

i-MEET

NEXT GENERATION

Multidisciplinary European Endovascular Therapy



MRA in diagnosis and surveillance of aortic pathology - benefits & risks

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May 31st 2018

Disclosures

Dan Devos:

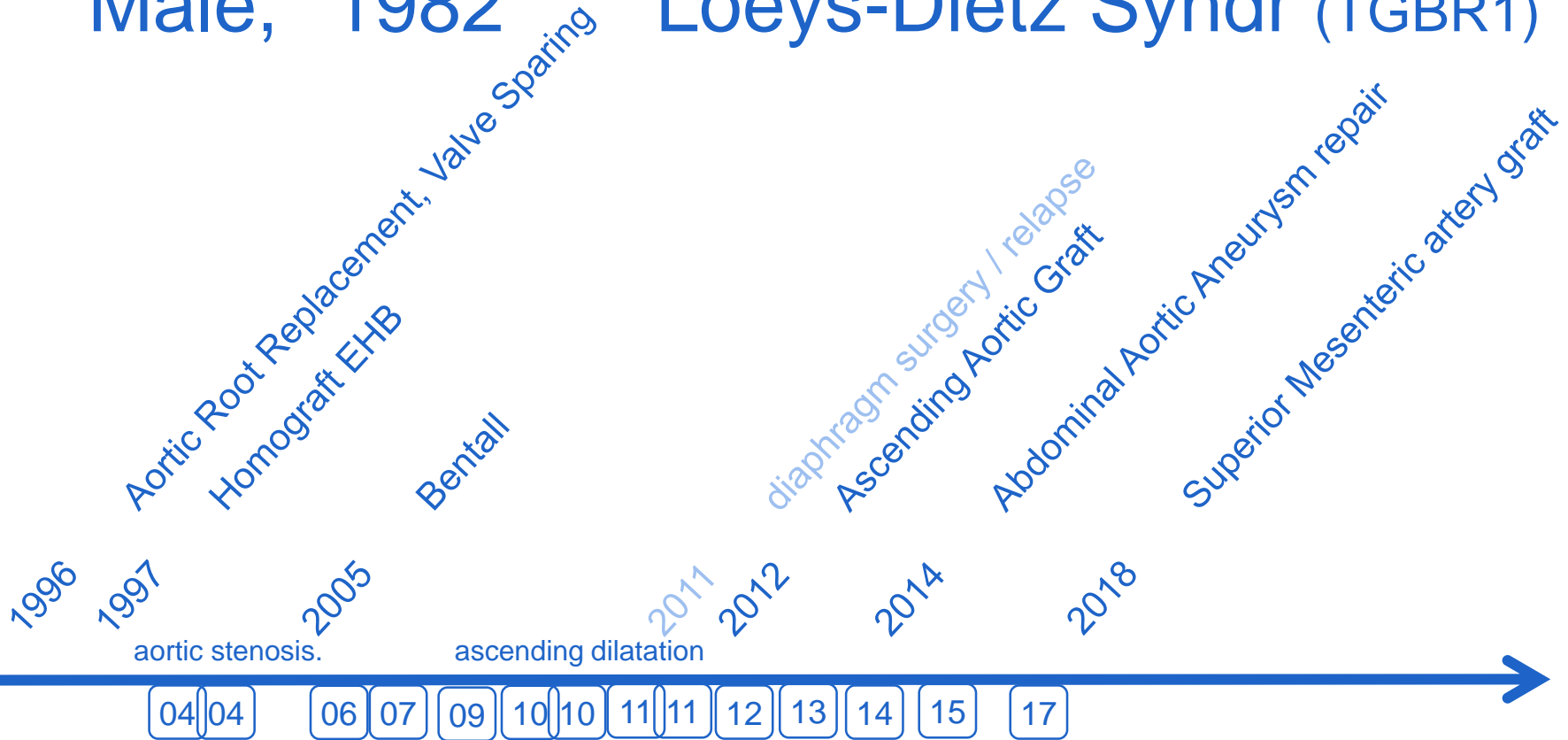
I do like Tomb Raidiology.

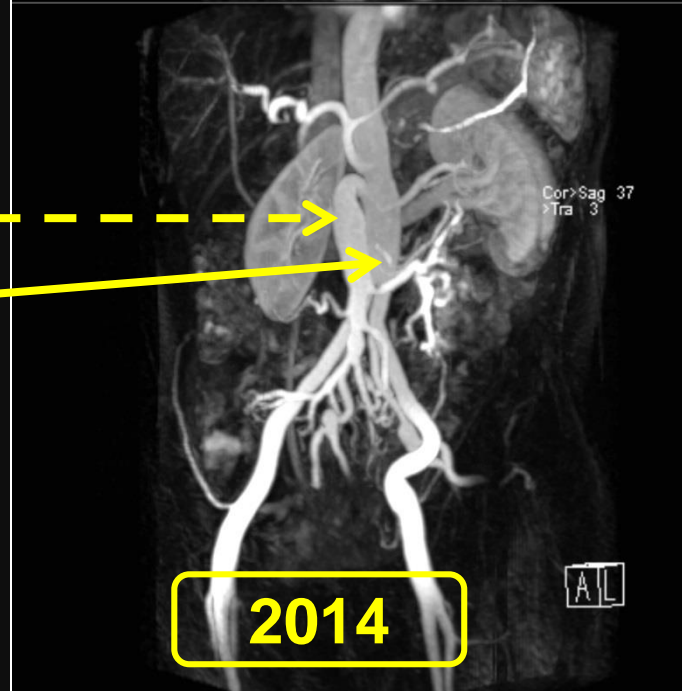
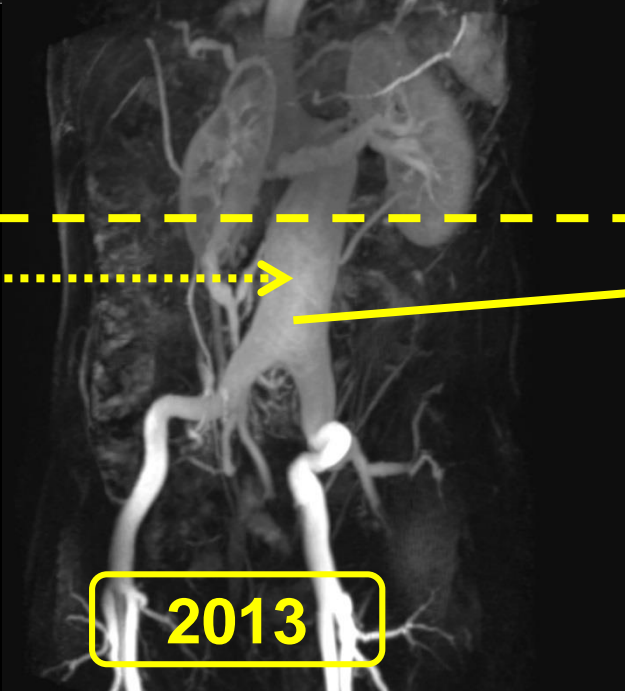
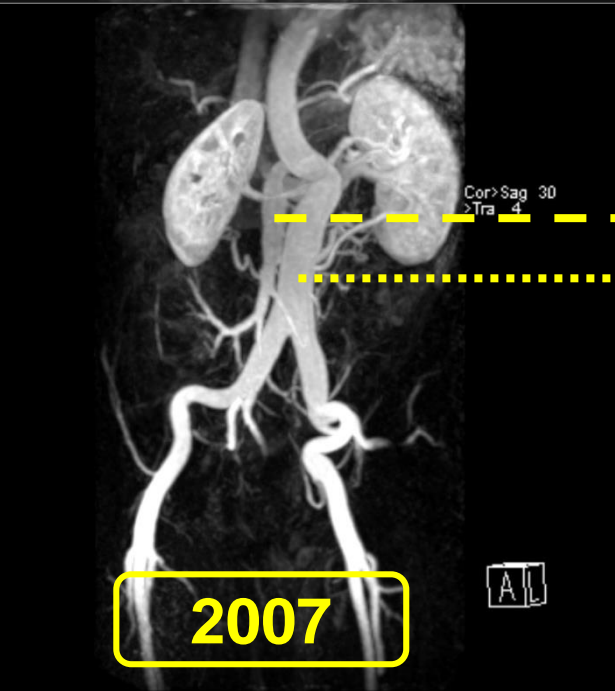
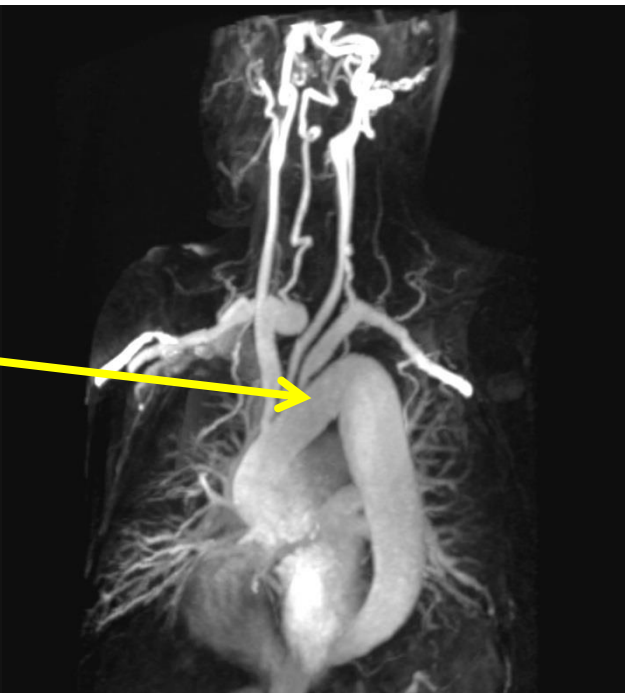
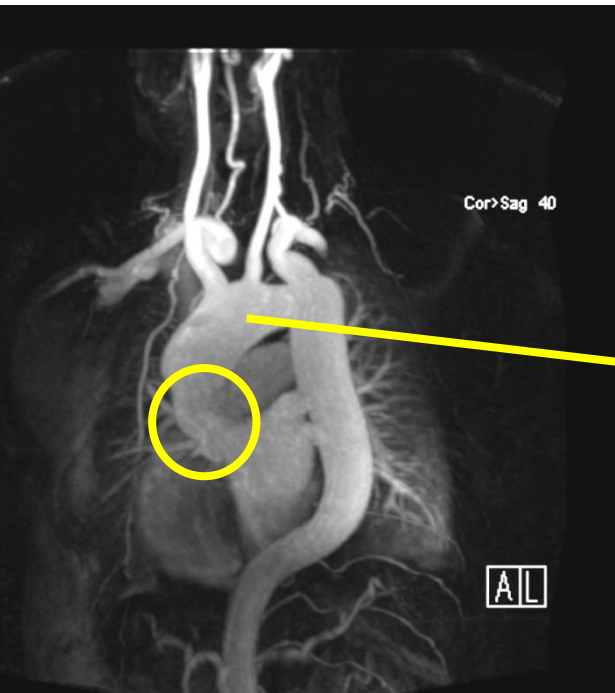
I still think digital watches are a pretty neat idea.

