

**Unità Operativa di Neurologia**  
Ospedale "Madonna del Soccorso"  
**San Benedetto del Tronto (AP)**  
Direttore M.Ragno

**STUDIO VENOSO  
CEREBRALE IN  
CONDIZIONI DI  
IPERAFFLUSSO(AVMs):  
Ruolo degli ultrasuoni**

**Perché il TCCD è  
diventato un esame  
insostituibile nella  
gestione del paz con  
patologia cerebrale?**

***Dr. Sandro Sanguigni***

**San Benedetto del Tronto**  
**6-8 Novembre 2017**



# CHARACTERISTIC TCD FINDINGS IN AVMs

## *Feeding Arteries:*

- Increased peak flow and mean flow velocity (medium to large AVMs)
- Reduced pulsatility index
- Impaired autoregulation
- Insonation of vessels in anatomically unusual location
- Bidirectional flow signals (overlapping spectra of several simultaneously insonated vessels)
- Sometimes stenosis of the feeding vessels (termed «high-flow angiopathy»)
- Significant audiosignal changes

## *Neighbouring arteries:*

- Usually decreased flow velocity
- Impaired autoregulation possible

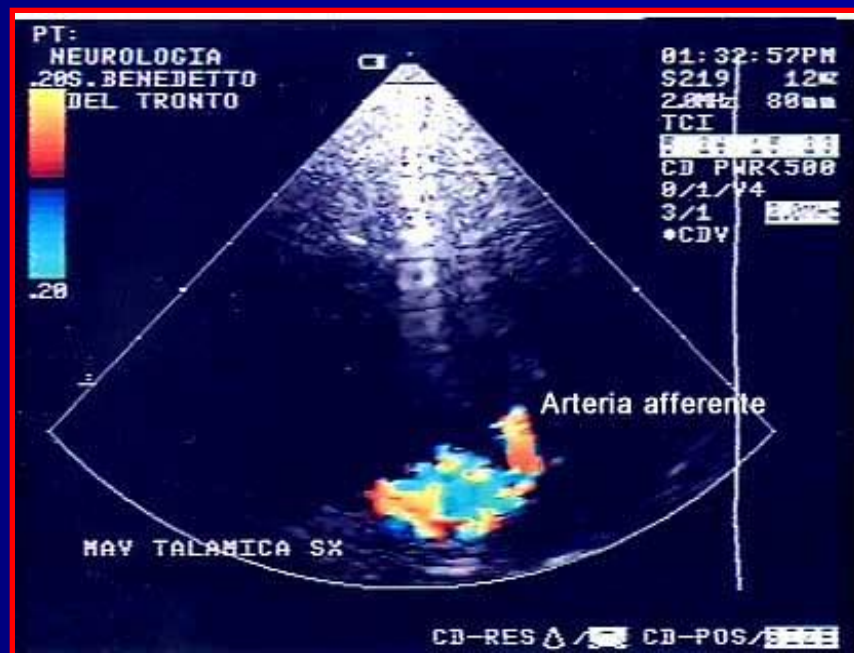
# MALFORMAZIONE ARTERO-VENOSA (MAV)



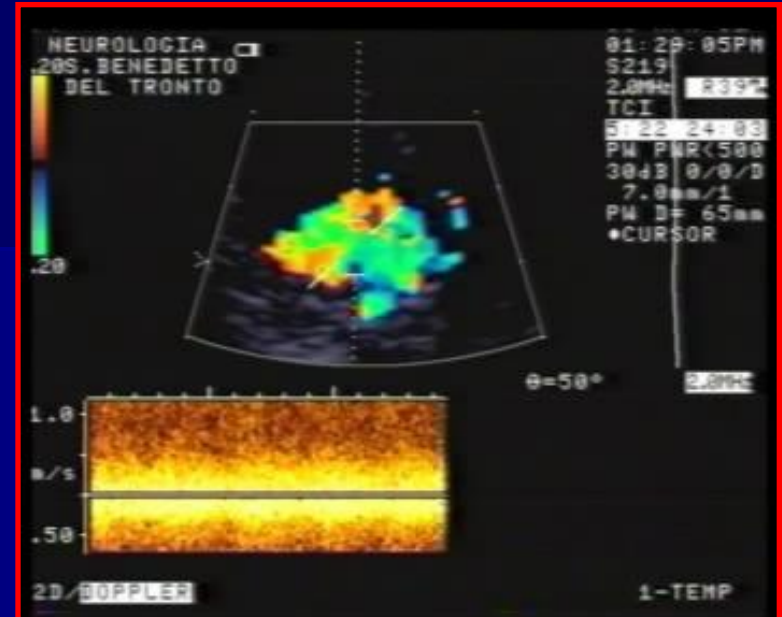
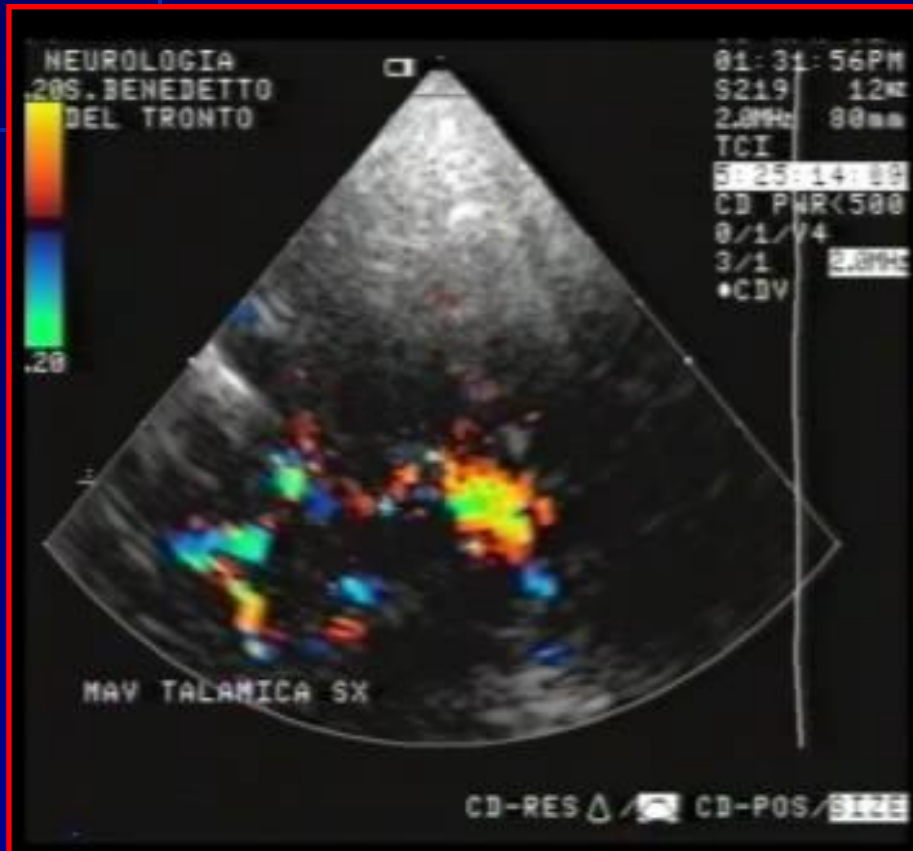
Nido vascolare

