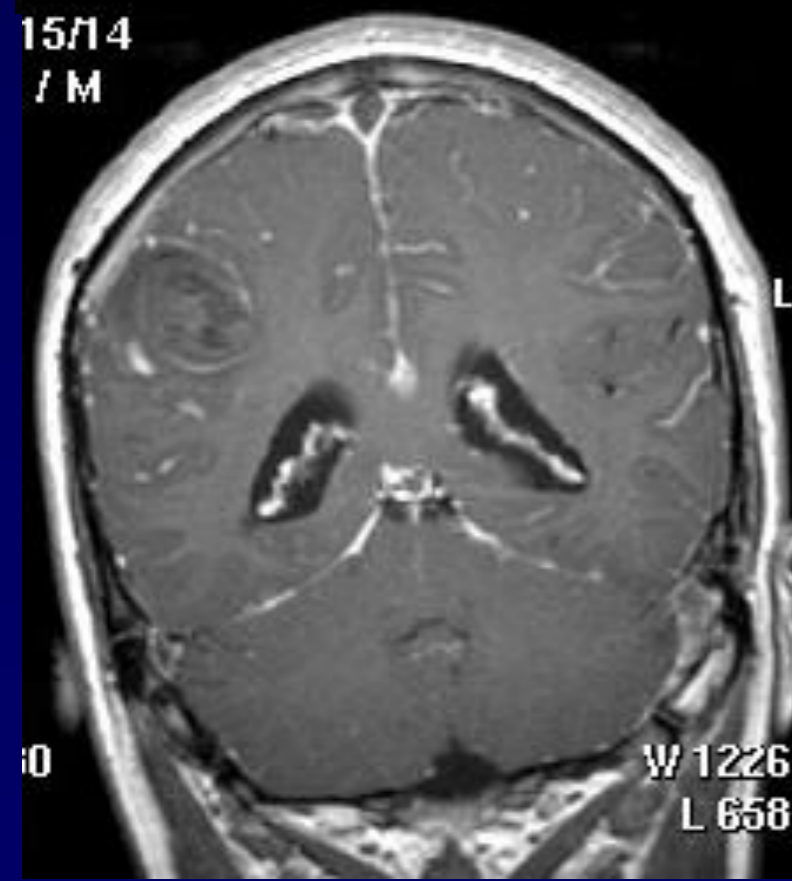
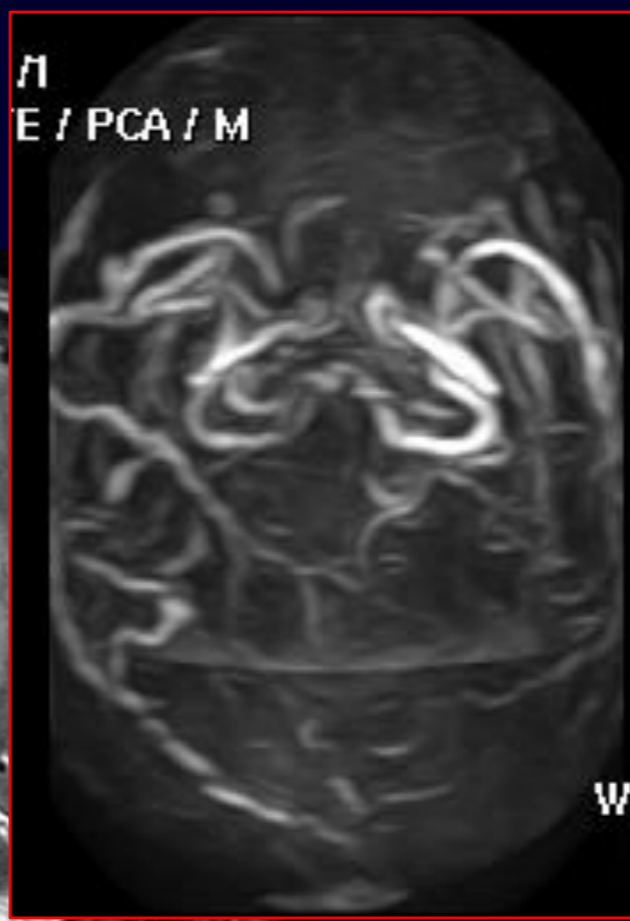
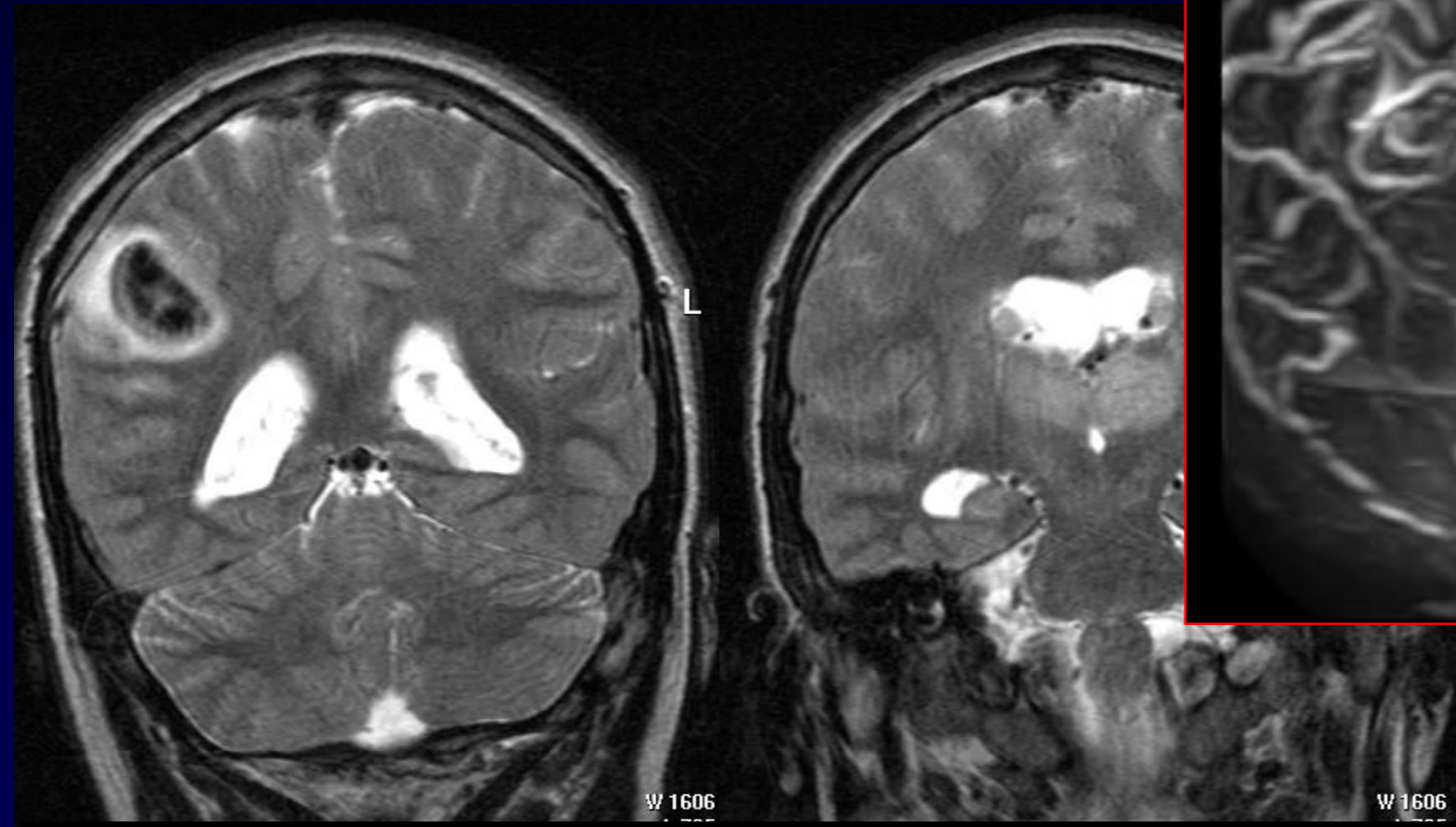
# Segno del DELTA: mancata opacizzazione del seno occluso con potenziamento

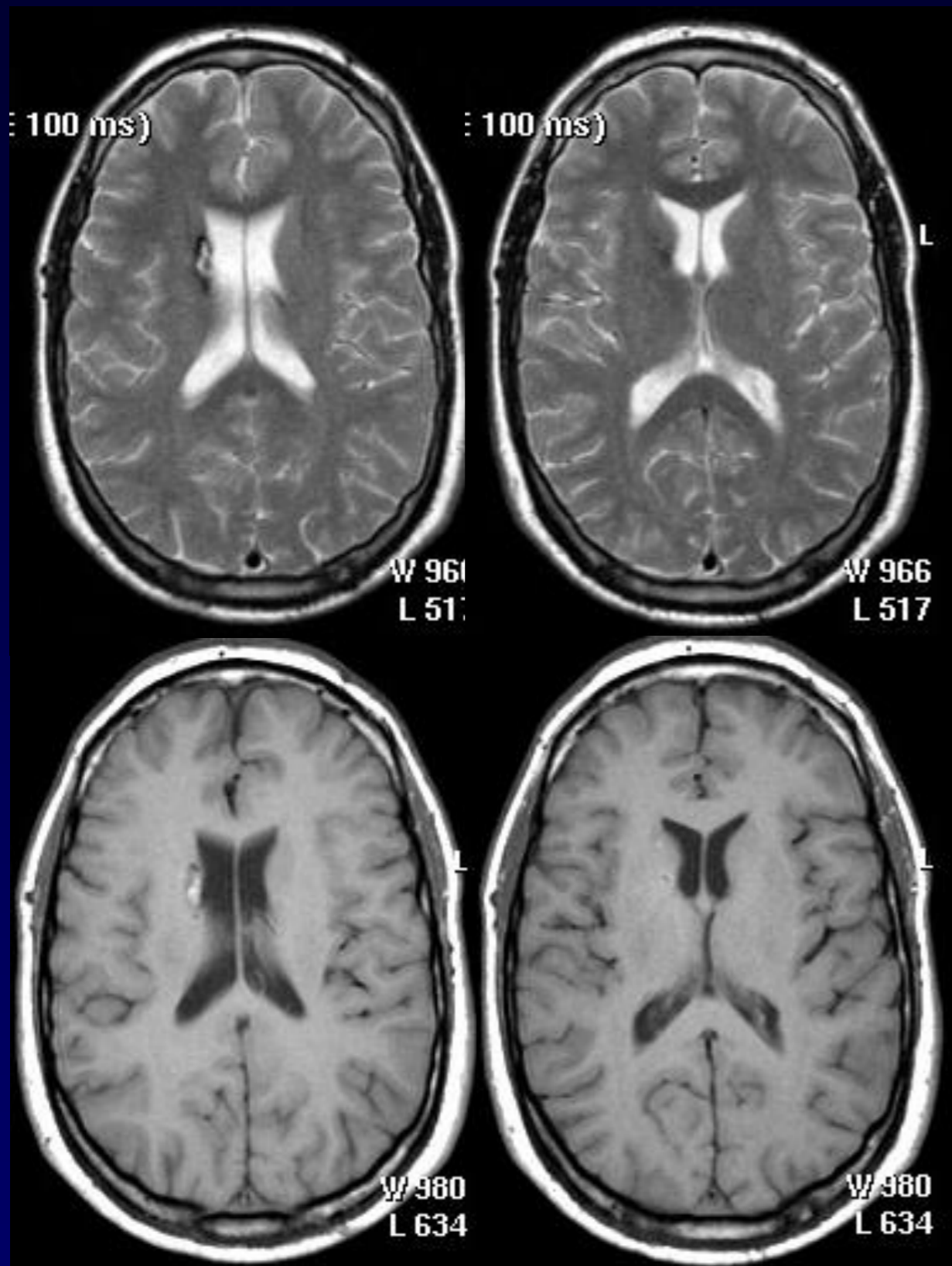


mdc (T1)



trombosi SSS, seni laterali, seno retto, VCI





.... 5 mesi dopo  
le vene sono ricanalizzate



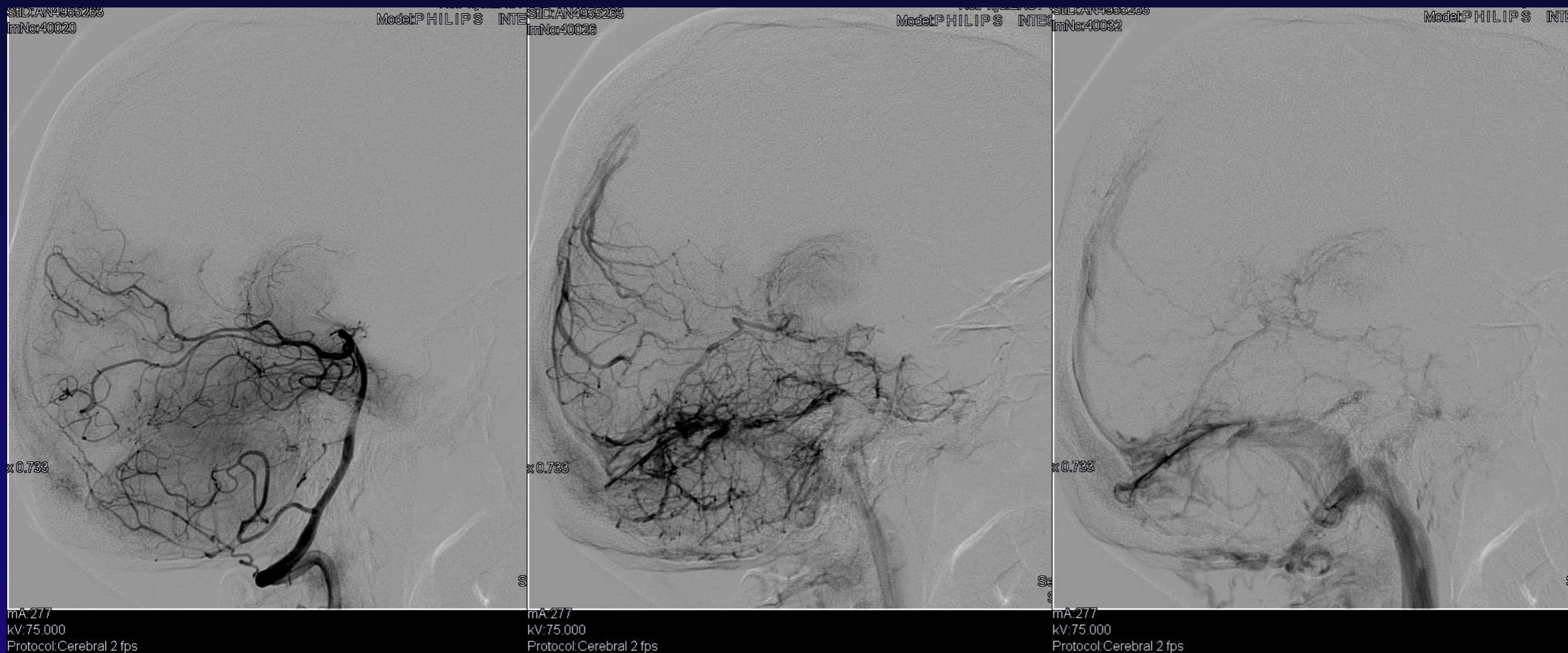
# TROMBOSI VENOSA CEREBRALE

La DSA non è più necessaria, ma a volte la trombosi è una diagnosi angiografica

*F, 46 aa*

*Inviata per ESA, GCS 15 al momento della DSA*

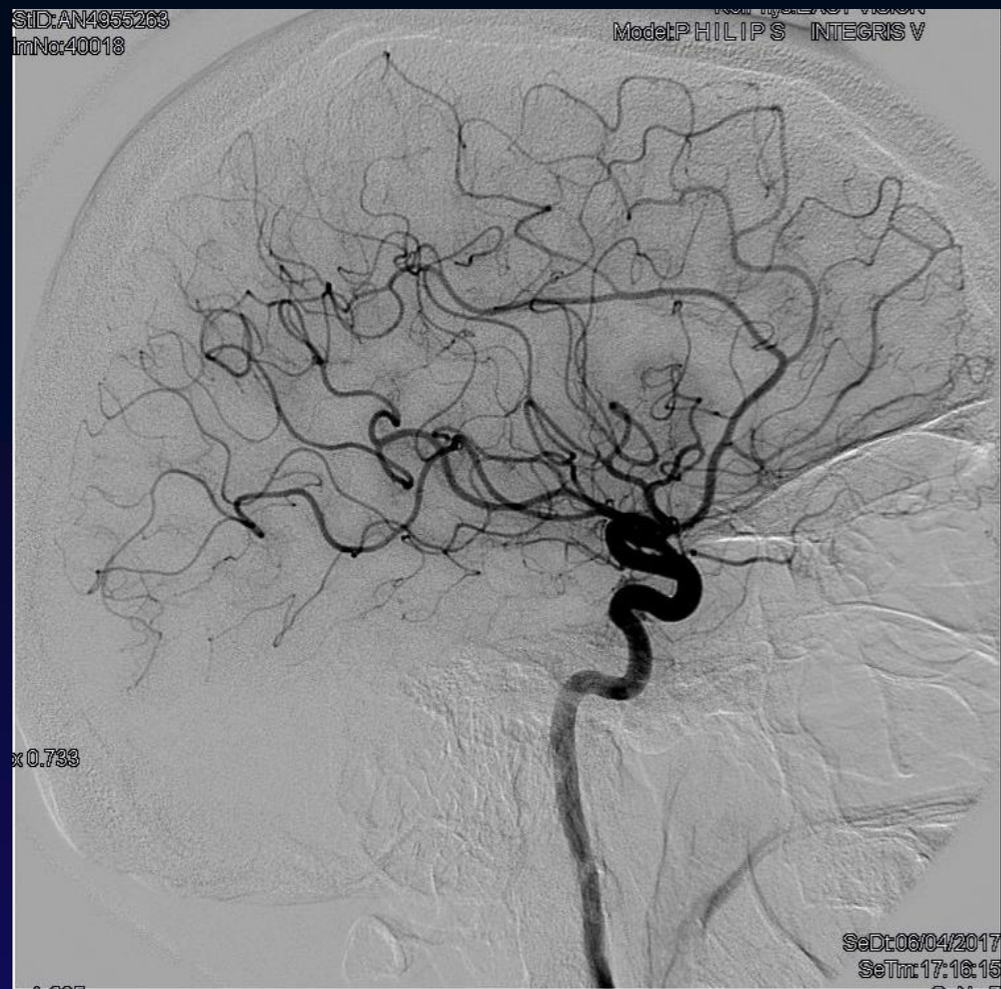
*Subito dopo rapido deterioramento stato di coscienza*



trombosi VCI, ampolla di Galeno, seno retto  
congestione vene talamiche

STD:AN4955263  
ImNo:40018

Model:PHILIPS INTEGRIS V



x0.733

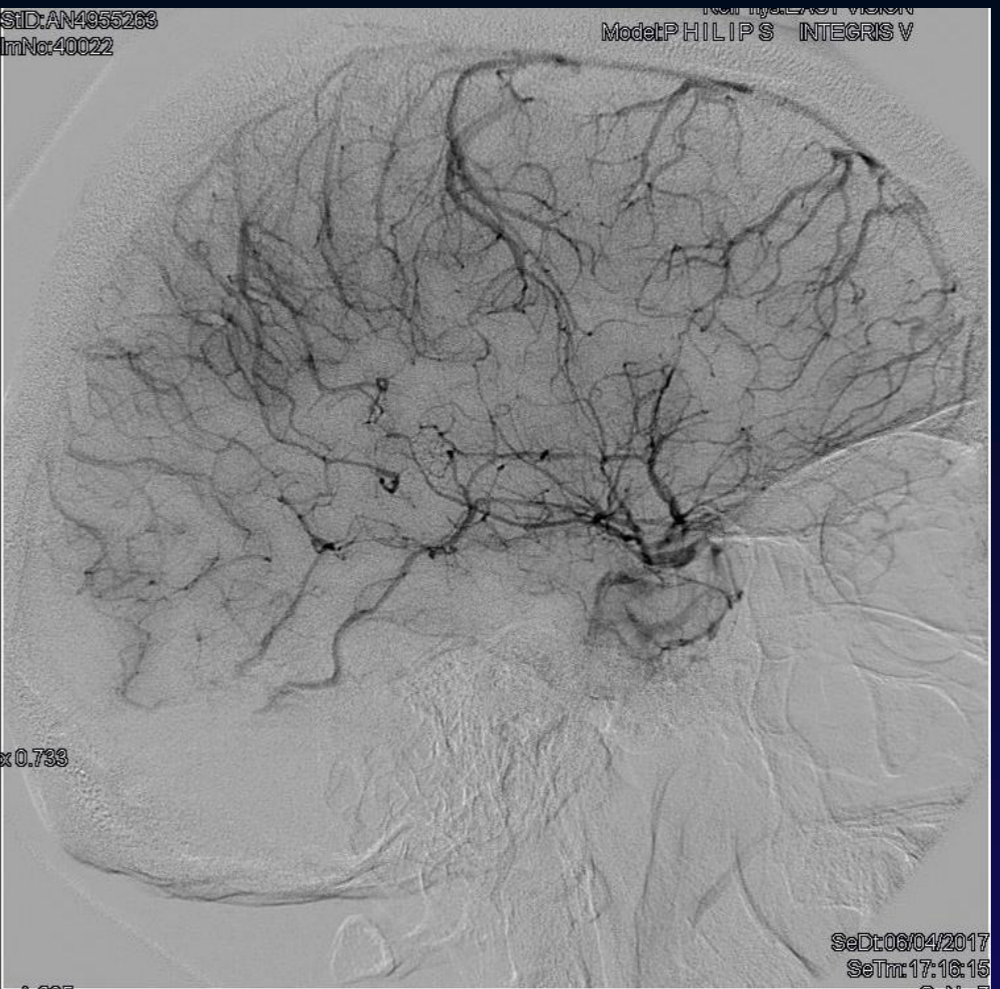
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mA:285

SeNo:7 mA:285

STD:AN4955263  
ImNo:40022

Model:PHILIPS INTEGRIS V



x0.733

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SeTm:17:16:15

SeNo:7

STD:AN4955263  
ImNo:40026

Model:PHILIPS INTEGRIS V



x0.733

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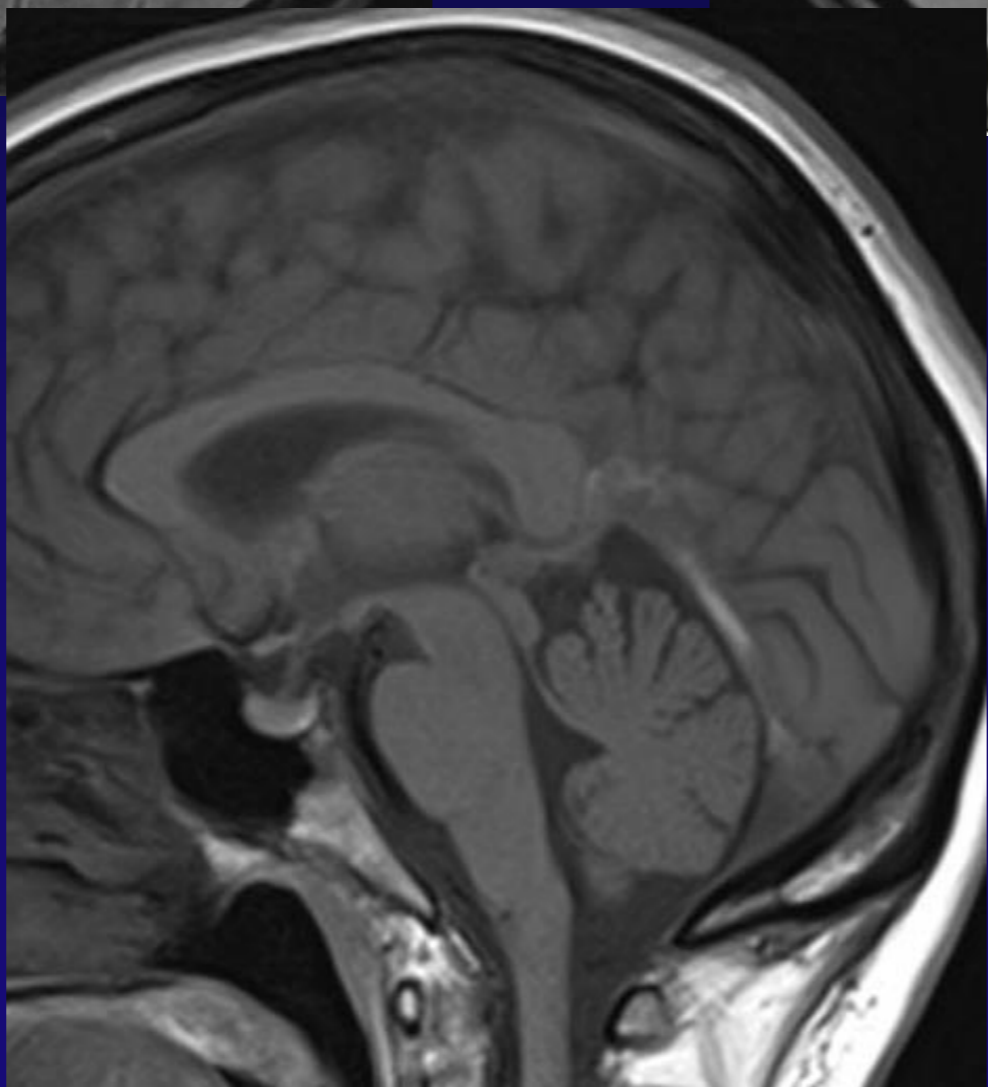
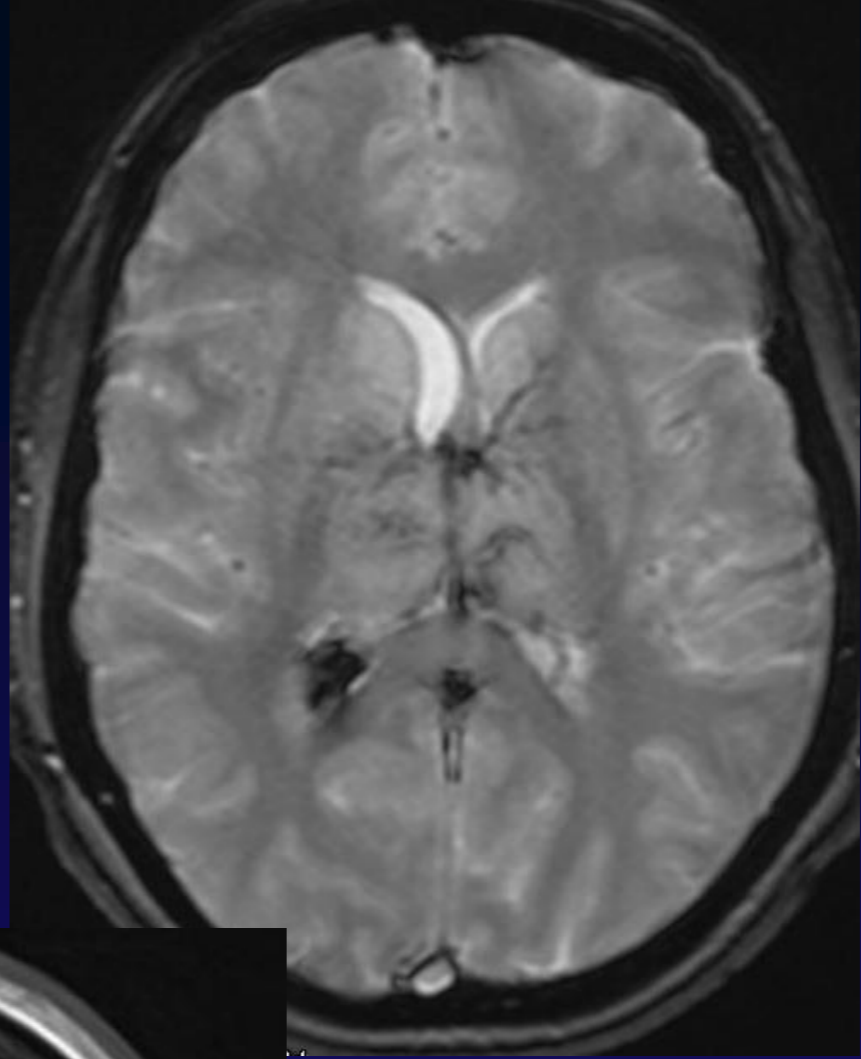
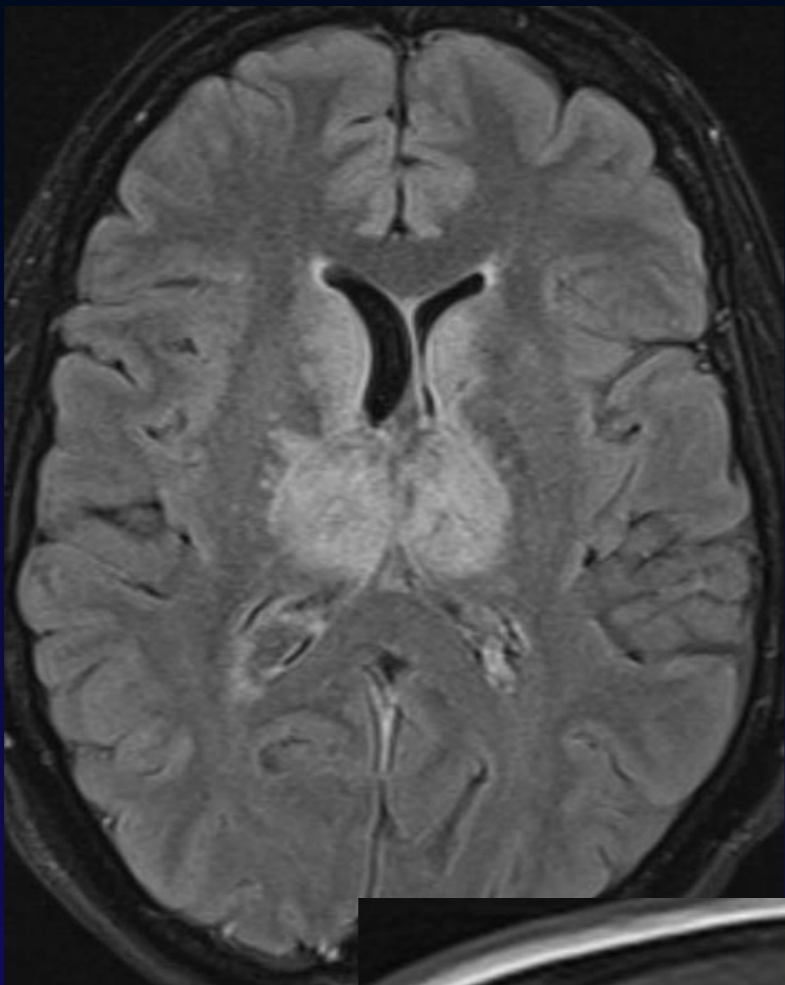
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SeNo:7





## TRATTAMENTO ENDOVASCOLARE

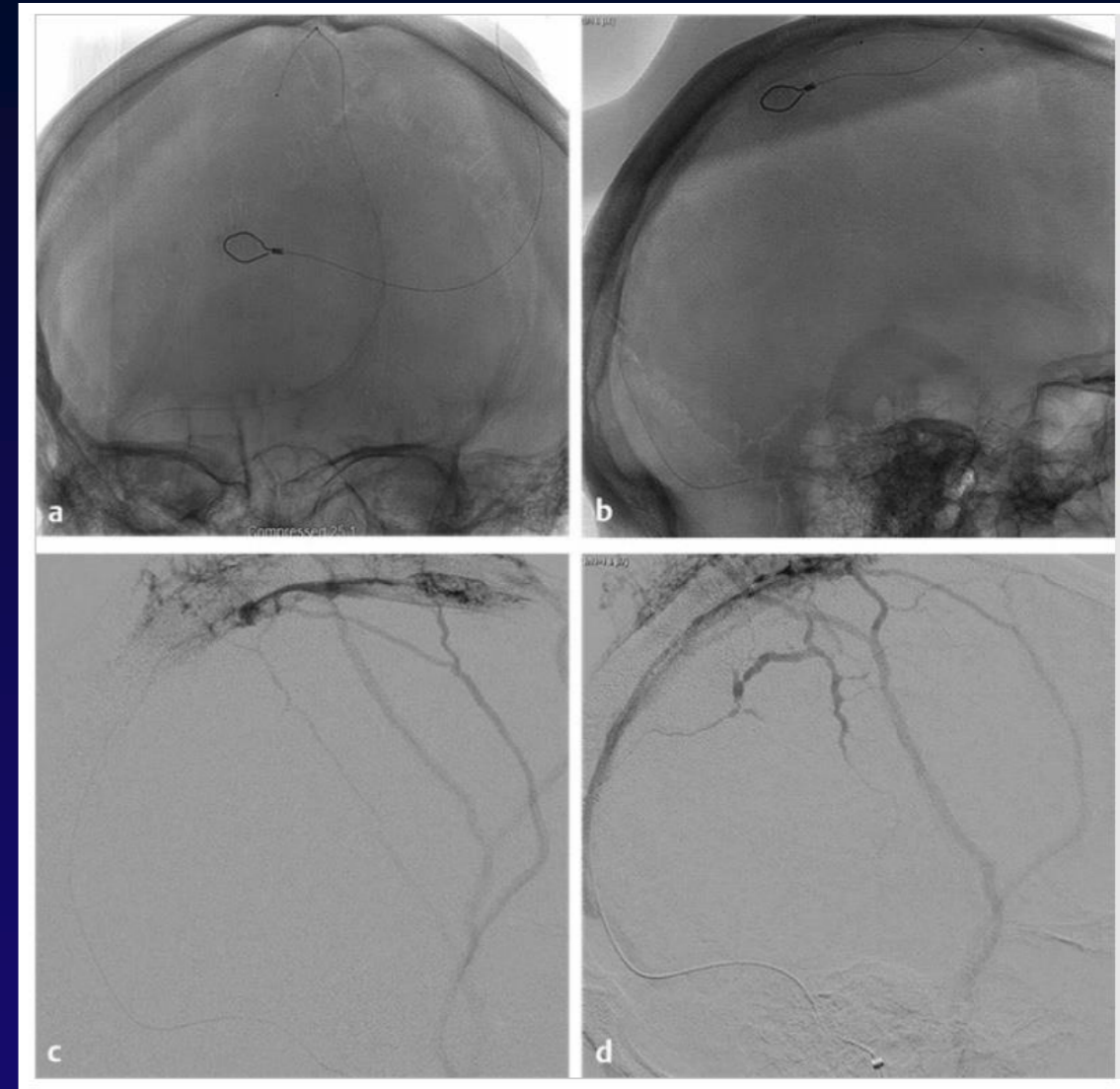
Trombolisi

Cateteri reolitici (Angiojet)

Tromboaspirazione

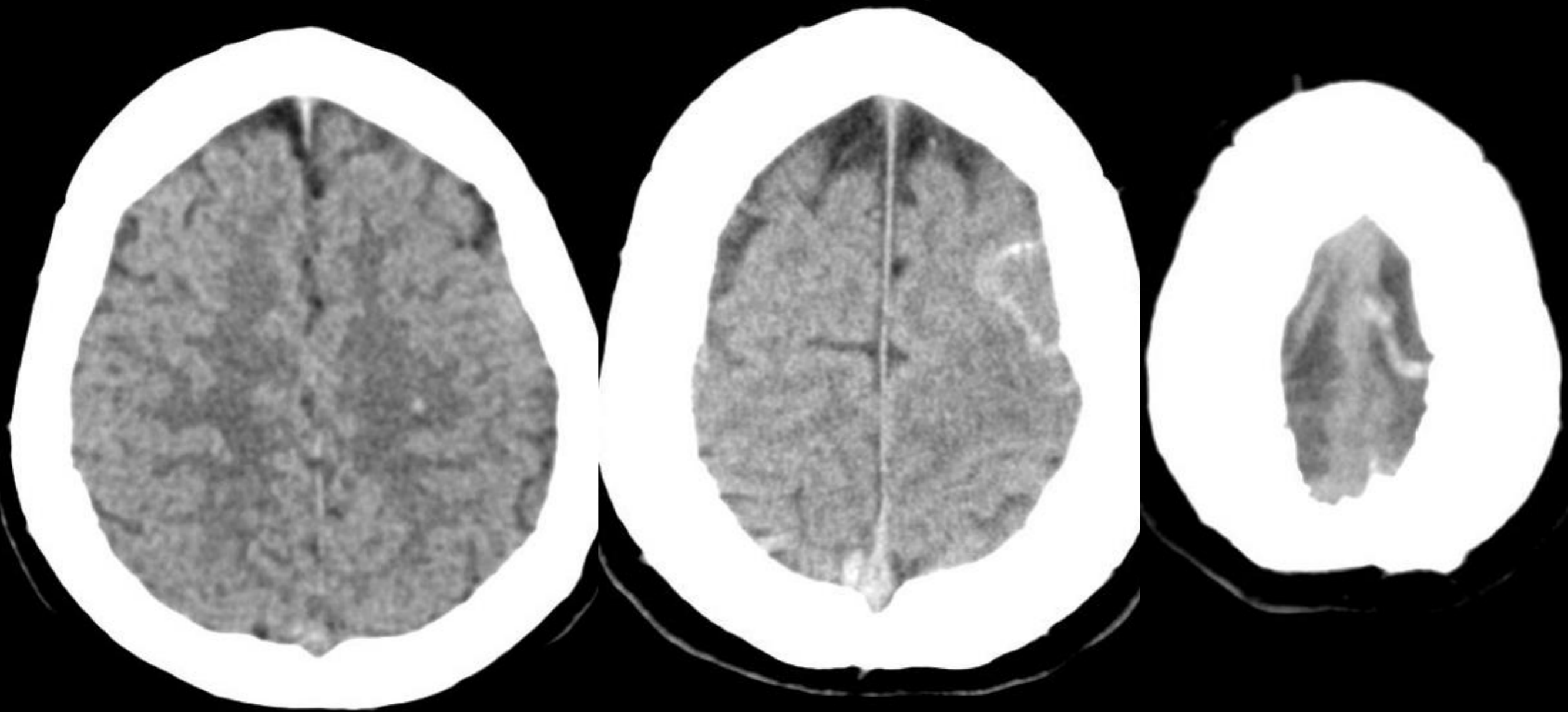
Trombectomia

Trattamento poco codificato, riservato raramente a casi resistenti alla terapia medica

