

CORSO DI LAUREA
TECNICHE DI RADIOLOGIA MEDICA, PER IMMAGINI E RADIOTERAPIA

ADO RMX102
«*Corso Monografico*»

ANNO ACCADEMICO 2022/2023



Gemelli



Insegnamento:
«**ANGIO-RM IN NEURORADIOLOGIA**»
12 ore MED/50 CFU 1

Formazione
per l'eccellenza

apr. '23

3° anno II semestre

Fondazione Policlinico Universitario Agostino Gemelli IRCCS
Università Cattolica del Sacro Cuore



Insegnamento:
ADO «ANGIO-RM IN NEURORADIOLOGIA»
RMX102 – 12 ore MED/50 CFU 1

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ap. '23
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CORSO DI LAUREA
TECNICHE DI RADIOLOGIA MEDICA, PER IMMAGINI E RADIOTERAPIA

ADO RMX102
«*Angio-RM in neuroradiologia*»

ANNO ACCADEMICO 2022/2023

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IN PRATICA:
IMPOSTAZIONE DELLE SEQUENZE



apr. '23

3° anno II semestre

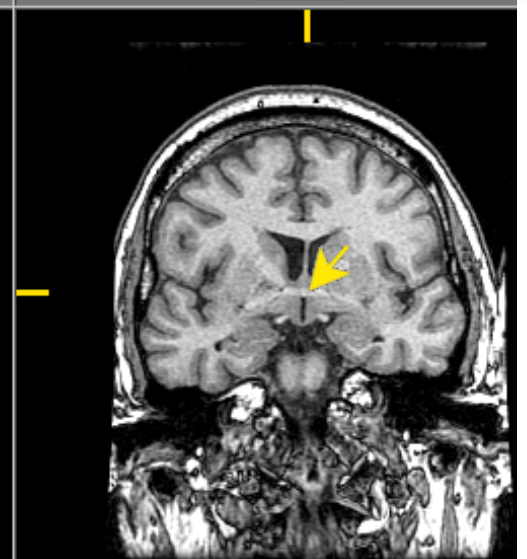
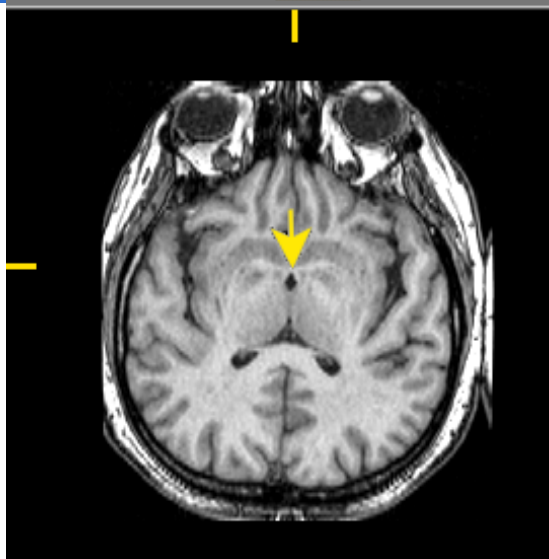
Fondazione Policlinico Universitario Agostino Gemelli IRCCS
Università Cattolica del Sacro Cuore



Argomenti del Corso

- ⌘ **Introduzione e cenni di Anatomia**
- ⌘ **Mezzi di contrasto in RM**
- ⌘ **Sequenze senza MdC**
 - ⌘ Sequenze Time of Flight (TOF)
 - ⌘ Sequenze Phase Contrast (PC-2D, 3D INHANCE)
 - ⌘ Perfusion ASL
- ⌘ **Sequenze con MdC**
 - ⌘ Sequenze 3D FSPGR – 3DFFE
 - ⌘ 4D/sequenziali: Tricks, Baleriaux, CE-MRA, 4D Track
 - ⌘ Perfusion T2* (DSC), T1 (DCE)
- ⌘ **Modalità di rilevamento del MdC**
- ⌘ **In Pratica: impostazione delle sequenze**

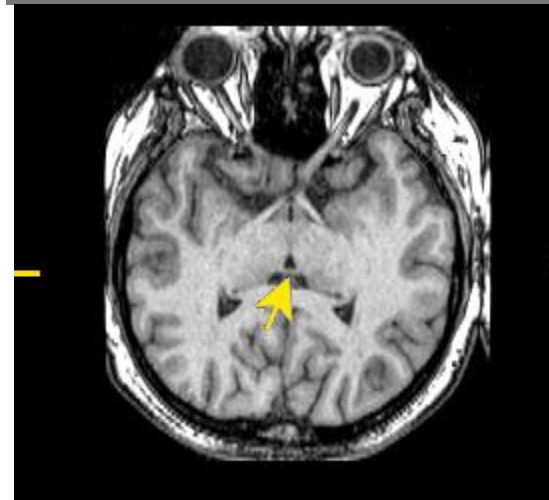
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Brain-hemispheric MR-T1
anterior commissure sync

Brain-hemispheric MR-T1
anterior commissure sync

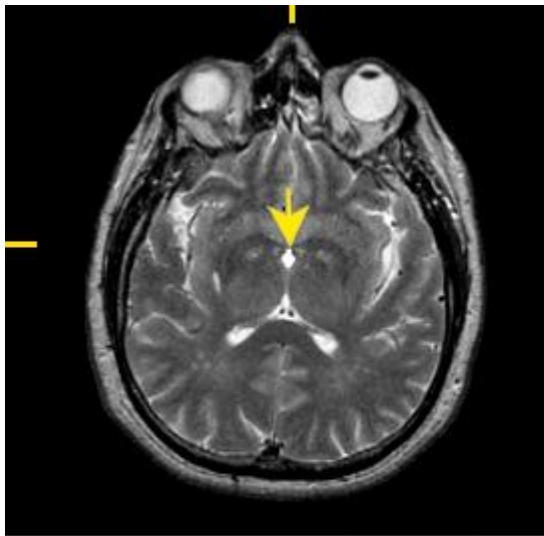
Brain-hemispheric MR-T1
anterior commissure sync



Brain-hemispheric MR-T1
posterior commissure sync

Brain-hemispheric MR-T1
posterior commissure sync

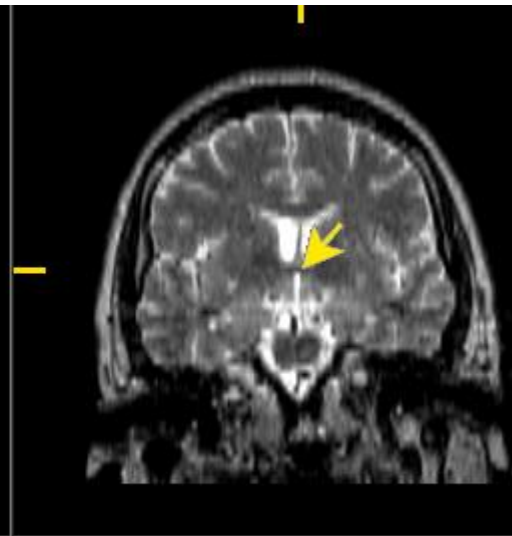
Brain-hemispheric MR-T1
posterior commissure sync



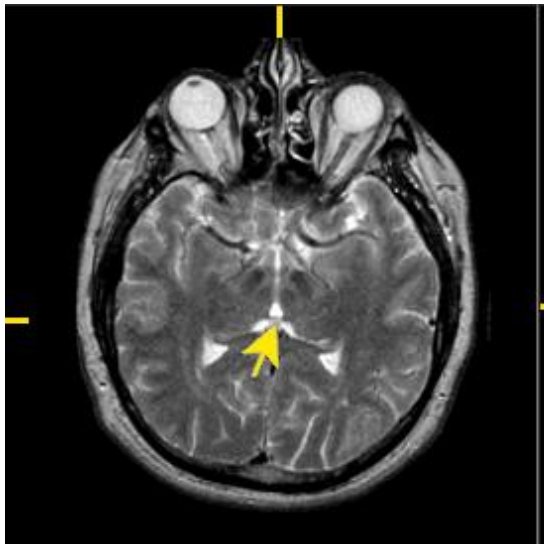
Brain-hemispheric ▼ MR-T2 ▼
anterior commissure ▼ sync



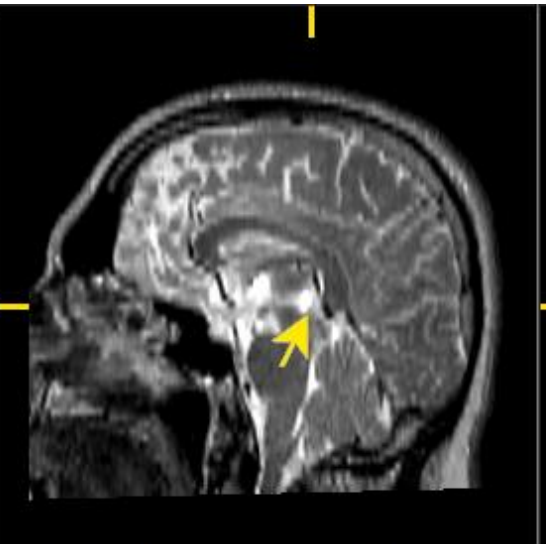
Brain-hemispheric ▼ MR-T2 ▼
anterior commissure ▼ sync



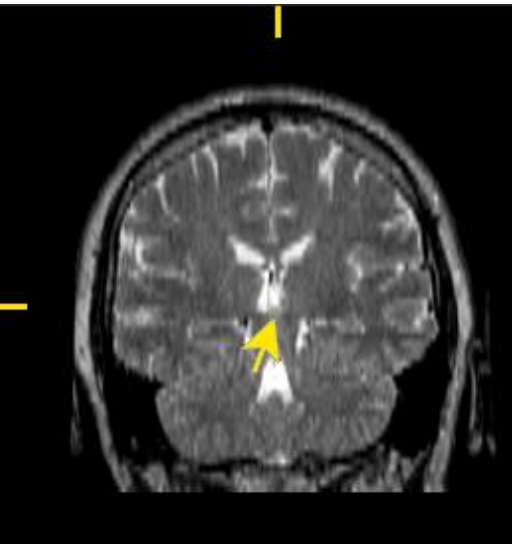
Brain-hemispheric ▼ MR-T2 ▼
anterior commissure ▼ sync



Brain-hemispheric ▼ MR-T2 ▼
posterior commissure ▼ sync

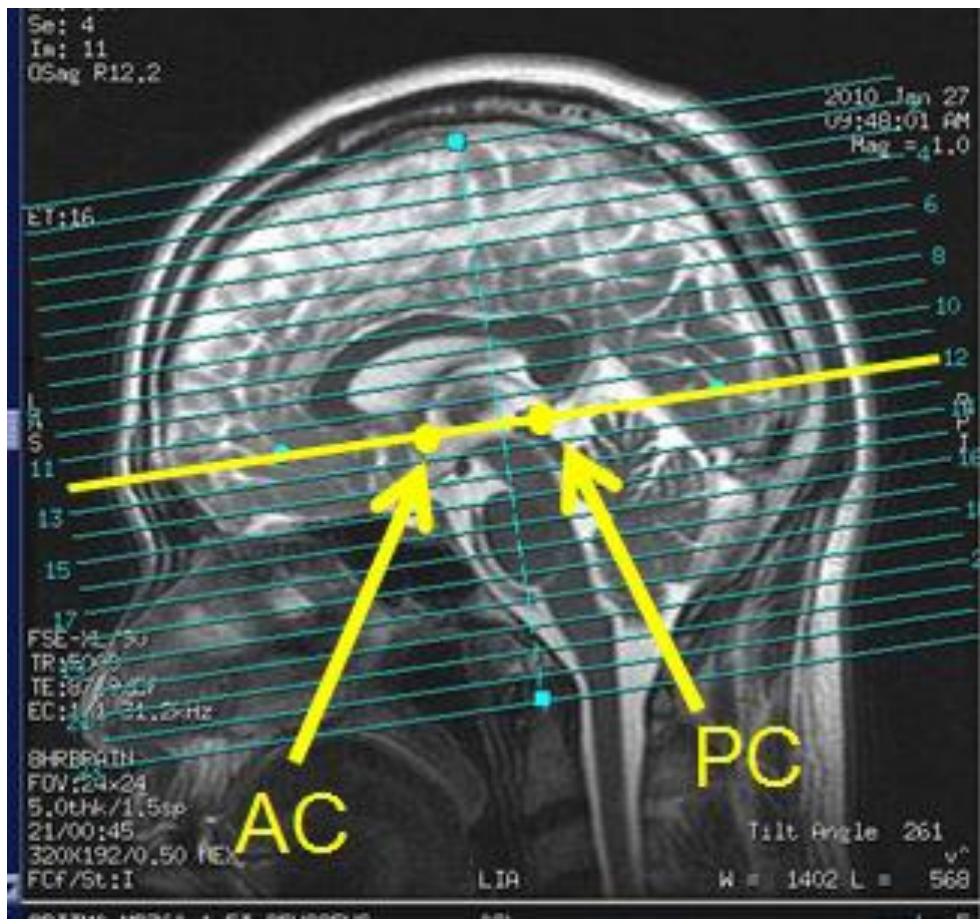


Brain-hemispheric ▼ MR-T2 ▼
posterior commissure ▼ sync



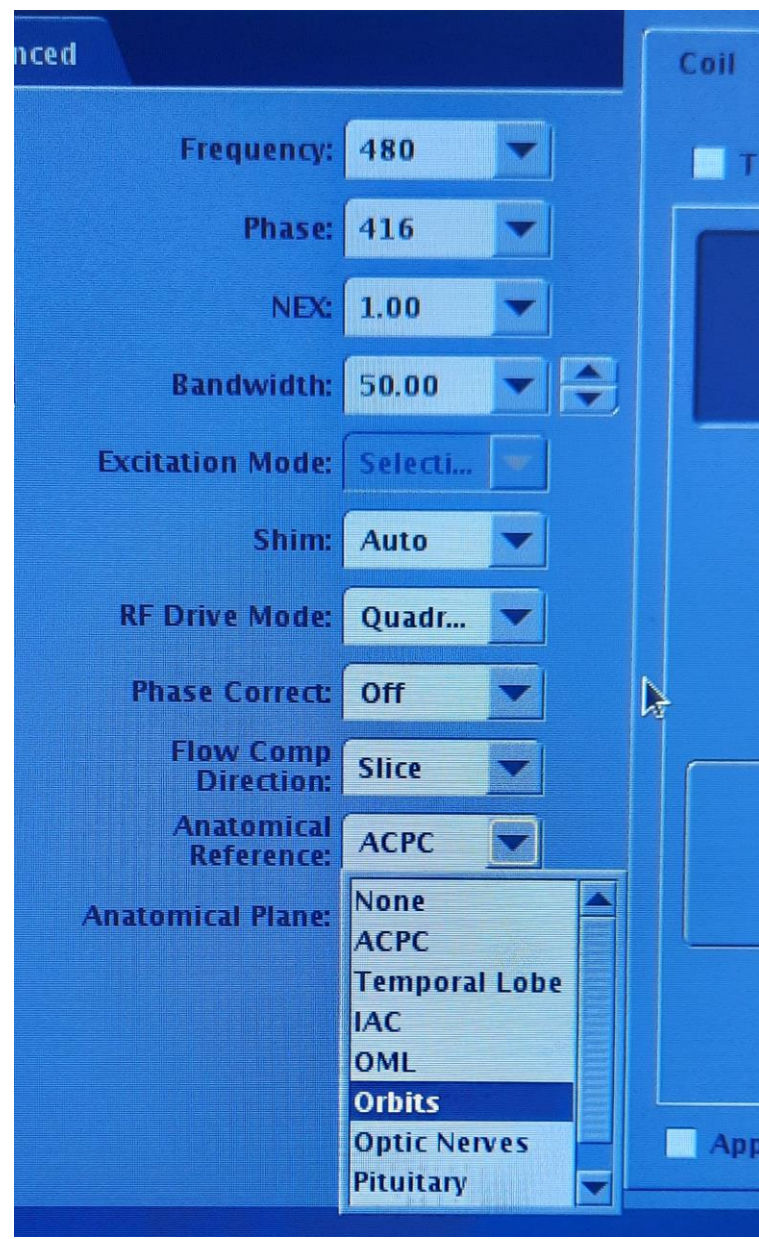
Brain-hemispheric ▼ MR-T2 ▼
posterior commissure ▼ sync

Pratica – linea bicommissurale



Imposta la linea ACPC, che si estende dalla superficie superiore della commessura anteriore al centro della commessura posteriore.

Pratica – linea bicommissurale



Deep Learning

Pratica: TOF

4:00
Mag = 1.0

L 151
A 174

SSFSE
 TR:832
 TE:30,6/Ef
 EC:1/1 83,3kHz

6HRBRAIN
 FOV:32x32
 8,0thk/3,0sp
 29/00:25
 256x192/0,53 NEX
 /ED/SQ

I 159 H = 1497 L = 403

I 159 H = 1497

4:06

Oblique Freq. Dir: A/P

20.0 TR: 23.0

0.88 # Slabs: 3

1.4 Locs per Slab: 34

12

A/P S/I Max # Slices: 256

A6.1 S68.4 # of Acqs: 3

A23.9 I20.8 Rel. SNR(%) 70

Fat SAT: S

SSFSE
 TR:832
 TE:30,6/Ef
 EC:1/1 83,3kHz

R 151

Pol Agostino Gemelli

Pratica: TOF

s3DI_MC FAST
02:55

Voxel: 0.60 x 0.90 x 1.40 Tra: 1.00 Rel. SNR: 6.9 TE: 23 TR: 23

← → Accept

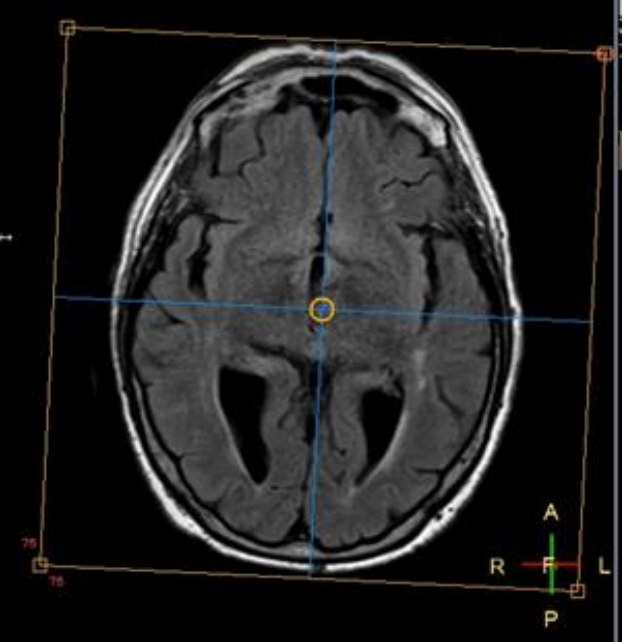
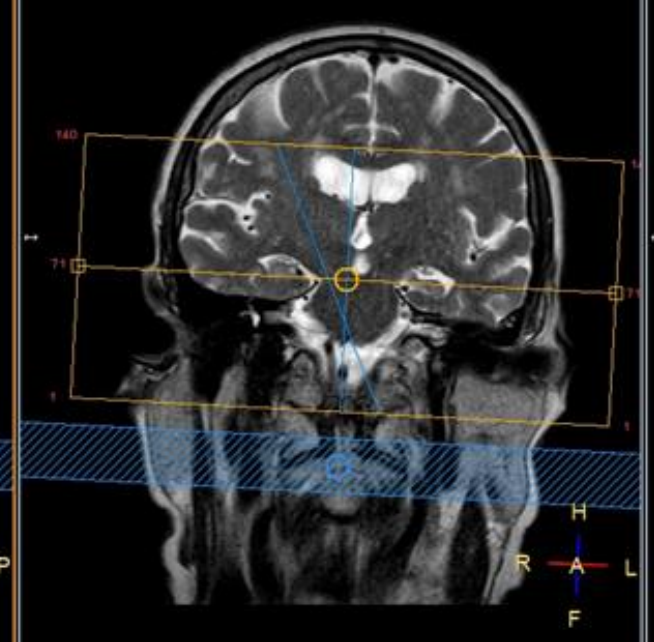
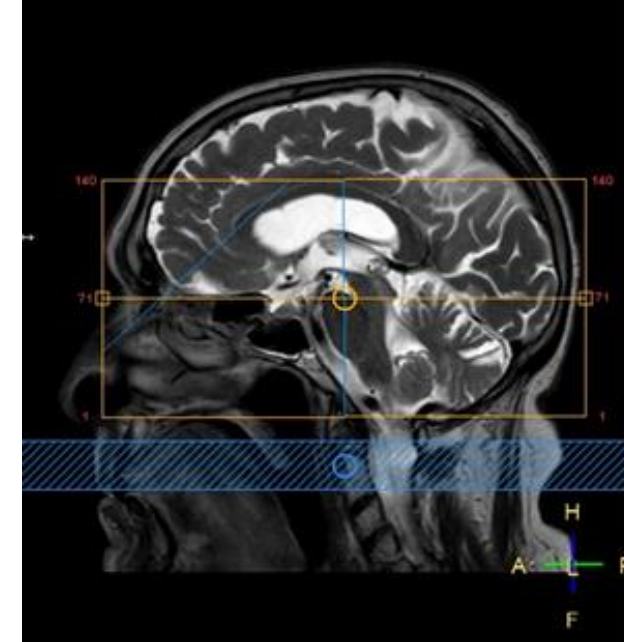
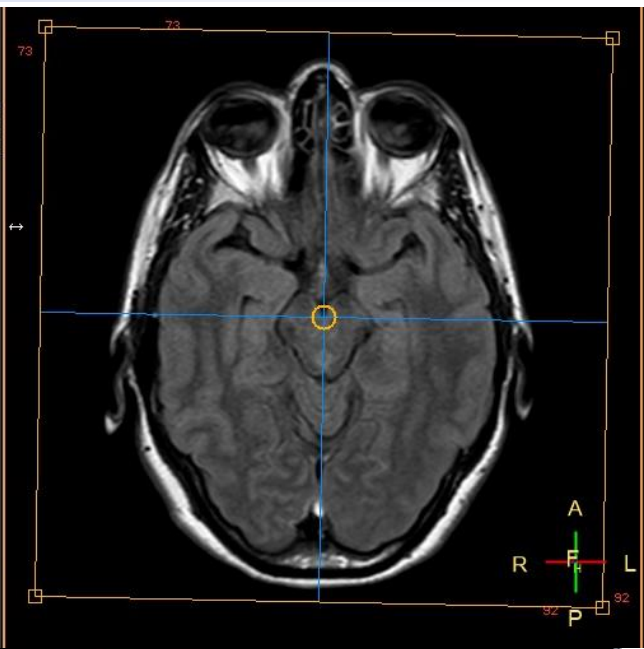
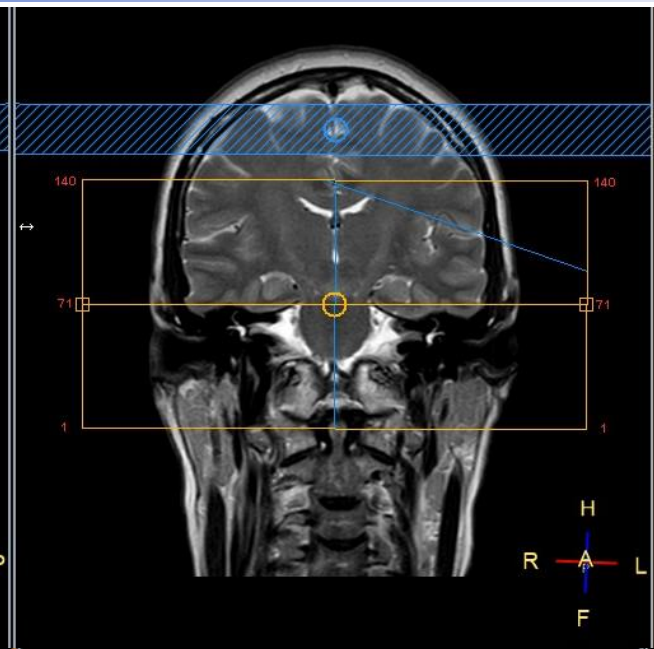
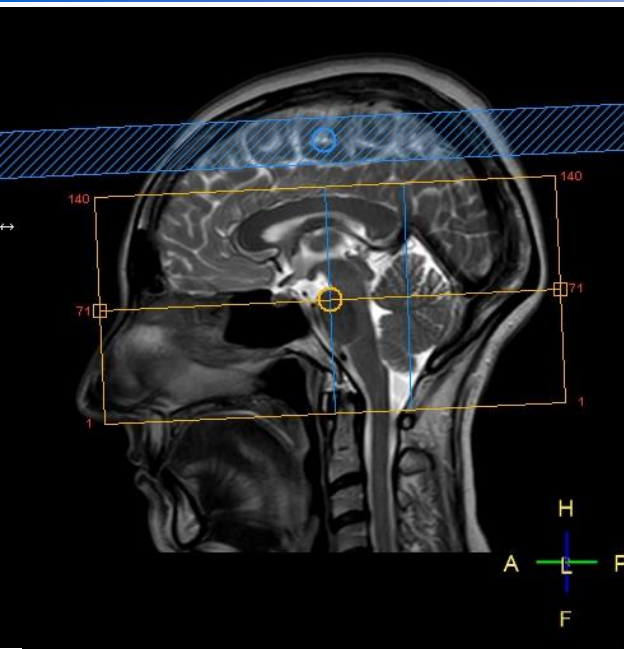
Summary | Geometry | Contrast | Motion | Dyn/Ang | Postproc | Offc/Ang | Coils | Conflicts <<

	AP (freq.)		RL (phase)		FH	
FOV	200	x	200	mm x	98	mm
Voxel	0.6	x	0.9	mm x	1.4	mm
Matrix	332	x	221	x	140	slices
			Gap	<input checked="" type="checkbox"/> Default	-0.7	mm

NSA: 1

Fat saturation: SPIR

Pratica: TOF



Pratica: TOF

s3DI_MC FAST		Voxel	Tra
02:55		0.60 x 0.90 x 1.40	
Summary	Geometry	Contrast	Motion
SCINDE		yes	
P reduction (RL)		3	
S reduction (FH)		1	
k-tBLAST		no	
Stacks		1	
slices		140	
slice orientation		transverse	
fold-over direction		RL	
fat shift direction		P	
Multi-chunk		yes	
chunks		5	
chunk scan order		HF	
PlanAlign		no	
REST slabs		1	
type		parallel	
thickness (mm)		20	
position		head	
gap		feet	
(mm)		head	
Interactive positioning		left	
		right	
		anterior	
		posterior	

REST slabs	1
type	parallel
thickness (mm)	20
position	head
gap	feet
(mm)	head
Interactive positioning	left
	right
	anterior
	posterior

Pratica: TOF

s3Di_MC

Three dimensional Multi chunk inflow sequence

Multi chunk sequence that makes use of the inflow effects of blood to visualize vessels.

Info:

Avoid saturation effects within large volumes by dividing the large volume into overlapping sub volumes (*Chunks*).

Decrease saturation effects within a chunk by *TONE*.

CHARM is used to eliminate or reduce Venetian Blind artifacts (in background).

REST-slab is used to suppress the venous flow

SENSE is used to improve the speed of the sequence.

Tips:

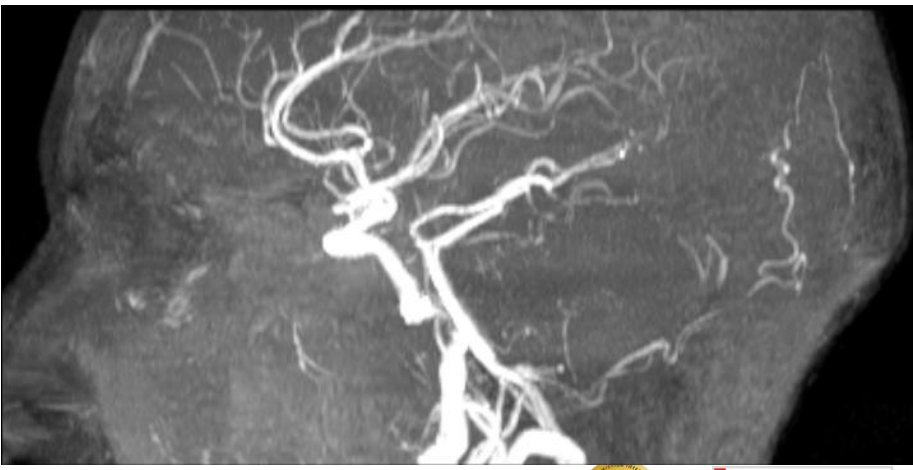
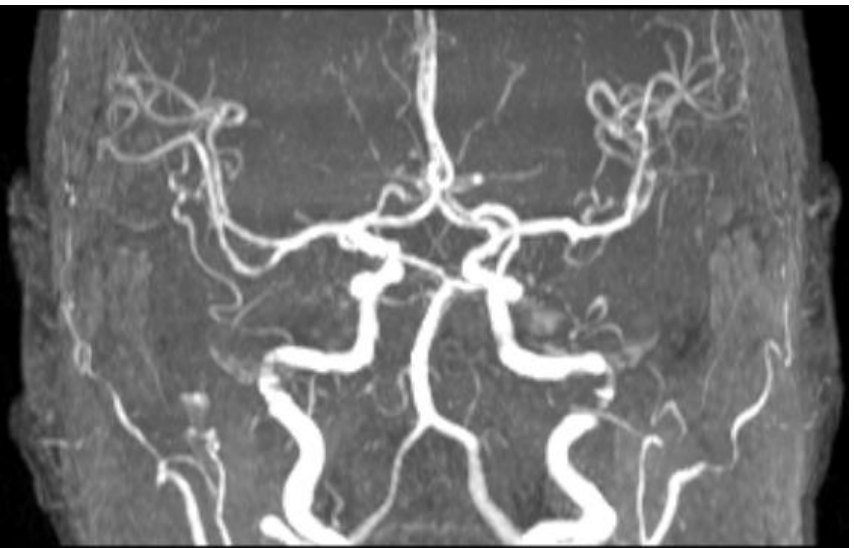
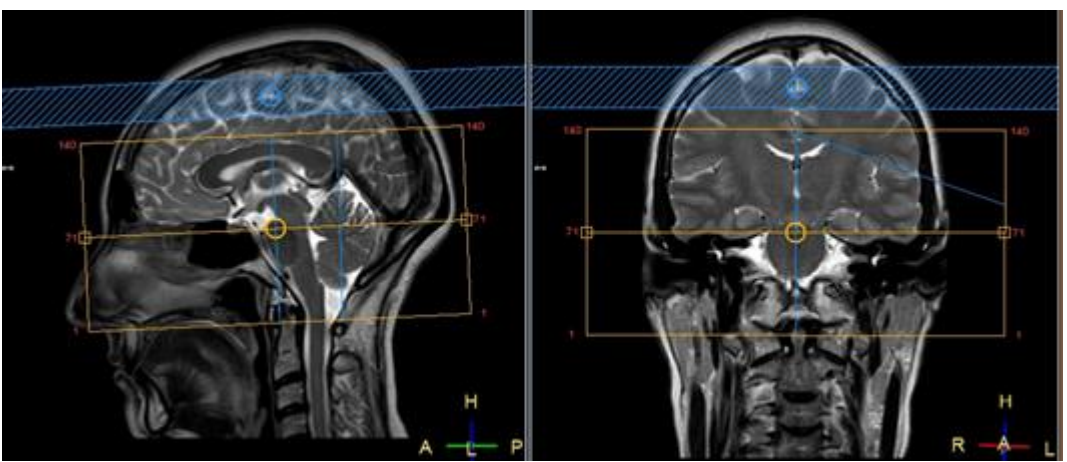
Always use an *out of phase* echo time. This will minimize the amount of fat signal within the images.

The number of *chunks* in combination with *TONE* and *CHARM* are optimized. The easiest way to extend your volume package is by adding a chunk with the same amount of slices per chunk as in the original preset procedure.

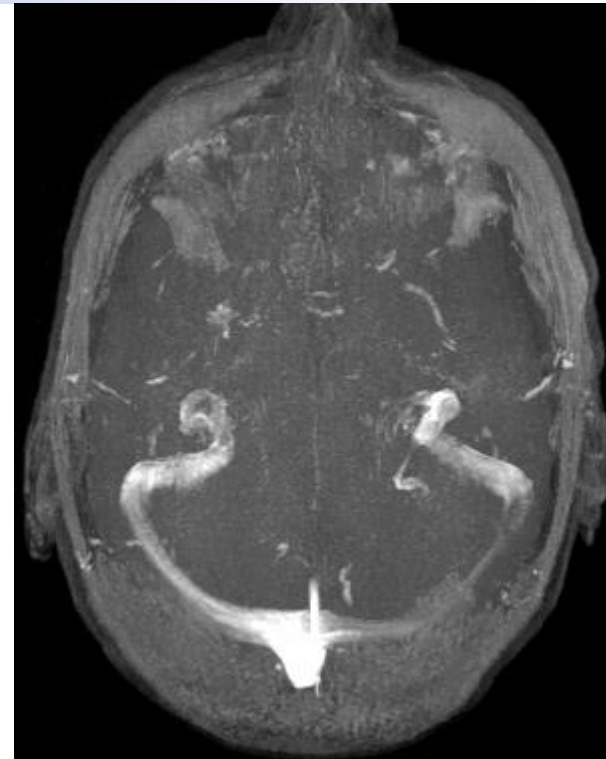
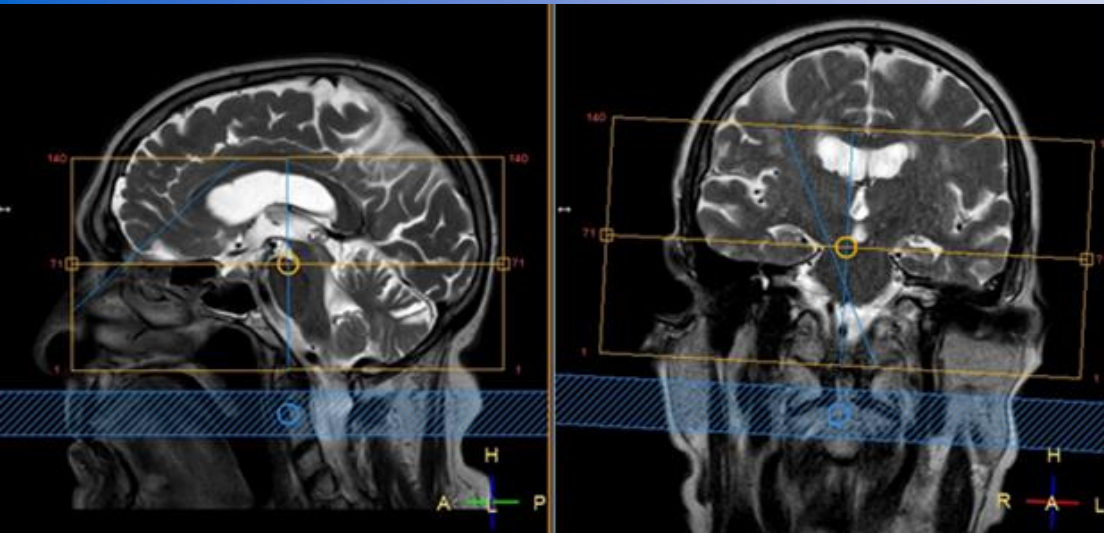
Chunk order must be chosen against the blood flow.

