

# Indicações clínicas da ressonância magnética

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Seção de Ressonância Magnética  
InCor - HCFMUSP

# Ressonância magnética

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- Histórico

- Bloch e Purcell - 1952 - Prêmio Nobel - RM de sólidos e líq.
- 1ª aplicação biológica da RM



Felix Bloch  
1905-1983



Edward Mills Purcell  
1912-1997

# Ressonância magnética

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- Histórico

- Técnica de análise química - 1950 -1951 - Proctor e Yu - Espectroscopia
- Magnetos supercondutivos - 1965
- Transformada de Fourier - 1966

# Ressonância magnética

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- Histórico

- Aplicações biomédicas - 1970 - Imagem por RM (NMR - MRI) (Lauterbur e Damadian) e Espectroscopia por RM (MRS) de tecidos biológicos
- Imagem - aplicação clínica imediata
- Espectroscopia - pesquisa - posteriormente aplicação clínica





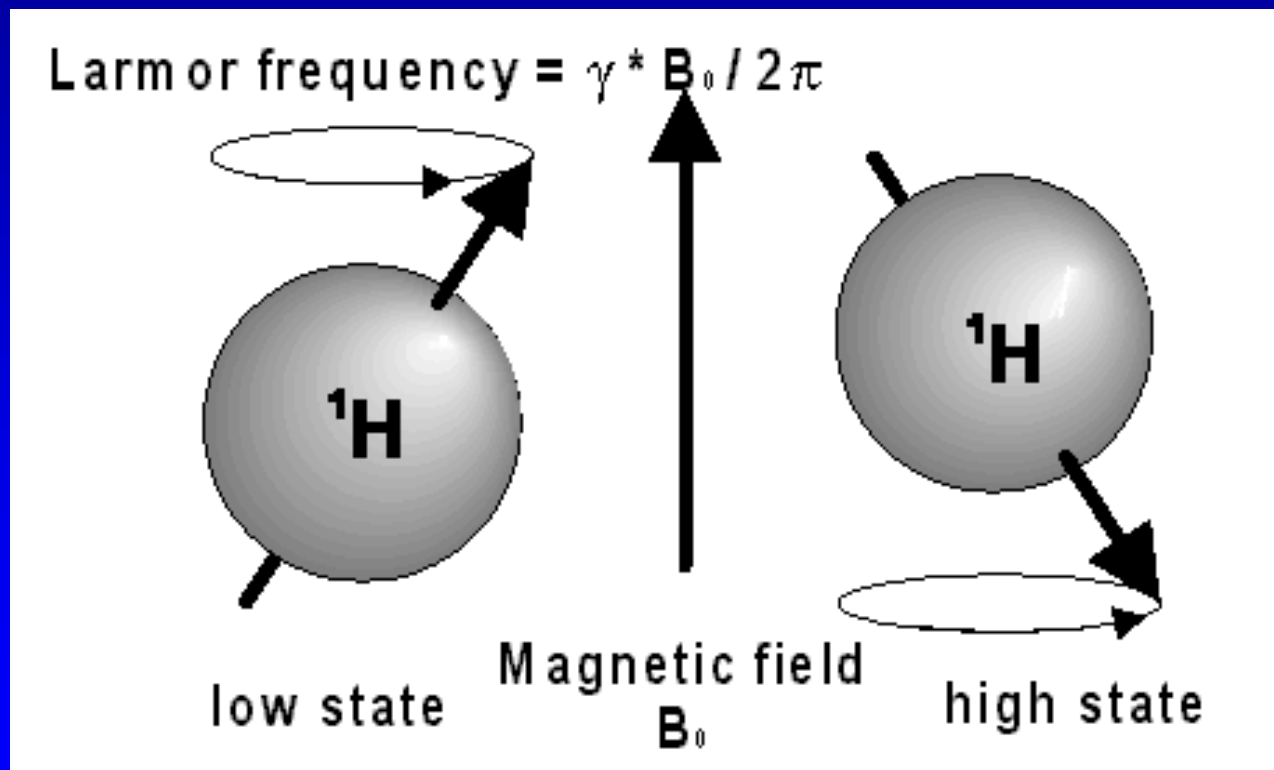
# Noções de física

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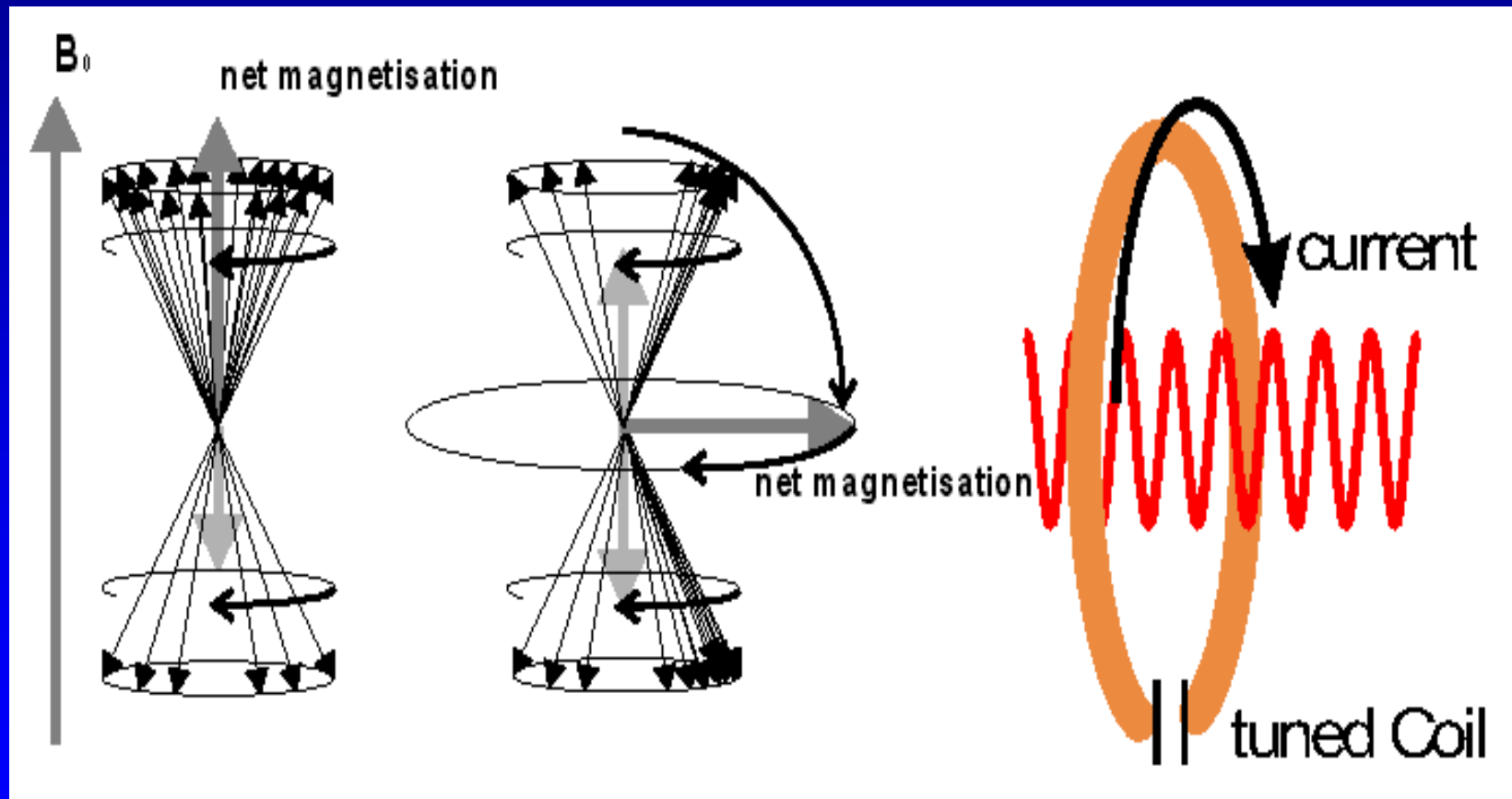
- Campo magnético
  - 1 Tesla = 10.000 Gauss
  - Terra = 0,5 Gauss
  - Aparelho 1,5 T = 30.000 x campo terra
- Radiofrequência
  - RM: 3 - 100 MHz
  - TV: > 64 MHz
  - FM: 88,8 - 108,8 MHz

# Noções de Física

- Frequência de Larmor



# Noções de Física

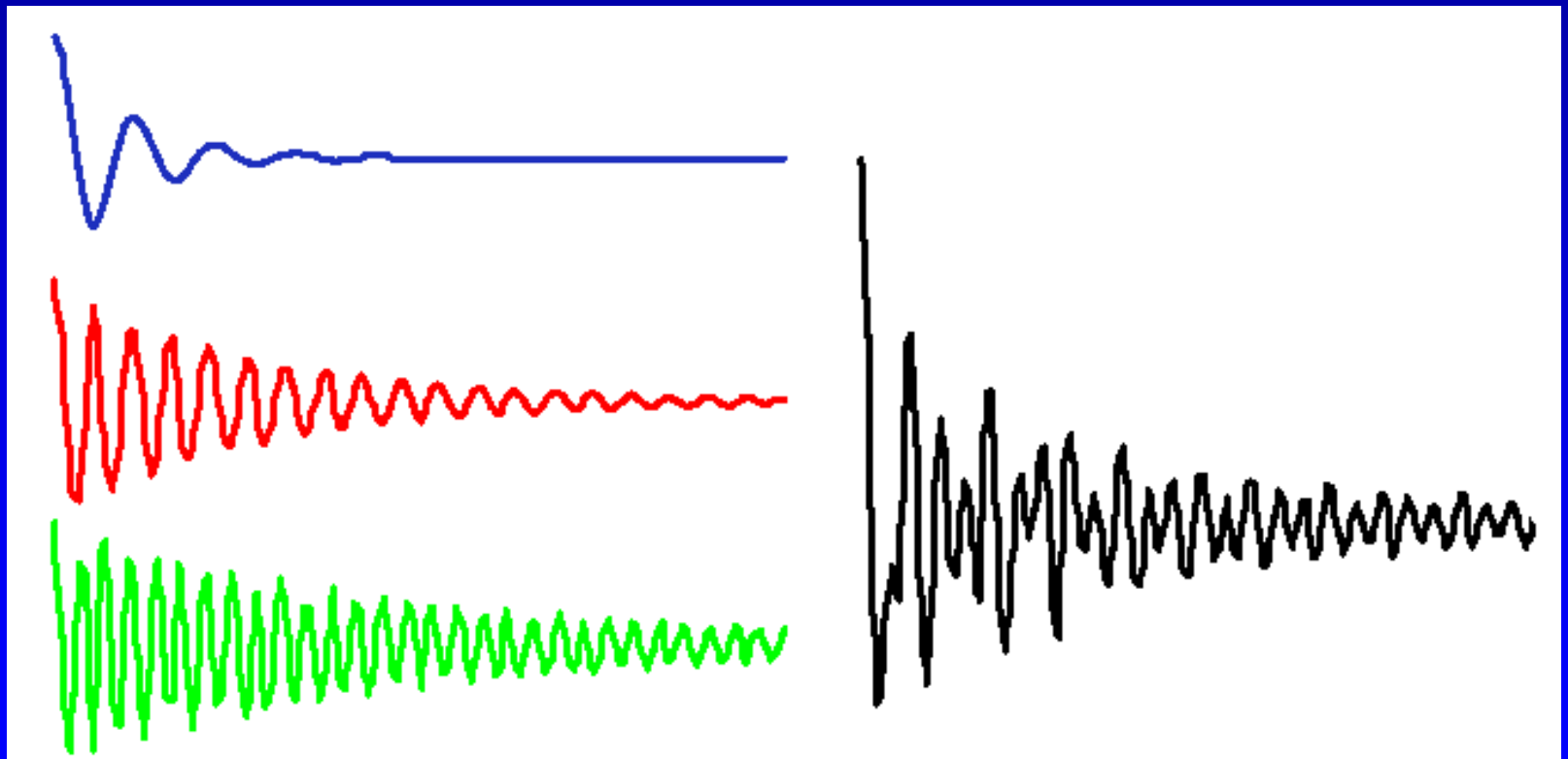




# Noções de Física

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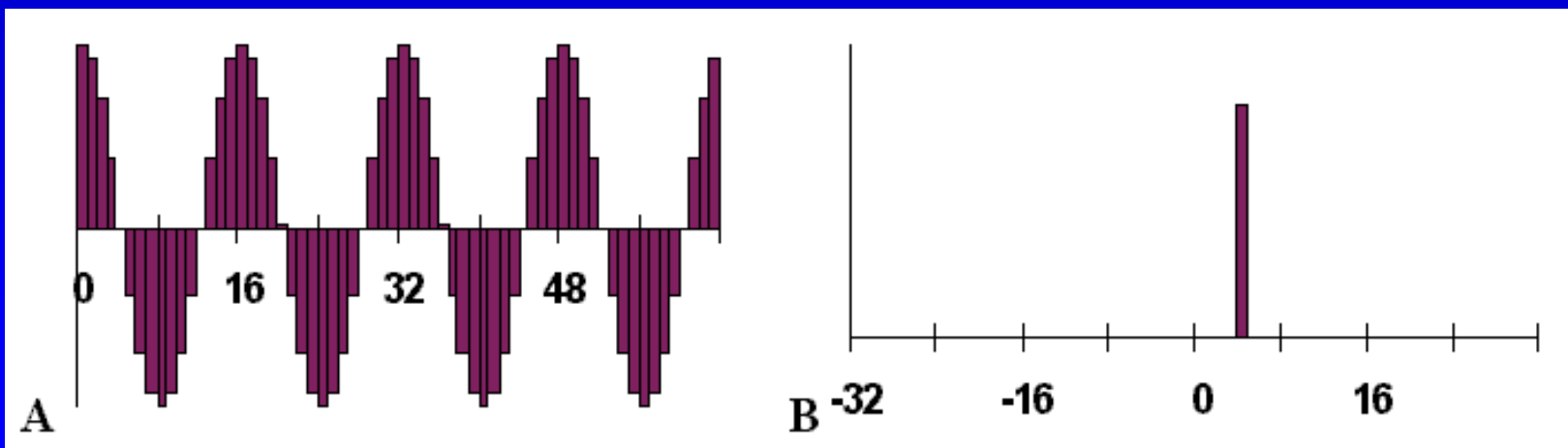
## FID - Domínio de Tempo



# Noções de Física

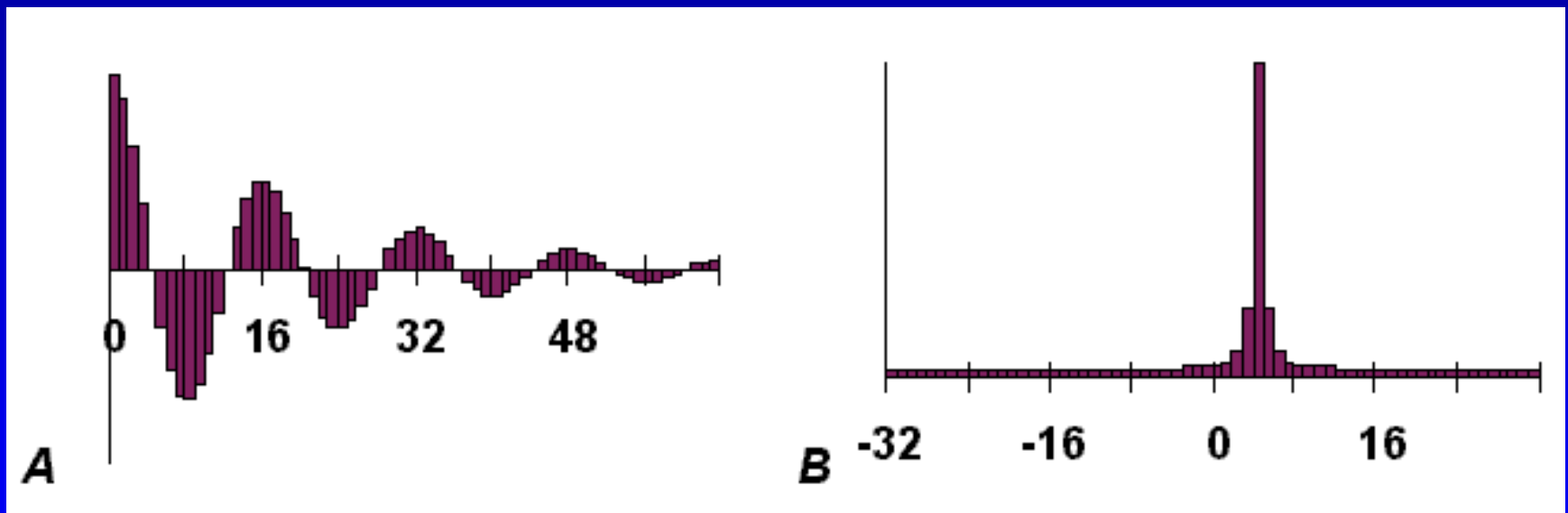
## Transformada de Fourier

$$F_j = \sum_{k=0}^{N-1} \left[ \cos\left(\frac{2\pi jk}{N}\right) + i \cdot \sin\left(\frac{2\pi jk}{N}\right) \right]$$



# Noções de Física

## Transformada de Fourier





# Noções de física

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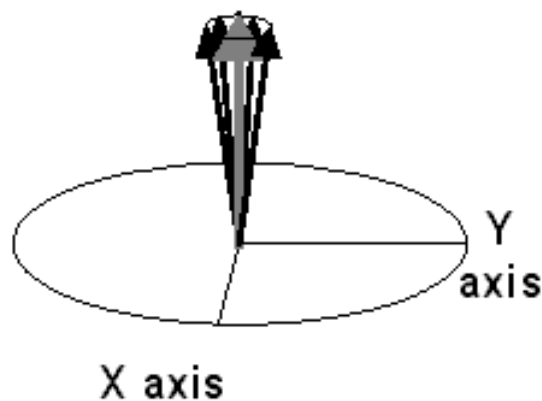
- Eco de spins (spin-echo)
- Tipo de sequência básica utilizada em RM
- Imagens pesadas em T1 e T2

# Noções de Física

equilibrium

$$\Omega = \gamma^* B_1$$

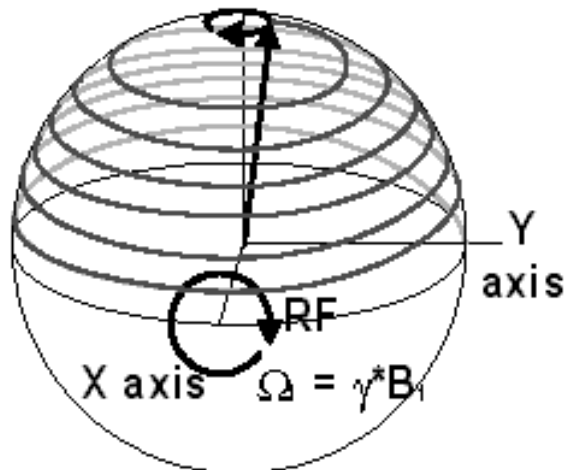
Z axis



RF pulse in the static frame

$$\Omega = \gamma^* B_1$$

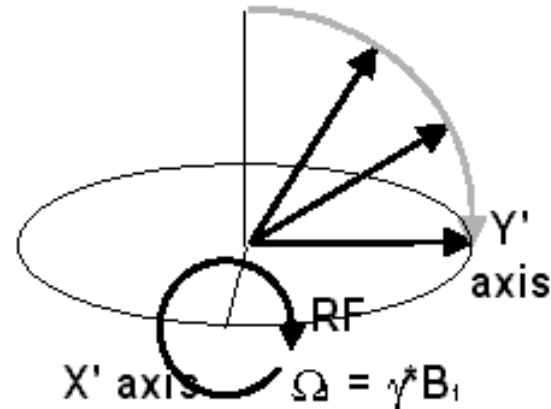
Z axis



RF pulse in the rotating frame

$$\Delta\Omega = 0$$

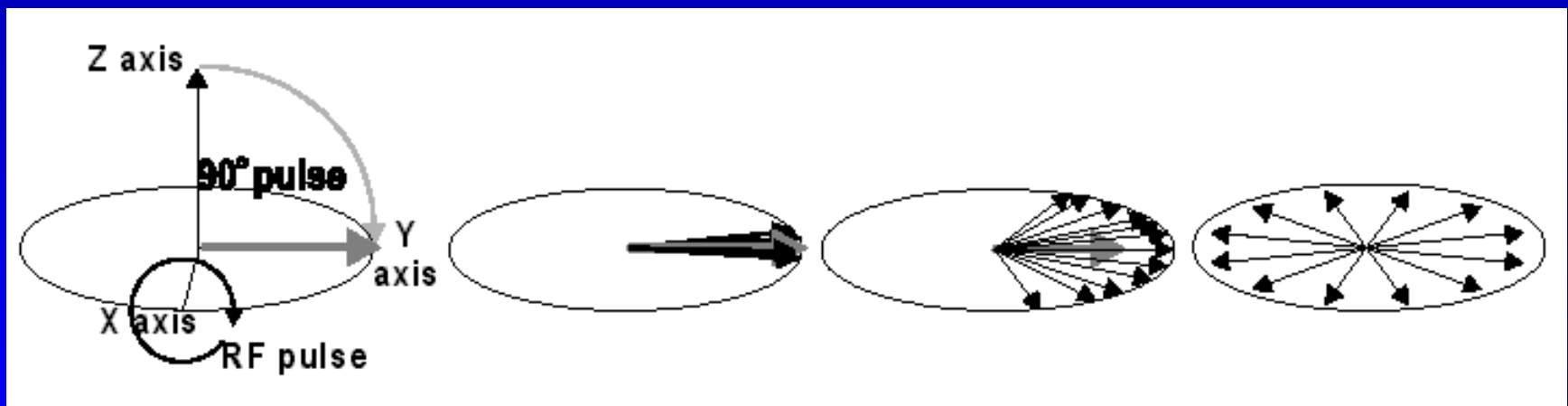
Z axis = Z' axis



# Noções de Física

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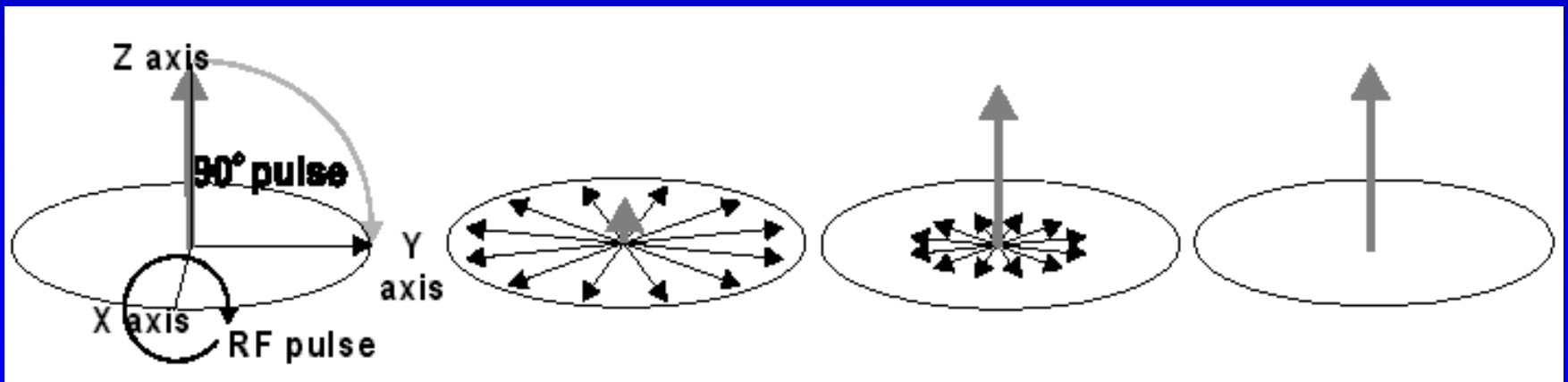
## Relaxação T2



# Noções de Física

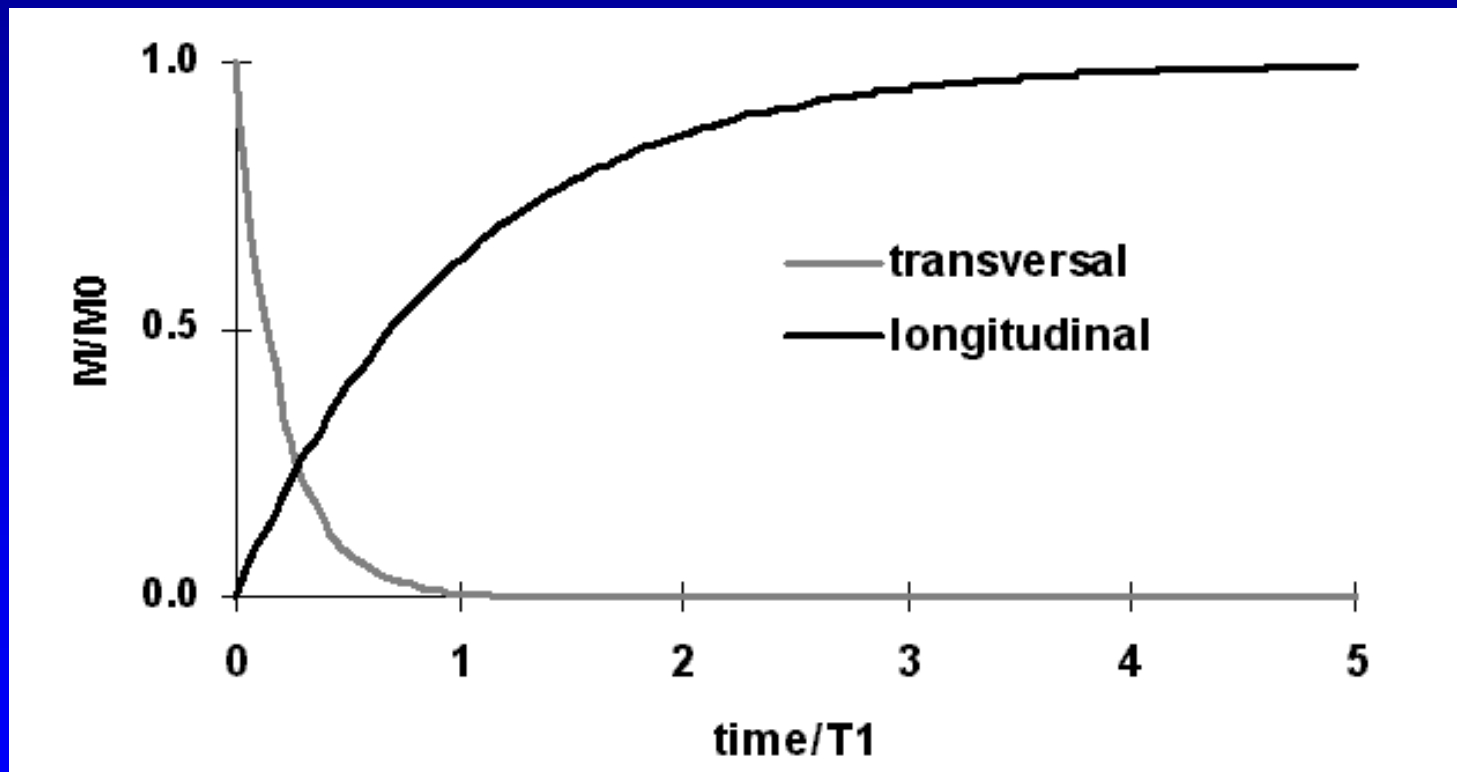
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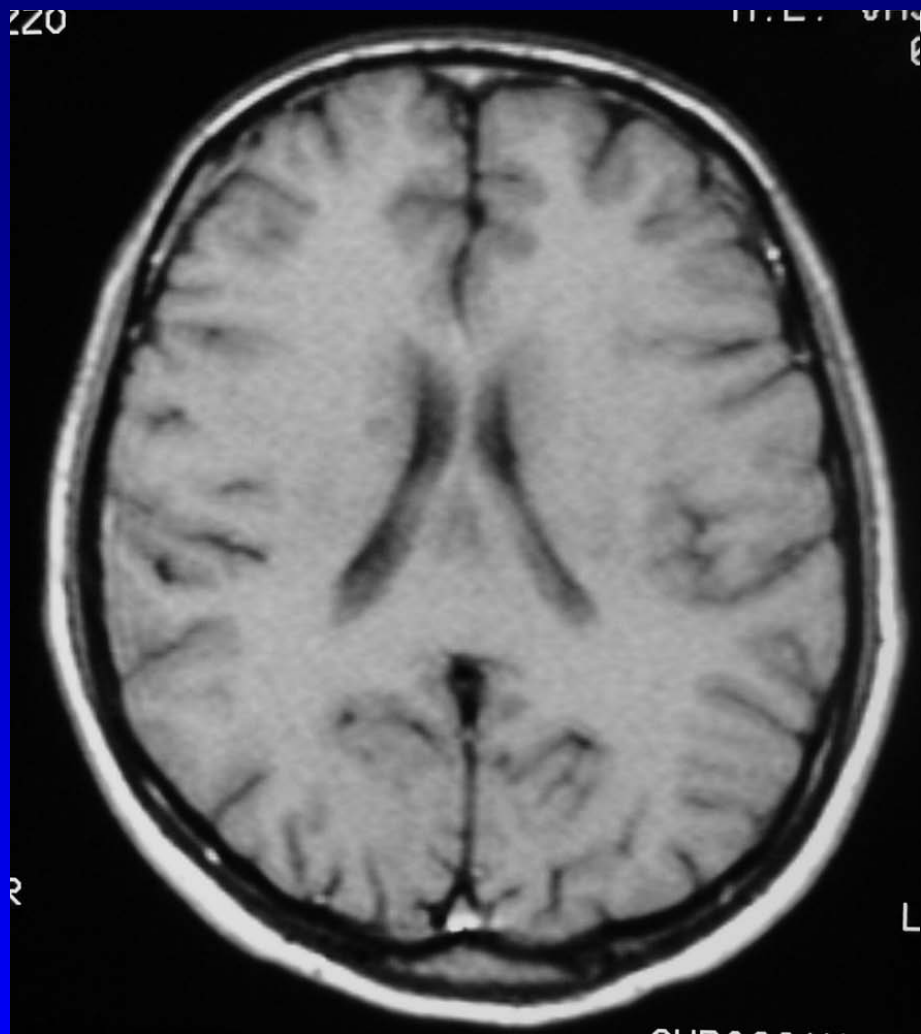
## Relaxação T1



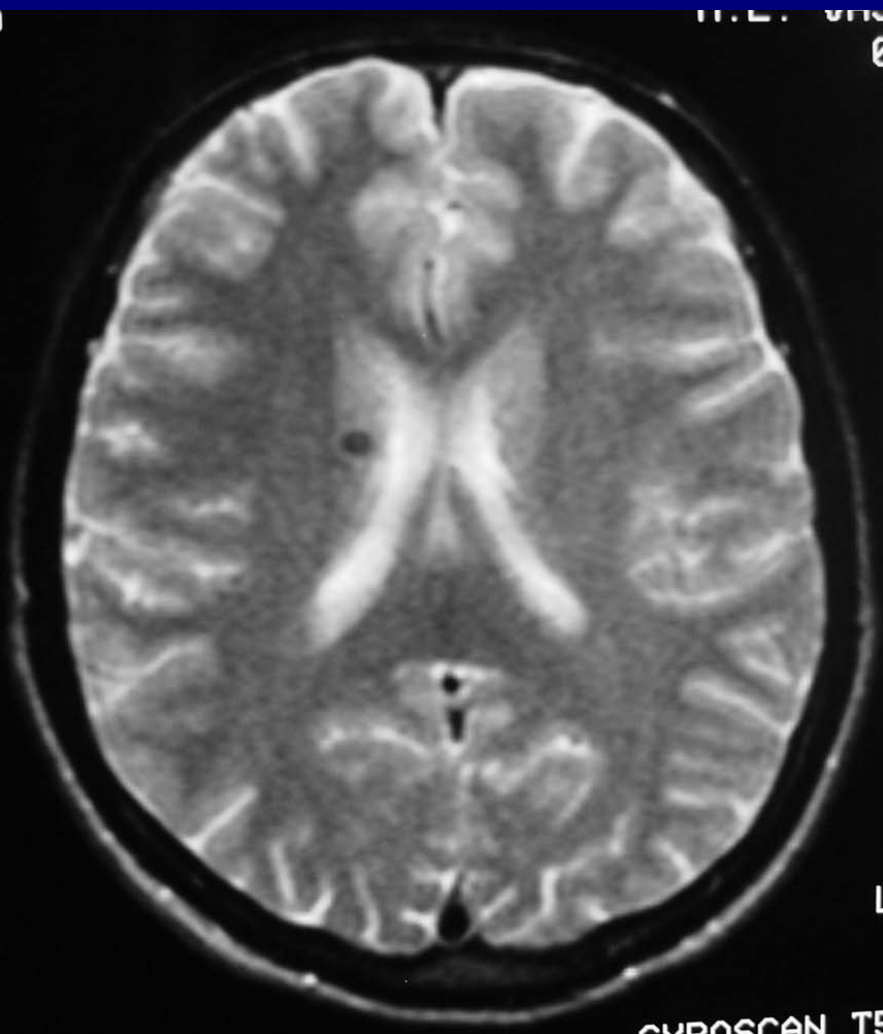
# Noções de Física

## Tempos de relaxação T1 e T2





T1



T2

# Terminologia

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- Hipointenso (hipossinal)
- Isointenso (isossinal)
- Hiperintenso (hipersinal)

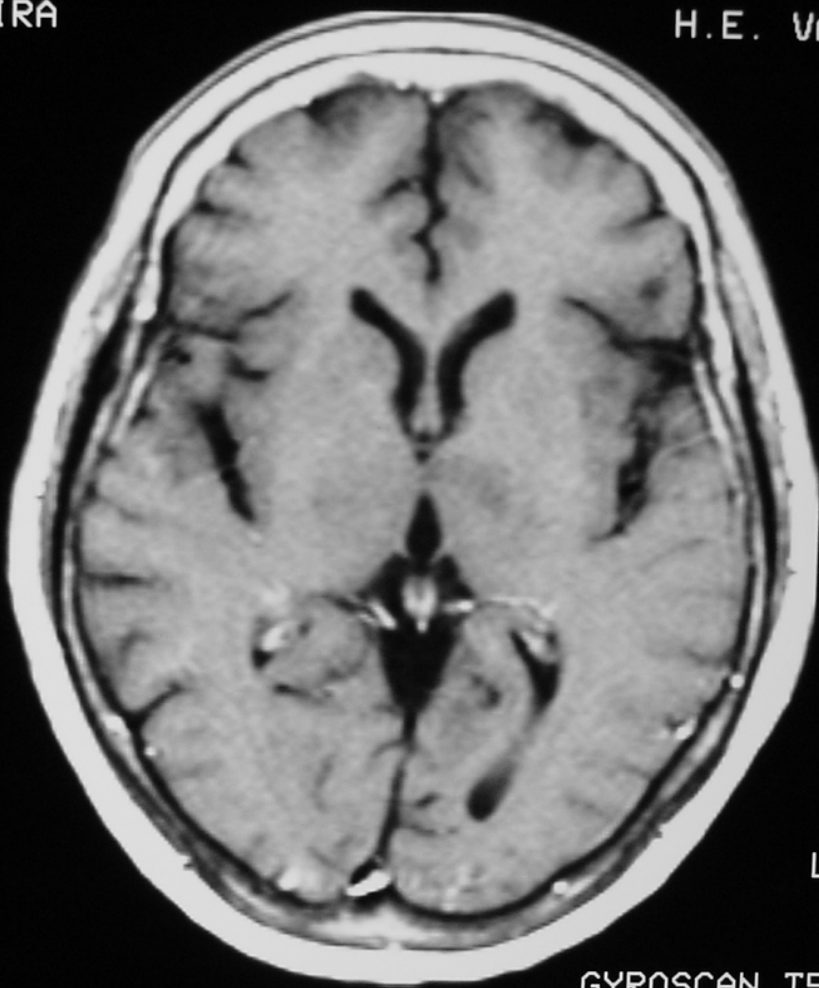


- Em T1 ou T2

IRA

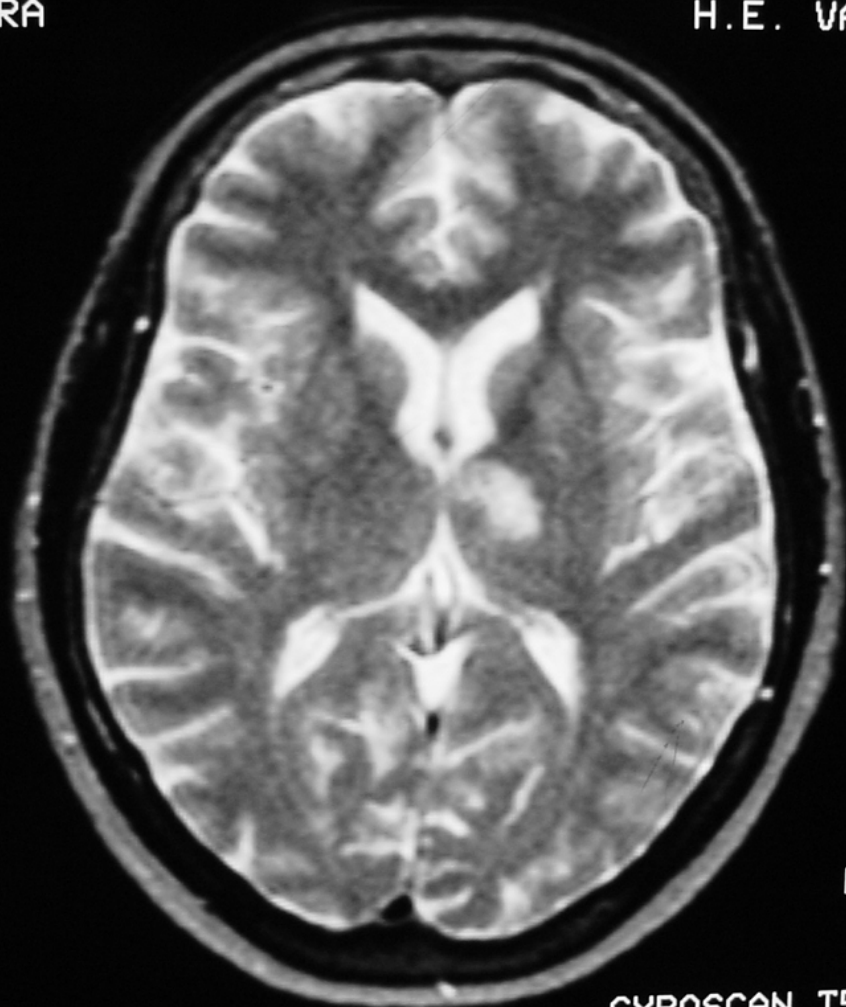
H.E. VA  
IRA

H.E. VA



L<sub>2</sub>

GYROSCAN T5-



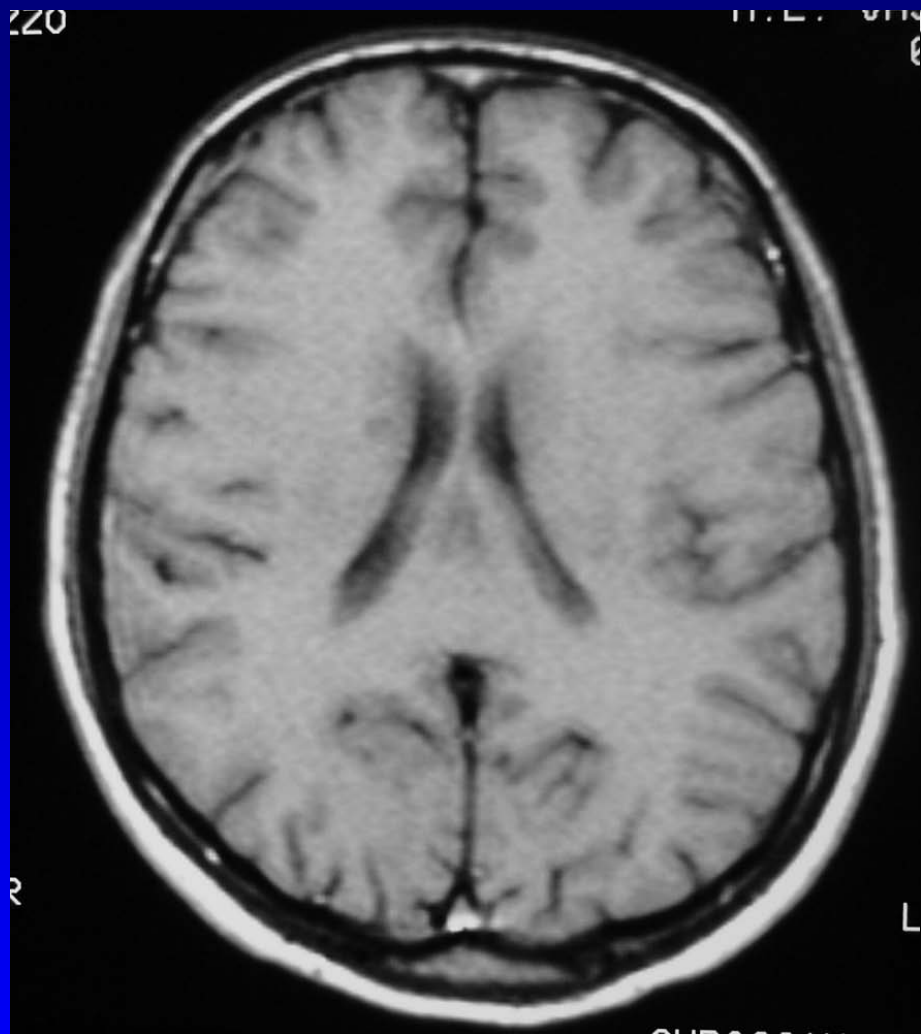
L

GYROSCAN T5

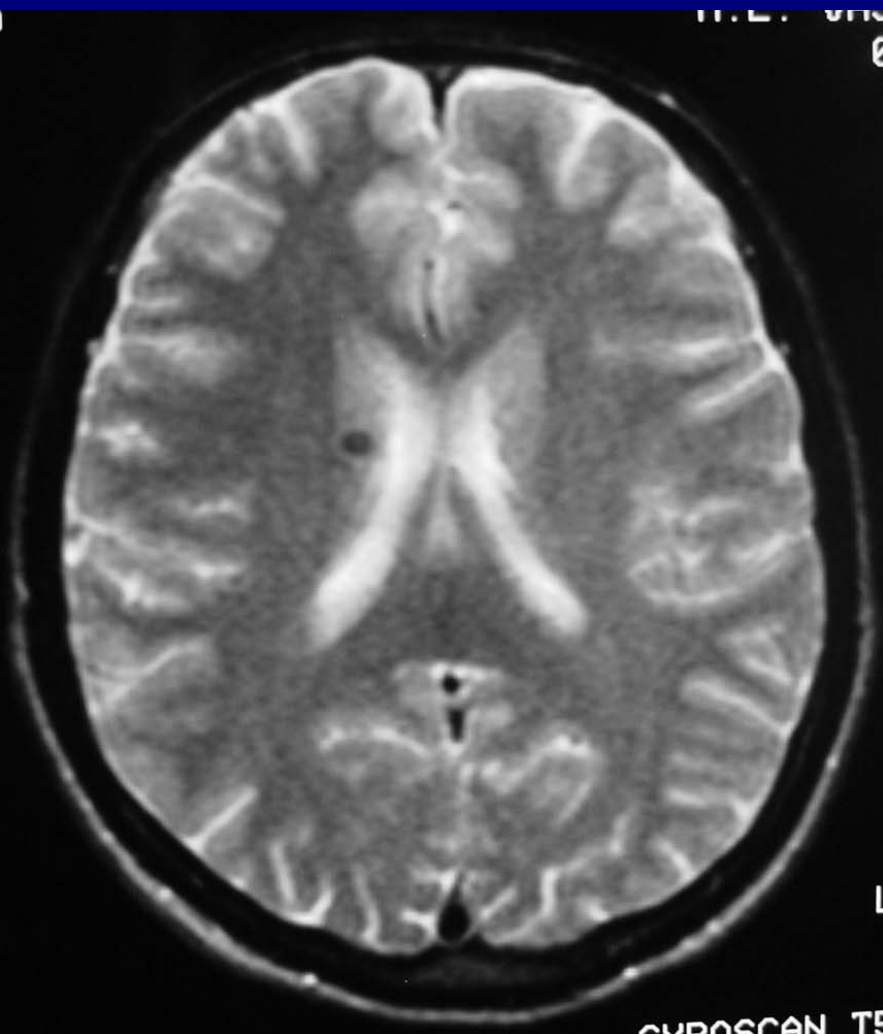


# Caracterização tecidual

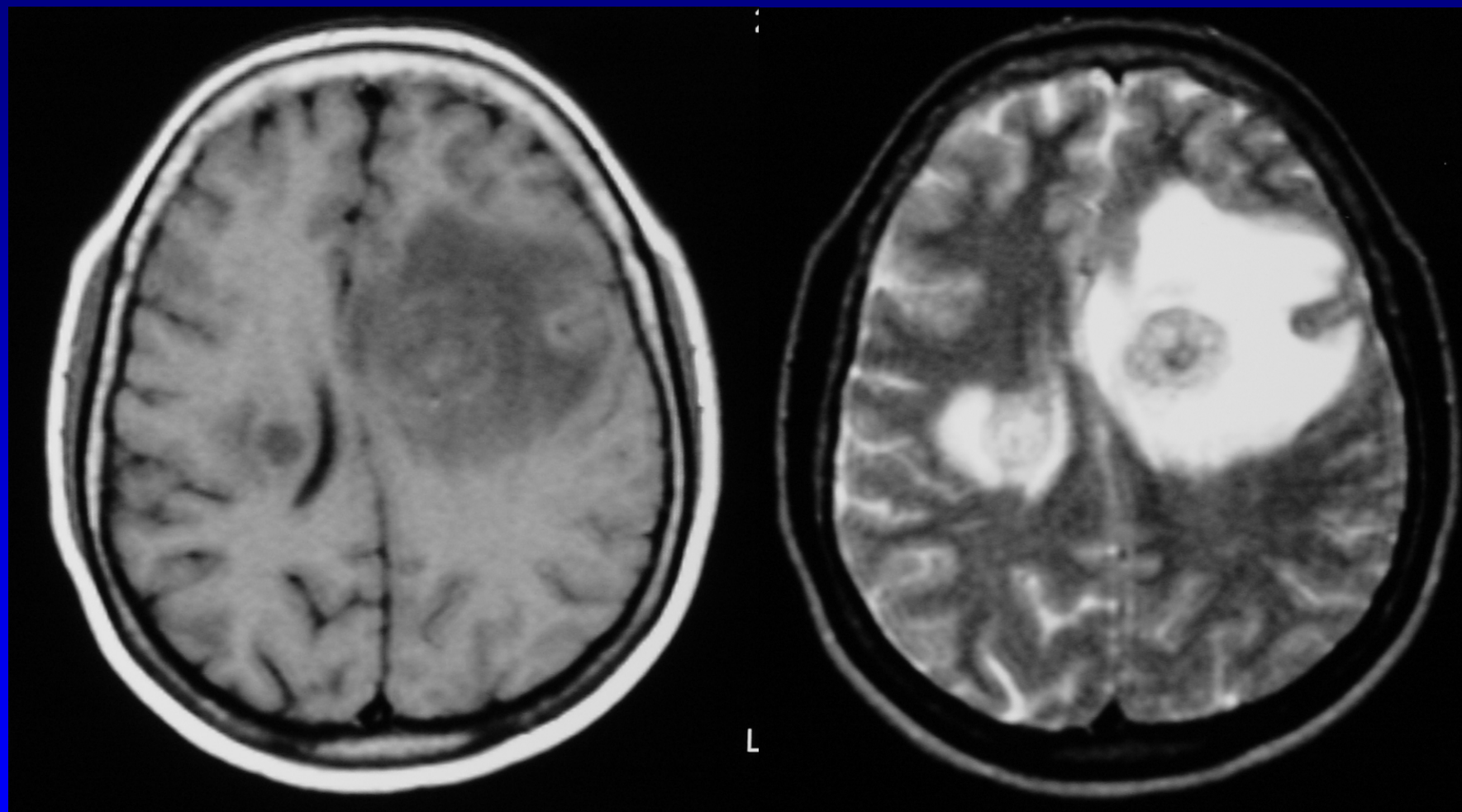
Material/Tecido	T1	T2
Água, edema	↓	↑
Gordura	↑	↓
Cálcio	↓	↓
Subst. cinzenta	↓	↑
Subst. branca	↑	↓
Tumor	↓	↑
Sangue	Variável	Variável
Músculo	↔	↔
Vaso	↓	↓

