

## 1. Supratentorial Brain Neoplasms

Astrocytomas are the most common primary intra-axial tumor, arising predominantly supratentorially in adults and infratentorially in children. Of these, grade I tumors (according to the World Health Organization) include pilocytic astrocytoma and subependymal giant cell astrocytoma, grade II diffuse astrocytoma and oligodendroglioma, grade III anaplastic astrocytoma and grade IV glioblastoma multiforme (GBM). The MR appearance of a grade I astrocytoma is typically that of a well circumscribed lesion, with increased signal intensity (SI) on T2-weighted images (T2WI) and decreased signal intensity on T1WI, reflecting increased extracellular fluid. These lesions usually enhance. Unlike other astrocytomas, grade I lesions carry a very good prognosis, and they are often cured by resection alone. Pilocytic astrocytomas, the most common grade I lesion, will be discussed in chapter 2. Grade II astrocytomas demonstrate a relatively homogenous appearance and may appear circumscribed on MR – belying their infiltrative nature (Fig. 1.1 A, B). Grade II astrocytomas however are typically not well demarcated along all margins. These tumors may grow large enough to exhibit significant mass effect, such as midline shift (mild left-to-right in the instance of Fig. 1.1 A, B), but they generally lack the degree of accompanying edema seen in higher-grade counterparts. Their lack of enhancement also helps distinguish them from a GBM.

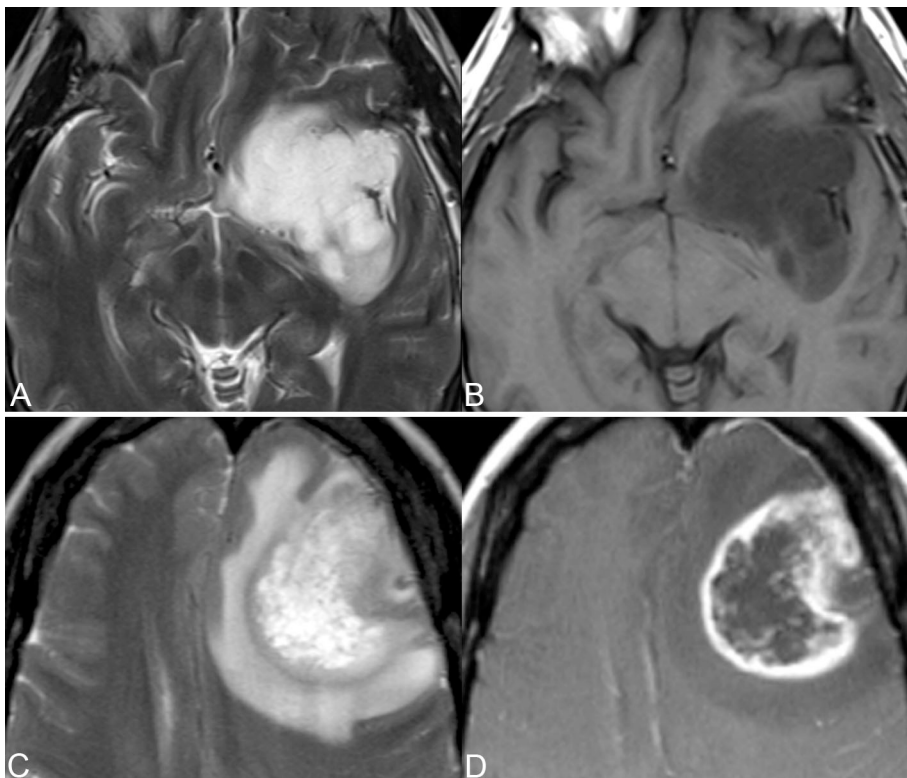


Fig. 1.1

MR perfusion scans may help distinguish borderline cases, with higher grade tumors demonstrating elevated cerebral blood volume. Oligodendrogliomas are uncommon, slow-growing tumors. Their distinctive feature is calcification, which is not well visualized on MRI. On the basis of imaging appearance alone, oligodendrogliomas cannot be differentiated from astrocytomas. The presence of calvarial erosion (with peripherally located lesions, due to slow growth) however favors an oligodendroglioma.

GBM (Fig. 1.1 C, D) is the most common primary intracranial neoplasm, comprising roughly half of solitary brain lesions (the other half being metastases). The prognosis is dismal, with death typically in under a year. Most GBMs involve the frontal and temporal lobes and may arise from a lower grade lesion. GBMs have the most characteristic MRI appearance of the astrocytomas. A heterogenous central lesion associated with prominent mass effect and margin irregularity is typical (Fig. 1.1 C, D). Areas of necrosis, correlating with high SI on T2WI (Fig 1.1 C) and low SI on T1WI (Fig. 1.1 D), occur where the GBM has outgrown its blood supply. Vascular flow voids may be seen. Calcification is less common than in lower grade astrocytomas but may be seen in GBMs arising secondarily to these. Peripherally the tumor is typically surrounded by areas of high SI on T2WI (Fig. 1.1 C) and low SI on T1WI (Fig. 1.1 B), correlating with vasogenic edema. All GBMs enhance, with an irregular, thick enhancing rim (Fig. 1.1 D, arrow) being the most characteristic pattern. Histologically, GBMs extend beyond the area delineated by abnormal contrast enhancement, and even beyond areas of high SI on T2WI. Characteristically, GBMs spread via white matter tracts, and can cross the corpus callosum to the opposite hemisphere (i.e. to produce a “butterfly glioma”). Along with lymphoma and metastases, GBMs are one of the few neoplastic lesions that involve the callosum. Grade III lesions, or anaplastic astrocytomas, may arise from lower grade astrocytomas and about half progress to GBM. Anaplastic astrocytomas demonstrate less distinctive imaging characteristics than GBMs: margins are not as irregular, there is less mass effect, enhancement is variable, and the SI heterogeneity is less. Unlike GBMs, not all anaplastic astrocytomas enhance. The presence of necrosis strongly implies the lesion is a GBM.

Differential considerations for a GBM include metastases and lymphoma. The presence of a second tumor focus favors the diagnosis of metastases, although multicentric GBMs do rarely occur. The incidence of CNS lymphomas has risen with the increase in the population of HIV (Human Immunodeficiency Virus) and transplant patients. Primary CNS lymphoma is typically of homogeneous low SI on T2WI, unlike GBMs. Restricted diffusion may be present, due to the dense cellularity of the tumor. Enhancement tends to be uniform, though it may be tempered by steroid treatments. Necrotic tumors (more common in HIV patients) may demonstrate ring-enhancement, mimicking toxoplasmosis.

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Periventricular location and lack of mass effect favor lymphoma.