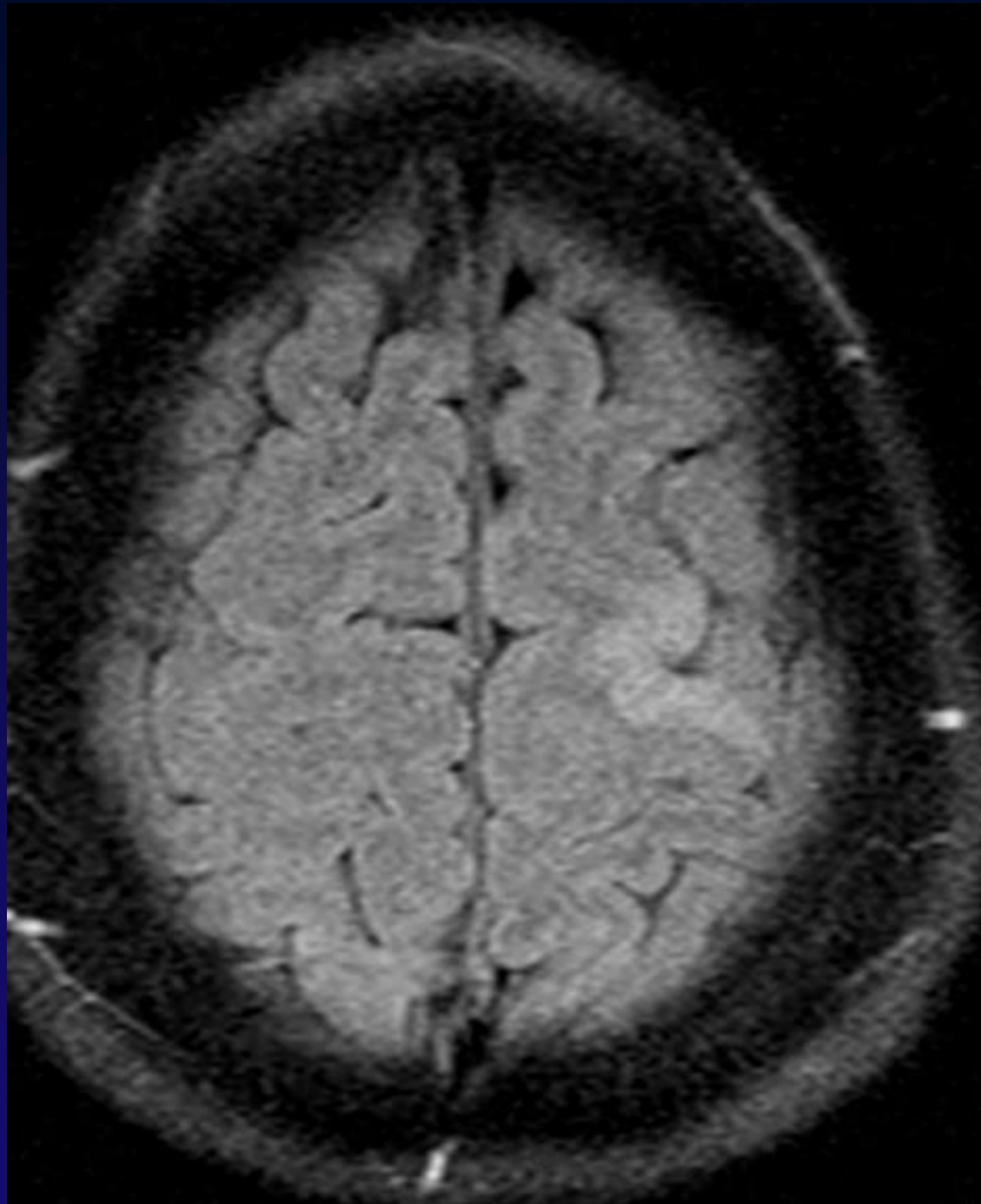


# TROMBOSI VENOSA CORTICALE

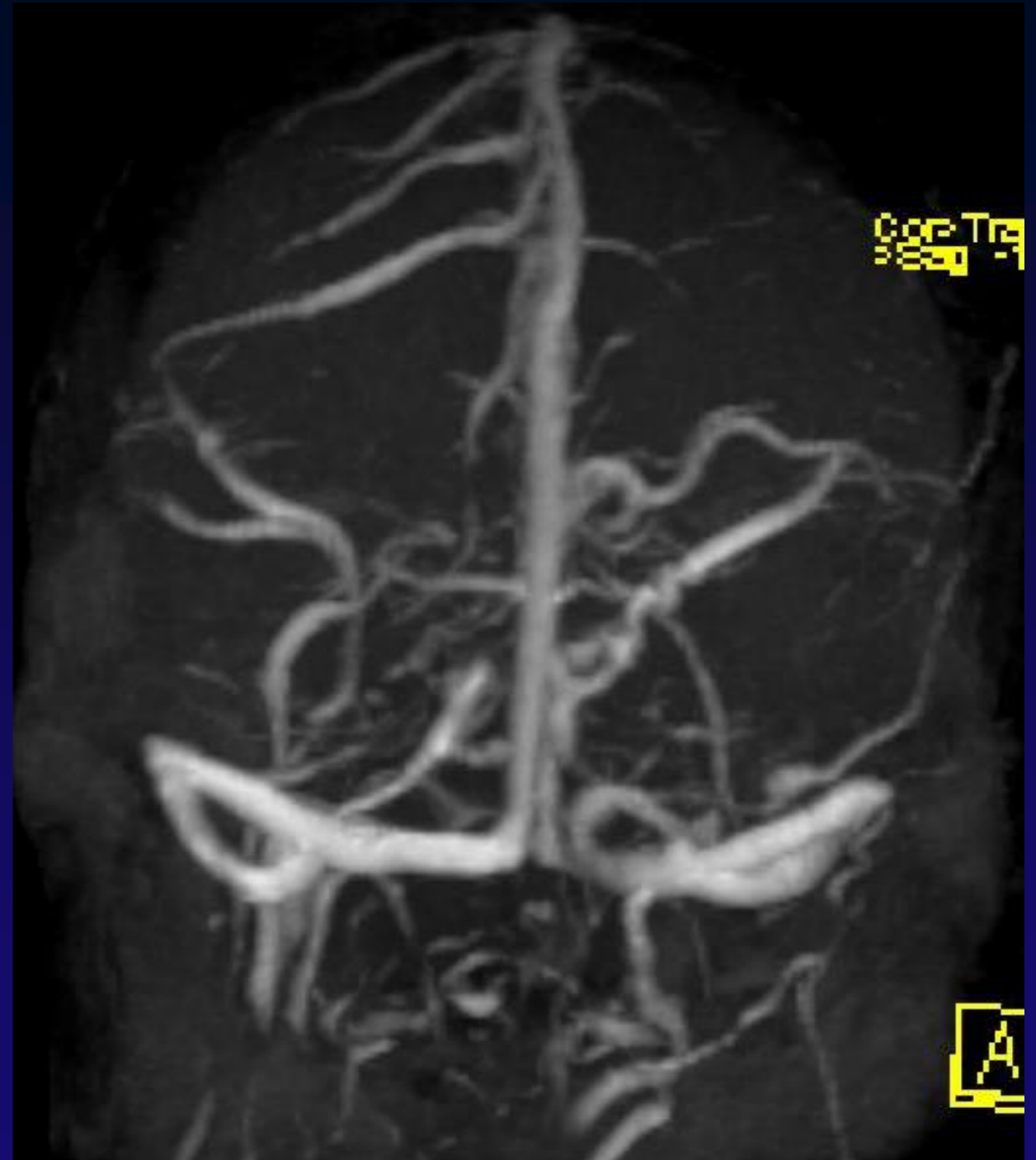
M, 43 anni  
Cefalea



- Petecchia emorragica sottocorticale
- ESA corticale
- Iperdensità della vena trombizzata

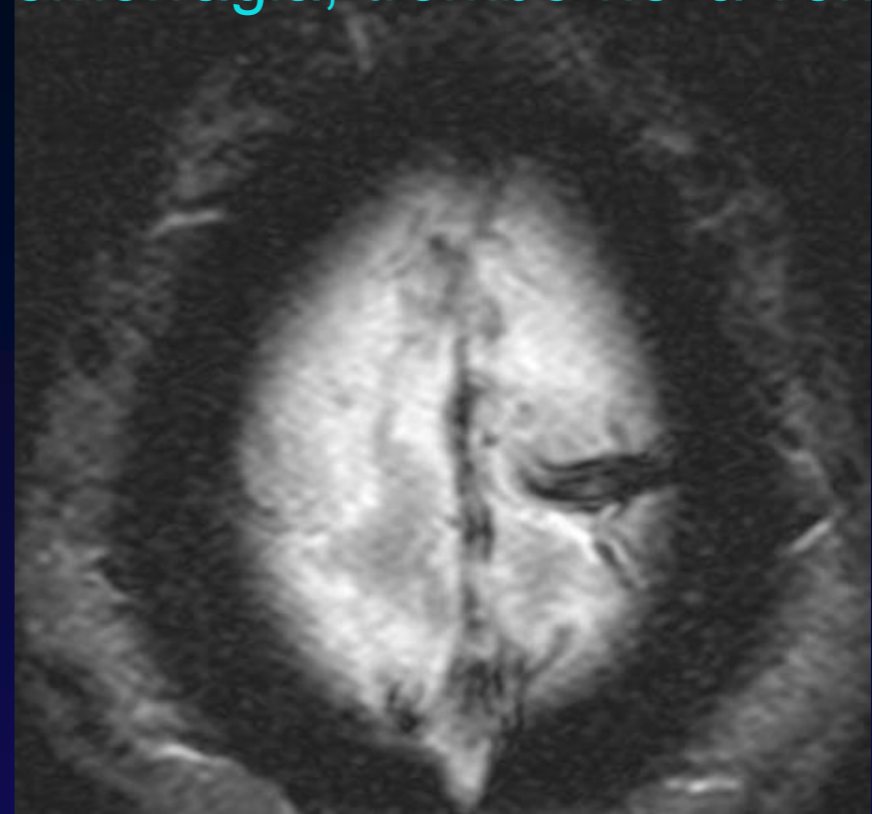
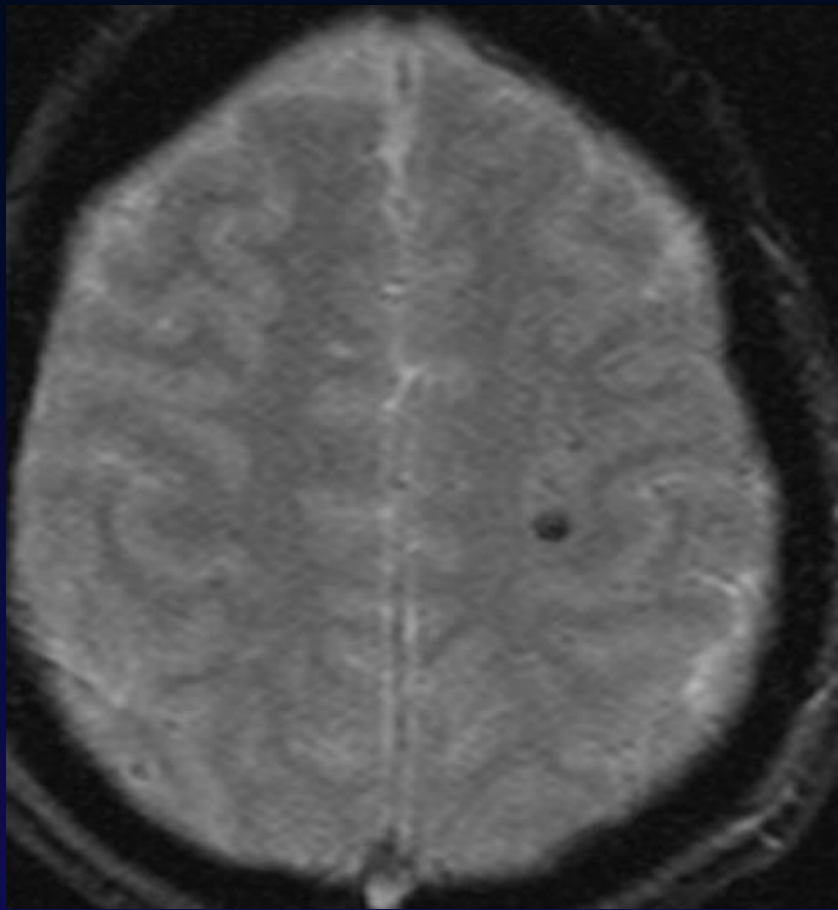


Edema cortico-sottocorticale

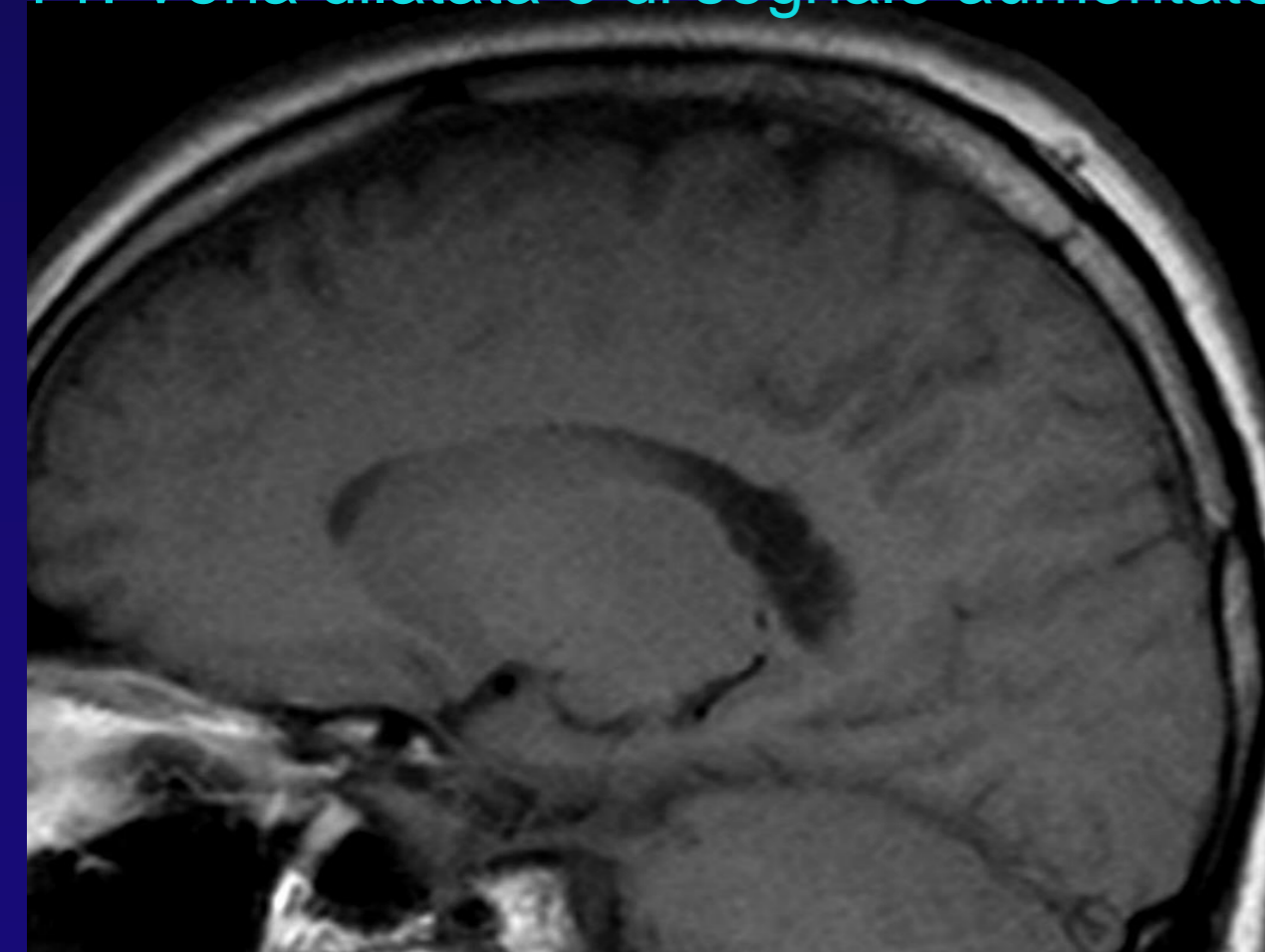


Segnale della vena assente in angio-RM

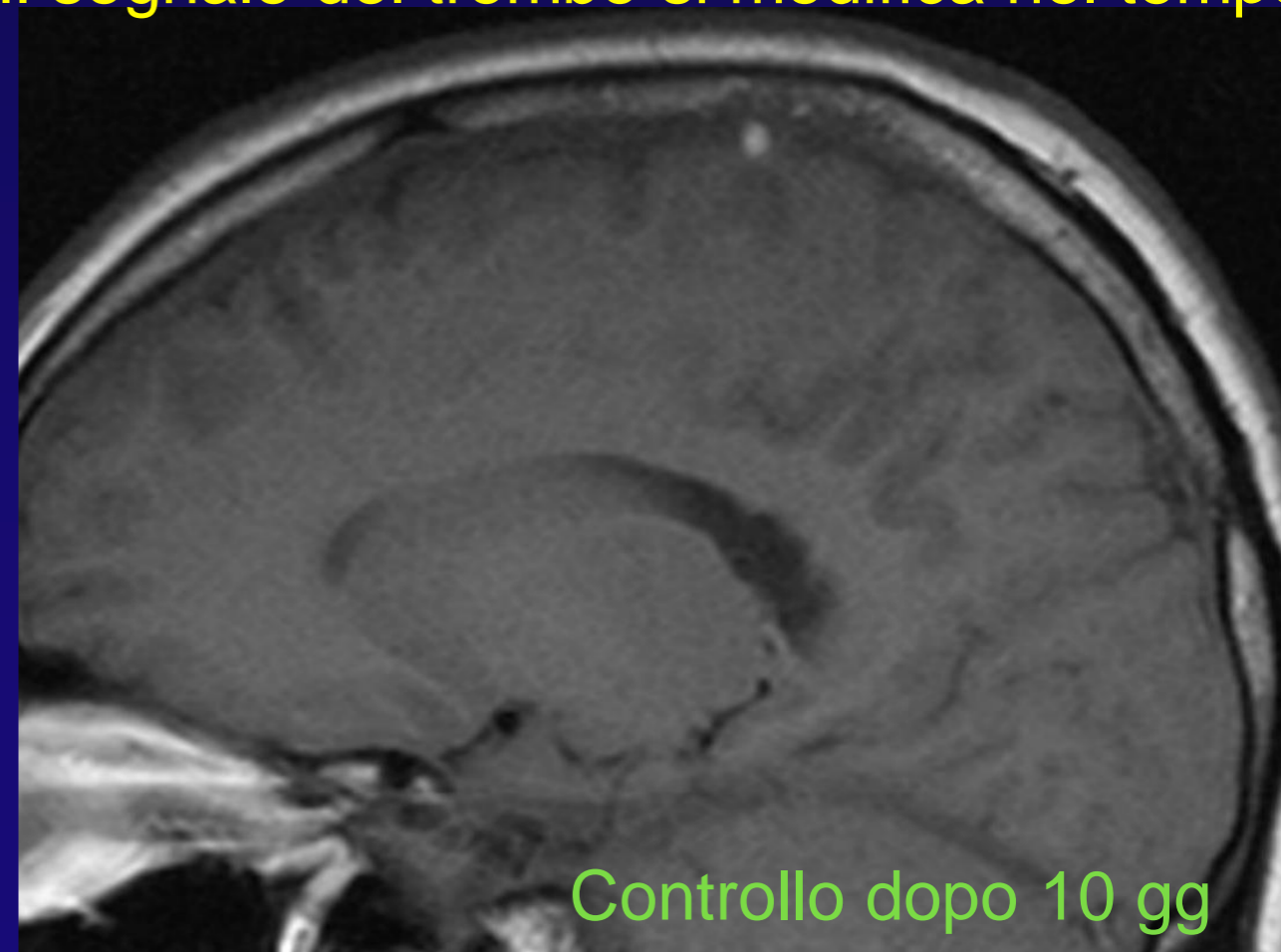
GE: emorragia, trombo nella vena



T1: Vena dilatata e di segnale aumentato



Il segnale del trombo si modifica nel tempo



# FISTOLE ARTERO-VENOSE DURALI

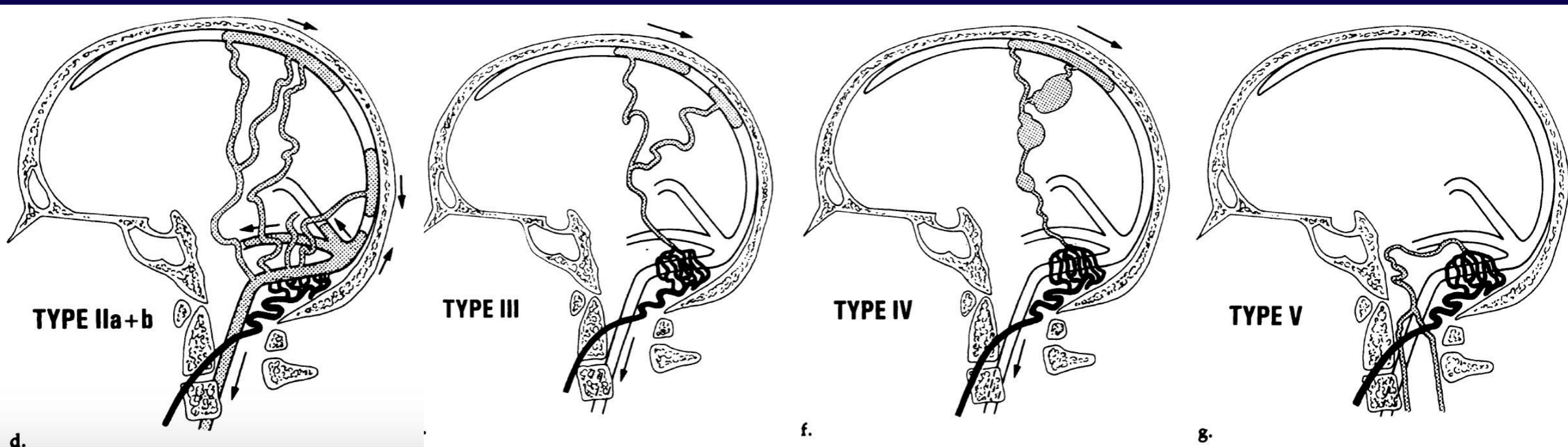
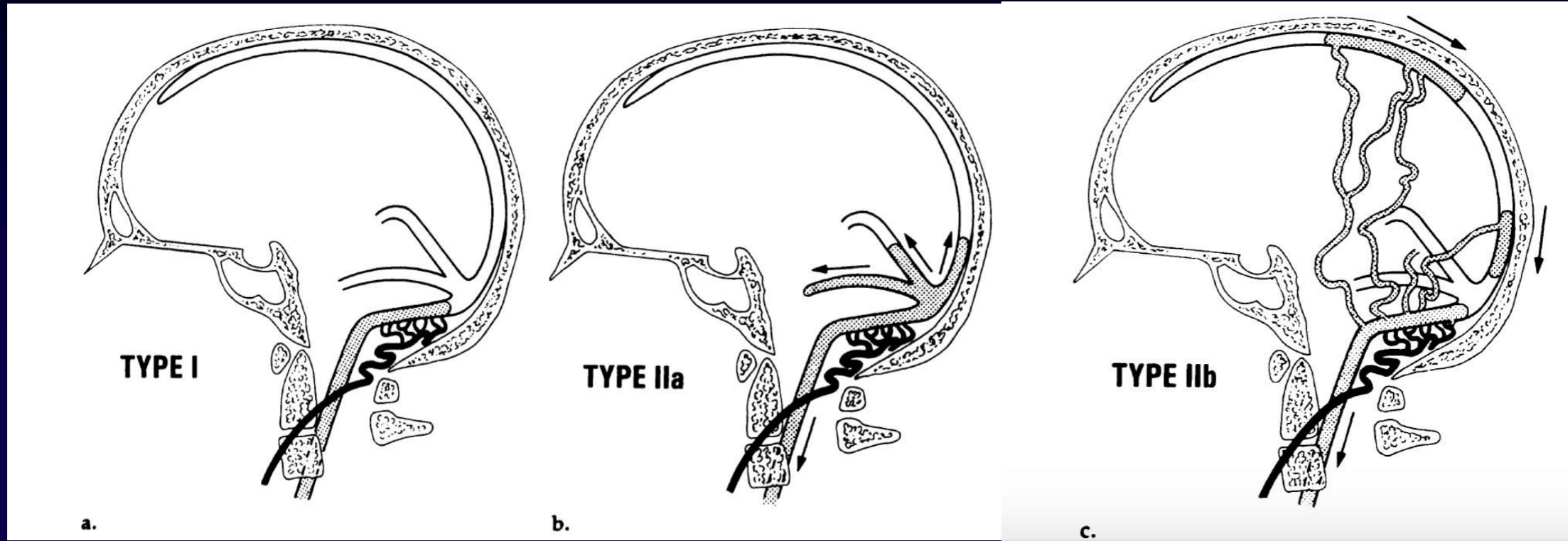
- Fistole arterovenose localizzate a livello della dura
- Multipli feeders arteriosi durali convergono verso un seno venoso e una vena corticale
- Lesioni acquisite (traumi? trombosi?)
- Sintomi variabili in base alla sede e all'angioarchitettura
- Spesso asintomatiche
- Sintomatiche: emorragia intra o extrassiale, acufeni, disturbi oculari, deficit nervi cranici, mielopatia, ecc
  
- TC e RM spesso negative
- Vasi venosi durali ectasici; trombosi venose
- Angiografia necessaria per diagnosi e stadiazione

**IN CASO DI EMORRAGIE ATIPICHE: ANGIOGRAFIA!**

Venous drainage pattern: intracranial DAVM		See Figure 4.13	Classification		
Site of shunt	Venous outflow		Djindjan	Cognard	Borden
Dural sinus/meningeal vein	Sinus, antegrade	A	1	1	1
Dural sinus/meningeal vein	Sinus, ante/retrograde	B	1	2/A	1
Dural sinus/meningeal vein with sinus occlusion	Sinus, retrograde	C	1	2/A	1
Dural sinus/meningeal vein	Sinus antegrade + reflux into subarachnoid vein	D	2	2/B	2
Dural sinus/meningeal vein	Sinus ante/retrograde + reflux into subarachnoid vein	E	2	2/A+B	2
Subarachnoid vein	Subarachnoid vein	F	3	3	3
Isolated sinus with reflux into subarachnoid vein	Subarachnoid vein	G	3	3	3
Venous lake	Subarachnoid vein	H	4	4	3
Spinal perimedullary vein	Subarachnoid vein	J	3	5	3

- Correlazione prognostica tra grado sec. Cognard e rischio emorragico!
- Quelle di tipo I sono da considerare benigne

# CLASSIFICAZIONE DI COGNARD



All'aumentare del grado aumenta il rischio emorragico

# TRATTAMENTO

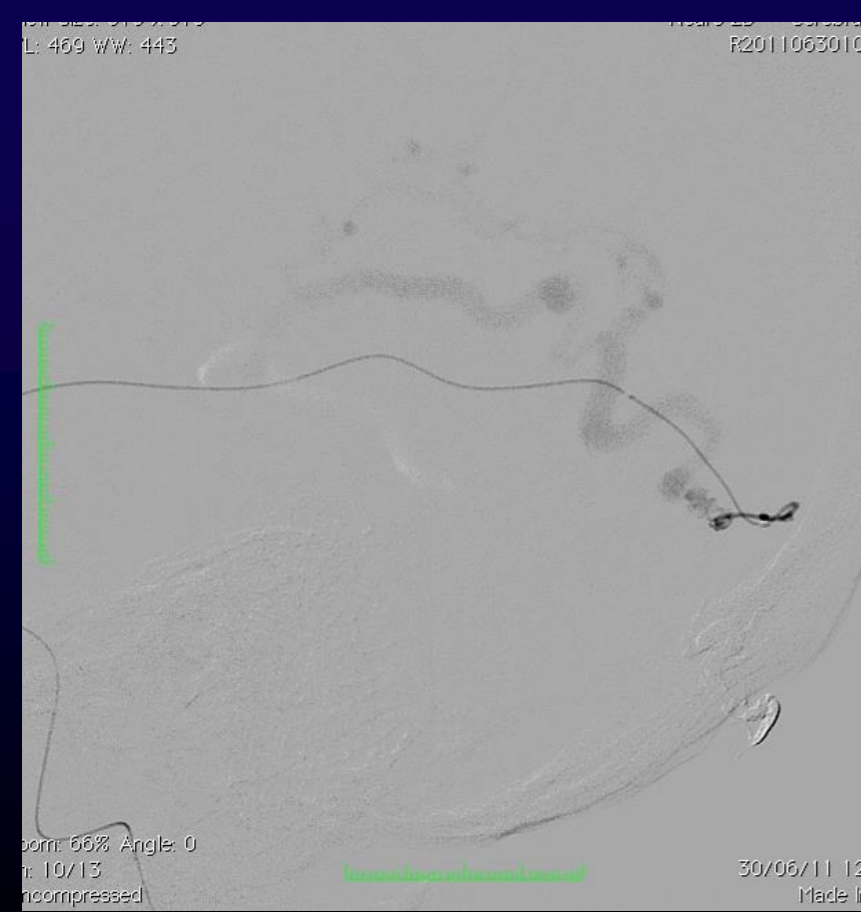
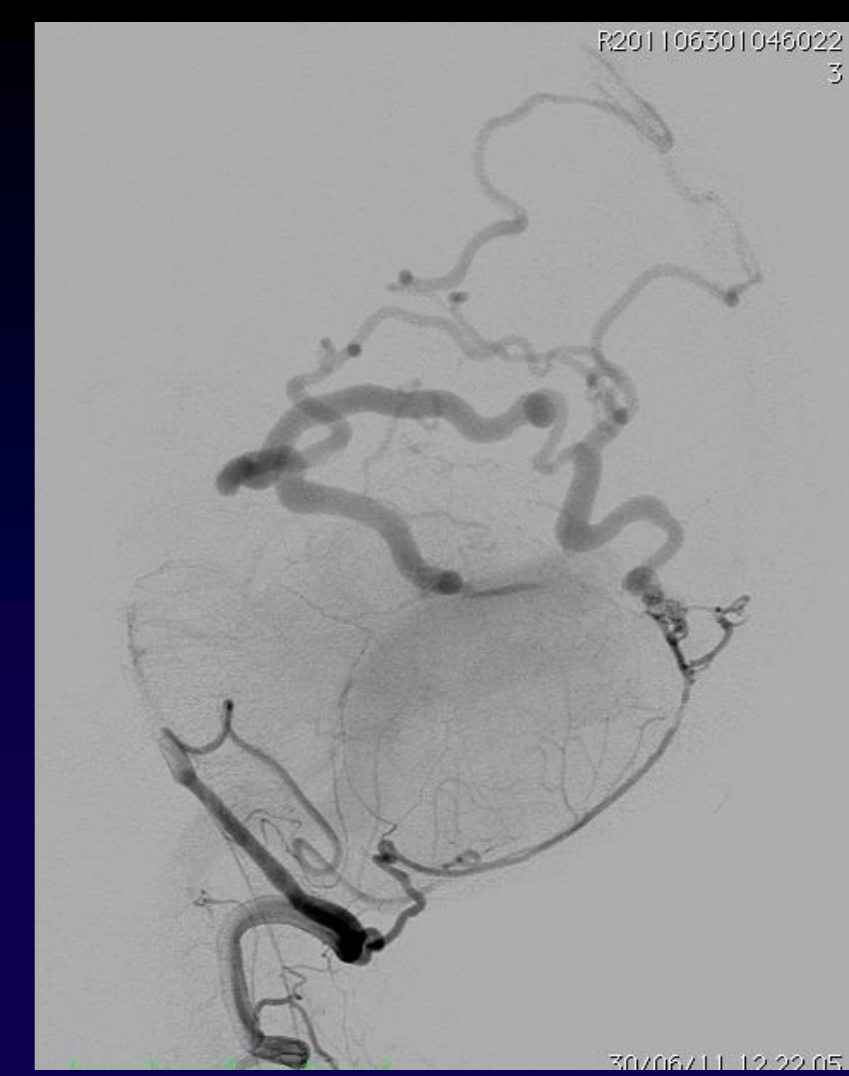
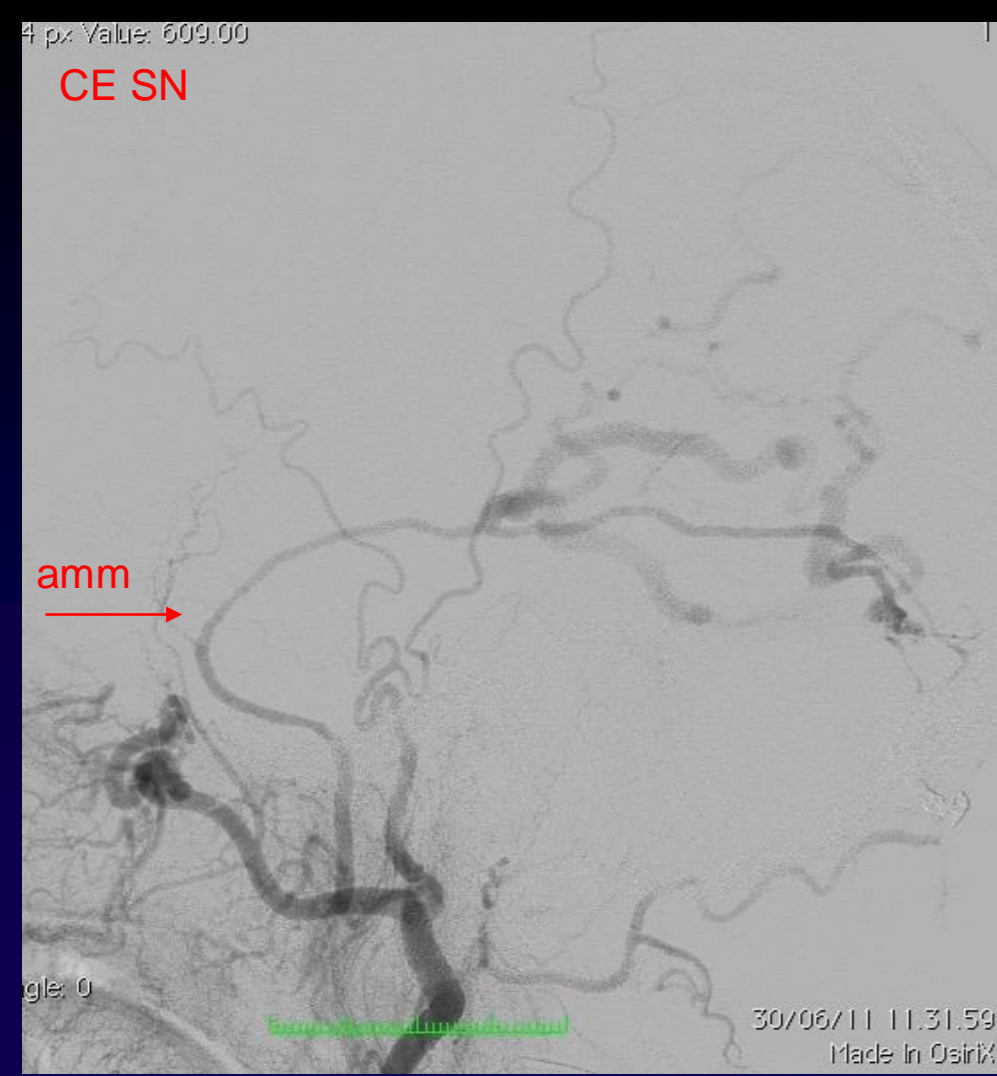
- Chirurgia possibile con buoni risultati in alcune sedi anatomiche
- Embolizzazione è terapia di scelta. Permette solitamente la cura completa o, in casi selezionati, la riduzione di flusso della fistola a fini palliativi

## Embolizzazione

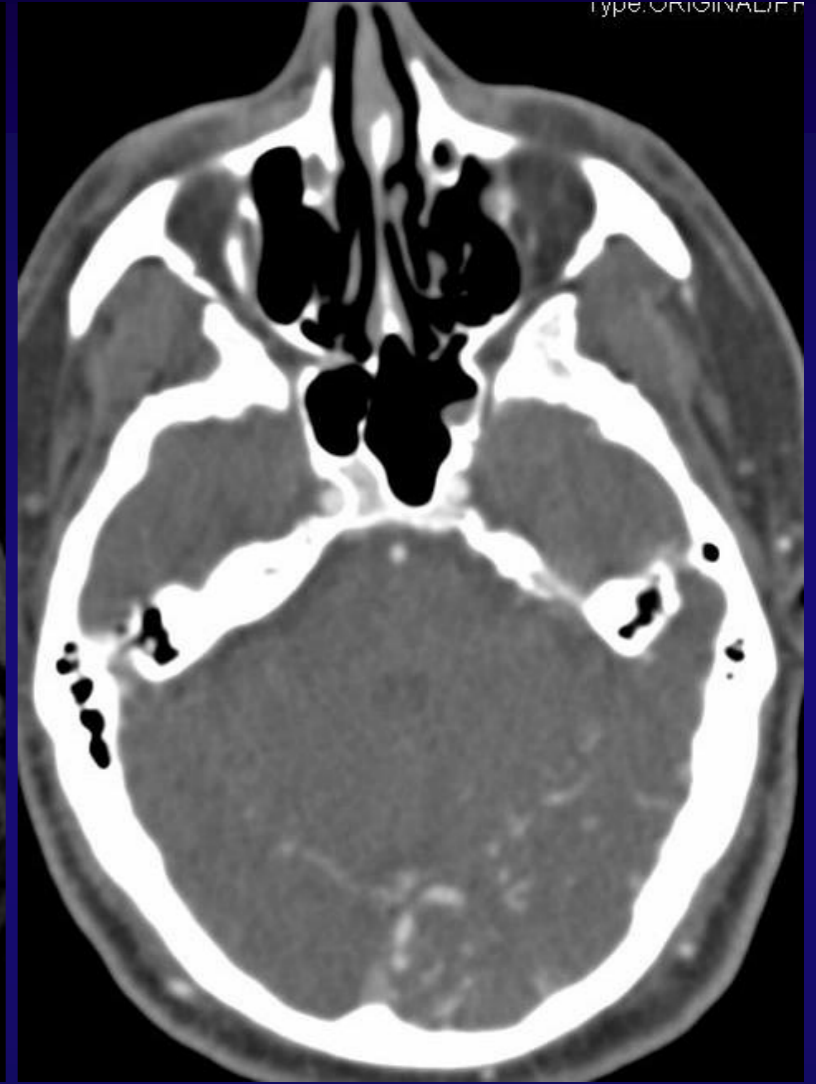
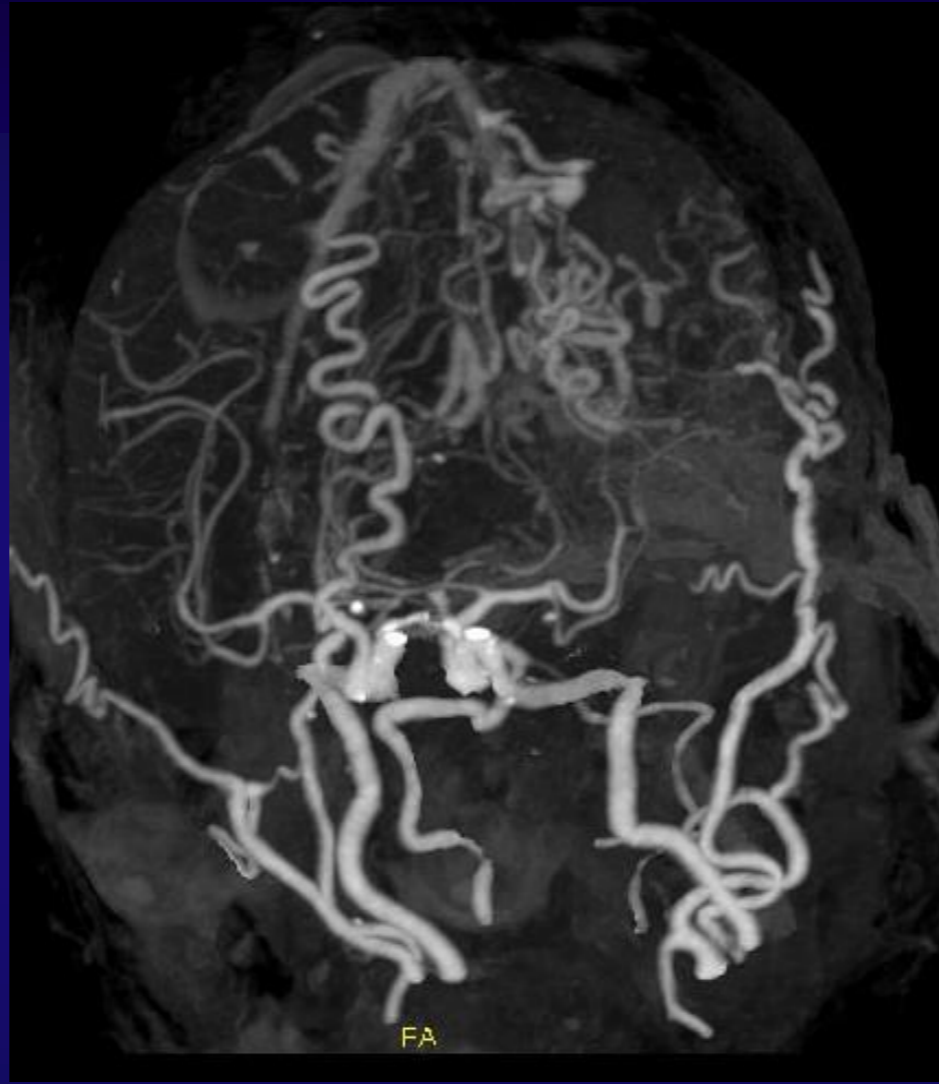
**Arteriosa:** Occlusione delle afferenze, la cura si ottiene solo se si raggiunge il punto di shunt A-V (occlusione della testa della vena).

