به نام خدا

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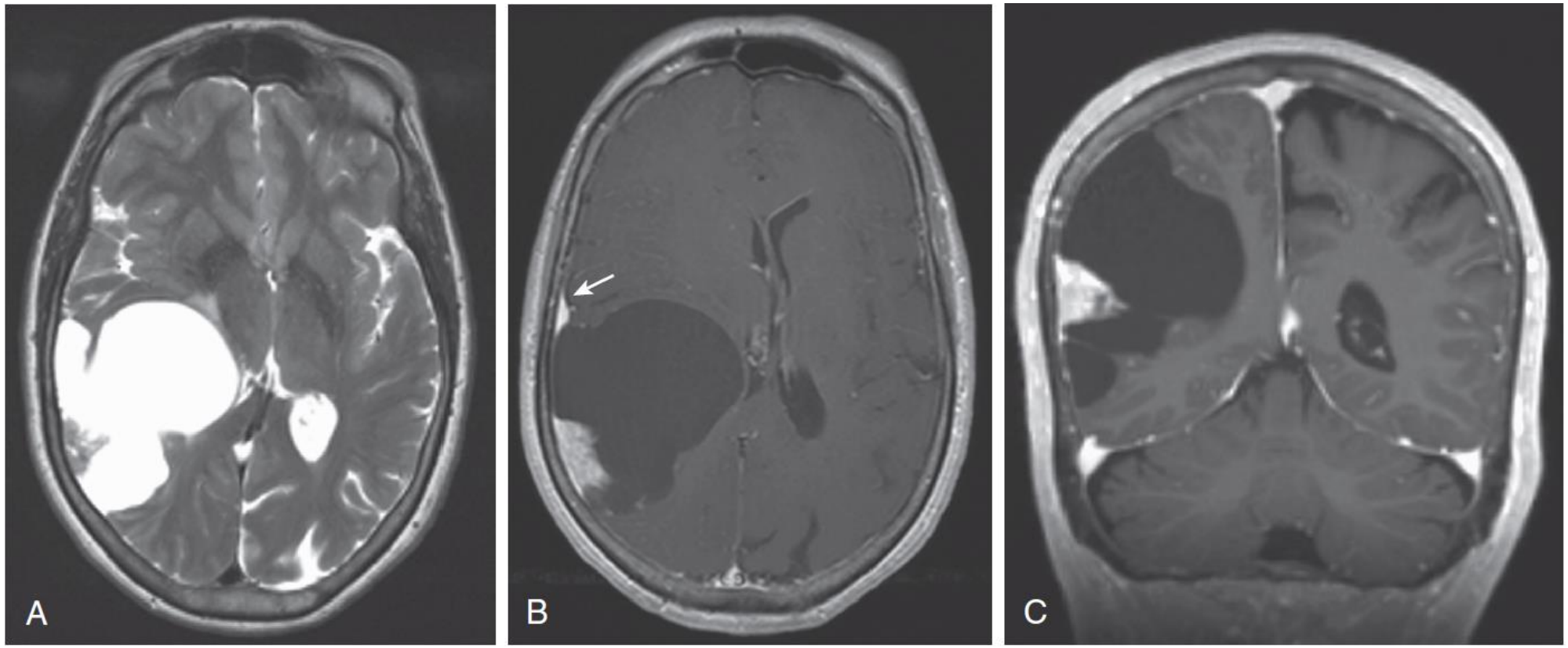
IMAGING CHARACTERISTICS OF BRAIN TUMORS BASED ON ANATOMIC LOCATION

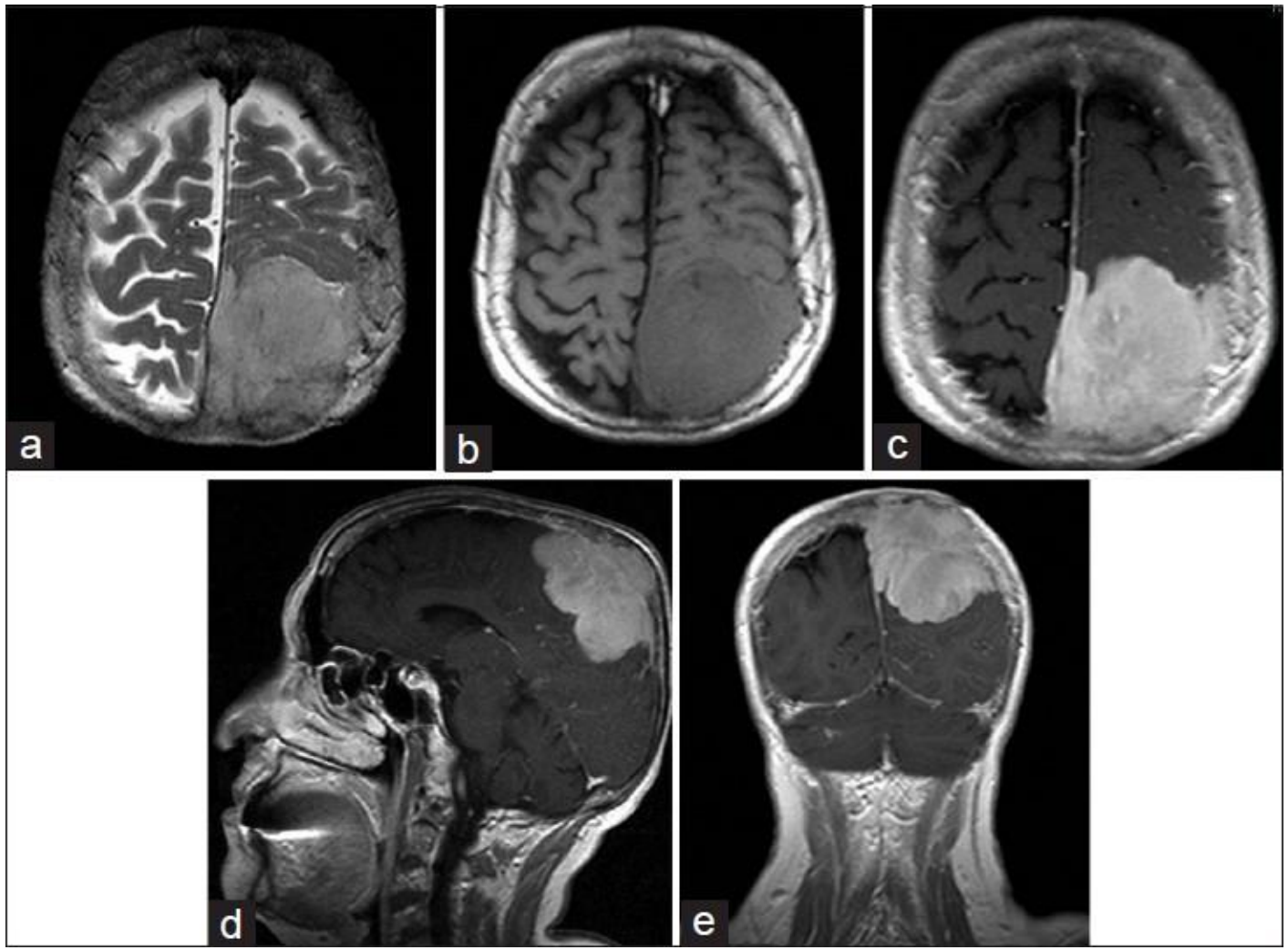
Extra-Axial Masses

Meningioma

- Meningiomas are the most common intracranial extra-axial neoplasm in adults.
- Meningiomas typically have higher density than normal brain parenchyma on CT
- meningiomas are typically isointense onT1-weighted images relative to gray matter, are slightly hyperintense). The signal characteristics of meningiomas, however, can be highly variable, occasionally having cystic or necrotic components.
- Meningiomas may show stippled or coarse calcifications, which can be an important diagnostic clue for differentiating meningiomas from other malignant extra-axial lesions such as metastasis and lymphoma.
- A widely discussed feature of meningiomas is the *dural tail,* which represents contrast enhancement extending along the dural margins.

The proton MR spectroscopic features of meningiomas include absence of NAA and elevations of choline peaks. Alanine has been suggested to be a specific marker for meningiomas, but with variable sensitivities.

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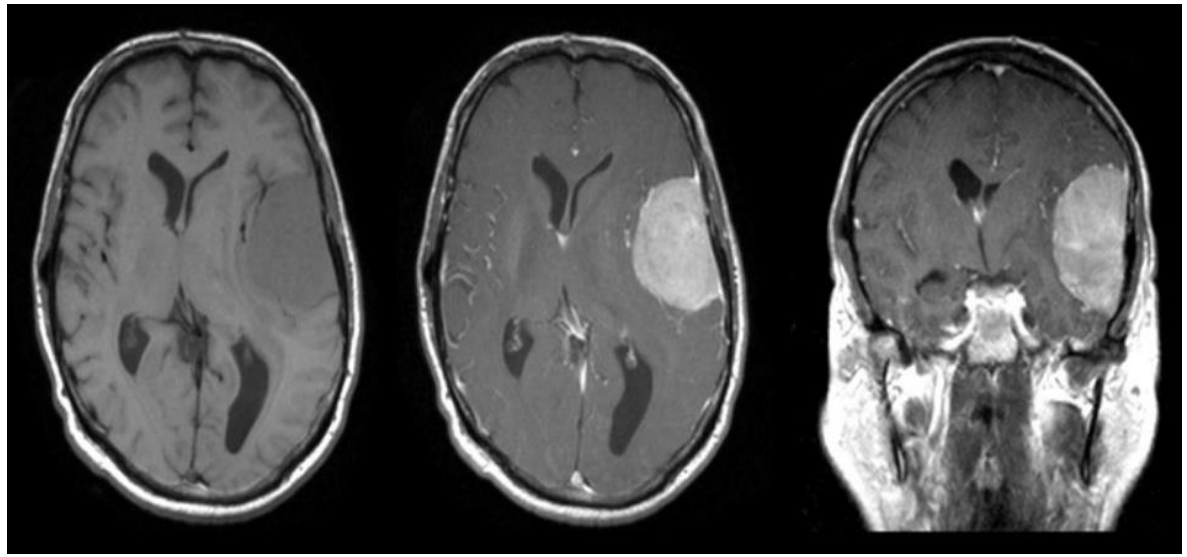
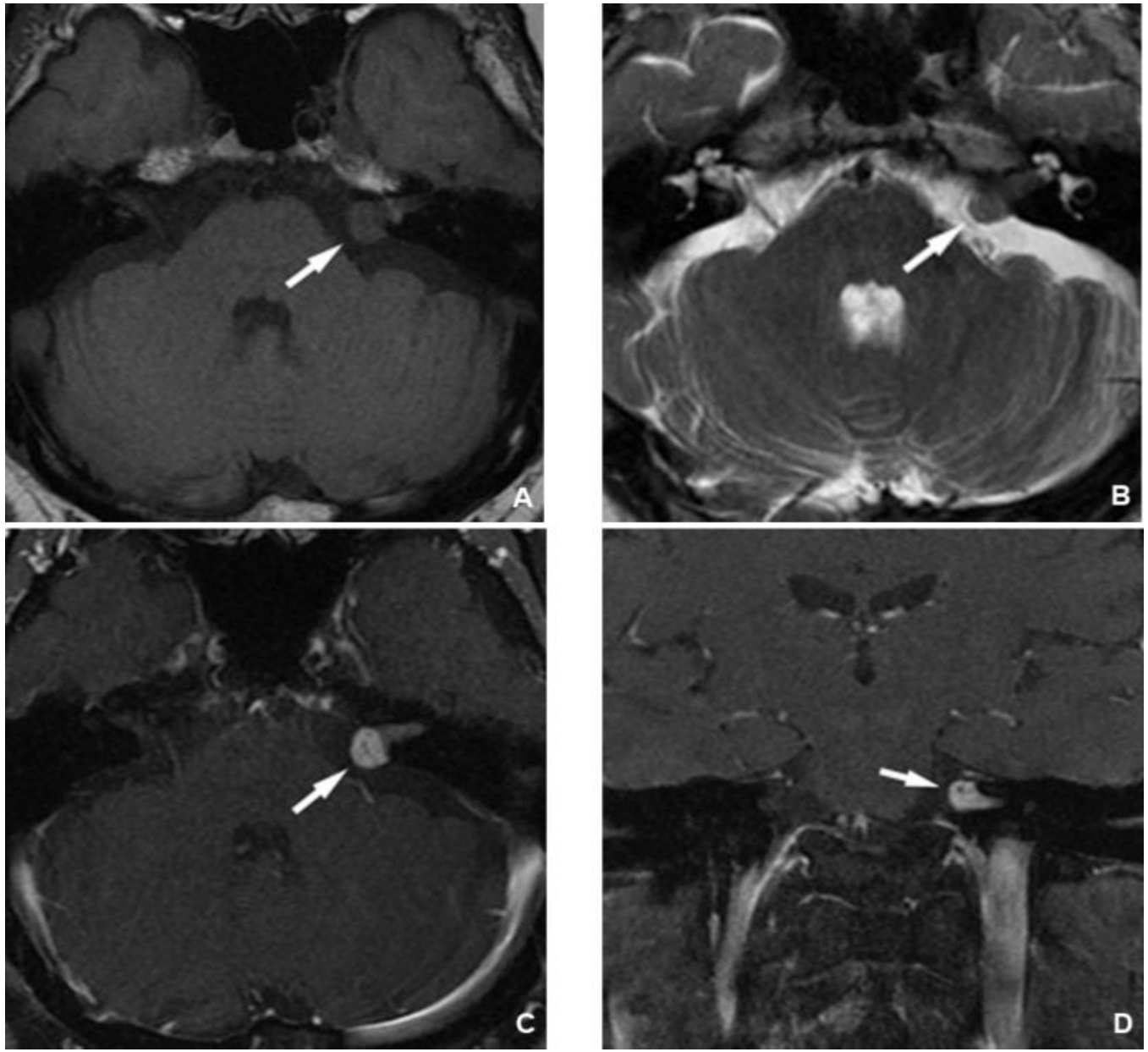