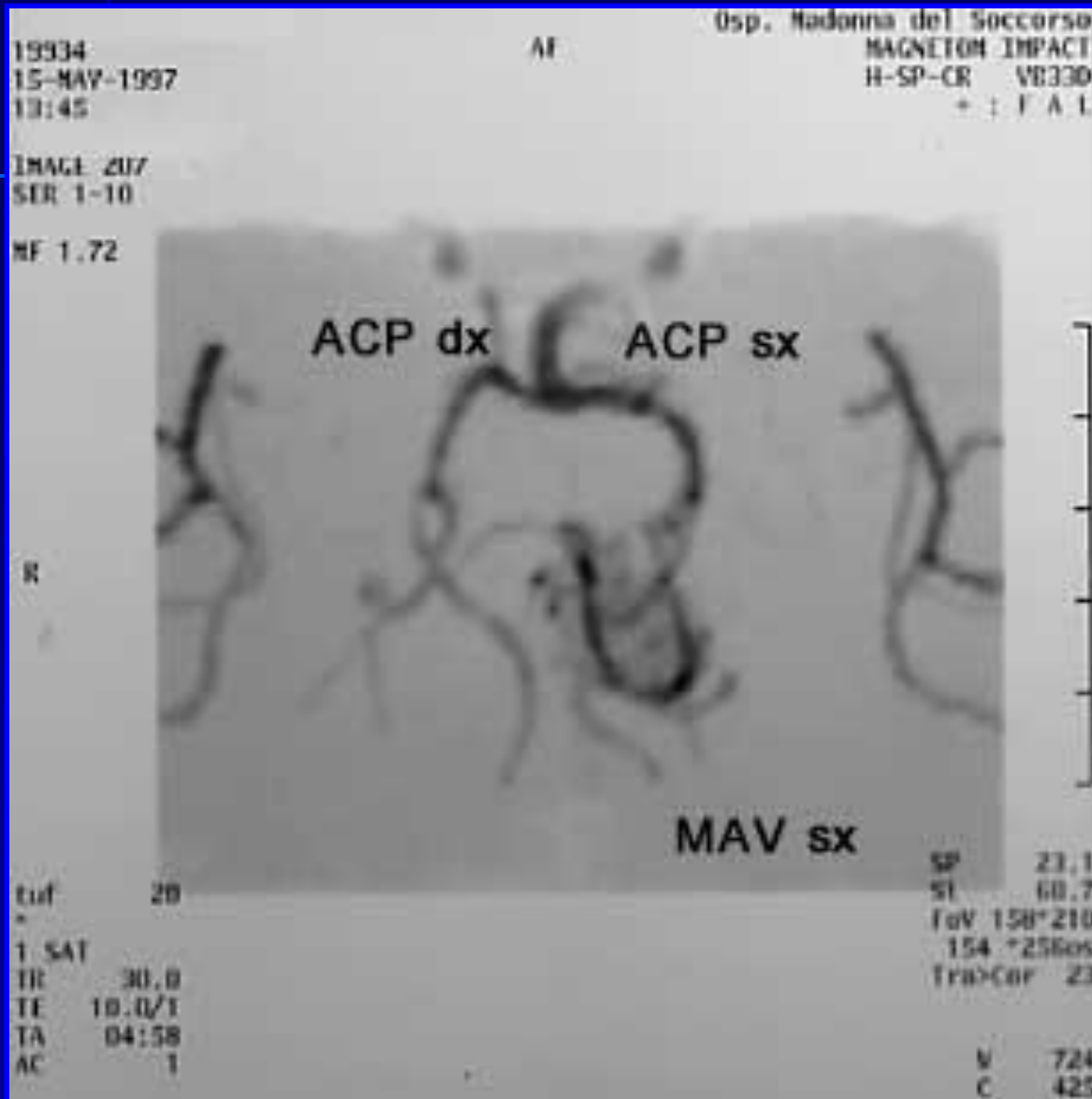
Vena efferente

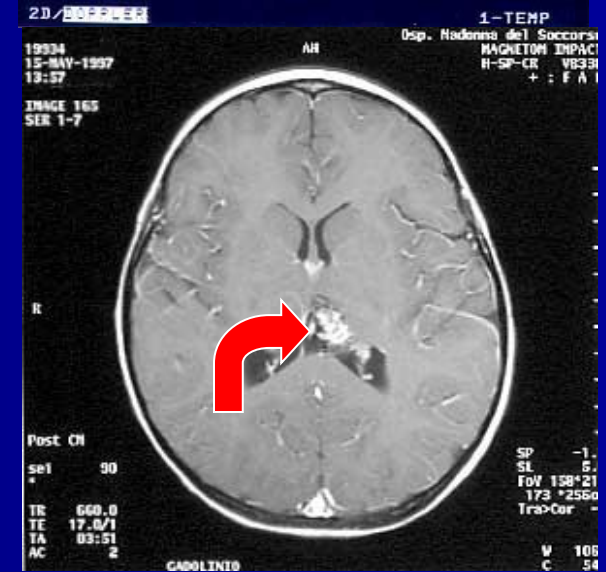
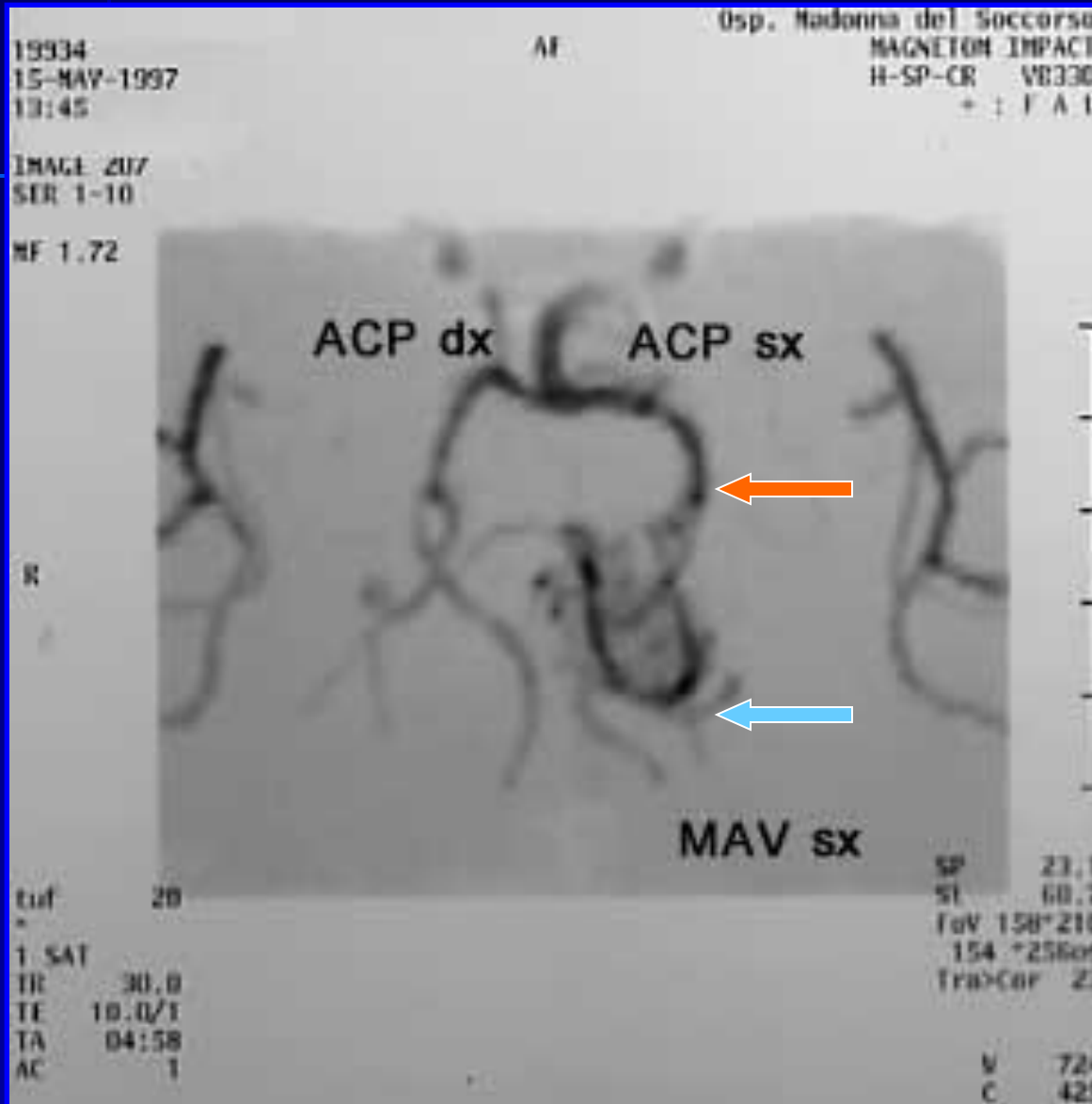
Arteria afferente



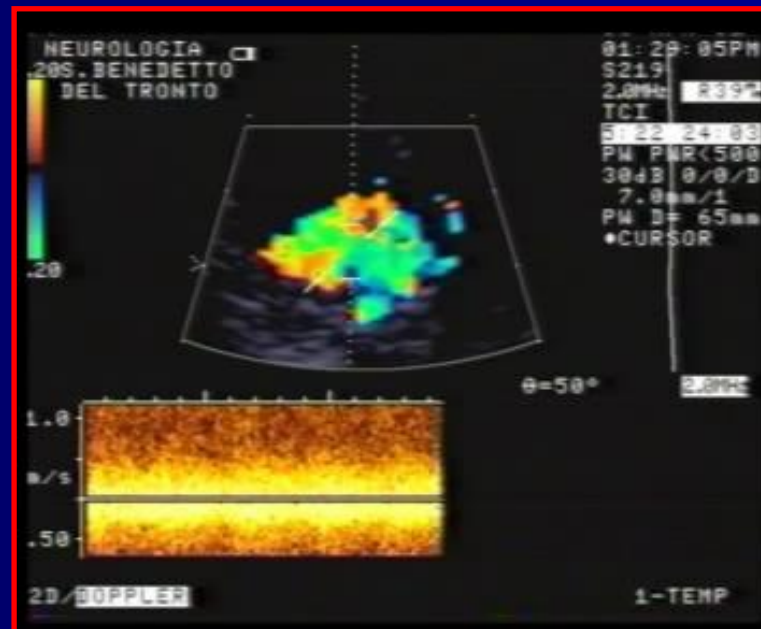
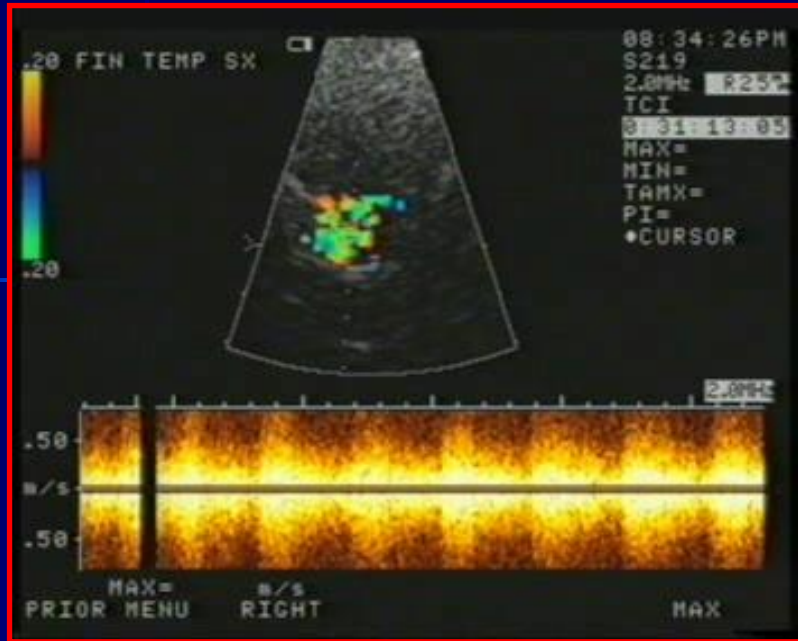
# MAV TALAMICA SX







