

*Diagnostica e timing:  
il neuroimaging nei protocolli PDTA*



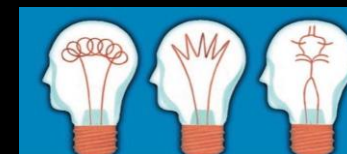
**Napoli**  
SURGERY

**PROGRAMMA SEMINARI**  
**28 SETTEMBRE**  
Aula Magna Scuola di Medicina di Scampia  
Centro Congressi Università degli Studi di Napoli Federico II  
Via Valerio Verbano Snc, Scampia - Napoli

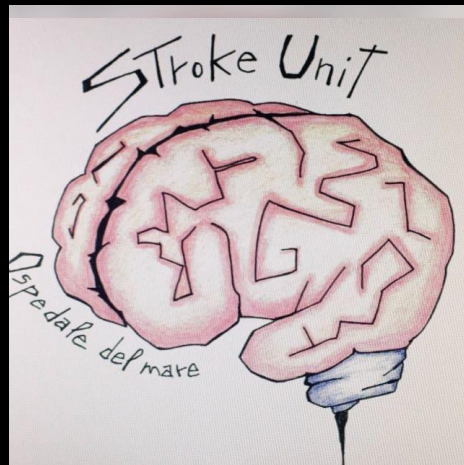
CON IL PATROCINIO DI:



**Dott. Alberto Negro**  
U.O.C. Neuroradiologia ODM



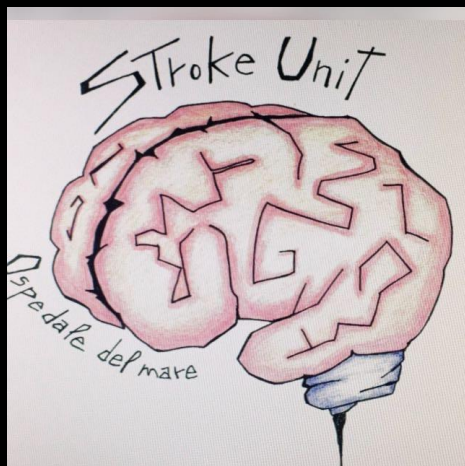
## Diagnostica non invasiva



## Diagnostica angiografica

## Trattamento endovascolare e/o rTPA



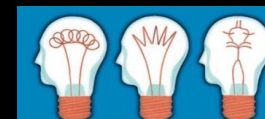


**Diagnostica non invasiva**

**Diagnostica angiografica**

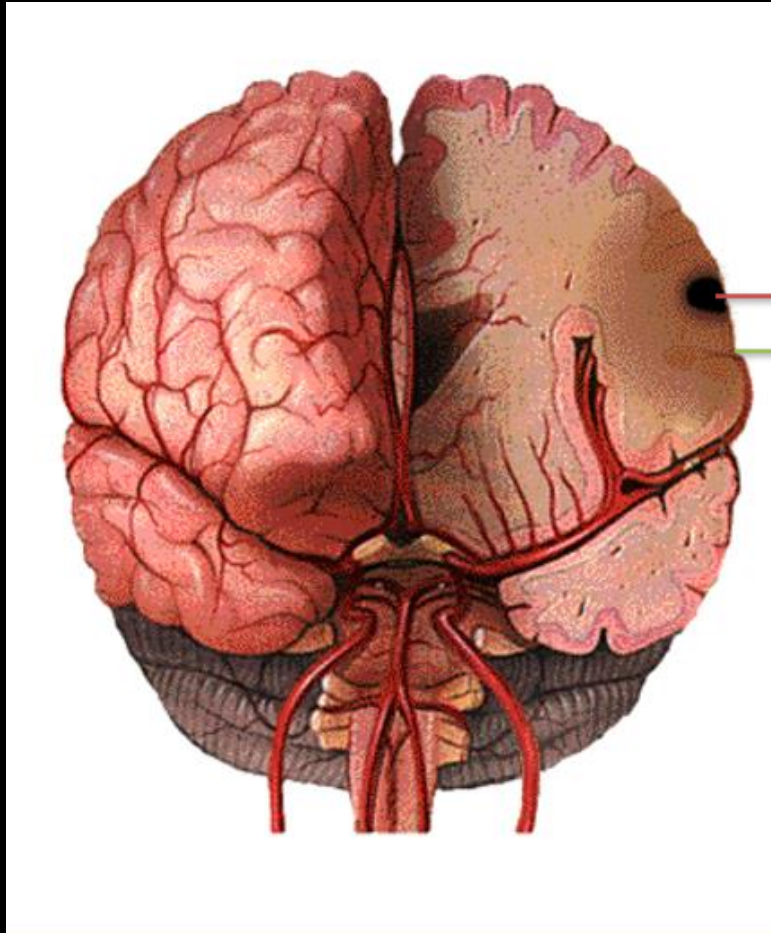
**Trattamento endovascolare**

**APPROCCIO MULTIMODALE**



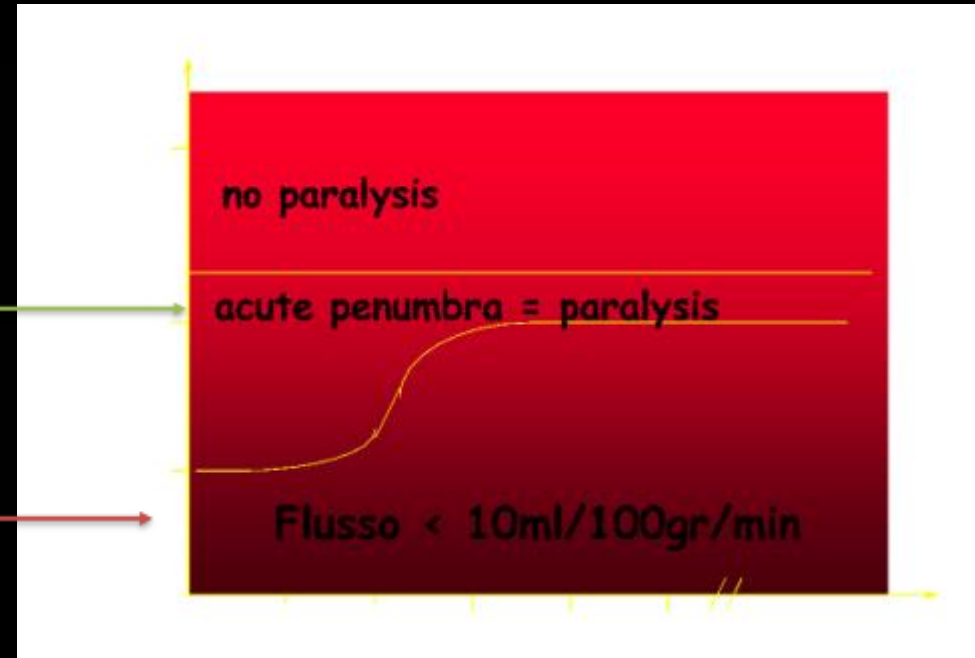
# ISCHEMIA CEREBRALE

## *processo dinamico*



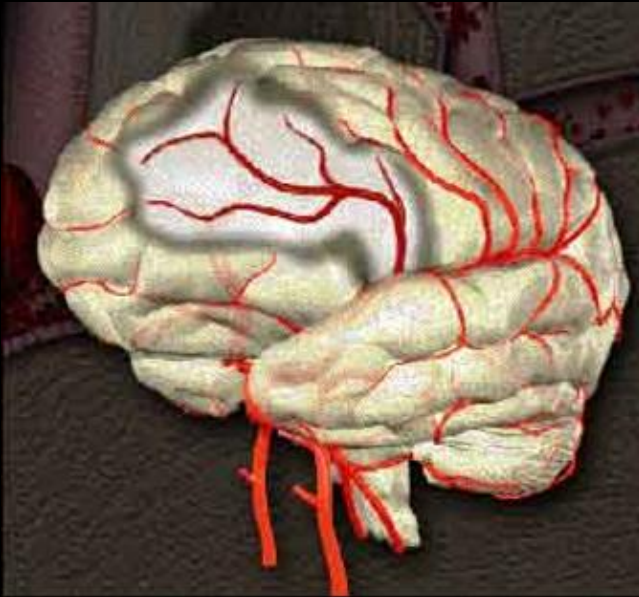
**CORE** = CBF < 10ml/100gr/min

**PENOMBRA** = CBF < 20/100gr/min ; neuroni silenti (freezing)



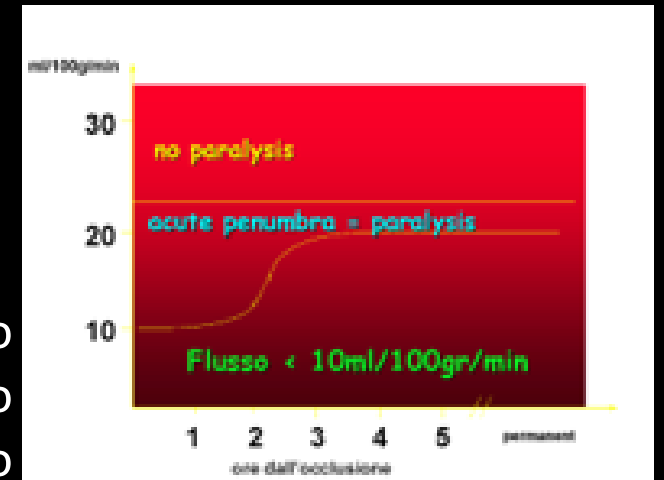
# ISCHEMIA CEREBRALE

## *processo dinamico*



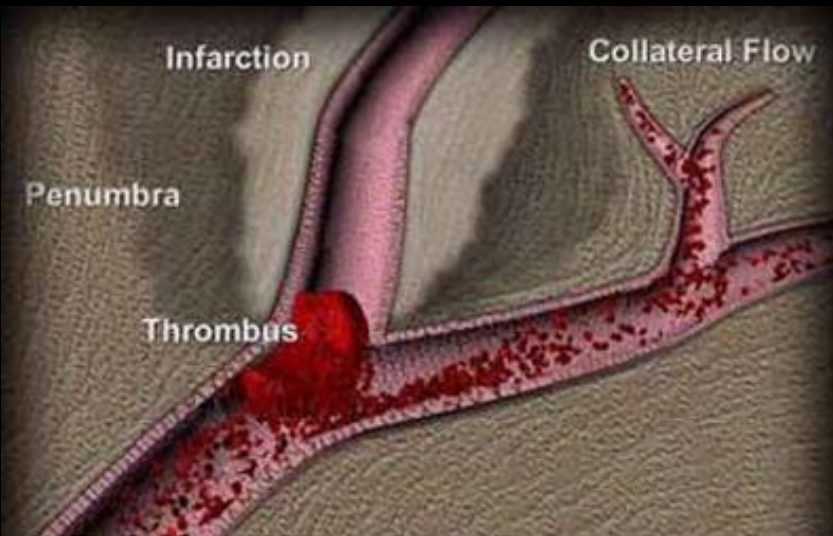
### «**CORE**»

Area situata al centro del territorio vascolare colpito dall'ischemia, il cui flusso è gravemente compromesso; tessuto ormai irrimediabilmente **compromesso**



### «**PENOMBRA**»

Area situata alla periferia, territorio vascolare compromesso che riceve una circolazione collaterale da territori vascolari vicini; tessuto potenzialmente **recuperabile**.

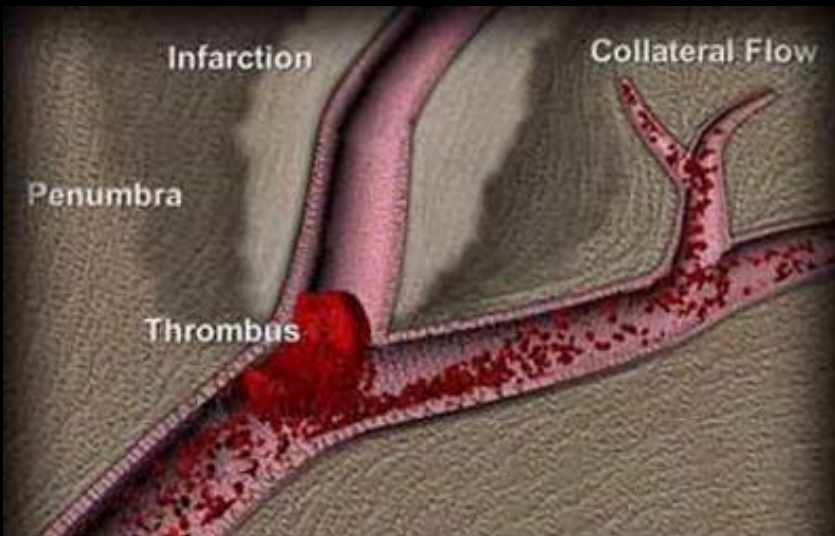
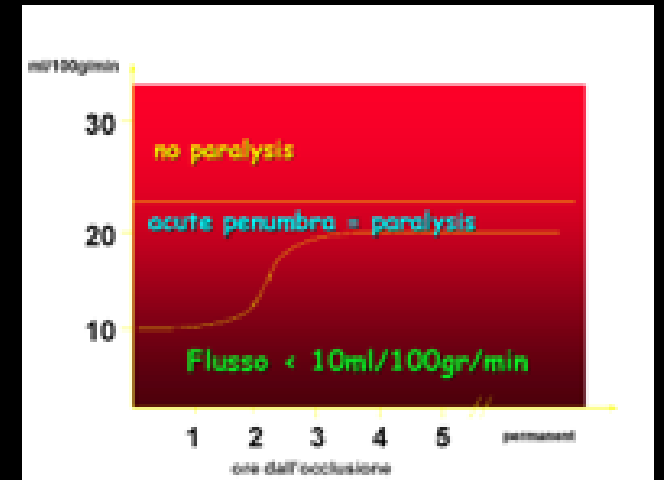
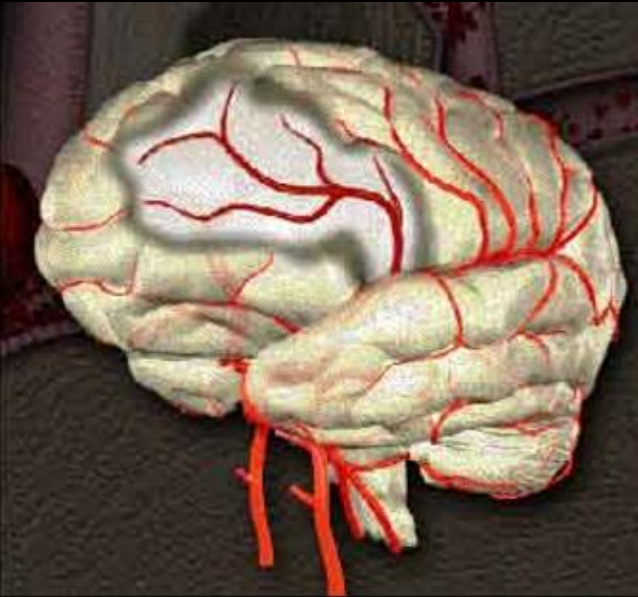


*Dal punto di vista **clinico** quello che vediamo è dovuto alla **somma** del Core e delle Penombra*



# ISCHEMIA CEREBRALE

## *processo dinamico*

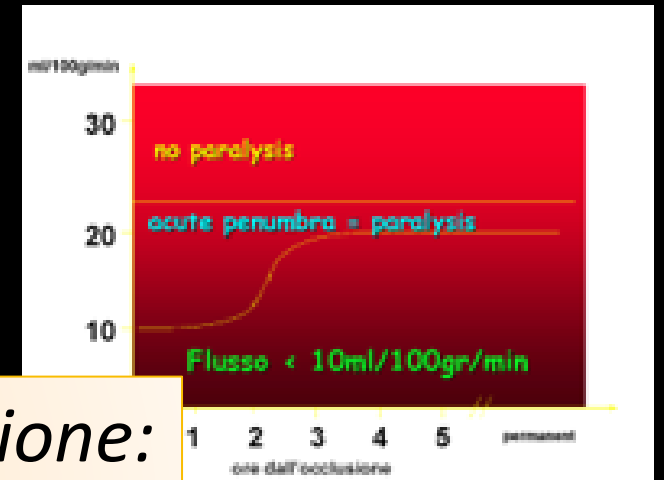
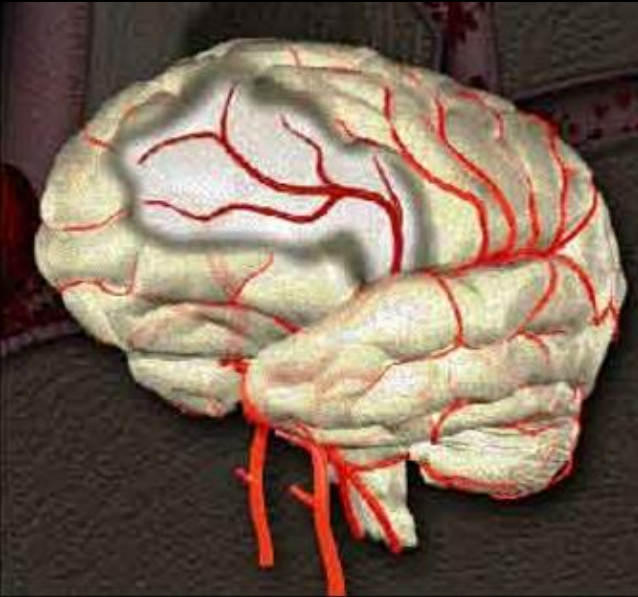


**PENOMBRA** non rimane così per sempre; una cascata di eventi con liberazione di sostanze vasoattive che dal core diffondono alla penombra danneggiandola porta ad una irreversibilità del danno anche se avviene la riperfusione.

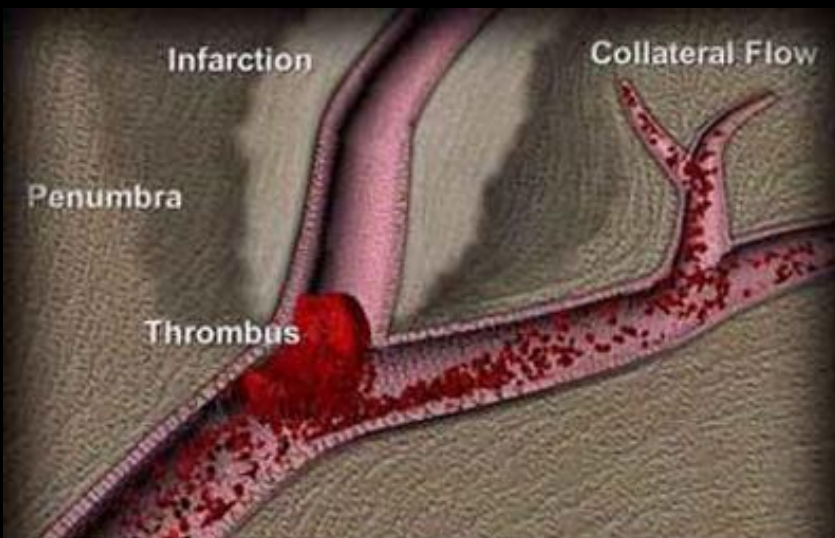


# ISCHEMIA CEREBRALE

## *processo dinamico*



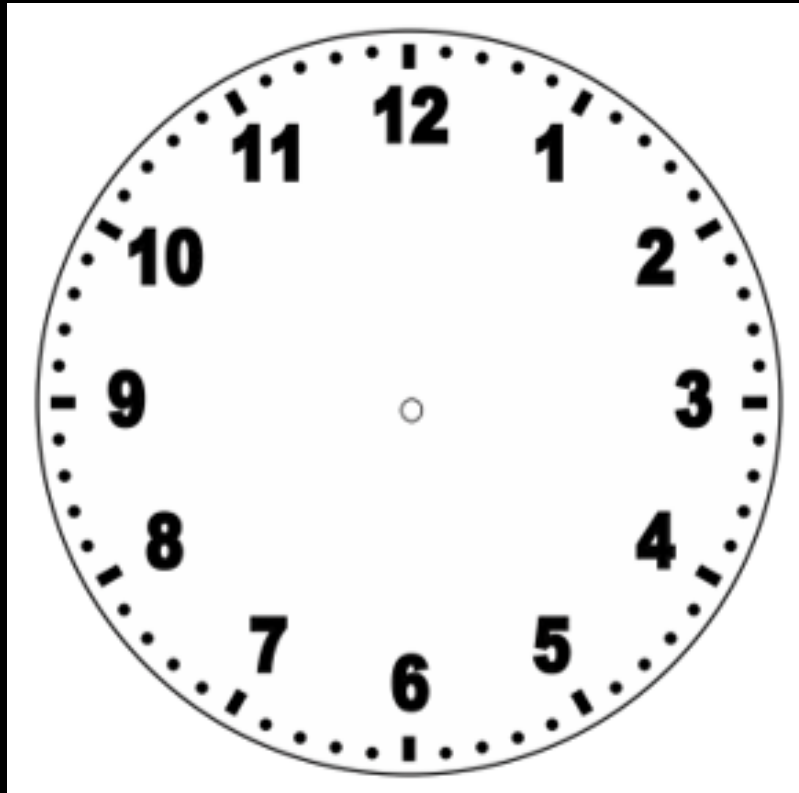
*Razionale della Rivascolarizzazione:*  
*salvare la Penombra!*



**PENOMBRA** non rimane così per sempre; una cascata di eventi con liberazione di sostanze vasoattive che dal core diffondono alla penombra danneggiandola porta ad una irreversibilità del danno anche se avviene la riperfusione.

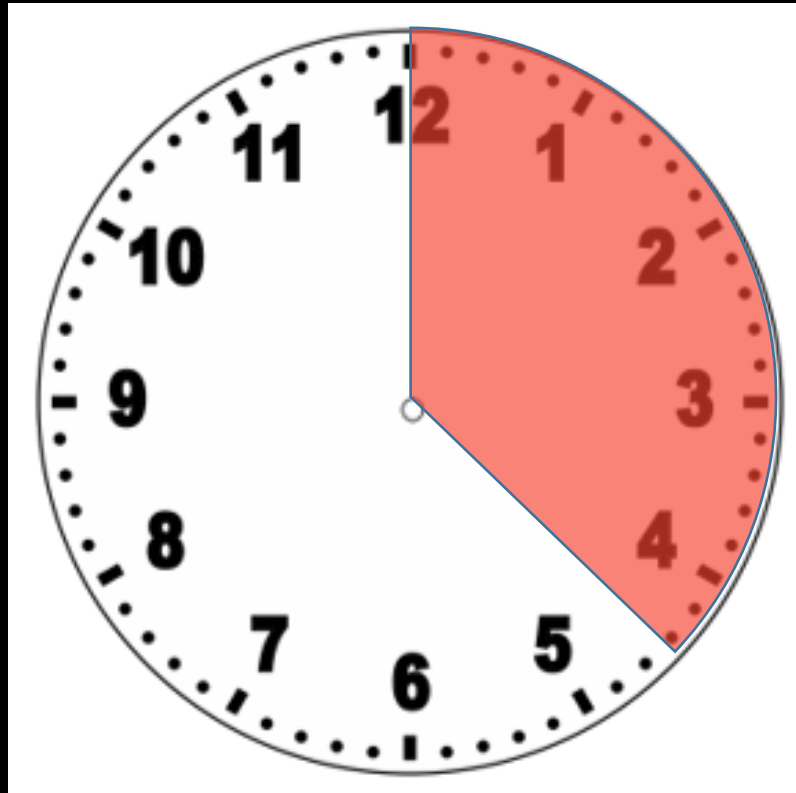


VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE





VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE

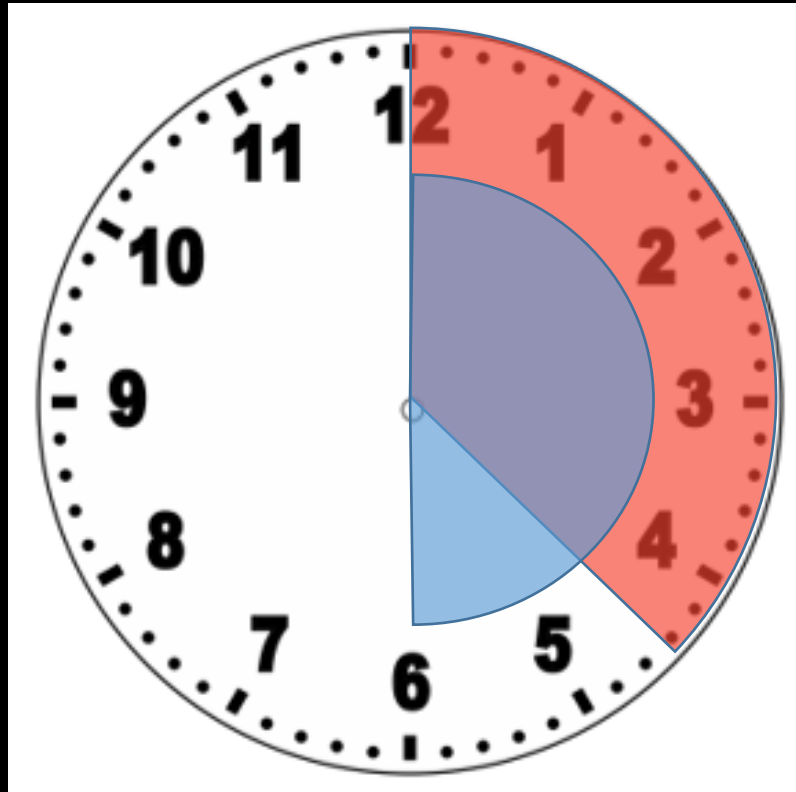


**rTPA e.v. entro 4.5h dall-esordio dei sintomi**

**→ TC SENZA MDC**

- Escludere emorragie
- Escludere ischemia conclamata
- Non si applica ASPECT per estensione del danno

VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE



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**Trombectomia entro 6h dall'esordio dei sintomi**

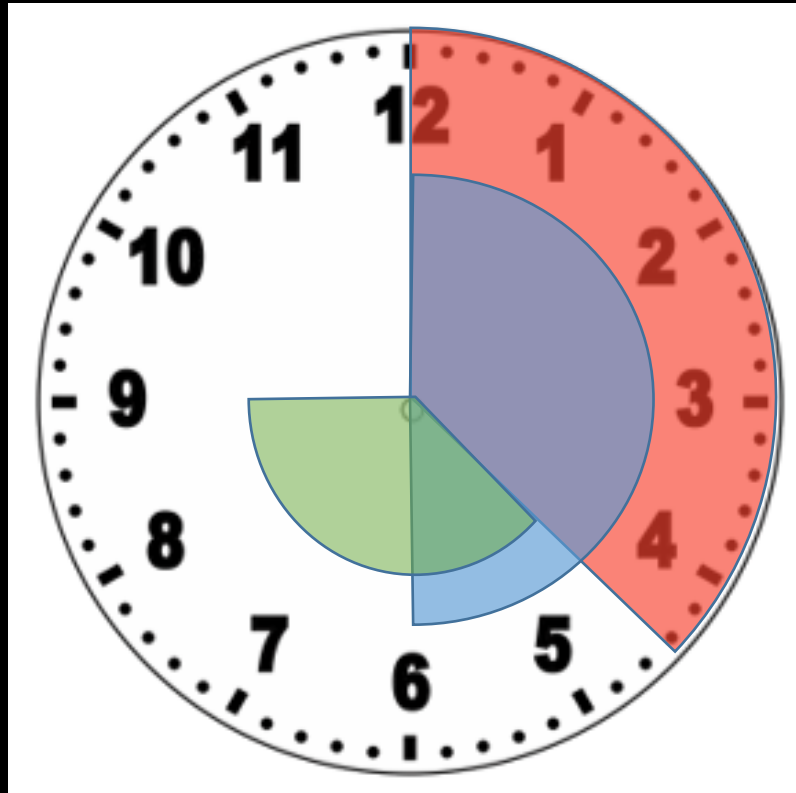
→ **TC SENZA MDC**

- ASPECT > 6

→ **ANGIO-TC (meglio MULTIFASICA)**

- Studio intra-extracranico per identificare sito di occlusione
- Valutazione circoli di compenso

VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE



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- ASPECT > 6

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**rTPA e.v. tra le 4.5 e le 9h dall-esordio dei sintomi**

→ **TC SENZA MDC**

→ **ANGIO-TC**

→ **TC PERFUSIONE (o Mismatch DWI-PWI)**

- **Criteria protocollo EXTEND**

(Volume core <70ml; Volume penumbra >= 10ml; Mismatch ratio: 1,2)

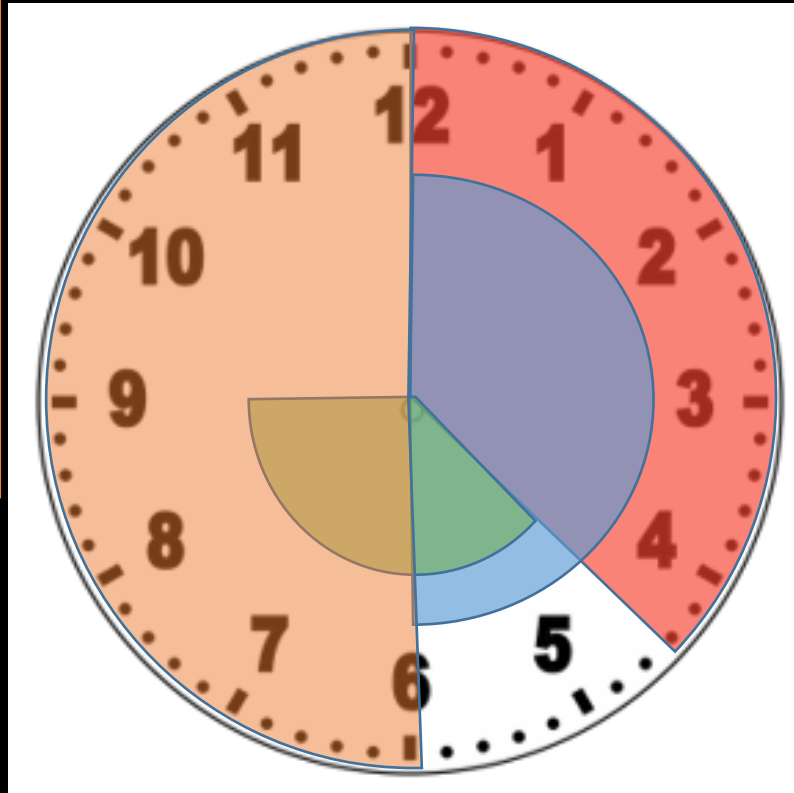
## Trombectomia *oltre 6h* dall'esordio dei sintomi

- TC SENZA MDC
- ANGIO-TC
- TC PERFUSIONE (O Mismatch DWI-PWI)
- Criteri protocollo DEFUSE 3
  - Volume core <70ml
  - Volume penombra >=15ml
  - Mismatch ratio: 1,8
- Criteri protocollo DAWN
  - >= 80aa, NIHSS >= 10, core <21 ml
  - < 80 aa, NIHSS >= 10, core <31 ml
  - < 80 aa, NIHSS >= 20, core fra 31-51

## rTPA e.v. *tra le 4.5 e le 9h* dall'esordio dei sintomi

- TC SENZA MDC
- ANGIO-TC
- TC PERFUSIONE (o Mismatch DWI-PWI)
- Criteri protocollo EXTEND  
(Volume core <70ml; Volume penombra >= 10ml; Mismatch ratio: 1,2)

## VADEMECUM LINEE GUIDA DIAGNOSTICA STROKE



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- TC SENZA MDC
- ASPECT > 6
- ANGIO-TC (meglio MULTIFASICA)
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- Valutazione circoli di compenso

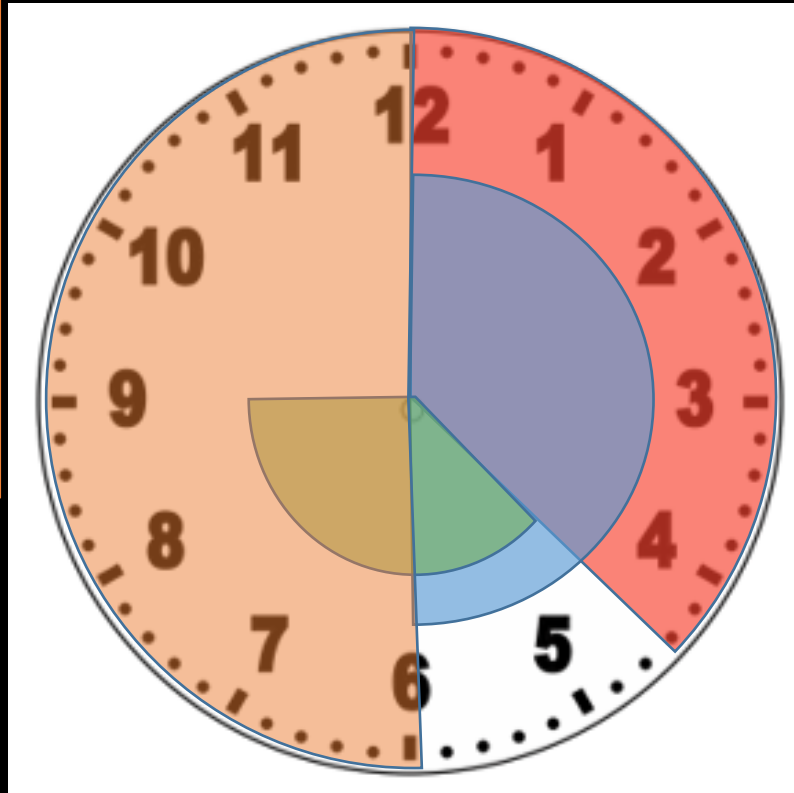
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- Criteri protocollo EXTEND  
(Volume core <70ml; Volume penombra >= 10ml; Mismatch ratio: 1,2)

