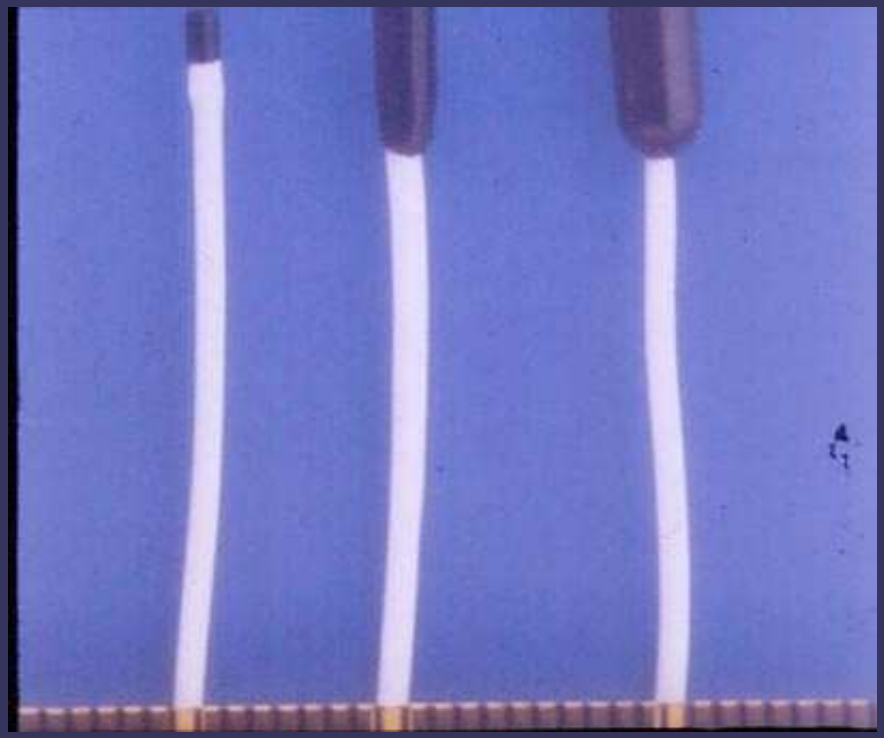
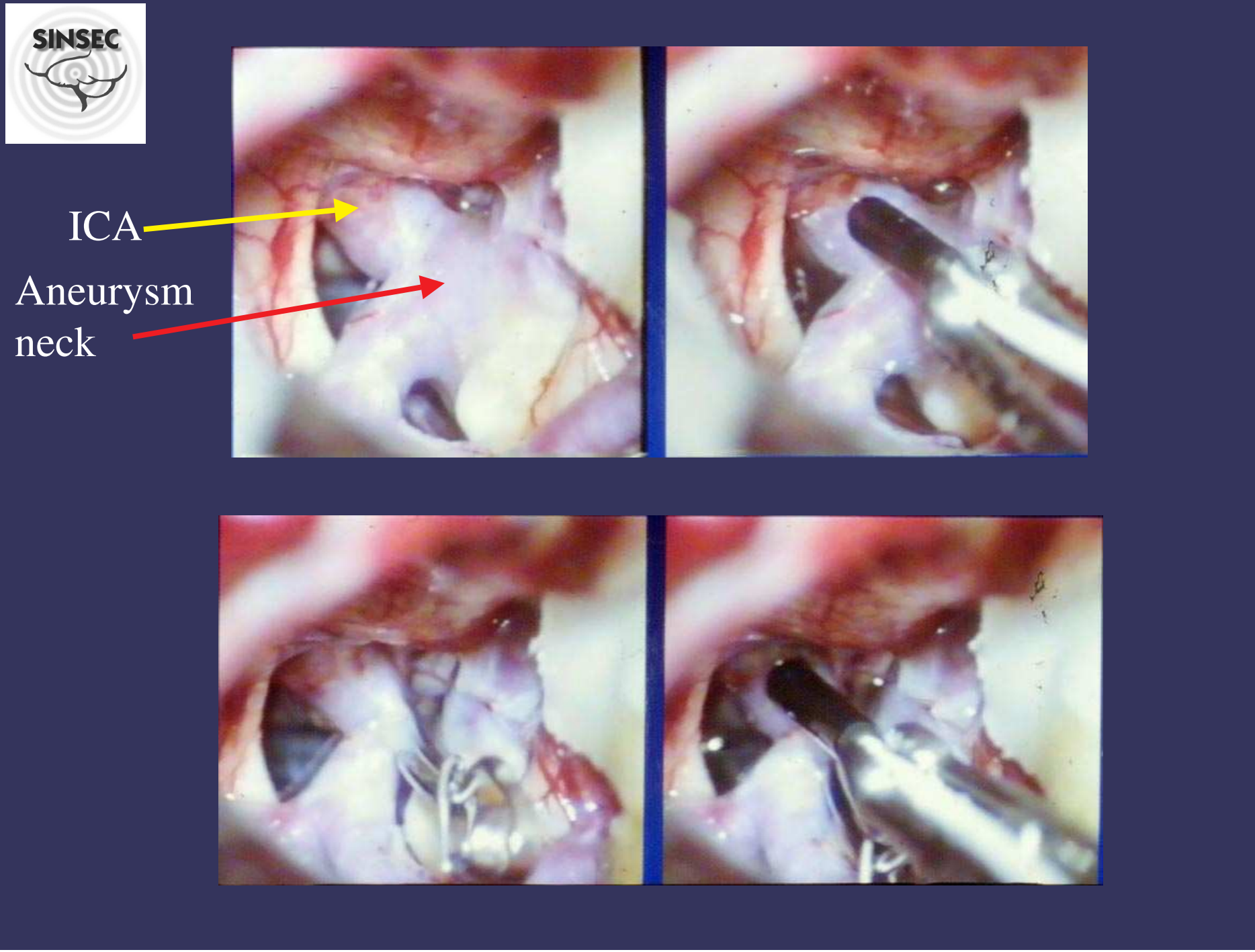
1st Residential Training Course of the ESNCH
Bertinoro (Italy) - September 7-12, 2008

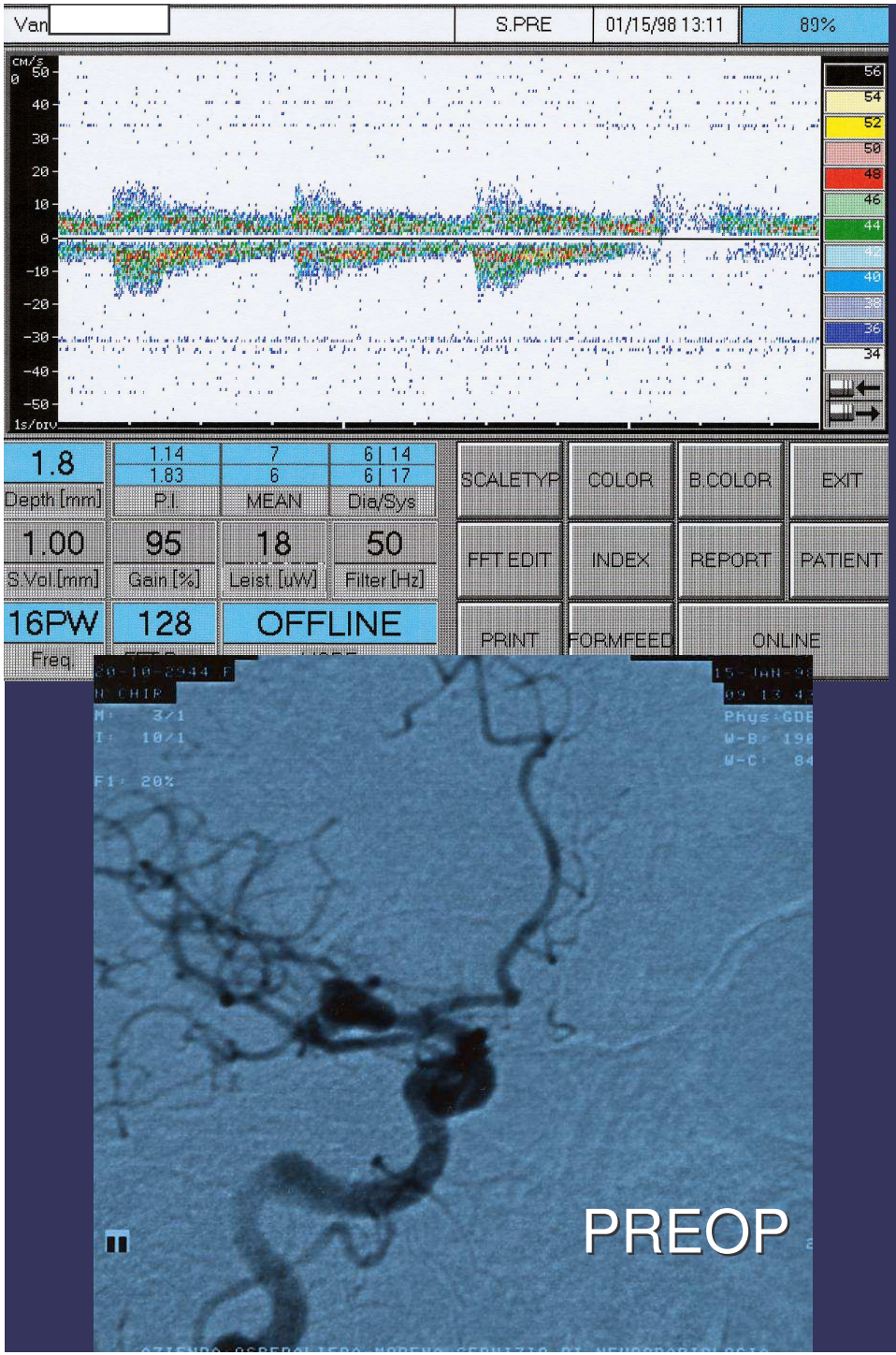
9:00-9:30 TCD monitoring in vascular surgery (P. Limoni)

MicroDoppler 16 (20) MHz



- CerebralAneurysm
- EC-IC Bypass
- Endarterectomy
- Spinal vascular malformations
- Endoscopic transsphenoid route for pituitary


