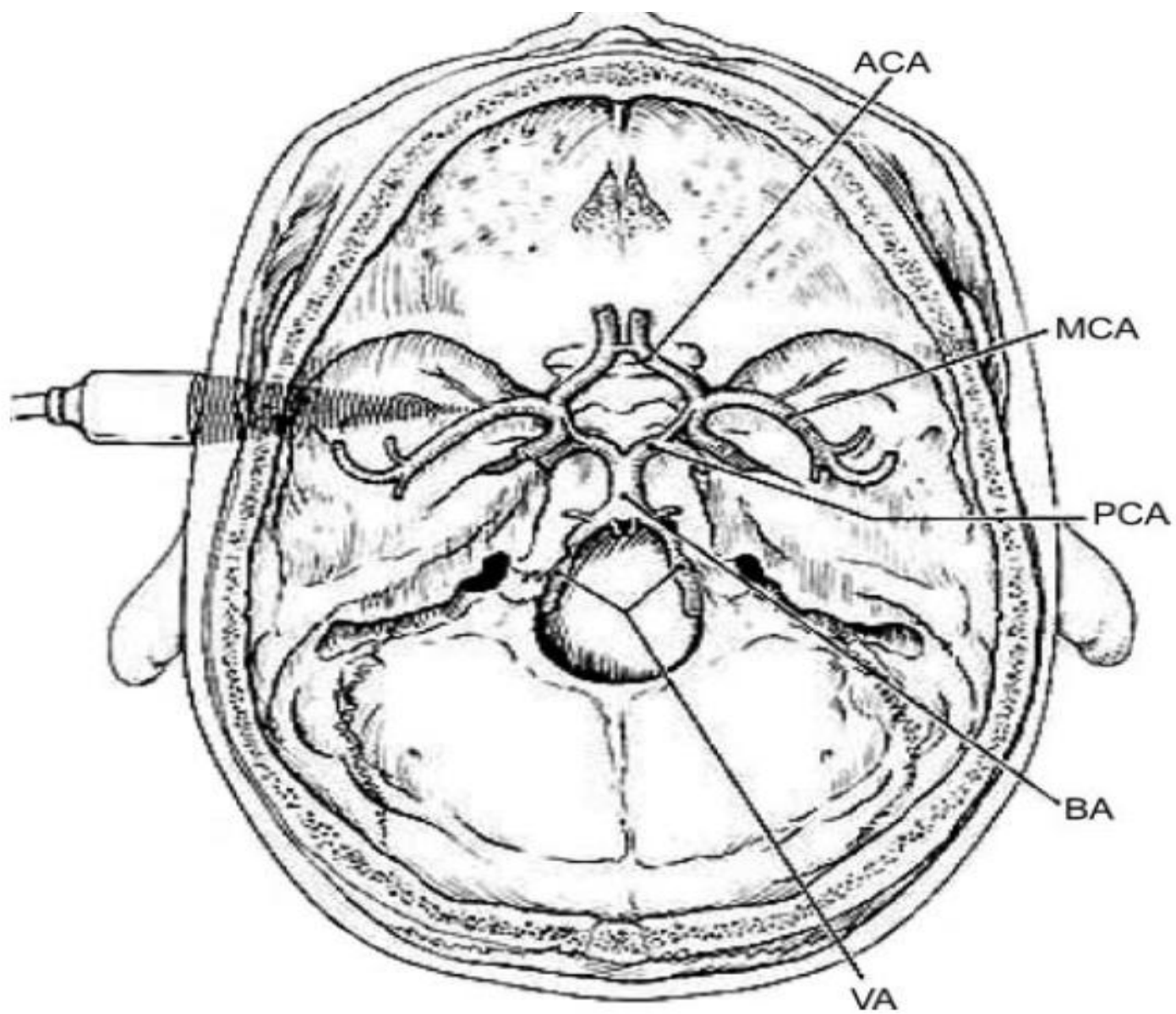


Trans Cranial Doppler in Cerebral Hemodynamics

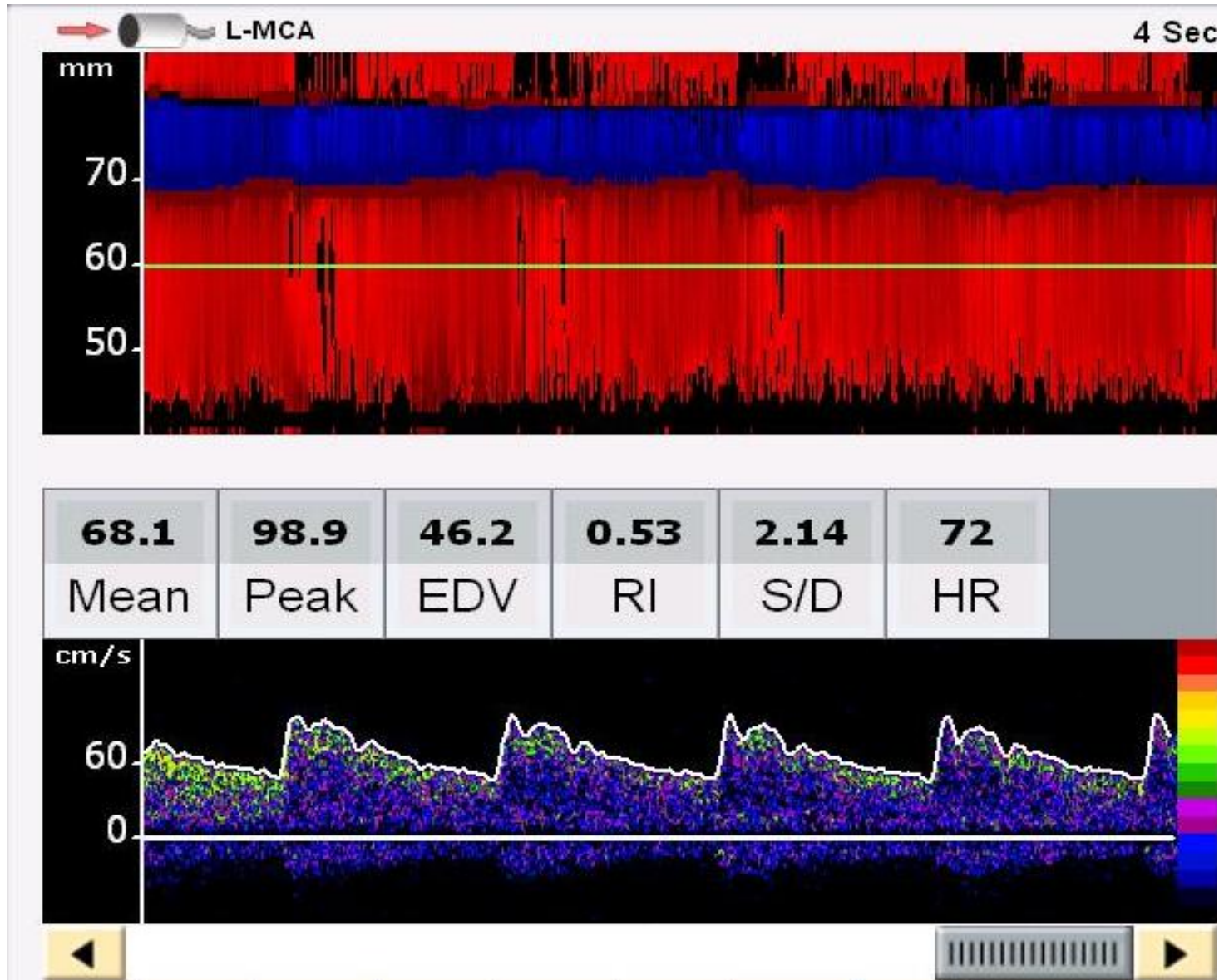
Lt Col Dr Ghulam Kawnayn
Combined Military Hospital Dhaka



- **Determining the downstream intracranial hemodynamic effects of carotid stenosis**
- **Identifying additional intracranial stenotic lesions**
- **Evaluating the vasomotor reactivity in the middle cerebral artery (MCA) ipsilateral to the stenosis for risk-stratification, especially in patients with asymptomatic carotid stenosis & intracranial stenosis**
- **Monitoring of SAH cases for vasospasm**

- **Monitoring spontaneous emboli in the distal intracranial branches for optimizing the antithrombotic therapy and risk-stratification**
- **Pre-operative planning for the requirement of a shunt placement during surgery to reduce perioperative cerebral hypoperfusion**
- **Continuous TCD monitoring during CEA may help in avoiding shower of embolization & cerebral hyperperfusion syndrome during CEA**

Normal M-mode and Doppler spectra



SEVERE STENOSIS



CareFusion

Patient Name

LEONG YING HOW

Patient ID

SJ7046318

Activated Protocol

N/A

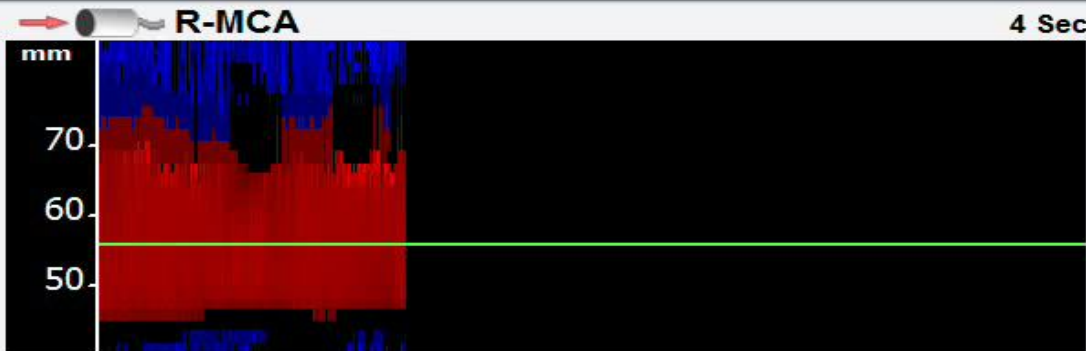
12/09/2013

10:12:00

Freeze

Invert

Mute



55.8	72.4	42.8	0.52	0.41	1.69	85
Mean	Peak	EDV	PI	RI	S/D	HR



Movie:

