

# Echo-Doppler Trans-Crânien

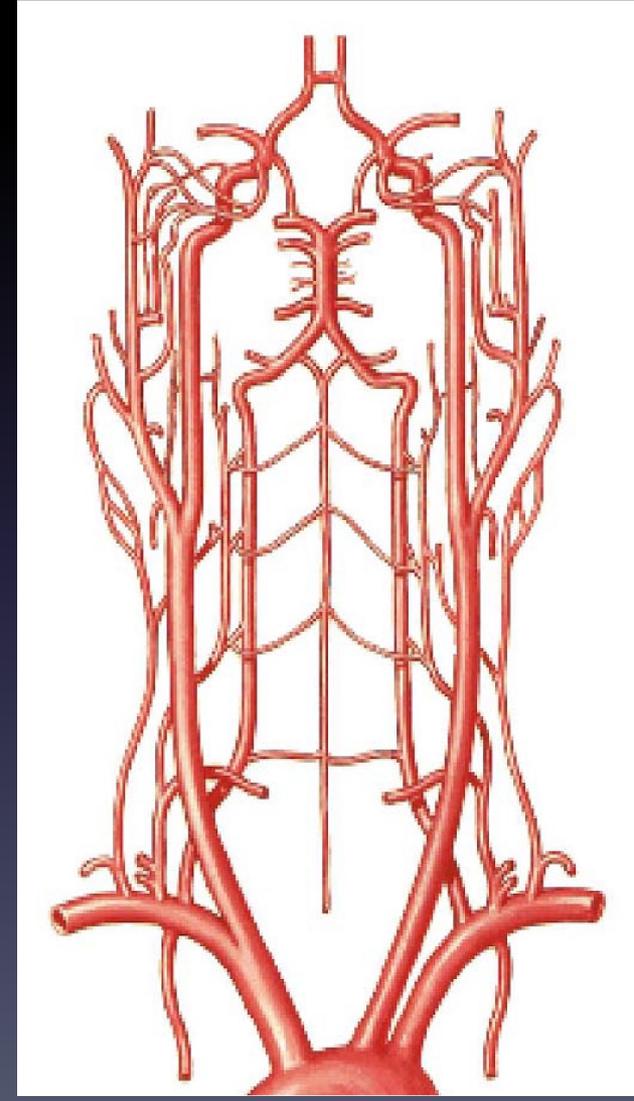
Capacité / DESC Médecine Vasculaire

Marseille – 21 mai 2021

JN POGGI

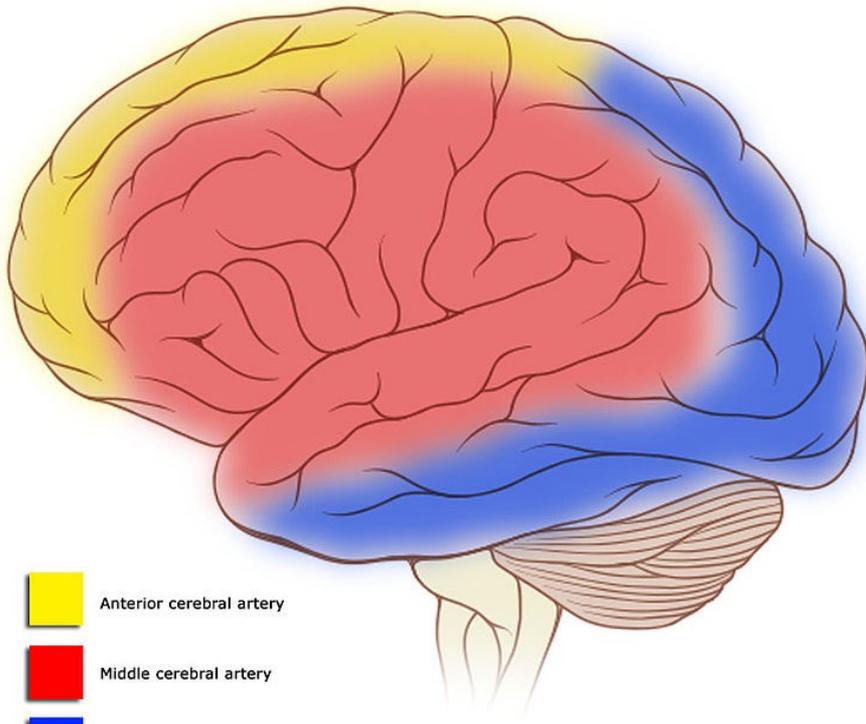
# Rappel Anatomique

- 4 axes cervicaux :
  - 2 C, 2 V.
- 2 systèmes :
  - 1 circulation ant (C).
  - 1 circulation post (VB).
- 2 territoires :
  - Superficiel.
  - Profond.
- Des anastomoses :
  - Polygone.
  - Extra-intra crânienne (Ophtalmique)
  - A. lepto-méningées.
- Des artères terminales :
  - Perforantes.
  - Pénétrantes.