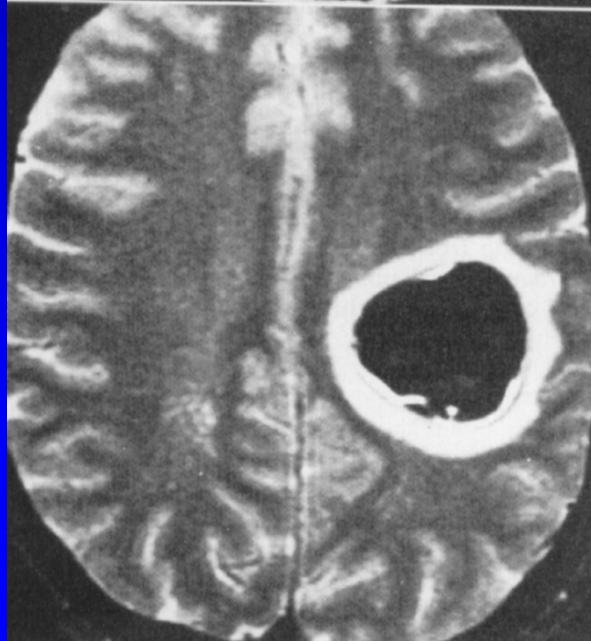
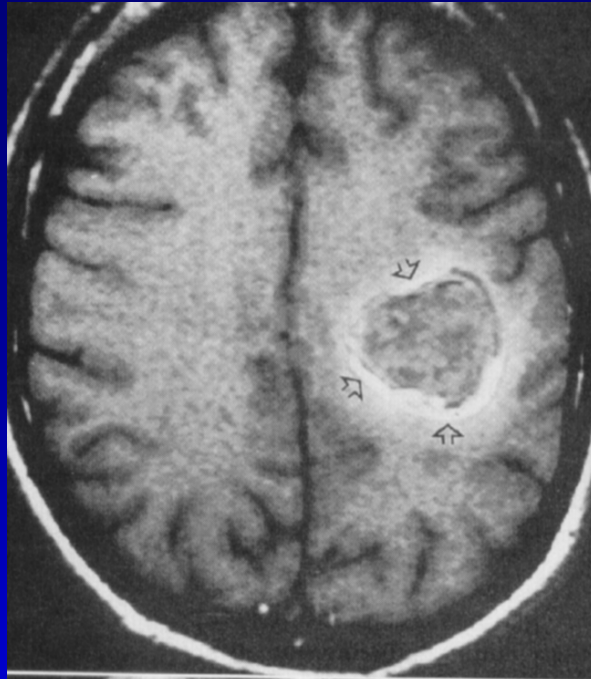


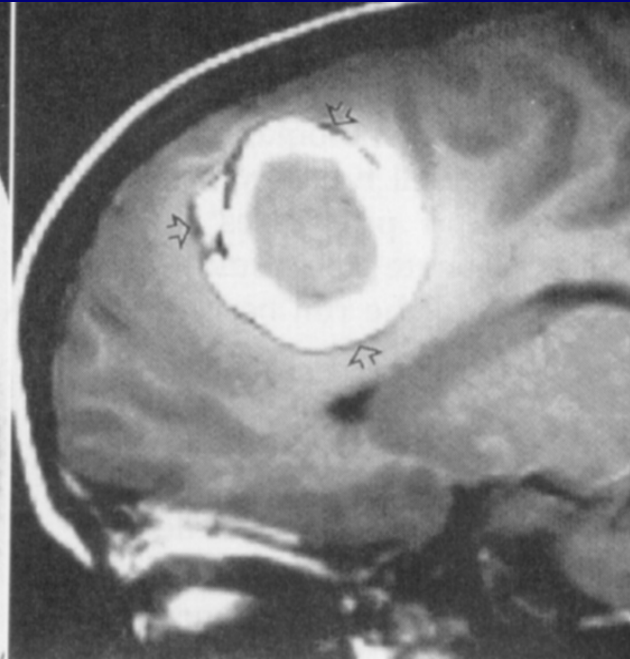
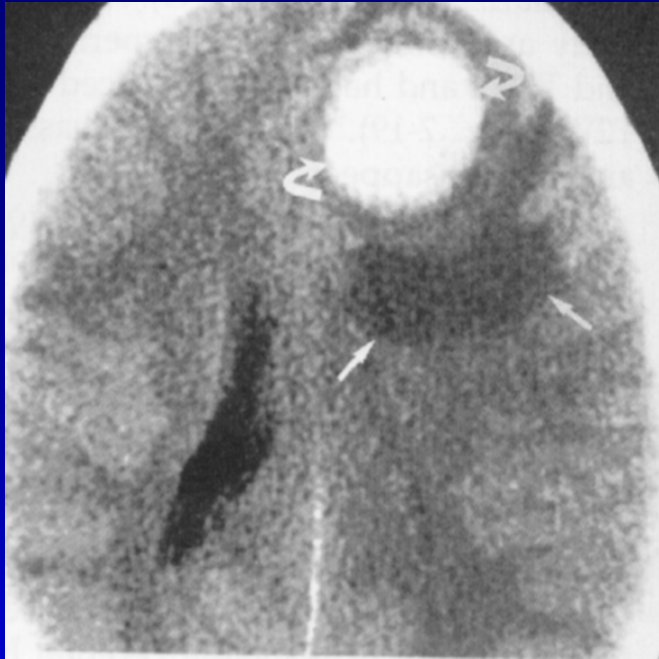
T1



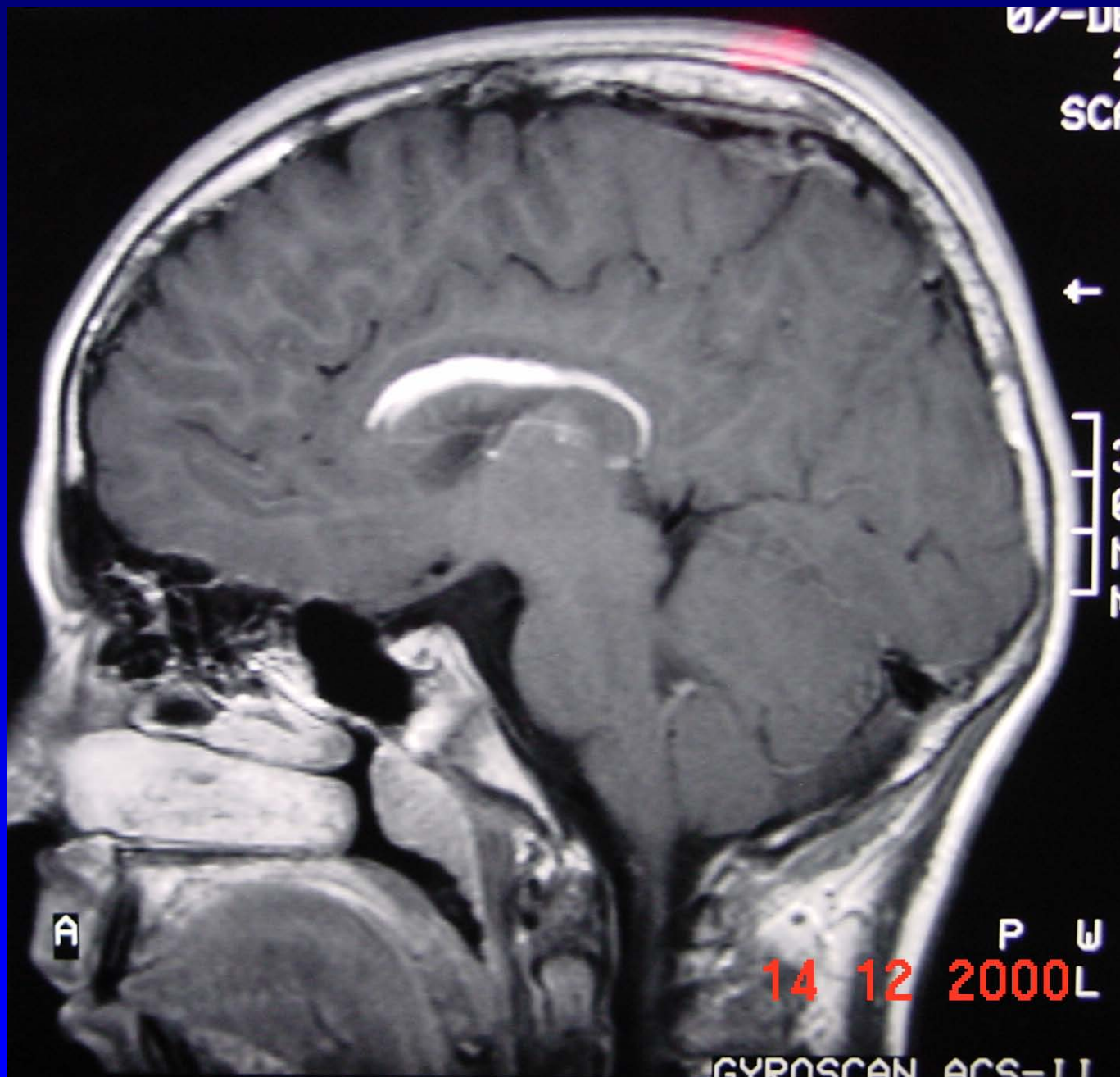
T2

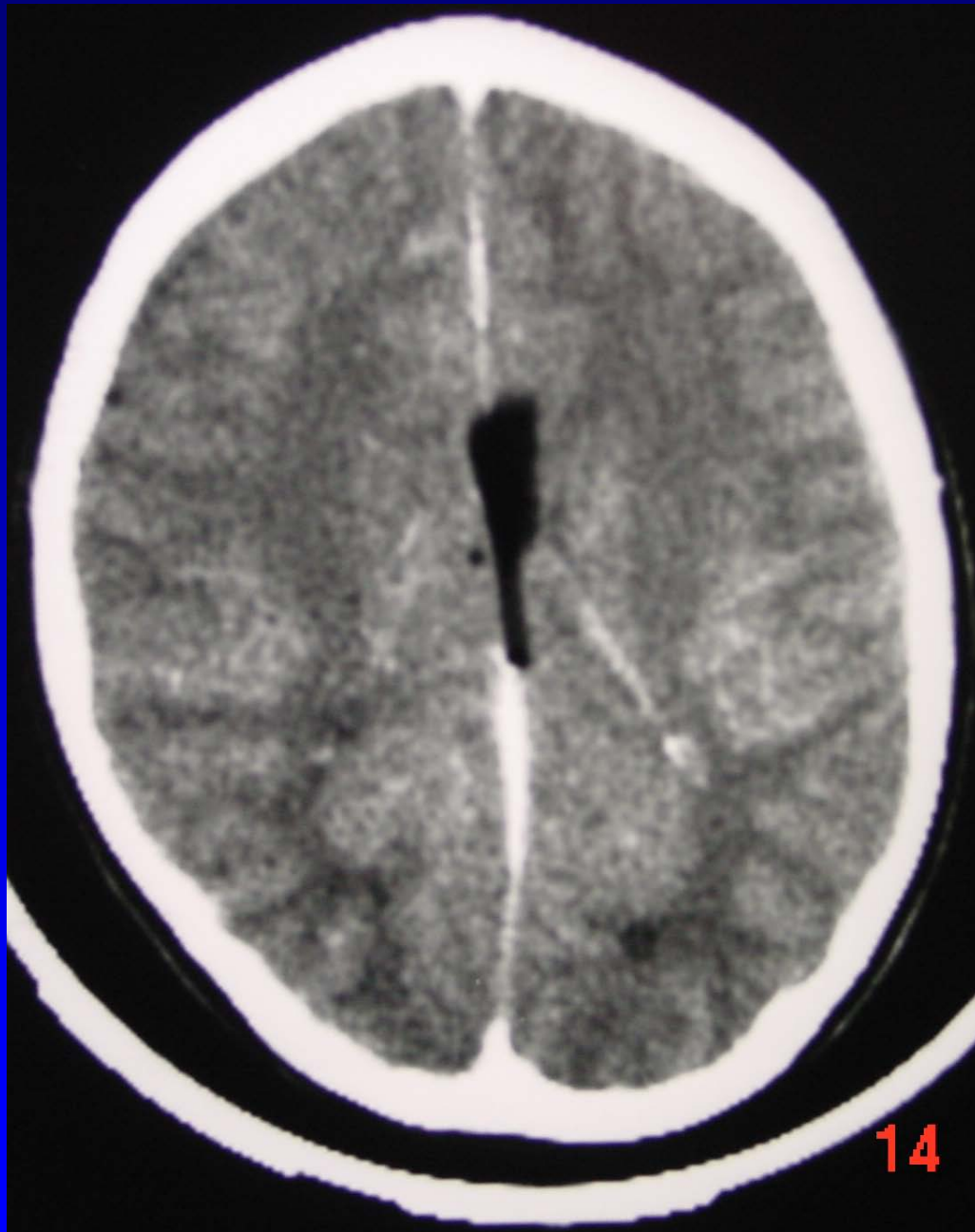












# Meios de contraste

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- Gadolínio - Elemento metálico
- Terras raras, série dos lantanídeos
- Símbolo: Gd
- Número atômico: 64
- Peso atômico: 157,25
- Temperatura de fusão: 1313°C
- Nomeado em homenagem a John Gadolin, químico finlandês (1760 - 1852)



# Gadolínio

1 1a	2 IIa											13 IIIa	14 IVa	15 Va	16 VIa	17 VIIa	18 0
H	He											B	C	N	O	F	Ne
Li	Be											Al	Si	P	S	Cl	Ar
Na	Mg	3 IIIb	4 IVb	5 Vb	6 VIb	7 VIIb	8 VIIIb	9 VIIIb	10 VIIIb	11 Ib	12 IIB	Ga	Ge	As	Se	Br	Kr
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	In	Sn	Sb	Te	I	Xe
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	Tl	Pb	Bi	Po	At	Rn
Cs	Ba											Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Unq <sup>†</sup>	Unp <sup>§</sup>	Unh	Uns	Uno	Une	Uun	Uuu								
		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
		Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	

	Alkali metals
	Alkaline earth metals
	Transition metals
	Lanthanide series
	Actinide series
	Other metals
	Nonmetals
	Noble gases

# Meios de Contraste

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- Gd-DTPA - menos tóxico que o íon metálico nativo
- Em uso desde o final dos anos 80
- Reações adversas - 3 %
- Maioria - reações leves
- Reações graves - 1 em 350.000 - 400.000  
(Carr JJ. Neuroimaging Clin N Am; 4(1): 43-54,1994)
- Mortes - história prévia de broncoespasmo

# Gadolínio-DTPA

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- Paramagnético
- Dose: 0,1 mmol/kg (0,2 ml/kg)
- Encurta T1
- Realce nas séries pesadas em T1
- Se muito concentrado encurta T2 - hipossinal em T2
- Extracelular
- Quebra barreira hemato-encefálica

# Fibrose sistêmica nefrogênica

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- (Dermopatia fibrosante nefrogênica)
- Descrita em 2000
- Causa indeterminada
- Pacientes em insuficiência renal, geralmente em diálise
- Espessamento cutâneo insidioso, pode ser confundido com edema

# Fibrose sistêmica nefrogênica

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- Pode ter progressão rápida levando o paciente à cadeira de rodas em poucas semanas
- Fisiopatologia
  - Deposição de colágeno
  - Espessamento e endurecimento da pele das extremidades
  - Imobilidade e contratura articular

# Fibrose sistêmica nefrogênica

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- Outros órgãos: pulmões, músculo, coração, diafragma, esôfago, etc.
- Algumas vezes se estabiliza
- Raramente regride
- Sem terapia adequada
- Correção rápida da função renal cessa a progressão e raramente há reversão dos sintomas

# Fibrose sistêmica nefrogênica

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- Possíveis causas
  - Níveis elevados de fosfato, ferro, zinco ou cobre podem competir pelo quelato de Gd – aumento de  $Gd^{3+}$  livre – aumento do risco da doença
  - Lantânio – carbonato de Lantânio (Fosrenol) – aglutinante de fosfato em pacientes com insuficiência renal terminal e hiperfosfatemia – idem
  - Administrações múltiplas de Gd e doença hepato-renal



A



B

**Fig. 1**—Two patients with nephrogenic systemic fibrosis (NSF) that developed after gadodiamide injection.

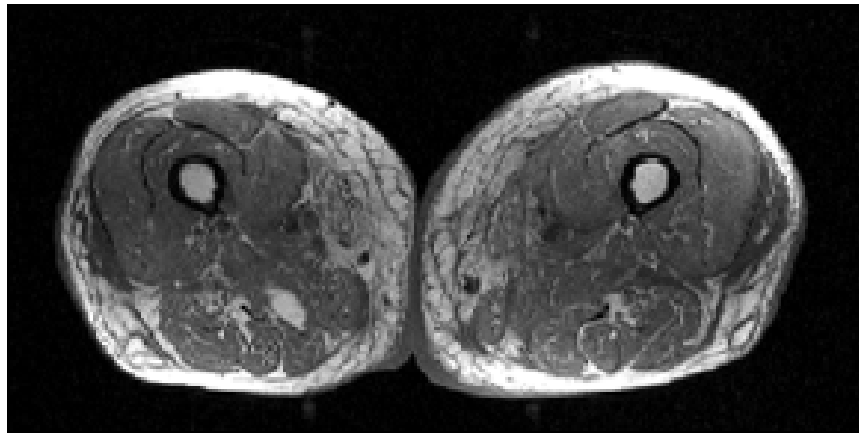
**A**, Photograph of 46-year-old man shows skin changes due to NSF, including slightly raised and erythematous nodular plaques, and linear and confluent regions of fibrosis.

**B**, Photograph of 30-year-old woman with soft-tissue swelling and flexion contractures of hand (with fingers maximally extended) due to NSF.

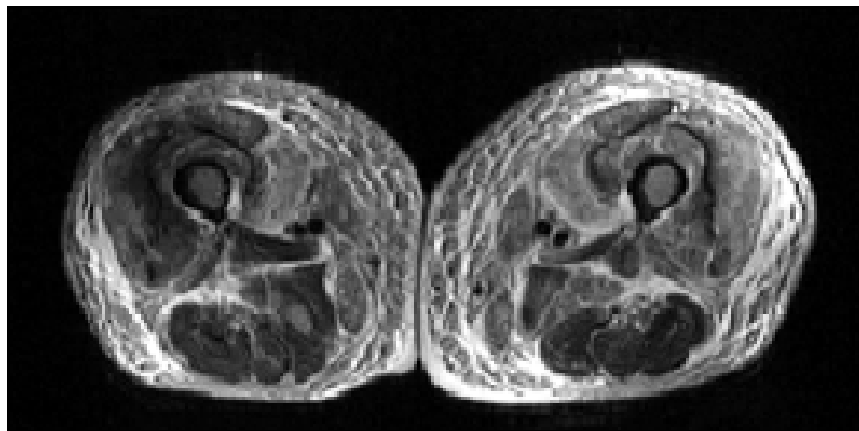




A



B



C

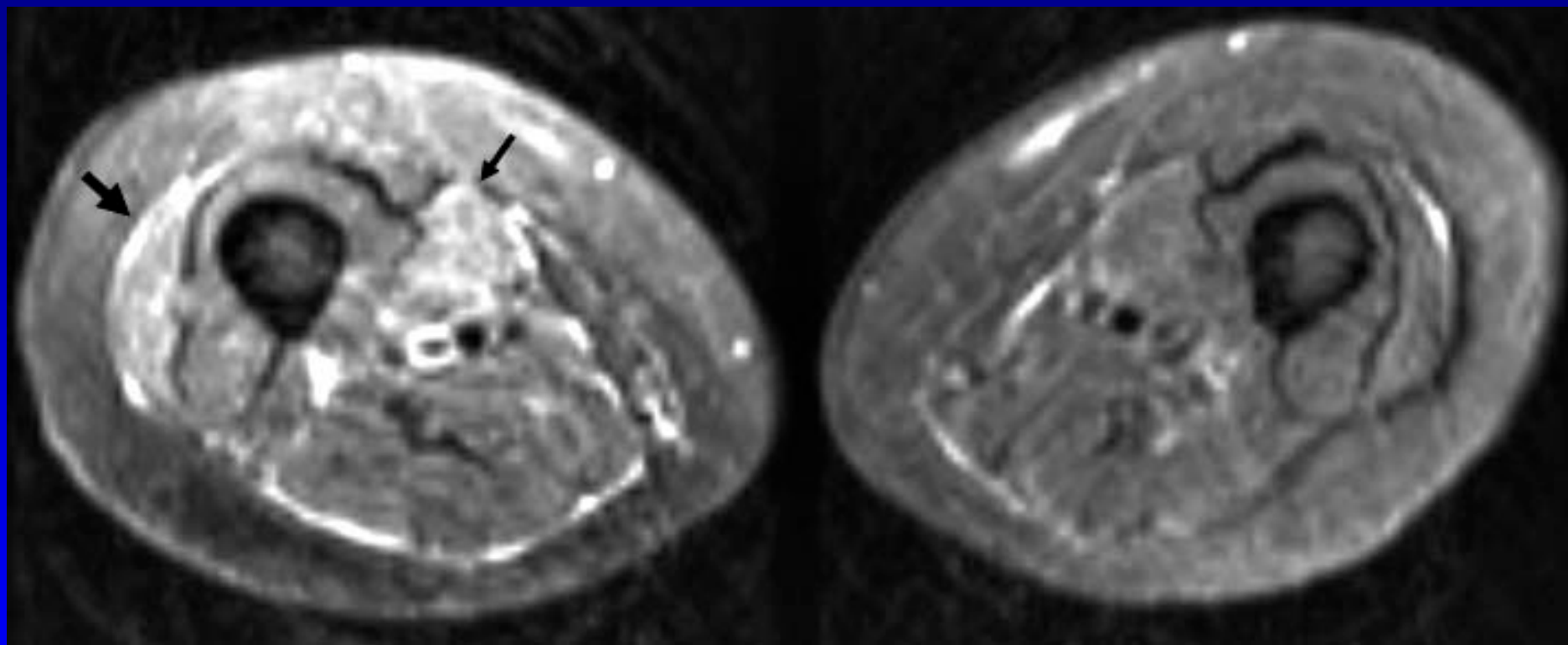
Fig. 2—59-year-old man with nephrogenic systemic fibrosis (NSF) with both skeletal muscle and skin findings.

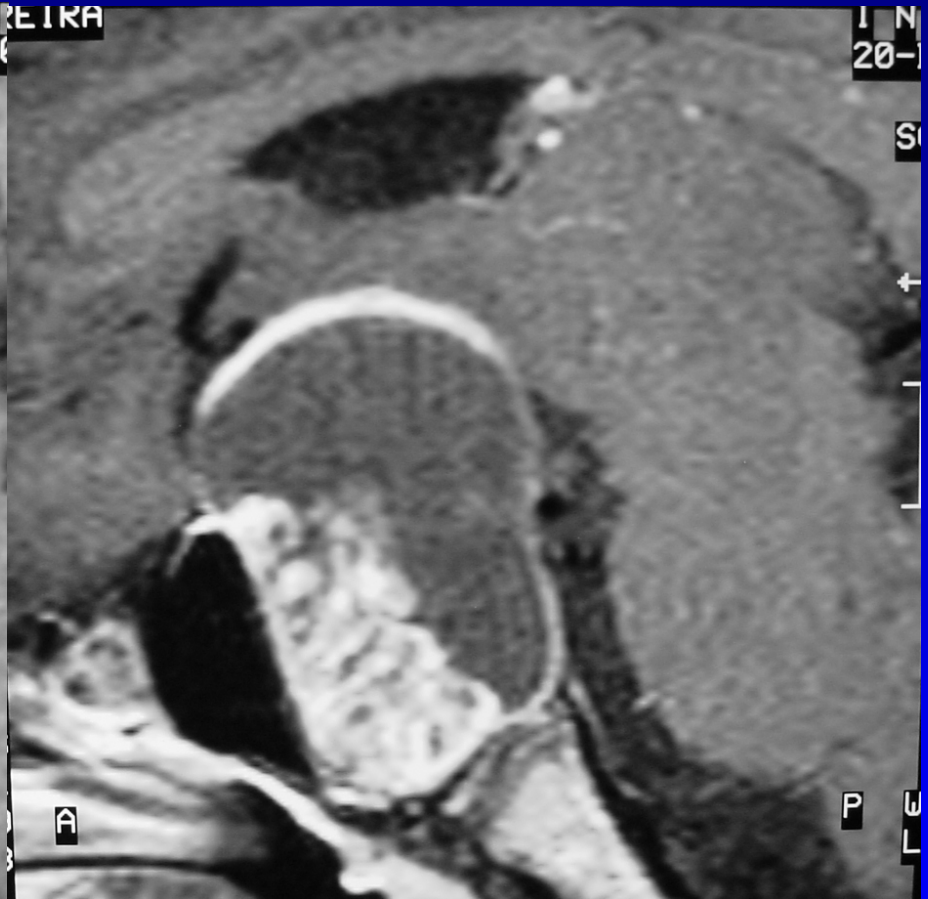
A, Anteroposterior  $^{99m}\text{Tc}$  HDP 3-hour bone scan shows symmetric increased radionuclide skin and muscle uptake in entire lower extremity and distal upper extremities.

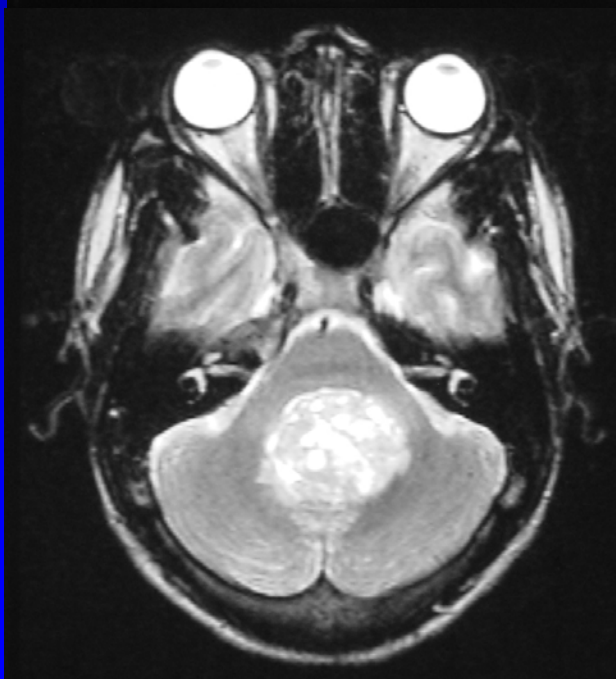
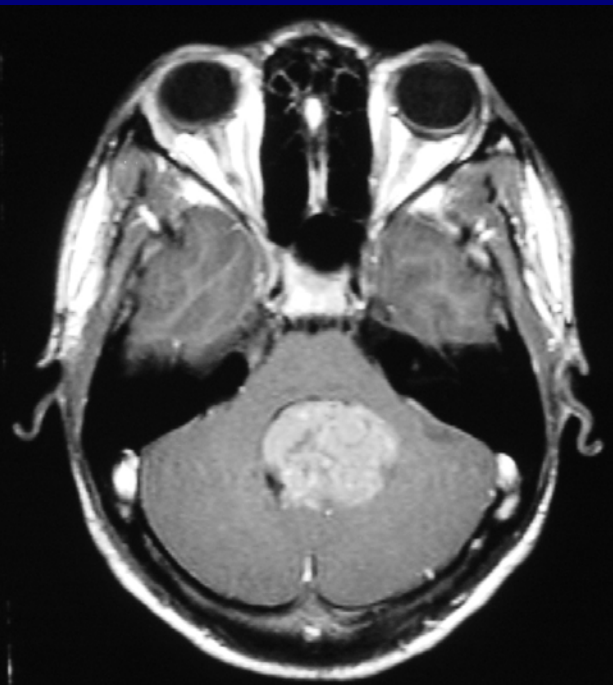
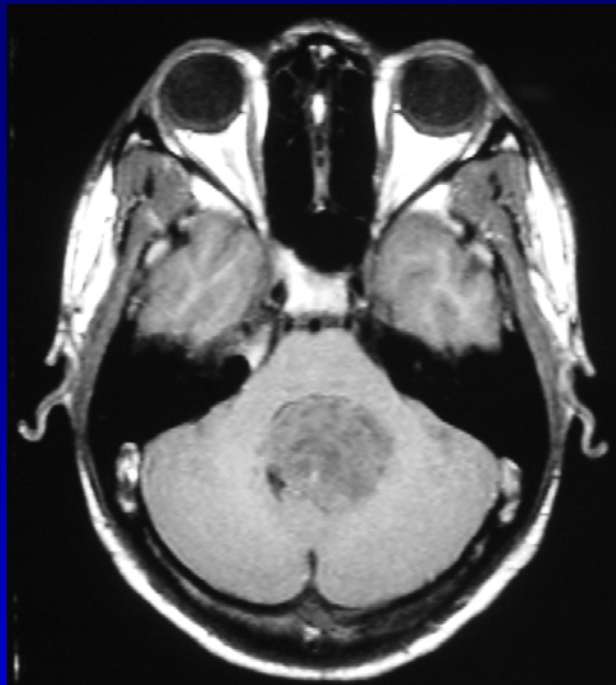
B and C, Axial T1- and fat-suppressed T2-weighted images of thighs show symmetric skin thickening and edema in medial thighs. There is also marked edema in subcutaneous fat, intermuscular fascia, and thigh muscles with some sparing of posterior thigh muscles.



Fig. 3—30-year-old woman with nephrogenic systemic fibrosis with predominant skin finding. A and B. Anteroposterior and lateral  $^{99m}\text{Tc}$  HDP delayed bone scan shows extensive symmetric skin uptake in lower extremities and distal upper extremities. Uptake is also seen in calf muscles, Achilles tendon, and chest wall.

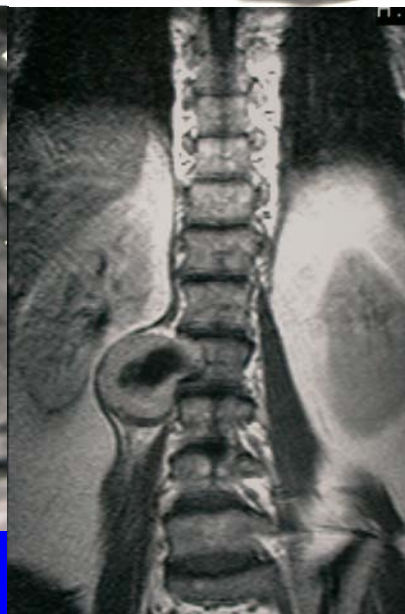


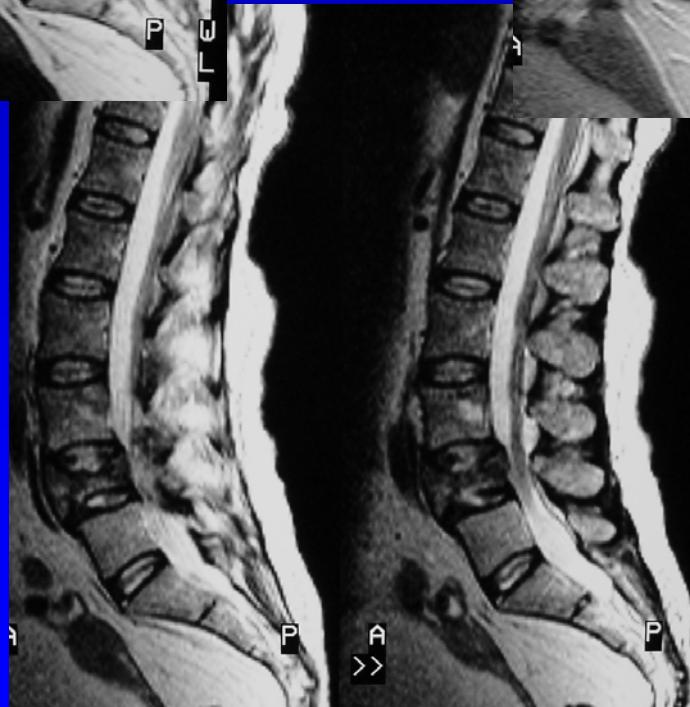
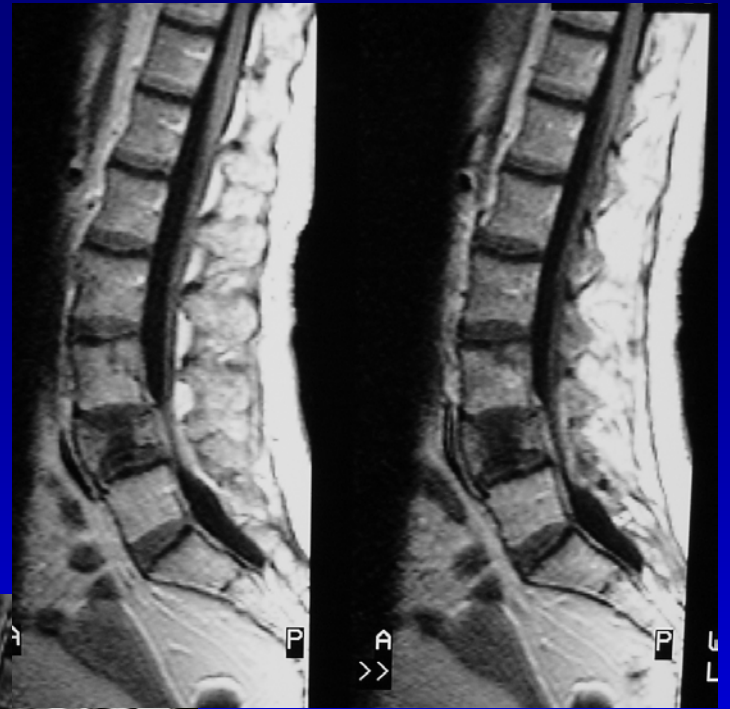
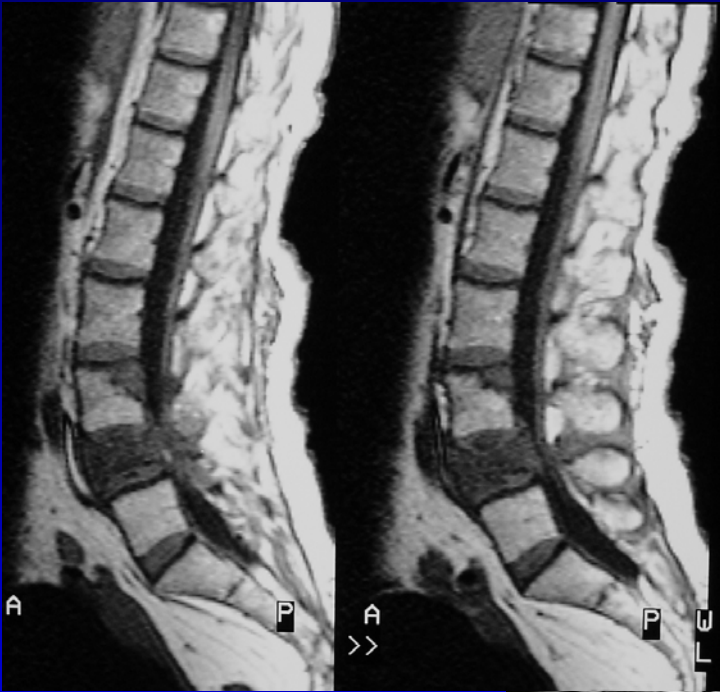




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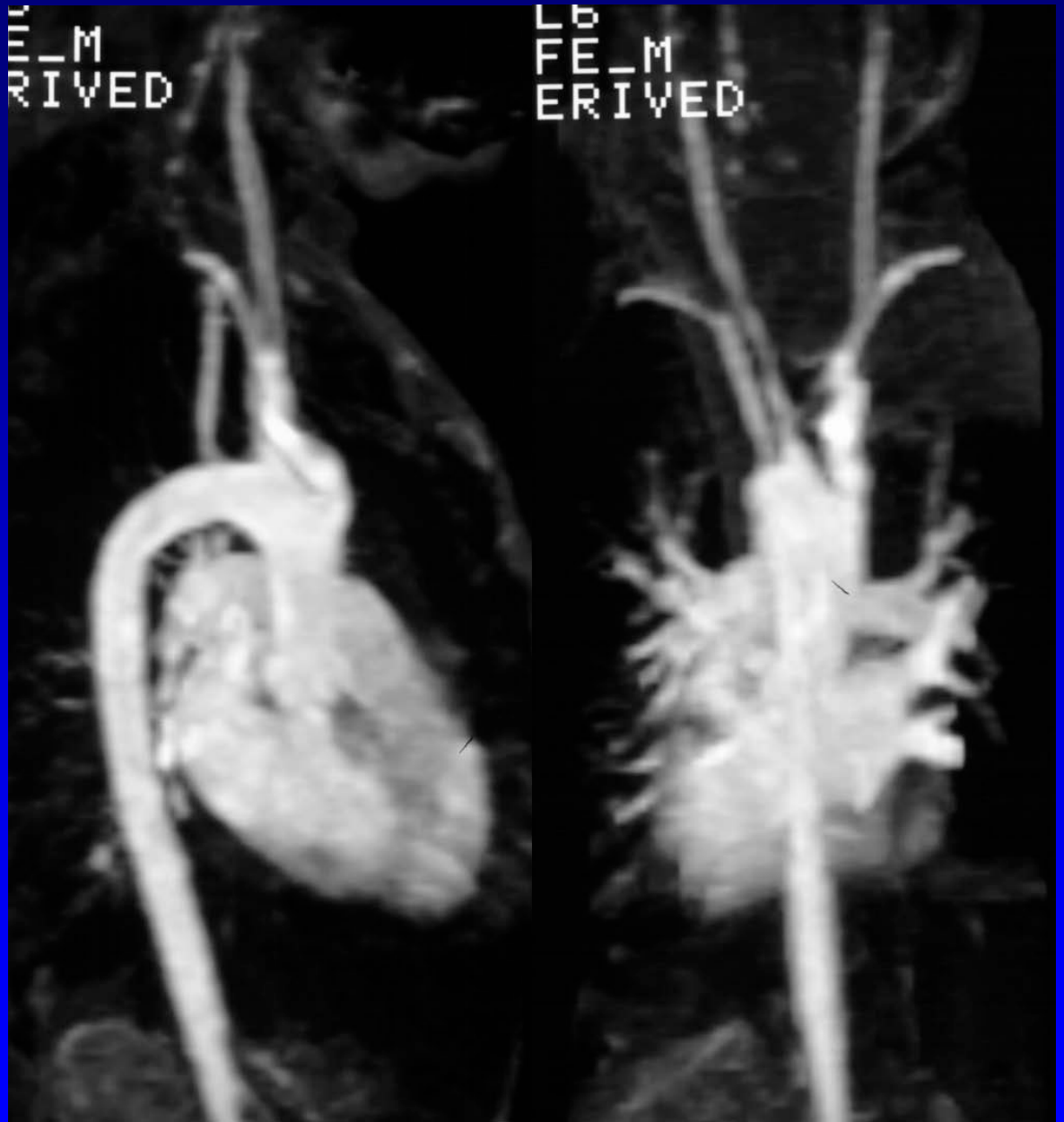






# Angiografia com Gd

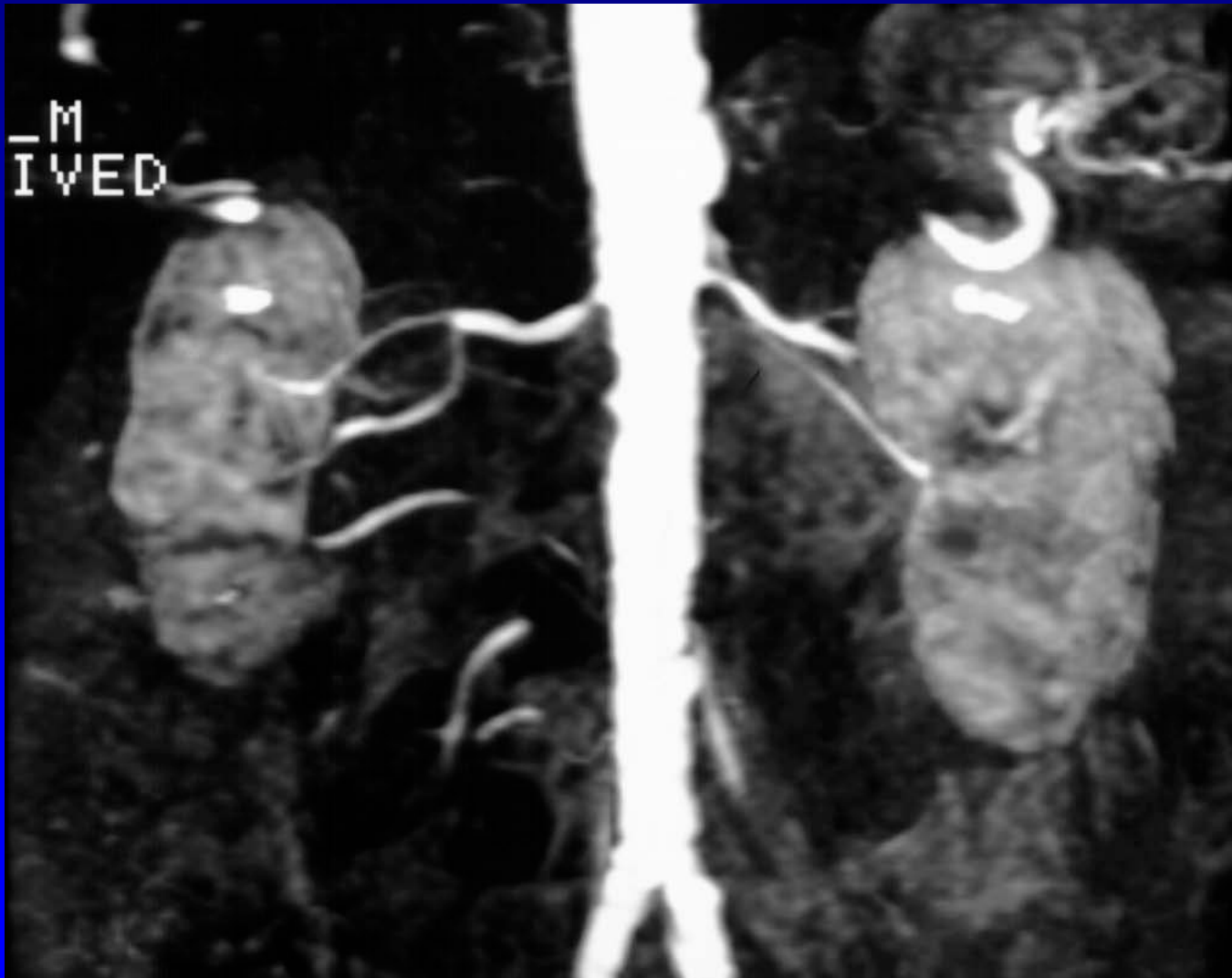
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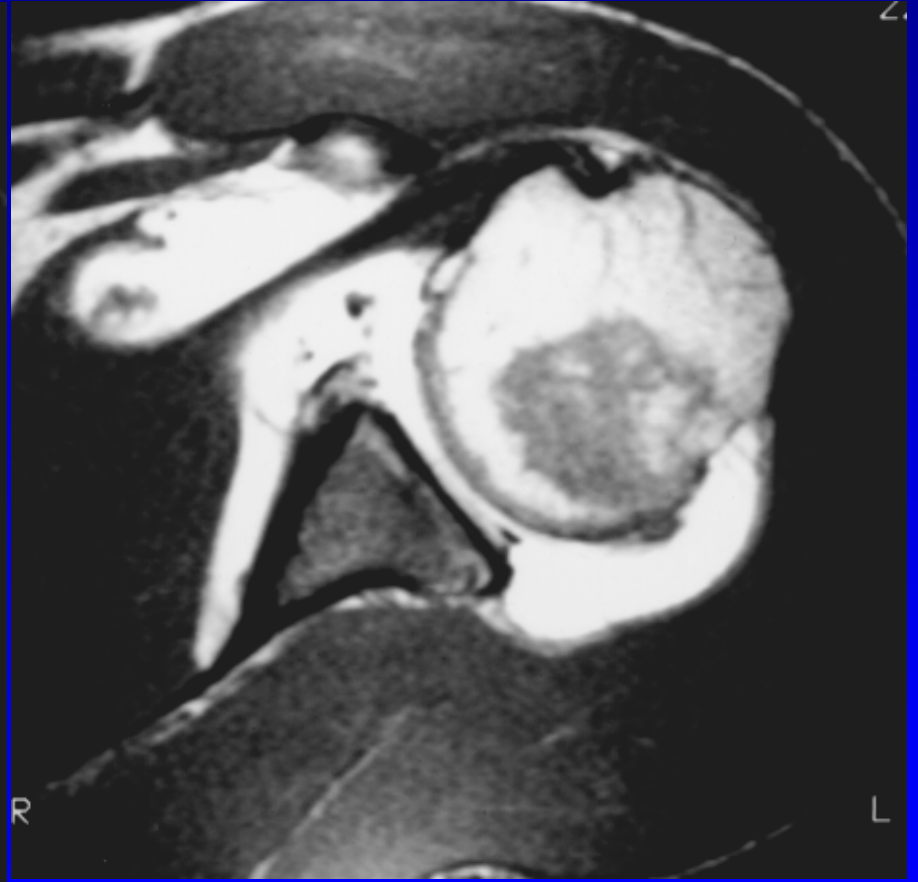
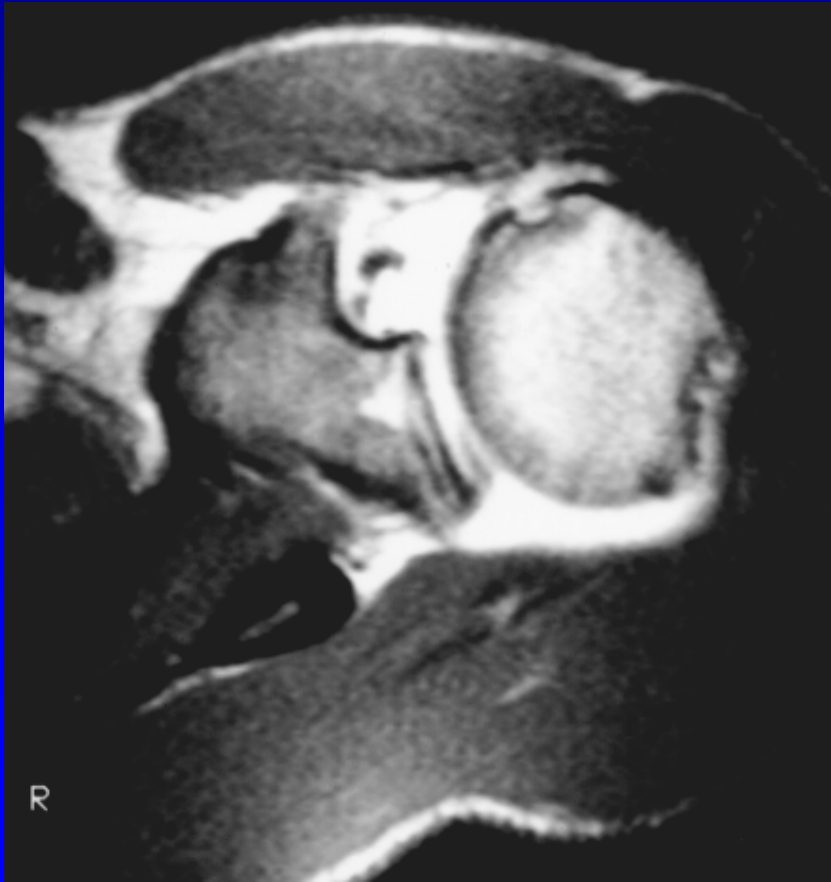
# Angiografia com Gd