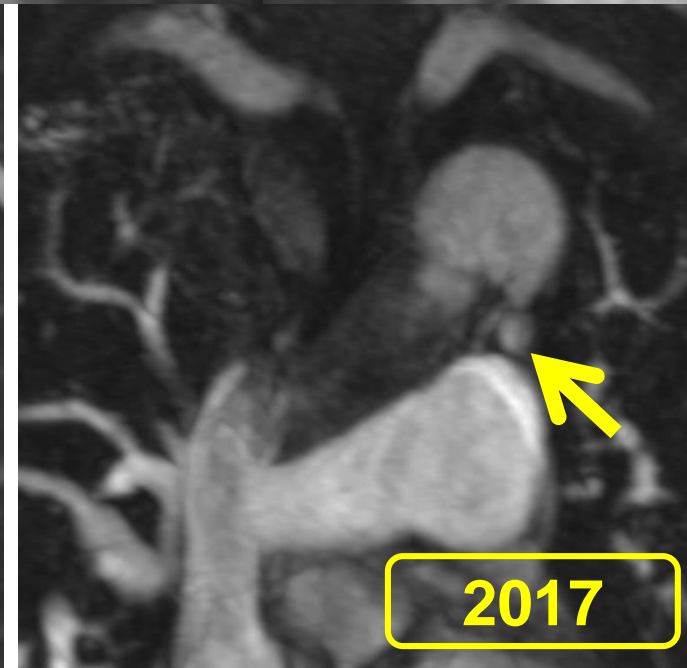
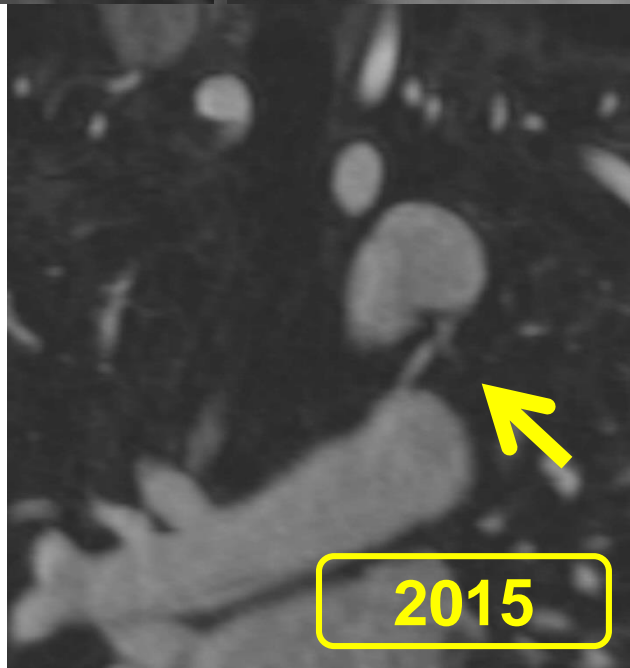
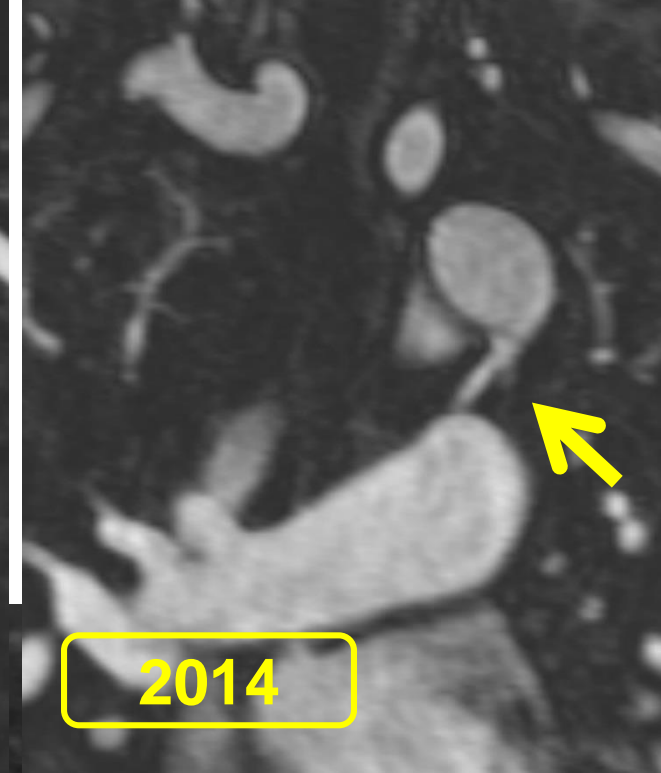
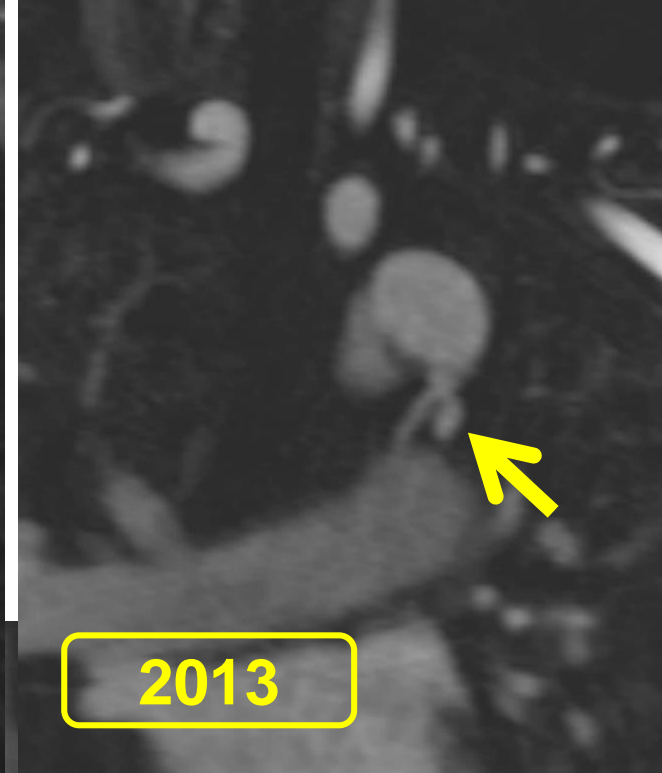
I do not have any potential conflict of interest.

