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Recent advances in imaging of brain tumors.

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The recent advances in brain tumor imaging offer unique anatomical as well as pathophysiological information that provides new insights on brain tumors, directed at facilitating therapeutic decisions and providing information regarding prognosis. This information is presently utilized in clinical practice for initial diagnosis and noninvasive, preoperative grading of tumors, biopsy planning, surgery, and radiation portal planning, as well as, prognostication. The newer advances described in this review include magnetic resonance (MR) diffusion and diffusion tensor imaging with tractography, perfusion imaging, MR spectroscopy, and functional imaging, using the blood oxygenation level dependent (BOLD) technique. Diffusion tensor MR imaging is the only noninvasive in vivo method for mapping white matter fiber tract trajectories in the human brain. In the current clinical practice, one of the most important indications of diffusion tensor imaging (DTI) is to study the relation of a tumor to the adjacent white matter tracts. Perfusion imaging with computed tomography (CT) and magnetic resonance imaging (MRI) is an exciting new radiological technique for noninvasive evaluation of cerebral hemodynamics, in certain definite clinical settings. Cerebral perfusion imaging describes the passage of blood through the brain's vascular network. Perfusion imaging, especially with MRI has become an integral component of the complete radiological assessment of brain tumors. MR Spectroscopy (MSR) is the only noninvasive technique capable of measuring chemicals within the body. MRS distinguishes various metabolites on the basis of their slightly different chemical shifts or resonance frequencies. Functional MRI refers to the demonstration of brain function with neuroanatomic localization on a real-time basis. In patient care, functional MR imaging is primarily used in the preoperative evaluation of the relationship of a brain tumor with an eloquent cortex. The next decade will witness further sophistication of these techniques, with data available from larger studies. It is expected that imaging will continue to provide new and unique insights in neuro-oncology, which should hopefully contribute to the better management of patients with brain tumors.

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