# FISTOLA CAROTIDO-CAVERNOSA SX



MAV

# FISTOLA CAROTIDO-CAVERNOSA SX

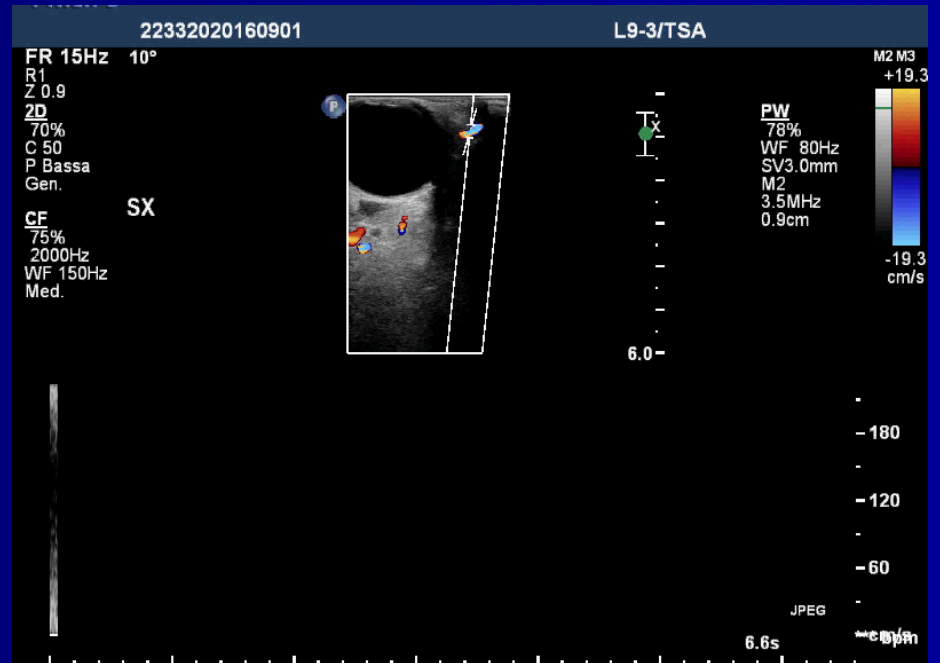
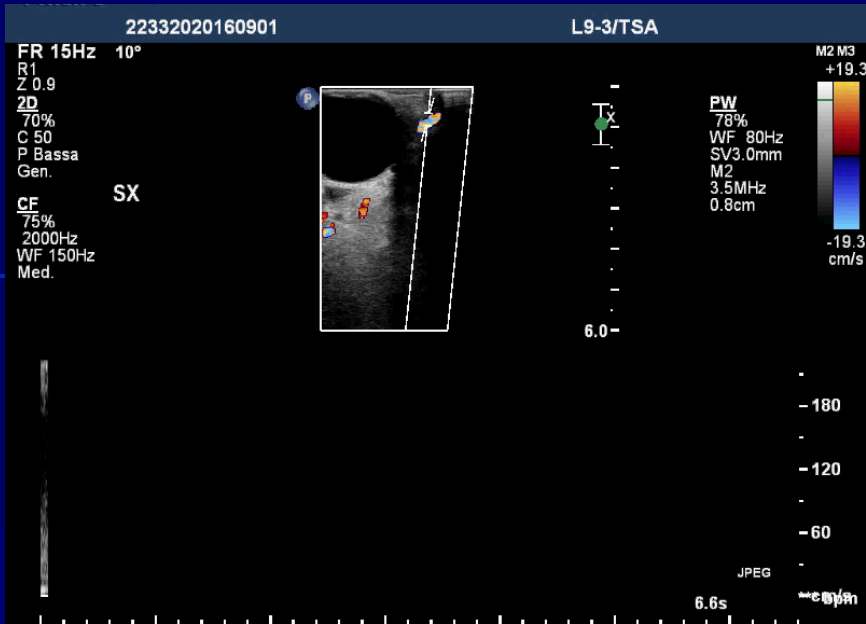


Vena Basilare sx



Vena Basilare dx

Diversa partecipazione della vena Basilare (Del Rosenthal) nel deflusso venoso !

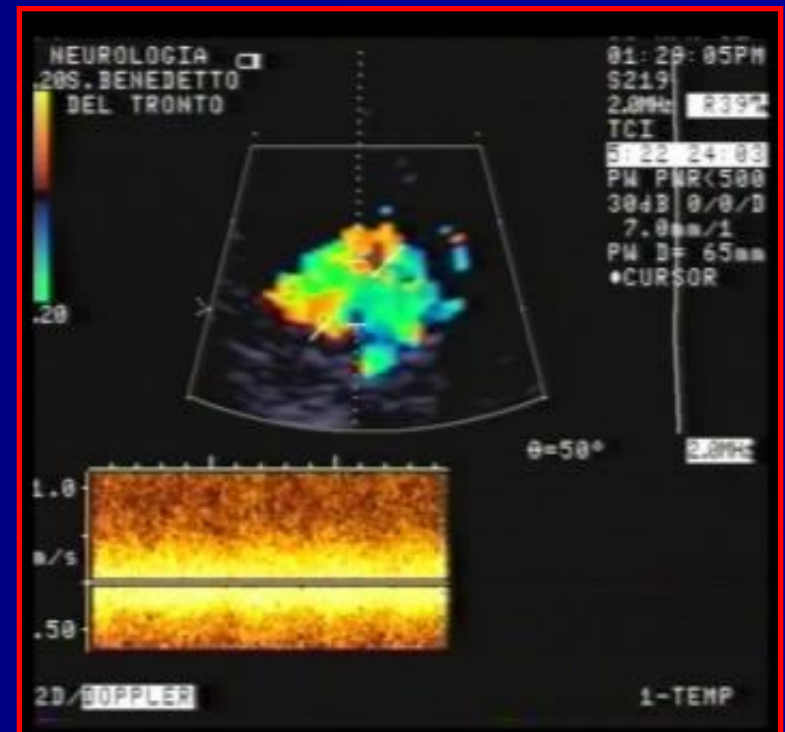


# FISTOLA CAROTIDO-CAVERNOSA

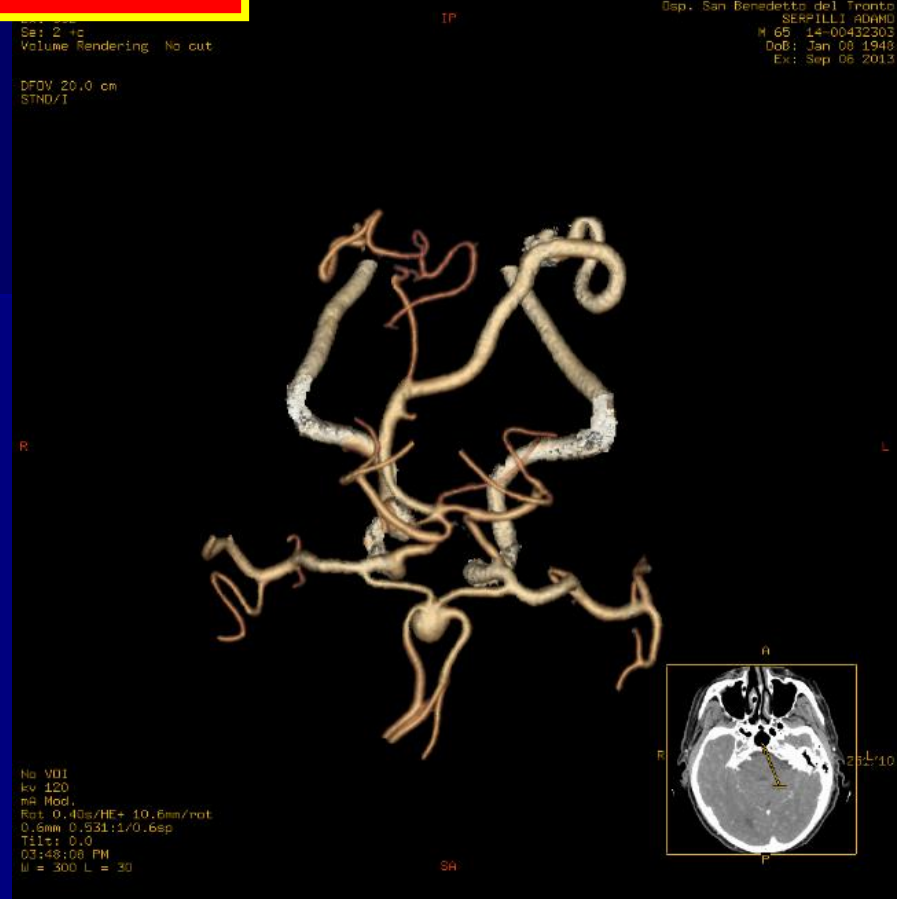
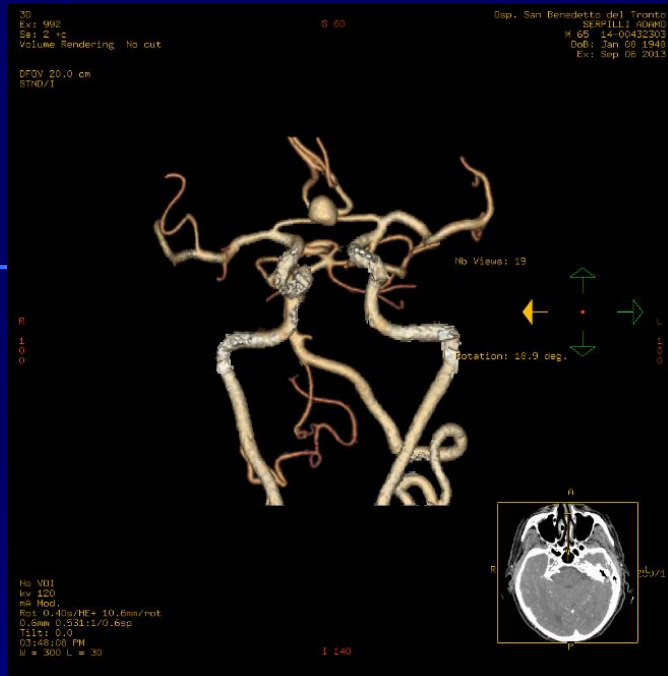