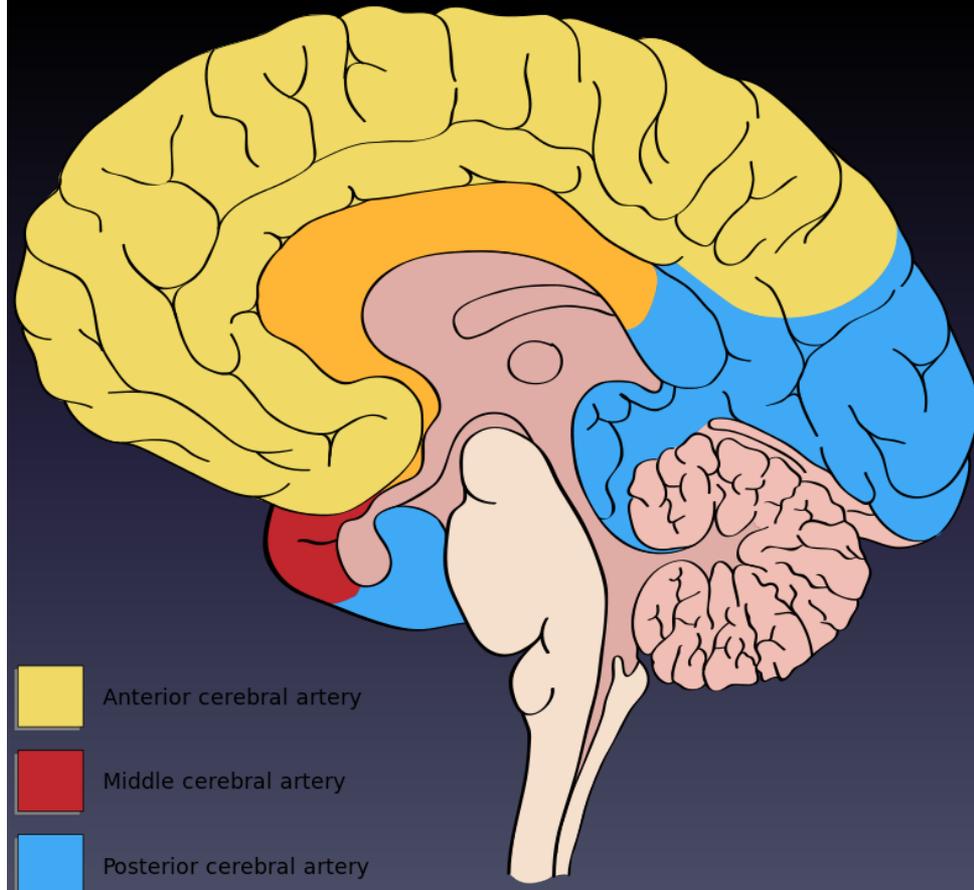


# Territoires vasculaires

Cortical vascular territories

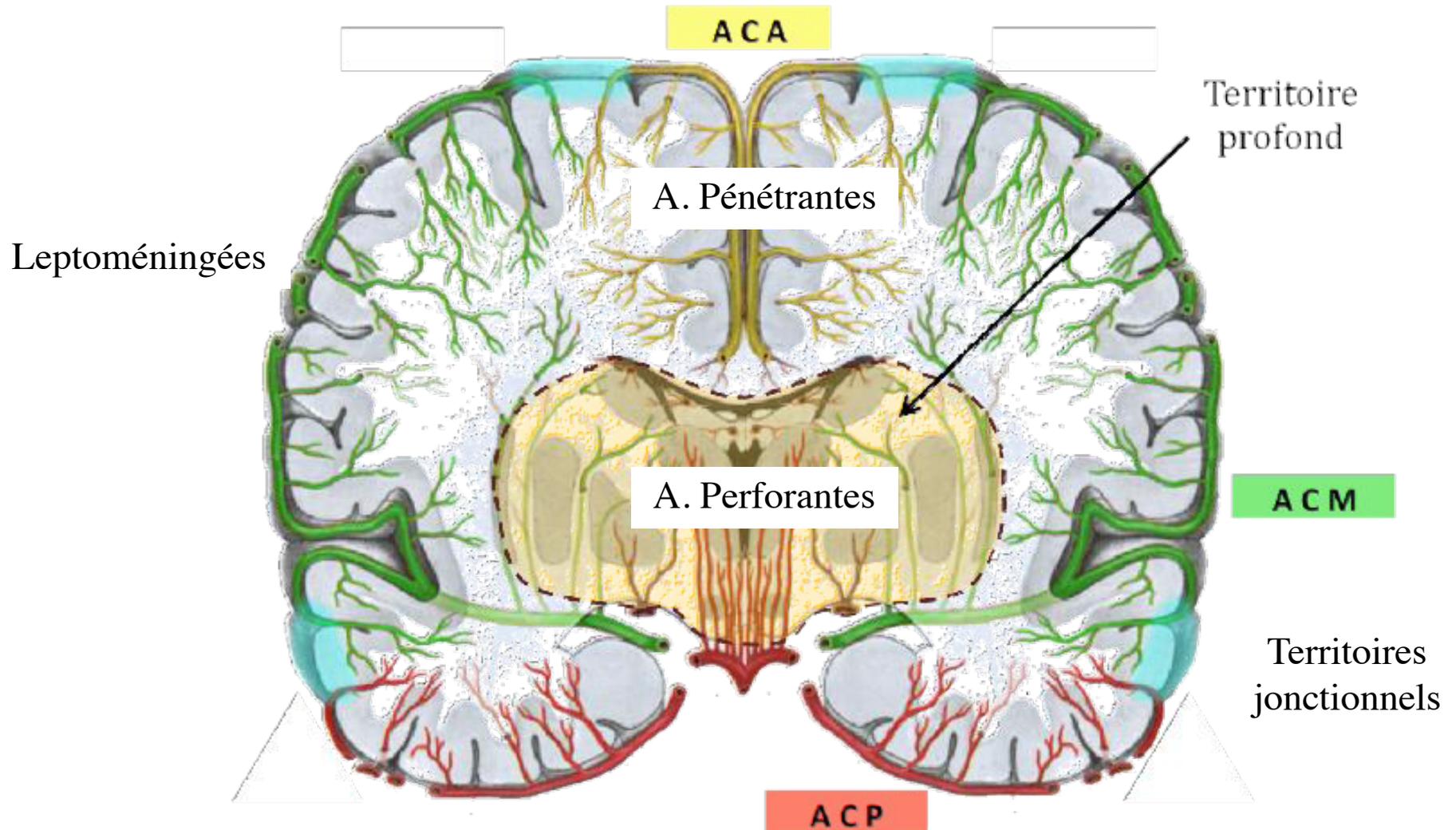


-  Anterior cerebral artery
-  Middle cerebral artery
-  Posterior cerebral artery

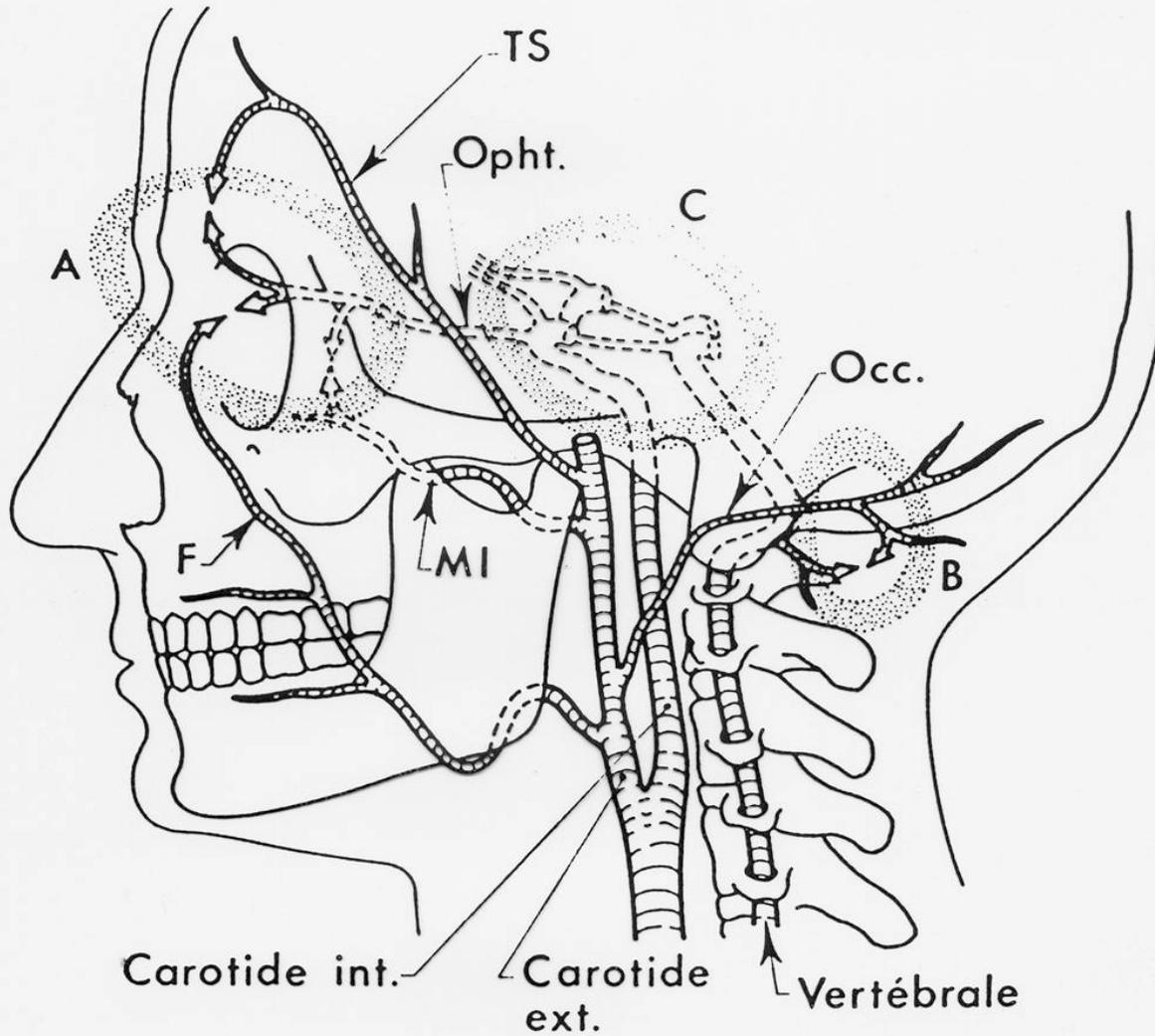


-  Anterior cerebral artery
-  Middle cerebral artery
-  Posterior cerebral artery