**Venosa:** quando possibile si occlude il seno venoso dove drena la fistola; possibile se il seno non raccoglie anche drenaggio normale.



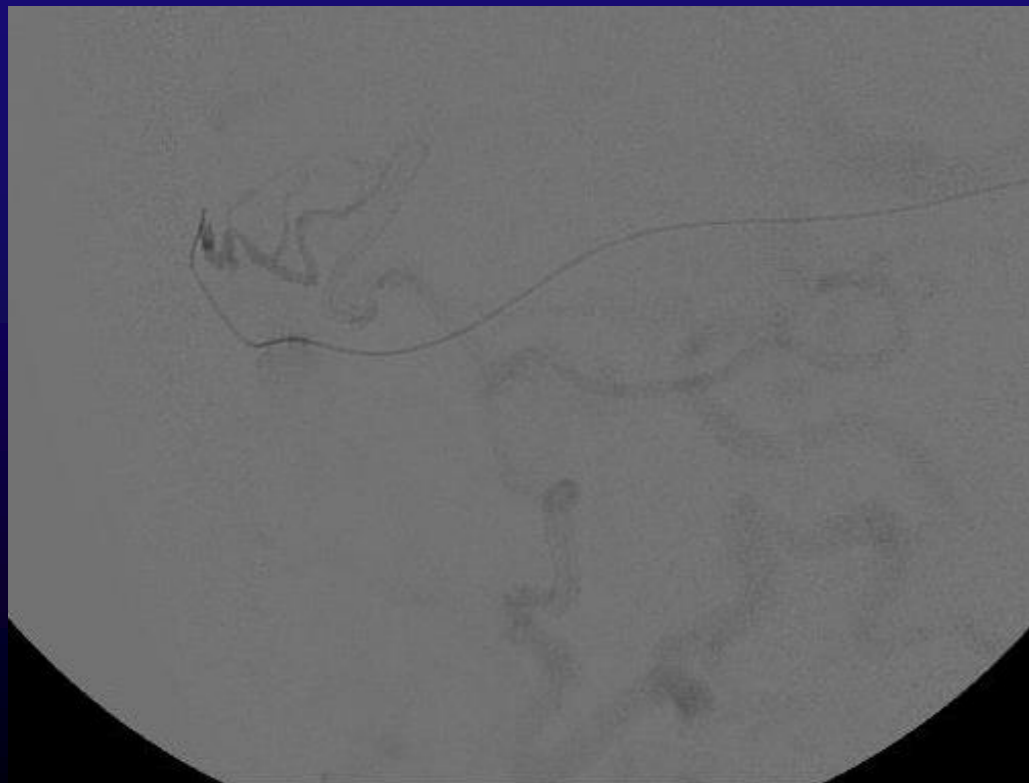
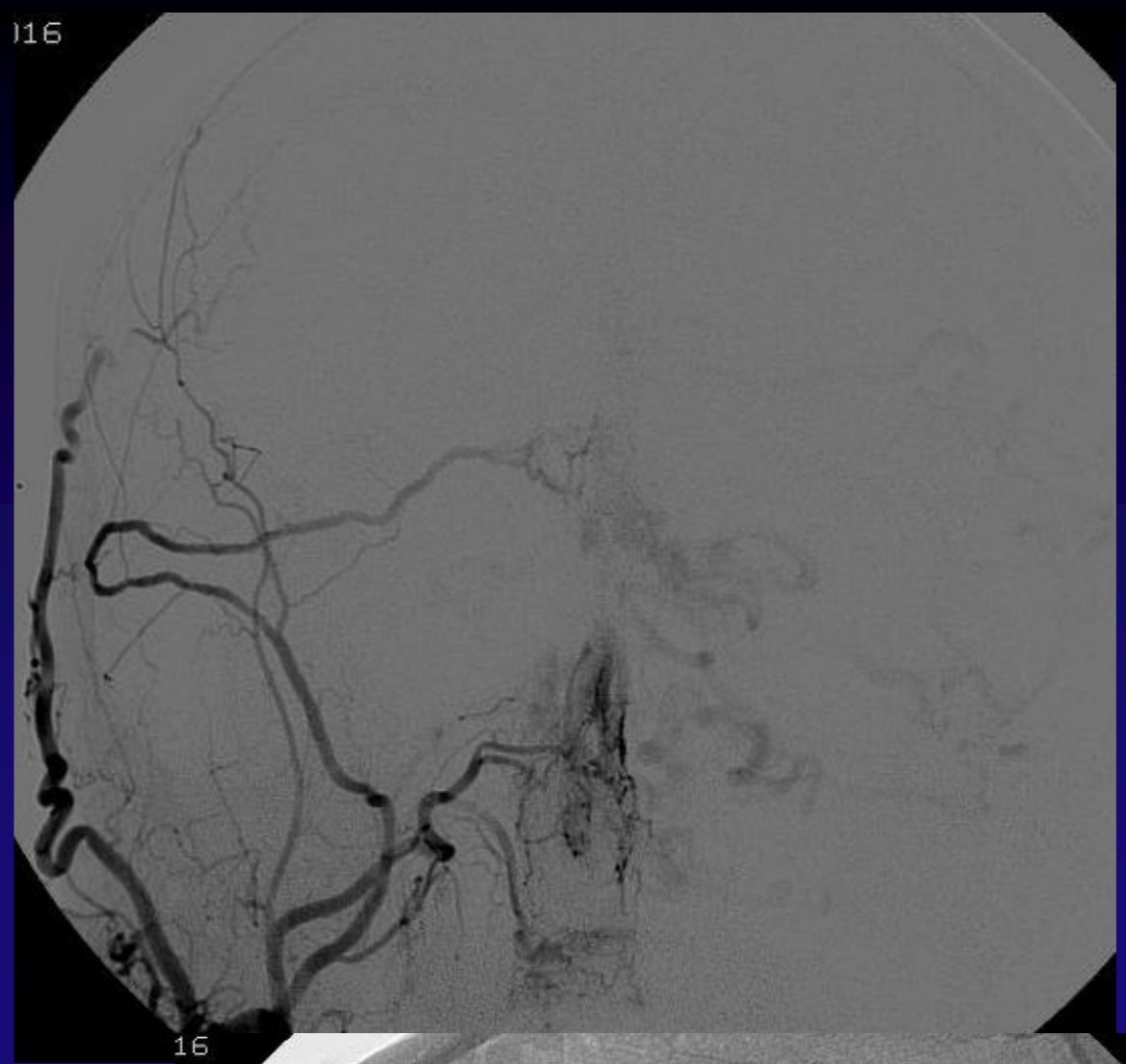


# FISTOLE ARTERO-VENOSE DURALI



Ematoma in sede atipica

# Embolizzazione con ONYX



116

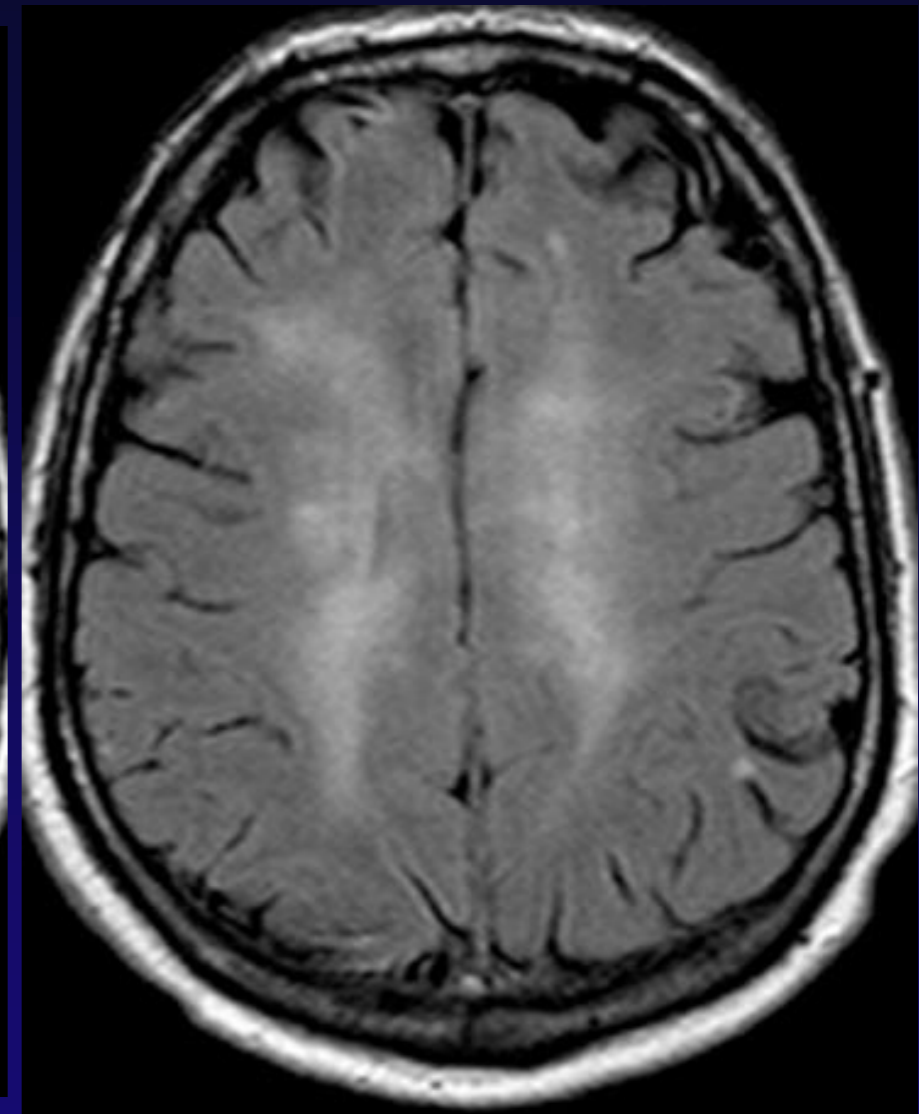
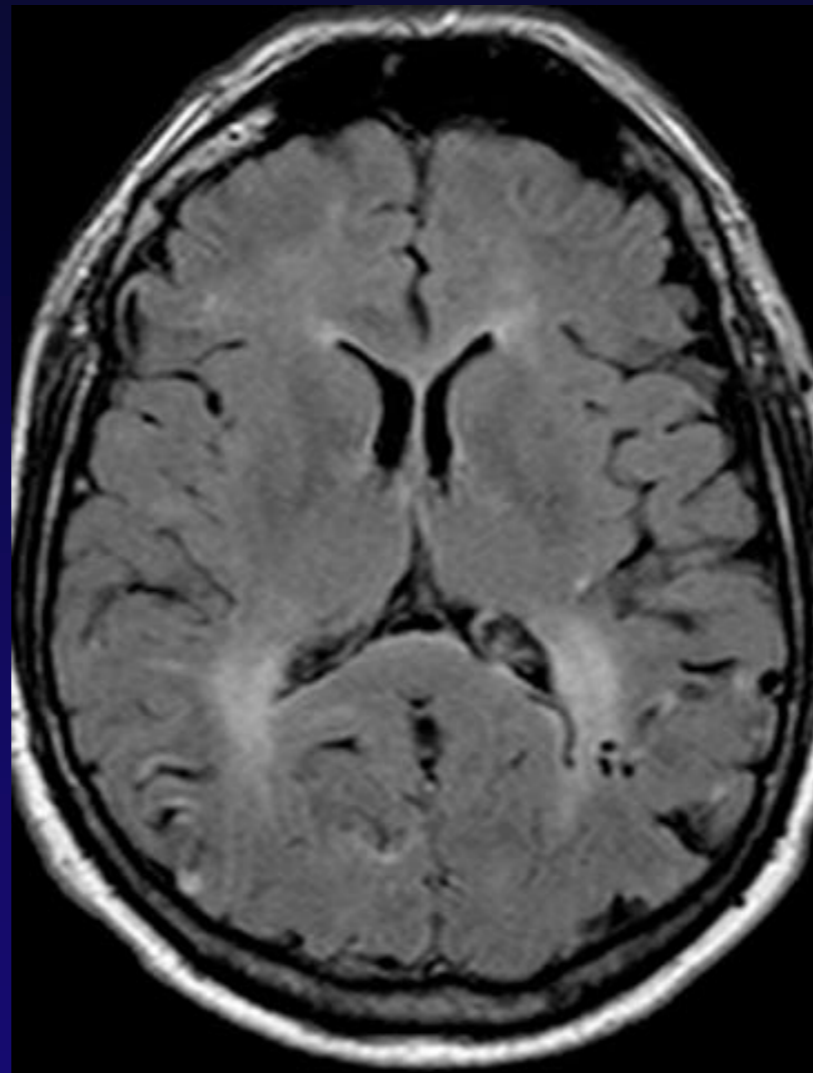
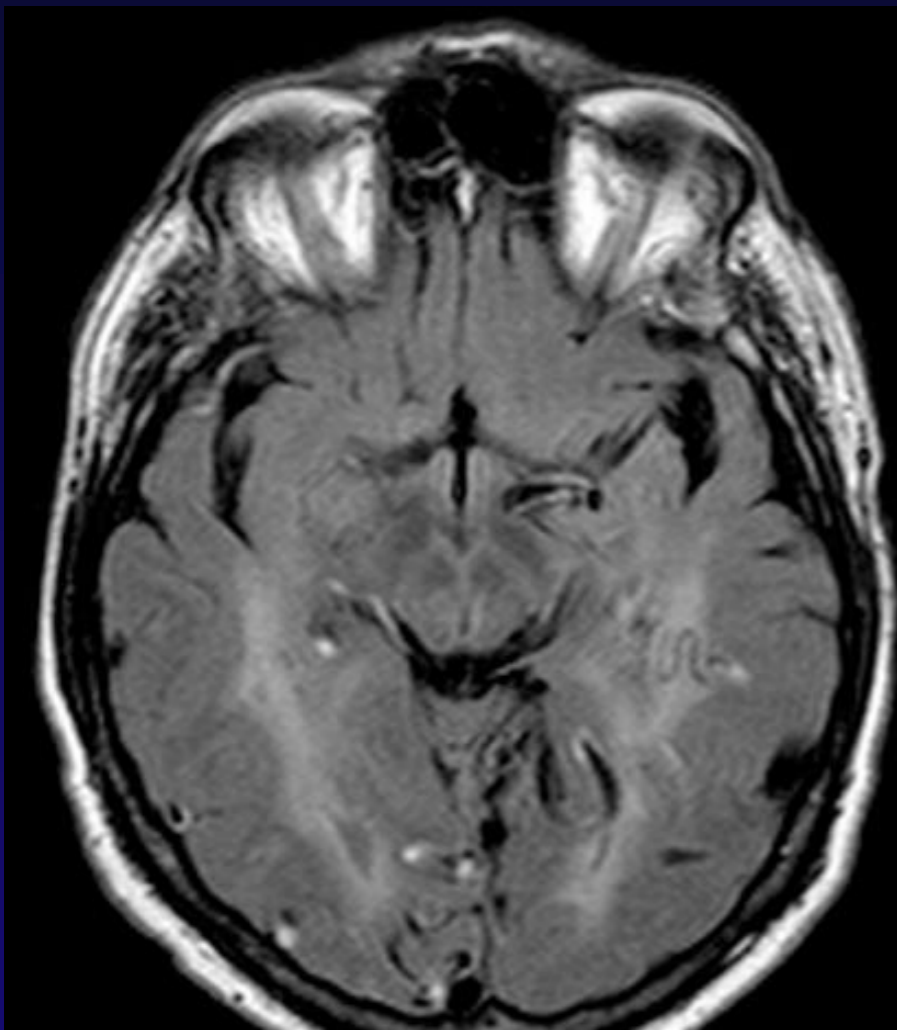
16

M, 55 aa

acufene pulsante dx, cefalea

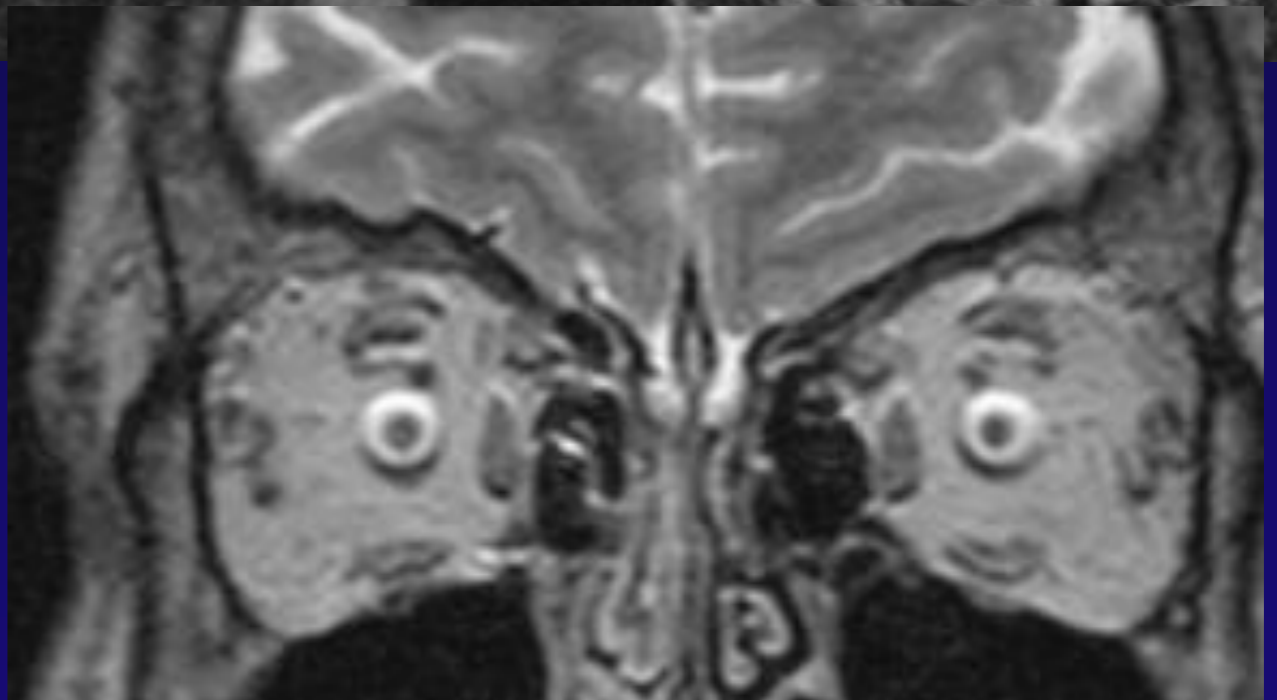
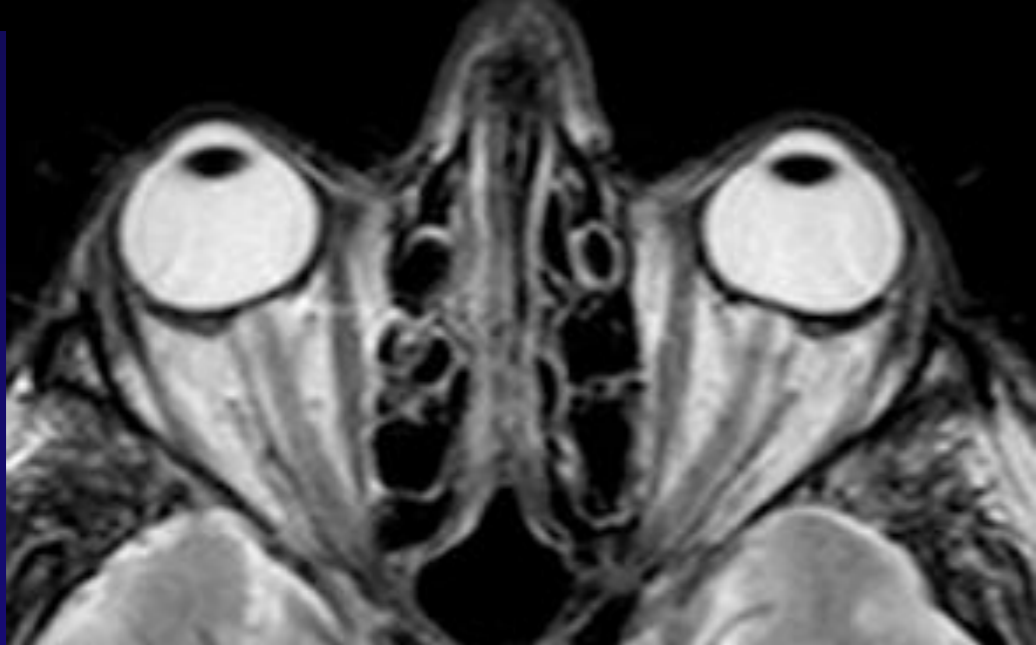
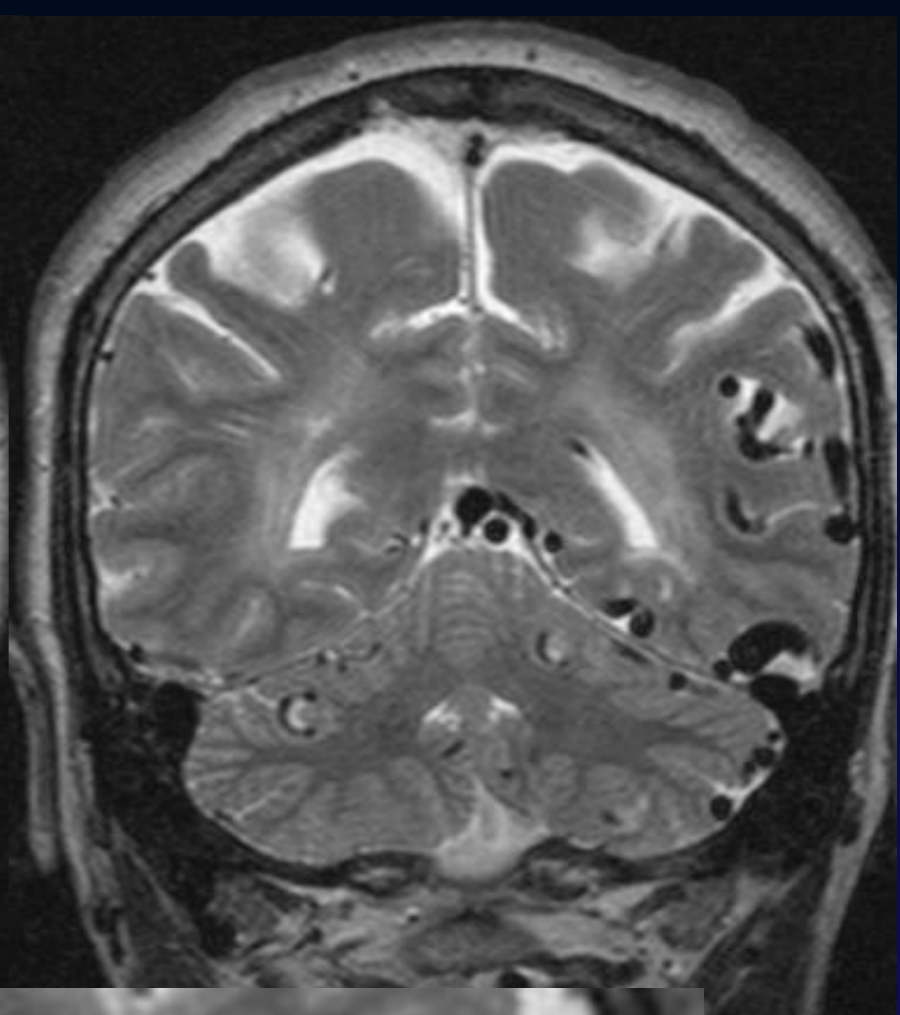
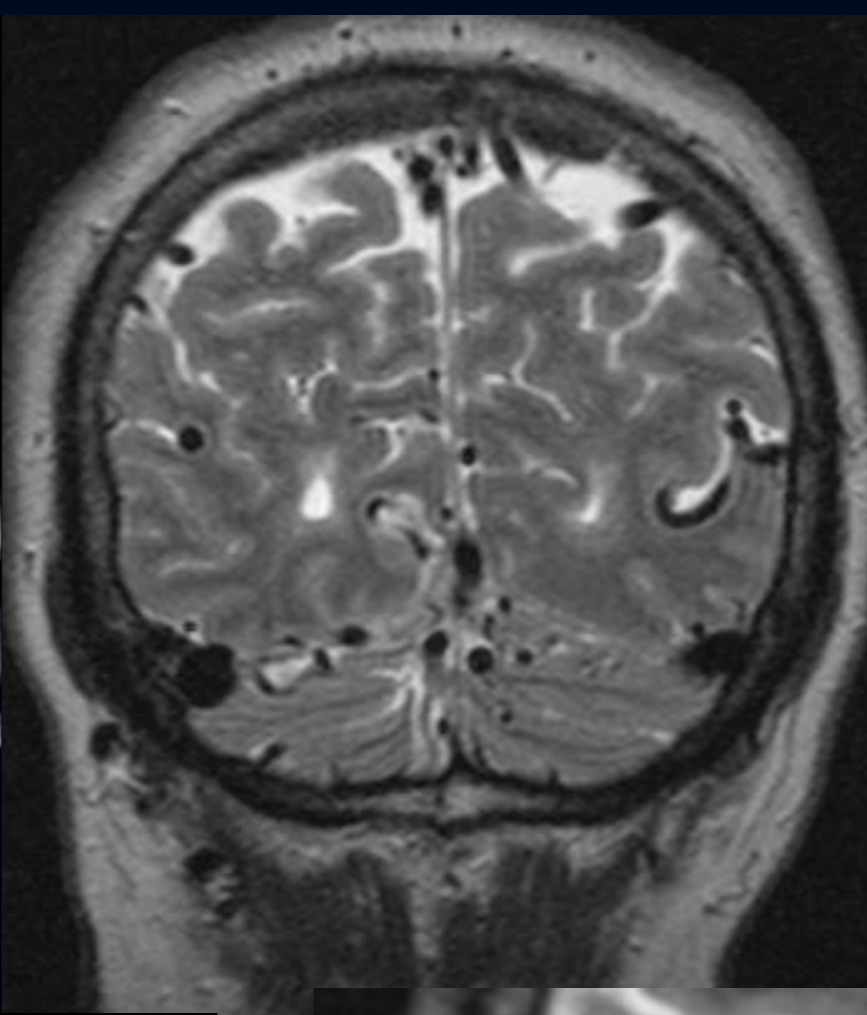
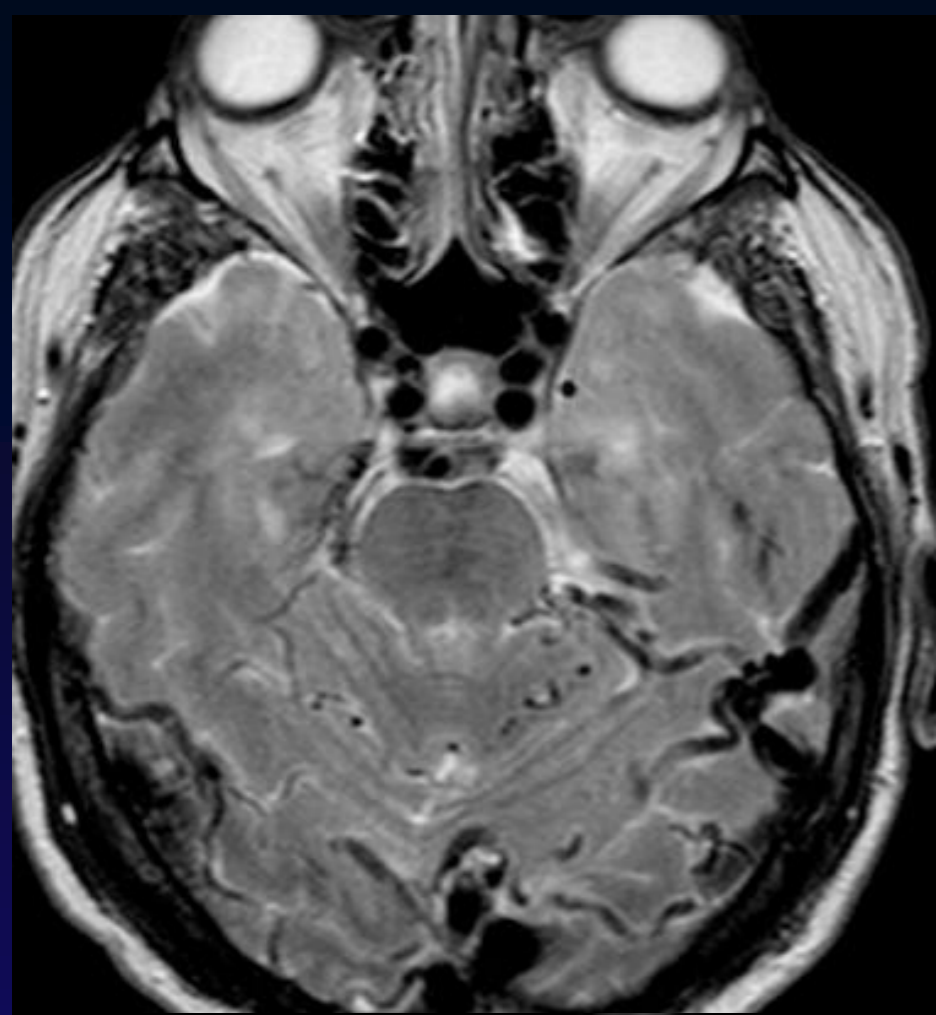
papilledema, modesta riduzione visus

iniziale rallentamento cognitivo

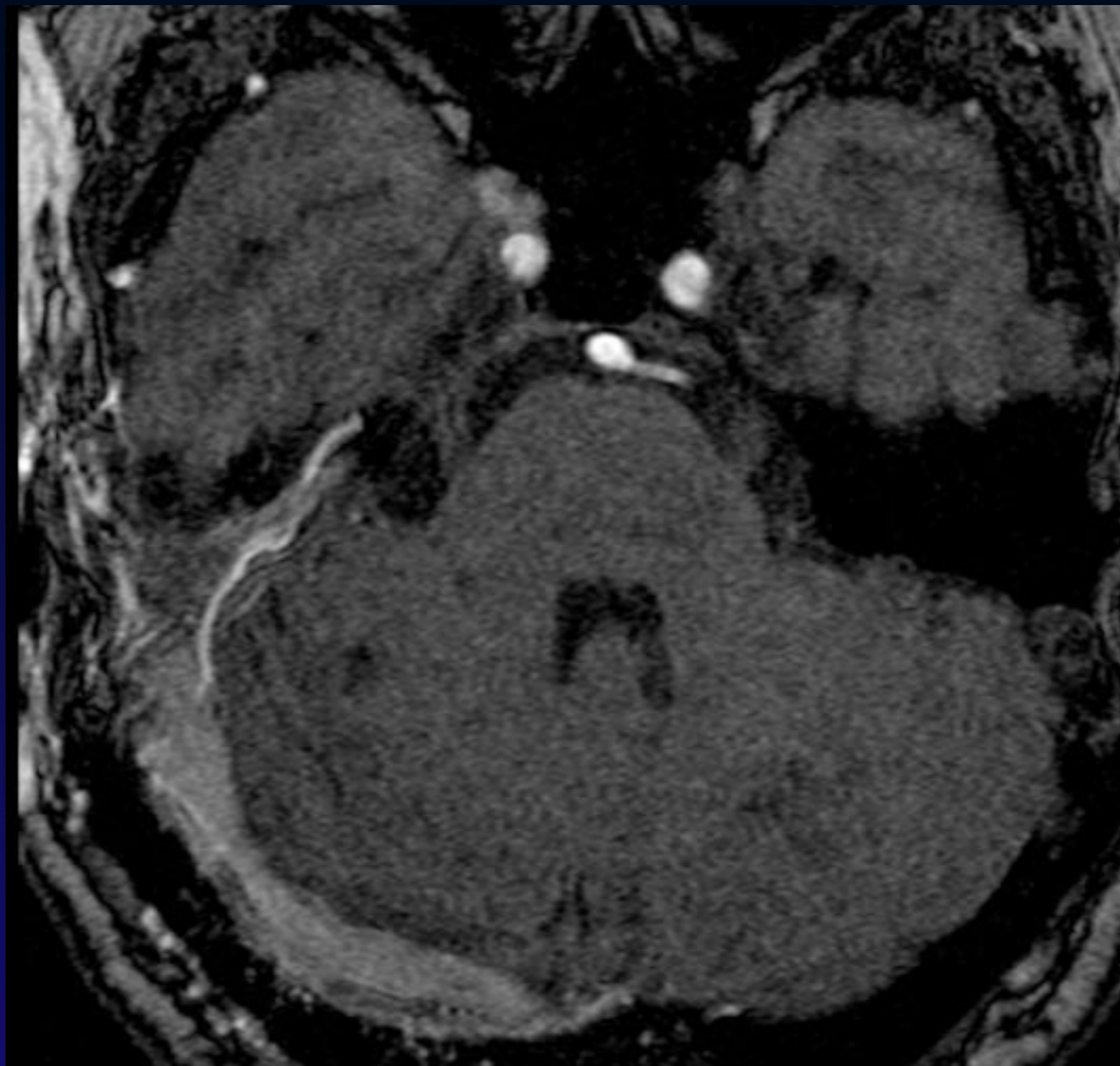
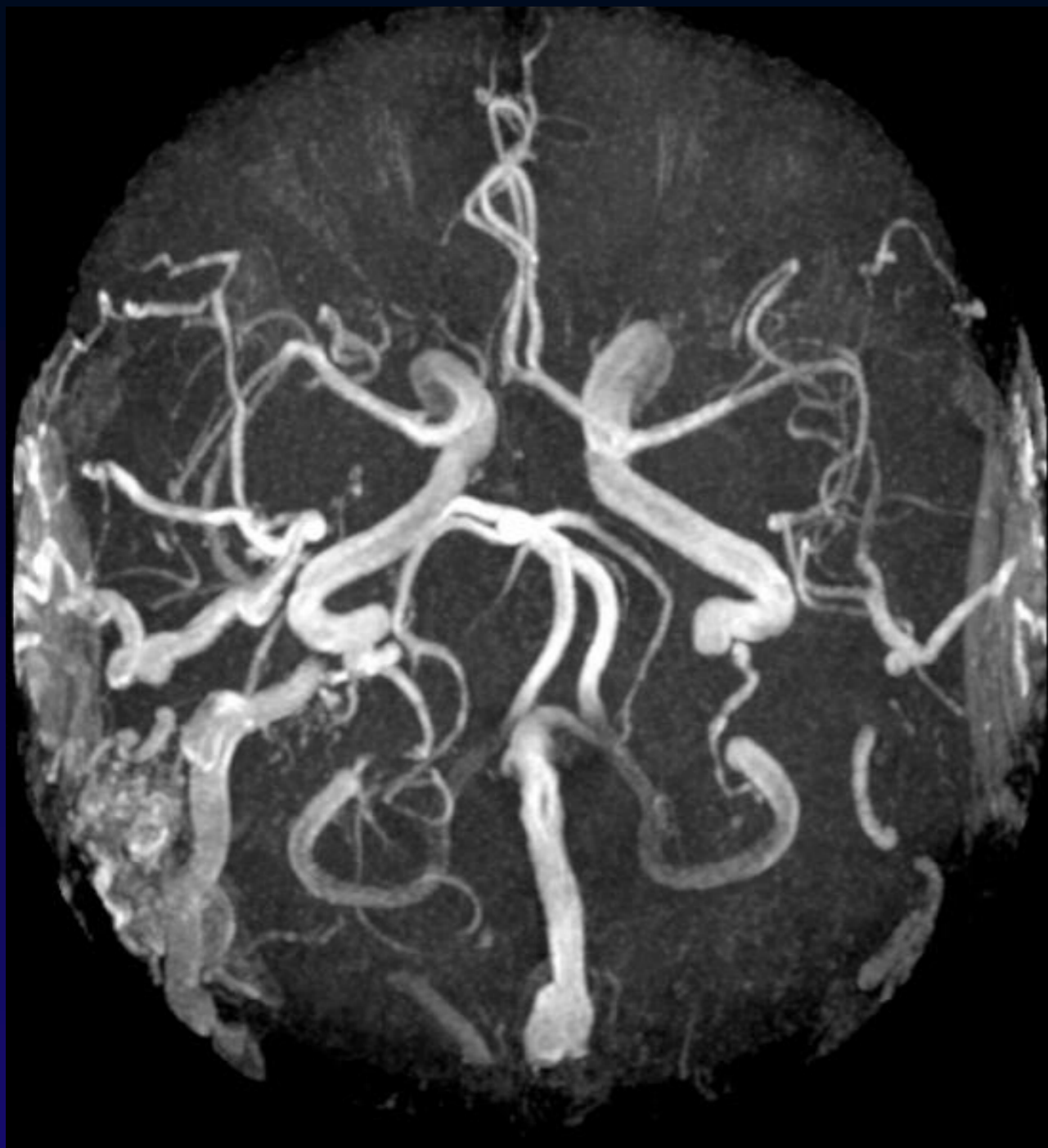