Male, °1982

Loeys-Dietz Syndr (TGFR1)









M, °1982 Loey-Dietz Syndr (TGBR1)

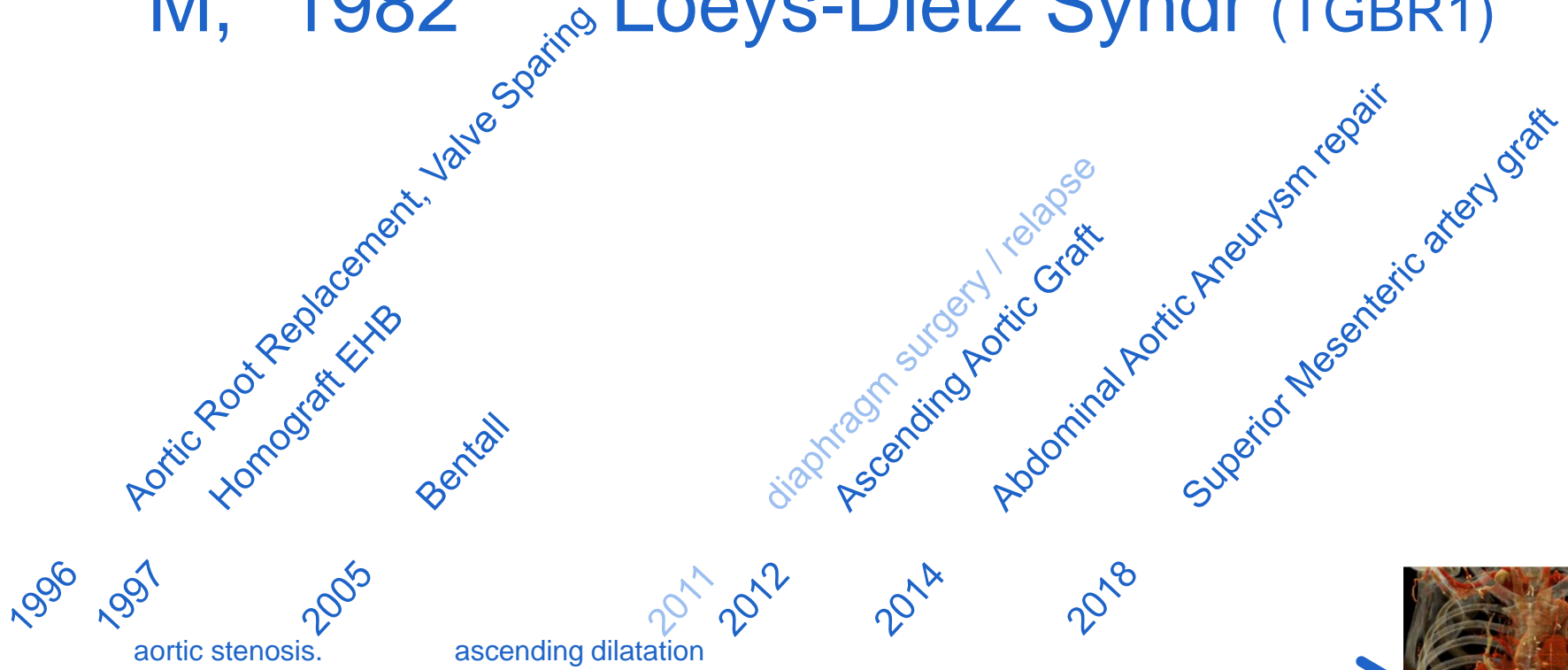
+ Patent Ductus Arteriosus Aneurysm

**Who would increase
follow up rate?**

Who would intervene?

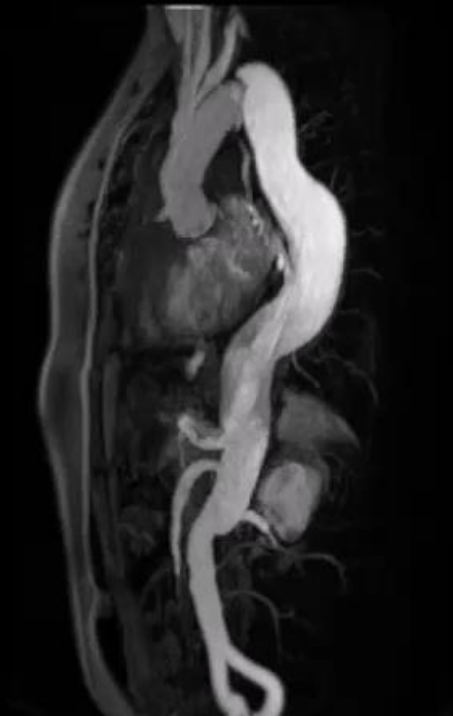
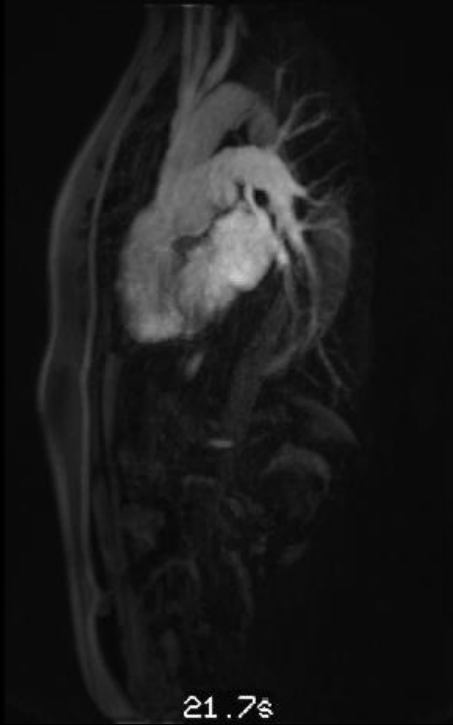
M, °1982

Loeys-Dietz Syndr (TGFR1)



Benefits?

- Radiation free
- Renal function
- Not sober
- Multimodality imaging
- Functional information
- (Hypersensitivity reaction)
- ...



MAGNETOM



MR – Magnetfeld
MR – Magnetic Field
Champ Magnétique RM
Campo magnético RM
Campo magnetico RM



Hochfrequenzfeld
High Frequency Field
Champ Haute Fréquence
Campo de alta frecuencia
Campo ad alta frequenza

Warnzeichen:
Warning sign:
Panneau d'avertissement:
Símbolo de advertencia:
Segnale di avvertimento:

Verbotsszeichen:
Prohibited signs (Danger!):
Panneaux d'interdiction:
Símbolos de prohibición:
Segnali di divieto:

Elektromagnetisch beeinflussbare Implantate,
z.B. Herzschrittmacher, Defibrillatoren, Hörgeräte,
Insulinpumpen, Medikamentendosiergeräte
Implants susceptible to electromagnetic effects,
e.g. cardiac pacemakers, defibrillators, hearing aids,
insulin pumps, medication pumps
Implants sensibles aux interférences électromagnétiques,
par ex. stimulateurs cardiaques, défibrillateurs, aides auditives,
pompes à insuline, dosificateurs de médicaments
Implantes sensibles a los campos electromagnéticos,
p. ej. Marcapasos, desfibriladores, audifonos,
bombas de insulina, dosificadores de medicamentos
Impianti suscettibili agli effetti elettromagnetici,
ad es. pacemaker cardiac, defibrillatori, apparecchi acustici,
pompe per l'insulina, dispositivi per la somministrazione di farmaci



Implantate aus Metall und sonstige
Metallgegenstände am Körper z.B. Splinter
Implants made of metal and other
metal objects in the body such as splinters
Implants en métal et divers objets
métalliques intra-corporels, par ex. éclats
Implantes de metal y otras
piezas metálicas en el cuerpo, p.ej. fragment
Impianti in metallo o altri oggetti metallici
presenti nel corpo, come ad es. schegge



Metalteile und medizinische
Instrumente aller Art
Metal parts and medical
instruments of all types
Éléments métalliques et instruments
médicaux divers
Elementos metálicos e instrumentos
médicos de cualquier tipo
Componenti metallici e strumenti
medici di qualsiasi tipo



Offenes Feuer
Raucherbot
Open fire
No smoking
Flammes ouvertes
Défense de fumer
Fuego abierto
Prohibido fumar
Fiamme libere
Divieto di fumare



Mechanische Uhren, elektronische Datenträger wie
Taschenrechner, Digitaluhren usw.
Mechanical watches, electrical data carriers, such as
pocket calculators, digital clocks, etc.
Montres mécaniques, supports de données électri-
ques, tels que calculatrice de poche, montres digitales, etc.
Relojes mecánicos, soportes de datos electrónicos,
p. ej. calculadoras de bolsillo y relojes digitales
Orologi meccanici, supporti elettronici di dati, come
calcolatori tascabili, orologi digital, ecc.