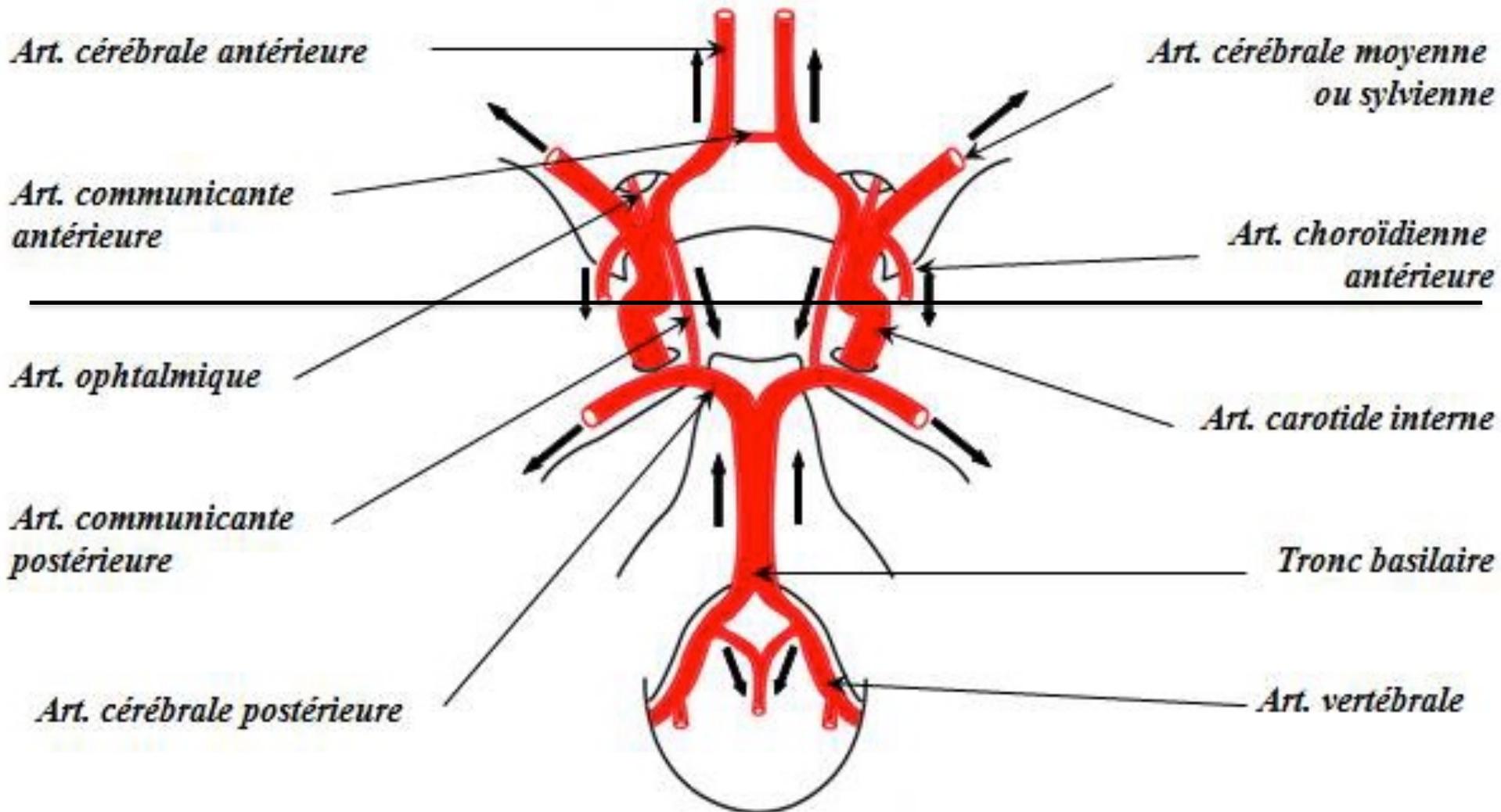
# Territoires vasculaires



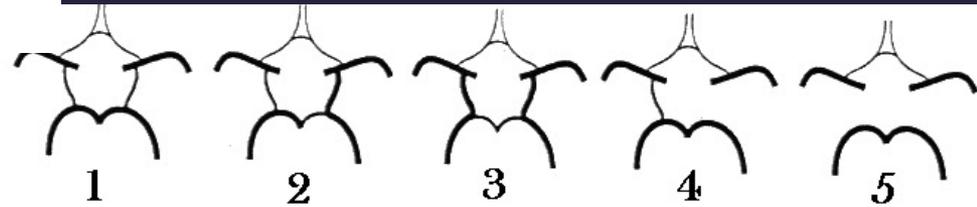
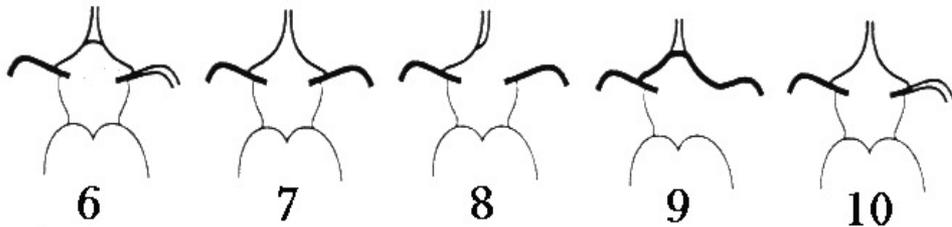
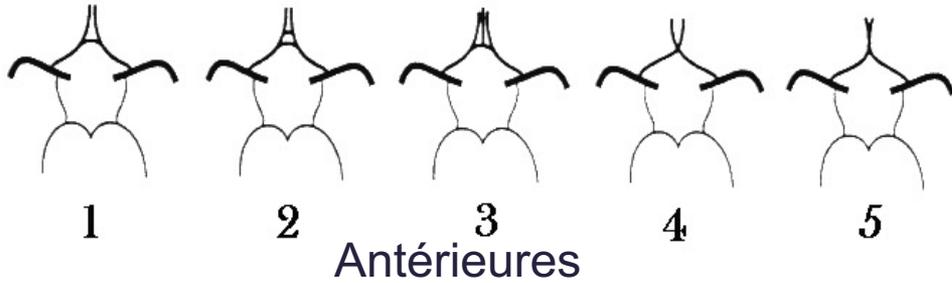
# Anastomoses



