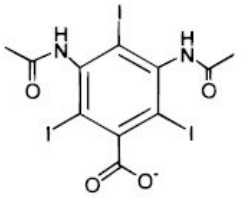
Неорганические вещества в медицине

II. Контрастные вещества

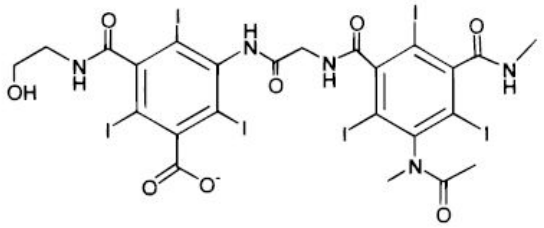
Первый рентгеновский снимок

Иодсодержащие контрастные вещества



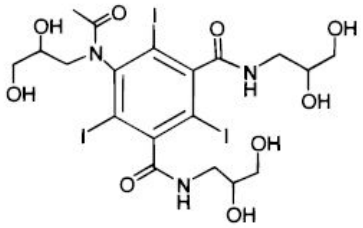
Diatrizoate

Ionic Monomer



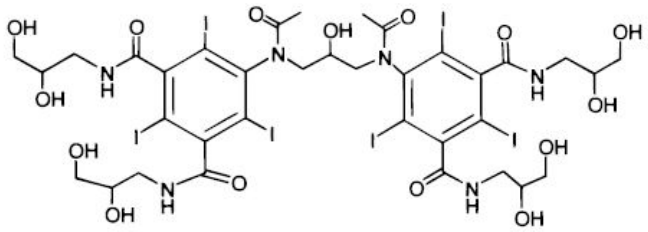
Ioxaglate

Ionic Dimer



Iohexol

Nonionic Monomer

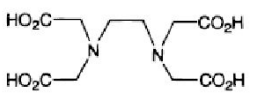


Iodixanol

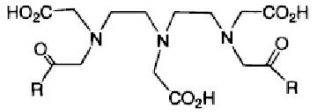
Nonionic Dimer

Хелатобразующие лиганды, используемые для введения контрастных препаратов, и некоторые характеристики соответствующих комплексов

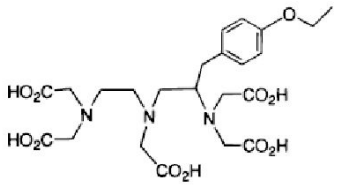
Linear Ligands



H_4EDTA

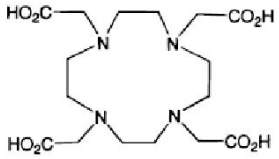


R = OH, H_5DTPA; R = NHMe, H_3DTPA-BMA

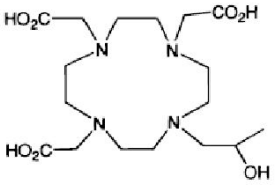


H_5EOB-DTPA

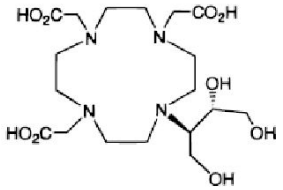
Cyclic Ligands



H_4DOTA



H_3HP-DO3A



H_3DO3A-butrol

complexes	log K	LD_{50}
$(NMG)_2GdDTPA$	22.4	6−10
$Na_2YbDTPA$	22.6	10 (rat)
GdDTPA-BMA	16.9	14.8
(NMG)GdDOTA	25.8	11
GdHP-DO3A	21.8	12
GdDO3A-butrol	23.8	∼30
$(NMG)_2GdEOB$-DTPA		7.5
(NMG)GdEDTA	17.3	0.3
$Na_2PbEDTA$	18.1	∼1.5 (rabbit)
$Na_2BiDTPA$	27.8	<1.4 (dog)

	molecular solubility (M)	tungsten atom solubility (M)	LD_{50} (mmol/kg)
$Na_2[W_2O_4(EDTA)]$	0.5	1.0	10
$Na_2[W_2O_2S_2(EDTA)]$	0.075	0.15	∼2.5 (MLD)
$(NMG)_2[W_2O_2S_2(EDTA)]$	0.3	0.6	∼5 (MLD)
$Na_2[W_3S_4O(TTHA)]$	0.17	0.51	6.5
$(NMG)_2[W_3S_4O(TTHA)]$	0.49	1.47	7.2
$Na_4[(W_3S_4)_2(EGTA)_3]$	0.04	0.24	
$(NMG)_4[(W_3S_4)_2(EDTA)_3]$	0.072	0.43	4 (MLD)
$Na_2P_2W_{18}O_{64}$			≪1 (MLD)

Некоторые характеристики комплексов гадолиния

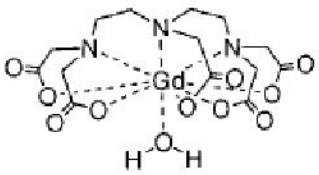
ligand	LD_{50}[f]	%ID[n]/gram	log K_{GdL}	log K^*_{GdL} (pH 7.4)	log K_{sel}	log K_{CaL}	log K_{CuL}	log K_{ZnL}
EDTA	0.3[m]	0.80	17.7[b] 17.37[l]	14.70 14.8[b]	4.23[m]	10.61[l]	18.78[l]	16.5
DTPA	5.6[m]	0.005	22.46[l]	17.70	7.04[m]	10.75[l]	21.38[l]	18.29[l]
DTPA-BMA	14.8[m]	0.03	16.85[m]	14.90	9.04	7.17[m]	13.03[m]	12.04[m]
DTPA-BMEA			16.84[b]					
DTPA-BP	2.8[m]		16.83[m]		5.32[m]			
DOTA	11[d]	NDR[o]	25.3[b] 24.6[h] 24.0[i] 22.1[k]	18.33[d] 18.6[b]	8.3[a]	17.23[e]	22.63[e]	21.05[e]
DO3A	7−9[a]	0.0080	21.0[b]	14.97[d] 14.5[b]	4.13[a]	11.74[d]	22.87[d]	19.26[d]
DO3MA			25.3[c]		8.3[a]			
HP-DO3A	12[e]	NDR[o]	23.8[b]	17.21[d] 17.1[b]	6.95[a]	14.83[d]	22.84[d]	19.37[d]
BOPTA			22.59[j]					