Alterazione di segnale periventricolare

Dilatazione vene corticali



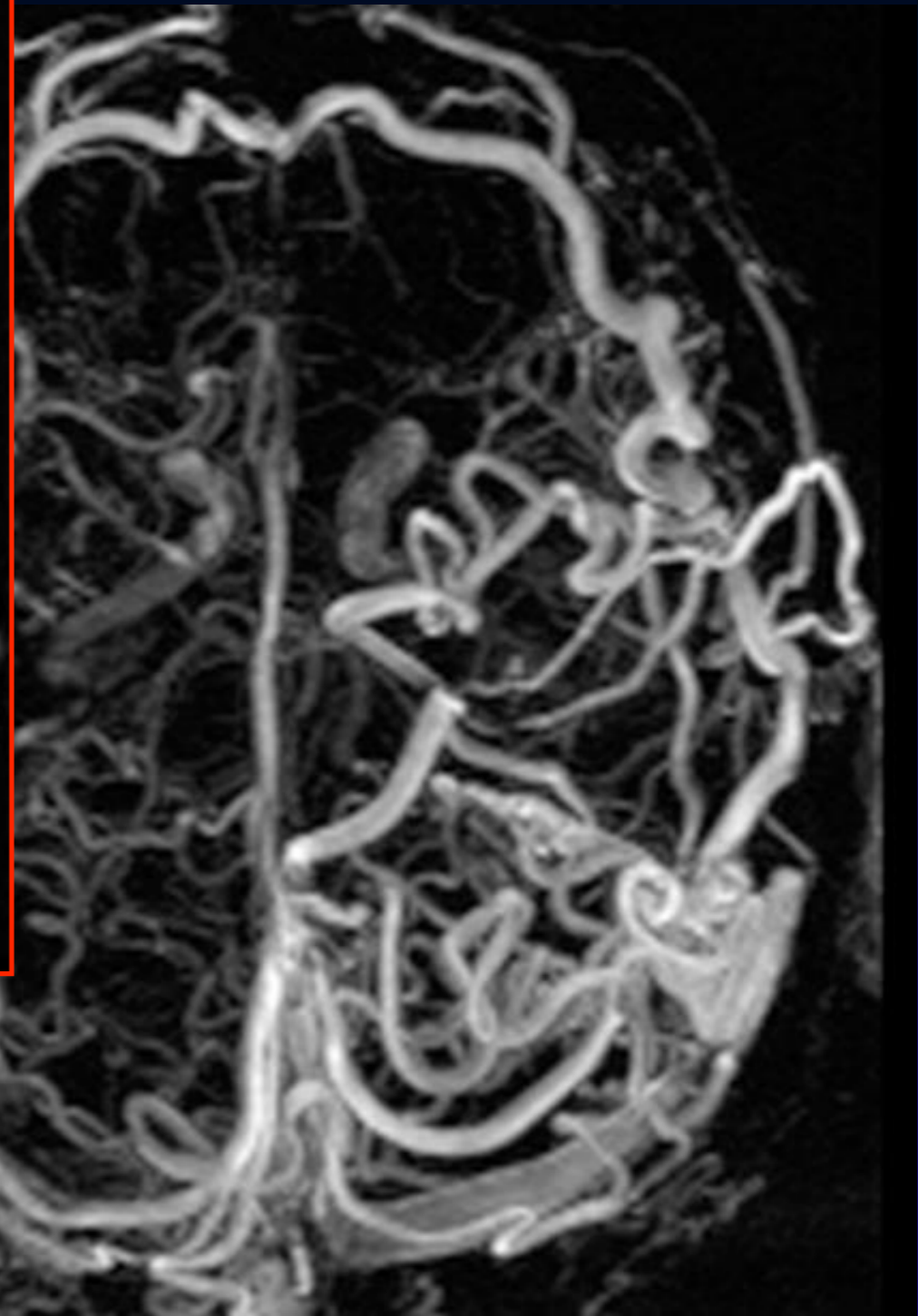
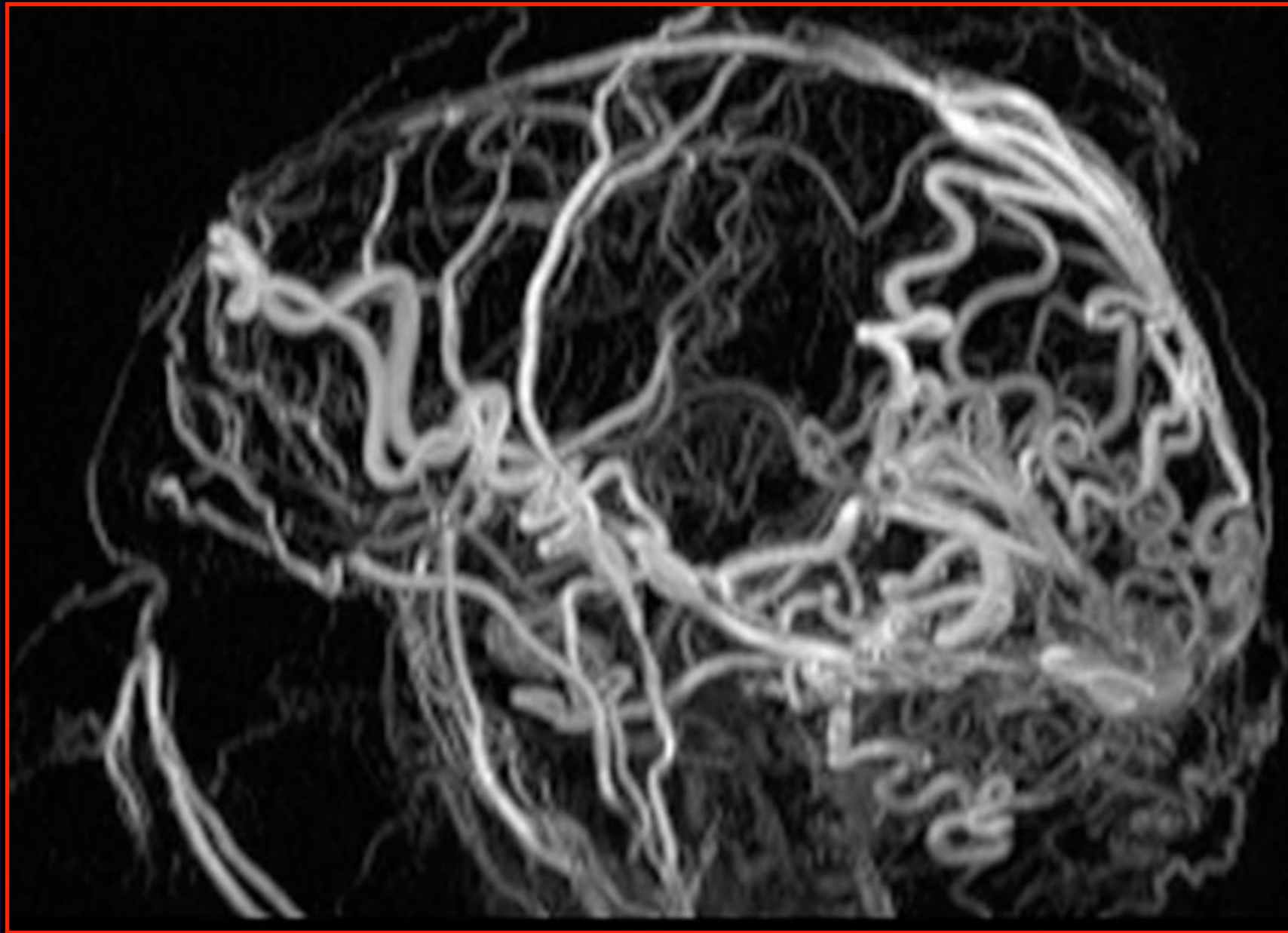
Dilatazione vene corticali  
Edema delle papille  
Distensione guaina dei nervi ottici



ANGIO-RM TOF

Arterializzazione flusso nel seno trasverso dx

Vasi durali ectasici



ANGIO-RM PC

Seni laterali dx non visibili (arterializzati)

Ectasia vene cerebrali sopra e sottotentoriali

Scarsa definizione SSS

FAVD seno trasverso (Cognard 2 A+B)  
Occlusione IJV  
Stenosi SSS

0.733

SeDt:04/05/2017  
05:00:44:54

733

SeDt:04/05/2017  
05:00:44:54



54



5



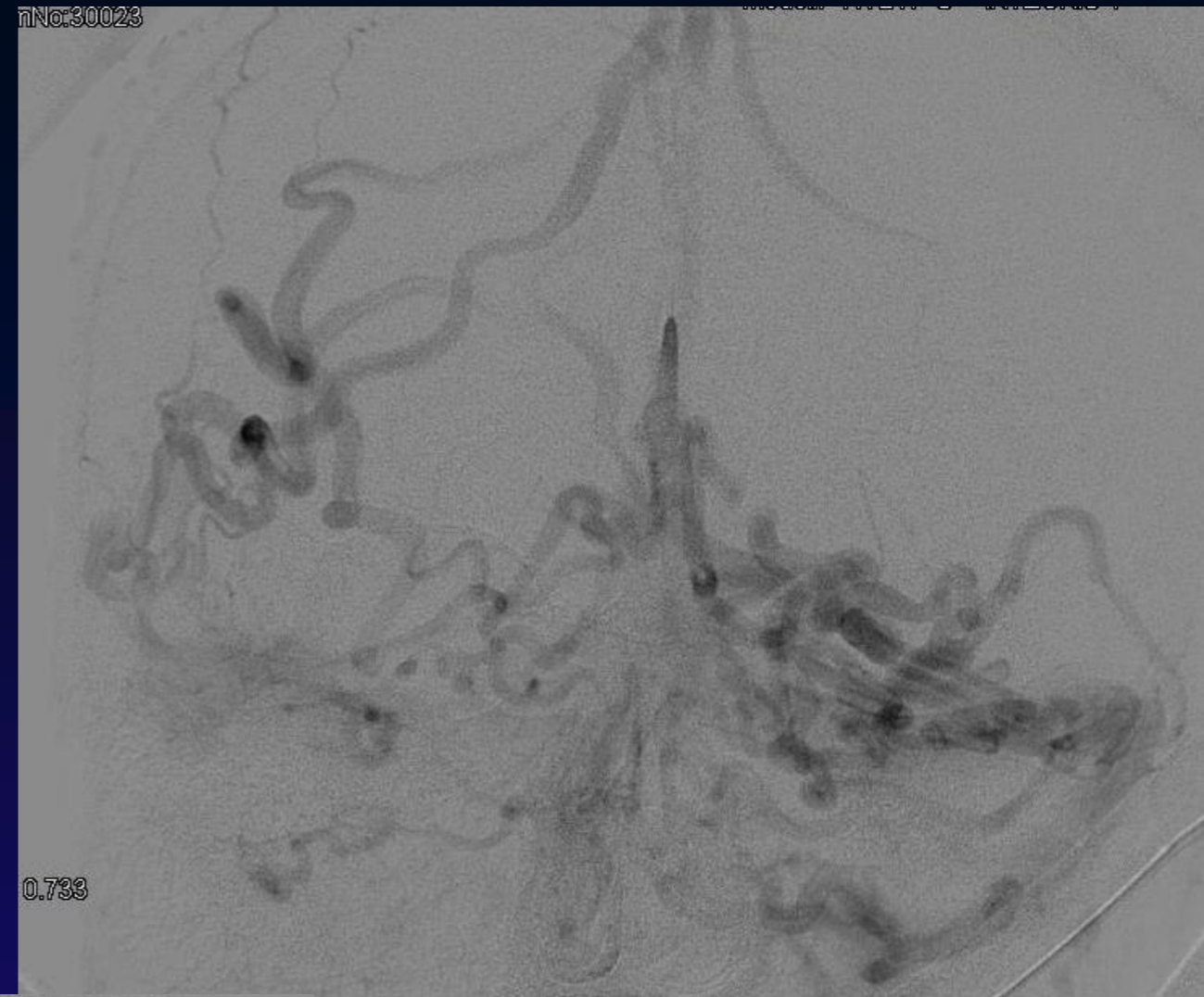
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Model PHILIPS INTEGRIS V

iNo:30023



0.733



0.733



0.733

SeDt:04/05/201  
SeTm:09:41:5



x0.733

SeDt:04/0  
SeTm:10

Ostacolo al normale  
drenaggio venoso cerebrale

x0.733

SeDt:04/05/2017  
SeTm:09:44:56

0.733

SeDt:04/05/2017  
SeTm:09:44:56

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Model:PHILIPS INTEGRIS V

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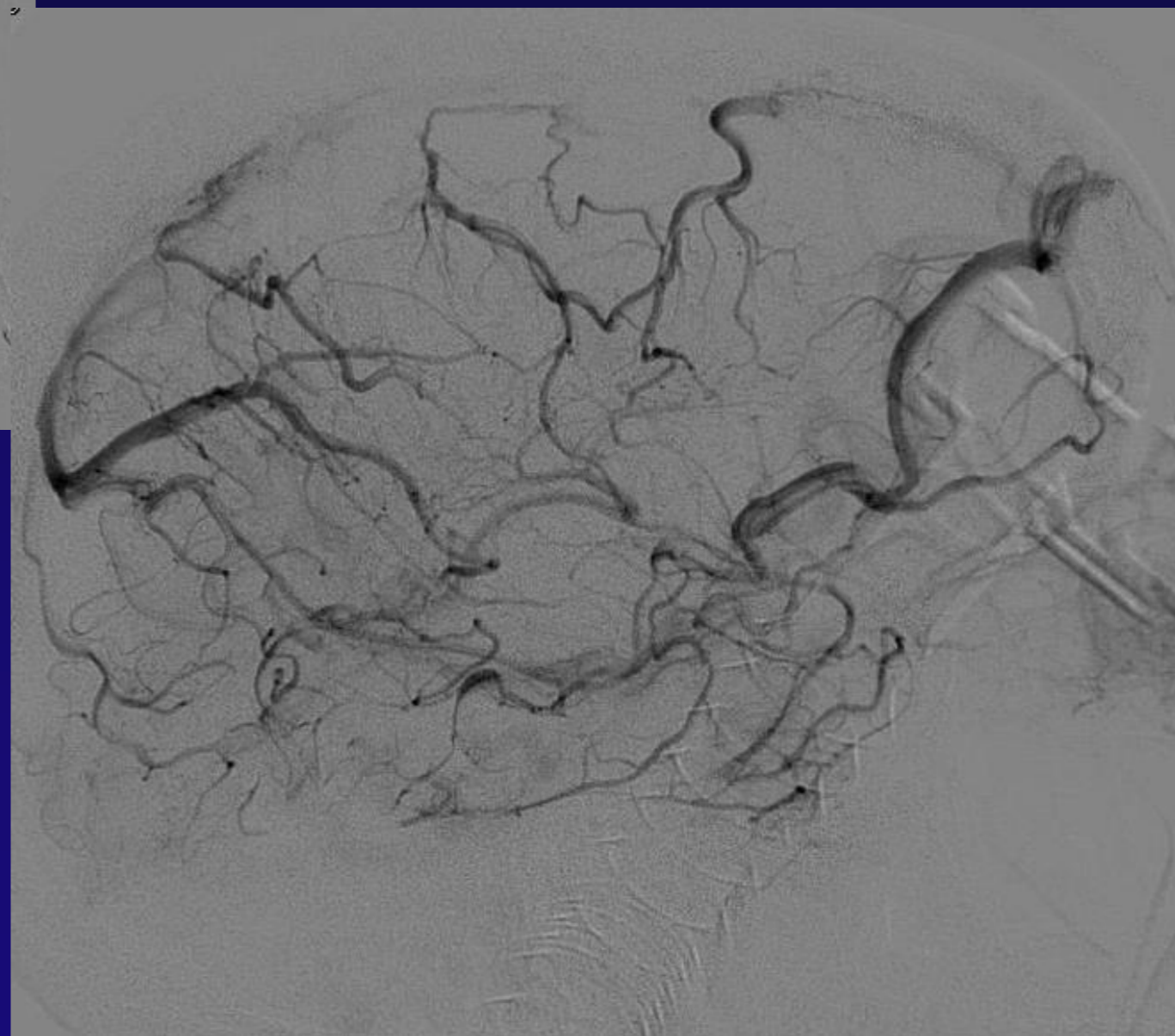
Stenosi SSS  
Stenosi IJV

EASY

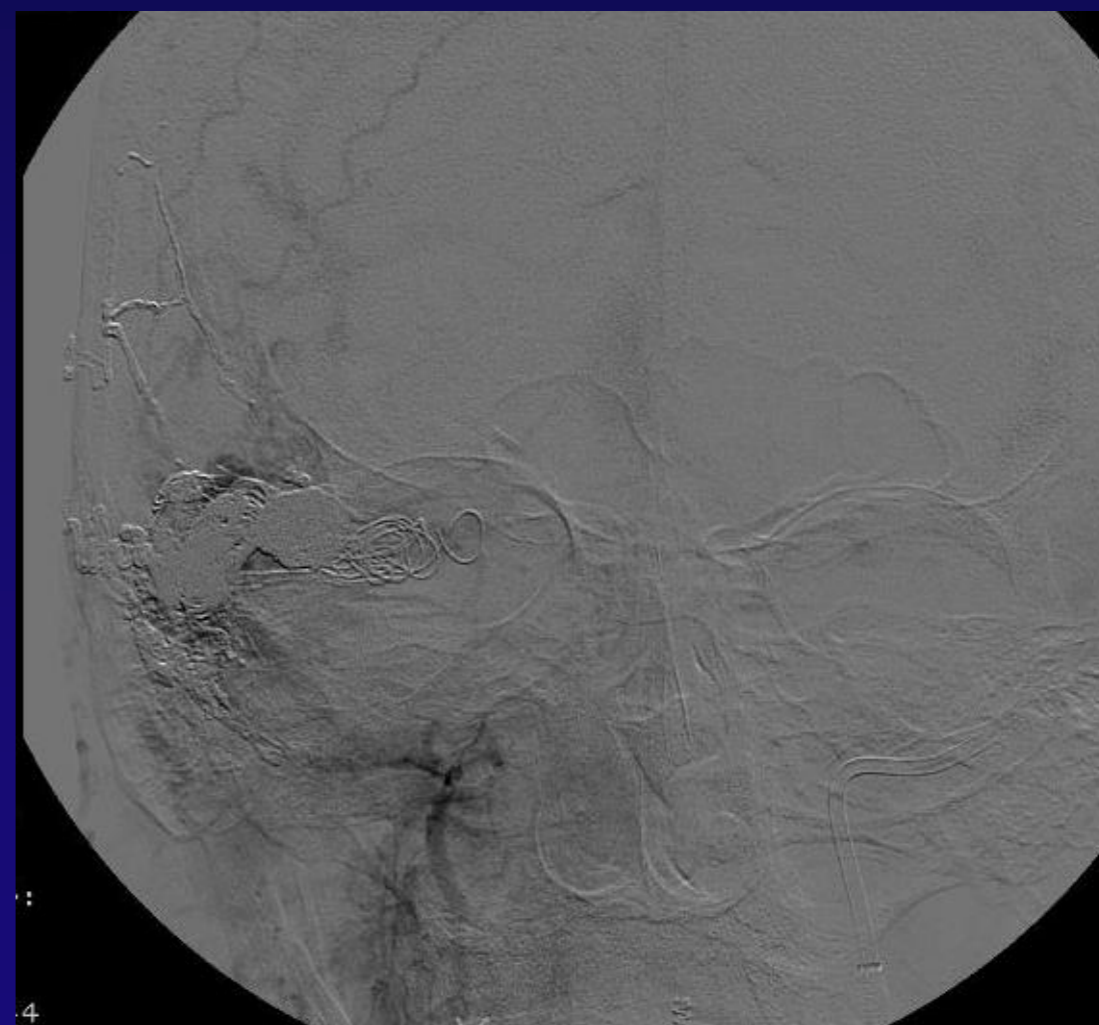
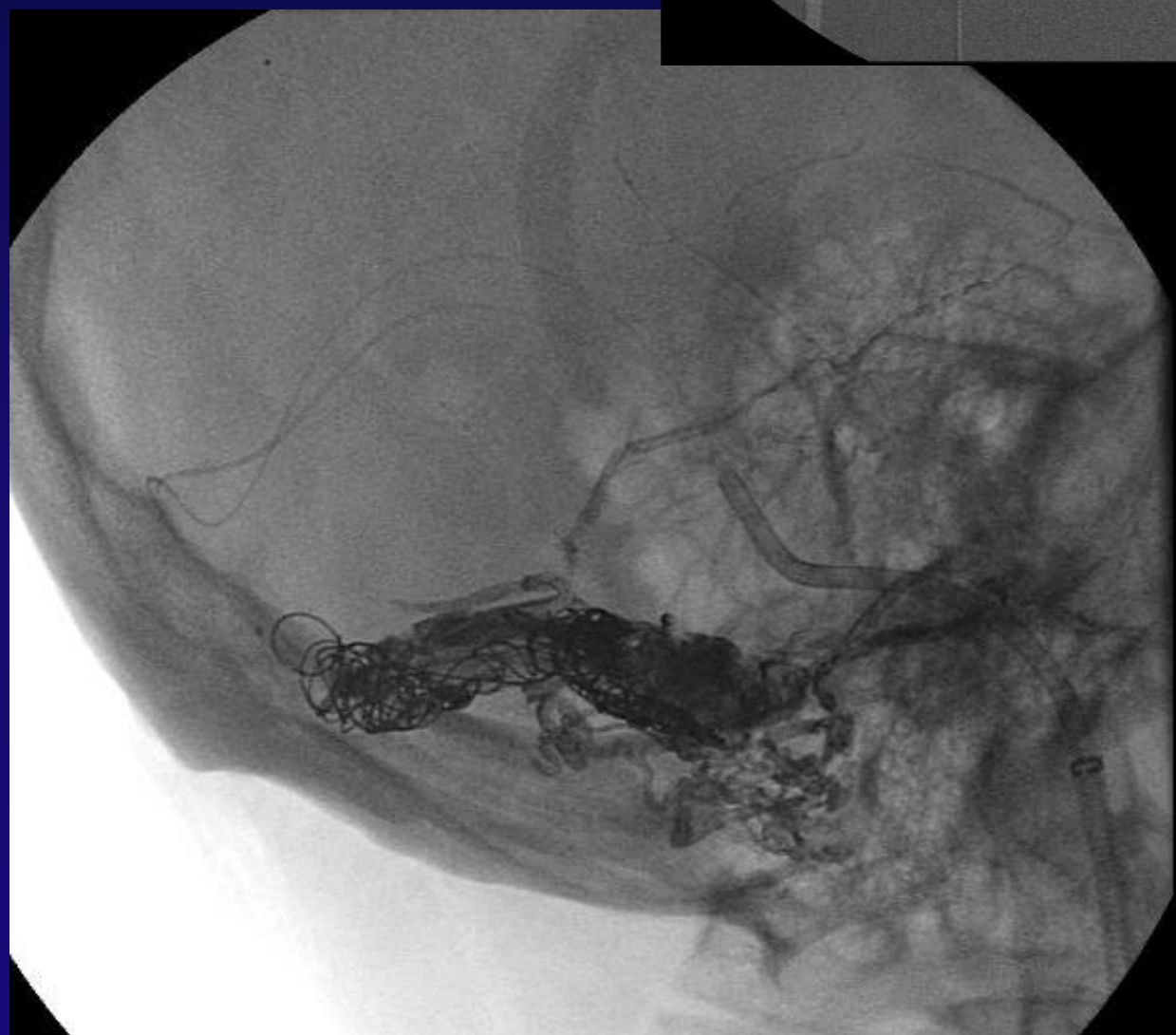
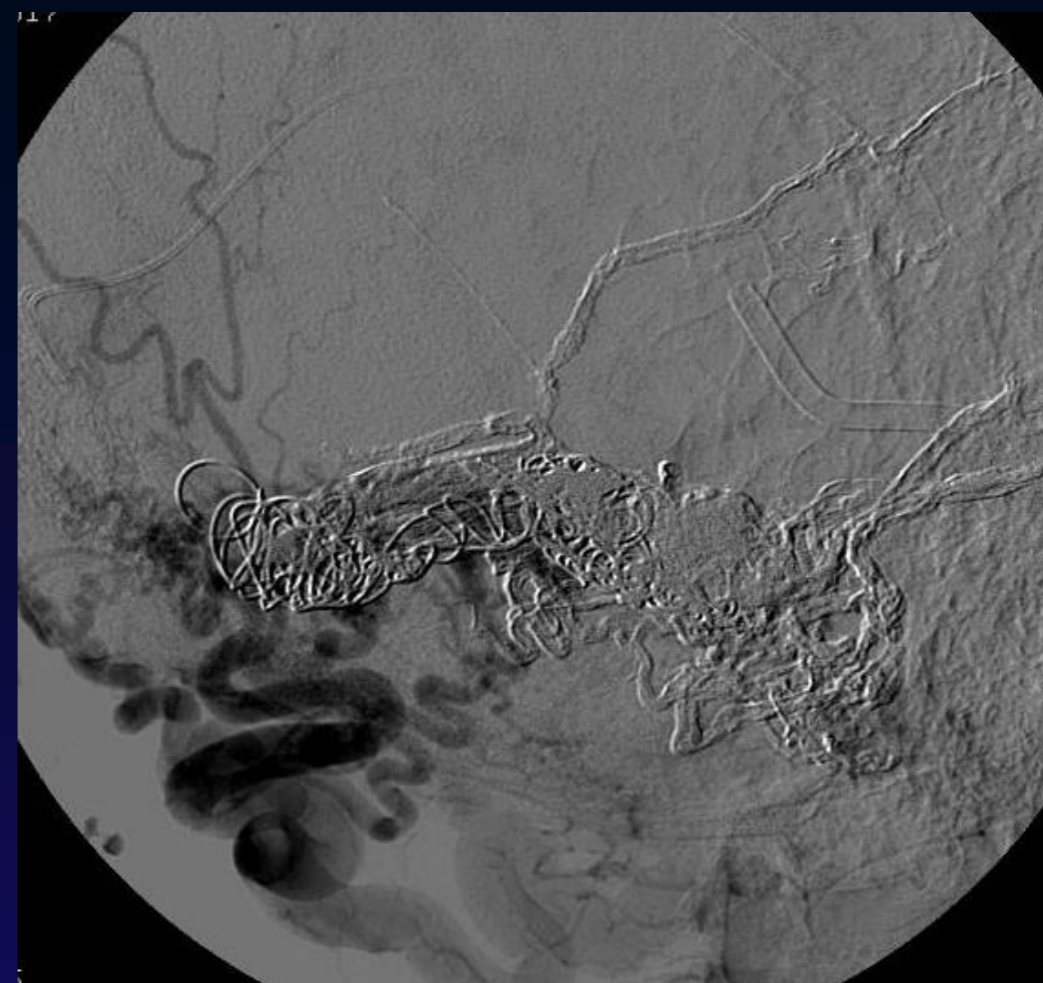
drenaggio FAVD



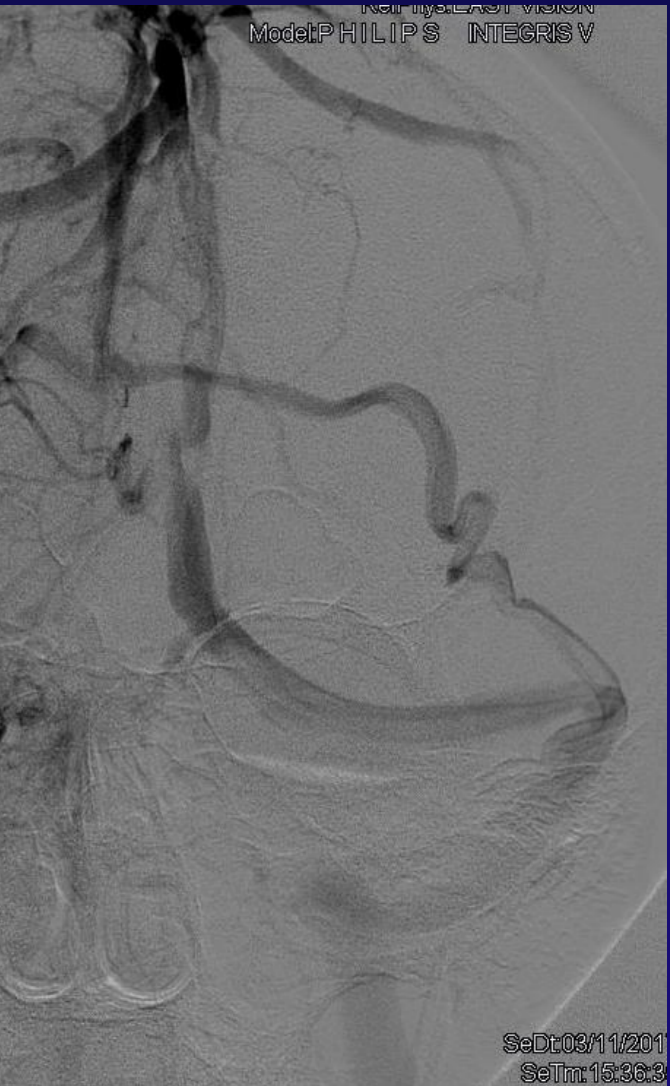
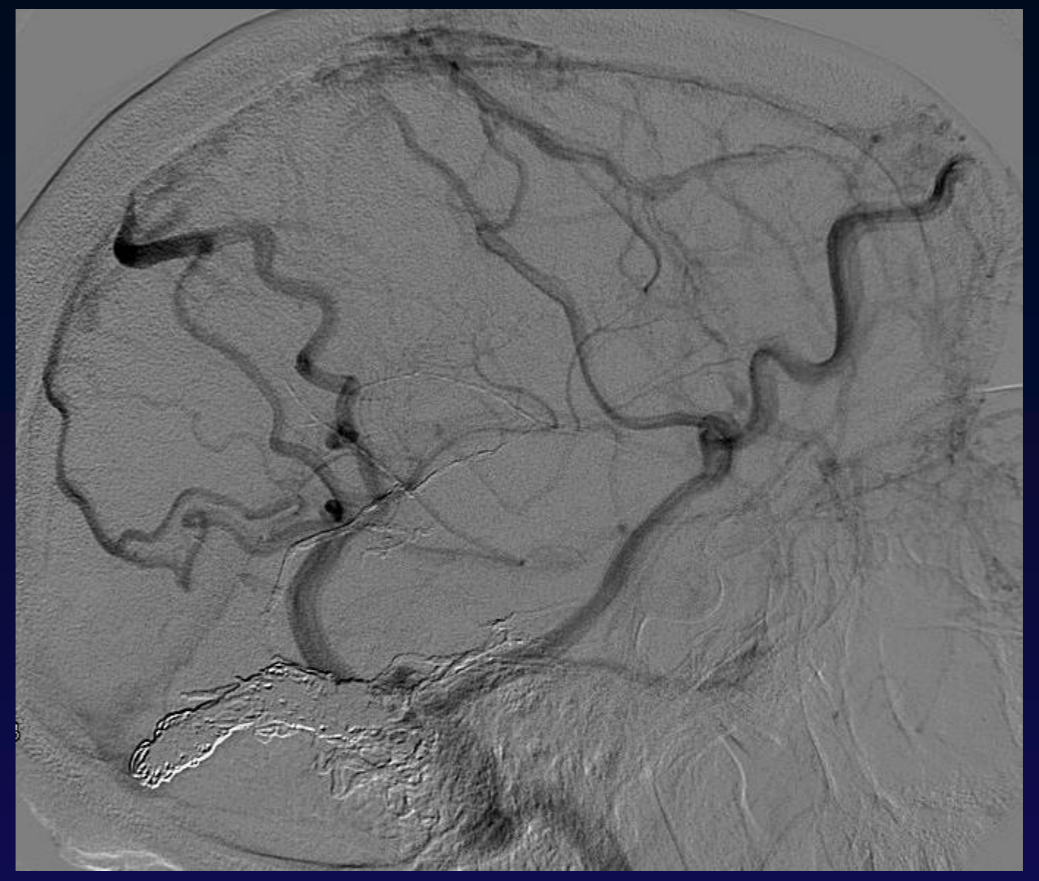
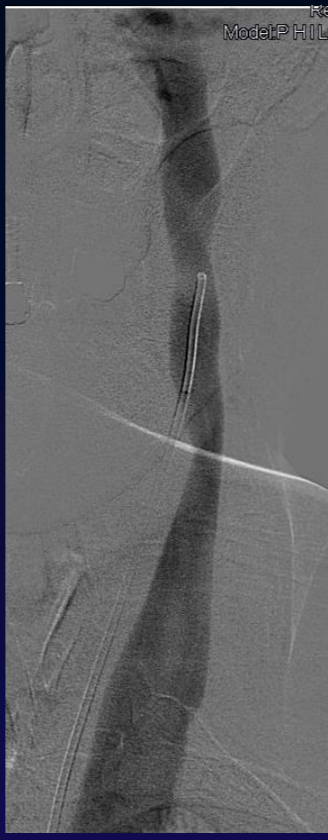
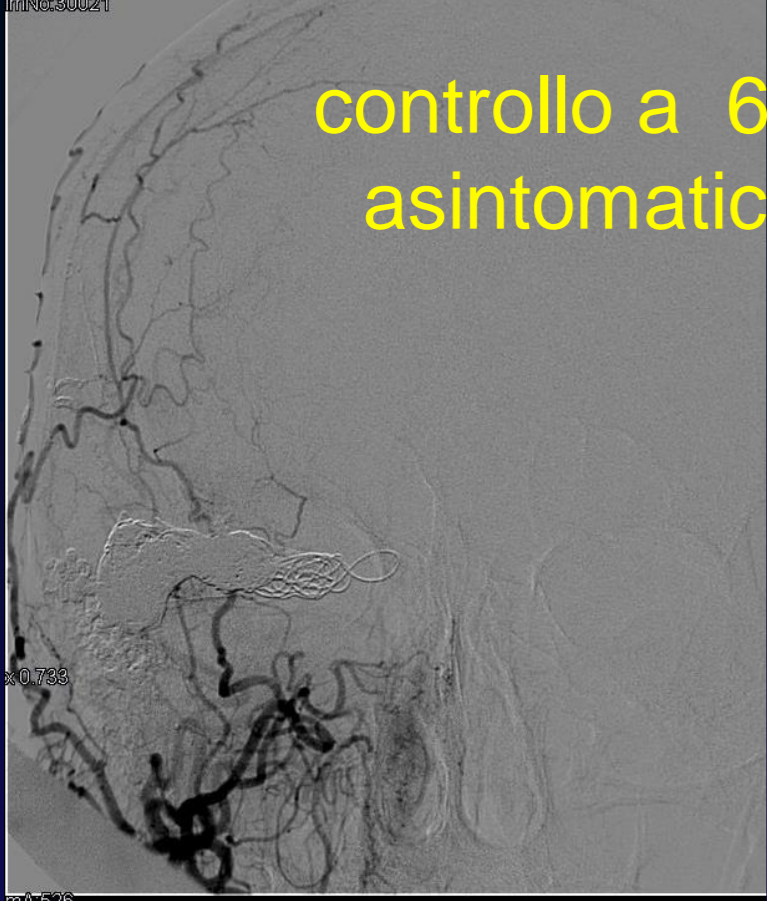
drenaggio  
cerebrale