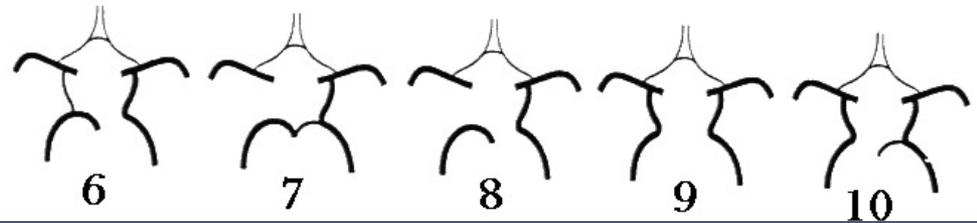
# Anastomoses



# Variantes anatomiques



Postérieures



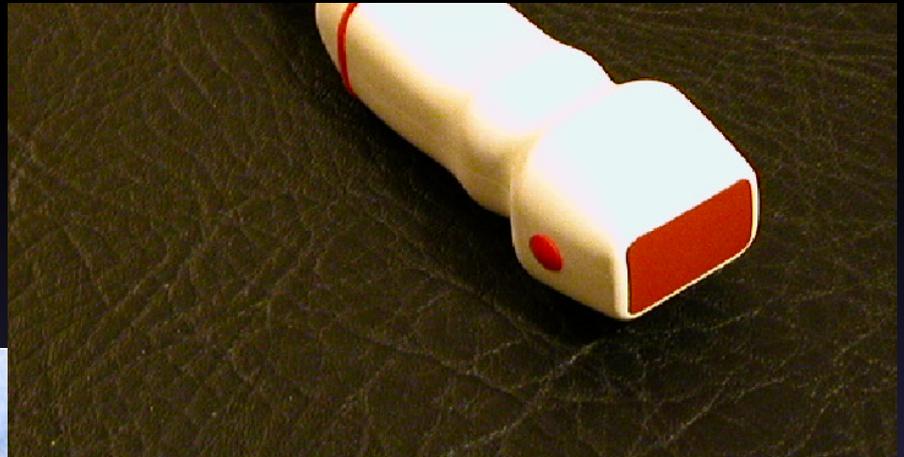
# Anastomoses



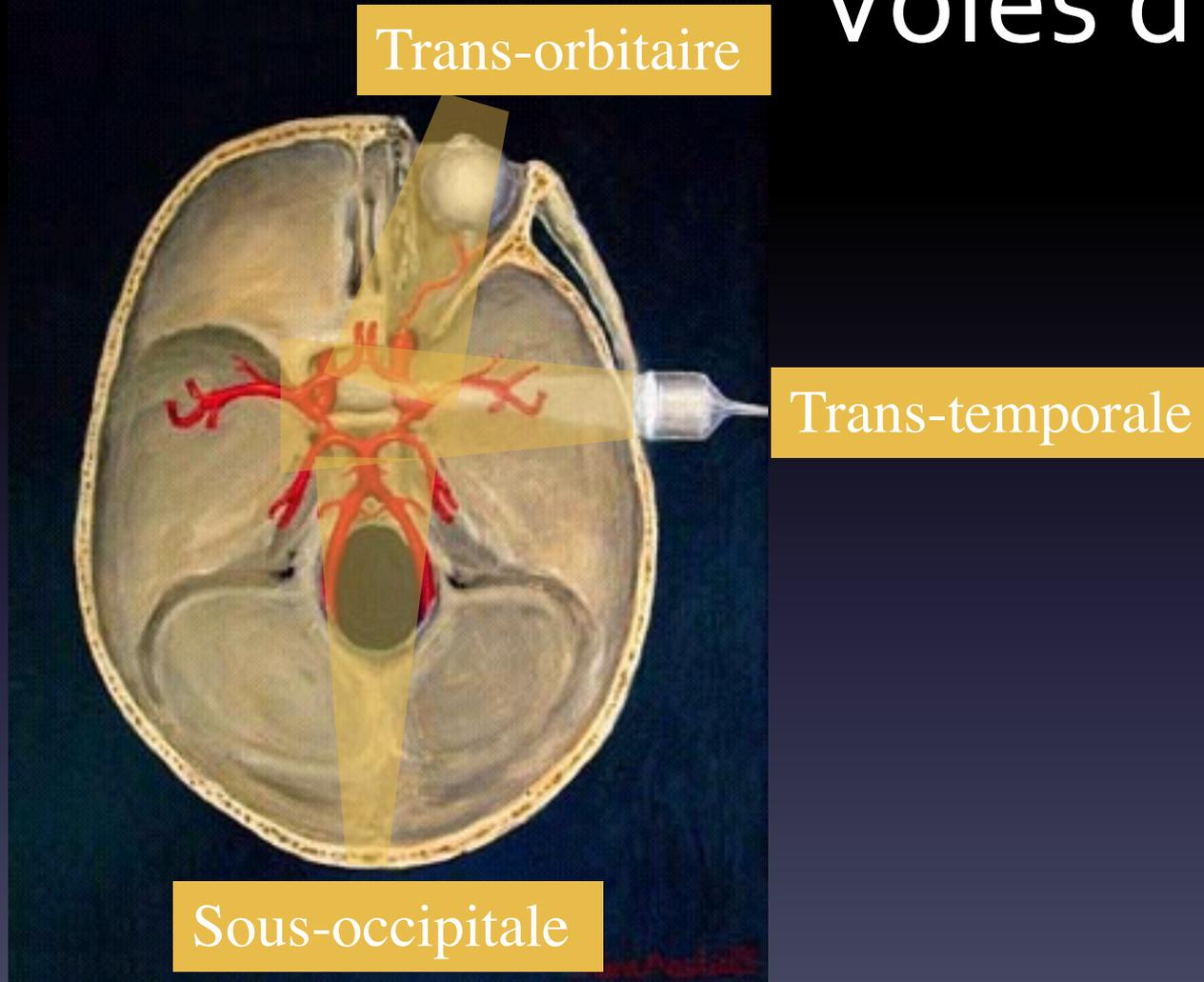
# Méthode d'Examen

- Matériel :
  - DP, sonde 2 MHz.
  - ED couleur, sonde phased array 1-3 MHz.
- Voies d'Abord :
  - Voie trans-temporale.
  - Voie occipitale.
  - Voie orbitaire (\*).