“Machine noise”

## MAV TALAMICA SX



# LA MORFOLOGIA E' TUTTO ?



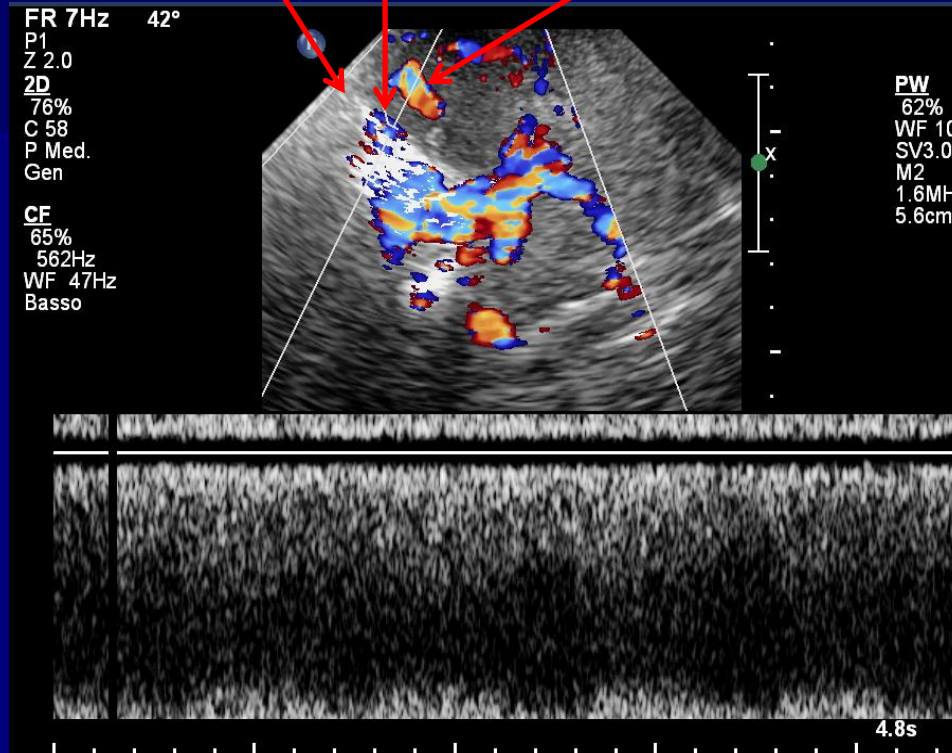
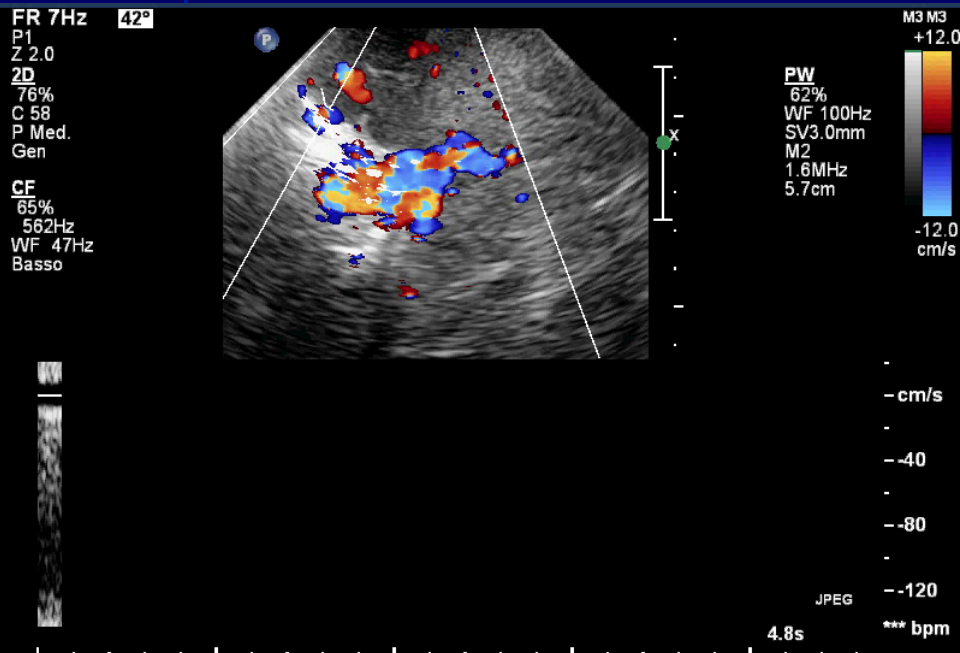
**Paz 54 years old ,male,arrived in  
Emergency Room for mild headache....**

# LA MORFOLOGIA E' TUTTO ?

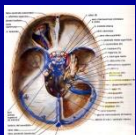
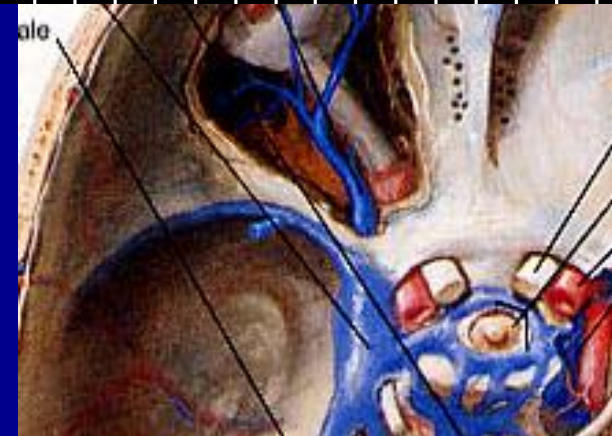
Lesser wing of the  
sphenoid bone

Middle cerebral artery

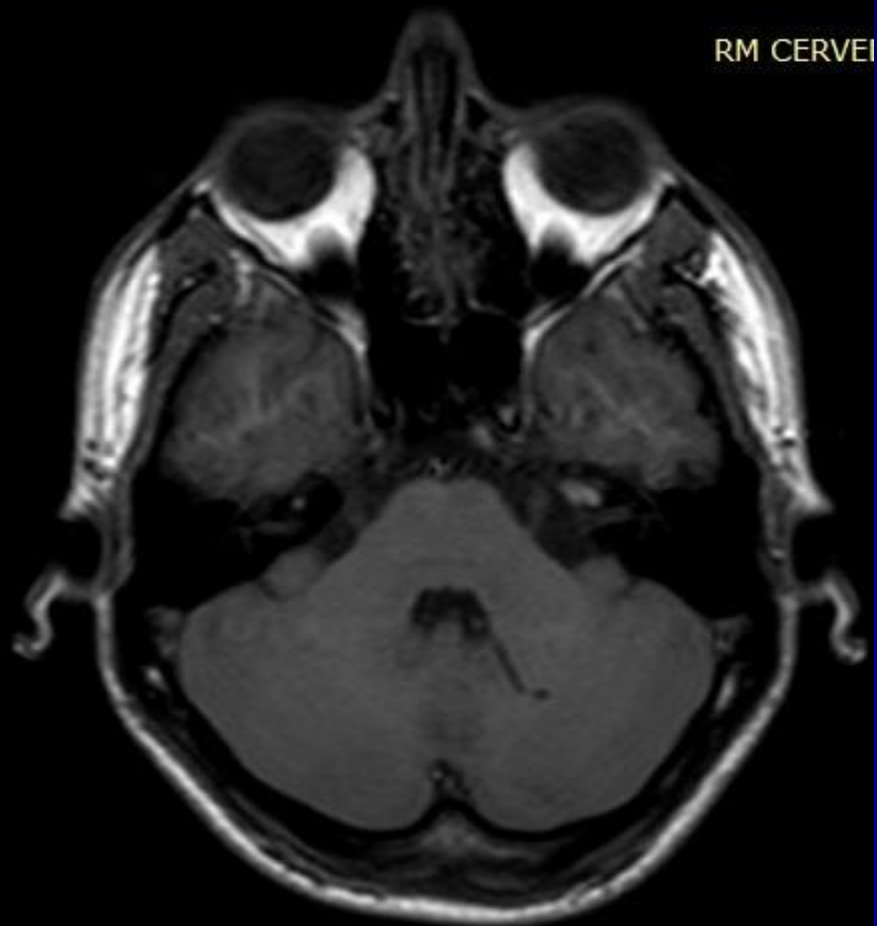
sphenoparietal sinous(blu)