Schwannoma

- Schwannomas are the second most common intracranial extraaxial tumor. The majority of intracranial schwannomas occur in the cerebellopontine angle near the internal auditory canal (IAC), arising most often from one of the vestibular branches of the eighth cranial nerve.

- vestibular schwannomas can contain cyst(s), necrosis, or hemorrhage and occasionally cause edema in adjacent brain tissue.

- On T1-weighted images, two thirds of VS cases are slightly hypointense and one third are isointense relative to adjacent brain tissue; cystic areas are hypointense.58 On T2-weighted images, VSs are heterogeneously hyperintense relative to adjacent brain tissue, and cystic areas contain fluid intensity. Postcontrast T1-weighted imaging shows avid contrast enhancement. In addition, there is a homogeneous pattern in small noncystic tumors, and a heterogeneous pattern in large and cystic lesions.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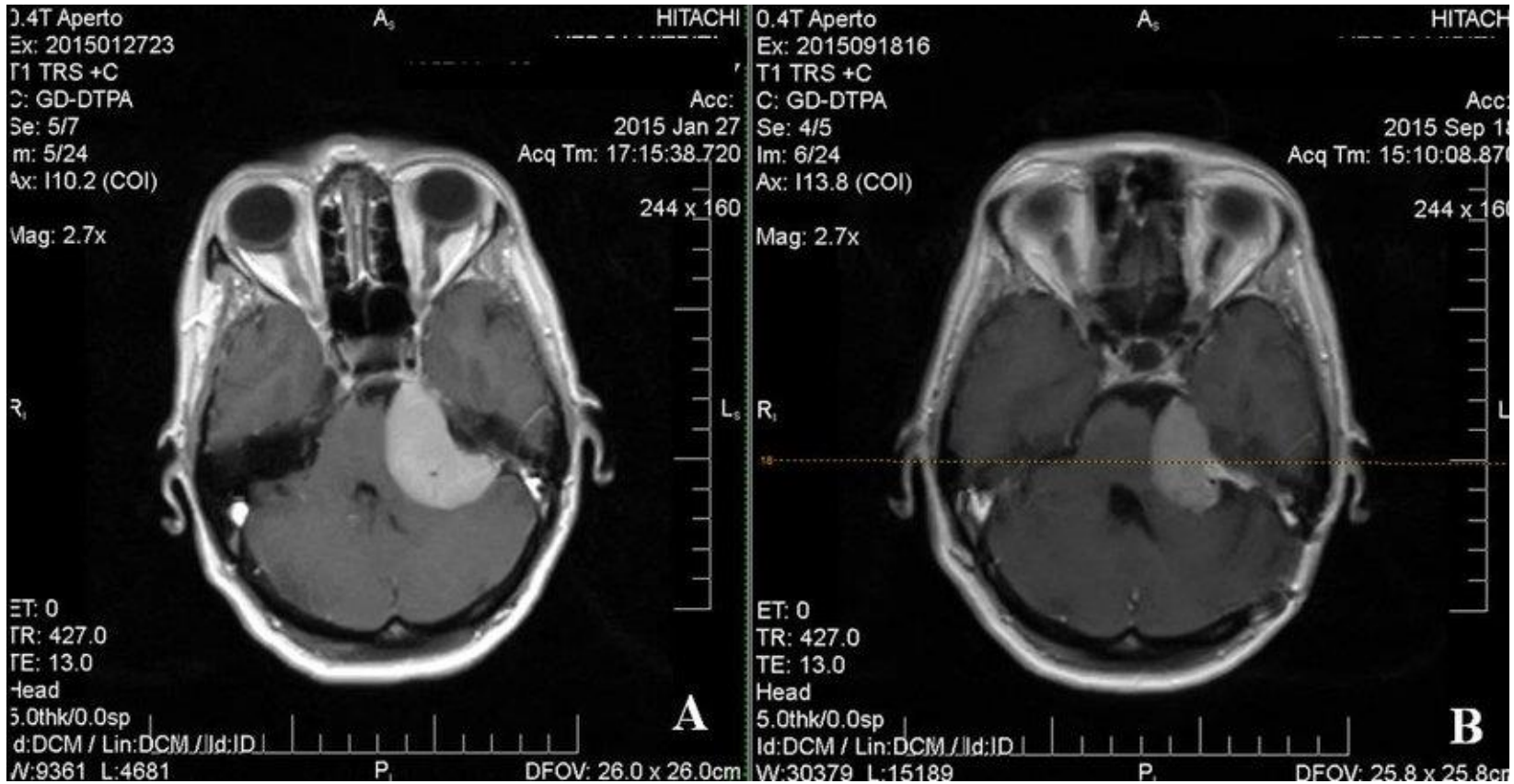
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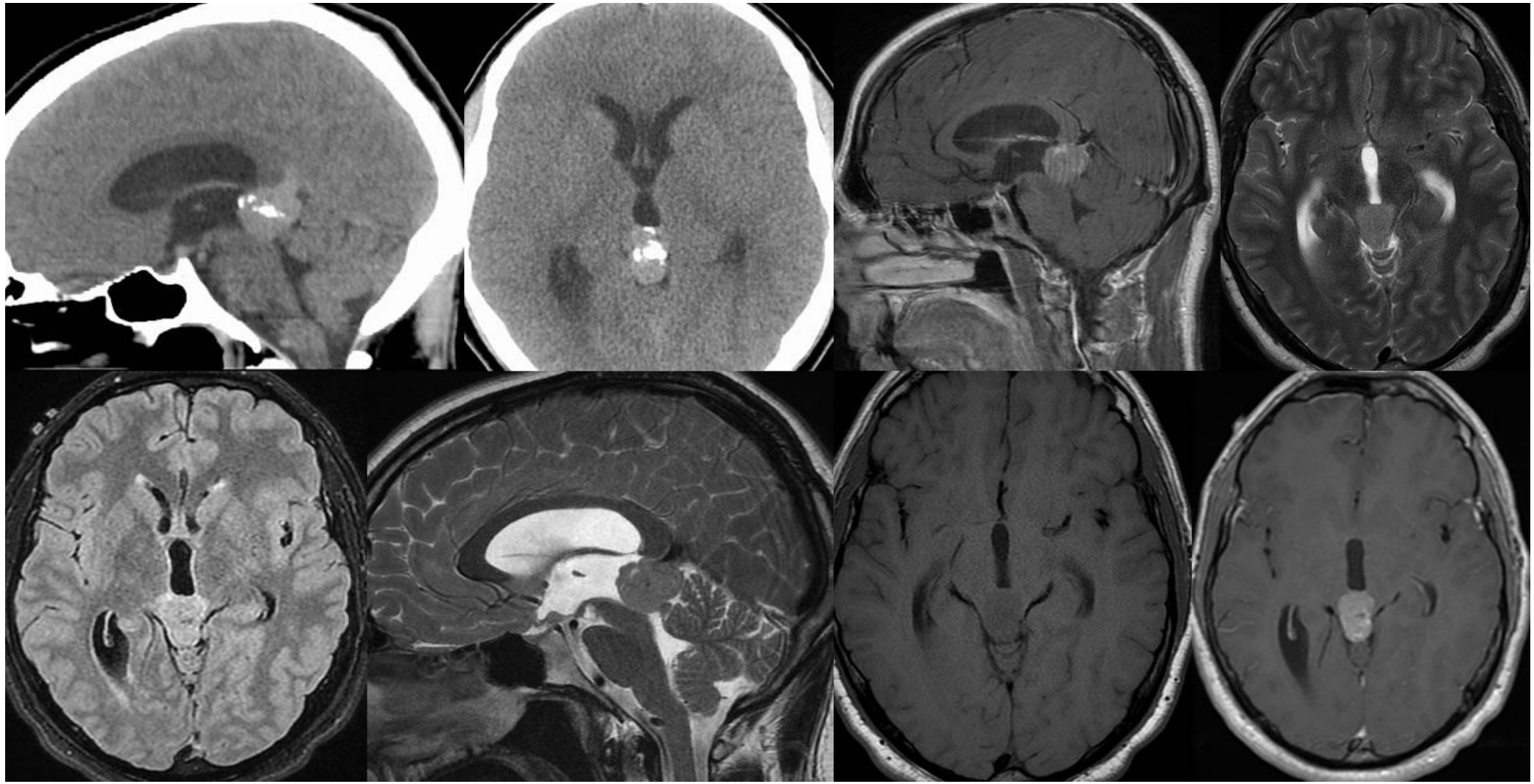
Pineal Region Tumors