# Matériel



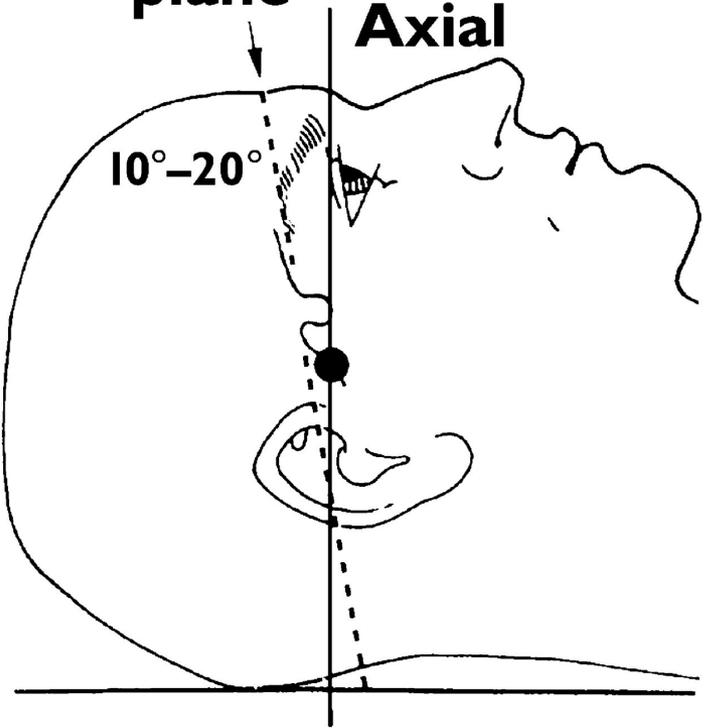
# Voies d'abord



**Oblique axial  
plane**

**Axial**

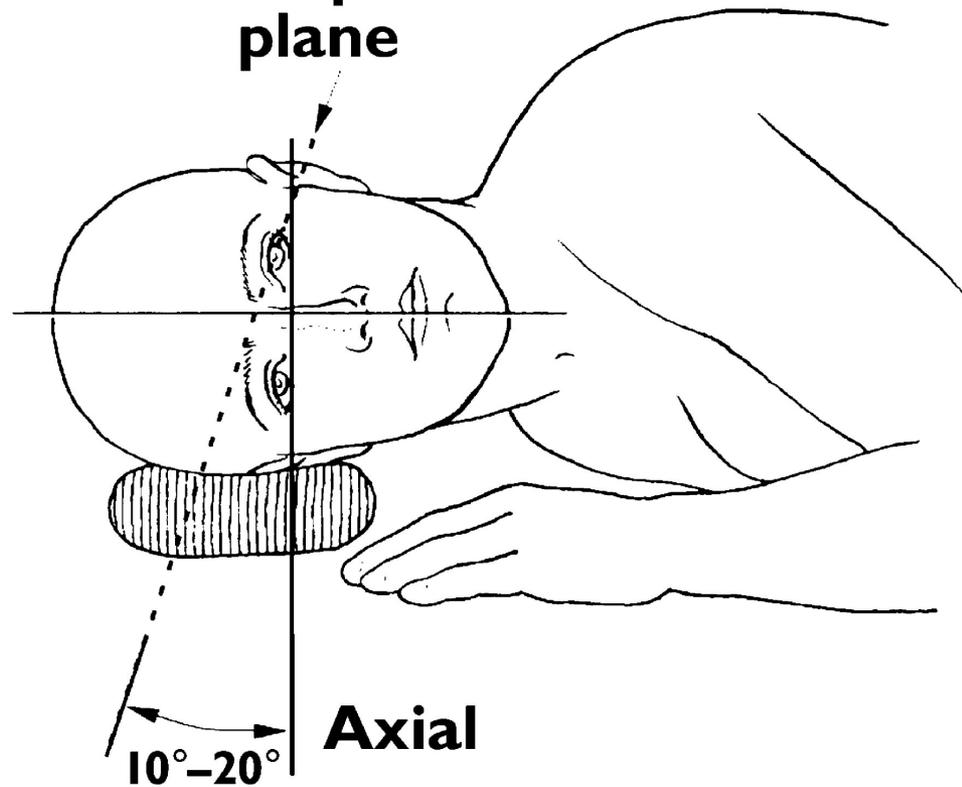
$10^{\circ}-20^{\circ}$

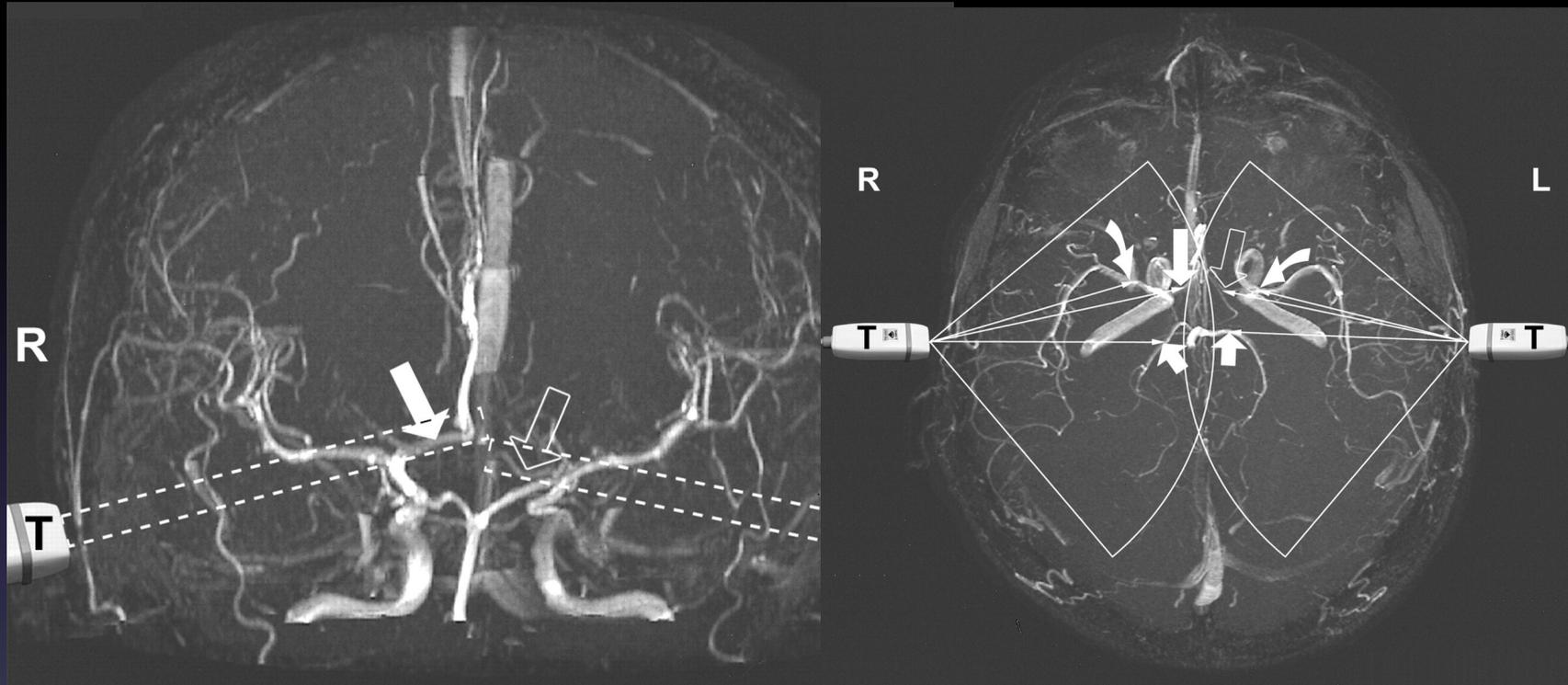


**Oblique axial  
plane**

**Axial**

$10^{\circ}-20^{\circ}$



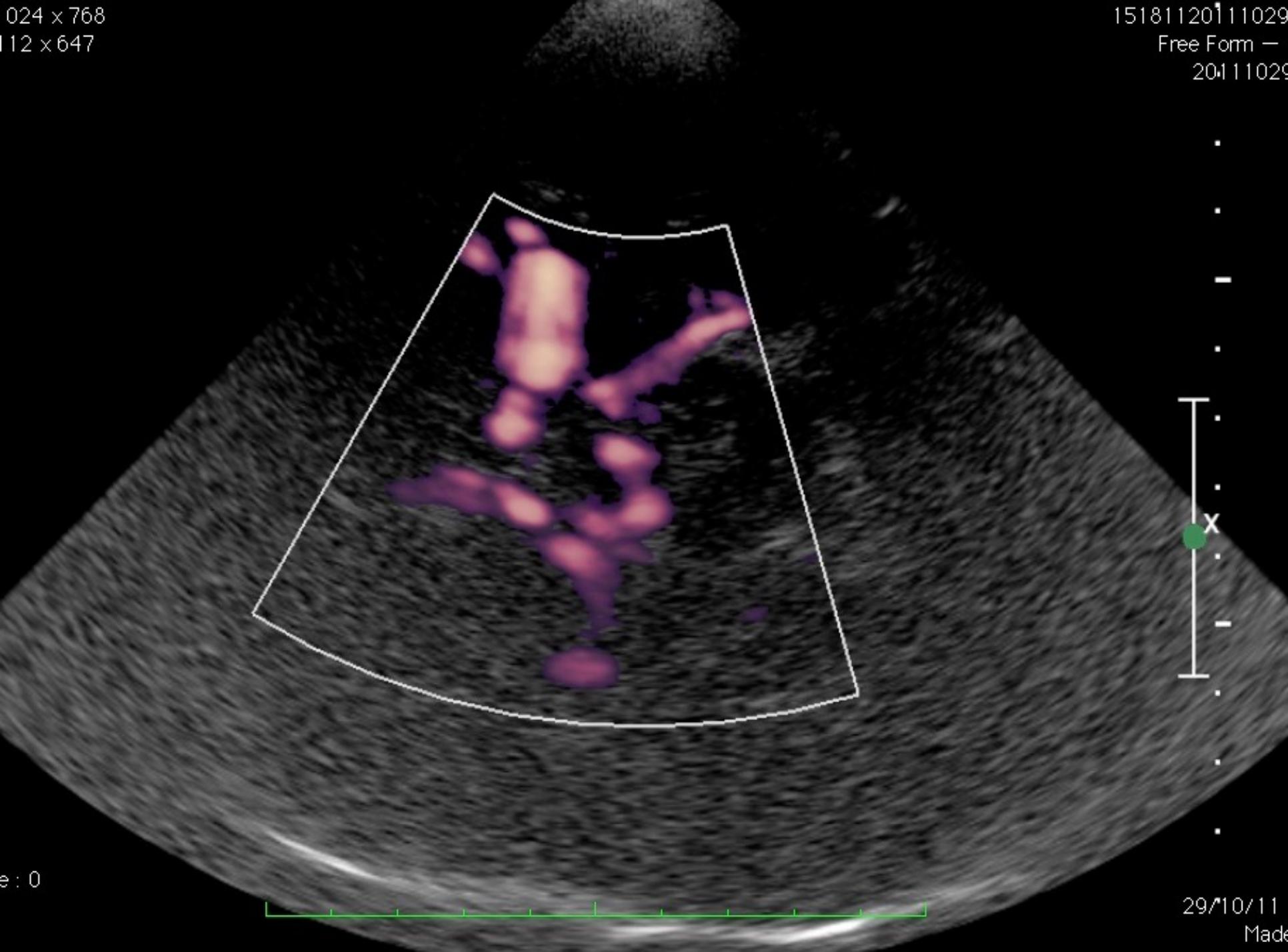


Krejza, J. et al. Am. J. Roentgenol. 2000;174:1297-1303



024 x 768  
112 x 647

15181120111029  
Free Form —  
20111029



e: 0

29/10/11  
Made

# Avantages

- Méthode non invasive.
- Examen peu coûteux.
- Pas de PC allergisant ou toxique.
- Pas d'irradiation.
- Pas de contre indication.

# Limites

- Pas d'information sur la paroi artérielle.
- Pas d'information sur la circulation veineuse.
- Absence de fenêtre trans-temporale 10 %
- Risque théorique de cataracte :
  - Baisser la puissance acoustique à 30 % pour la voie trans-orbitaire.

# Indications

Situations	Grade	Niveau
Risque d' AVC chez les enfants drépanocytaires	A	I
Monitorage du Vasospasme (HM)	A	I-II
Diagnostic de la Mort Cérébrale	A	II
Détection de Shunt D-G	A	II

# Indications

Situations	Grade	Niveau
Monitoring Thrombolyse phase $\alpha$	B	II-III
Monitoring Micro-Emboles	B	II-IV
Monitoring Endartériectomies	B	II-III
Monitoring Pontages Coronariens	B	II-III
Réserve Vasomotrice Cérébrale	B	II-III

# Indications :

- Patient Symptomatique (IC/AIT) :
  - En complément de l'ED cervical.
  - Recherche systématique d'une lésion intra cérébrale.
    - (Détection de HITS).
- Sténose de la CI (sympto ou asympto) :
  - Retentissement hémodynamique d'une lésion cervicale.
    - Evaluation de la suppléance.