Feuerlöscher mit magnetisier-
barem Metallgehäuse
Fire extinguishers with magnetizable
metal housing
Extincteurs à corps
métallique magnétisable
Extintores con carcasa
de metal magnétizable
Estintori con alloggiamento
metallico magnetizabile



Datenträger wie Kreditkarte, Seckarten und
Ausweise mit Magnetstreifen, Magnetbänder
Data carriers, such as credit cards and
identity cards with magnetic strips, magnetic tapes
Support de données tels que cartes de crédit,
cartes d'identité à piste magnétique, bandes magnétiques
Soportes de datos, p. ej. tarjetas de crédito,
cheque electrónico y carnés con banda magnética,
cintas magnéticas
Supporti di dati come carte di credito e tessere
di identificazione con bande magnetiche, nastri magnetici

FOR ANY OF THE FOLLOWING: SEVERE SYMPTOMS



LUNG

Shortness of
breath, wheezing,
repetitive cough



HEART

Pale or bluish
skin, faintness,
weak pulse,
dizziness



THROAT

Tight or hoarse
throat, trouble
breathing or
swallowing



MOUTH

Significant
swelling of the
tongue or lips



SKIN

Many hives over
body, widespread
redness



GUT

Repetitive
vomiting, severe
diarrhea



OTHER

Feeling
something bad is
about to happen,
anxiety, confusion

**OR A
COMBINATION**

of symptoms
from different
body areas.

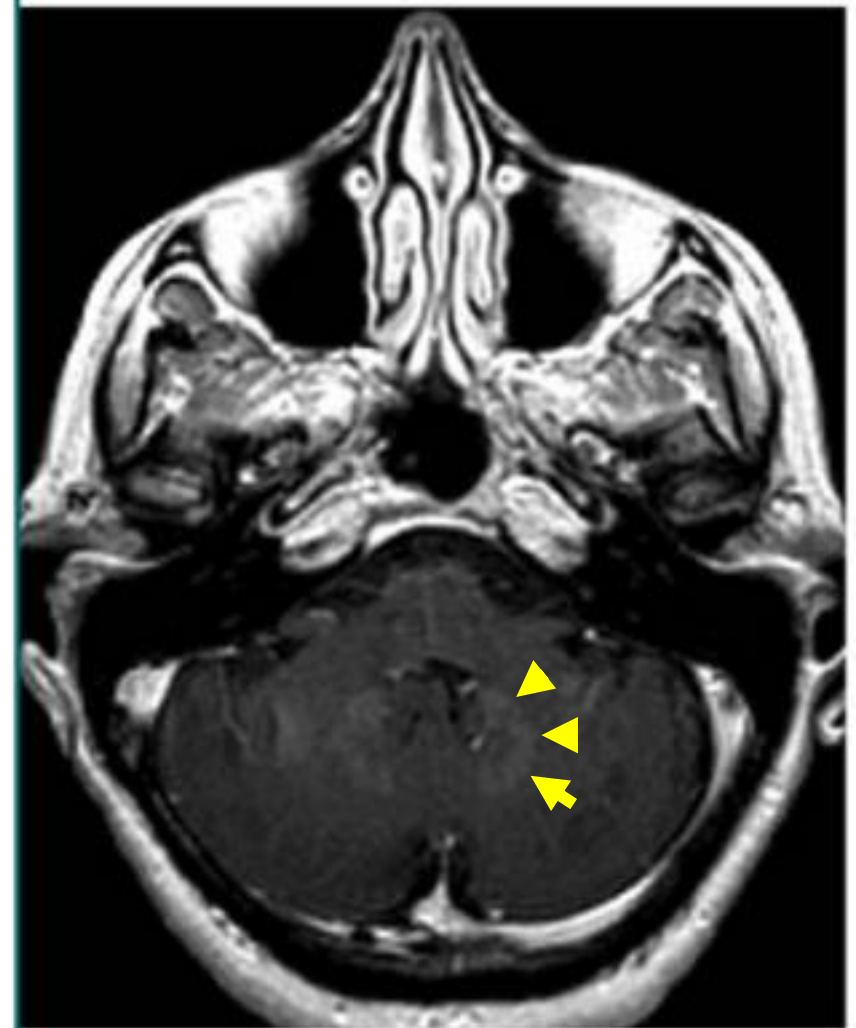


- INJECT EPINEPHRINE IMMEDIATELY.**
- Call 911.** Tell emergency dispatcher the person is having anaphylaxis and may need epinephrine when emergency responders arrive.
 - Consider giving additional medications following epinephrine:
 - » Antihistamine
 - » Inhaler (bronchodilator) if wheezing
 - Lay the person flat, raise legs and keep warm. If breathing is difficult or they are vomiting, let them sit up or lie on their side.
 - If symptoms do not improve, or symptoms return, more doses of epinephrine can be given about 5 minutes or more after the last dose.
 - Alert emergency contacts.
 - Transport patient to ER, even if symptoms resolve. Patient should remain in ER for at least 4 hours because symptoms may return.

Risks?

NSF

Nephrogenic Systemic
Fibrosis



PERIODIC TABLE OF THE ELEMENTS

1 IA																	18 VIIIA	
1 H Hydrogen 1.0079	2 IIA		<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>14 ← Group IUPAC IVA ← Group CAS</p> <p>Atomic Number → 6 ← Selected Oxidation States Symbol → C Name → Carbon Electron Configuration → 2-4 ← Atomic Mass 12.011</p> </div>										13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
2 Li Lithium 6.941	3 Be Beryllium 9.0122											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.179	
3 Na Sodium 22.990	4 Mg Magnesium 24.305	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIII	9 VIII	10 VIII	11 IB	12 IIB	13 Al Aluminium 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulphur 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948	
4 K Potassium 39.098	5 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.922	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80	
5 Rb Rubidium 85.468	6 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29	
6 Cs Cesium 132.91	7 Ba Barium 137.33	57-71 La Lanthanide	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.225	78 Pt Platinum 195.084	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)	
7 Fr Francium (223)	8 Ra Radium (226)	89-103 Ac Actinide	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (277)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Cn Copernicium (285)	113 Nh Nihonium (284)	114 Fl Flerovium (289)	115 Mc Moscovium (288)	116 Lv Livermorium (293)	117 Ts Tennessine (294)	118 Og Oganesson (294)	

Electron Shells

1	K	2	S ²	P	D	F
2	L	8	2	6		
3	M	18	2	6	10	
4	N	32	2	6	10	14
5	O	32	2	6	10	14
6	P	18	2	6	10	
7	Q	8	2	6		
8	R	2	2			

Lanthanide

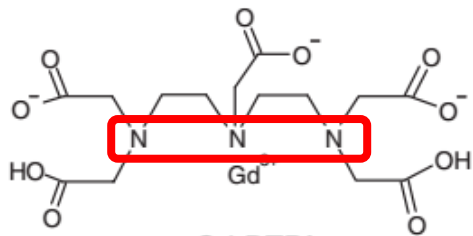
57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.97
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Actinide

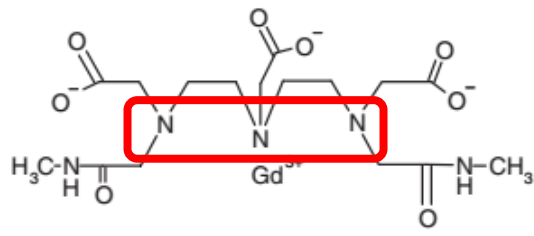
89 Ac Actinium (227)	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)
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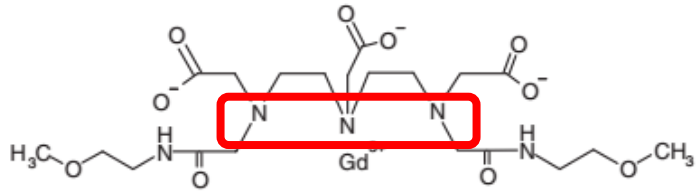
metals metalloids halogens