Tumors of Germ Cell Origin

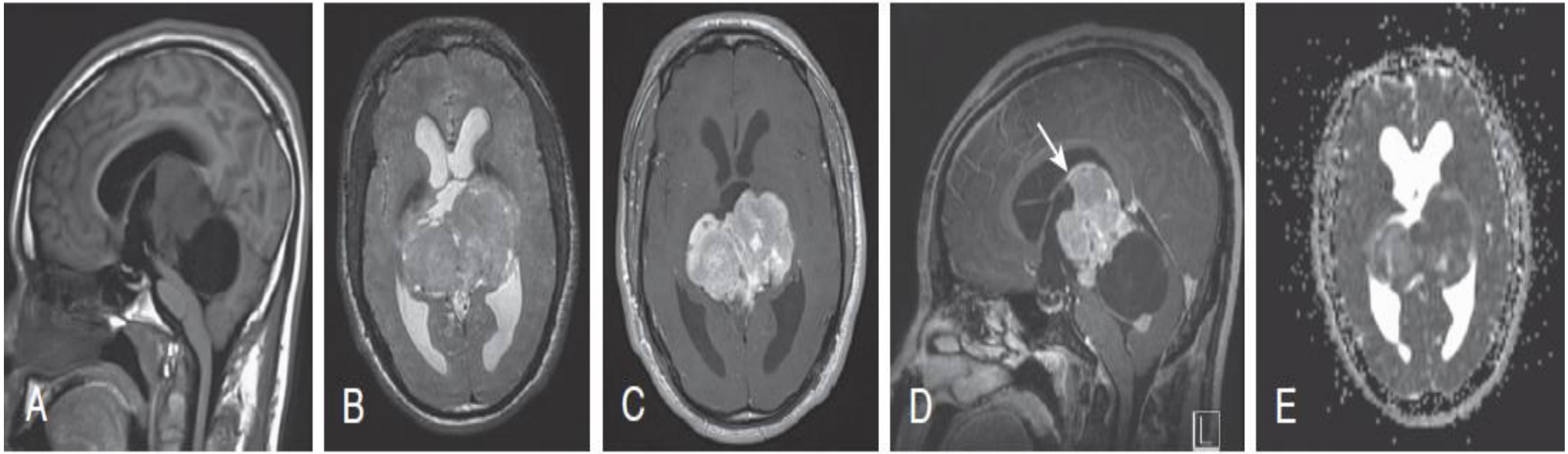
- Germinomas are typically similar or higher in density in comparison with gray matter on CT. These tumors are isointense to hypointense to gray matter on T1- and T2-weighted images, often demonstrating avid homogeneous enhancement.

- Teratomas and dermoid tumors contain fat and can be detected by their low density on CT and hyperintensity on T1-weighted MR.



Pineal Cell Tumors

Primary tumors of the pineal gland include pineocytomas and pineoblastomas. Pineoblastomas grow more rapidly and have a more aggressive clinical course



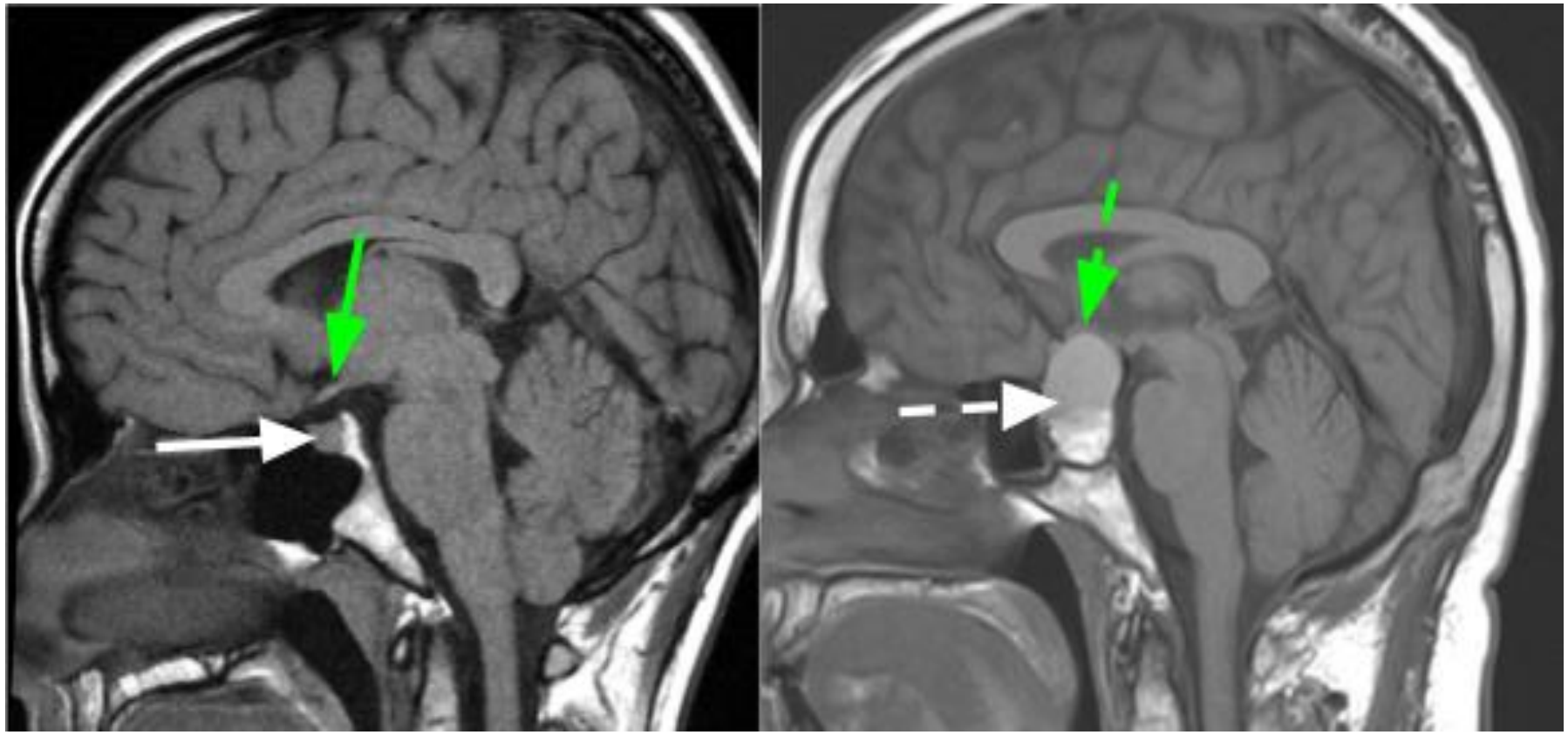
Sellar Lesions

Pituitary adenomas

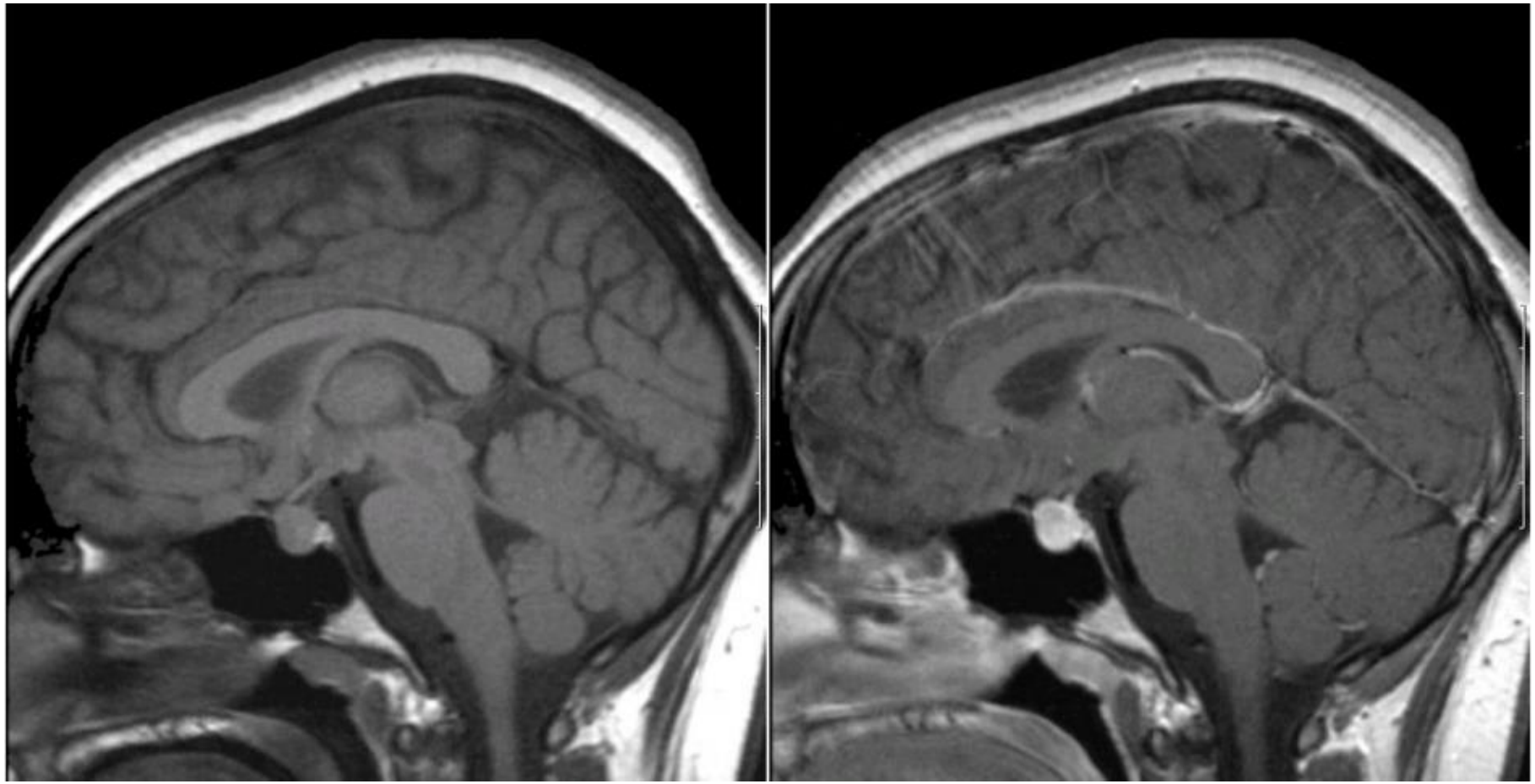
- Both microadenomas and macroadenomas can contain hemorrhage or proteinaceous material, appearing hyperintense on T1-weighted imaging. In the setting of acute intratumoral hemorrhage or pituitary apoplexy, a blood-fluid level can be detected along with associated clinical findings such as headache and visual field disturbance.

- Following intravenous gadolinium administration, most pituitary microadenomas show a relative lower degree of enhancement than the avidly enhancing pituitary gland.