Save

Cancel

Exit

Patient

Setup

Generated by CareFusion SONARA System

Preview

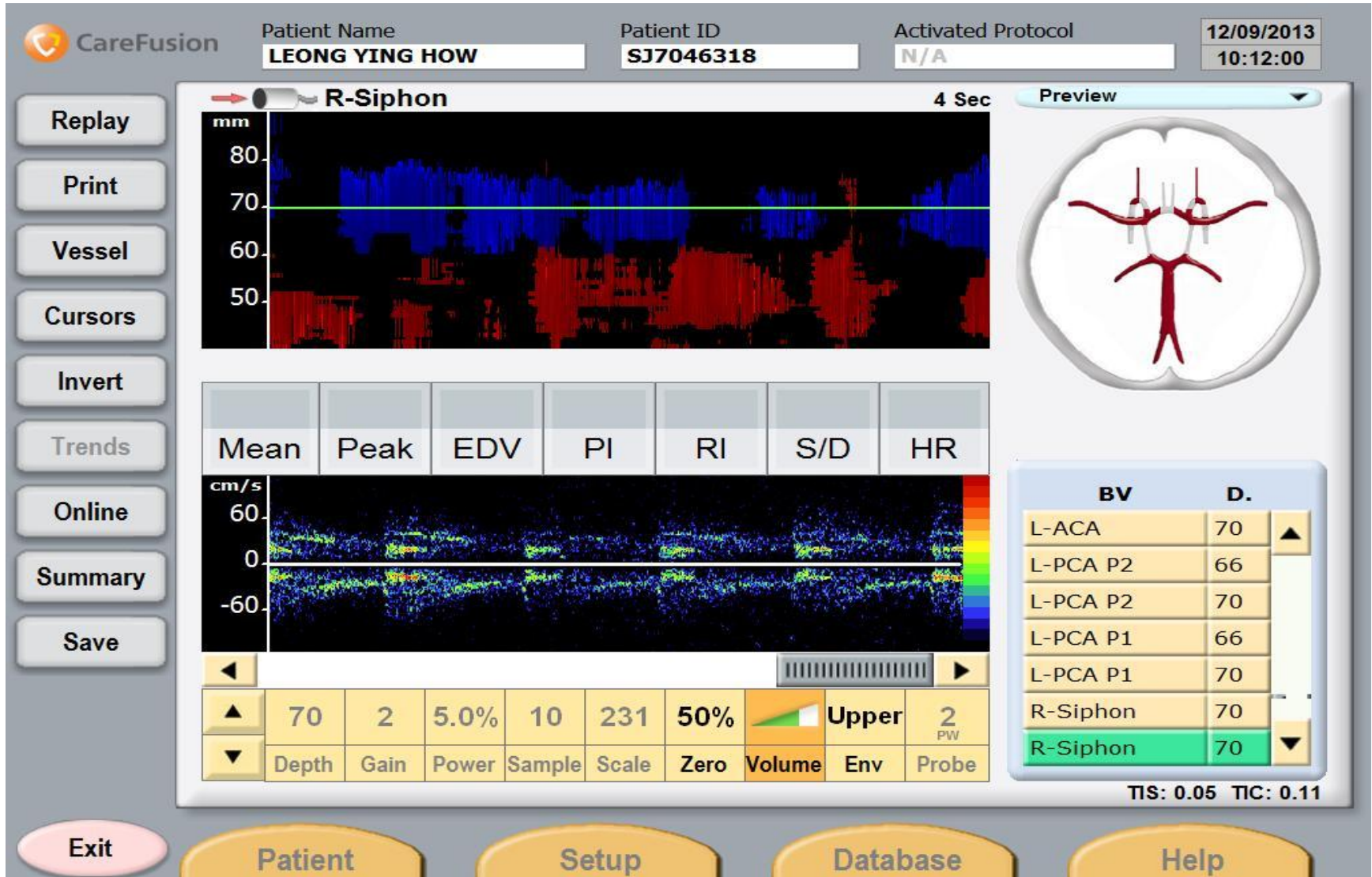


BV D.

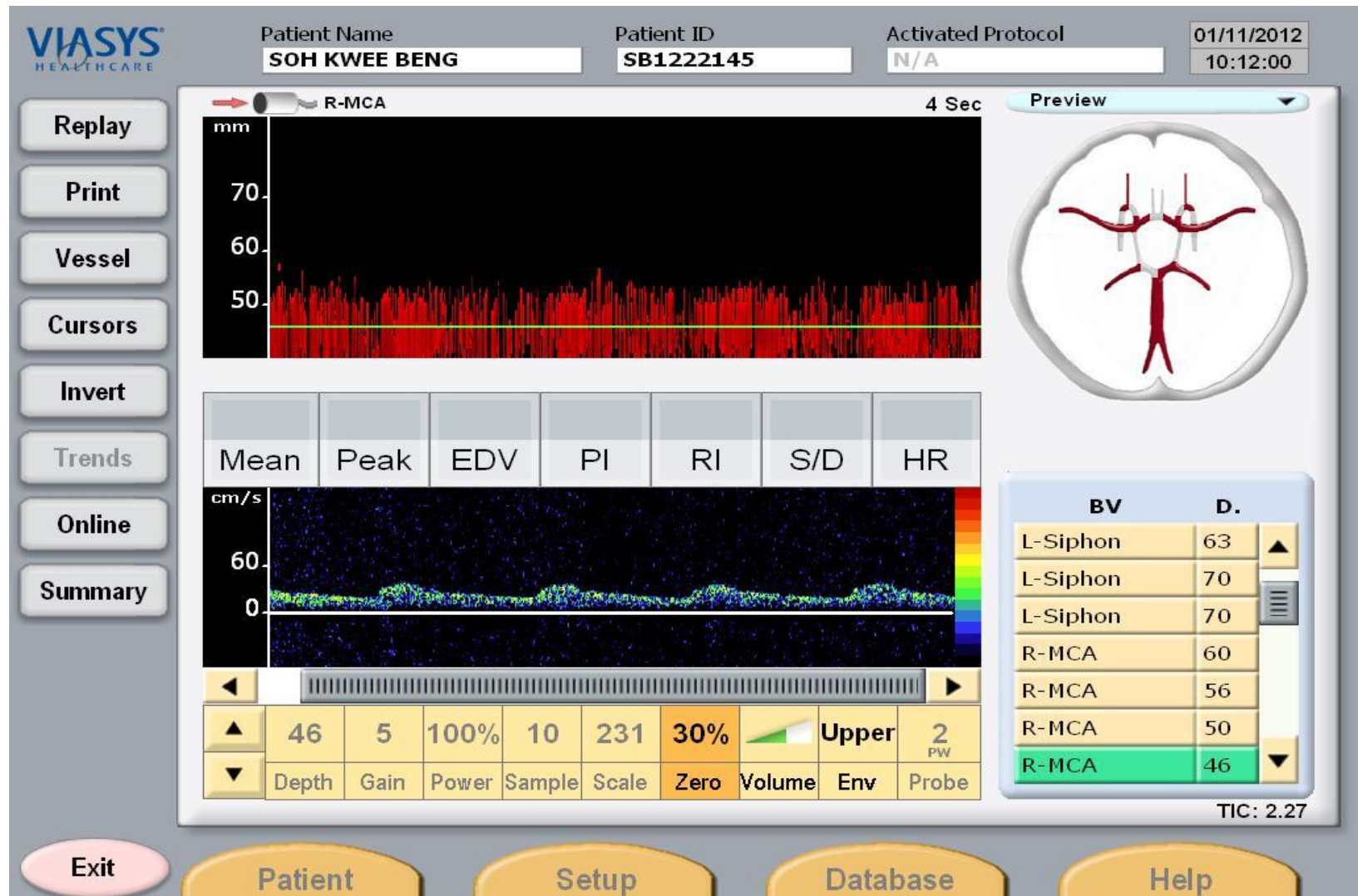
R-Siphon	60
R-Siphon	70
L-OA	46
L-Siphon	70
L-Siphon	70
R-MCA	60
R-MCA	56

TIC: 3.76

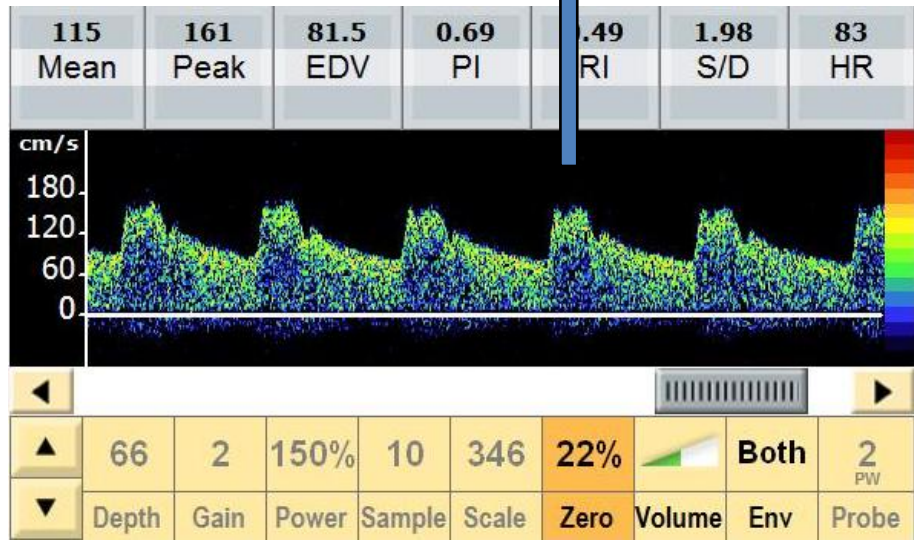
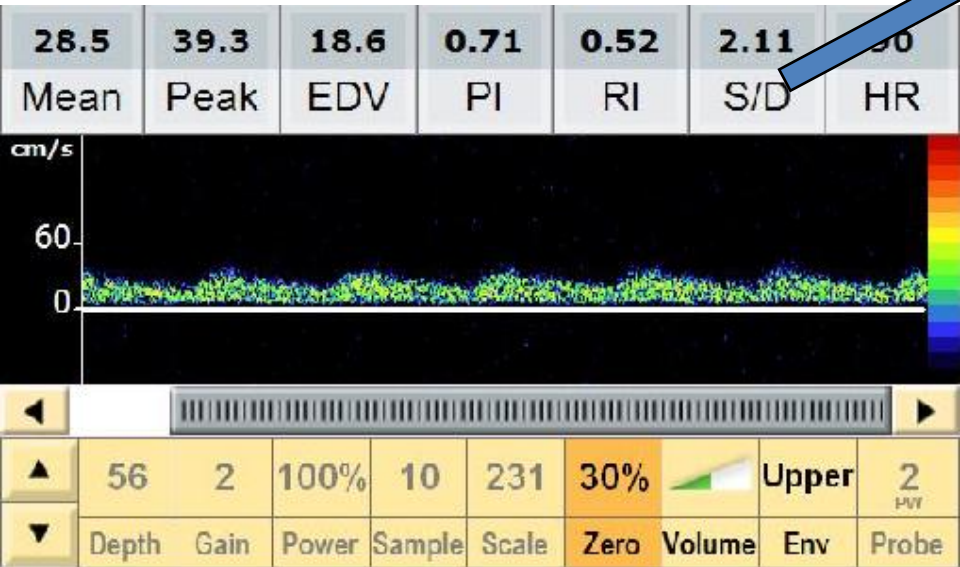
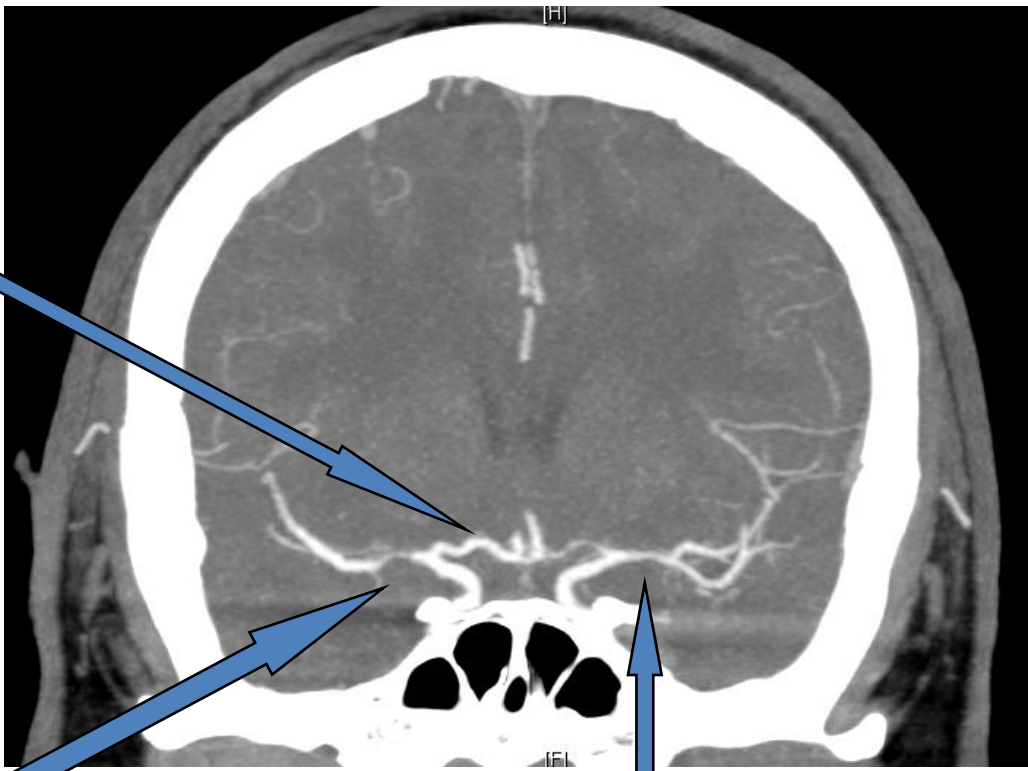
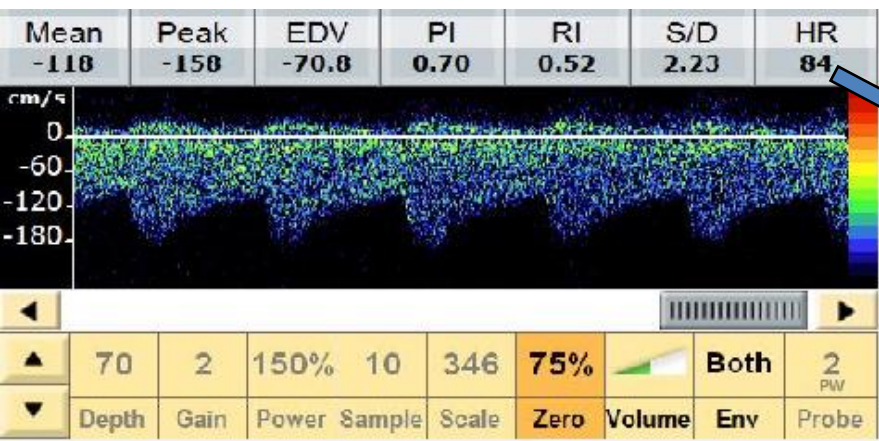
SEVERE STENOSIS