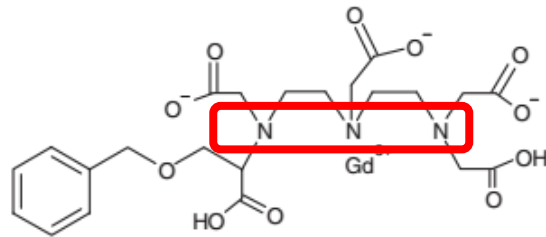
Gd-DTPA



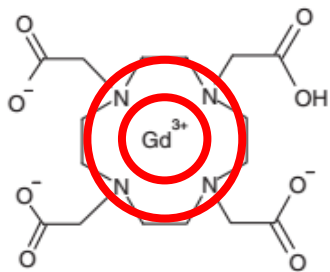
Gd-DTPA-BMA



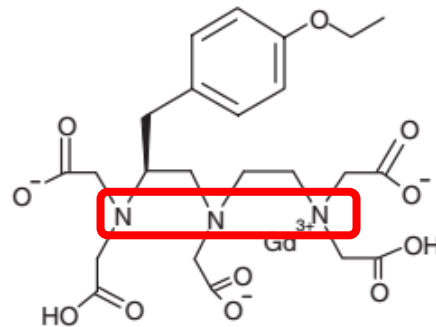
Gd-DTPA-BMEA



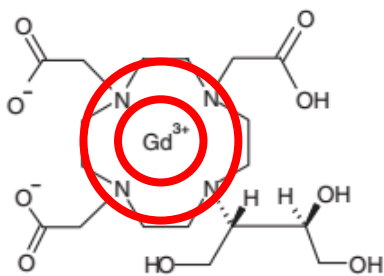
Gd-BOPTA



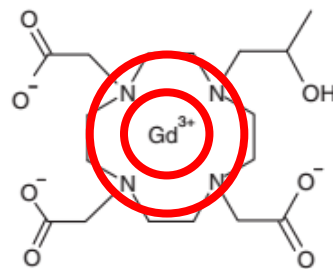
Gd-DOTA



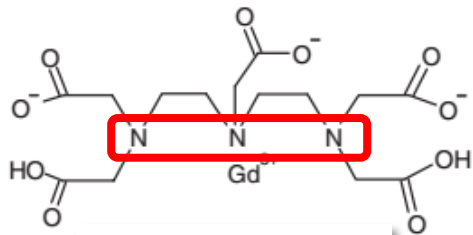
Gd EOB-DTPA



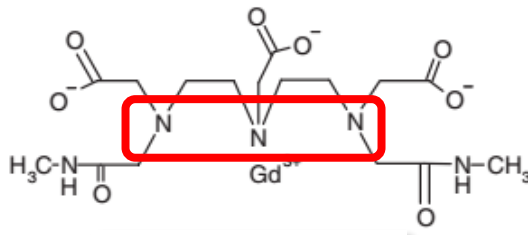
Gd-BT-DO3A



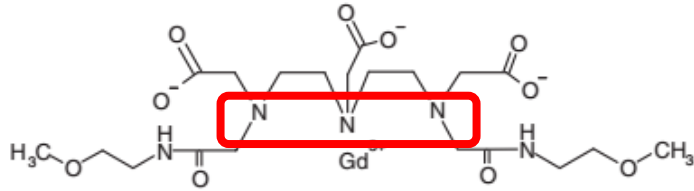
Gd HP-DO3A



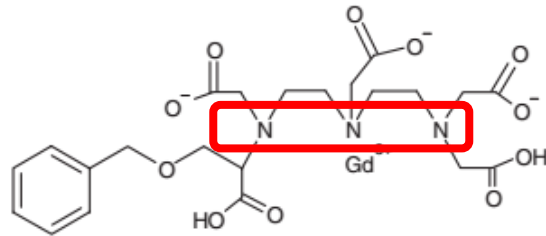
Magnevist® H⁺



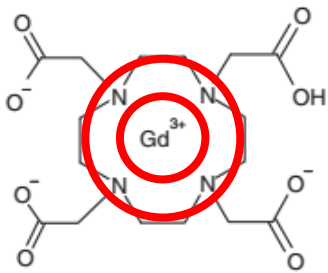
Omniscan®



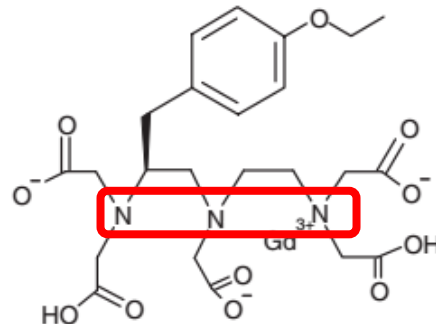
Optimark®



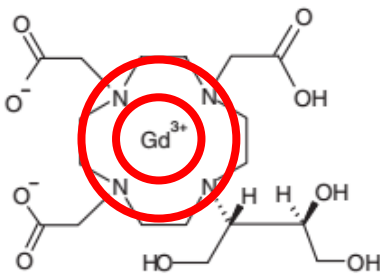
MultiHance® H⁺



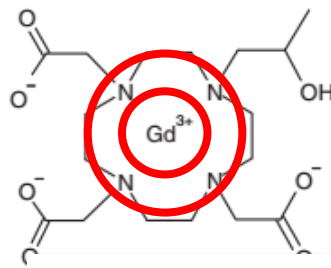
Dotarem® H⁺



Primovist® H⁺



Gadovist®



ProHance®



Magnevist® H+



Omniscan®

Guerbet



Optimark®



LIFE FROM INSIDE

MultiHance® H+

Guerbet



Contrast for Life

Dotarem® H+



Primovist® H+



Gadovist®

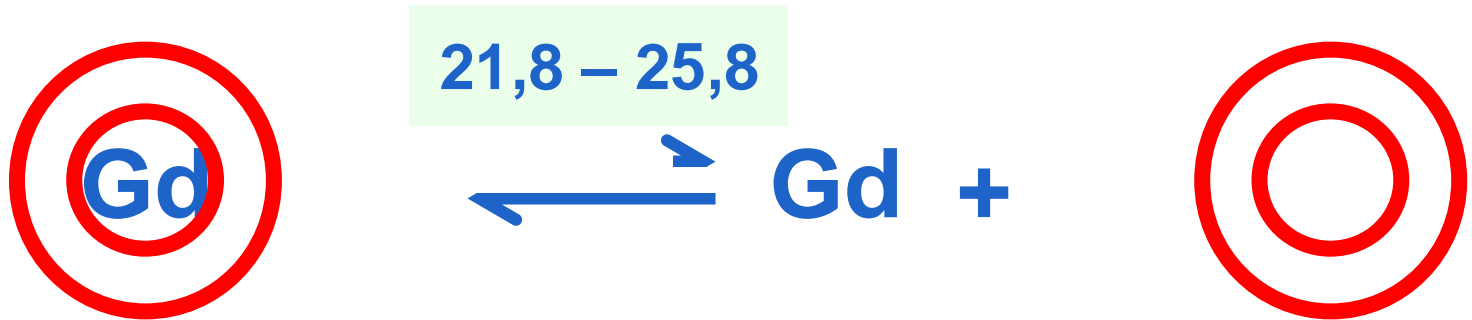


LIFE FROM INSIDE

ProHance®

2009

Log K_{therm}



Gadolinium Contrast Agents

- Dissociation constant & kinetics
- Transmetallation Zn^{2+} , Fe^{2+} , Ca^{2+}
- Free Ligand
- Gd @ Liver, Bone, Brain, Skin.