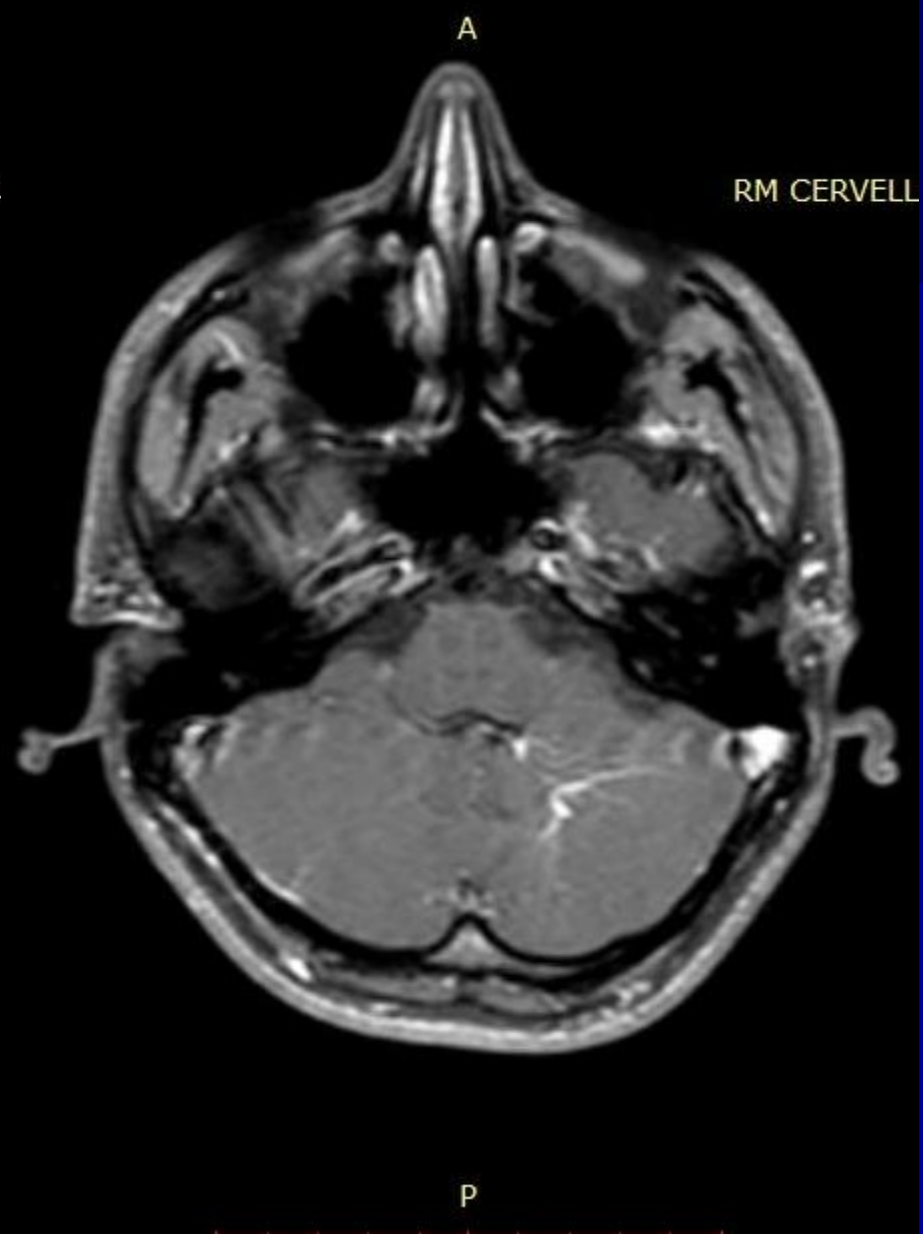
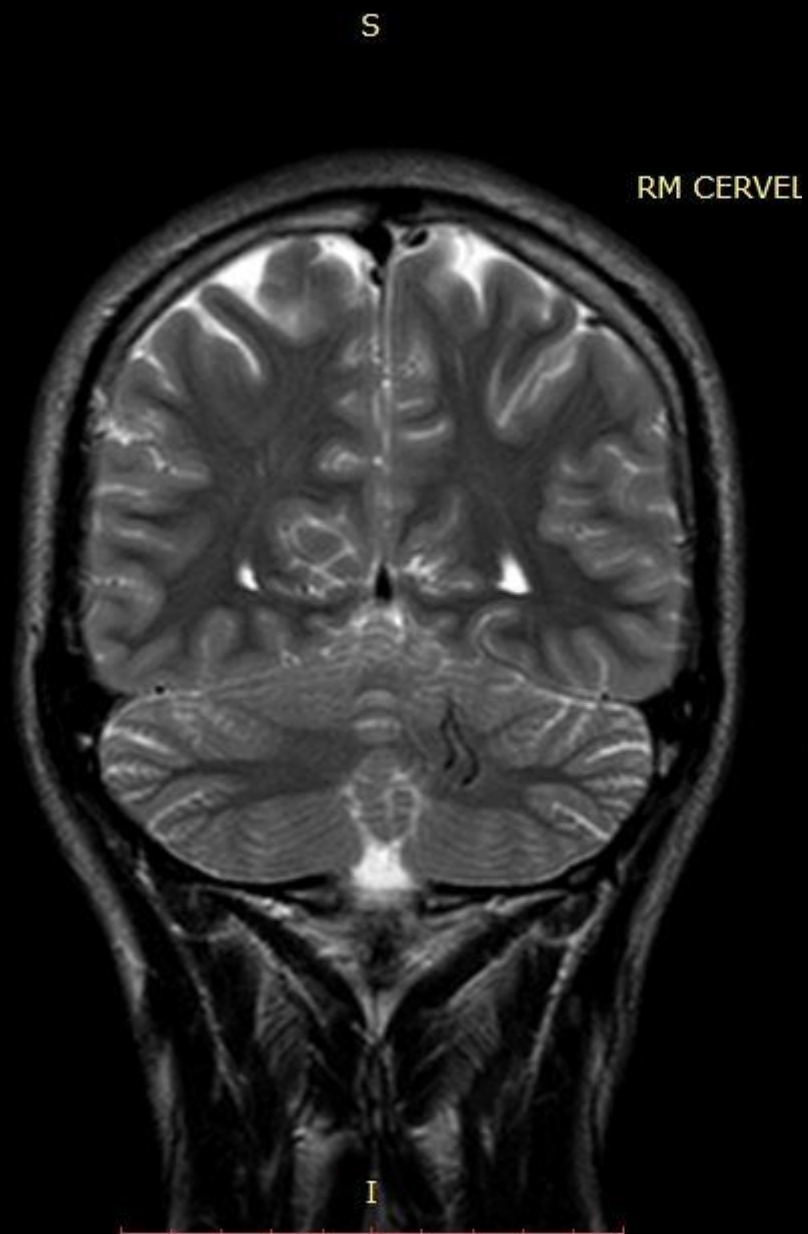


**Congestione massiva del seno sfenoparietale  
PSV: ~ 1 m/sec !**



**LA MORFOLOGIA E' TUTTO ?**





A

RM CERVE



P

A

RM CERVELL



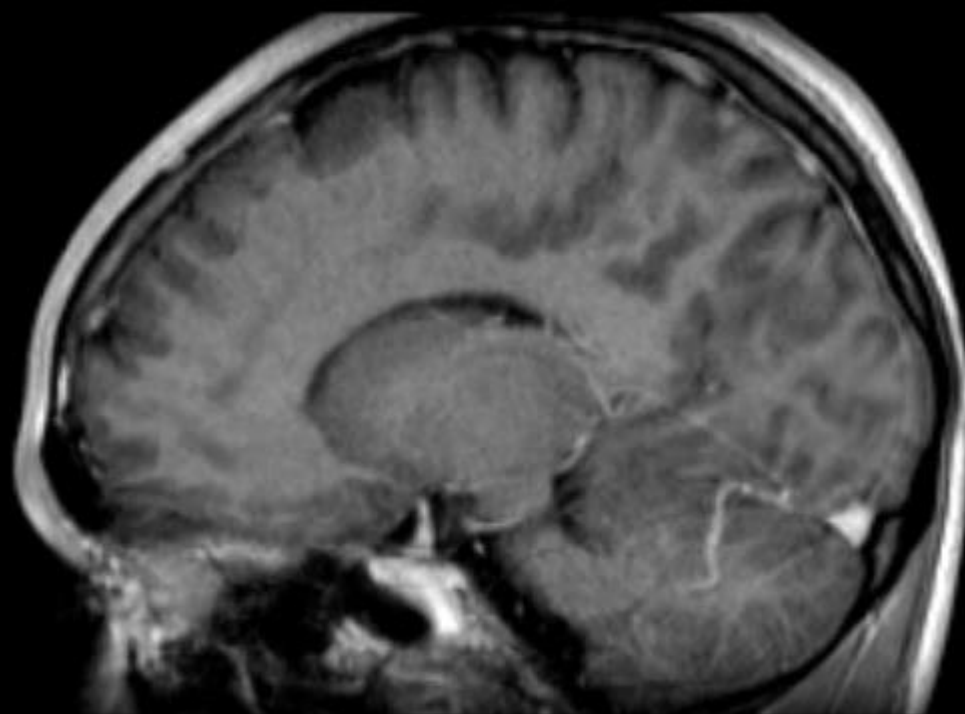
P

A

S

RM CERV

RM CERVELLO E



P

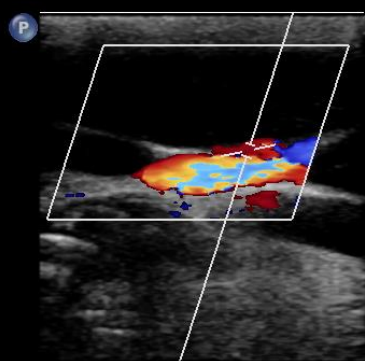
I



FR 30Hz 60°  
R1  
2D  
61%  
C 50  
P Bassa  
Gen

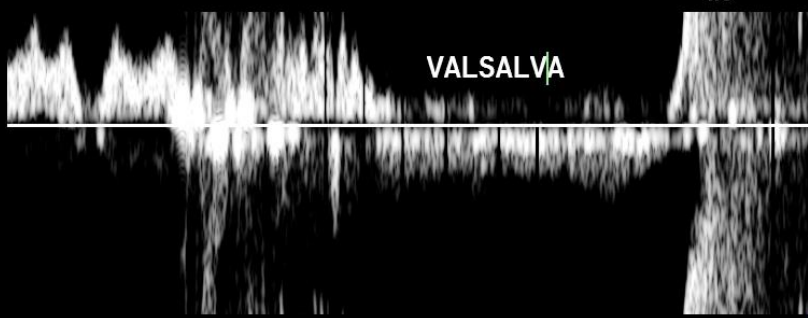
CF  
79%  
1250Hz  
WF 68Hz  
Med.