Per gli artefatti vedi presentazione 10 – MRI - ARTEFATTI

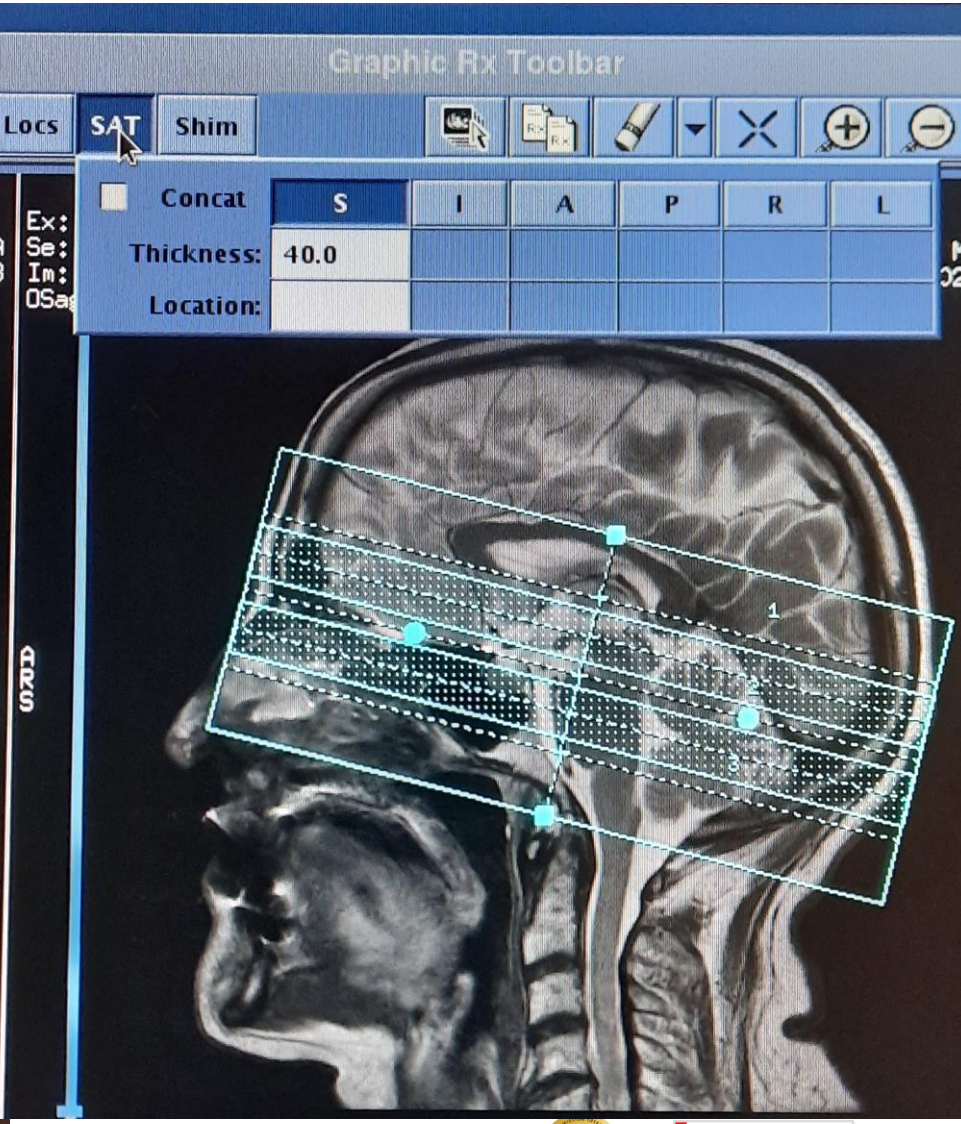
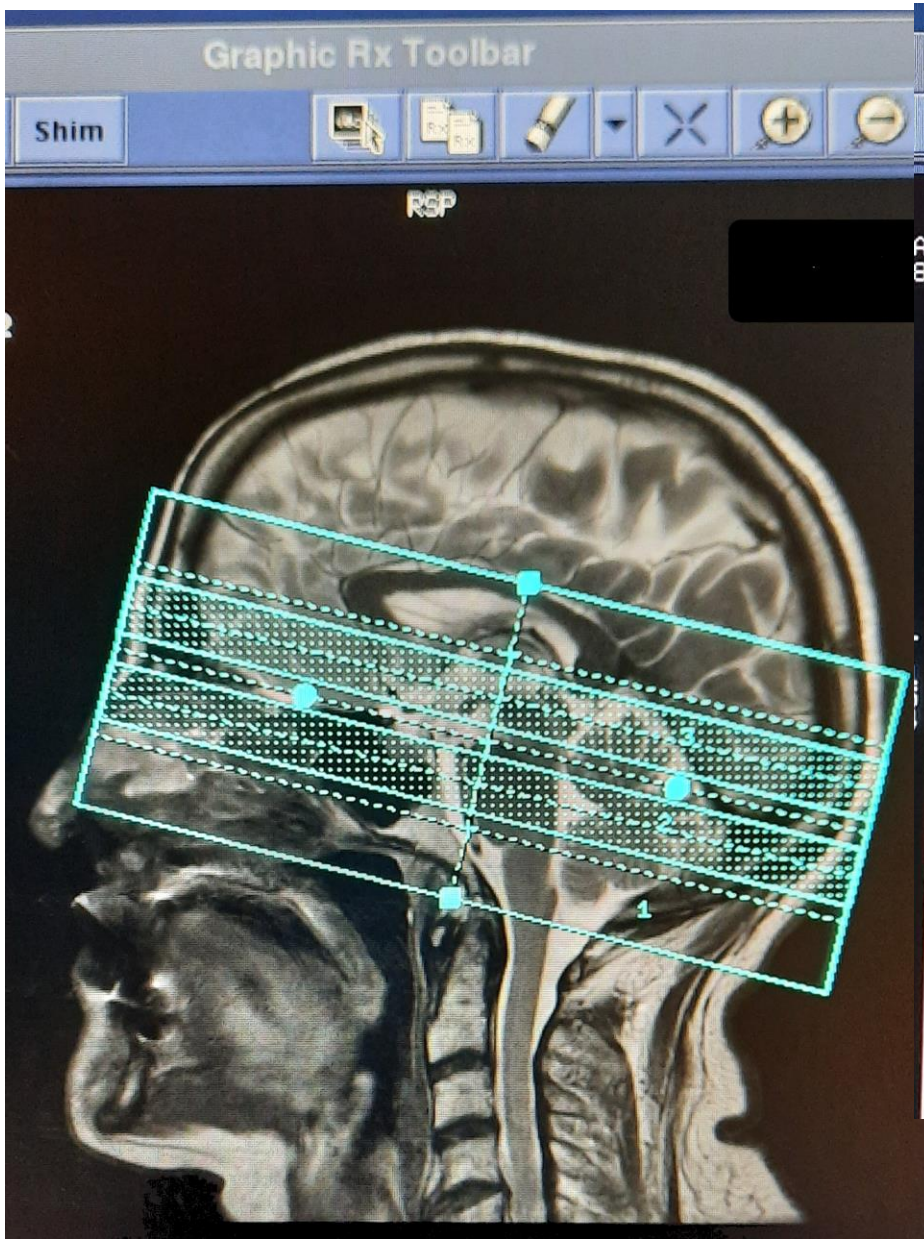
Pratica: TOF

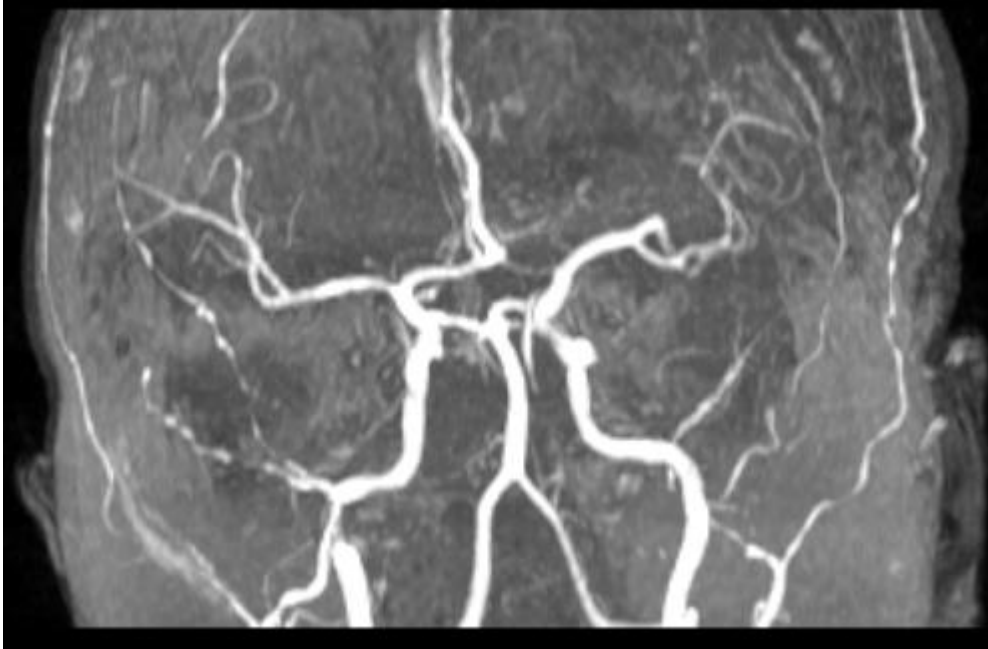


Pratica: TOF

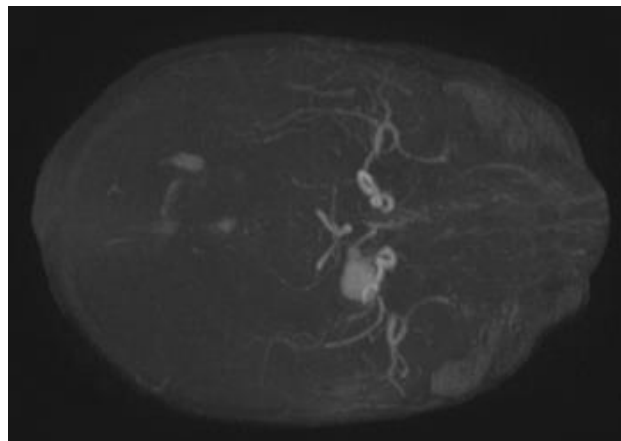
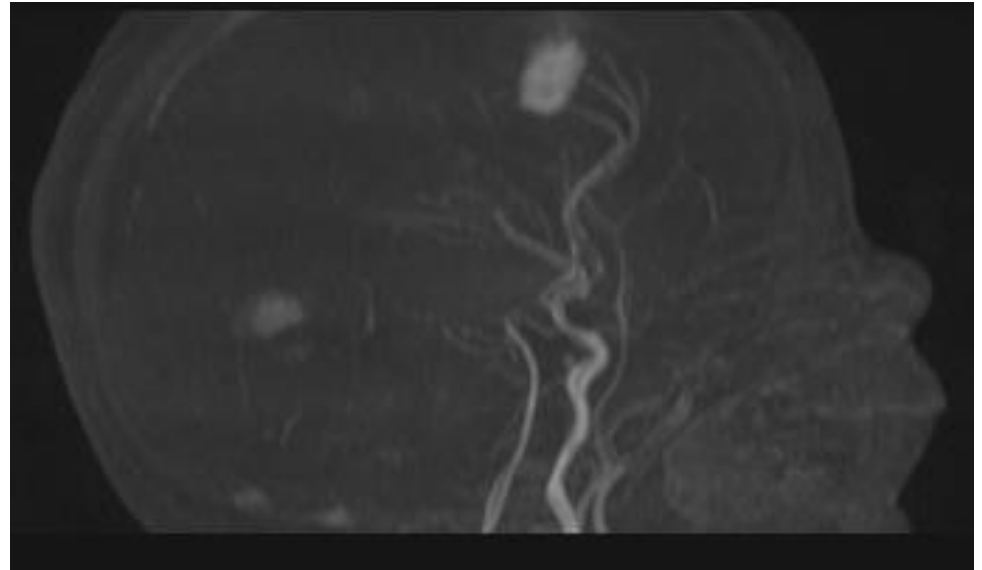
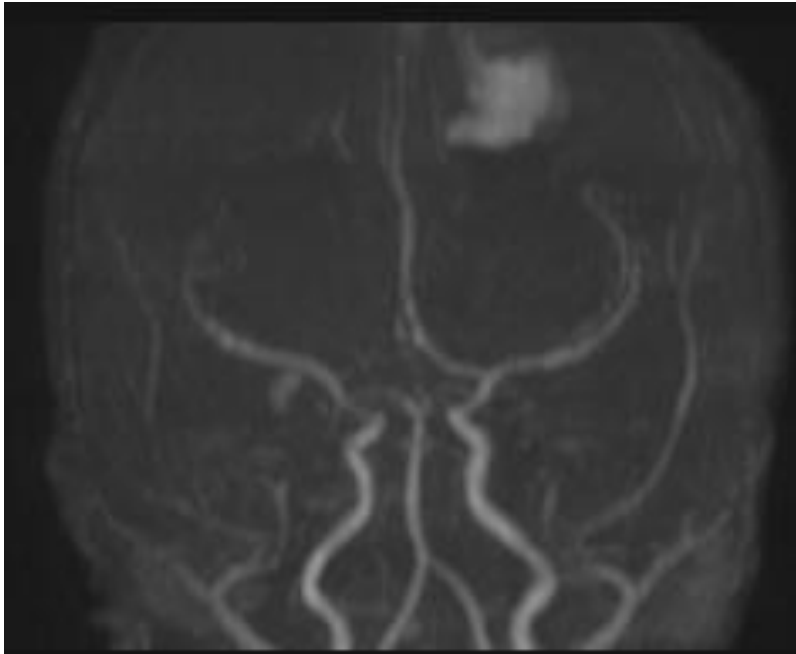


Pratica: TOF





2021: Neonato 10gg – ipossica-ischemica



Ricostruzioni MIP

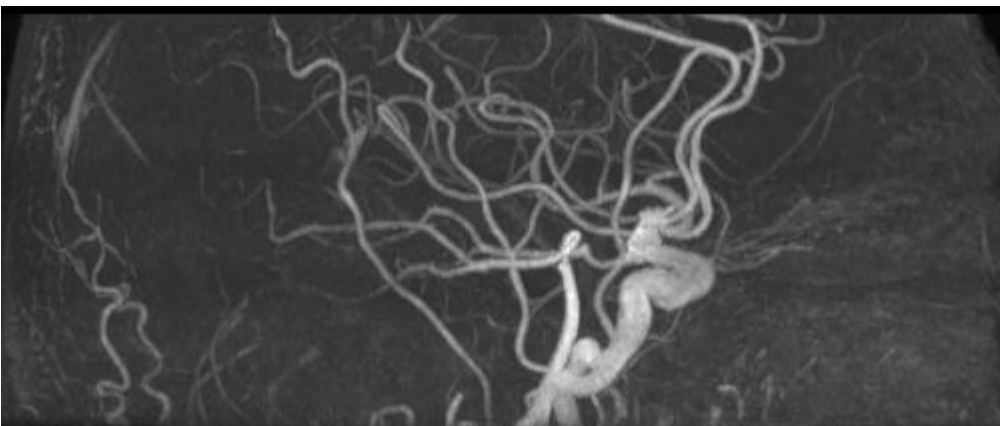
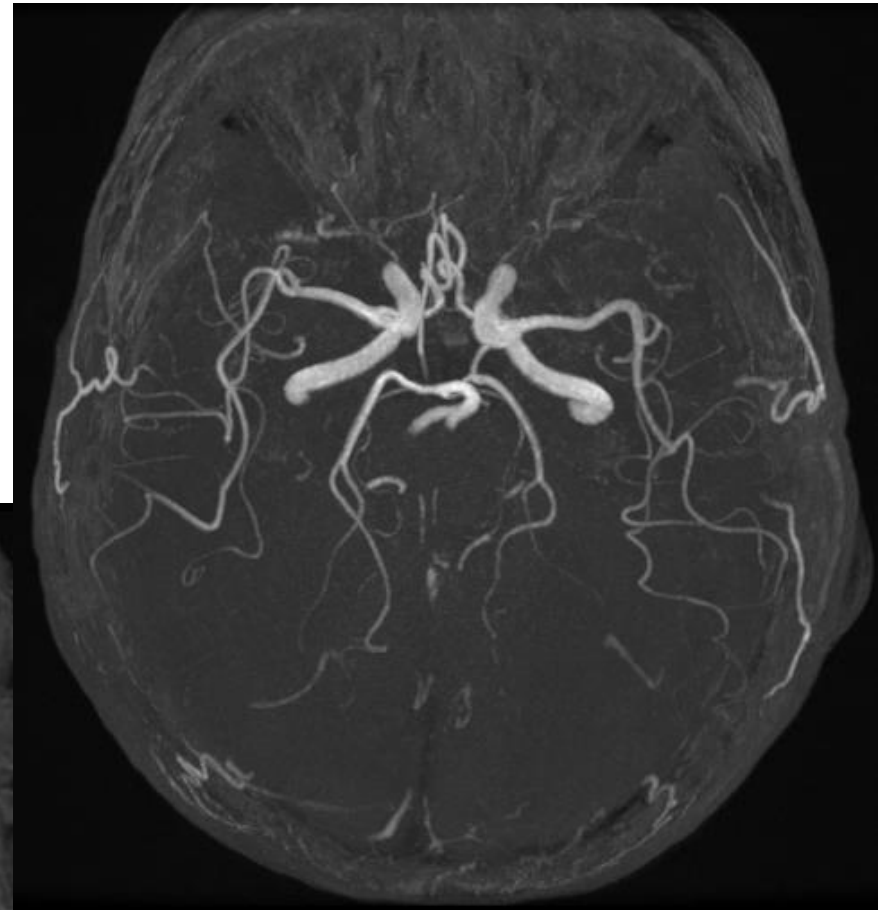
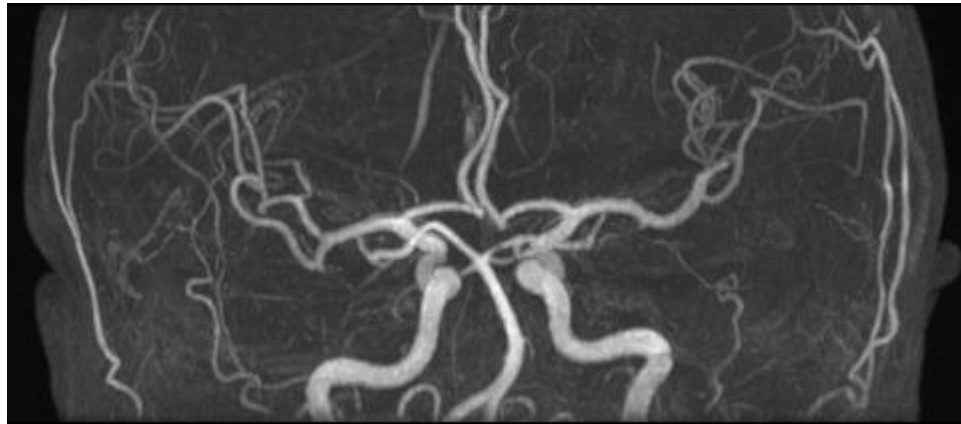
ANGIO-RM DINAMICA (1 DISTRETTO) CON MDC
3D Ax TOF SPGR FS

SIGNA Premier
15-April-2022 15:50:35

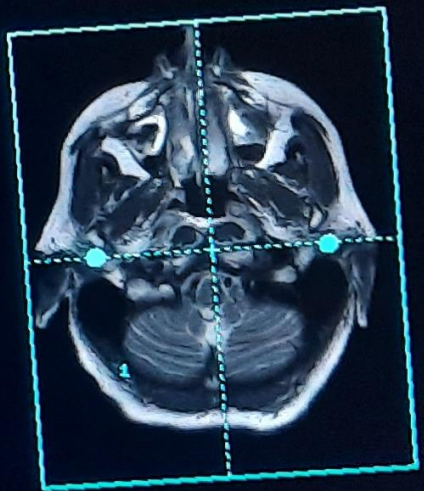
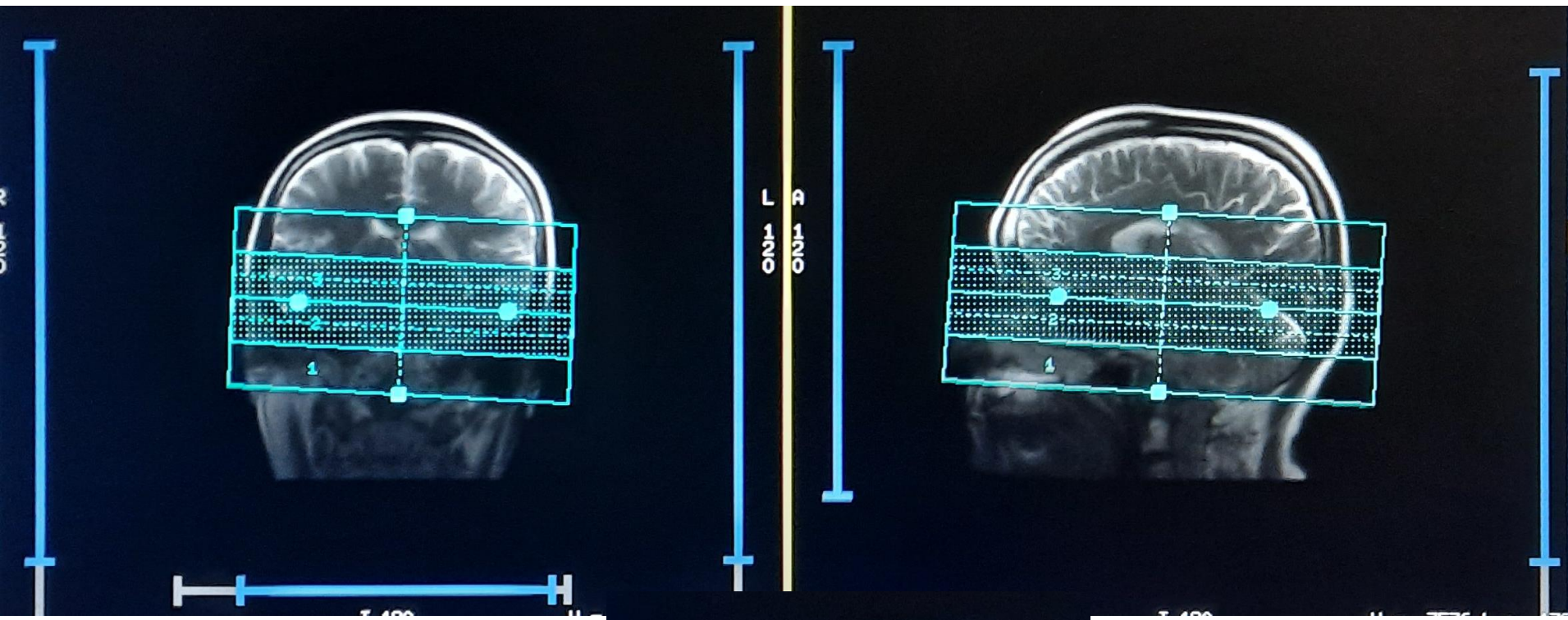


ST: 1.00 SL: 4.87
RT: 19.00 ET: 3.40
FS: 3.00
MR
LittleEndianExplicit
Images: 1/168
Series: 5

WL: 292 WW: 585



Pratica: TOF



Pratica: TOF

3D Ax TOF SPGR GRx 3:58 Details Vascular Acceleration Advanced

Scan Plane: **Oblique** ▼ Freq. Dir: **A/P** ▼ # of TE(s) per Scan: **1.0** ▼ ▲ Frequency: **380** ▼

Freq. FOV: **21.0** ▼ ▲ TR: **Minimur** ▼ ▲ TE: **of Phase** ▼ ▲ Phase: **360** ▼

Phase FOV: **0.80** ▼ # Slabs: **3** Flip Angle: **15** ▼ ▲ Bandwidth: **41.67** ▼ ▲

No Phase Wrap: **1.00** ▼ ▲ Locs per Slab: **40** ▼ ▲ Intensity Correction: **SCENIC** ▼ Excitation Mode: **Selecti...** ▼

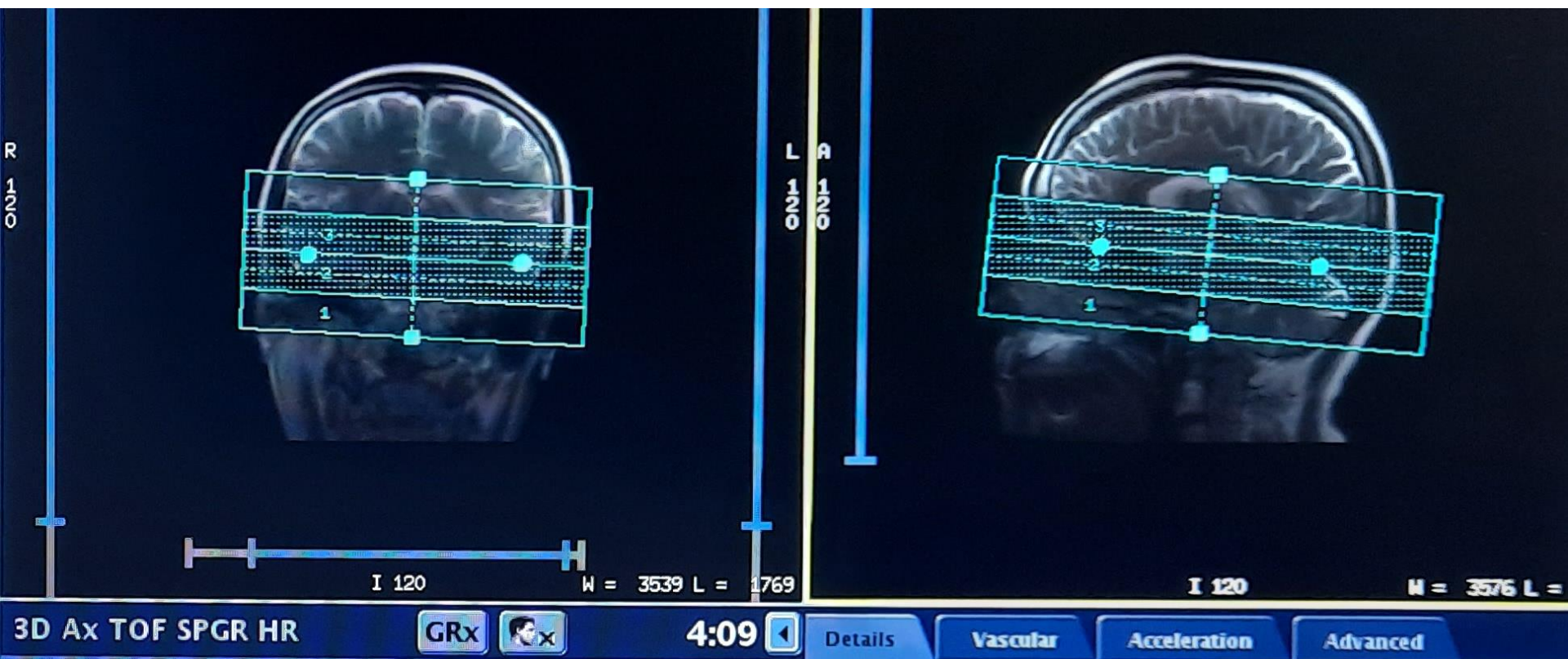
Slice Thickness: **1.4** ▼ ▲ Max # Slices: **256** Calibration In Prescan: **On** ▼ Shim: **Auto** ▼

Overlap Loc: **16** # of Acqs: **3** Intensity Filter: **None** ▼ RF Drive Mode: **Preset** ▼

Start R/L **L2.3** A/P **A14.8** S/I **175.9** Rel. SNR00: **100** ▲ ▼ Save Original: Phase Correct: **Off** ▼

End R/L **L7.0** A/P **A9.8** S/I **S12.1** Pixel Size: **0.6x0.6** 3D Geometry Correction: Anatomical Reference: **None** ▼

Chem SAT: **Fat** ▼ BW/Pixel: **219.3** Anatomical Plane: **None** ▼



Pratica: TOF HR

3D Ax TOF SPGR HR GRx 4:09

Details **Vascular** **Acceleration** **Advanced**

Scan Plane: **Oblique**
 Freq. Dir: **A/P**
 Freq. FOV: **21.0**
 Phase FOV: **0.80**
 No Phase Wrap: **1.00**
 Slice Thickness: **1.2**
 Overlap Loc: **16**

Freq. Dir: **A/P**
 TR: **Minimur**
 # Slabs: **3**
 Locs per Slab: **40**

Max # Slices: **256**
 # of Acqs: **3**
 Rel. SNR: **100**
 Pixel Size: **0.5x0.6**
 BW/Pixel: **200.3**

of TE(s) per Scan: **1.0**
 TE: **of Phase**
 Flip Angle: **15**
 Intensity Correction: **SCENIC**
 Calibration In Prescan: **On**
 Intensity Filter: **None**
 Save Original:
 3D Geometry Correction:

Frequency: **416**
 Phase: **380**
 Bandwidth: **41.67**
 Excitation Mode: **Select...**
 Shim: **Auto**
 RF Drive Mode: **Preset**
 Phase Correct: **Off**
 Anatomical Reference: **None**
 Anatomical Plane: **None**

R/L A/P S/I
 Start **L2.7** **A12.1** **I67.0**
 End **L6.4** **A5.0** **S8.2**

Chem SAT: **Fat**
 SAT: S

Pratica: TOF HR

3D Ax TOF SPGR HR GRx 4:09 Details Vascular Acceleration Advanced

Scan Plane: **Oblique** Freq. Dir: **A/P** Time of Flight:
 Freq. FOV: **21.0** TR: **Minimur** Projection Images: **0** Collapse: On Off
 Phase FOV: **0.80** # Slabs: **3** Ramp Pulse: **I/P/L**
 No Phase Wrap: **1.00** Locs per Slab: **40**
 Slice Thickness: **1.2**
 Overlap Loc: **16**

3D Ax TOF SPGR HR GRx 4:09 Details Vascular Acceleration Advanced

Scan Plane: **Oblique** Freq. Dir: **A/P** Phase: **2.00** Slice: **1.00**
 Freq. FOV: **21.0** TR: **Minimur** HyperSense: **1.30**
 Phase FOV: **0.80** # Slabs: **3**
 No Phase Wrap: **1.00** Locs per Slab: **40**
 Slice Thickness: **1.2**
 Overlap Loc: **16**

Pratica: TOF HR

3D Ax TOF SPGR HR GRx 4:09

Details Vascular Acceleration Advanced

Scan Plane: **Oblique** Freq. Dir: **A/P**

Freq. FOV: **21.0** TR: **Minimur**

Phase FOV: **0.80** # Slabs: **3** CV9

No Phase Wrap: **1.00** Locs per Slab: **40** CV30

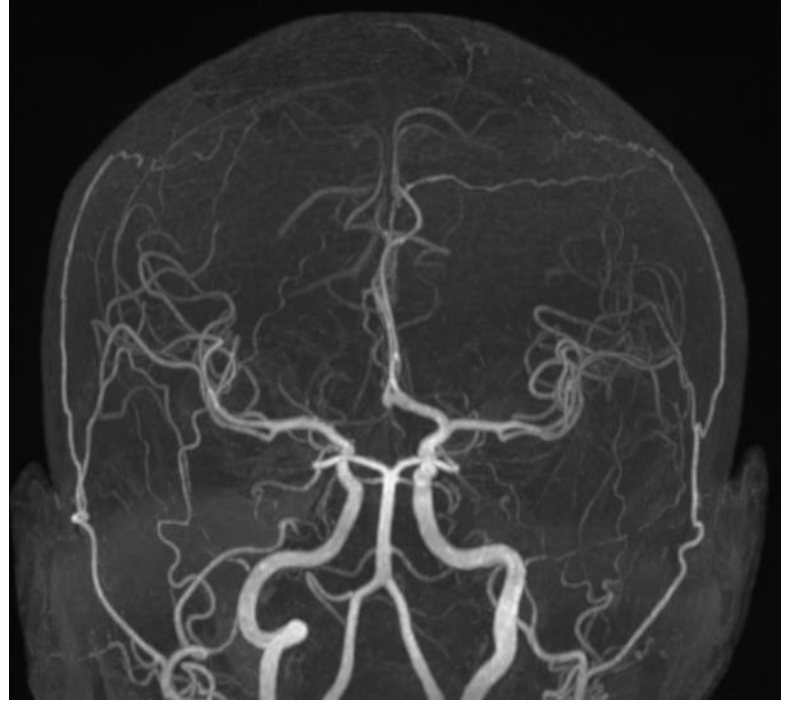
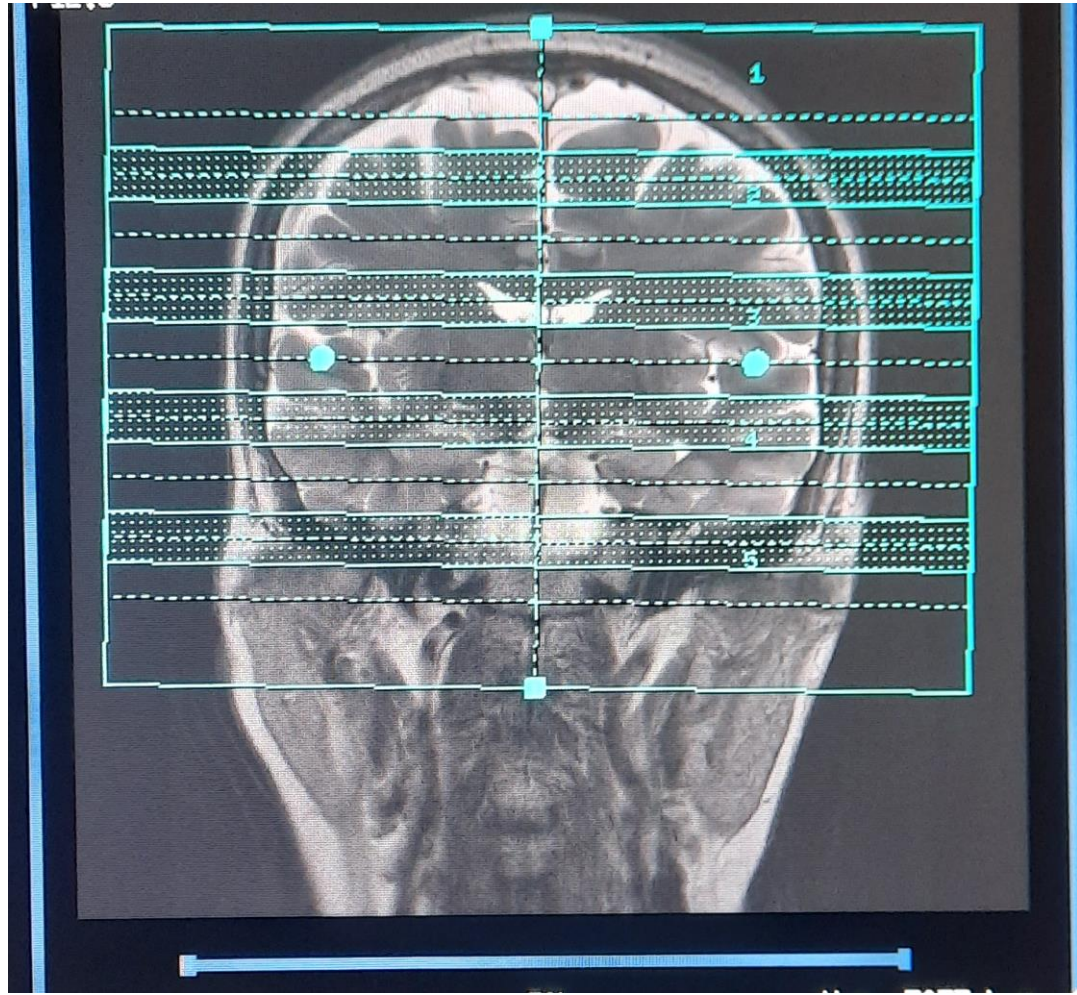
Slice Thickness: **1.2** CV41