## VADEMECUM LINEE GUIDA DIAGNOSTICA STROKE



ICTUS AL RISVEGLIO  
Mismatch DWI/FLAIR  
ANGIO-RM  
Mismatch DWI/PWI

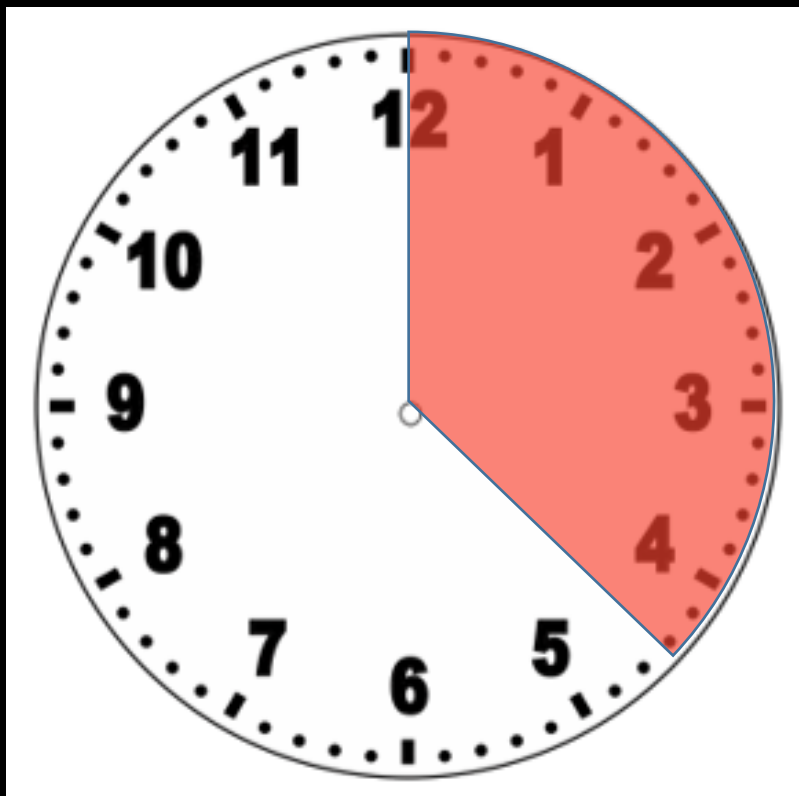
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VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE



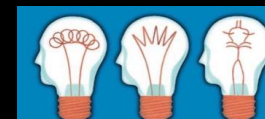
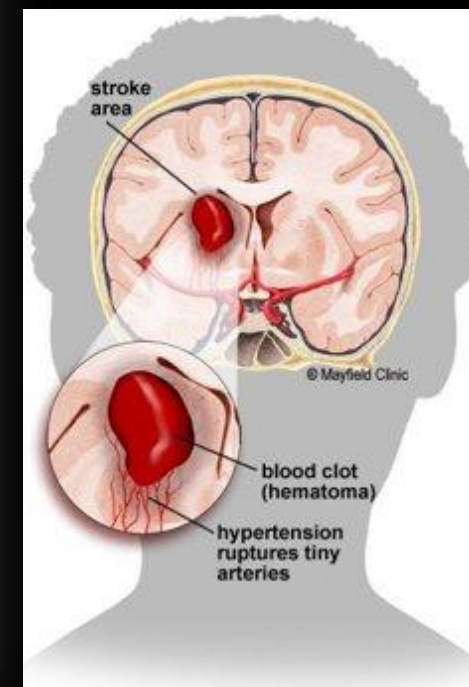
**rTPA e.v. entro 4.5h dall-esordio dei sintomi**

**→ TC SENZA MDC**

- Escludere emorragie
- Escludere ischemia conclamata
- Non si applica ASPECT per estensione del danno

# TC

TC: escludere la presenza di emorragie



# TC

TC: riconoscere, se presenti, i segni precoci di ischemia cerebrale

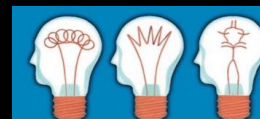


## Iperdensità vasale

Specificità 100%

Sensibilità 70%

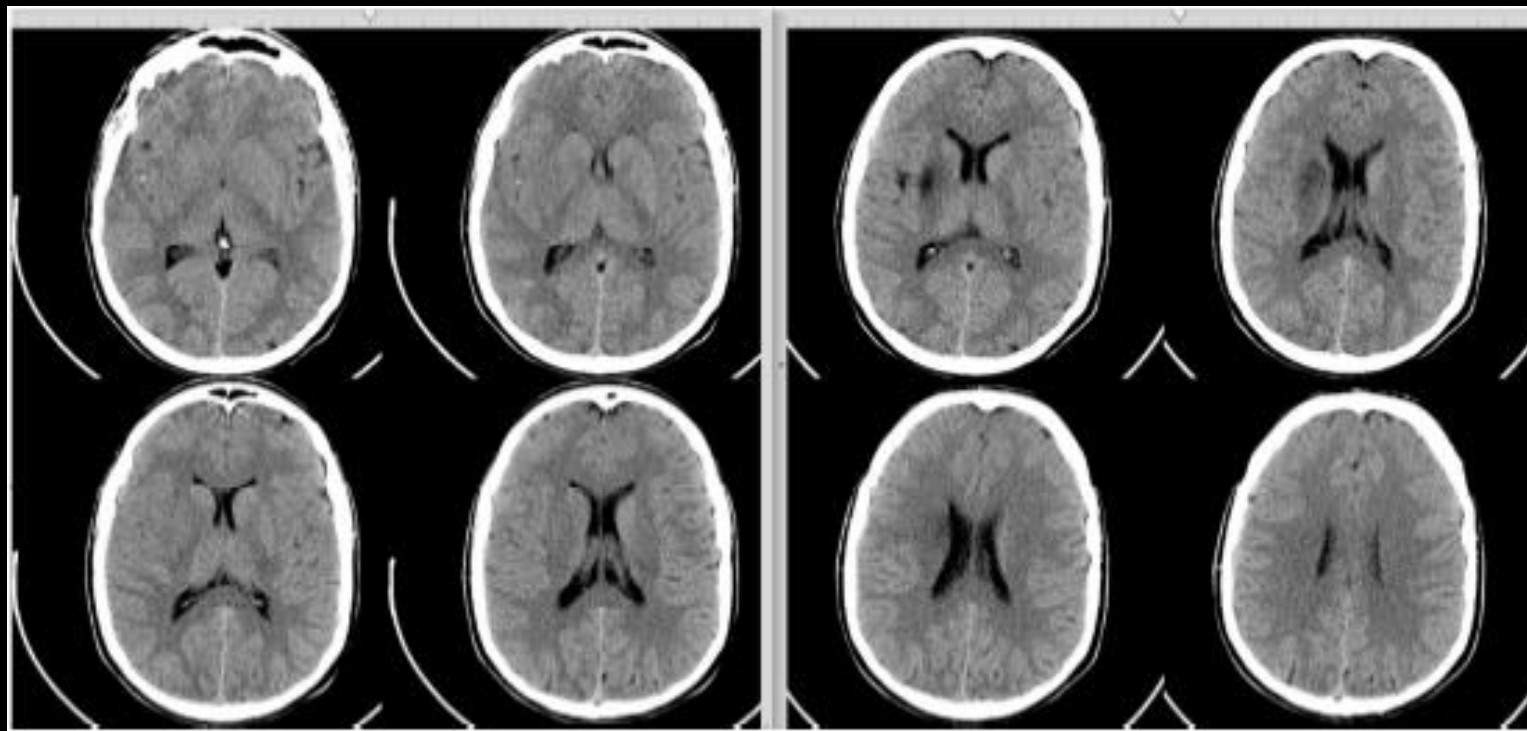
Non rappresenta criterio di esclusione alla trombosi





# TC

TC: riconoscere, se presenti, i segni precoci di ischemia cerebrale



4 h

48 h

Sylvian dot sign

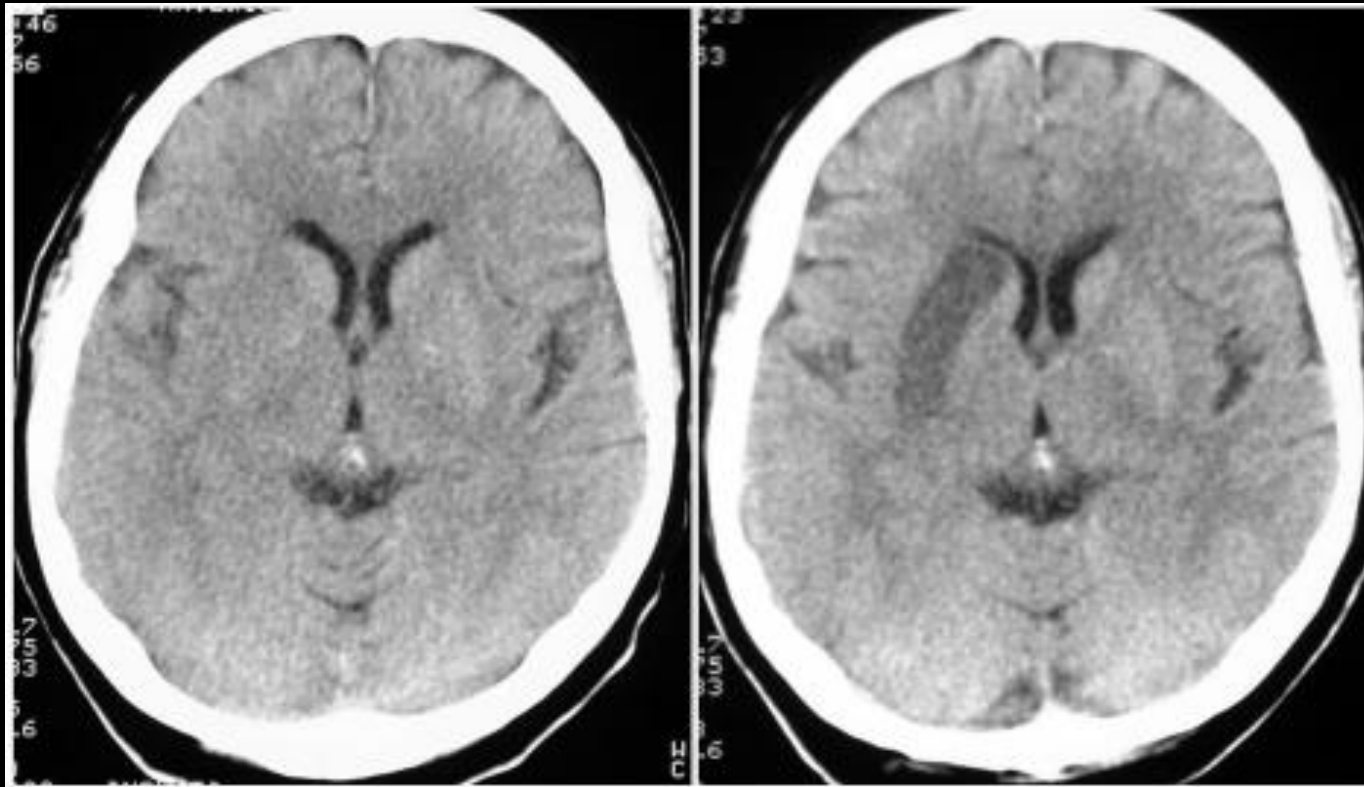
Occlusione periferica

Alta specificità



# TC

TC: riconoscere, se presenti, i segni precoci di ischemia cerebrale



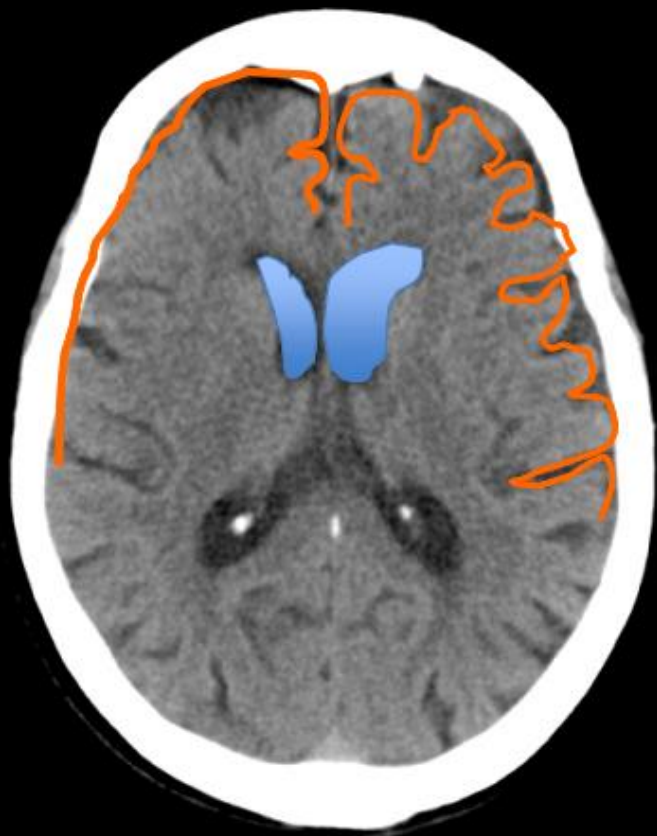
4 h

72 h

**Ipodensità gangli  
della base**

# TC

TC: riconoscere, se presenti, i segni precoci di ischemia cerebrale



4 h



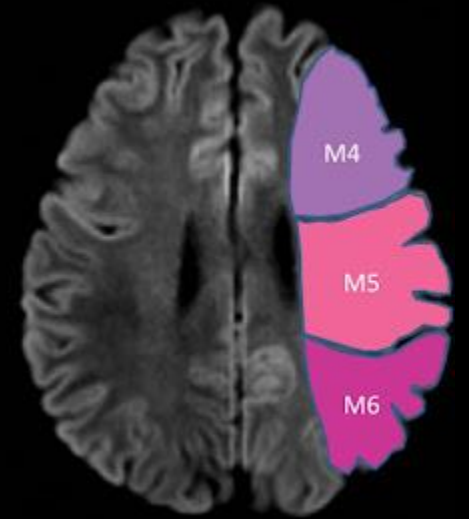
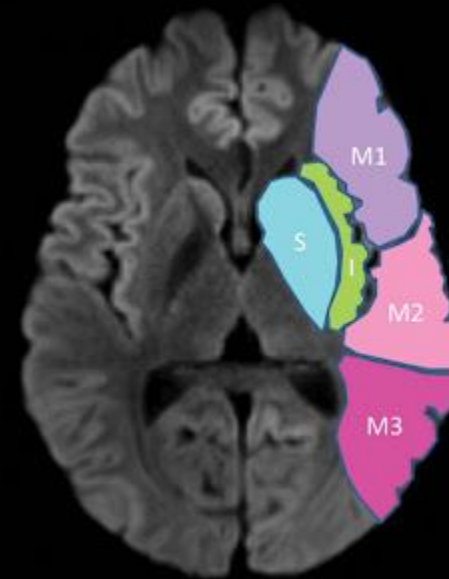
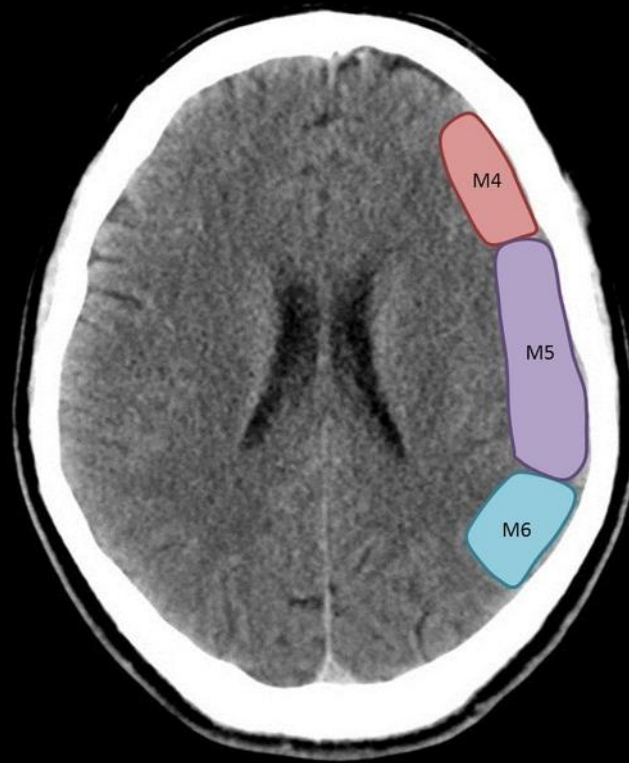
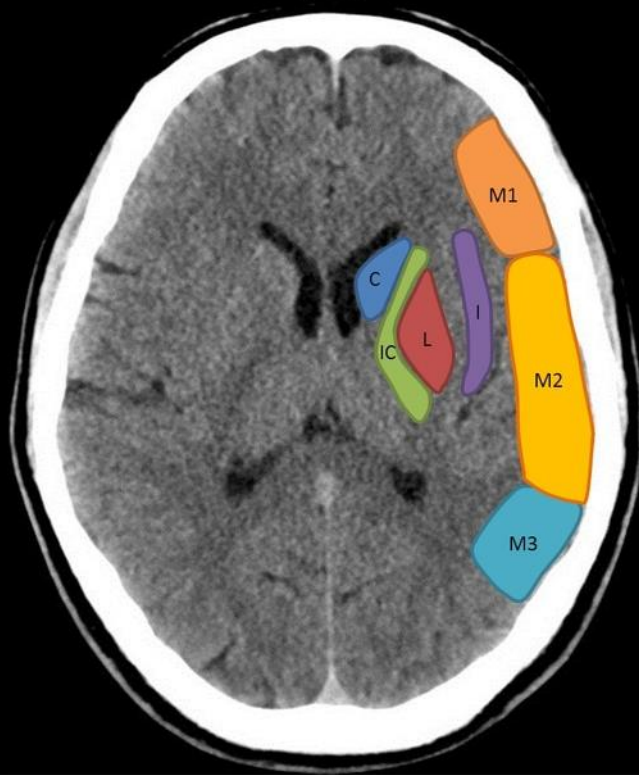
72 h

**Rigonfiamento  
senza ipodensità**

# Alberta Stroke Programme Early CT (*ASPECT*) SCORE

Basal ganglia level

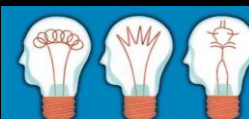
Corona radiata level



## 10 regioni ACM, profonde e corticali

- Nucleo caudato C
- Nucleo lenticolare L
- Braccio post. capsula interna IC
- Insula I
- Cort. frontale antero-inferiore M1
- Cort. temporale anteriore M2
- Cort. temporale posteriore M3
- Cort. frontale antero-superiore M4
- Cort. frontale posteriore M5
- Cort. parietale M6

*10 – la somma dei territori coinvolti da ischemia*

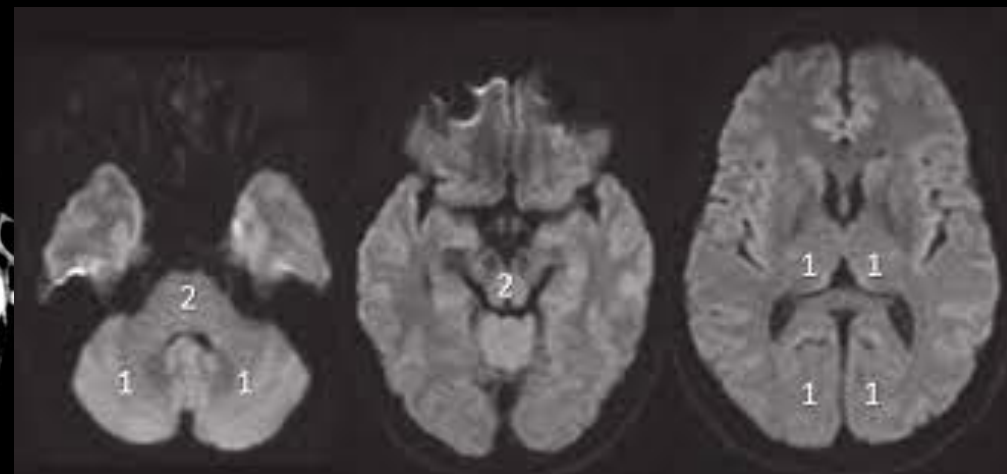
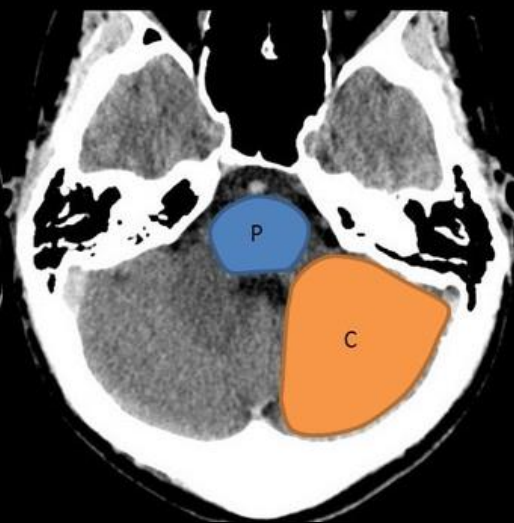
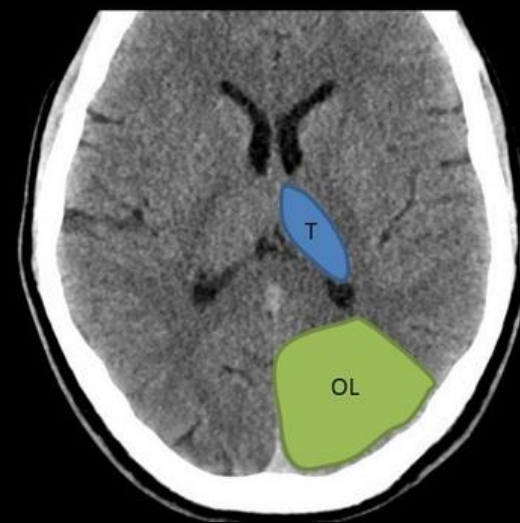


# Posterior Circulation Alberta Stroke Programme Early CT (PC-ASPECT) SCORE

Thalami level

Midbrain level

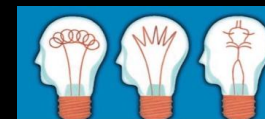
Pons level



## 10 regioni ACM, profonde e corticali

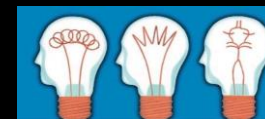
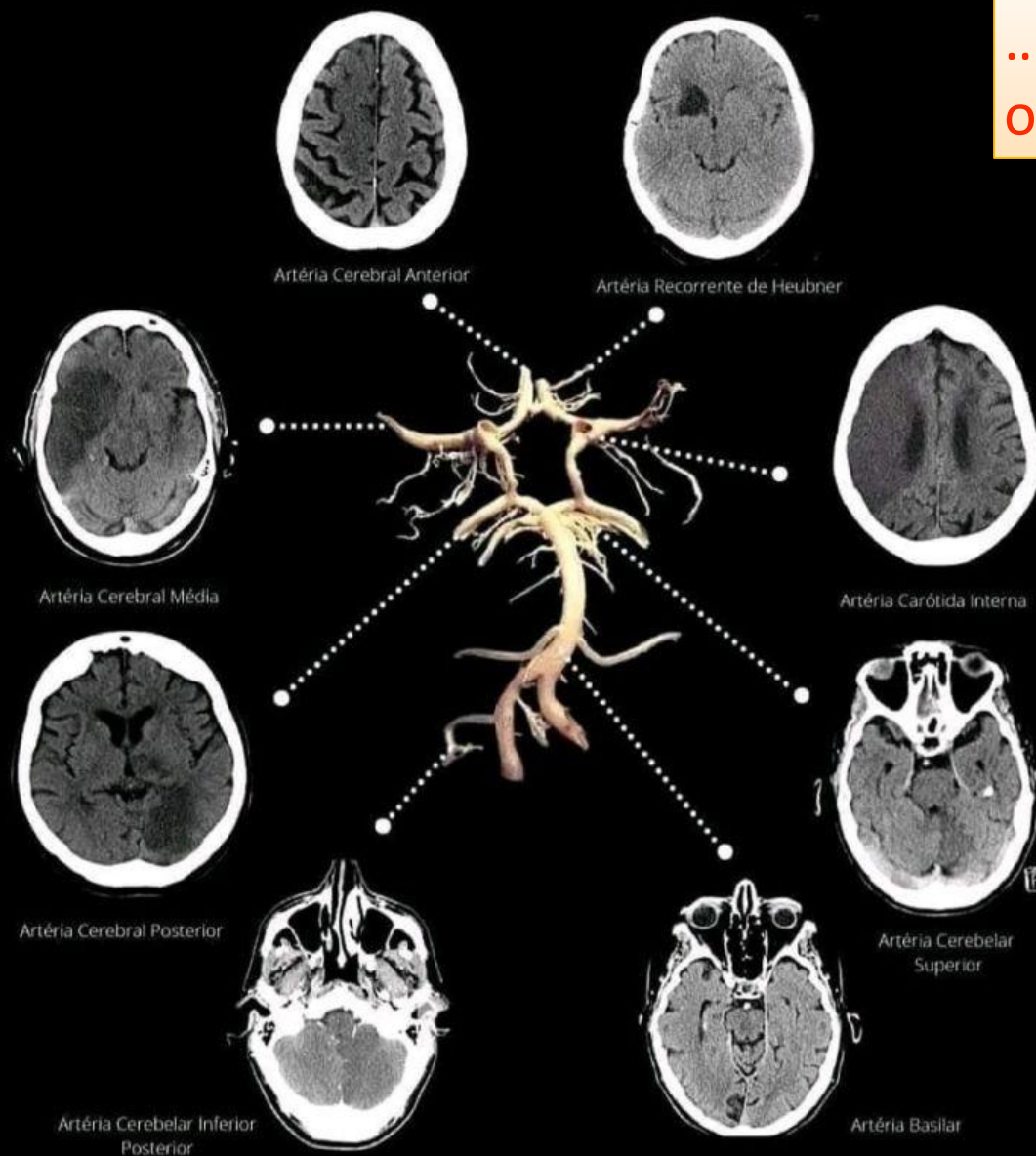
- Nucleo caudato C
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- Insula I
- Cort. frontale antero-inferiore M1
- Cort. temporale anteriore M2
- Cort. temporale posteriore M3
- Cort. frontale antero-superiore M4
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*10 – la somma dei territori coinvolti da ischemia*

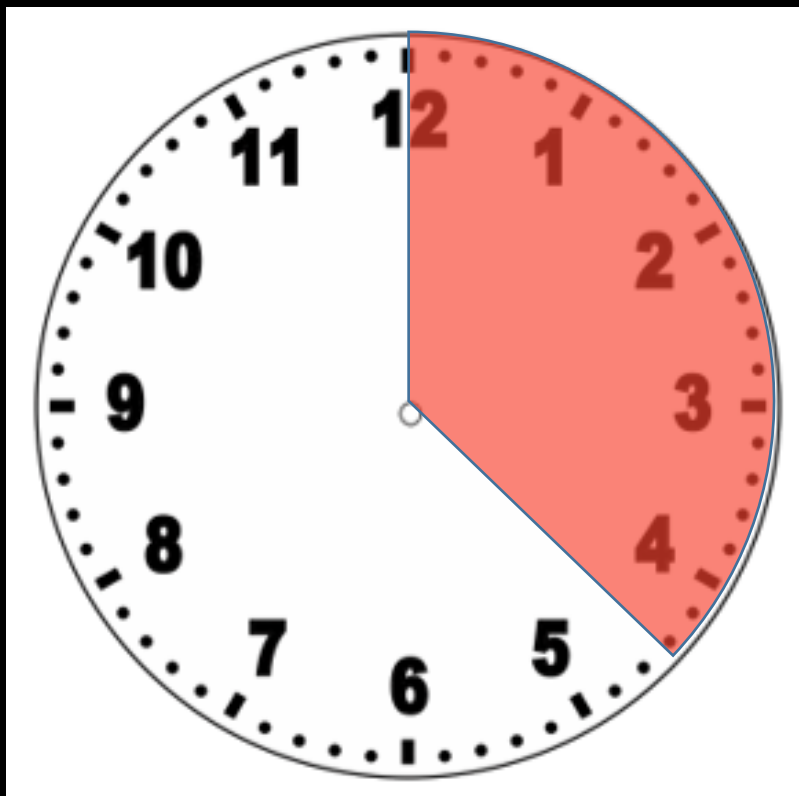


# TC

... «suggerire» sito di occlusione vasale.



VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE

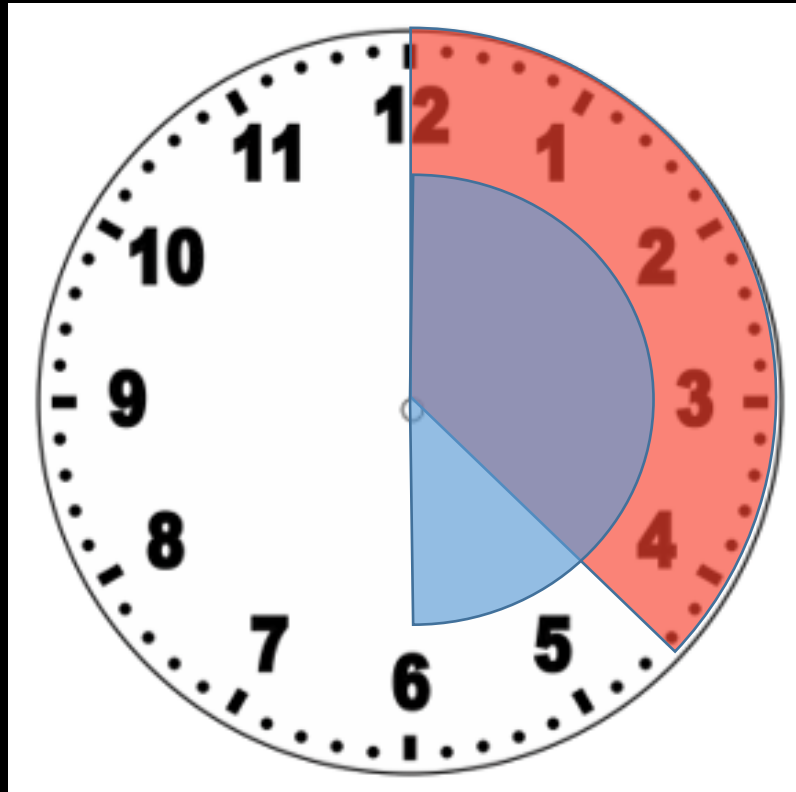


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VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE



**rTPA e.v. entro 4.5h dall'esordio dei sintomi**

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**Trombectomia entro 6h dall'esordio dei sintomi**

→ **TC SENZA MDC**

- ASPECT > 6

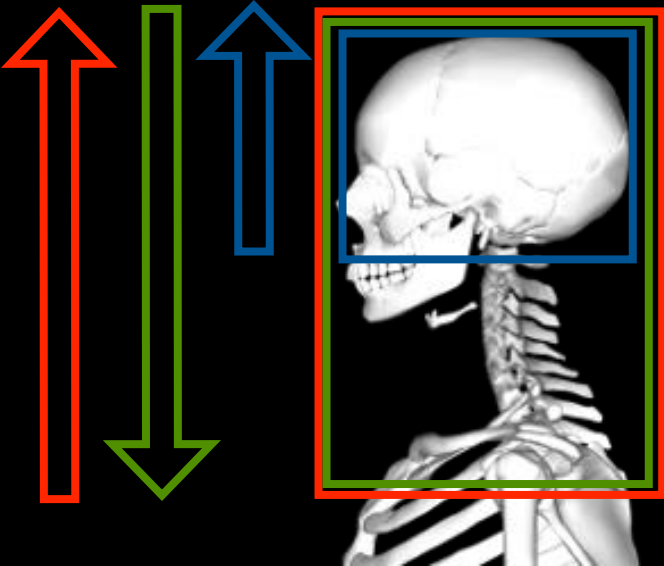
→ **ANGIO-TC (meglio MULTIFASICA)**

- Studio intra-extracranico per identificare sito di occlusione
- Valutazione circoli di compenso



# Angio-TC

MULTIFASICA

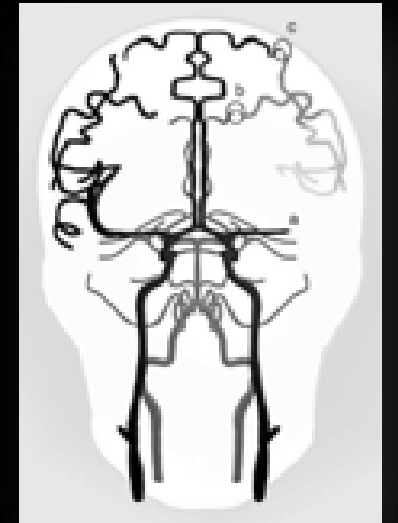
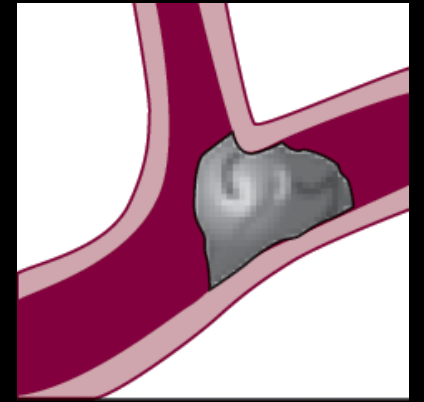


Agocannula 18 Ga a destra  
(almeno!)