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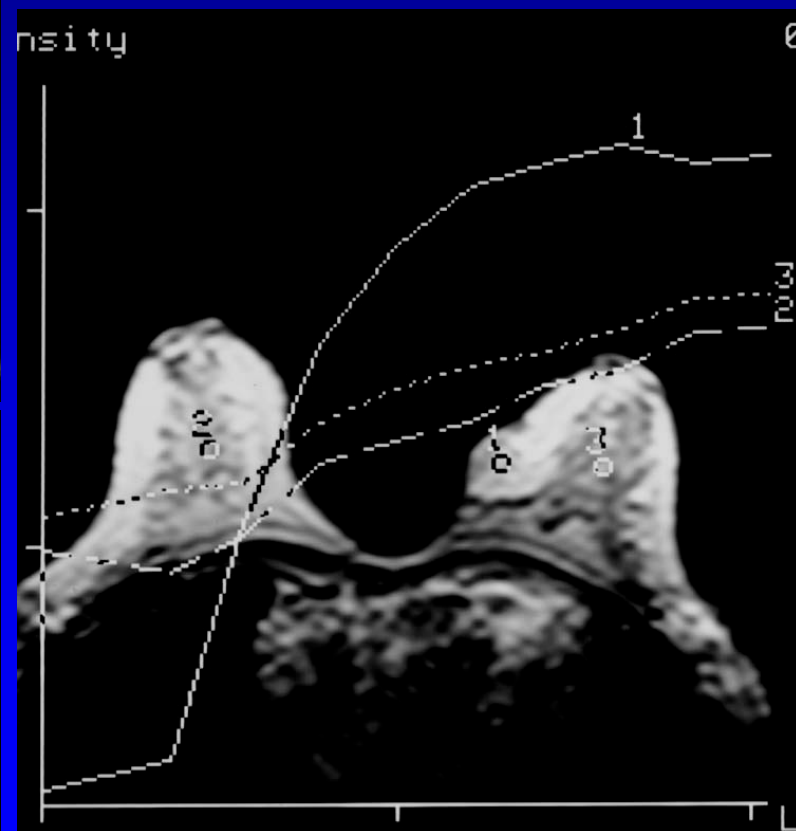
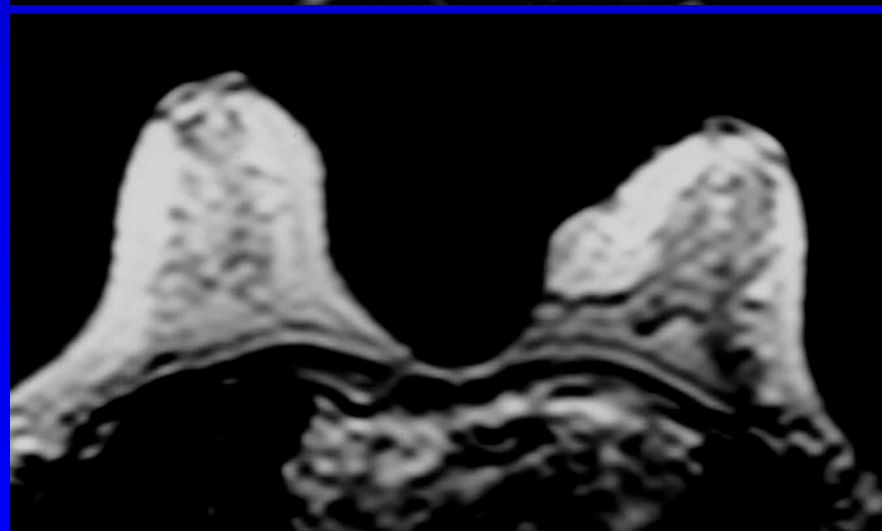
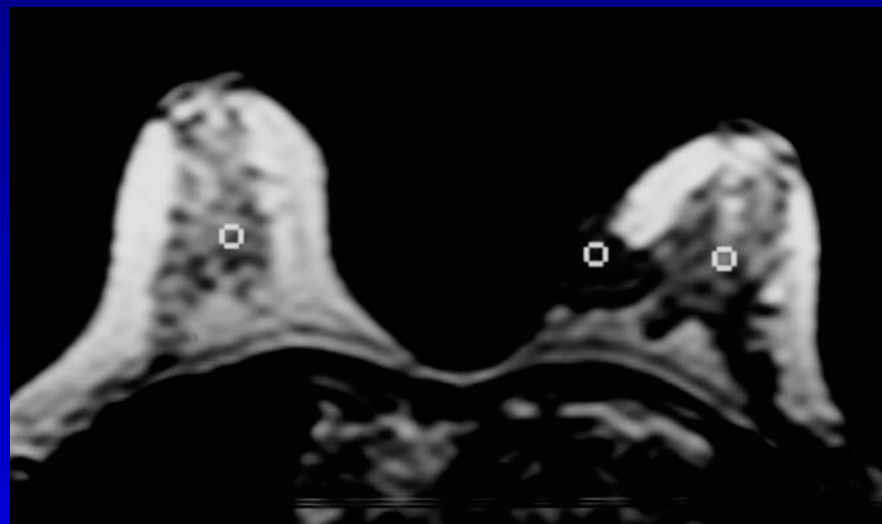


# Artrografia por RM

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# Gd-DTPA - *Dinâmico*



# Segurança

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- Contra-indicações
  - Clipes de aneurisma
  - Marcapasso
  - Fragmentos metálicos intra-oculares
  - Implantes cocleares
  - Próteses metálicas

# Segurança

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- Projéteis
  - Material metálico (chaves, moedas, cilindros de oxigênio, macas, cadeiras de roda, etc...)
- Material magnético
  - Cartões de crédito, passes de metrô, etc.





# Técnicas especiais de ressonância magnética

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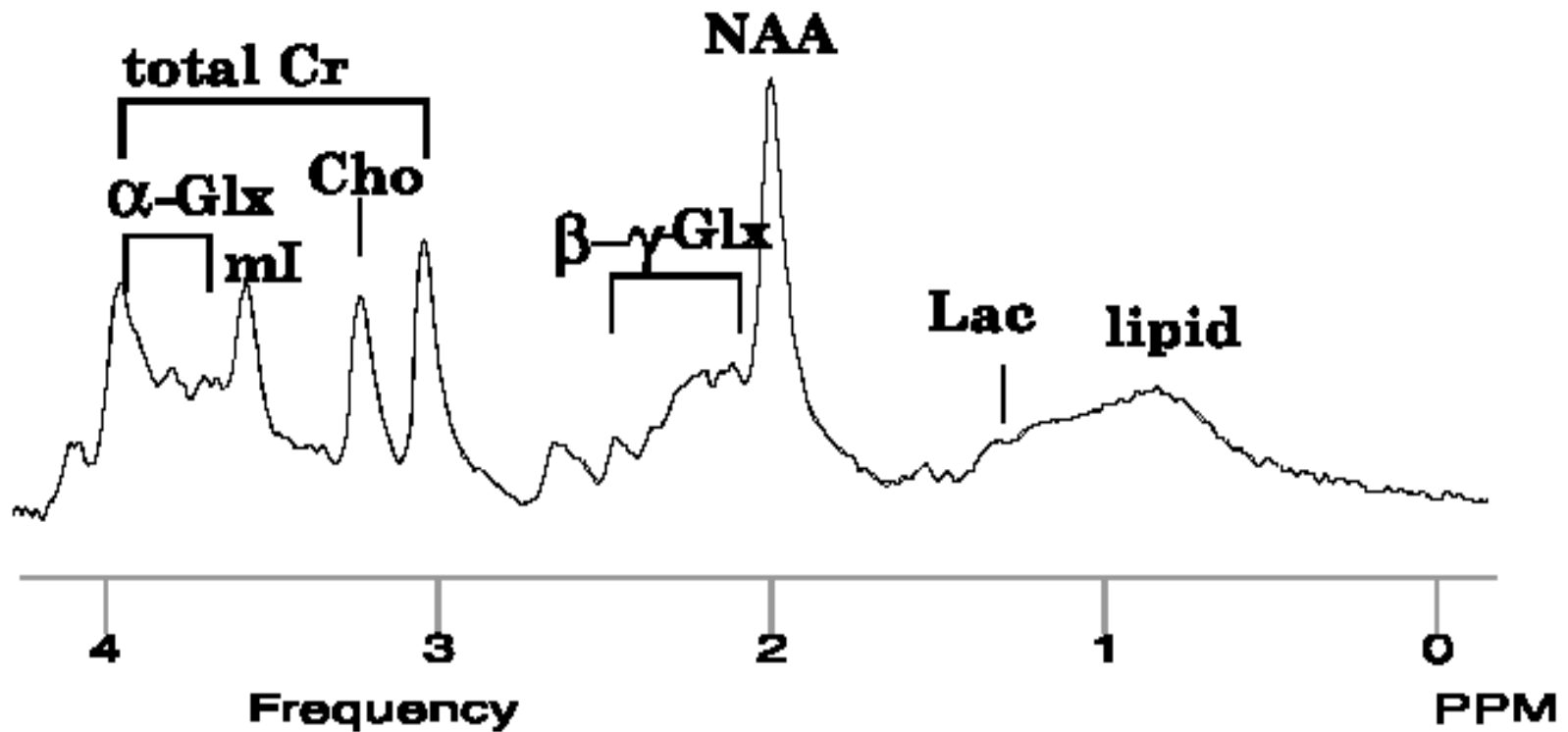


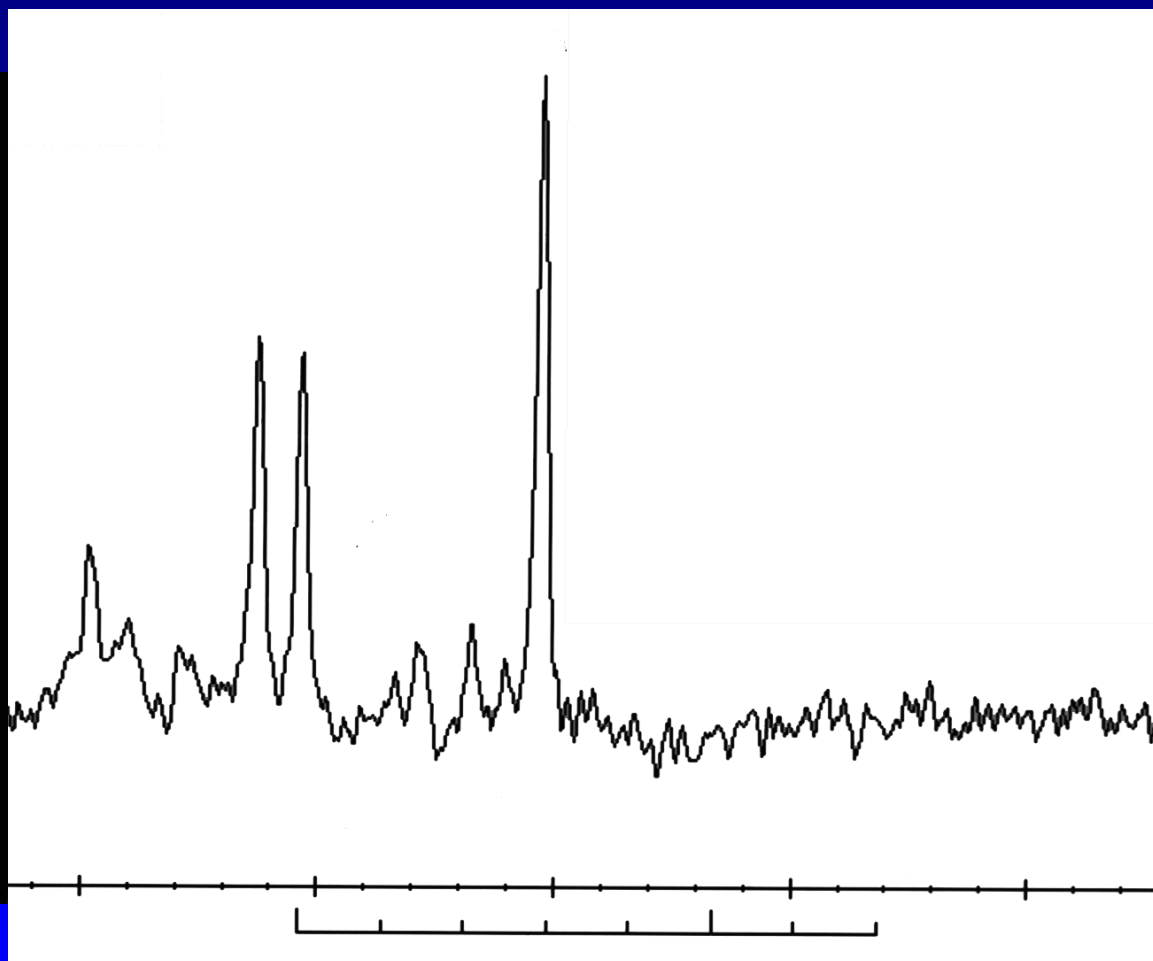
# Espectroscopia

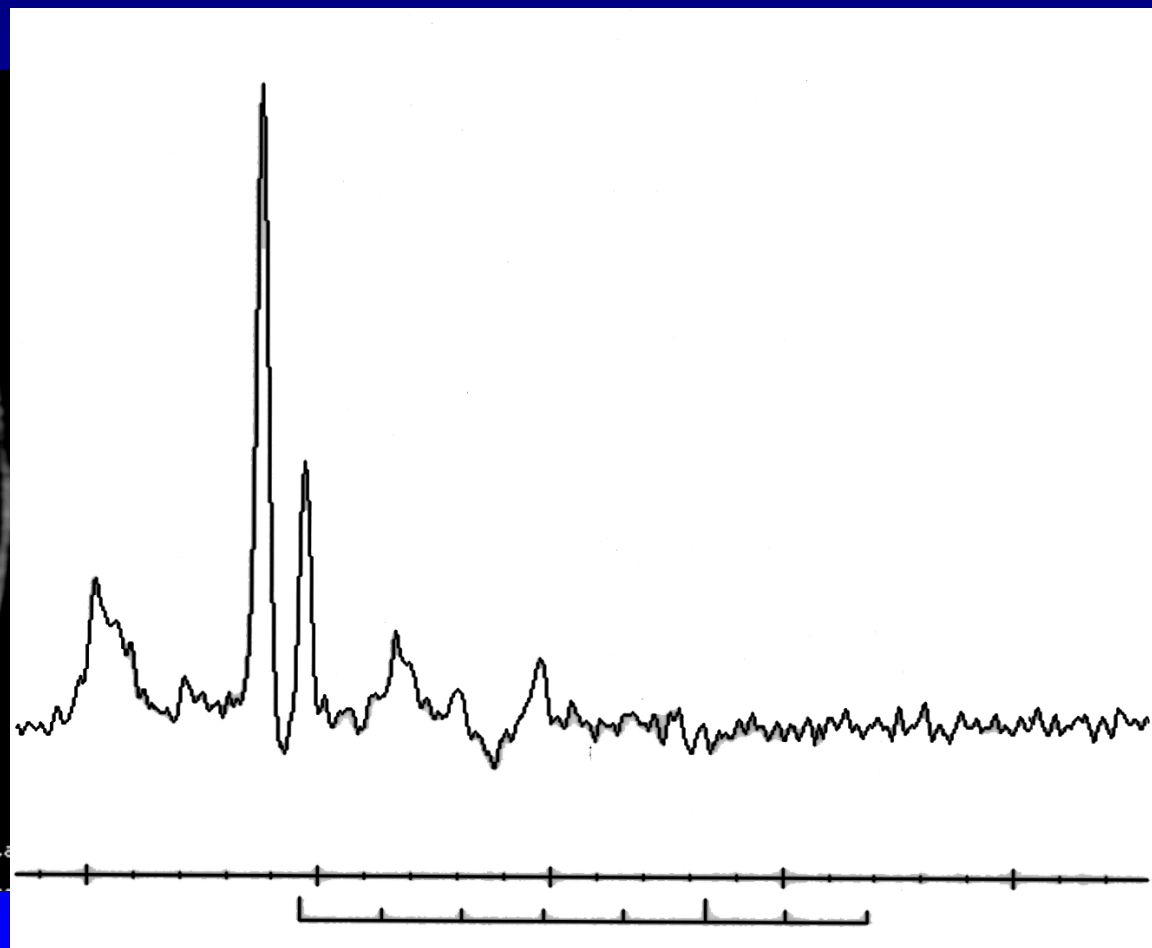
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- Hidrogênio
  - Metabólitos do encéfalo *in vivo*
    - NAA
    - Cr
    - Cho
    - Lac
- Fósforo
  - Encéfalo / músculo: ATP, PCr, Pi, PME, PDE

# Próton ( $^1\text{H}$ )

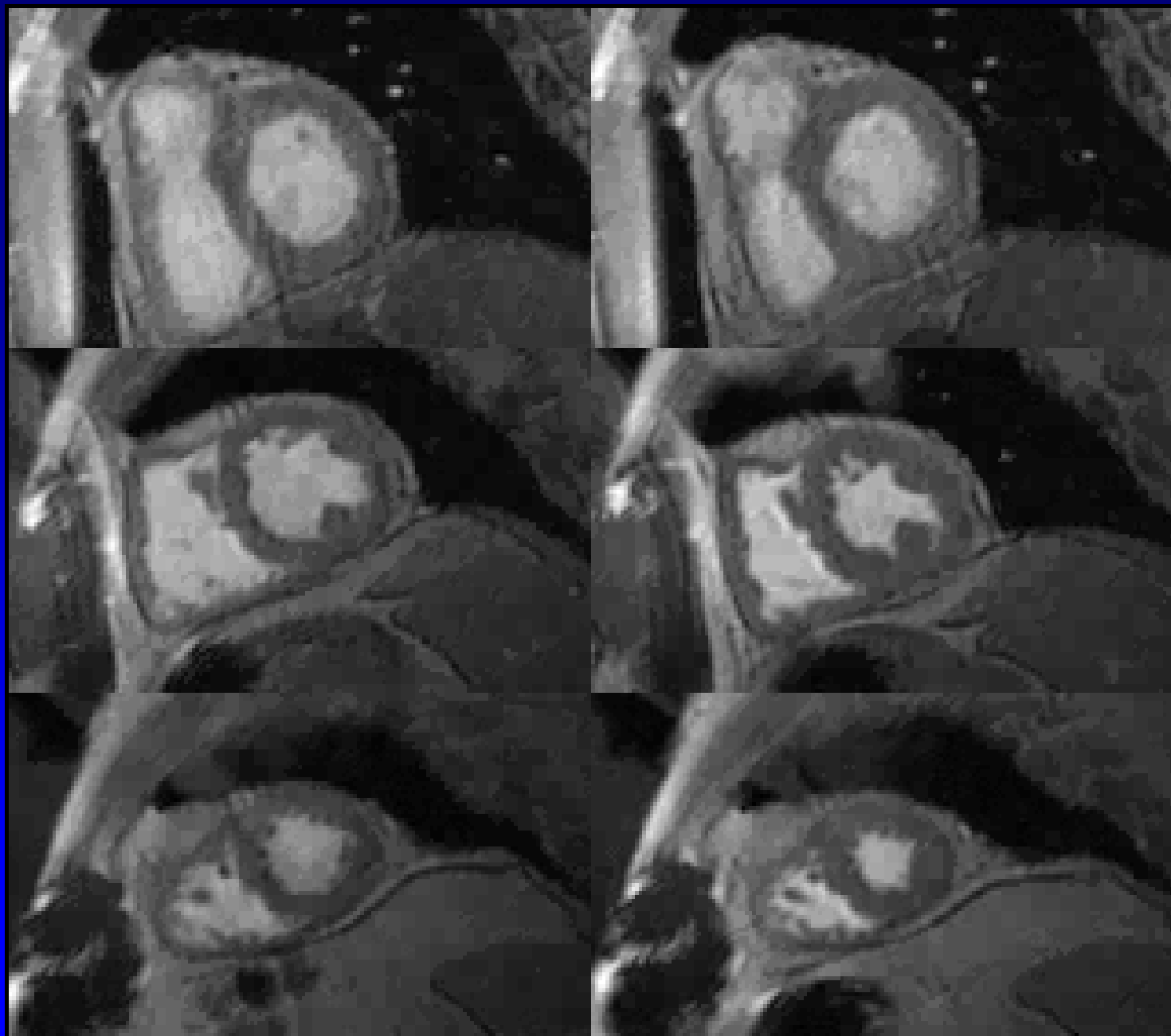






# Cine-RM

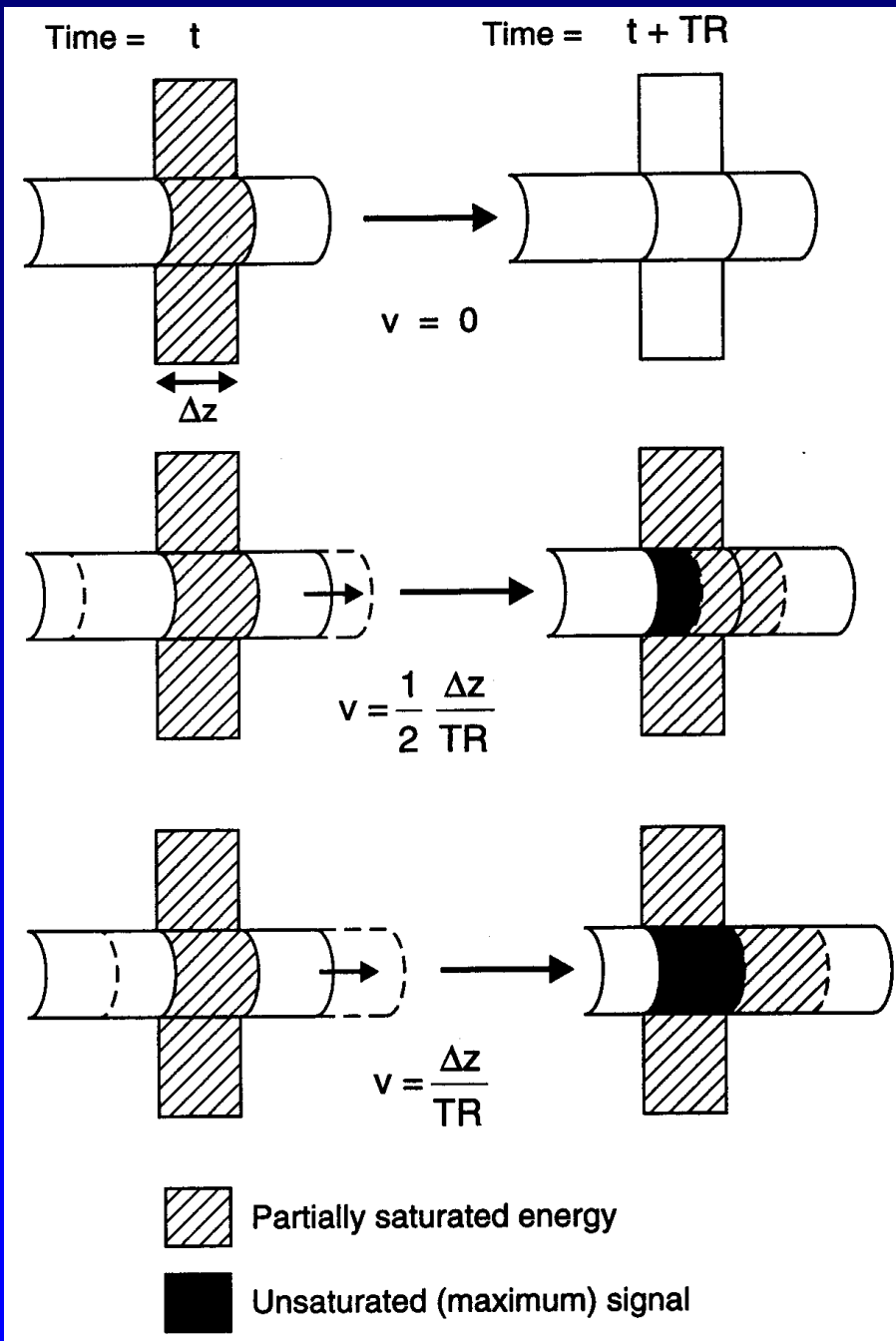
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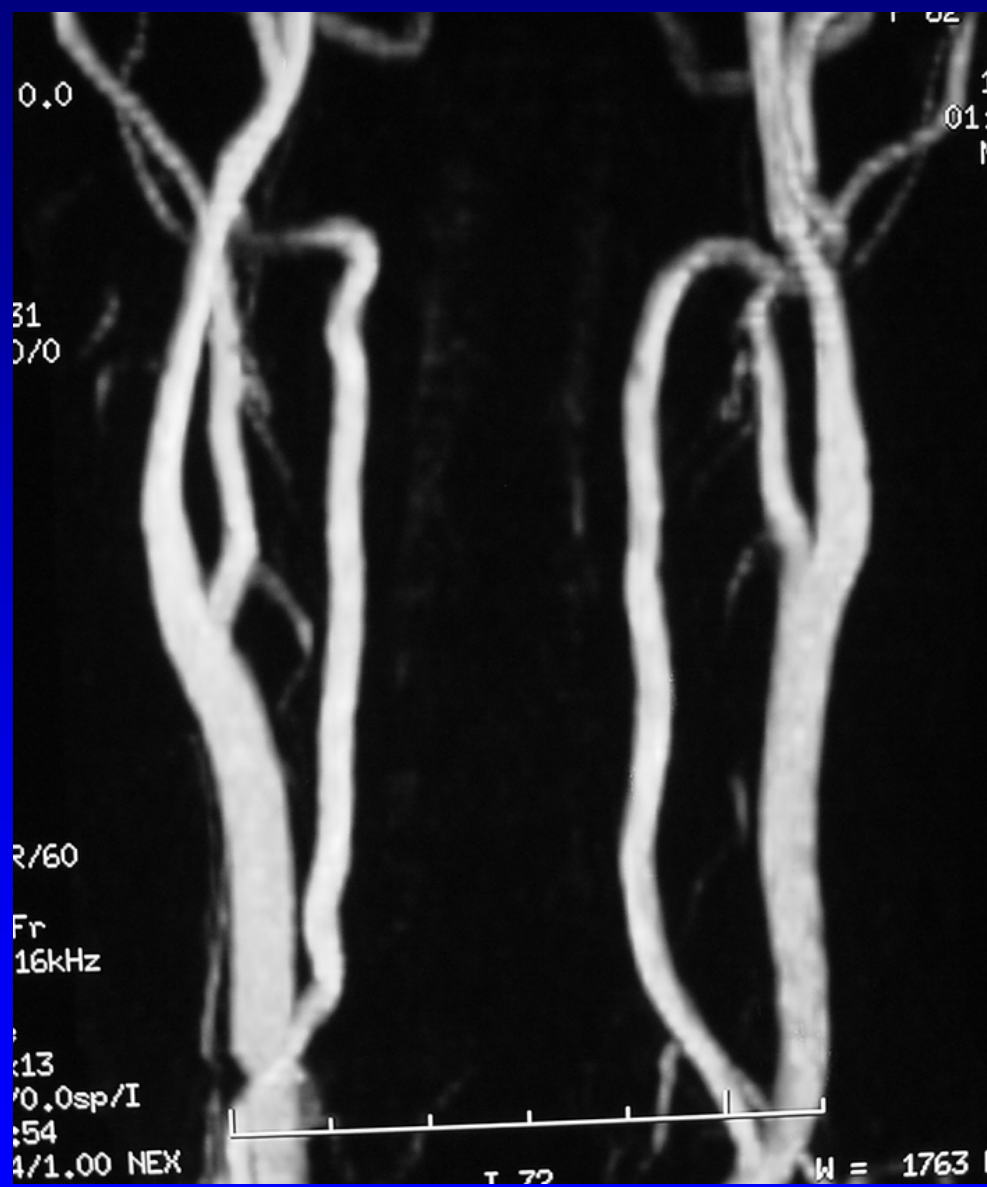
# Angiografia por RM

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- Sem contraste
  - Vantagem: sem contraste
  - Desvantagem: tempo longo, falsos positivos
- Com contraste
  - Vantagem: tempo curto, sem falsos positivos
  - Desvantagem: contraste, custo

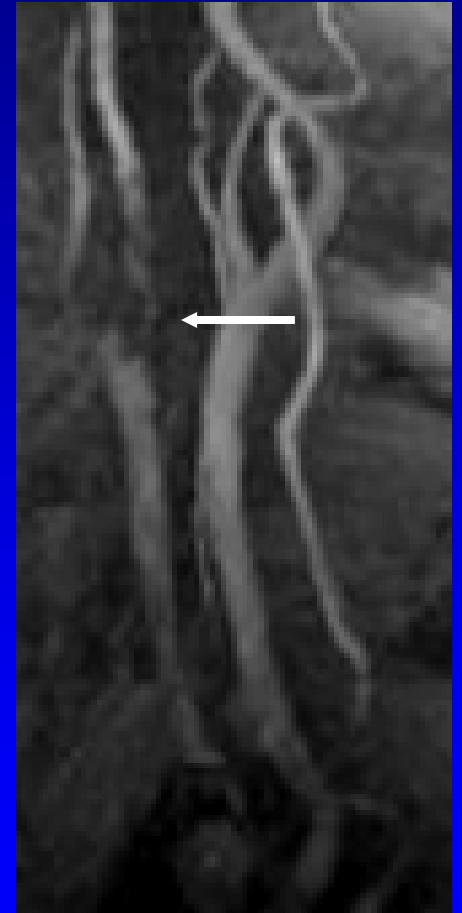
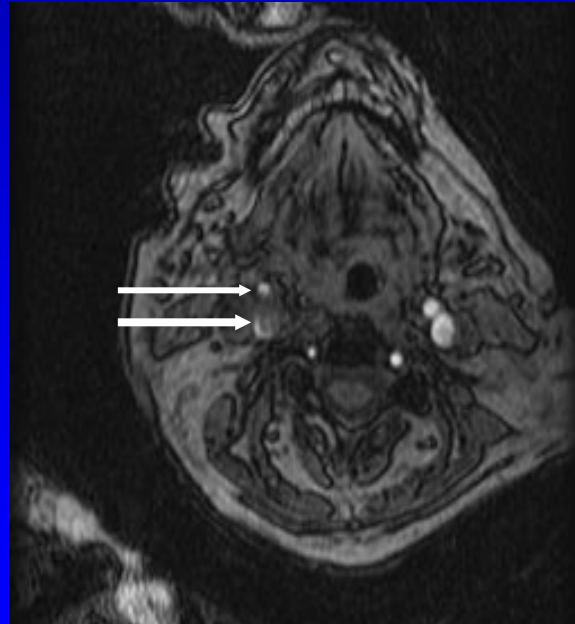
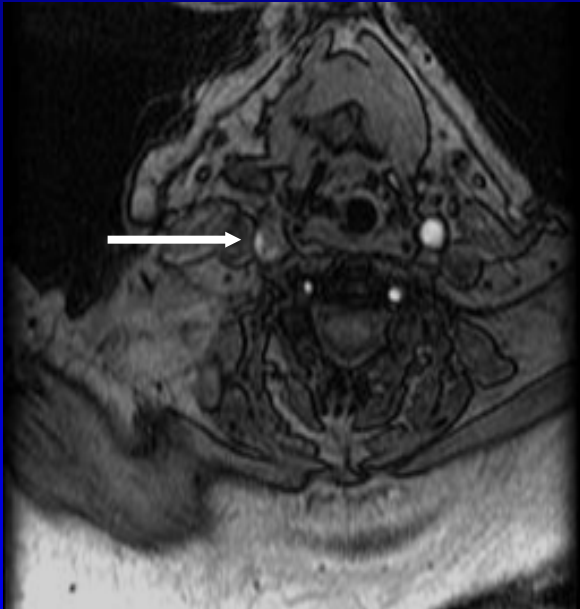




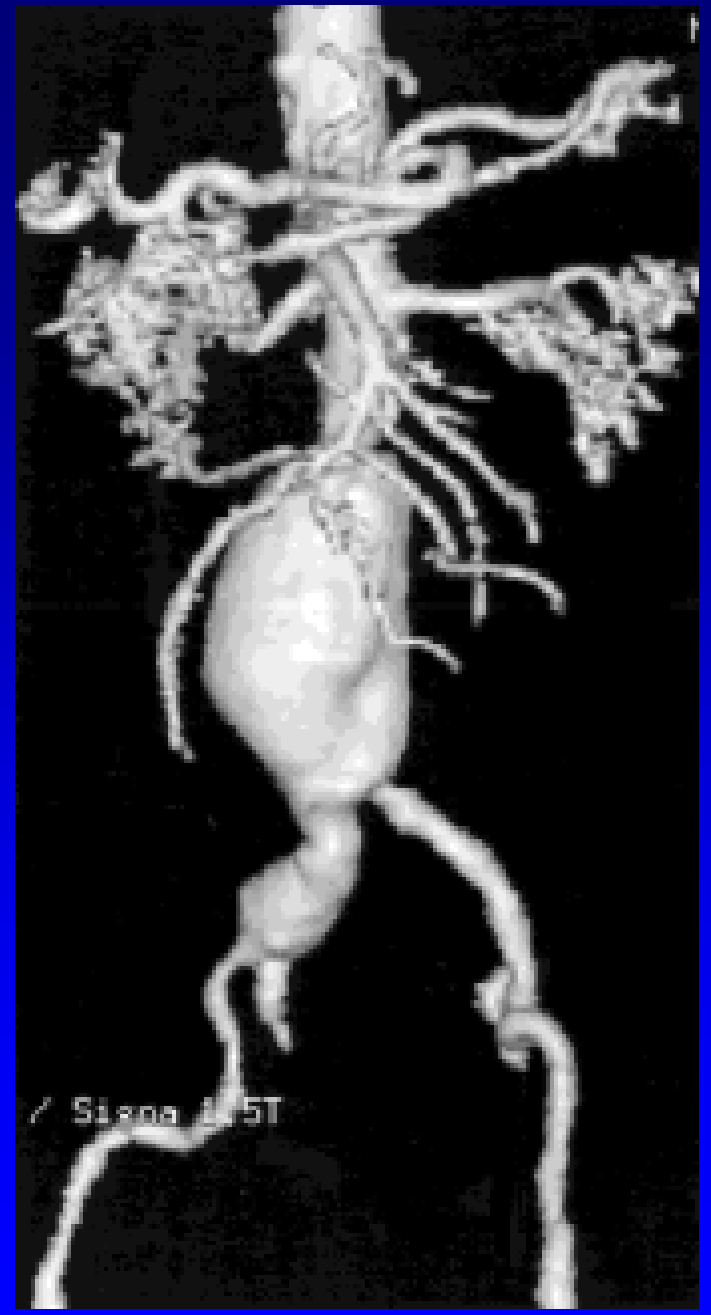
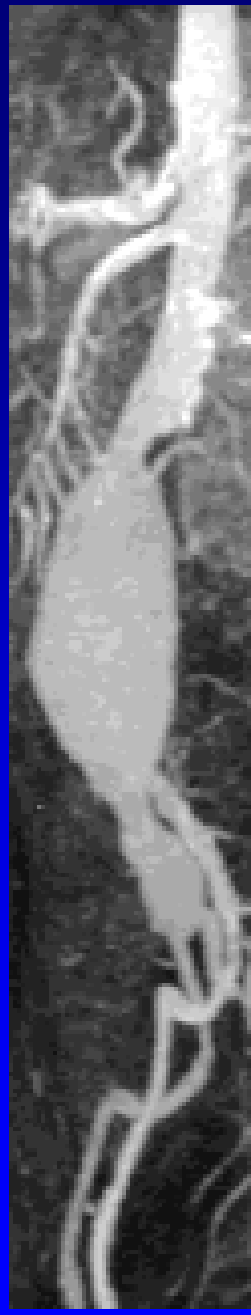
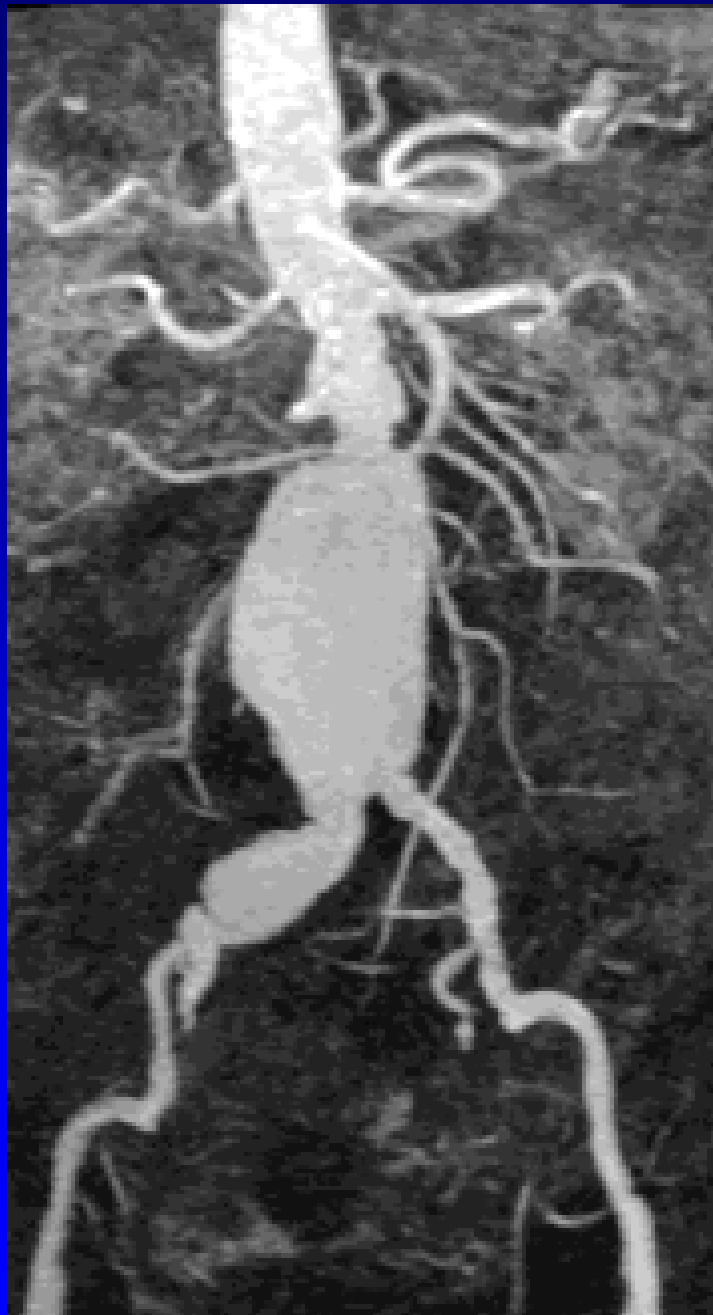


# Angio-RM

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Navg  
Ex: 4701  
Se: 4 +c  
Smooth 84 v 45.0  
+ 170.0 mm

SLA

INCOR  
FELIX B. CAVALCANTI  
M 77 553075669K  
Sep 22 2000

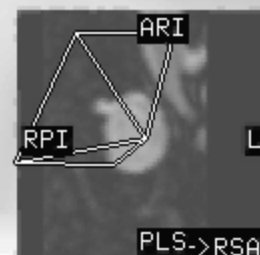
36.0 x

285/99

A  
I  
L

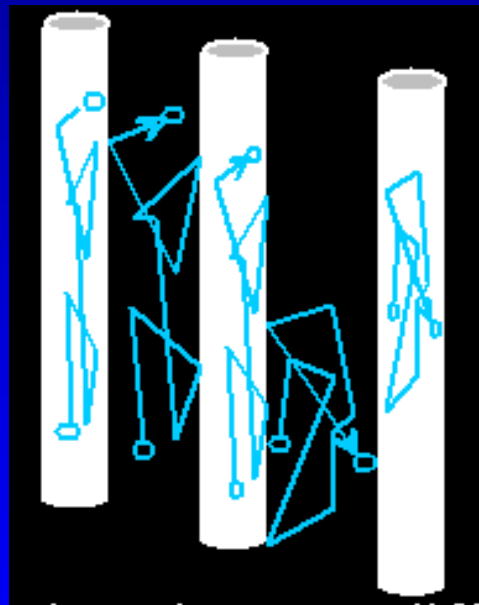
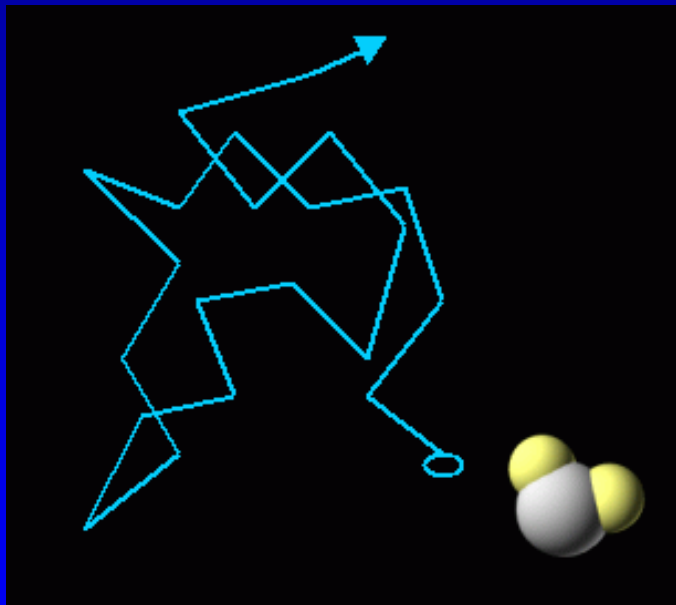
P  
S  
R