SINSEC
ICA
Aneurysm
neck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S.PRE
01/15/98 13:11
89%
CM/S
1s/DIV
1.8
Depth [mm]
1.14
1.83
P.I.
7
6
MEAN
6 | 14
6 | 17
Dia/Sys
SCALETYP
COLOR
B.COLOR
EXIT
1.00
S.Vol.[mm]
95
Gain [%]
18
Leist. [uW]
50
Filter [Hz]
FFT EDIT
INDEX
REPORT
PATIENT
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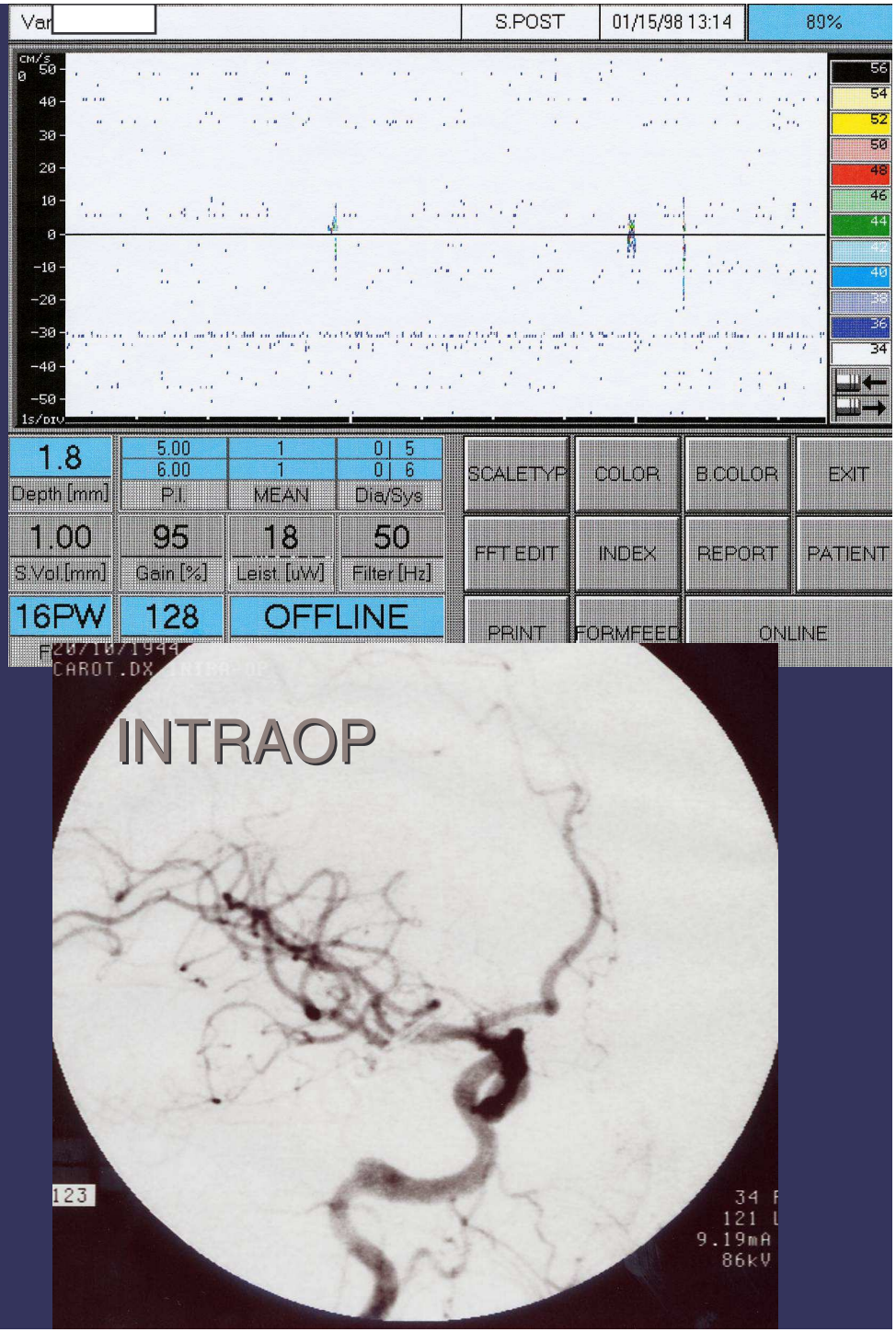
Freq.
128
OFFLINE
PRINT
FORMFEED
ONLINE
PREOP


Var
S.POST
01/15/98 13:14
89%
CM/S
1s/DIV
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Depth [mm]
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6.00
P.I.
1
1
MEAN
0 | 5
0 | 6
Dia/Sys
SCALETYP
COLOR
B.COLOR
EXIT
1.00
S.Vol.[mm]
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Gain [%]
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REPORT
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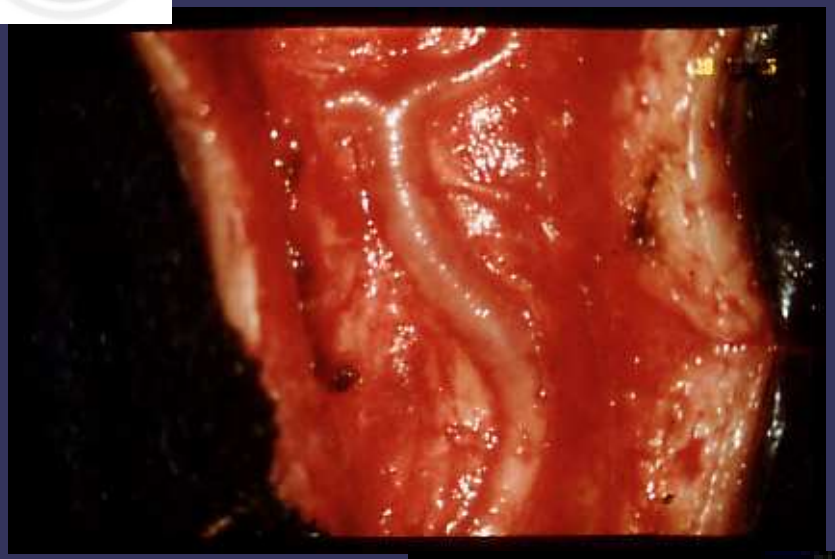
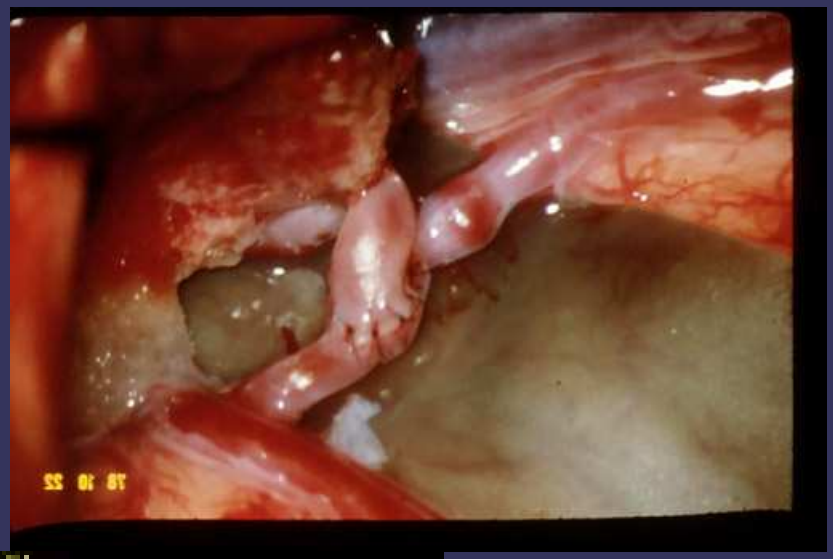
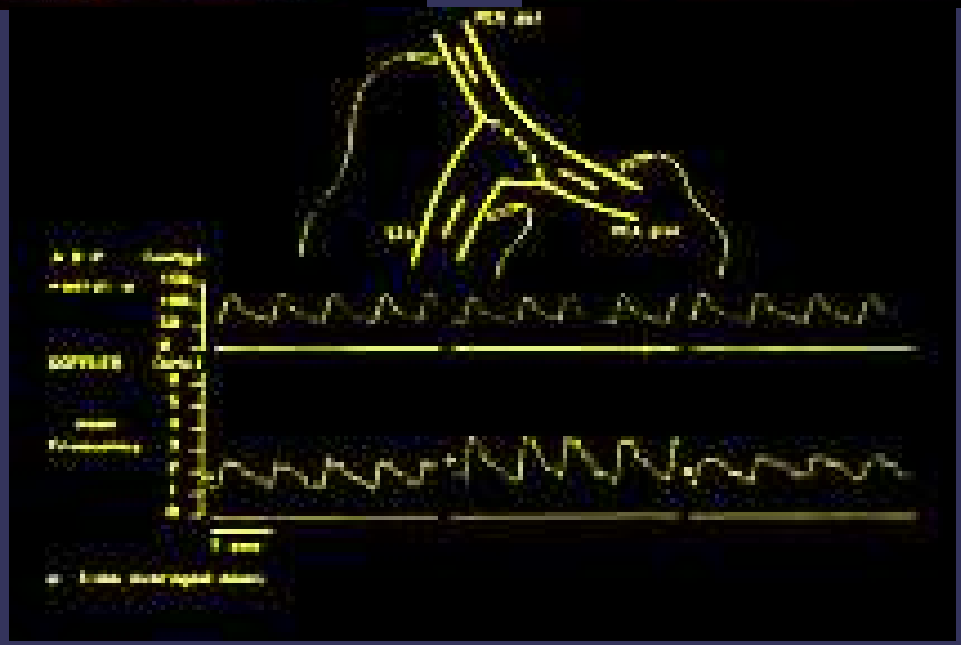
INTRAOP
123
9.19mA
86kV