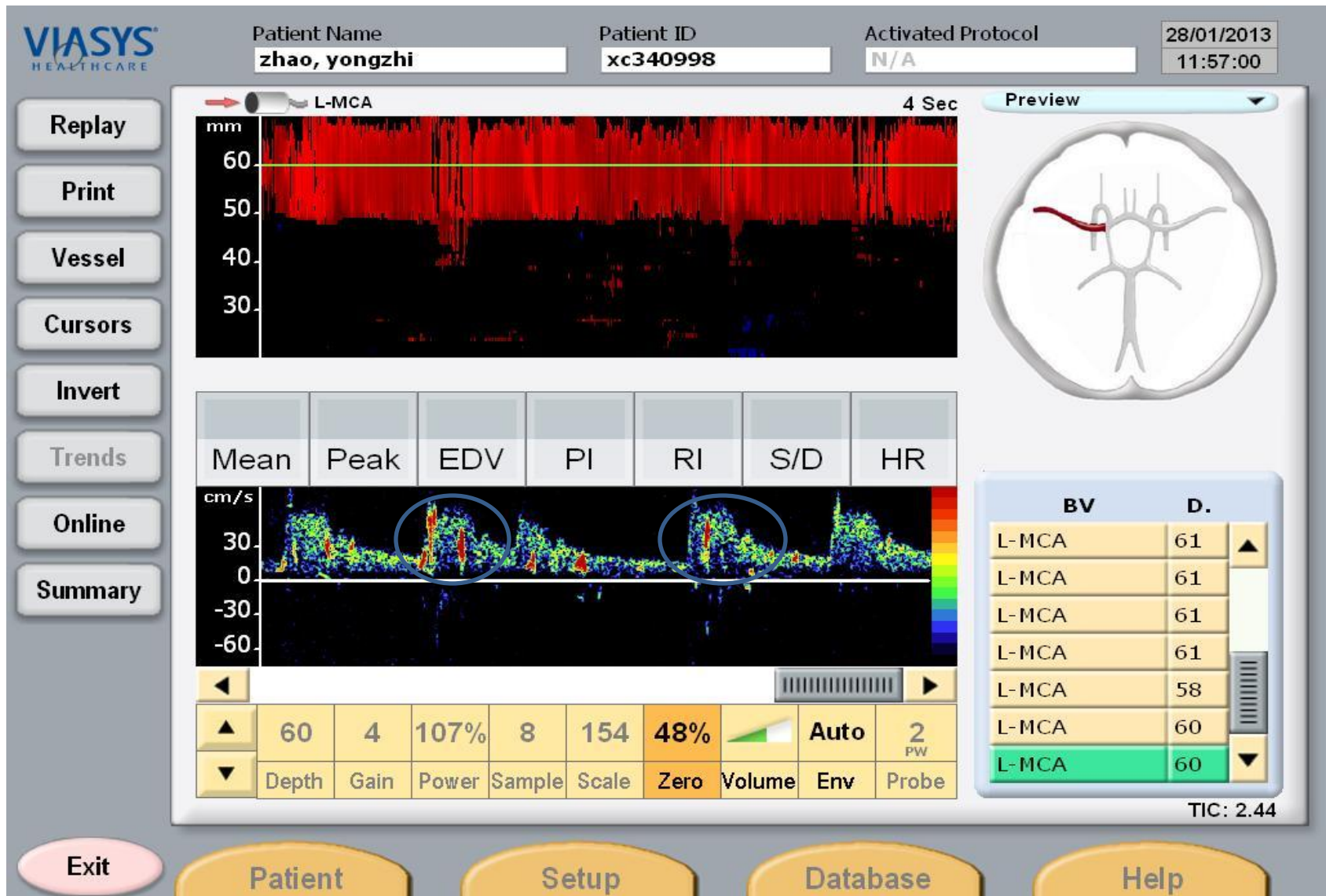
SEVER STENOSIS & DISTAL FLOW BLUNTING



BIL MCA STENOSIS



EMBOLIC SIGNALS



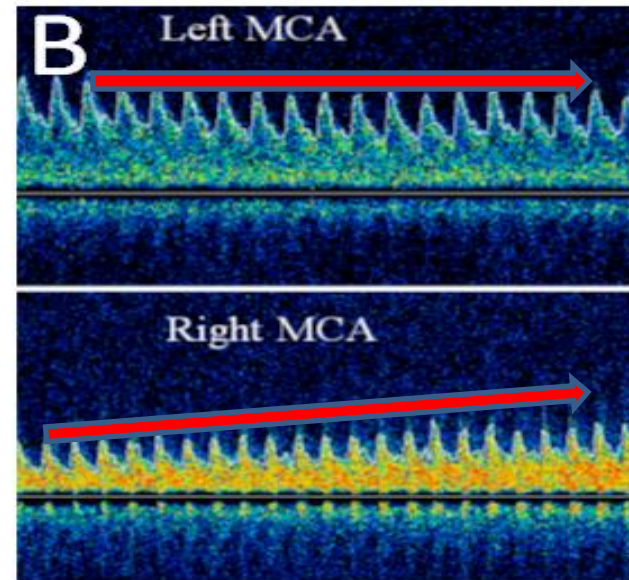
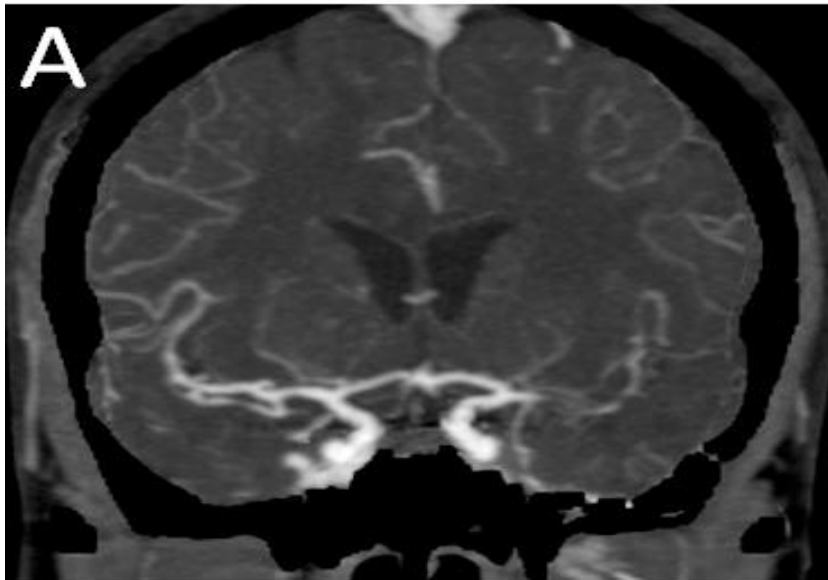
Stroke Risk Estimates for Asymptomatic Carotid Stenosis $\geq 70\%$

Overall Risk of Any Ischemic Stroke – 7.9% per observation year

- | | |
|--------------------|-------|
| 1. BHI ≥ 0.69 | 4.1% |
| 2. BHI < 0.69 | 13.9% |

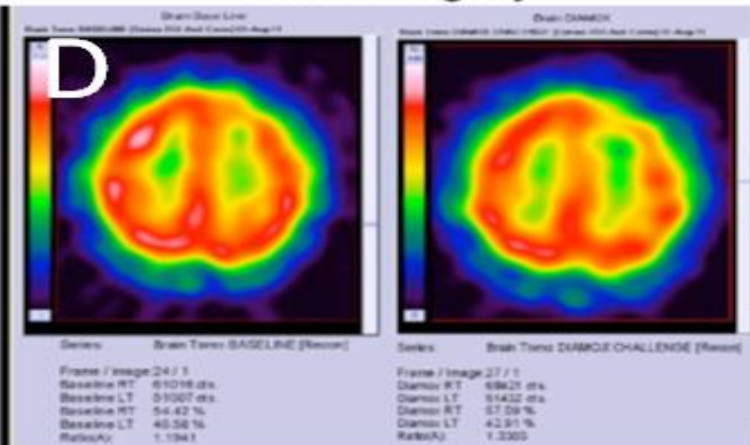
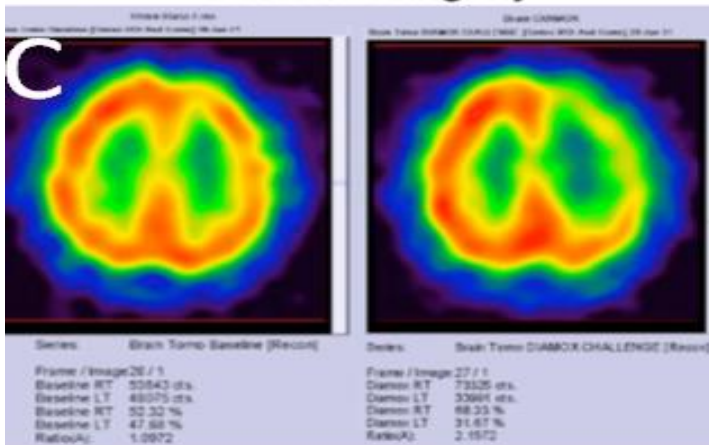
$$\text{BHI} = [\text{MFV}_{30\text{s}} - \text{MFV}_{\text{rest}} / \text{MFV}_{\text{rest}}] \times (100 / 30)$$