IRP



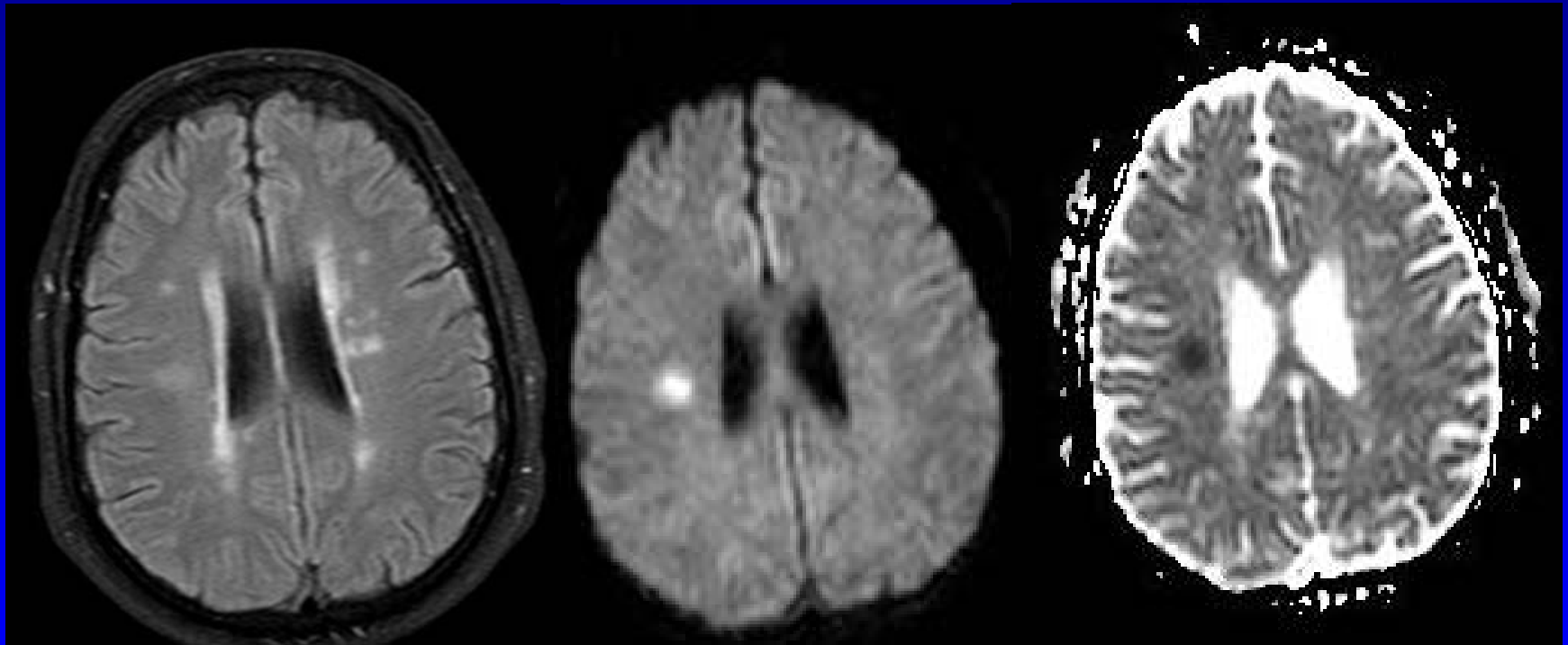
# Difusão

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# Difusão

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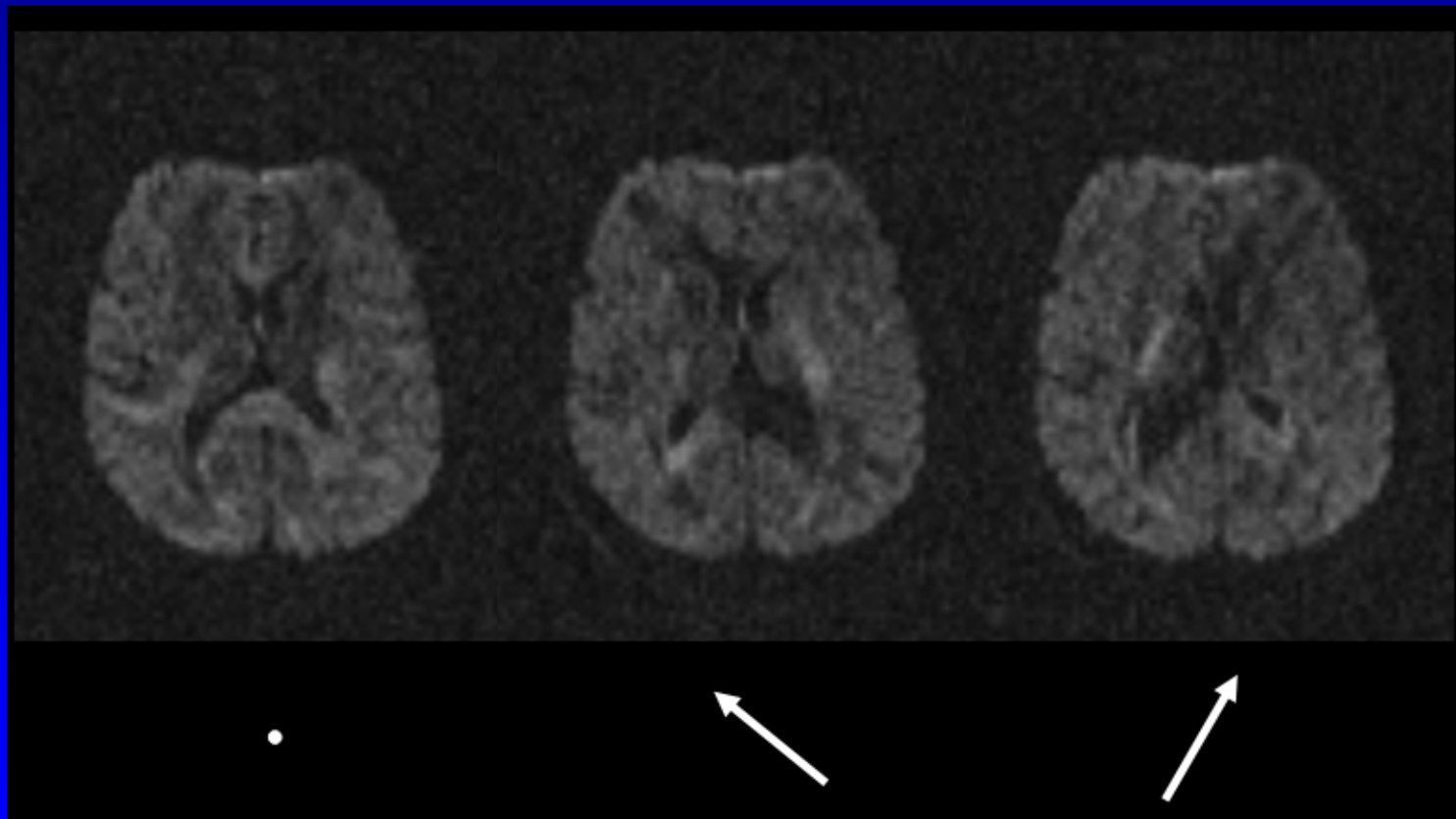
FLAIR

Difusão

ADC

# Tractografia

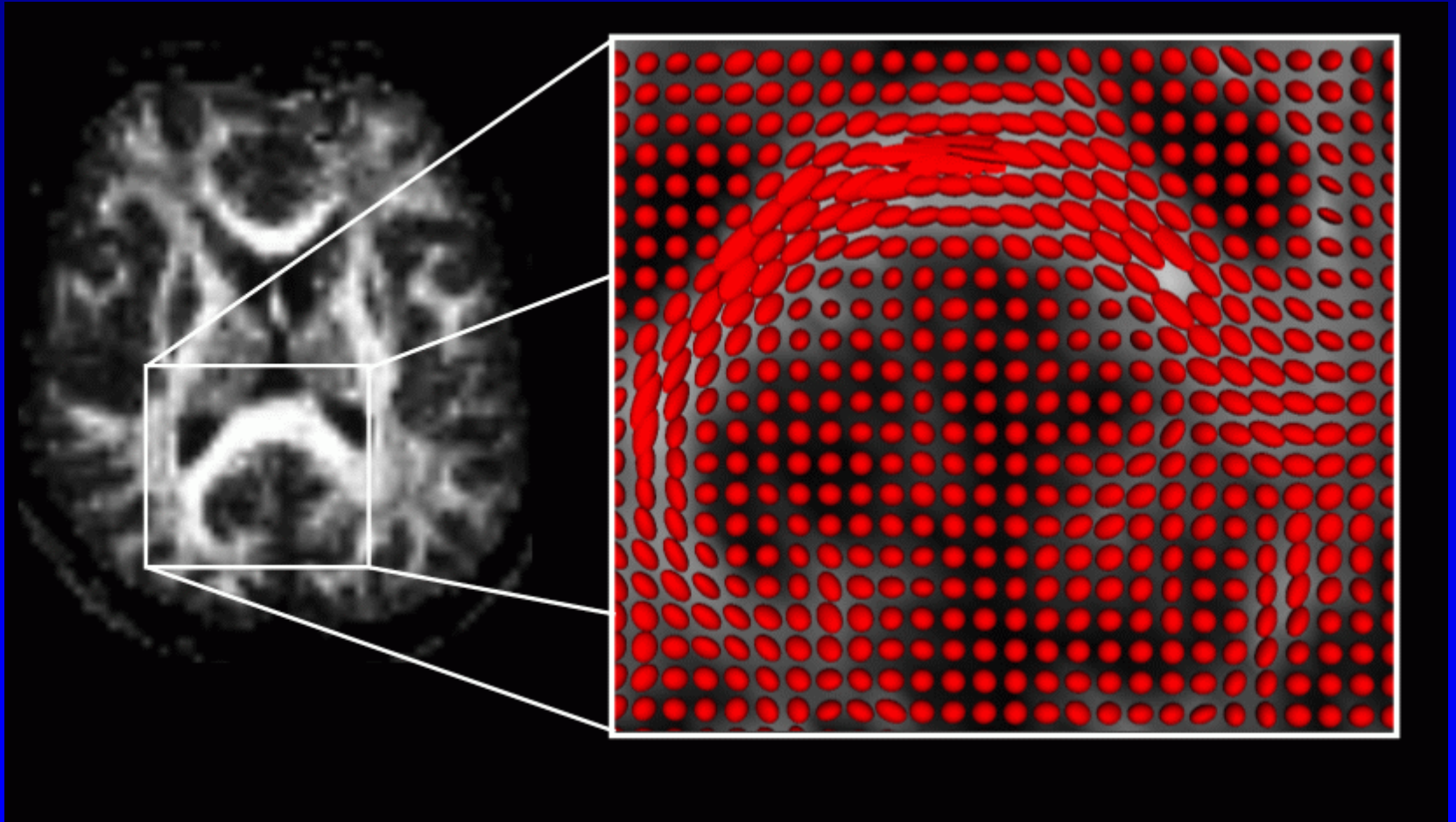
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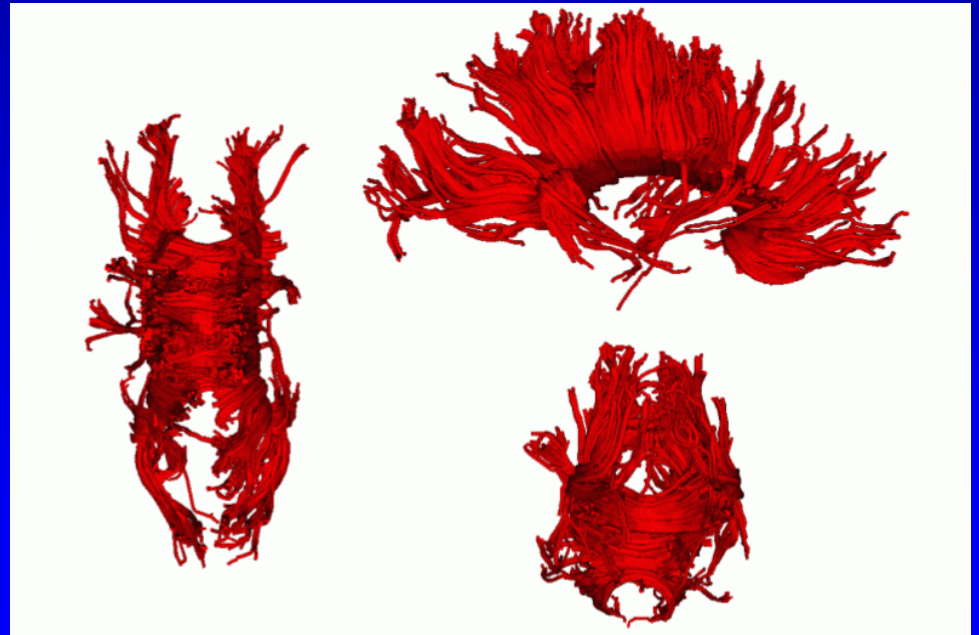
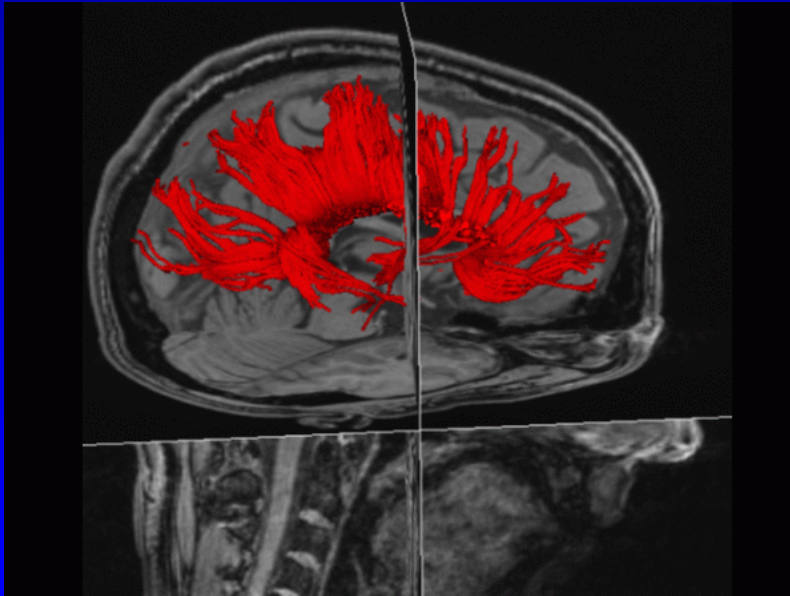
# Tractografia

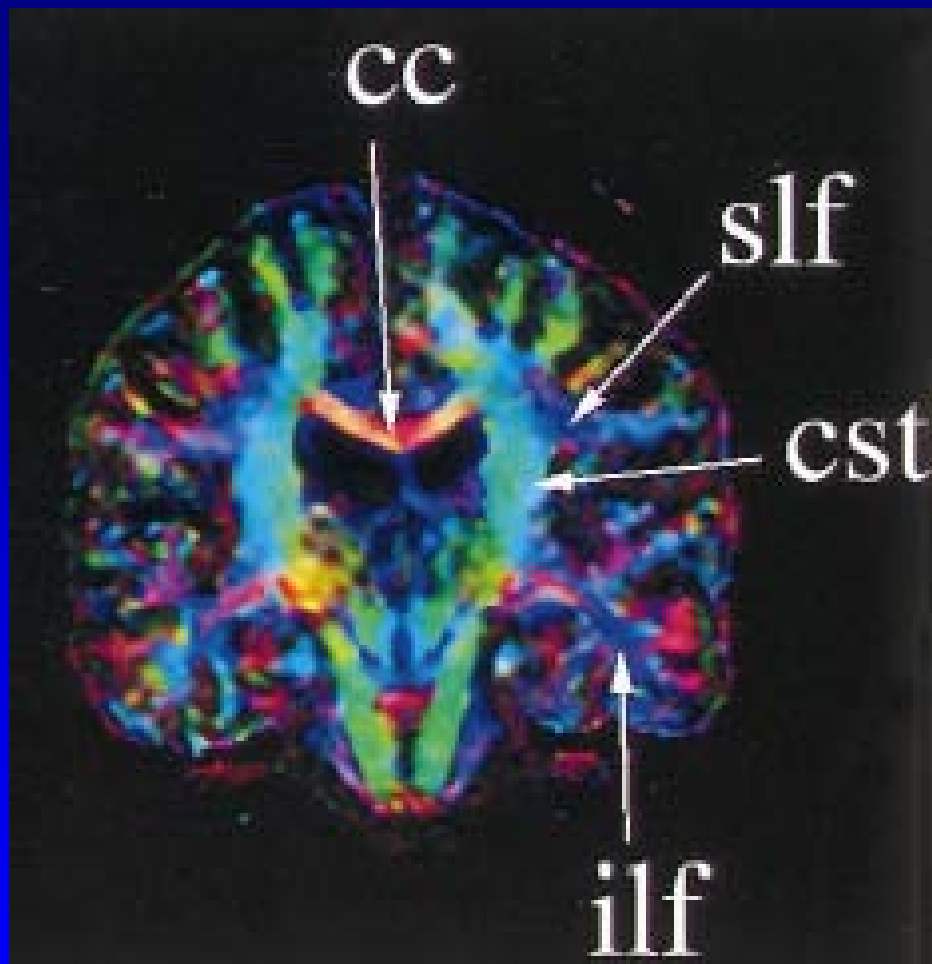
---



# Tractografia

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Elias R. Melhem, ... Peter C. M. van Zijl. AJR 2002;178:3–16

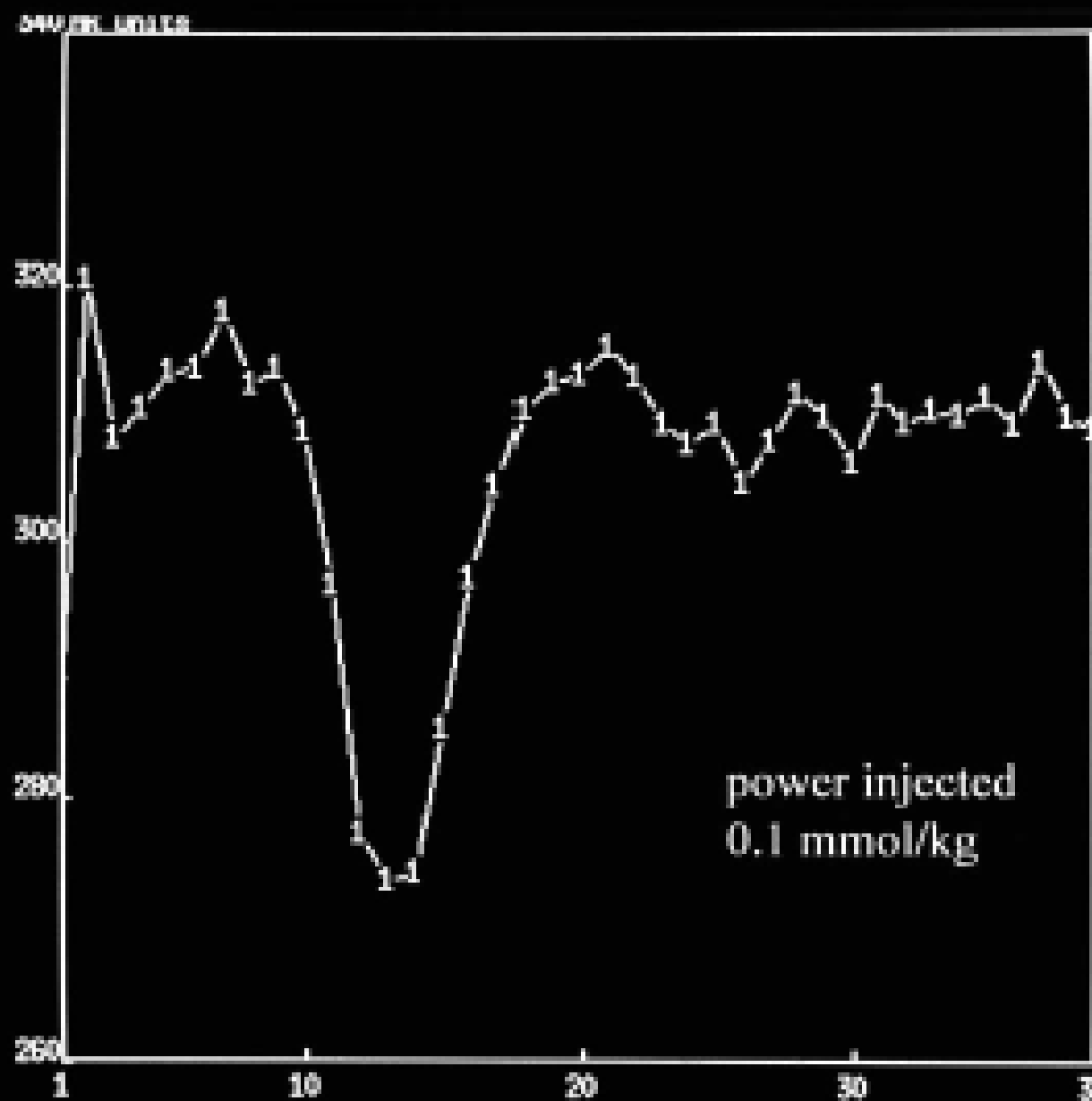
# Perfusão

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# Perfusão

---

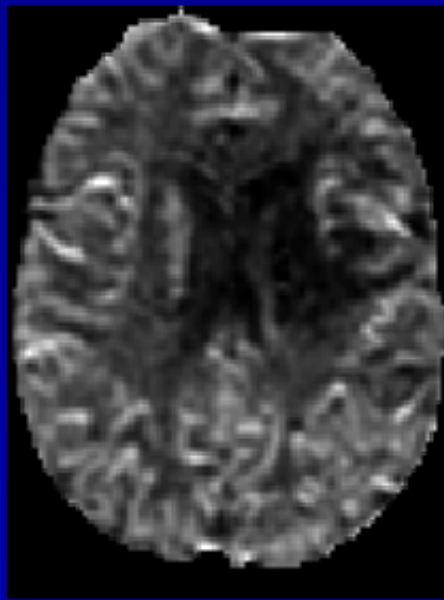
- Primeira passagem de meio de contraste pelo leito capilar
- Sensível a fluxo sanguíneo a nível microscópico, tissular
- Efeito  $T2^*$  do Gd - perda de sinal
- Curva intensidade x tempo
- EPI - múltiplos cortes em pouco tempo
- SE avalia somente capilar, GRE capilar + vasos maiores



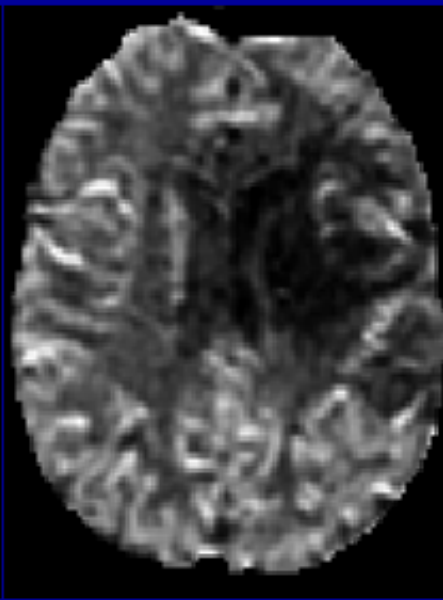
# Perfusão

---

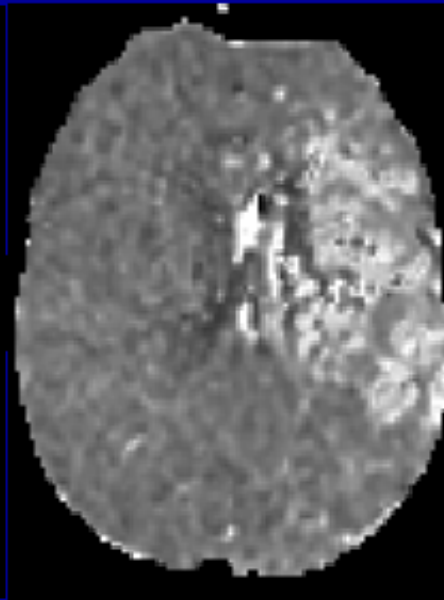
- 4 parâmetros
  - Cerebral blood volume (rCBV)
  - Cerebral blood flow (rCBF)
  - Mean transit time (MTT)
  - Time to peak (TTP)
  
- r: valores relativos



rCBV



rCBF



MTT

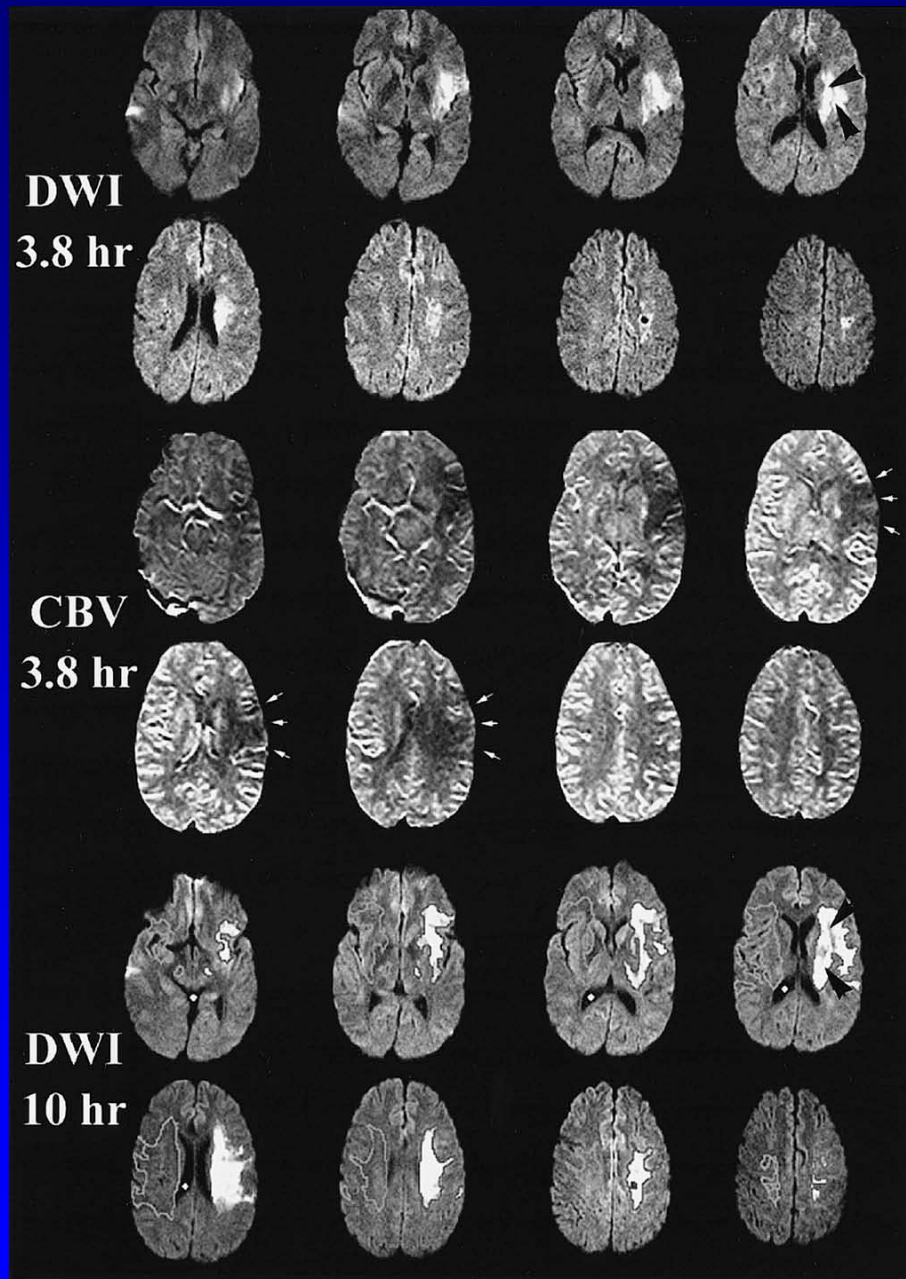


rCBV



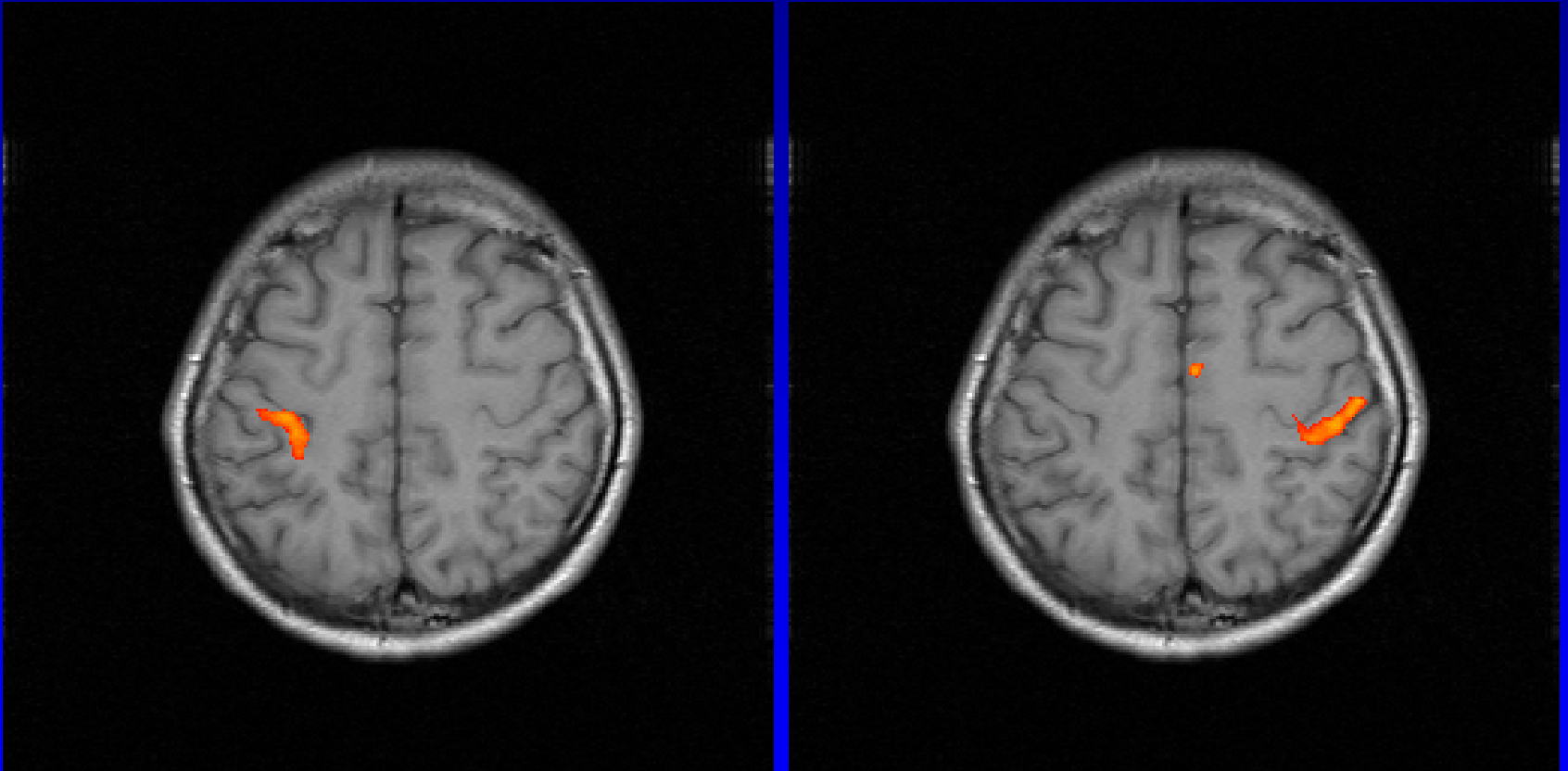
# Perfusão

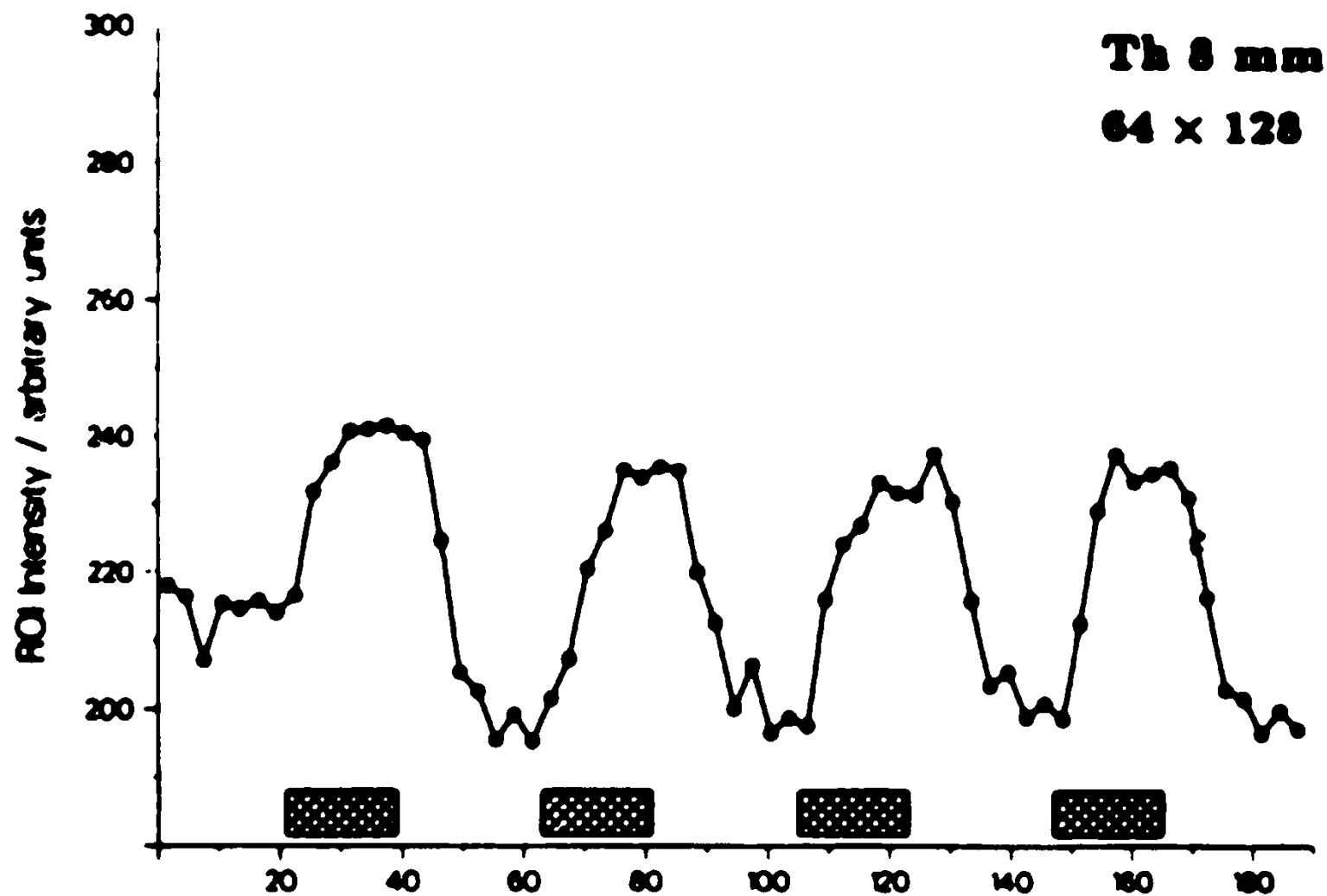
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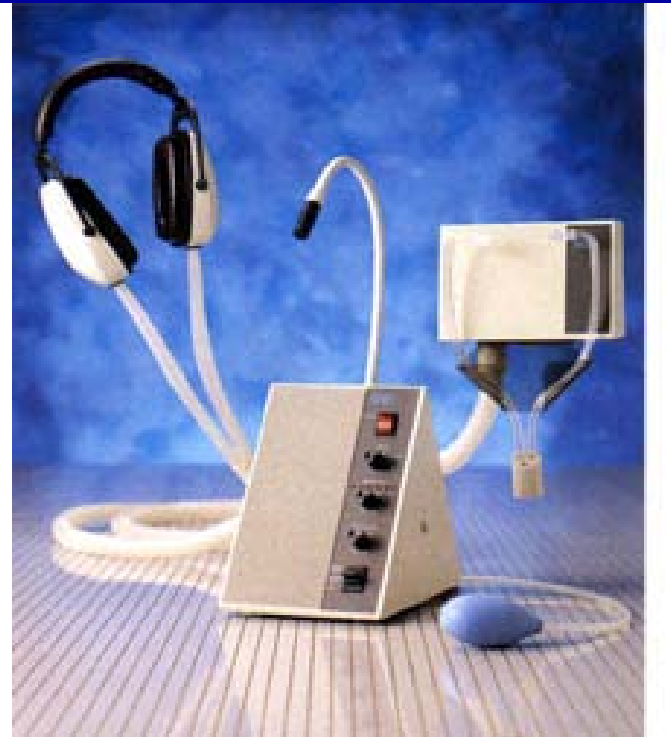


# RM Funcional

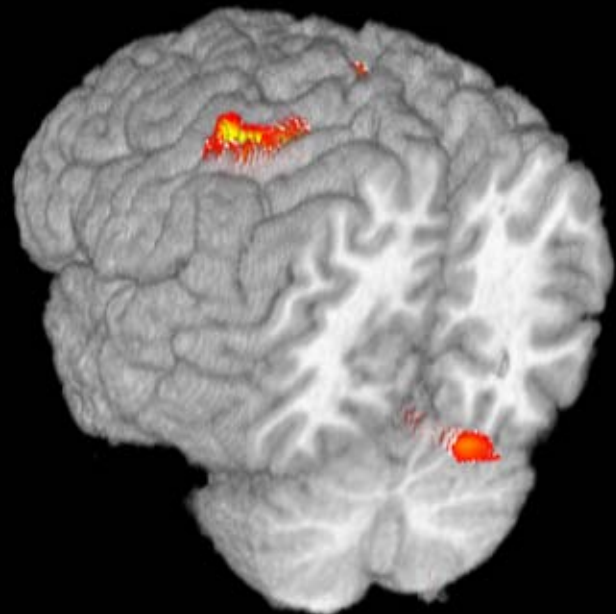
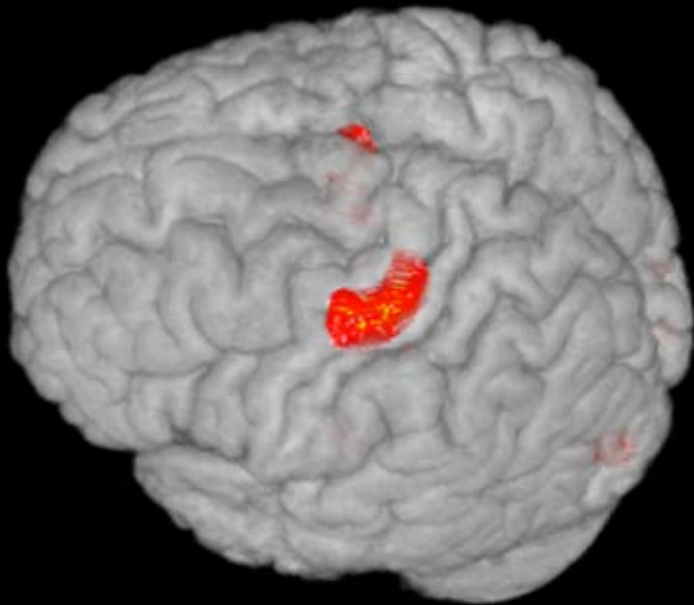
---







## Movimento mão direita



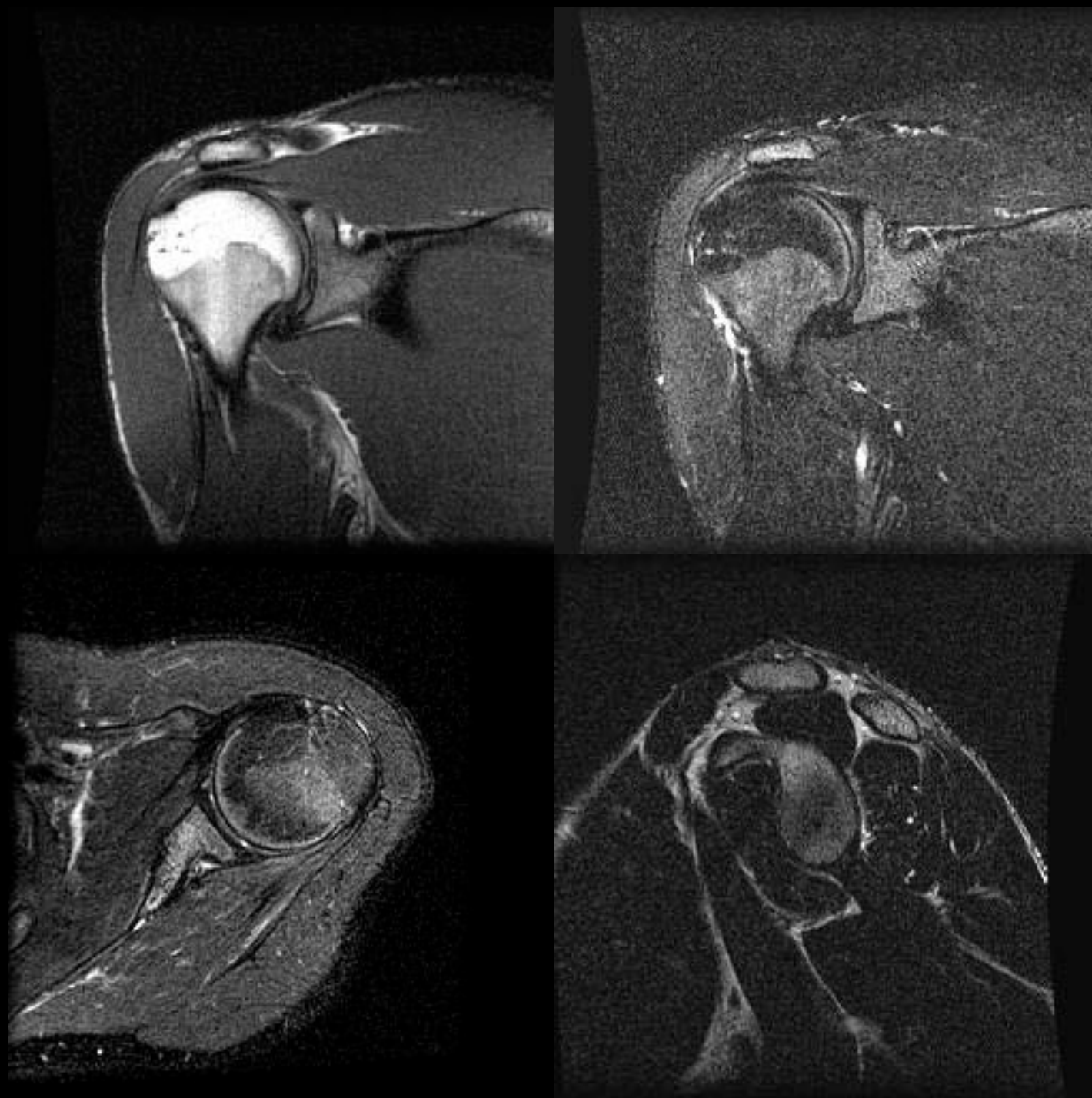
# Sistema músculo-esquelético

---

# Músculo-esquelético

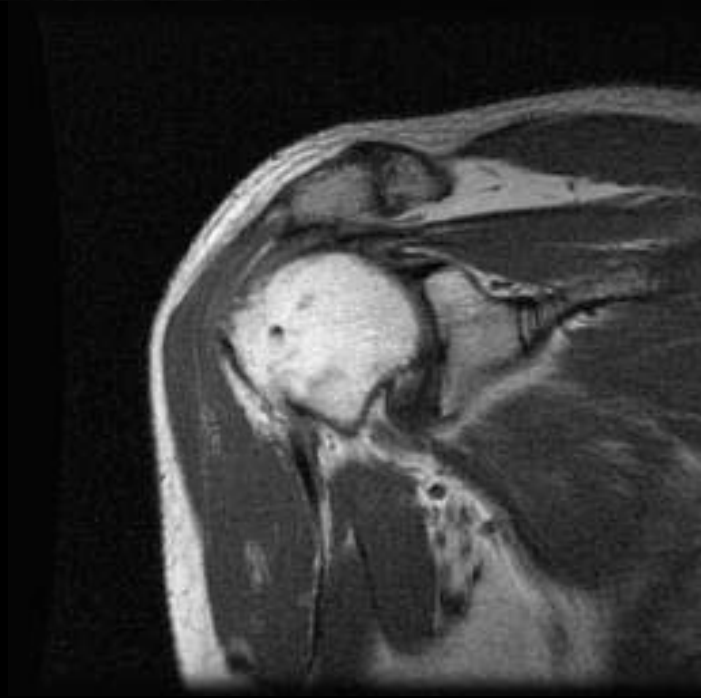
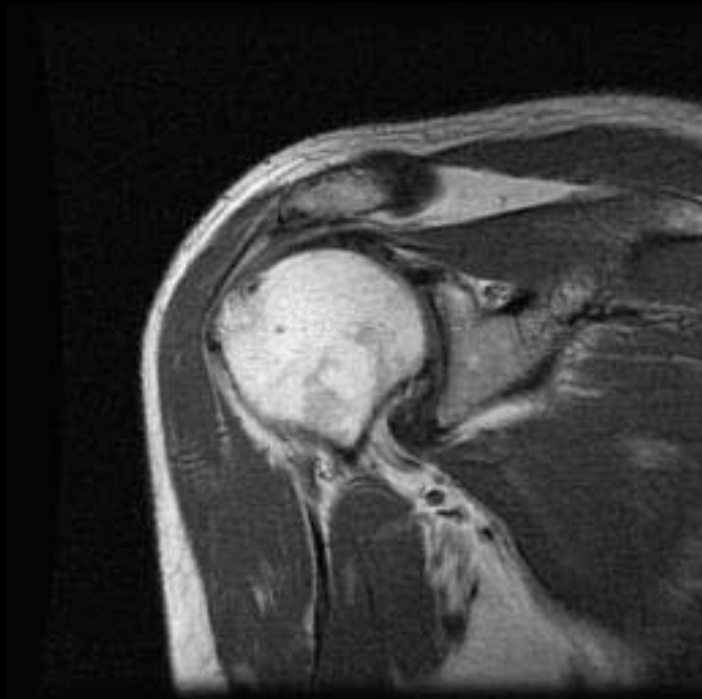
---