EC-IC Bypass

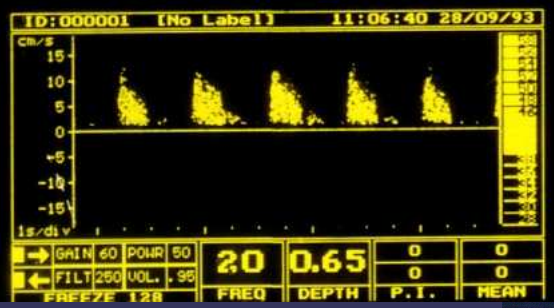




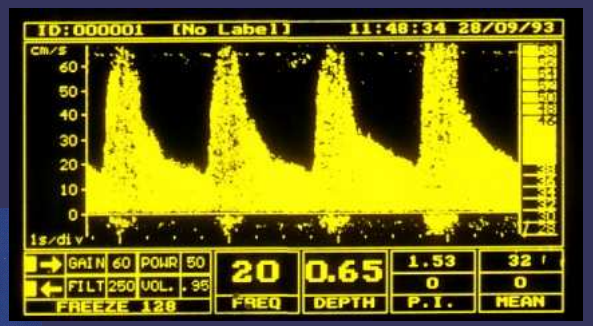


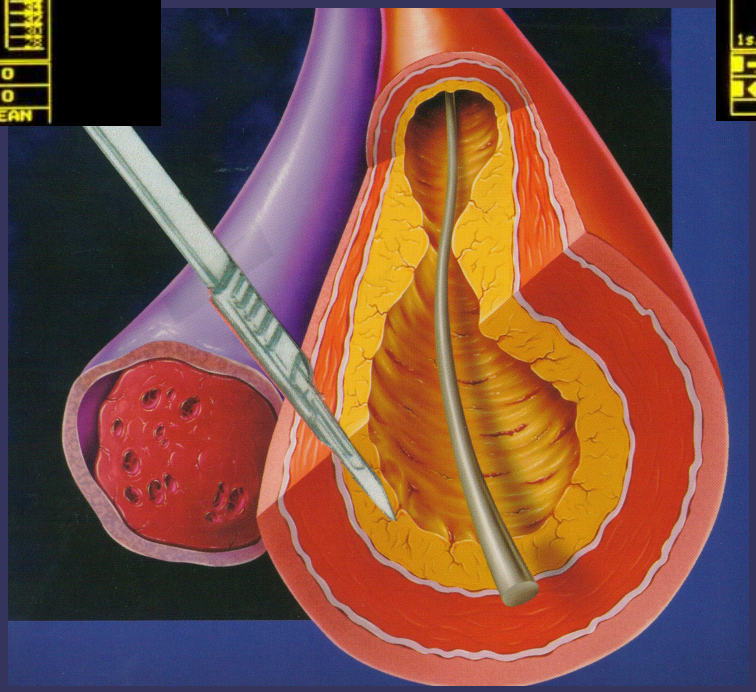
Carotid Endarterectomy

Before plaque removal

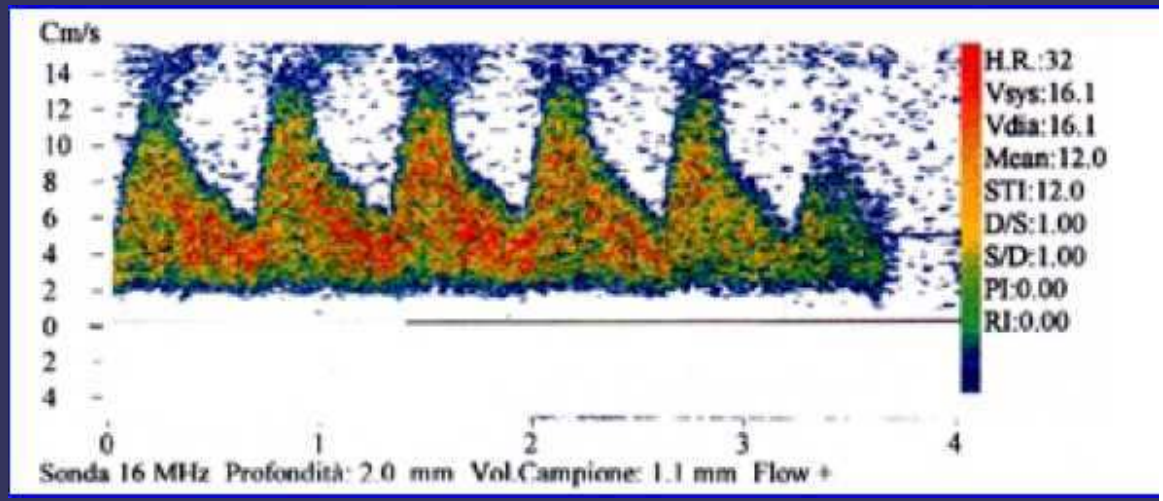


Restored flow after suture



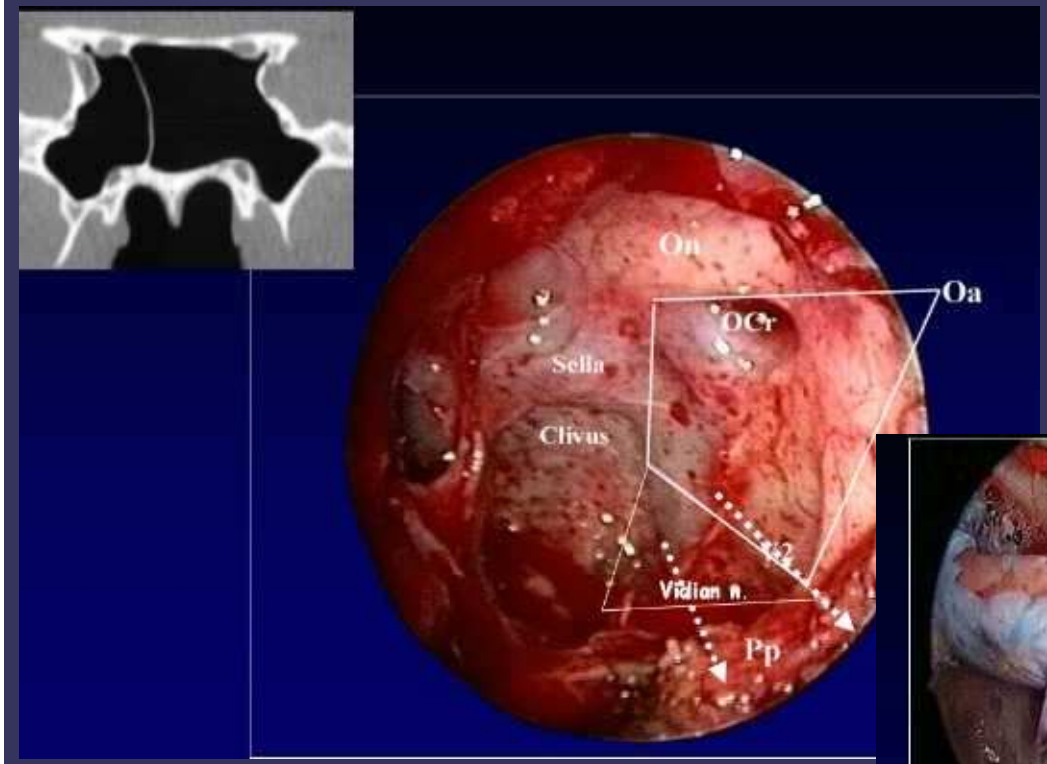


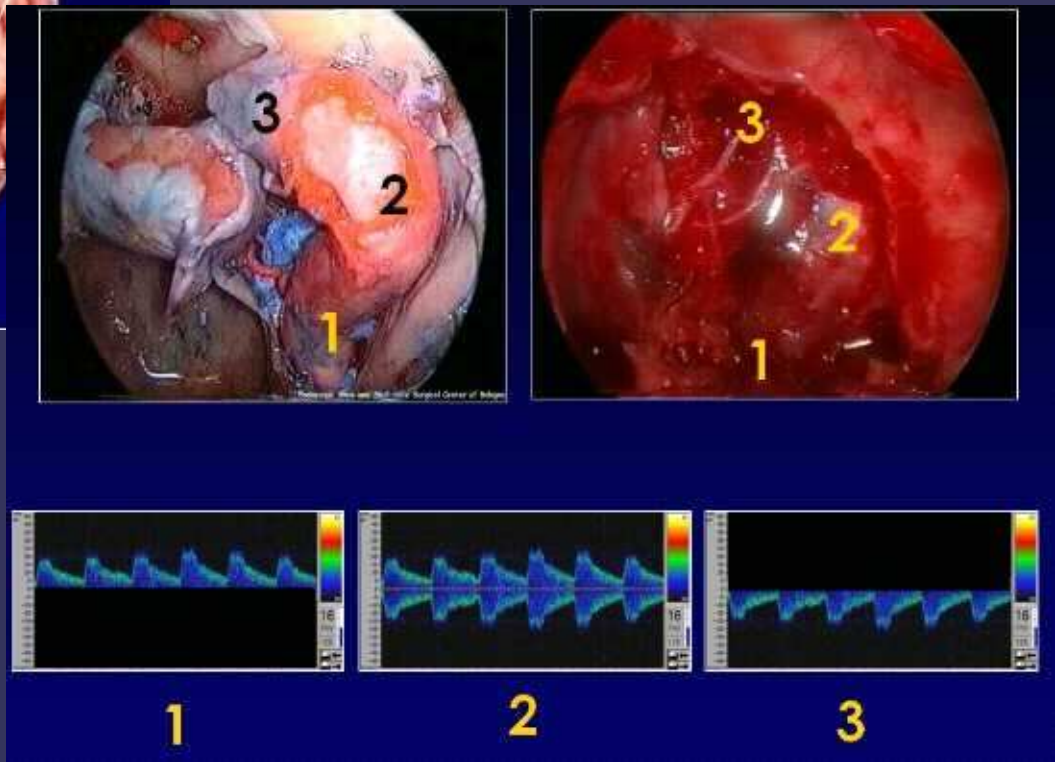
Spinal Vascular Malformations



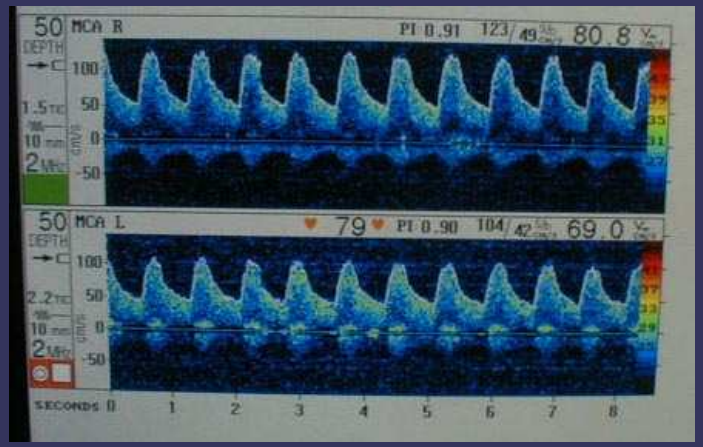
D.G. Iacopino , *Neurosurg. Focus / Volume 10 / February, 2001*

Endoscopic Pituitary Surgery



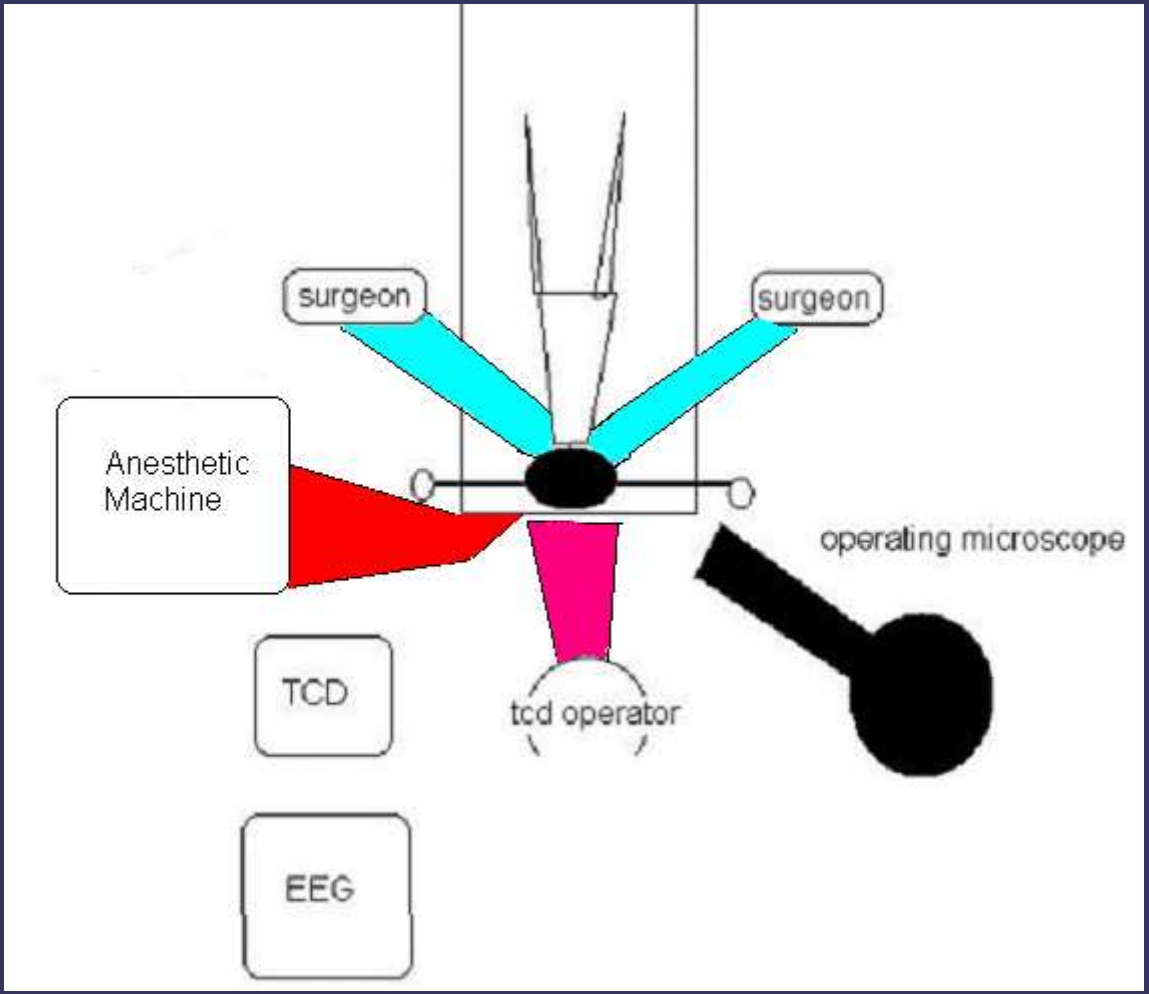


Intraop Monitoring (Carotid Endarterectomy)