# Valeurs Normales

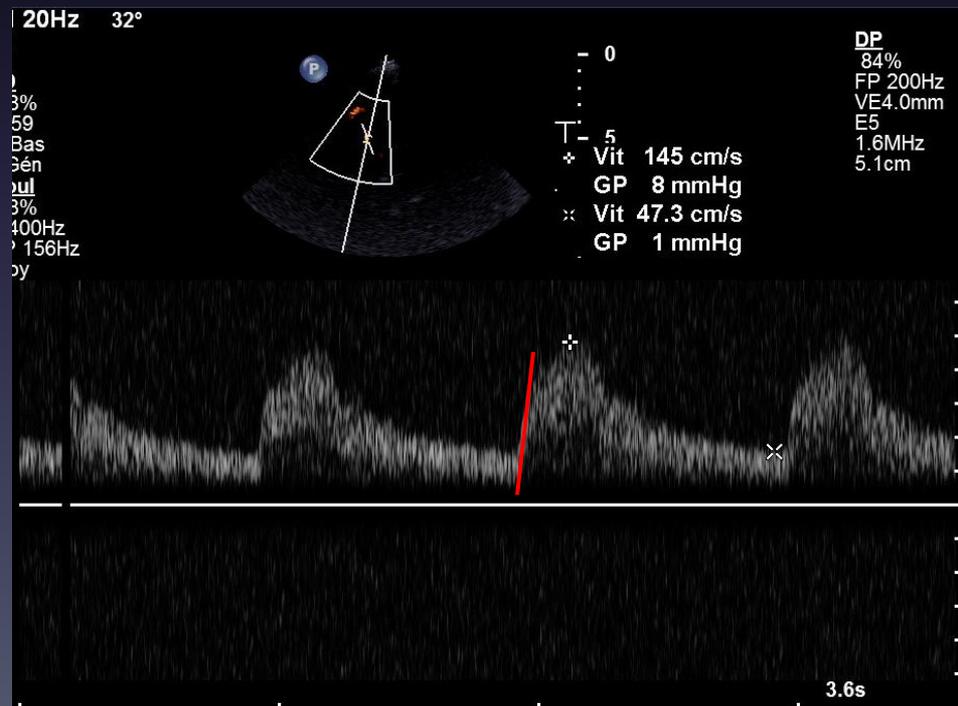
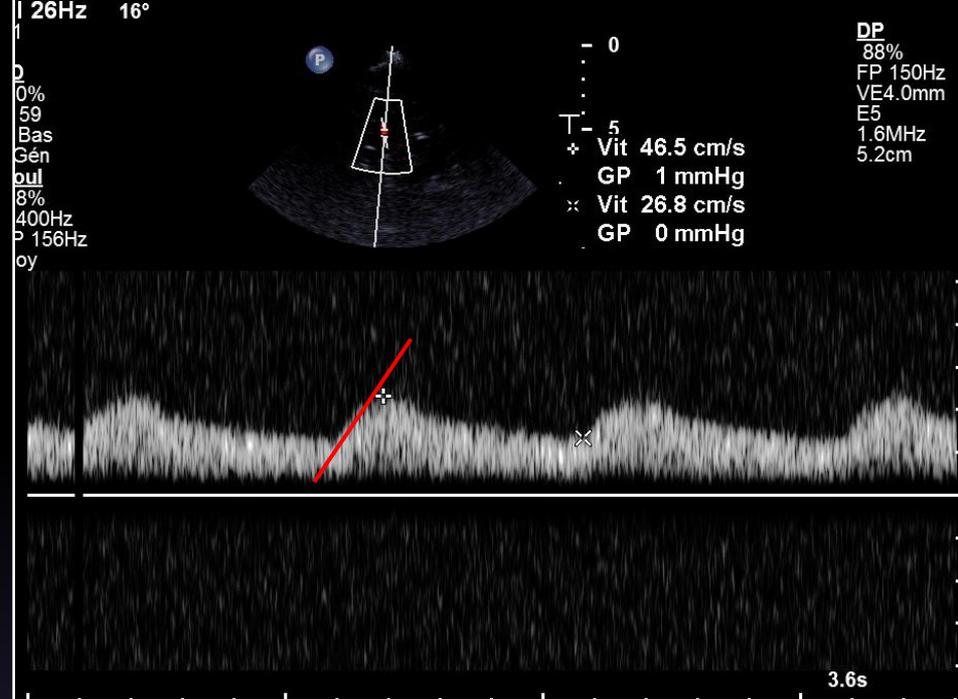
<b>TABLE I</b>		<b>Normal Reference Values of Blood Flow Velocities in the Basal Cerebral Arteries in Different Age Groups</b>			
Blood Flow Velocity (cm/sec)	n	Subjects			
		All	20-40 Years Old	41-60 Years Old	>60 Years Old
ACA	313				
Peak		79 (37-121)	82 (40-124)	80 (36-124)	72 (52-102)
Mean		53 (33-83)	56 (42-84)	53 (37-85)	44 (22-66)
End-diastolic		35 (13-57)	38 (16-60)	35 (13-57)	28 (12-44)
MCA	335				
Peak		110 (54-166)	120 (64-176)	109 (65-175)	92 (58-126)
Mean		73 (33-133)	81 (41-121)	73 (35-111)	59 (37-81)
End-diastolic		49 (21-77)	55 (29-81)	49 (23-75)	37 (21-53)
PCA	336				
Peak		71 (39-103)	75 (43-107)	74 (40-108)	62 (38-86)
Mean		49 (25-73)	52 (28-76)	51 (25-75)	40 (22-58)
End-diastolic		33 (15-51)	36 (20-52)	34 (18-50)	26 (14-38)

ACA = anterior cerebral artery, MCA = middle cerebral artery, PCA = posterior cerebral artery. Range of velocities (calculated as mean  $\pm$  2 SD) is given in parentheses.

# Retentissement des Lésions Cervicales

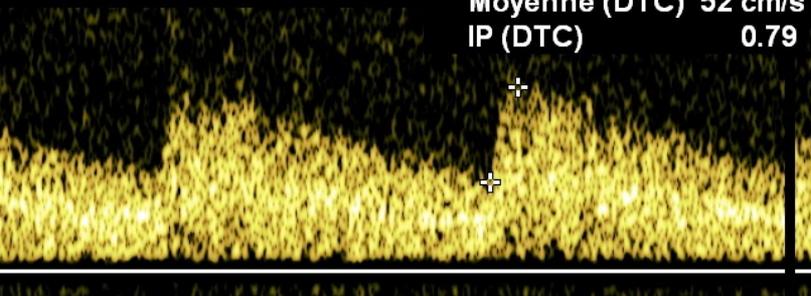
# Retentissement

- Flux démodulé
  - VS et VM diminuées
  - IR abaissé
  - TMS augmenté
- Asymétrie IR
  - significative > 20 %



Mr B.

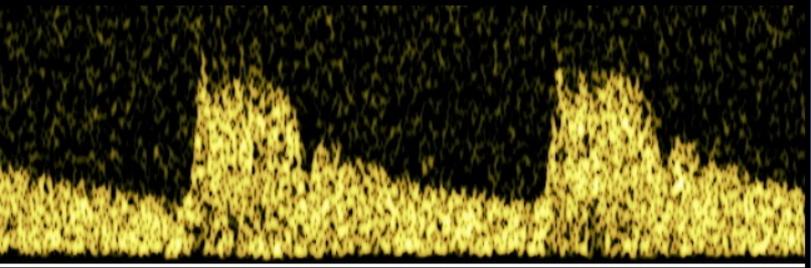
Profondeur VE	5.4 cm
VSM	79.0 cm/s
VTD	38.1 cm/s
IR	0.52
Moyenne (DTC)	52 cm/s
IP (DTC)	0.79



Sylvienne Dte

Mr A.

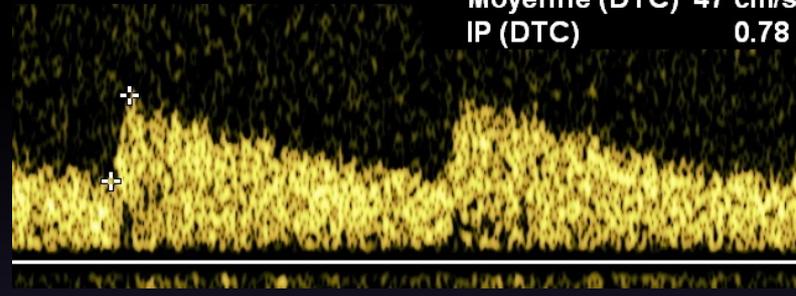
10-



OCCULSION-CING

Mr G.