IJV DX



4.0

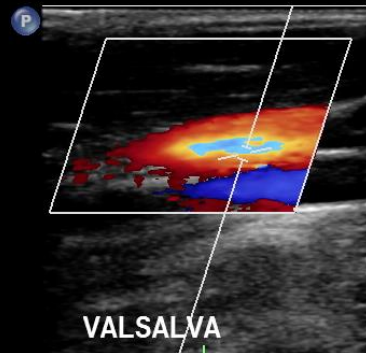
VALSALVA



FR 30Hz 60°  
R1  
2D  
60%  
C 50  
P Bassa  
Gen

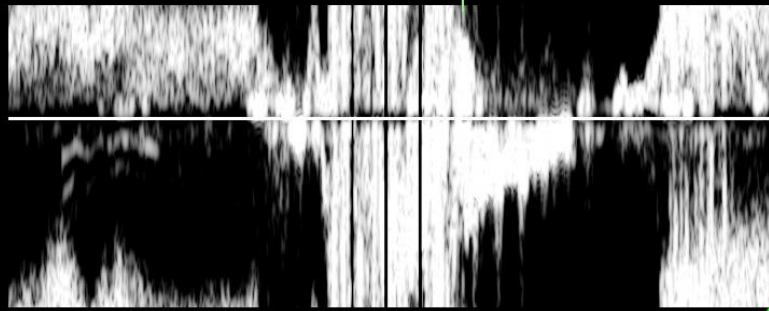
CF  
79%  
1250Hz  
WF 68Hz  
Med.

IJV SX



4.0

VALSALVA

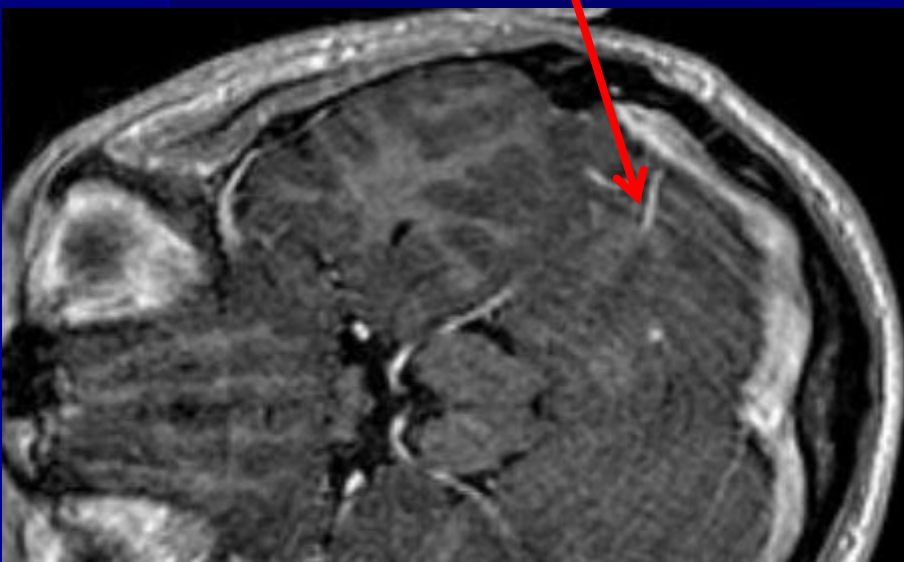


6.6s

PW  
50%  
WF 40Hz  
SV1.5mm  
M2  
3.5MHz  
1.8cm

M2  
+  
-10  
cm

-20  
-10  
-cm  
-10  
-20  
-30



FR 7Hz  
P1

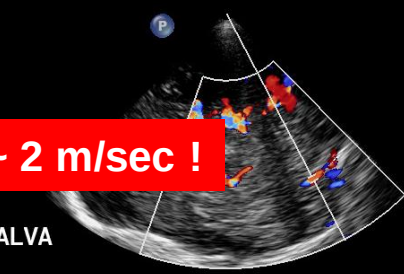
2D  
71%  
C 58  
P Med.  
Gen

CF  
65%  
67%  
WF 37Hz  
Basso

SX

PSV ~ 2 m/sec !

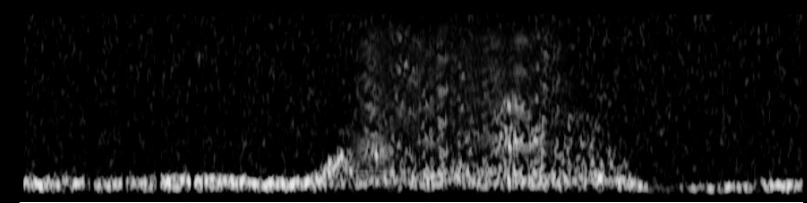
VALSALVA



14

PW  
58%  
WF 100Hz  
SV3.0mm  
M2  
1.6MHz  
10.2cm

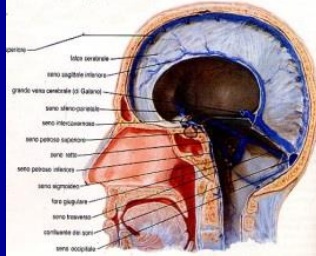
M3 M3  
+14.4  
-14.4  
cm/s

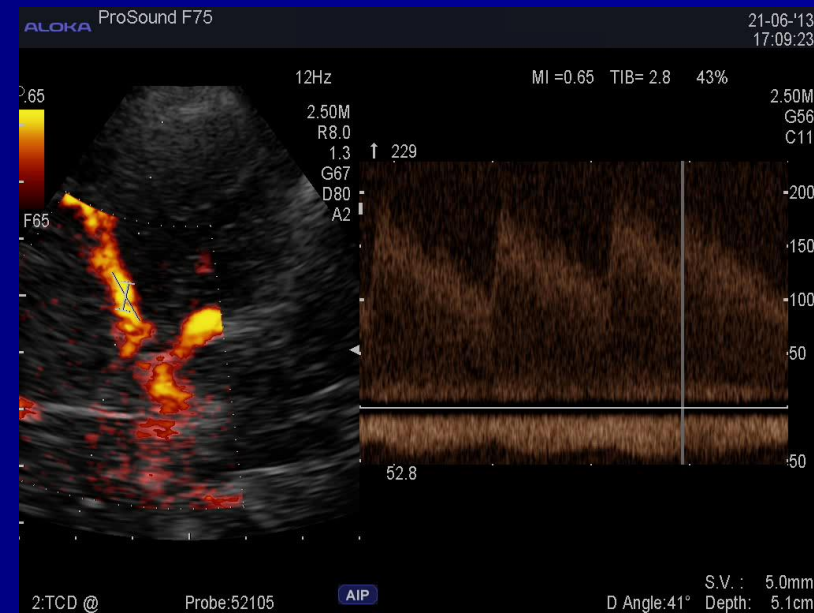
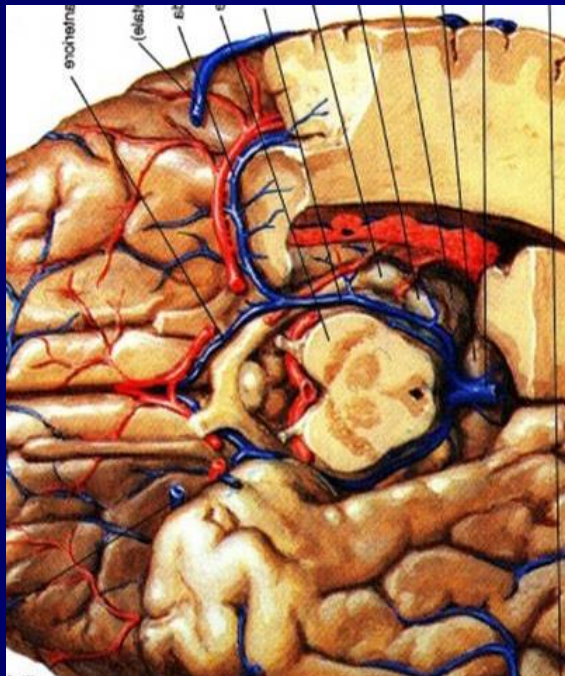
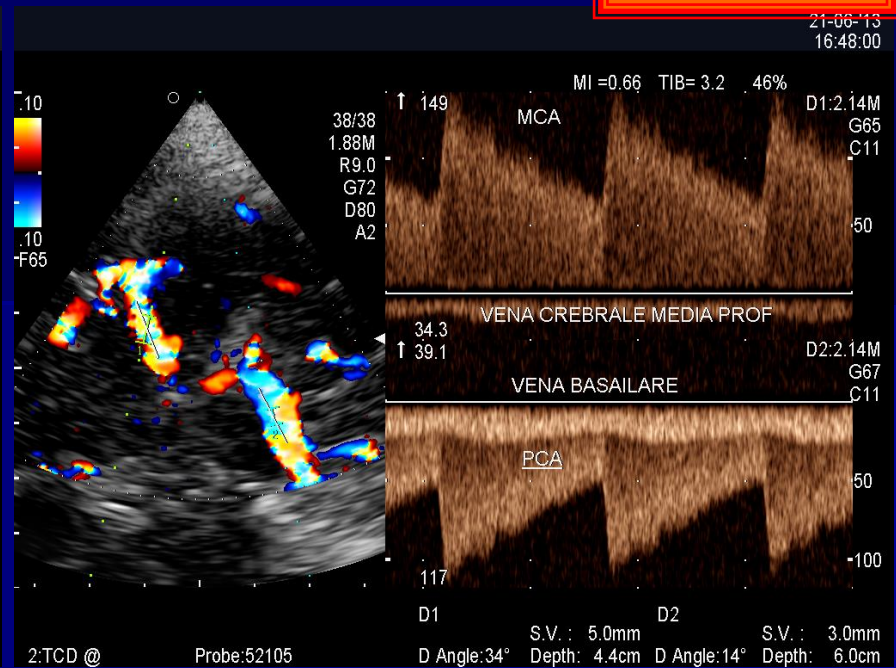
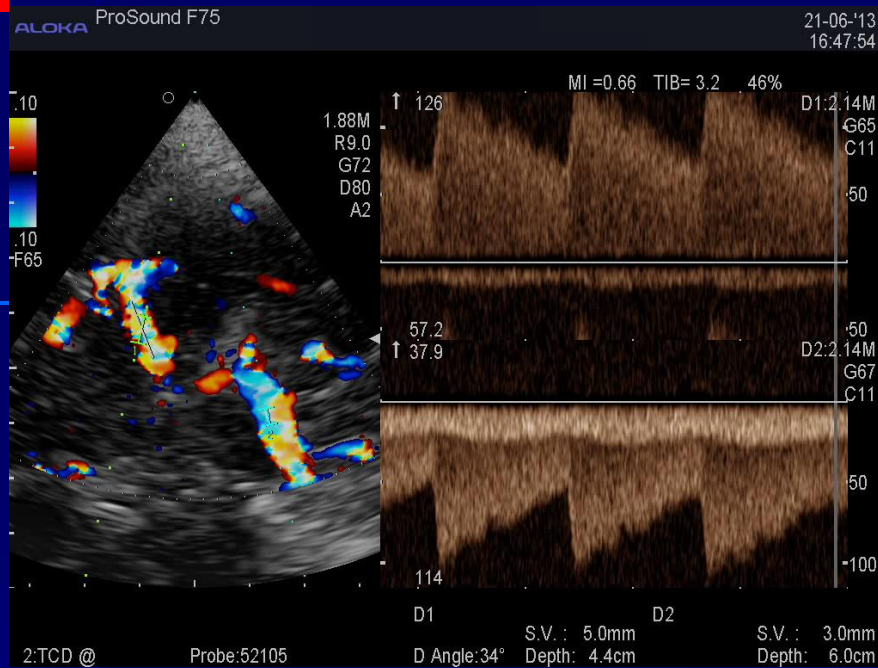