1) *EEG*
2) SSEP
3) Stump Pressure
4) Local Anesthesia
5) Xenon
6) *TCD sonography*

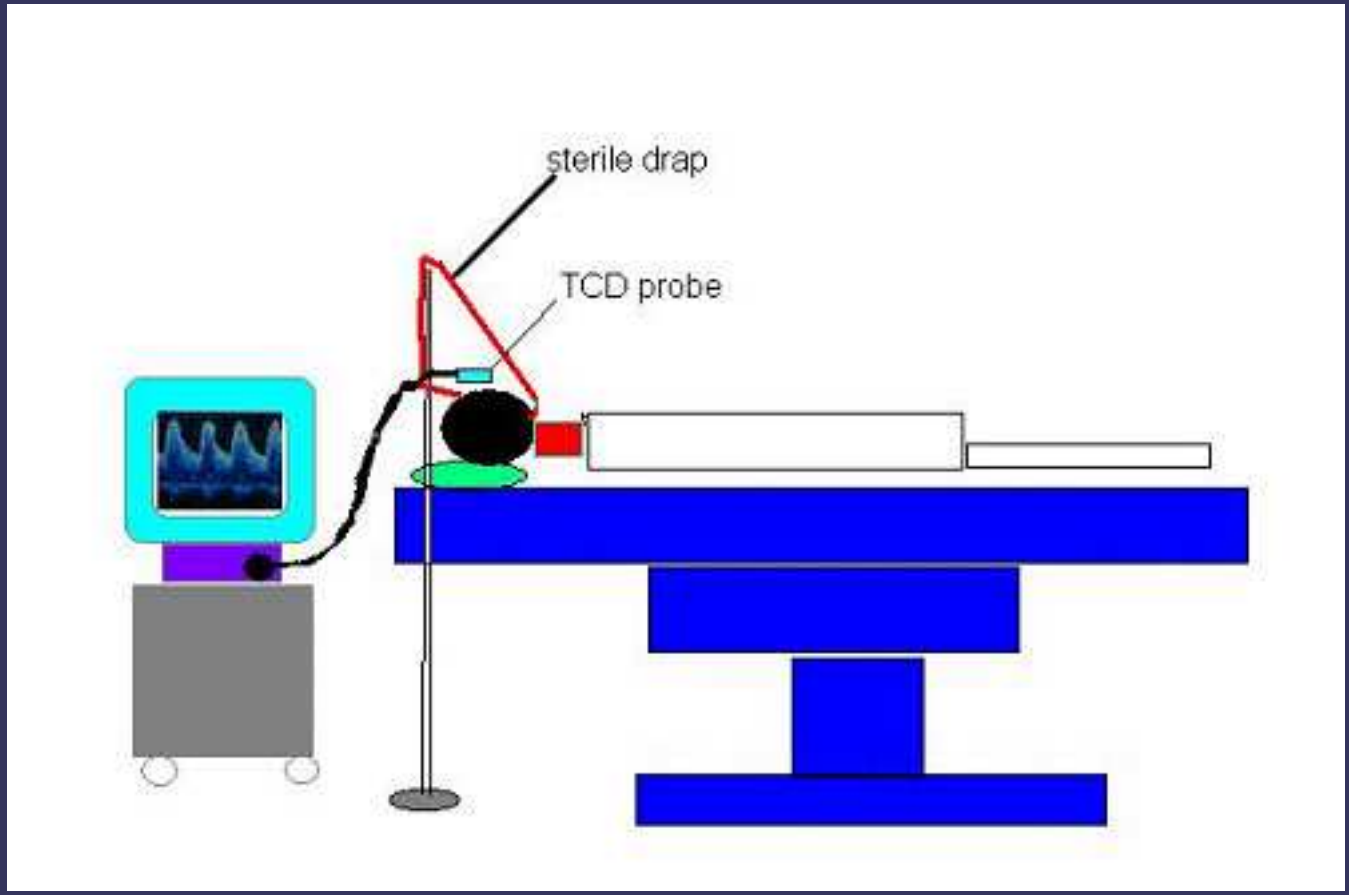
Working Area

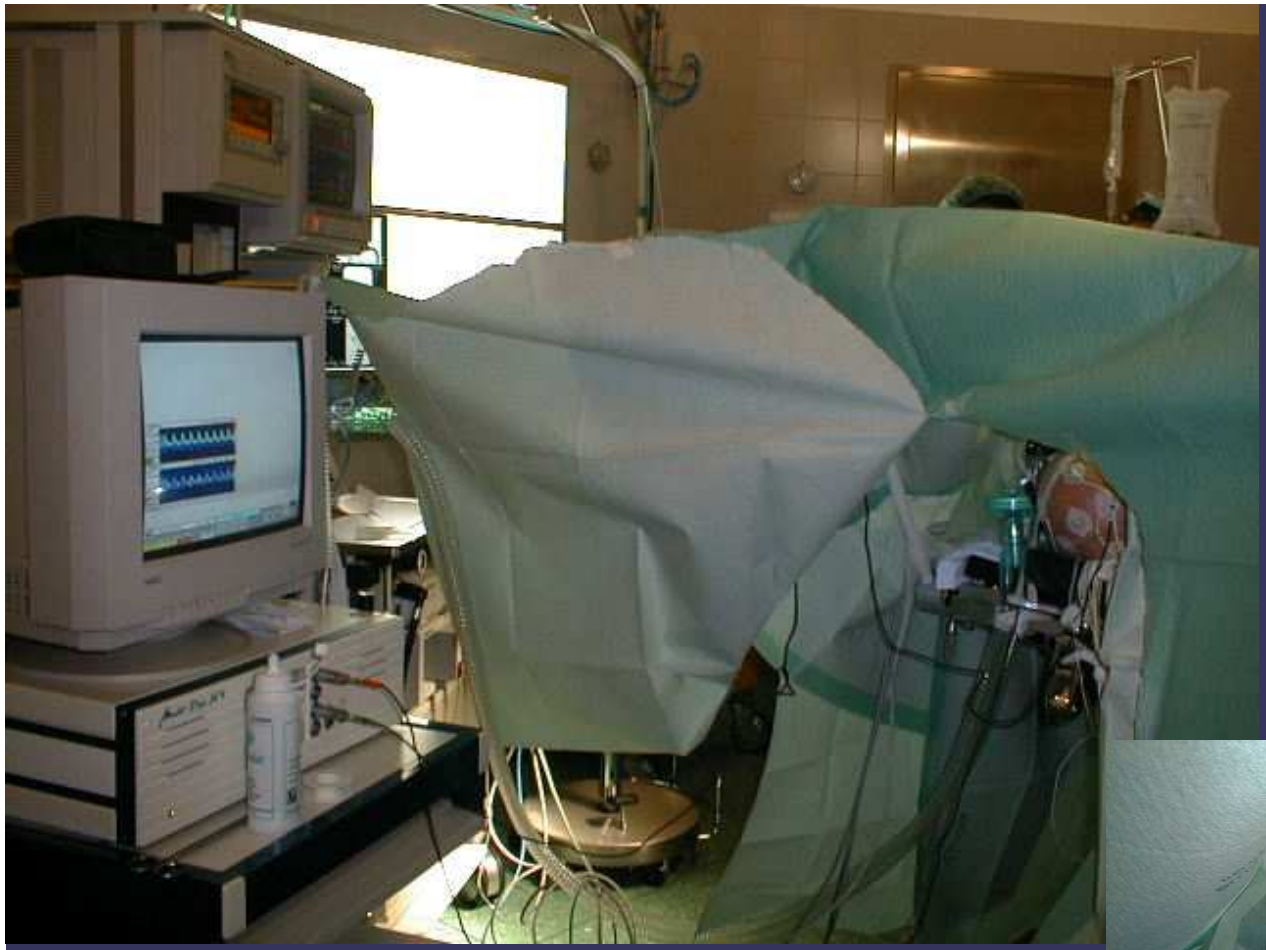


surgical

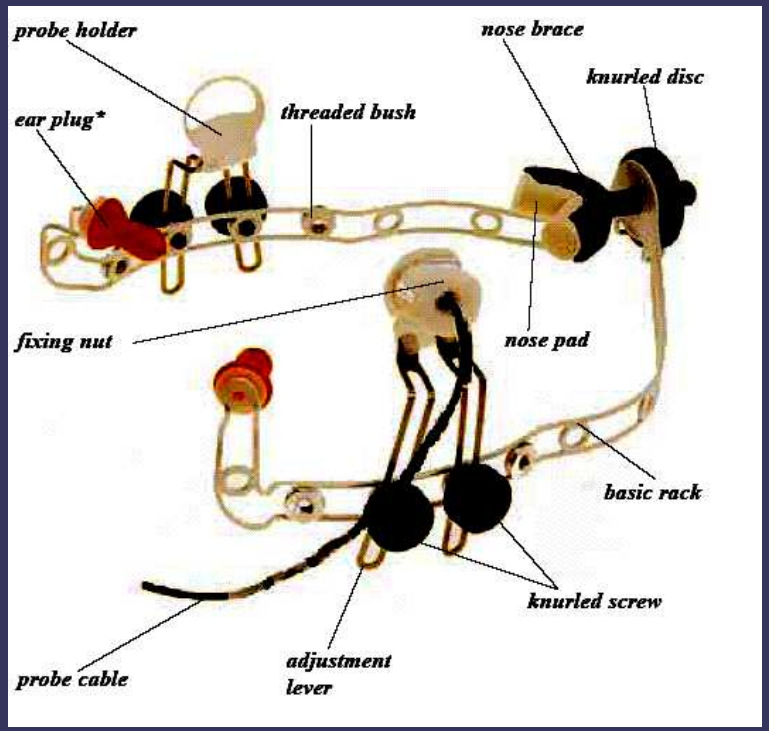
anesthesiological

neurosonological

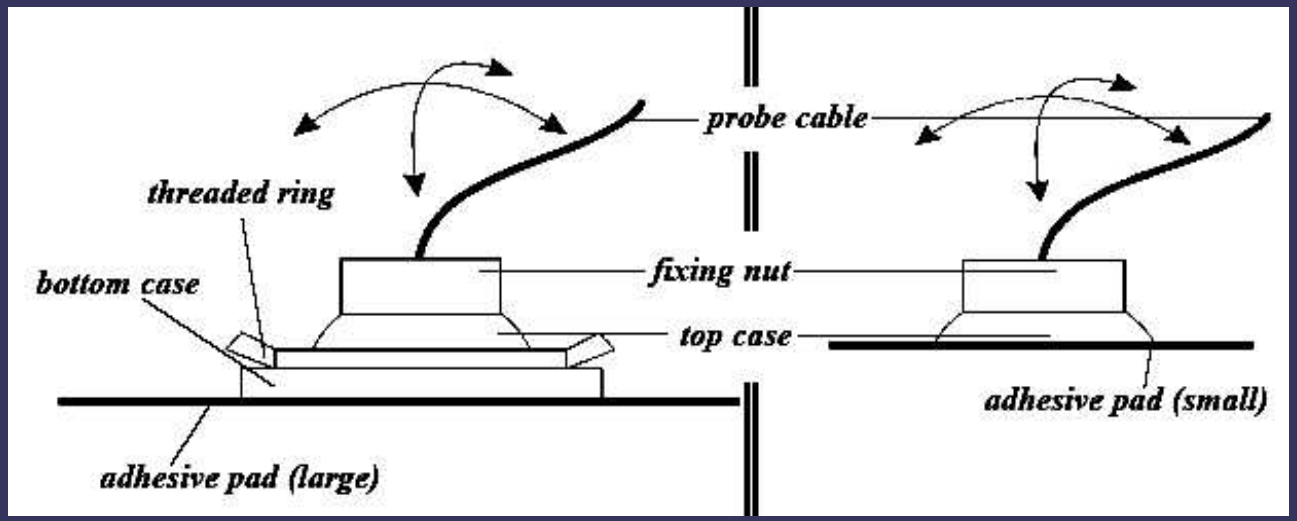

sterile drap
TCD probe



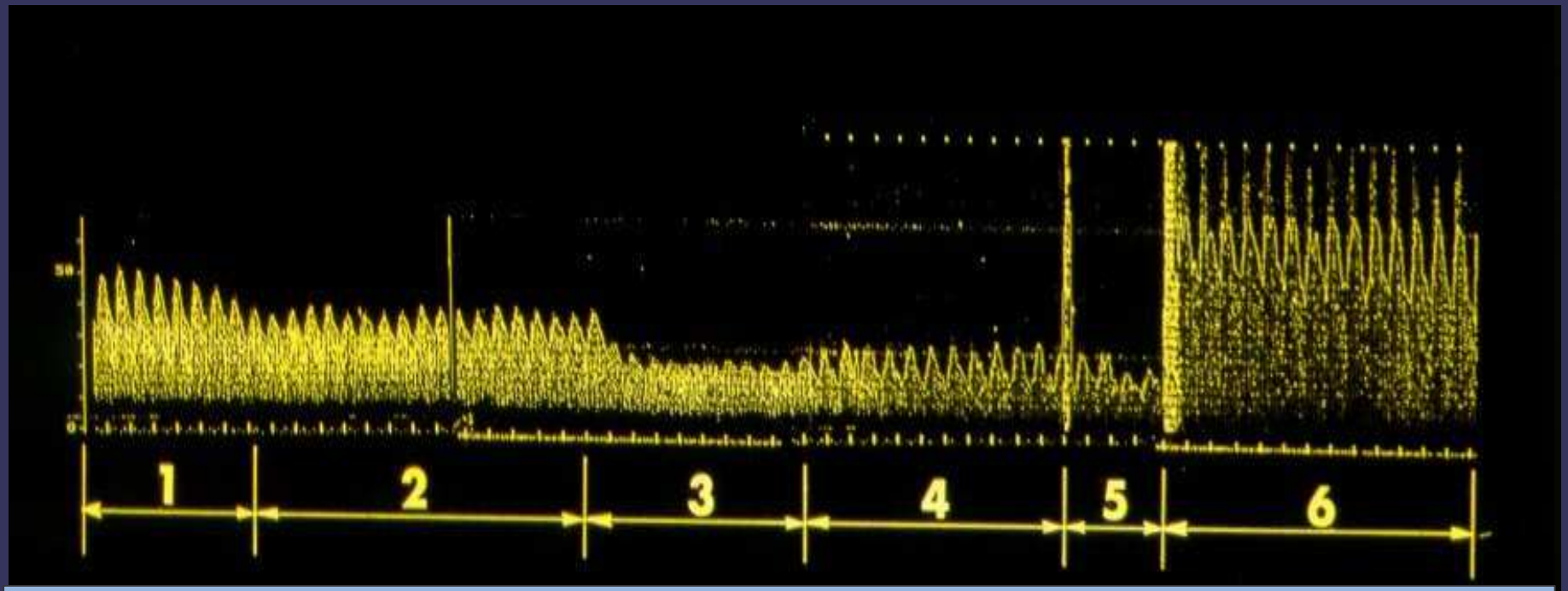
Monitoring Probes Fixations . 1



Monitoring Probes Fixations .2



Intraop Recording (Carotid Endarterectomy)



1. Induction
2. External Car. clamp
3. Internal Car. clamp
4. Plaque removal