- Melhor resolução e contraste entre tecidos
- Artro-RM



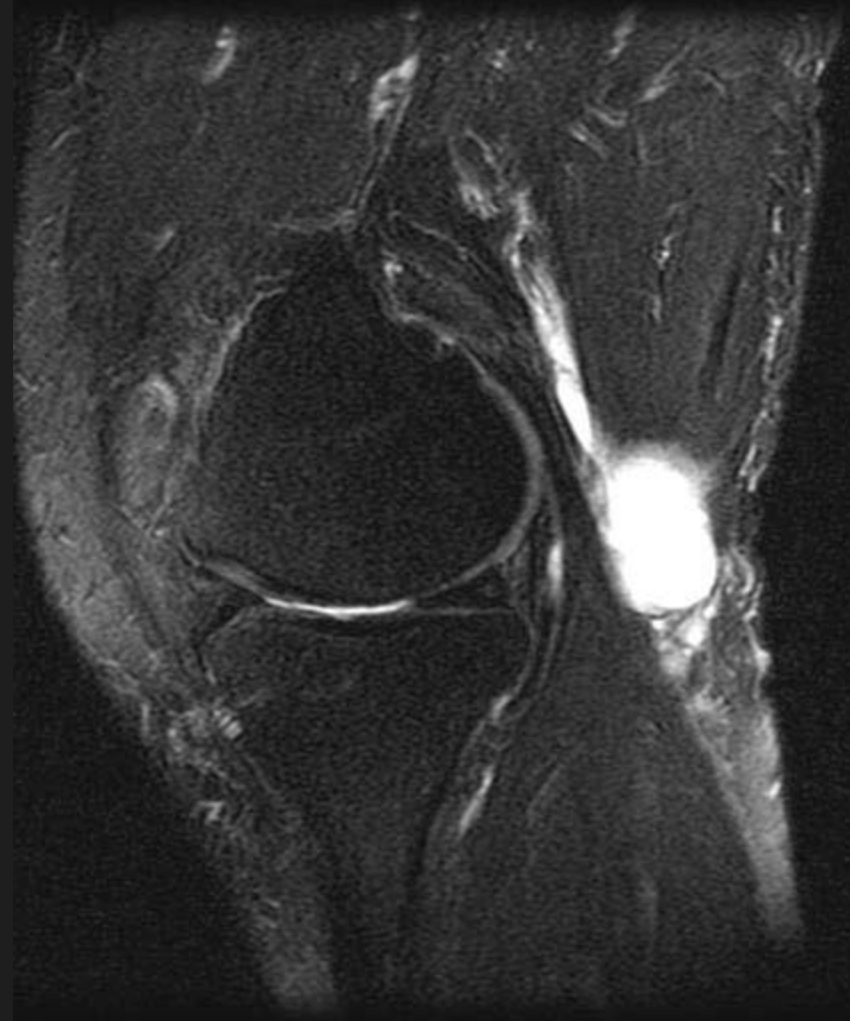
Ombro  
normal







Degeneração meniscal



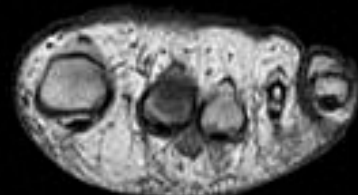
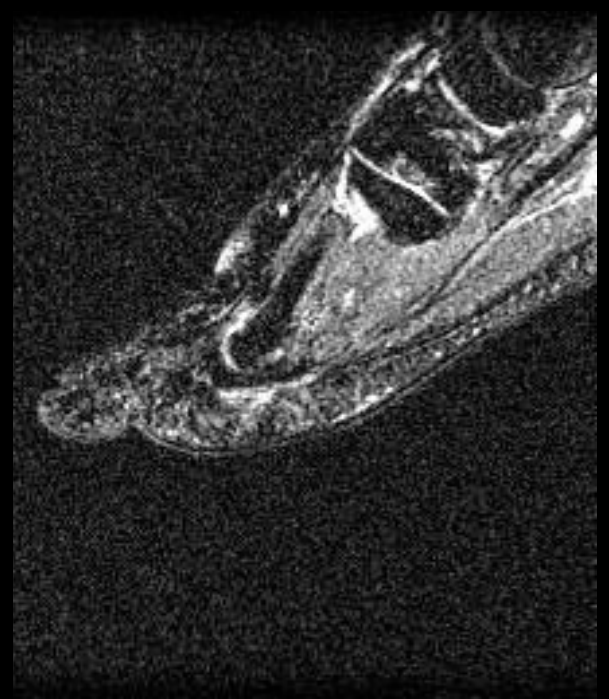
Baker



Alça de balde



Artrose, lesão LCA



Neuroma de Morton

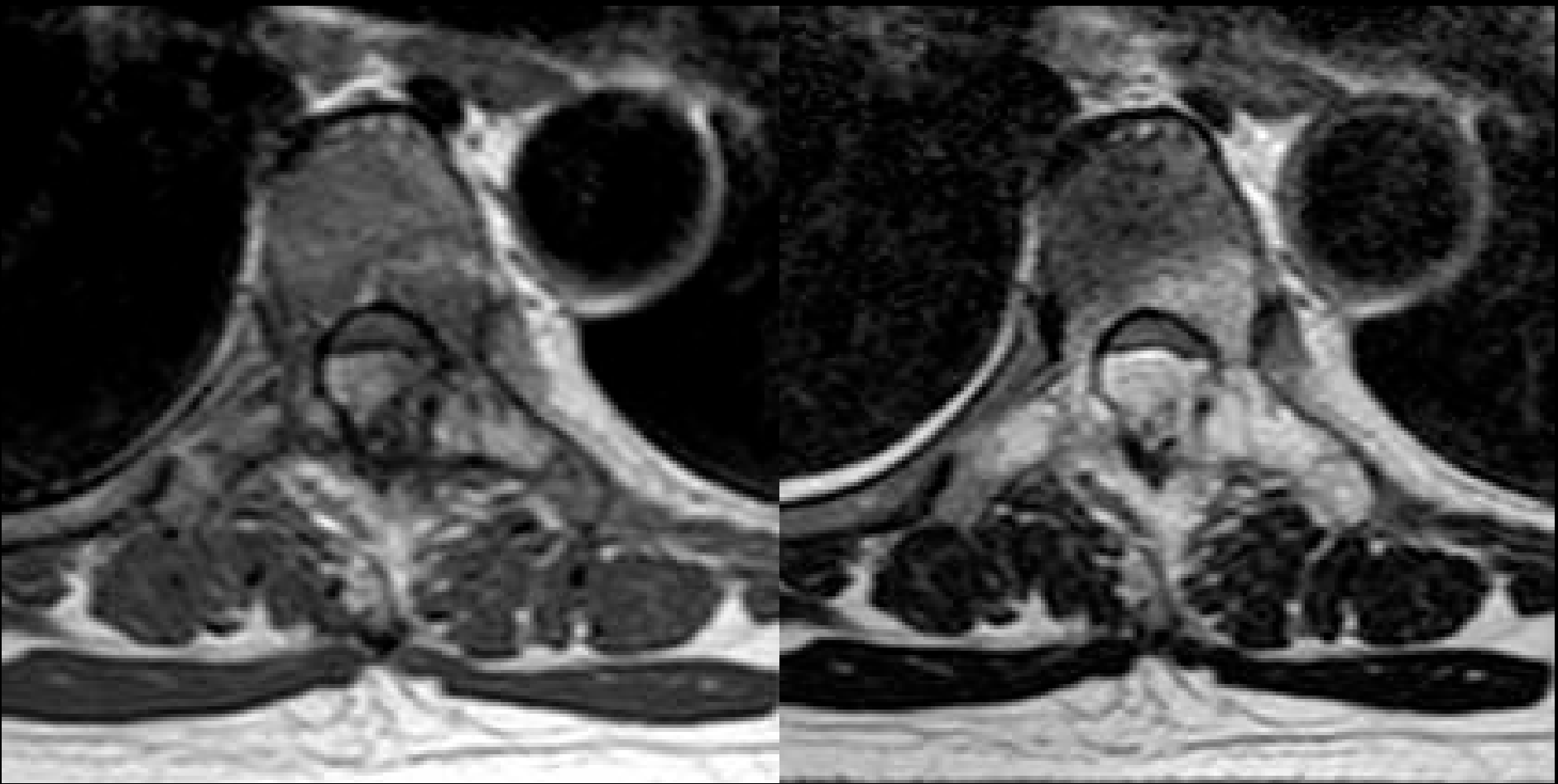








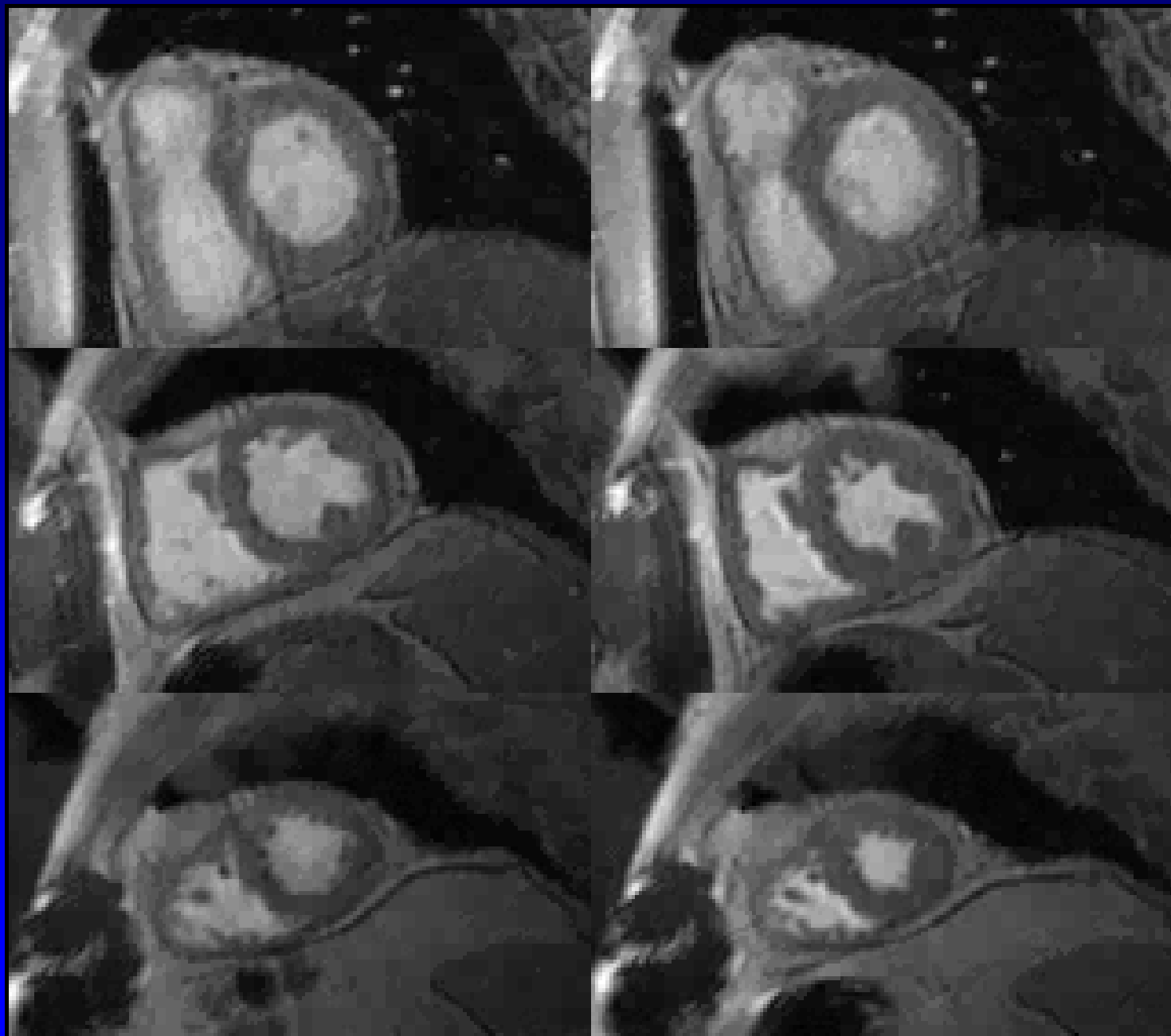




# Tórax

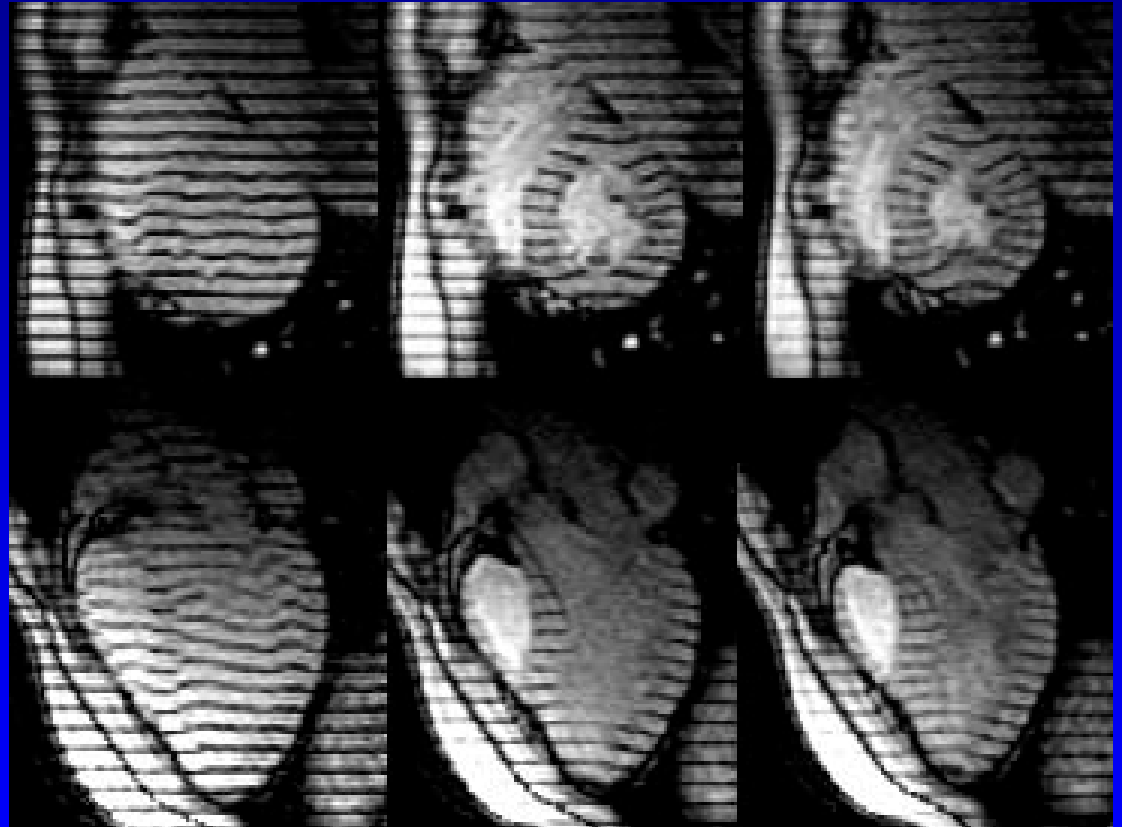
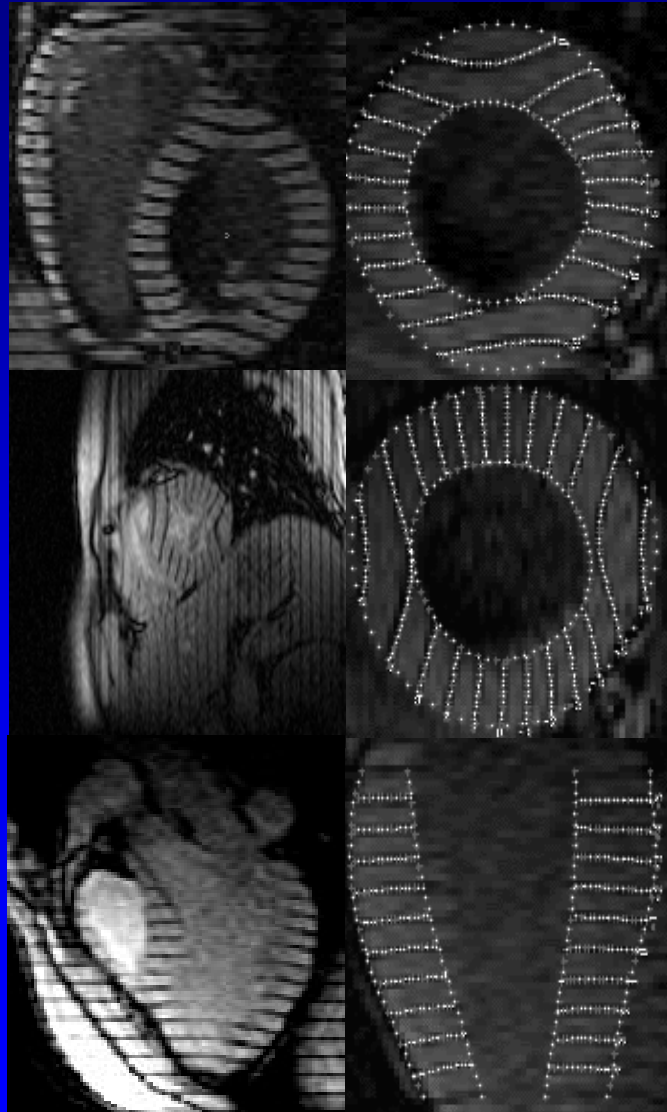
---

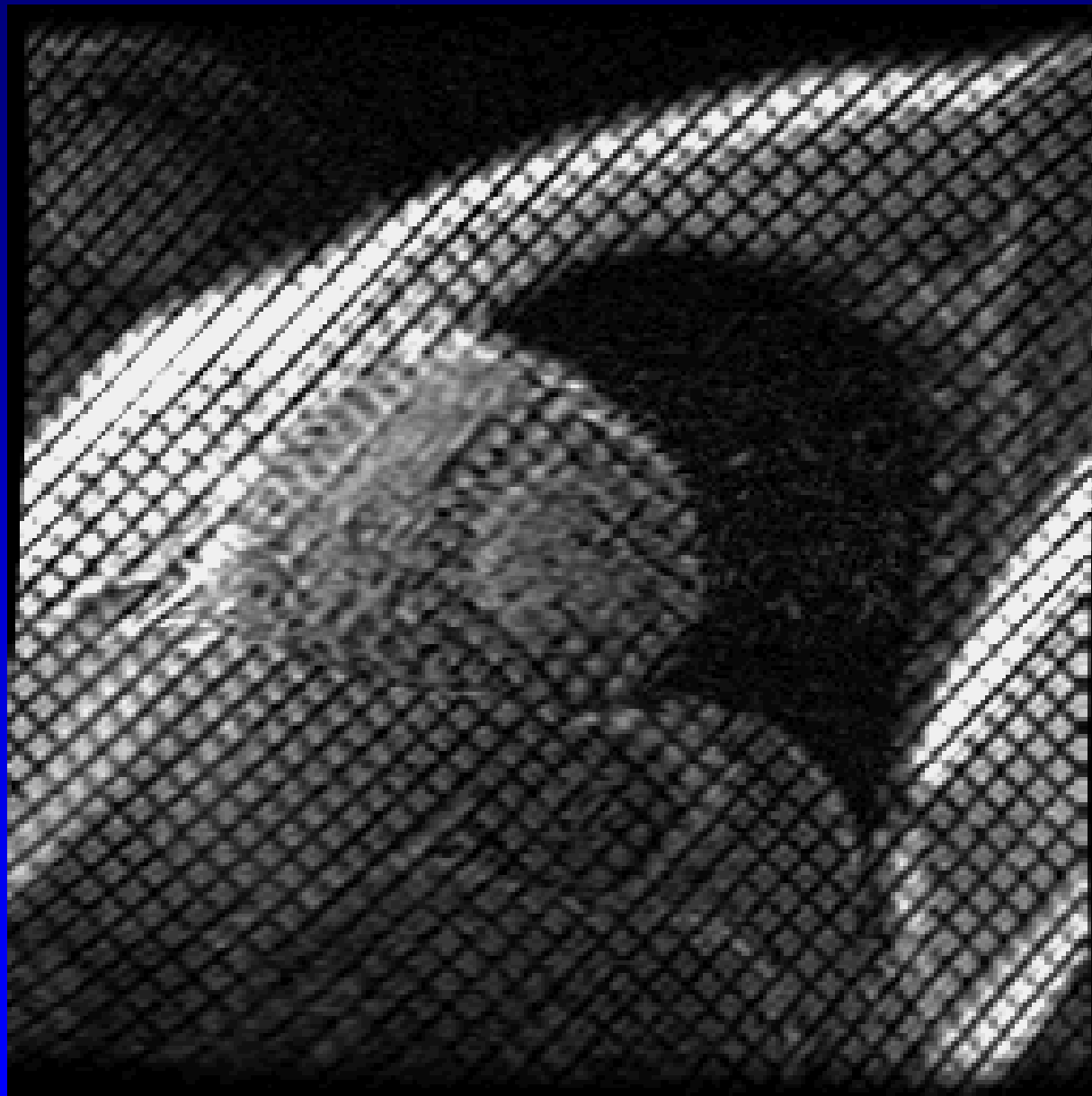
- Mediastino / pleura / parede / mamas
- Coração: morfologia e função  
(contratilidade, perfusão, viabilidade, coronária)
- Angiografia
- Ruim para parênquima pulmonar





# Tagging



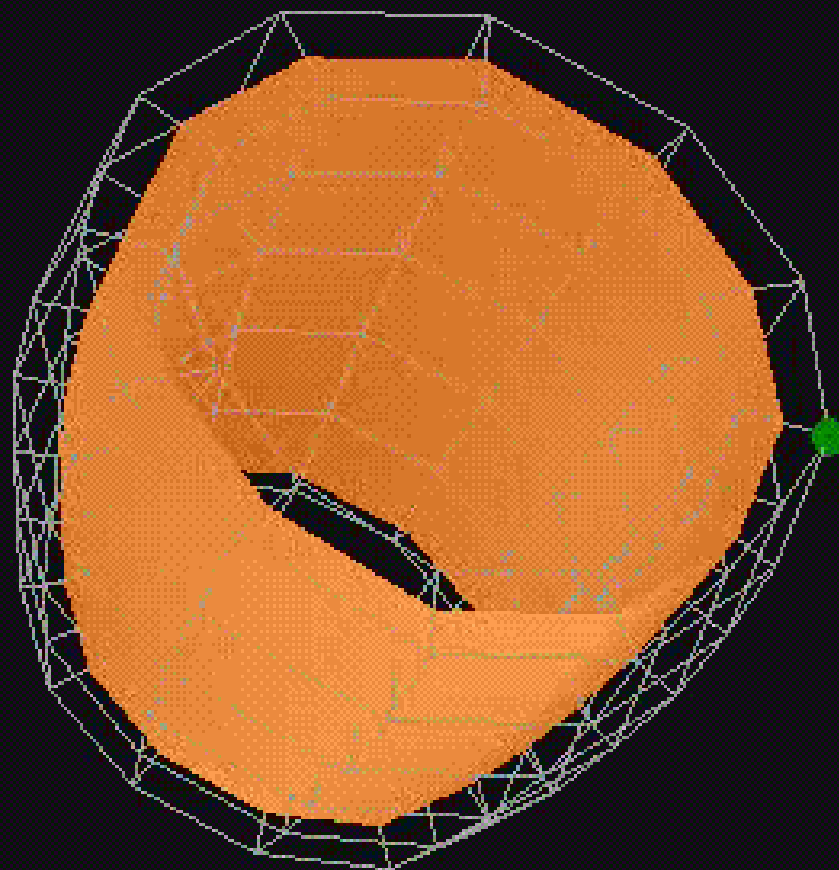


def\_rcl->UI\_cc  
MidSeptum

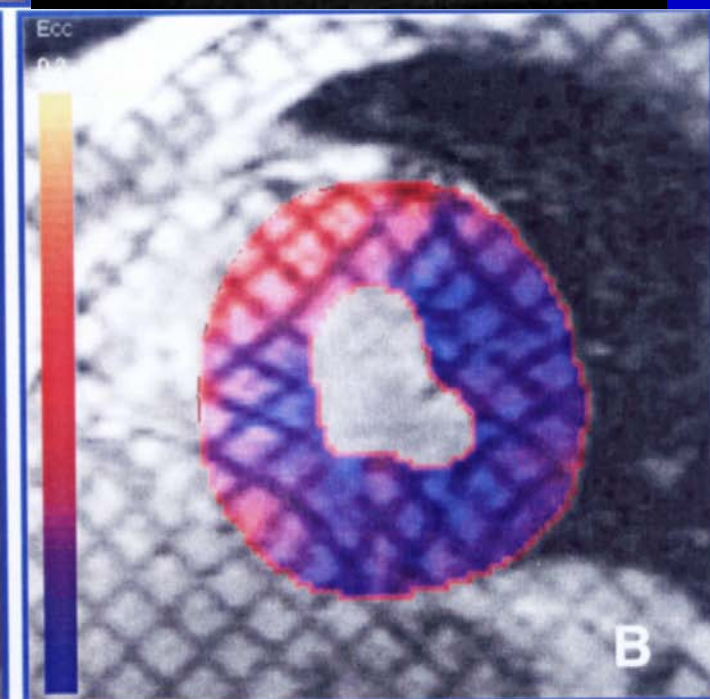
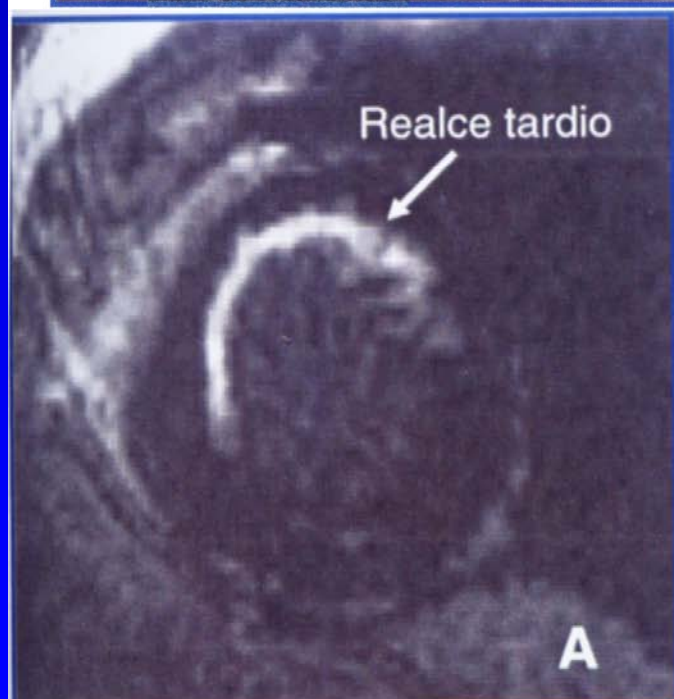
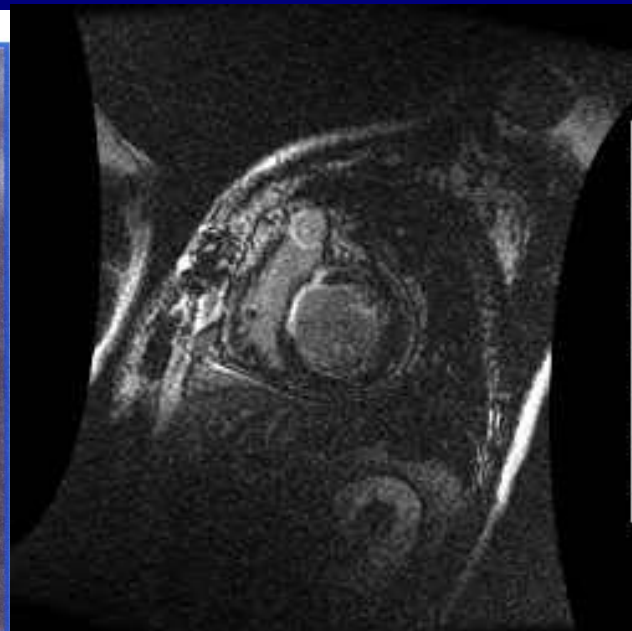
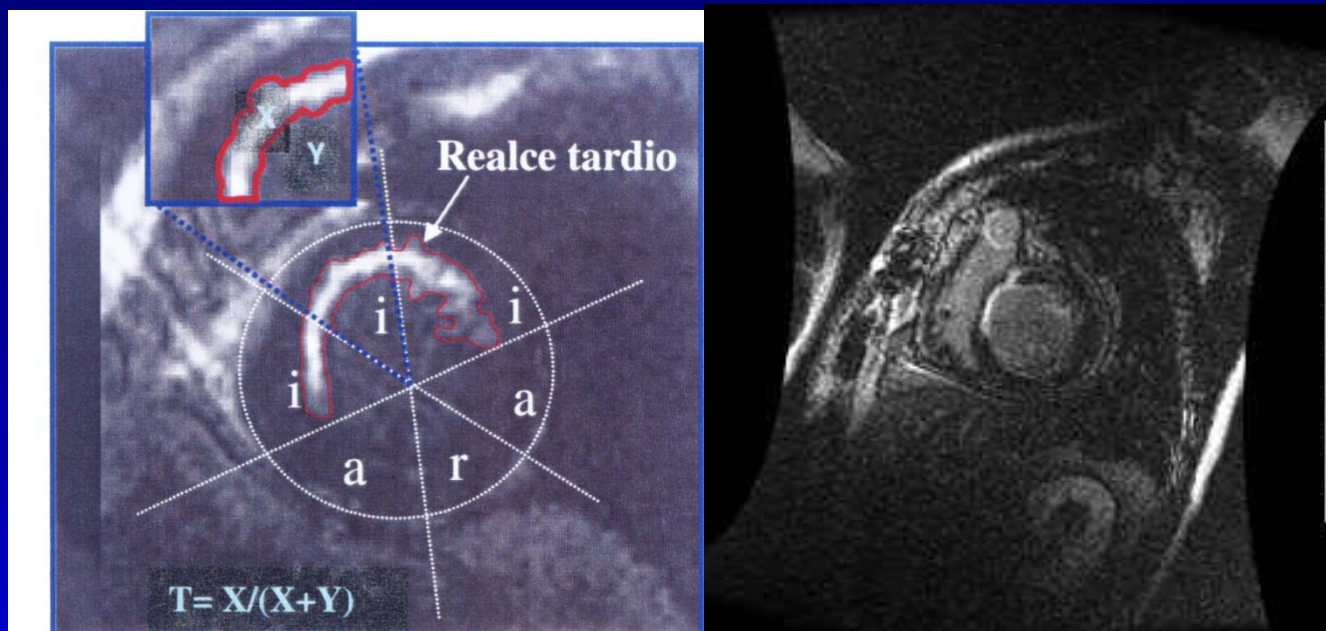
0.17



-0.42



TF: 0  
time = 38.0 ms







Im: 4  
OAx S76.4  
77 bpm  
TD:198  
Ph:1/1

Jan 10 01  
12:03:07 PM  
Mag = 1.2  
FL:  
ROT:

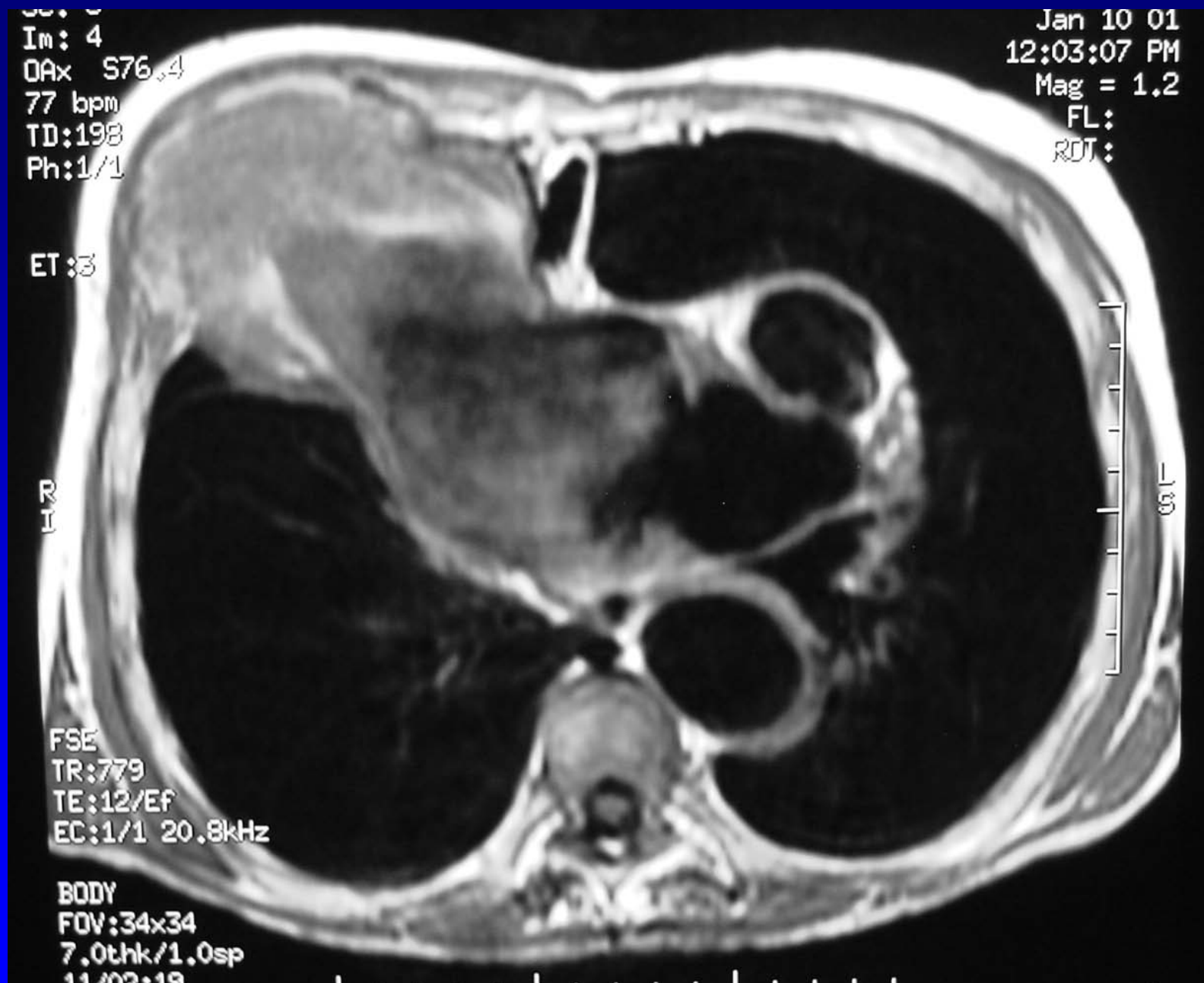
ET:3

R  
I

FSE  
TR:779  
TE:12/EF  
EC:1/1 20.8kHz

BODY  
FOV:34x34  
7.0thk/1.0sp  
11/02/19

130







Fiesta



Gd

F 38 00-46103  
DOB: Mar 11 1962  
Oct 25 00  
12:58:54 PM  
Mag = 1.1  
FL:  
ROT:

+C

P  
3  
1

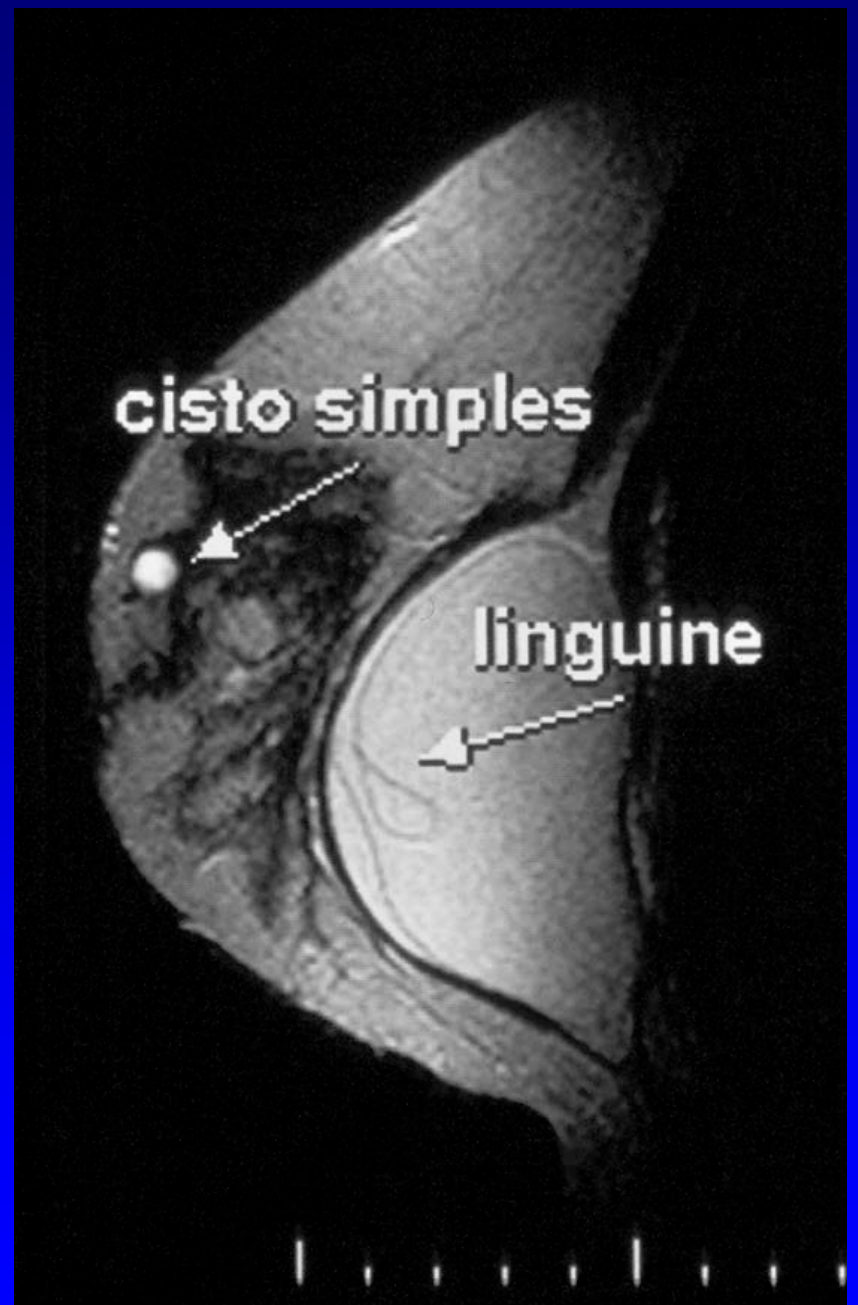
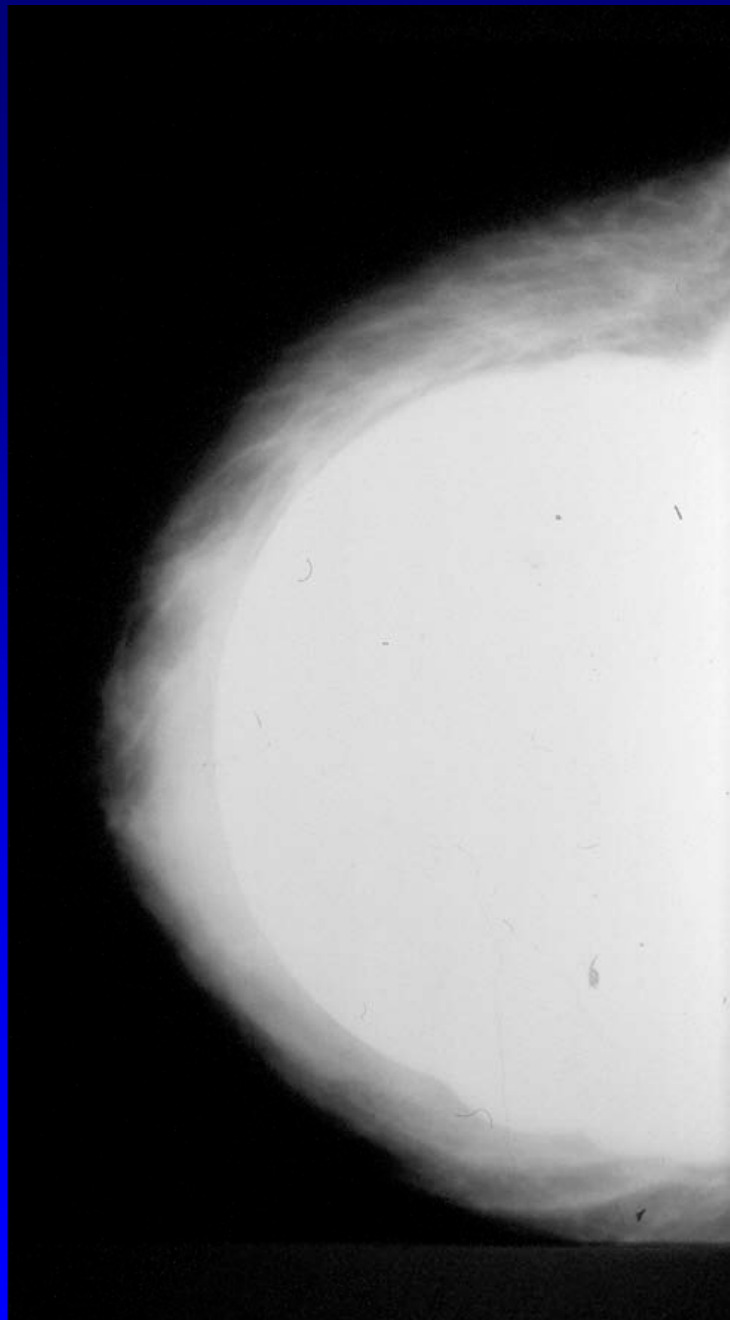
15