PTA IJV  
Embolizzazione  
combinata  
arteriosa (Onyx) e  
venosa (coils)

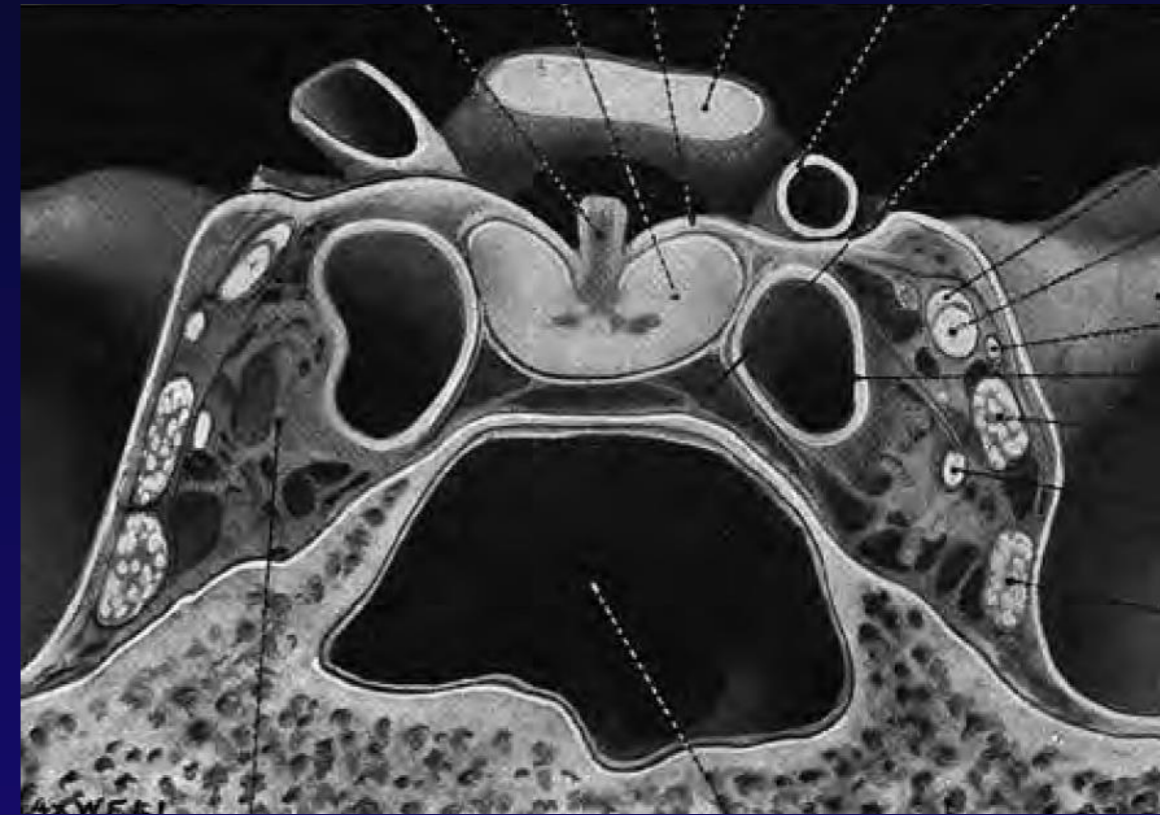
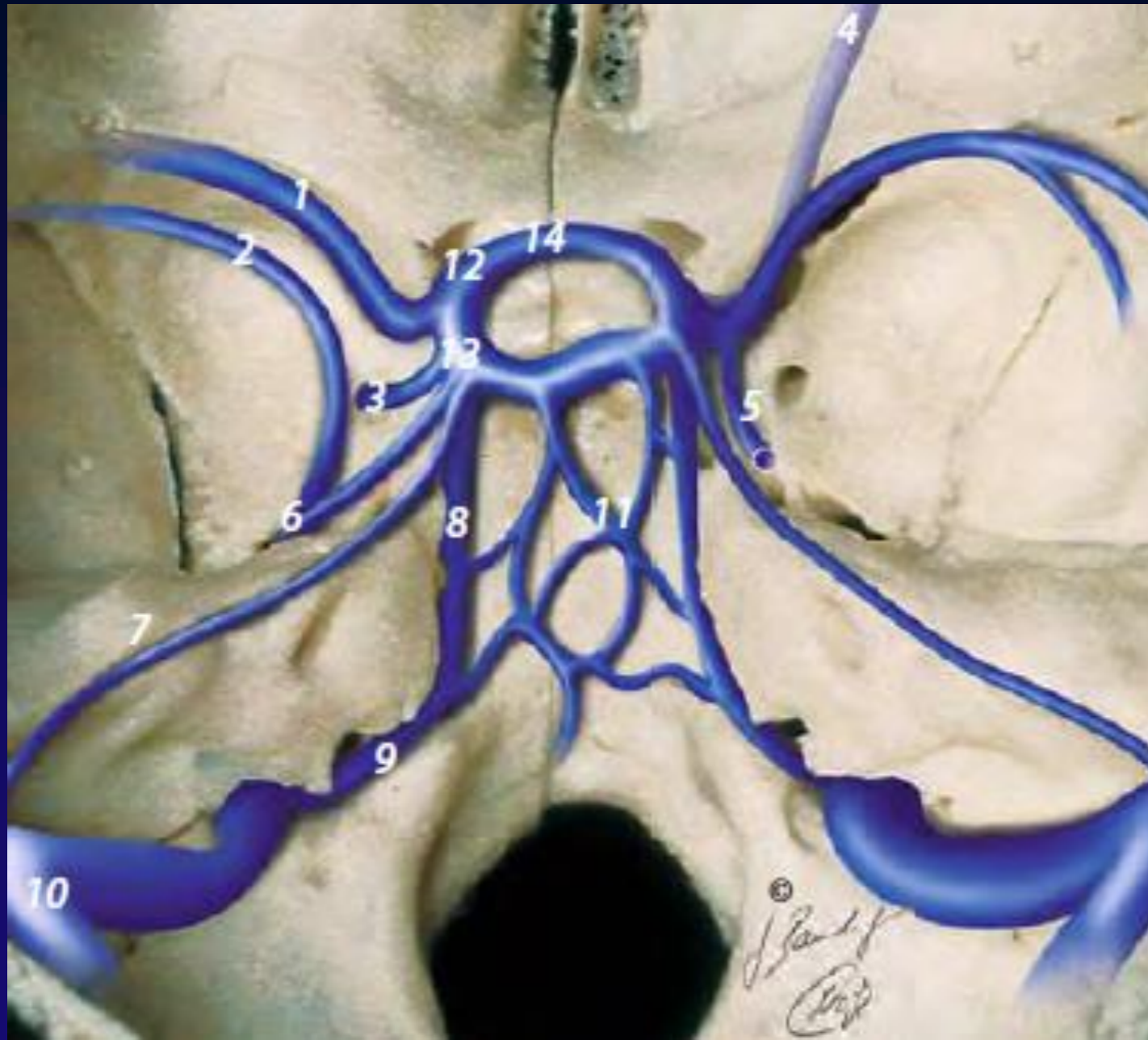


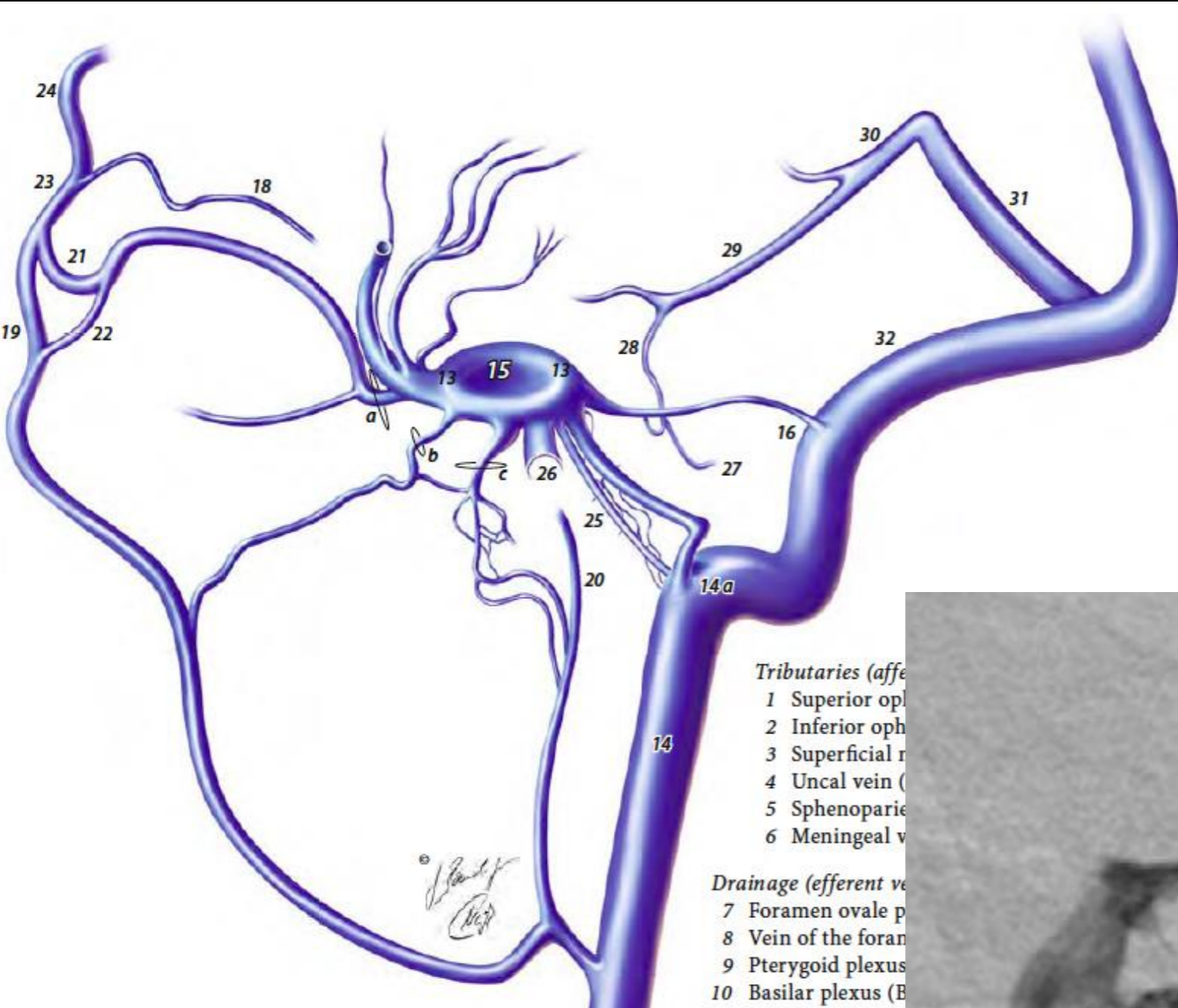
controllo a 6 m  
asintomatico



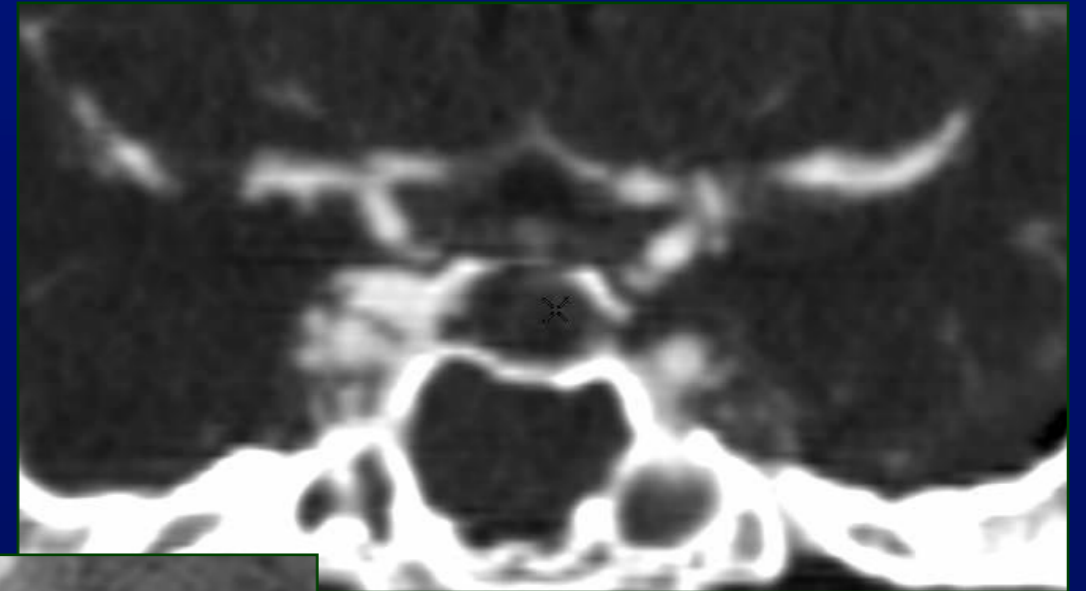
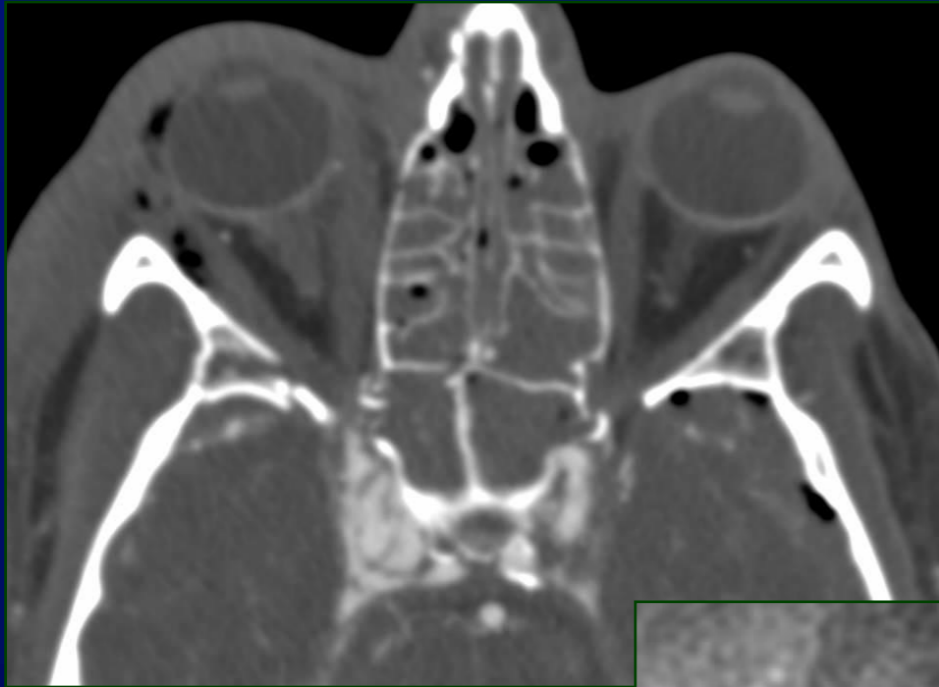
fistola chiusa  
migliorata parzialmente la congestione  
permane stenosi SSS  
risolta stenosi IJV

# SENO CAVERNOSO

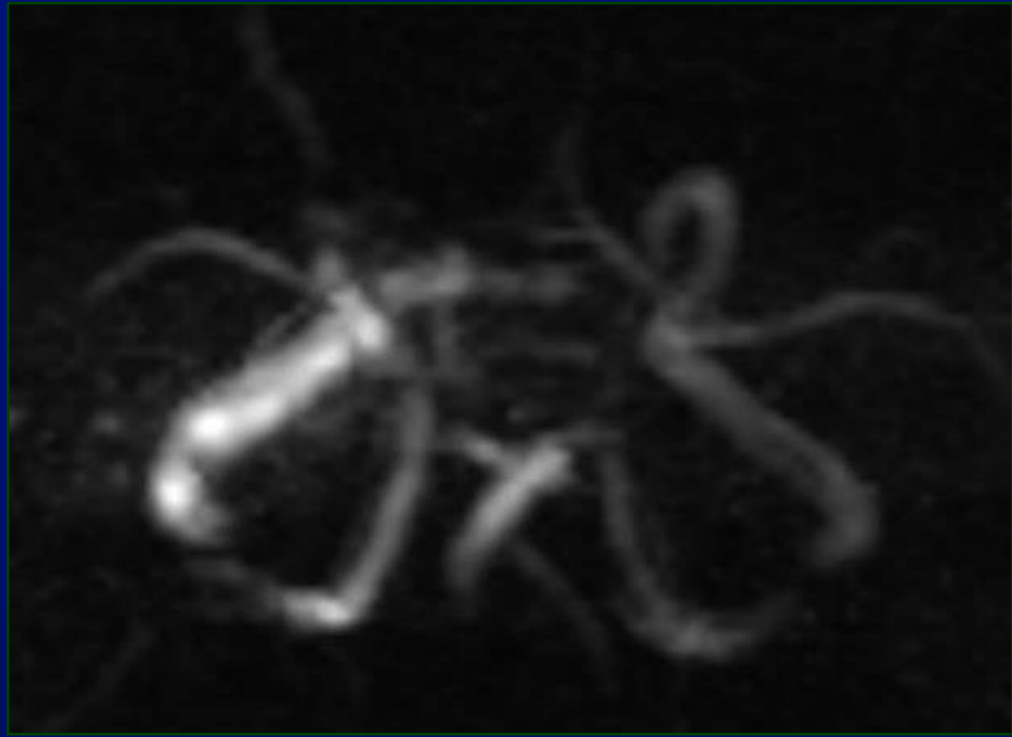




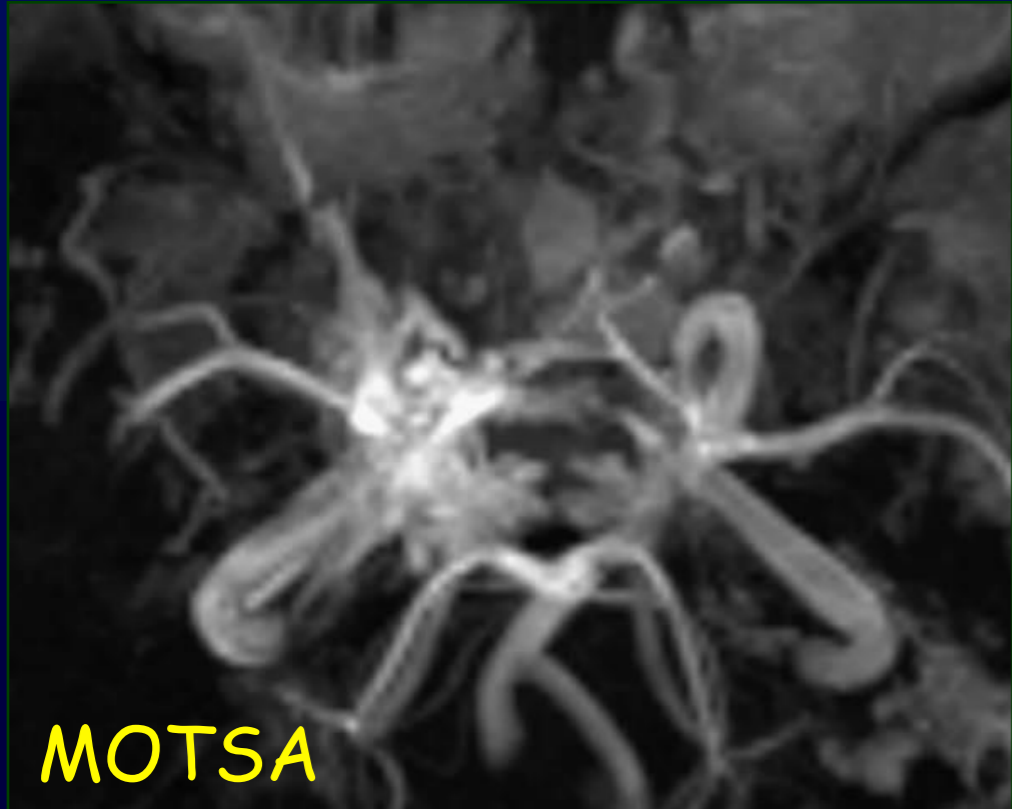
# FISTOLA CAROTIDO-CAVERNOSA DIRETTA POST-TRAUMATICA



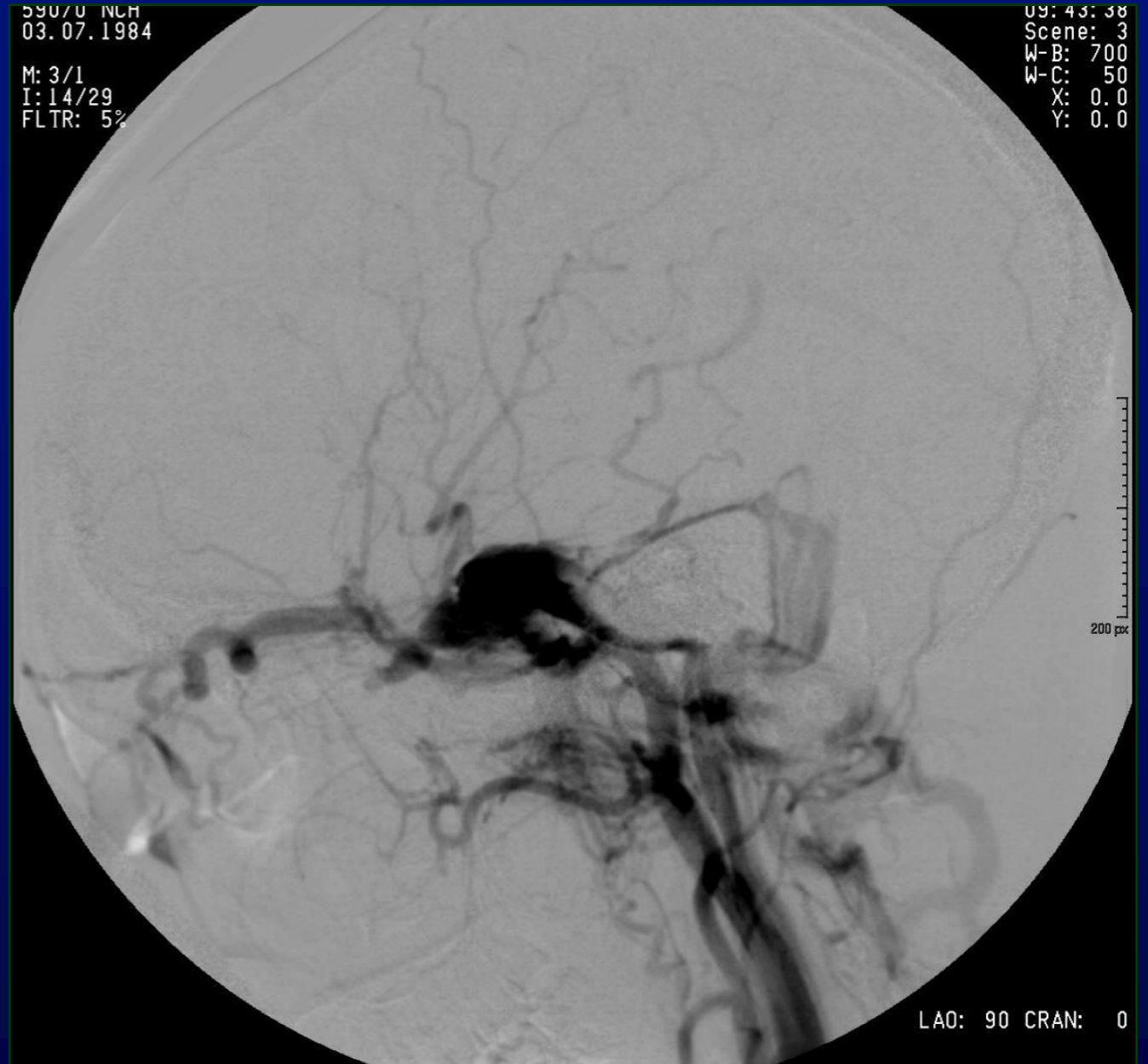




PC



MOTSA



590/0 INCH  
03.07.1984  
M: 3/1  
I: 14/29  
FLTR: 5%

09: 43: 38  
Scene: 3  
W-B: 700  
W-C: 50  
X: 0.0  
Y: 0.0

200 px

LAO: 90 CRAN: 0

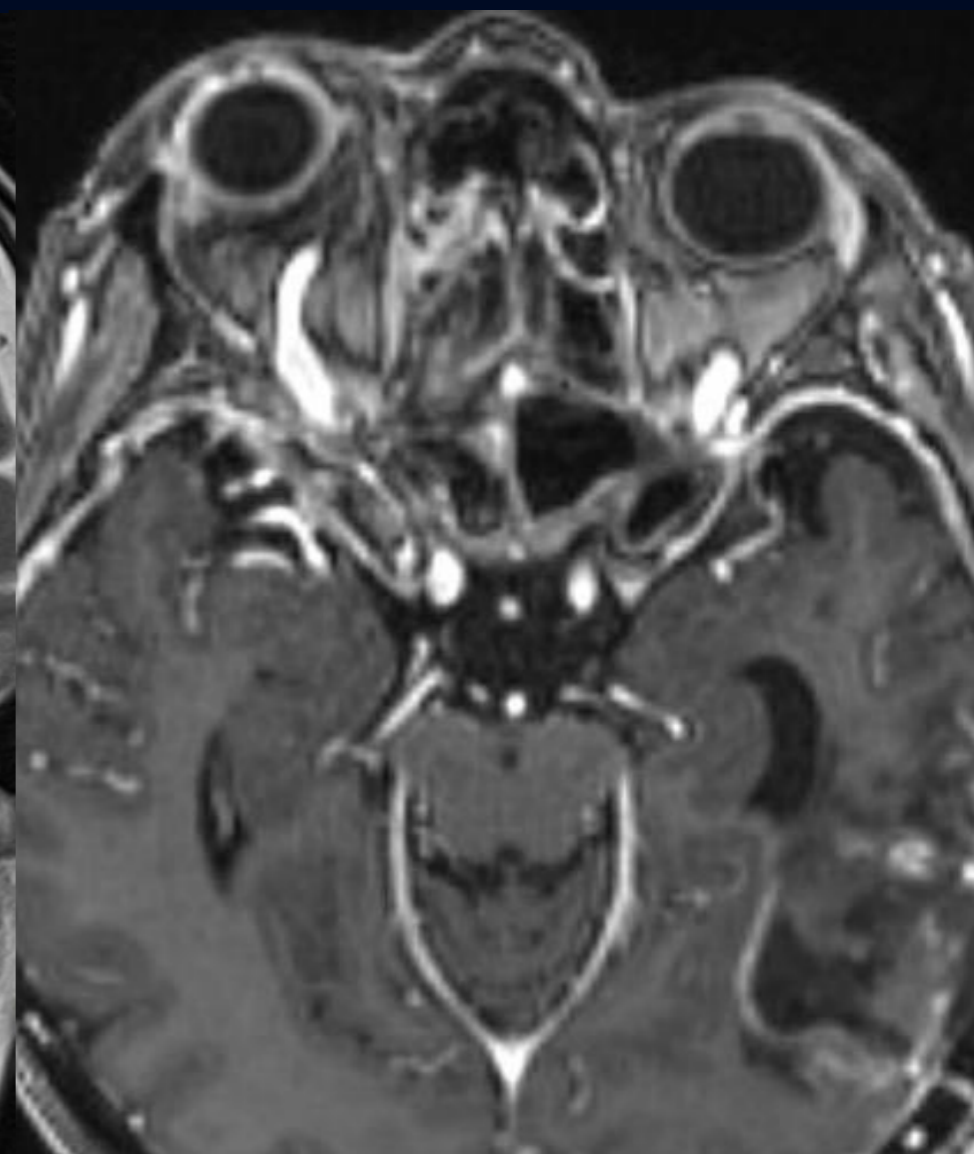
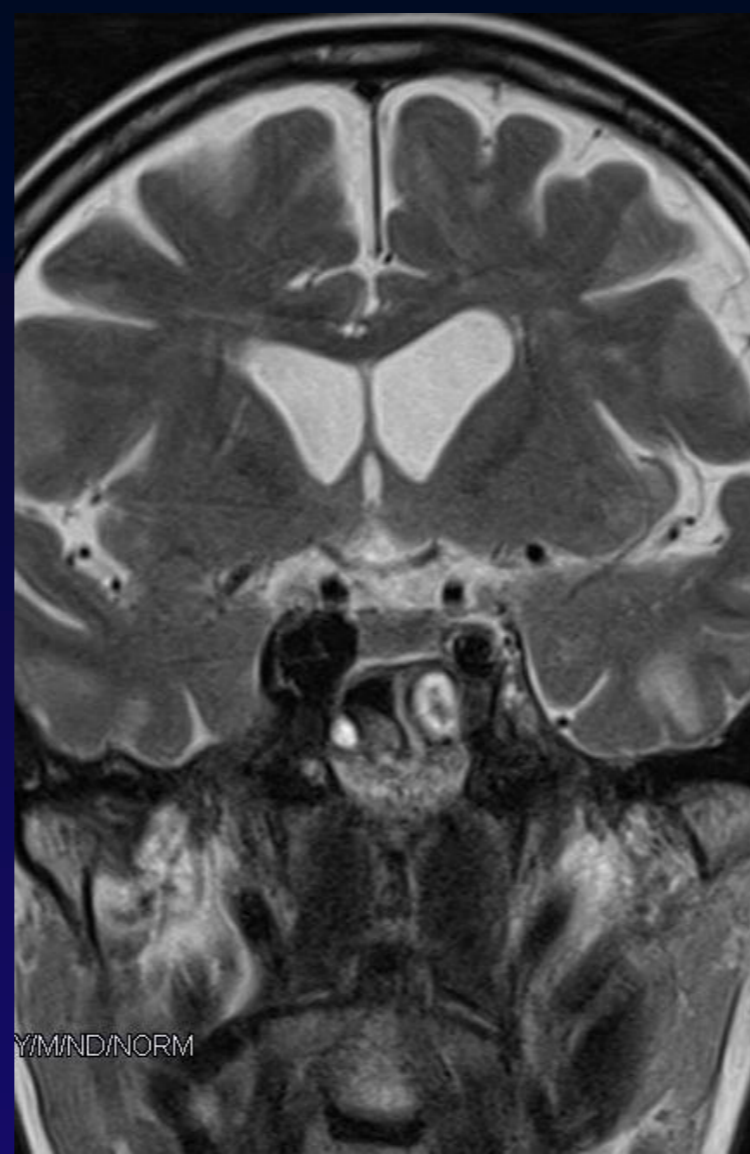
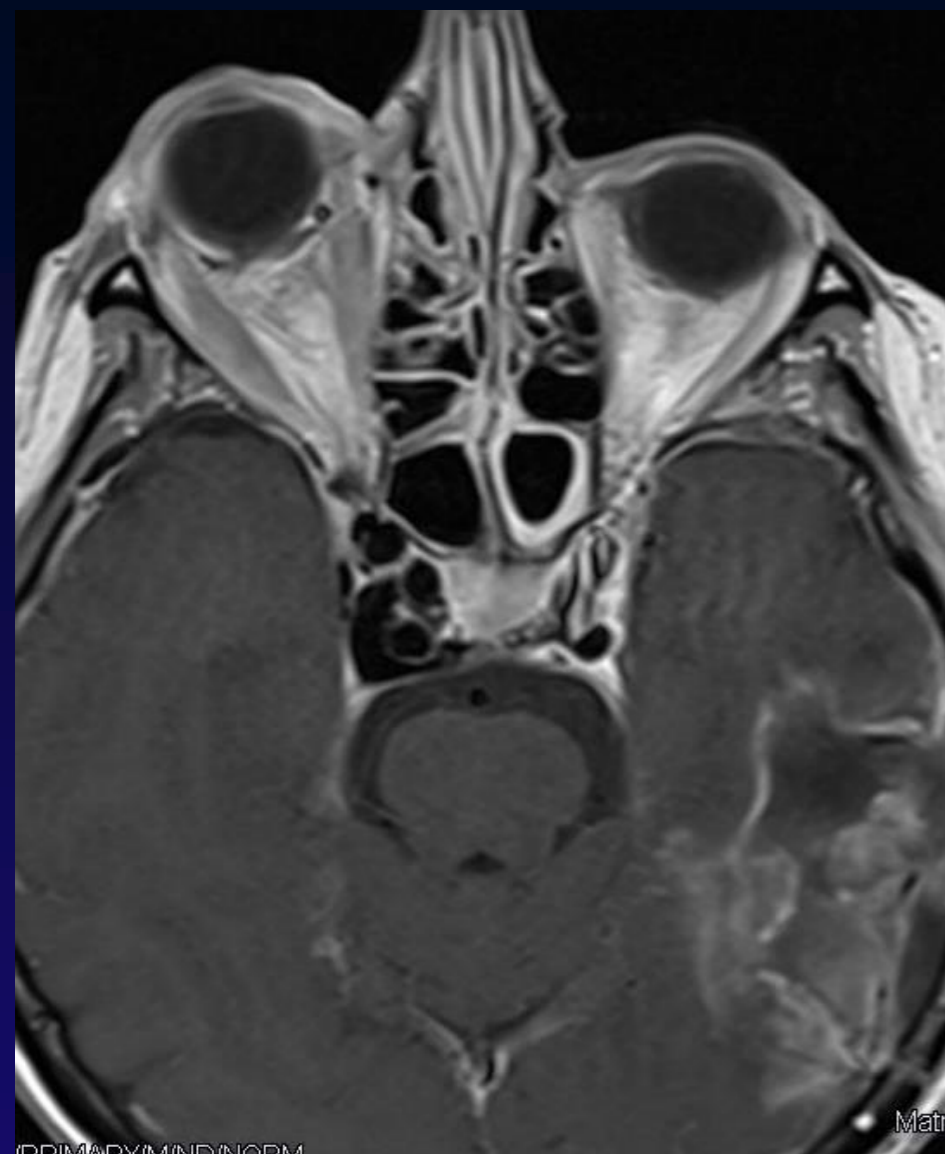
F, 75 aa

Recente trauma cranico (ematoma subdurale sn, contusioni emorragiche multiple)