Overlap Loc: **16**

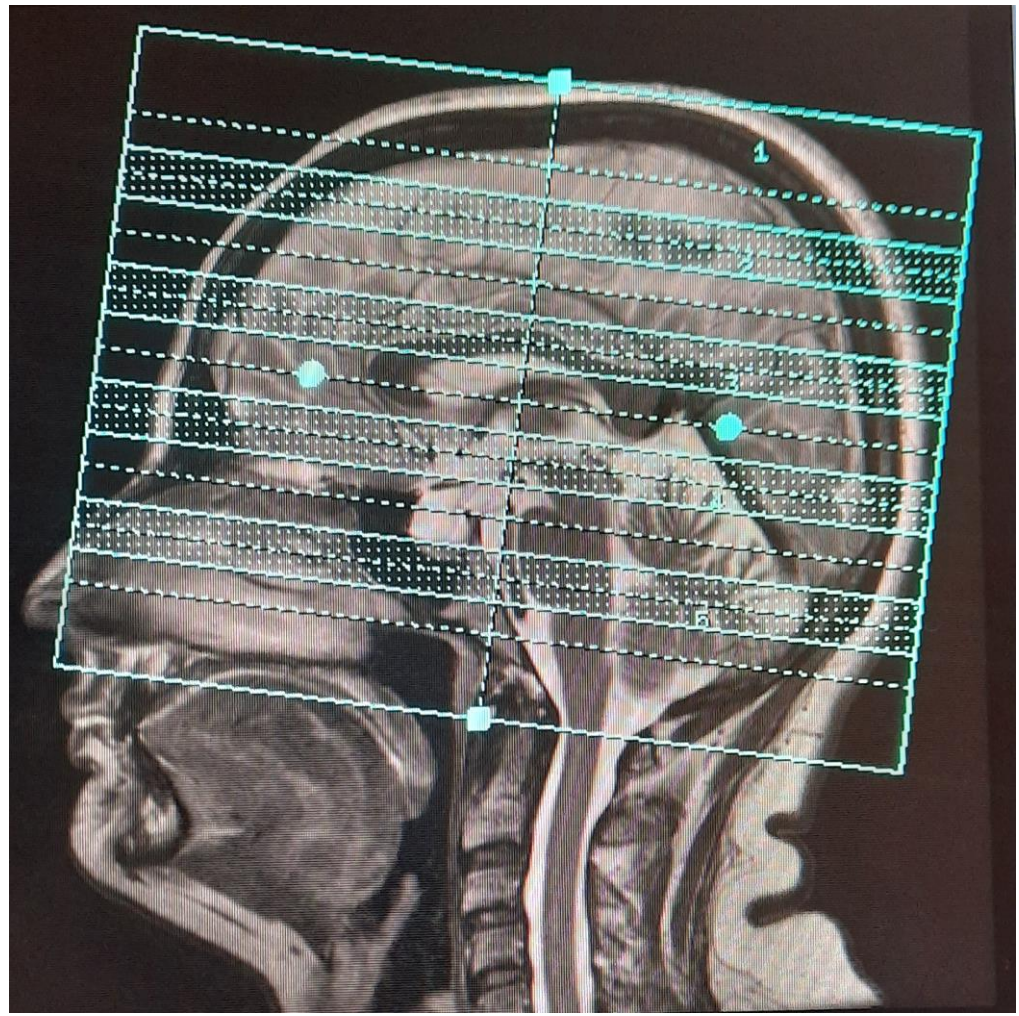
User Control Variables

		Min	Max
FAT enhancement (0=off; 1=on):	1.00	0.0	1.0
Apodization Level: 0=Weak, 1=Medium, 2=Strong:	1.00	0.0	2.0
PURE compensation:	0.00	-100.0	100.0

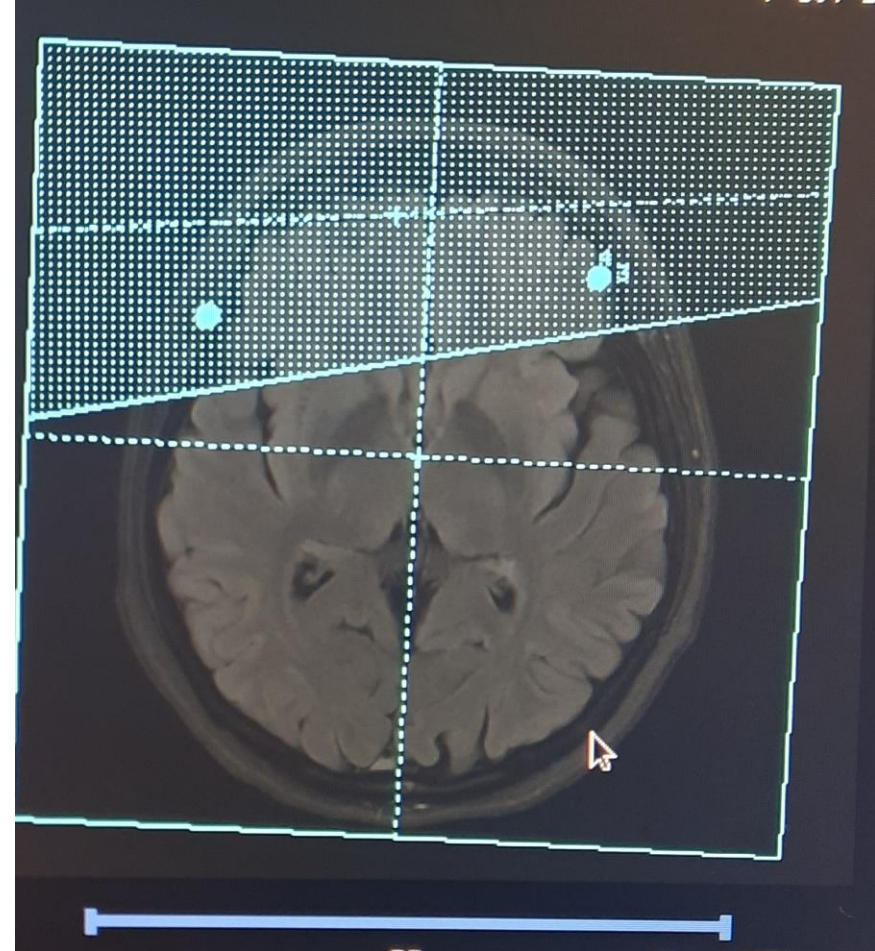
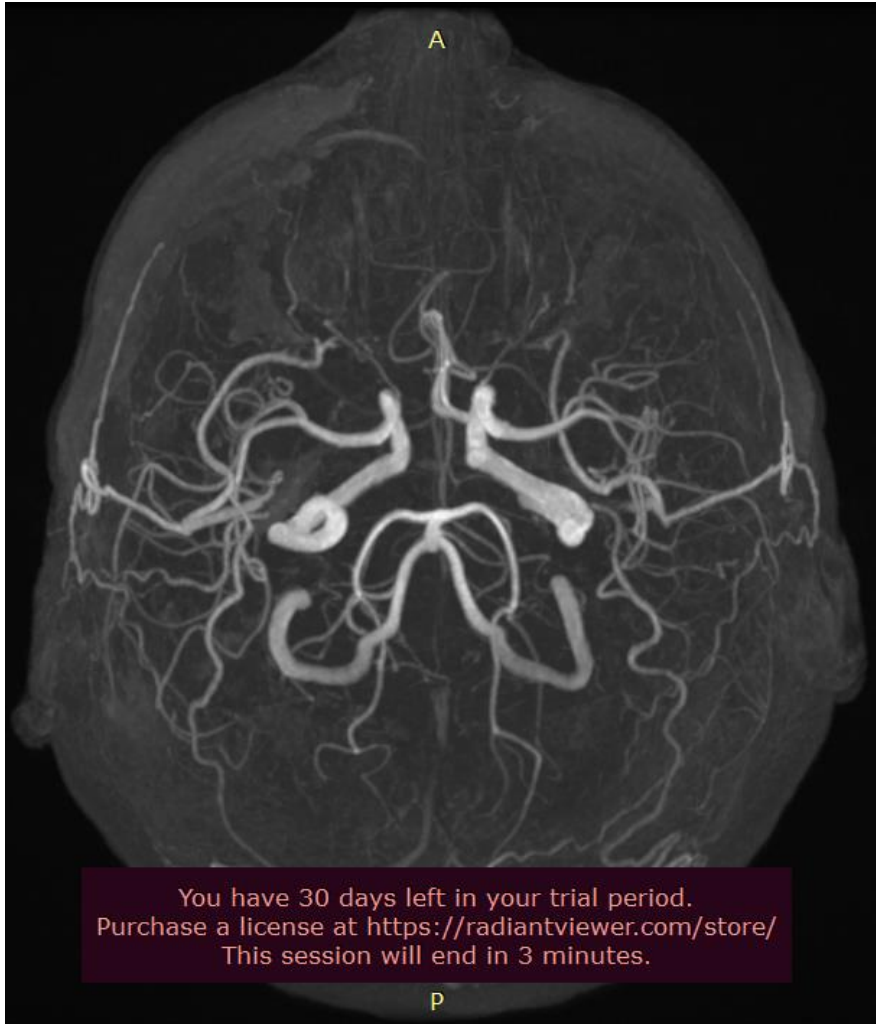
Pratica: 3D AX TOF SPGR FS whole head



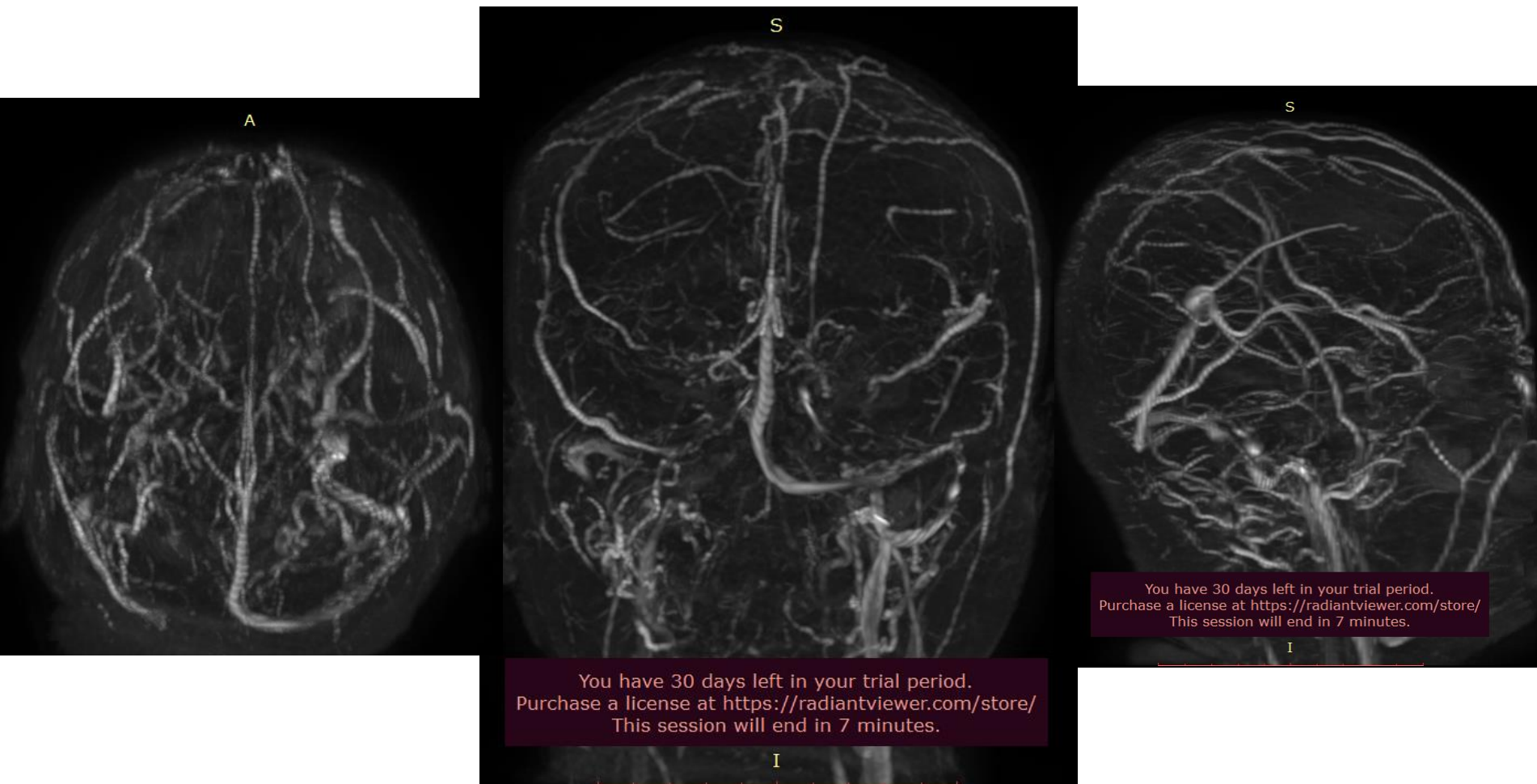
Pratica: 3D AX TOF SPGR FS whole head



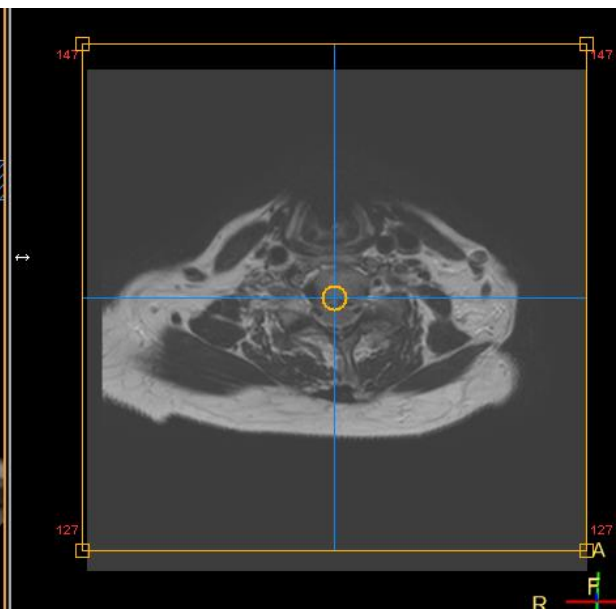
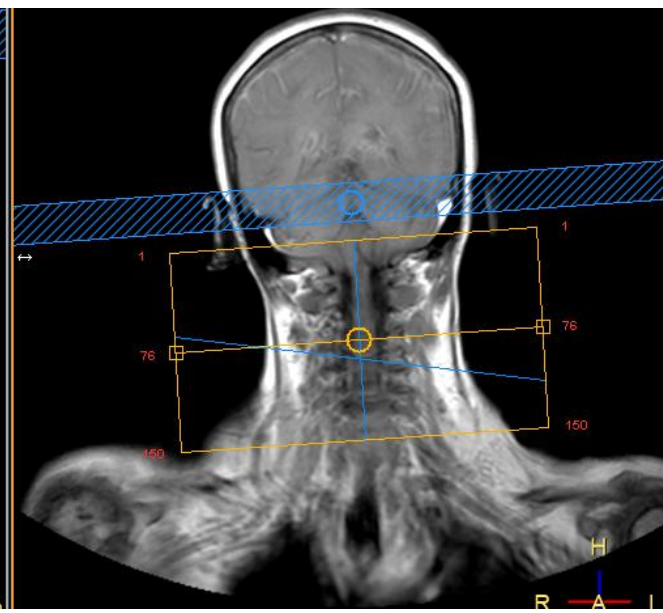
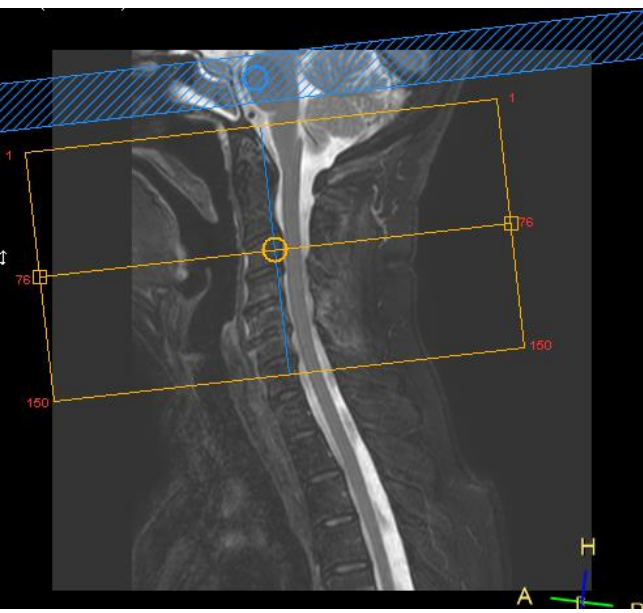
Pratica: 3D AX TOF SPGR FS whole head

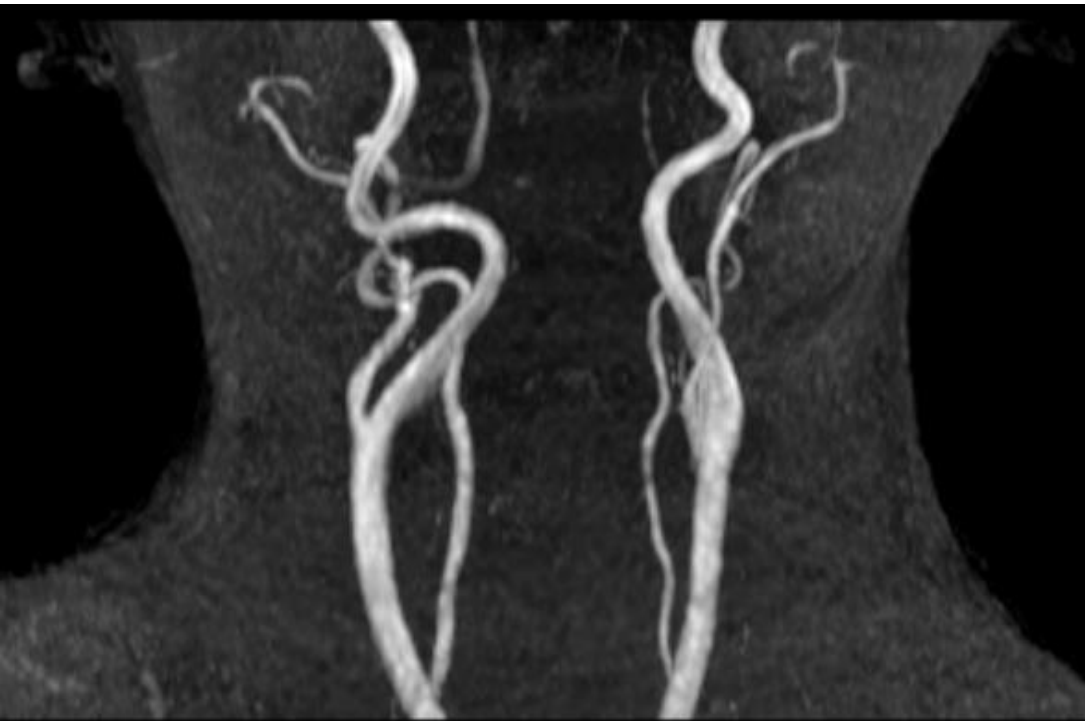


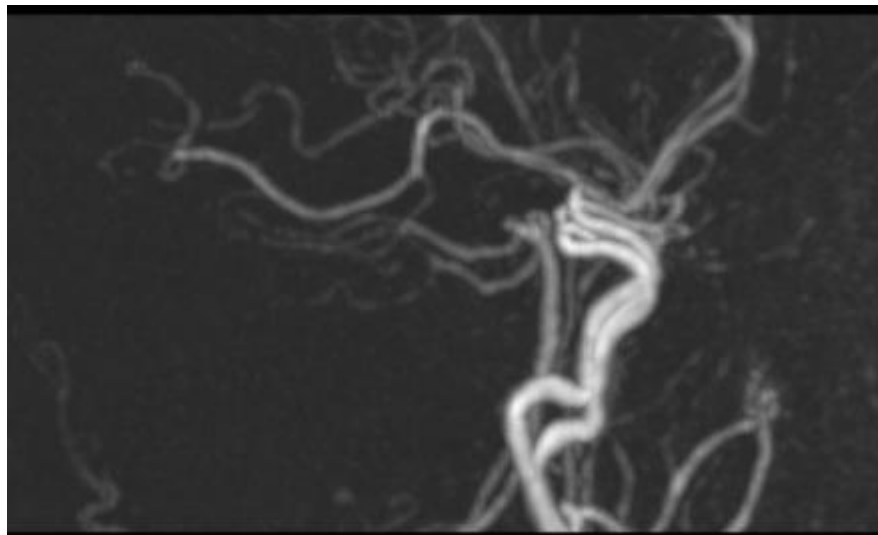
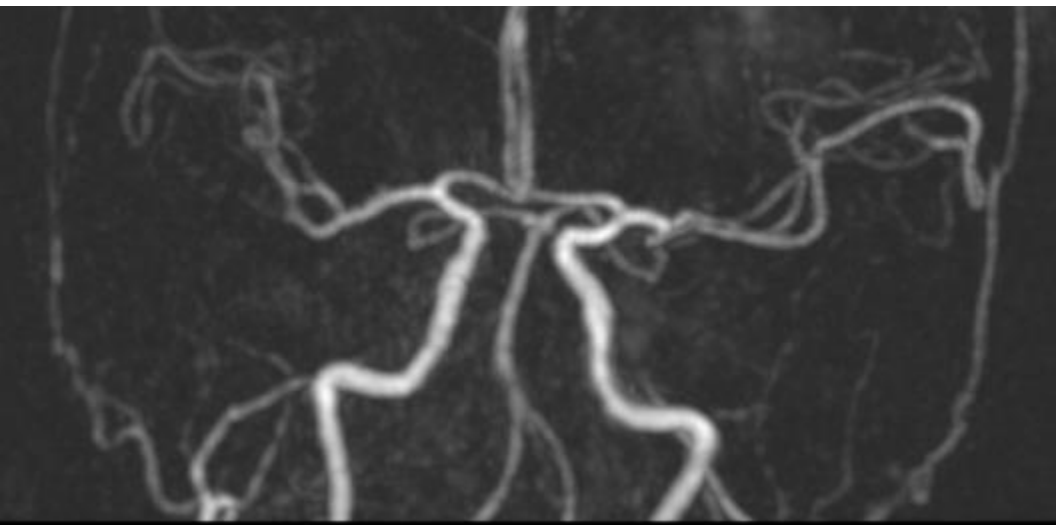
Pratica: COR 2D TOF MRV



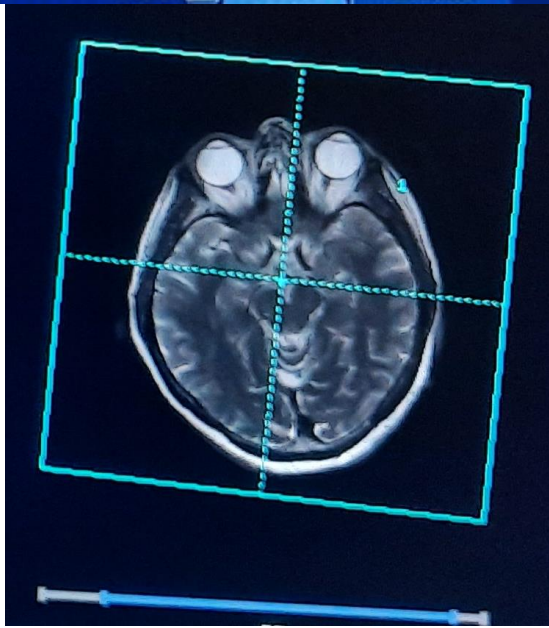
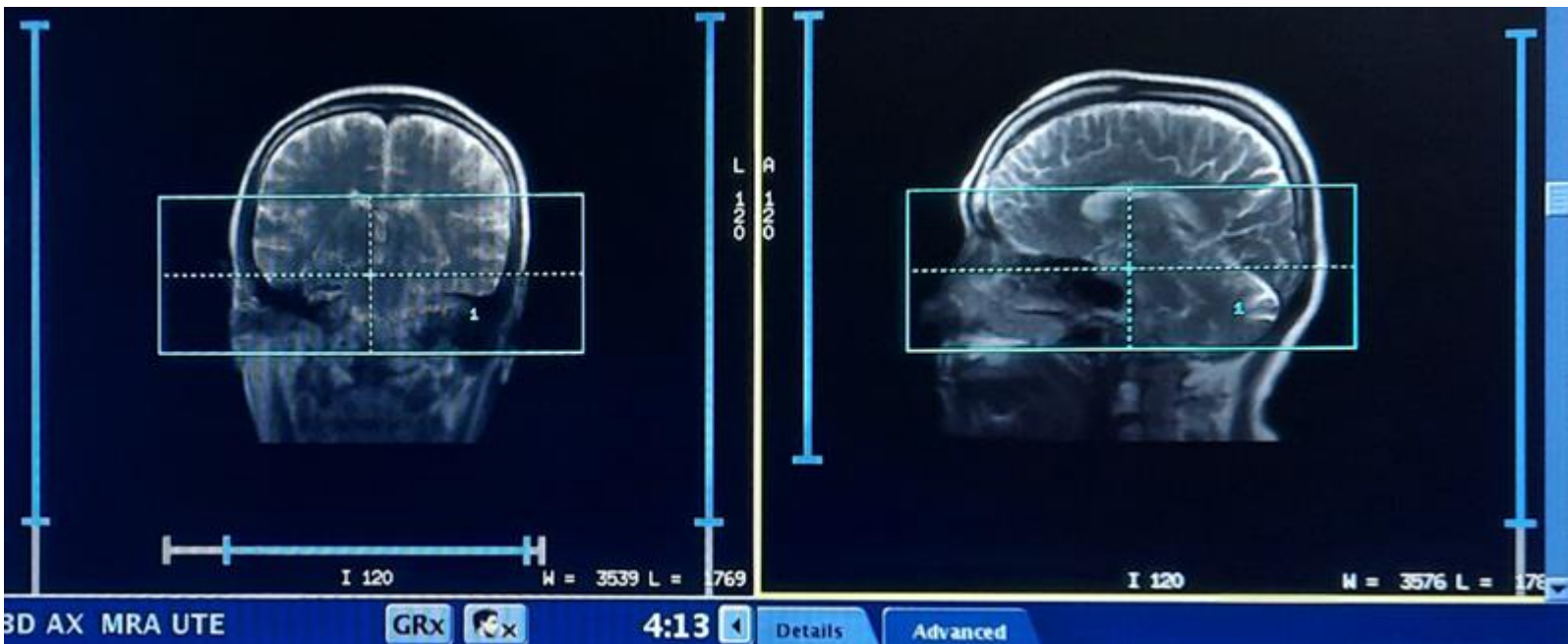
Pratica: TOF COLLO







Pratica: 3D AX MRA UTE



Pratica: 3D AX MRA UTE

3D AX MRA UTE GRx 4:13 Details **Advanced**

Scan Plane: Axial Freq. Dir: A/P

Freq. FOV: 22.0

Slice Thickness: 1.2

of Scan Locs: 68

Max # Slices: 320

of Acqs: 1

Rel. SNR(%): 417

Pixel Size: 1.2x1.2

Chem SAT: None

S/I L/R P/A

Start I73.0 L0.8 A14.2

End S7.4 L0.8 A14.2

of TE(s) per Scan: 1.0

TE: 0.0

Flip Angle: 5

Auto IR Band: On

Intensity Correction: SCENIC

Calibration In Prescan: On

Intensity Filter: None

Save Original:

3D Geometry Correction:

Frequency: 180

Spokes Per Segment: 512

NEX: 1.00

Bandwidth: 20.83

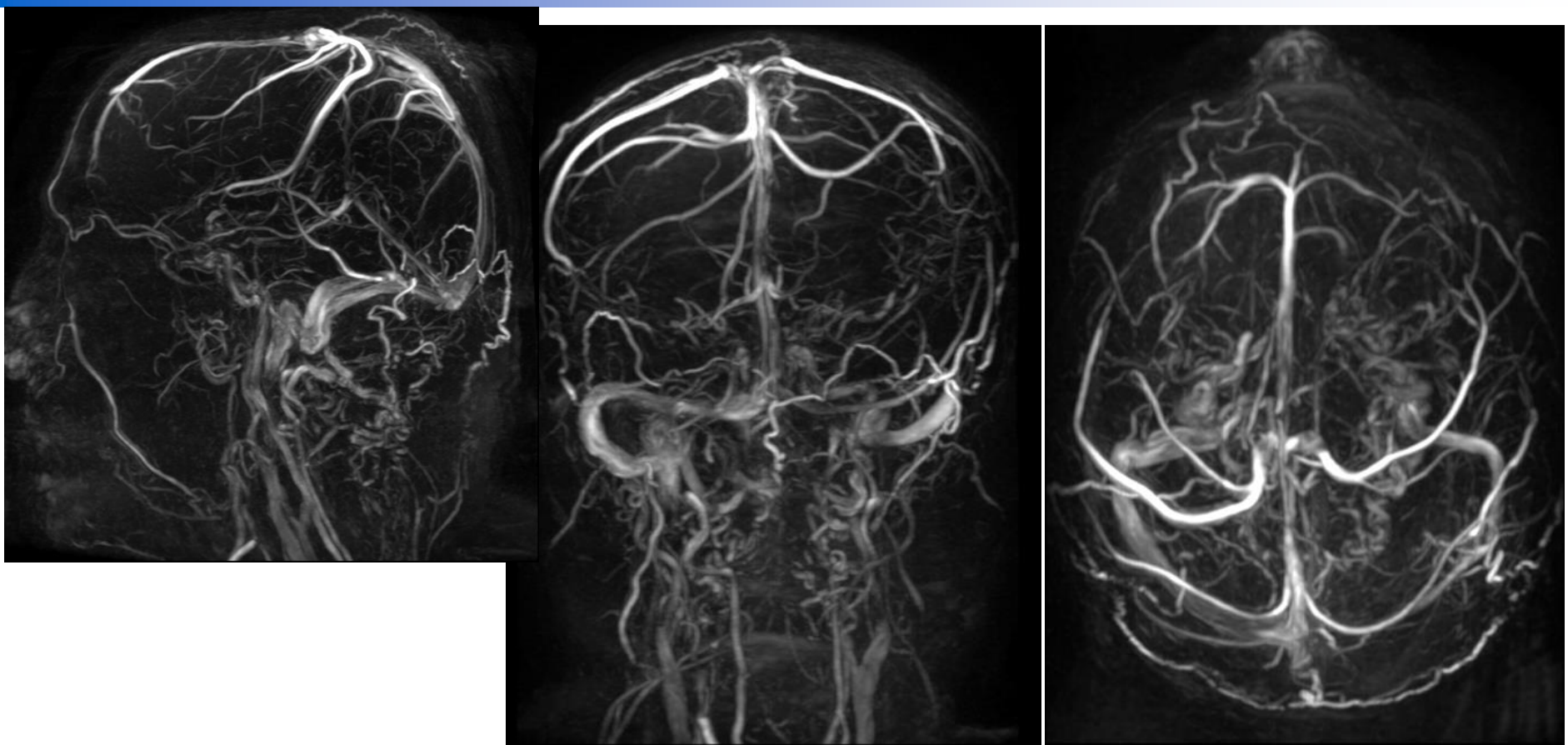
Excitation Mode: Selecti...