5. External Car.opening
6. Internal Car.opening

Intraoperative NeuroMonitoring

1) EEG
2) SSEP
3) Stump Pressure
4) Local Anesthesia
5) Xenon

6) *TCD sonography*

a) Real-time direct detection of alterations of intracranial arterial blood velocity

b) superior to the intermittent methods (Xenon, SEP…)

Mechanisms of Stroke during CEA

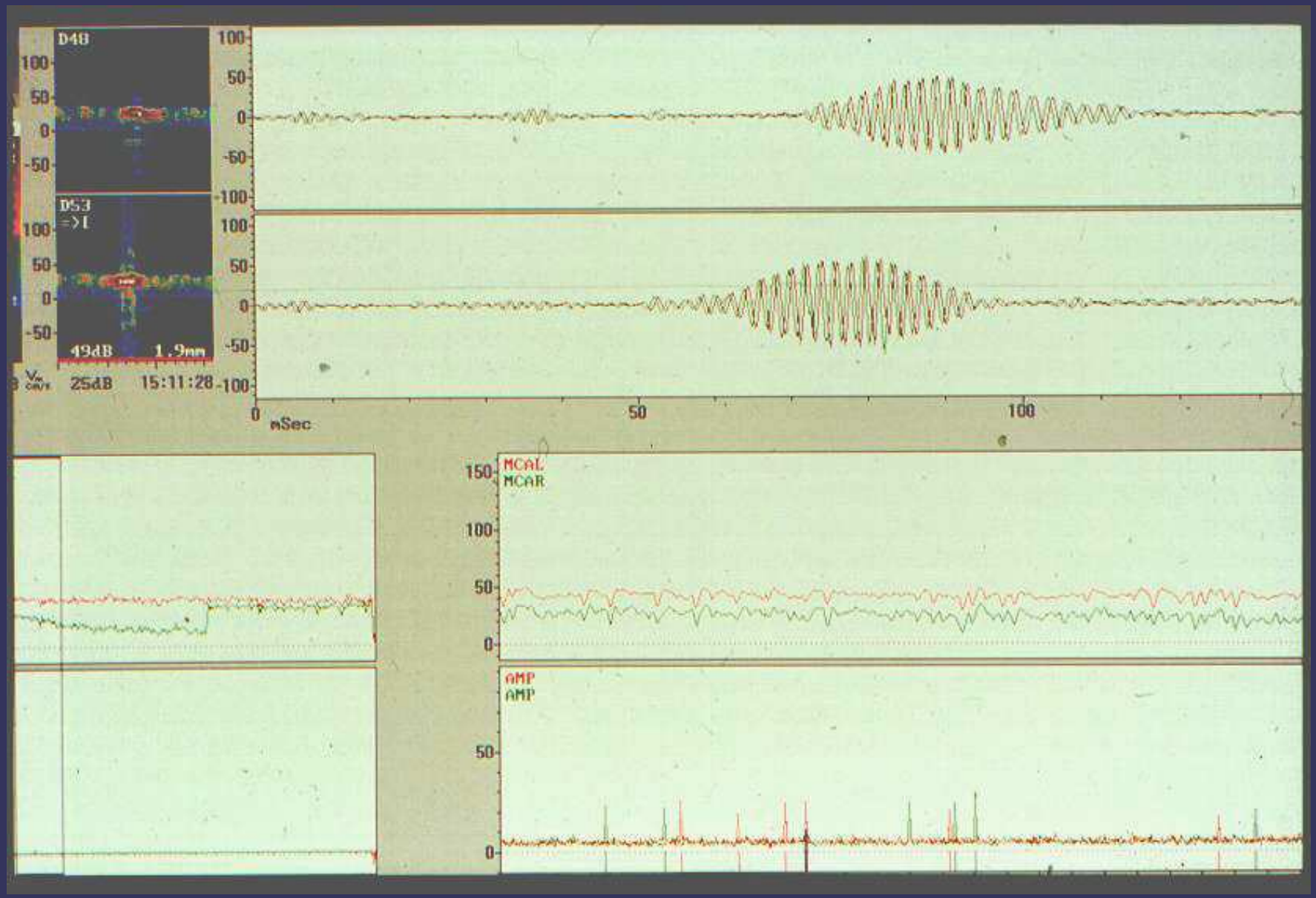
Stroke most common major complication of CEA

- 5,5% among NASCET
- 6,5% among ECST

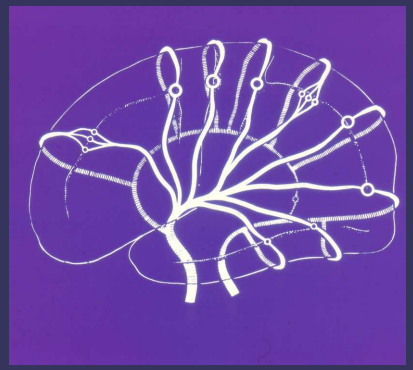
- Hemodynamic compromise → Periop Brain ischemia
- *Embolism* → more common mechanism