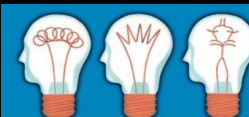
Somministrazione ev di mdc a  
bolo (4/5ml/sec almeno)

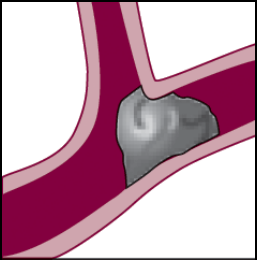
1) Sede di occlusione

2) Circoli collaterali



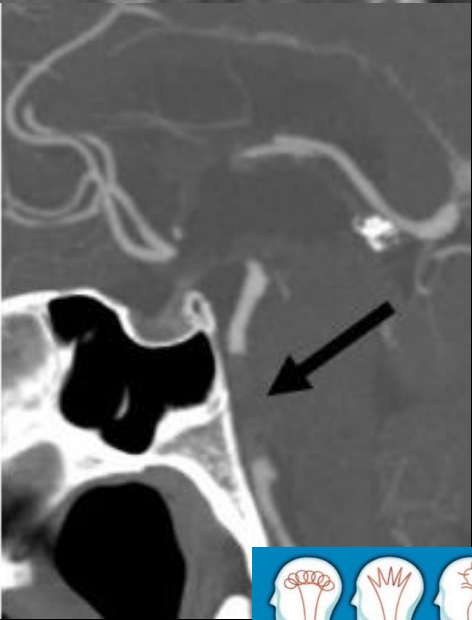
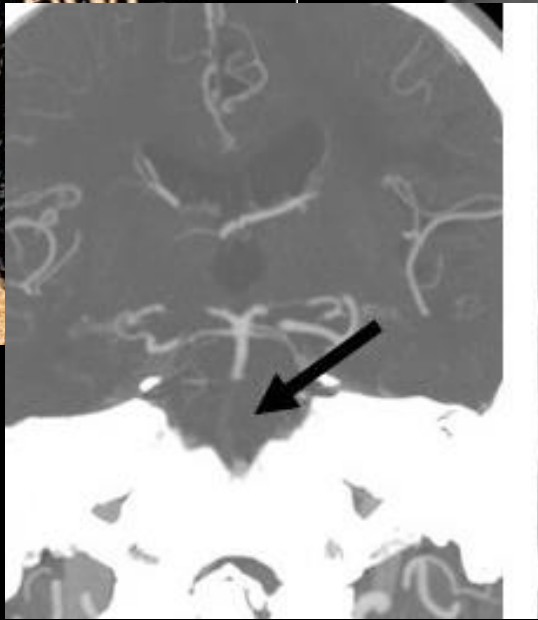
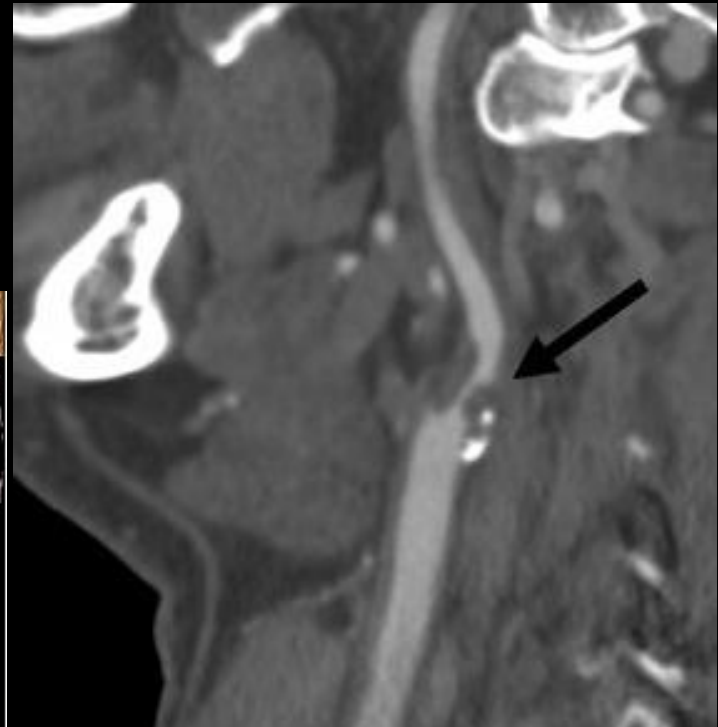
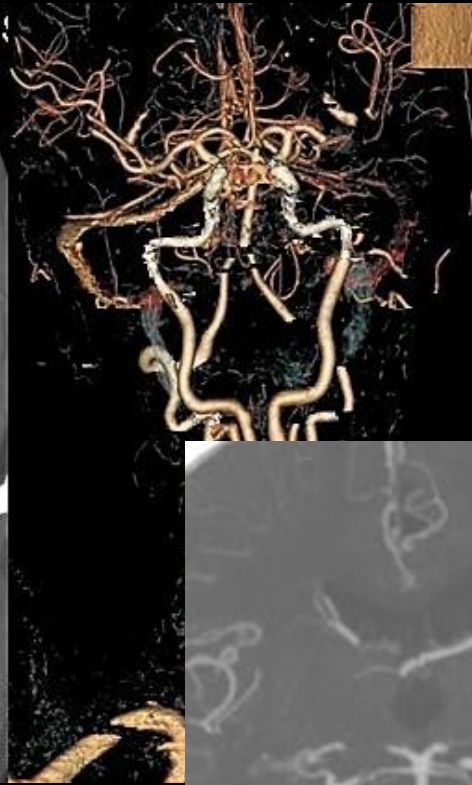
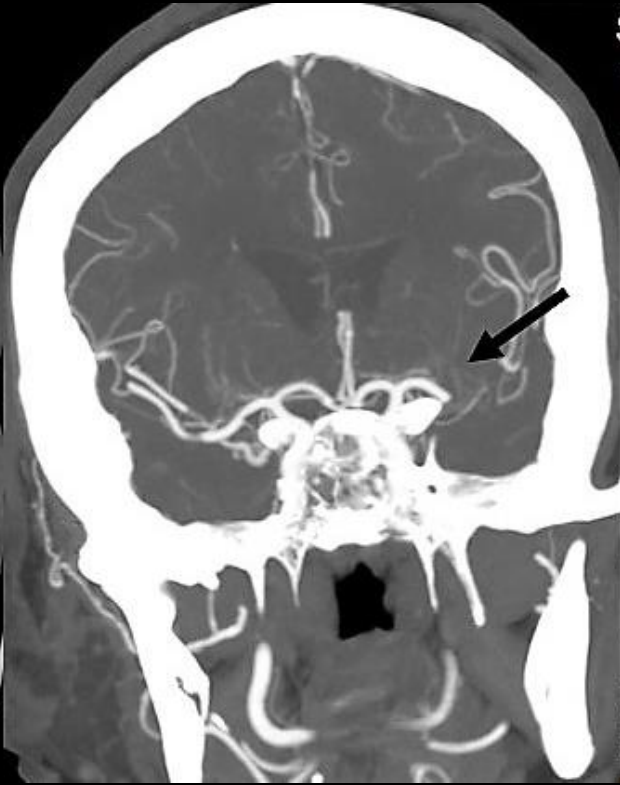
*Il paziente deve arrivare in TC con doppio accesso vascolare effettuato in PS!*

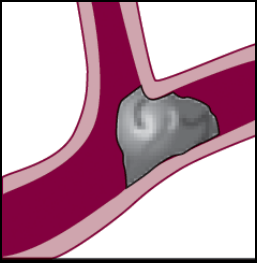




Sede di occlusione

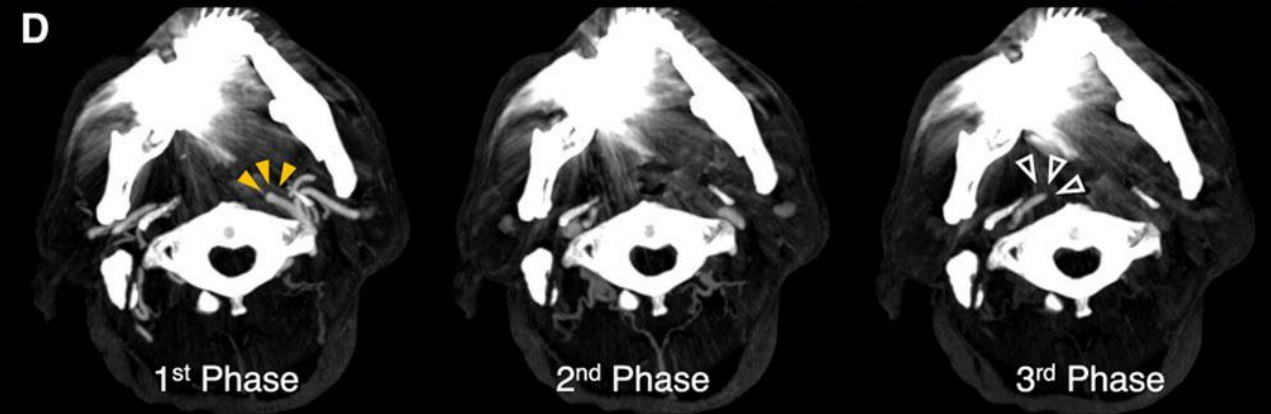
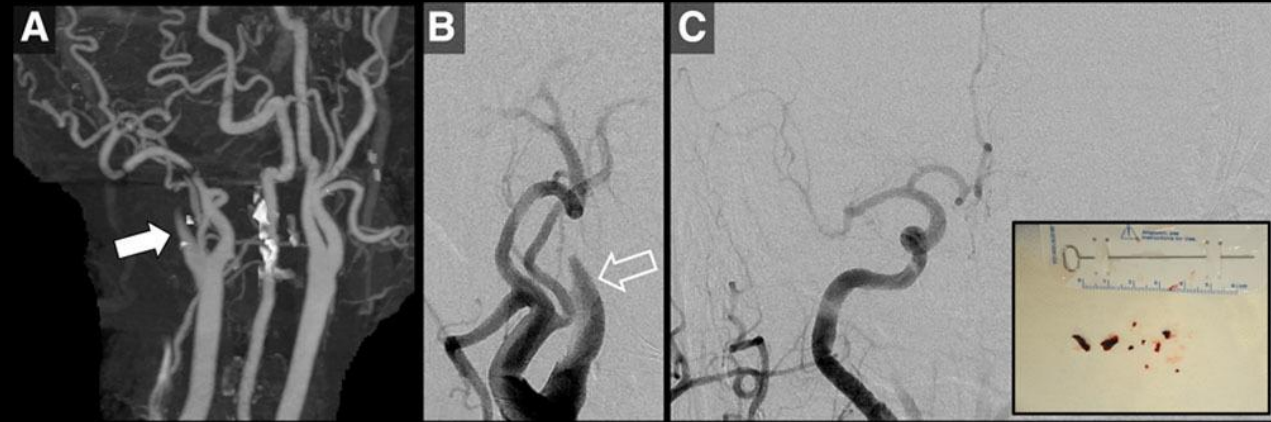
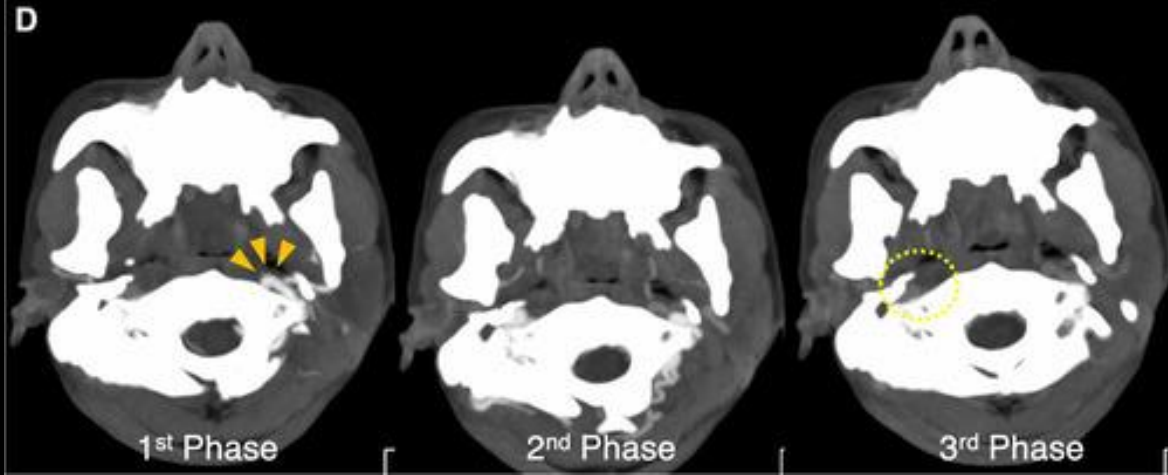
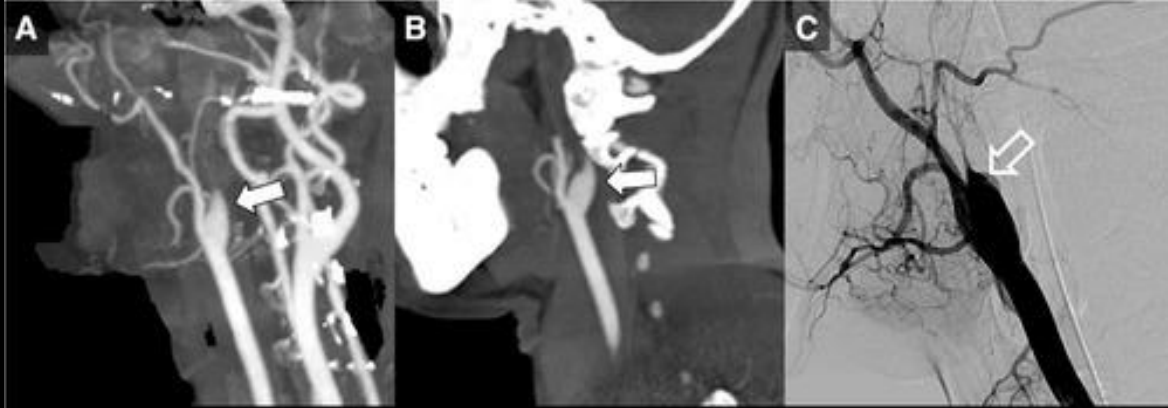
# Angio-TC





# Angio-TC

*Pseudo-occlusione!*

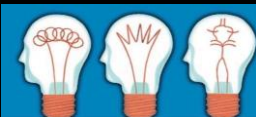
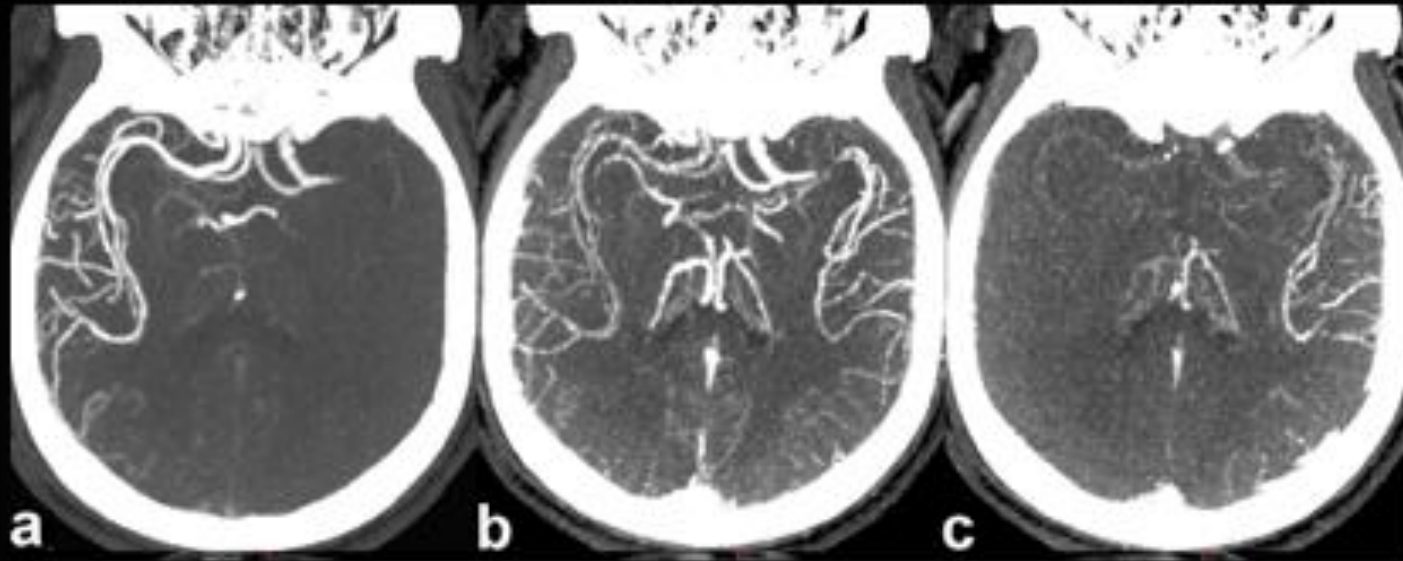
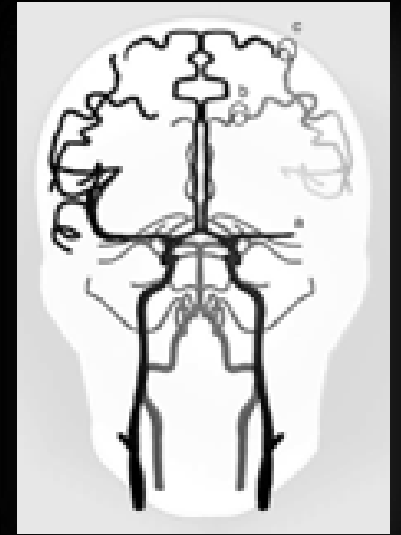


# Angio-TC

Circoli collaterali



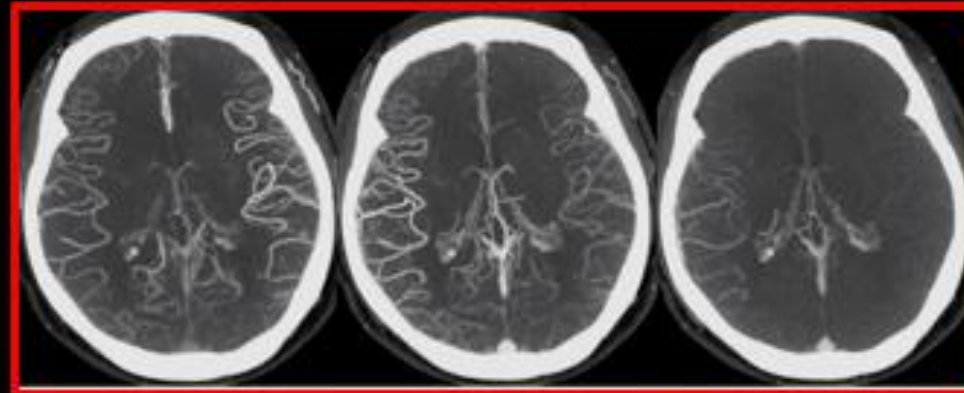
*Ottenendo una singola fase di acquisizione angiografica non verrebbero considerati pazienti con flussi arteriosi lenti*



# Angio-TC

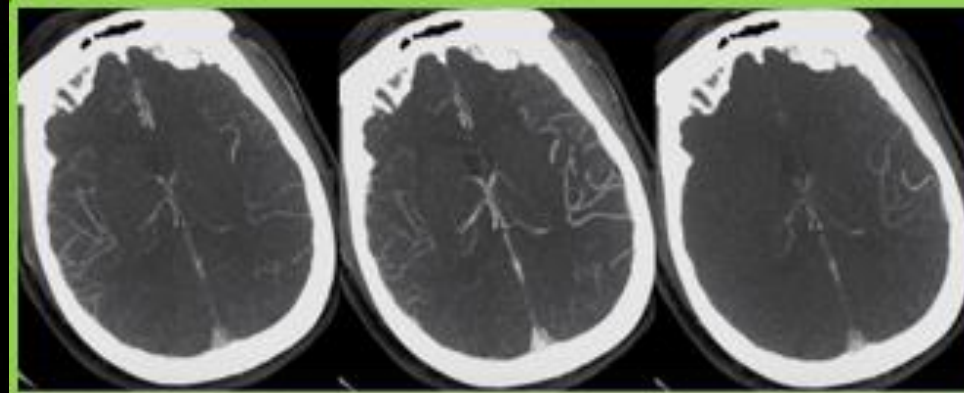
## Circoli collaterali

*La qualità dei c.c. dipende dalla loro rappresentazione rispetto al lato sano e dalla velocità di visualizzazione (fase arteriosa, venosa)*



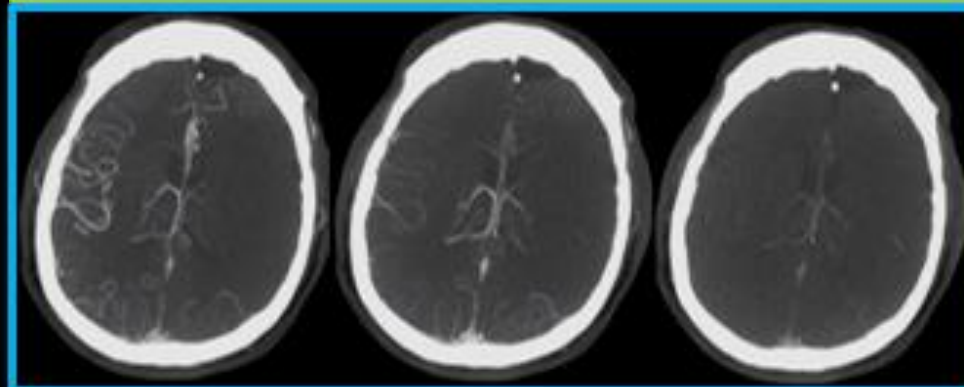
**Buoni**

Più visibili in fase arteriosa o venosa precoce

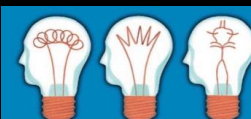
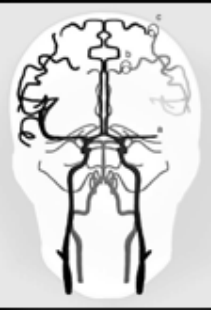


**Intermedi**

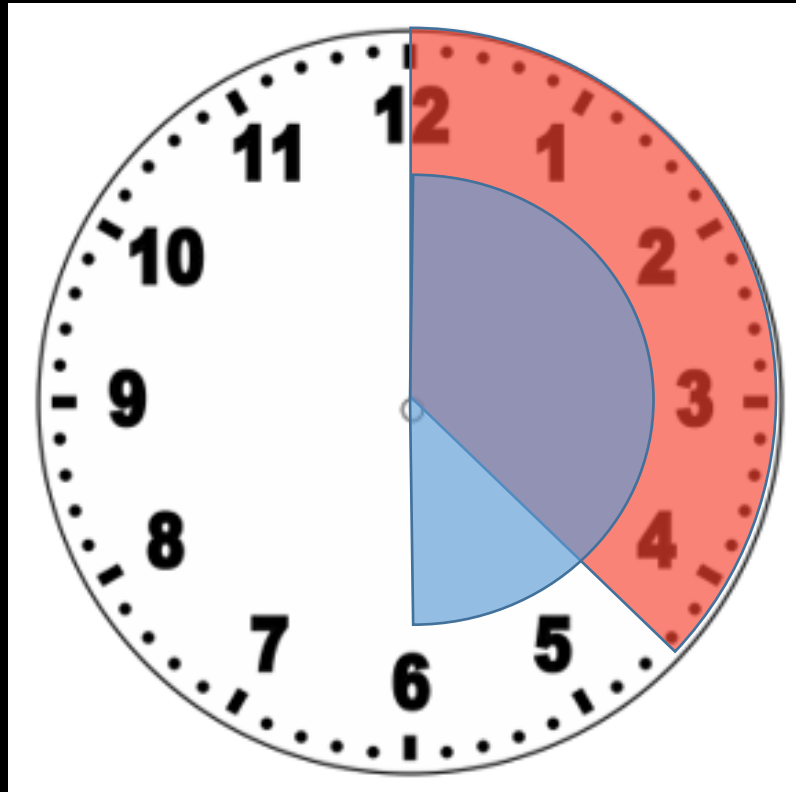
Più visibili in fase venosa



**Scarsi-assenti**



VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE



**rTPA e.v. entro 4.5h dall'esordio dei sintomi**

→ **TC SENZA MDC**

- Escludere emorragie
- Escludere ischemia conclamata
- Non si applica ASPECT per estensione del danno

**Trombectomia entro 6h dall'esordio dei sintomi**

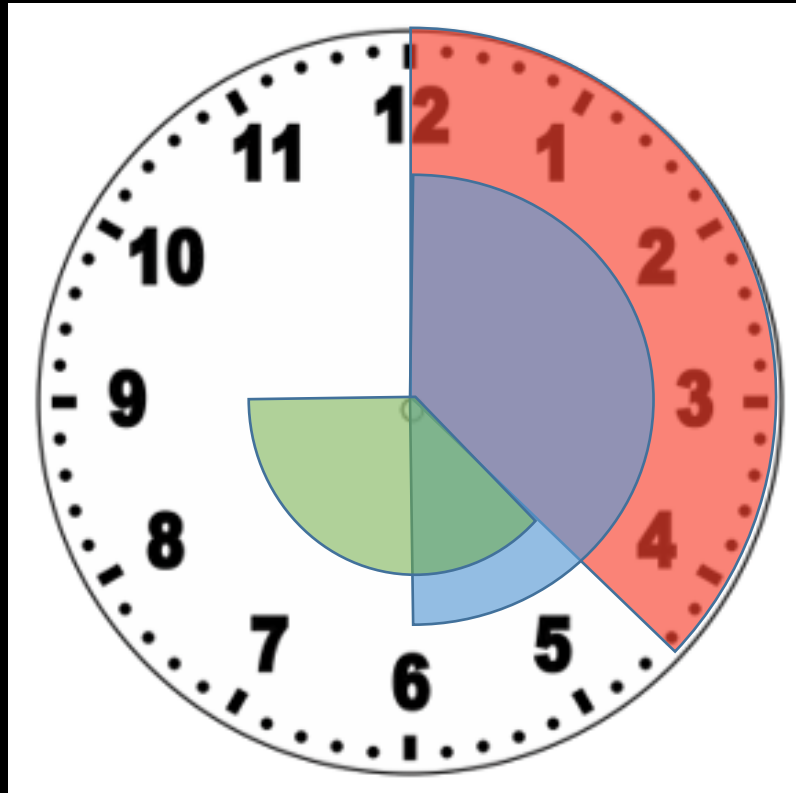
→ **TC SENZA MDC**

- ASPECT > 6

→ **ANGIO-TC (meglio MULTIFASICA)**

- Studio intra-extracranico per identificare sito di occlusione
- Valutazione circoli di compenso

VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE



**rTPA e.v. entro 4.5h dall'esordio dei sintomi**

→ **TC SENZA MDC**

- Escludere emorragie
- Escludere ischemia conclamata
- Non si applica ASPECT per estensione del danno

**Trombectomia entro 6h dall'esordio dei sintomi**

→ **TC SENZA MDC**

- ASPECT > 6

→ **ANGIO-TC (meglio MULTIFASICA)**

- Studio intra-extracranico per identificare sito di occlusione
- Valutazione circoli di compenso

**rTPA e.v. tra le 4.5 e le 9h dall'esordio dei sintomi**

→ **TC SENZA MDC**

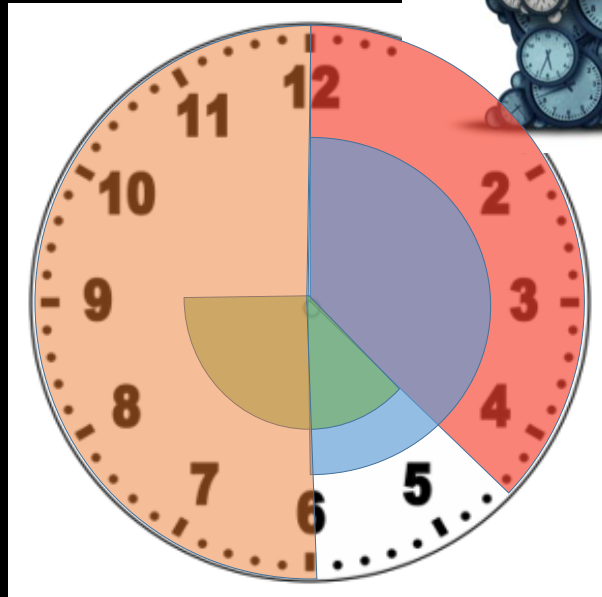
→ **ANGIO-TC**

→ **TC PERFUSIONE (o Mismatch DWI-PWI)**

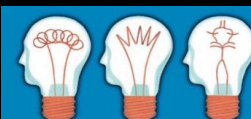
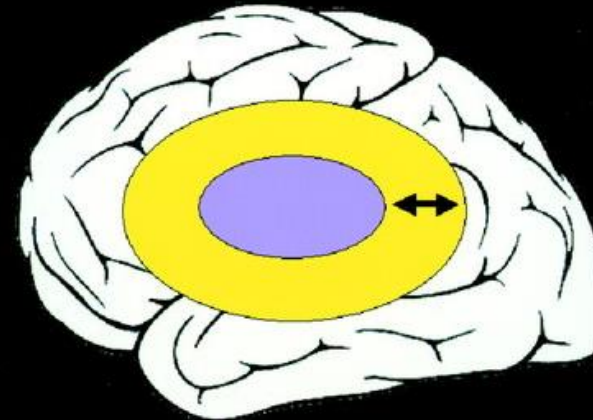
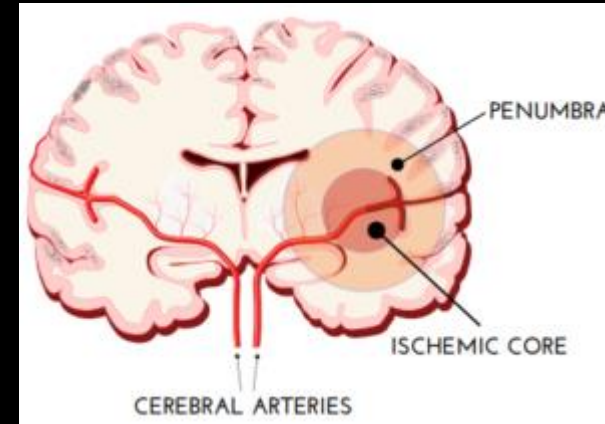
- **Criteria protocollo EXTEND**

(Volume core <70ml; Volume penumbra >= 10ml;  
Mismatch ratio: 1,2)

*TIME....*



*...TISSUE!*

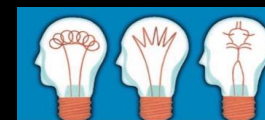
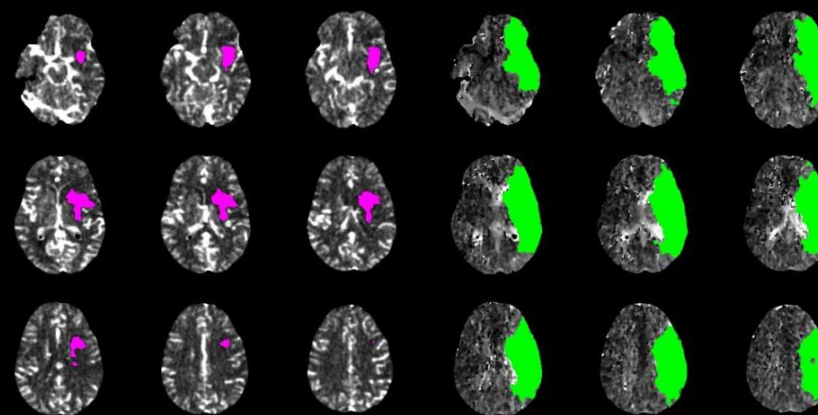