Shim: On

RF Drive Mode: Preset

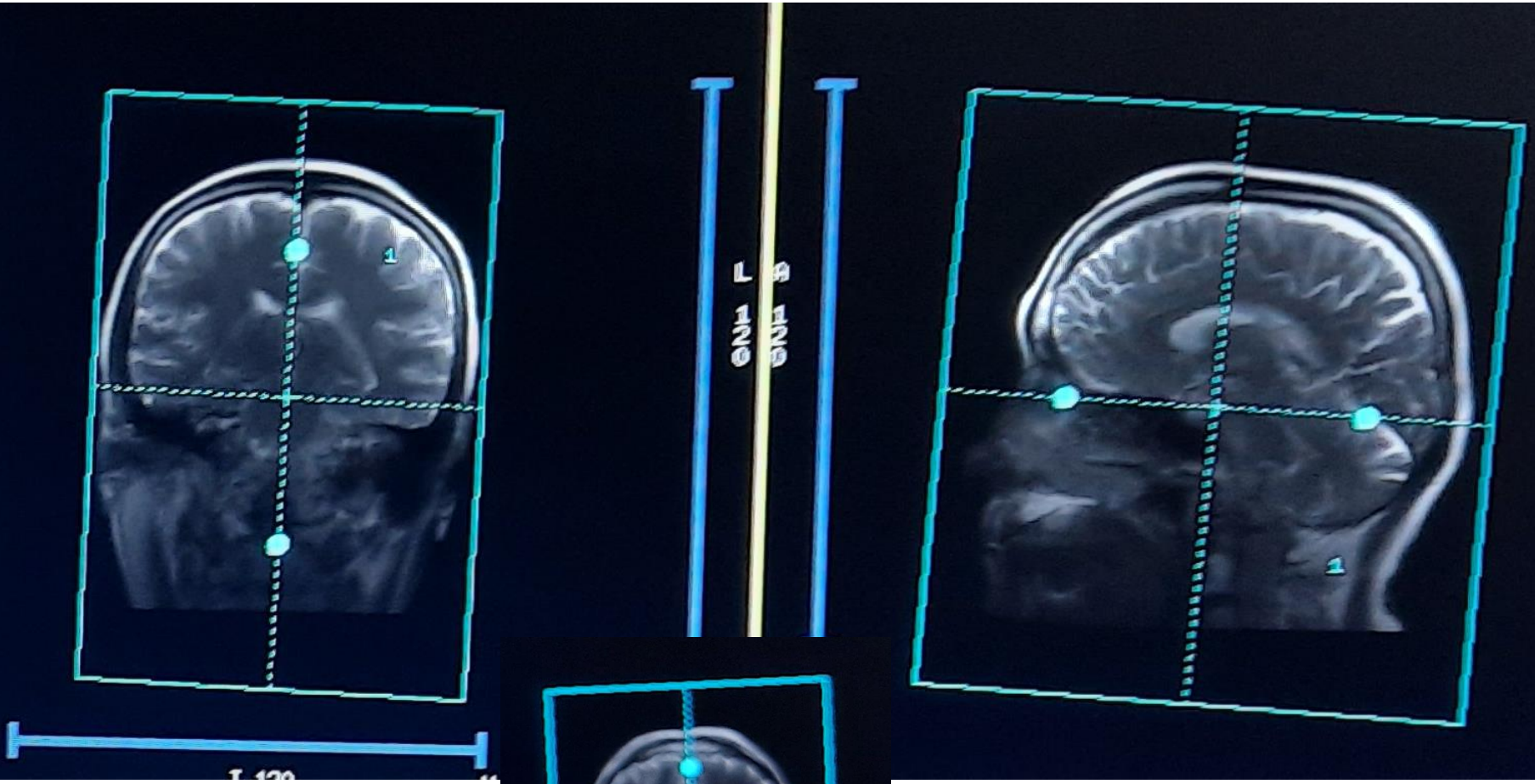
Phase Correct: Off

Pratica: 3D sag Inhance Venosa



3T: 3D SAG INHANCE
Velocity encoding: 7

Pratica: 3D sag Inhance Venosa



Pratica: 3D sag Inhance Venosa

3D Sag Inhance Ven... GRx 5:44 Details Vascular Acceleration Advanced

Scan Plane: **Oblique**
 Freq. FOV: **24.0**
 Phase FOV: **0.90**
 Slice Thickness: **1.4**
 # of Scan Locs: **114**

Freq. Dir: **S/I**
 TR: **Minimur**

Max # Slices: **1020**
 # of Acqs: **1**
 Rel. SNR@: **72**
 Pixel Size: **0.7x1.0**
 BW/Pixel: **177.6**

R/L A/P S/I
 Start **L81.6** **A29.2** **I33.5**
 End **R75.0** **A8.0** **I28.4**

Chem SAT: **None**

of TE(s) per Scan: **1.0**
 TE: **linimum**
 Flip Angle: **8**
 Intensity Correction: **NONE**
 Calibration In Prescan: **On**
 Intensity Filter: **None**
 Save Original:
 3D Geometry Correction:

Frequency: **352**
 Phase: **240**
 Bandwidth: **31.25**
 Excitation Mode: **Select**
 Shim: **Auto**
 RF Drive Mode: **Preset**
 Phase Correct: **Off**
 Anatomical Reference: **None**
 Anatomical Plane: **None**

Pratica: 3D sag Inhance Venosa

3D Sag Inhance Ven... GRX 5:44 Details Vascular Acceleration Advanced

Scan Plane: Oblique Freq. Dir: S/I Freq. FOV: 24.0 Phase FOV: 0.90 Slice Thickness: 1.4 # of Scan Locs: 114

Start R/L: 181.6 A/P: 29.2 S/I: 133.5 End R/L: 75.0 A/P: 8.0 S/I: 128.4

Chem SAT: None

Max # Slices: 1020 # of Acqs: 1 Rel. SNR: 72 Pixel Size: 0.7x1.0 BW/Pixel: 177.6

Phase Contrast Vas PC Proj Img: 0 Collapse: On Off Flow Recon Type: Complex Diff. Flow Analysis: On Off Velocity Encoding: 7.0 0.5 Min. 550.0 Max Acquisition Flow Direction Images: ALL

Additional Flow Images:
 Oblique R/L Flow
 Oblique A/P Flow
 Oblique S/I Flow
 MAG

3D Sag Inhance Ven... GRX 5:44 Details Vascular Acceleration Advanced

Scan Plane: Oblique Freq. Dir: S/I Freq. FOV: 24.0 Phase FOV: 0.90 Slice Thickness: 1.4 # of Scan Locs: 114

Phase: 2.00 Slice: 1.00

Pratica: 3D sag Inhance Venosa

3D Sag Inhance Ven... GRx 5:44 Details Vascular Acceleration Advanced

Scan Plane: Oblique Freq. Dir: S/I Phase: 2.00 Slice: 1.00

Freq. FOV: 24.0 TR: Minimur

Phase FOV: 0.90

Slice Thickness: 1.4

of Scan Locs: 114

3D Sag Inhance Ven... GRx 5:44 Details Vascular Acceleration Advanced

User Control Variables

	Min	Max
CV23 Percentage of pfr (80%-100%):	80.0	100.0

Scan Plane: Oblique Freq. Dir: S/I

Freq. FOV: 24.0 TR: Minimur

Phase FOV: 0.90

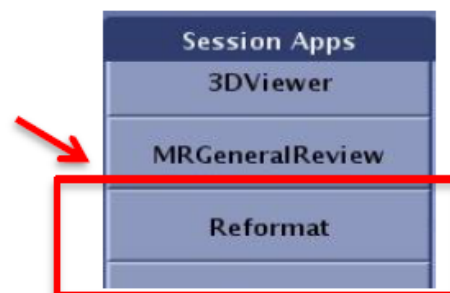
Slice Thickness: 1.4

of Scan Locs: 114



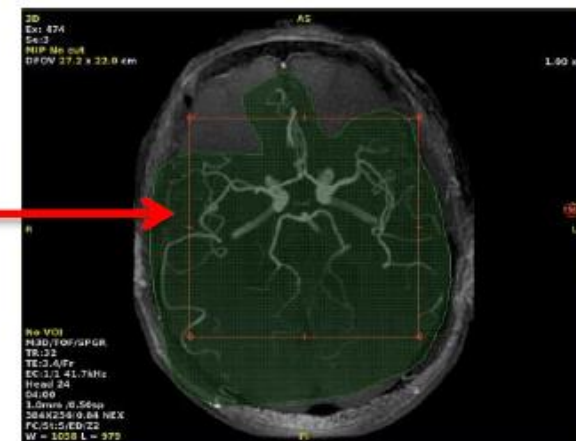
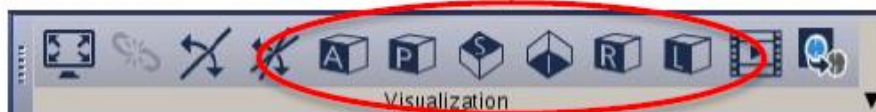
3D MIP Workflow

1. Select an appropriate series from the Series List and open **Reformat**
2. From the Review Steps, select the **3D MIP**

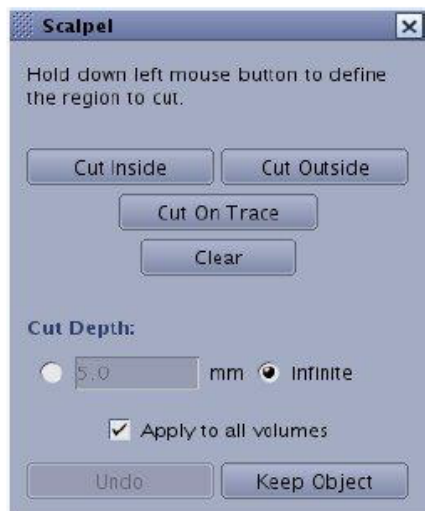



3. On the 3D image, middle-click and drag to adjust the window and level.

4. Use the Anatomic Orientation icons on the **Visualization** toolbar to change the plane of the 3D image, or hover over the 3D image and use the red box to manipulate the image orientation





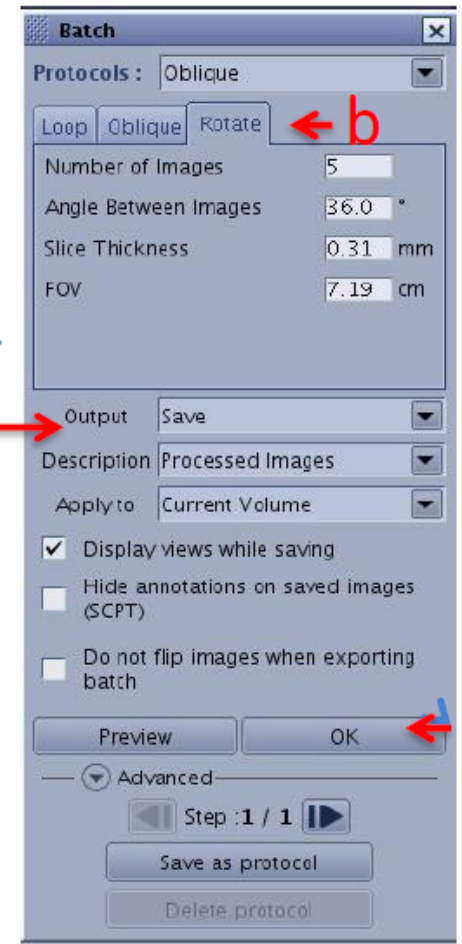
5. Define a MIP cut.



- From the **Segmentation** toolbar, click the **Scalpel** icon 
- Move the cursor to the start location of your cut
- Click and drag around the anatomy of interest
- To edit a trace, place the cursor over the trace edge and drag it to a new location
- To completely erase the trace and start over, click Clear on the Scalpel screen.
- Click **Cut Outside** or **Cut Inside** on the Scalpel screen.
- Repeat this process until the undesired anatomy is removed

Pratica: TOF

6. From the **Export Toolbar**, click the **Batch**  icon to view the Batch screen
 - a. Click on the view to be used as a reference
 - b. From the Batch screen, click the **Rotate** tab
 - c. Click on a direction arrow  to set the direction of rotation
 - d. Change the number of views or rotations
 - e. Make sure Output field is set to **Save**
 - f. Click on **OK** to save as a new series in the Patient List

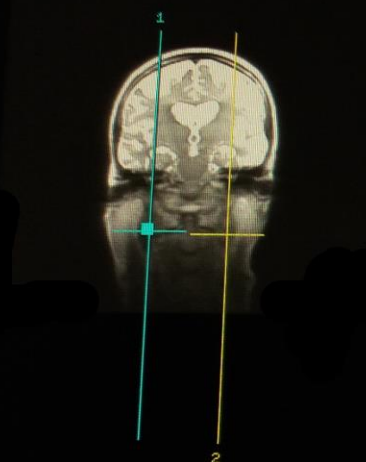


Imagination at work.

DOC1896112



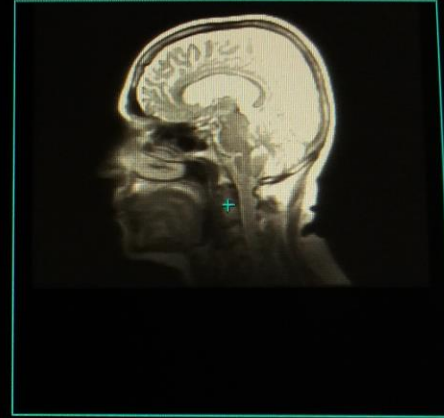
Sag 2D PC



SSFSE
TR:1038
TE:27.1/Ef
EC:1/1 83.3kHz

8HRBRAIN
FOV:32x32
8.0thk/3.0sp
29/00:30
256X192/0.53 NEX
/ED/SQ

I 160 W = 795 L = 24



SSFSE
TR:1038
TE:27.1/Ef
EC:1/1 83.3kHz

8HRBRAIN
FOV:32x32
8.0thk/3.0sp
29/00:30
256X192/0.53 NEX
/ED/SQ

I 160 W =

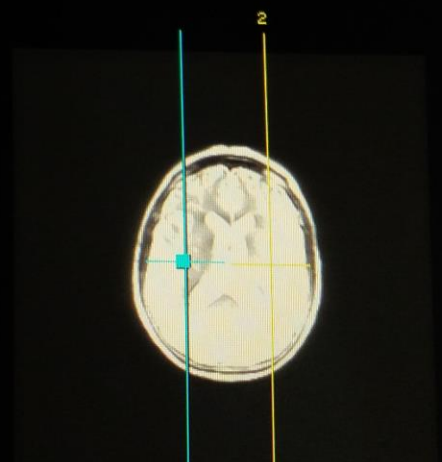
Sag 2D PC GRx 2:33 Signal HDxt 1.5T Ex: 17974 A 175

Ex: 17974 Se: 1 Im: 4 Ax: S0.0

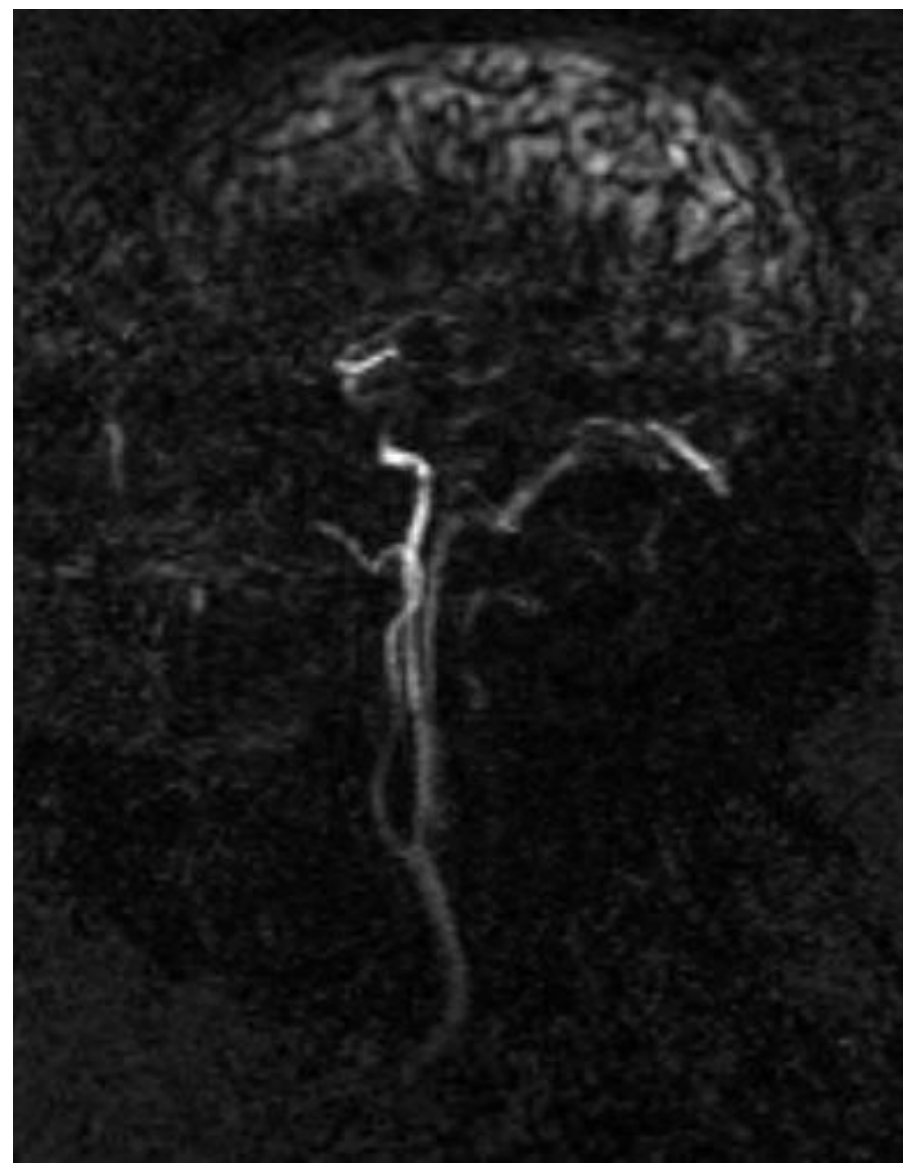
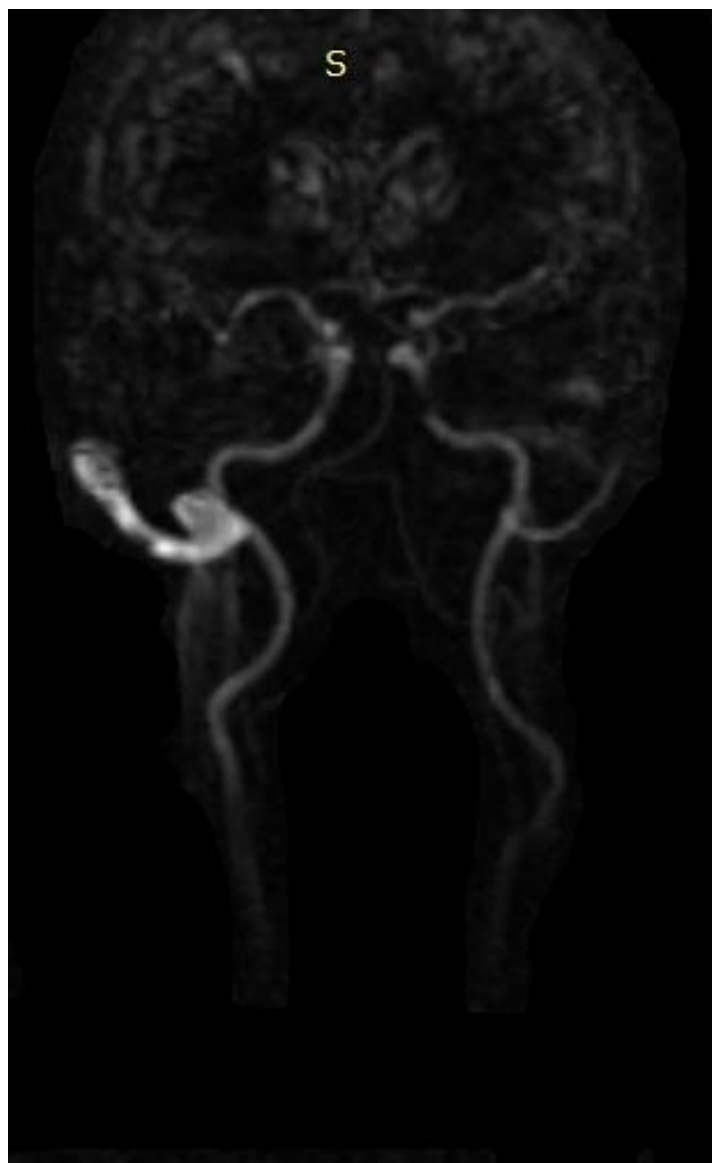
Scan Plane: Sagittal	Freq. Dir: S/I
Freq. FOV: 35.0	TR: 33.0
Phase FOV: 1.00	# Slices: 1
Slice Thickness: 60.0	
Spacing: 0.0	

R/L	P/A	I/S	Max # Slices: 1
Start R28.8	A16.0	I89.8	# of Acqs: 2
End R28.8	A16.0	I89.8	Rel. SNR@: 100

Chem SAT: None

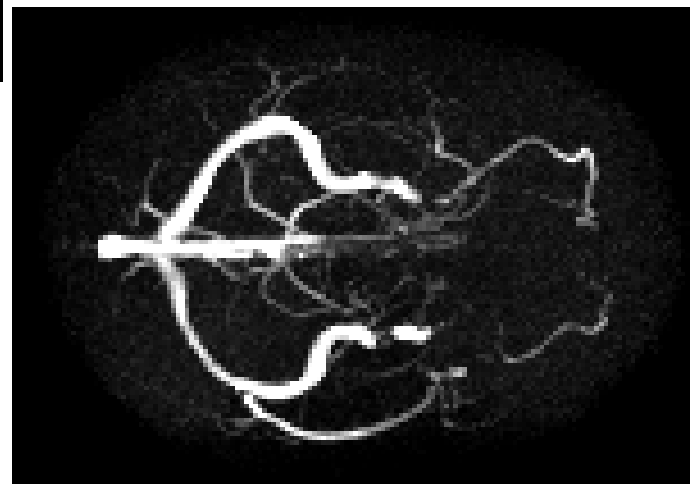
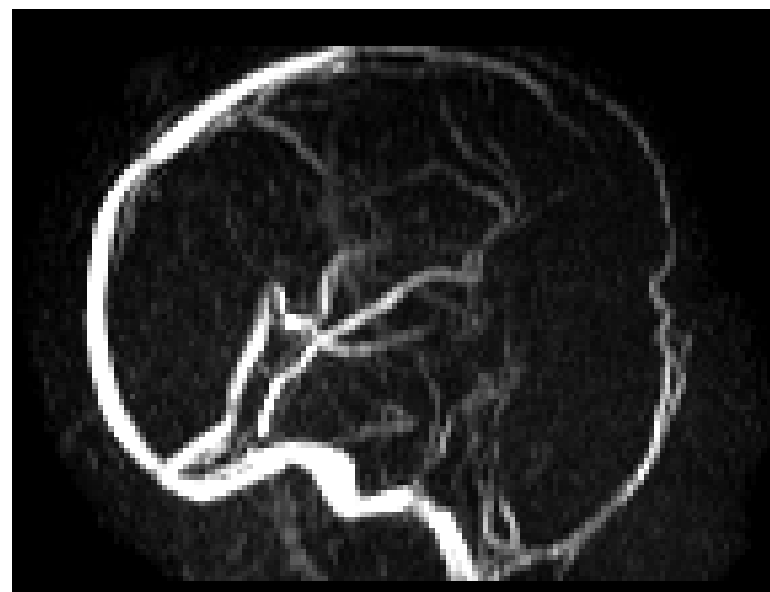