Gadolinium Contrast Agents

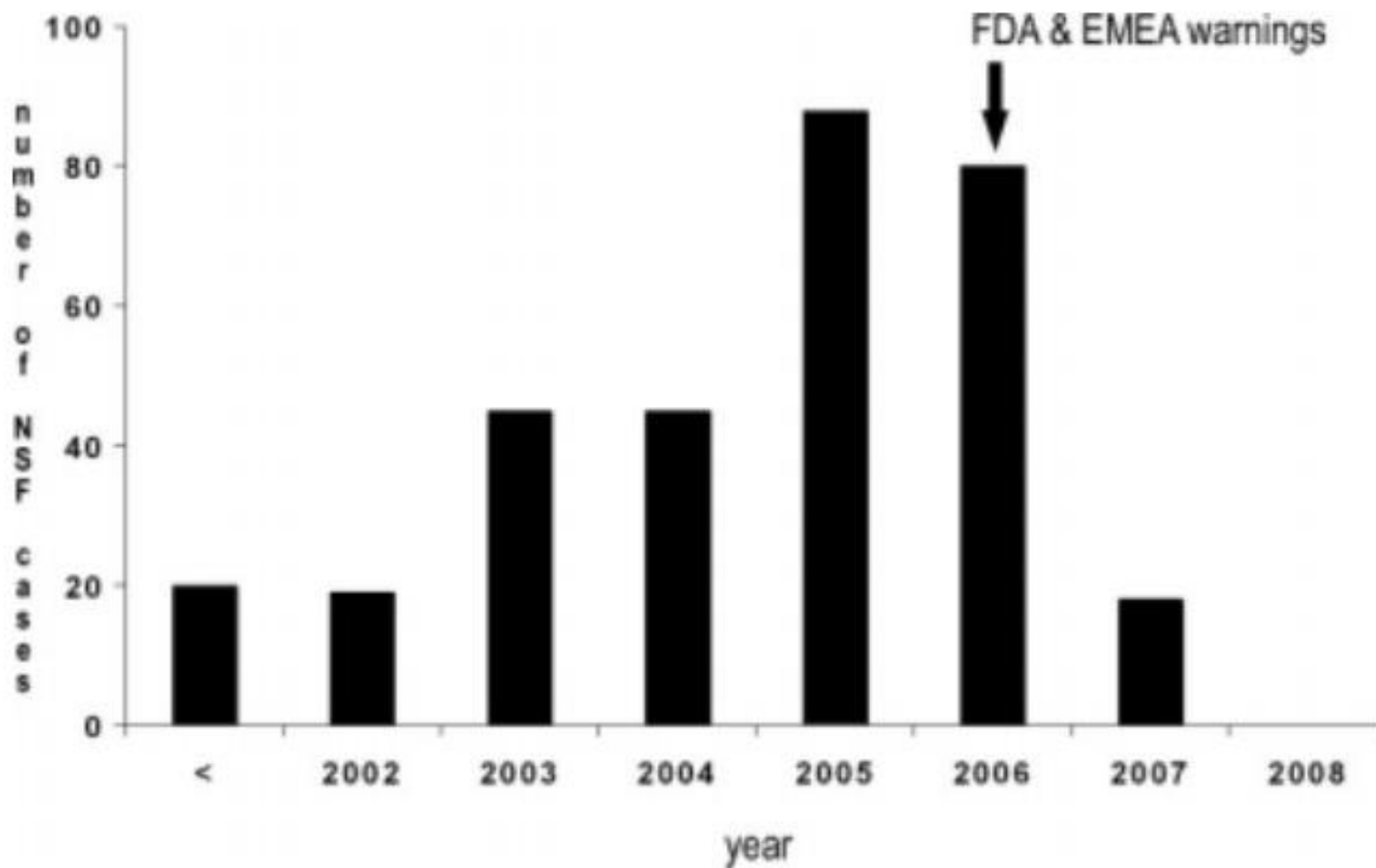
- Half life: 1,5h @ normal renal function
- 30.000.000 doses / year
- >2017: >300.000.000 doses
- 0.03% Serious Adverse Reaction

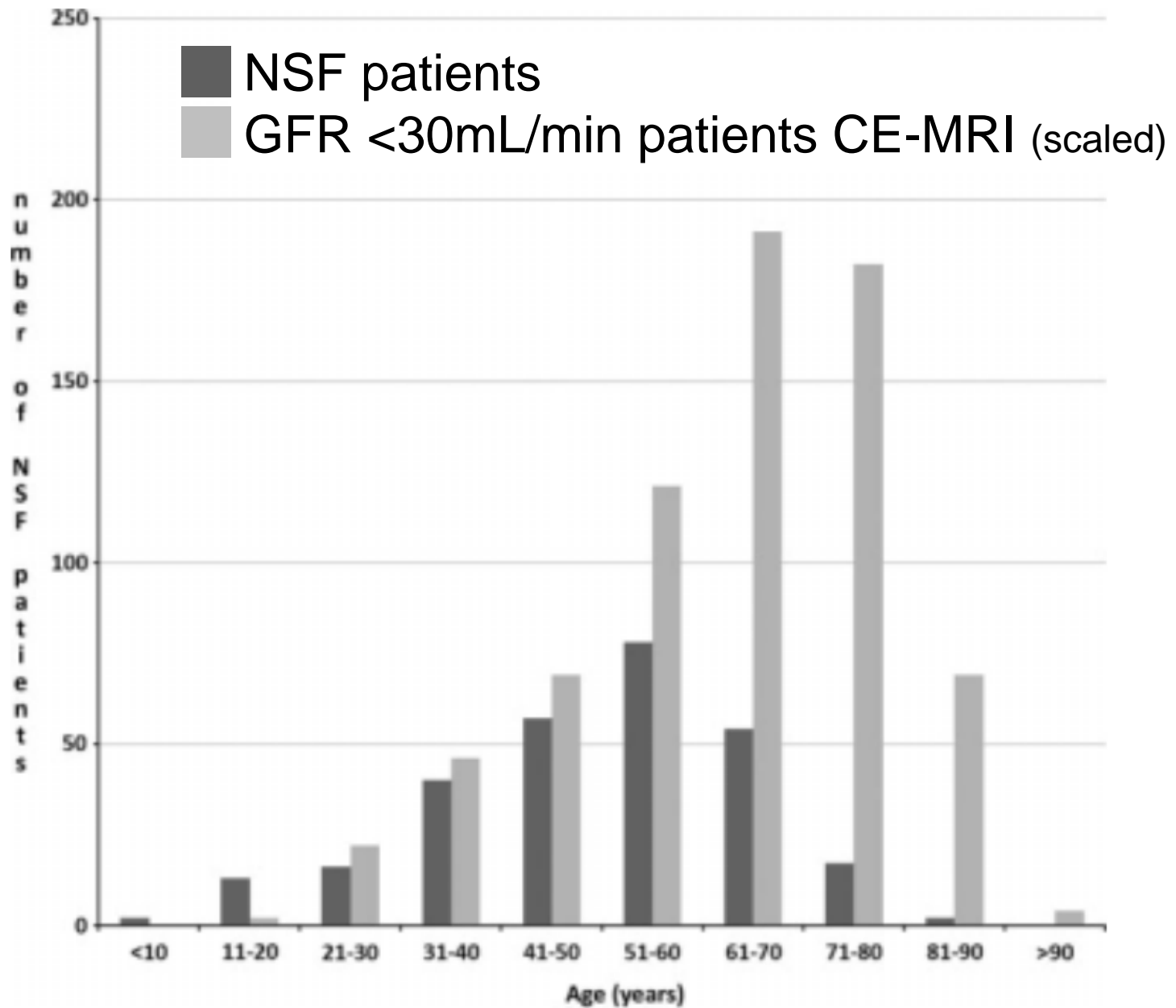




Cowper SE et al. The Lancet 2000;356: 1000-1001

Nephrogenic Systemic Fibrosis





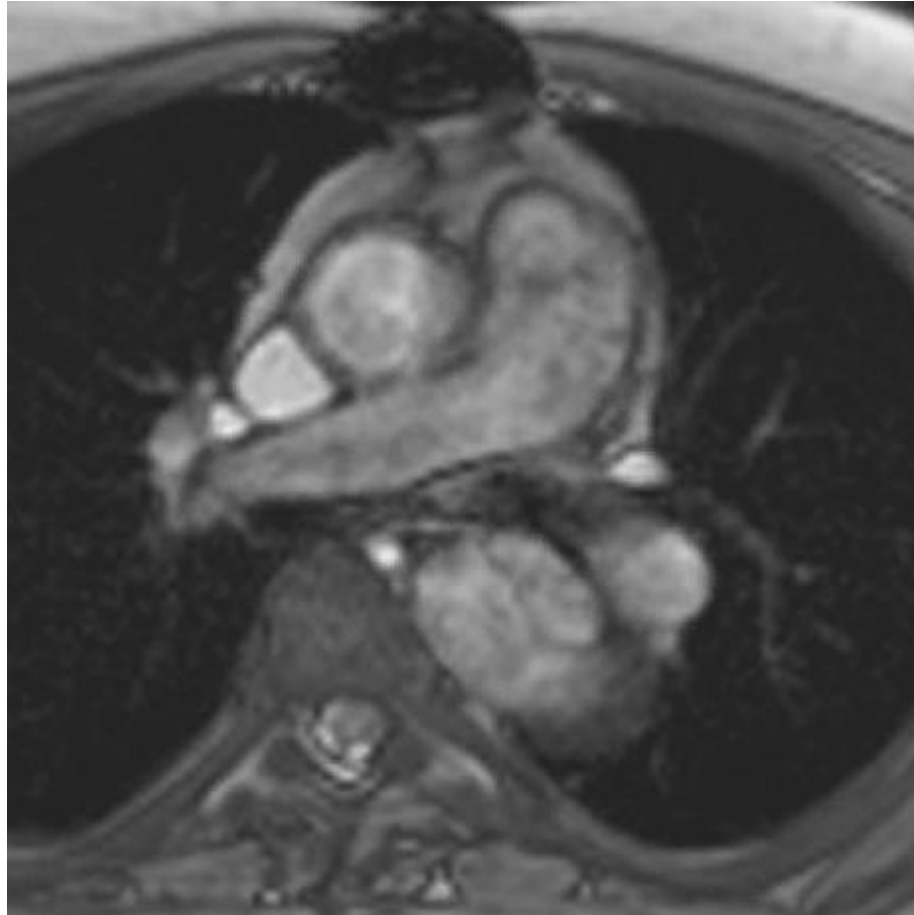
Chronic Kidney Disease: MRA vs CTA

- GFR **>30** ml/min/1,73m² → MRA
- GFR **< 30** ml/min/1,73m² → (MRA)