*TIME....*

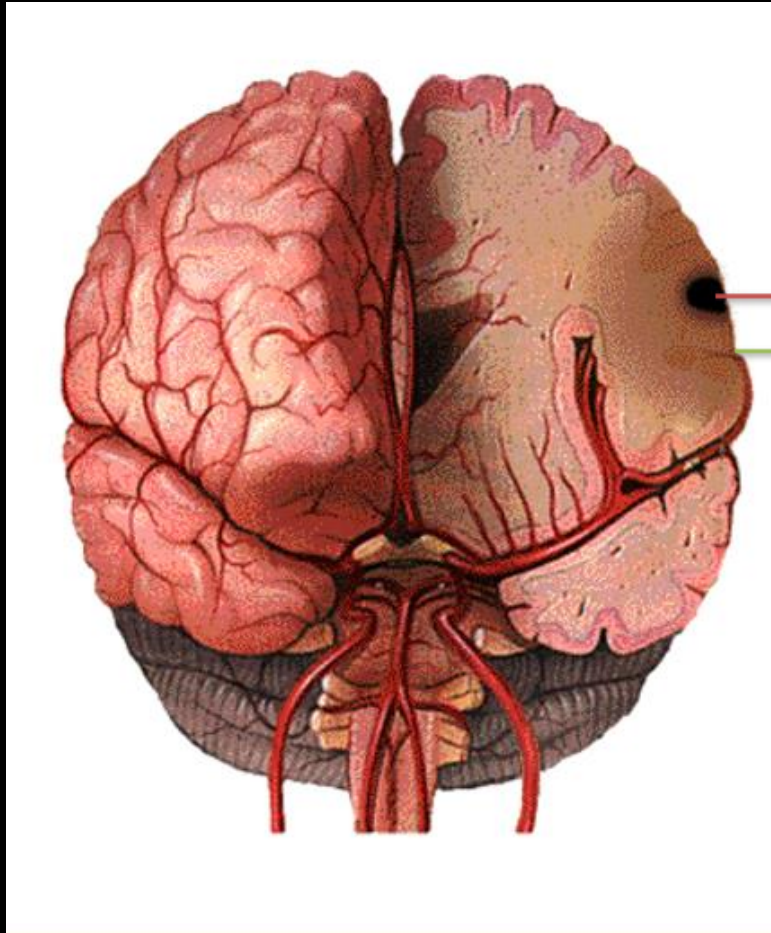


*...TISSUE  
IS BRAIN!*



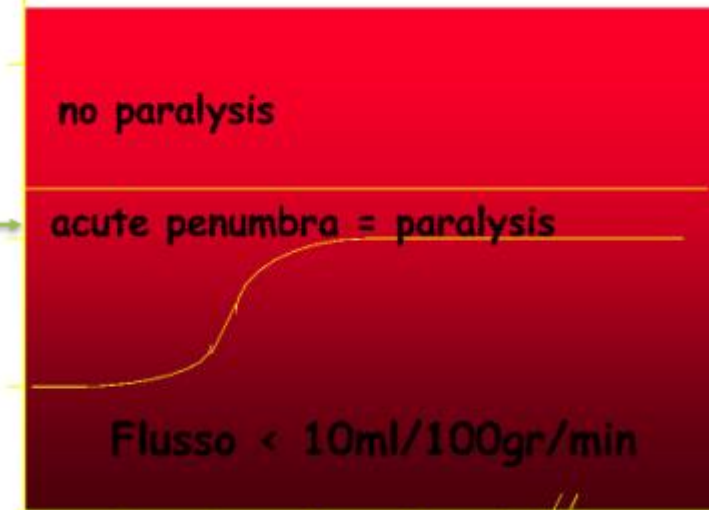
# ISCHEMIA CEREBRALE

## *processo dinamico*

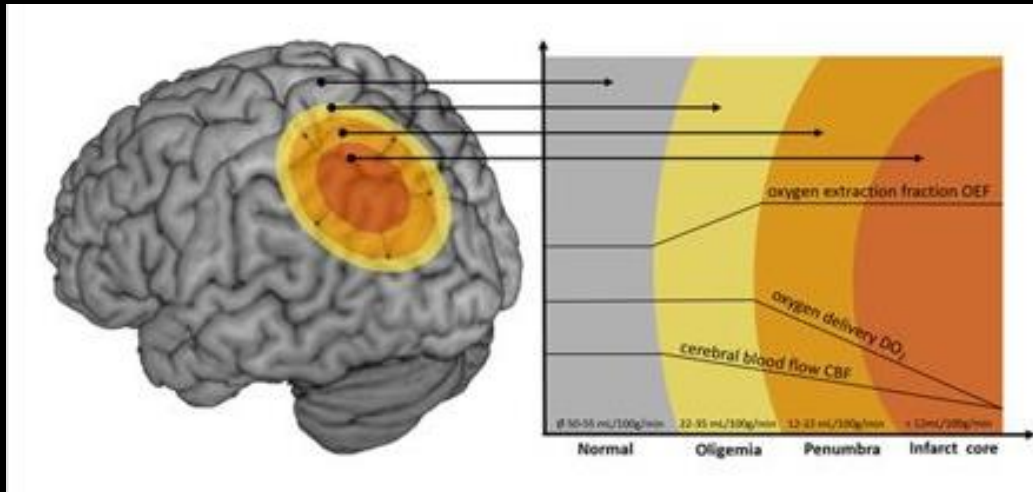


**CORE** = CBF < 10ml/100gr/min

**PENOMBRA** = CBF < 20/100gr/min ; neuroni silenti (freezing)



# TC di Perfusione



## Core ischemico

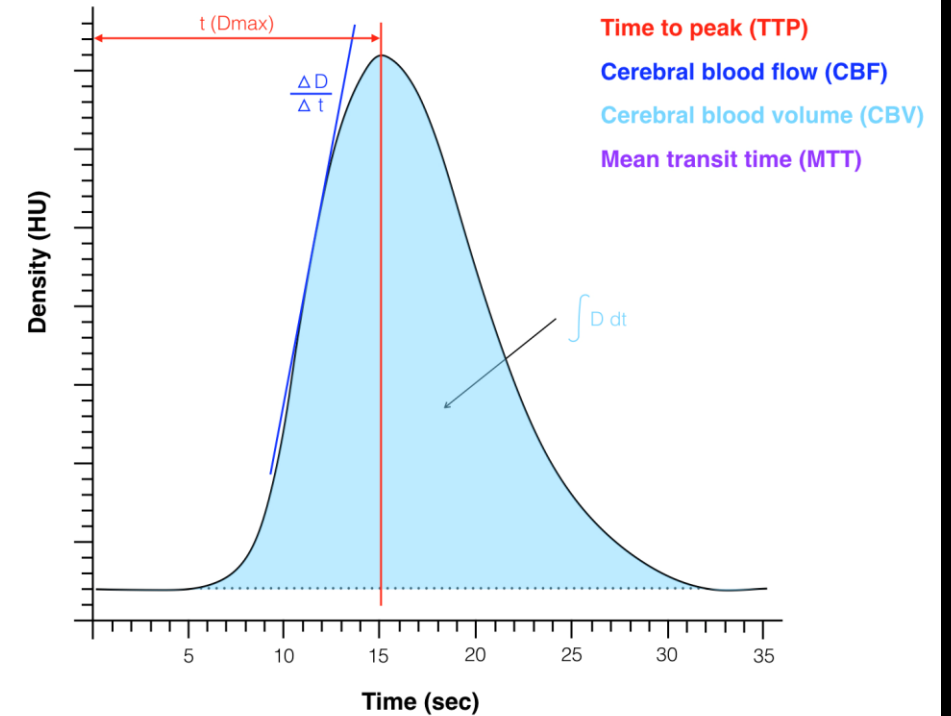
Tessuto cerebrale irreversibilmente alterato

## Penombra ischemica

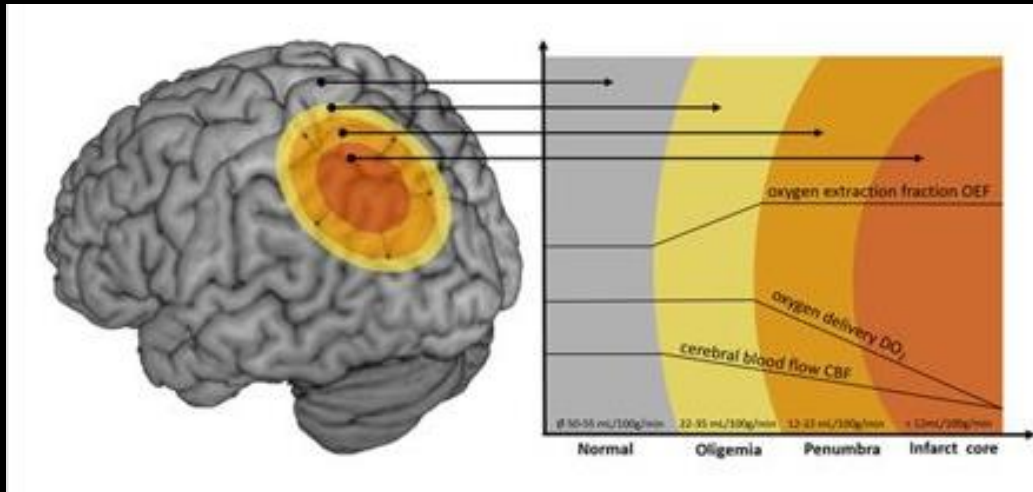
Tessuto cerebrale alterato ma salvabile sostenuto da meccanismi di compenso:

- 1) Emodinamici (circoli collaterali e autoregolazione)
- 2) Metabolici (aumento estrazione dell'ossigeno sanguigno)

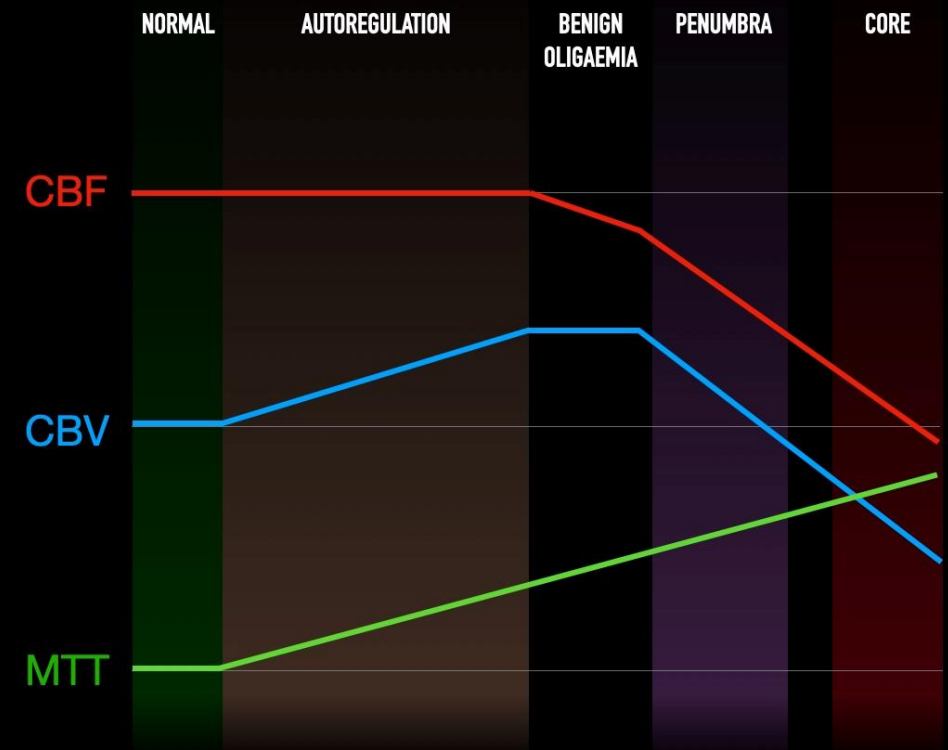
## TIME ATTENUATION CURVE



# TC di Perfusione



← compensated → ← decompensated →



## PARAMETRI PERFUSIONALI

### Flusso ematico cerebrale (Cerebral Blood Flow – CBF)

Quantità di sangue che attraversa un certo volume di tessuto in un determinato intervallo di tempo e si esprime in ml/100g/min

### Volume ematico cerebrale (Cerebral Blood Volume – CBV)

Volume di sangue che è presente in un dato tessuto e si esprime in ml/100 g di tessuto

### Tempo medio di transito (Mean Transit Time – MTT)

Tempo che impiega il sangue ad attraversare i vasi capillari cerebrali; corrisponde al tempo di circolo e si esprime in secondi

### Tempo al picco massimo della curva di funzione residua (Tmax)

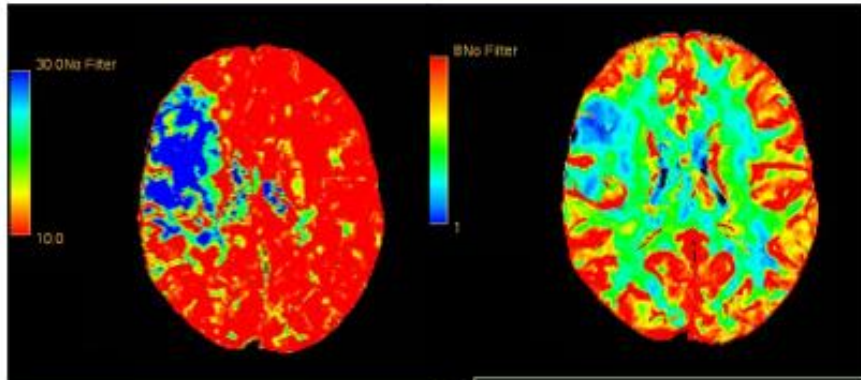
Tempo che trascorre dall'inizio dell'iniezione del mezzo di contrasto sino al picco massimo della curva di funzione residua; riflette il ritardo del bolo di contrasto e si esprime in secondi

Slide adapted with permission from Aaron S. Field MD, PhD



# TC di Perfusione

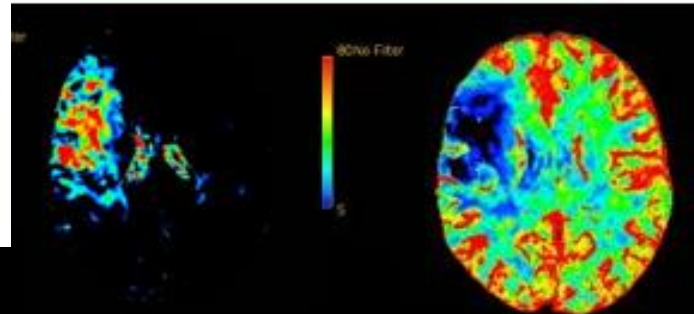
Mismatch MTT-CBV  
(usato precedentemente)



AREA IPOPERFUSA rMTT  
> 145%

CORE  
CBV < 2.0 ml/100 g

mismatch  
Tmax-CBF



Tmax > 6sec  
Ipoperfusione totale  
(in parte recuperabile)

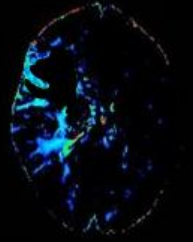
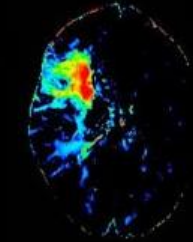
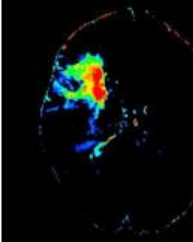
rCBF < 30%  
Rispetto al controlato sano =  
Core infartuale

*non ancora sottoposto a verifica nei trials*

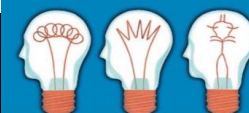
CORE INFARTUALE  
Tmax > 16sec

AREA IPOPERFUSA  
Tmax > 9,5sec

PENOMBRA  
Tmax<sub>9,5</sub> - Tmax<sub>16</sub>



MISMATCH



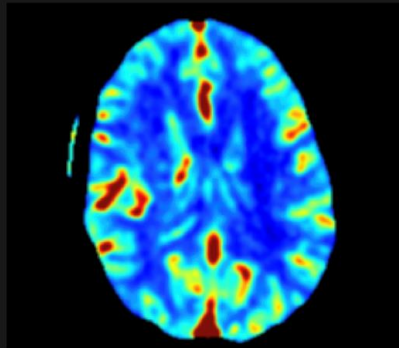
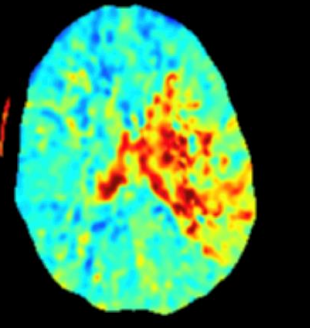
# TC di Perfusione

Prof Peter Mitchell, rID 45248

Key concept

Ischaemic penumbra

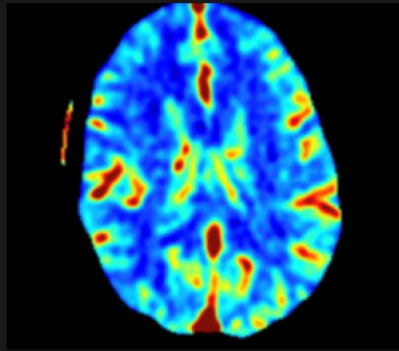
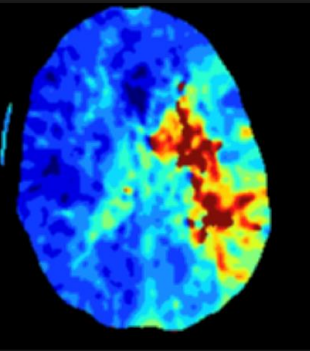
MTT



CBF



TTP  
(Tmax)

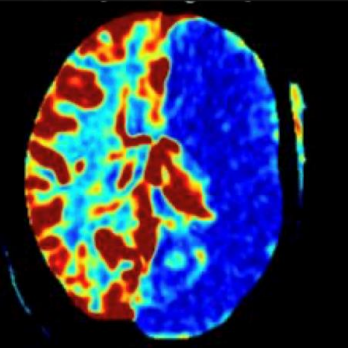
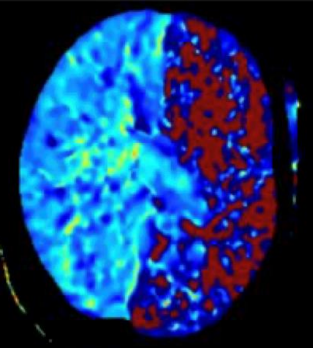


CBV

normal  
or  
↑



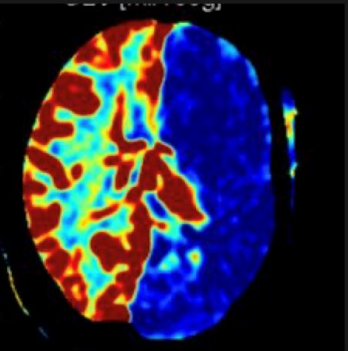
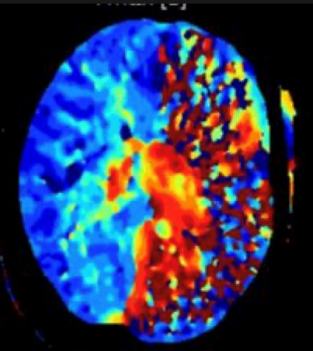
MTT



CBF



TTP  
(Tmax)



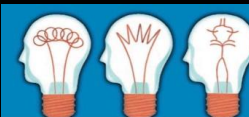
CBV



Core = CBF

Penombra = Tmax-CBF

ipoperfusone totale = Tmax



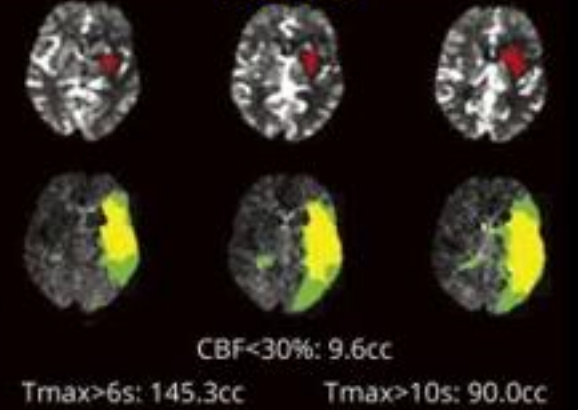
# Automated CTP software



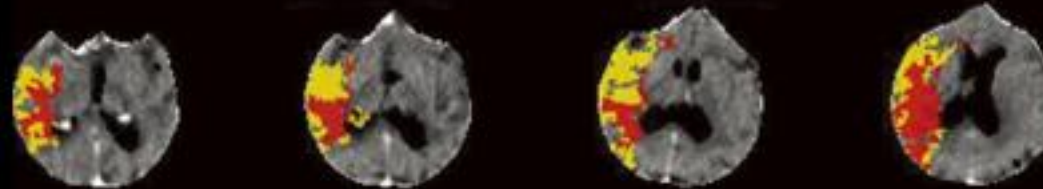
## RAPID



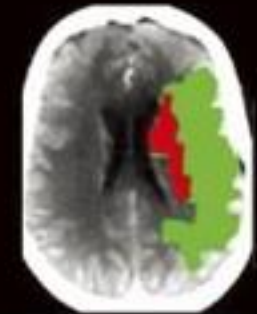
## VIZ-AI



Volume 1	rrBF<30%	32.05cc
	aDelay>2s	
Volume 2	aDelay>2s	77.90cc



## OLEA

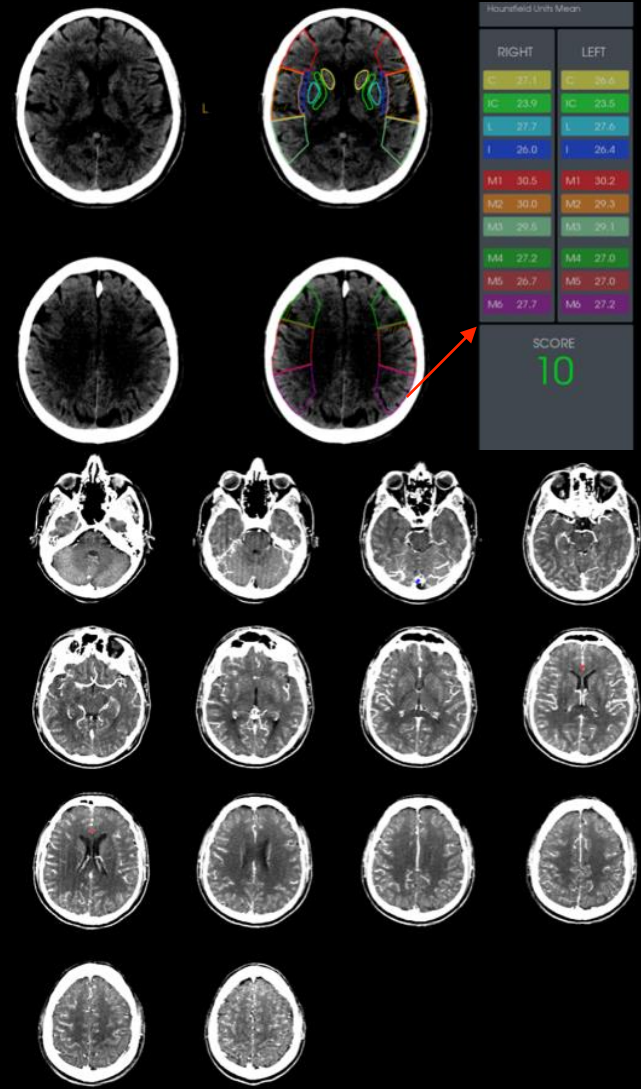
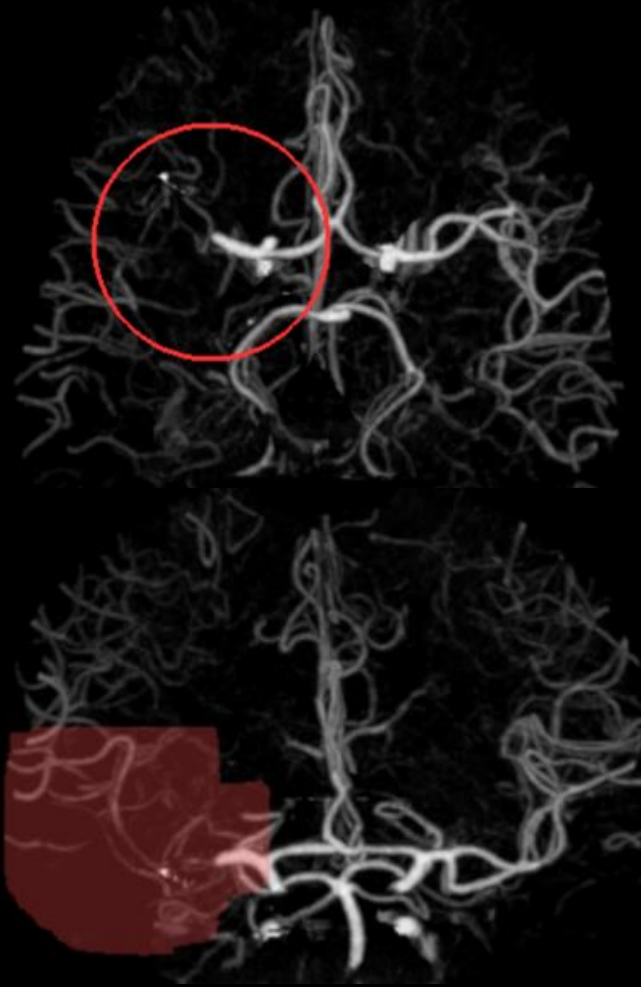


## MISTar



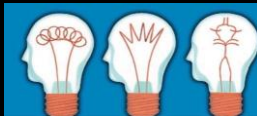
# Automated CTP software: *RAPID*

LVO detected



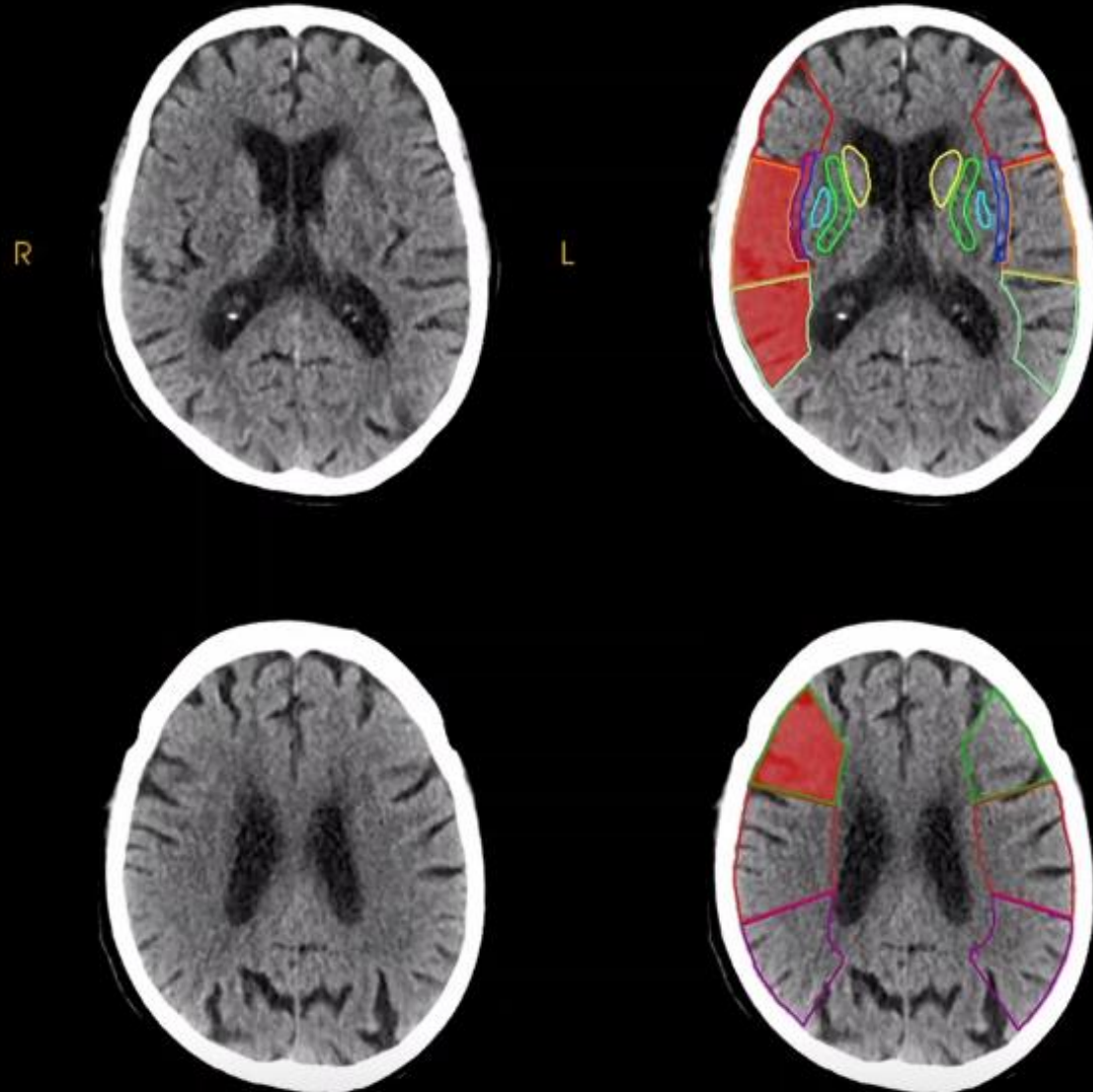
Hounsfield Units Mean	
RIGHT	LEFT
25.1	26.6
IC 23.9	IC 23.5
I 27.7	I 27.6
I 26.0	I 26.4
M1 30.5	M1 30.2
M2 30.0	M2 29.3
M3 29.8	M3 29.1
M4 27.2	M4 27.0
M5 26.7	M5 27.0
M6 27.7	M6 27.2

SCORE  
**10**





# RAPID ASPECTS: Automated ASPECT score

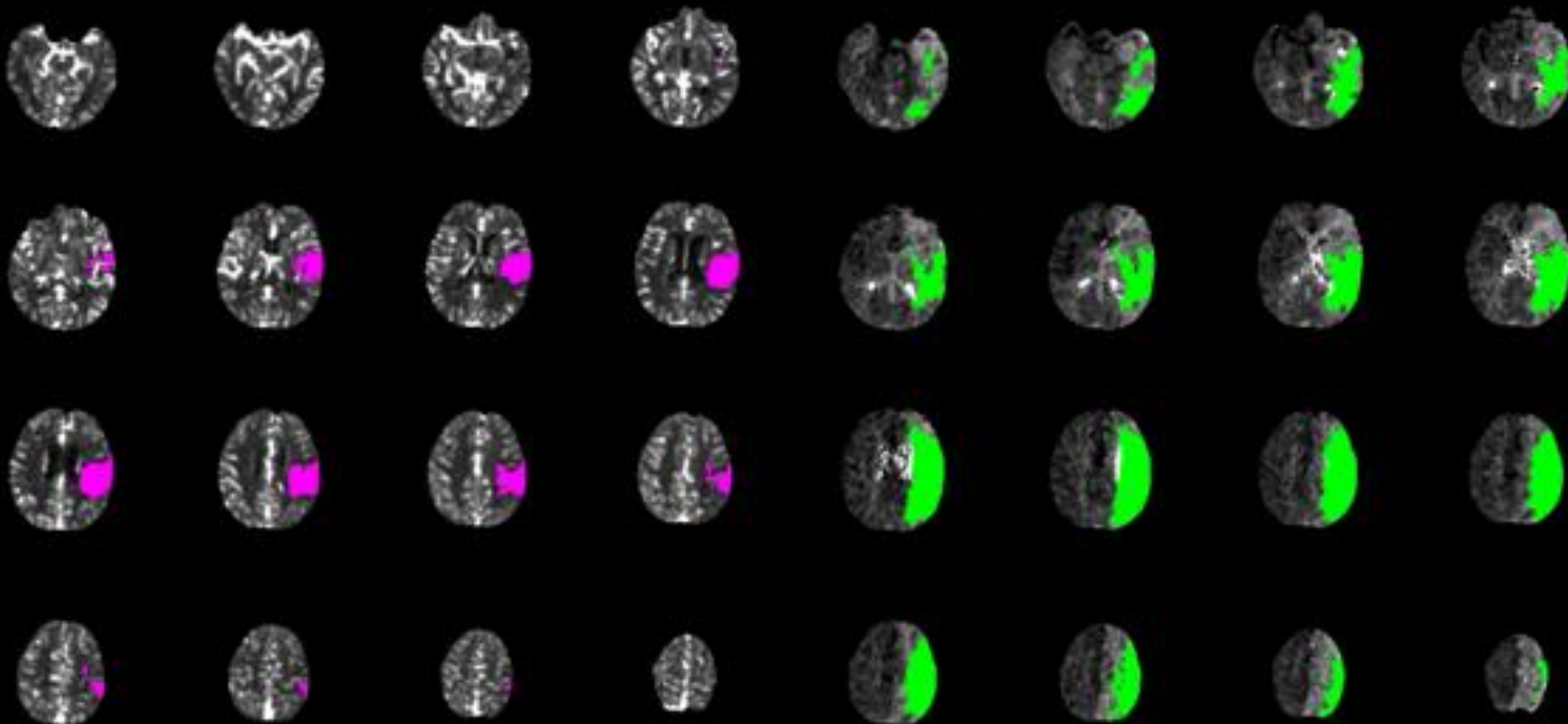


Hounsfield Units Mean

	RIGHT	LEFT
C	35.7	35.0
IC	33.1	32.8
L	36.3	36.7
I	33.5	35.0
M1	36.2	36.7
M2	36.3	36.6
M3	37.0	38.6
M4	36.5	37.7
M5	36.1	37.0
M6	38.2	38.2

SCORE  
**6**  
RAPIDASPECTS





CBF < 30% volume: 44 ml

Tmax > 6.0s volume: 177 ml

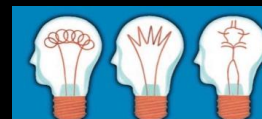
Mismatch volume: 133 ml  
Mismatch ratio: 4.0