SSFSE
TR:1038



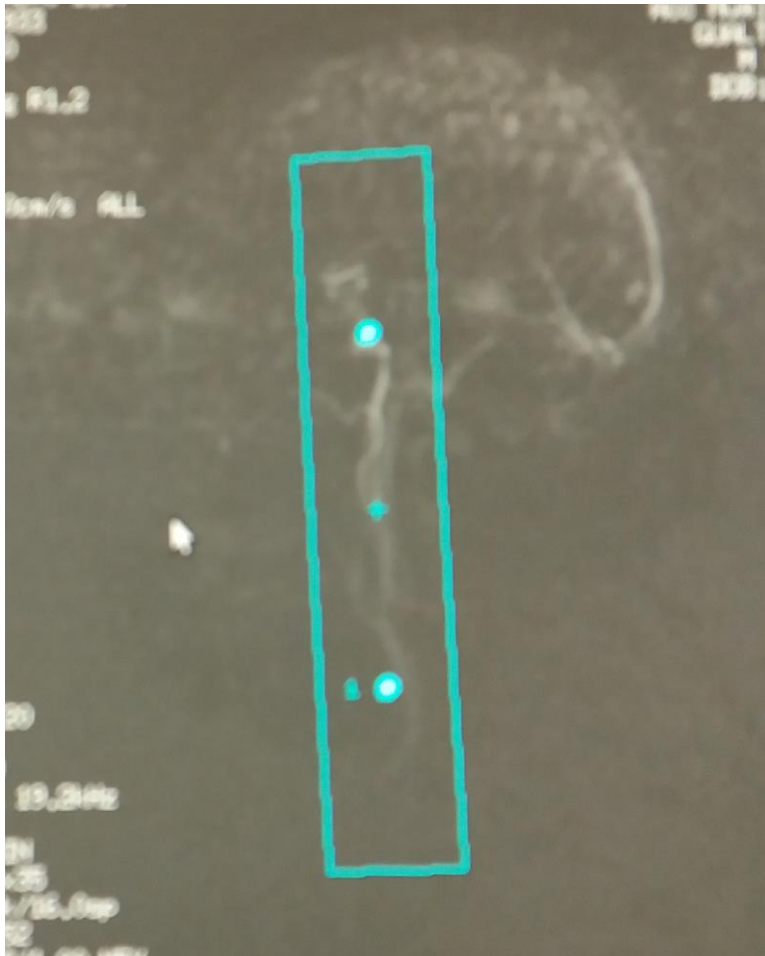
Pratica: PHASE CONTRAST

2021: Neonato 10gg – ipoossica-ischemica

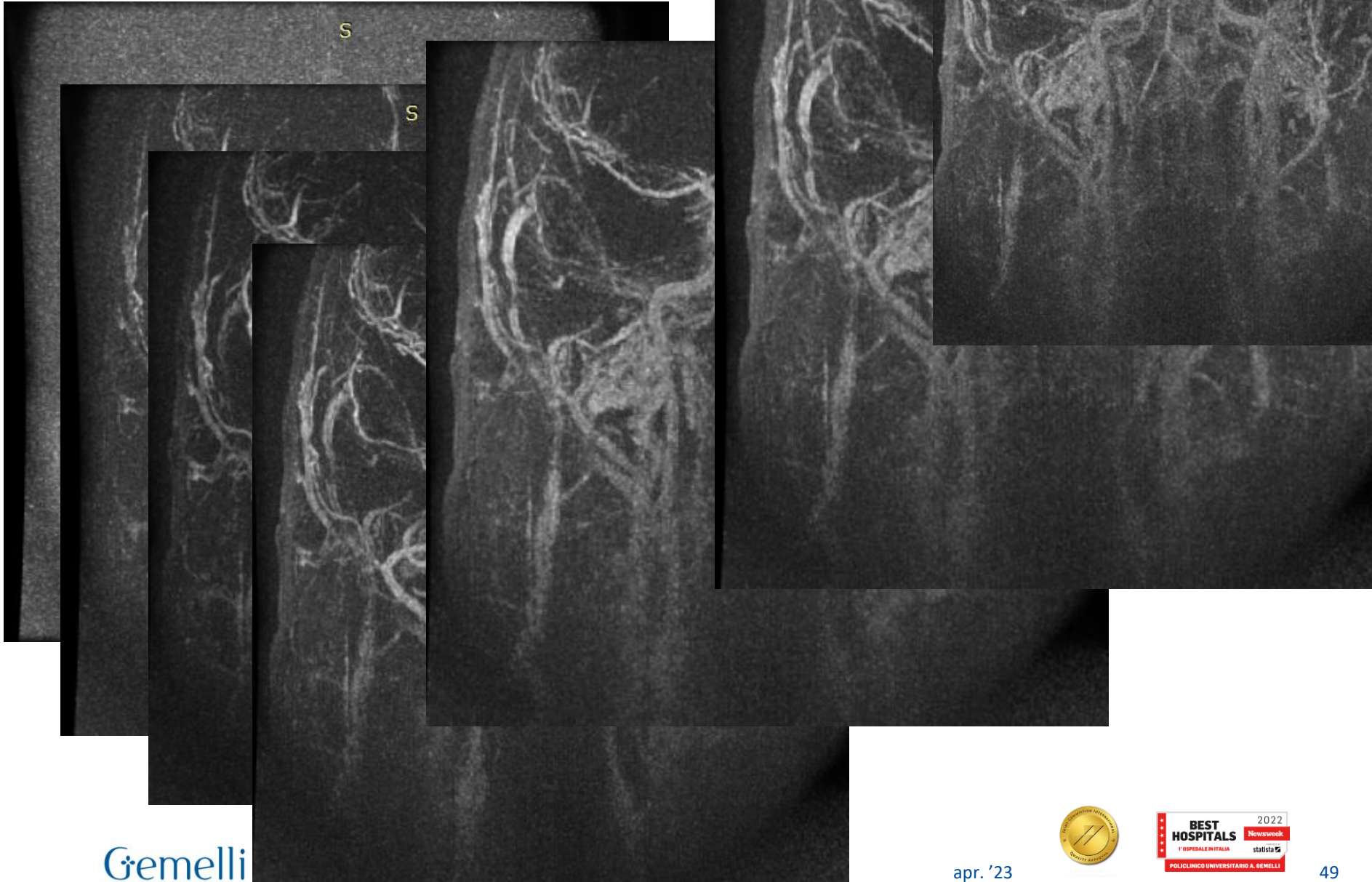


Ricostruzioni MIP

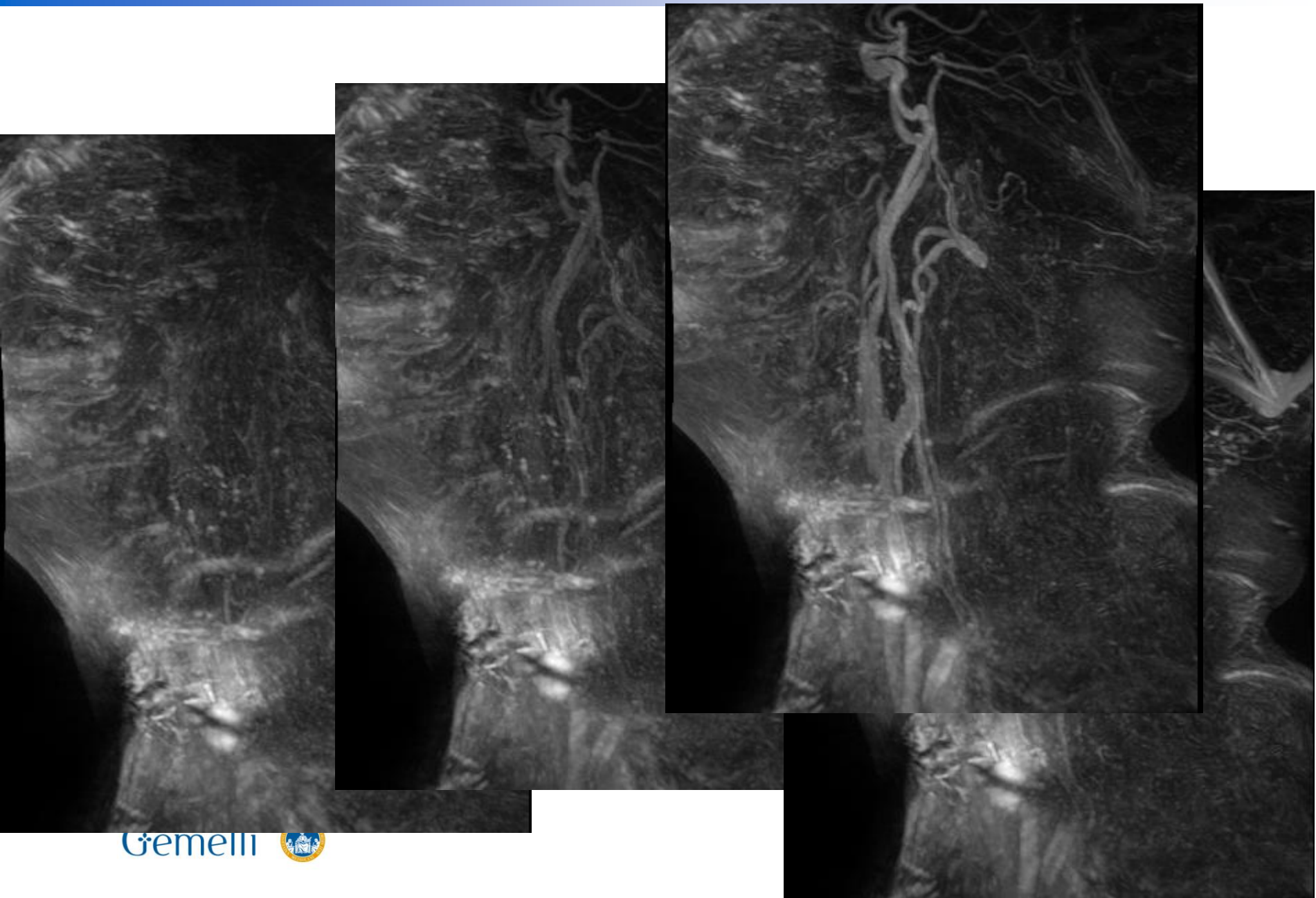
Tricks: 7 fasi



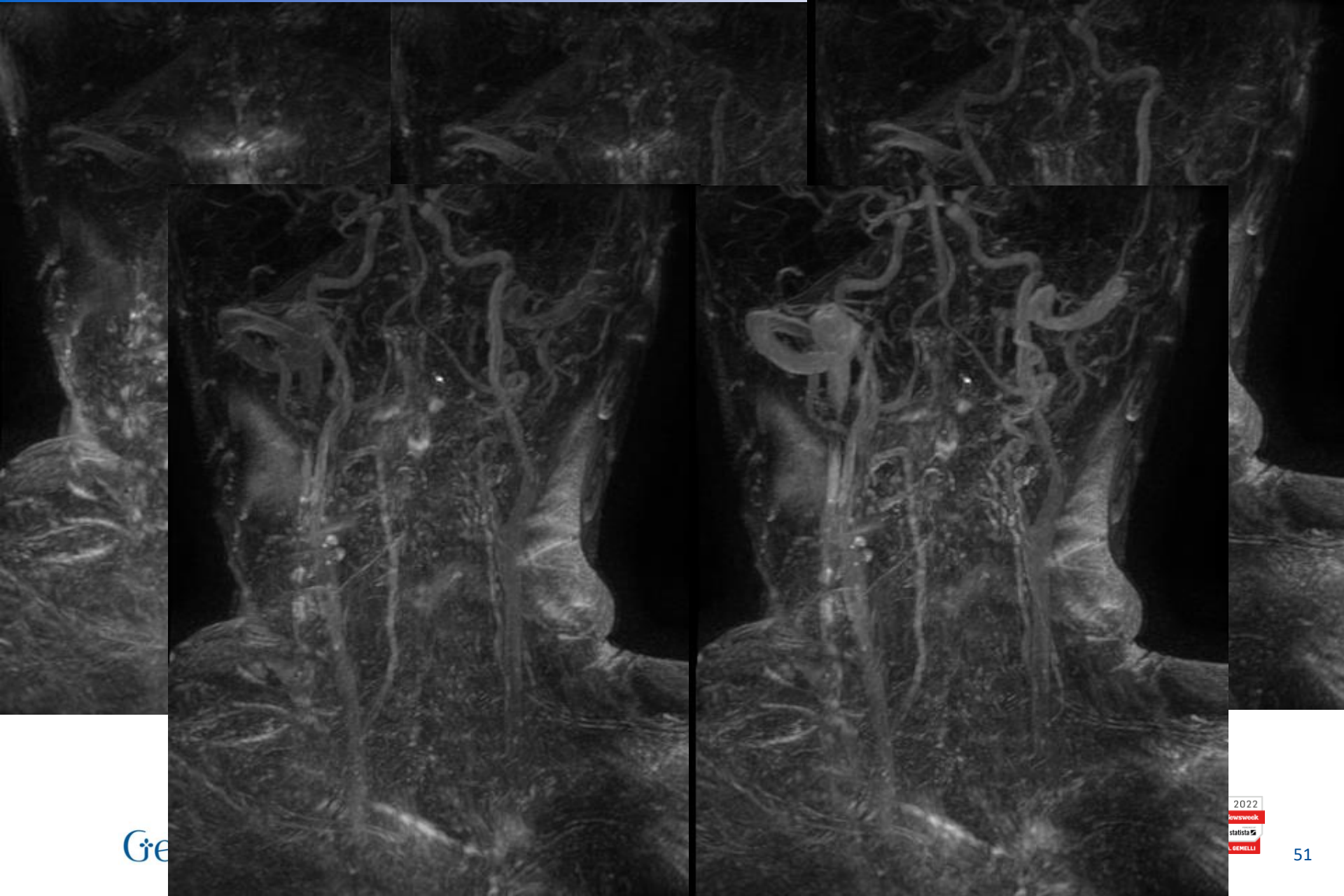
Tricks: 7 fasi

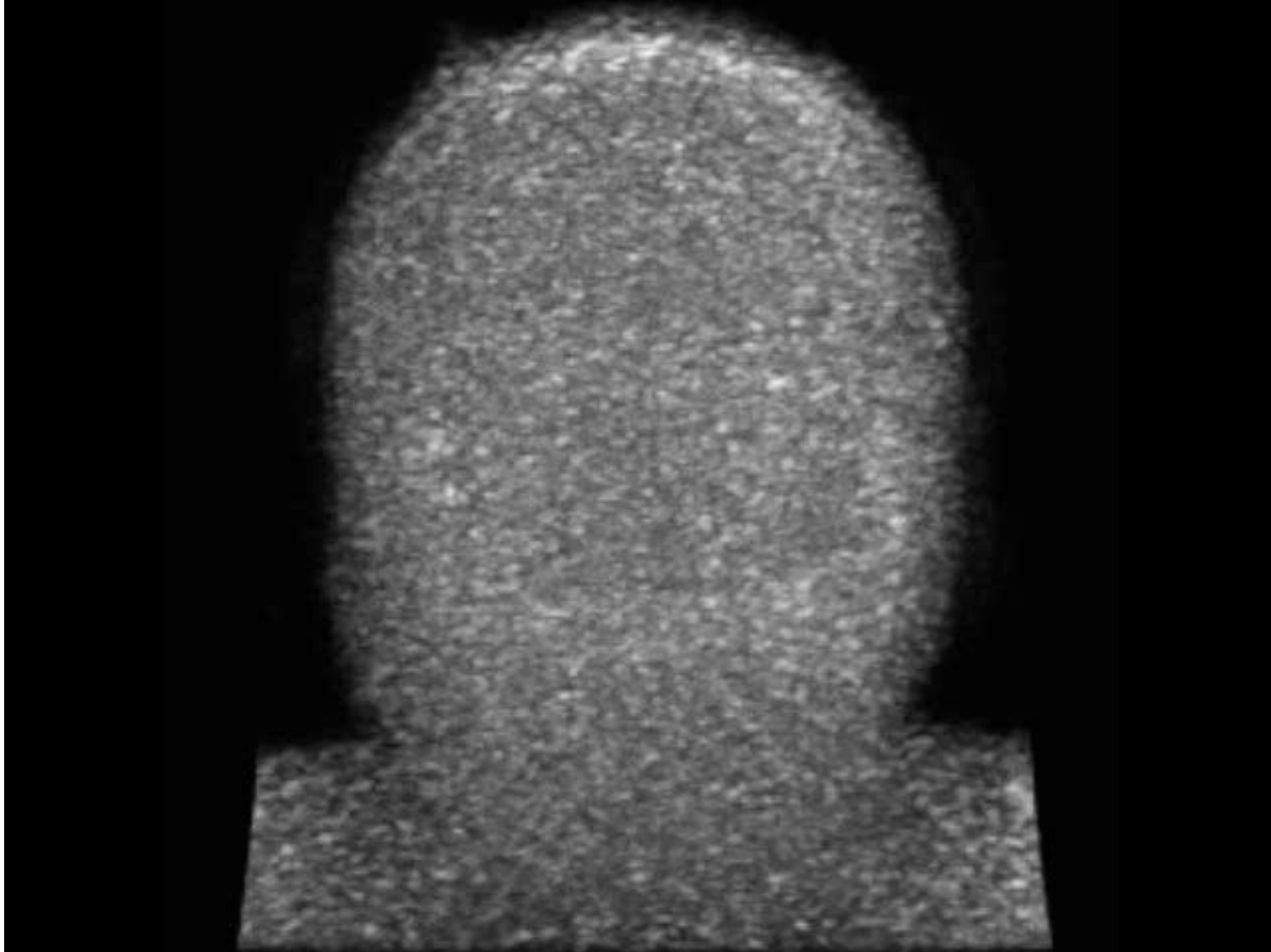


Tricks: Carotidi SAG



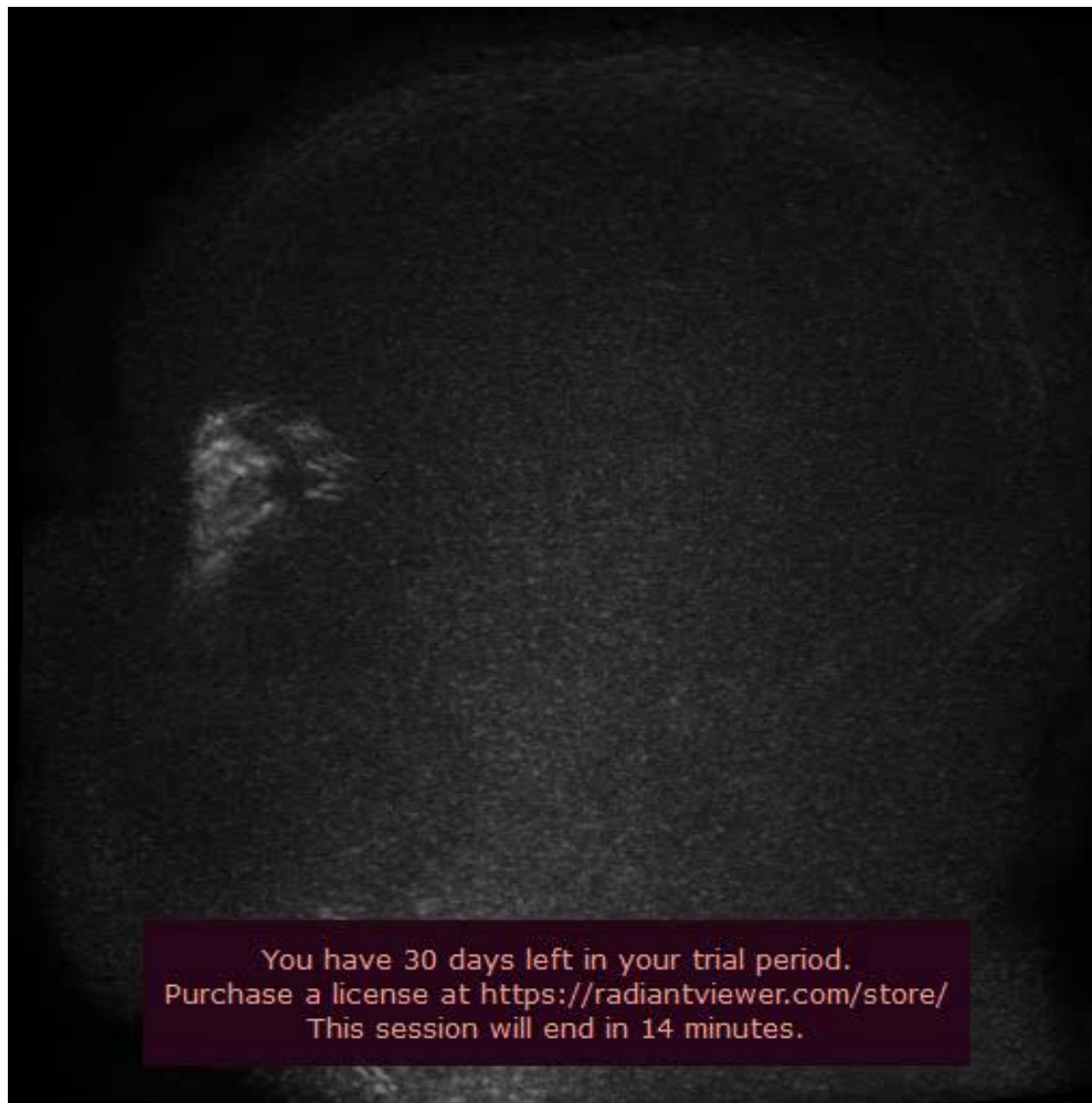
Tricks: Carotidi Cor





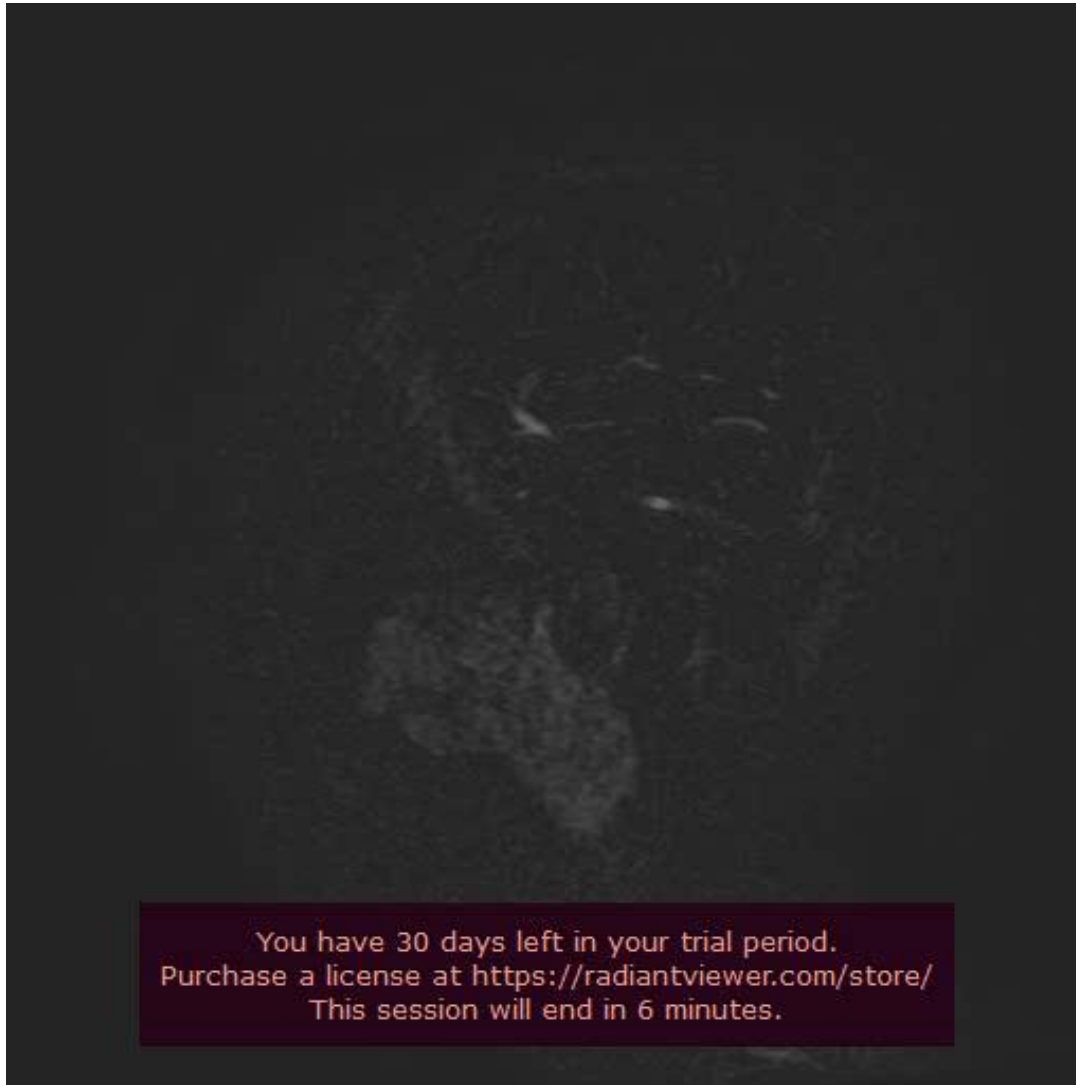
3D SAG MRV TRICKS +C

Signa
Premiere
3T

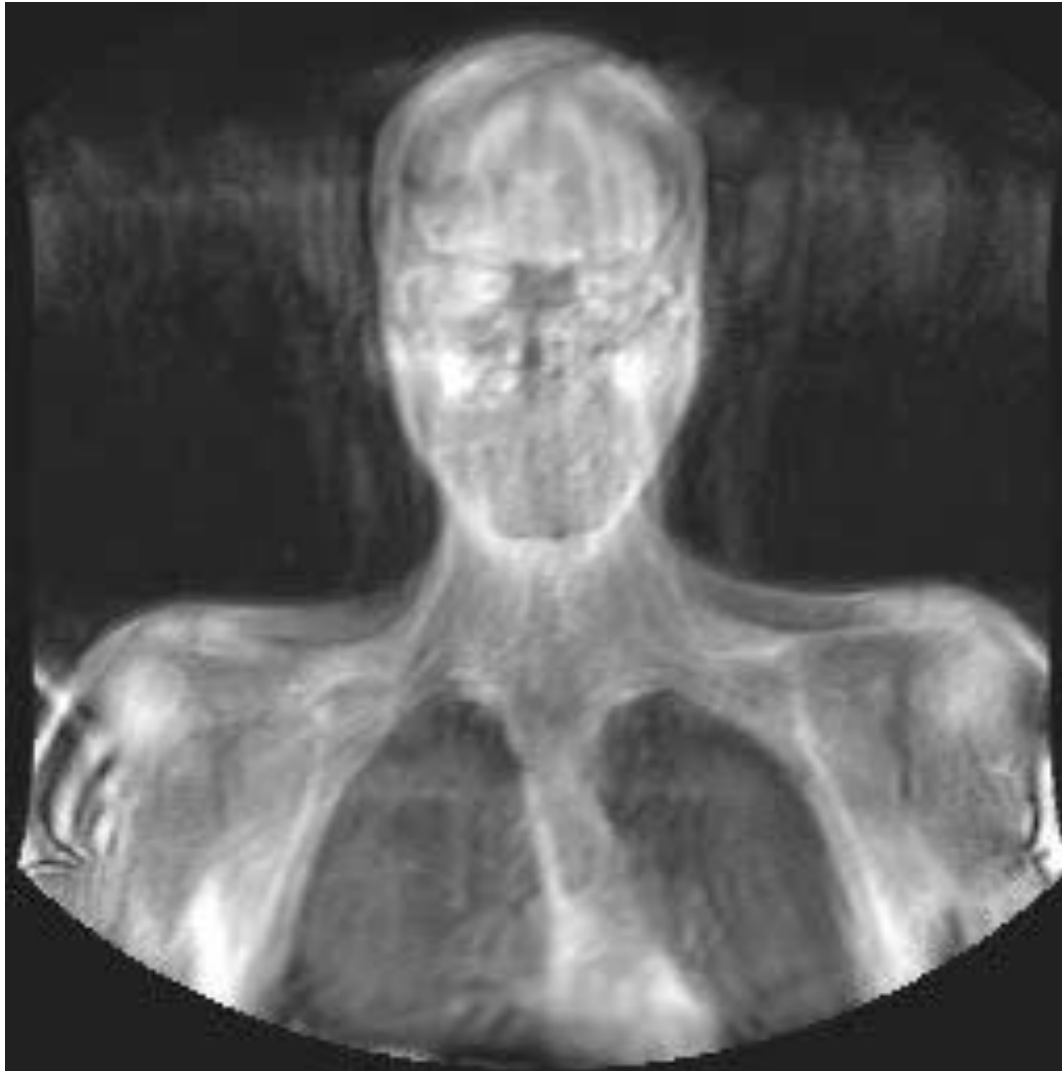


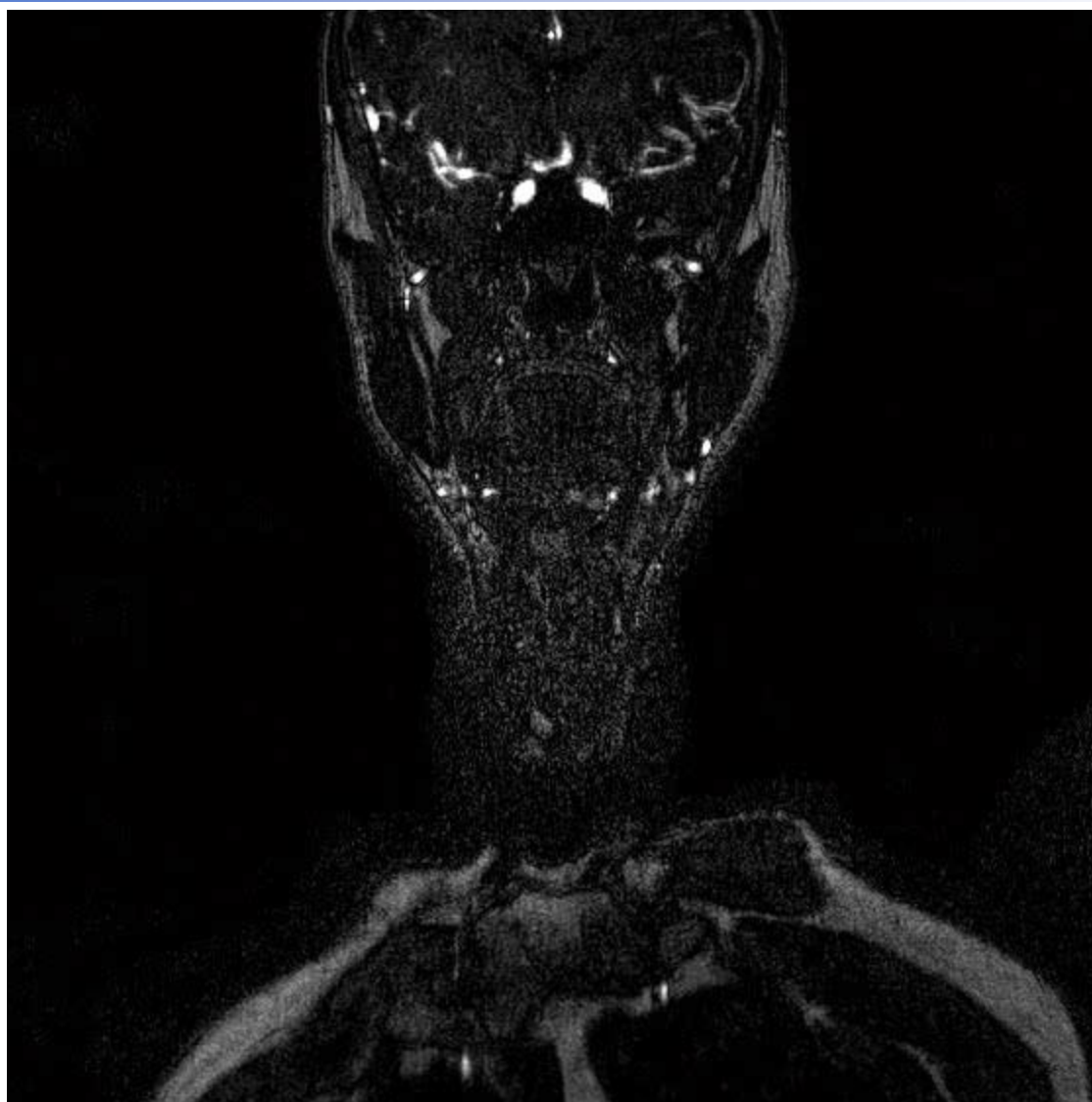
You have 30 days left in your trial period.
Purchase a license at <https://radiantviewer.com/store/>
This session will end in 14 minutes.

Signa
Premiere
3T



2D-Bolus Track Angio Collo







ANGIO-RM TSA

Cfr .Tutorial ANGIO-RM TSA









Pratica: perfusione DSC

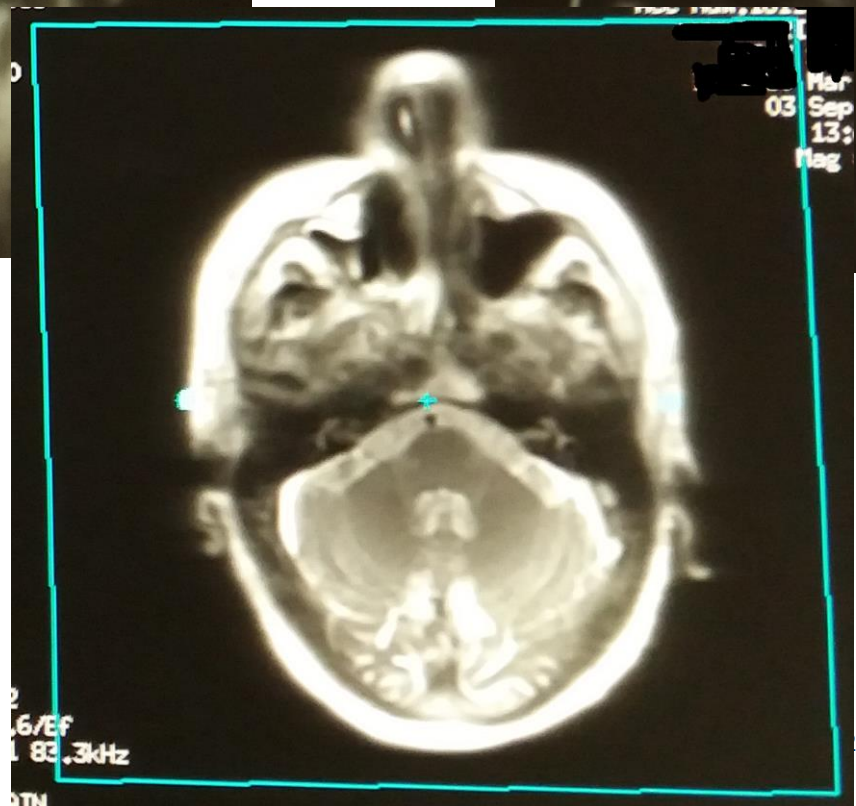
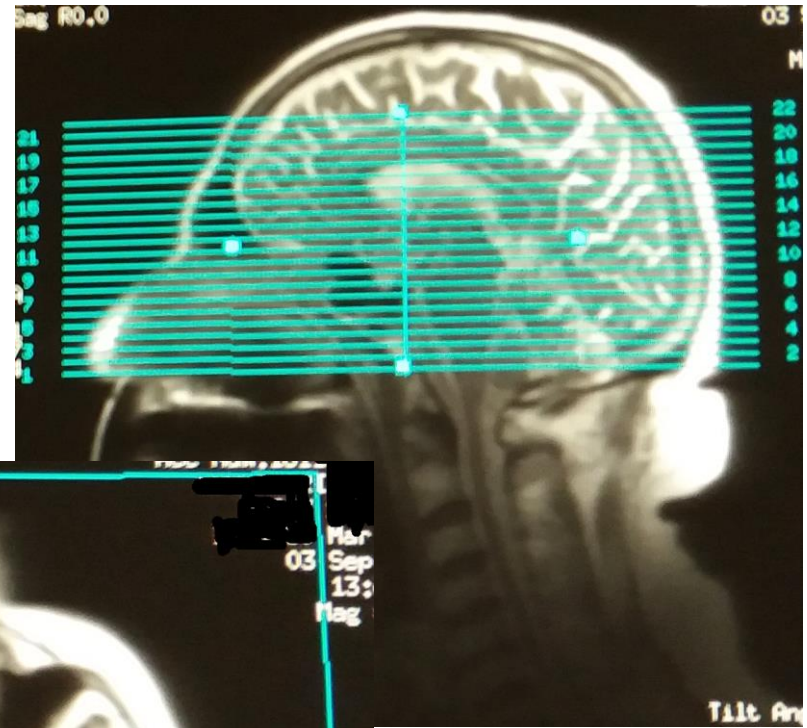
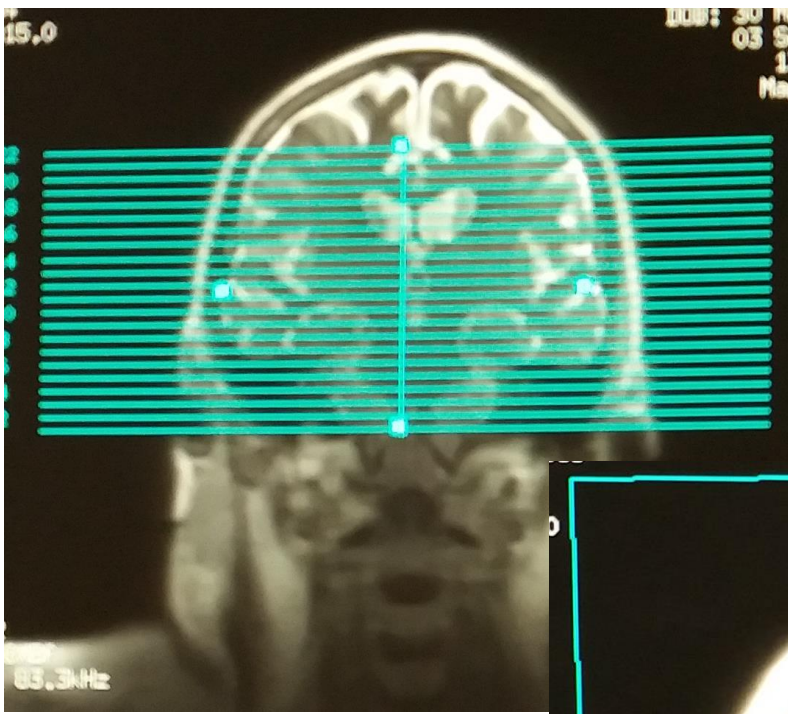
Top Left Sagittal View:
 SSFSE
 TR:832
 TE:30.6/Ef
 EC:1/1 83.3kHz
 GMRBRAIN
 FOV:32x32
 8.0cm/3.0cm
 29/00:25
 256x192/0.53 NEX
 /ED/5Q
 I 159
 M = 1292 L = 498
 Tilt Angle 90

Top Right Sagittal View:
 SSFSE
 TR:832
 TE:30.6/Ef
 EC:1/1 83.3kHz
 GMRBRAIN
 FOV:32x32
 8.0cm/3.0cm
 29/00:25
 256x192/0.53 NEX
 /ED/5Q
 I 159
 M = 1292 L = 498
 Tilt Angle 270

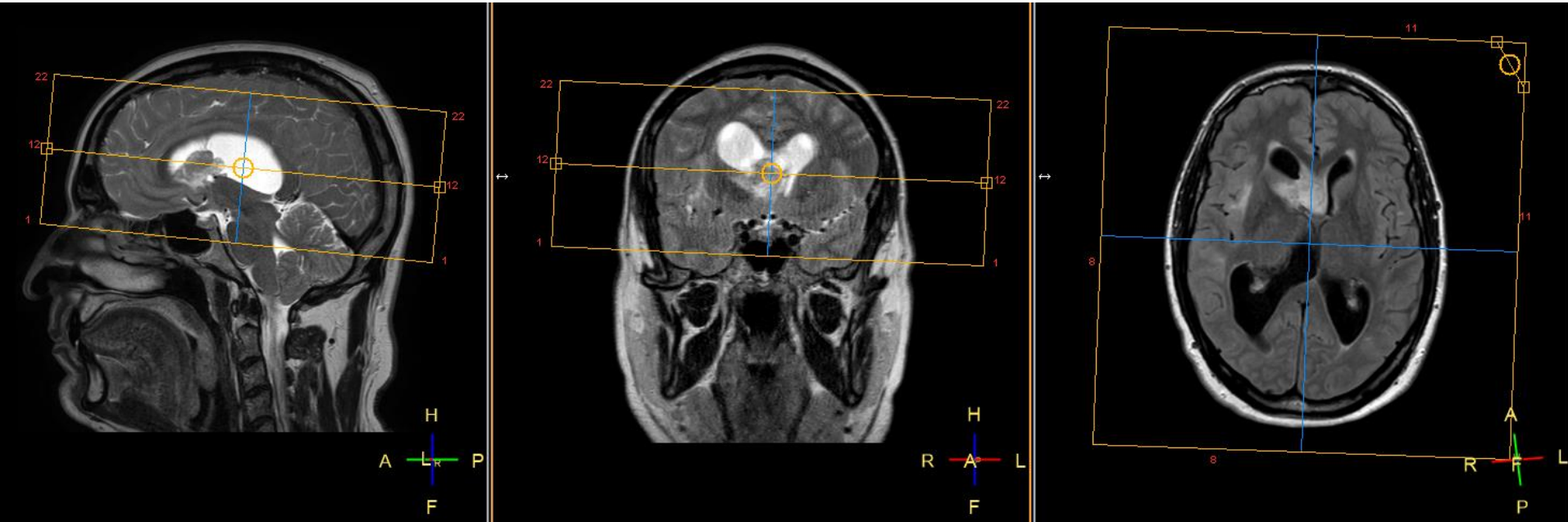
Bottom Left Software Panel:
Perfusion GRx 1:30
 Scan Plane: Oblique Freq. Dir: R/L
 Freq. FOV: 24.0 TR: 1500.0
 Phase FOV: 1.00 # Slices: 22
 Slice Thickness: 4.0
 Spacing: 0.4
 Max # Slices: 22
 # of Acqs: 1
 Rel. SNR@: 70
 Start: R0.6 A33.3 I13.1
 End: R0.6 A32.9 S79.3
 Chem SAT: None
 Contrast: Agent 18 Amt

Bottom Right Axial View:
 Sigma Hbct 1.5T
 Ex: 17933
 Sp: 1
 In: 4
 Pr: 50.0
 SSFSE
 TR:832
 TE:30.6/Ef
 EC:1/1 83.3kHz
 GMRBRAIN
 FOV:32x32

Pratica: perfusione DSC



Pratica: perfusione DSC

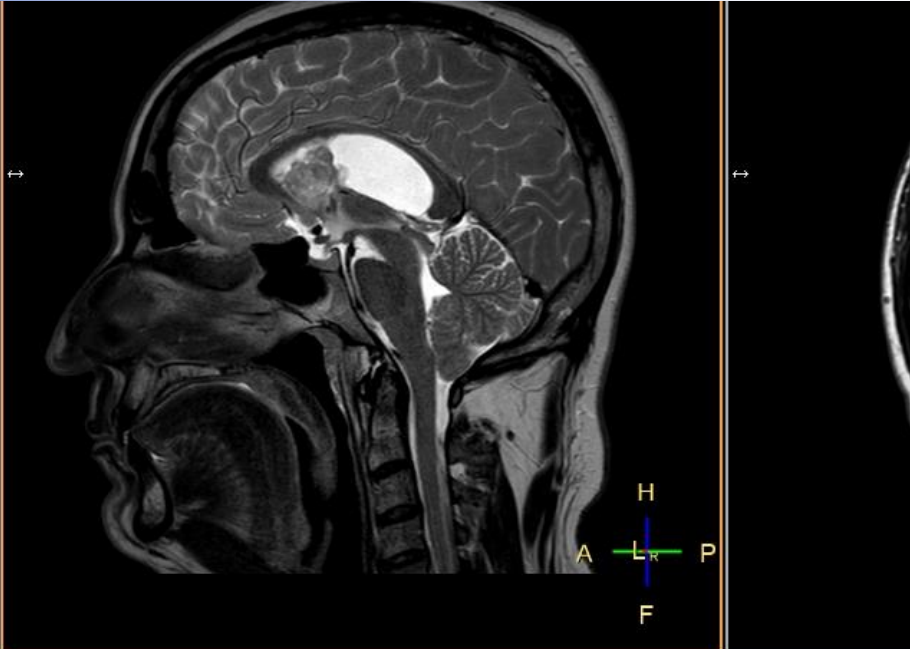


Pratica: perfusione DSC

Cranio tumori 00:15:58

- 1,1 ✓ SmartBrain ☆
- 1,2 ✓ MPR - SmartBrain
- 2,1 ✓ T2W_TSE_SA... ☆ SAG
- 3,1 ✓ T2W_TSE_AX ☆ AX
- 4,1 ✓ FLAIR_longTR ☆ AX
- 5,1 ✓ SWIp_ ☆ AX
- 6,1 ✓ DWI ☆ AX
- ✗ T2W_TSE_CO... ☆ cor
- 7,1 ✓ T1W_AX TSE ☆ AX
- 8,1 ✓ T2W_TSE_CO... ☆ cor
- Perfusione_T2
- SV_PRESS_144 SV
- sT1W_3D_WATS ☆ AX
- T1W_AX TSE ☆ AX

+ Add new scan item..



H
A — L — P
F

Perfusione_T2

01:49

Voxel	Tra	Rel. SNR	TE	TR
2.50 x 2.56 x 4.00		1.01	40	1677

Summary >>

	RL (freq.)	AP (phase)	FH
FOV	230 mm	230 mm	88 mm
Voxel	2.5 mm	2.5 mm	4 mm
Matrix	92	90	22 slices
NSA			0 mm

Fat s

Scanner

Waiting for start of dynamic study...

OK Cancel

Pratica: perfusione DSC

Perfusione_T2
01:49

Voxel 2.50 x 2.56 x 4.00 Tra Rel. SNR 1.00 TE 40 TR 1677

Summary Geometry Contrast Motion Dyn/Ang Postproc **Offc/Ang** Coils Conflicts <<

Stacks	1	Total scan duration	01:49.0
Stack Offc. AP (P=+mm)	-5.97	Rel. SNR	1
RL (L=+mm)	6.39	Act. TR/TE (ms)	1677 / 40
FH (H=+mm)	36.51	Dyn. scan time	00:01.7
Ang. AP (deg)	2.11	Time to k0	0.838
RL (deg)	-3.54	ACQ matrix M x P	92 x 90
FH (deg)	9.15	ACQ voxel MPS (mm)	2.50 / 2.56 / 4.00
Free rotatable	no	REC voxel MPS (mm)	1.60 / 1.60 / 4.00
		Scan percentage (%)	97.8
		Packages	1
		Min. slice gap (mm)	0
		EPI factor	45
		Act. WFS (pix) / BW (Hz)	7.080 / 30.7
		BW in EPI freq. dir. (Hz)	1930.2
		Min. WFS (pix) / Max. BW...	7.069 / 30.7
		Min. TR/TE (ms)	1677 / 18
		Head SAR	< 4%
		Whole body SAR / level	0.0 W/kg / normal
		SED	0.0 kJ/kg
		Max B1+rms	1.02 uT

Quante dinamiche???

