

protons in the presence of a magnetic field, resulting in a high signal on T1W images and a low signal on T2W images (the latter requires a sufficient local concentration, usually in the form of an IV bolus). Unlike iodinated contrast agents, the effect of MR contrast agents depends on the presence of local hydrogen protons on which it must act to achieve the desired effect. There are nine different gadolinium agents approved in the United States for use with MRI. These differ according to the attached chelated moiety, which also affects the strength of chelation of the otherwise toxic gadolinium element. The chelating carrier molecule for gadolinium can be classified by whether it is macrocyclic or has linear geometry and whether it is ionic or nonionic. Macrocyclic ligands (Group 2 agents) are considered more stable as the gadolinium ion is “caged” in the cavity of the ligand, and thus the rate of dissociation of gadolinium is slower compared to linear ligands (Group 1 agents). Most agents are excreted by the renal system.

BRAIN ACCUMULATION OF GADOLINIUM It recently has become evident that gadolinium accumulates in the dentate nuclei and globus pallidus of the brain after serial administration of some linear Group 1 gadolinium agents. This has not been demonstrated for Group 2 macrocyclic agents. Gadolinium deposition in the brain appears to be dose dependent and occurs in patients with no clinical evidence of kidney or liver disease. To date, there have been no reports to suggest these deposits are associated with histologic changes that would suggest neurotoxicity, even among agents with the highest rates of deposition.

ALLERGIC HYPERSENSITIVITY Gadolinium-DTPA (diethylenetriaminepentaacetic acid) does not normally cross the intact BBB immediately but will enhance lesions lacking a BBB ([Fig. 423-3A](#)) as well as areas of the brain that normally are devoid of the BBB (pituitary, dura, choroid plexus). However, gadolinium contrast slowly crosses an intact BBB over time and especially in the setting of reduced renal clearance or inflamed meninges. The agents are generally well tolerated; overall adverse events after injection range from 0.07–2.4%. True allergic reactions are rare (0.004–0.7%) but