**CBF < 30%**

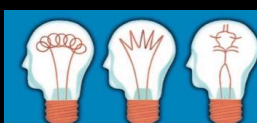
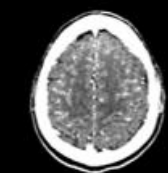
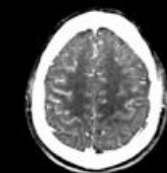
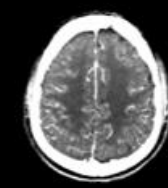
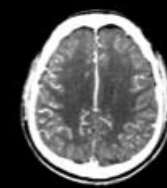
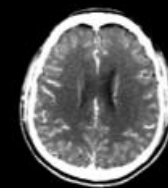
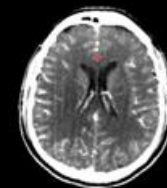
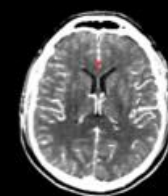
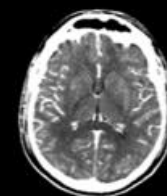
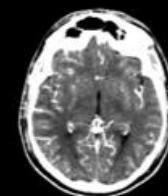
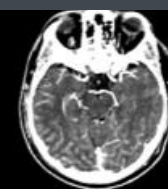
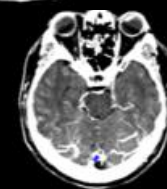
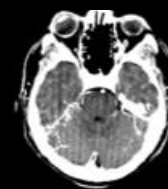
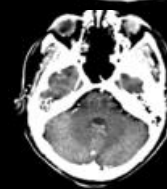
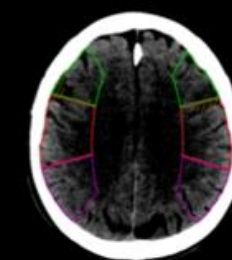
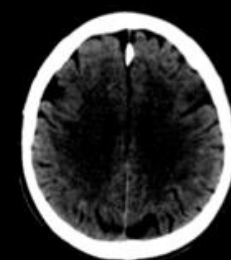
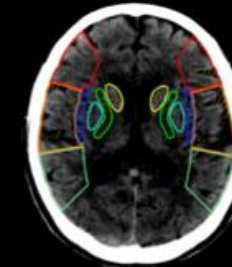
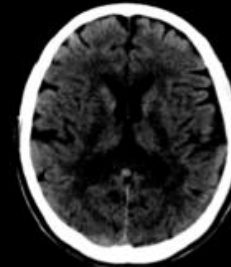
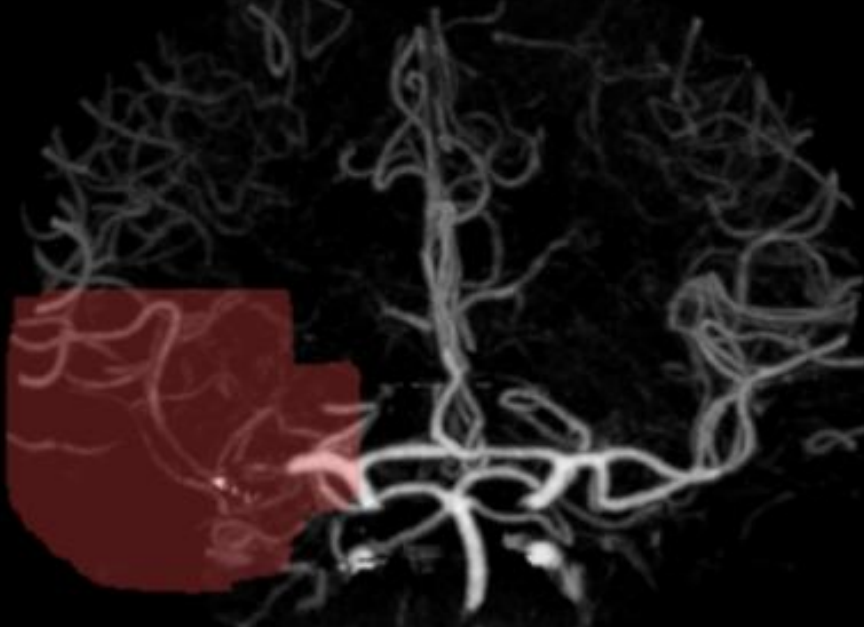
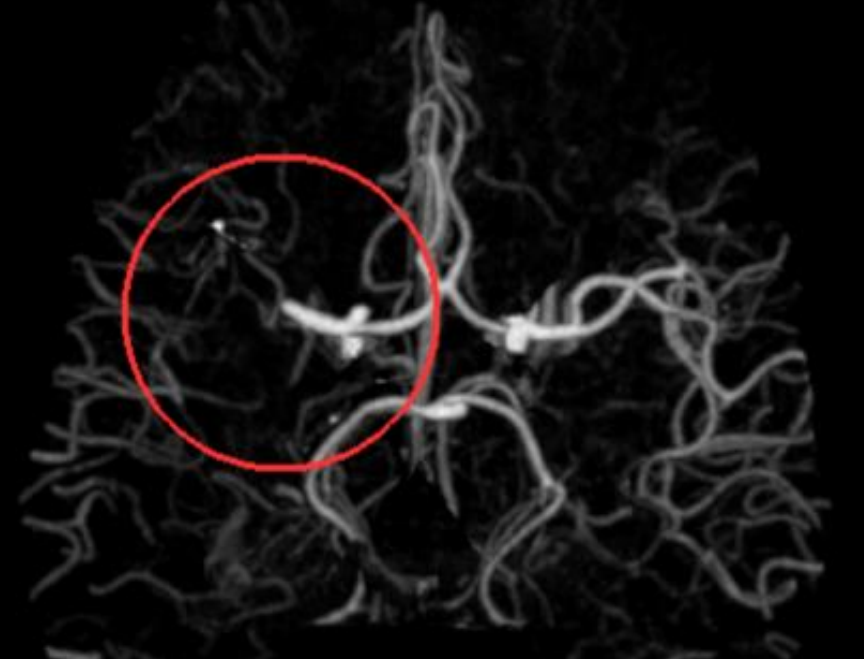
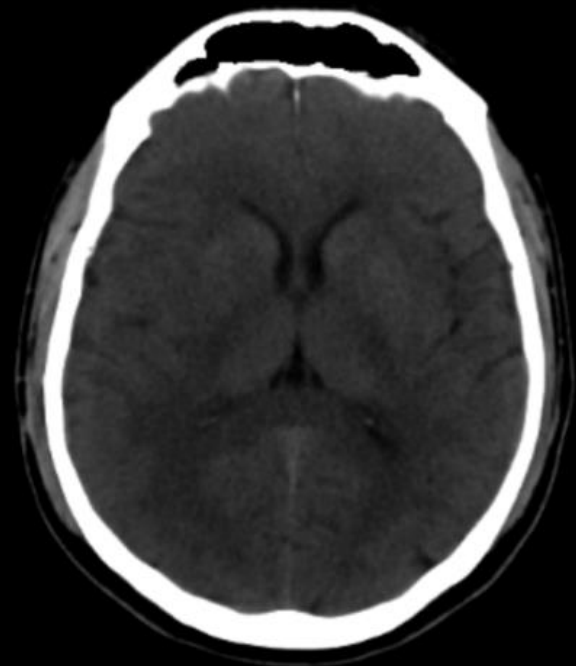
Tessuto ischemico irreversibile  
(verosimilmente non recuperabile)

**Tmax > 6sec**

Tessuto ipoperfuso  
(in parte recuperabile)



LVO detected



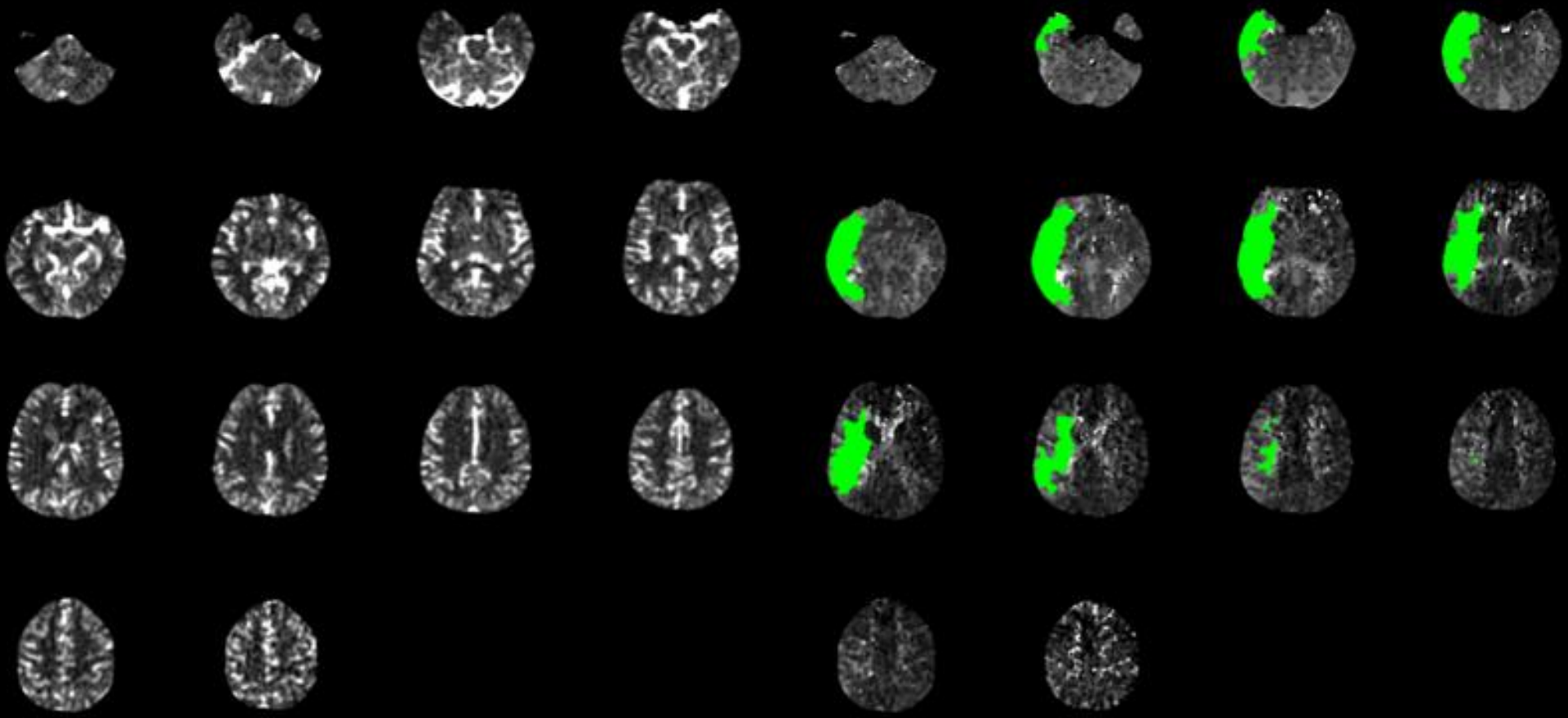
Hourfield Units Mean

	RIGHT	LEFT
C	23.1	26.6
IC	23.9	23.5
L	27.7	27.6
I	26.0	26.4
M1	30.5	30.2
M2	30.0	29.3
M3	29.5	29.1
M4	27.2	27.0
M5	26.7	27.0
M6	27.7	27.2

SCORE  
10

CBF

Tmax

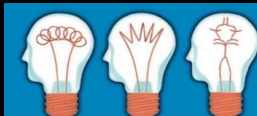


● CBF<30%: 0 ml

● Tmax>6.0s: 106 ml

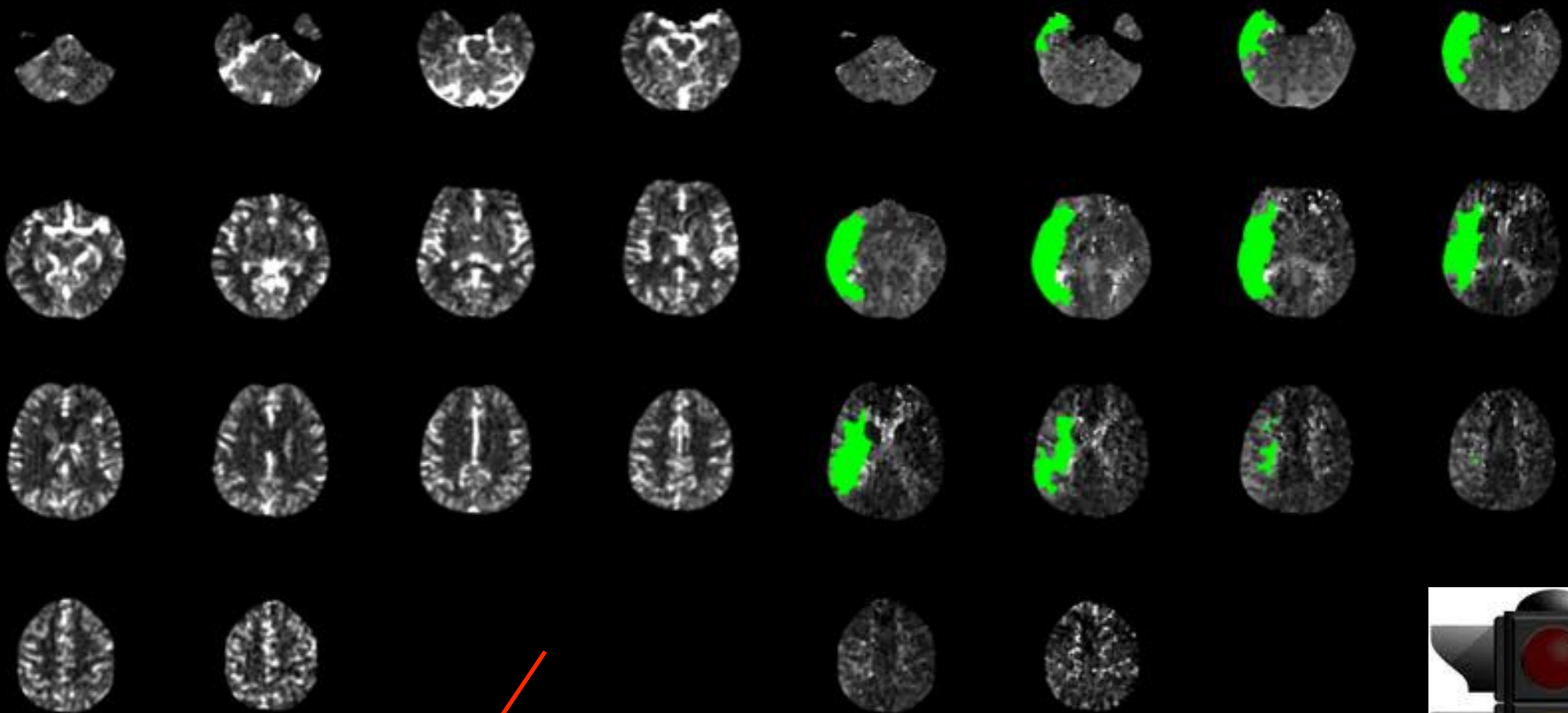
Mismatch volume: 106 ml  
Mismatch ratio: infinite

RAPID



CBF

Tmax



● CBF < 30%: 0 ml

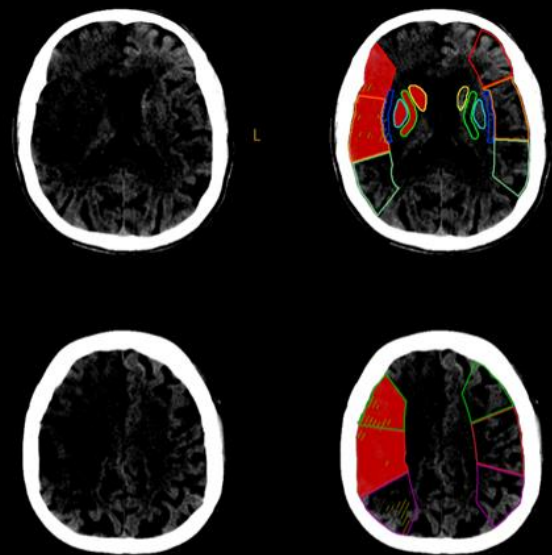
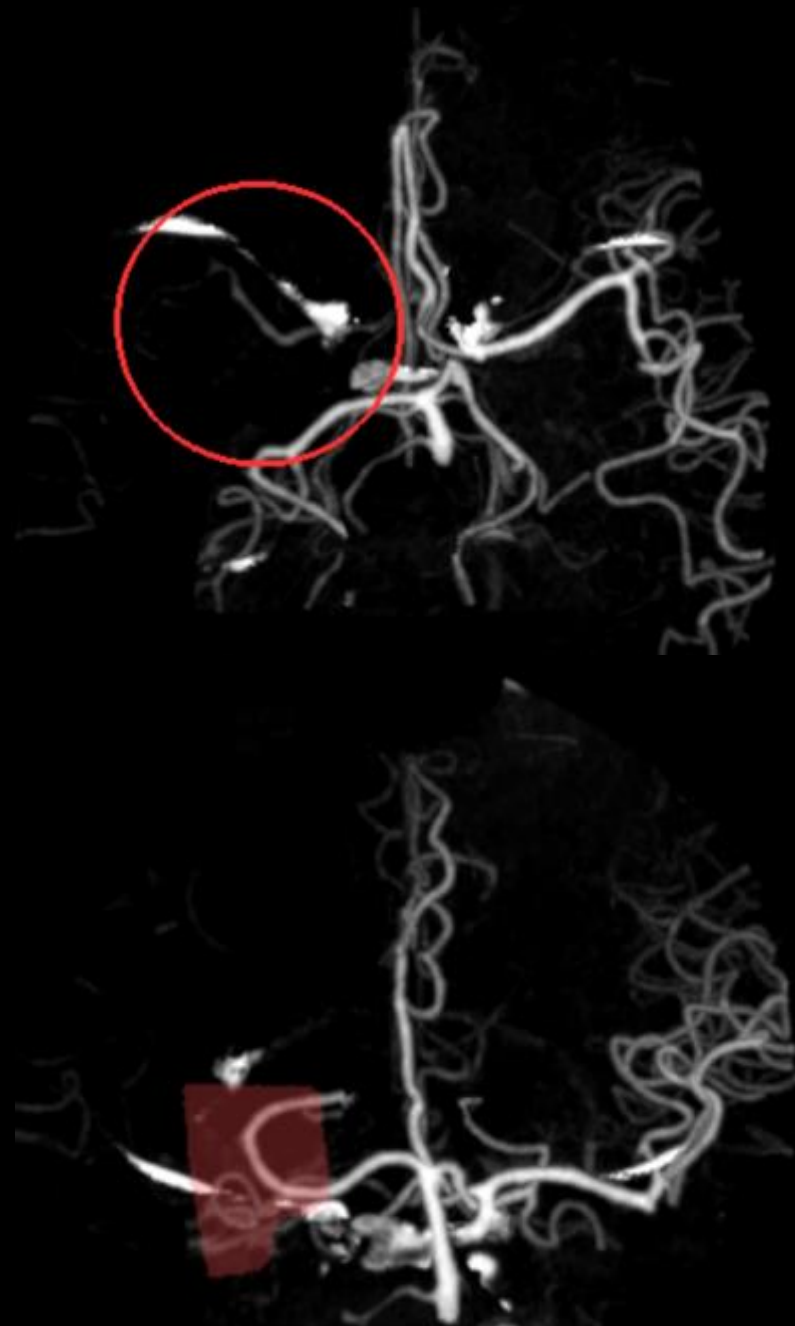
● Tmax > 6.0s: 106 ml

Mismatch volume: 106 ml  
Mismatch ratio: infinite



RAPID

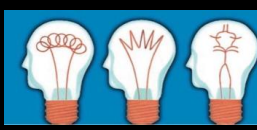
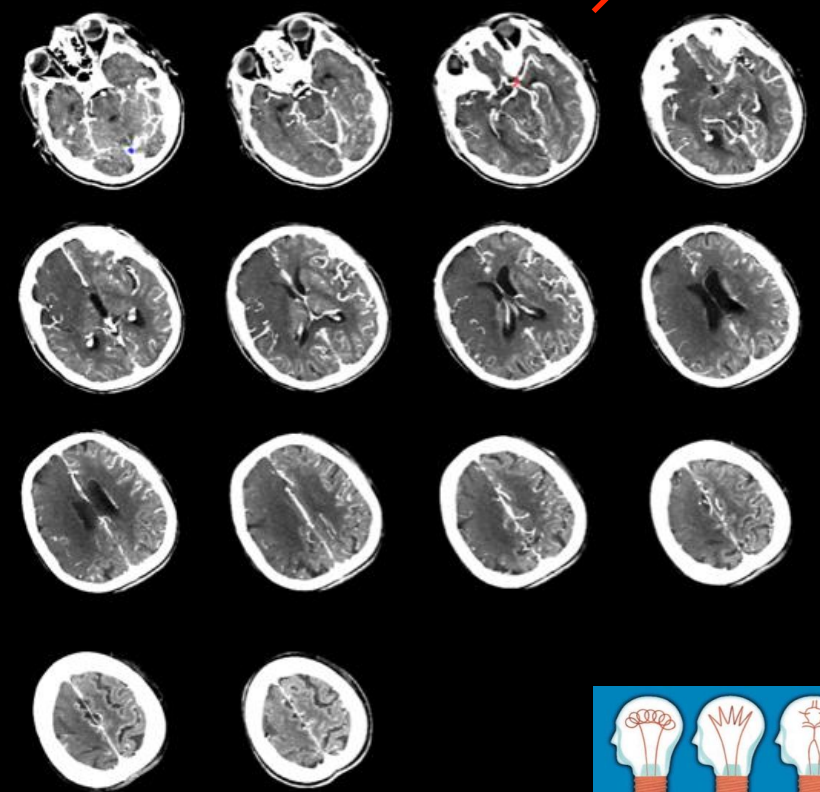
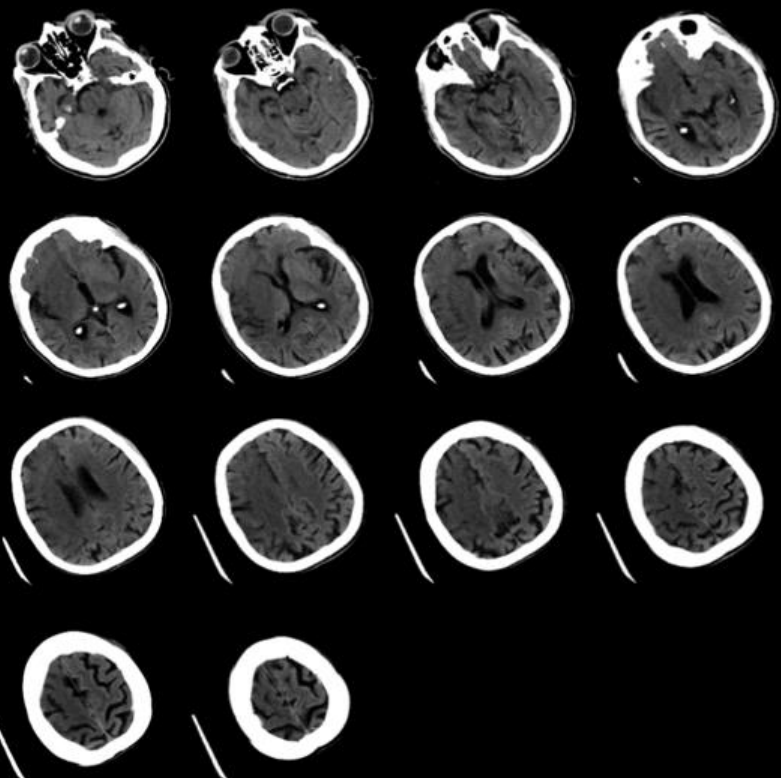
LVO detected



Hounsfield Units Mean

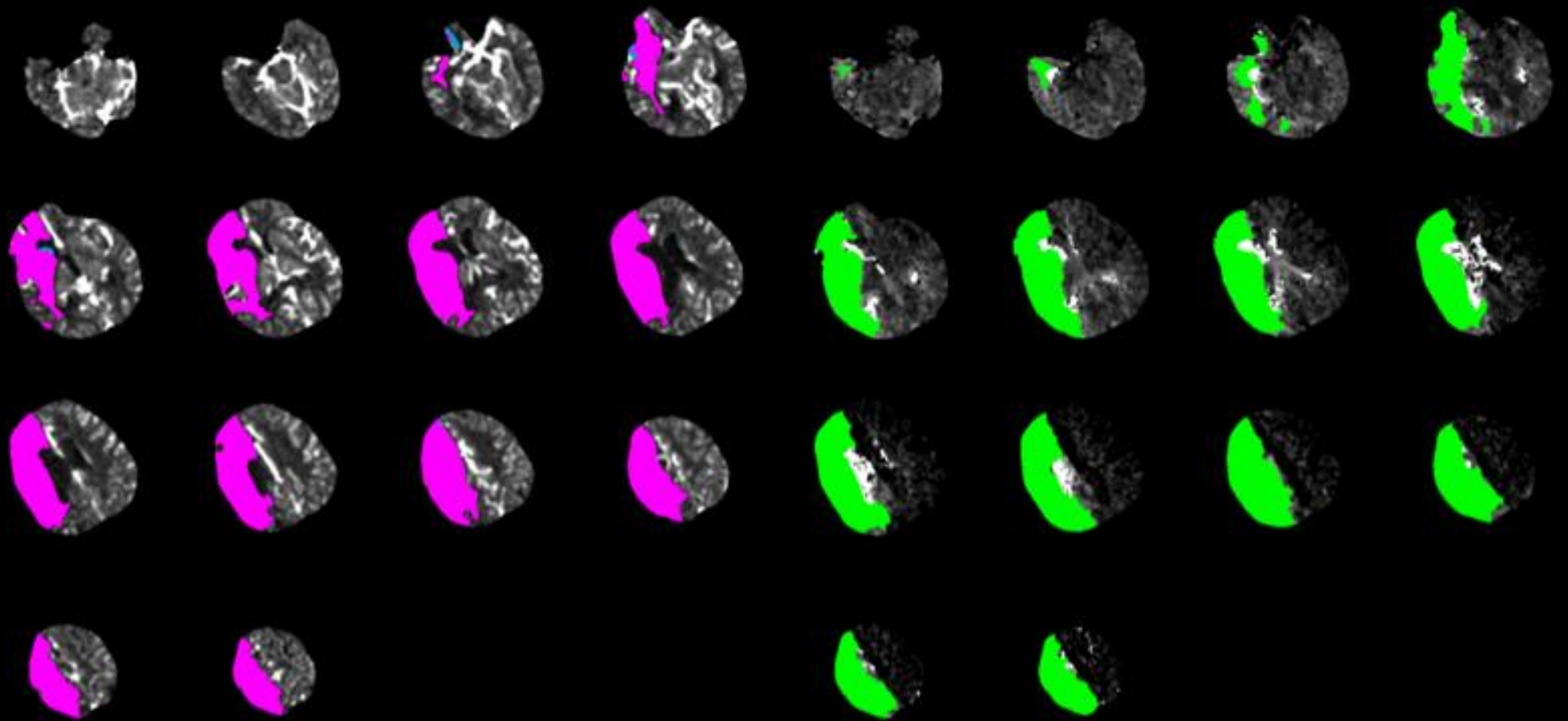
	RIGHT	LEFT
C	19.1	23.7
IC	19.2	22.7
L	19.2	27.3
I	-	24.4
M1	24.6	29.9
M2	24.8	25.9
M3	24.9	25.0
M4	22.0	25.6
M5	20.8	23.3
M6	24.7	25.5

SCORE  
3



CBF

Tmax

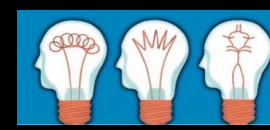


● CBF<30%: 208 ml  
● Hypodensity  $\geq 5$  and  $\leq 12$  HU

● Tmax>6.0s: 262 ml

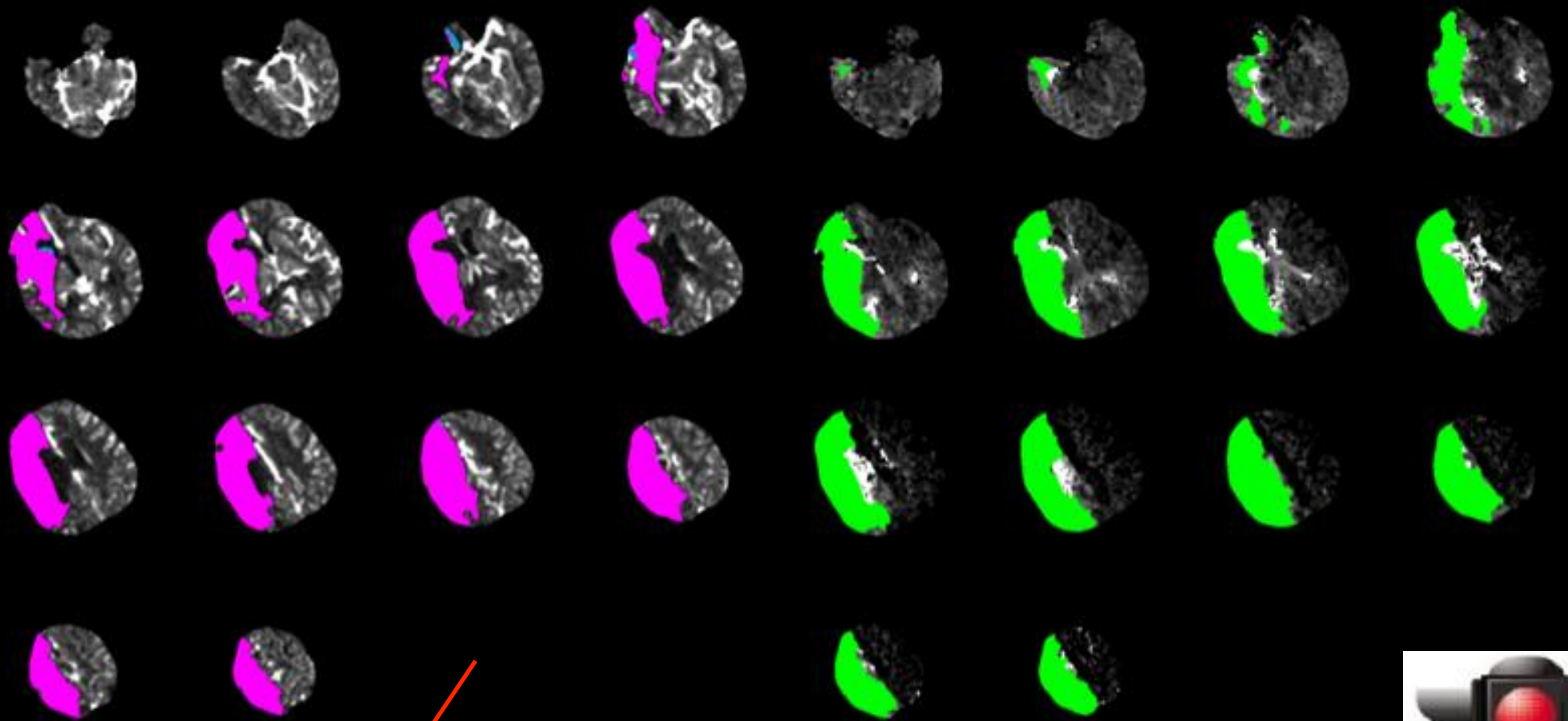
Mismatch volume: 54 ml  
Mismatch ratio: 1.3

RAPID



CBF

Tmax



● CBF < 30%: 208 ml  
● Hypodensity  $\geq 5$  and  $\leq 12$  HU

● Tmax > 6.0s: 262 ml

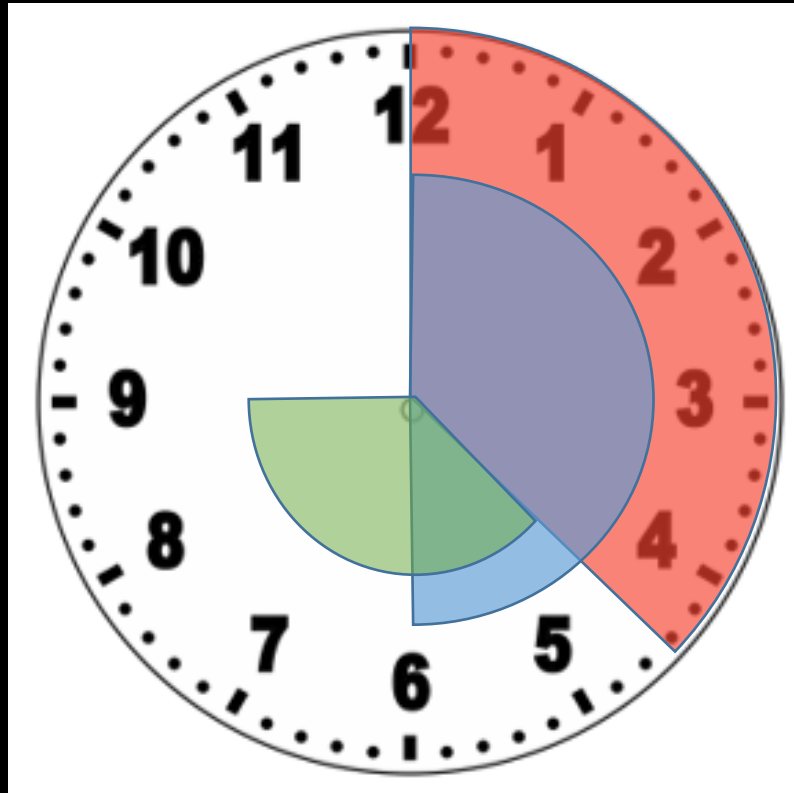
Mismatch volume: 54 ml  
Mismatch ratio: 1.3



RAPID



VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE



**rTPA e.v. entro 4.5h dall-esordio dei sintomi**

→ **TC SENZA MDC**

- Escludere emorragie
- Escludere ischemia conclamata
- Non si applica ASPECT per estensione del danno

**Trombectomia entro 6h dall'esordio dei sintomi**

→ **TC SENZA MDC**

- ASPECT > 6

→ **ANGIO-TC (meglio MULTIFASICA)**

- Studio intra-extracranico per identificare sito di occlusione
- Valutazione circoli di compenso

**rTPA e.v. tra le 4.5 e le 9h dall-esordio dei sintomi**

→ **TC SENZA MDC**

→ **ANGIO-TC**

→ **TC PERFUSIONE (o Mismatch DWI-PWI)**

- **Criteri protocollo EXTEND**

(Volume core <70ml; Volume penumbra >= 10ml;  
Mismatch ratio: 1,2)