VMR BY TCD AND SPECT

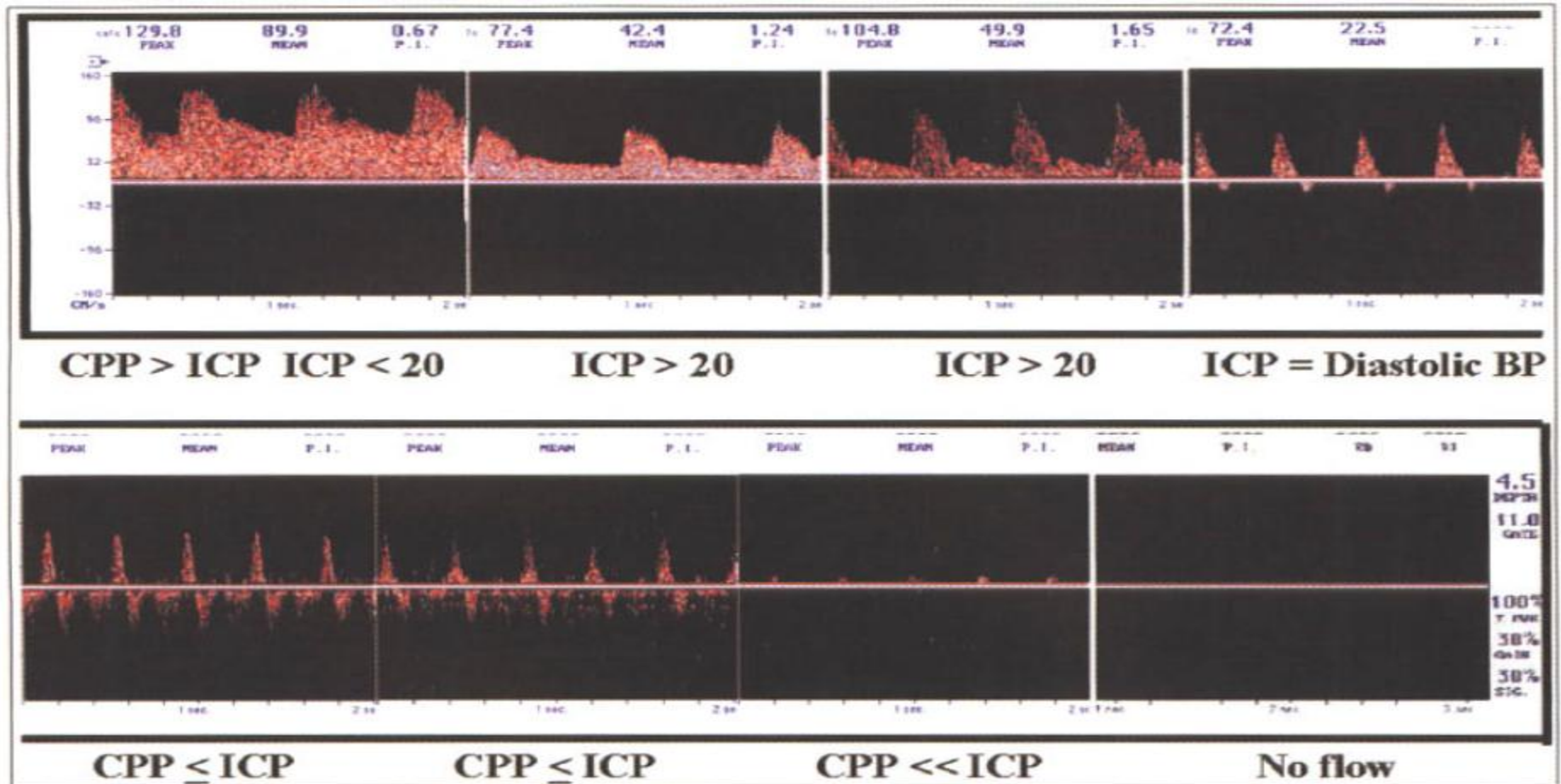


Before surgery

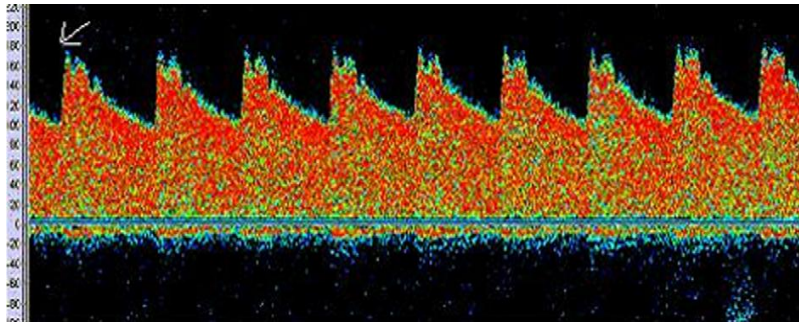
After surgery



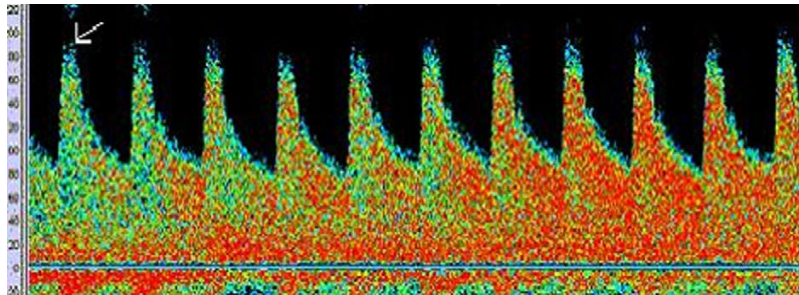
TRANSCRANIAL DOPPLER DERIVED PULSATILITY INDEX IS A RELIABLE MARKER FOR MONITORING INTRACRANIAL PRESSURE



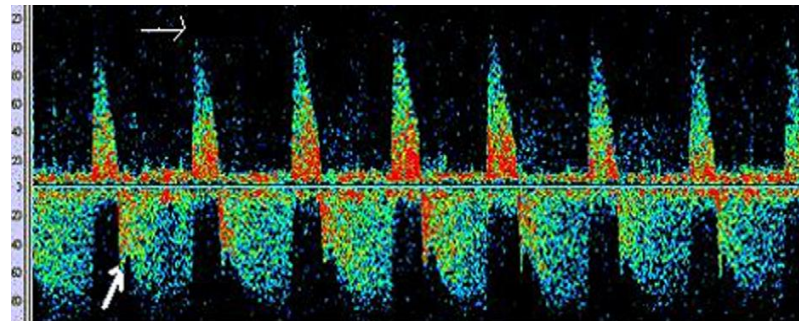
TCD-ICP relationship



Day-2----- ICP 13mm CSF

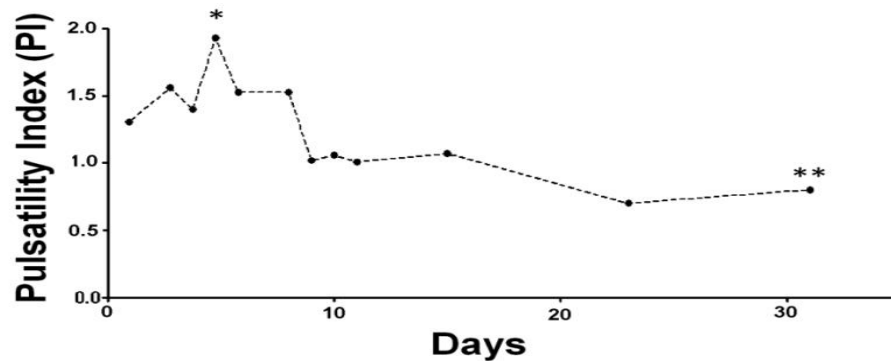


Day-4----- ICP 33cm CSF

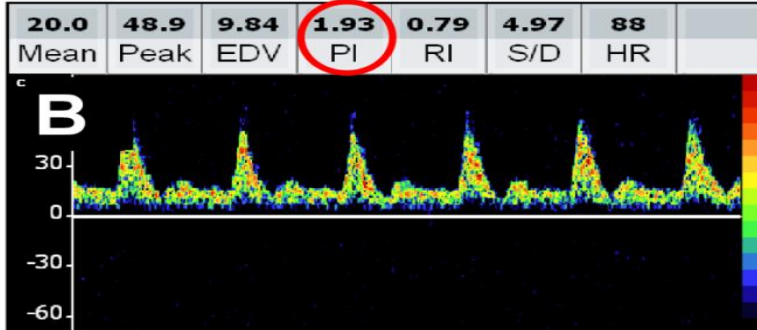


Day-6-----ICP 52cm CSF

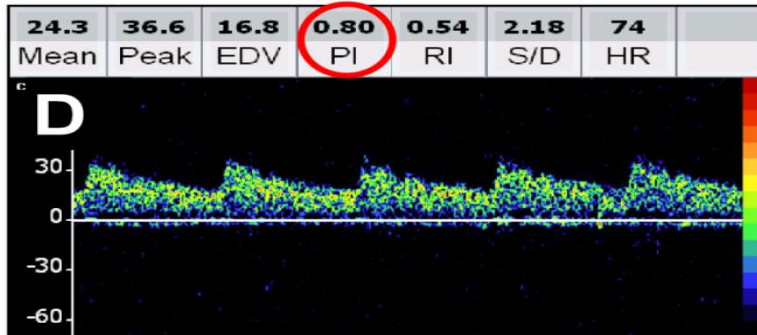
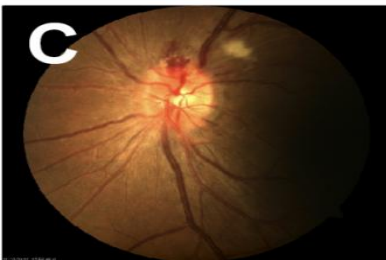
ABSOLUTE VALUES OF PI ARE NOT RELIABLE TO PREDICT ICP. HOWEVER, SERIAL ESTIMATIONS ARE RELIABLE TO MONITOR THE LONGITUDINAL CHANGES IN ICP.



Day 5 *



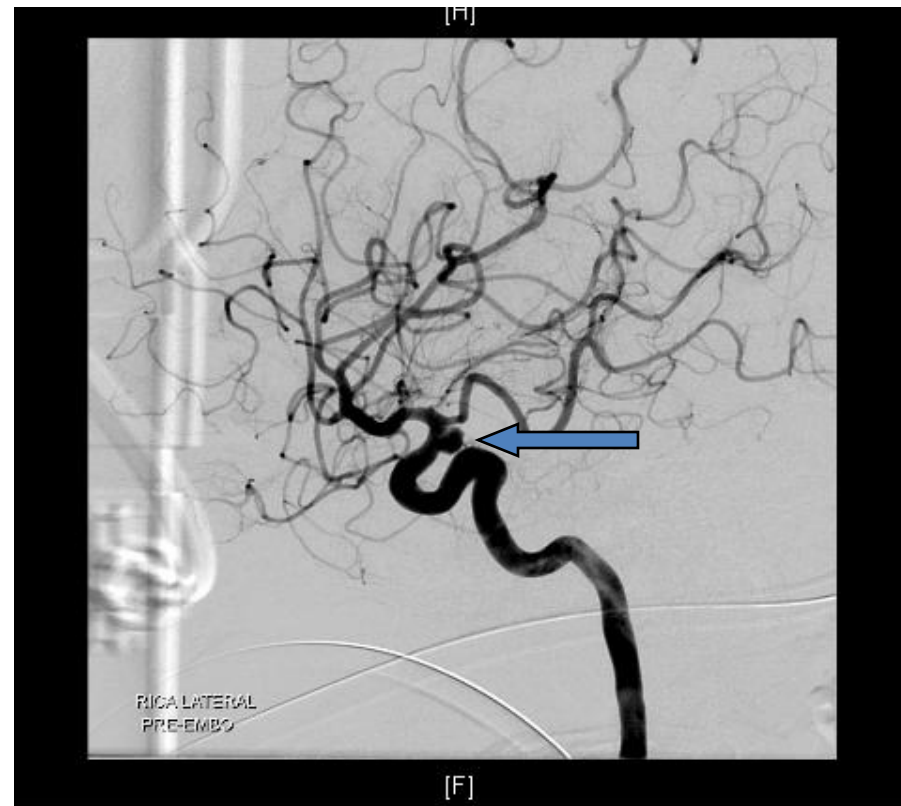
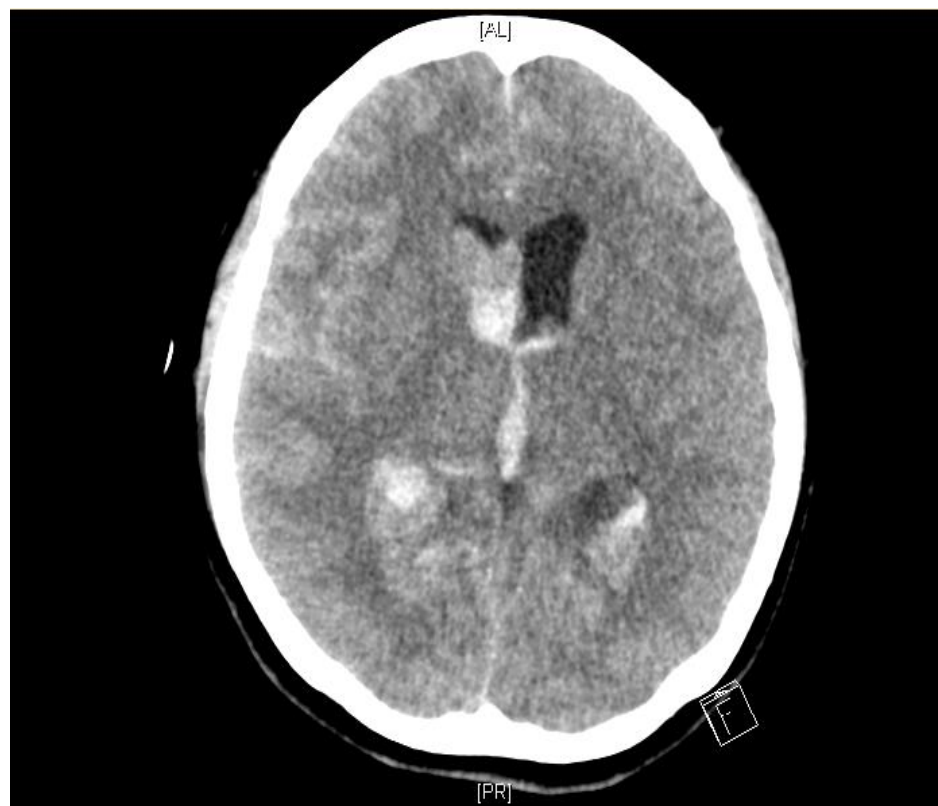
Day 31 **