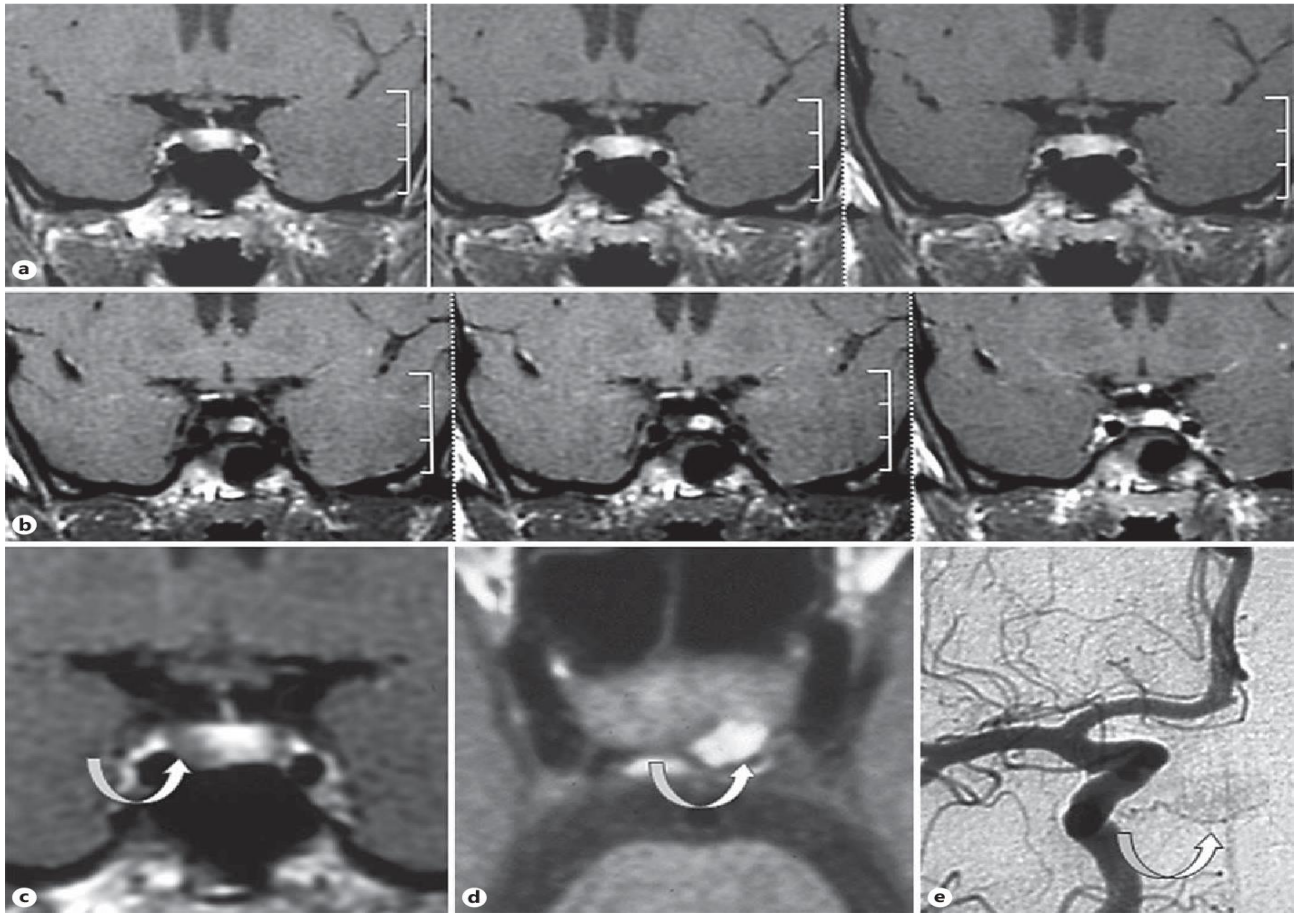
MRI images showing the normal pituitary gland (solid white arrow) and a pituitary tumor (dashed white arrow). The optic chiasm (where the optic nerves meet) is shown by the green arrows and is pushed up by the pituitary tumor.

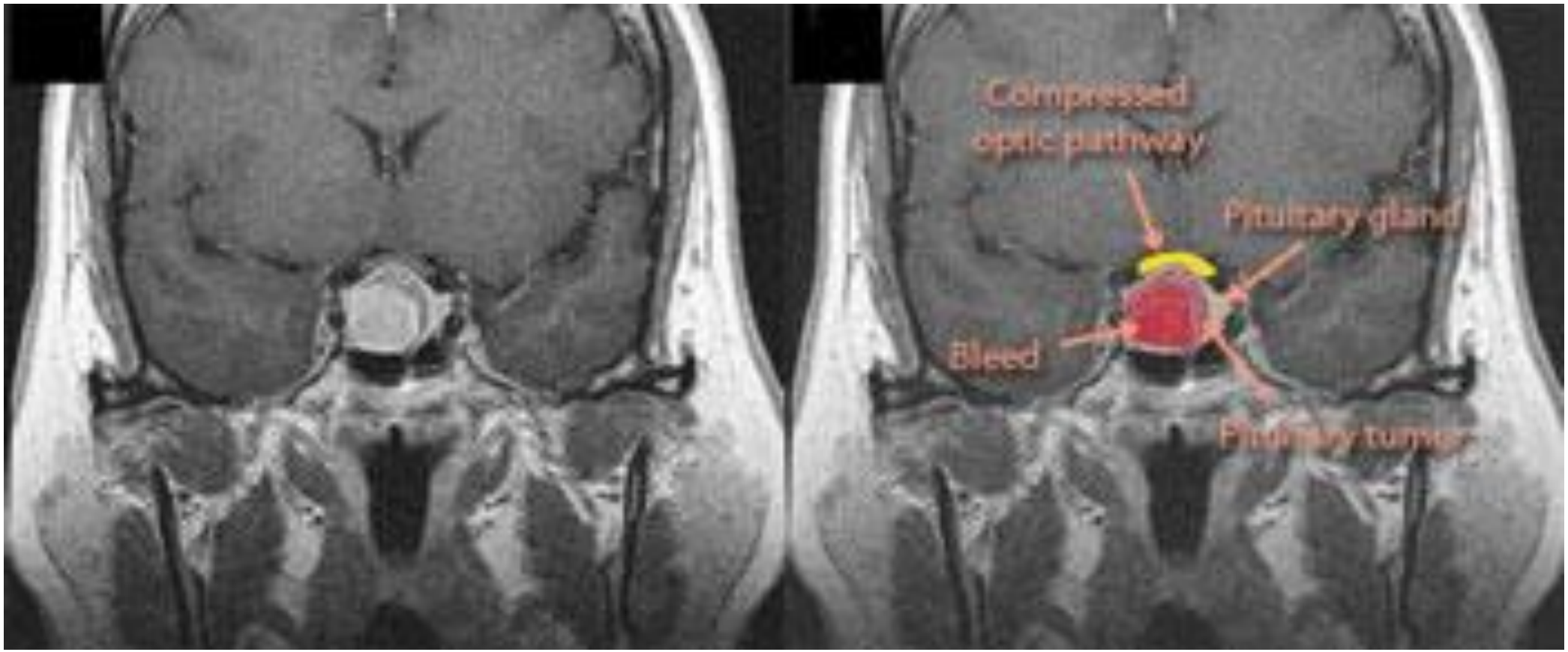


(Left) T1-weighted sagittal MRI; (Right) T1-weighted with gadolinium sagittal MRI. Note the large enhancing mass that fills the sella. This is the typical appearance of a small pituitary macroadenoma that is growing beyond the sella. The optic chiasm can be seen above and is not yet affected.



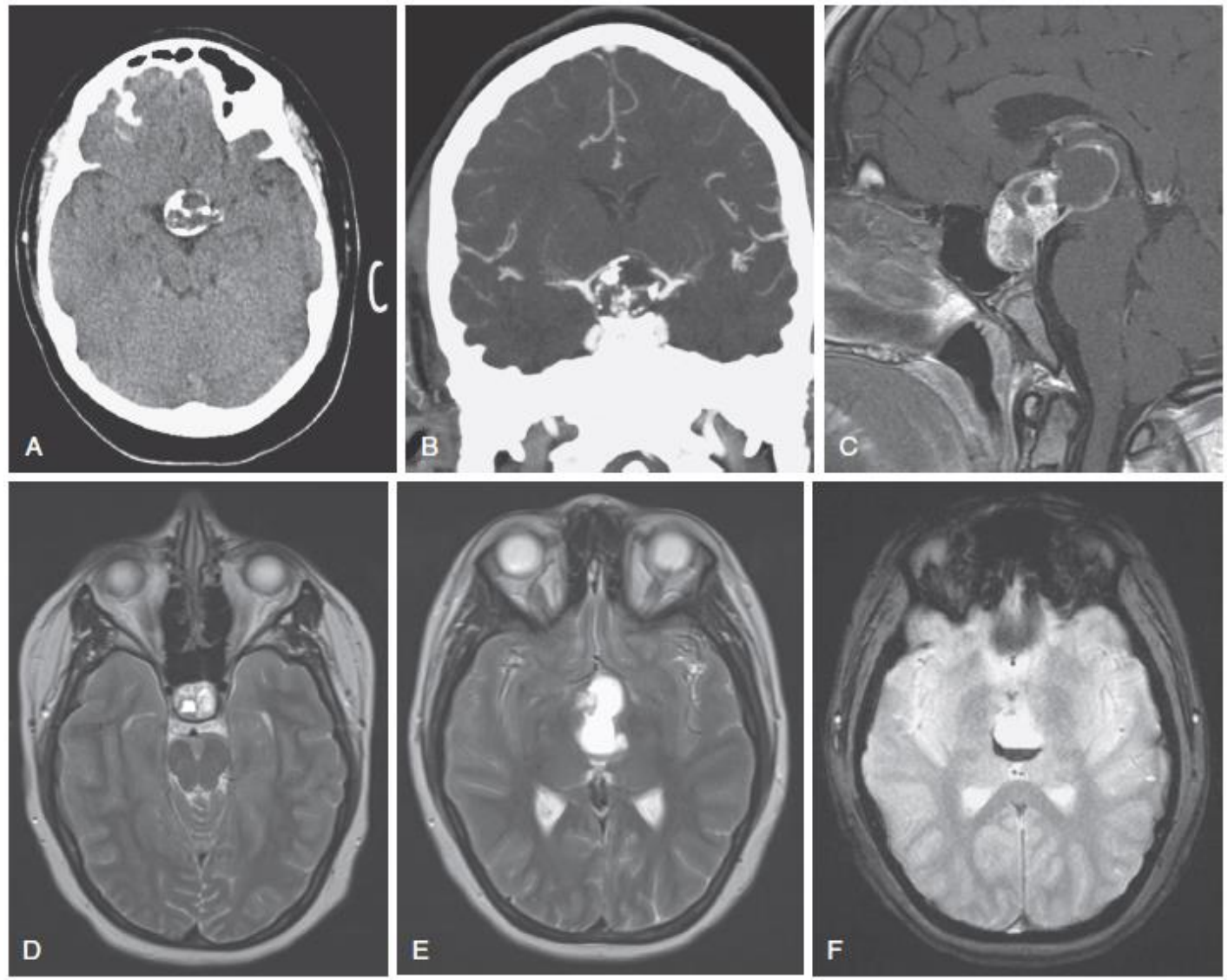
To detect suspected pituitary microadenomas that are not apparent on delayed contrast-enhanced MRI, dynamic contrast MRI can be performed to increase lesion-to-gland contrast on the basis of the different contrast wash-in and washout properties of adenoma and pituitary tissues. The typical adenoma demonstrates delayed wash-in of contrast with respect to the normal pituitary gland.