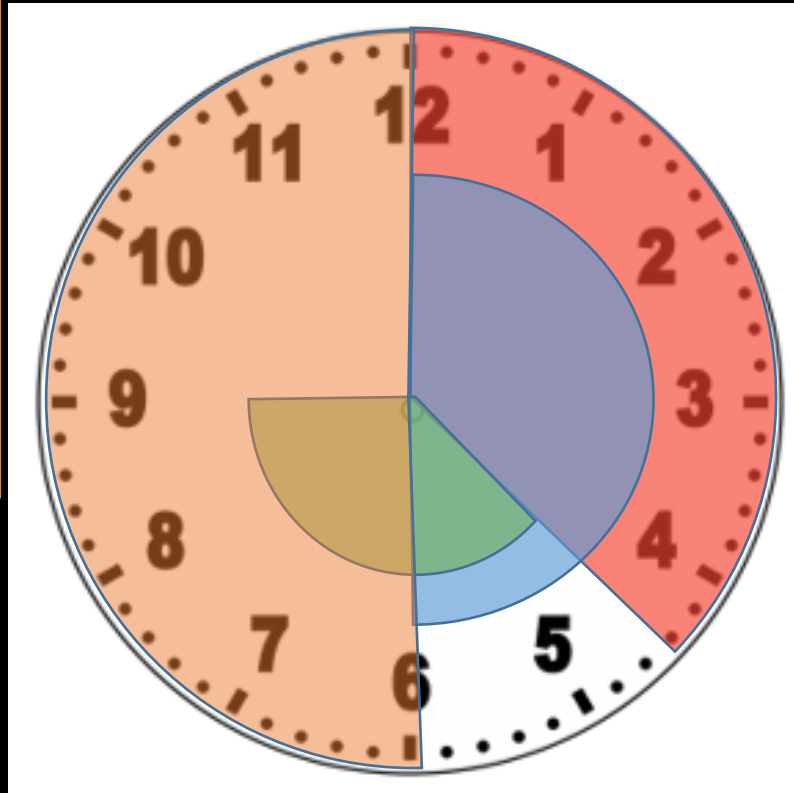
## Trombectomia *oltre 6h* dall'esordio dei sintomi

- TC SENZA MDC
- ANGIO-TC
- TC PERFUSIONE (O Mismatch DWI-PWI)
- Criteri protocollo DEFUSE 3
  - Volume core <70ml
  - Volume penombra >=15ml
  - Mismatch ratio: 1,8
- Criteri protocollo DAWN
  - >= 80aa, NIHSS >= 10, core <21 ml
  - < 80 aa, NIHSS >= 10, core <31 ml
  - < 80 aa, NIHSS >= 20, core fra 31-51

## rTPA e.v. *tra le 4.5 e le 9h* dall'esordio dei sintomi

- TC SENZA MDC
- ANGIO-TC
- TC PERFUSIONE (o Mismatch DWI-PWI)
- Criteri protocollo EXTEND  
(Volume core <70ml; Volume penombra >= 10ml; Mismatch ratio: 1,2)

## VADEMECUM LINEE GUIDA DIAGNOSTICA STROKE



## rTPA e.v. *entro 4.5h* dall'esordio dei sintomi

- TC SENZA MDC
- Escludere emorragie
- Escludere ischemia conclamata
- Non si applica ASPECT per estensione del danno

## Trombectomia *entro 6h* dall'esordio dei sintomi

- TC SENZA MDC
- ASPECT > 6
- ANGIO-TC (meglio MULTIFASICA)
- Studio intra-extracranico per identificare sito di occlusione
- Valutazione circoli di compenso

VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE



VADEMECUM LINEE  
GUIDA DIAGNOSTICA  
STROKE

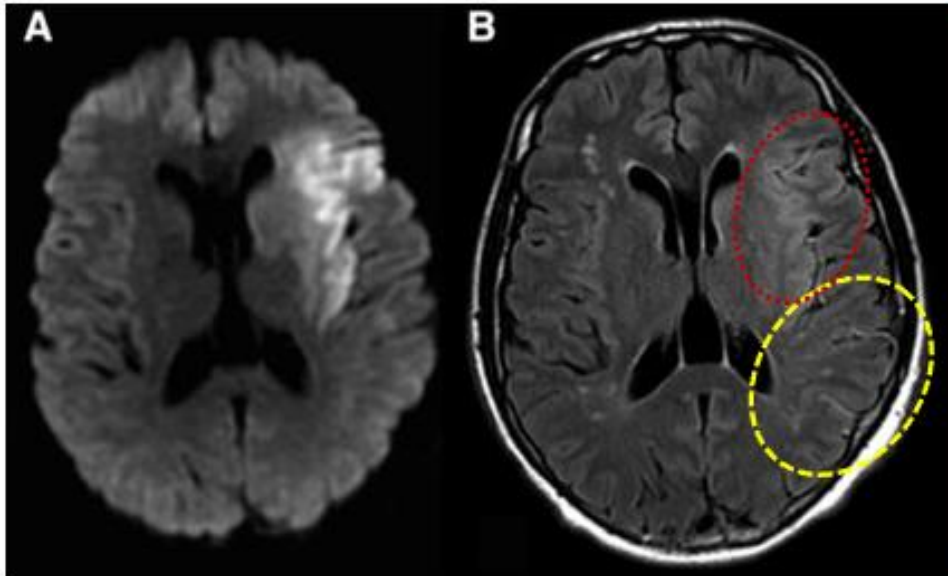


**ICTUS AL RISVEGLIO**  
Mismatch DWI/FLAIR  
ANGIO-RM  
Mismatch DWI/PWI

# RM



# RM



- a) Determinare **tempistica** ischemia (< o > a 4.5h)
- b) Valutare la presenza di **emorragia**
- c) Implementare valore diagnostico GRE per la **valutazione del trombo**
- d) Valutazione dello **slow-flow nei collaterali**

## Fluid-Attenuated Inversion Recovery Vascular Hyperintensities–Diffusion-Weighted Imaging Mismatch Identifies Acute Stroke Patients Most Likely to Benefit From Recanalization

Laurence Legrand, MD; Marie Tisserand, PhD\*; Guillaume Turc, PhD\*; Myriam Edjlali, MD; David Calvet, PhD; Denis Trystram, MD; Pauline Roca, PhD; Olivier Naggara, PhD; Jean-Louis Mas, MD; Jean-Francois Méder, PhD; Jean-Claude Baron, ScD; Catherine Oppenheim, PhD

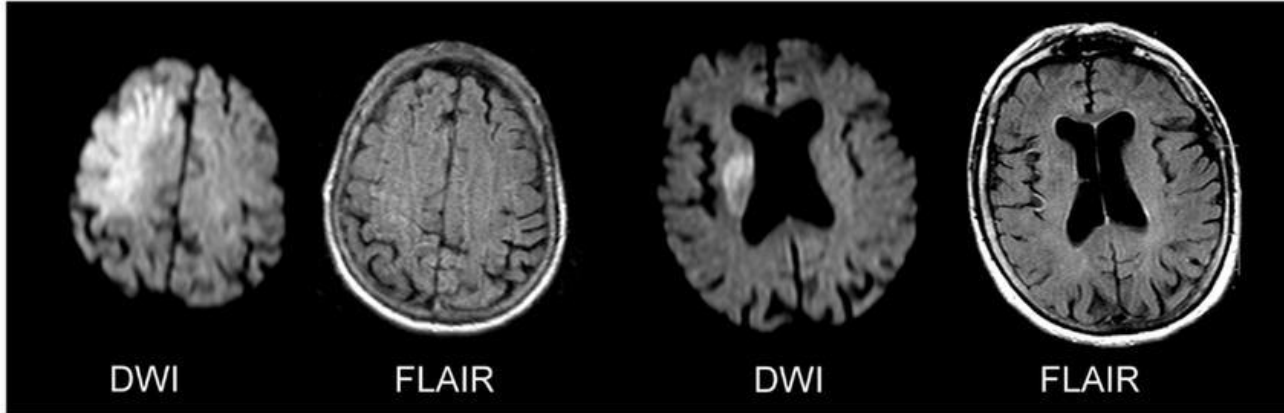
(*Stroke*. 2016;47:424-427.

**TEMPISTICA**

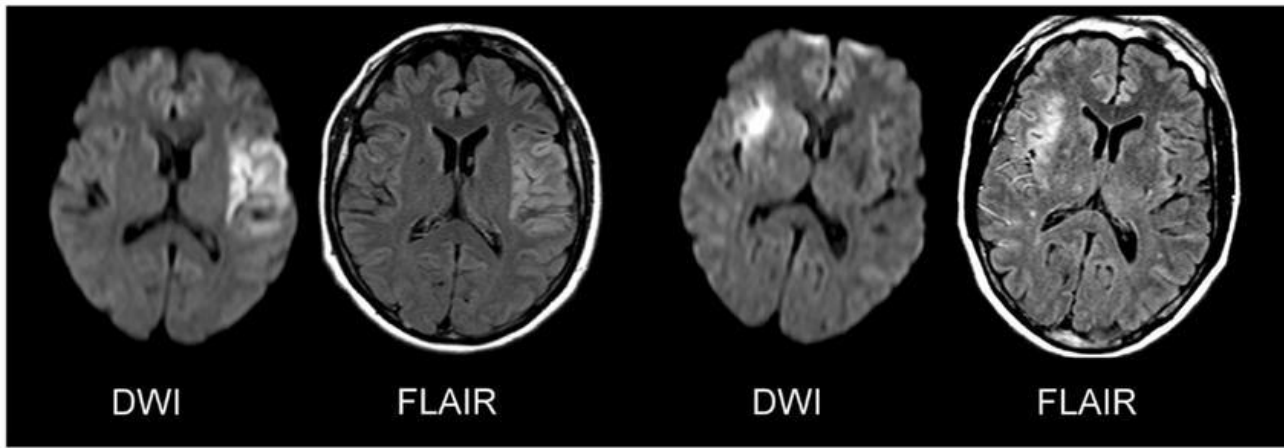


# RM

DWI-FLAIR-mismatch



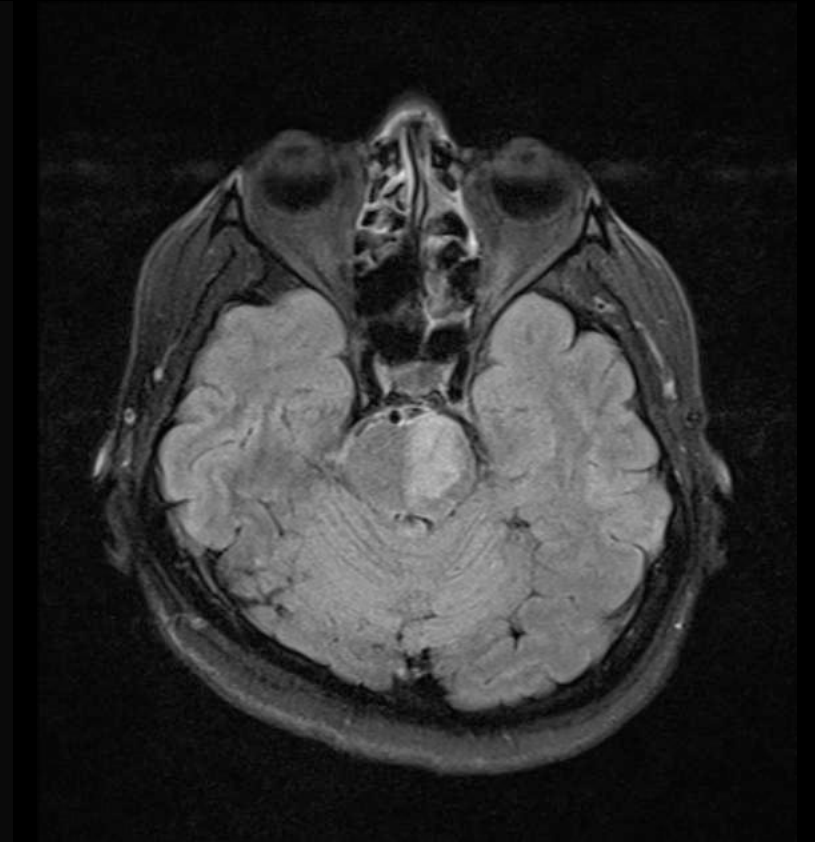
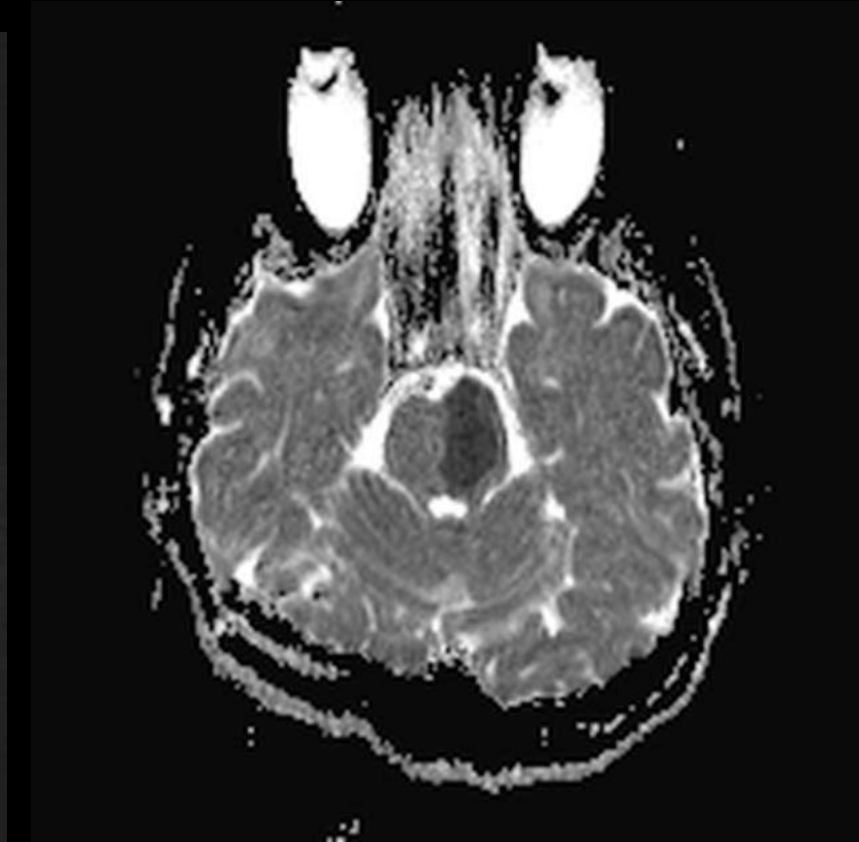
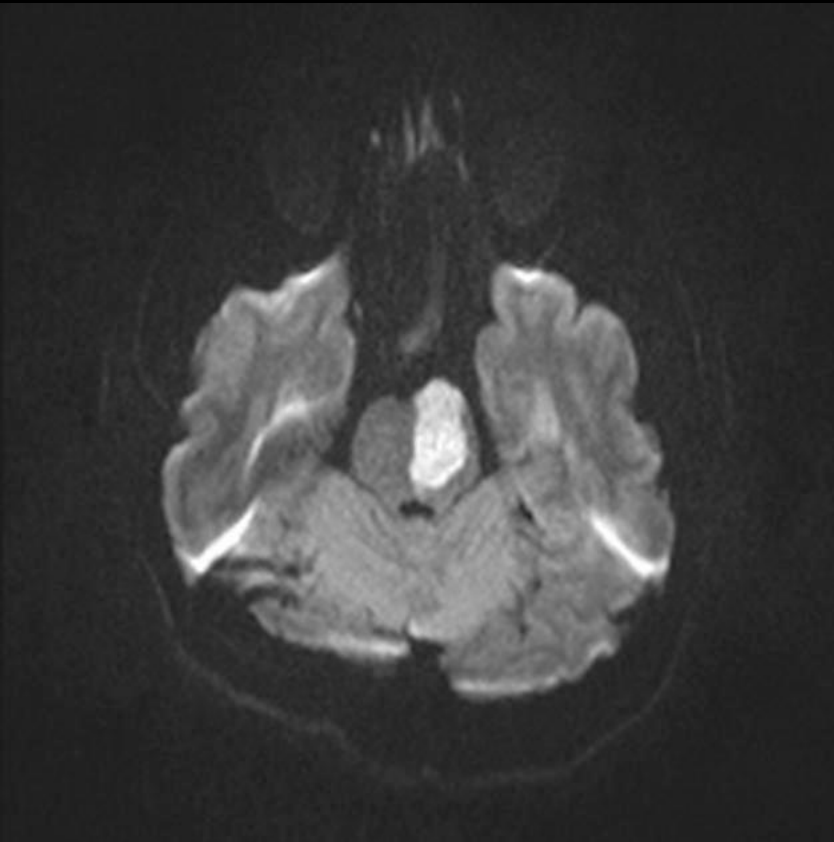
No DWI-FLAIR-mismatch



	DWI	FLAIR
<b>A.</b> <b>MISMATCH:</b>  DWI + FLAIR - < 4.5 hours		
<b>B.</b> <b>MATCH:</b>  DWI + FLAIR + > 4.5 hours		



RM



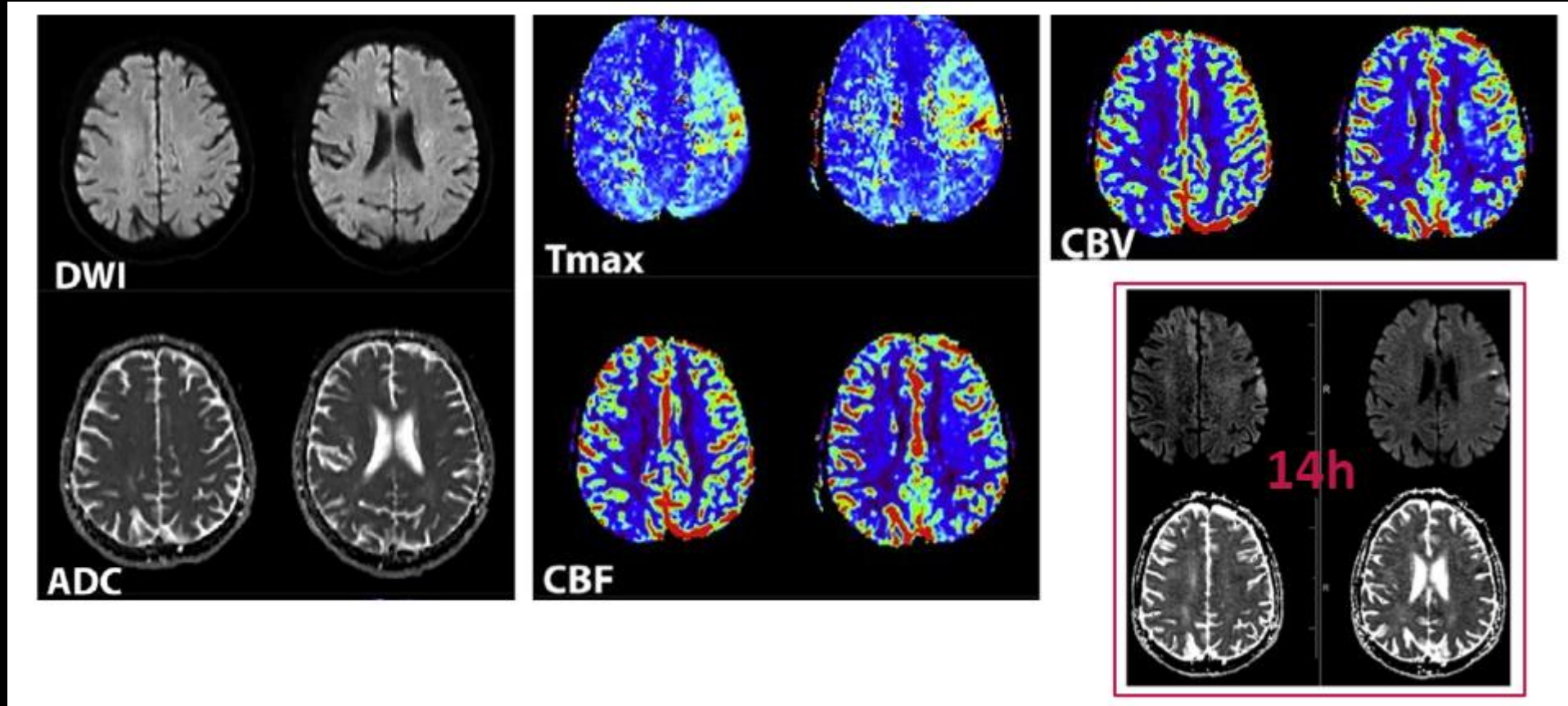
**CIRCOLO POSTERIORE**





# RM

## RM PERFUSIONE

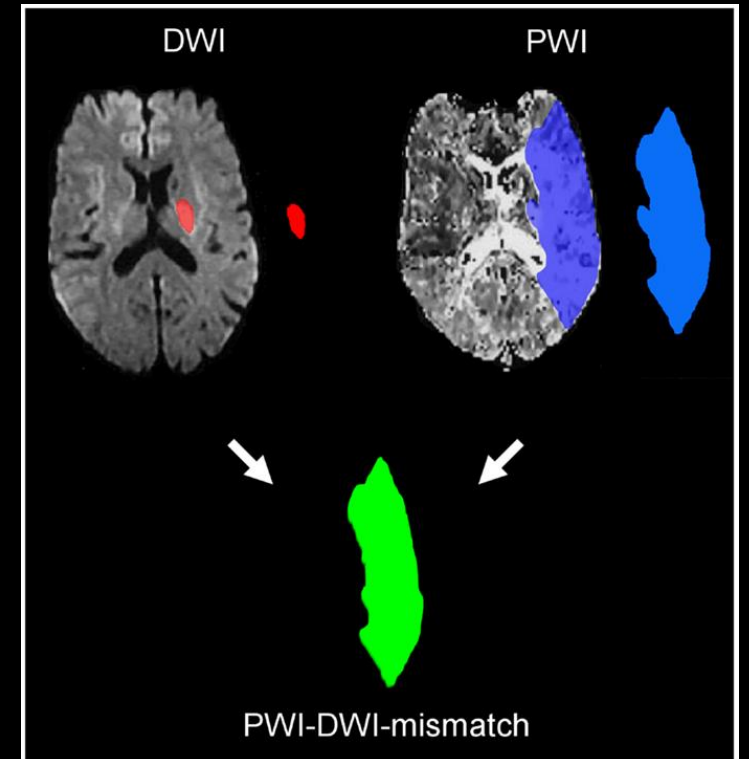
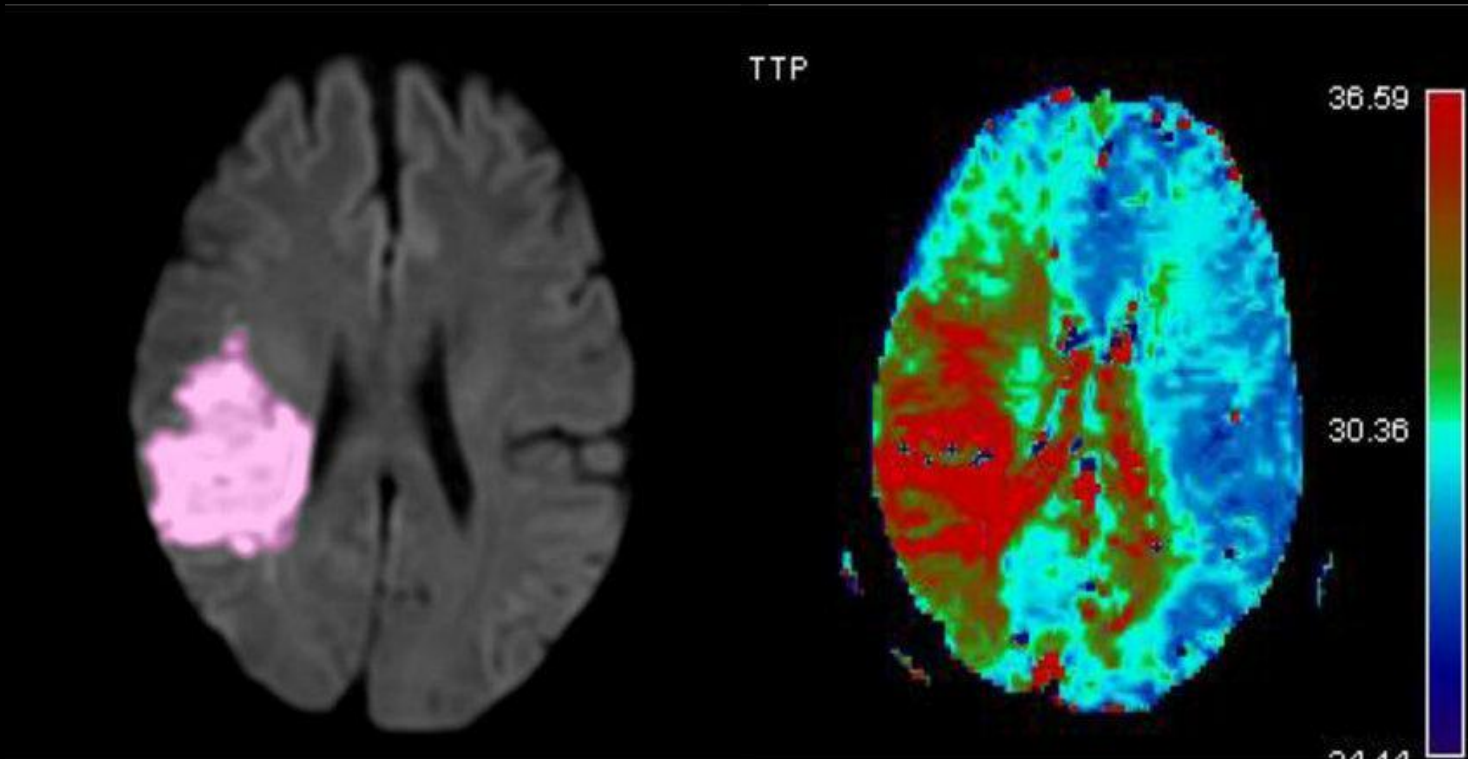


**VALUTAZIONE CORE-PENOMBRA**



# RM

## RM PERFUSIONE



**MISMATCH DWI-PWI**

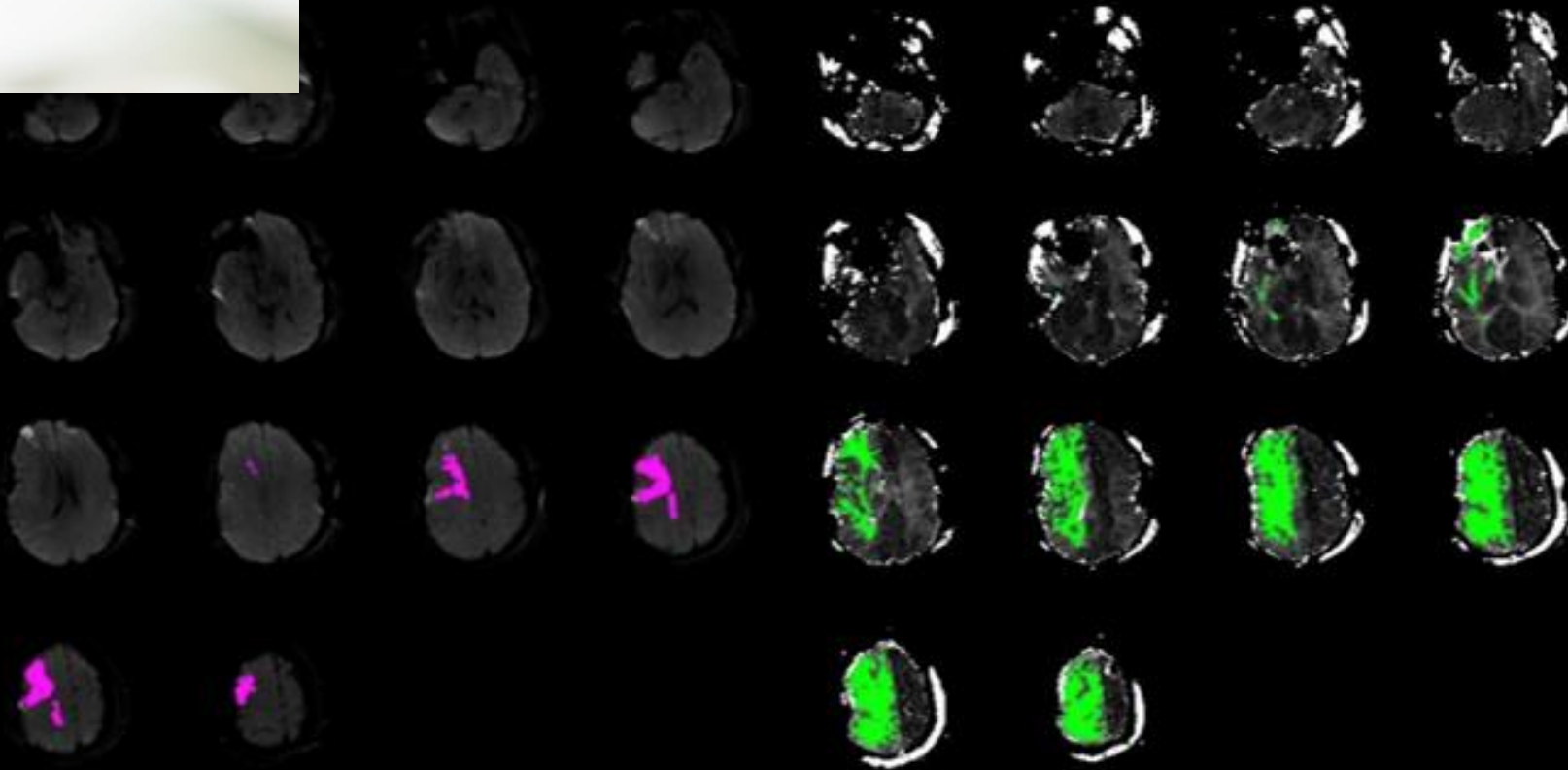




Automated CTP software: *RAPID*

ADC < 620

Tessuto  
ischemico  
irreversibile



Tmax > 6sec

Tessuto  
ipoperfuso

DWI (ADC<620) volume: 33.6 ml

Perfusion (Tmax>6.0s) volume: 166.7 ml

Mismatch volume: 133.1 ml

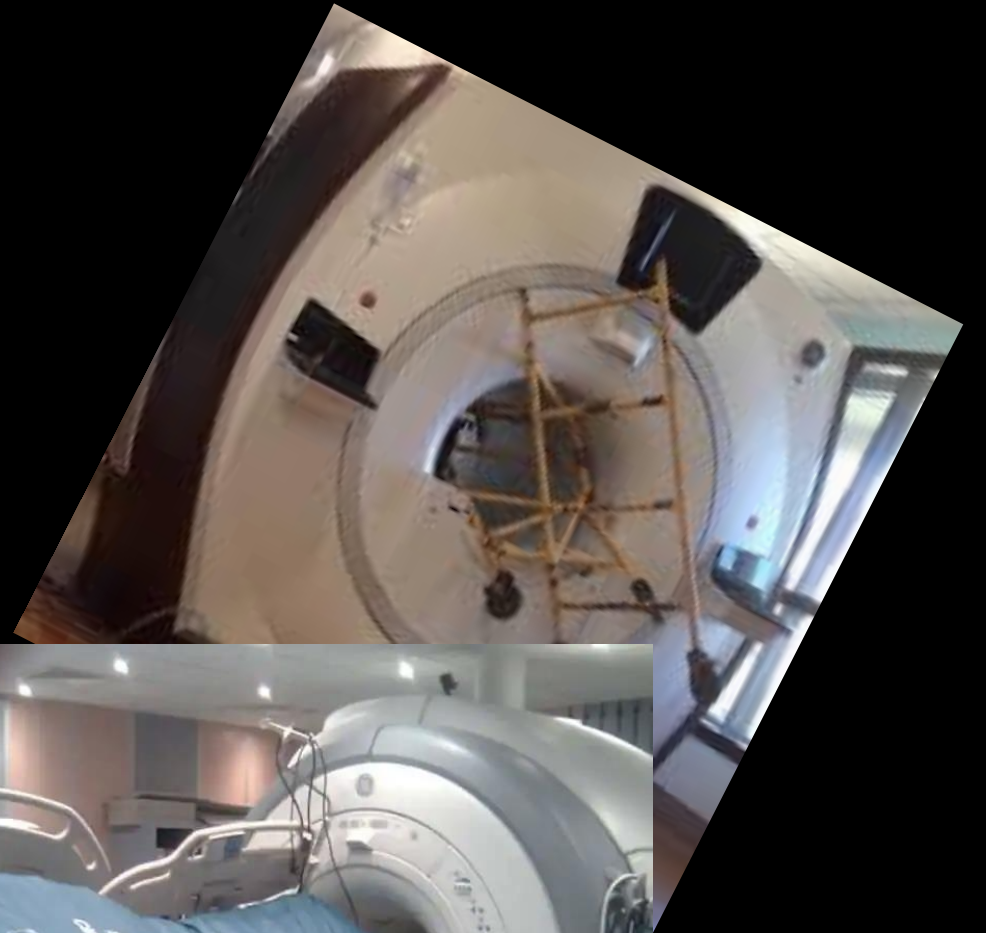
Mismatch ratio: 5.0



# RM

## Controindicazioni!!!

- Pace Maker;
- Corpi metallici;
- Device non rimovibili non RM compatibili.





Diagnostica non invasiva (TC, Angio-TC, TP/  
RM, Angio-RM, Diff, Perf ecc)

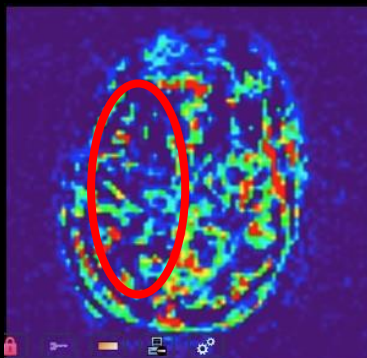


Paziente candidabile al trattamento  
endovascolare?