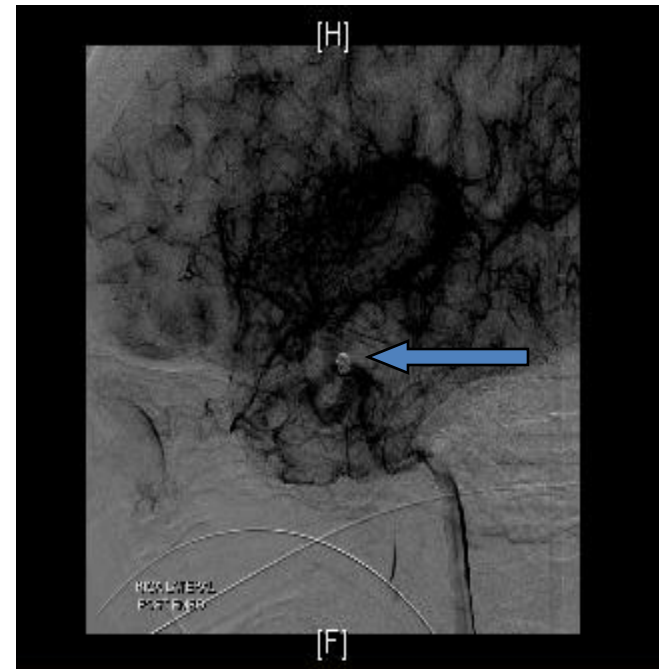
Vasospasm and TCD in SAH

- 42 years old Chinese Female
- Presented with h/o sudden severe headache followed by LOC
- GCS on admission was 9 (E4M5VT)
- CT Head: Extensive SAH with intraventricular extension
- DSA : aneurysm at the right internal carotid artery (ICA)

Non traumatic SAH secondary to aneurysm rupture



Embolisation of aneurysm with detachable coils



DAY 2

- Patient was extubated
- GCS – 14
- Daily TCD for assessment of vasospasm

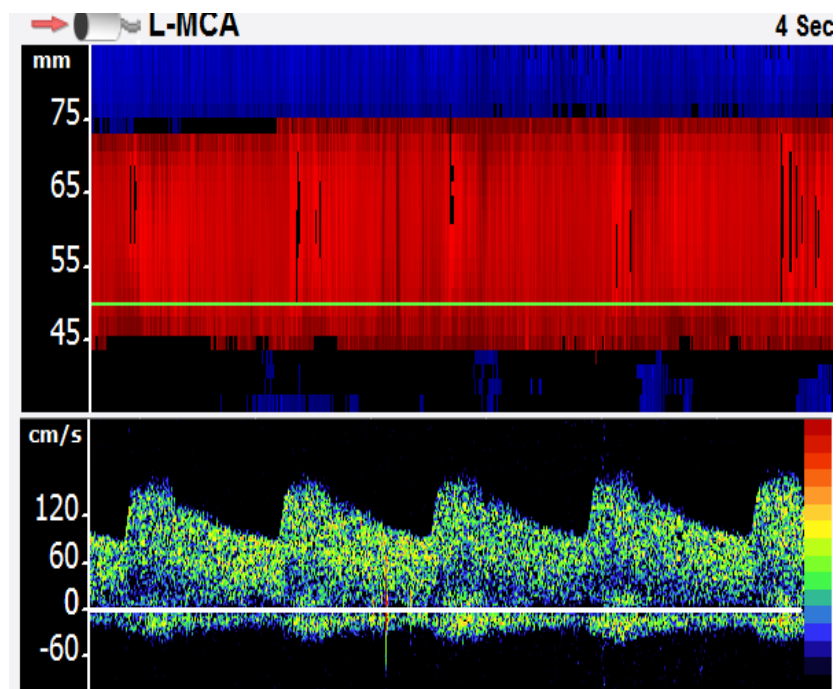
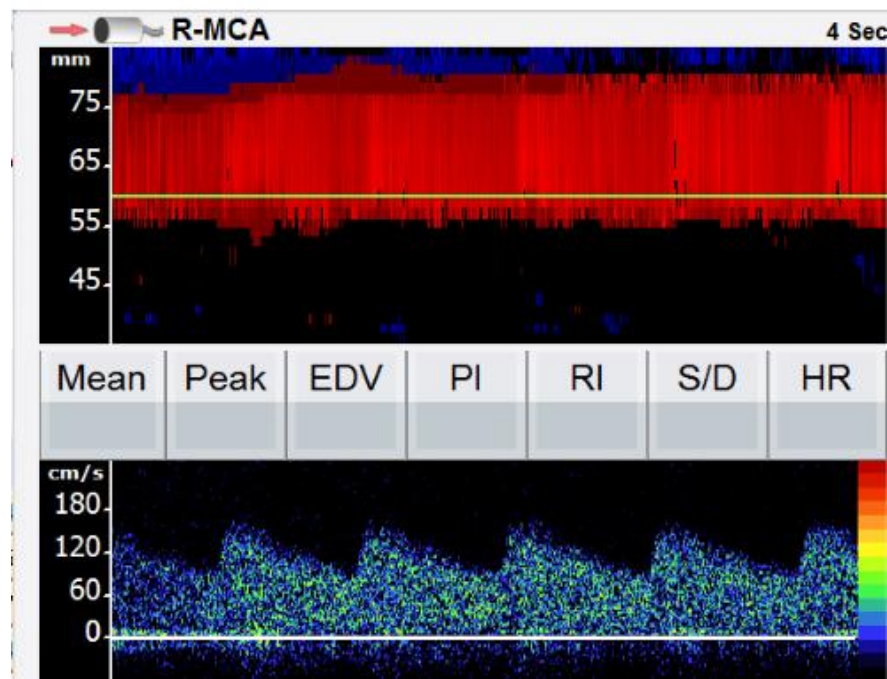
DAY 3

	Right	Left
ORBITAL	-	-
OA	Ante	Ante
ICA SIPHON	210/125	140/77
-		
TEMPORAL		
MCA M1	171/89 (MFV: 116)	187/90
MCA M2	69/33	188/108 (MFV: 134)
ACA A1	80/41	58/88
PCA P1	40/24	-
PCA P2	44/23	65/38
TICA	45/24 (MFV: 31)	56/29 (MFV: 38)

LGR

3-4

3-4



DAY 3

MFV(cm/sec)	Lindegaard Ratio	Interpretation
>80 - <120	<3	Normal
>80 - <120	3 - 4	Hyperemia + mild VS
>120 - < 180	3 - 4	mild VS + Hyperemia
>120 - < 180	5 - <6	Moderate VS
>180	6	Moderate to severe VS
>200	>6	Severe VS
>200	4 - 6	Moderate VS + Hyperemia
>200	3 - 4	Mild VS+ Hyperemia
>200	<3	Hyperemia

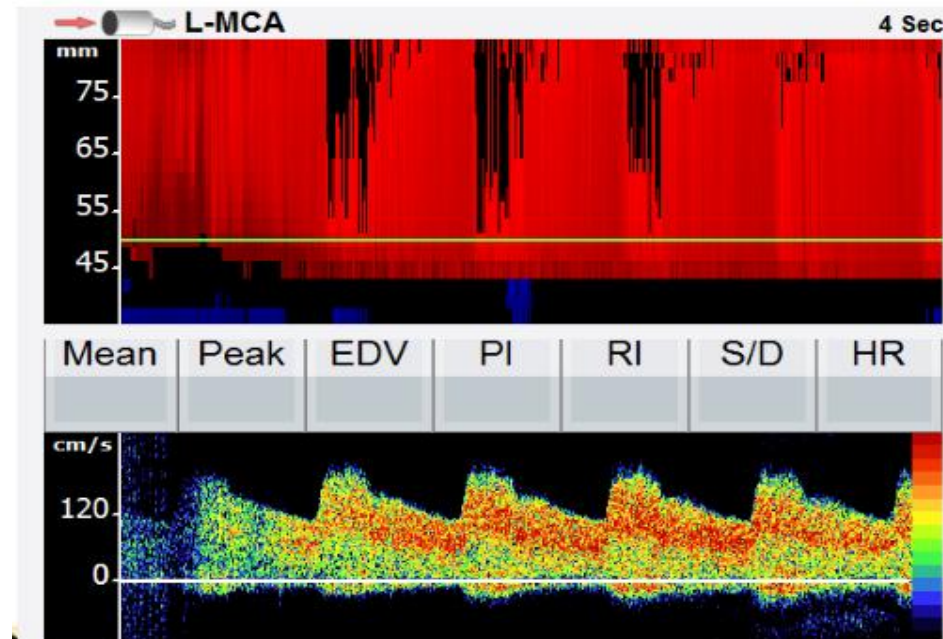
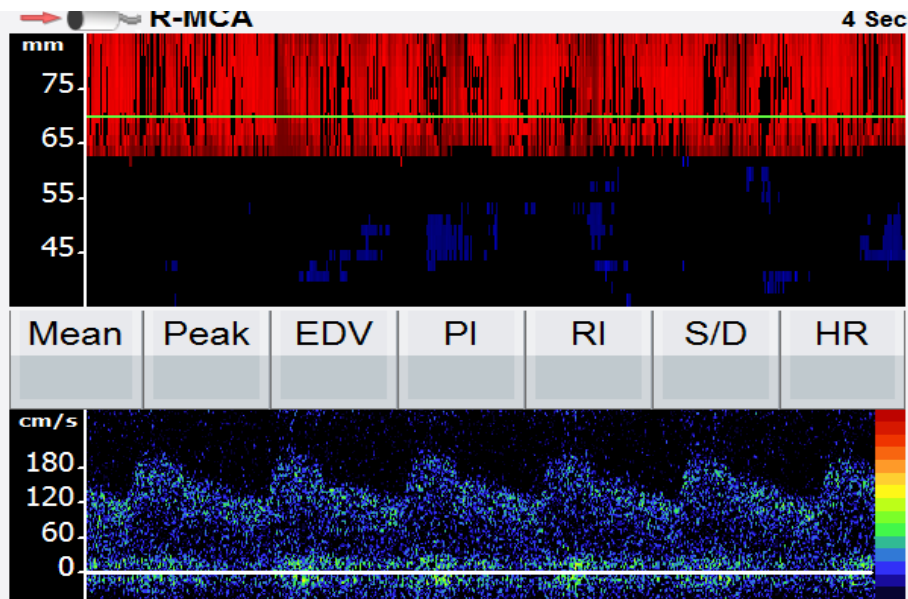
DAY 4

	Right	Left
-		
ORBITAL	-	-
OA	Ante	Ante
ICA SIPHON	164/88	134/76
-		
TEMPORAL		
MCA M1	218/130 (Bruit) (MFV:159)	203/122 (Bruit)
MCA M2	133/72	218/117 (Bruit) (MFV: 150)
ACA A1	124/66	198/126
PCA P1	37/18	44/22
PCA P2	27/09	41/28
TICA	44/21 (MFV: 28)	41/20 (MFV: 27)