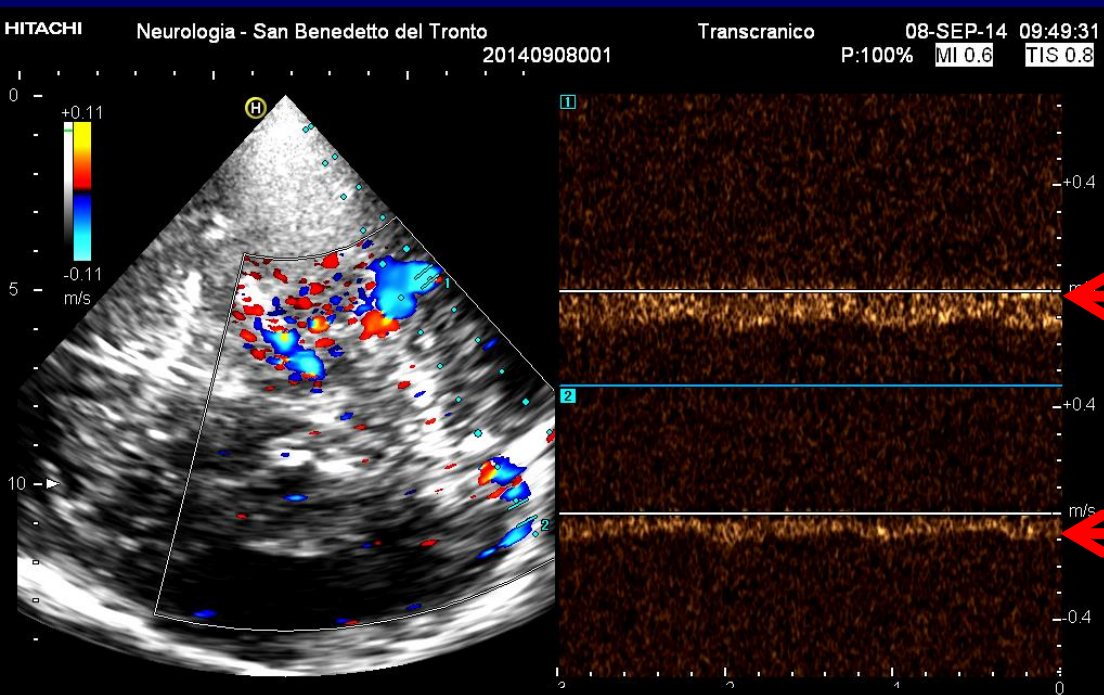
4.8s

-80  
-60  
-40  
-20  
-cm/s  
-20

1

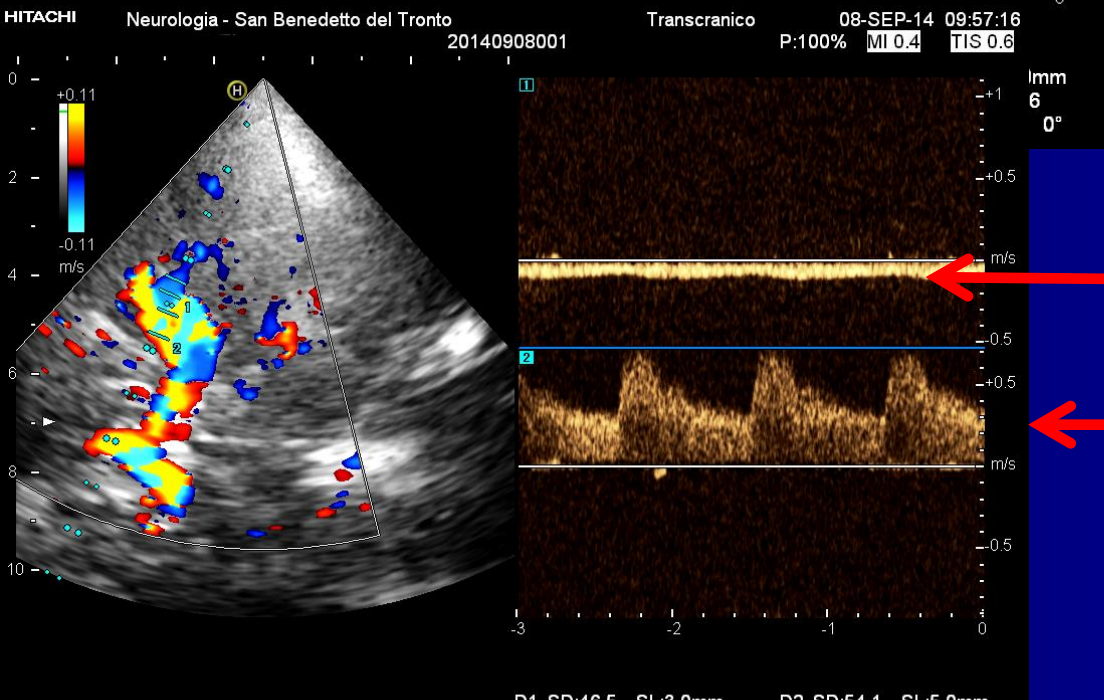






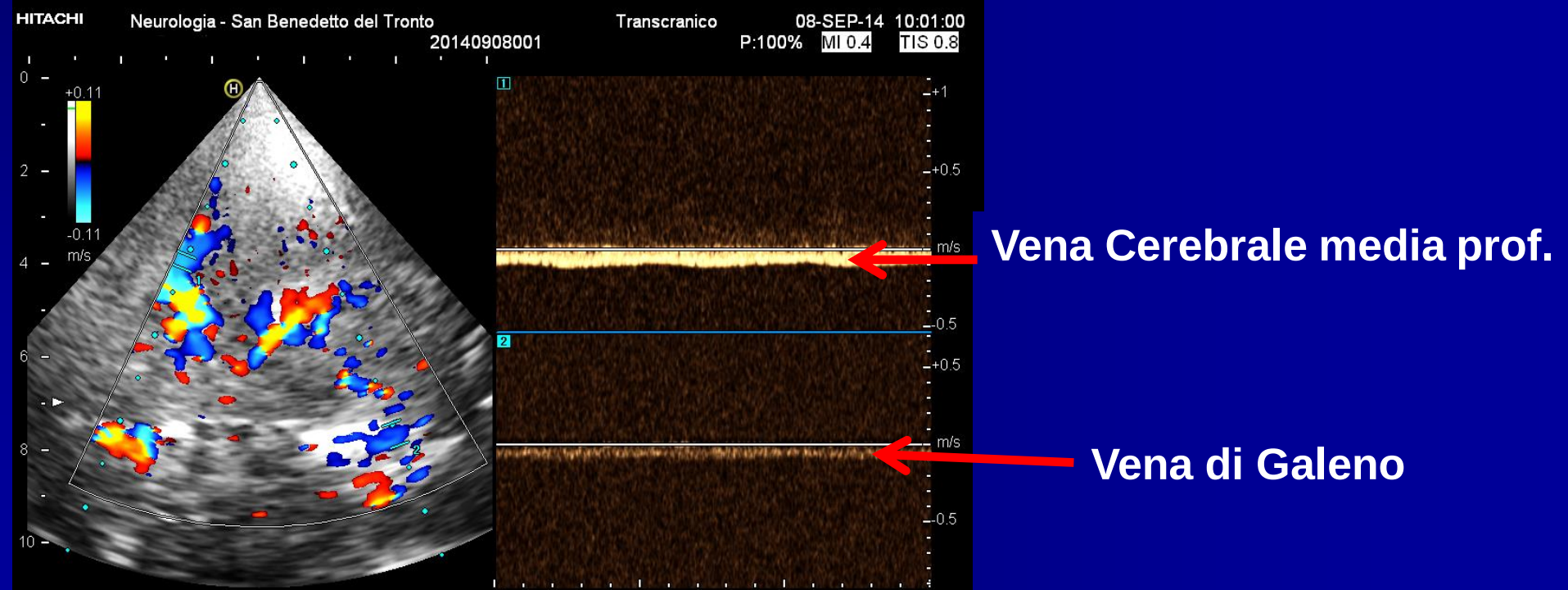
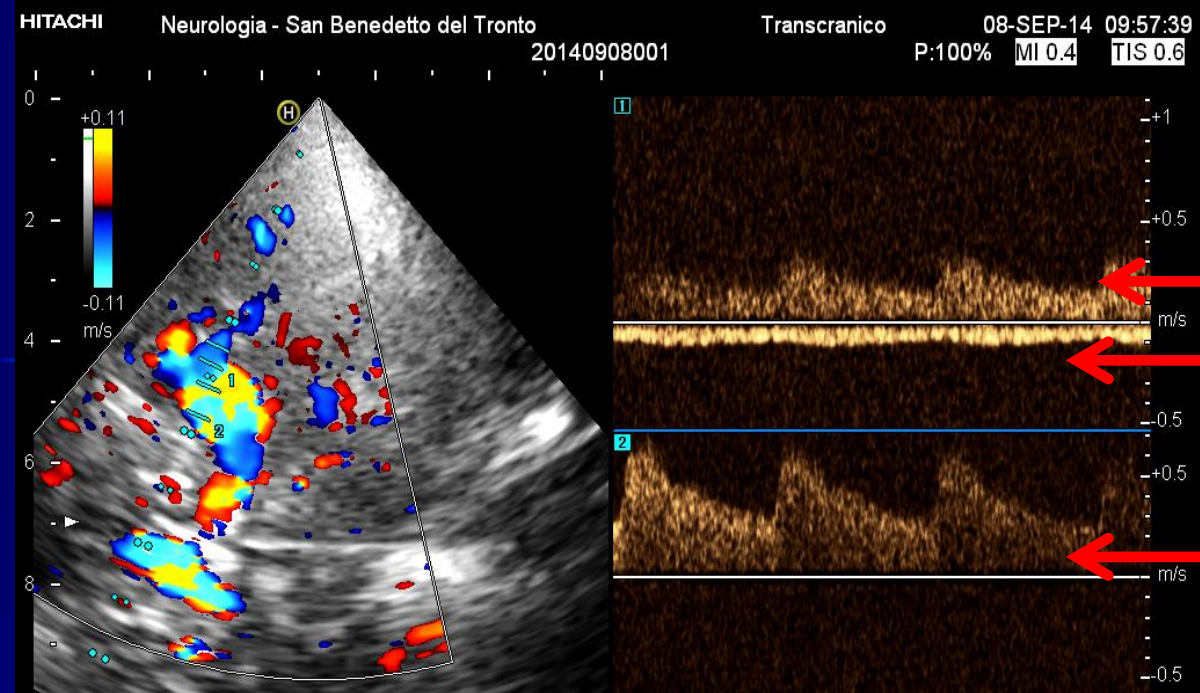
Vena Basilare

Seno trasverso



Vena Cerebrale media prof.

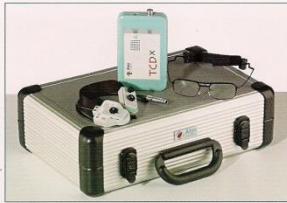
ACM



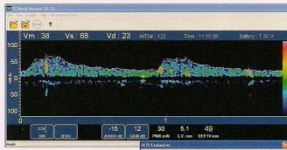
## Our «ongoing» experiences :



Probe fixation and recording system with an inbuilt loudspeaker



TCDX case



Display of emboli on the spectrum

List of detected emboli

| Time     | Depth | Velocity | Direction | Filter | Gain | Scale | Unit |
|----------|-------|----------|-----------|--------|------|-------|------|
| 10:00:00 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:01 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:02 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:03 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:04 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:05 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:06 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:07 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:08 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:09 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:10 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:11 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:12 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:13 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:14 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:15 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:16 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:17 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:18 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:19 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |
| 10:00:20 | 20.0  | 10.0     | 10.0      | 10.0   | 10.0 | 10.0  | 10.0 |

### TCDX

#### Ambulatory monitoring for emboli detection

**STANDARD TRANSCRANIAL DOPPLER ARE ILL-ADJUSTED**  
Emboli detection monitoring by transcranial Doppler (TCD) has been available for more than 15 years. Such monitoring requires the patient to be stationary during the recording period with a bulky and uncomfortable headframe that is prone to movement artefacts and loss of signal. Monitoring, although possible, is impractical and not well tolerated by patients. Besides, it lasts at most one hour as it has been documented that, because of the temporal variability in embolization, long time monitoring is highly desirable to prevent missing the embolic episodes.