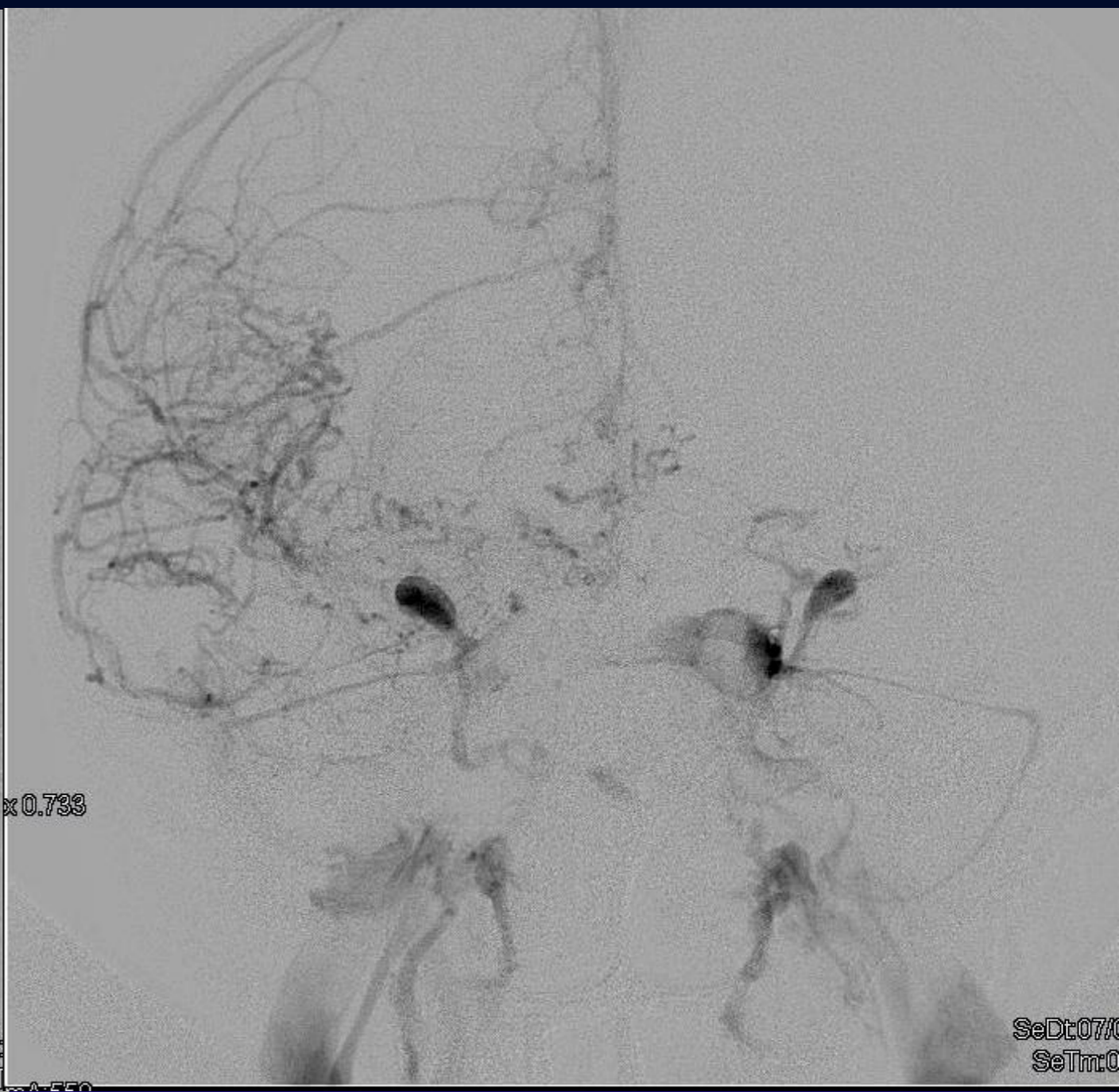
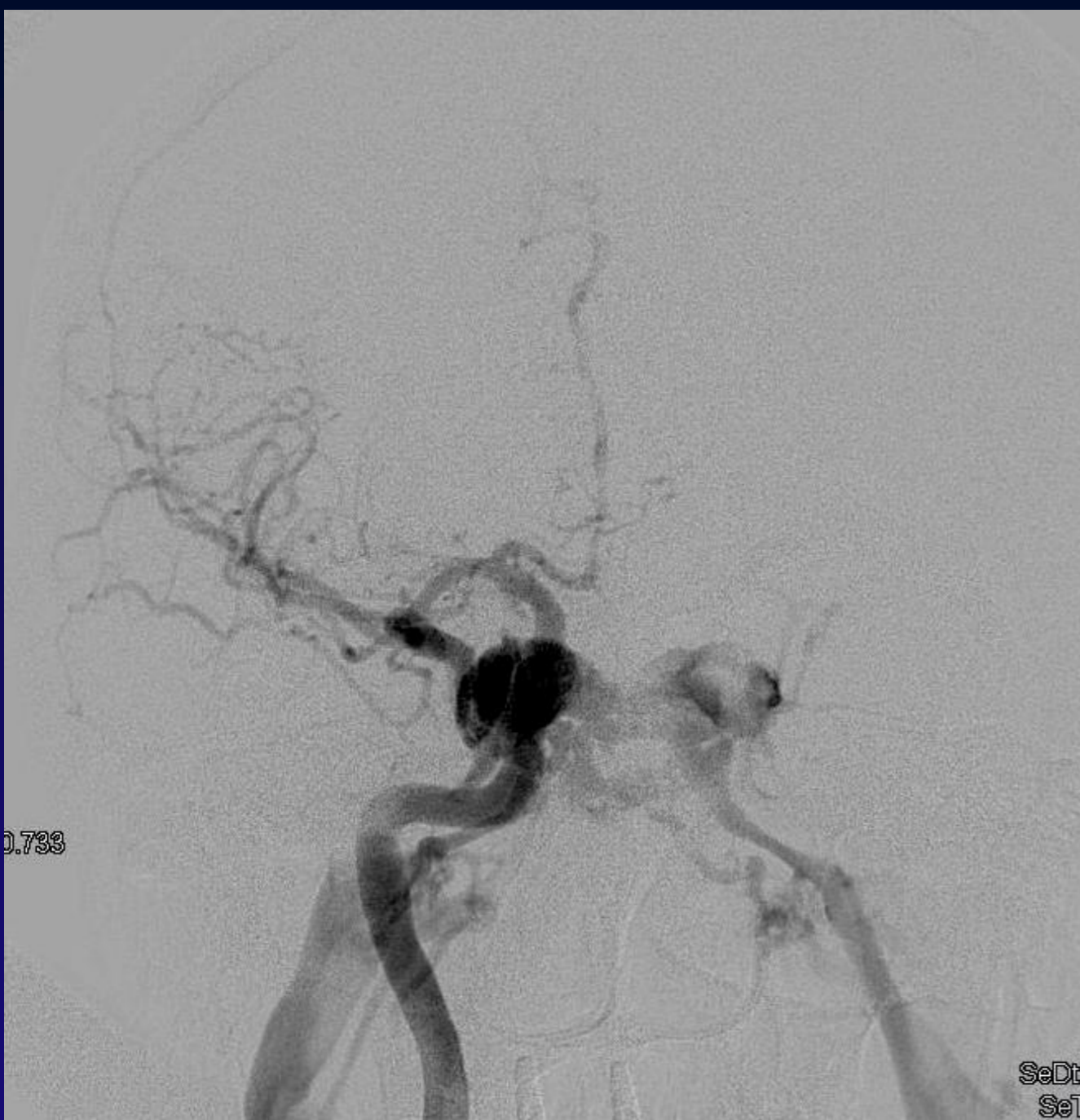
A dx perdita subtotale del visus, chemosi, esoftalmo, ptosi oftaloplegia

Inviata da oculista, dopo ricovero in altro ospedale, per "sospetta" FCC





Seno cavernoso dilatato e con vuoto di segnale (flusso elevato)  
Vena oftalmica superiore dilatata  
Esoftalmo



Fistola carotido-cavernosa dx diretta

4955470  
046

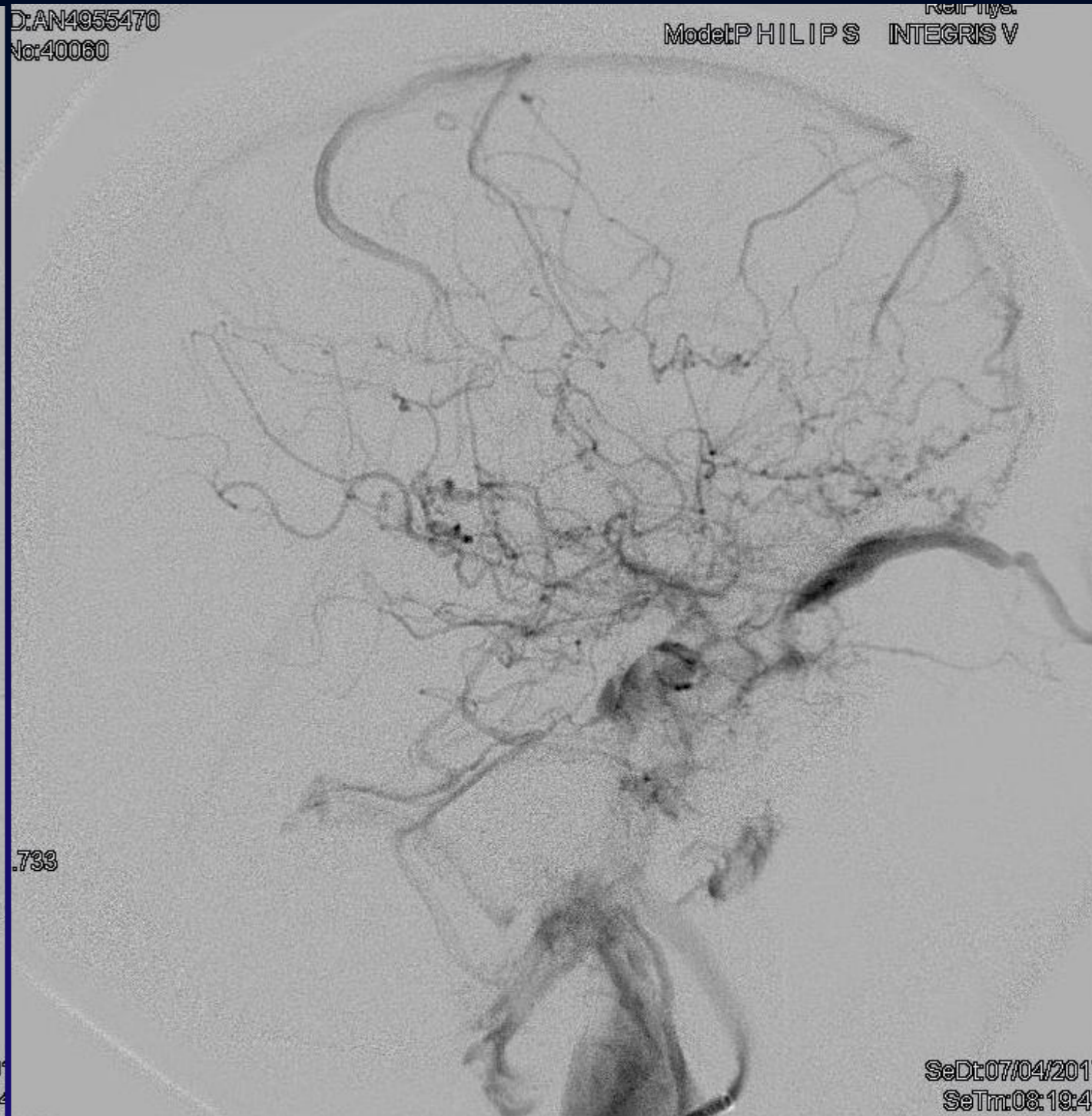
Model: PHILIPS INTEGRIS V



SeDt:07/04/201  
SeTm:08:19:4

D:AN4955470  
Ncr:40060

Model: PHILIPS INTEGRIS V



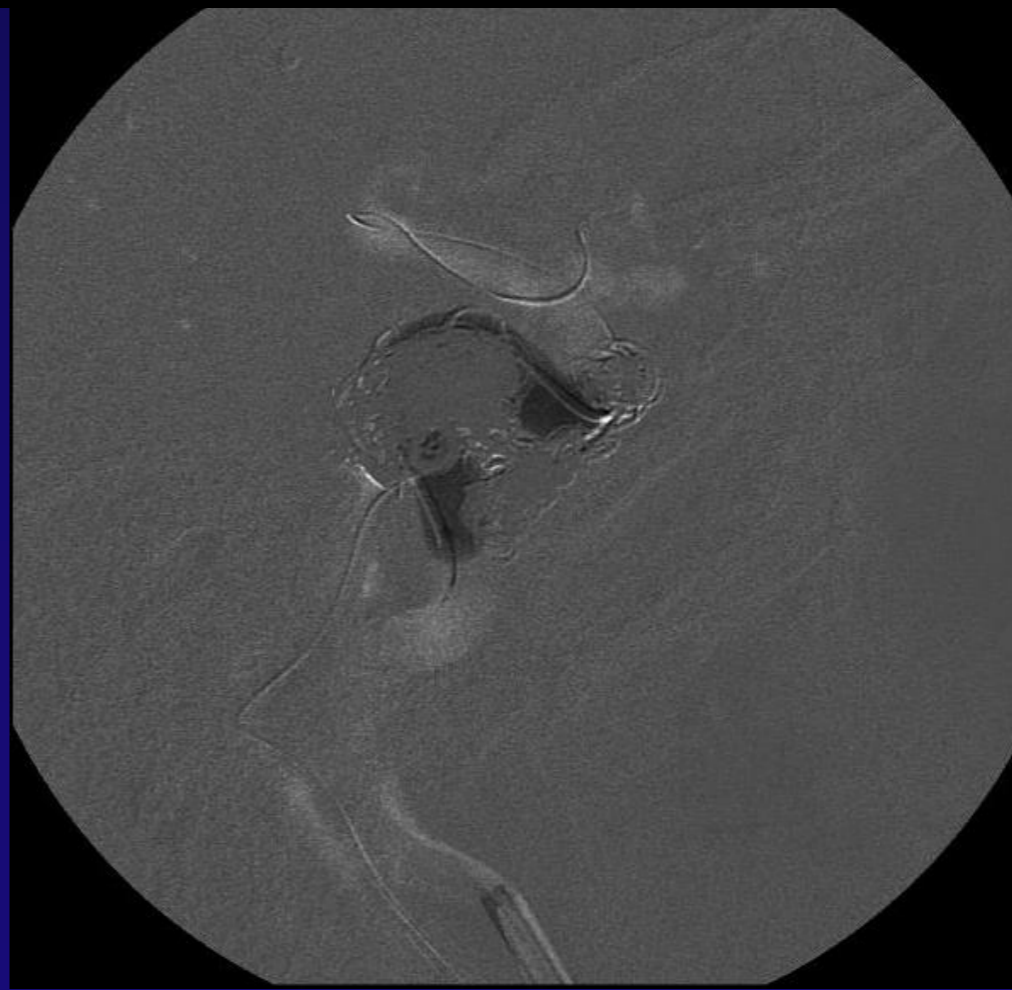
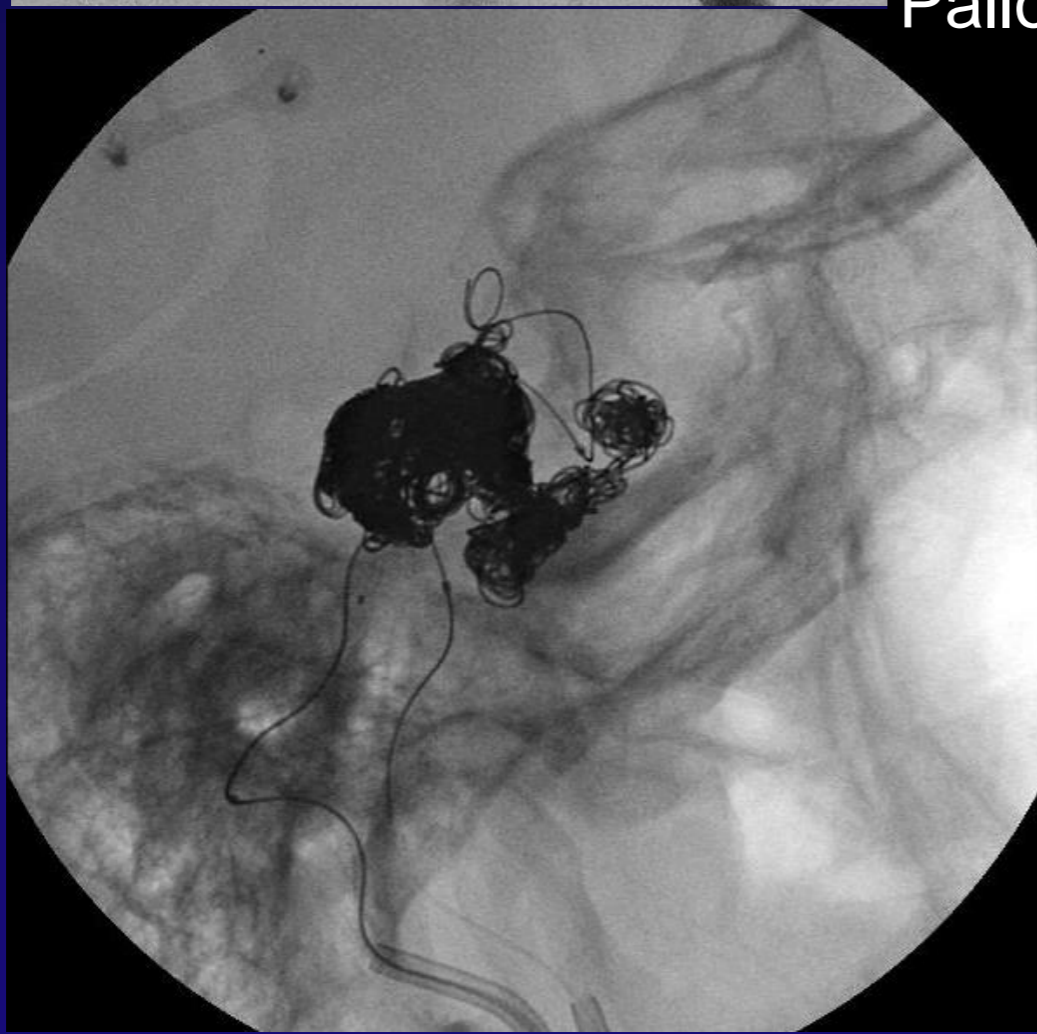
.733

SeDt:07/04/201  
SeTm:08:19:4

AN4955470  
t40012



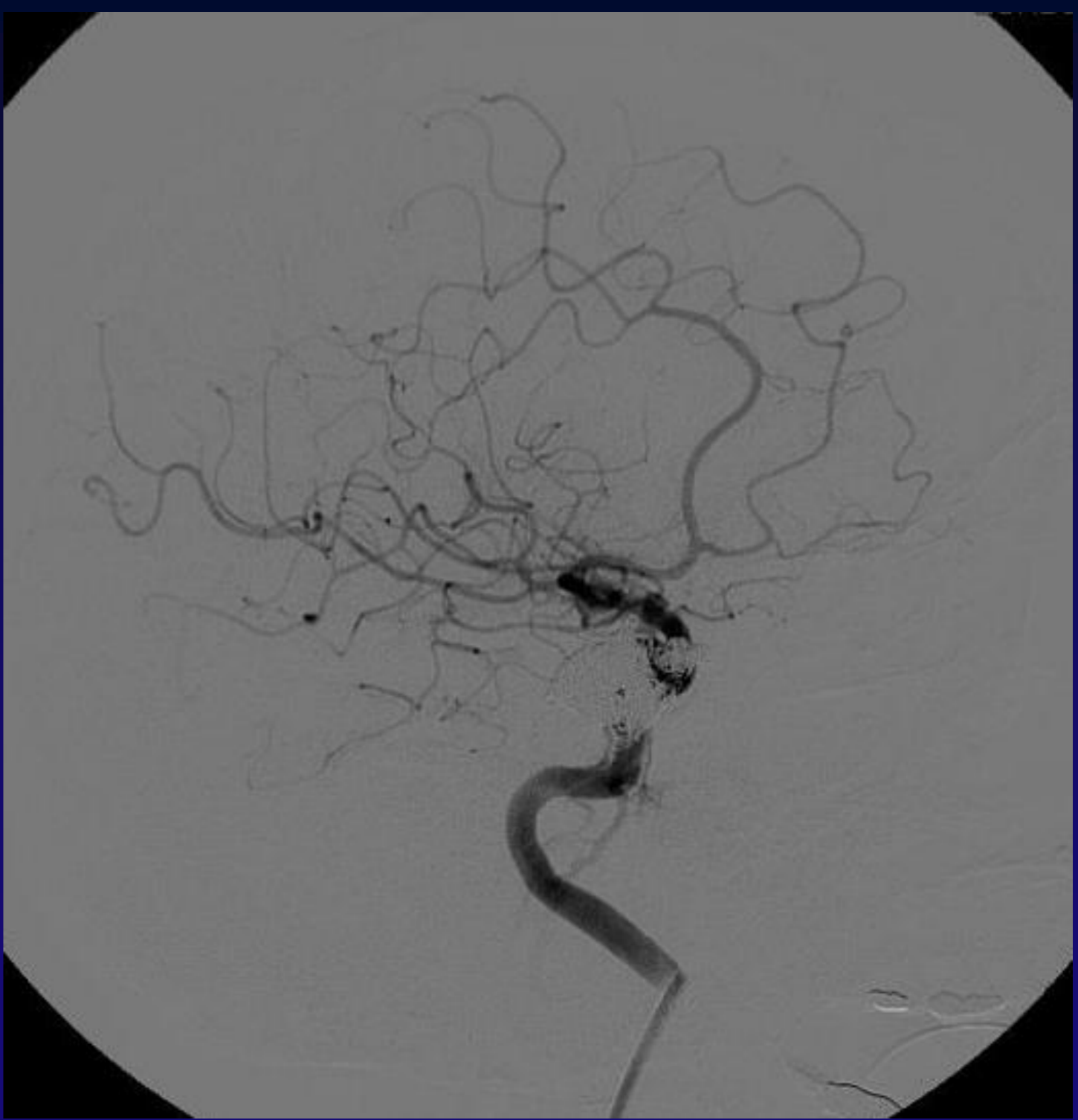
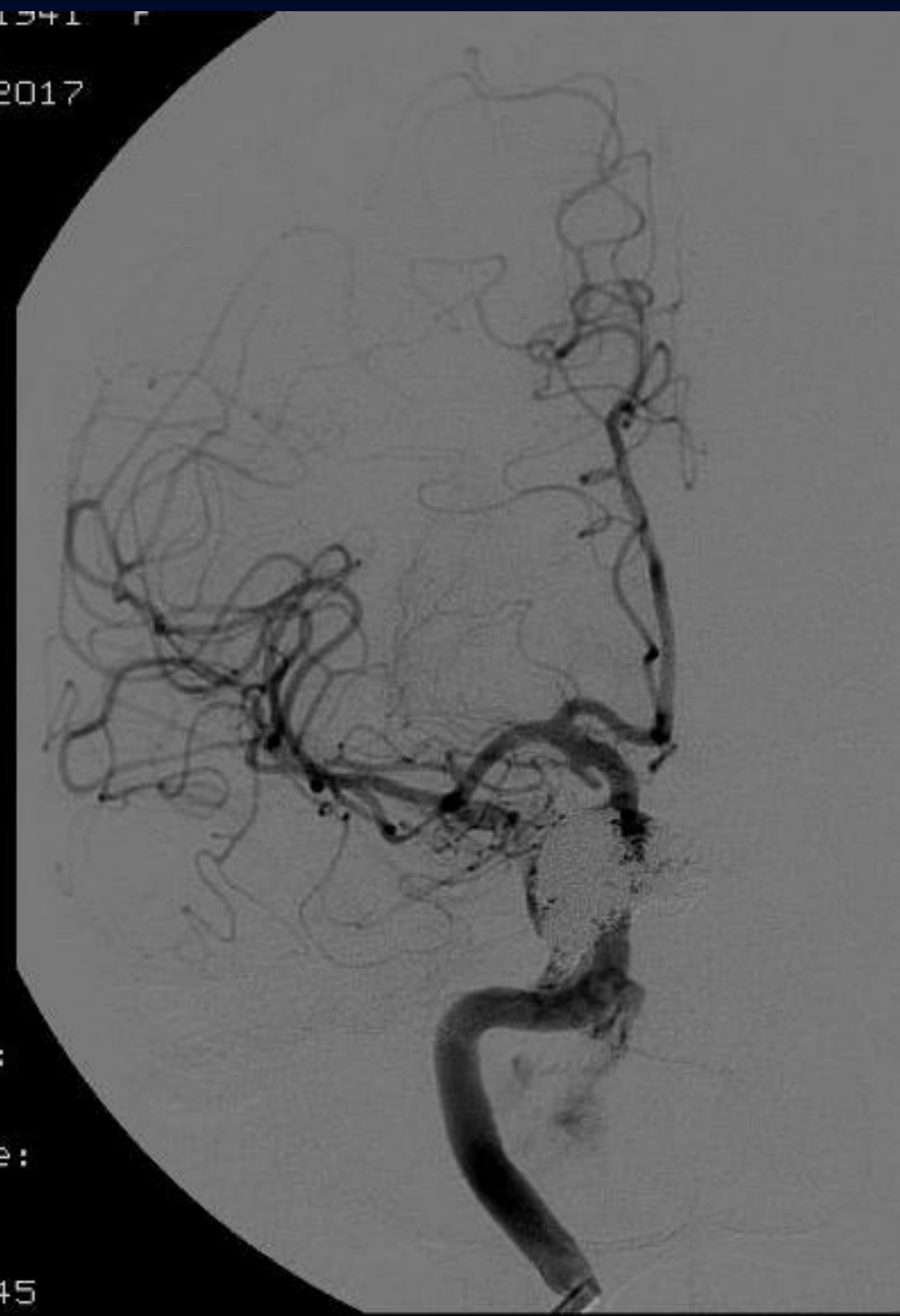
Embolizzazione transarteriosa e transvenosa  
Pallone di protezione nel sifone carotideo

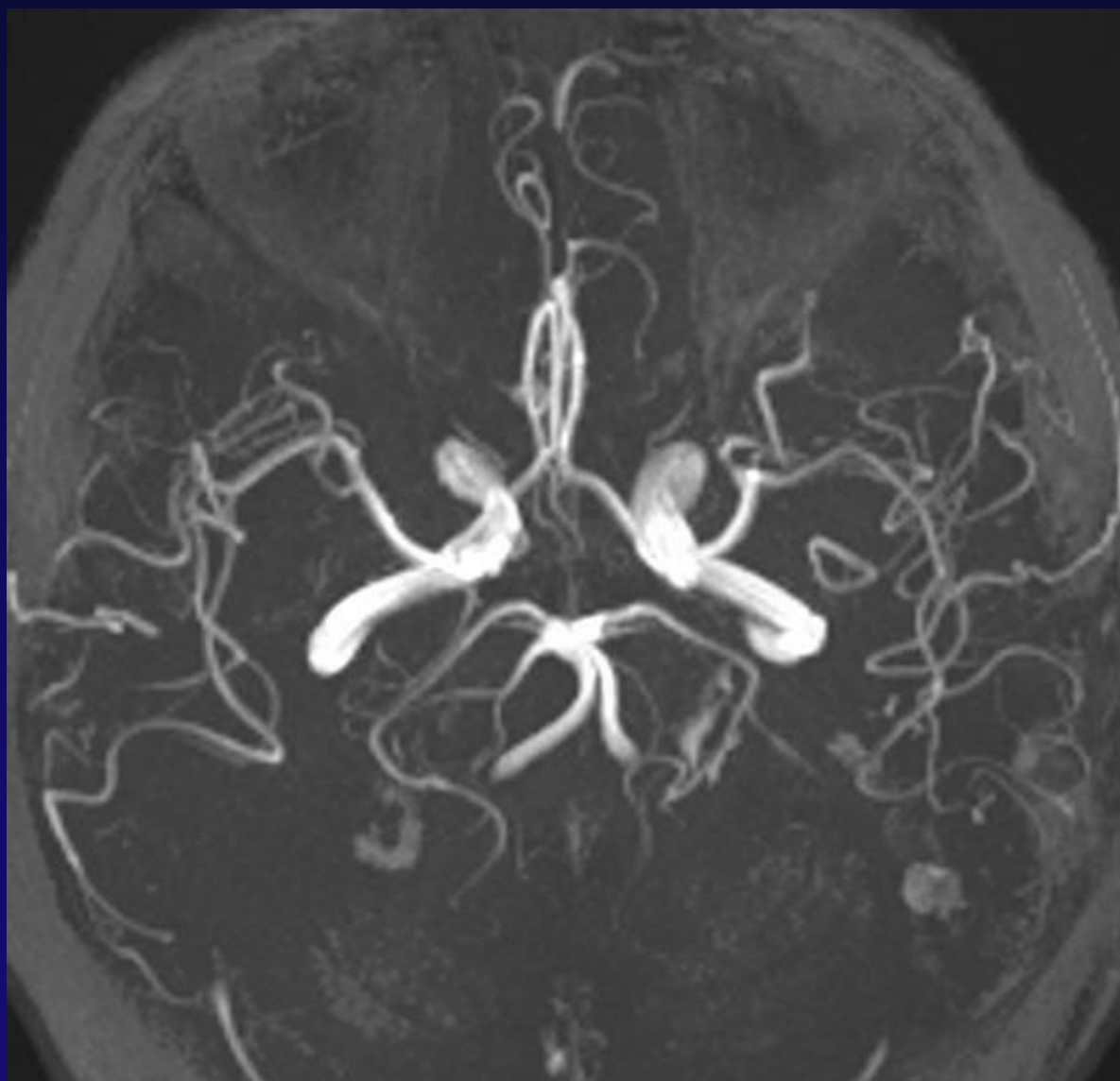


1341 F

2017

45

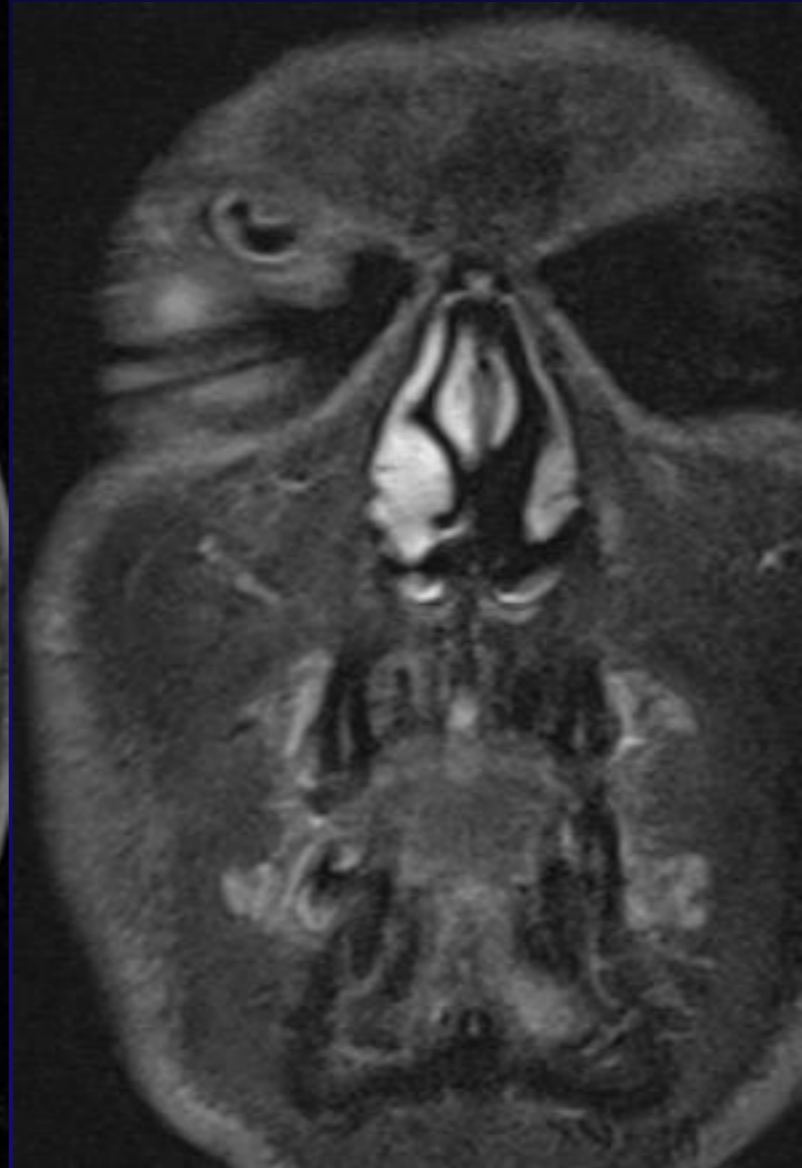
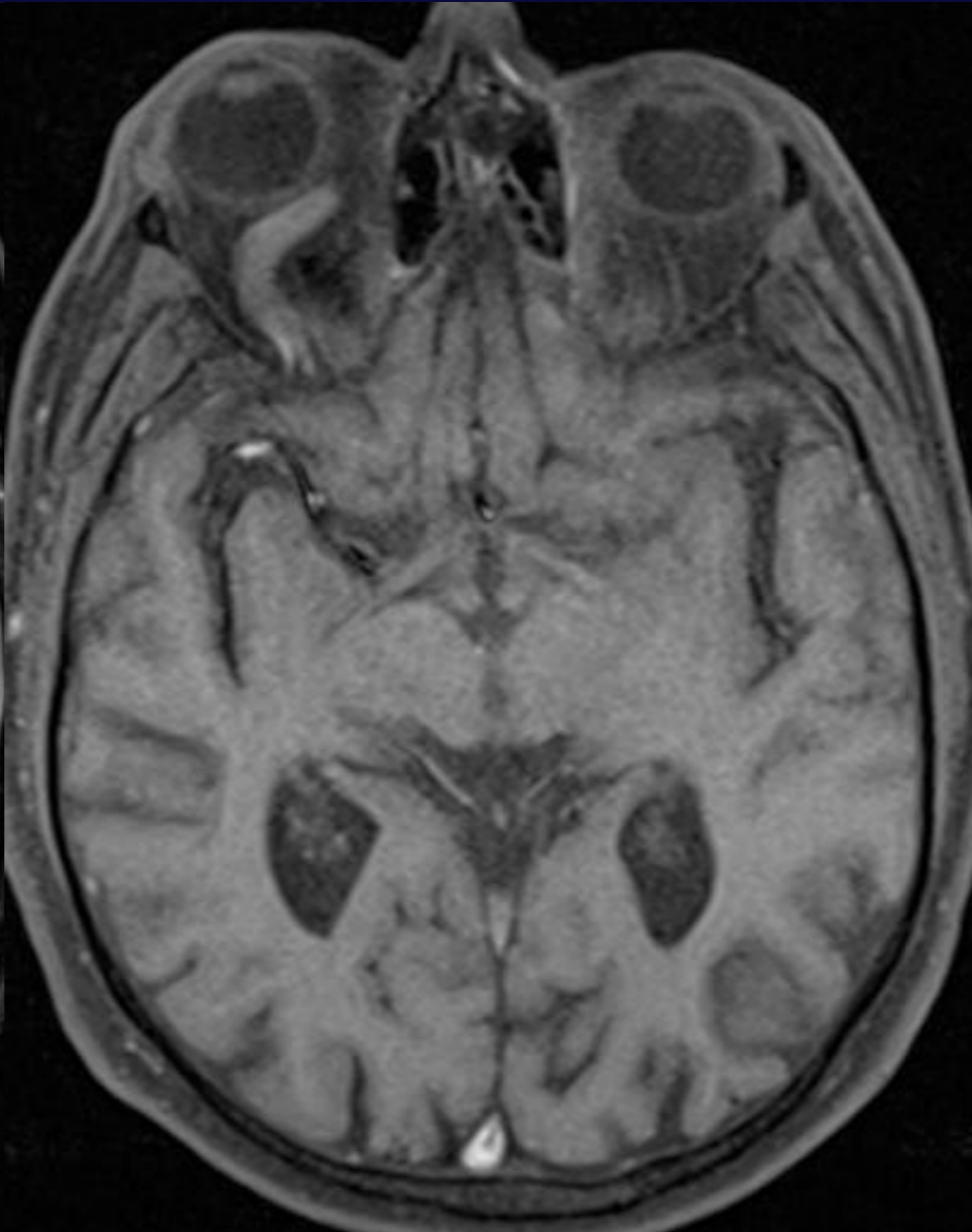
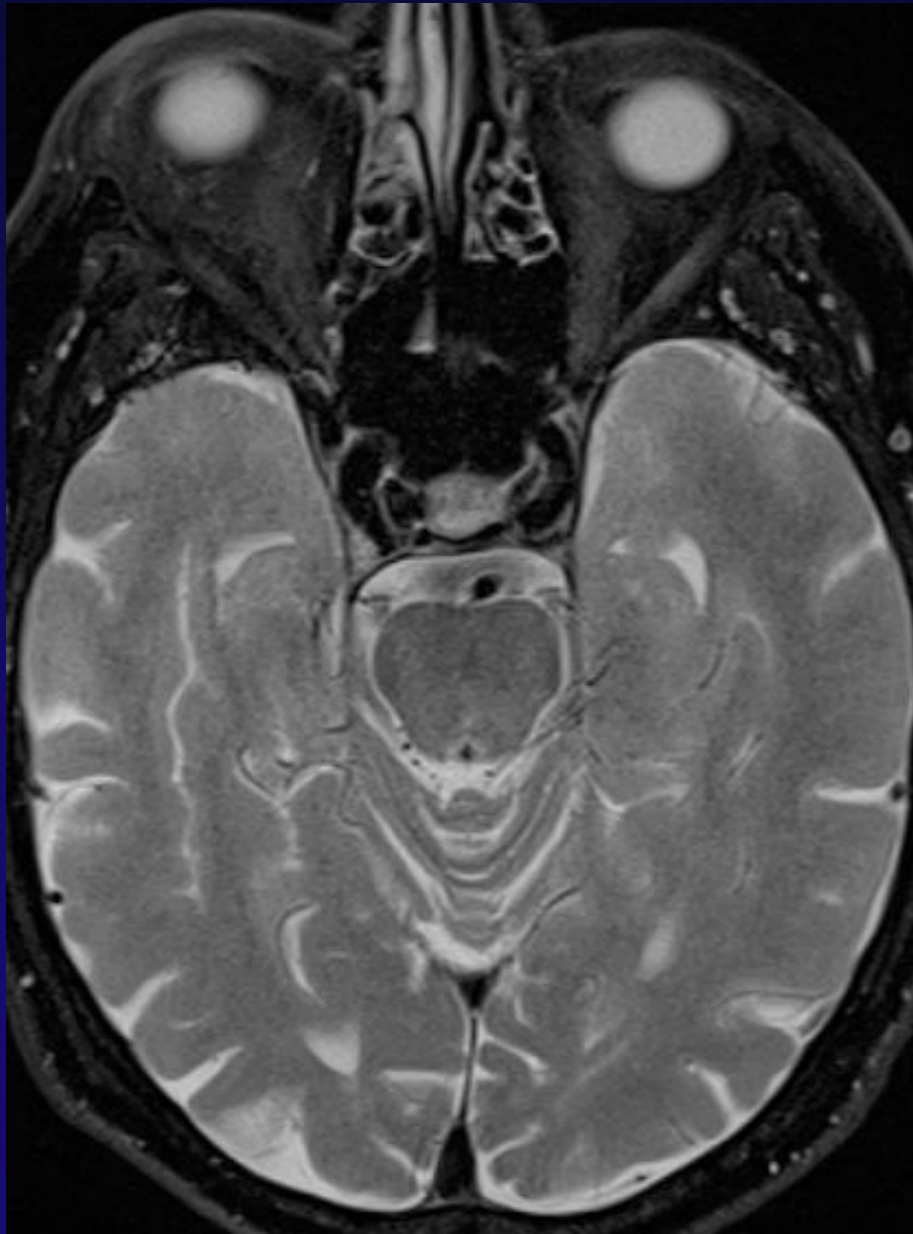