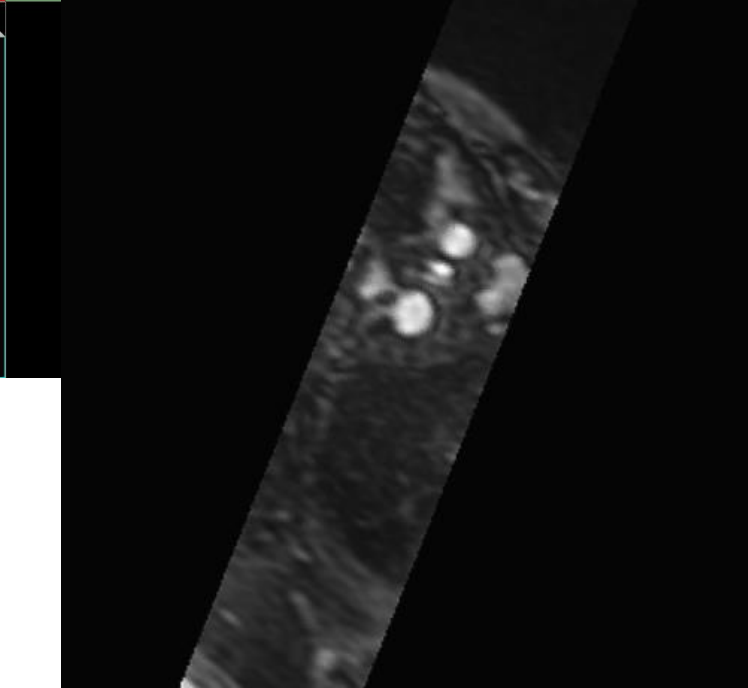
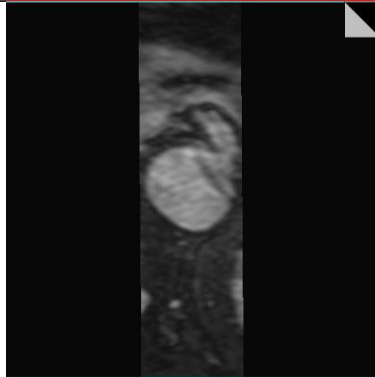
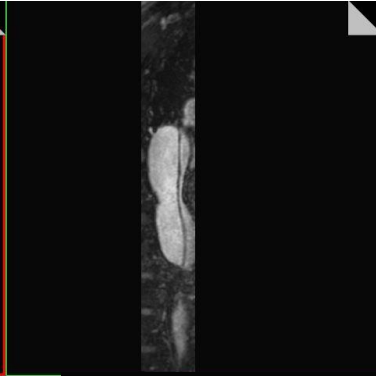
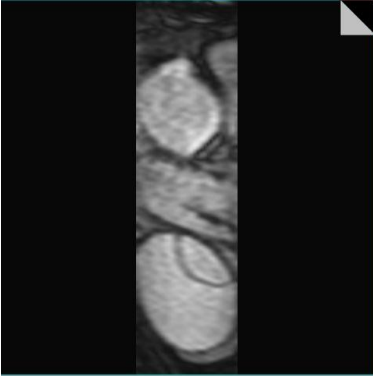
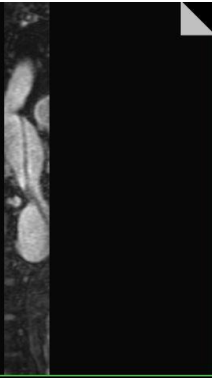
- Acute Renal Failure: → (MRA)

- Dialysis: → CTA

No Contrast MRA



No Contrast MRA

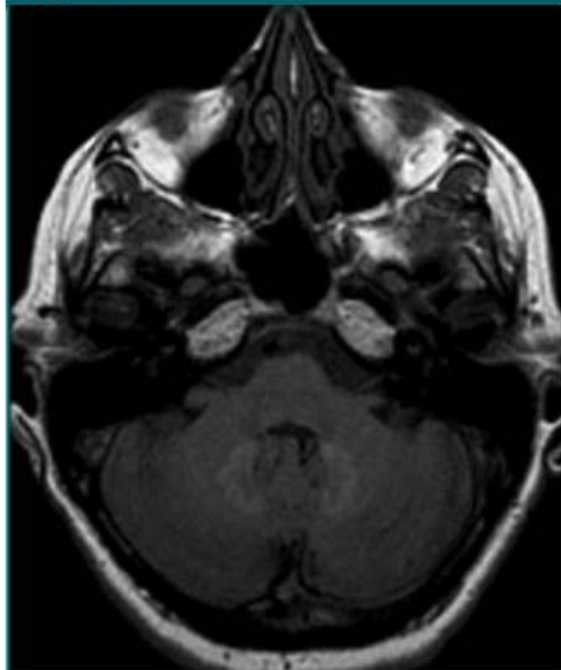


No Contrast MRA

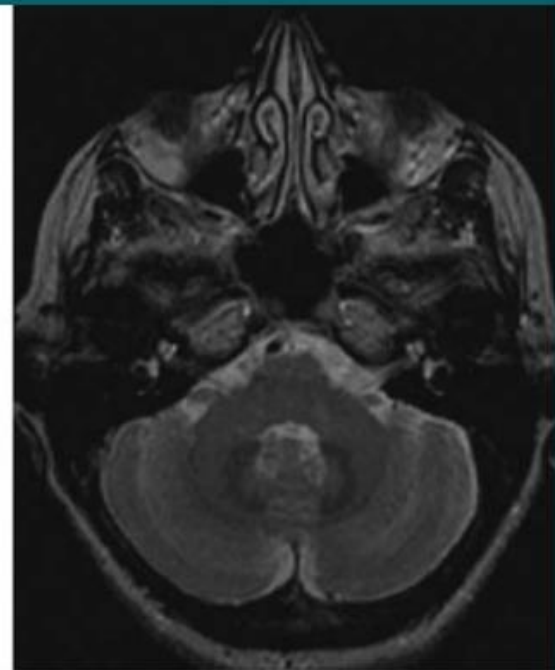


2009

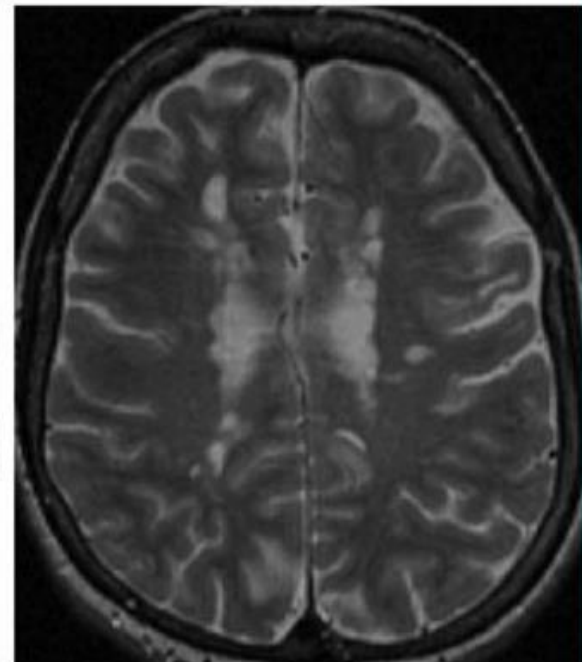
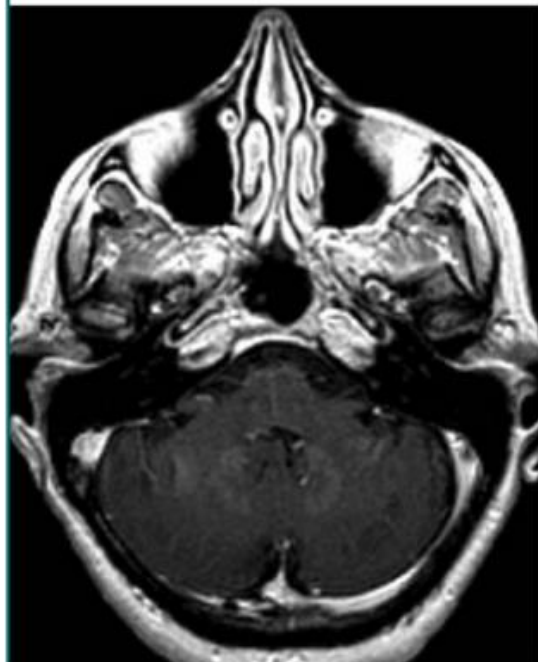
Figure 1