Compressed optic pathway
Pituitary gland
Bleed
Pituitary tumor

- Other sellar/suprasellar neoplasms include craniopharyngiomas, meningiomas, germ cell tumors, gliomas, metastasis, lymphoma, and Langerhans' cell histiocytosis.

- Craniopharyngiomas may be entirely solid or may contain cysts. Calcifications occur in more than 90% of craniopharyngiomas, which typically are not apparent on MRI but are readily visualized on CT. The cyst of a craniopharyngioma may be hyperintense on T1-weighted images, as a result of either hemorrhage or the cyst's high protein content.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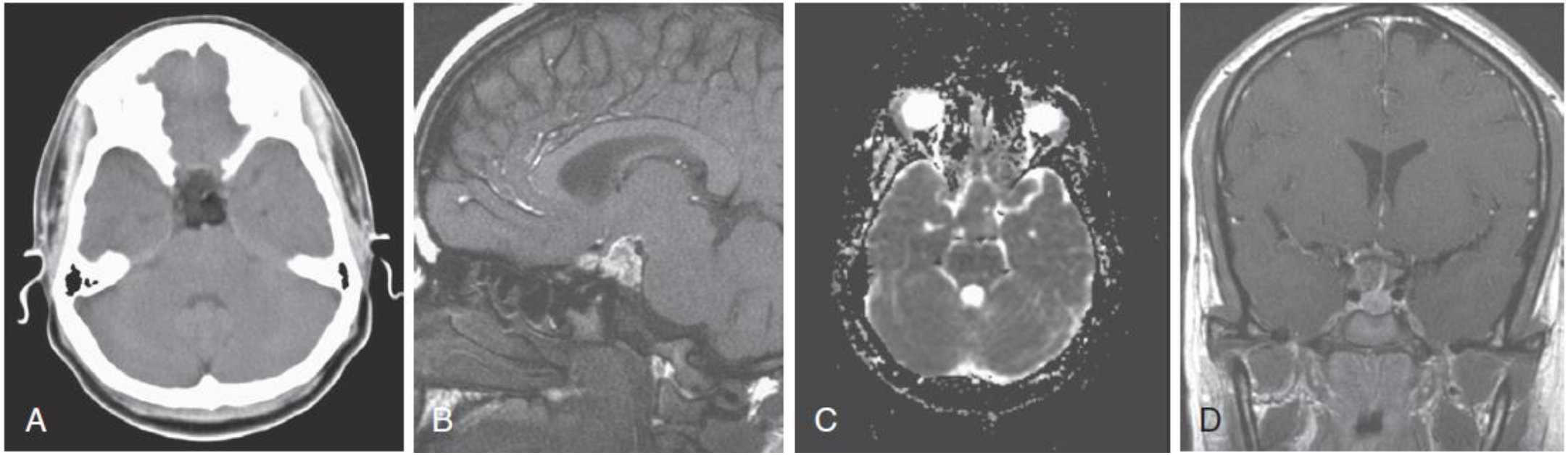
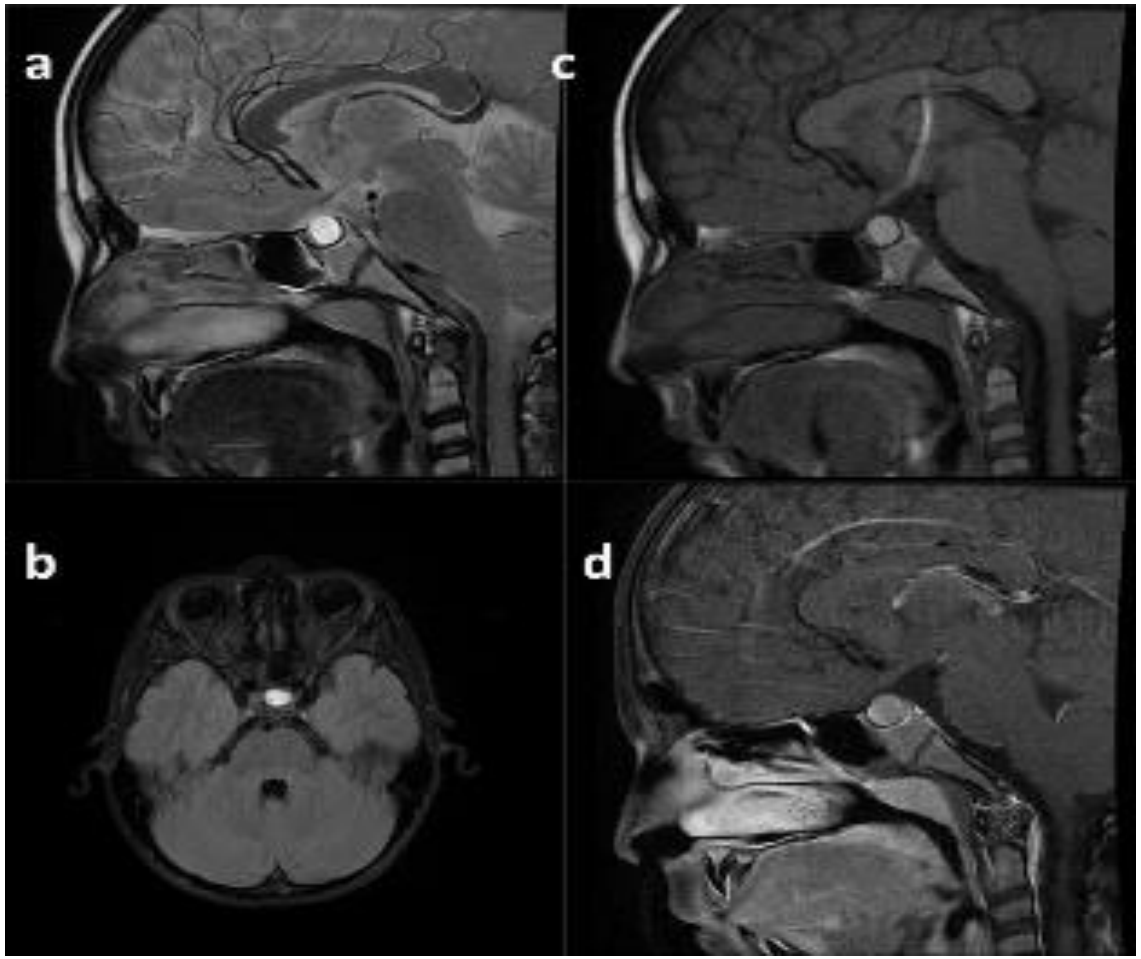
Teratomas and dermoid tumors contain fat and can be detected as low density on CT and hyperintensity on T1-weighted MRI. Ruptured dermoids can show subarachnoid dissemination of these fatcontaining particles, which may float to nondependent locations because they are less dense than CSF.



Rathke’s cleft cyst can have variable signal intensity within cystic cavity and is distinguished from craniopharyngioma by the lack of nodular enhancement.



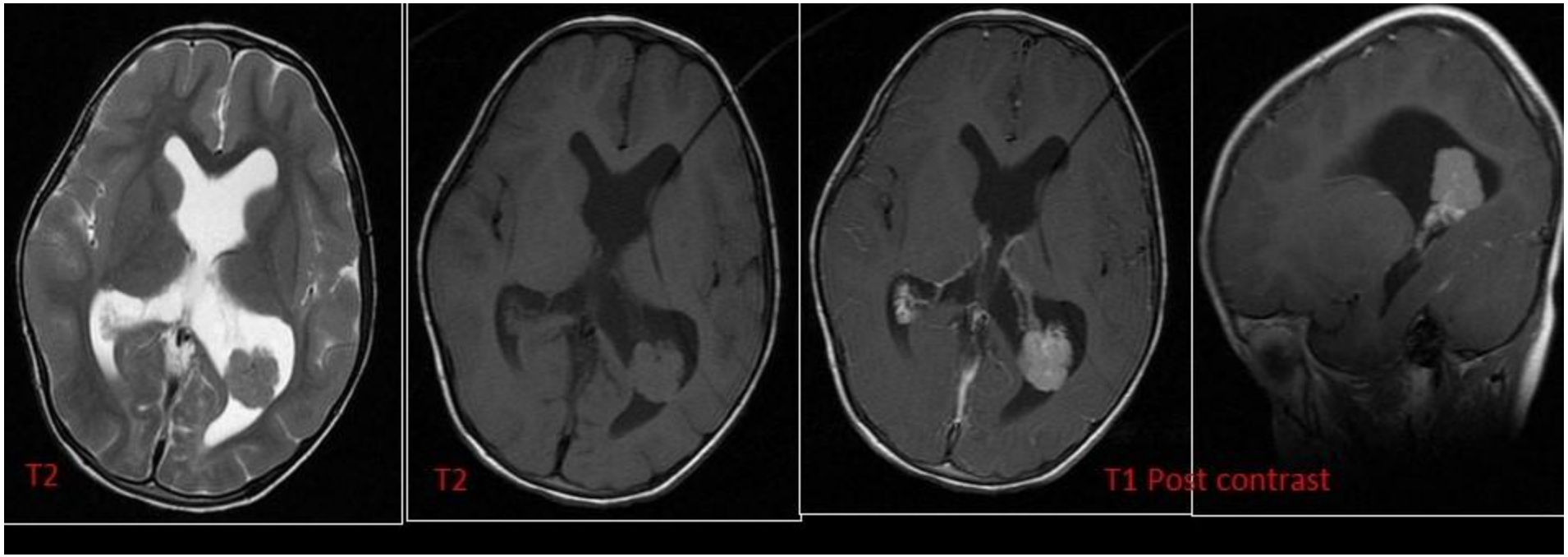
Hyperintense on T2W (a), FLAIR (b) and pre-contrast T1W image due to internal contents. Post-contrast T1WI (d) demostrates no enhancement

Intraventricular Masses

Choroid Plexus Papilloma

The choroid plexus papilloma is characterized by its frond-like borders, avid contrast enhancement, and characteristic location at the glomus of the lateral ventricle (80% of childhood choroid plexus papillomas).These tumors are highly vascular, and one can see flow voids or calcifications as areas of low signal intensity within the lesions. Choroid plexus papilloma is commonly associated with hydrocephalus.