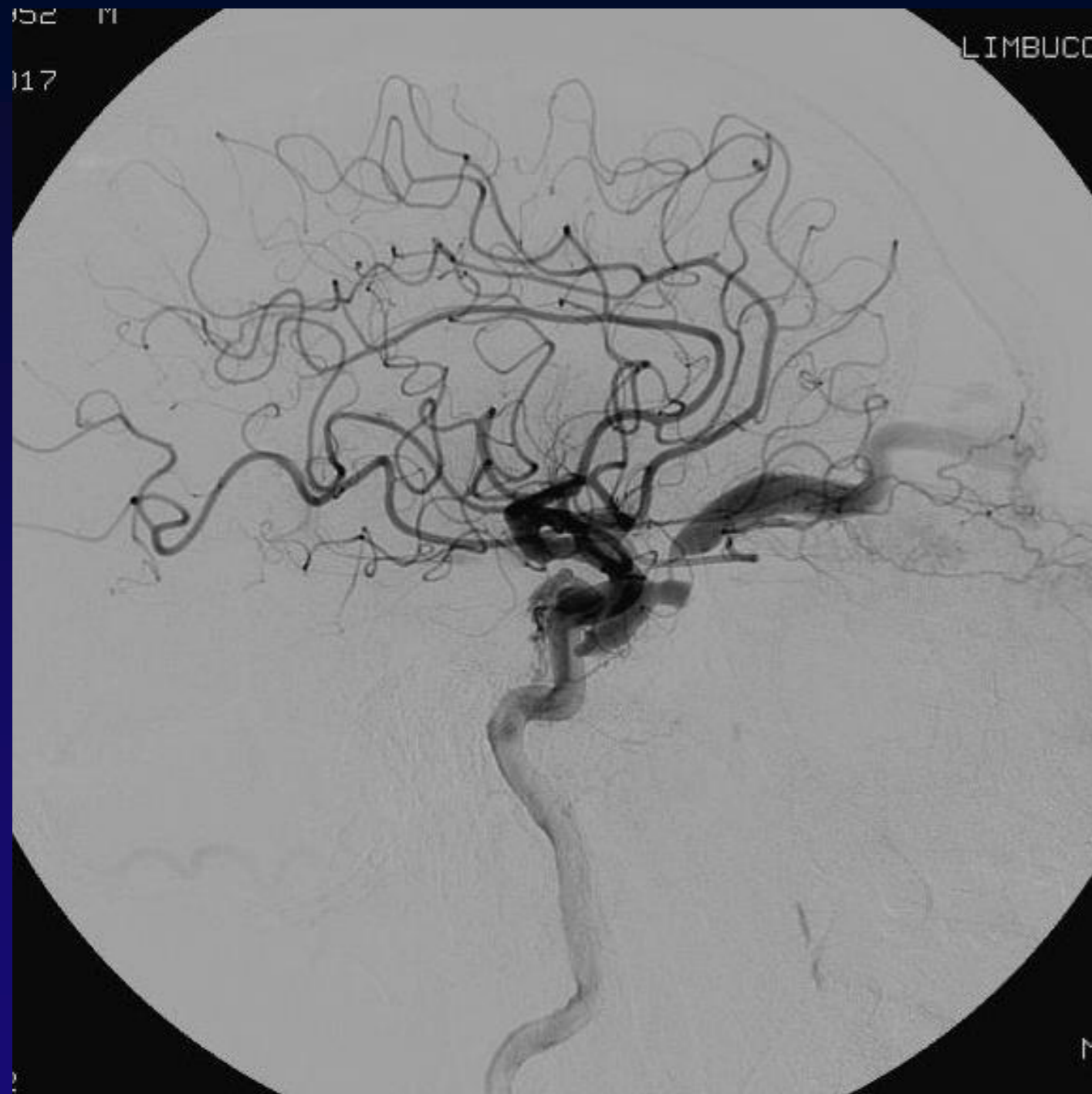
M, 64 aa

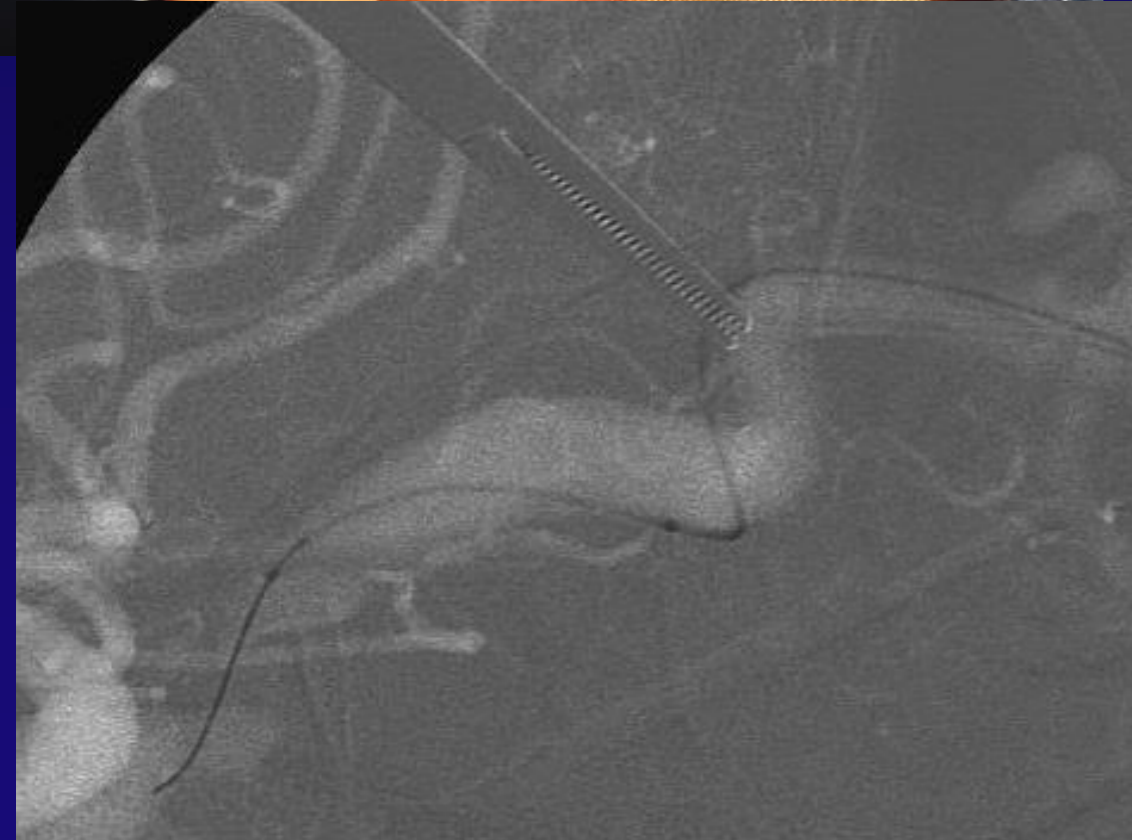
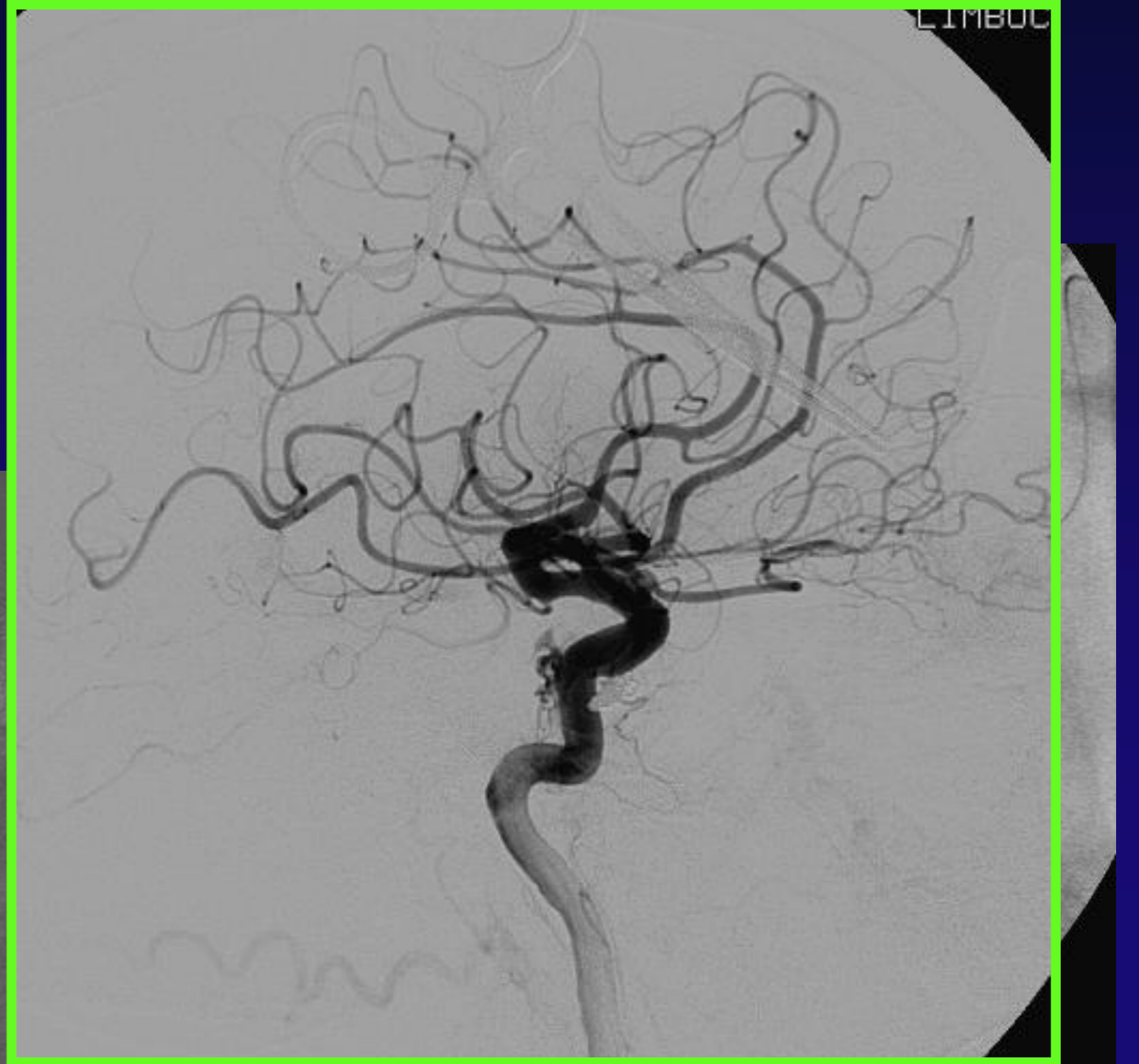
Progressiva comparsa di diplopia ed esoftalmo a dx. Cefalalgico



# FISTOLA ARTEROVENOSA DURALE DEL SENO CAVERNOSO

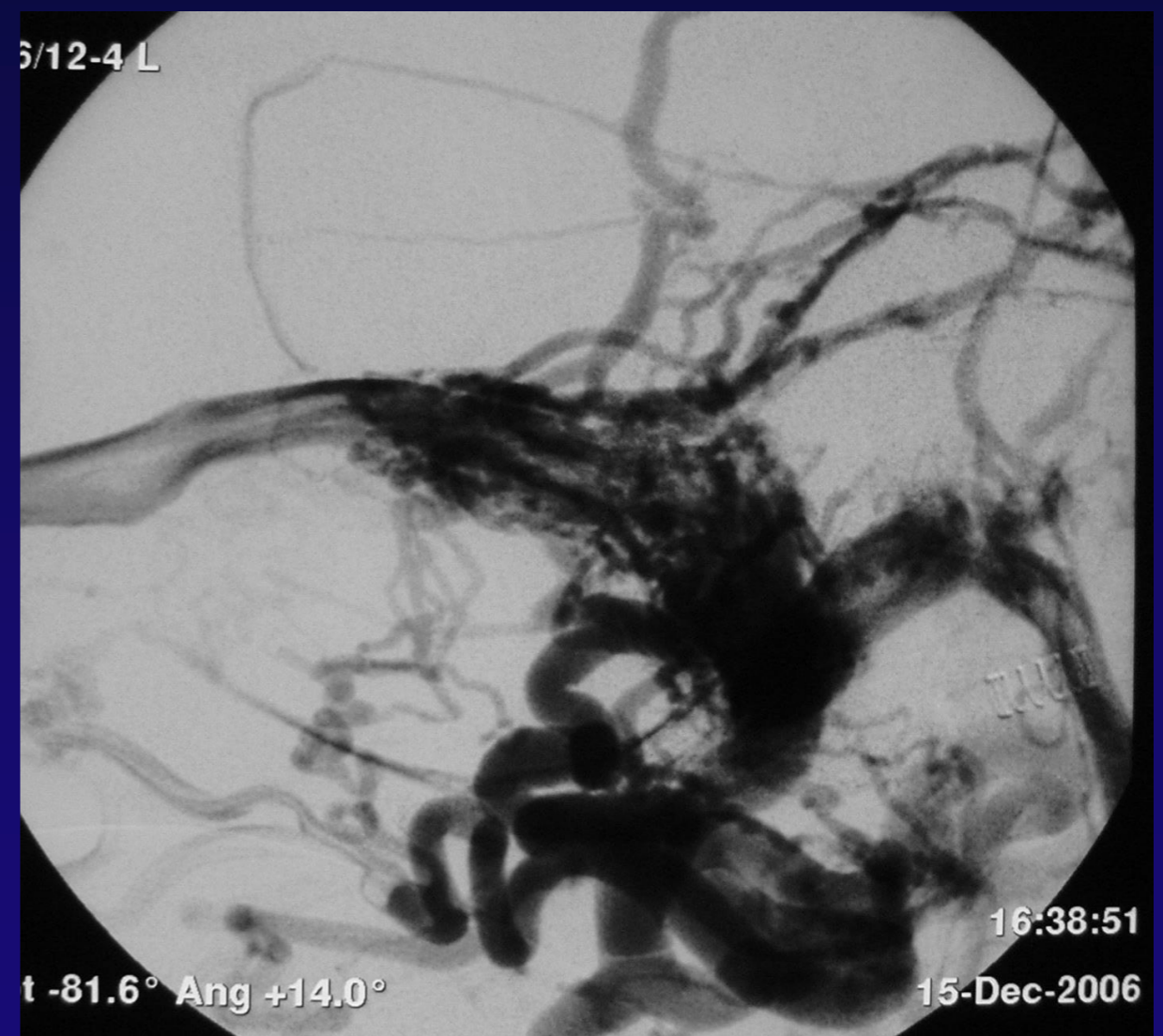
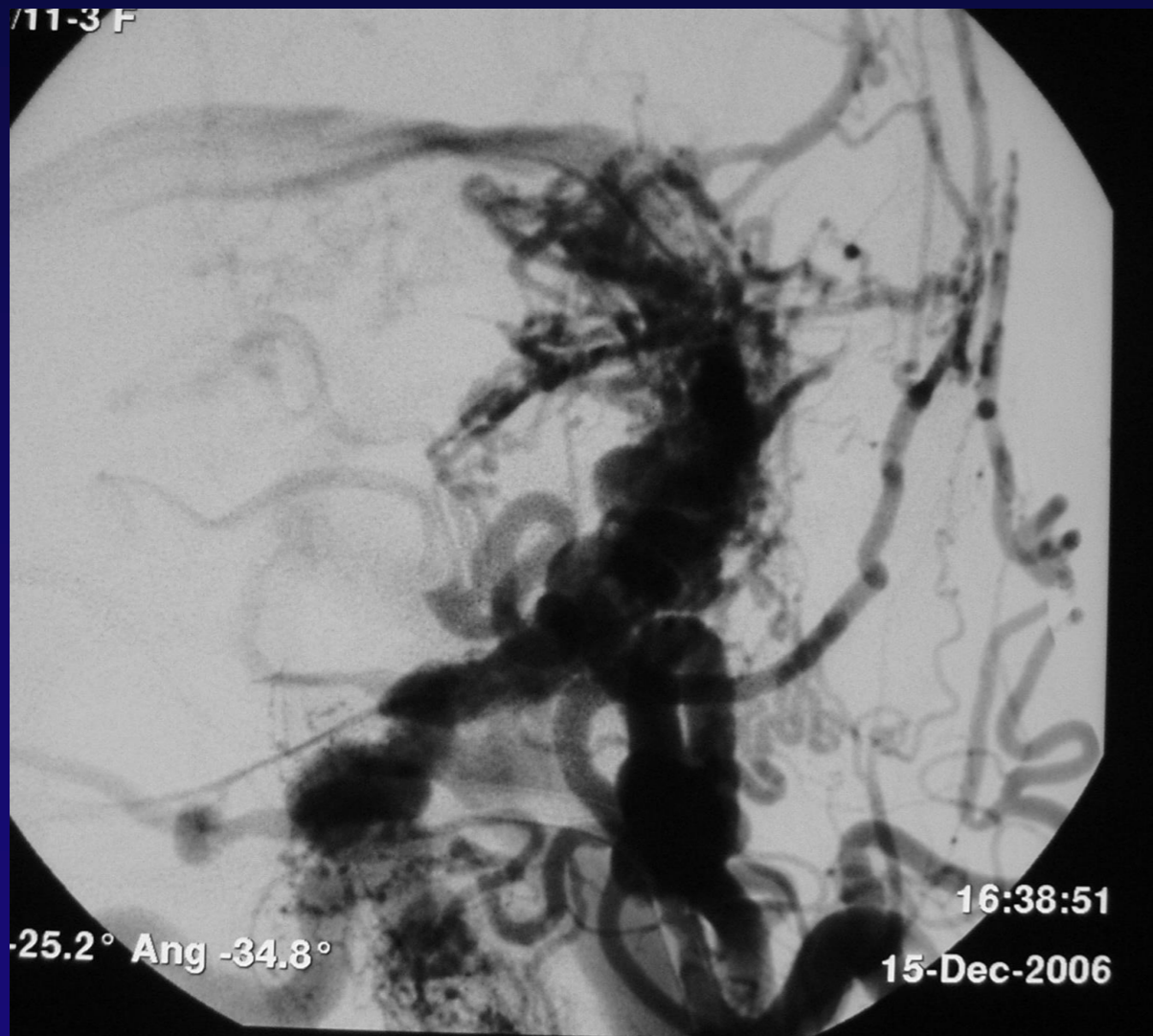
## Fistola carotido-cavernosa dx INDIRETTA





# Sequele a distanza da trauma: FAVD seni

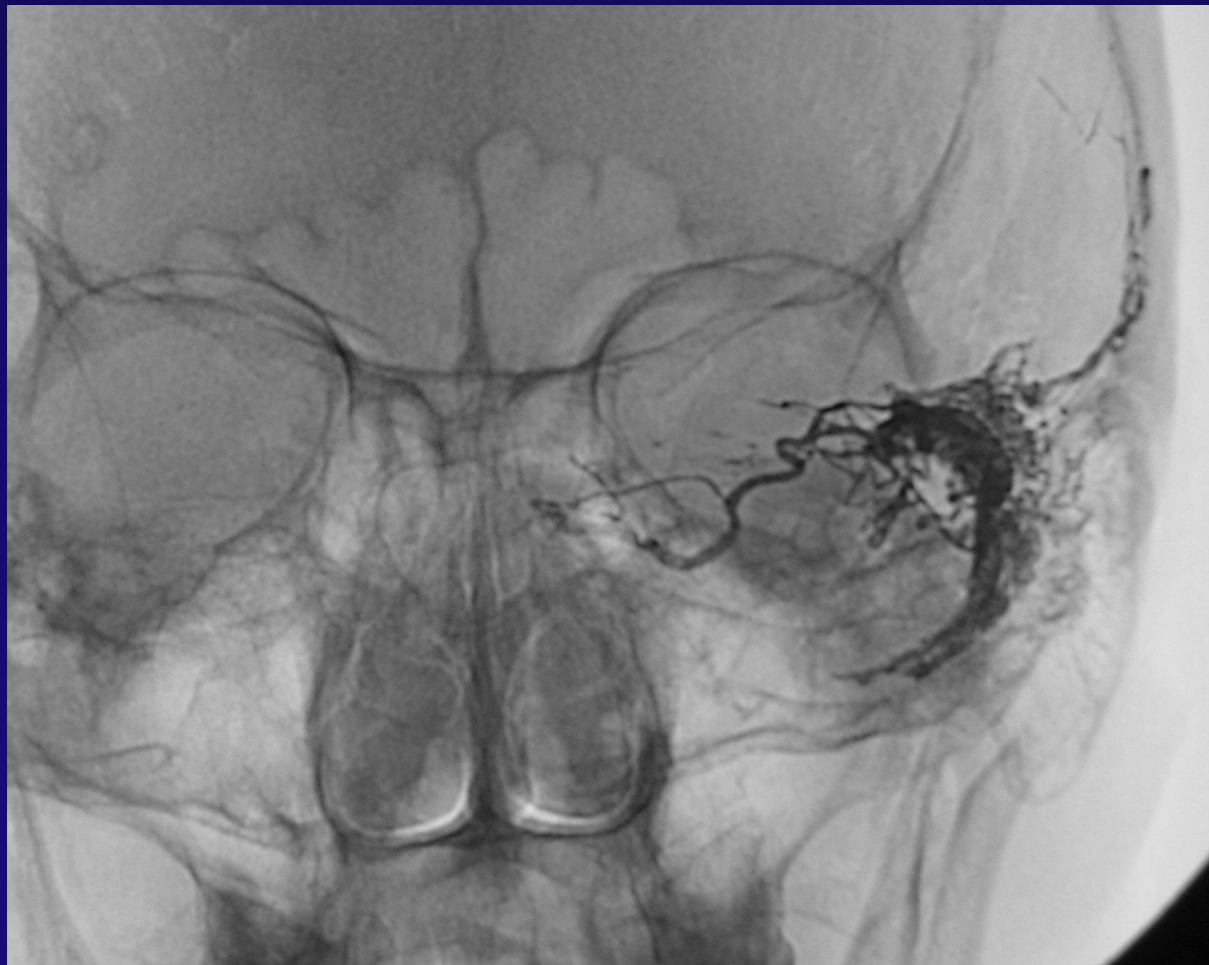
F, trama cranico 18 mesi prima :acufeni pulsanti, decorso ingravescente



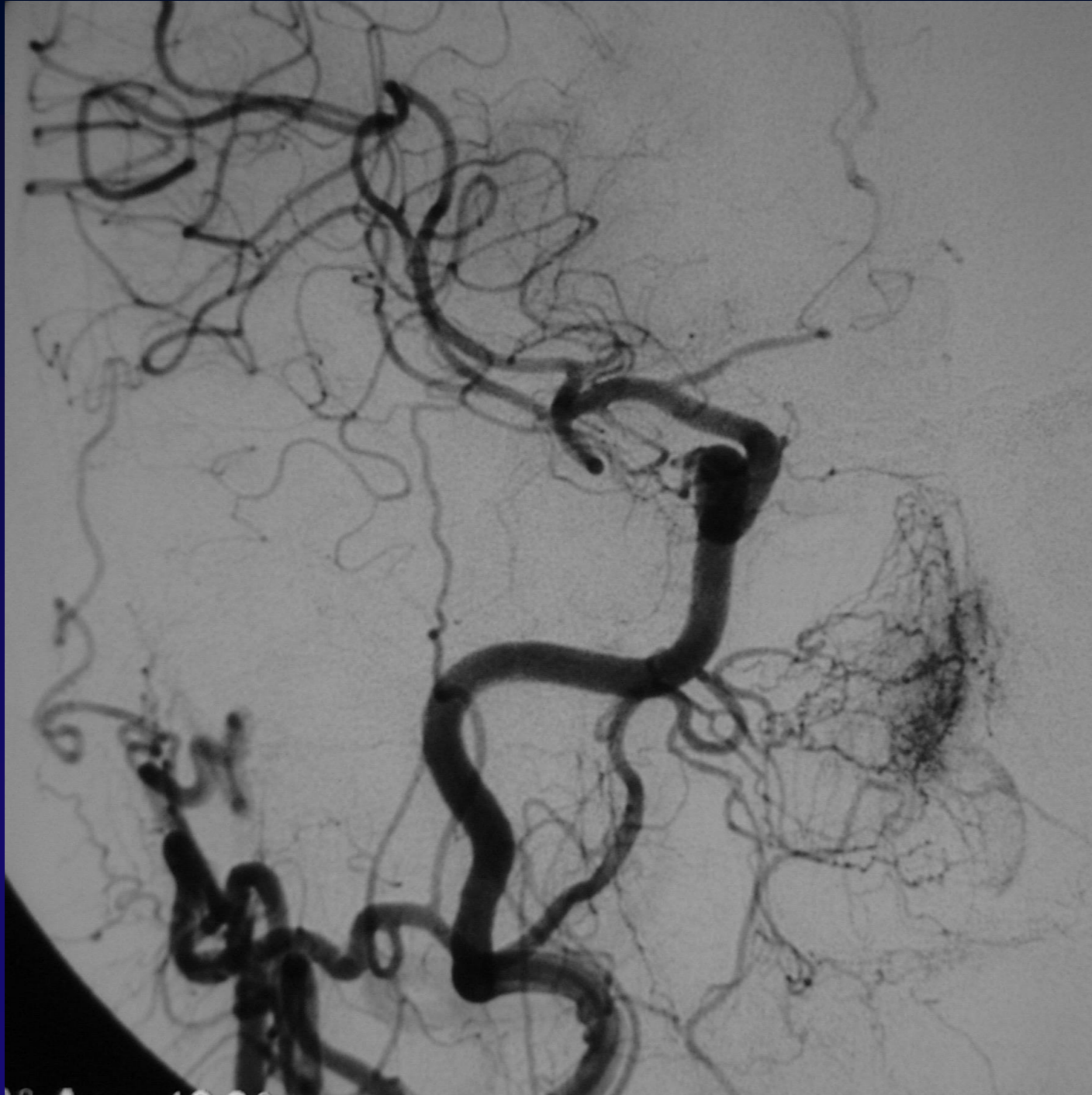
C Est sin pre embol



**Calco finale**  
**Onyx 3 cc**



# FINALE



CC dx



CC sin

# PSEUDOTUMOR CEREBRI

## (Ipertensione Intracranica Idiopatica)

“aumento della pressione intracranica in assenza di un tumore o altre cause”

### TRIADE CLINICA:

cefalea

disturbi del visus (vista binoculare)

papilledema

### LIQUOR:

> 25 cm H<sub>2</sub>O

Composizione normale

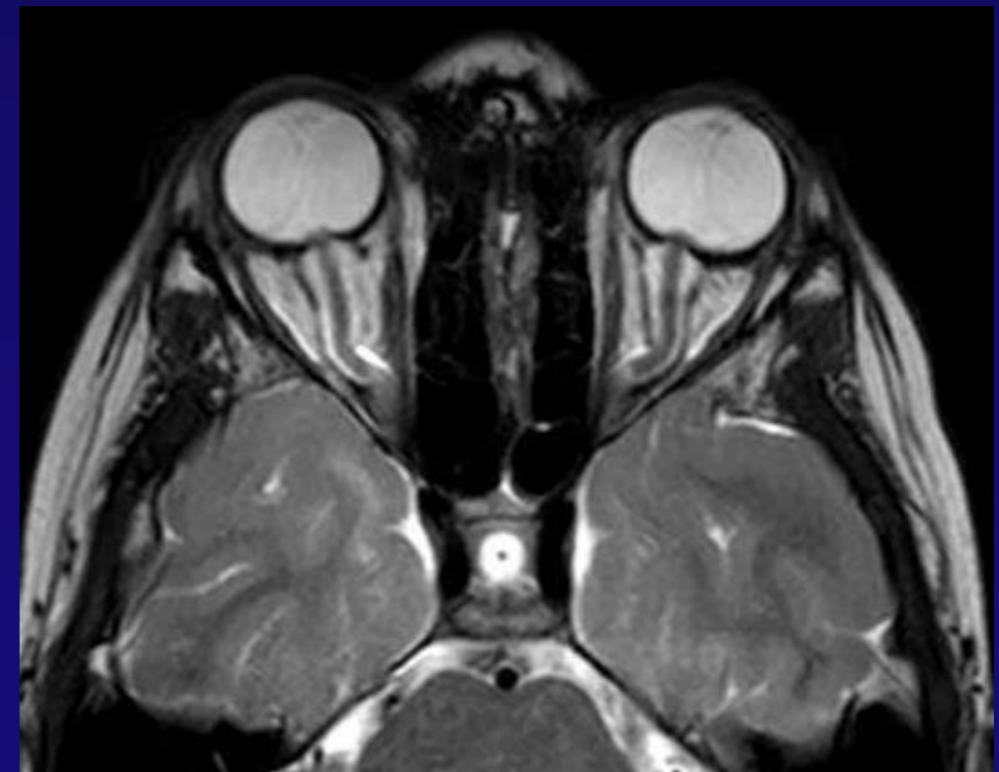
### IMAGING:

Distensione della guaina dei nervi ottici

Tortuosità dei nervi ottici

Sella vuota

Stenosi dei seni durali



# Modified Dandy criteria

- **No focal neurological deficits**
- **Increased CSF pressure on lumbar puncture (> 25cmHg)**
- **MR: absence of neuroradiological signs. Ventricular system not enlarged.**

Indirect signs: partially empty sella turcica, increased CSF space around the optic nerves. Venous sinus stenosis.

- **Patients is alert/ awake**
- **No other causes of intracranial hypertension**



## EPIDEMIOLOGIA

0.5-2 / 100000 nella popolazione generale

12-20/100000 tra le donne obese

Tipicamente donne giovani obese

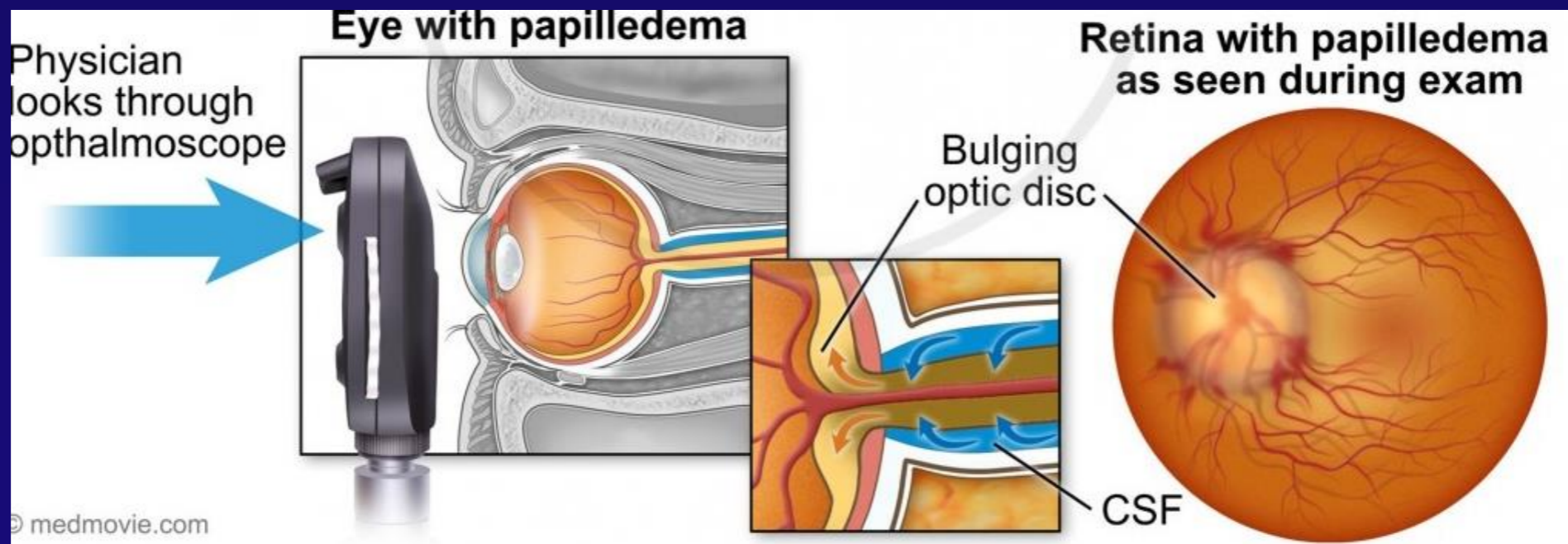
Raro negli uomini e in età pediatrica

**SPESSO NON RICONOSCIUTO COME UNA VERA PATOLOGIA**

**PAZIENTI DEPRESSI**

**SI ASSOCIANO SINTOMI GENERICI (fatica, disestesia)**

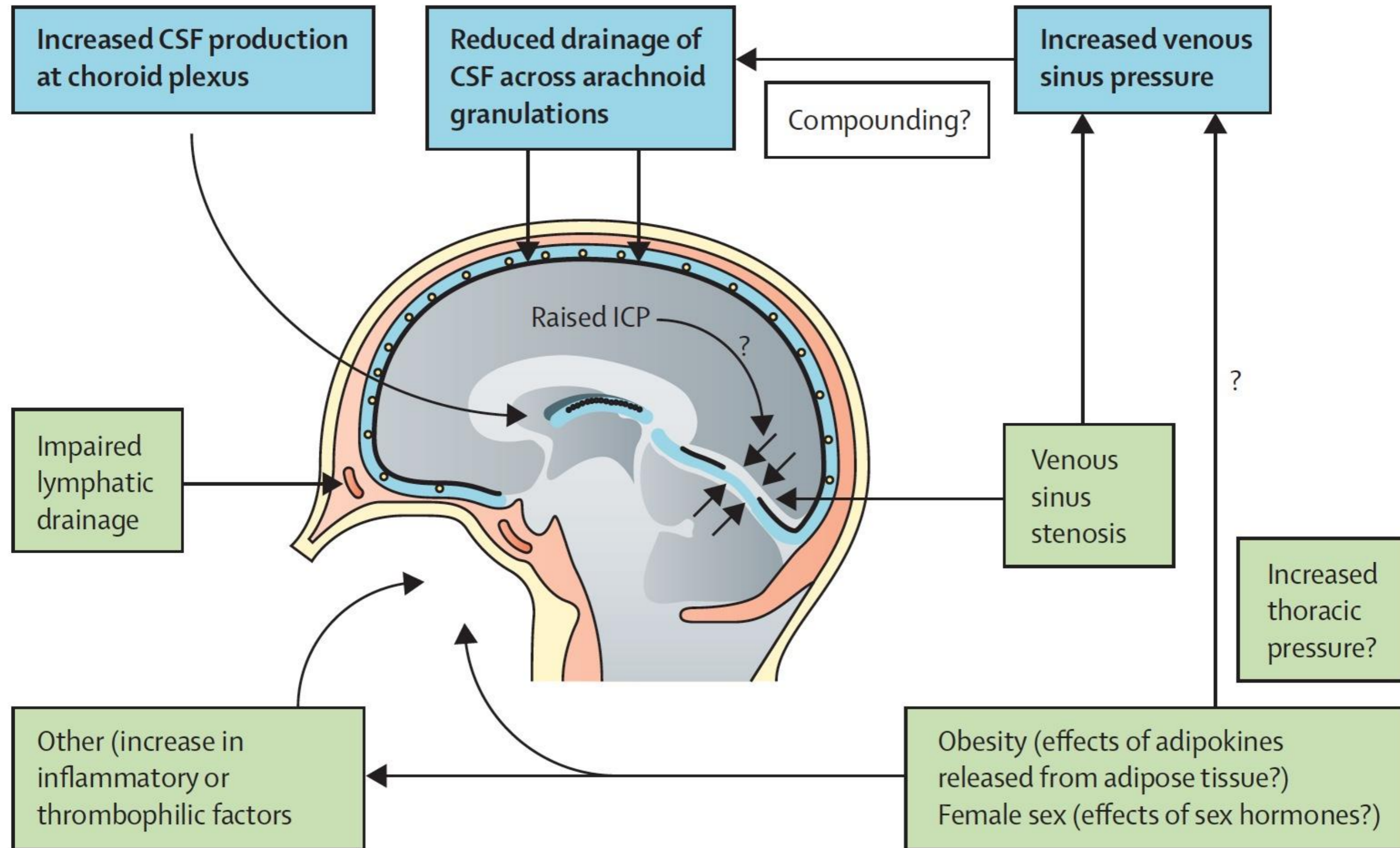
**A VOLTE ACUFENE E DEFICIT NERVI CRANICI**



# Understanding idiopathic intracranial hypertension: mechanisms, management, and future directions

Lancet Neurol 2016

Keira A Markey, Susan P Mollan, Rigmor H Jensen, Alexandra J Sinclair



# TRATTAMENTO

## TERAPIA MEDICA:

Spesso efficace nei casi meno severi

Diuretici (acetazolamide)

Correzione obesità (< 10% del peso può migliorare sintomi)

## DIVERSIONE CSF:

VP vs LP vs VJ vs VA ecc Non evidenza di superiorità

Miglioramento dei sintomi oftalmici > 50% dei casi, poco effetto sul tinnito

Nel 50% necessaria revisione ; nel 30% multiple revisioni

## FENESTRAZIONE GUAINA NERVI OTTICI:

Papilledema migliora >80%

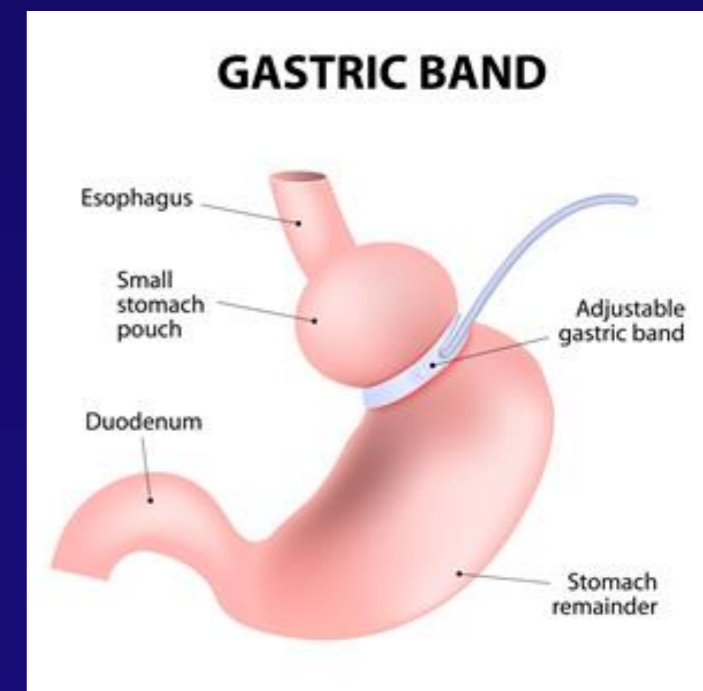
Poco effetto su acufeni e cefalea

Complicanze 5-25%

## CHIRURGIA BARIATRICA (bypass o bendaggio):

riduzione sintomi nel 90% dei casi

Complicanze severe 3% mortalità 0.3%



# TRATTAMENTO ENDOVASCOLARE

Da alcuni anni dimostrata la frequente associazione tra PTC e stenosi dei seni durali  
Miglioramento clinico dopo ricanalizzazione dei seni

## STENOSI:

granulazioni?

compressione estrinseca?

esito trombosi?

fibrosi?