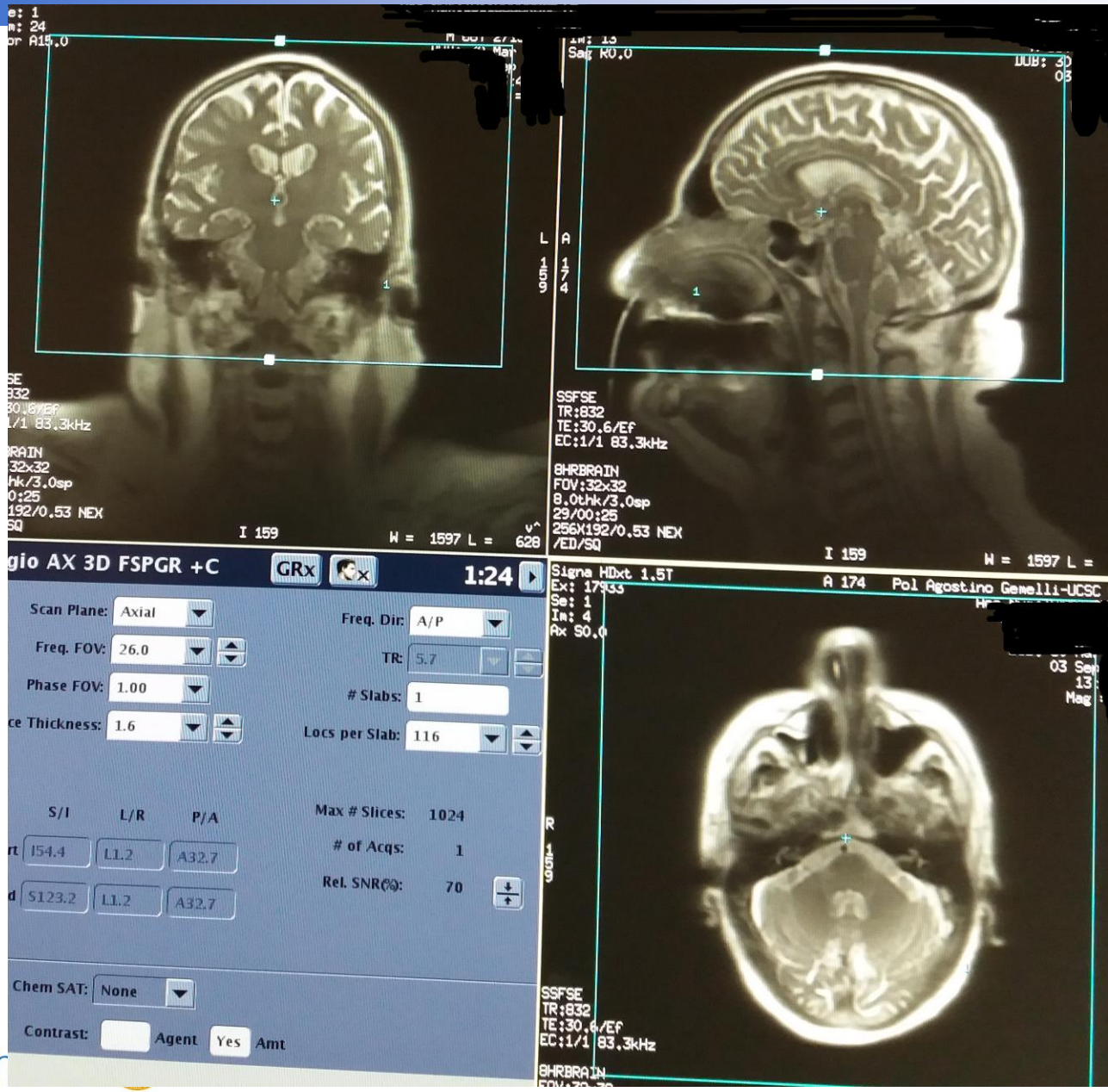
Pratica: perfusione DSC

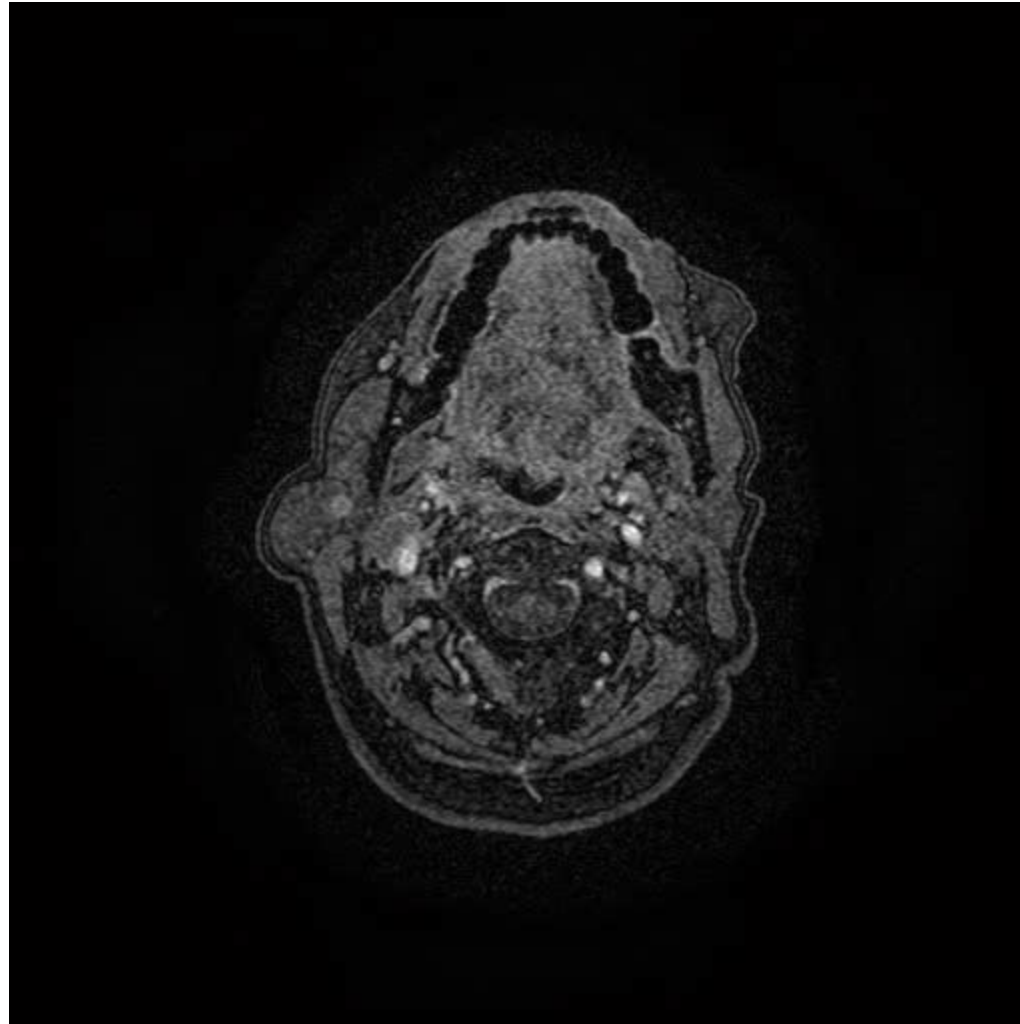
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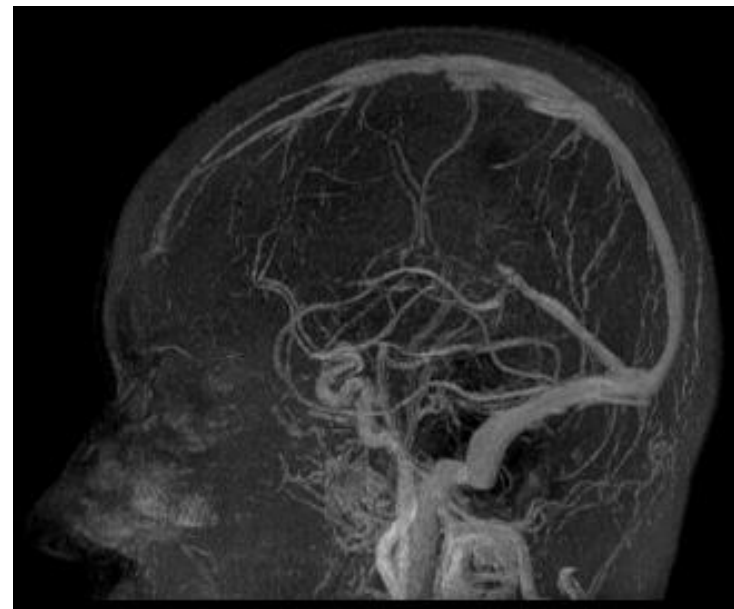
11:26 Performing dynamic scan 10...
11:26 Performing dynamic scan 9...
11:26 Performing dynamic scan 8...
11:26 Performing dynamic scan 7...
11:26 Performing dynamic scan 6...
11:26 Performing dynamic scan 5...
11:26 Performing dynamic scan 4...
11:26 Performing dynamic scan 3...
11:26 Performing dynamic scan 2...
11:26 Performing dynamic scan 1...
11:26 Performing dynamic scan 10...
    