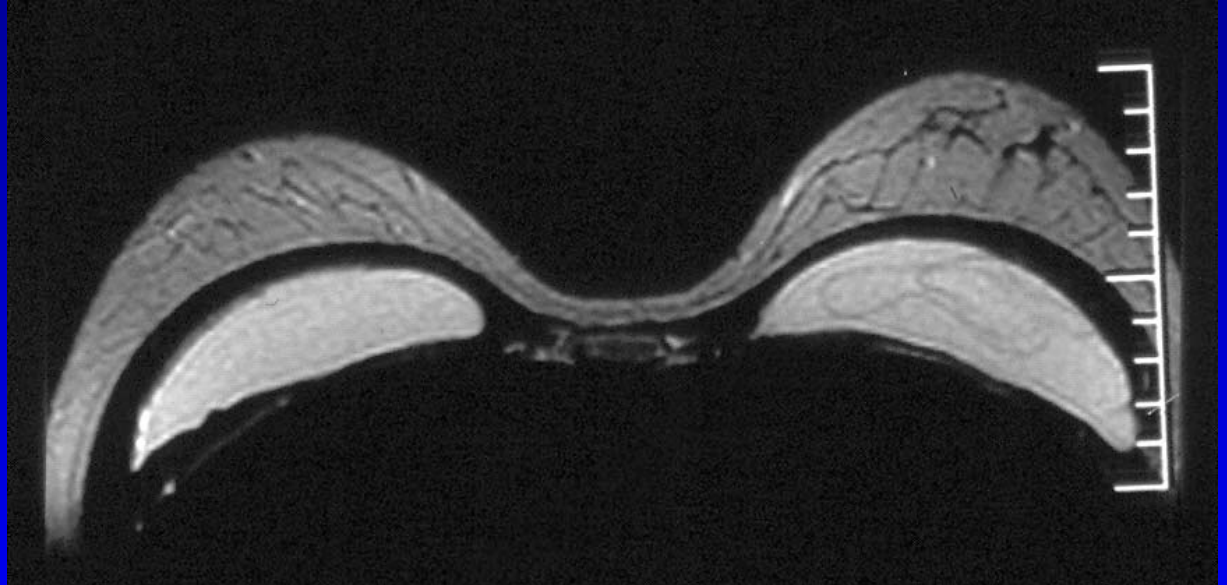
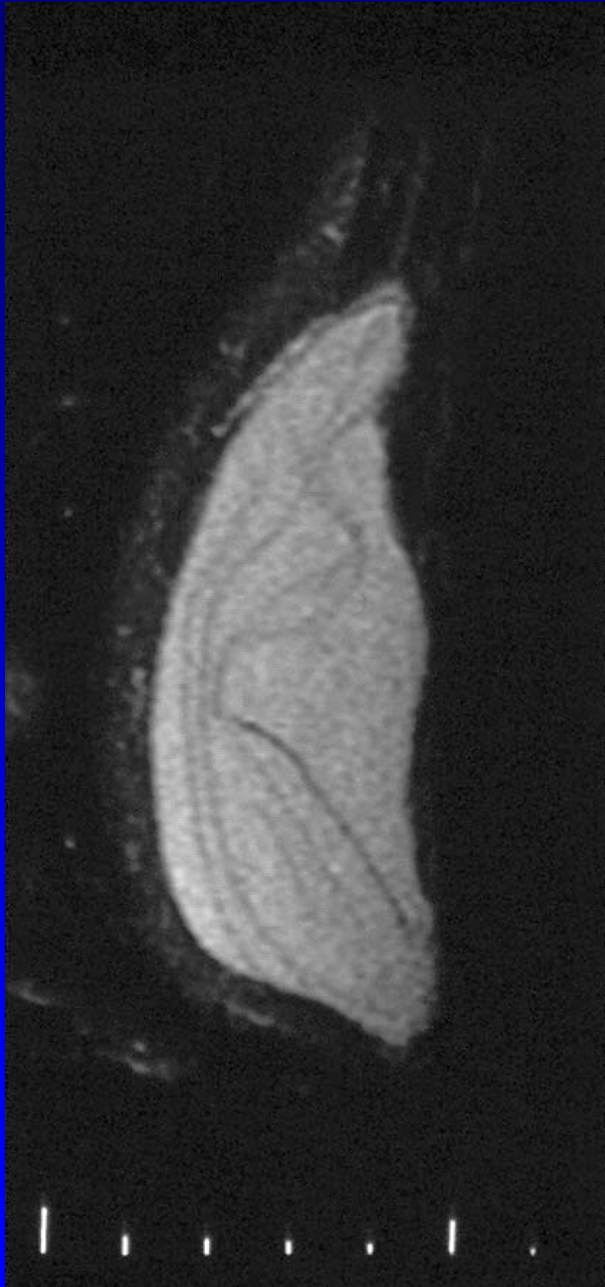
kHz

ip









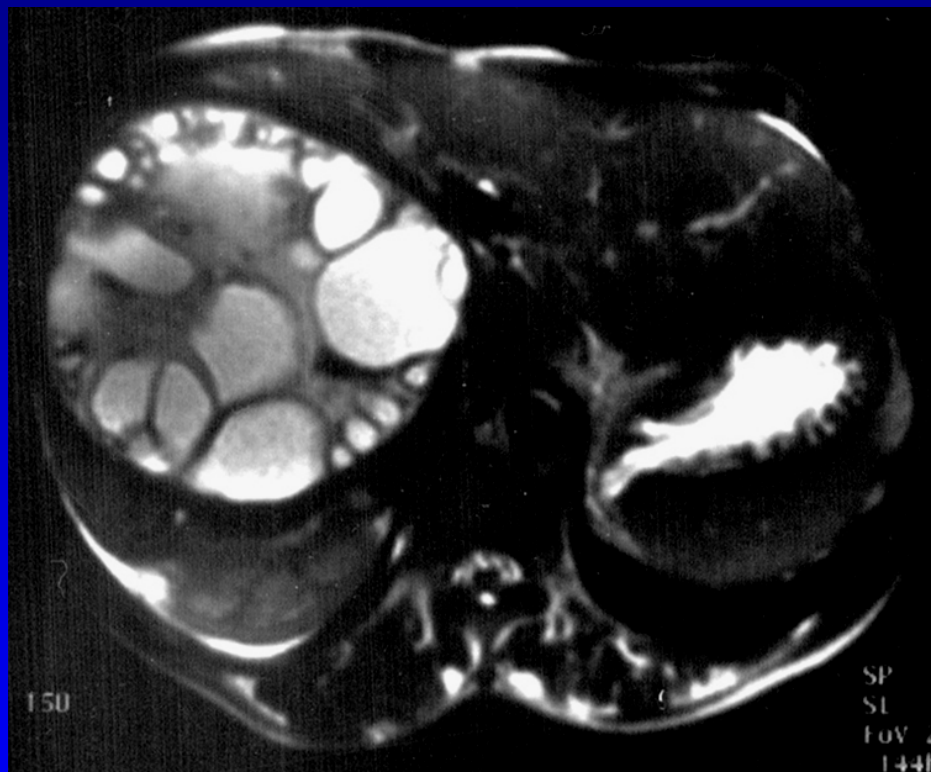


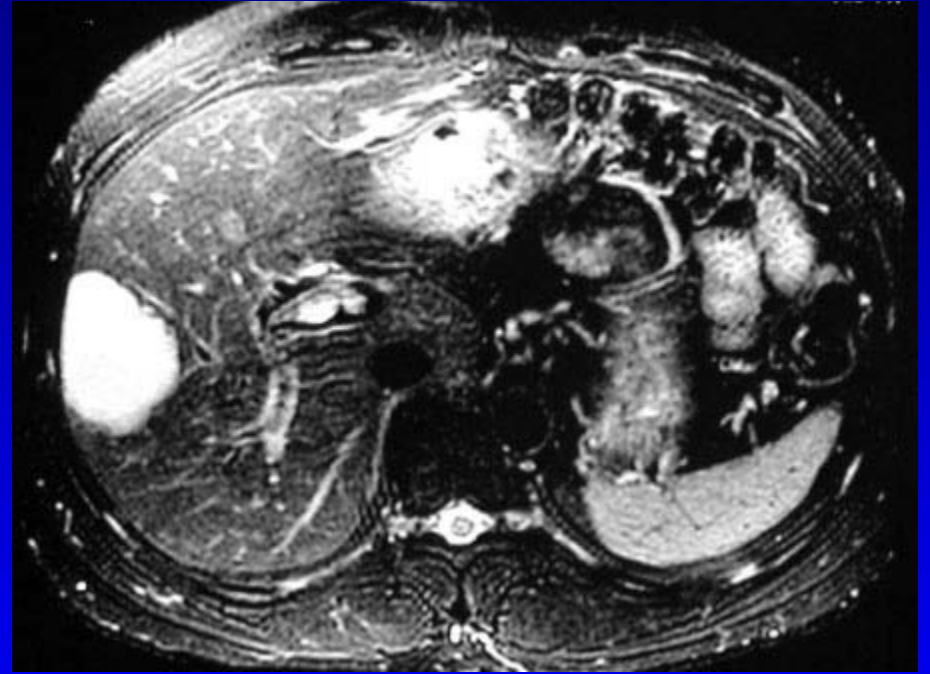
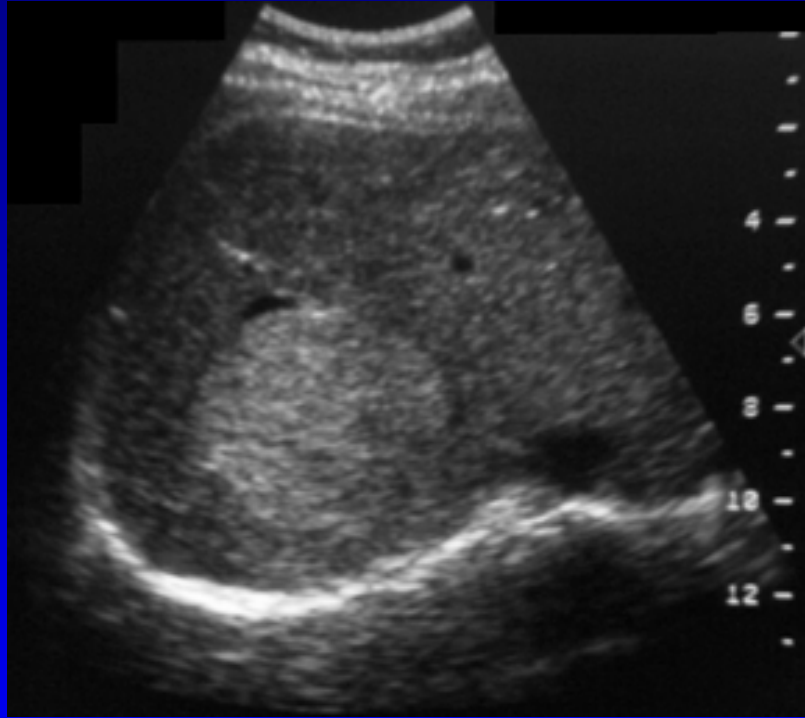


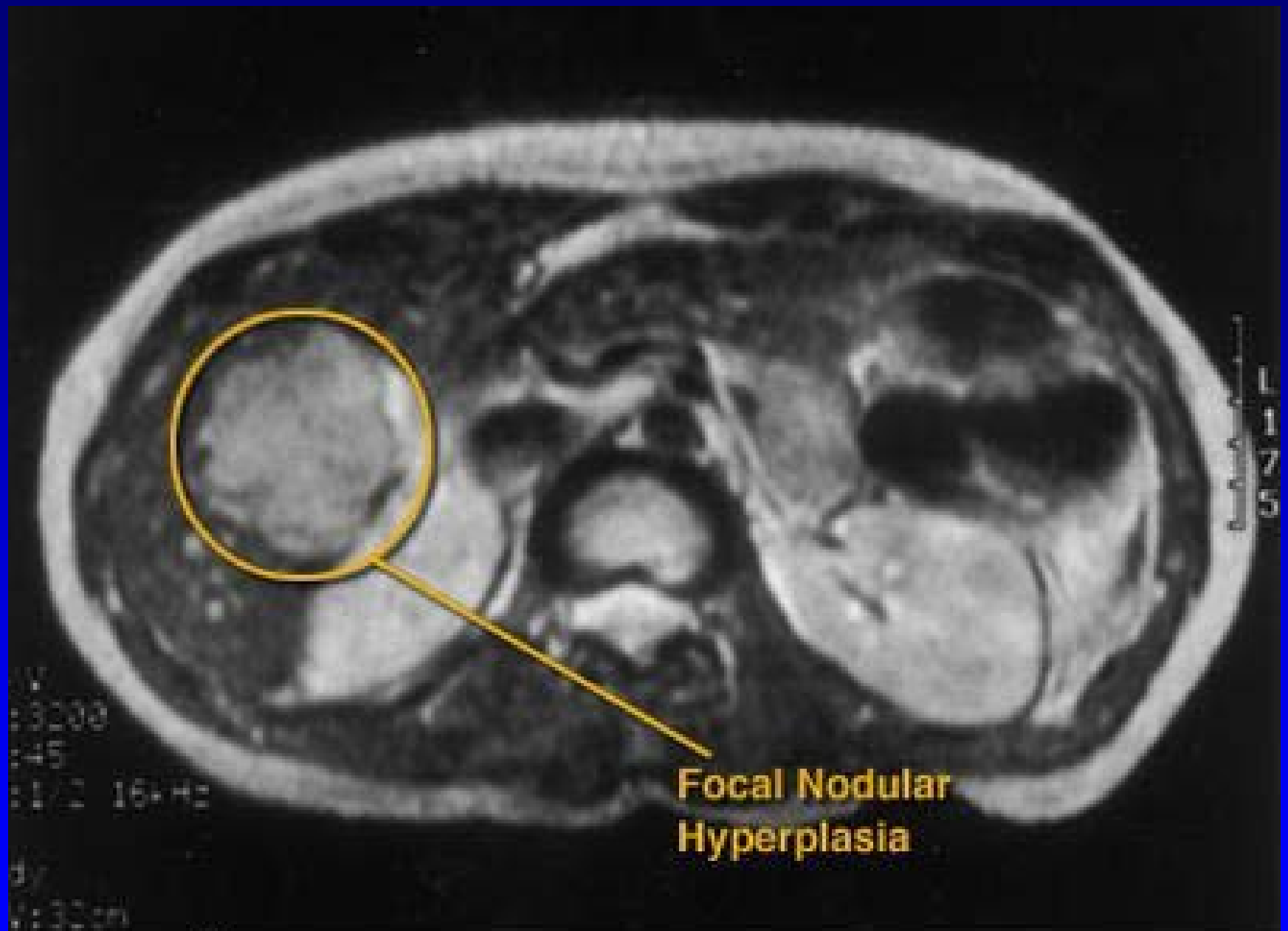
# Abdome / pelve

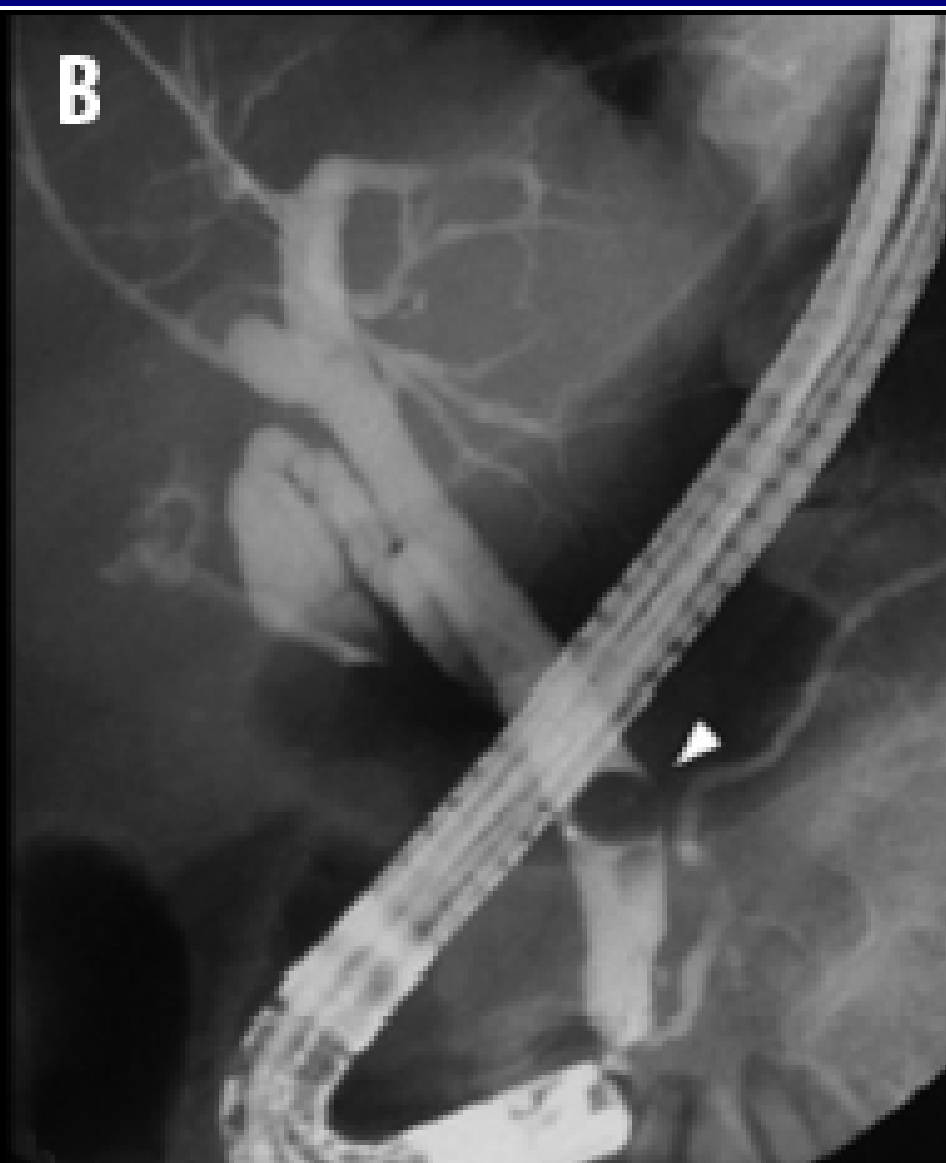
---

- Semelhante a TC
- Colangiografia
- Pielografia
- Angiografia
- Enema / trânsito de delgado
- Superior à TC na pelve

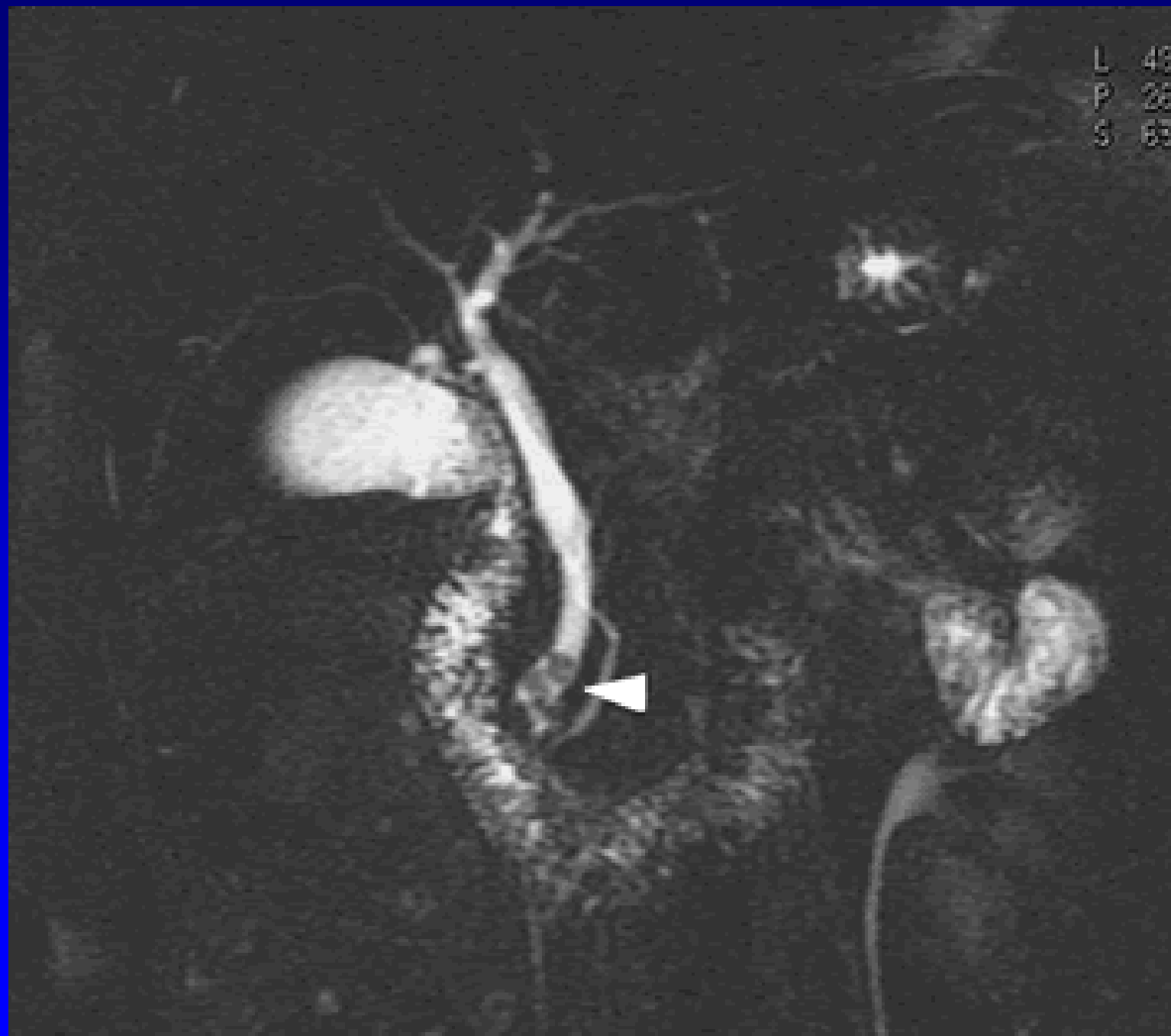




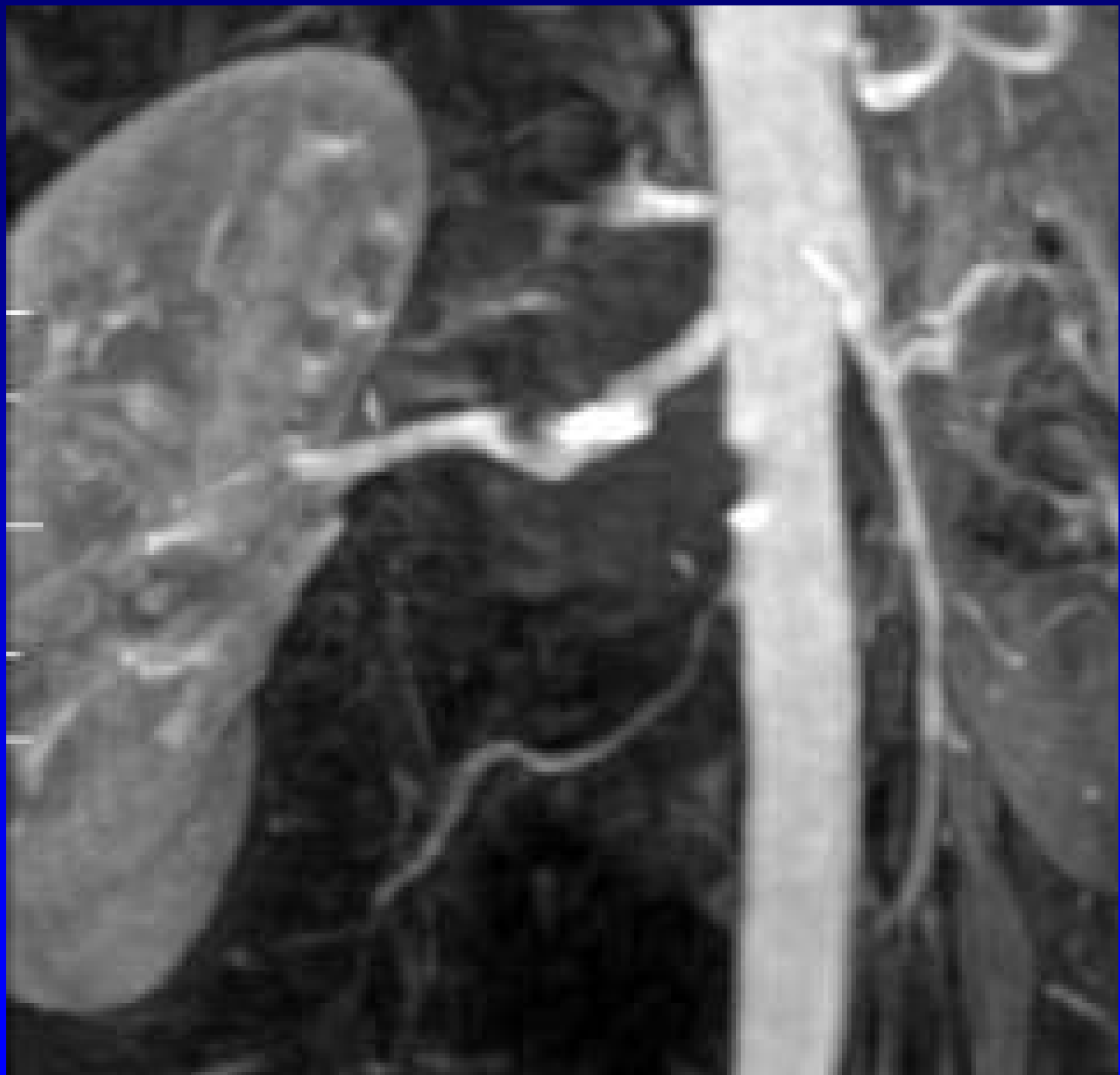




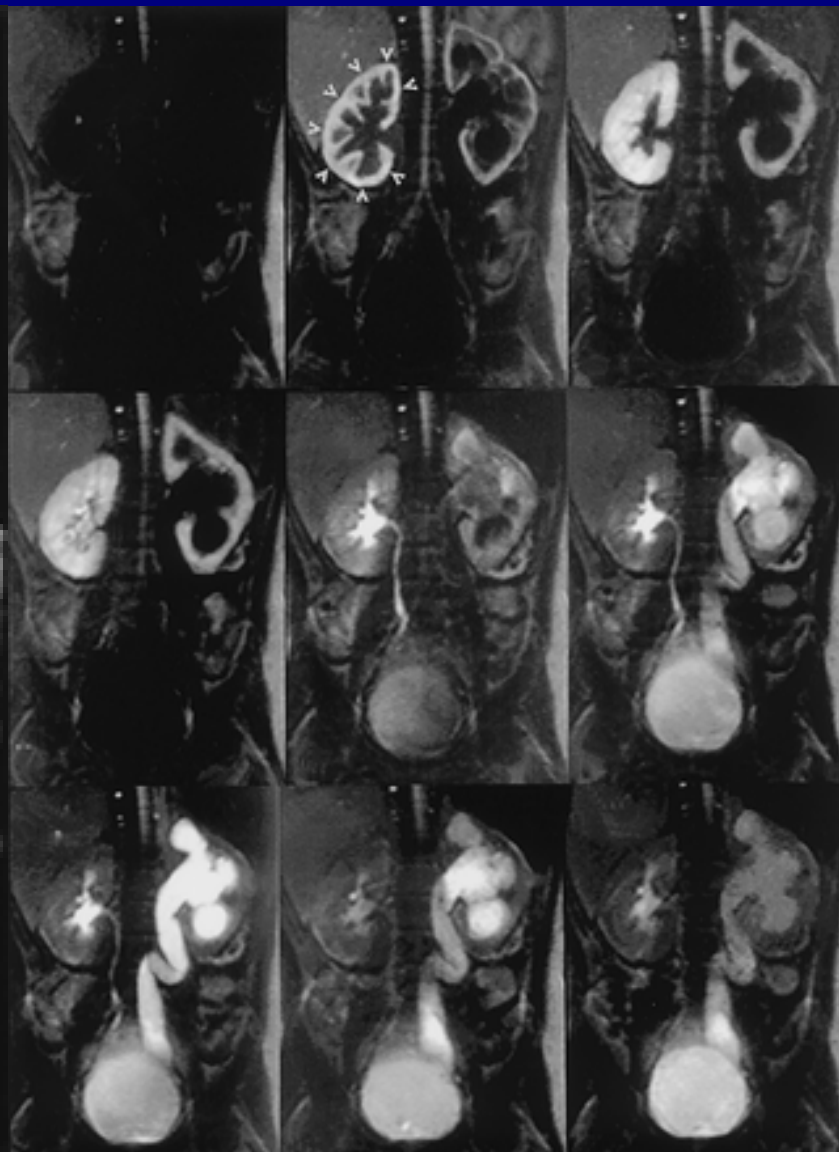
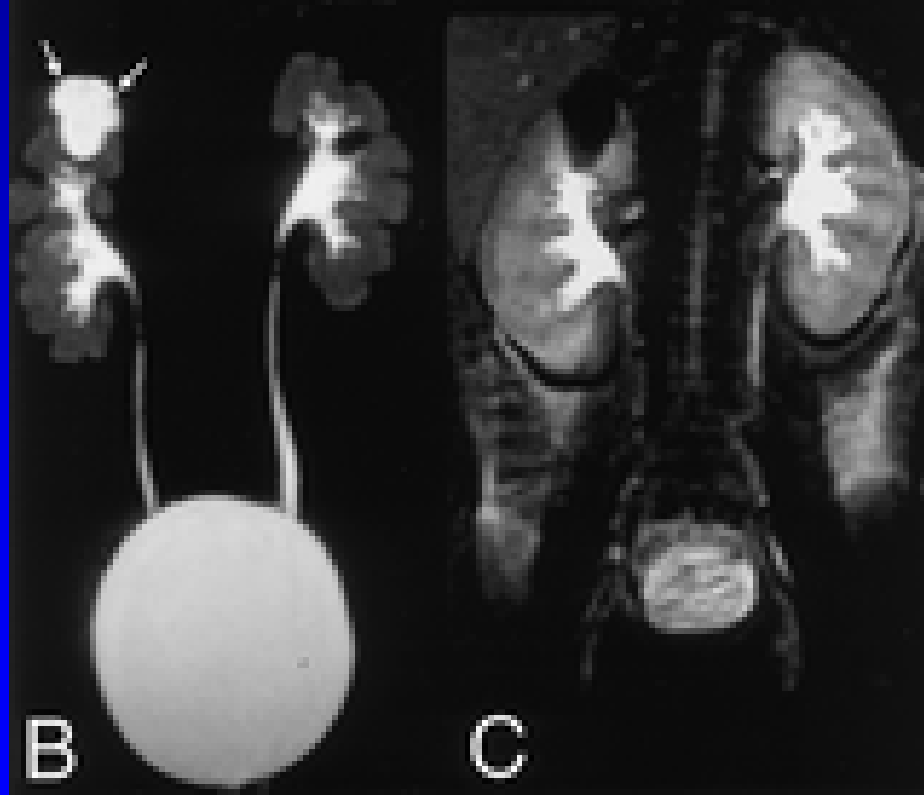
L 43  
P 26  
S 83

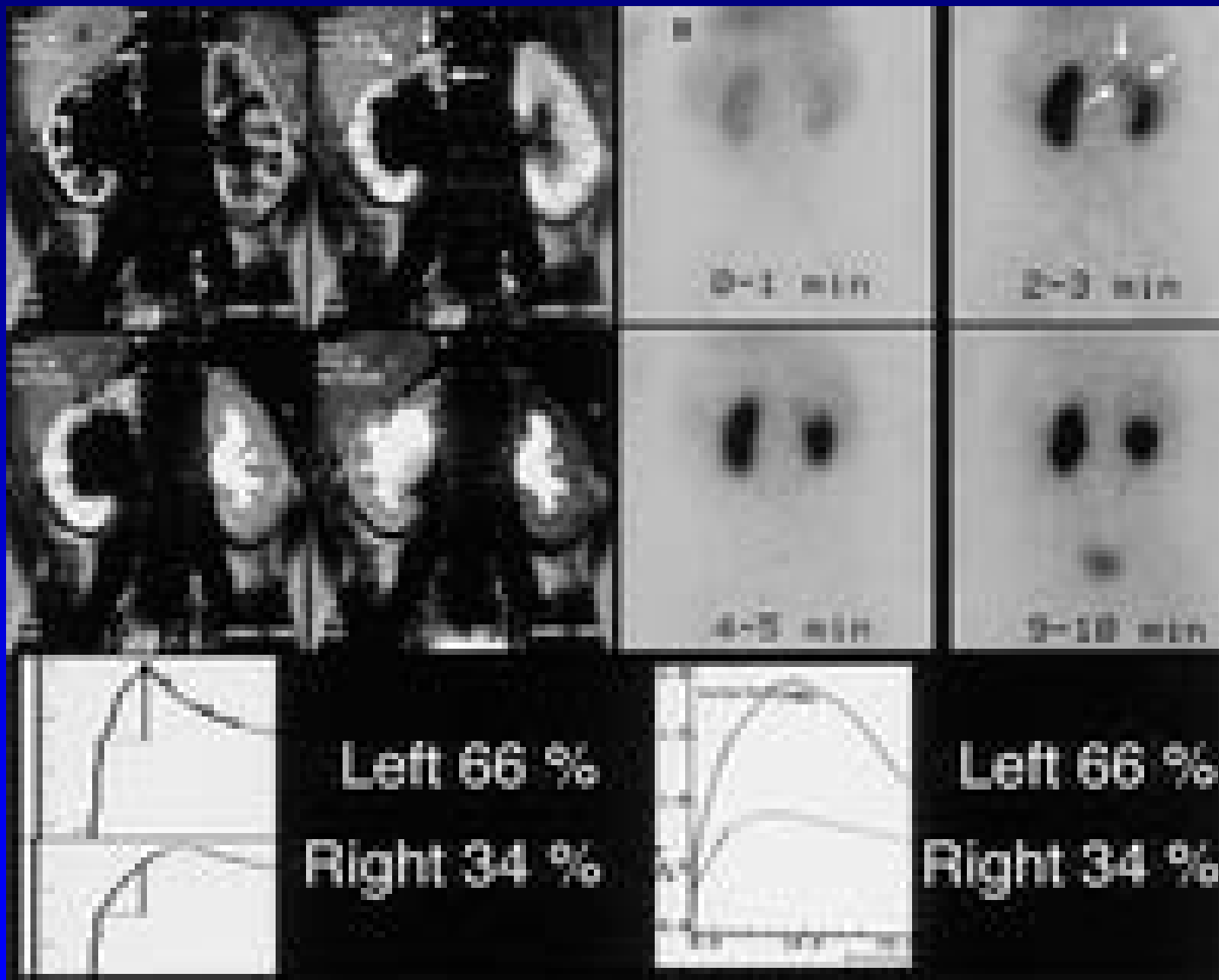


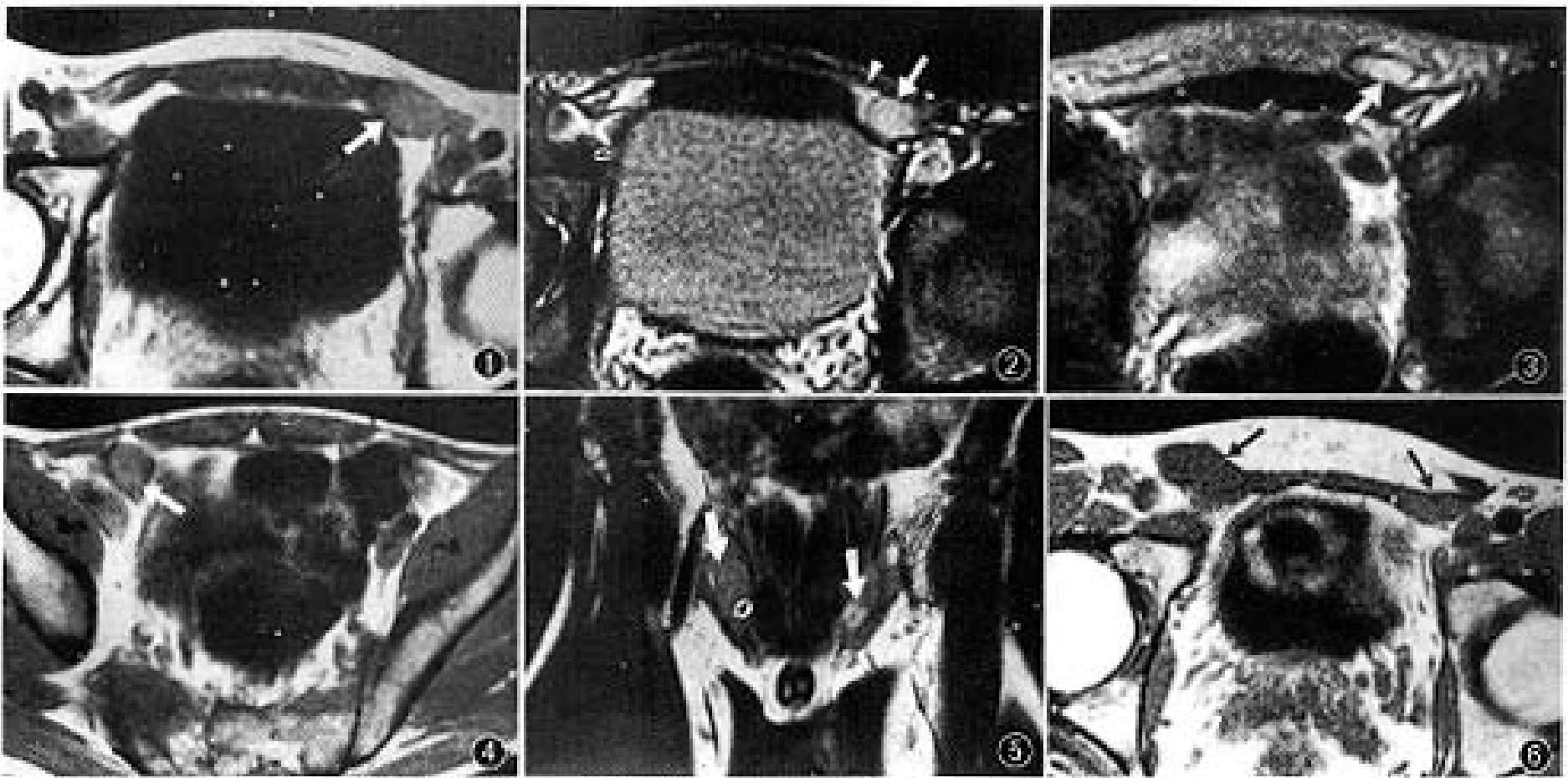




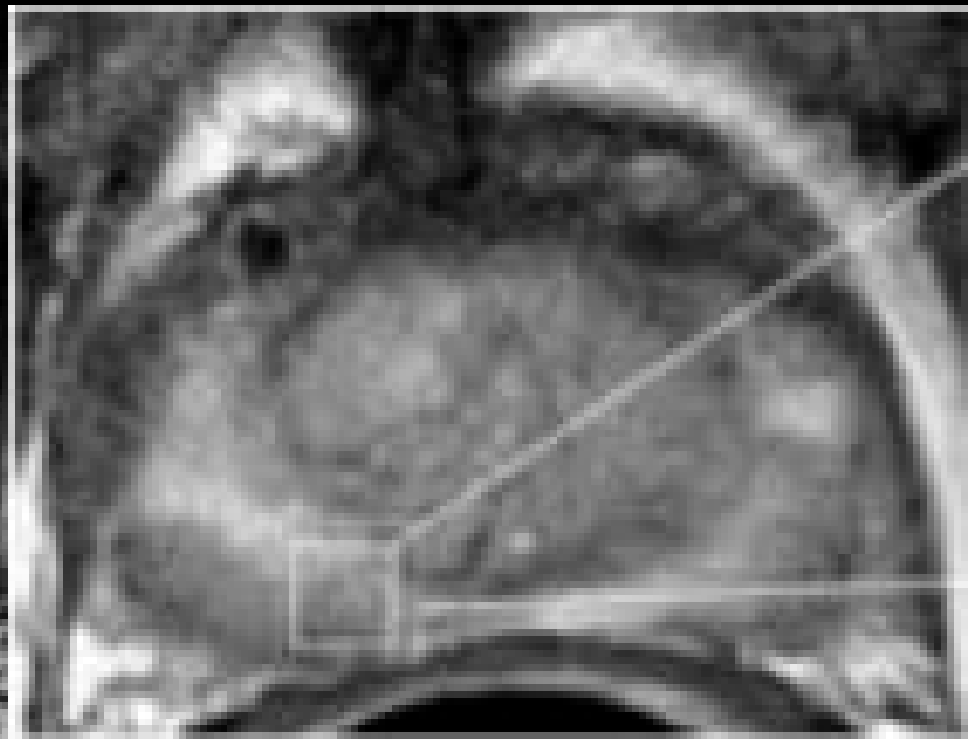






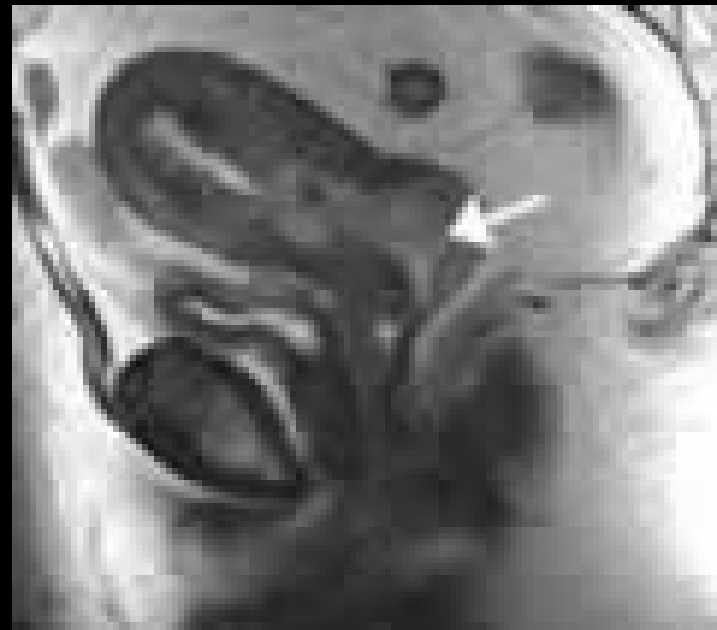


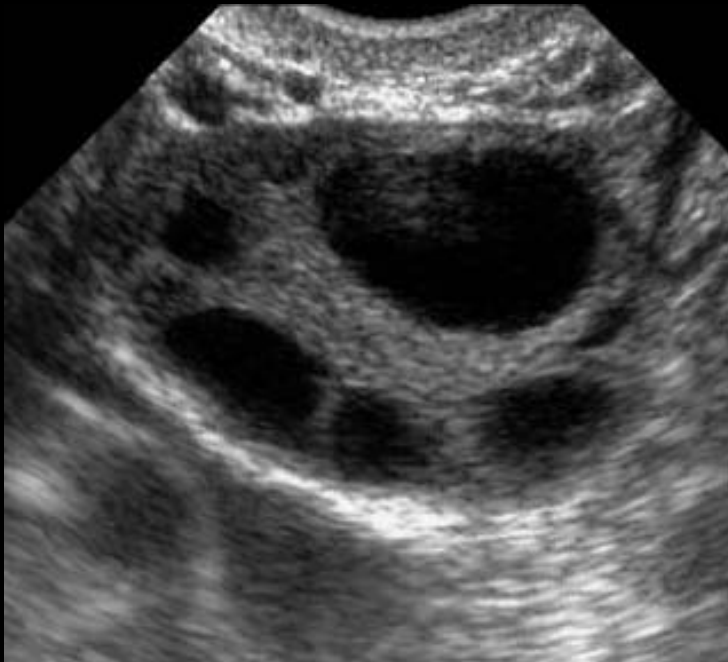
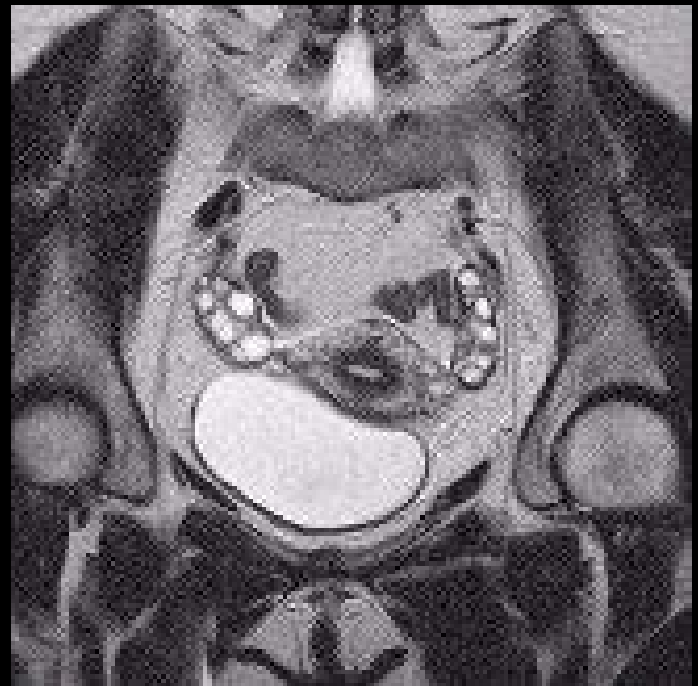
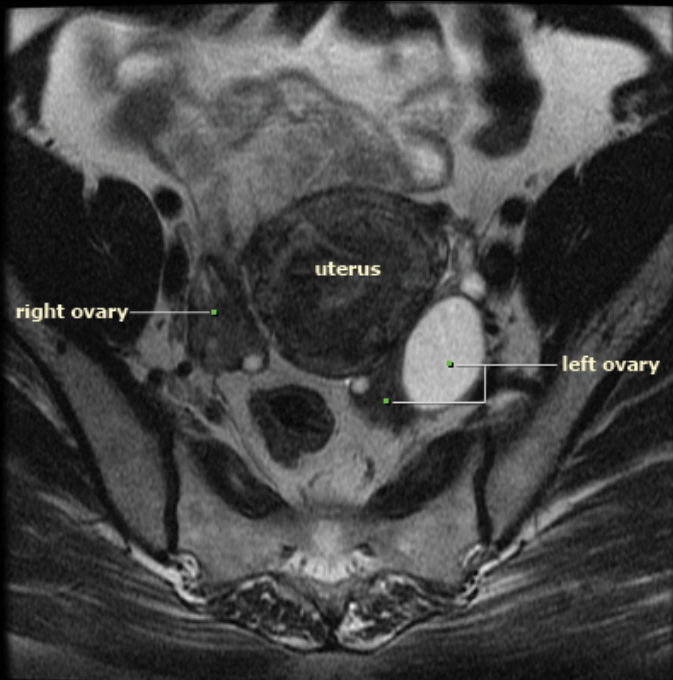
Criptorquidia