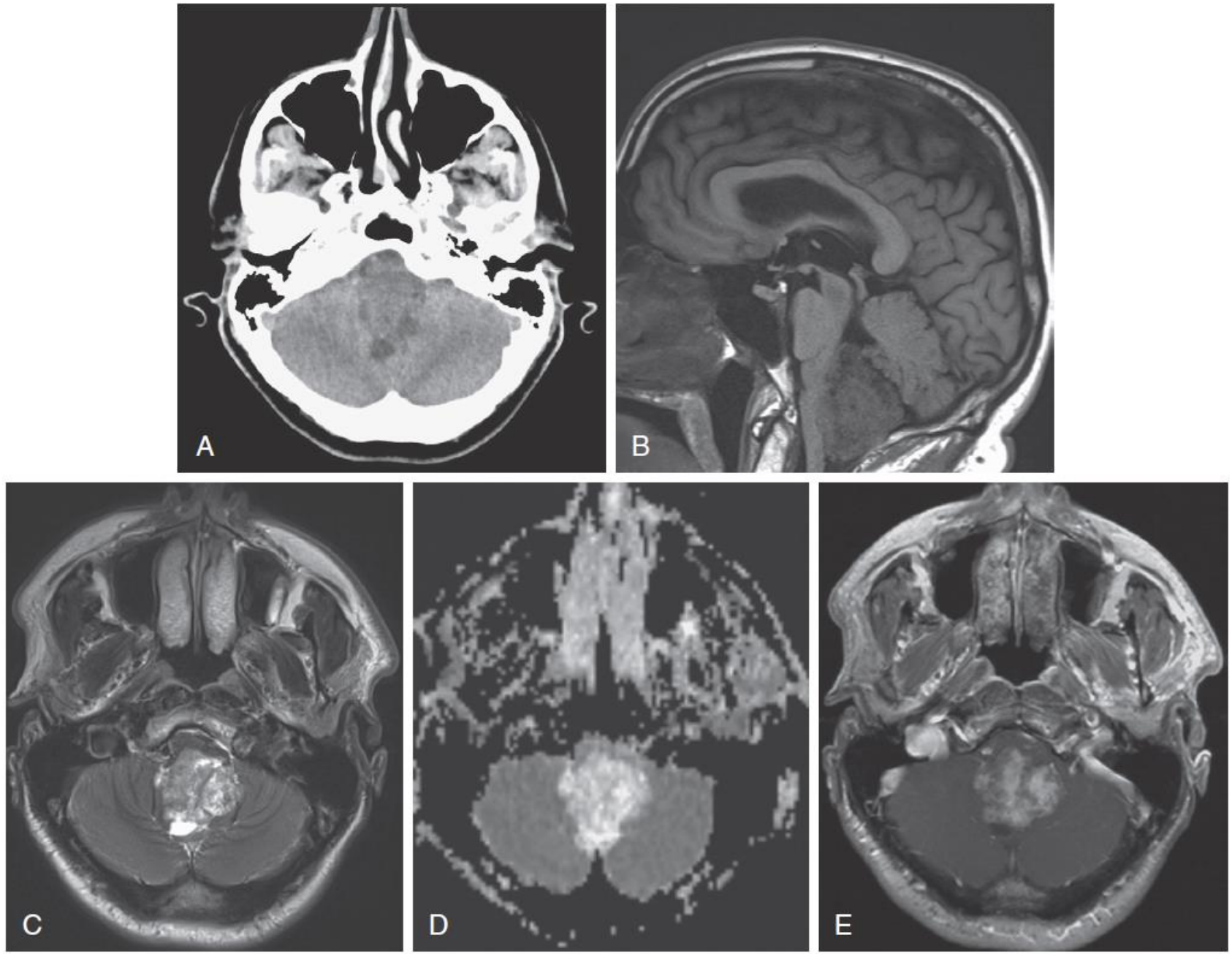
They are among the most common tumors in children younger than 2 years.


T2
T2
T1 Post contrast

Ependymoma

- Ependymomas arise from the ependyma of the ventricular system. In pediatric patients, ependymomas are frequently seen near the fourth ventricle, causing characteristic widening of the fourth ventricle as well as the foramina of Luschka and Magendie. In contrast, medulloblastomas tend to displace and efface the fourth ventricle.

- As many as 40% of ependymomas in the pediatric population calcify.
- Cyst formation is unusual, but ependymomas may show intratumoral hemorrhage.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Intra-Axial Neoplasms

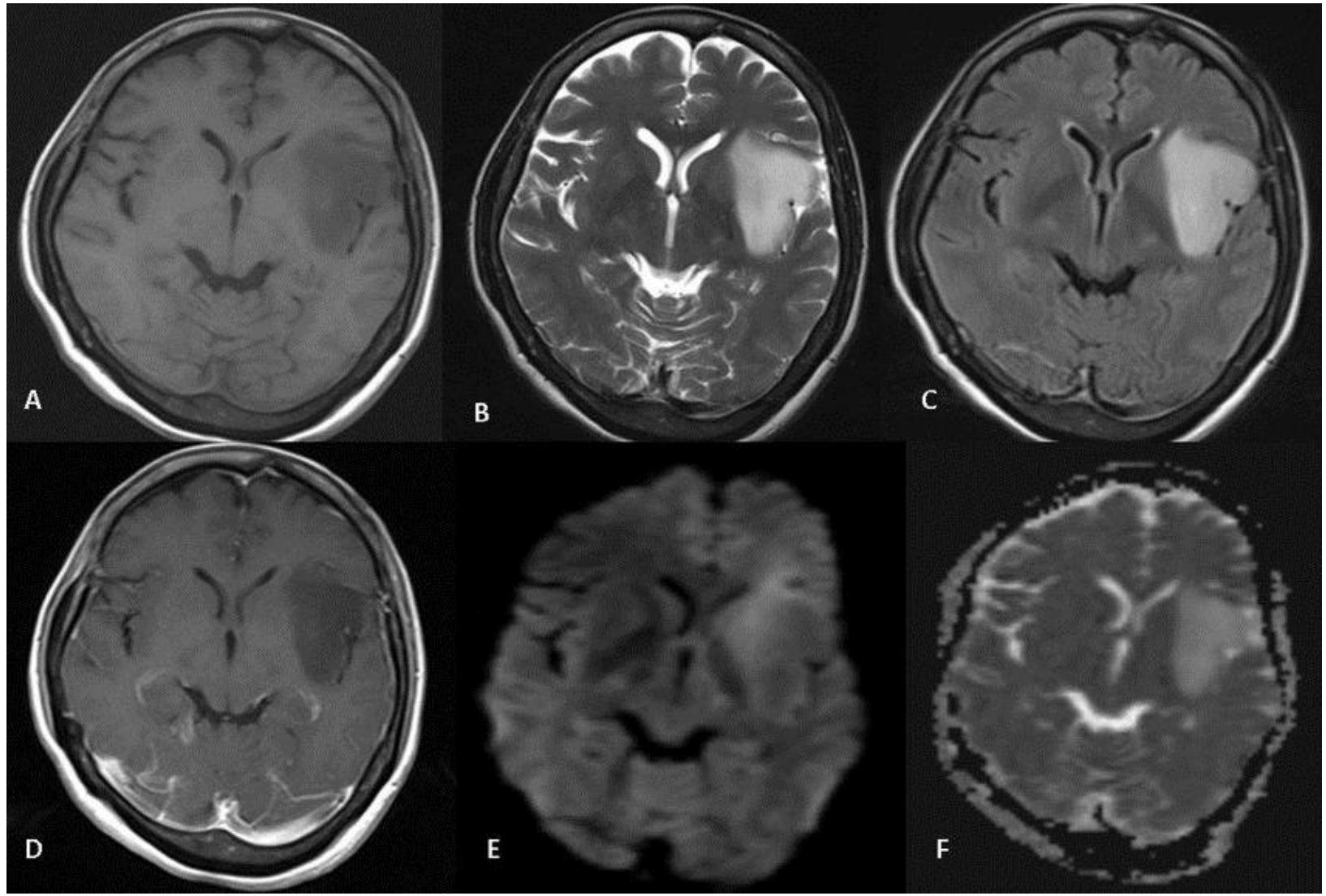
Astrocytomas

- The latest WHO CNS tumor classification divides astrocytomas into focal (benign) astrocytomas, nonfocal astrocytomas, anaplastic astrocytomas, and glioblastoma.

Glioblastoma

- Glioblastoma is characterized by irregular infiltrating margins , extensive edema, necrosis, increased permeability with various patterns of enhancement (irregular, nodular, or ring-like), and hypervascularity (evidenced by observation of flow voids on standard imaging or elevated blood volume on perfusion imaging). Intratumoral hemorrhage is also common and can be readily ndetected by T2*-weighted sequences .

- The infiltrative component of a glioblastoma tends to follow white matter tracts, including the corpus callosum, and is best depicted by FLAIR imaging, although tumor cells are known to migrate far beyond those outlined by standard sequences.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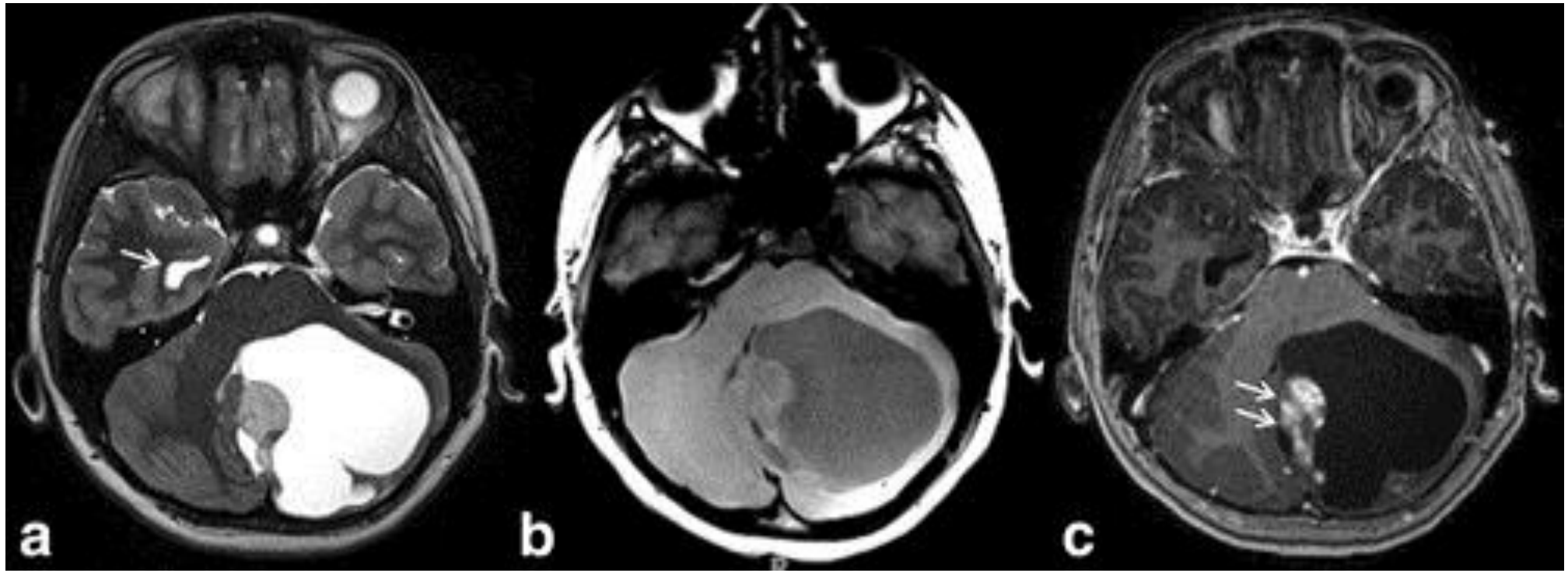
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Anaplastic (WHO Grade III) Astrocytoma and Low-Grade (WHO Grade II) Astrocytoma