```

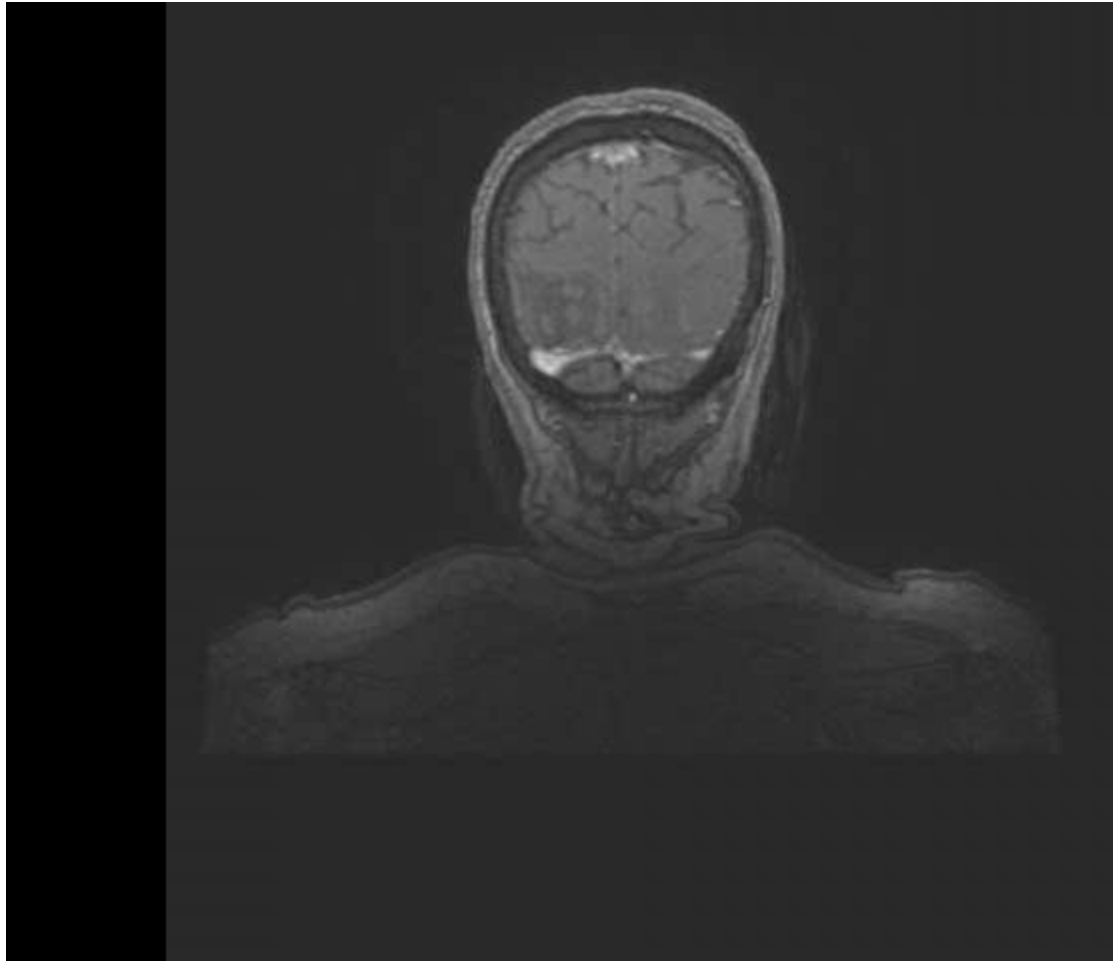
Dopo l'acquisizione delle prime 10 scansioni dinamiche basali, iniettare il mezzo di contrasto...

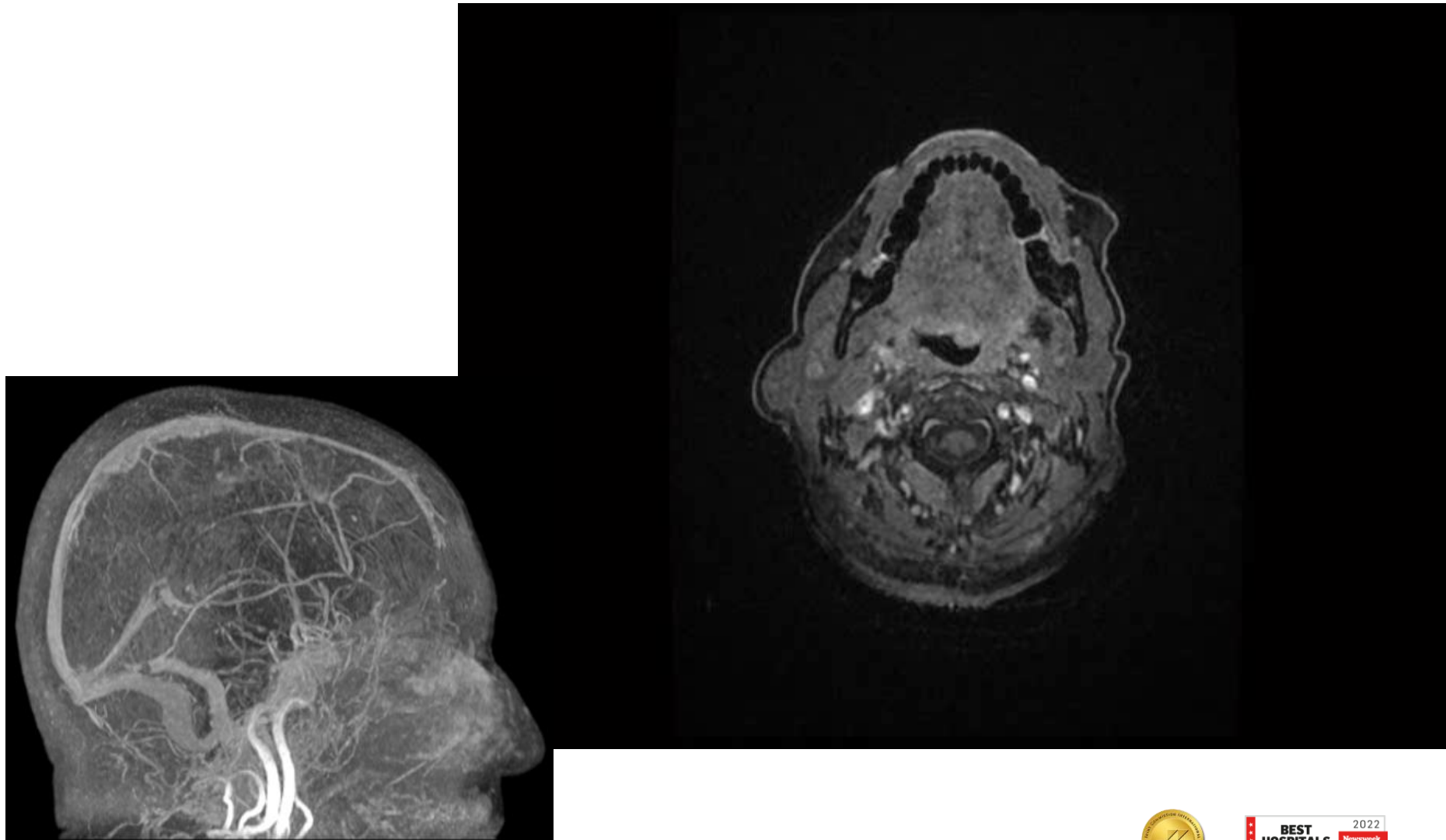
Pratica: ANGIORM VENOSA

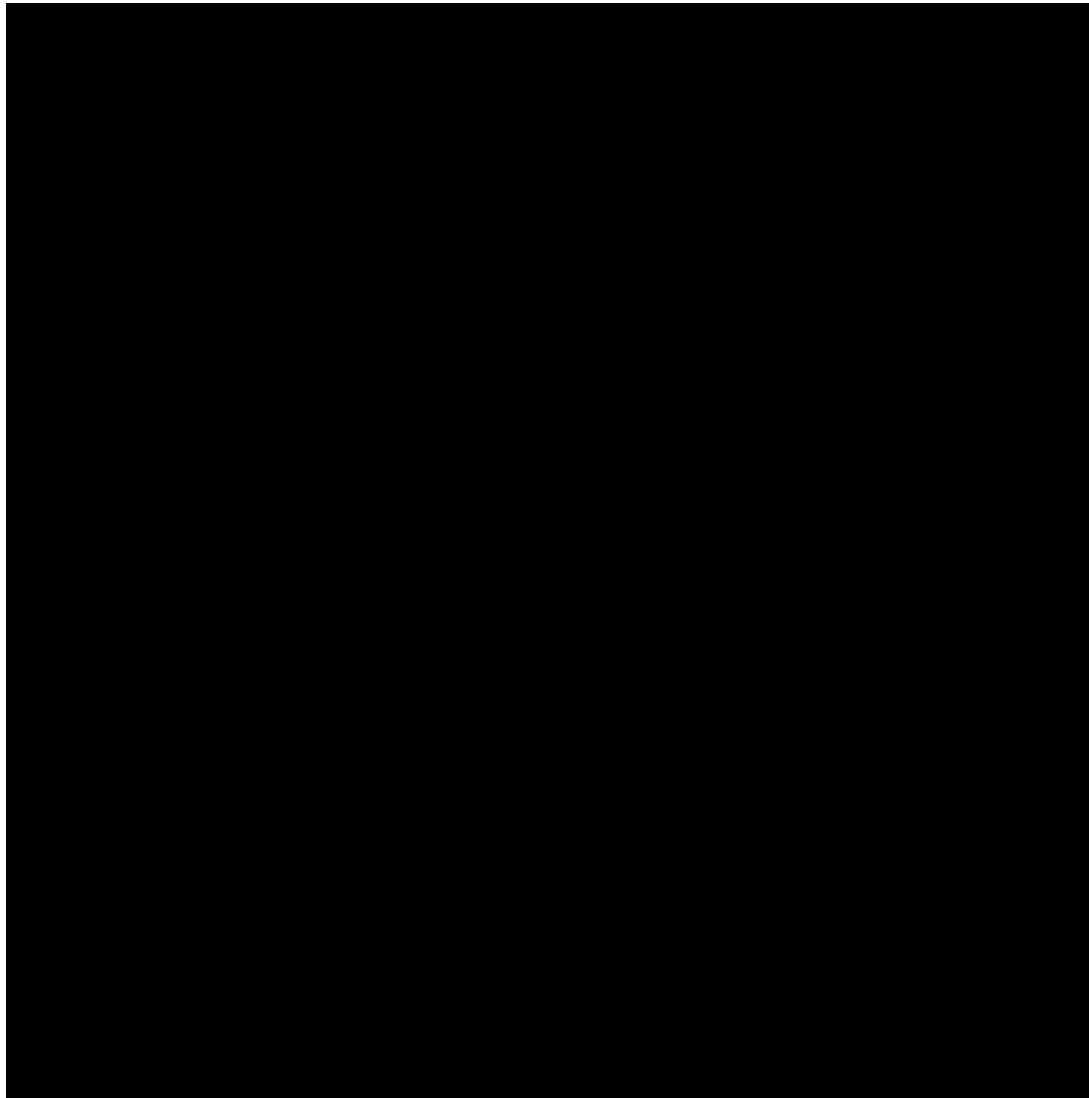


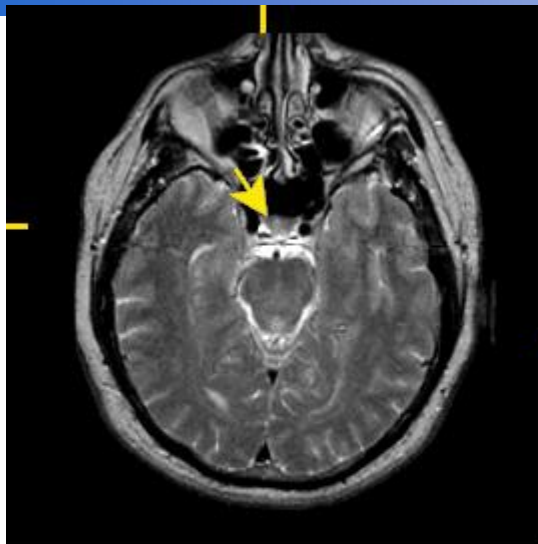








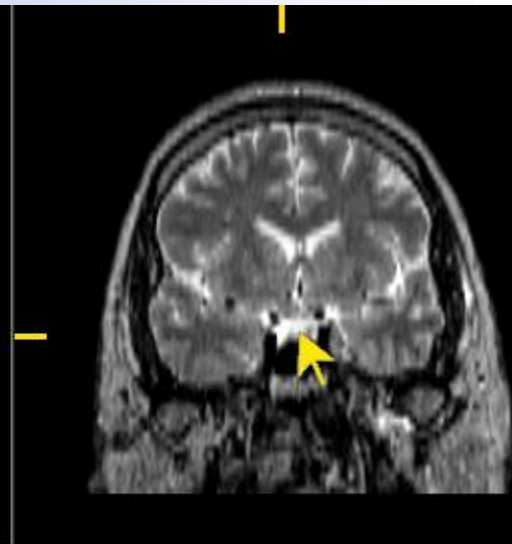




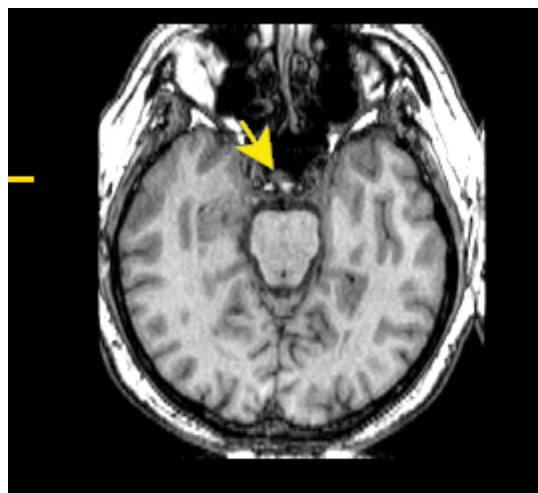
Bone/Nerve/Endocr ▼ MR-T2 ▼
pituitary ▼ sync



Bone/Nerve/Endocr ▼ MR-T2 ▼
pituitary ▼ sync



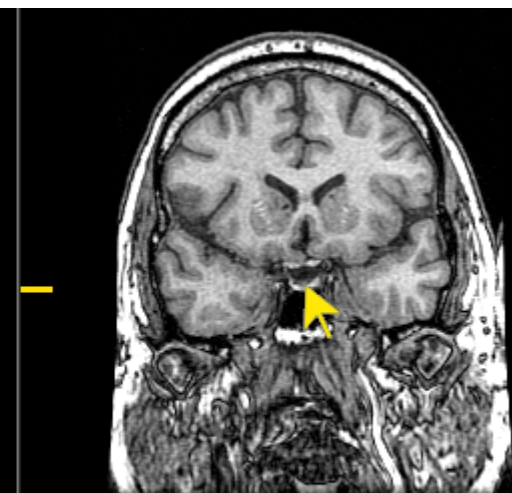
Bone/Nerve/Endocr ▼ MR-T2 ▼
pituitary ▼ sync



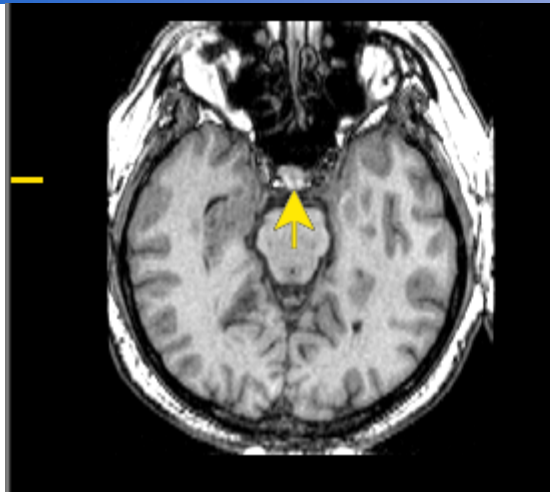
Bone/Nerve/Endocr ▼ MR-T1 ▼
pituitary ▼ sync



Bone/Nerve/Endocr ▼ MR-T1 ▼
pituitary ▼ sync



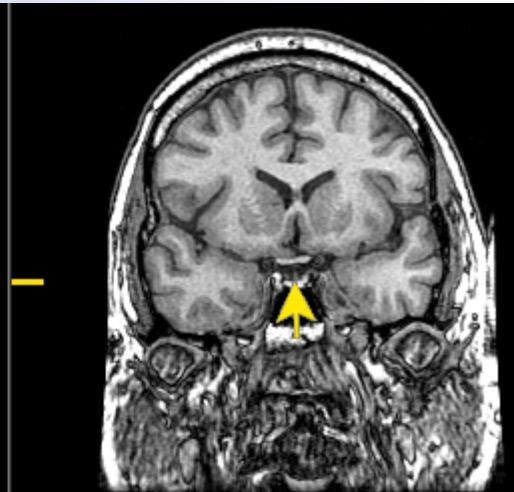
Bone/Nerve/Endocr ▼ MR-T1 ▼
pituitary ▼ sync



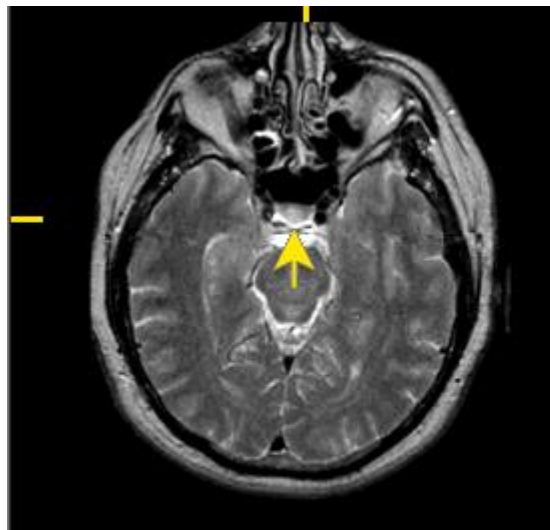
Bone/Nerve/Endocr ▼ MR-T1 ▼
sella turcica ▼ sync



Bone/Nerve/Endocr ▼ MR-T1 ▼
sella turcica ▼ sync



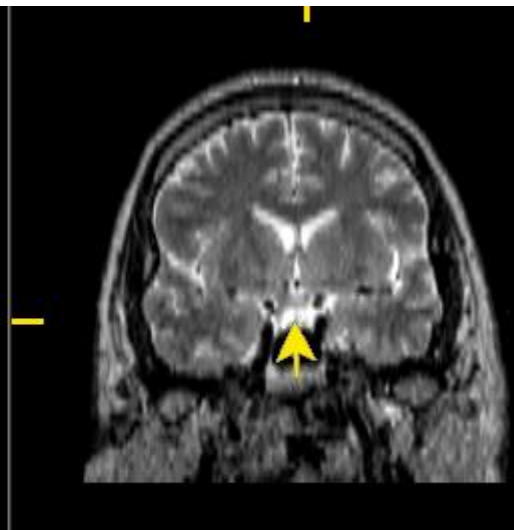
Bone/Nerve/Endocr ▼ MR-T1 ▼
sella turcica ▼ sync



Bone/Nerve/Endocr ▼ MR-T2 ▼
sella turcica ▼ sync



Bone/Nerve/Endocr ▼ MR-T2 ▼
sella turcica ▼ sync



Bone/Nerve/Endocr ▼ MR-T2 ▼
sella turcica ▼ sync

Pituitary Gland

eBook for Undergraduate Education in Radiology

The pituitary gland lies in the sella turcica (figure 13), below the hypothalamus and optic chiasm; it is divided into anterior (adenohypophysis) and posterior (neurohypophysis) lobes. The pituitary stalk connects the pituitary gland to the brain. The cavernous sinuses are located lateral to the pituitary gland, they contain the cranial nerves III, IV, V1, V2, VI and the cavernous segment of the internal carotid artery (ICA).

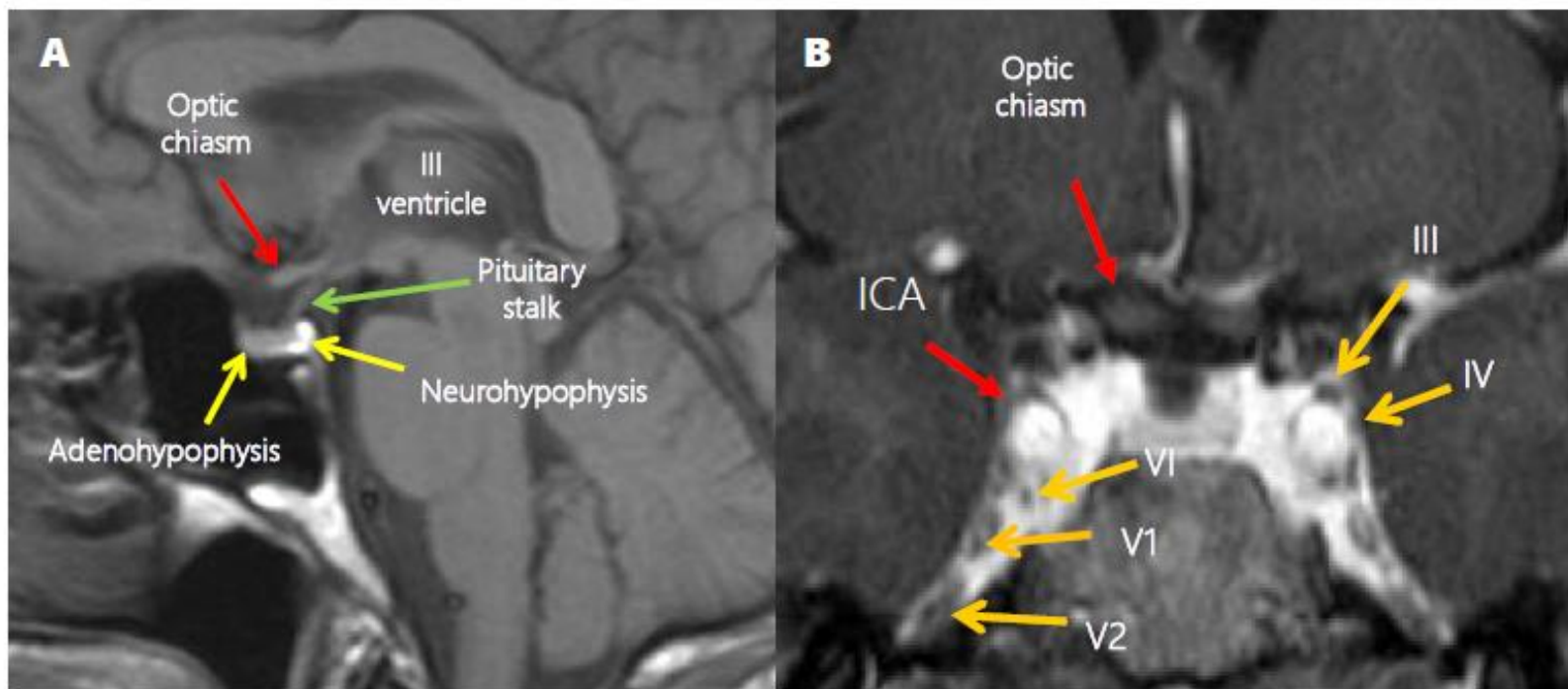
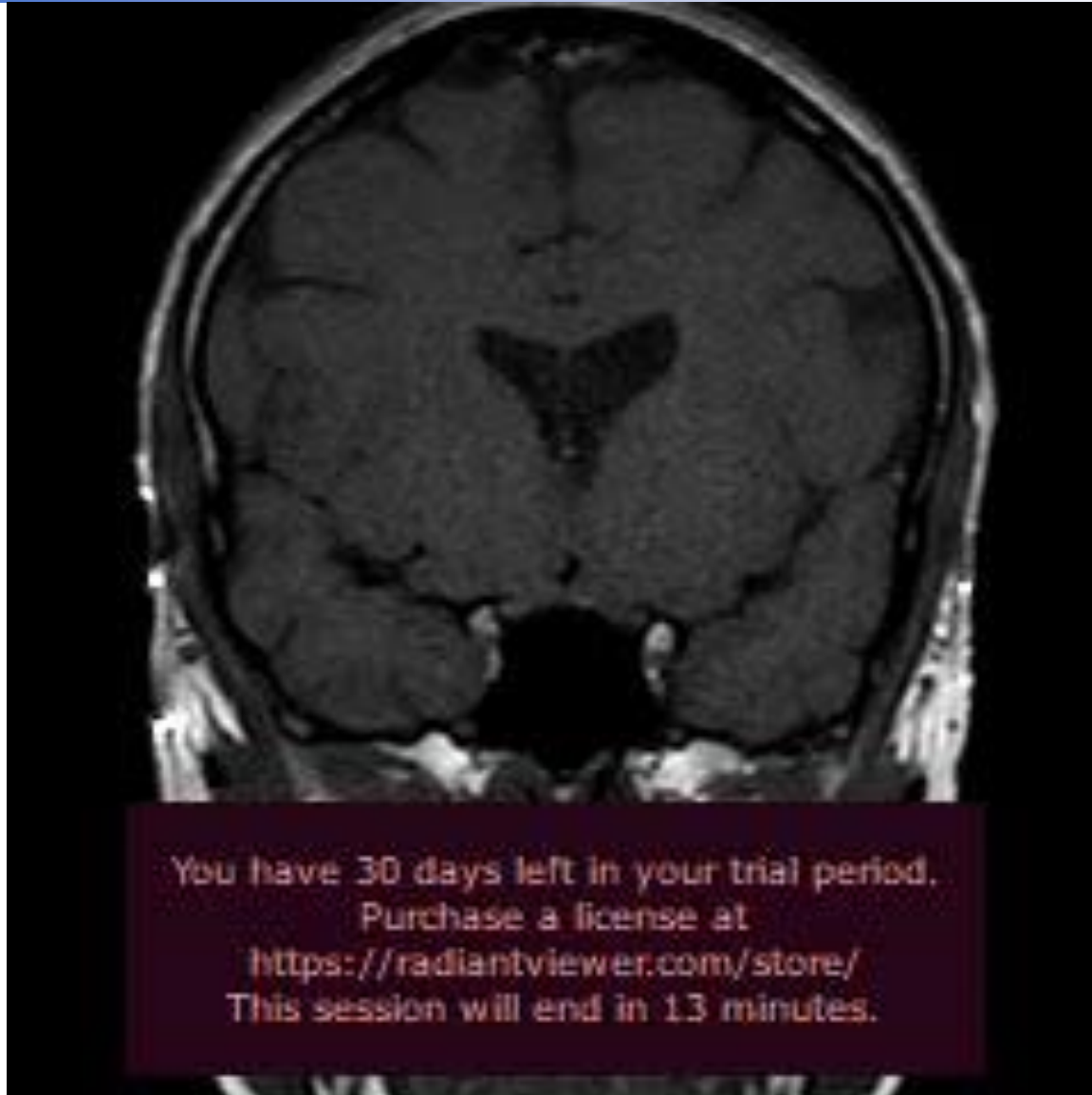
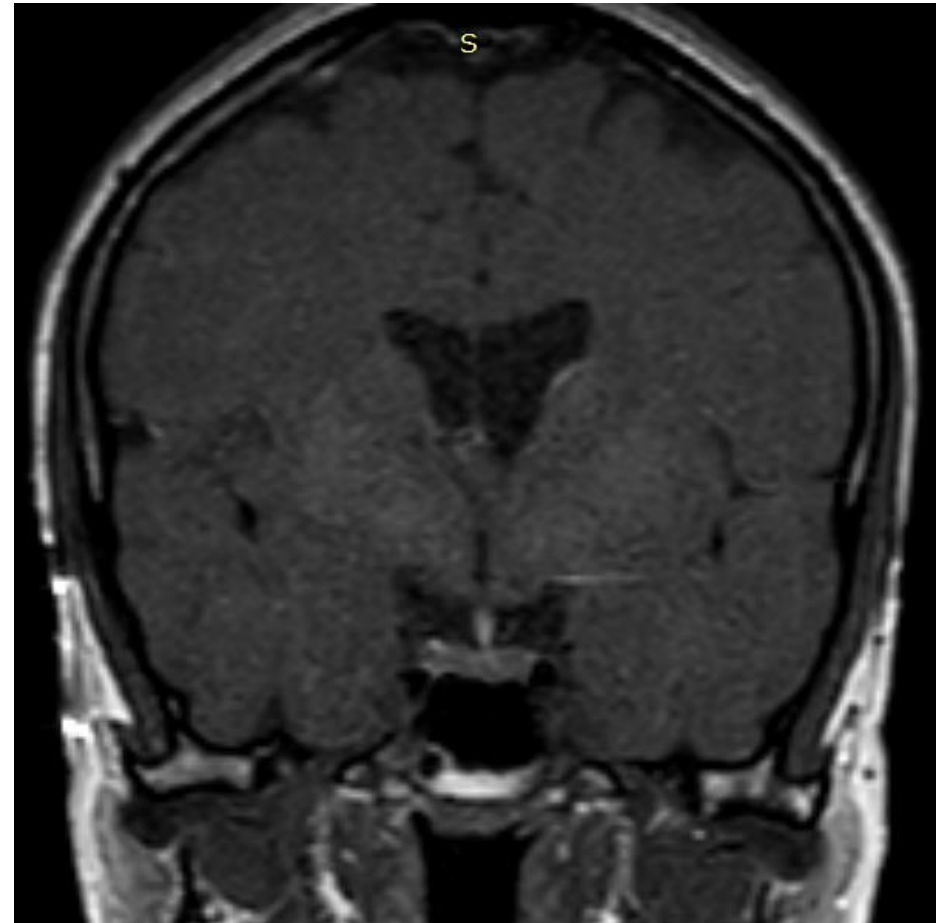
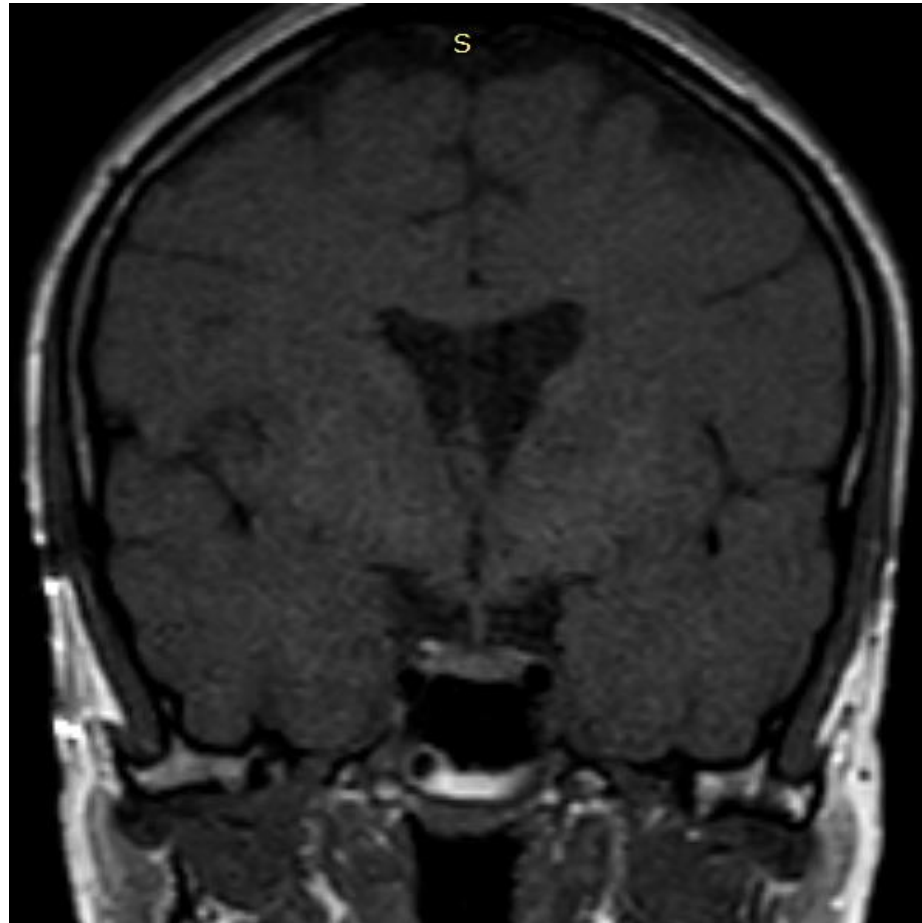
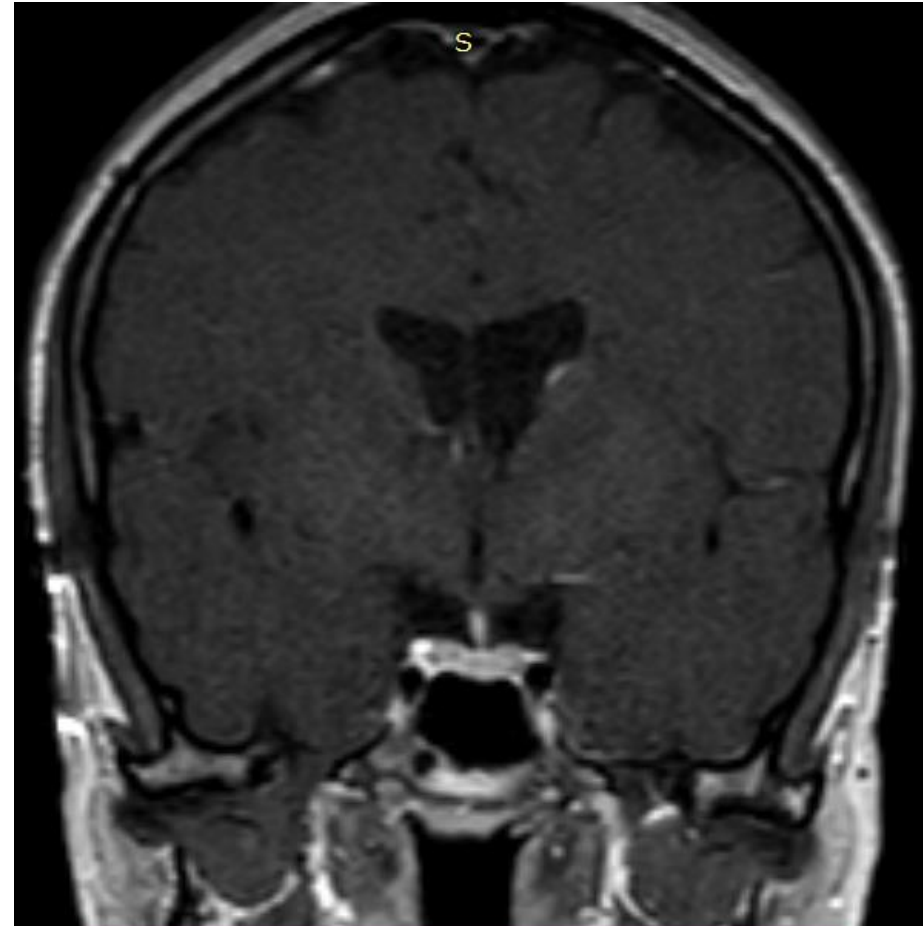
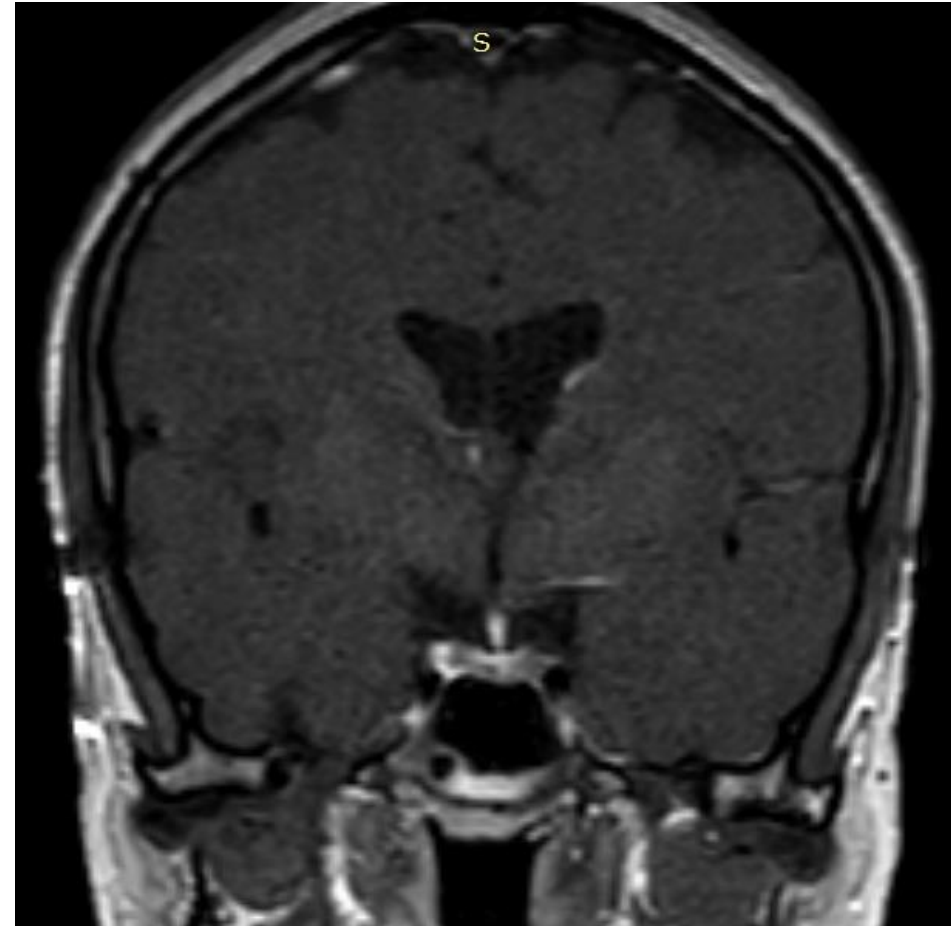


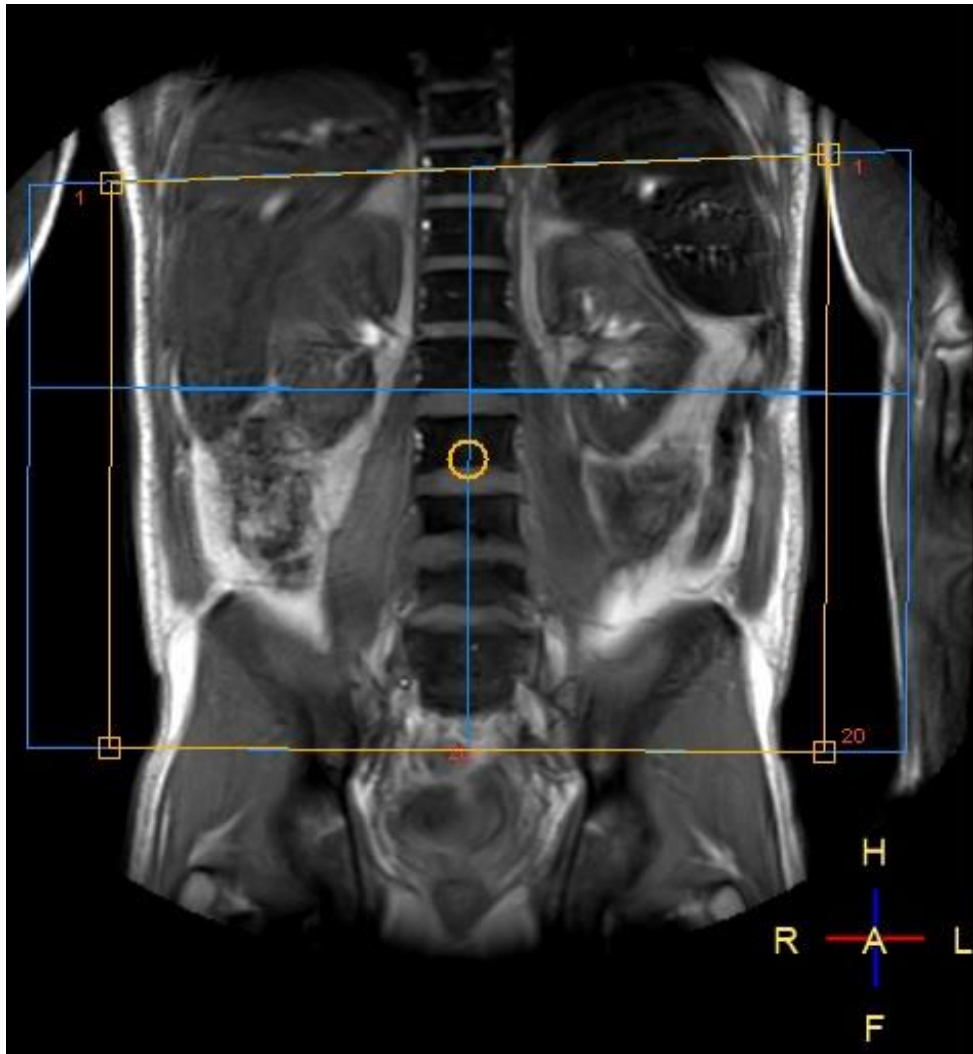
Fig. 13. Anatomy of the pituitary fossa and cavernous sinuses as seen on sagittal T1- weighted (A) and contrast-enhanced coronal T1-weighted (B) images.

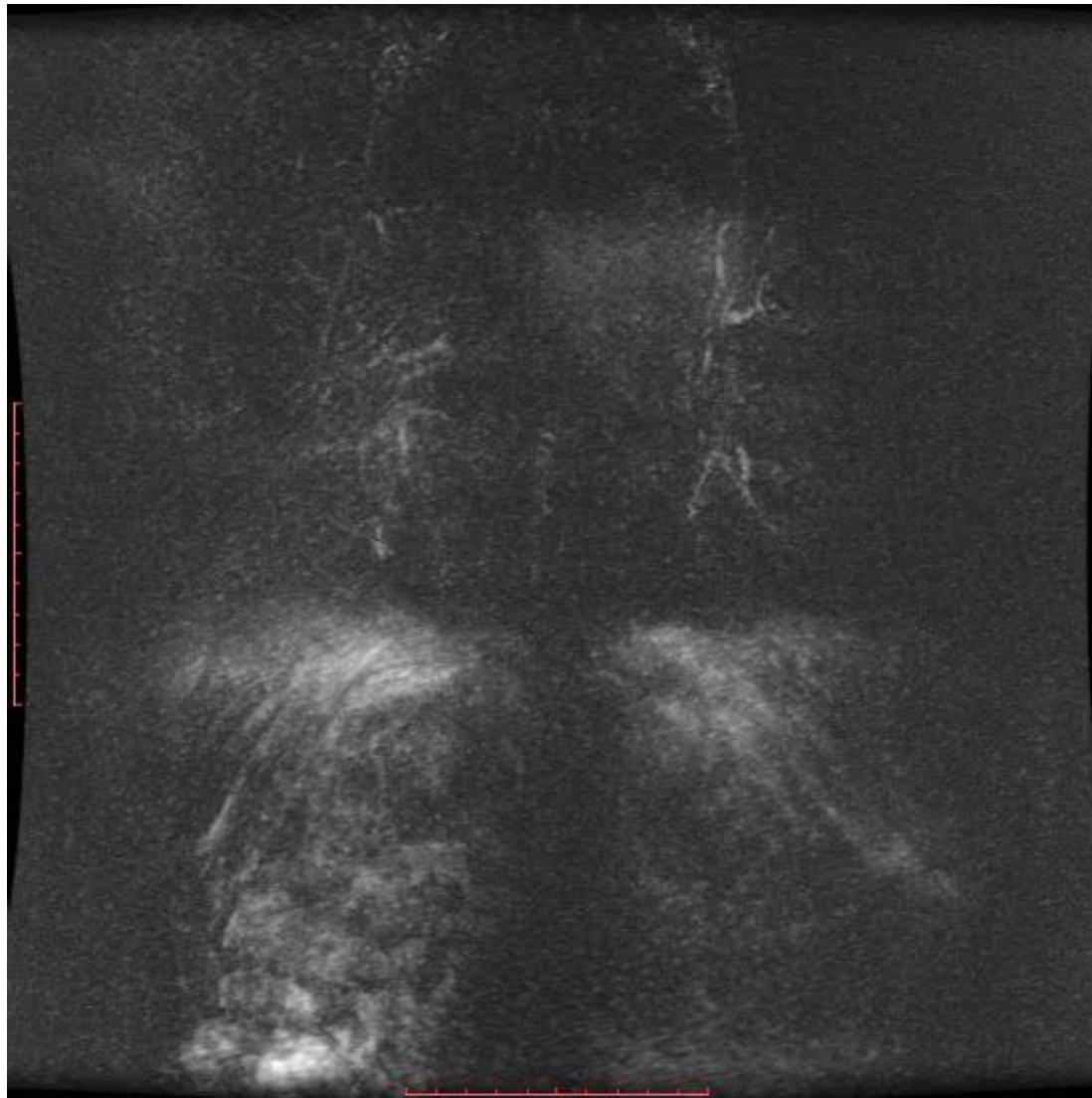


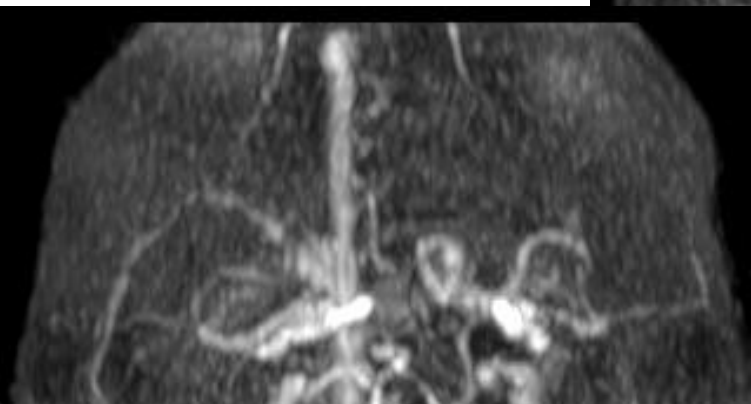
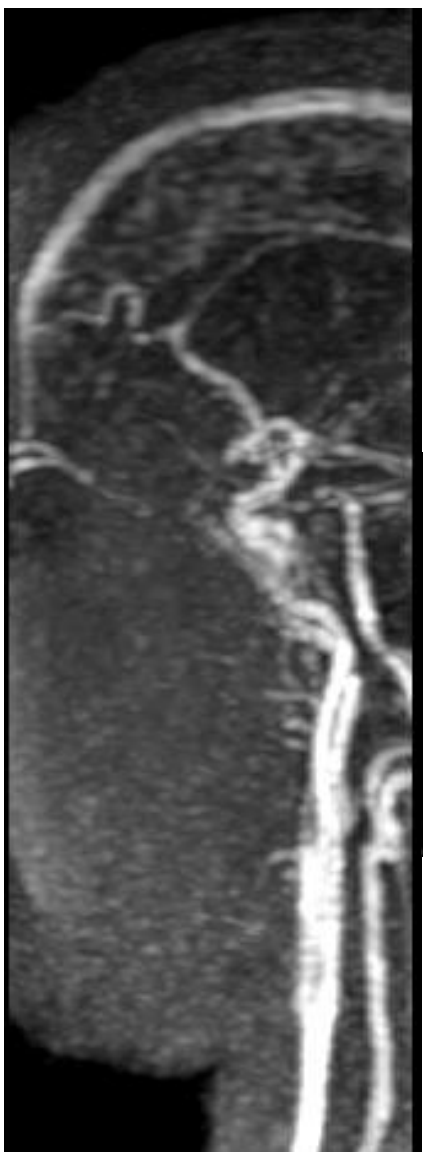


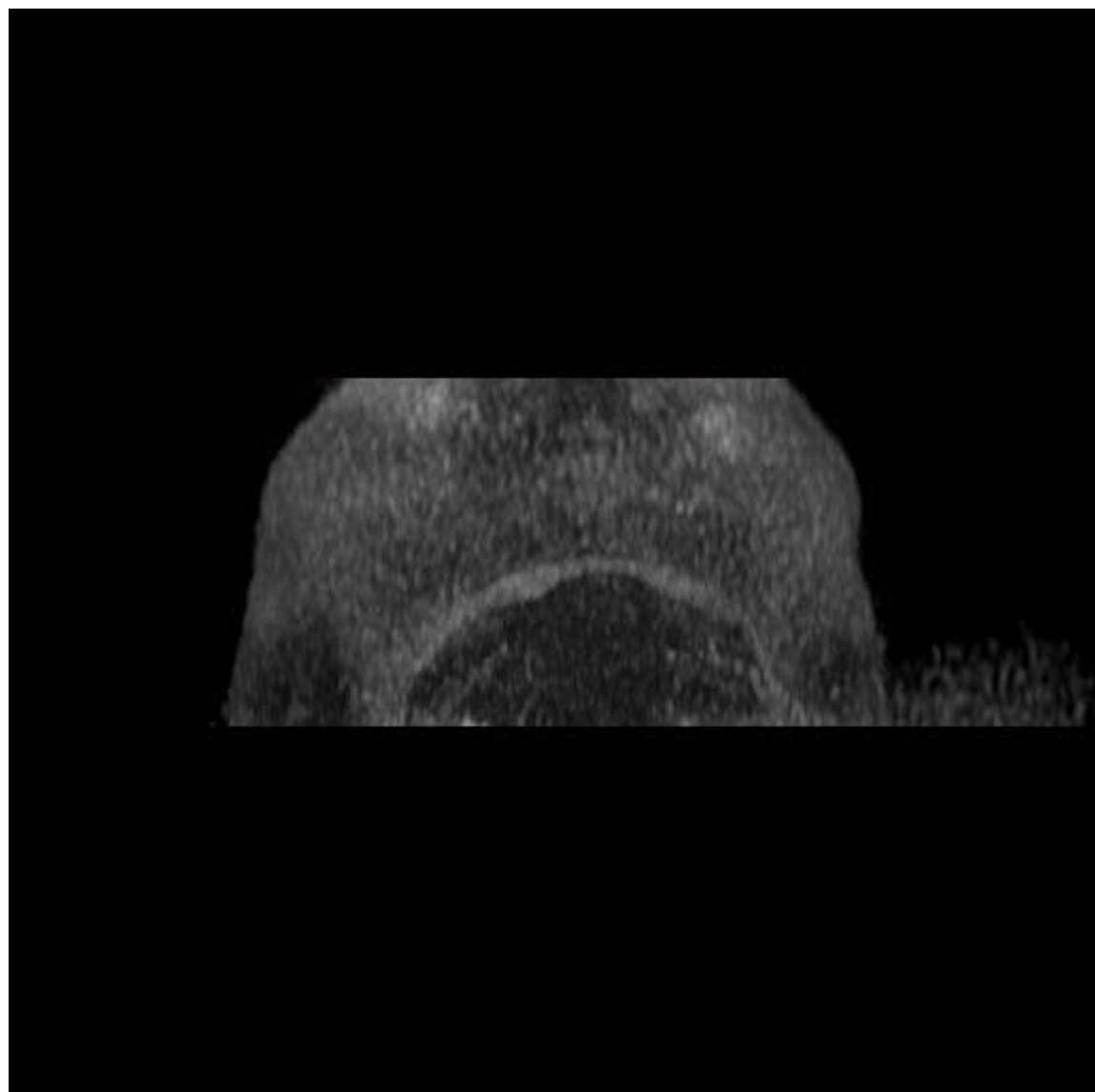




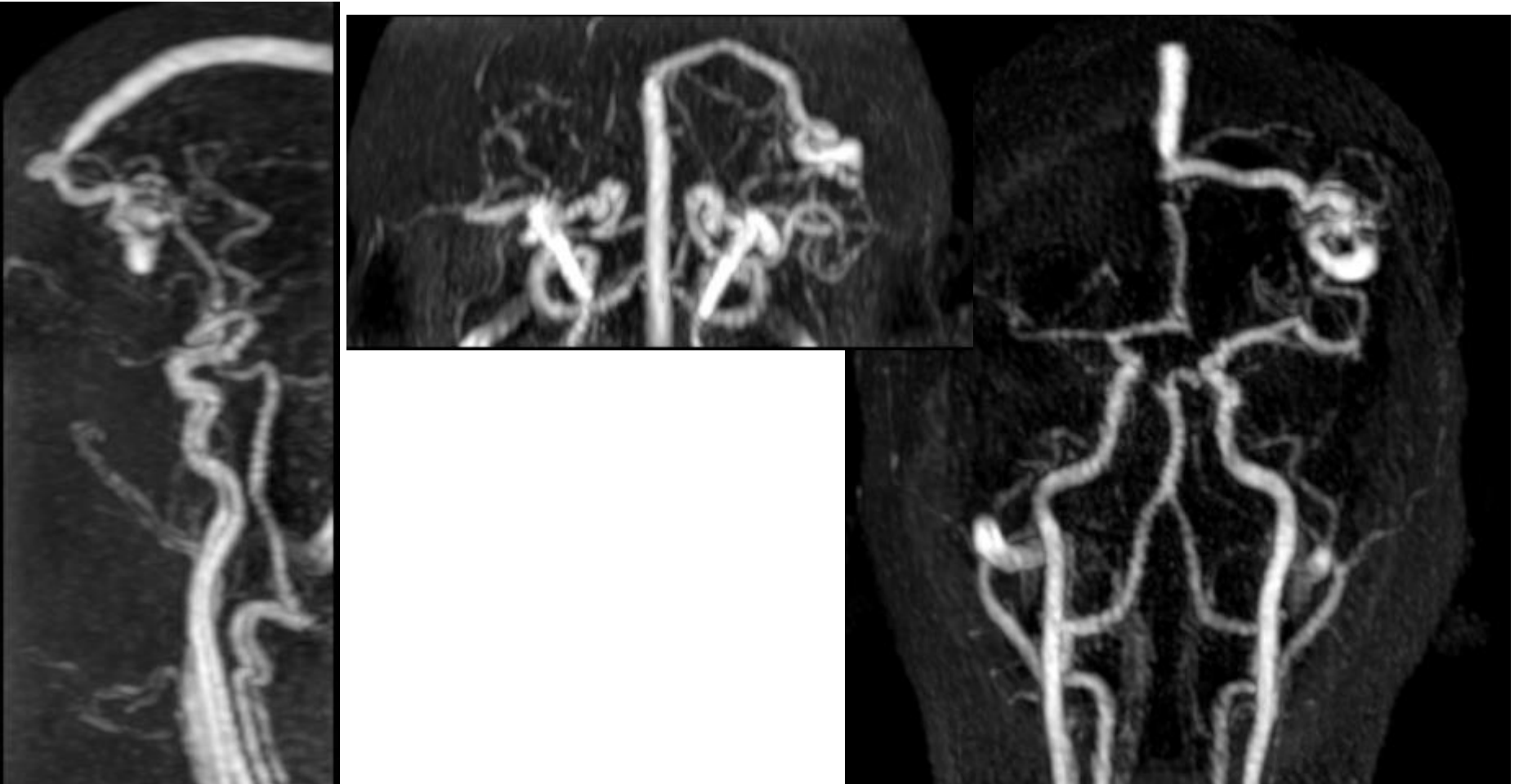








Bambino/a del 2010: residuo/recidiva di malformazione artero-venosa
in sede frontale sinistra

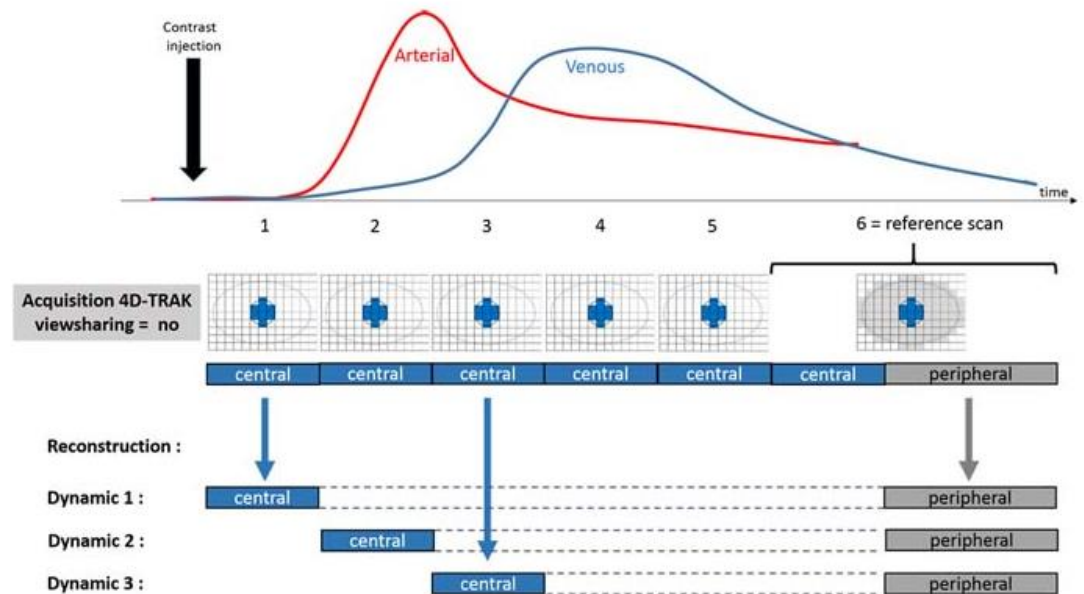




4D-TRAK (4D Time-Resolved Angiography using Keyhole) rende possibili nuovi standard nell'MRA con mezzo di contrasto (CE-MRA). Offre velocità di scansione nettamente superiori per le scansioni CE-MRA ad alta risoluzione spaziale e temporale. 4D-TRAK utilizza la tecnica di scansione 3D FFE e combina tutti i vantaggi di dS-SENSE, Keyhole e CENTRA.

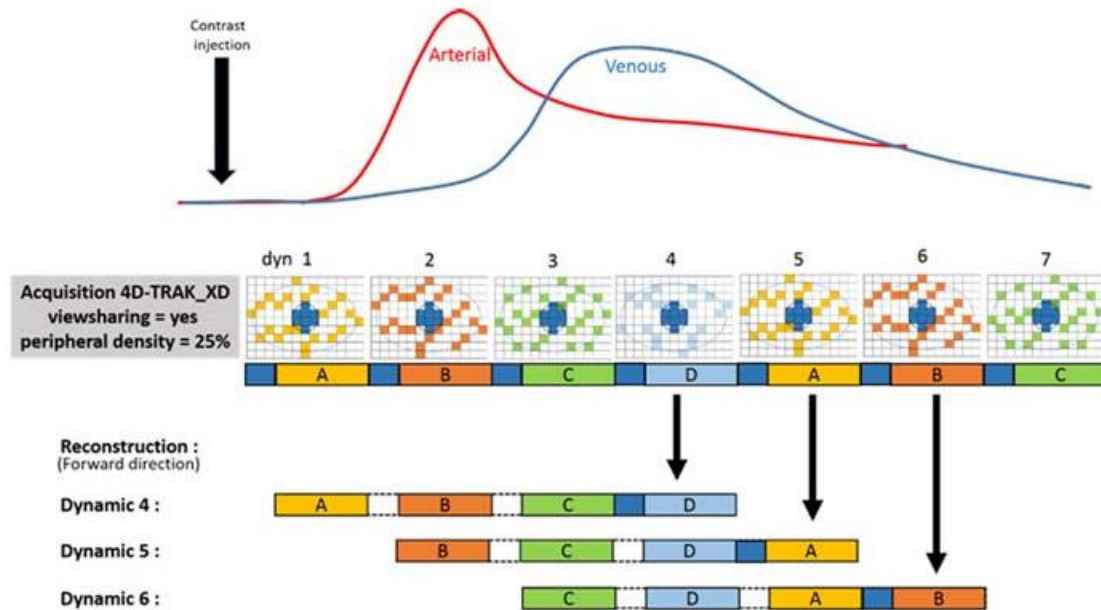
Presentazione schematica di 4D-TRAK (viewsharing = no)

- **Keyhole = sì**
- **Keyhole - dimensioni centrali = 25%**
- **Viewsharing = no**
- **Keyhole - scansione rifer. = ultima**



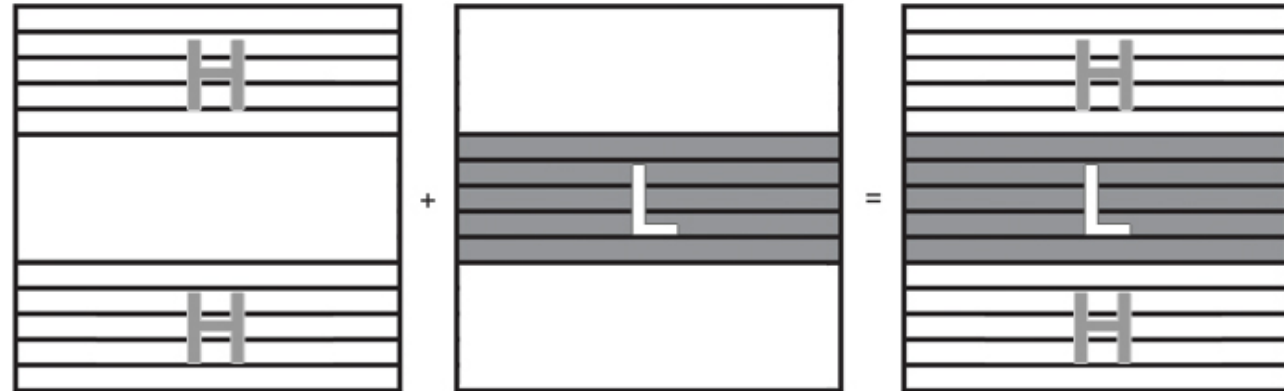
Presentazione schematica di 4D-TRAK XD (viewsharing = no)

- **Keyhole = sì**
- **Keyhole - dimensioni centrali = 25%**
- **Viewsharing = sì**
- **Viewsharing - densità periferica = 25%**
- **Viewsharing - dir. condivisione = avanti**



Keyhole è una tecnica che può essere utilizzata in qualsiasi tipo di scansione dinamica per rendere più rapida la scansione.

Keyhole in modalità di scansione 2D e MS



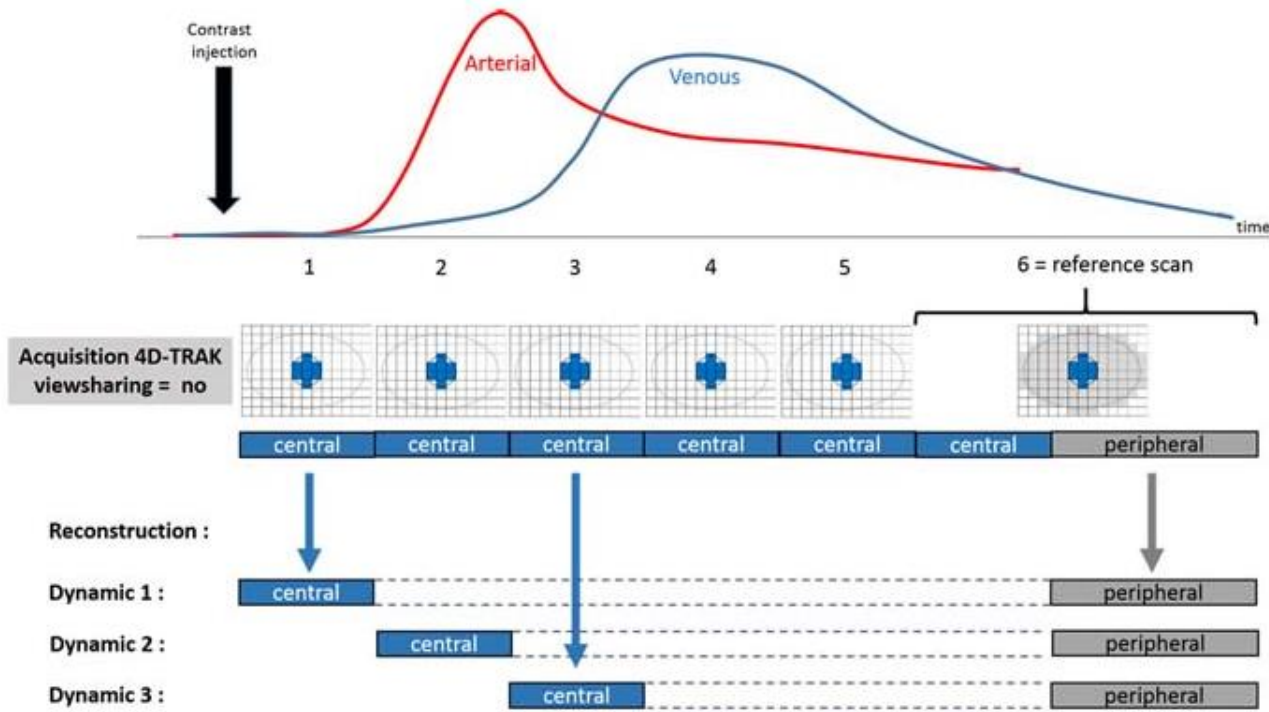
Keyhole:

- Assicura una significativa riduzione del tempo di scansione rispetto alle scansioni non keyhole, poiché riduce l'acquisizione dei dati per le scansioni dinamiche keyhole, ad eccezione della scansione dinamica di riferimento (ultima o prima dinamica), in caso di viewsharing = no. La prima o l'ultima scansione dinamica è denominata scansione dinamica di riferimento, mentre le altre scansioni sono definite scansioni dinamiche keyhole.
- Consente di acquisire tutti i profili dello spazio k richiesti per la scansione dinamica di riferimento.
- Consente di acquisire solo i profili per la determinazione del contrasto (profili centrali) per le scansioni dinamiche keyhole. La dimensione della riduzione per le scansioni keyhole può essere definita dai valori assegnati agli specifici parametri keyhole.

Keyhole:

- Fornisce informazioni di scansione complete copiando la parte mancante dalla scansione di riferimento (in caso di viewsharing = no) o da altre scansioni dinamiche keyhole durante la ricostruzione (in caso di viewsharing = sì). In tal modo combina l'alta risoluzione spaziale della scansione di riferimento con il contrasto che si osserva nelle scansioni dinamiche keyhole a bassa risoluzione spaziale.