LGR

5-6

5- 6



DAY 4

MFV(cm/sec)	Lindegaard Ratio	Interpretation
>80 - <120	<3	Normal
>80 - <120	3 - 4	Hyperemia + mild VS
>120 - < 180	3 - 4	mild VS + Hyperemia
>120 - < 180	5 - <6	Moderate VS
>180	6	Moderate to severe VS
>200	>6	Severe VS
>200	4 - 6	Moderate VS + Hyperemia
>200	3 - 4	Mild VS+ Hyperemia
>200	<3	Hyperemia

- General condition stable
- HHH therapy initiated

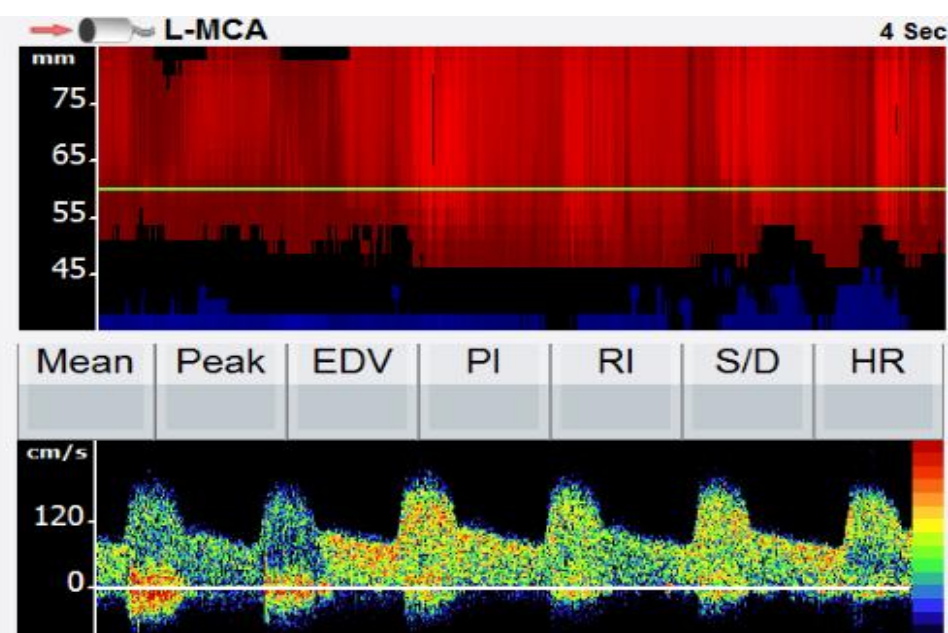
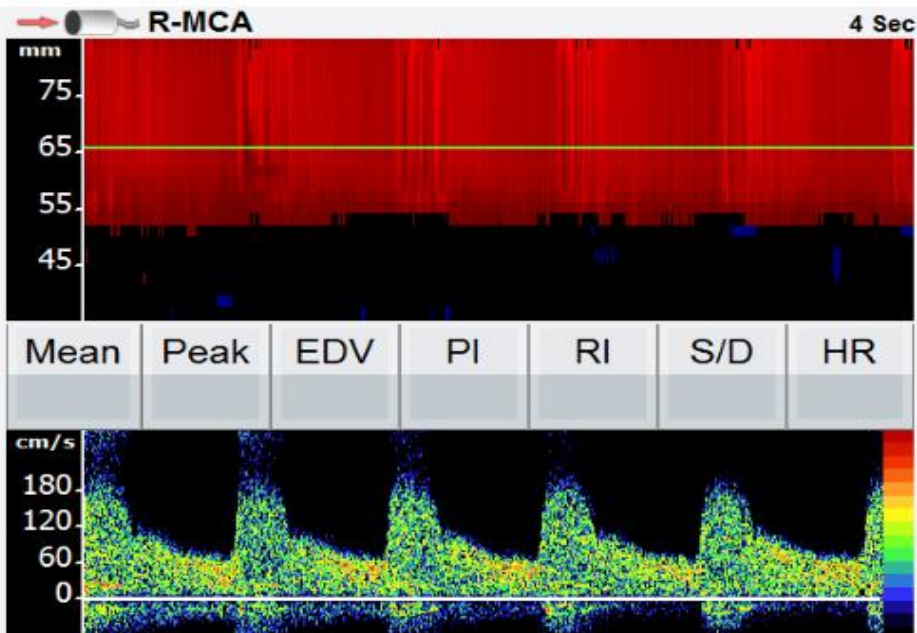
DAY 5

-	Right	Left
ORBITAL	-	-
OA	Ante	Ante
ICA SIPHON	232/84 (bruit)	150/60
-		
TEMPORAL		
MCA M1	220/74 (MFV = 122)	213/90 (MFV = 131)
MCA M2	157/59	170/72
ACA A1	124/34	218/85
PCA P1	40/12	-
PCA P2	33/11	45/17
TICA	26/08 (MFV = 14)	32/15 (MFV = 20)

LGR

>6

>6



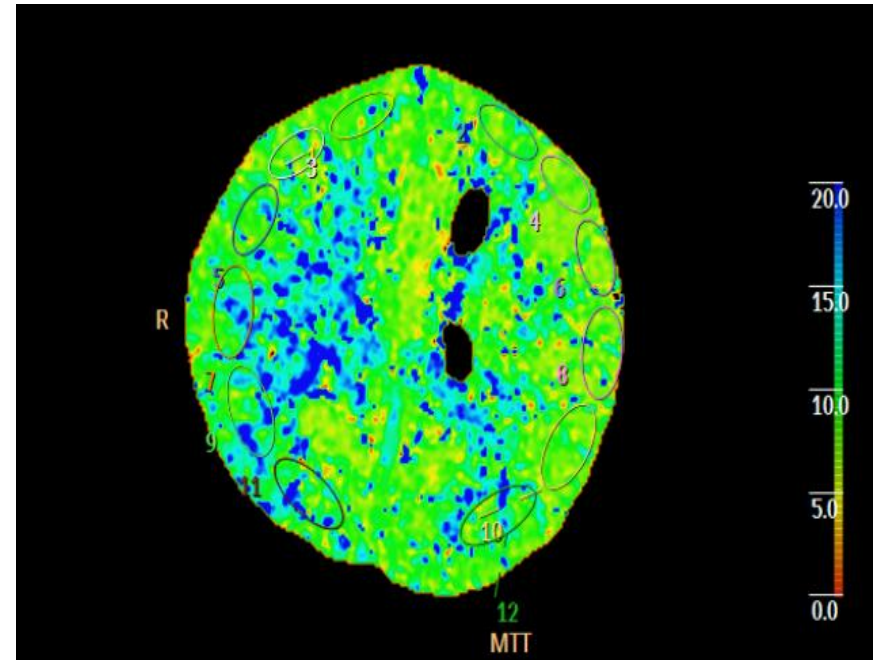
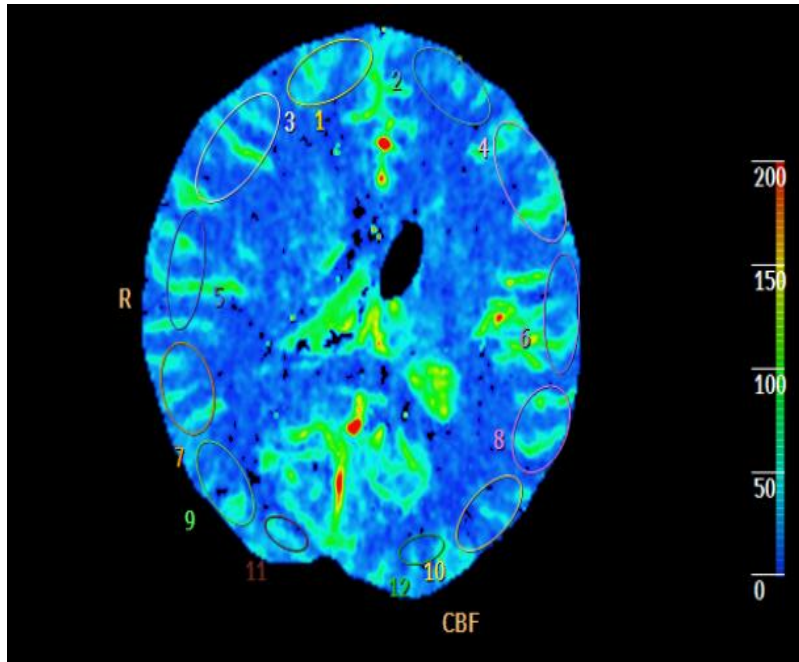
DAY 5

MFV(cm/sec)	Lindegaard Ratio	Interpretation
>80 - <120	<3	Normal
>80 - <120	3 - 4	Hyperemia + mild VS
>120 - < 180	3 - 4	mild VS + Hyperemia
>120 - < 180	5 - <6	Moderate VS
>180	6	Moderate to severe VS
>200	>6	Severe VS
>200	4 - 6	Moderate VS + Hyperemia
>200	3 - 4	Mild VS+ Hyperemia
>200	<3	Hyperemia

DAY 5

- General condition deteriorated
- GCS -11
- Evaluated with CTP
- HHH therapy continued

DAY 5



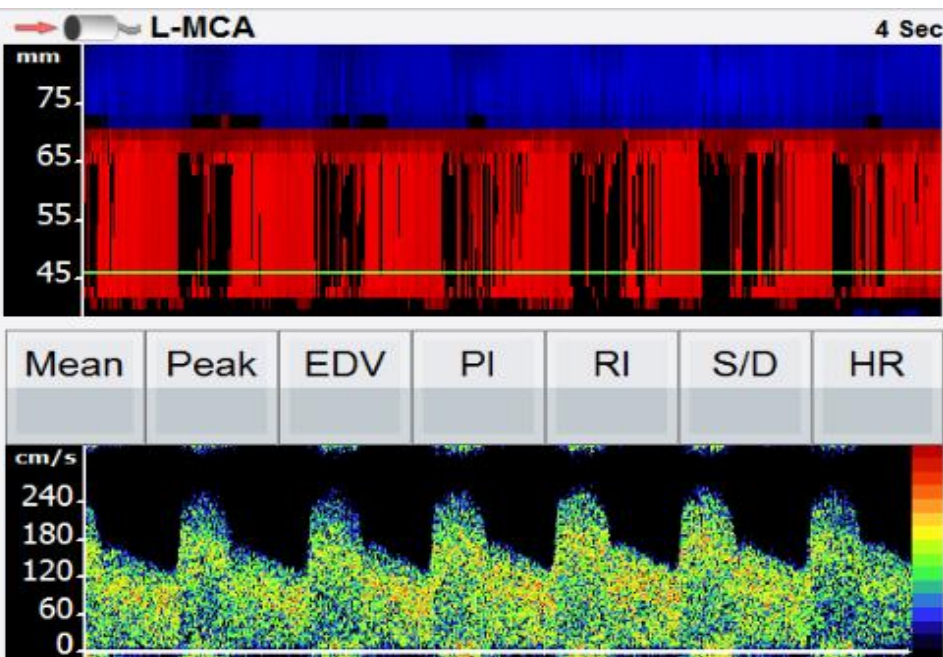
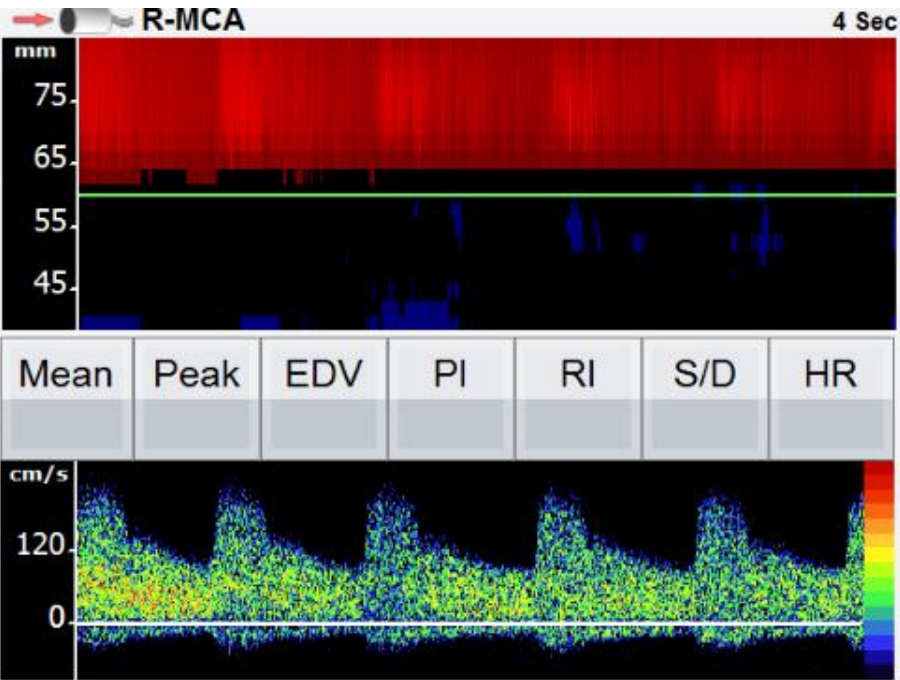
DAY 6