Not Mutually exclusive, but occurring in different phases of CEA

Dual-Gate Recording Emboli

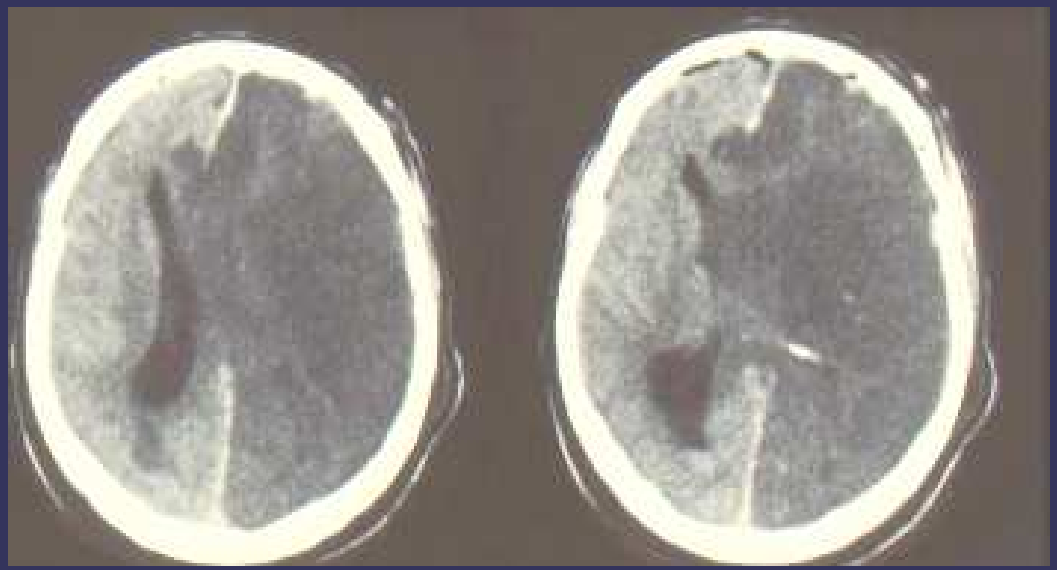


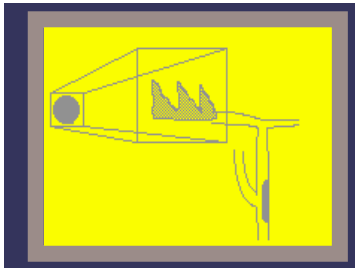
Willisian circle normally working



Activation Intracranial Collateral Circulation

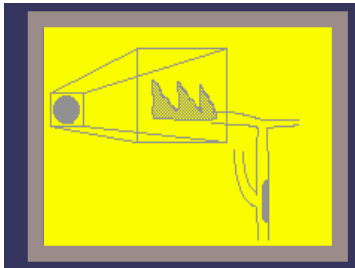
Prevention of Cerebral Ischemia





preoperative TCD evaluation

1. - asymmetry of MCA mean velocity and P.I.
2. - collateral circulation activated by the stenosis
3. - CerebroVascular Reserve (apnea)
4. - evaluation patency ACoA/ACoP



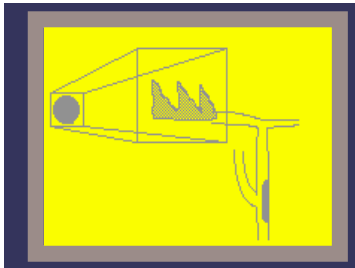
Data from Italian multicentre prospective study (SCITEA)
(513 pts.) **Cerebrovascular Dis., in press**

- **asymmetry of MCA mean velocity and P.I.**

MCA ipsilaterally to carotid stenosis is not significantly reduced

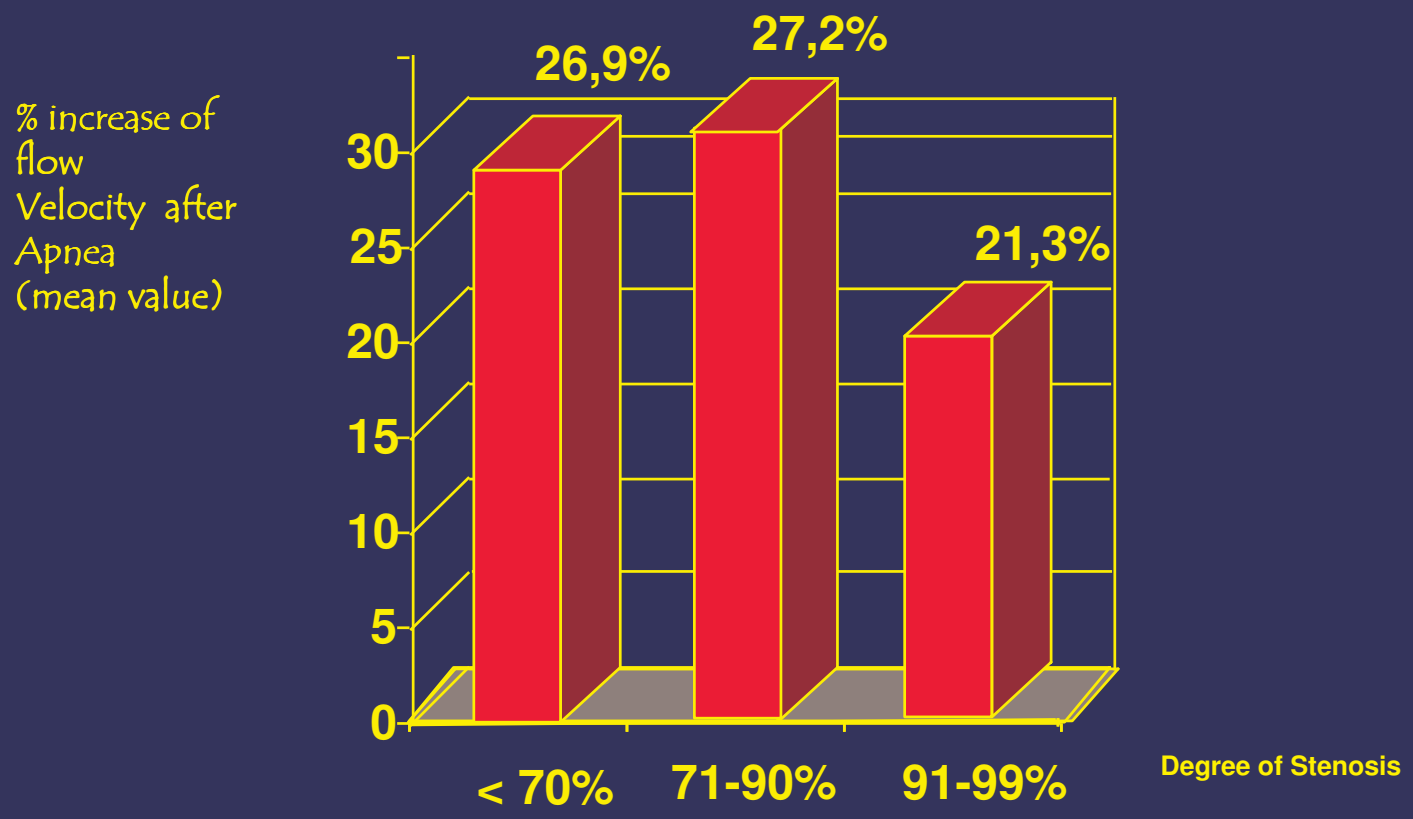
2. collateral circulation activated by the stenosis

% of Intracranial pathways activated increase with the degree of carotid stenosis



3. CEREBROVASCULAR RESERVE (CVR)

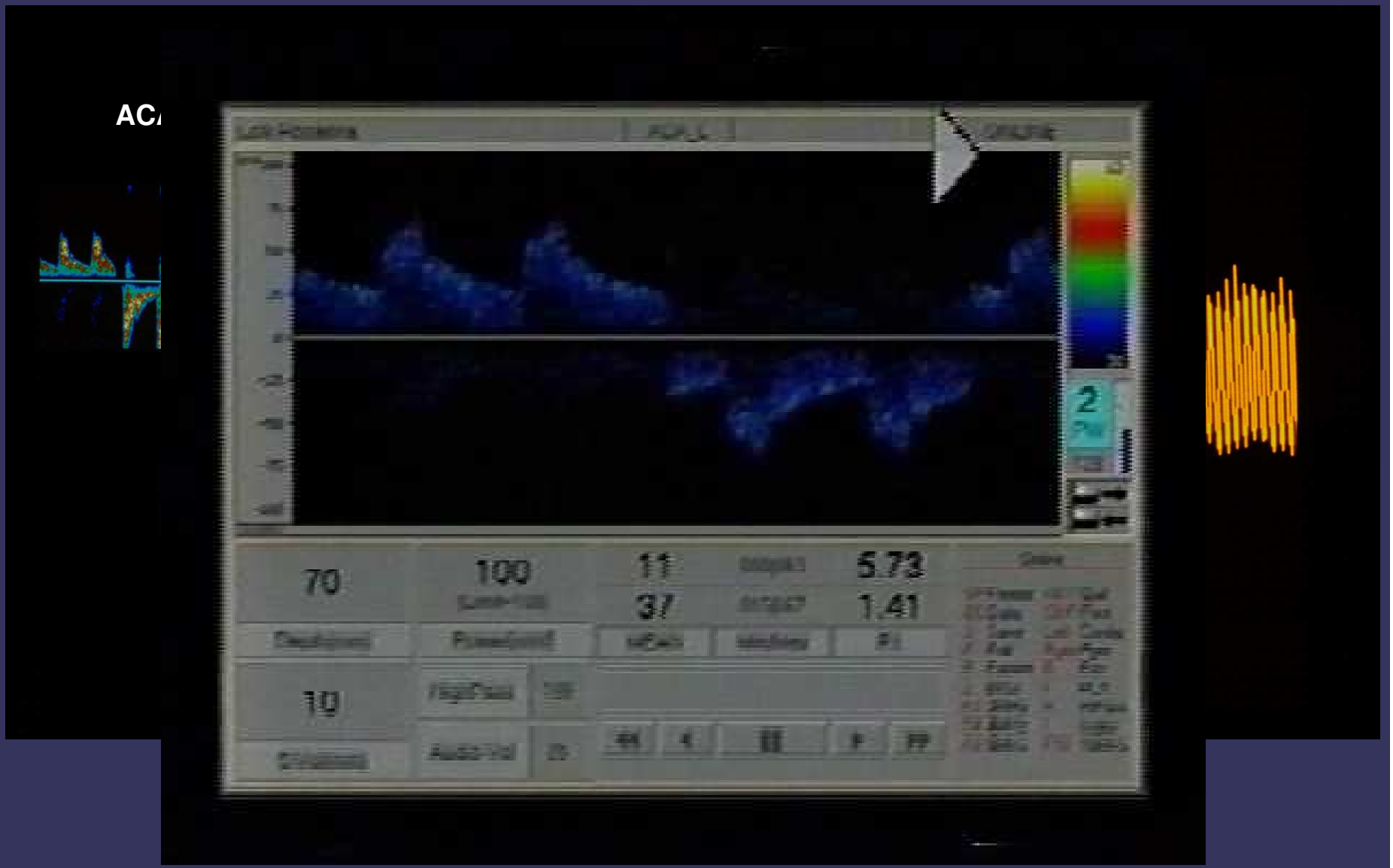
Carotid Stenosis Vs. Ipsilateral Increase of Flow Velocity after Apnea