- Può essere combinata con viewsharing. Combinate con studi di contrasto, le acquisizioni keyhole possono essere utilizzate per ottenere un'elevata risoluzione temporale.

Keyhole in 3D



Dimensioni centrali keyhole (%)

Questo parametro determina la percentuale (%) del numero di stadi di codifica di fase nella scansione dinamica keyhole rispetto alla scansione dinamica di riferimento.

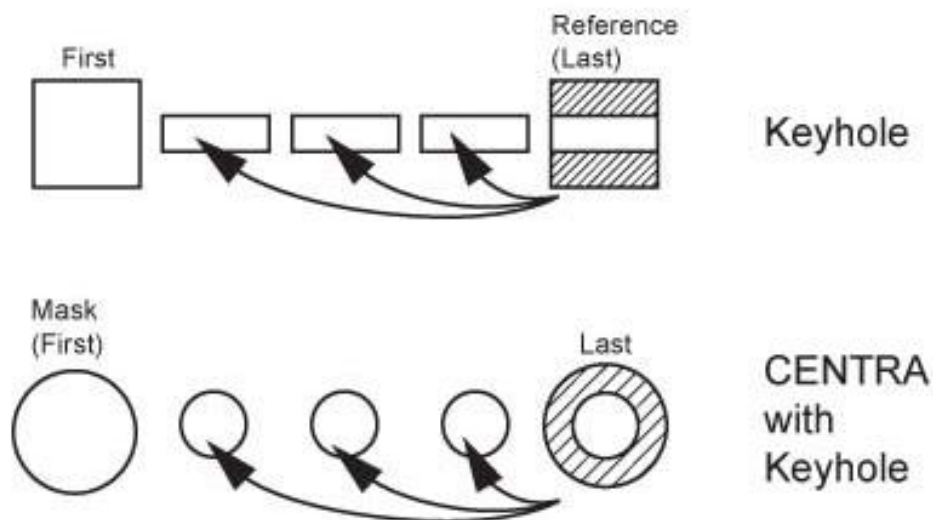
Il parametro dimensioni centrali (%) deve essere impostato su **15 - 25%** per avere una buona copertura dei dati di contrasto.

Limitazioni/svantaggi

Se la raccolta di profili è minima (15%), è possibile che parte delle informazioni di contrasto venga persa.

DIN/ANG → Keyhole → maschera

Viene acquisita una maschera utilizzabile per la sottrazione (dinamiche post-contrasto meno maschera precontrasto). Se attivata, la maschera è la prima scansione dinamica (precontrasto).



4D_TRAK → 0.8 sec

Summary	Geometry	Contrast	Motion	Dyn/Ang	Postproc	Offc/Ang	Coils	Conflicts
s8_4D_Trak 2sec		Voxel	Sag	Rel. SNR	TE	TR		
02:05 ↑		1.09 x 1.11 x 2.20	1.00	1.23	3.1			Acc
Angio / Contrast enh.		contrast enh.		Total scan duration	02:05.4			
Quantitative flow		no		Rel. SNR	1			
CE profile order		CENTRA		Act. TR/TE (ms)	3.1 / 1.23			
Manual start		yes		Dyn. scan time (keyh.)	00:01.3			
Dynamic study		individual		Ref/Mask scan time	00:06.7			
dyn scans		40 (20)		Time to k0	0.669			
dyn scan times		user defined		ACQ voxel MPS (mm)	1.09 / 1.11 / 2.20			
(mm:ss)				REC voxel MPS (mm)	0.94 / 0.94 / 1.10			
fov time mode		default		Scan percentage (%)	98.6			
dyn mov scans		0		Act. slice gap (mm)	-1.1			
Immediate scan start		no		Act. WFS (pix) / BW (Hz)	0.210 / 1032.9			
fast next scan		no		Min. WFS (pix) / Max. BW...	0.210 / 1033.1			
synch. ext. device		no		Head SAR	< 57%			
prospect. motion corr.		no		Whole body SAR / level	< 0.3 W/kg / normal			
Keyhole		yes		SED	< 0.1 kJ/kg			
central size (%)		20		Max B1+rms	3.69 uT			
mask		yes		PNS / level	61% / normal			
Arterial Spin labeling		no		dB/dt	49.7 T/s			
				Sound Pressure Level (dB)	19.5			

«Dyn scans»: impostare al massimo possibile... (64?)

Su «dyn scan times» togliere le pause e mettere sempre shortest.

P reduction: 3

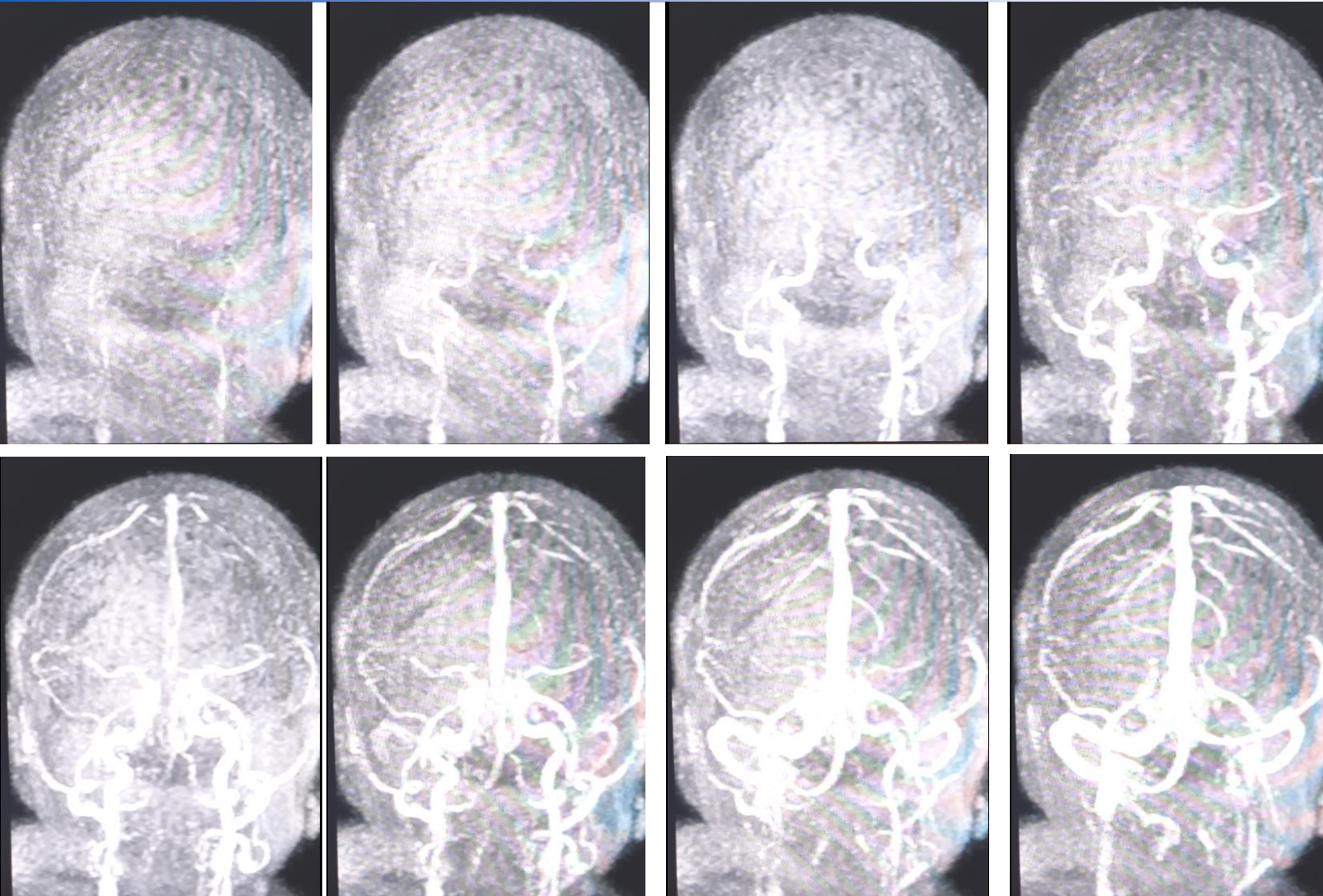
S reduction: 3

Dyn scan time: ≤ 0.8sec

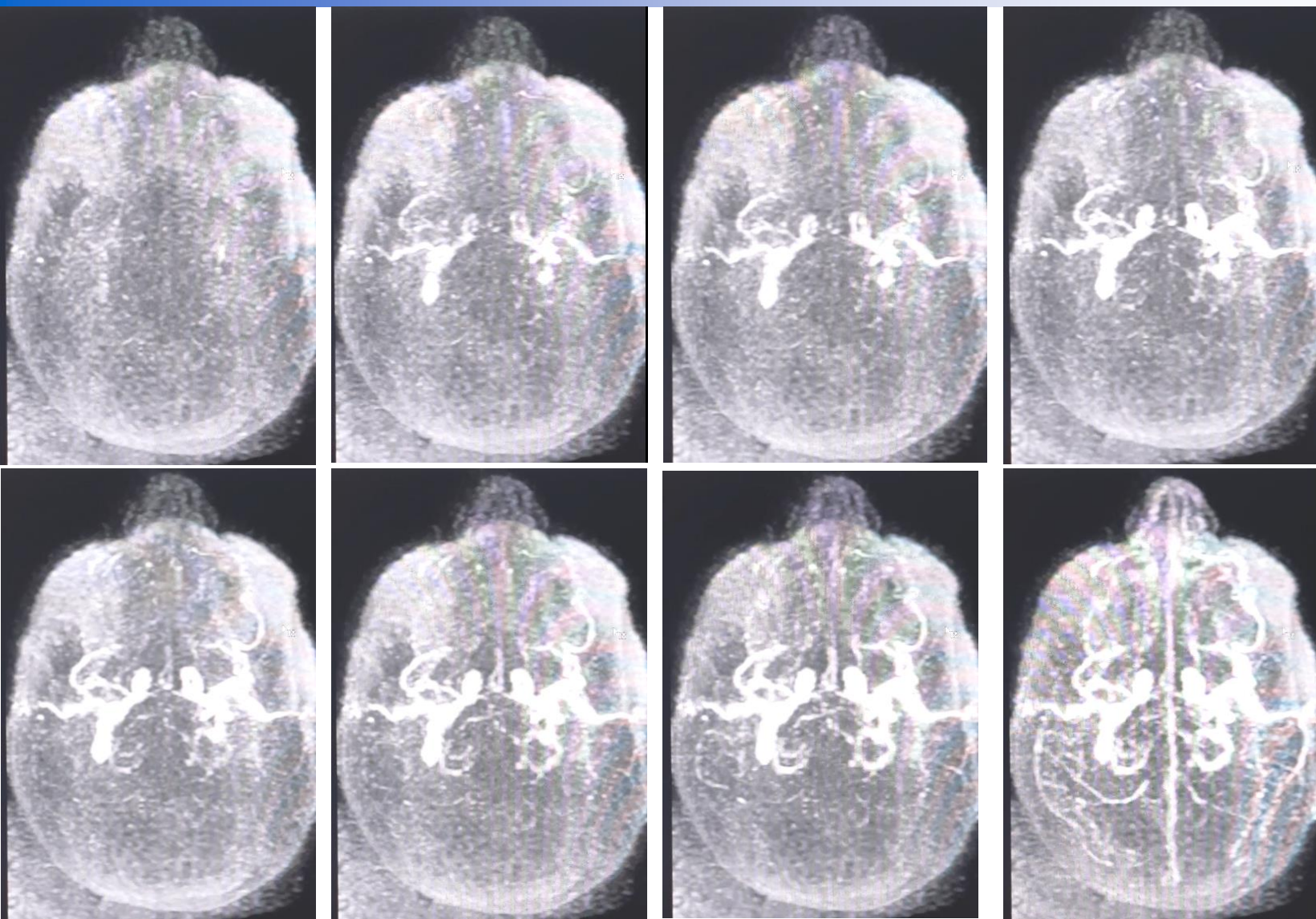
La sequenza deve durare intorno al minuto.

Controllare i tempi nel riepilogo.

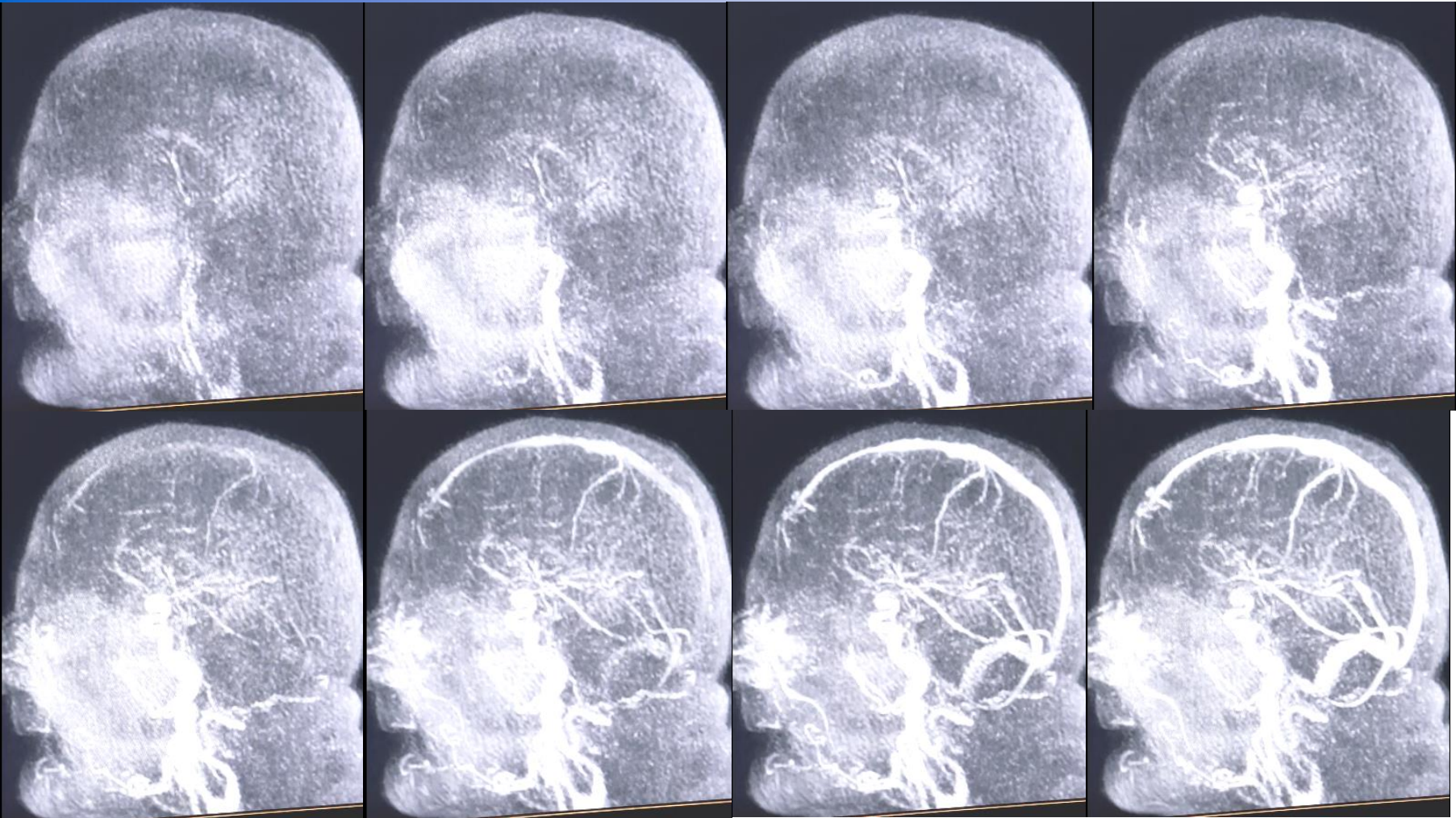
4D_TRAK → 0.8 sec



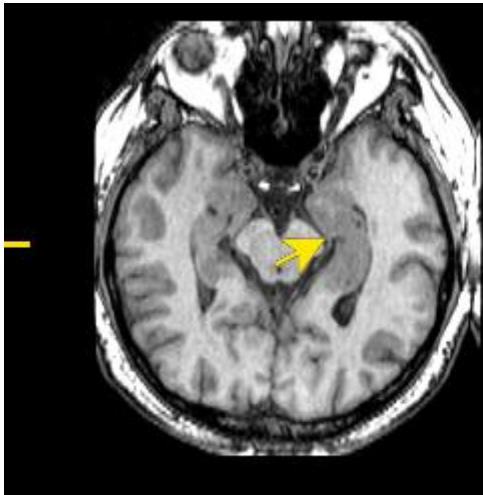
4D_TRAK → 0.8 sec



4D_TRAK → 0.8 sec



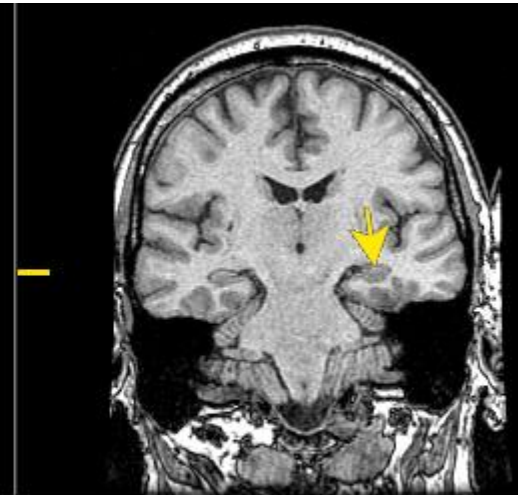
Pratica: Ippocampo



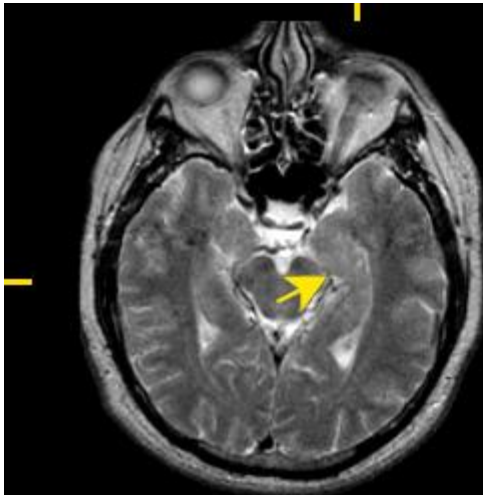
Brain-hemispheric ▾ MR-T1 ▾
hippocampus ▾ sync



Brain-hemispheric ▾ MR-T1 ▾
hippocampus ▾ sync



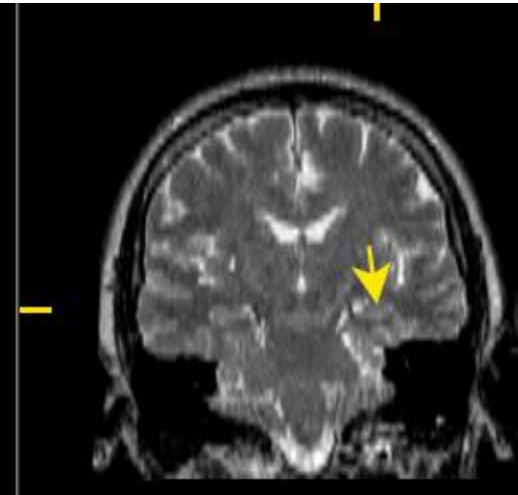
Brain-hemispheric ▾ MR-T1 ▾
hippocampus ▾ sync



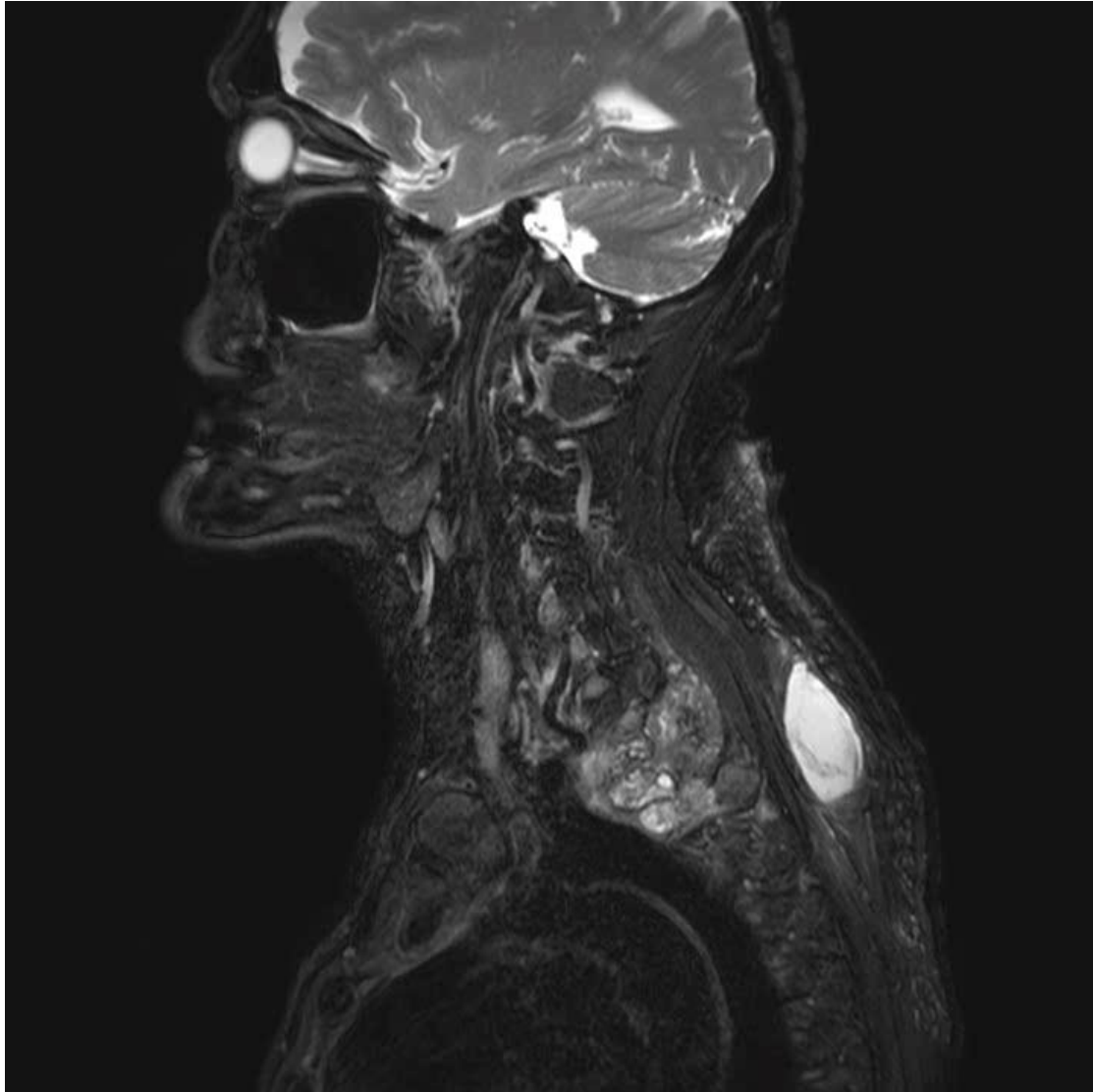
Brain-hemispheric ▾ MR-T2 ▾
hippocampus ▾ sync



Brain-hemispheric ▾ MR-T2 ▾
hippocampus ▾ sync



Brain-hemispheric ▾ MR-T2 ▾
hippocampus ▾ sync



Esame RM colonna in
toto in urgenza.
Sag T2 dixon

eBook for Undergraduate Education in Radiology

Vascular disorders of the spinal cord can be caused by venous or arterial ischemia and vascular malformations.

Acute arterial ischemia is typically seen as a complication of aortic aneurysm surgery or catheterization. Spinal cord infarctions show a swollen cord and hyperintensity on T2-weighted images (figure 67).

Vascular malformations depict abnormal, dilated, serpiginous vascular structures within the spinal cord or subarachnoid space (figure 68).

Colonna: lesioni vascolari



Fig. 67. Spinal cord infarction demonstrating cord swelling and increased signal (red arrows) on a sagittal T2-weighted image. Areas without spinal cord infarction (green arrows)

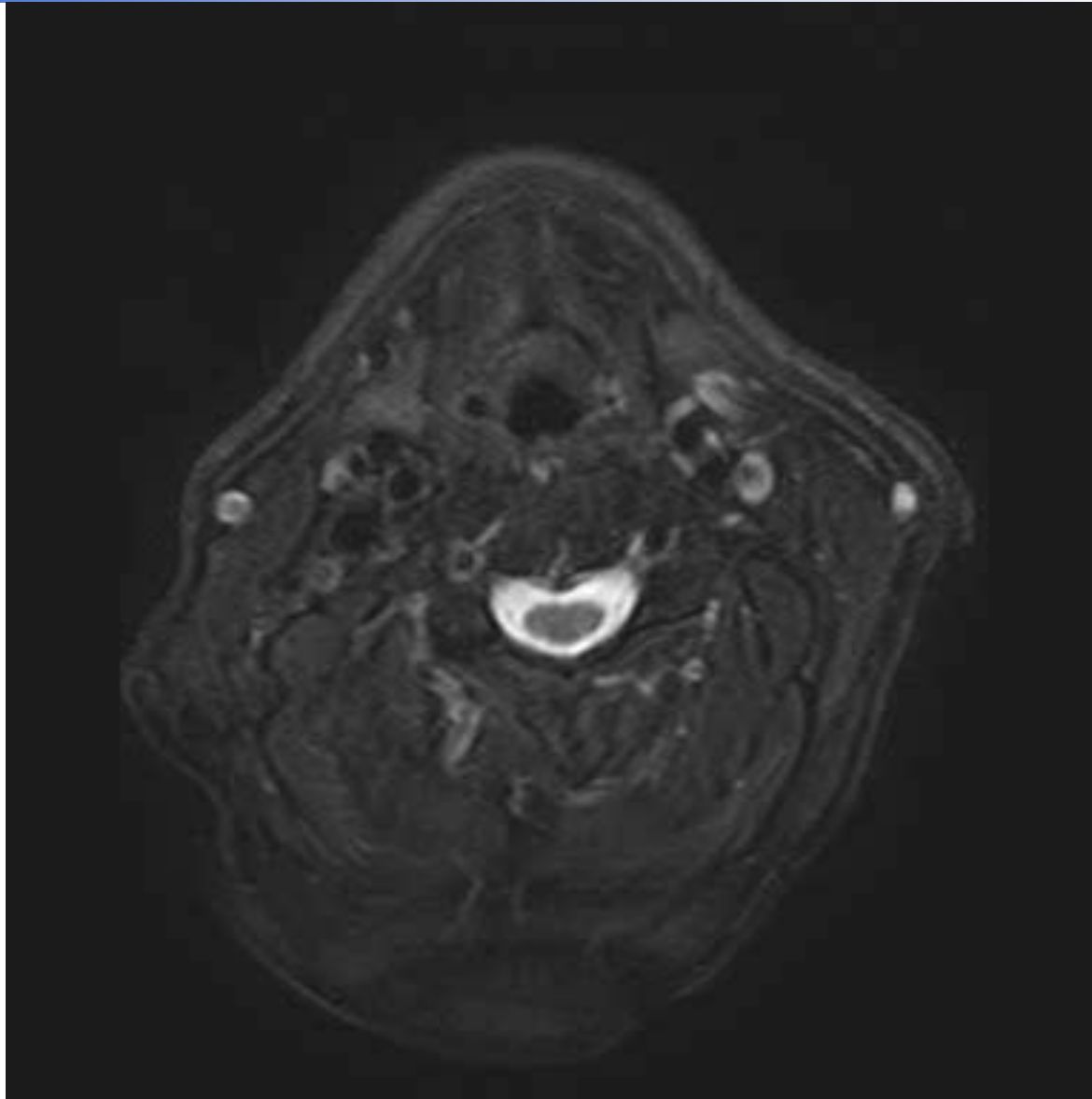


Fig. 68. Vascular malformation. Sagittal T2-weighted image showing dilated serpiginous vessels (arrows).

Pratica: Colonna con mdc in urgenza



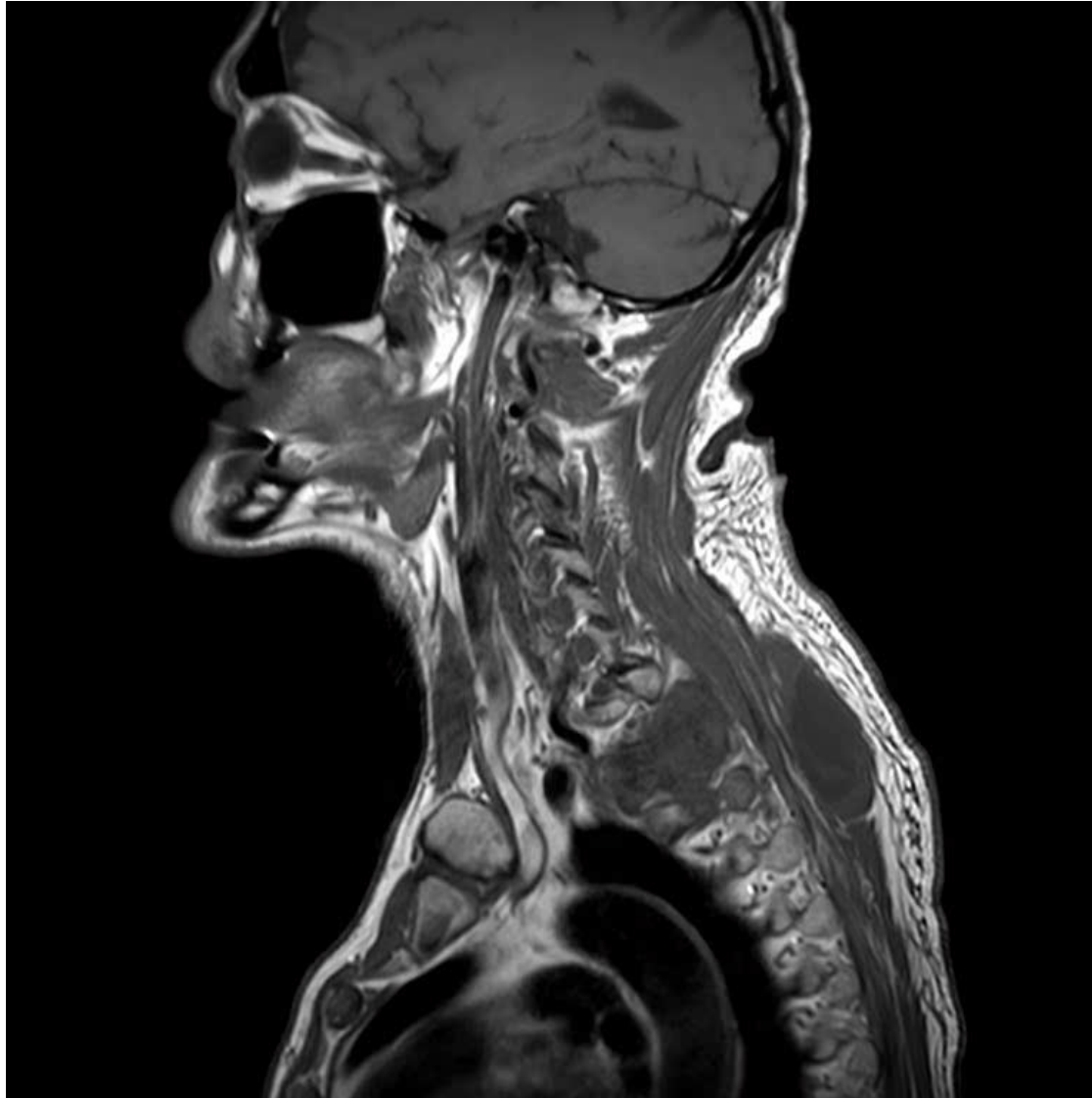
Ax T2W
Dixon TSE



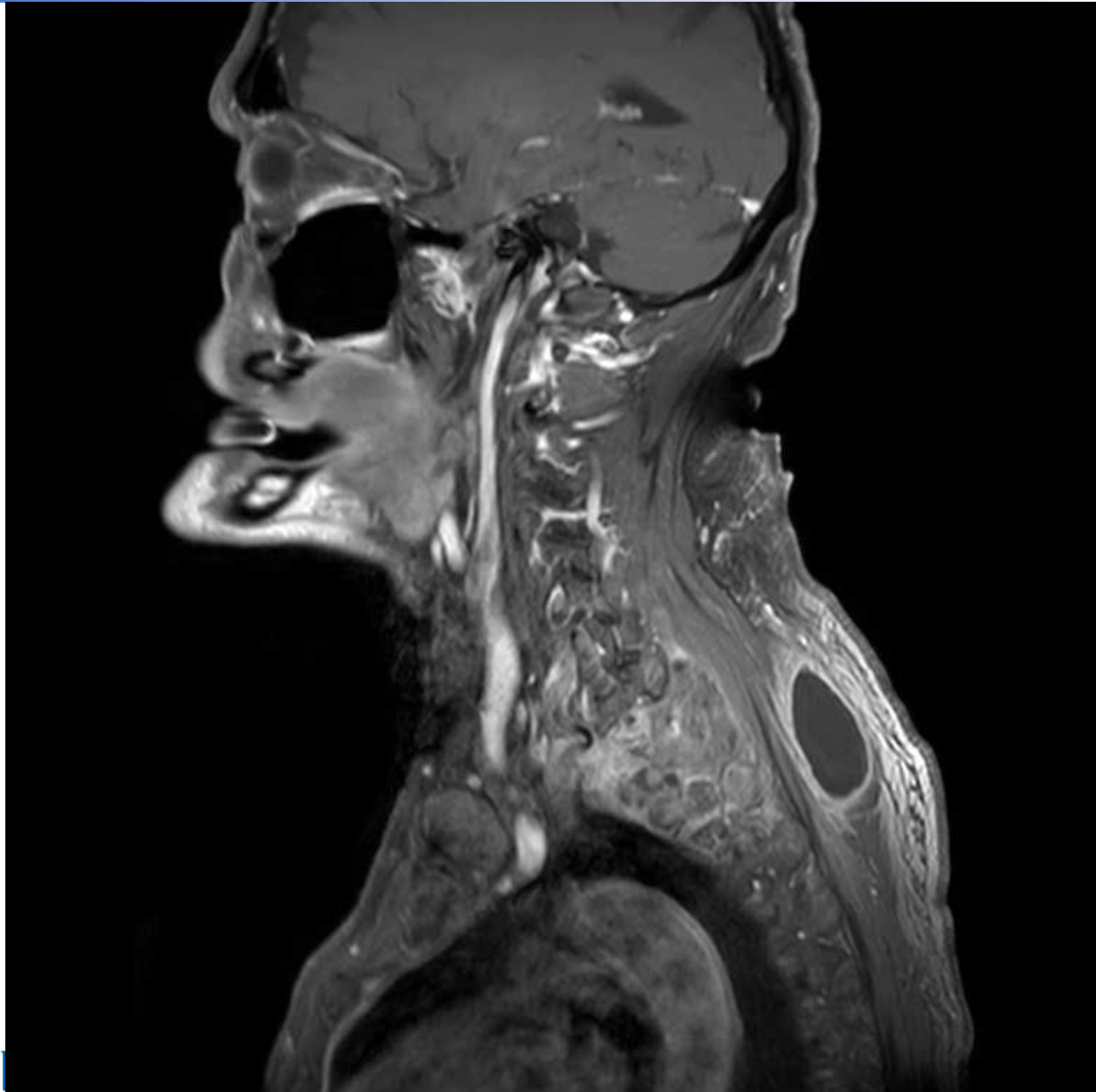
Pratica: Colonna senza e con mdc in urgenza



Pratica: Colonna senza mdc in urgenza



Pratica: Colonna con mdc in urgenza





Paziente
con
vertigini,
poi
progressiva
perdita di
coscienza
fino al
coma.
ICTUS
ISCHEMICO

«...Mancato segnale di flusso in corrispondenza dell'apice di arteria basilare e dei tratti P1 di entrambe le ACP. Non rilevabile segnale di flusso anche nei restanti tratti di entrambe le arterie cerebrali posteriori (ove probabilmente è marcatamente rallentato)...»

Controllo Rm dopo tromboaspirazione in sala angiografica



«... pervia l'arteria basilare ed entrambe le ACP ...»

Pratica: 3T Angio arti inferiori



N.B. Il quantitativo di MdC dipende sempre dal peso del paziente