	Right	Left
ORBITAL	-	-
OA	Ante	Ante
ICA SIPHON	87/22	196/101
-		
TEMPORAL		
MCA M1	258/110 (MFV = 159)	262/134
MCA M2	62/25	264/137 (MFV = 180)
ACA A1	142/56	187/40
PCA P1	42/16	42/11
PCA P2	40/19	37/15
TICA	51/19 (MFV = 29)	51/20 (MFV = 30)

LGR

5 -6

6

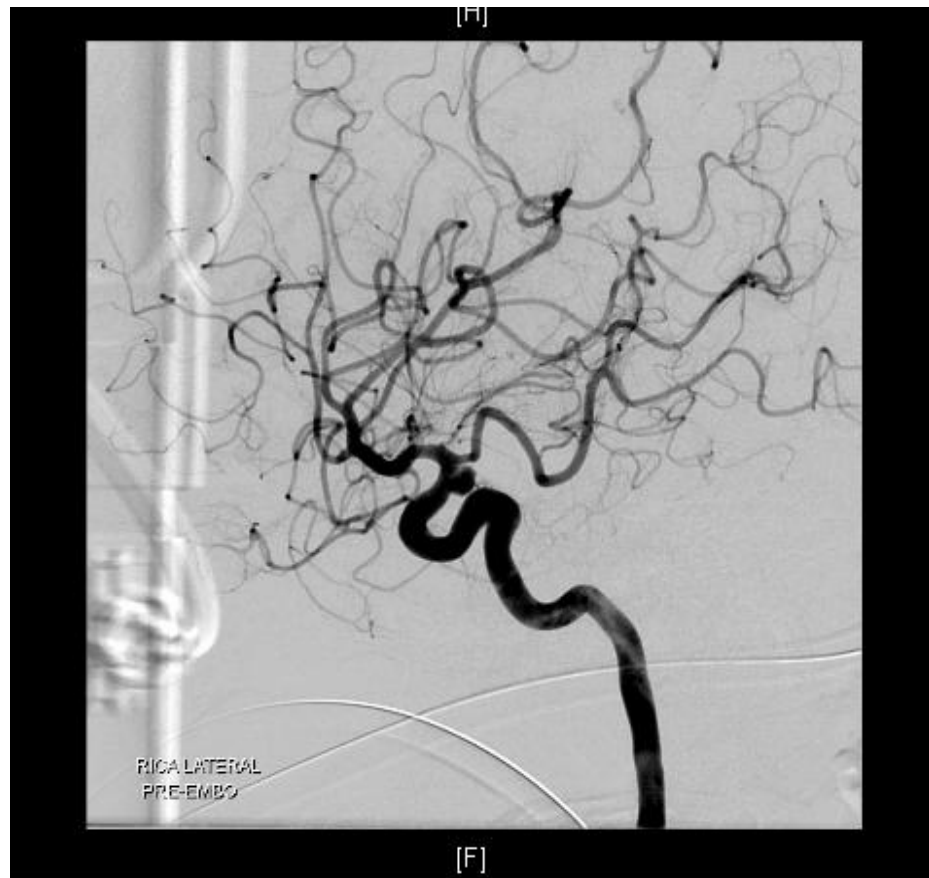


DAY 6

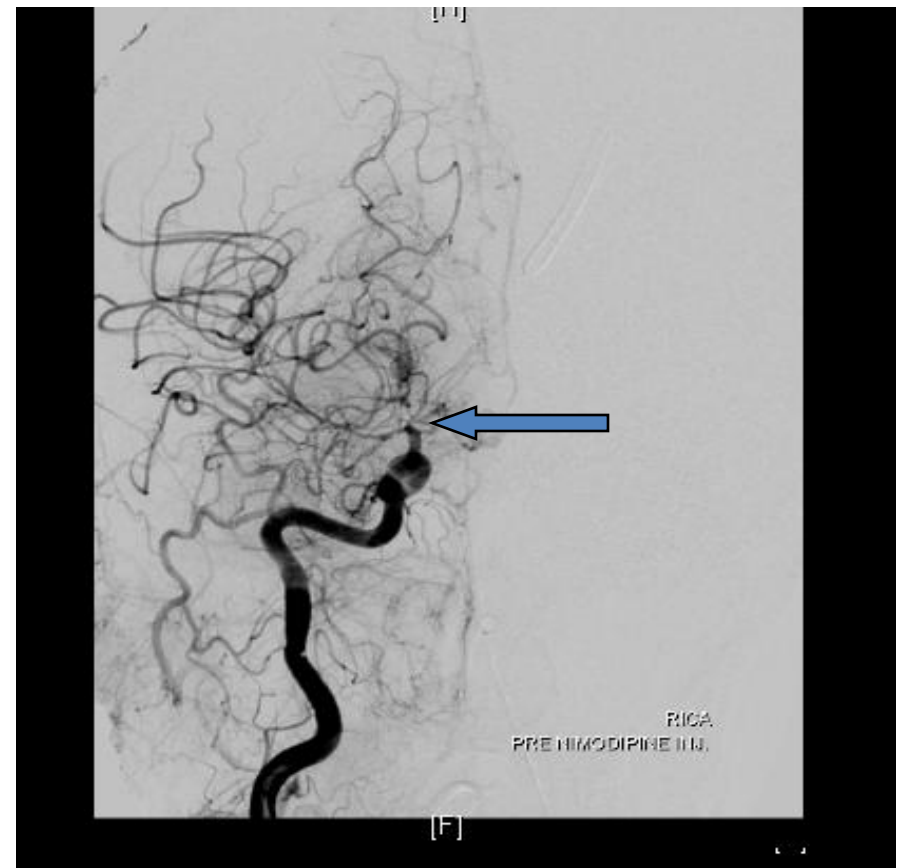
MFV(cm/sec)	Lindegaard Ratio	Interpretation
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>180	6	Moderate to severe VS
>200	>6	Severe VS
>200	4 - 6	Moderate VS + Hyperemia
>200	3 - 4	Mild VS+ Hyperemia
>200	<3	Hyperemia