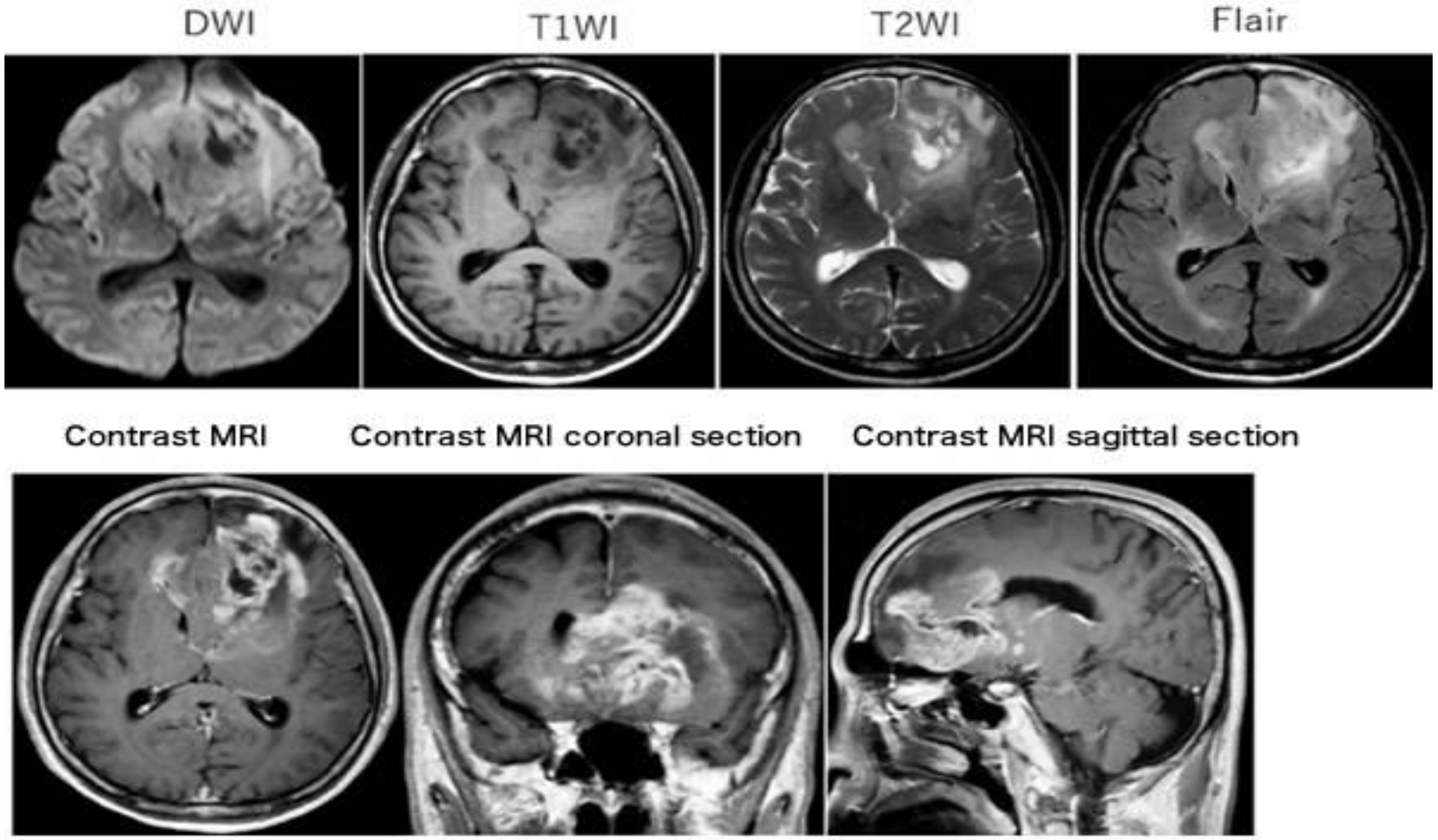
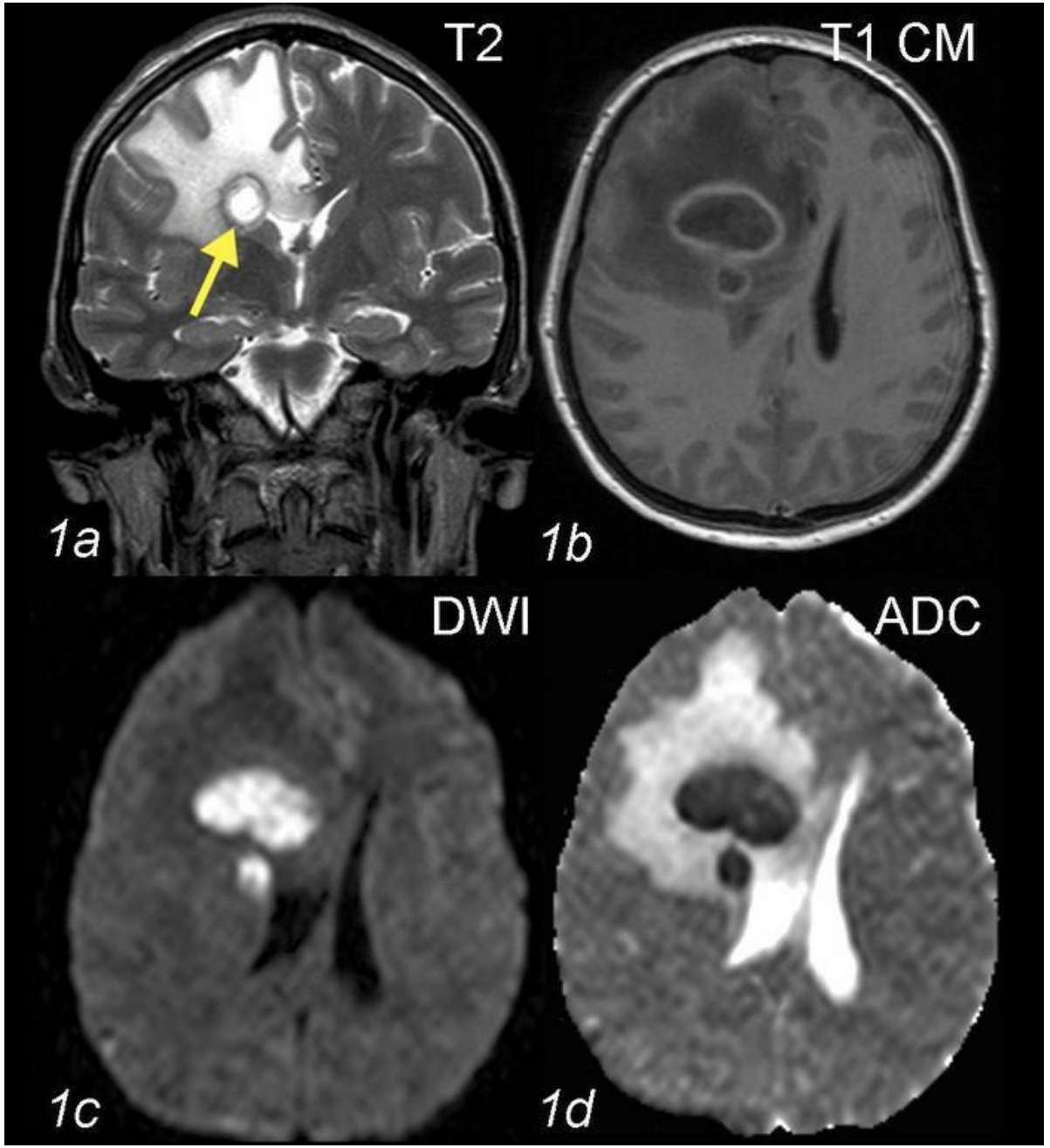


Fig.8 Progress sample of Glioblastoma to opposite side through callosum
Butterfly pattern is shown with the extension from left to right

Brain abscesses can appear similar to necrotic glioblastoma because both lesions frequently demonstrate peripheral enhancement and perilesional edema. The enhancing walls of glioblastomas, however, tend to be thicker and more irregular and are often associated with cortical infiltration in addition to edema. DWI is particularly helpful in differentiating the two, in that pyogenic abscesses tend to be bright on DWI and dark on ADC maps, indicating restricted diffusivity, whereas tumoral cysts and necrosis are dark on DWI and bright on ADC maps, consistent with facilitated diffusivity.