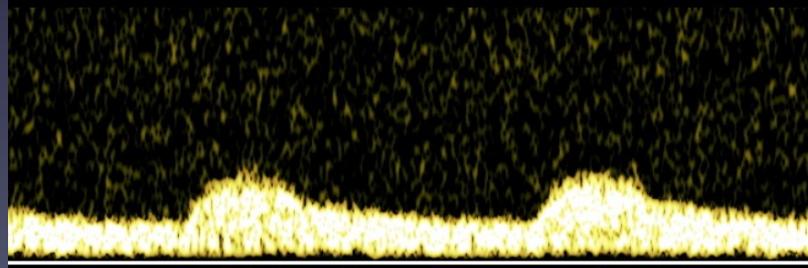
Profondeur VE	5.1 cm
VSM	72.2 cm/s
VTD	35.1 cm/s
IR	0.51
Moyenne (DTC)	47 cm/s
IP (DTC)	0.78



Sylvienne G



10-

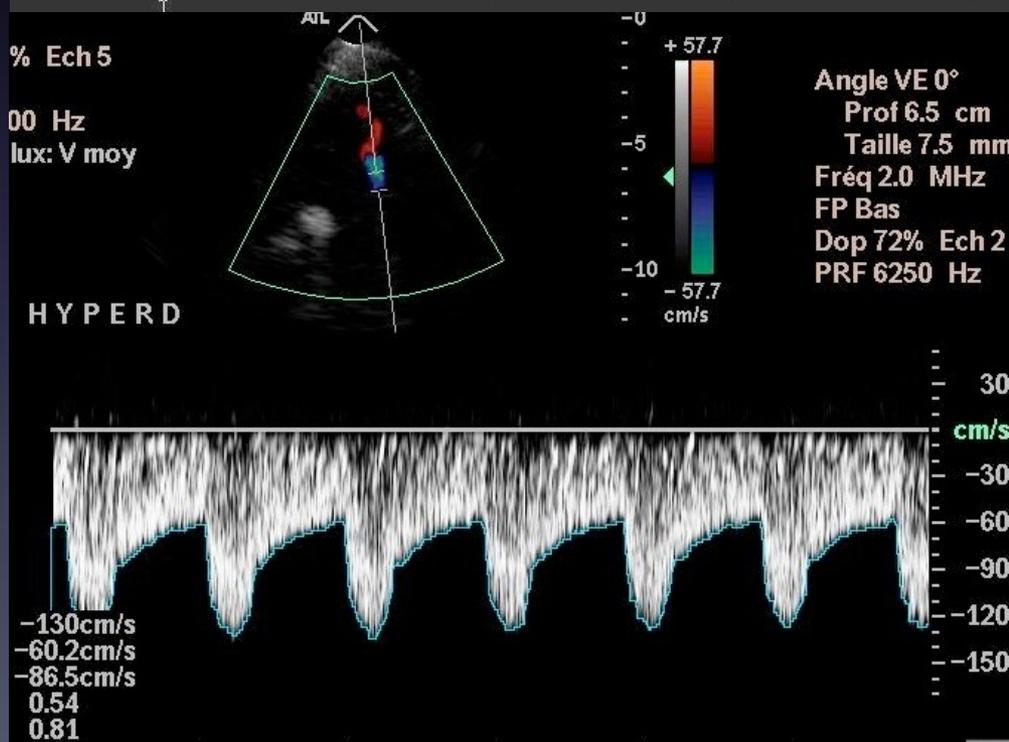
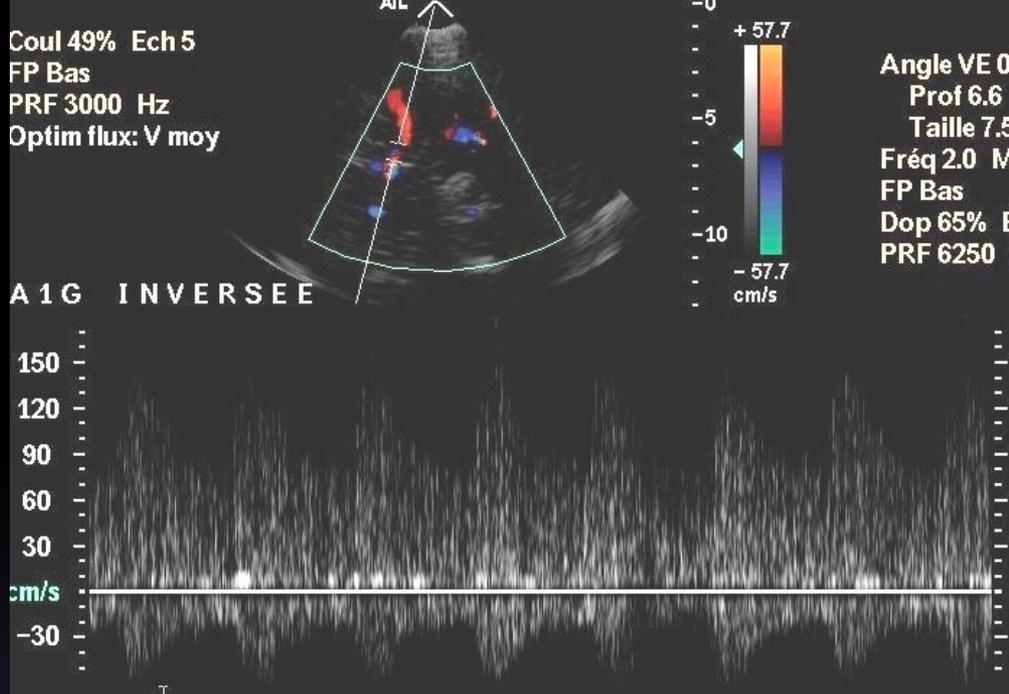
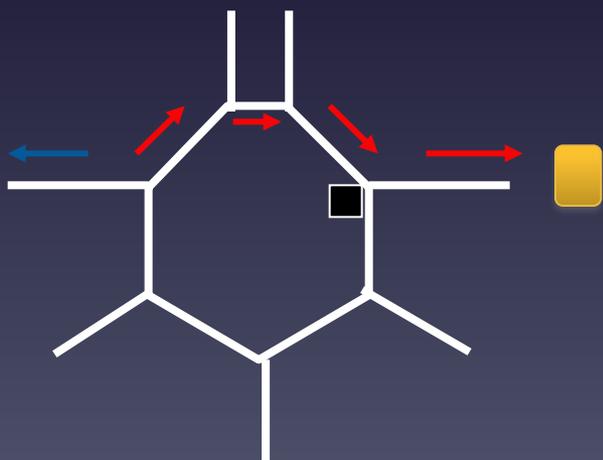