LD – летальная доза

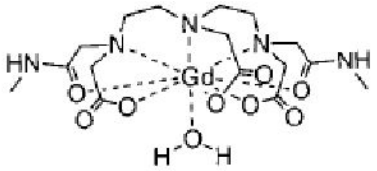
ID - присутствие в бедренной кости через 14 дней после введения

NDR – определить не удалось

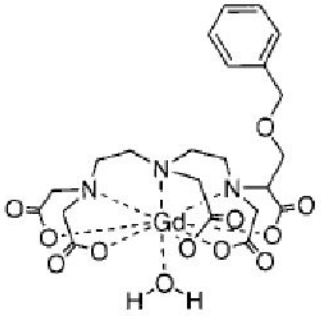
Важнейшие соединения, используемые при проведении МРТ



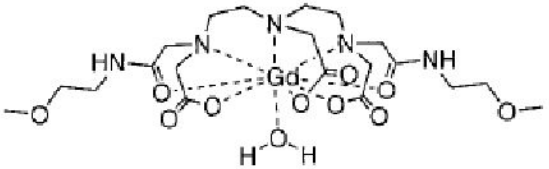
$[Gd(DTPA)(H_2O)]^{2-}$ (Magnevist™)



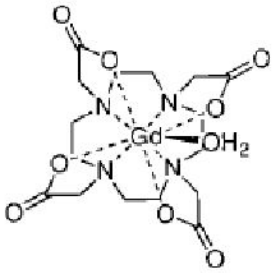
$[Gd(DTPA\text{-}BMA)(H_2O)]$ (Omniscan™)



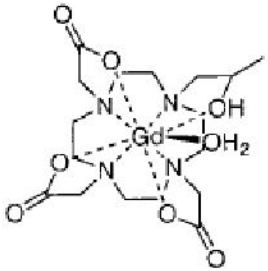
$[Gd(BOPTA)(H_2O)]^{2-}$ (MultiHance™)



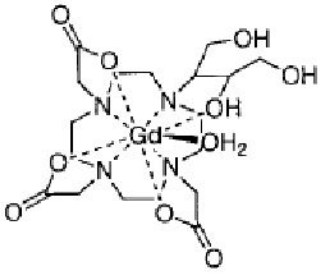
$[Gd(DTPA\text{-}BMEA)(H_2O)]$ (OptiMARK™)



$[Gd(DOTA)(H_2O)]^{-}$ (Dotarem™)



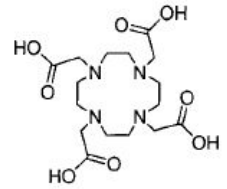
$[Gd(HP\text{-}DO3A)(H_2O)]$ (ProHance™)



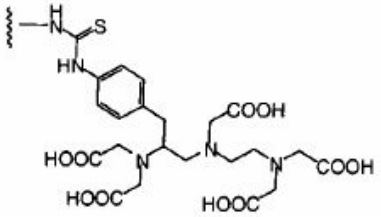
$[Gd(DO3A\text{-}butrol)(H_2O)]$ (Gadovist™)

Таргетные контрастные агенты на основе комплексов гадолиния

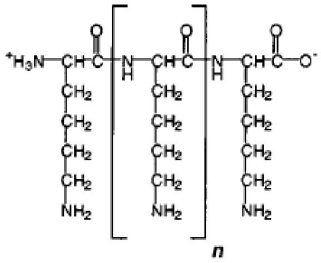
macromolecular contrast agent	conjugate	chelate type	target
Gd–PL-DTPA-HSA	HSA	DTTA-MA	vascular
Gd–PL-DOTA-HSA	HSA	DO3A-MA	vascular
f-PANAM-TU-DTPA	folic acid	DTPA	folate receptor
PL-Gd-DTPA$_{24-28}$–anti CEA	anti-CEA Fab(ab′)$_2$	DTTA-MA	Colorectal carcinoma
PL-Gd-DOTA$_{24-28}$–anti CEA	anti-CEA Fab(ab′)$_2$	DO3A-MA	Colorectal carcinoma



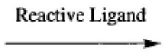
DOTA

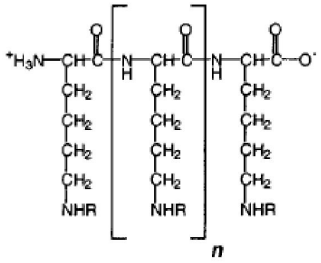


DTPA

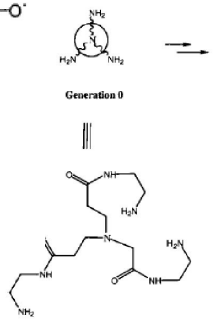


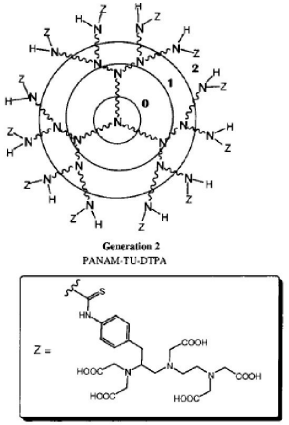
Polylysine





Polylysine conjugate





PANAM-TU-DTPA dendrimer