#### THE TCDX, AN INNOVATIVE AND UNIQUE SYSTEM

Atys has developed the **TCDX** to make emboli detection easier, reliable and clinically useful.

- The probe fixation is lightweight and comfortable.
- The probe is robotized and thus self-adjusting. An autosearch algorithm restores vessel insonation should signal quality fall.
- The **TCDX** recorder is small, lightweight and battery operated with recording time higher than 5 hours.
- The patient is no longer attached to a TCD. The patient may engage in normal daily activities, even perform exercise or sport.
- The post-processing of the recorded TCD signal for emboli detection is automatic and fast. Each embolic event is tagged and the operator has full access to both its spectral signature and its audible characteristic.

#### AUTOMATIC FUNCTIONS FOR MORE EFFICIENCY

At installation of the probe on the patient's head, the **TCDX** is connected to a PC fitted with the dedicated Doppler software. The robotized probe is positioned on the acoustic window. The Doppler spectrum is viewed in real time on the display of the PC. Set-up and control are performed via this PC. The Doppler signal is optimized using the autosearch software module.

Then the **TCDX** is disconnected from the PC and placed in a small bag carried by the patient. The TCD signal is recorded and automatic searches for the best signal are performed at preset interval or when the signal gets weak.

The full Doppler signal is stored on a memory card. After the monitoring period, it is downloaded to a PC for its analysis with Doctor **Rune Aaslid's** high speed and reliable emboli detection software. Embolic events are isolated and presented so that the operator does not have to review the whole monitoring session.

#### Novel insight into cerebral embolization

## A NEW MILESTONE IN TRANSCRANIAL DOPPLER

# TCDX

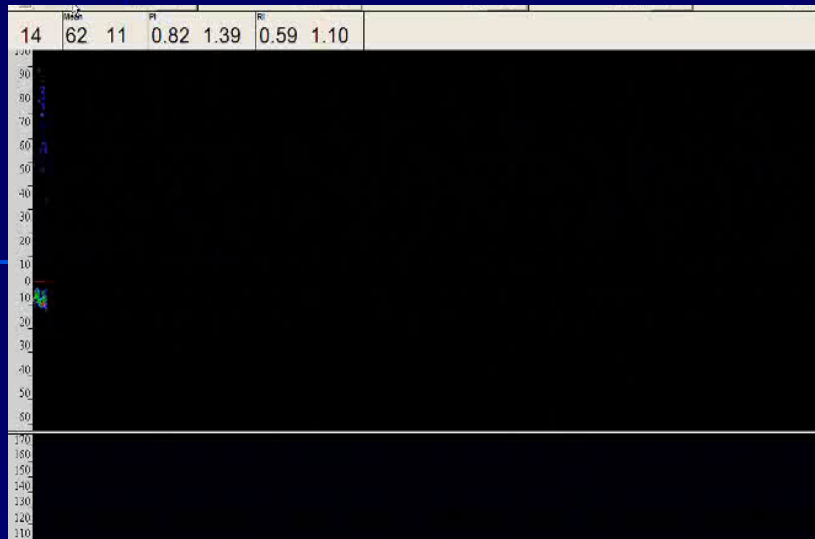
## THE FIRST TRANSCRANIAL HOLTER

- Angiologist
- Vascular specialist
- Neurologist
- Cardiologist
- Physiologist



**Long time monitoring for emboli detection with a robotized probe and a portable recorder.**





Probe fixation and recording system with an inbuilt loudspeaker





**San Benedetto del Tronto**

**GRAZIE PER L'ATTENZIONE**