

47 Contrast Media: Gadolinium Chelates with Protein Binding

By slight changes in structure, agents with improved relaxivity and altered distribution have been developed, with further research likely in this area. Gadavist (Gadovist, outside the U.S.) intrinsically has higher relaxivity than the other extracellular agents. MultiHance, which demonstrates transient protein binding, likewise has higher relaxivity (40% at 1.5 T, equivalent to double dose, the highest in this class of agents) and in addition partial hepatobiliary excretion, both due to addition of a phenyl moiety. **Fig. 47.1** illustrates the improved enhancement of a brain metastasis at 1.5 T with MultiHance

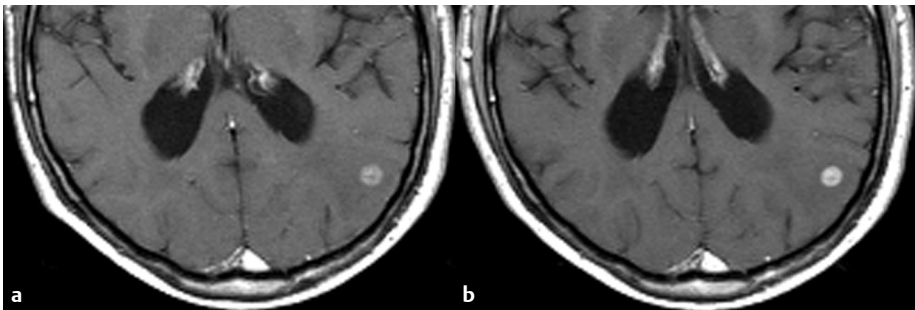
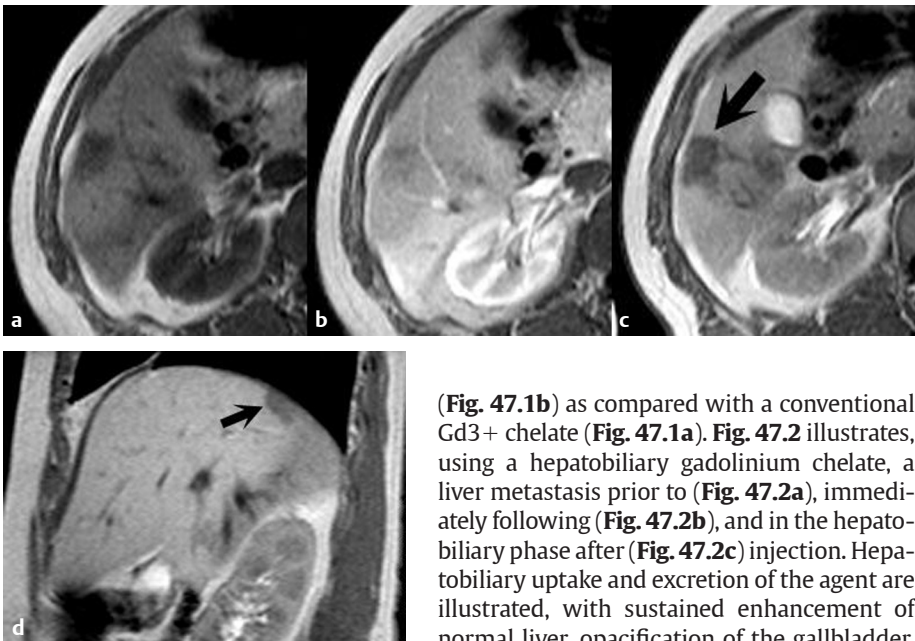


Fig. 47.1



(**Fig. 47.1b**) as compared with a conventional Gd³⁺ chelate (**Fig. 47.1a**). **Fig. 47.2** illustrates, using a hepatobiliary gadolinium chelate, a liver metastasis prior to (**Fig. 47.2a**), immediately following (**Fig. 47.2b**), and in the hepatobiliary phase after (**Fig. 47.2c**) injection. Hepatobiliary uptake and excretion of the agent are illustrated, with sustained enhancement of normal liver, opacification of the gallbladder, and slightly improved visualization of a liver

metastasis (arrow) on the delayed image. High-quality breath-hold imaging in all three orthogonal planes is possible in the hepatobiliary phase, providing improved detection of liver metastases, such as that seen immediately below the dome of the diaphragm (**Fig. 47.2d**, arrow). Agents with very high hepatobiliary excretion (i.e., Eovist [gadotetate disodium or Gd EOB-DTPA], ~50%, as opposed to MultiHance with 4–6%) and prolonged residence in the bloodstream (i.e., Ablavar [gadofosveset trisodium], mean half-life 16 hours), due to albumin binding, are now approved for use in the United States, and for specifically Eovist (Primovist, outside the U.S.), widely across the world.

Some of the newer gadolinium chelates have advantages as well in contrast-enhanced MR angiography. For example, vessel signal intensity has been shown to be markedly improved with both Gadavist and MultiHance, the former principally due to its higher formulation concentration (1 molar) and the latter due to transient albumin binding, compared with more conventional agents. These improvements, together with technologic advances in equipment design, have made possible high resolution whole-body 3D contrast-enhanced MR angiography (**Fig. 47.3**), with five 3D datasets, slightly overlapping, acquired in immediate succession following a single intravenous contrast dose. **Fig. 47.4** illustrates patient positioning and image acquisition for three such image sets.



Fig. 47.3
Courtesy of Mathias Goyen.

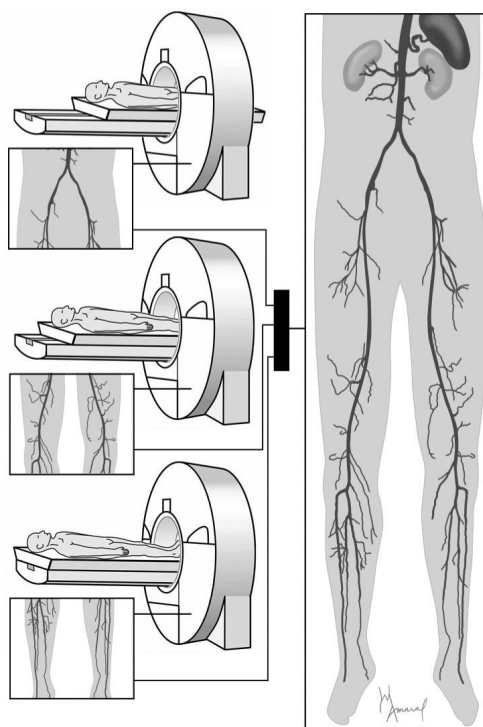


Fig. 47.4