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Brain Tumor Imaging without Gadolinium-based Contrast Agents: Feasible or Fantasy?

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Abstract

Gadolinium-based contrast agents (GBCAs) form the cornerstone of current primary brain tumor MRI protocols at all stages of the patient journey. Though an imperfect measure of tumor grade, GBCAs are repeatedly used for diagnosis and monitoring. In practice, however, radiologists will encounter situations where GBCA injection is not needed or of doubtful benefit. Reducing GBCA administration could improve the patient burden of (repeated) imaging (especially in vulnerable patient groups, such as children), minimize risks of putative side effects, and benefit costs, logistics, and the environmental footprint. On the basis of the current literature, imaging strategies to reduce GBCA exposure for pediatric and adult patients with primary brain tumors will be reviewed. Early postoperative MRI and fixed-interval imaging of gliomas are examples of GBCA exposure with uncertain survival benefits. Half-dose GBCAs for gliomas and T2-weighted imaging alone for meningiomas are among options to reduce GBCA use. While most imaging guidelines recommend using GBCAs at all stages of diagnosis and treatment, non-contrast-enhanced sequences, such as the arterial spin labeling, have shown a great potential. Artificial intelligence methods to generate synthetic postcontrast images from decreased-dose or non-GBCA scans have shown promise to replace GBCA-dependent approaches. This review is focused on pediatric and adult gliomas and meningiomas. Special attention is paid to the quality and real-life applicability of the reviewed literature.

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