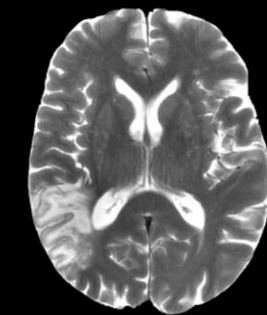
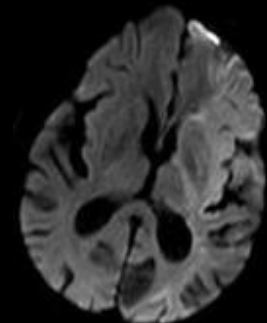
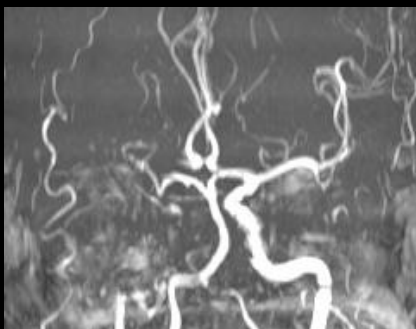
SI

NO

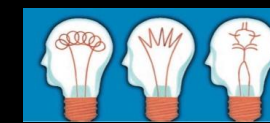


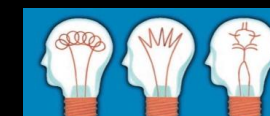
va in sala  
angiografia

non va in sala  
angiografica







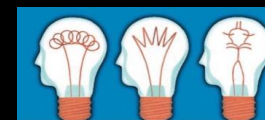
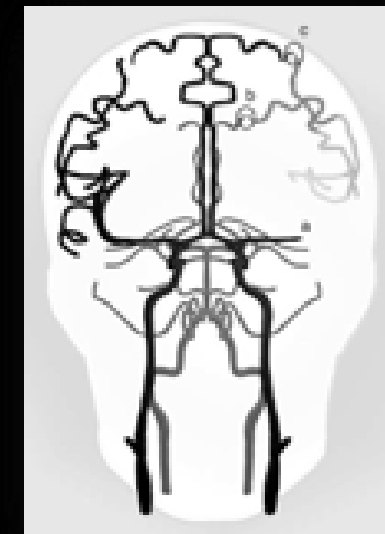






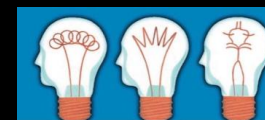
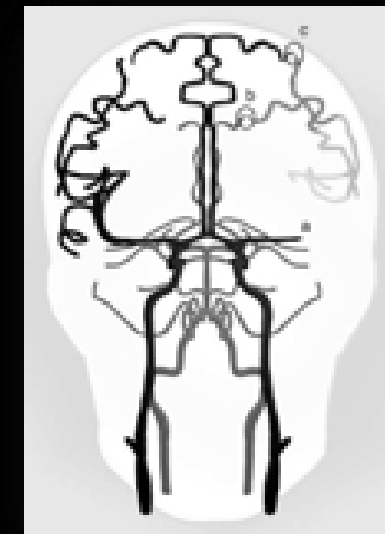
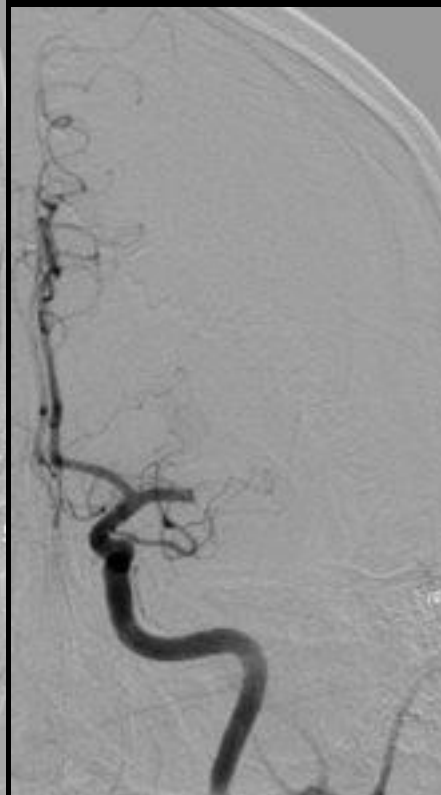
# Angio-TC

Circuiti collaterali



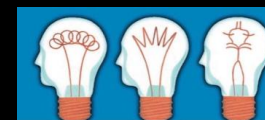
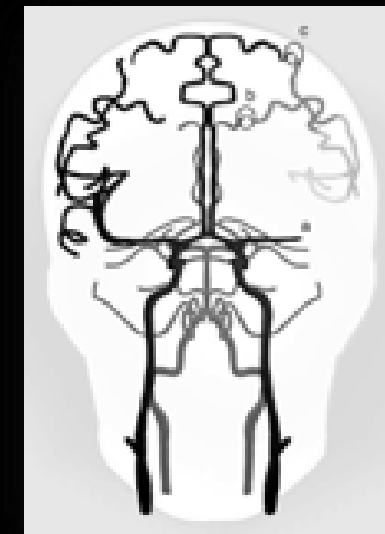
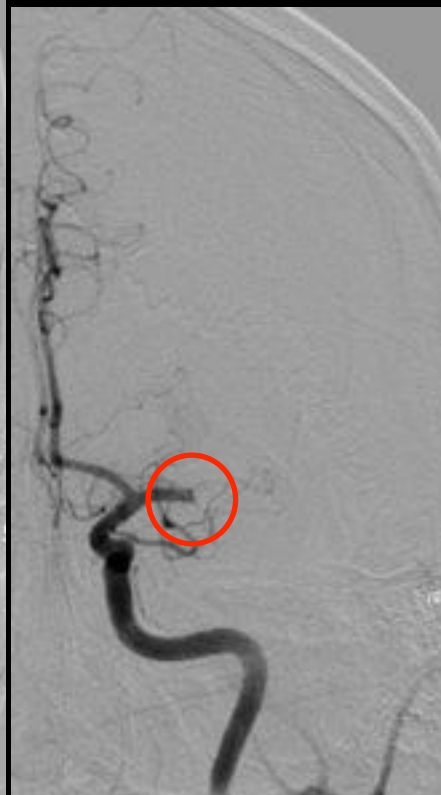
# Angio-TC

Circuiti collaterali



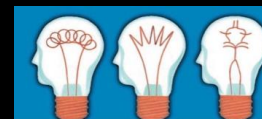
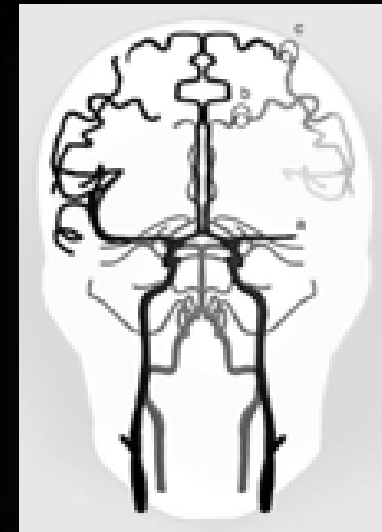
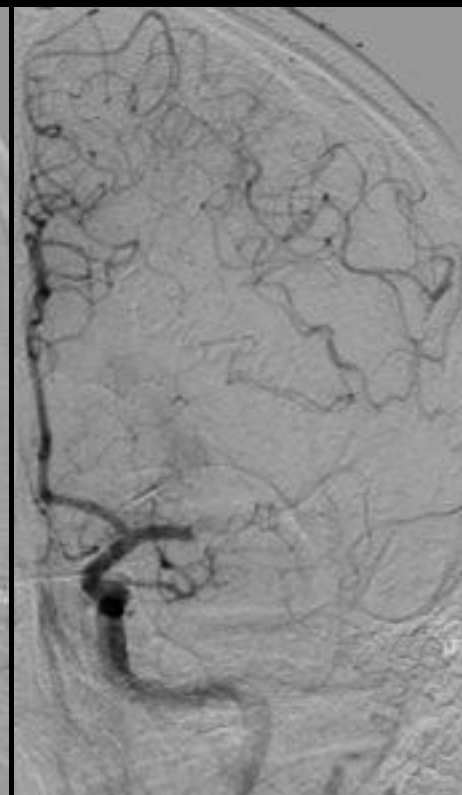
# Angio-TC

Circoli collaterali



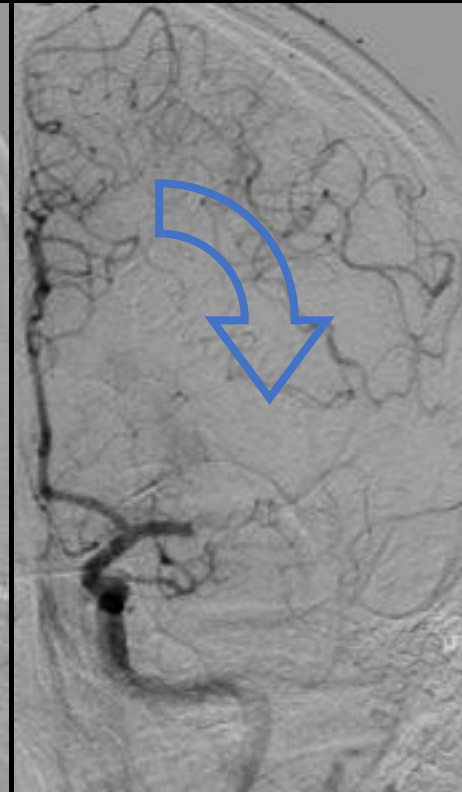
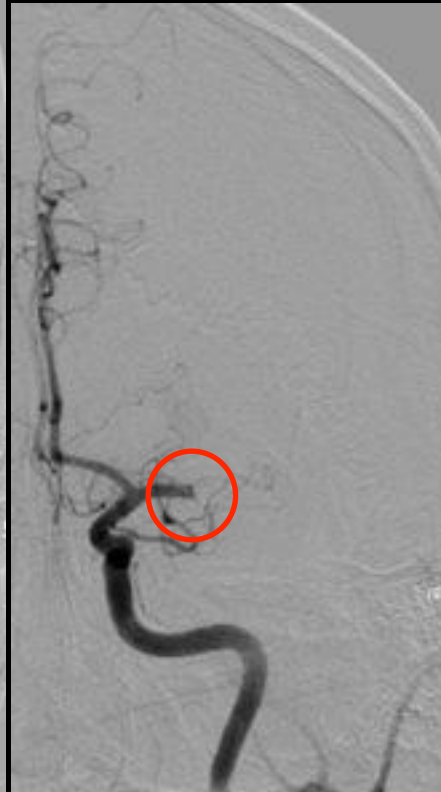
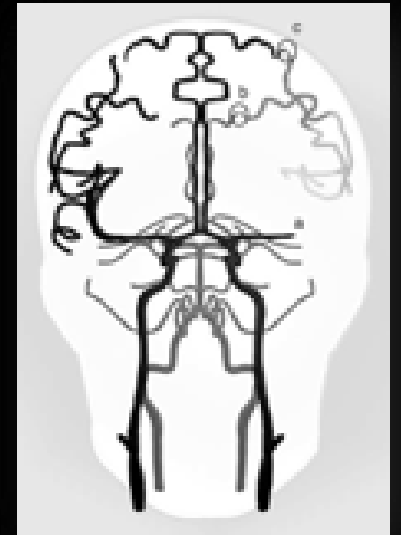
# Angio-TC

Circuiti collaterali



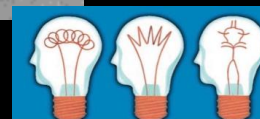
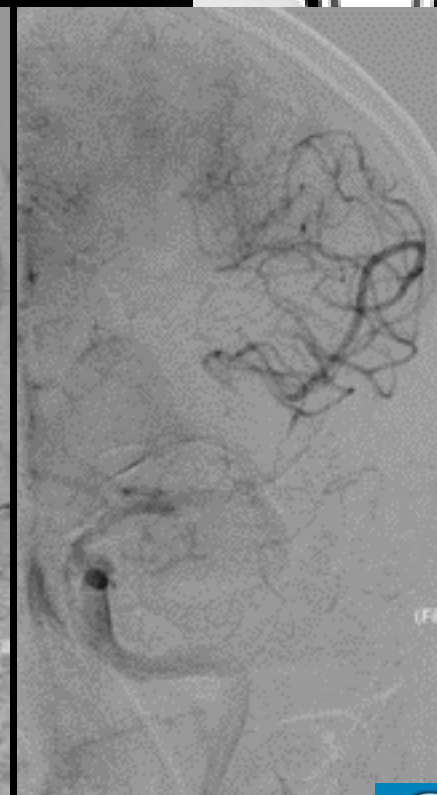
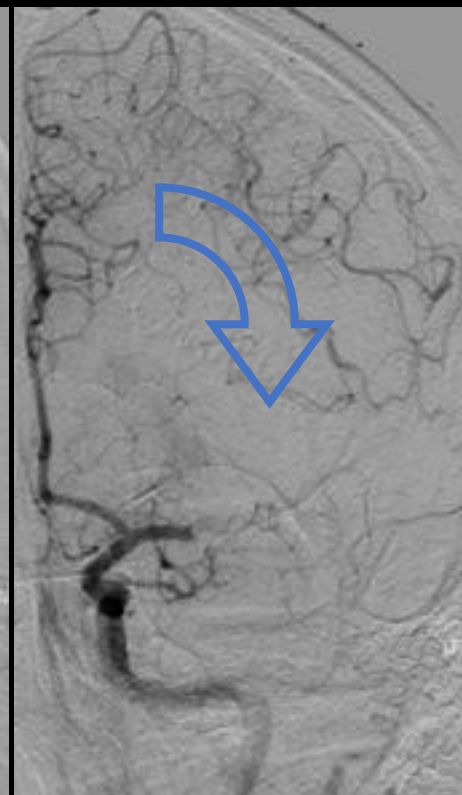
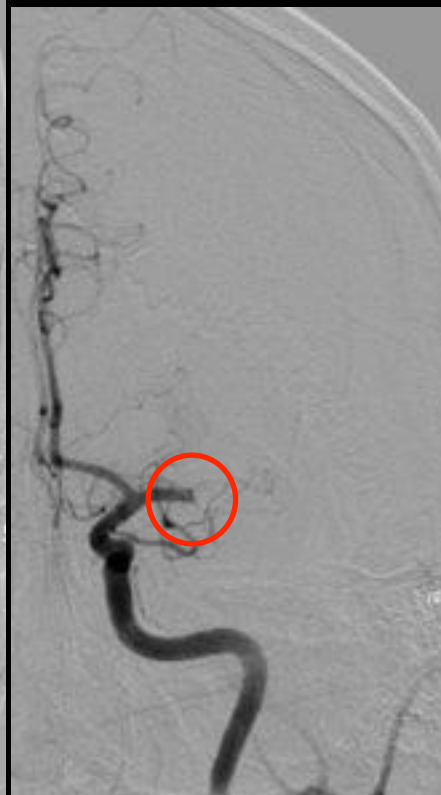
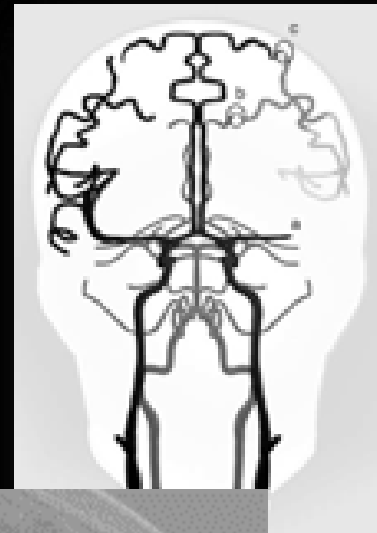
# Angio-TC

Circuiti collaterali



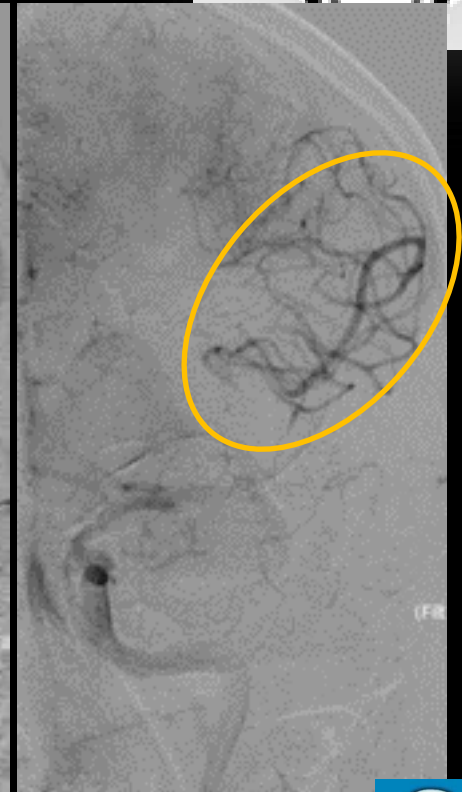
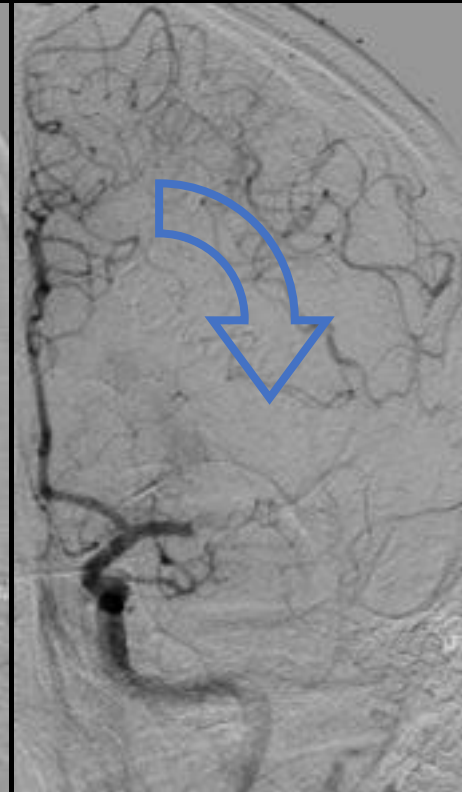
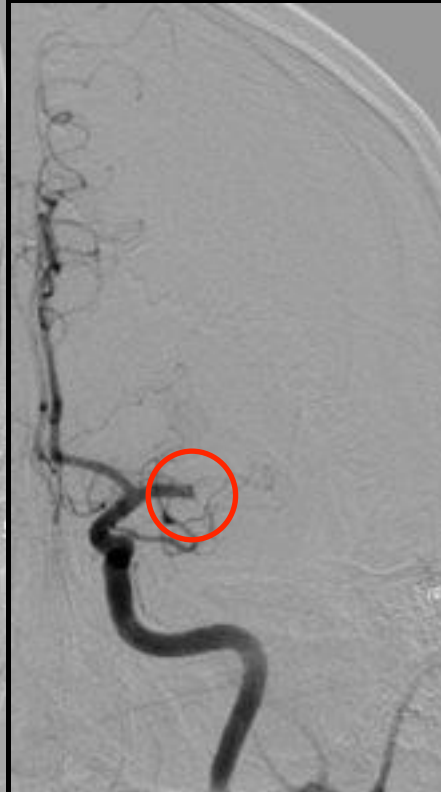
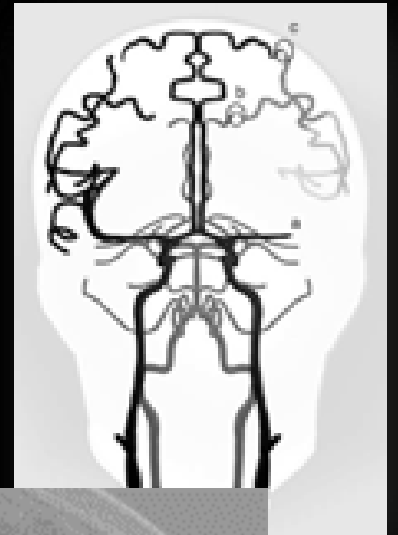
# Angio-TC

Circuiti collaterali



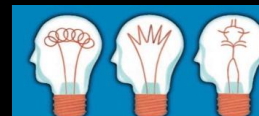
# Angio-TC

Circoli collaterali





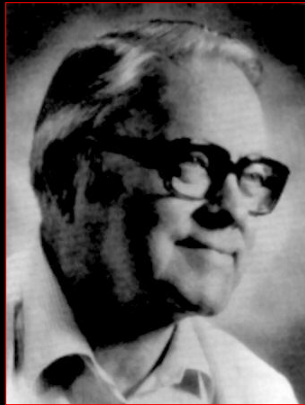
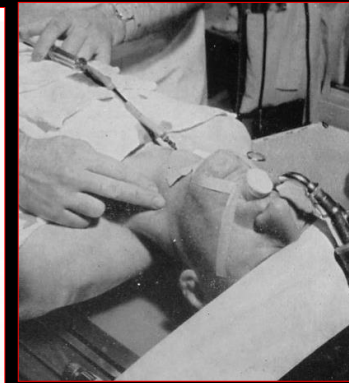
# Trattamento Endovascolare



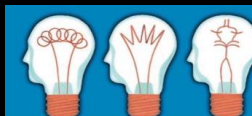
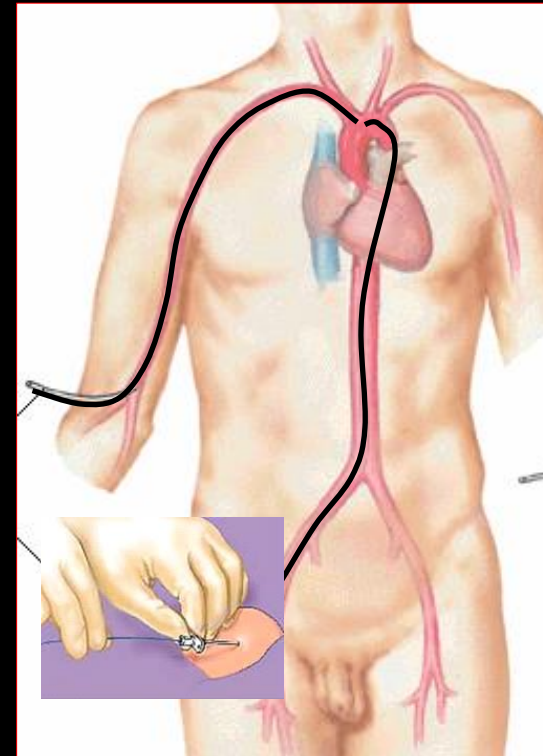
# Trattamento Endovascolare



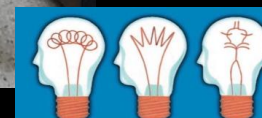
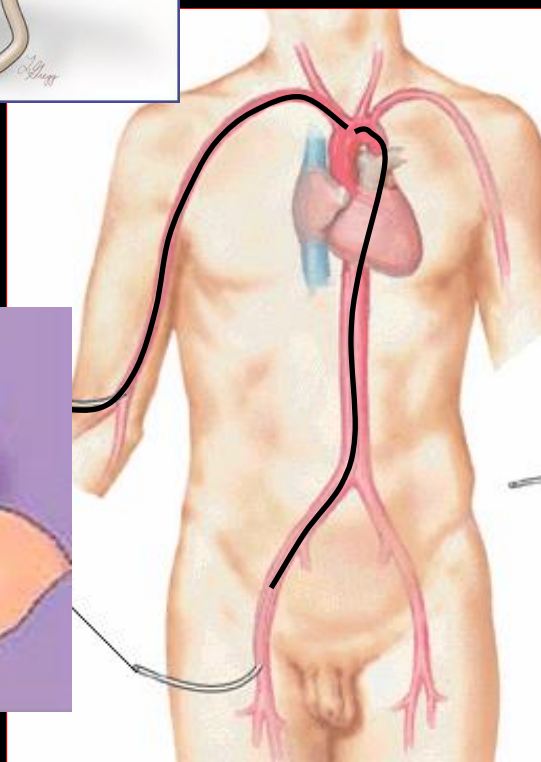
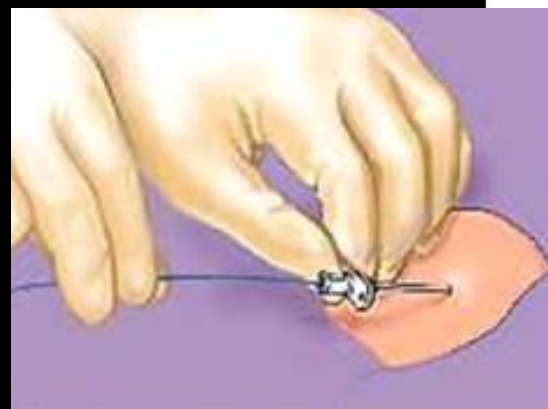
*1927 Moniz presenta la prima angiografia cerebrale mediante puntura diretta della carotide*



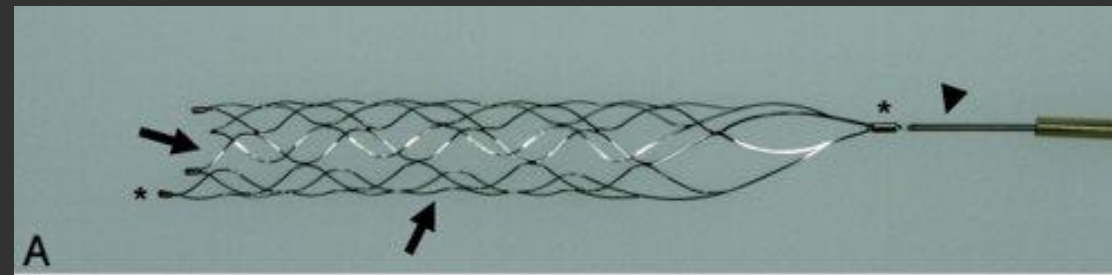
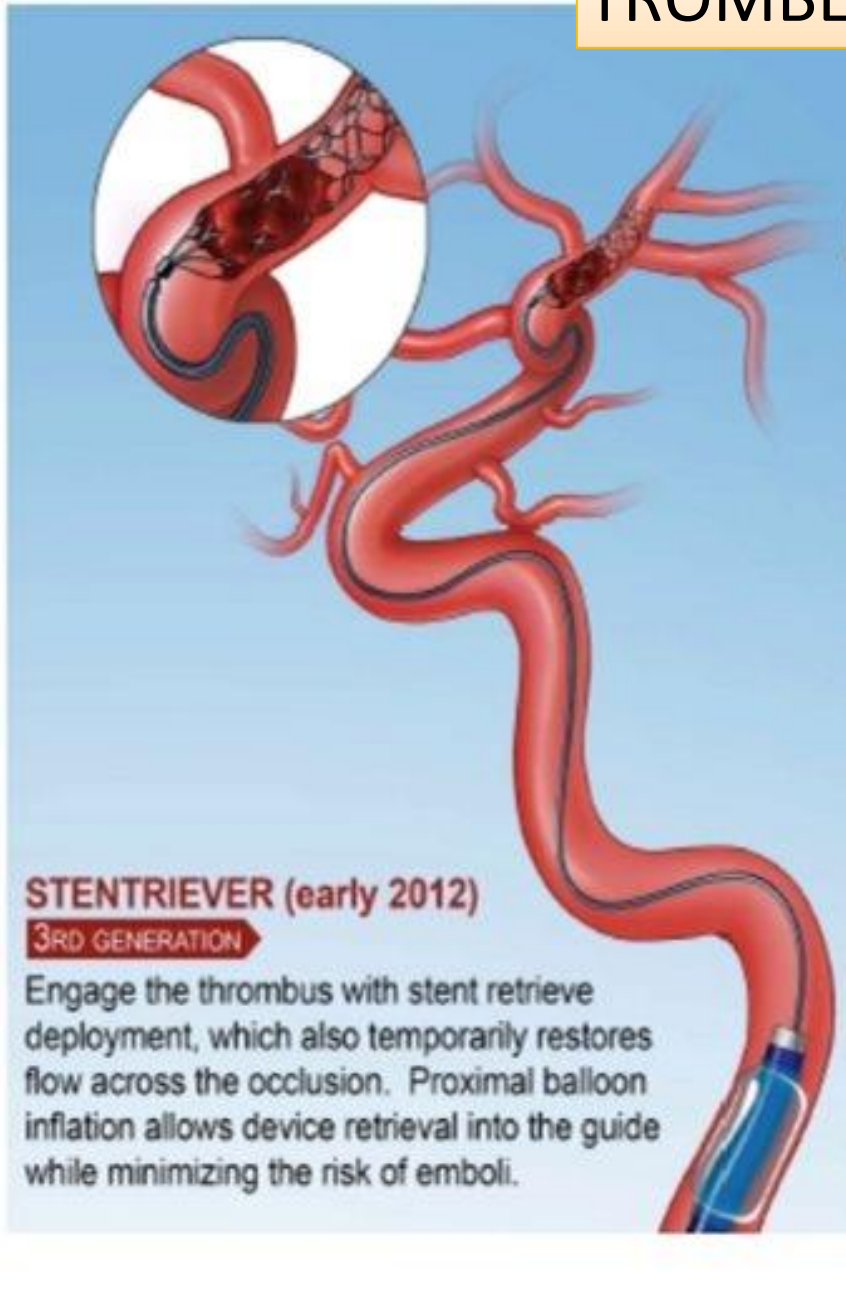
*1950 Seldinger presenta la tecnica di angiografia mediante cateterismo arterioso con approccio periferico*