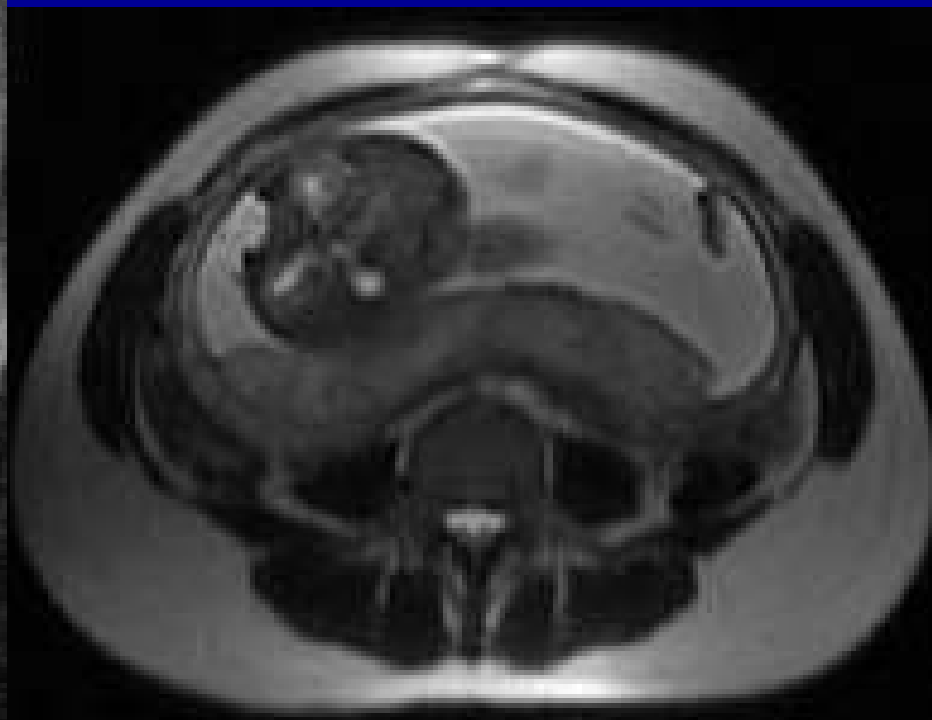




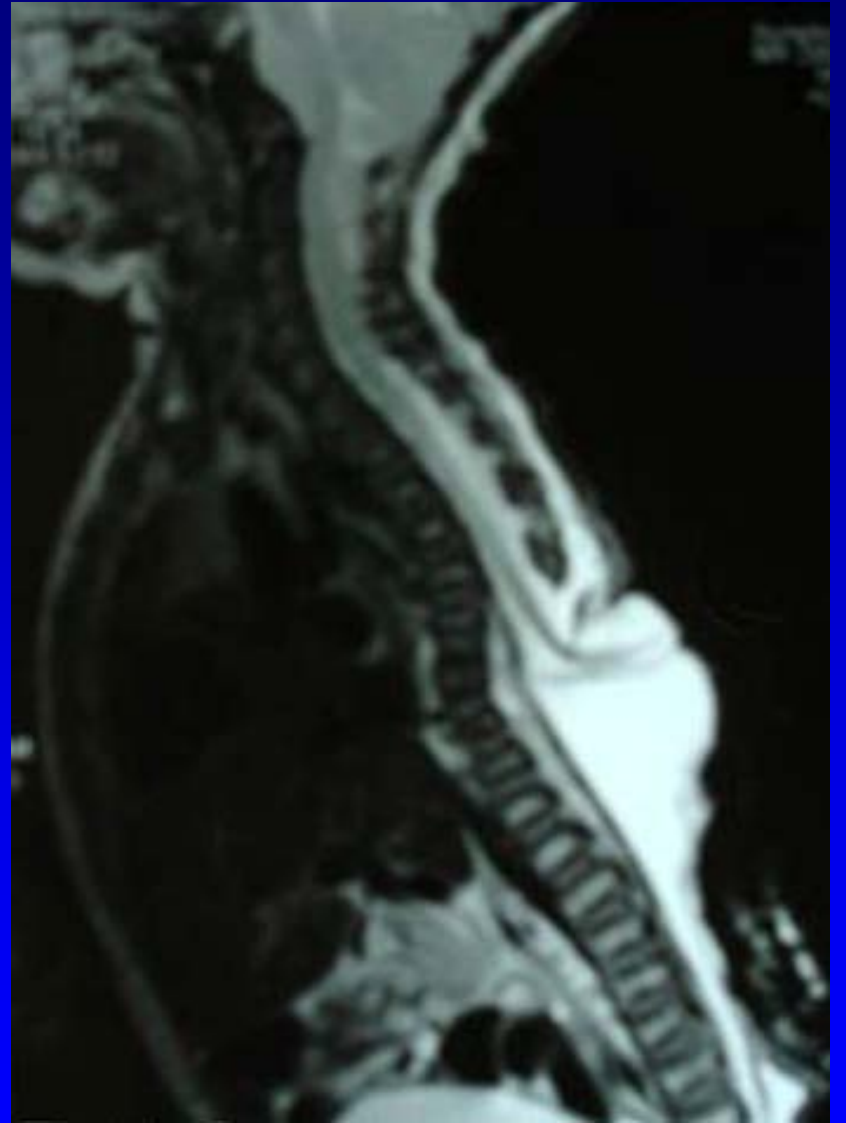
H











# Vascular

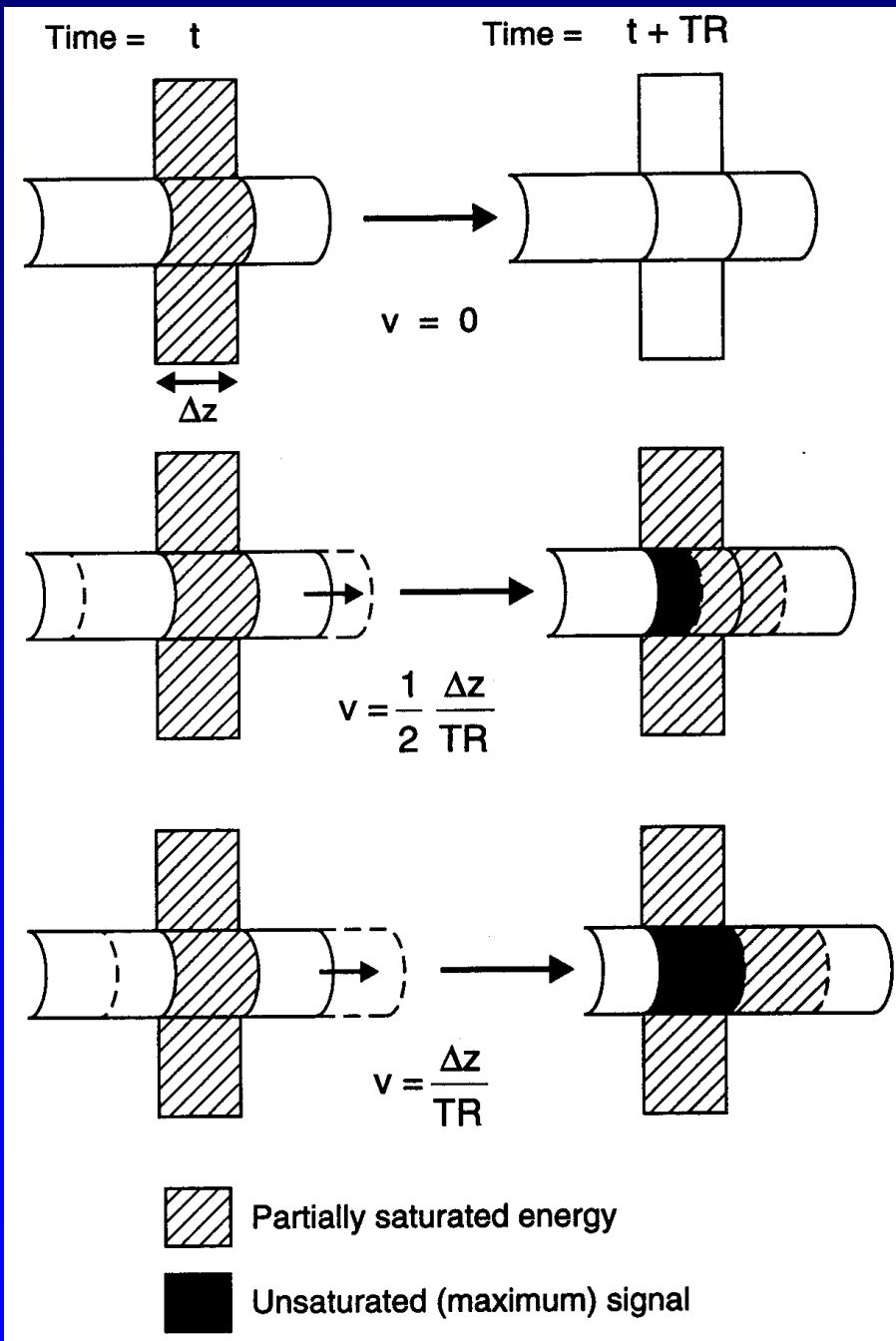
---

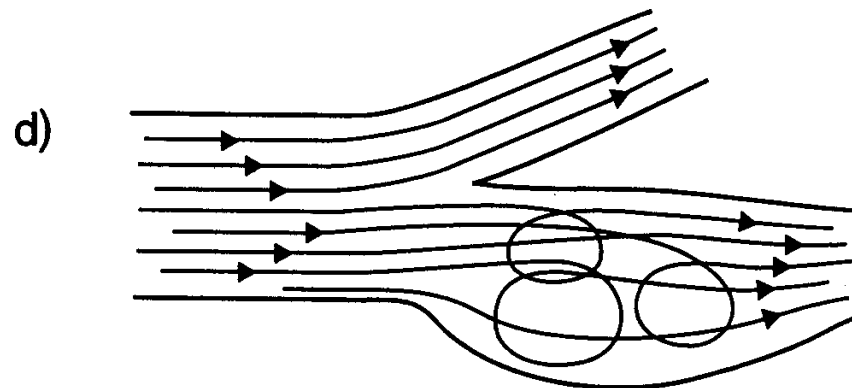
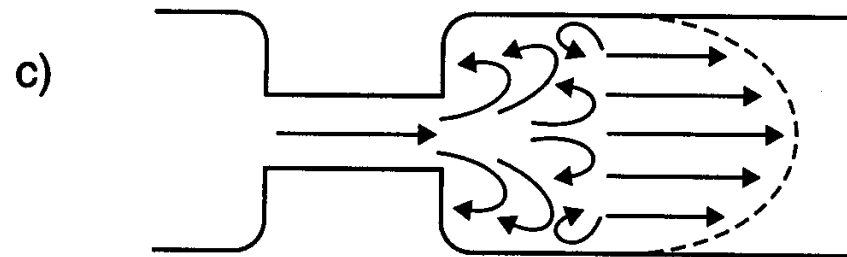
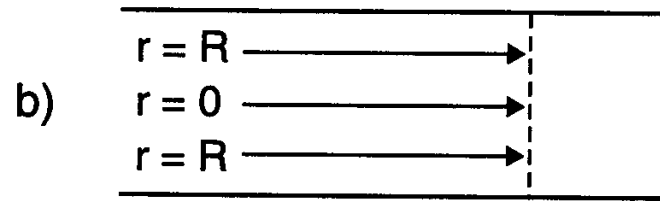
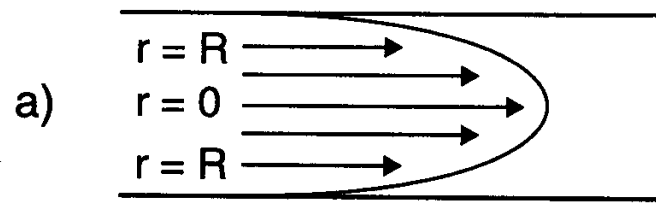
- Angiografia
  - Sem contraste
  - Com contraste
- Quantificação de fluxo
- Caracterização de placas (aterosclerose)

# Técnicas de Angio-RM

---

- Convencionais
  - "Time of flight", "inflow"
    - 2D
    - 3D
  - "Phase contrast"
    - 2D
    - 3D
  - 2D (mais rápidas) x 3D (melhor relação sinal-ruído)





Signa 1.5T SYS#GEMSON  
Ex: 7566  
Se: 382  
Im: 1  
PJN Cor 0.0

S 56

InCor

15 Aug 01  
01:07:50 PM  
Mag = 1.0  
FL:  
ROT:

TH: 1:1931  
PA: -90/0/0

R  
6  
3

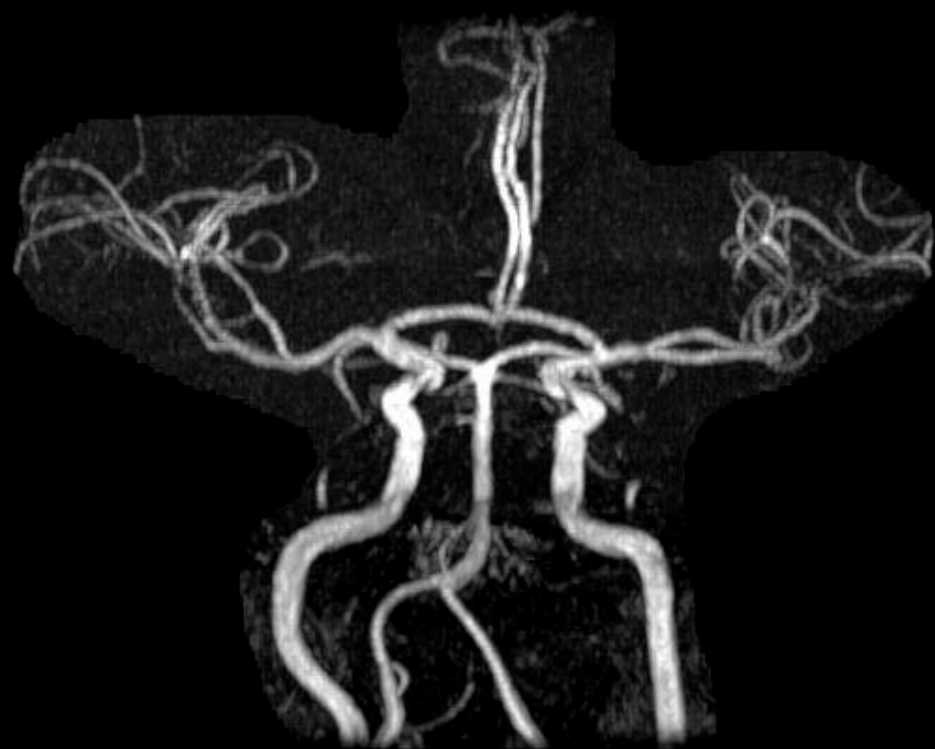
L  
6  
5

TOF/SPGR/60  
TR:34  
TE:4.7/Fr  
EC:1/1 16kHz

Surface  
FOV:13x13  
1.5thk/0.0sp/I  
121/11:54  
256X224/1.00 NEX

T 72

W = 1763 L = 1051  
v?



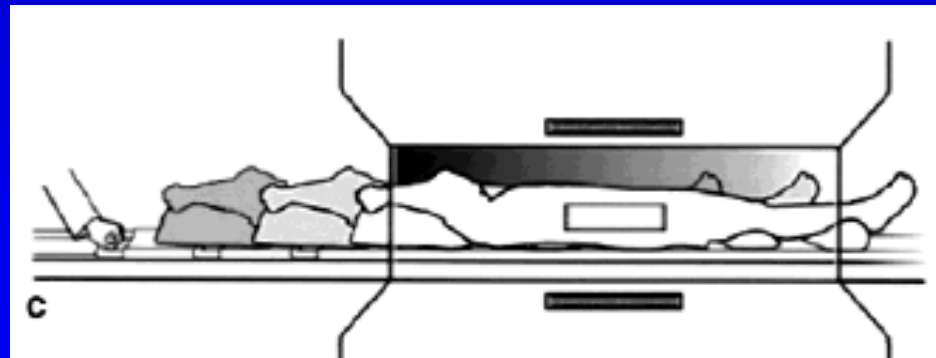
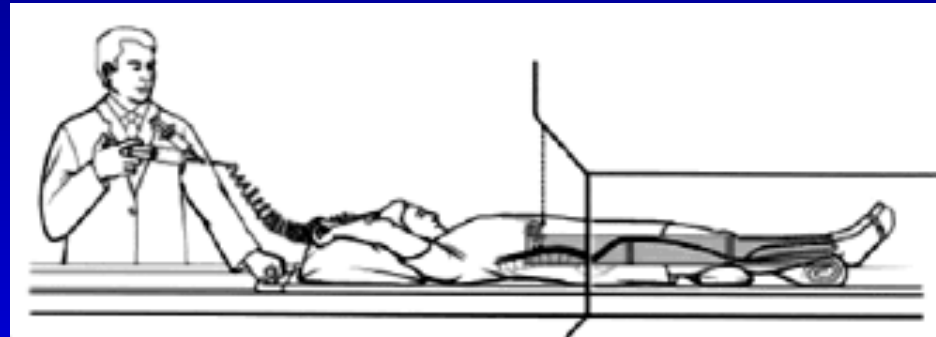
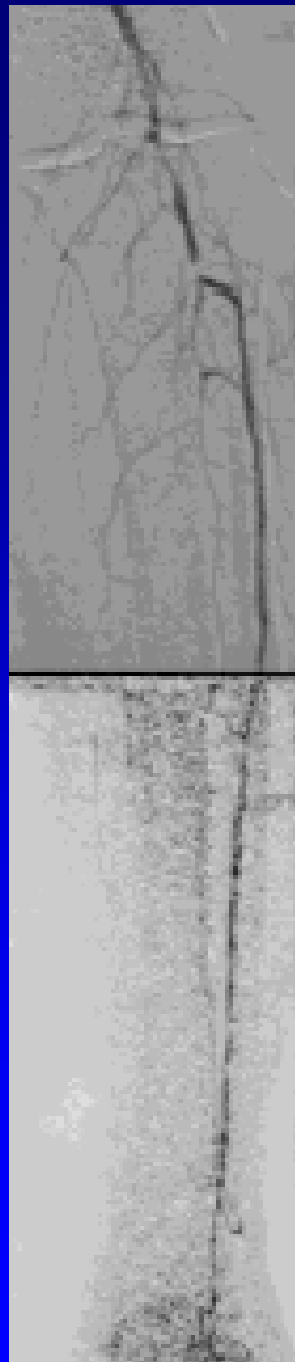
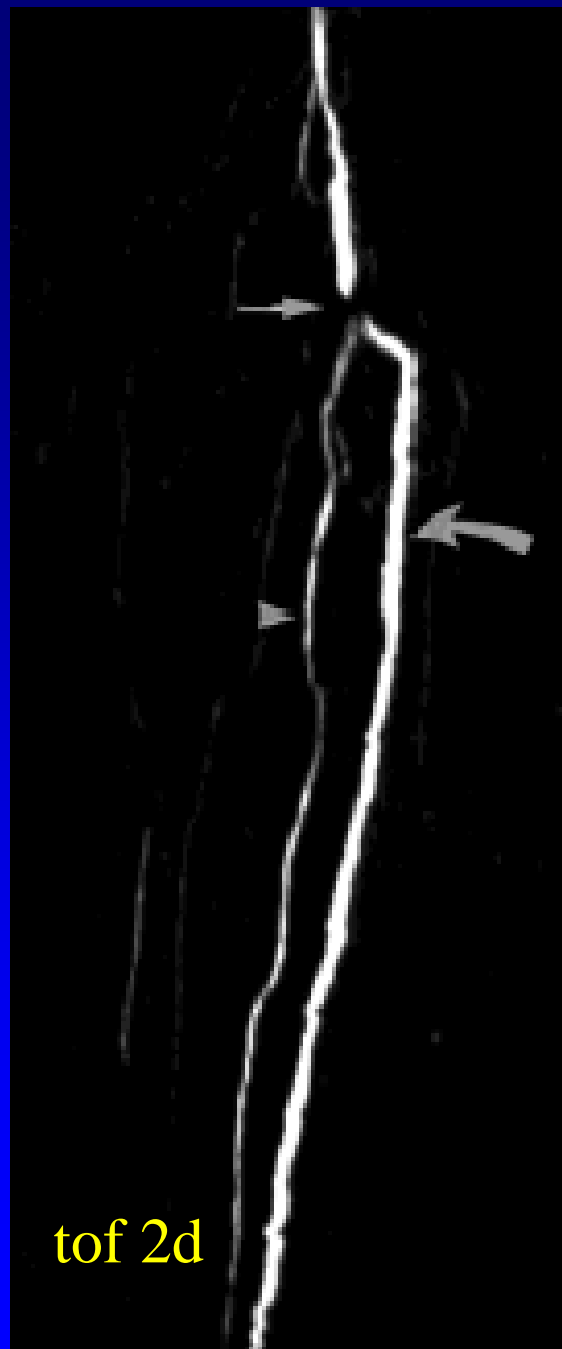
# ARM com contraste

---

- Contraste paramagnético (Gd)
  - Melhora qualidade de imagem
  - Aumenta relação sinal-ruído
  - Elimina artefatos de fluxo
- Sequência 3D
  - Artefatos de movimento diluídos no volume
  - Melhor relação sinal-ruído
  - Cortes mais finos e TR mais curtos
  - Coleta de volume 3D em apnéia de 20-40 s



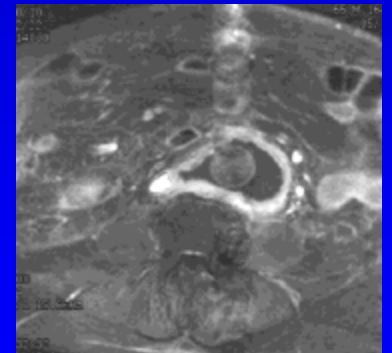
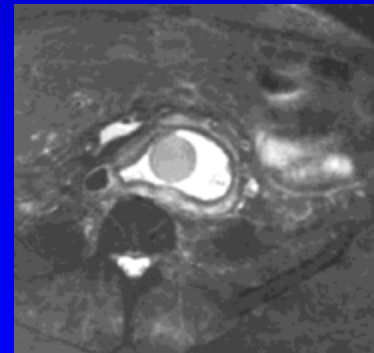
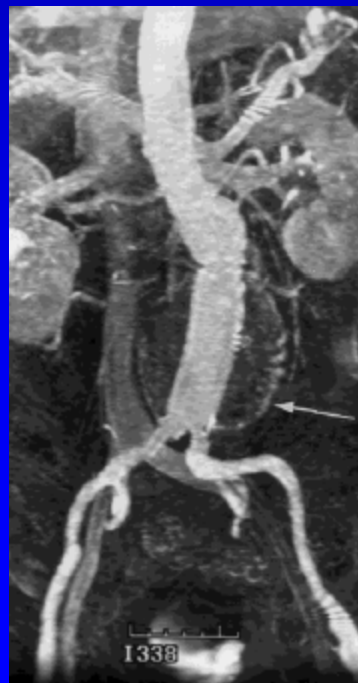
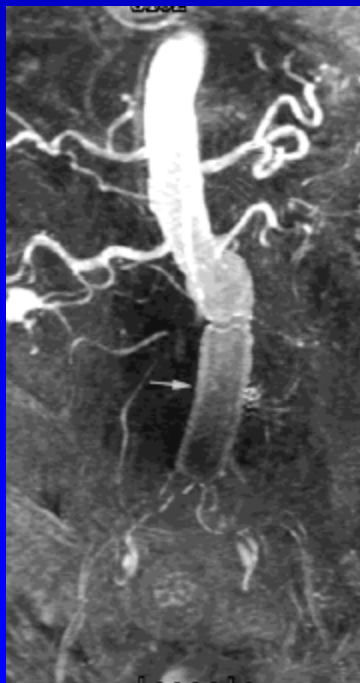
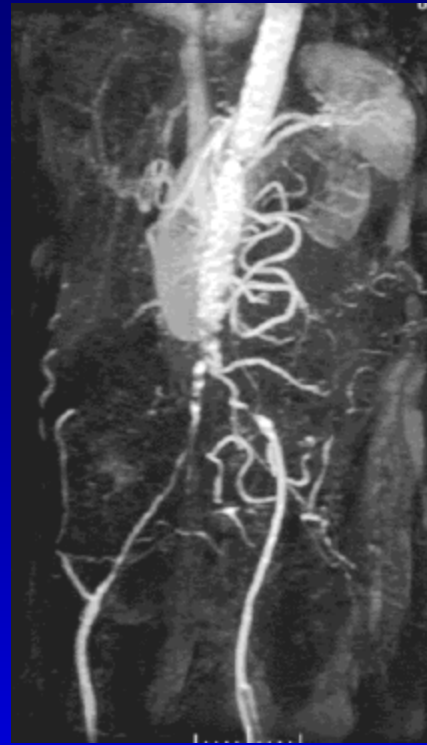
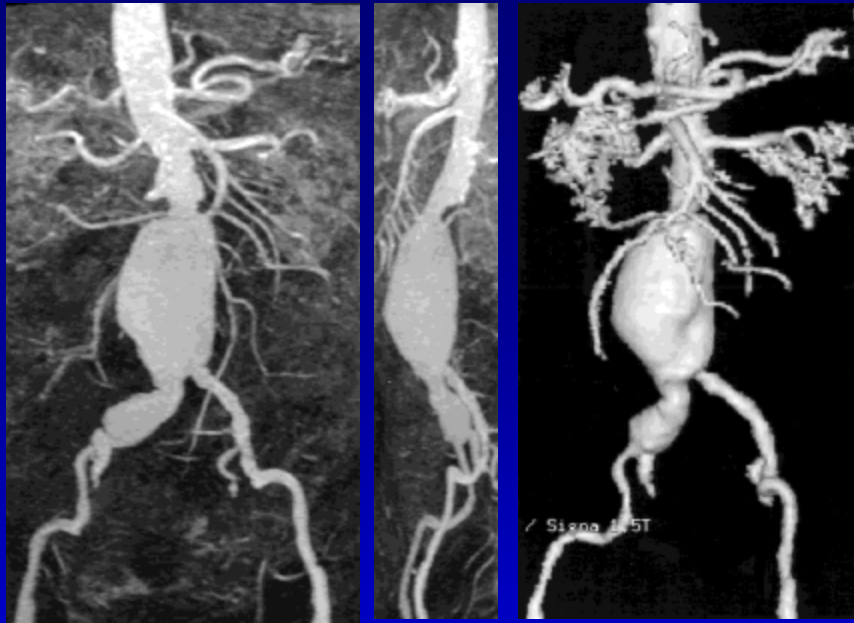




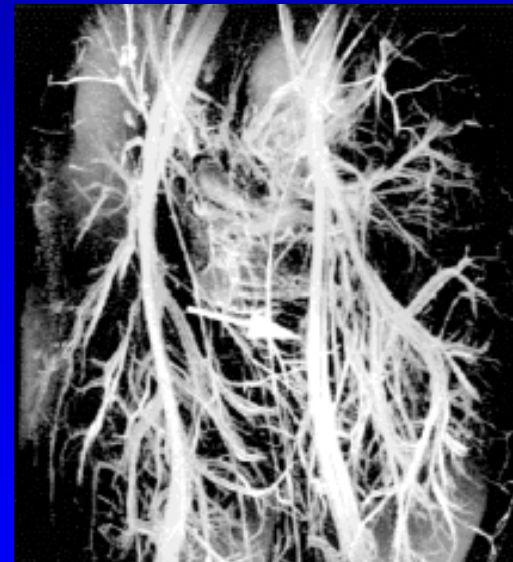
Grist, JMRI 11:32, 2000



Grist, JMRI 11:32, 2000



Grist, JMRI 11:32, 2000



Grist, JMRI 11:32, 2000

Signa 1.5T SYS#GEMSON  
Ex: 6884  
Se: 724  
Im: 2  
PJN 0Cor 0.0+C

Stn:0/0 TH: 0:276  
PA: 0/0/0

R  
2  
1  
2

RM :3dfgre/45  
TR:5.5  
TE:1/1Fr  
EC:1/1 31.2kHz

Body  
FOV:42x42  
4.0thk/0.0sp  
30/00:23  
256X128/1.00 NEX  
VB

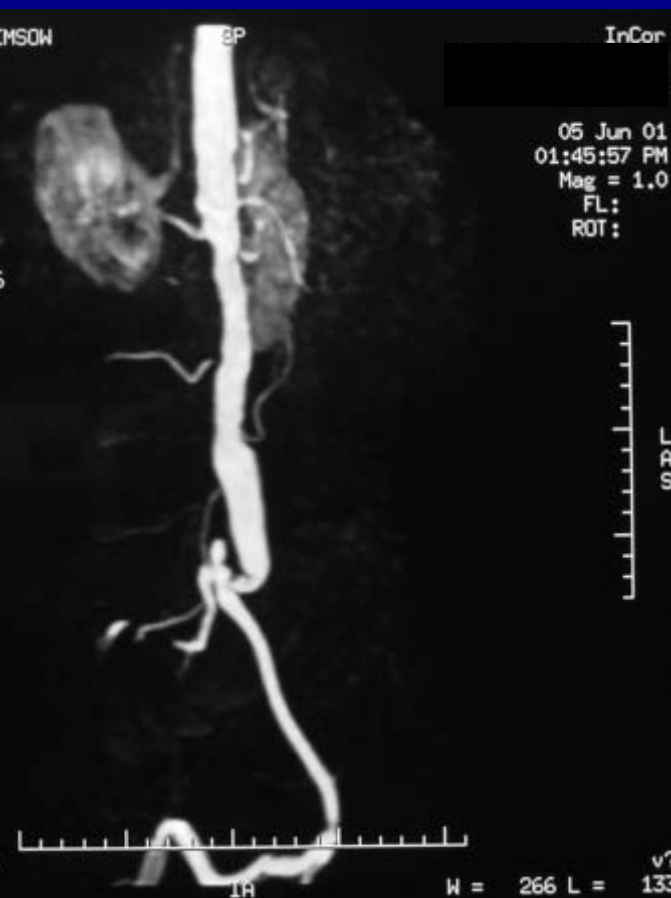


Signa 1.5T SYS#GEMSON  
Ex: 6884  
Se: 724  
Im: 10  
PJN 0Sag 0.0+C

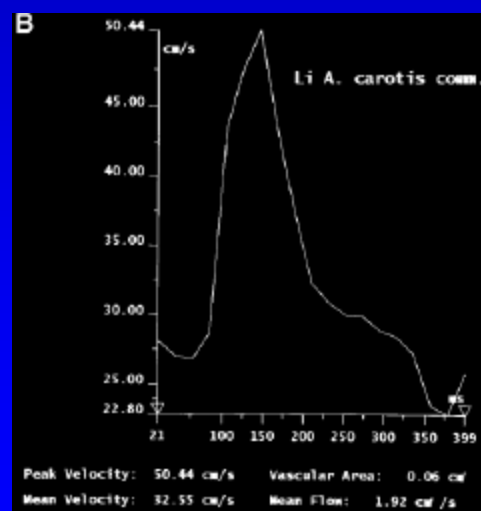
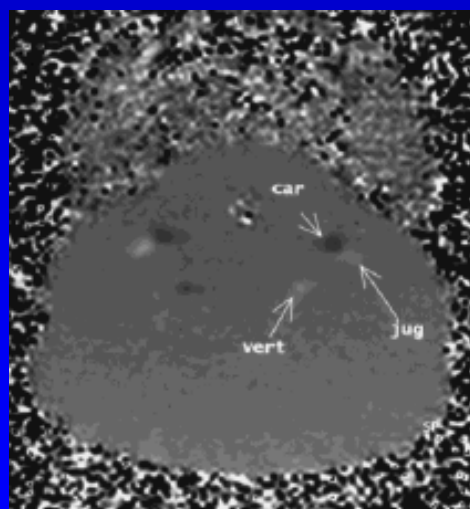
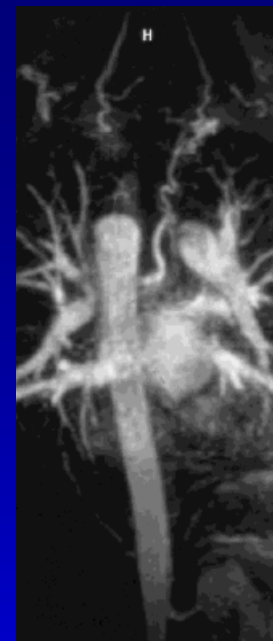
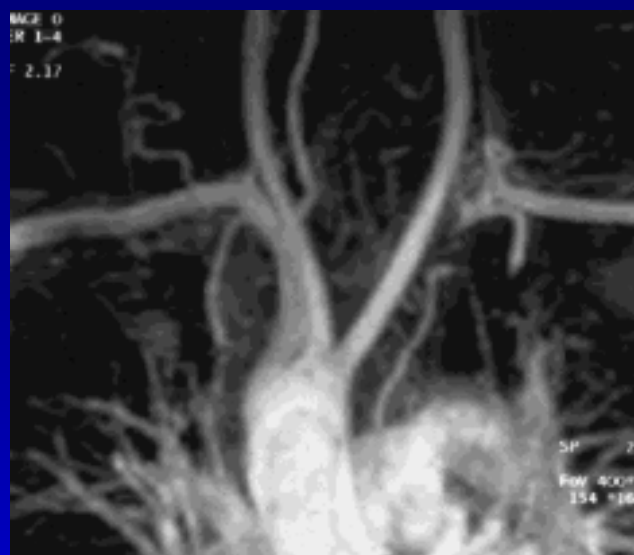
Stn:0/0 TH: 0:276  
PA: 0/60/0

RM :3dfgre/45  
TR:5.5  
TE:1/1Fr  
EC:1/1 31.2kHz

Body  
FOV:42x42  
4.0thk/0.0sp  
30/00:23  
256X128/1.00 NEX  
VB

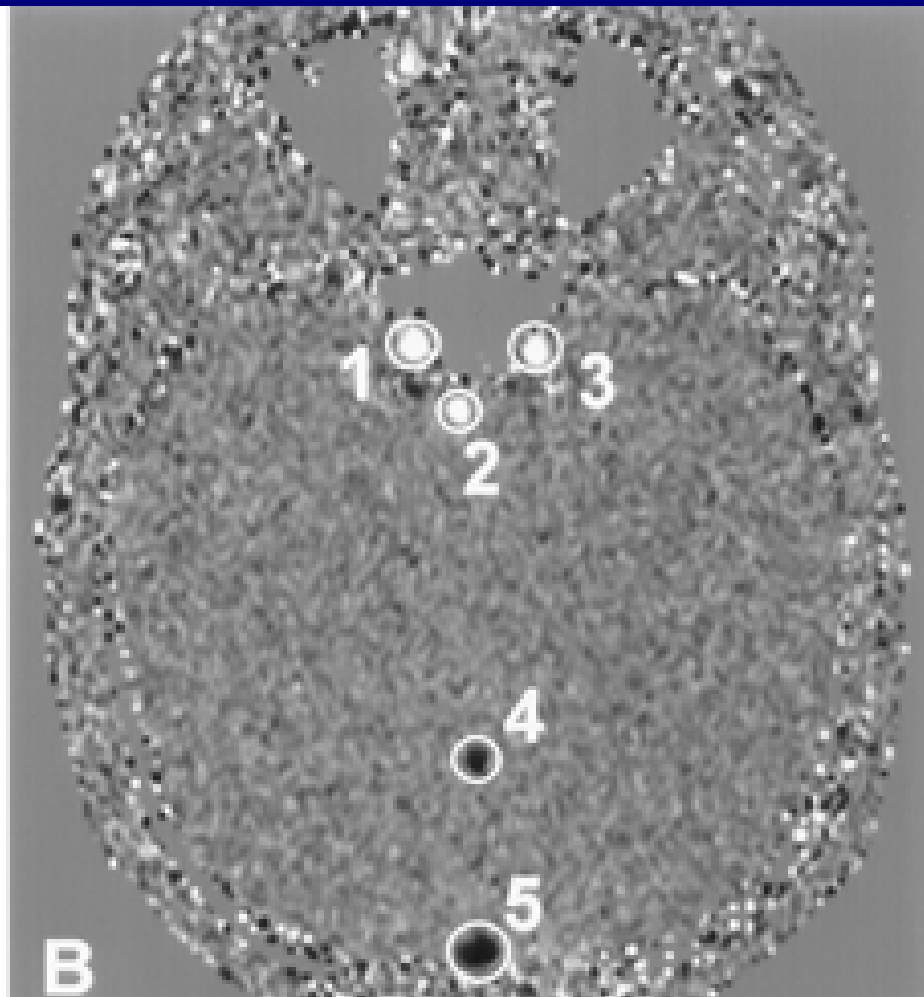
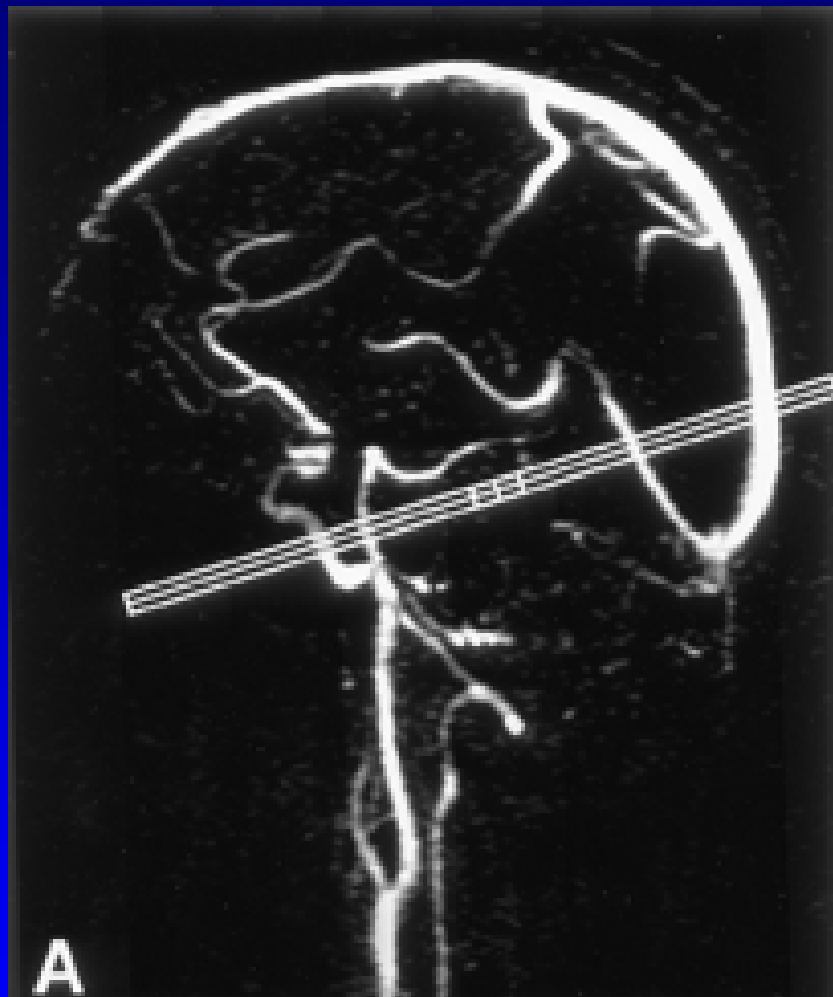






Sd roubo subclávia

Grimberge et al, JMRI 12:339, 2000



Boorder et al. *Stroke*. 2004;35:1350



Navg  
Ex: 4701  
Se: 4 +c  
Smooth B4 v 45,0  
+ 138,5 mm

SPL

INCOR  
FELIX B. CAVALCANTI  
M 77 553075569K  
Sep 22 2000

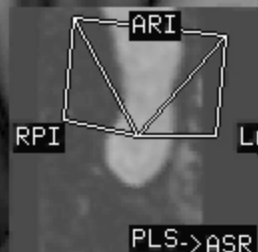
35,0 x

285/199

L  
B  
S

R  
P  
I

IAR

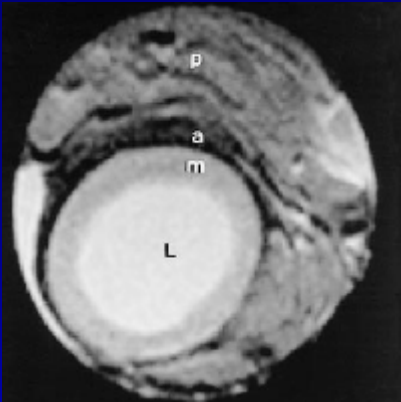


# Classificação das placas da AHA adaptada para RM

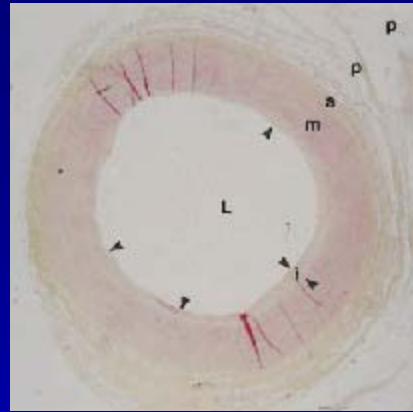
---

<b>Tipo</b>	<b>Descrição</b>
0	Sem espessamento da íntima
I-II	Placa fina (<10% estenose) sem calcificação
III	Placa com pequenos centros lipídicos, sem calcificação
IV-Va	Placa com centro lipídico grande, coberta por cápsula fibrosa, calcificações pequenas
Vb	Placa com centro lipídico ou tecido fibrótico, com calcificações grandes
Vc	Placa com tecido fibroso, sem centro lipídico, calcificações pequenas
VIb-c	Placa com hemorragia ou trombose

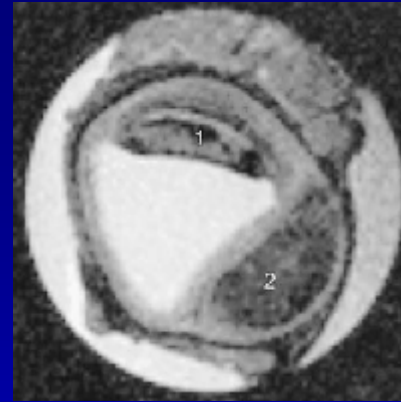
Serfaty et al., Radiology 219:403, 2001



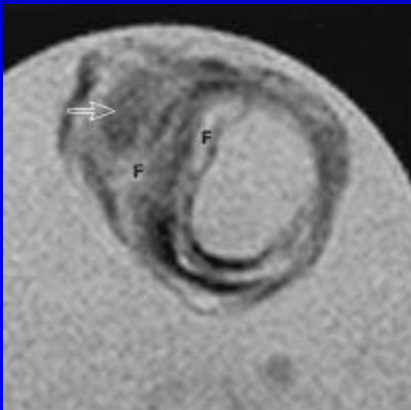
SE T2 2000/50



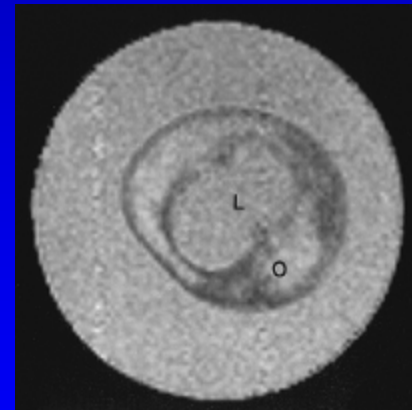
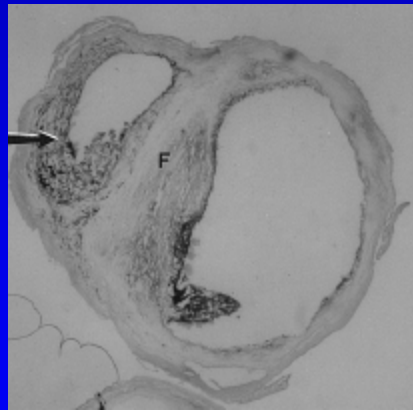
Tipo 0



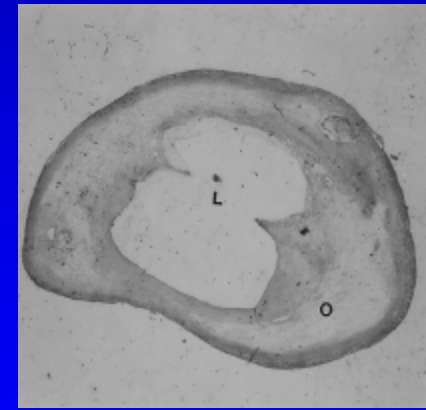
1 fibrocálcica, Vb  
2 IV-Va

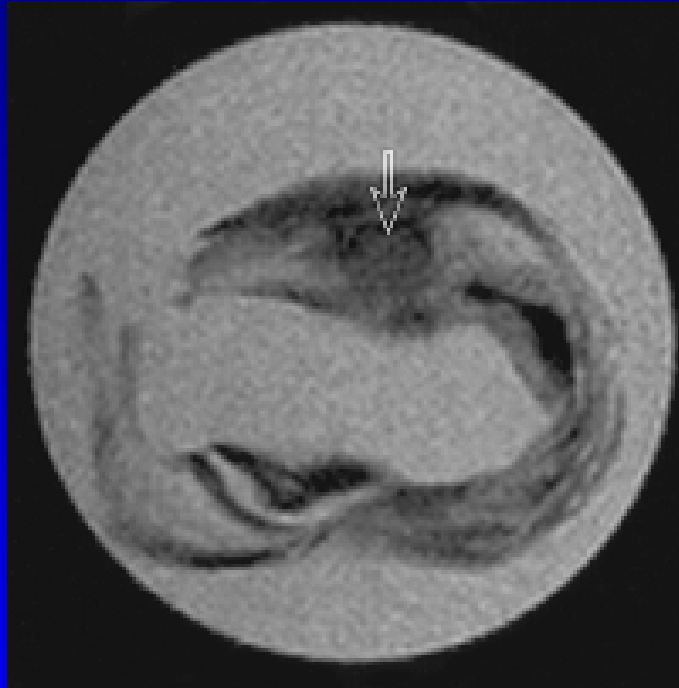


IV-Va

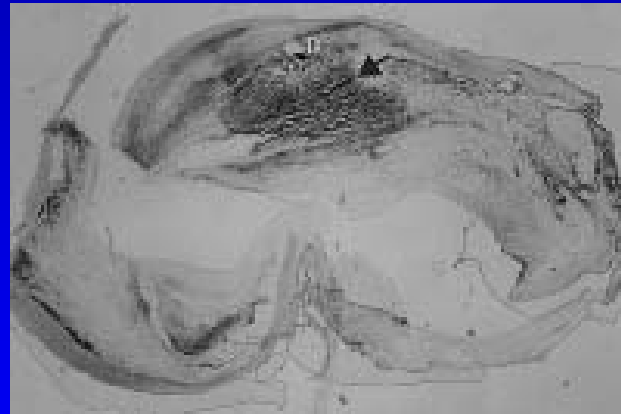
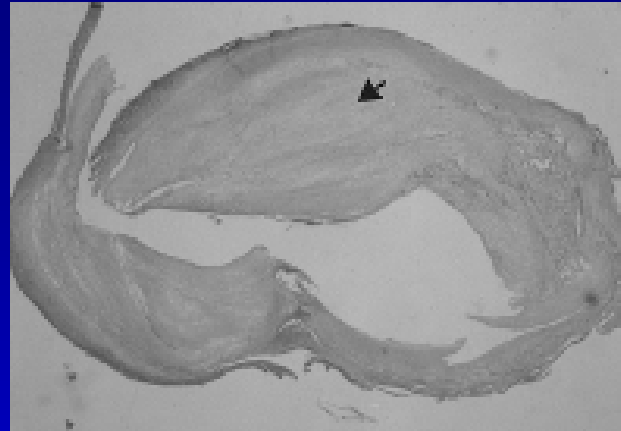


Vc (necrose)