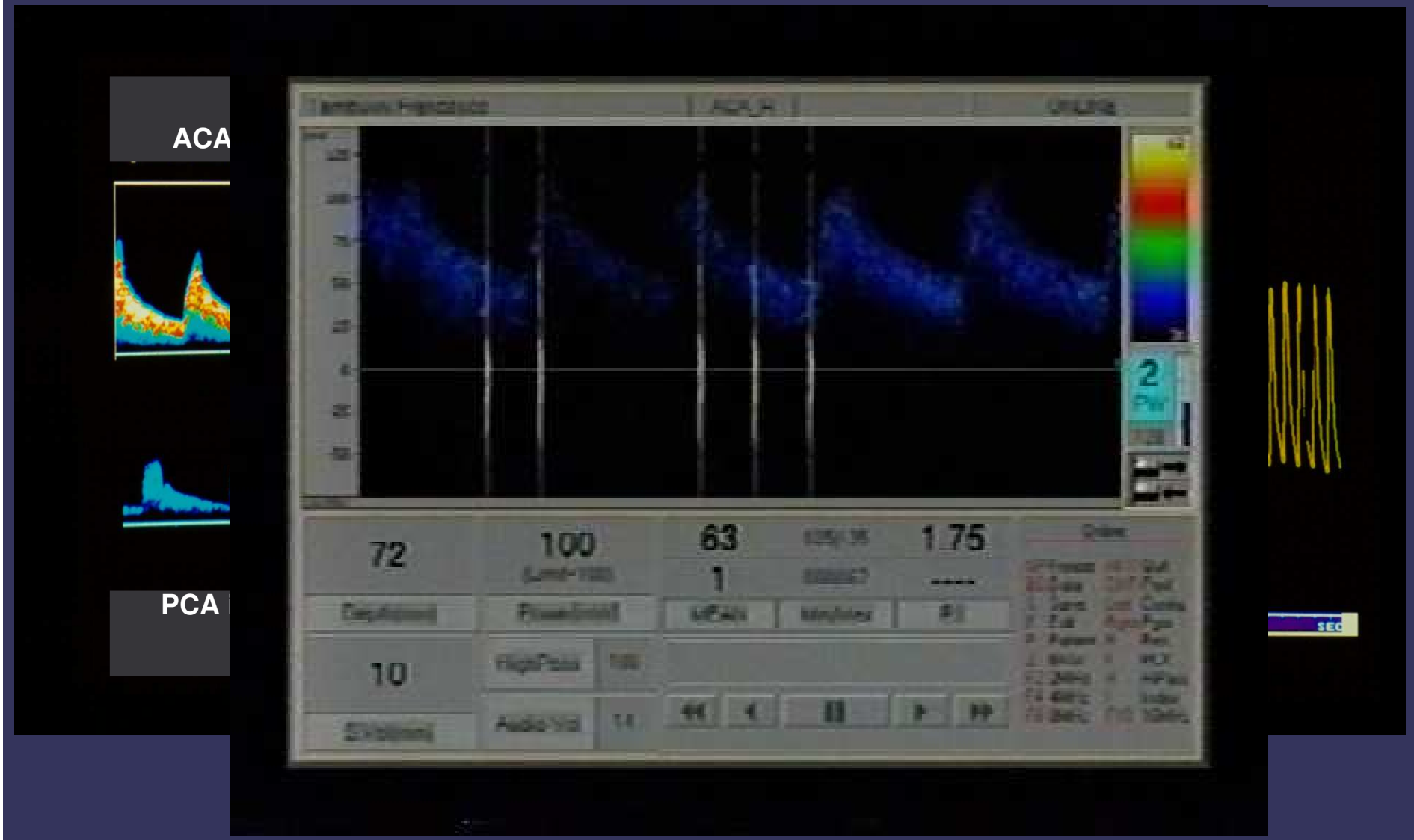
An index of cerebral hemodynamic impact of carotid stenosis

is given by CVR compromise

Compression Tests 1



Compression tests 2



Predictors of Carotid Clamping Intolerance during Endarterectomy That Would Be Wise to Apply to Stenting Procedures

G.P. Anzola[a] P. Limoni[b] G. Cavrini[c] on behalf of the SCITEA group

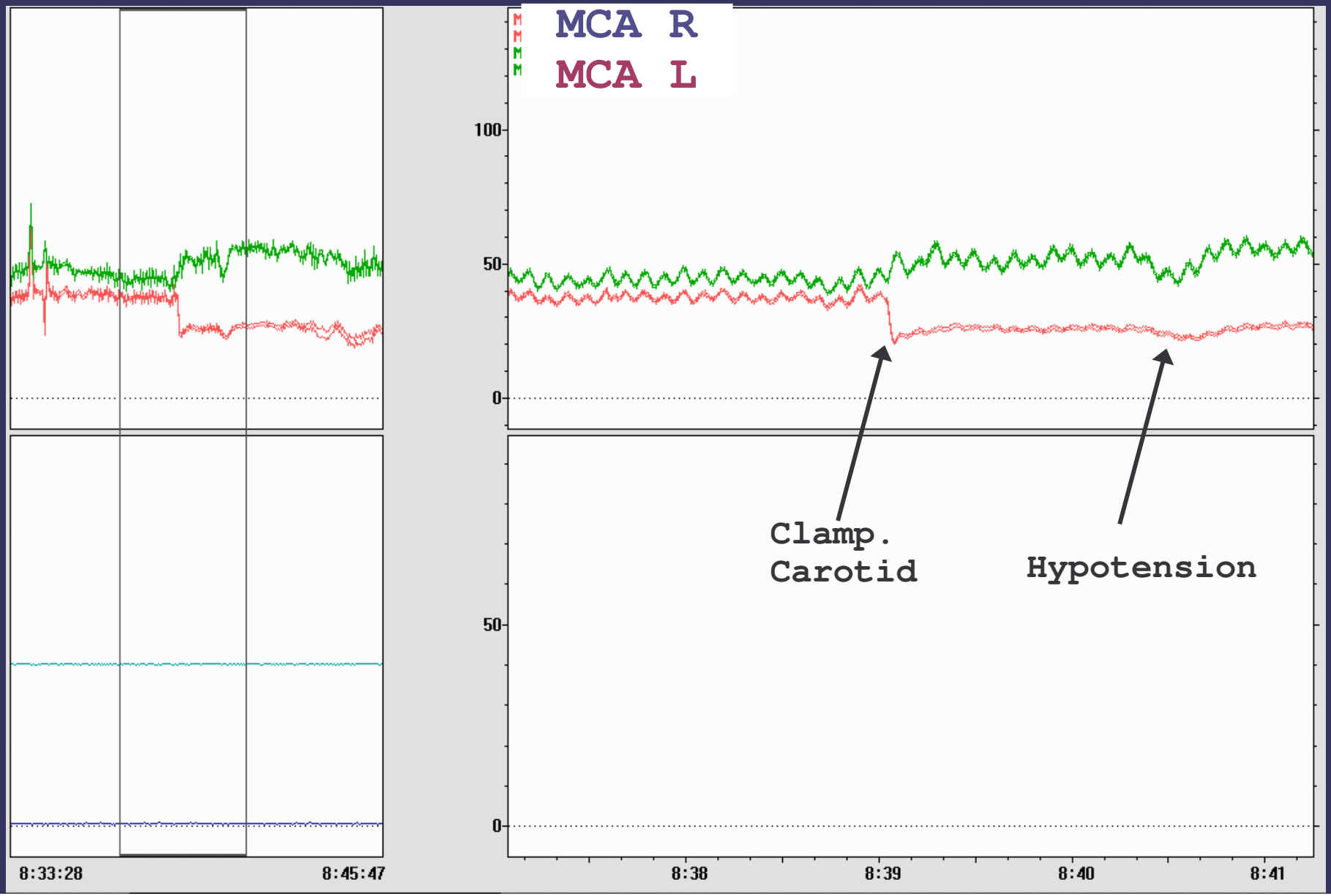
[a]Heart and Brain Department, S. Orsola Hospital FBF, Brescia, [b]Neurosciences Department, Division of Neurosurgery, Bellaria Hospital, and [c]Department of Statistics, University of Bologna, Bologna, Italy

Combining the results of both compression tests (MCA decrement and collateral recruitment) …….. an overall accuracy of 95% in predicting shunt insertion