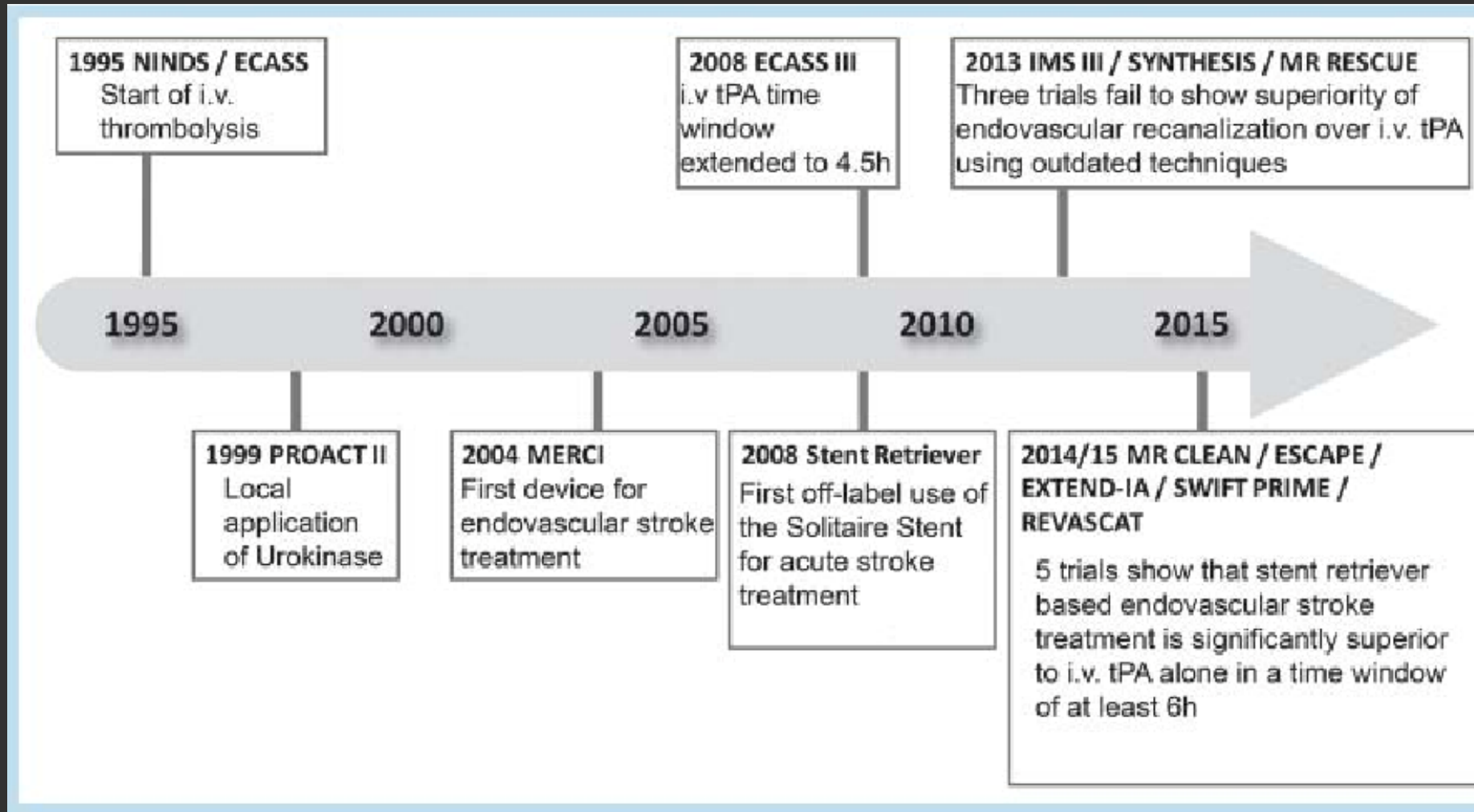
# Trattamento Endovascolare



# TROMBECTOMIA MECCANICA: STENT

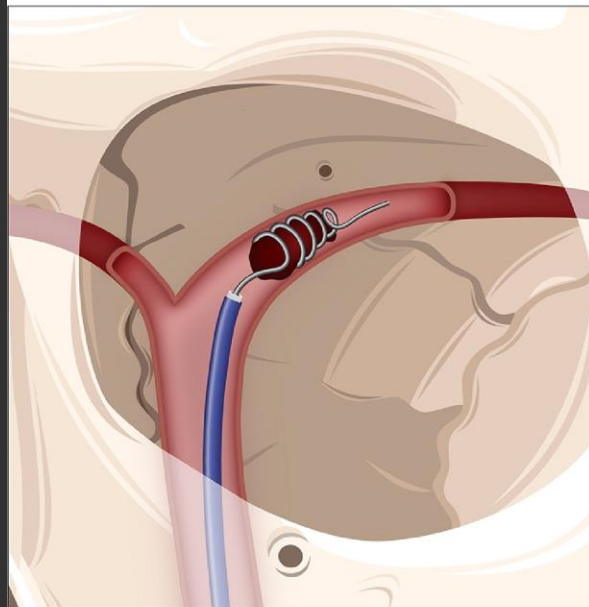


# TROMBECTOMIA MECCANICA: EVIDENZE

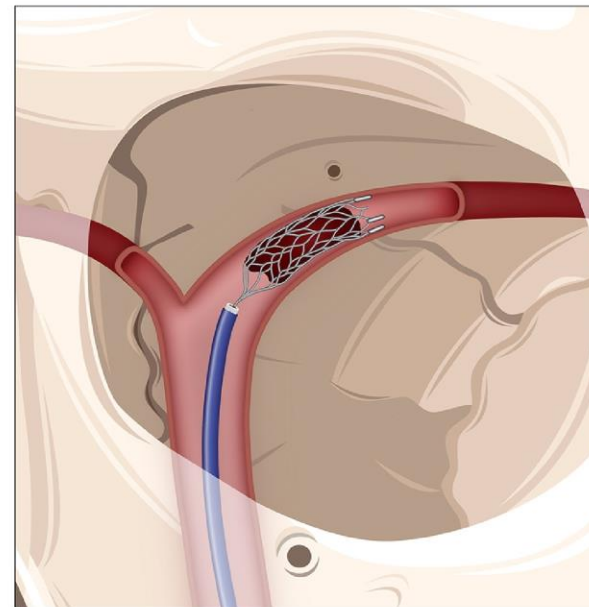


# Thrombectomy Devices for Acute Ischemic Stroke:

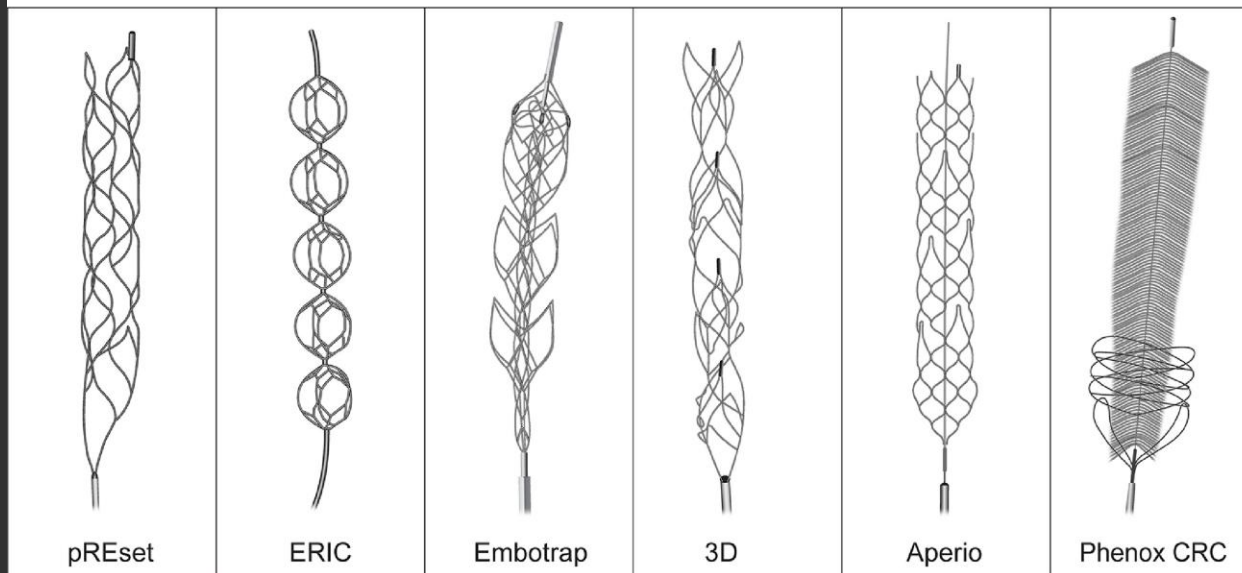
## A. First Generation



## B. Second Generation



## C. Third Generation



pREset

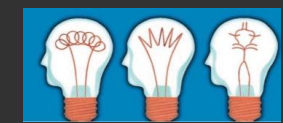
ERIC

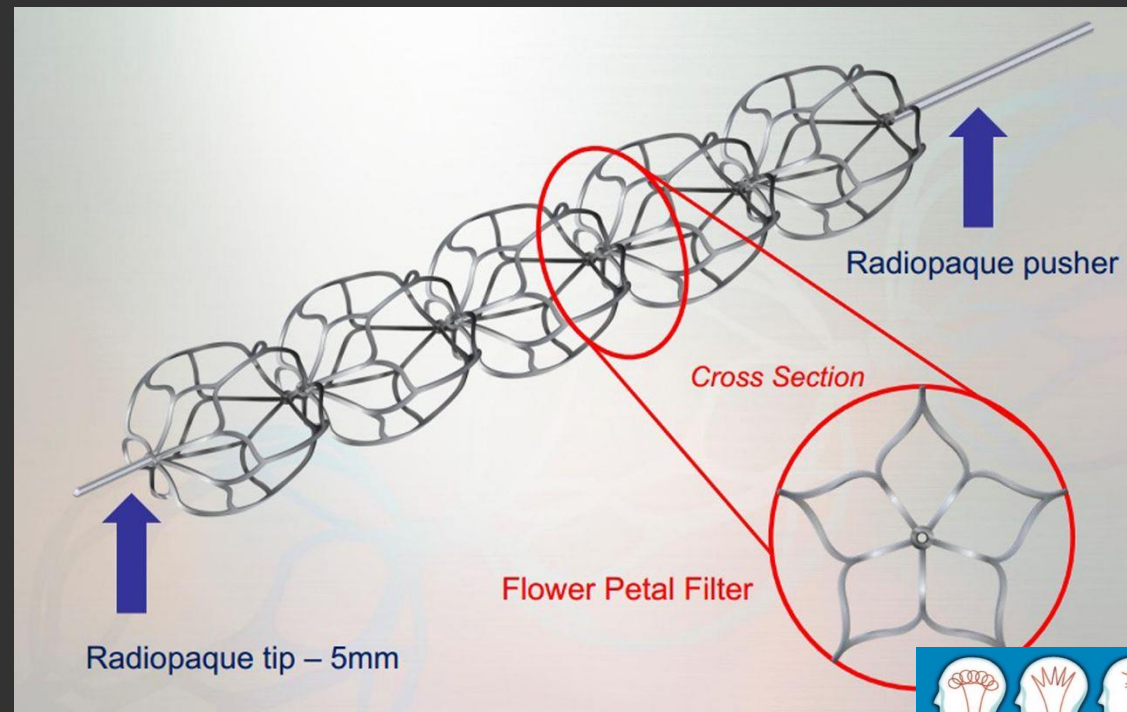
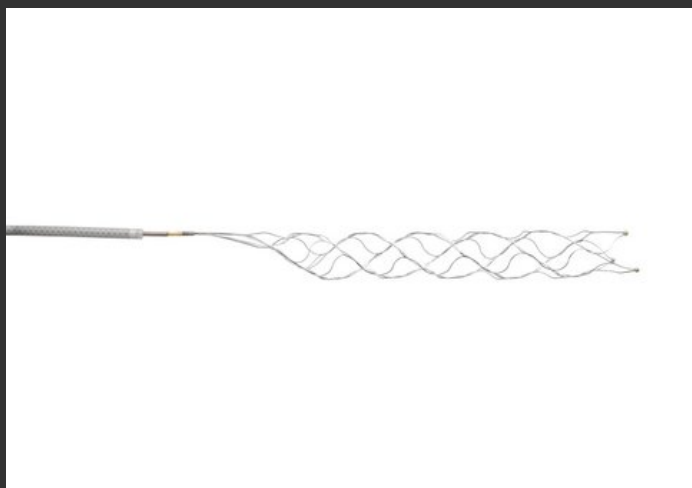
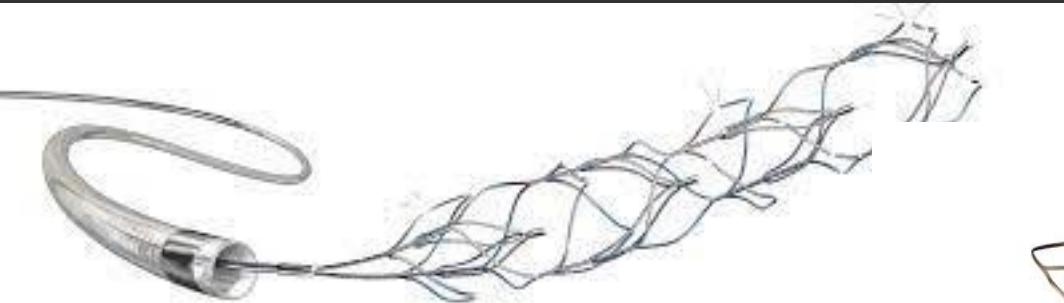
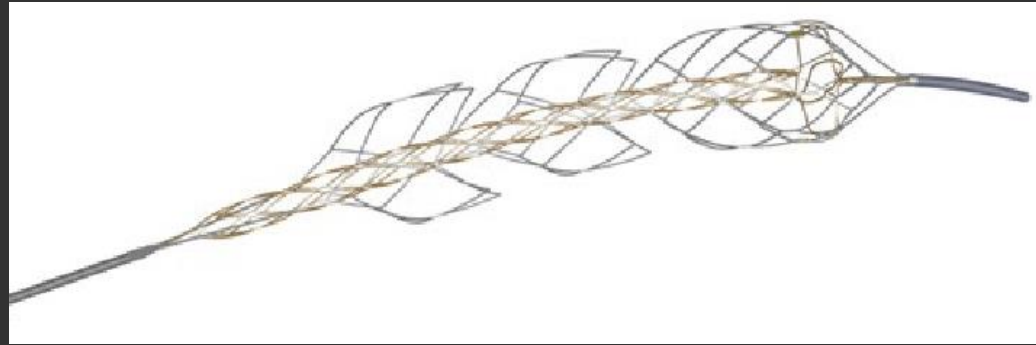
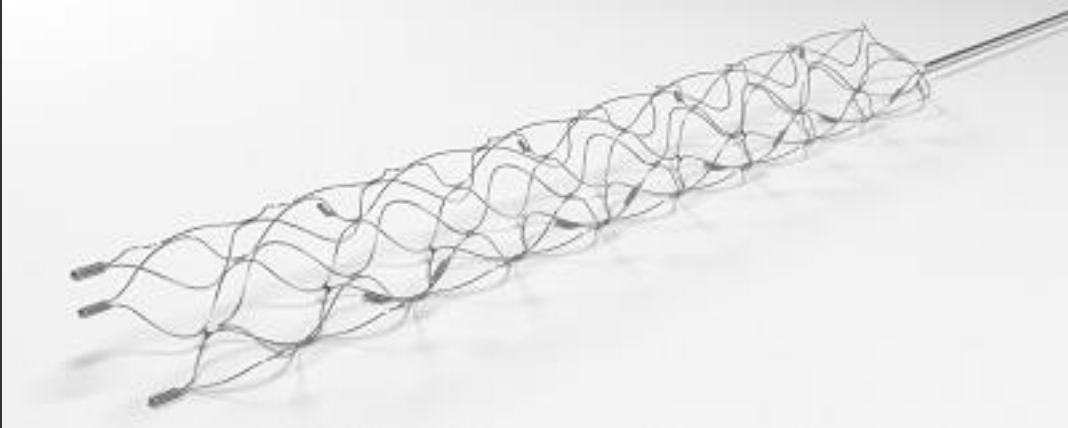
Embotrap

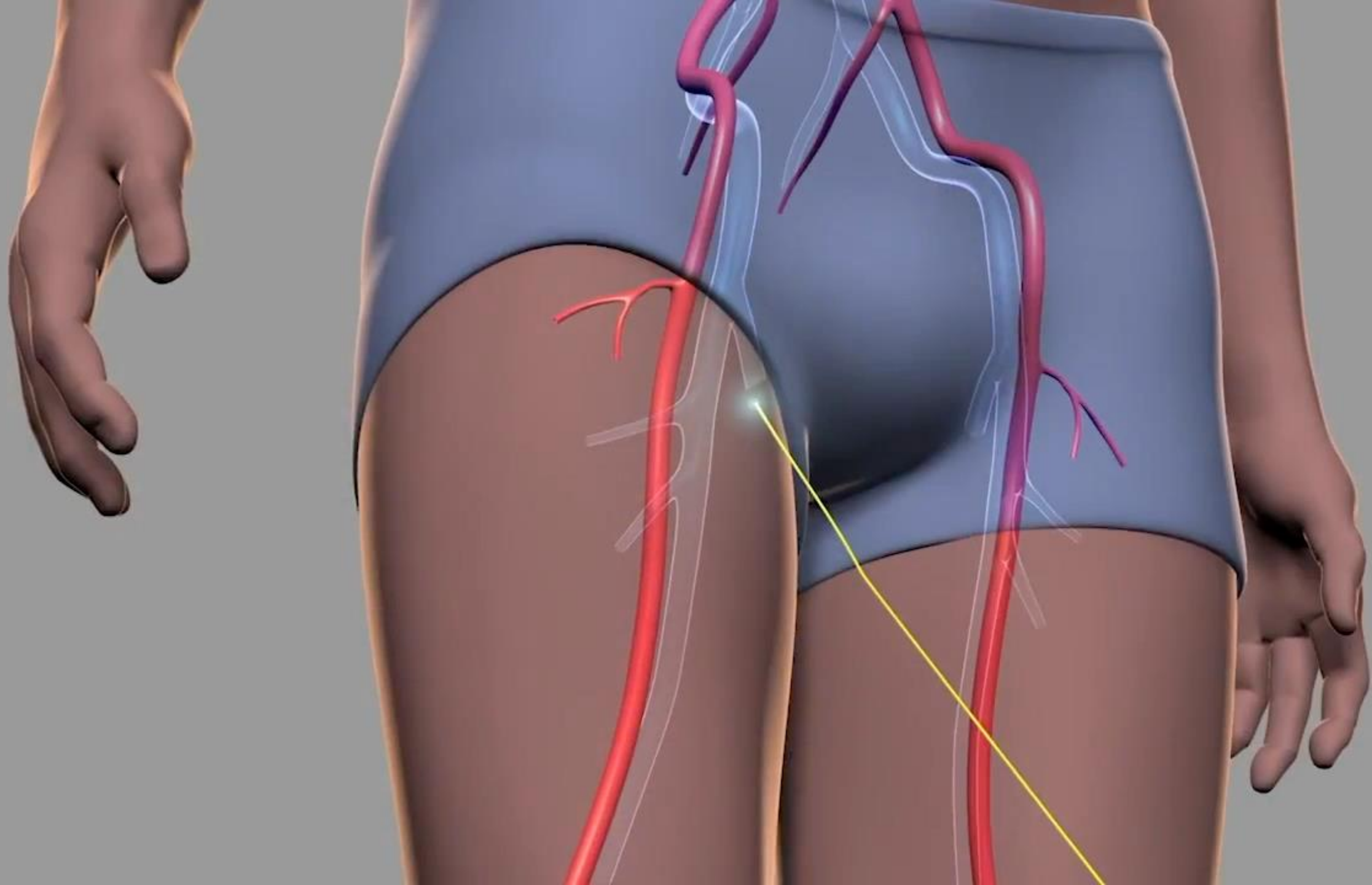
3D

Aperio

Phenox CRC





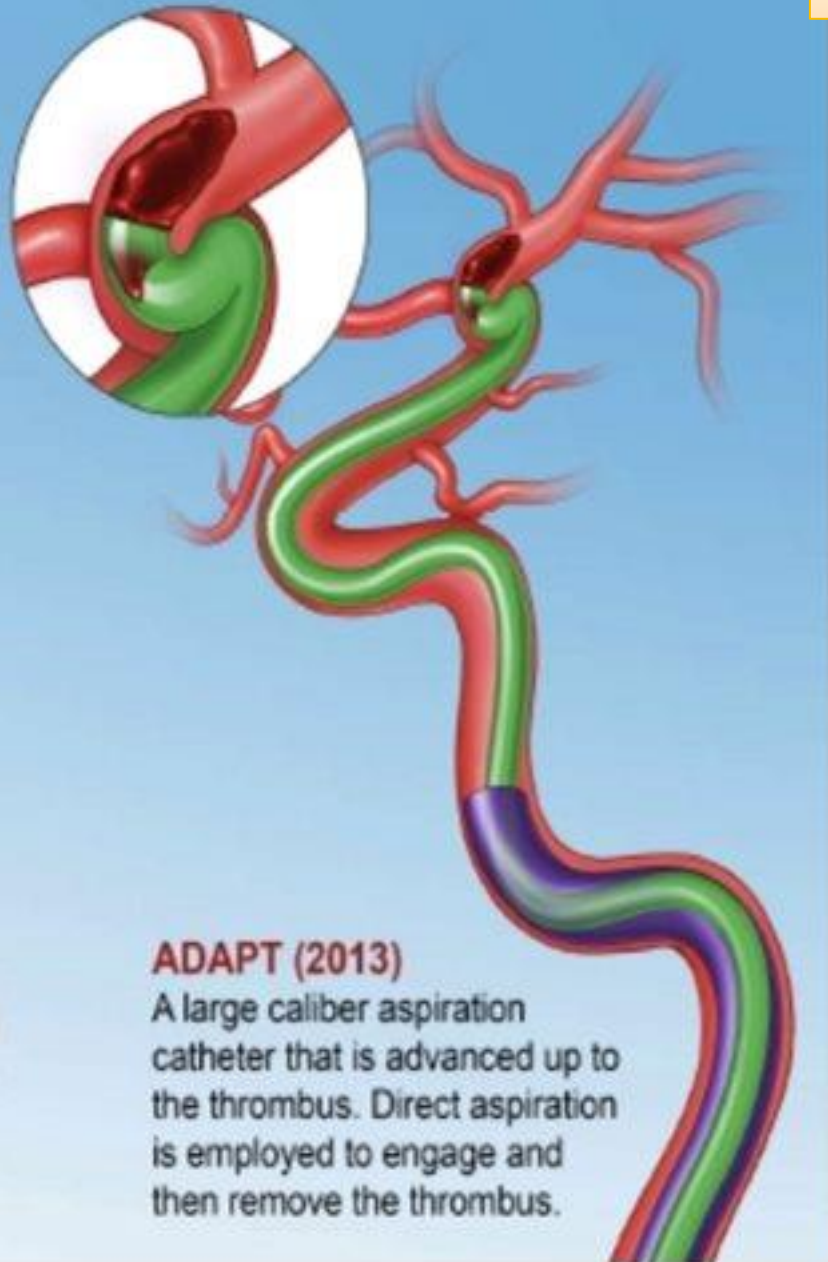




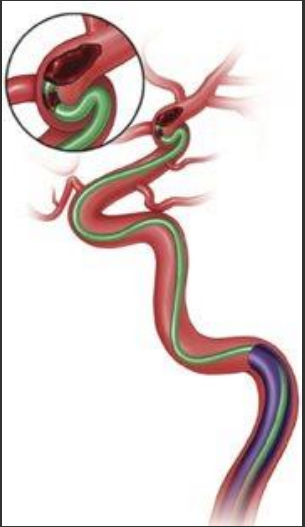
# TROMBOASPIRAZIONE

*“ADAPT”*

*A Direct Aspiration First Pass technique*



# TROMBOASPIRAZIONE



Ace 68



Sofia Plus



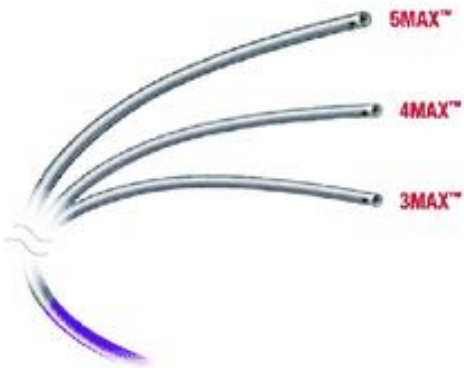
Cat 6



Revive IC



Arc



Penumbra Max Series



Penumbra Aspiration system



Medtronic Riptide Aspiration system





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# TROMBECTOMIA/TROMBOASPIRAZIONE



# TROMBECTOMIA/TROMBOASPIRAZIONE

## EVIDENZE

MR CLEAN  
EXTEND I-A  
ESCAPE  
SWIFT PRIME  
REVASCAT



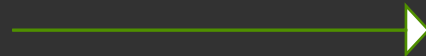
Superiorità della trombectomia con stent retriever rispetto a IV-tPA (mRS)

DAWN (6-24)  
DEFUSE-3 (6-16)



Efficacia della trombectomia meccanica con stent retriever ben oltre le 6h

ASTER  
COMPASS  
PENUMBRA SEPARATOR  
3D



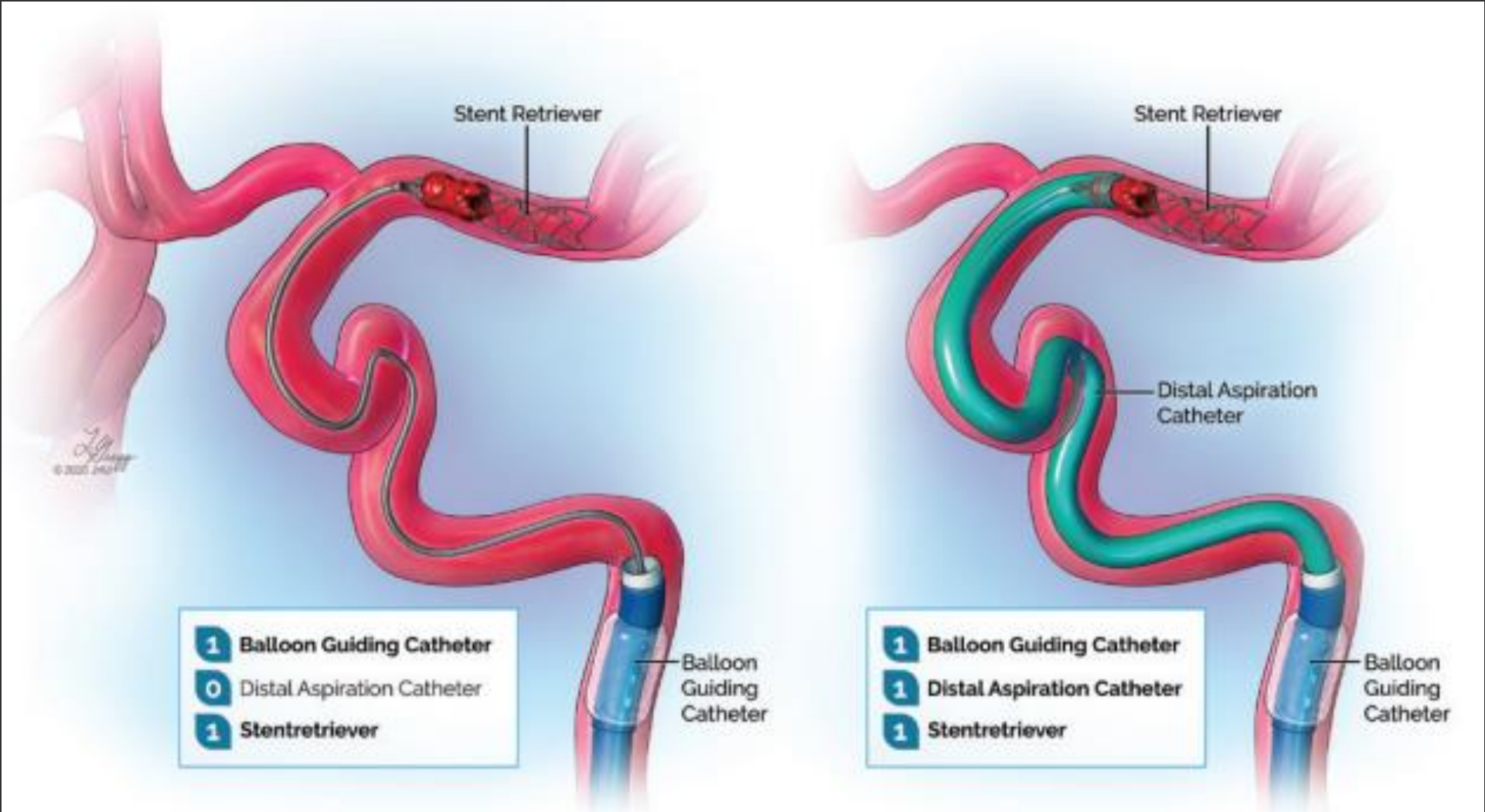
Non differenze significative nella riperfusione (outcome primario) e nel mRS a 3 mesi (outcome secondario) tra Stent Retriever e ADAPT



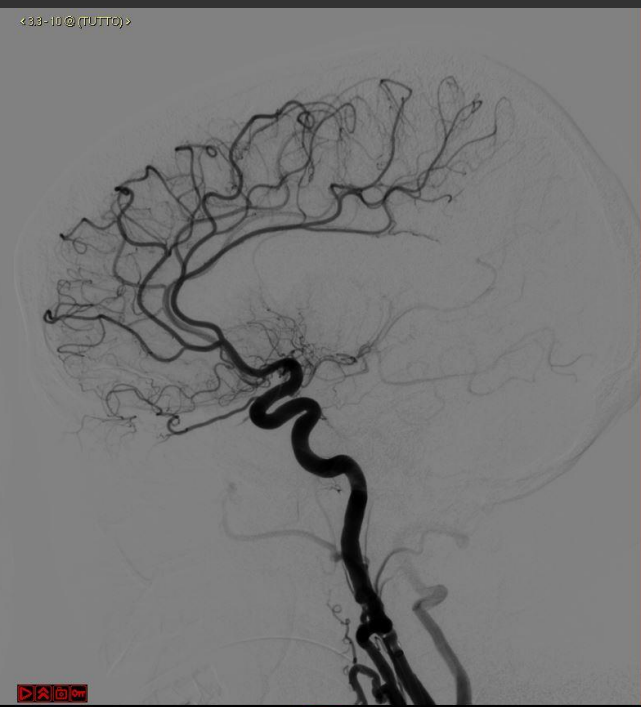
# TROMBECTOMIA/TROMBOASPIRAZIONE



# COMBINED TECHNIQUE

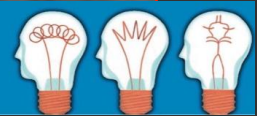
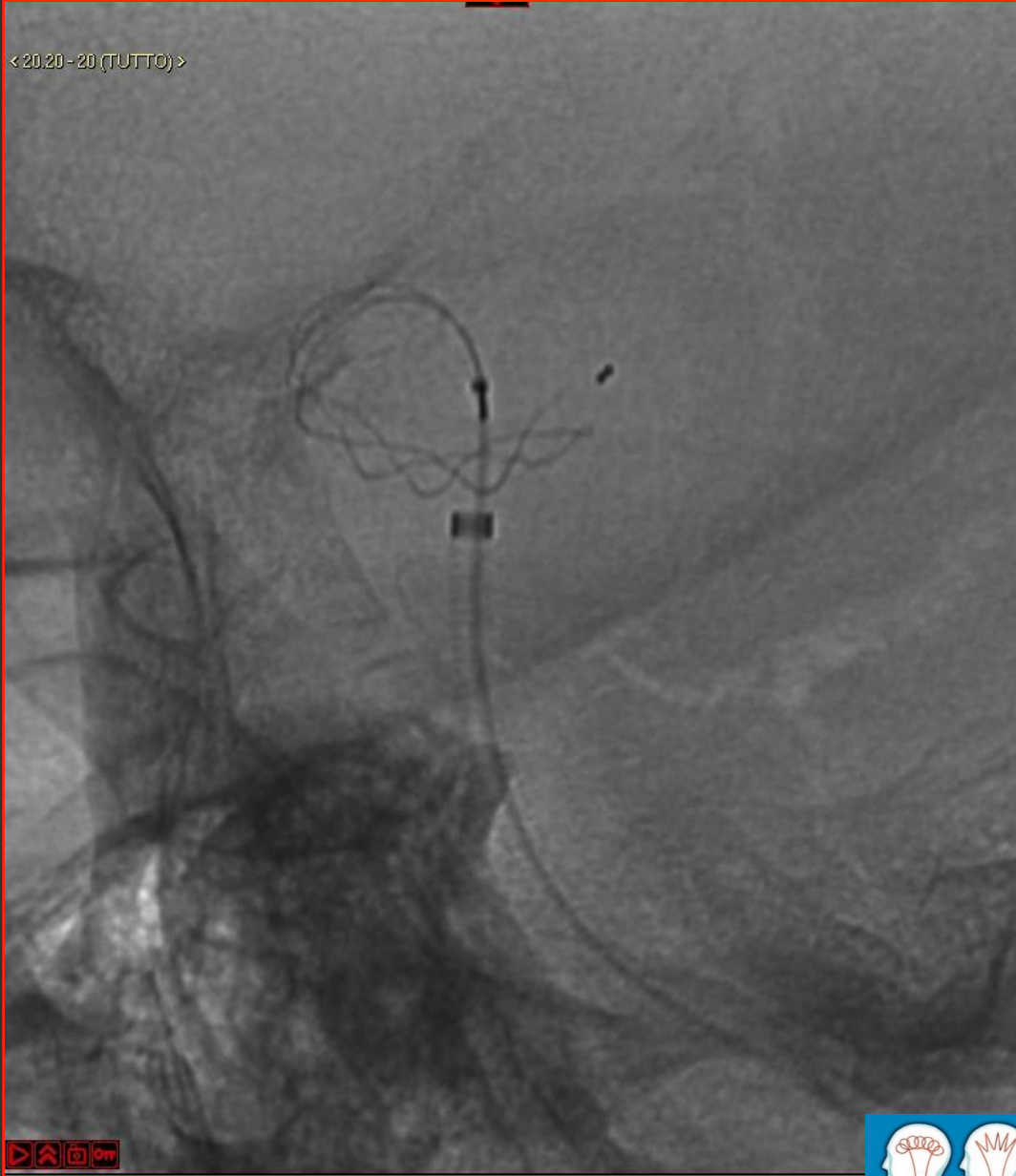
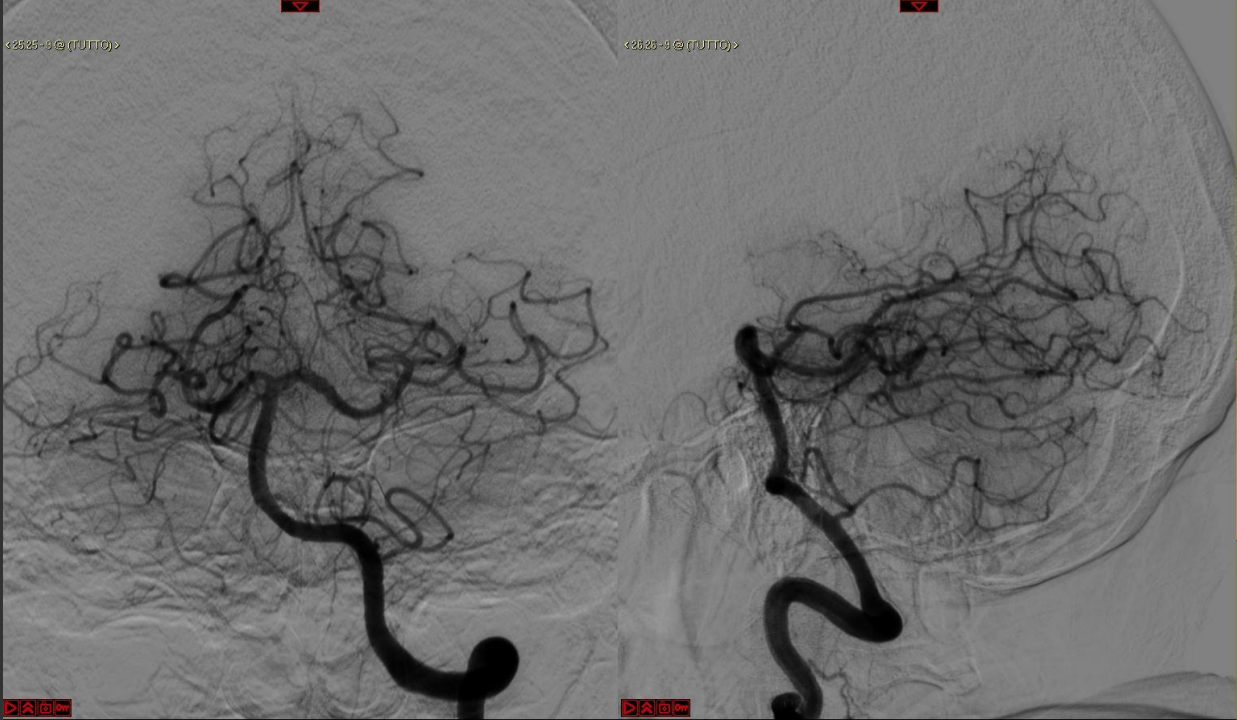


..qualche esempio..





..qualche esempio..



..qualche esempio..