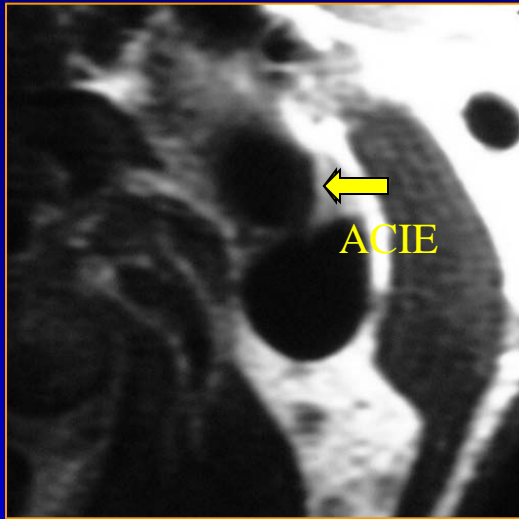




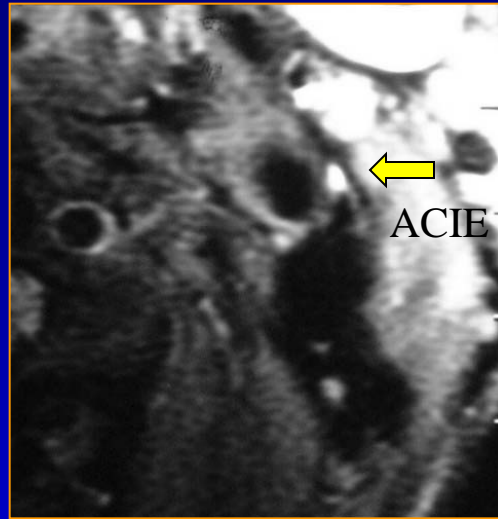
SE T2 2000/50  
seta-centro lipídico



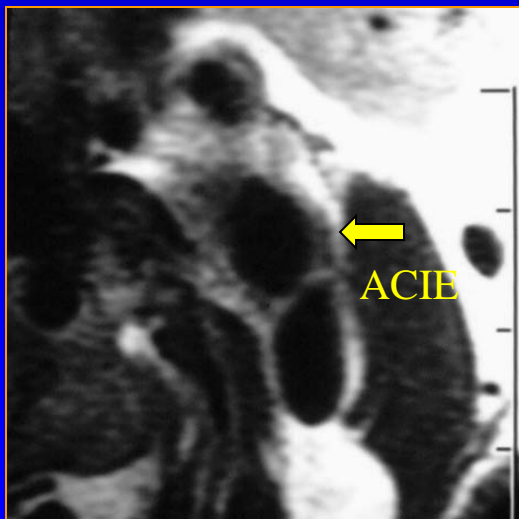
IV-Va



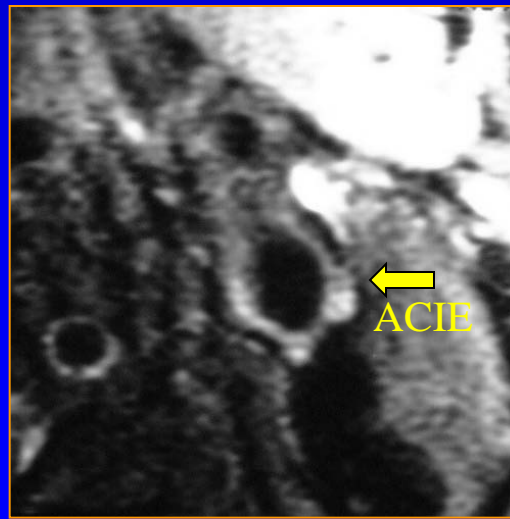
T1 - BB



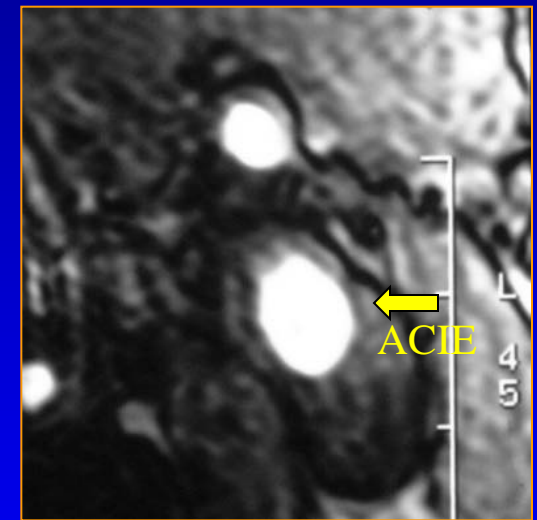
T1 - FSBB



T2 - BB



T2 - FSBB

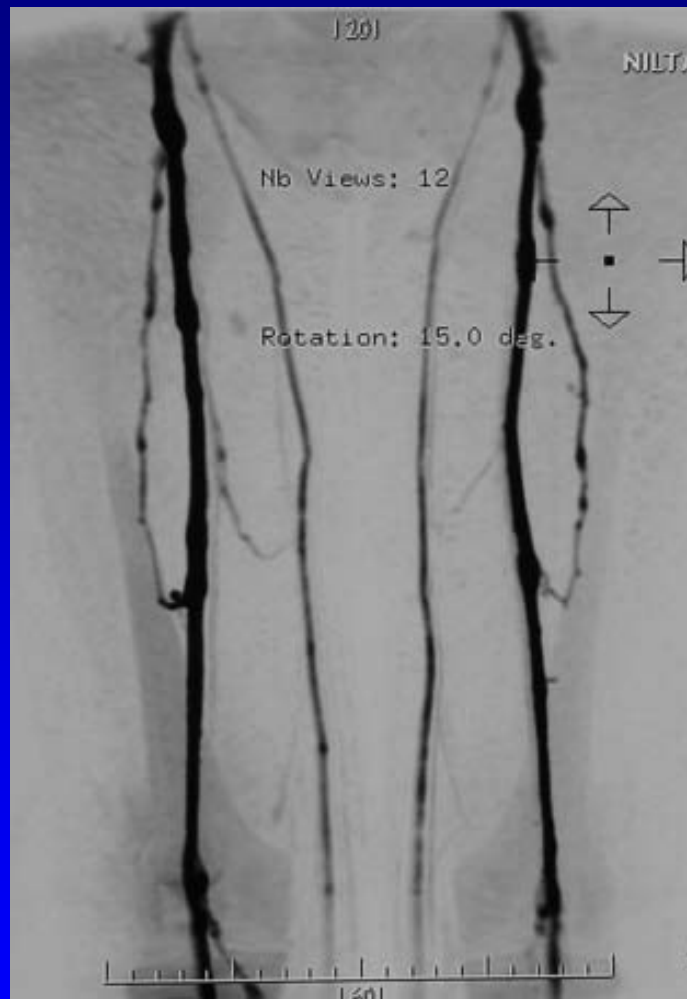


3D TOF

# Flebo-RM

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- Indicação: TEP
- 1 ml Gd / 20 ml sol. total - injetar cerca de 60 ml em cada perna
- 3 segmentos, cranial p/ caudal
- Smart prep (GE) / Bolus Trak (Philips) na VCI

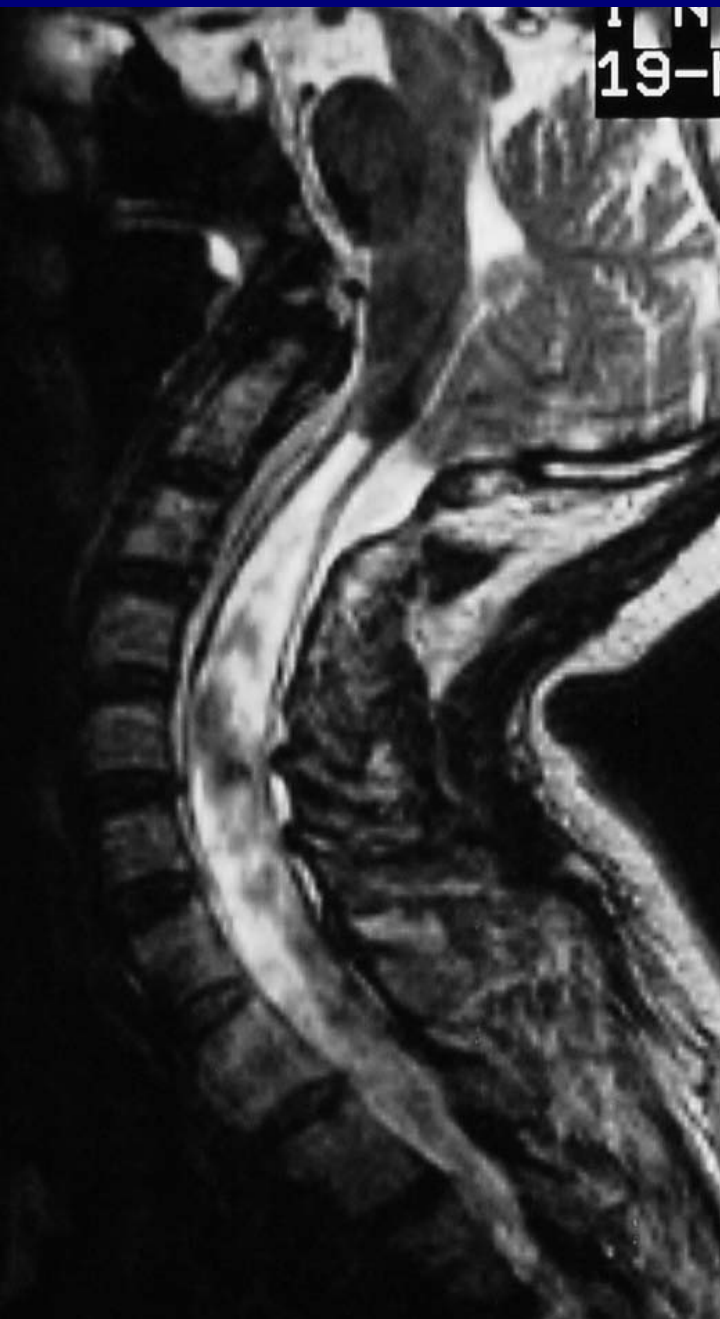


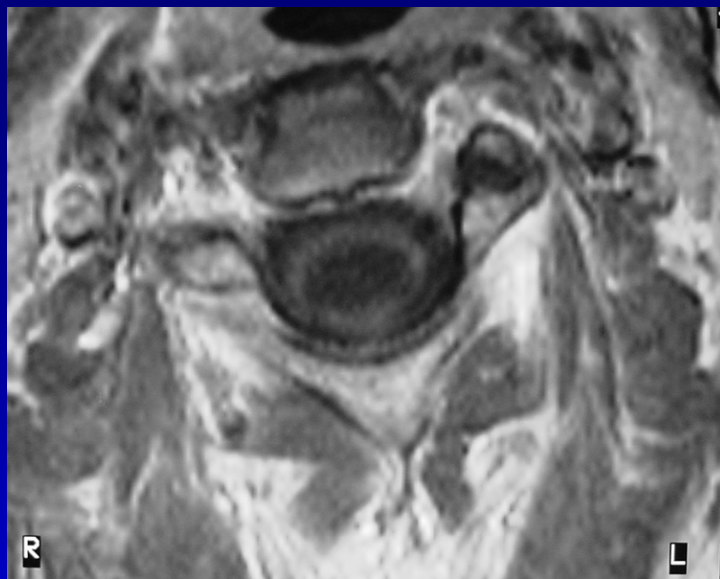
# Neuro

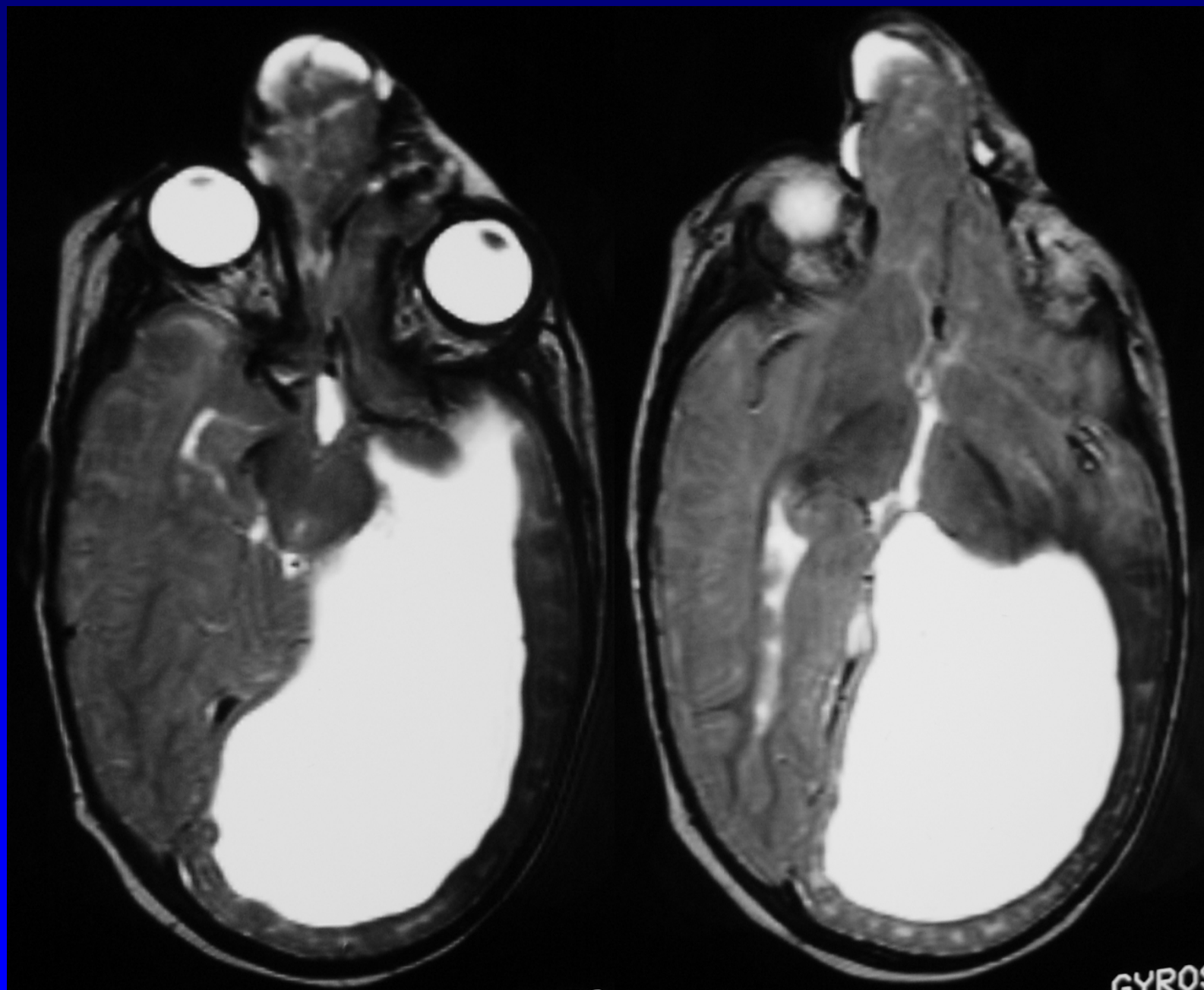
---

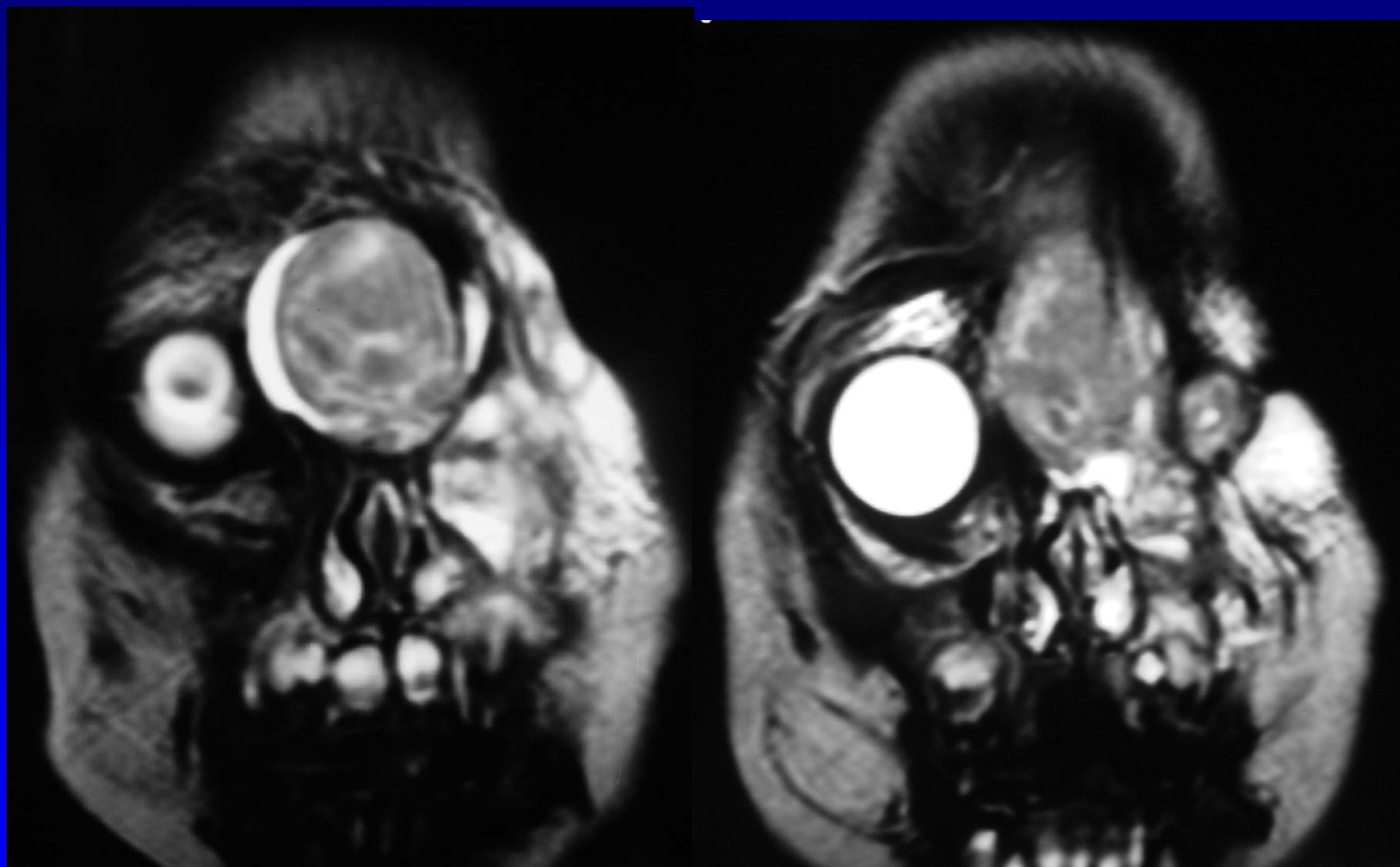
- RM mais sensível que TC
- Difusão / perfusão
- Espectroscopia
- RM funcional
- Angiografia



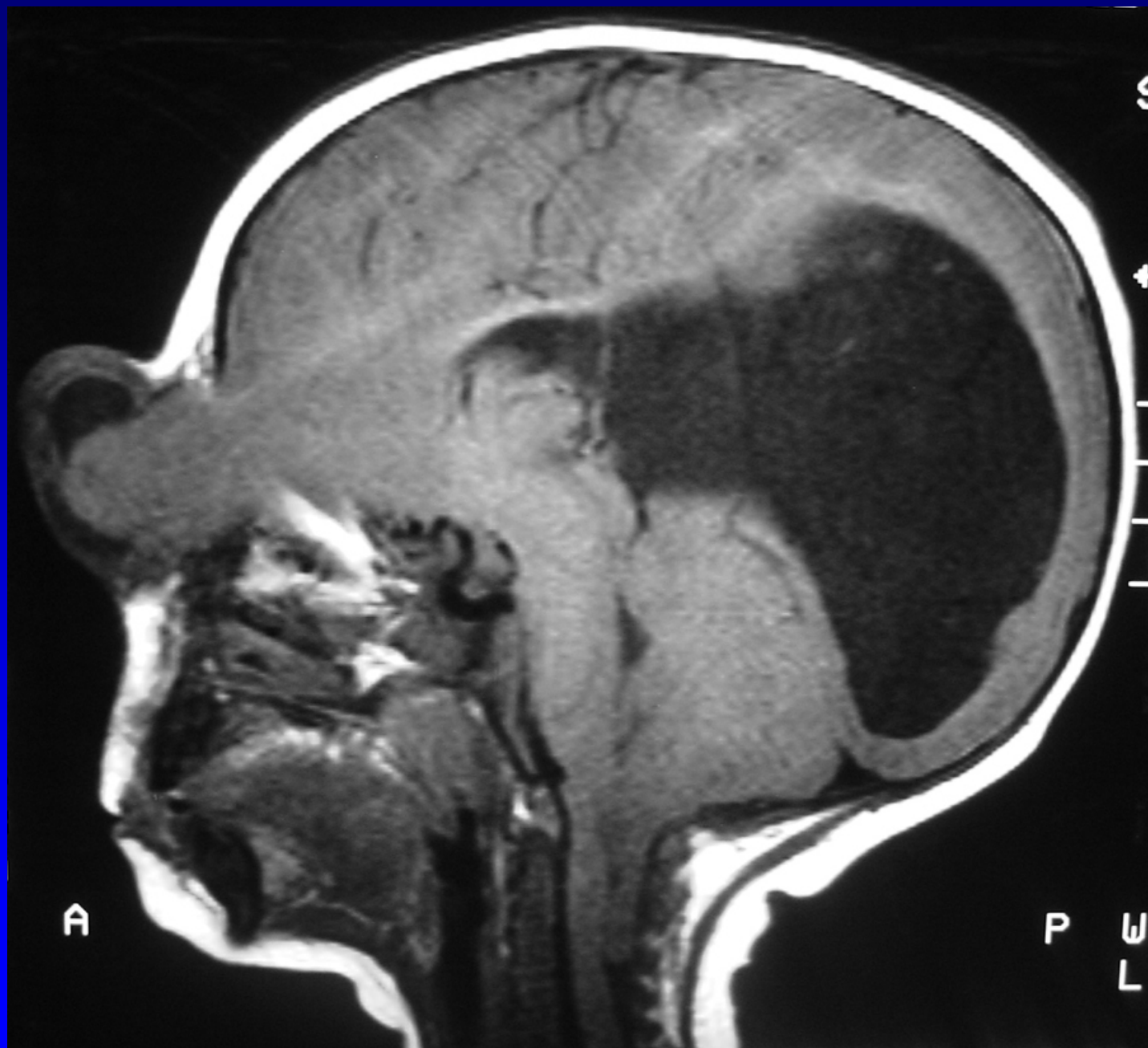












# Tumores

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- OMS – primários e metastáticos
- Primários – 9 grupos; mais comuns nos adultos – neuroepiteliais (astrocitomas, oligodendrogliomas, tumores ependimários, tumores do plexo coróide)
- Adultos – metástases > primários
- Crianças – astrocitomas de baixo grau – mais comuns

# M54, GBM



# Meningeoma



\*\*\*  
I0.6  
DFOV 20.0 cm

AI

Nov 26 2001

Ex: 1926

Se: 6

Im: 5

R 61.6mm

P 78.9mm

S 1.5mm

6

R  
9  
5

L  
1  
0  
4

rank = 5 / 20  
time = 0 sec

PS

auto W = 299 L = 240



\*\*\*  
I0.6  
DFOV 20.0 cm

AI

Nov 26 2001

Ex: 1926

Se: 7

Im: 5+c

R 65.9mm

P 77.3mm

S 1.5mm

18

R  
9  
2

L  
1  
0  
8

rank = 5 / 20  
time = 0??

PS

auto W = 482 L = 314



\*\*\*  
I0.6  
DFOV 20.0 cm

AI

Nov 26 2001

Ex: 1926

Se: 4

Im: 5

L 73.8mm

P 66.6mm

S 1.2mm

21

R  
9  
6

L  
1  
0  
4

rank = 5 / 20  
time = 0 sec

PS

auto W = 395 L = 281



\*\*\*  
IO.6  
DFOV 20.0 cm

AI

Nov 26 2001

Ex: 1926

Se: 5

Im: 5

R 44.2mm

P 74.5mm

S 1.4mm

18

R  
9  
4

L  
1  
0  
6

rank = 15 / 40  
time = 0??

PS

auto W = 698 L = 411



\*\*\*  
P33.0  
DFOV 20.0 cm

SA

Nov 26 2001

Ex: 1926

Se: 9

Im: 6+c

R 68.9mm

P 34.3mm

I 36.8mm

19

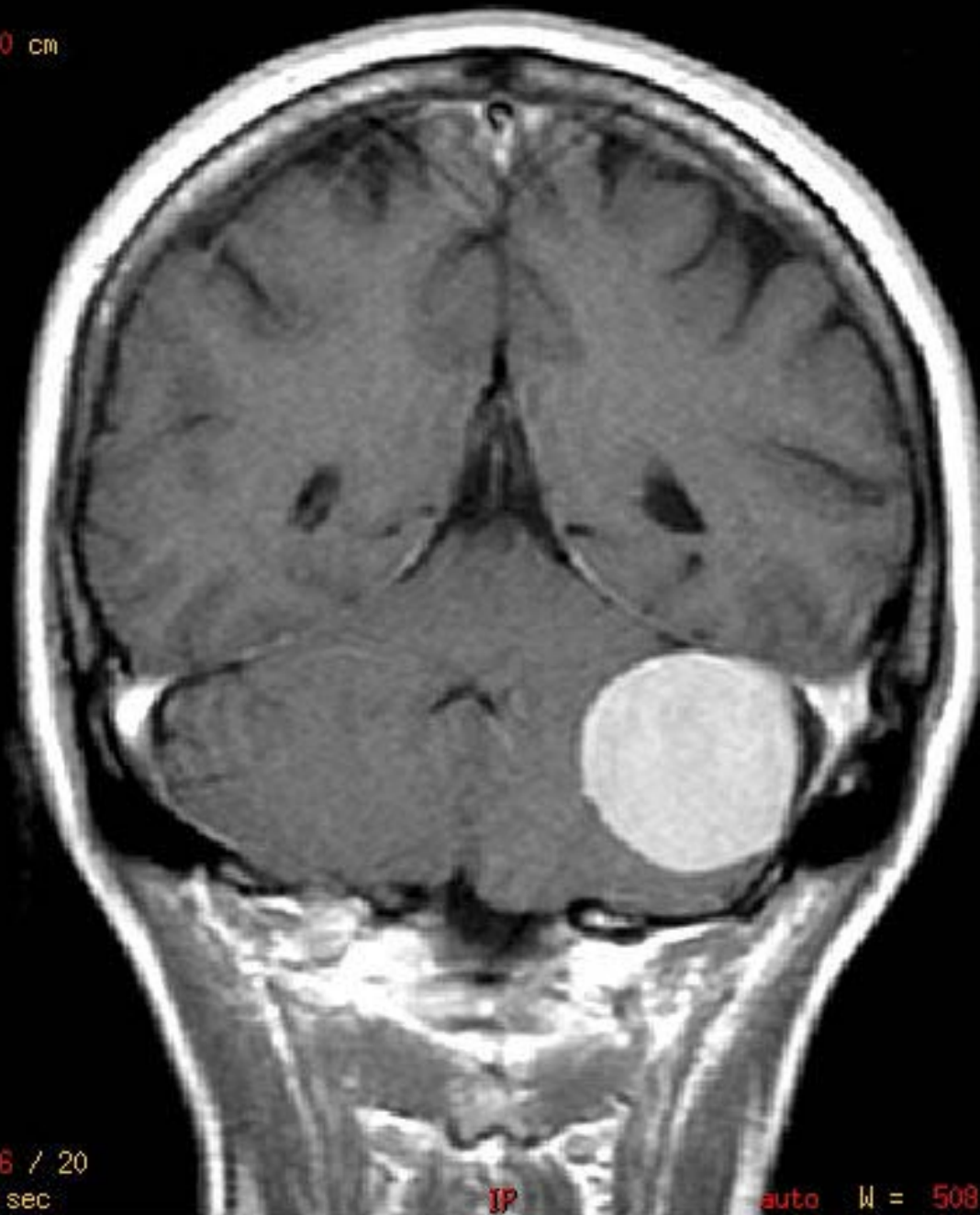
R  
9  
3

L  
1  
0  
7

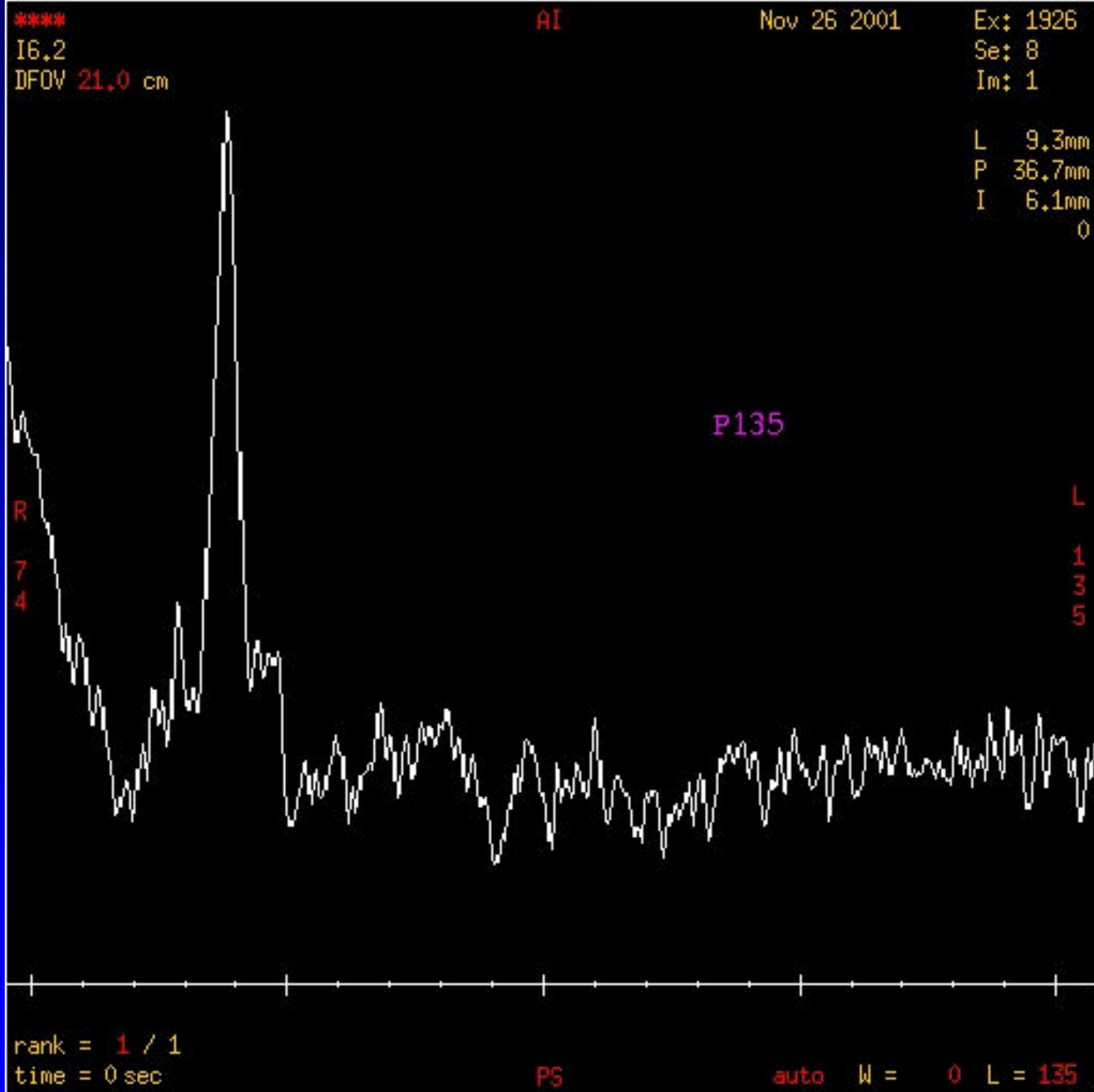
rank = 6 / 20  
time = 0 sec

IP

auto W = 508 L = 318





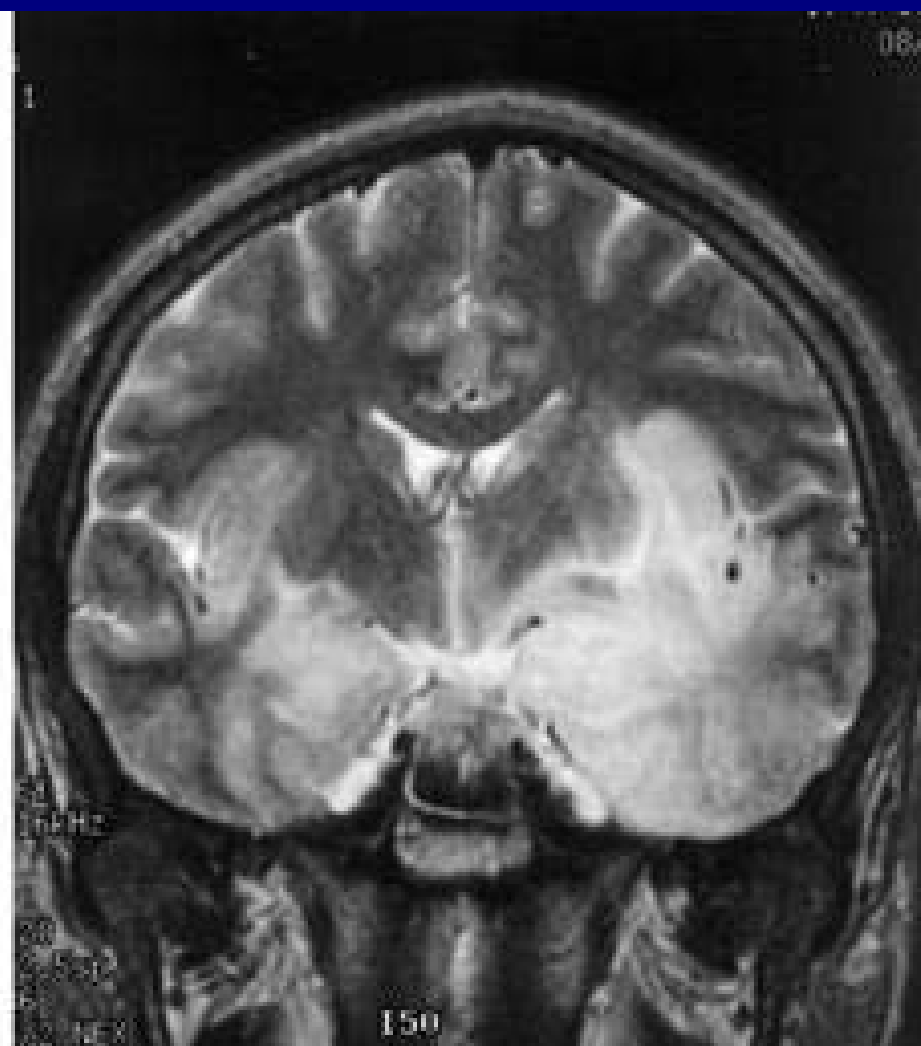
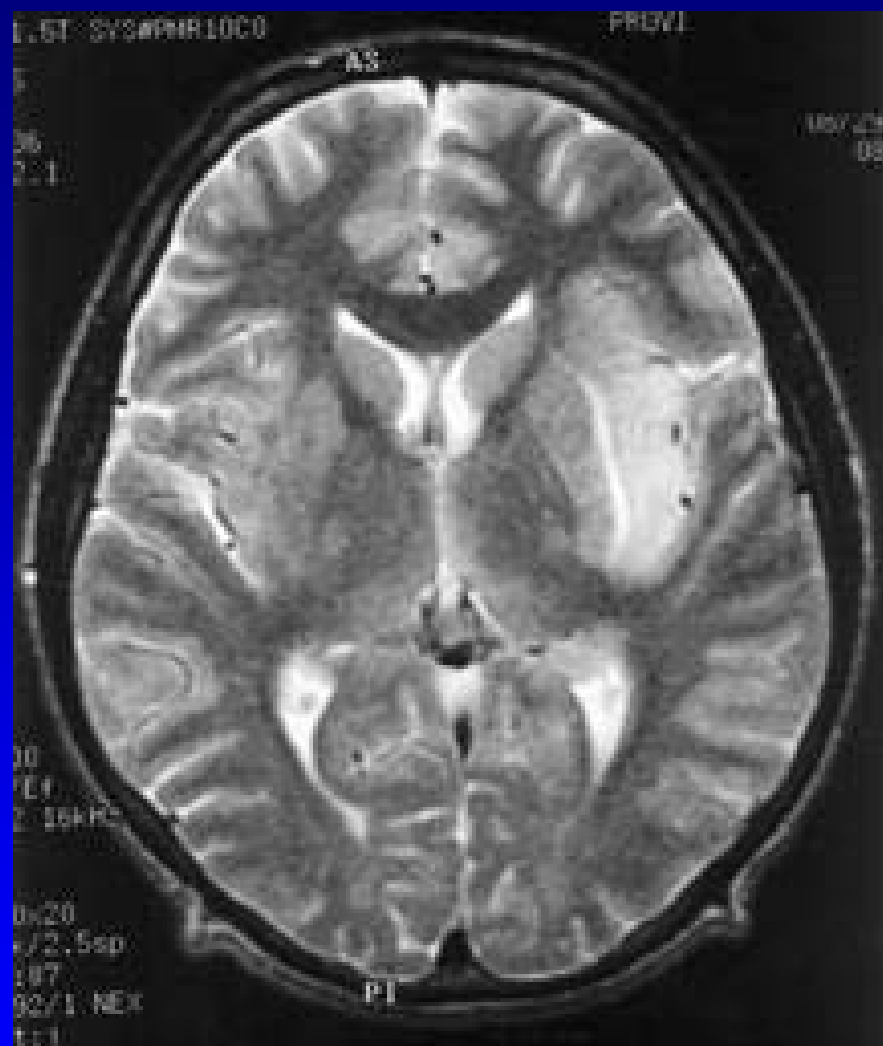


PRESS  
TE 135  
NAA 0  
Cho au-  
mentada

# Infecções/infestações

---

- Congênicas – TORCH
- Adquiridas
  - Bacterianas (meningite, abscesso, TB)
  - Virais (meningite, encefalite)
  - Fungos
  - Protozoários (toxoplasmose)
- Sistemática





Scan: 25648  
S1: 7/19  
Pos: 1.8  
Oblique  
Z: 1.6

SE  
TA: 180.0  
550/18  
18.0x22.0cm  
200x270  
6.0mm  
Enc: ->  
3: 40/2max

C: 1458



# Caso clínico

---

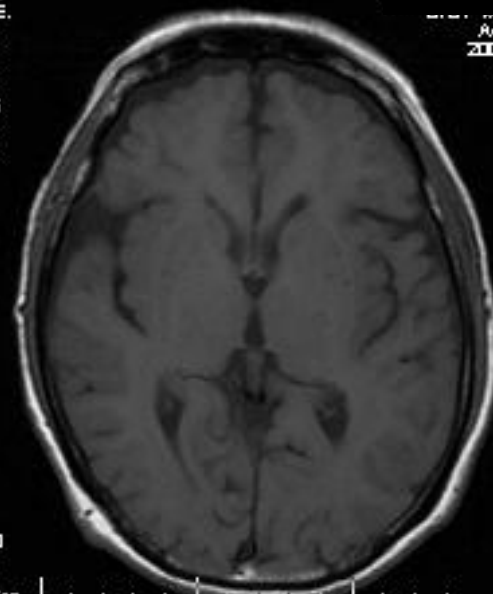
- M 78
- Dislalia
- Suspeita de AVCI cardioembólico
- Infarto na ínsula E

1.5T GBIS000  
Ex: 16360  
AX T1 SE  
Se: 3/22  
Im: 11/20  
Ac: 837.7

256 x 256

Mag: 1.0x

R



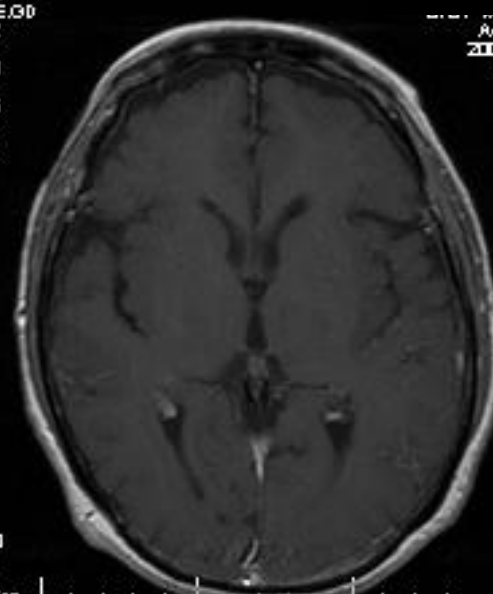
ET: 0  
TR: 450.0  
TE: 14.0  
HEAD  
6.0Ink0.6sp  
W: 47 L: 37.3

1.5T GBIS000  
Ex: 16360  
AX T1 SE,00  
Se: 10/22  
Im: 11/20  
Ac: 838.3

256 x 256

Mag: 1.0x

R



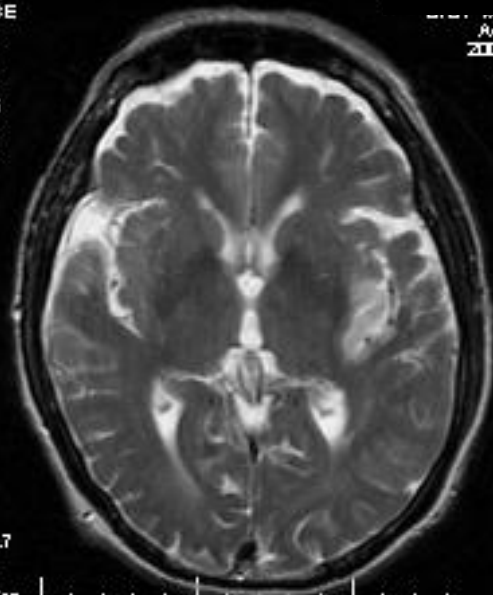
ET: 0  
TR: 450.0  
TE: 14.0  
HEAD  
6.0Ink0.6sp  
W: 46 L: 47.3

1.5T GBIS000  
Ex: 16360  
AX T2 FSE  
Se: 2/22  
Im: 11/20  
Ac: 837.7

256 x 256

Mag: 1.0x

R



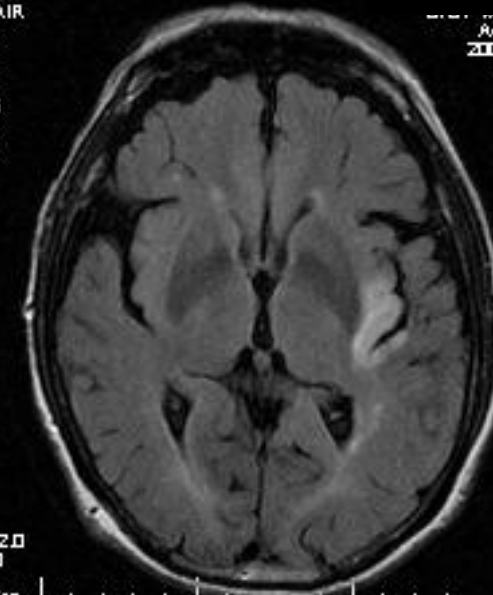
ET: 12  
TR: 5316.7  
TE: 98.0  
HEAD  
6.0Ink0.6sp  
W: 216 L: 408

1.5T GBIS000  
Ex: 16360  
AX T2 FSE  
Se: 4/22  
Im: 11/20  
Ac: 837.7

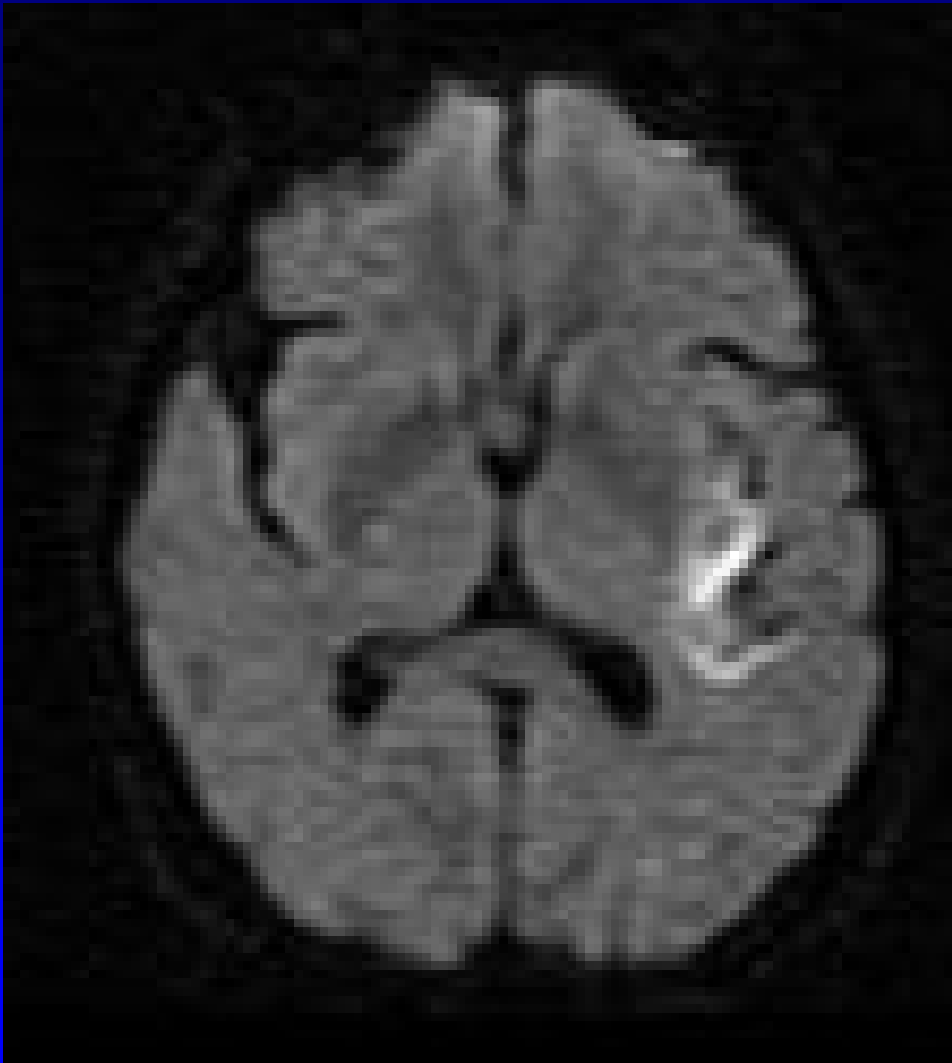
256 x 256

Mag: 1.0x

R



ET: 0  
TR: 10002.0  
TE: 161.0  
HEAD  
6.0Ink0.6sp  
W: 443 L: 221



1.5T GEMSOW

Ex: 16360

PJN

Se: 209/22

Im: 4/16

Cor: P32.2

512 x 512

Mag: 1.0x

R

ET: 0

TR: 36.0

TE: 4.6

1.2thk/0.0sp  
W:368 L:262

S

InCor

078Y M 272873I

Acc: 16360

2003 Dec 31

08:52:26

1.5T GEMSOW

Ex: 16360

PJN

Se: 209/22

Im: 9/16

Ax: S15.7

512 x 512

Mag: 1.0x

R

ET: 0

TR: 36.0

TE: 4.6

1.2thk/0.0sp  
W:368 L:262

P

InCor

078Y M 272873I

Acc: 16360

2003 Dec 31

08:52:26

512 x 512

Mag: 1.0x

R

ET: 0

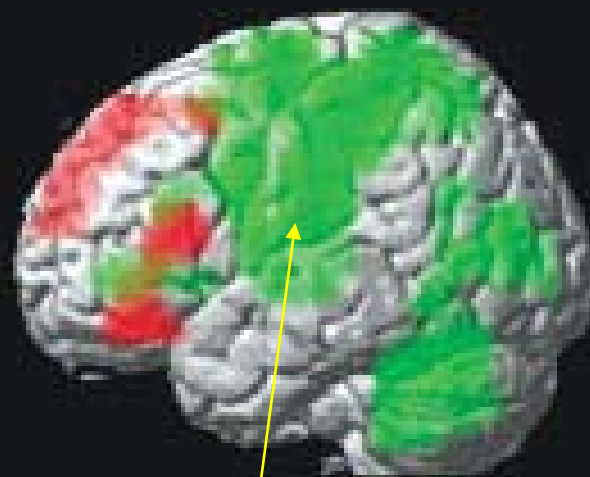
TR: 36.0

TE: 4.6

1.2thk/0.0sp  
W:368 L:262

DFOV: 14.1 x 14.1cm

DFOV: 14.1 x 14.1cm



Verdade

Mentira

FIM