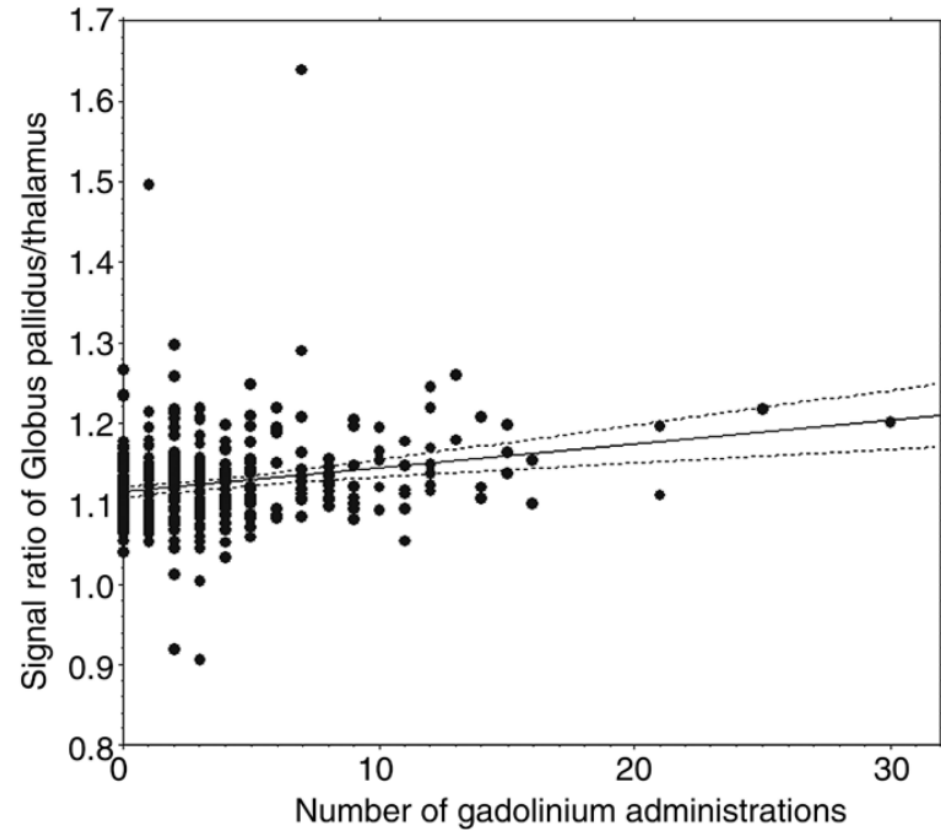
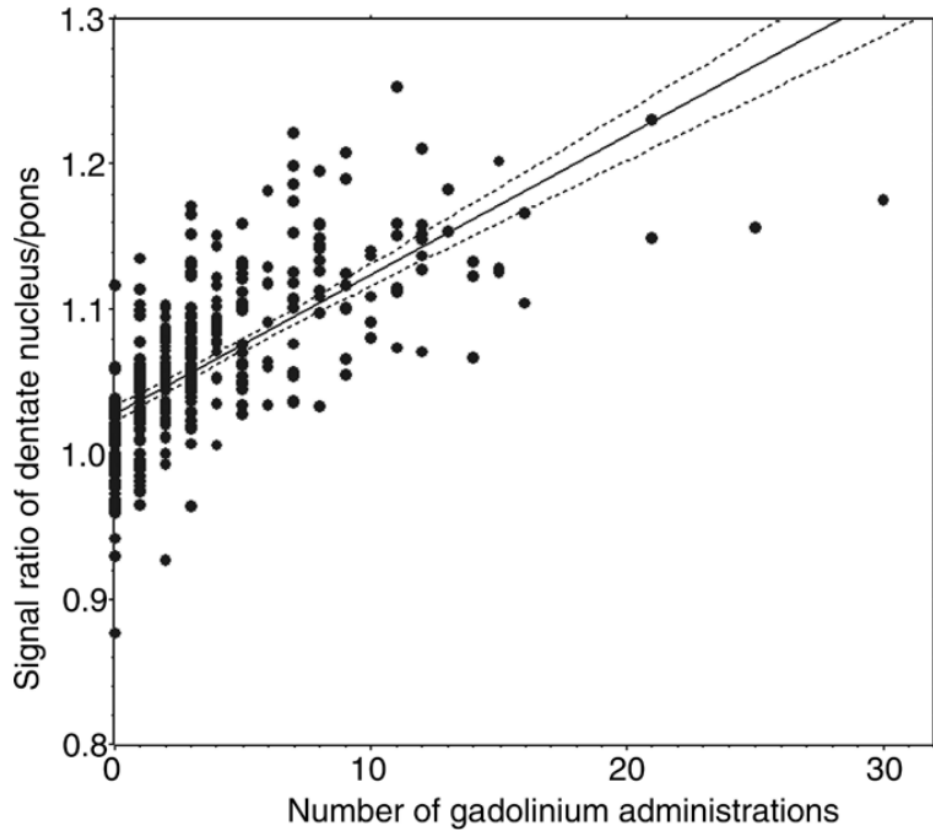
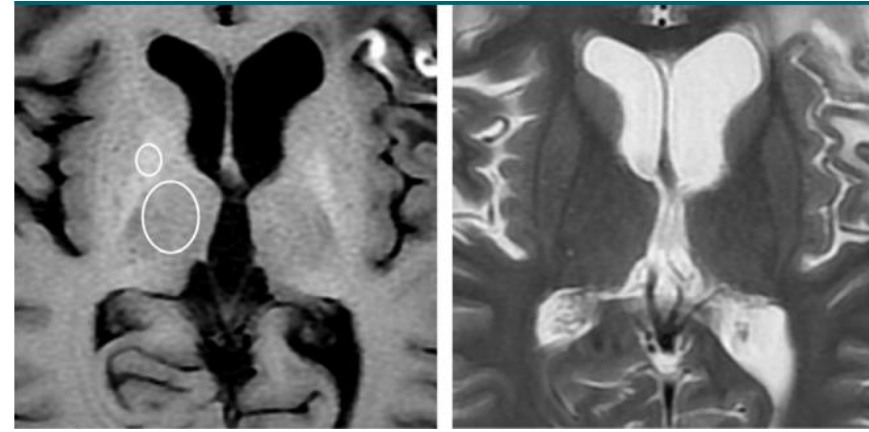
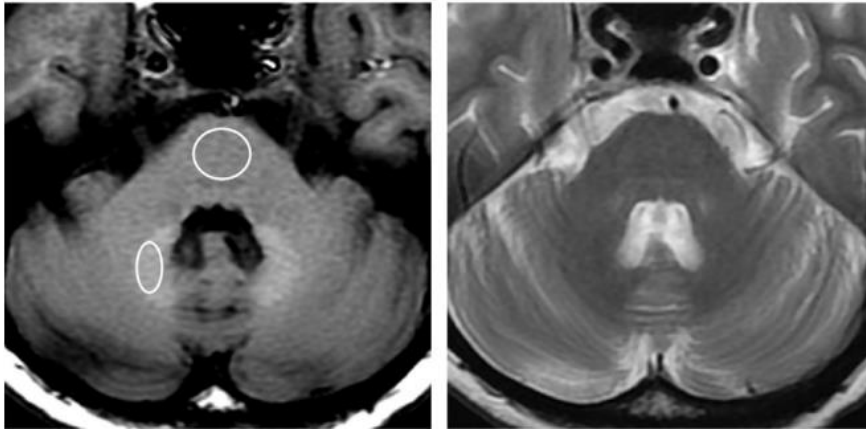


a.



b.





M, °1982

Loeys-Dietz Syndr (TGBR1)

MR

- ▶ 14 MRA
- ▶ 225ml Gadolinium Contrast

- ▶ 290mSv not delivered
- ▶ 1400ml I-contrast not administered

▶ FOLLOW UP

CT

- ▶ 6 CT
- ▶ +/- 600 ml contrast
- ▶ Eff. Dose 130mSv

▶ URGENCIES

Take Home Message

- MRA contrast is only slightly risky
- MRA is hugely beneficial
 - Diameters
 - Dynamic MRA
- Non contrast MR solution exist:
- Involve & challenge your radiologist
- Specifically ask for information you need from MR images