Vasculopatia da stress emodinamico?

Viene prima la stenosi o l'ipertensione?



# TRATTAMENTO ENDOVASCOLARE: STENTING

## CRITERI DI INCLUSIONE:

Stenosi focale o segmentaria FUNZIONALE

Indispensabile la misurazione DIRETTA del gradiente pressorio

No ipoplasia costituzionale

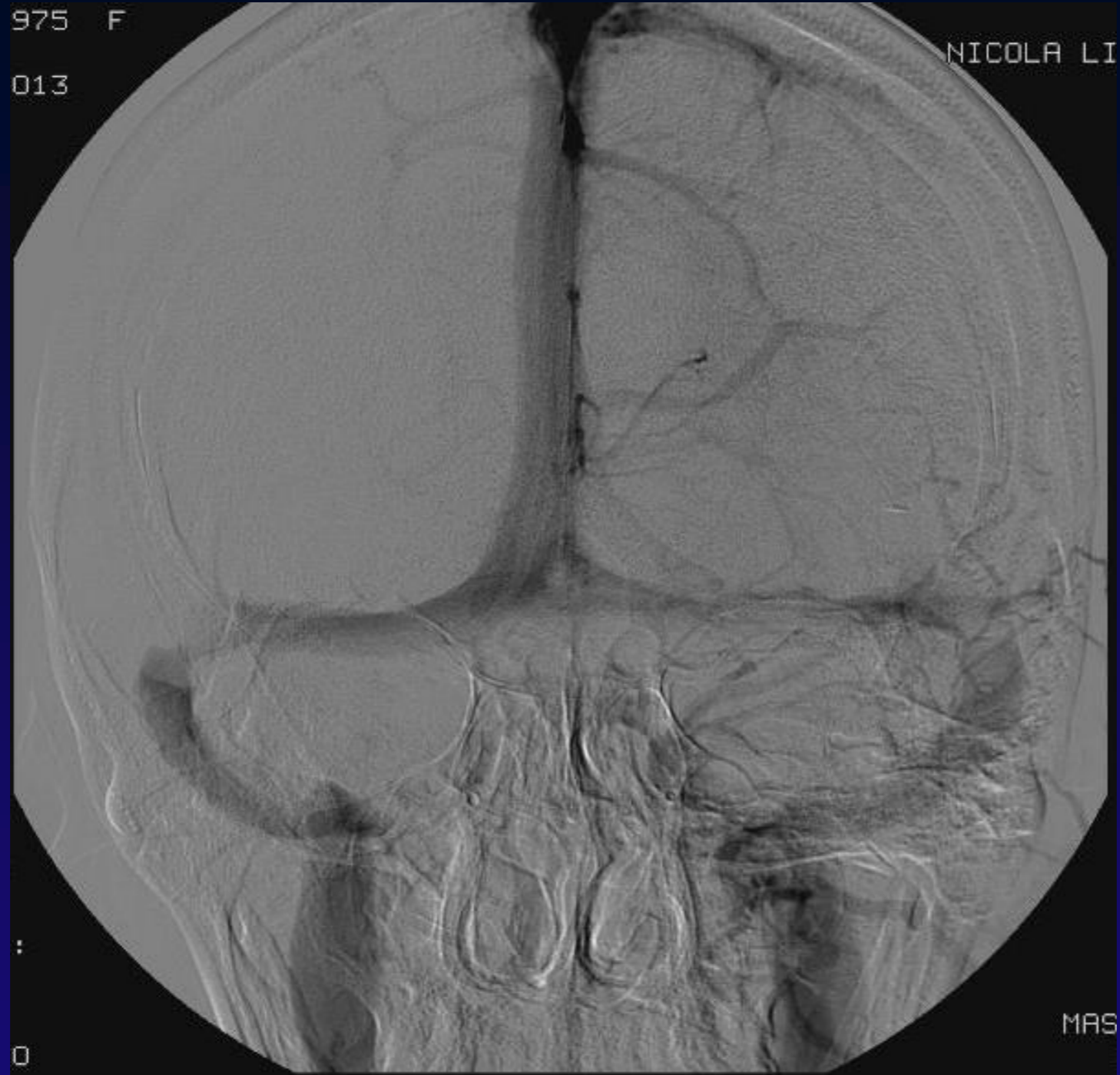
Resistenza alla terapia medica o clinica fulminante

Rapido miglioramento del gradiente pressorio (breve e lungo termine)

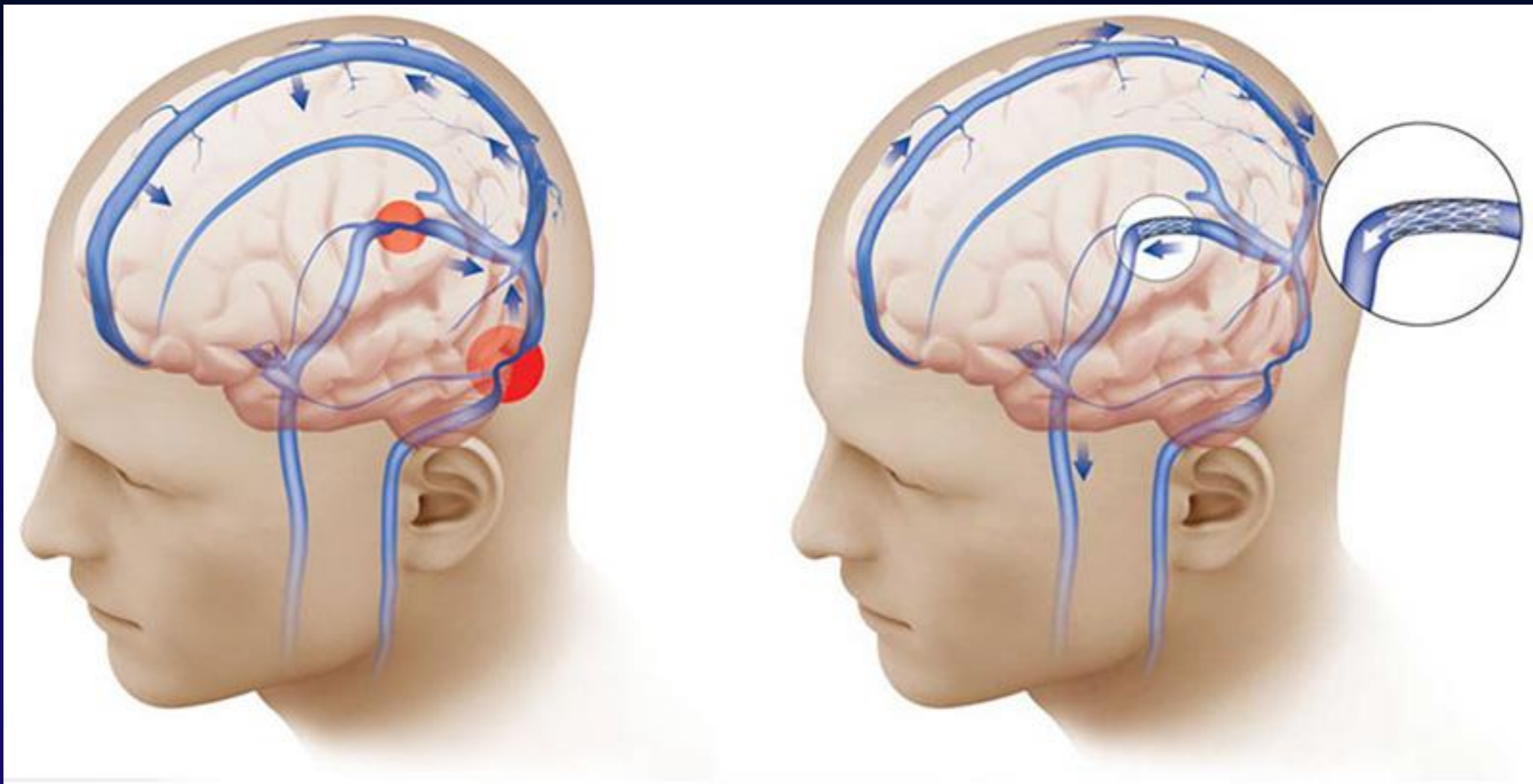
Riduzione sintomi marcata >60%

Profilo di rischio accettabile (complicanze severe < 2%)





Gradiente 15 mmHg a dx e 11 mm Hg a sn



# Idiopathic intracranial hypertension: 120-day clinical, radiological, and manometric outcomes after stent insertion into the dural venous sinus

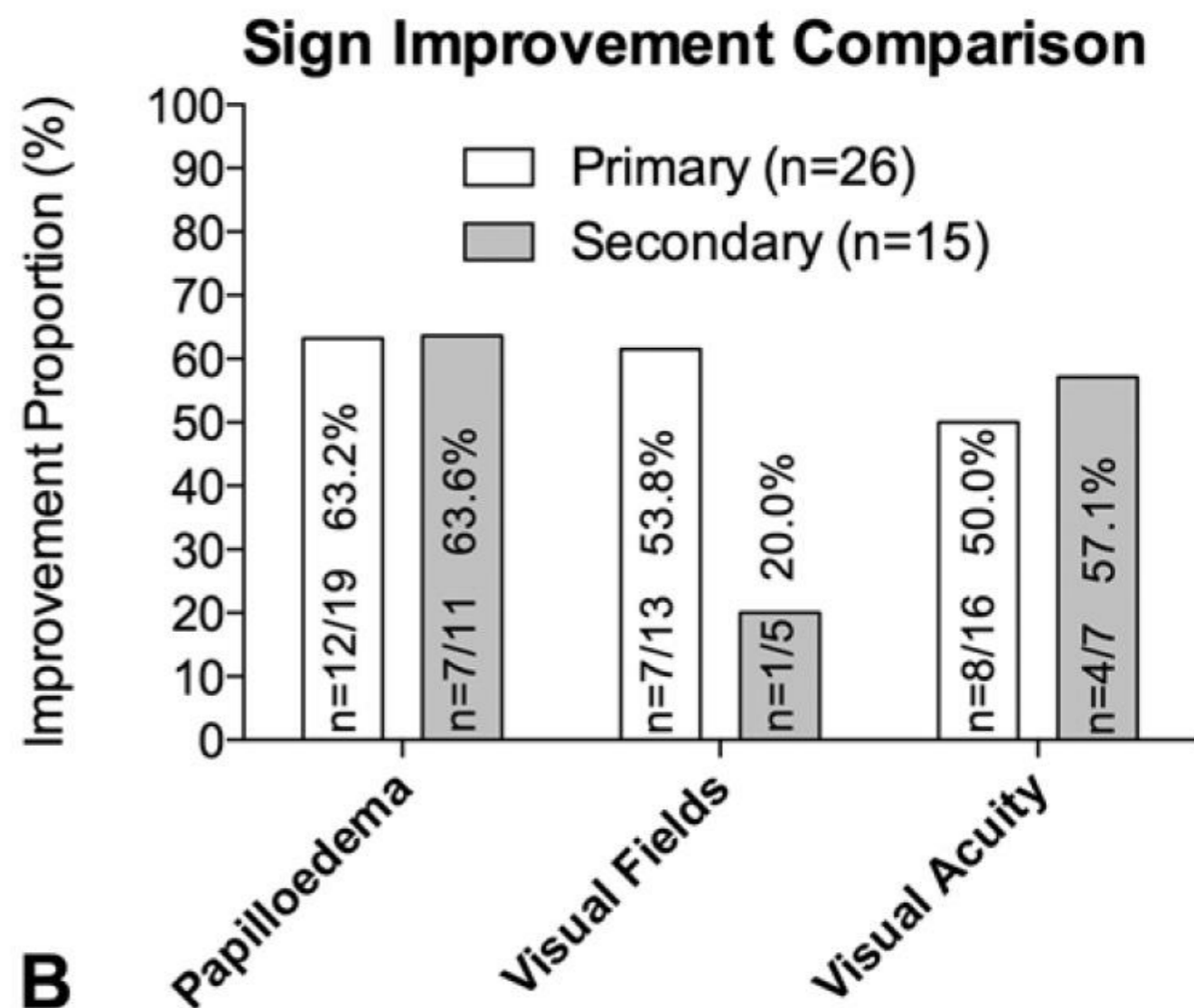
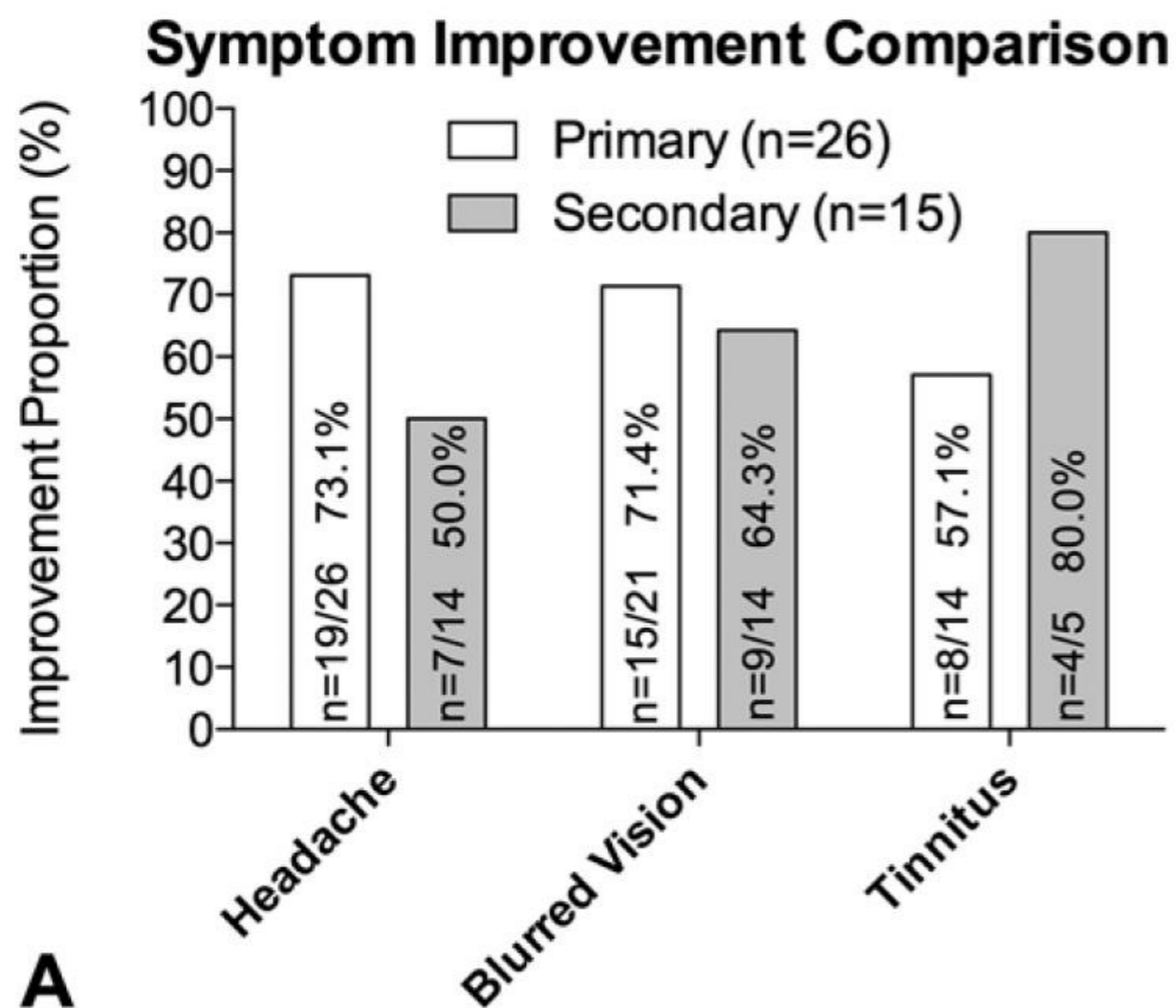
Journal of Neurosurgery 2017

\*Hasan Asif, MRCS, Claudia L. Craven, MSc, MRCS, Almas H. Siddiqui, MBBS, Syed N. Shah, MBBS, Samir A. Matloob, MRCS, Lewis Thorne, FRCS(SN), Fergus Robertson, MD, MA, MRCP, FRCR, Laurence D. Watkins, MA, FRCS(SN), and Ahmed K. Toma, MD, FRCS(SN)

Victor Horsley Department of Neurosurgery, National Hospital for Neurology and Neurosurgery, London, United Kingdom

41 pazienti

(26 trattam primario, 15 dopo fallimento di terapia chirurgica)





# Efficacy, complications and cost of surgical interventions for idiopathic intracranial hypertension: a systematic review of the literature

Acta Neurochir 2017

Aristotelis V. Kalyvas<sup>1,2</sup> • Mark Hughes<sup>1,3</sup> • Christos Koutsarnakis<sup>3,4</sup> •

Metanalisi 41 studi (728 pz)

200 shunt CSF - 342 ONSF - 32 chirurgia bariatrica - 155 stent seni durali

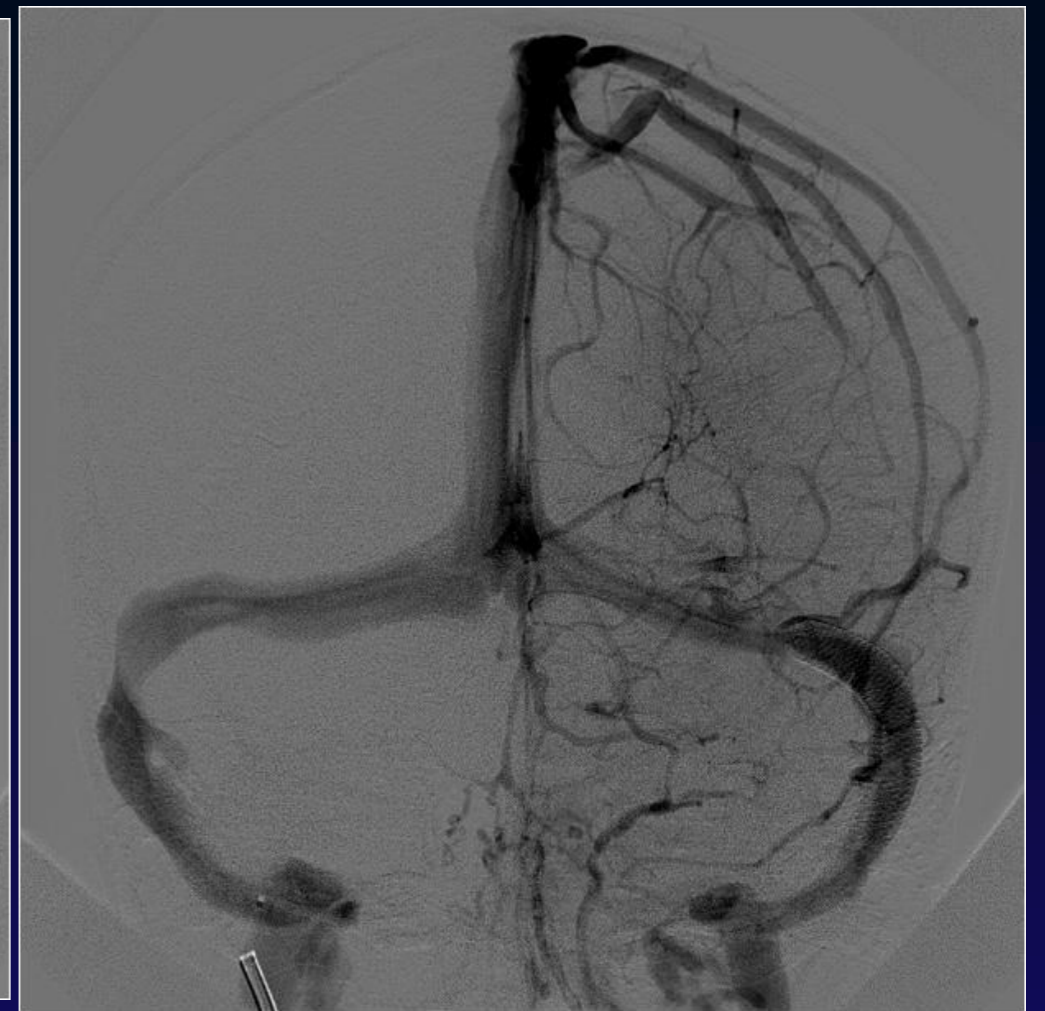
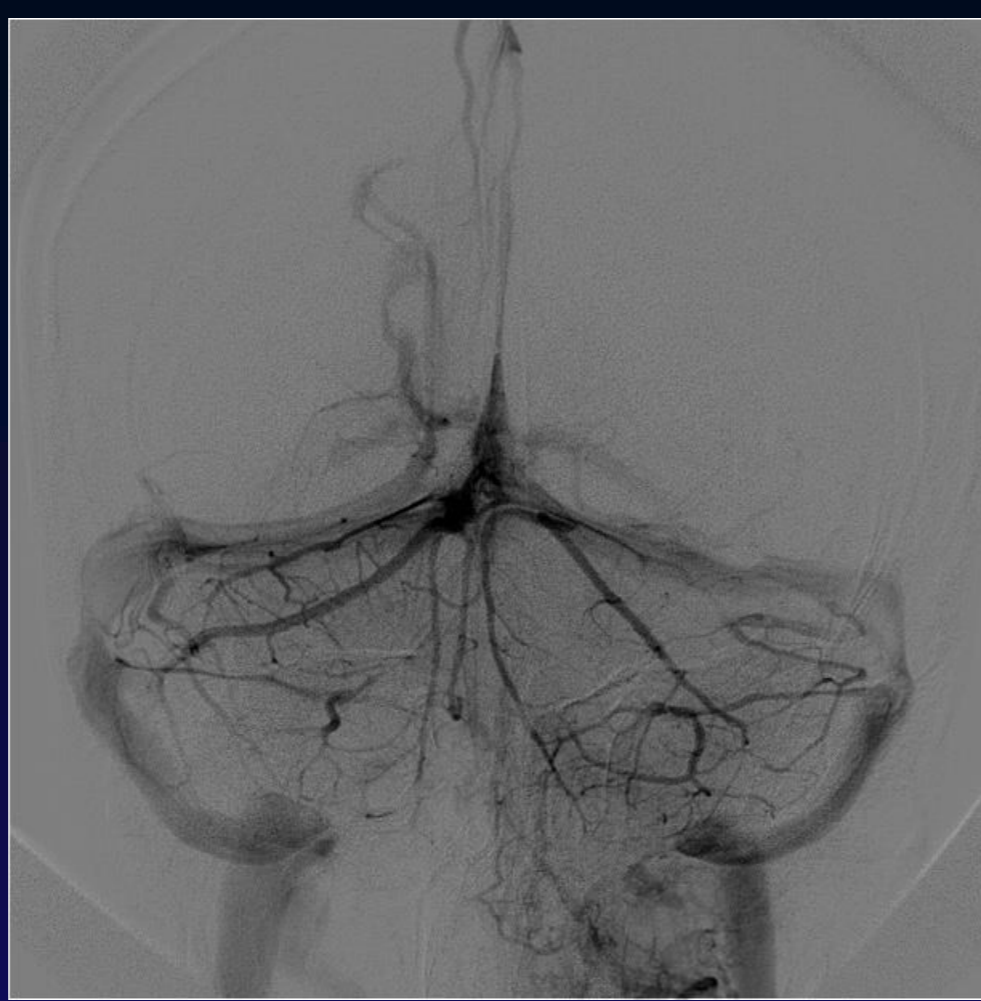
**Table 10** Summary of studies comparing outcomes between surgical interventions

Intervention	Studies	Pts	Female %	Obese %	Mean follow-up, months	Mean age, years,	First surgery performed %	Impr VF %	Primary outcomes					
									Impr VA %	Impr HA %	Impr papp %	RR %	Complications %	Revisions (RPPR)
ONSF	15	341	83.6	94.9	42.3	31.7	75	64	67	41	95	15.9	26	NA
LPS	7	128	90.1	81.7	44.7	32.5	98.3	71	67	96	91	NA	38	211 (4.3)
VPS	6	72	74.2	51.1	39.6	35.2	59.1	69	55	93	90	NA	41	53 (1.83)
Sinus stenting	11	155	88.4	75.7	22.2	34.6	80.3	75	65	77	98	8	12	NA
Bariatric surgery	2	32	100	100	46.8	33.8	80.3	87.5	NR	96	100	10	87	NA

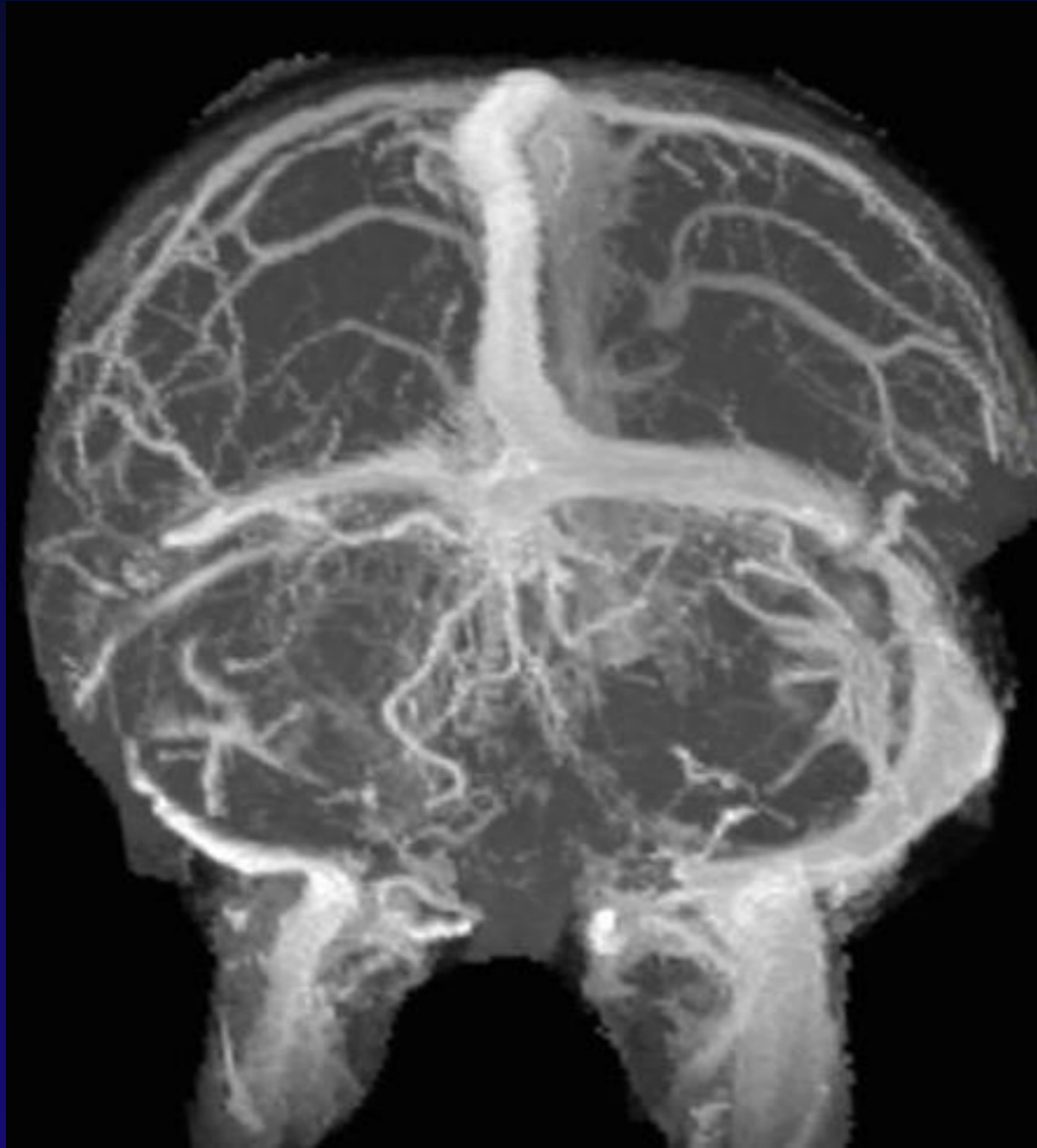
**stent seni durali:**

minori complicanze, minor tasso di recidive  
outcome su cefalea e acuità visiva simili

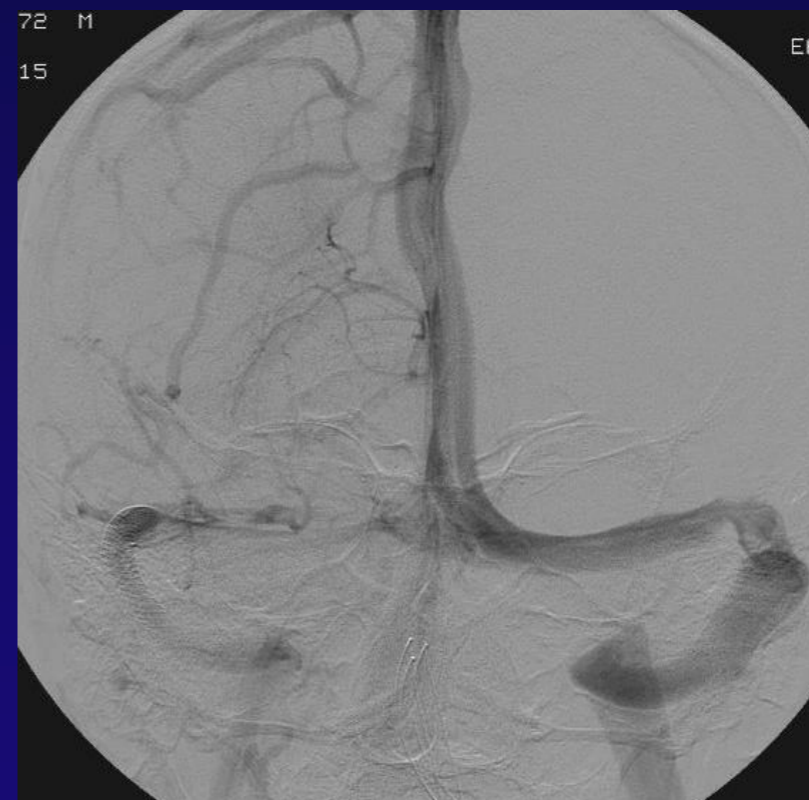
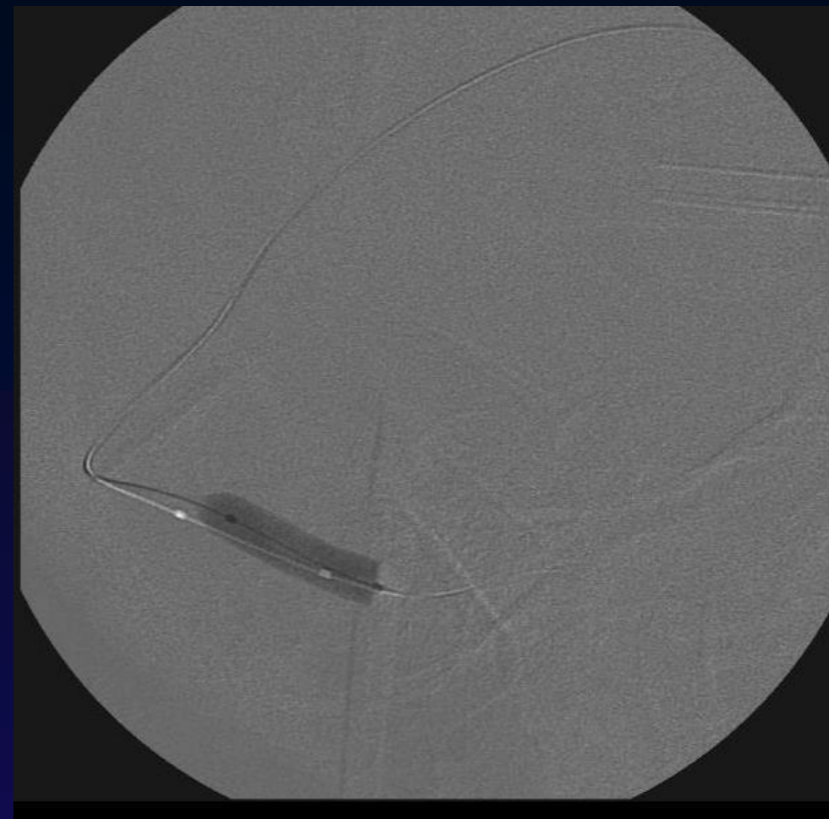
F34 aa  
Obesa, cefalea,  
acufeni, deficit visus  
Stenting bilaterale  
passaggio seni  
trasversi e sigmoidei



M 40 aa  
atleta professionista  
cefalea e deficit visus  
PL positiva



Gradiente 10 mmHg a dx



Dopo PTA - stenting  
Gradiente 2 mmHg a dx  
Miglioramento clinico stabile

# TRATTAMENTO ENDOVASCOLARE PTC

Esistono molti interventi “secondari” per lo PTC resistente a terapia medica

Non inferiorità dello stenting venoso

Alto profilo di sicurezza in centri dedicati di interventistica neurovascolare

## DOMANDE

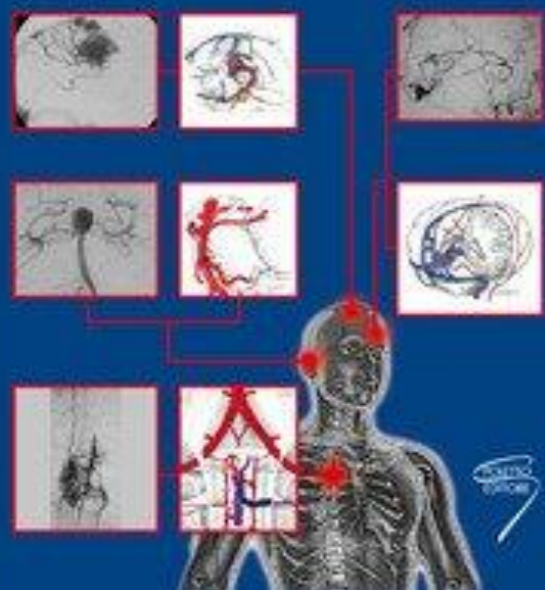
Outcome a lungo termine?

Come ottimizzare la selezione del paziente?



# GRAZIE PER L'ATTENZIONE

**AiNR** **Interventistica  
neurovascolare**  
*a cura di Salvatore Mangifico*



[nicolalimb@gmail.com](mailto:nicolalimb@gmail.com)