Cerebrovascular Diseases

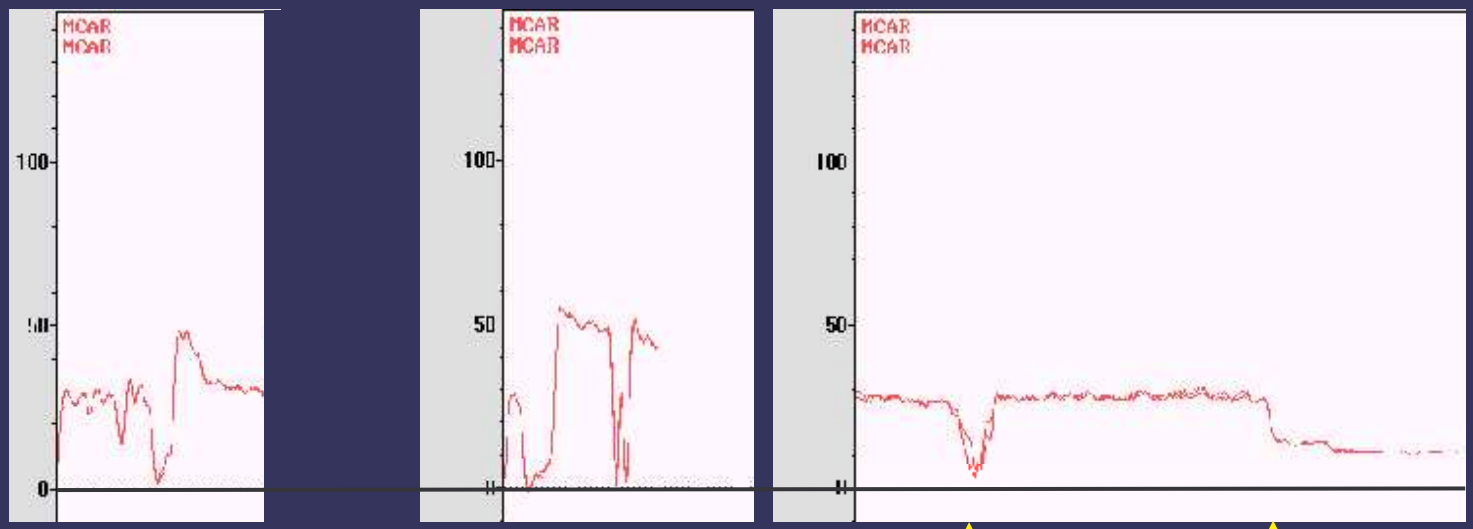
In press

Bilateral TCD Monitoring during Carotid Endarterectomy



Preop **Intraop**

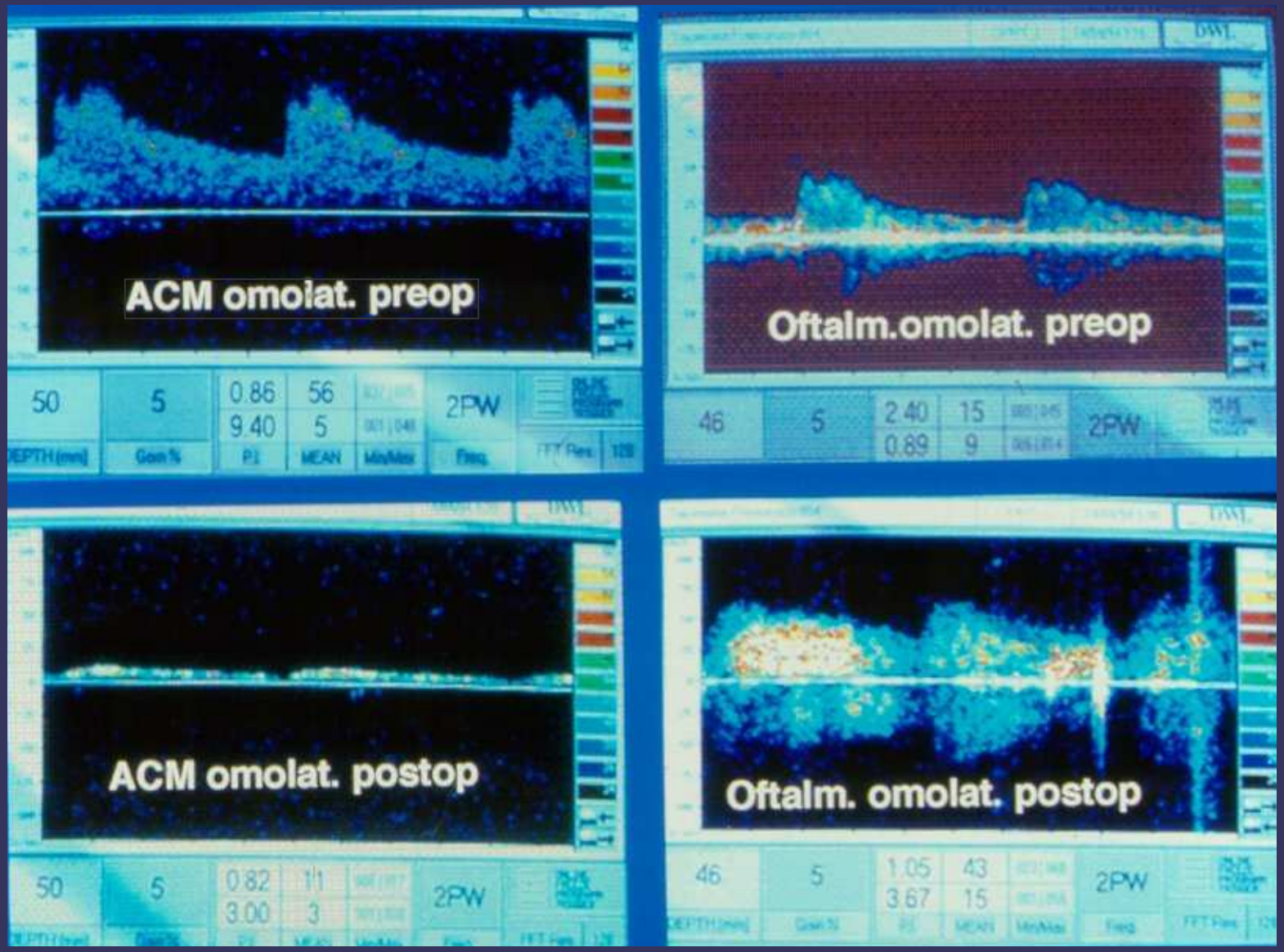
BP 150/80 **BP 190/90**



Preop Compres. **Clamp 1** **Clamp 2** **Definitive clamping**

Preop Tests. : record BP at carotid compression !

POST-OP TCD : Early carotid Occlusion



Intraoperative Embolism

- dissection
- shunt insertion
- clamp release
- *12 hrs immediately after CEA*
  >25% of all infarcts

TCD recording even after the end of surgery !

Intraoperative Embolism

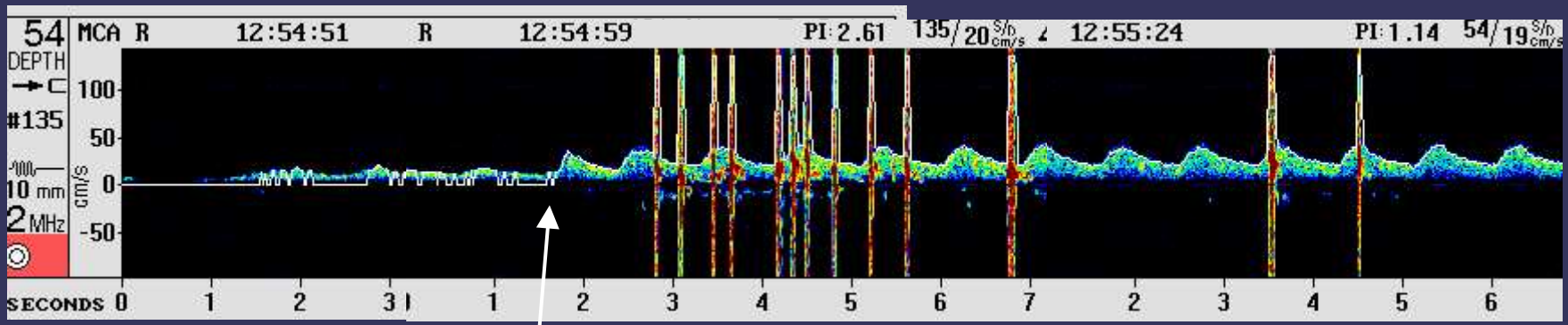
Period	Emboli	Postop Deficit
Clamp release	Gaseous	NO
Shunting	Air+particulate	Sometimes
Dissection	Particulate	frequently

Ackerstaff,2000

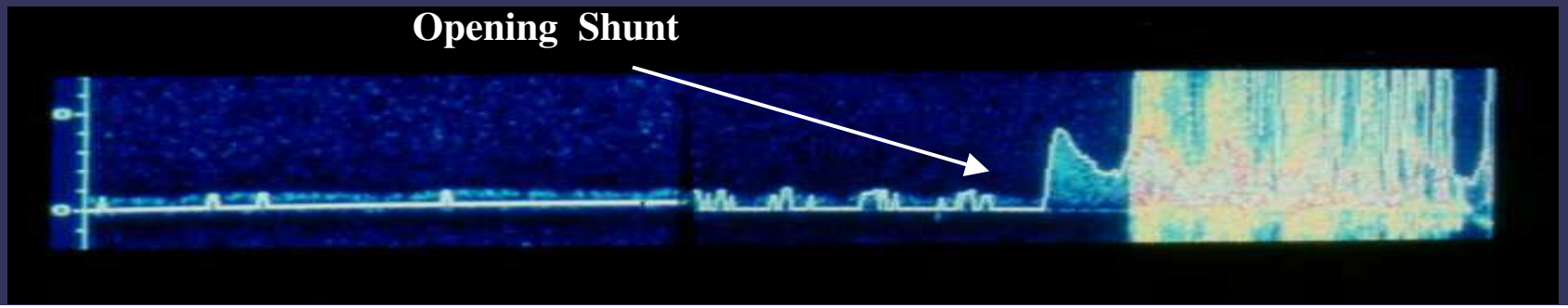
TCD Monitoring
Microemboli and intracarotid shunt

Carotid occlusion
Shunt Insertion

Opening Shunt
emboli



Opening Shunt

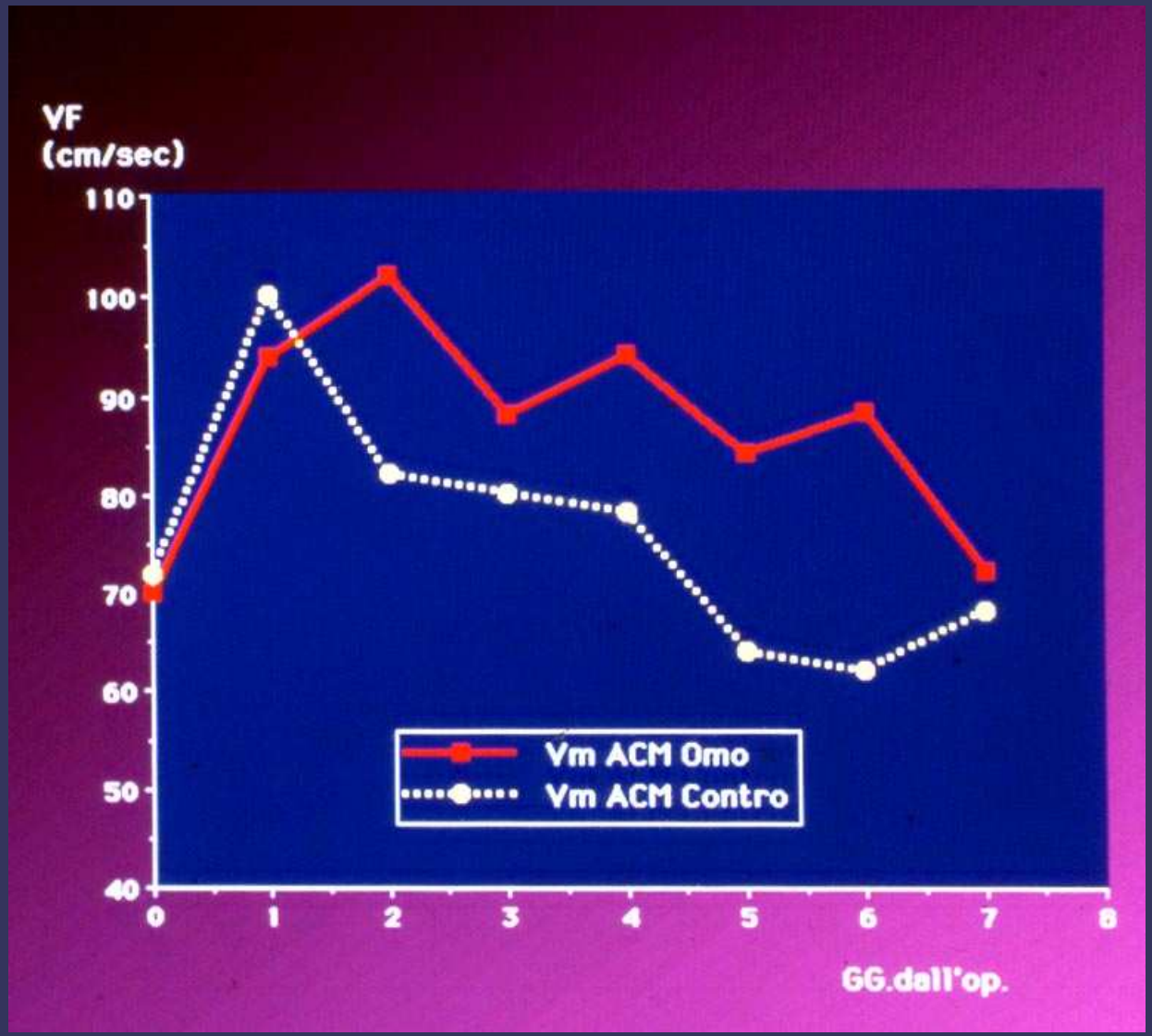


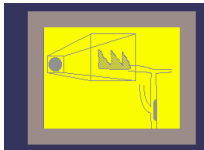
Microemboli and intracarotid shunt

MES and CEA

- MES early post-op 28,5% ScheidelerK,1997
- MES more freq if intraop stroke Muller M.,1998
- MES 1h postop; PPV >50/h stroke Levi CR., 1997
- MES if recovery room >5/15 min-> MRI lesion Cantelmo NL,1998

Hyperperfusion Syndrome





In conclusion :

TCD preop.	**Patency of communicanting** **Risk of Ischemia after clamp.** **Prediction of shunt**
TCD periop.	**Intraop. surveillance** **Emboli recording**
TCD postop.	**Hyperperfusion syndrome** **Early Carotid occlusion** **Emboli**

Finally for a good TCD monitoring during carotid endarterectomy is essential a good collaboration between surgeon, anesthesist and TCD operator

BUT sometimes the TCD operator is not well tolerated……..