62  
FP  
VE:  
E2  
1.6  
5.4

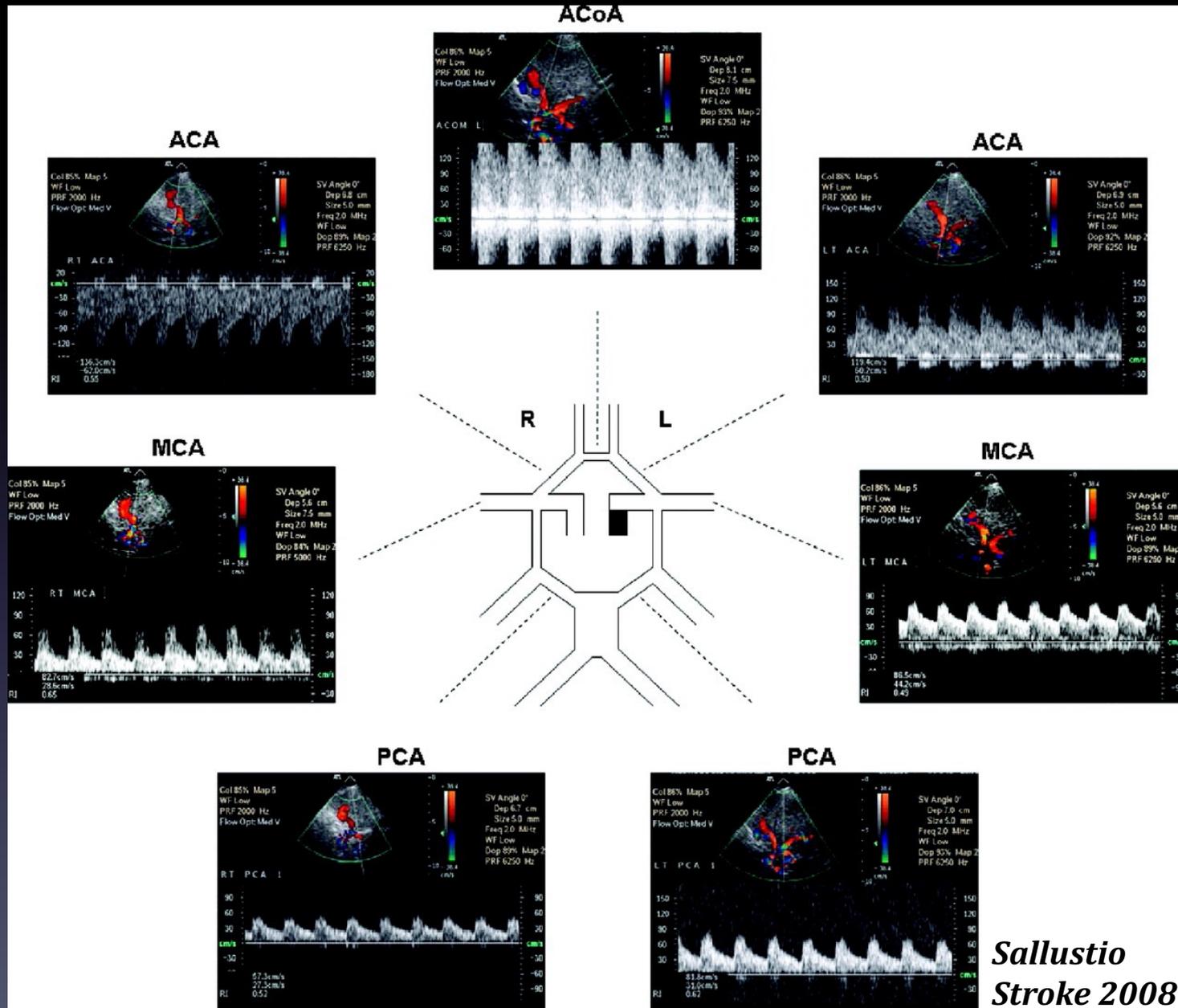
62  
FP  
VE:  
E2  
1.6  
5.1

# Suppléance

- AcomA fonctionnelle :
  - ACA inversée en A1
  - Hyperdébit ACA controlatérale
  - (Sens 100 %, Spé 100 %)



# TCCD example of CF in a patient with left ICA occlusion



# Lésions Intra-Crâniennes

# Epidémiologie

GESICA : **8 % des IC**

Evolution à 2 ans :

- Récidive 38,2 % (13,7 % AVC, 24,5 % AIT)

*Mazighi M et al. Neurology, 2006, 66(8), 1187.*

WASID 2 :

Facteurs Prédicatifs de Récidive :

- Sténose  $\geq 70$  % (OR = 2,03)
- Inclusion  $\leq 17$  jours (OR = 1,69)
- Sexe féminin (OR= 1,59)

*Kasner SE et al. Circulation, 2006, 113, 555.*

# Sténose Sylvienne

- Critère direct :
  - Accélération localisée +++
- Critères indirects :
  - IR diminué et TMS augmenté en aval
  - Asymétrie D/G
- Evolution dans le temps :
  - Si les signes régressent => embole ou dissection

# Sténose Sylvienne : *Baumgartner RW et al, Stroke. 1999, 30, 87.*

**TABLE 1. Ultrasonic Detection of  $\geq 50\%$  Intracranial Stenoses (n=31) With Angiography as Standard of Reference**

	Ultrasound					Angiography	
	PSV Cutoff, cm/s	Sensitivity, %	Specificity, %	Positive Predictive Value, %	Negative Predictive Value, %	No.	Mean $\pm$ SD Degree (Range)
ACA	$\geq 155$	100	100	100	100	4	60 $\pm$ 8 (52–71)
MCA	$\geq 220$	100	100	100	100	11	67 $\pm$ 11 (50–80)
PCA	$\geq 145$	100	100	100	91	10	63 $\pm$ 7 (50–72)
BA	$\geq 140$	100	100	100	100	3	67 $\pm$ 14 (53–85)
VA	$\geq 120$	100	100	100	100	3	69 $\pm$ 14 (55–84)

**TABLE 2. Ultrasonic Detection of  $< 50\%$  Intracranial Stenoses (n=38) With Angiography as Standard of Reference**

	Ultrasound					Angiography	
	PSV Cutoff, cm/s	Sensitivity, %	Specificity, %	Positive Predictive Value, %	Negative Predictive Value, %	No.	Mean $\pm$ SD Degree (Range)
ACA*	$\geq 120$	100	99	73	100	5	38 $\pm$ 12 (20–47)
MCA	$\geq 155$	94	100	95	100	18	36 $\pm$ 8 (22–48)
PCA	$\geq 100$	100	100	100	100	5	29 $\pm$ 12 (13–41)
BA	$\geq 100$	100	100	100	100	4	33 $\pm$ 4 (29–37)
VA	$\geq 90$	100	100	100	100	5	32 $\pm$ 6 (25–39)

\*One stenosed anterior cerebral artery was missed because of an inadequate temporal bone window.

# Sténose Sylvienne

Sténoses	VMS
Légères (30 à 49 %)	140 - 209 cm/s
Modérées (50 à 69 %)	210 - 279 cm/s
Serrées ( $\geq 70$ %)	$\geq 280$ cm/s

# Sténose ACM

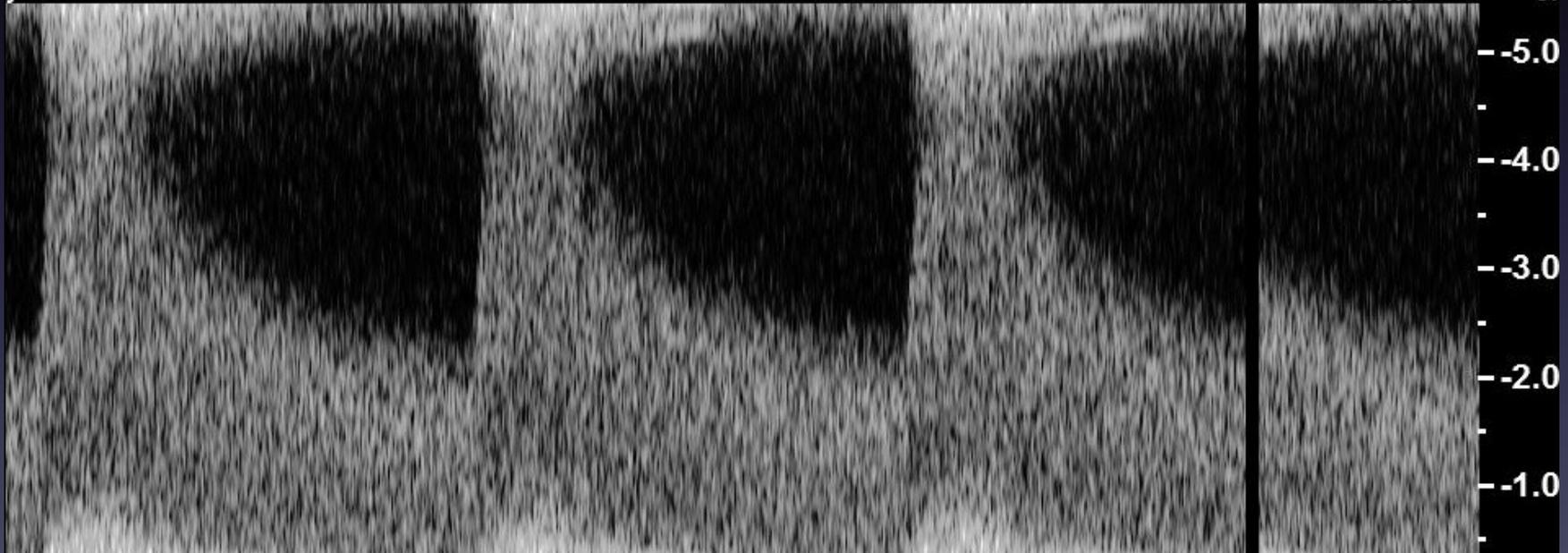
%  
i0  
}as  
én  
ul  
%  
00Hz  
140Hz  
y



VE4.0mm  
E5  
1.6MHz  
4.6cm



Inv  
-5.0  
-4.0  
-3.0  
-2.0  
-1.0



**MERCI POUR VOTRE ATTENTION**