RMCA

DAY 1



DAY 6



LMCA

DAY 1



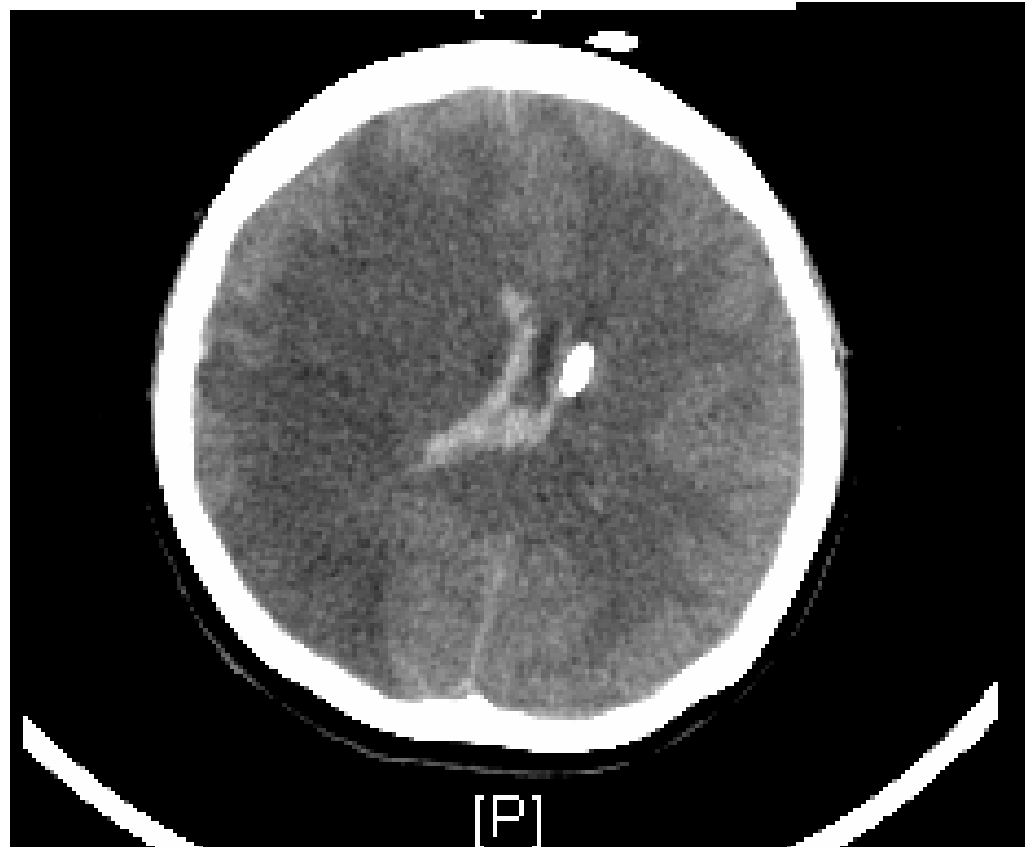
DAY 6



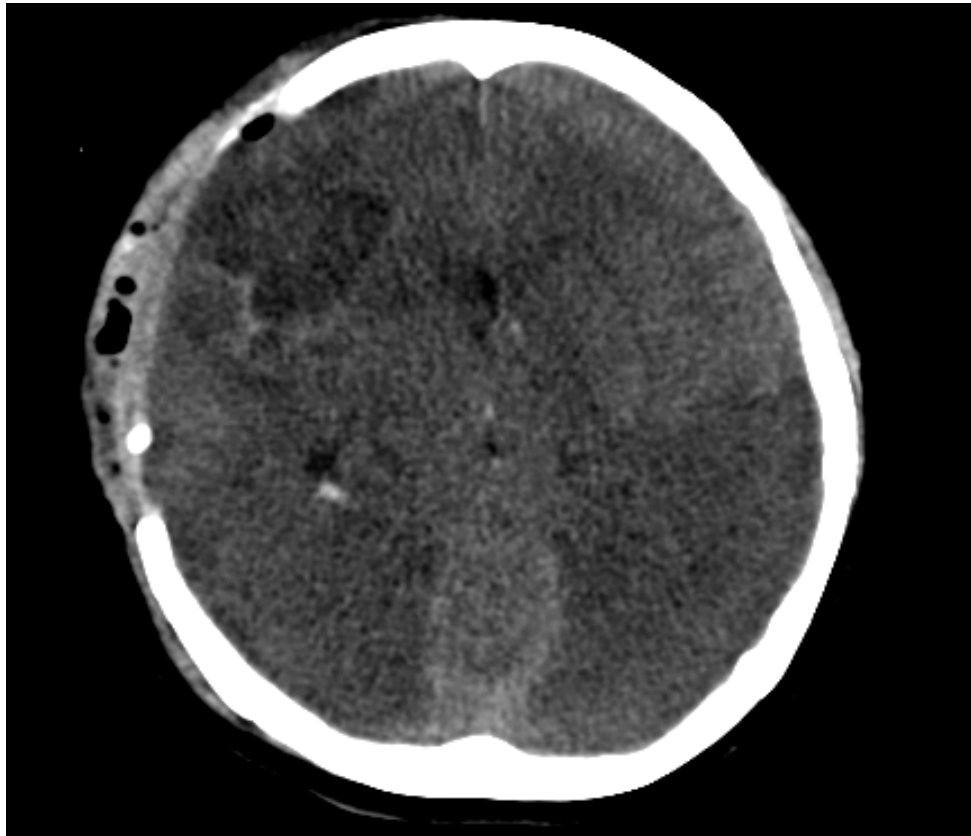
DAY 6

- Intraarterial Nimodipine injected

DAY 7



DAY 7

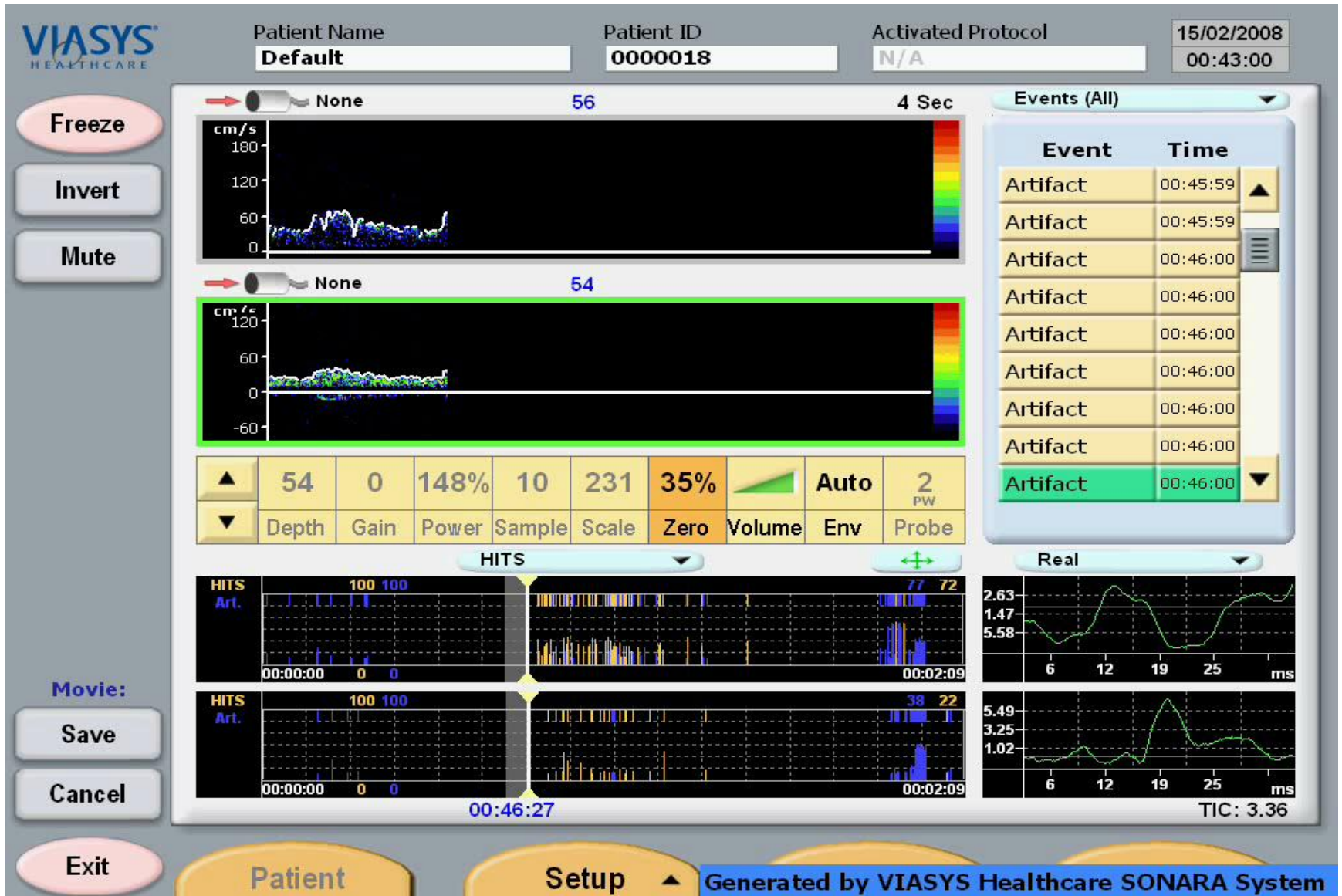


PFO DETECTION

**PFO IS ONE OF THE IMPORTANT ETIOLOGY OF STROKE
PLATYPNOEA-ORTHODEXIA IS WELL KNOWN IN PFO.**

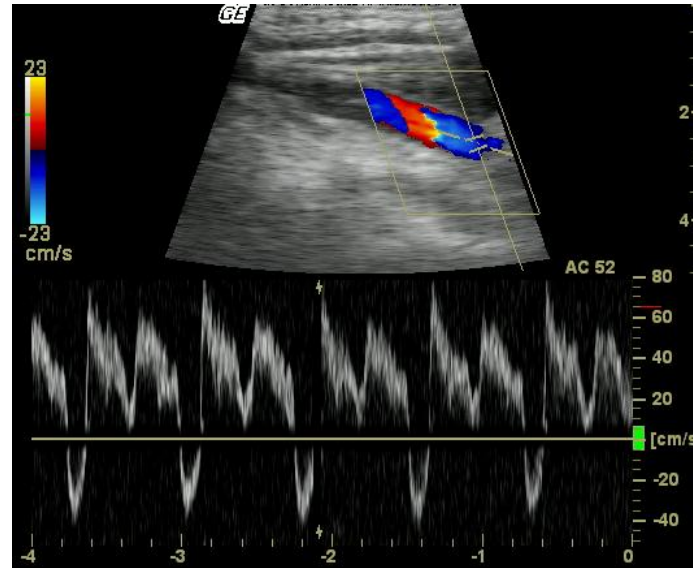
**TCD HAS 100% SENSITIVITY IN DETECTING A
SHUNT AT BEDSIDE**

PFO DETECTION

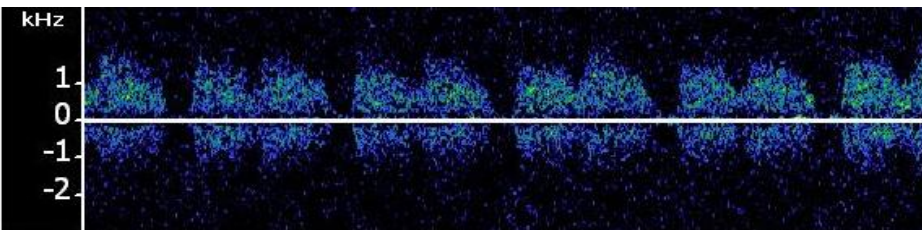


HELPING CARDIOLOGISTS

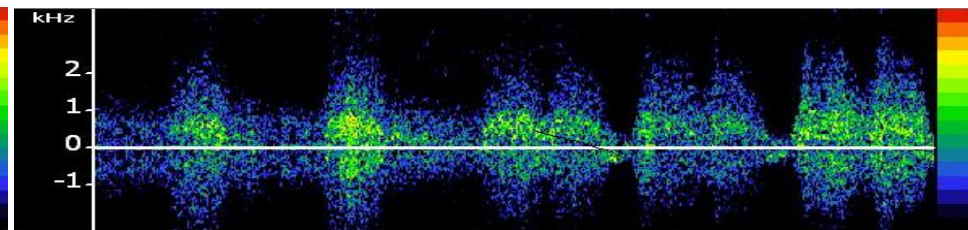
62 years old man, put on IABP for intractable angina, planned CABG next day. Within 30 minutes of starting IABP, he is noted to become drowsy.



Duplex-consistent with IABP



TCD with IABP on



IABP turned off transiently

Brain perfusion occurs mainly during diastole. An absent diastolic flow in cerebral arteries is an unwanted finding.

Minor change in IABP settings and pulling the IABP balloon by about 2cm in aorta were sufficient to make a significant change in cerebral perfusion and improved patient's level of consciousness.

TCD in pre-operative assessment

Neurologists are often consulted to assess the operative risk in patients with severe carotid/intracranial stenosis.

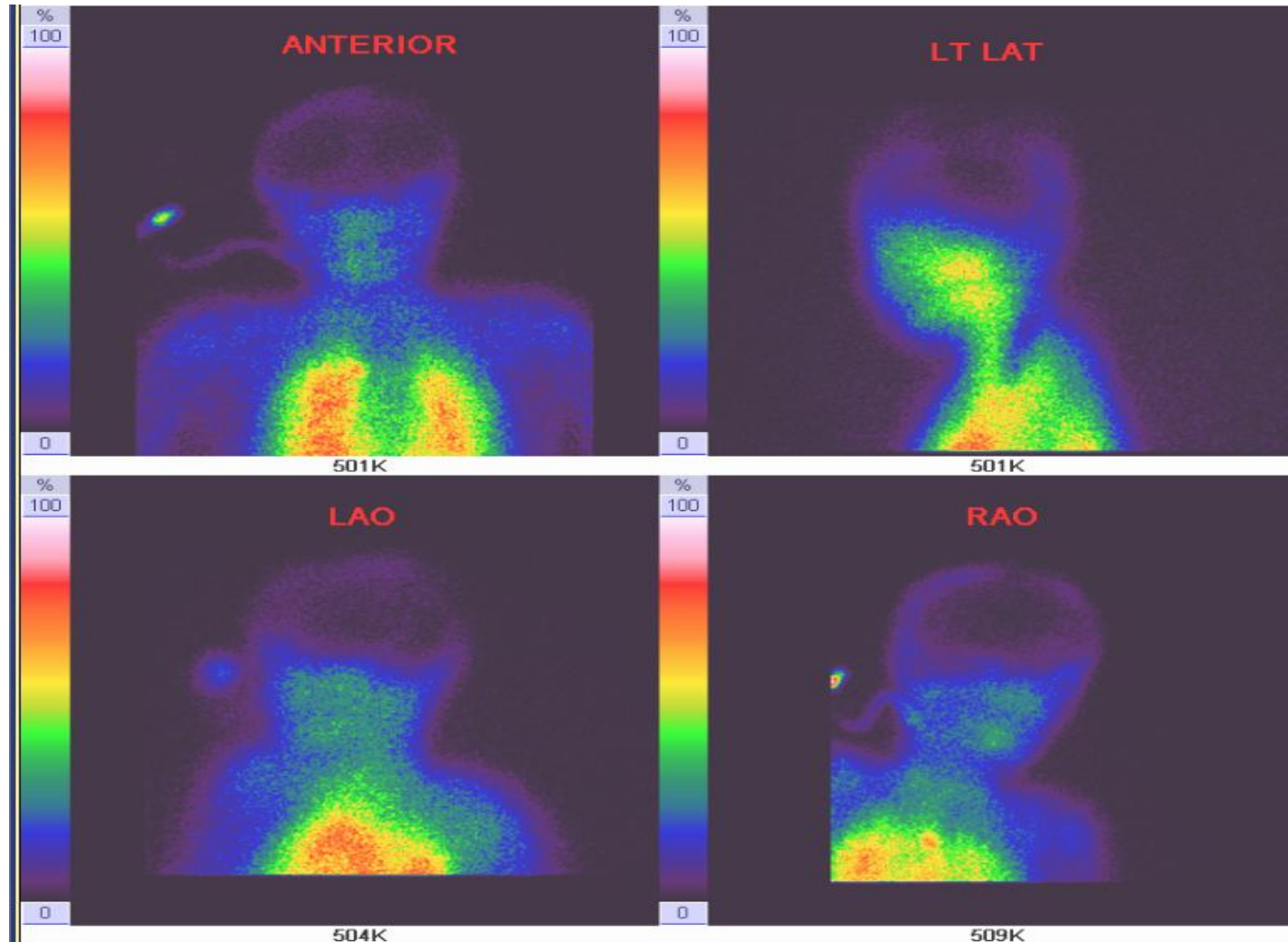
TCD can help in making an intelligent 'guess'.

TCD and brain death

Bed-side clinical diagnosis (brainstem function testing) is the gold standard for diagnosing brain death.

Many tests (DSA, EEG, TCD, SPECT etc) are used to assist in the confirmation (all are considered supplementary).

Brain death on HMPAO-SPECT (no metabolic activity in the brain)



TCD and brain death