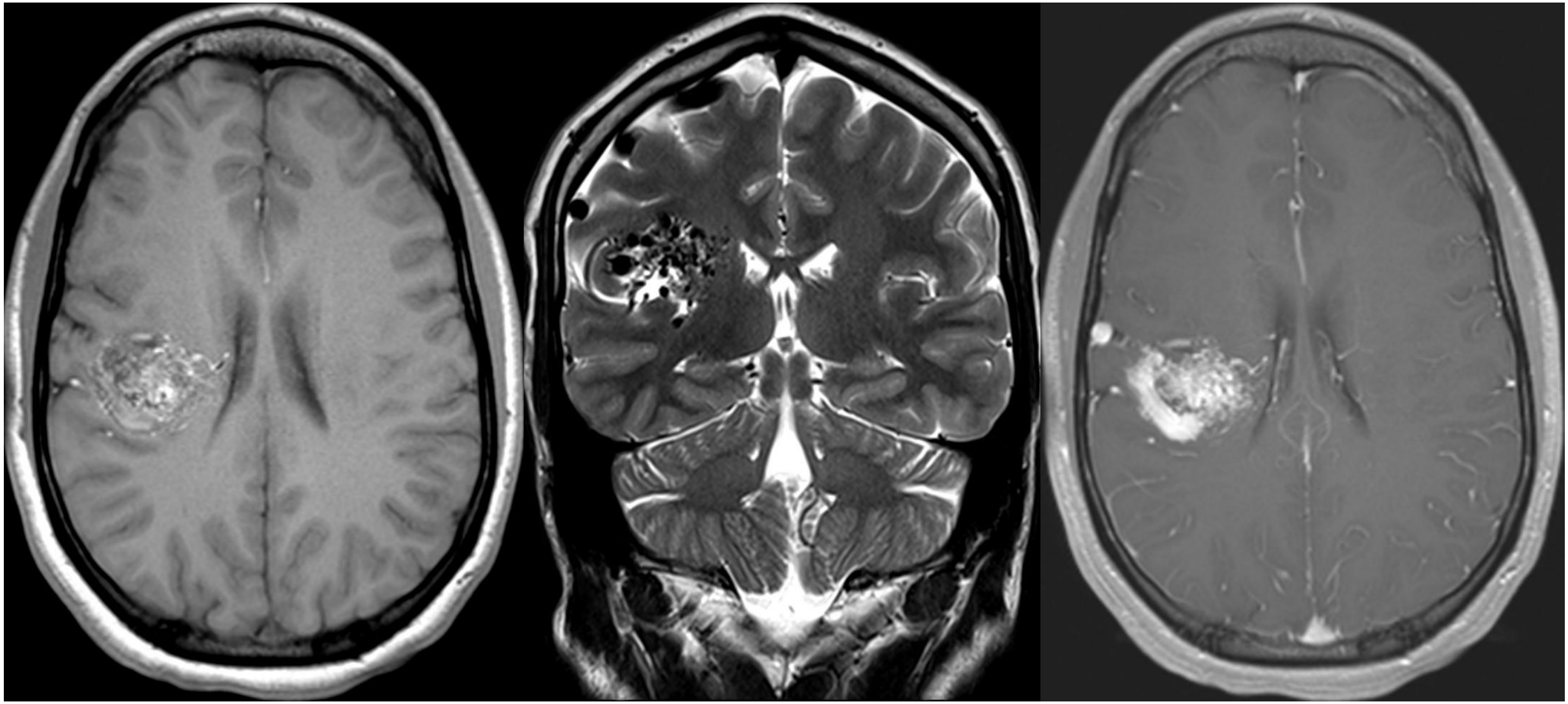
Vascular Malformations

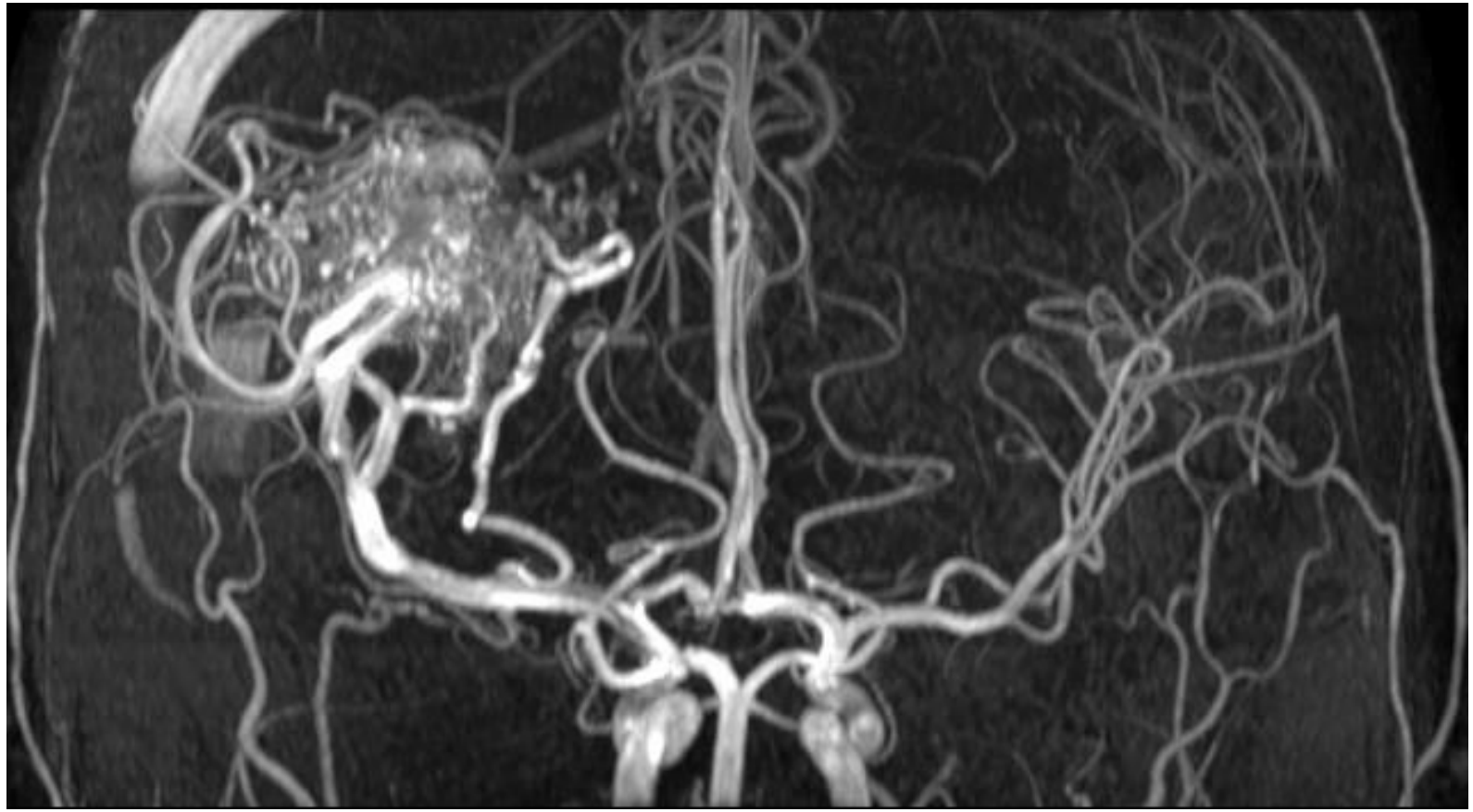
ARTERIOVENOUS MALFORMATION

- AVMs are vascular abnormalities consisting of fistulous connections of arteries and veins without normal intervening capillary beds. Typically, they are triangular with the base toward the meninges and the apex toward the ventricular system.
- Calcification is identified in 25% to 30% of cases.
- Magnetic resonance imaging (MRI), however, is superior in sensitivity and specificity. It is useful to determine the size, location, and evidence of previous symptomatic or subclinical hemorrhage, as well as secondary changes such as mass effect, edema, and ischemic changes in adjacent brain tissue.

- The typical AVM appears as a tightly packed “honeycomb” of flow voids on T1- and T2-weighted images as a result of high-velocity flow signal loss. Increased signal may be seen in thrombosed or low-flow vessels.

There is little or no mass effect unless an associated hemorrhage or venous varix is present.



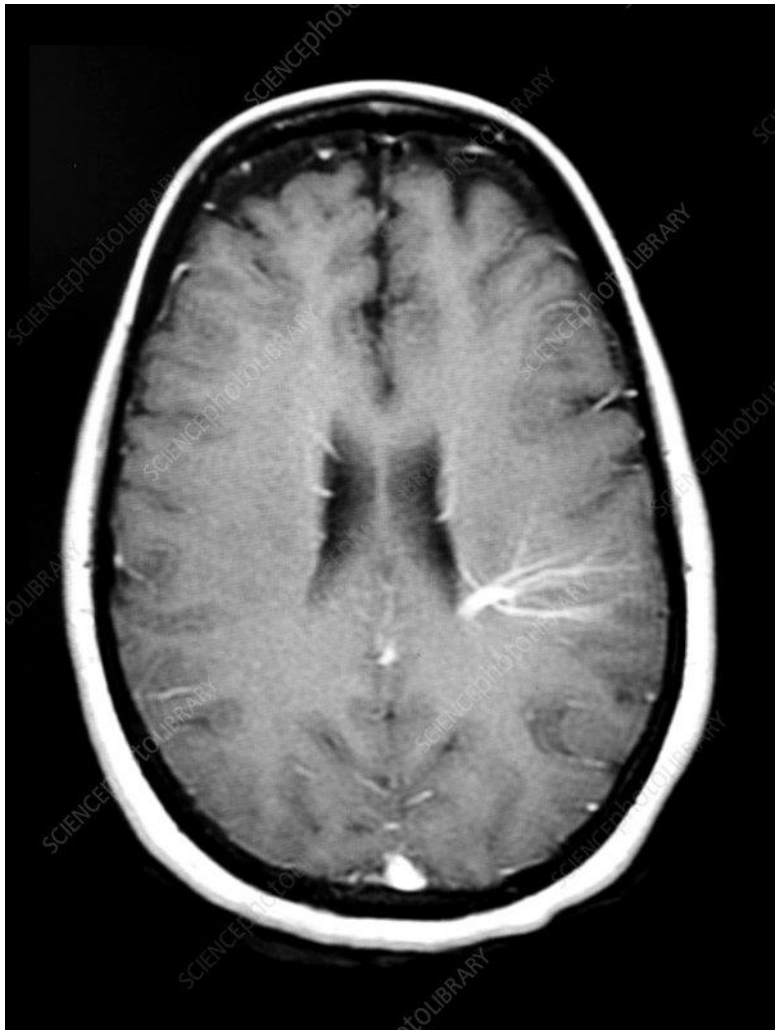


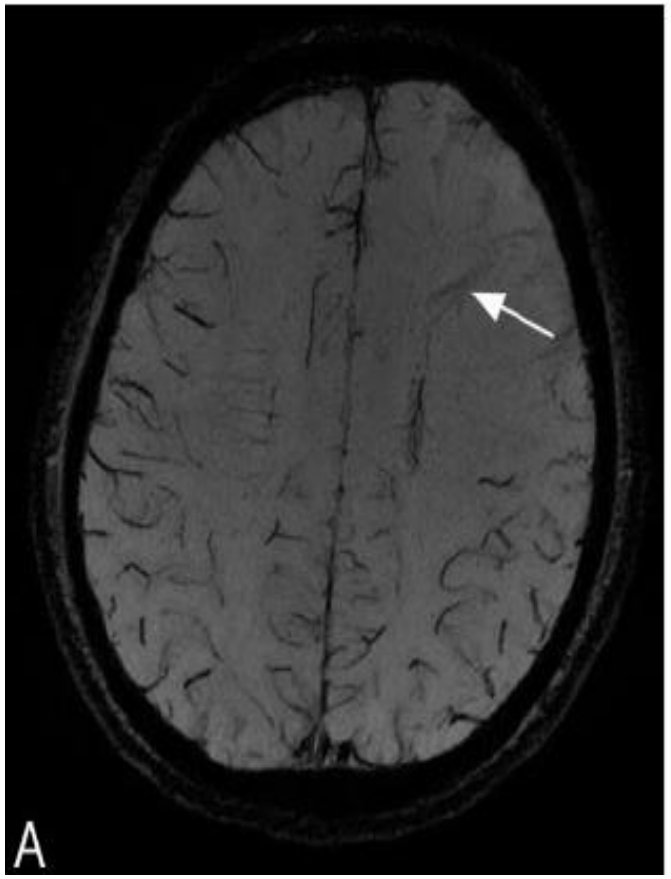
DEVELOPMENTAL VENOUS ANOMALY

Synonyms: venous malformation, venous angioma

- DVAs are congenital venous anomalies. It is hypothesized that an intrauterine event occurs and there is focal arrest of venous development and thus retention of the primitive medullary veins.
- DVAs are rarely diagnosed without a contrast-enhanced image (CT or MRI). Contrast-enhanced imaging studies reveal a stellate mass or linear enhancement of a transcerebral vein without parenchymal abnormalities .259 They may be categorized as small (<15 mm), medium (15-25 mm), and large (>25 mm) based on cross-sectional imaging.

- A T1-weighted contrast magnetic resonance image demonstrates the witch’s broom appearance of a cerebellar developmental venous anomaly.

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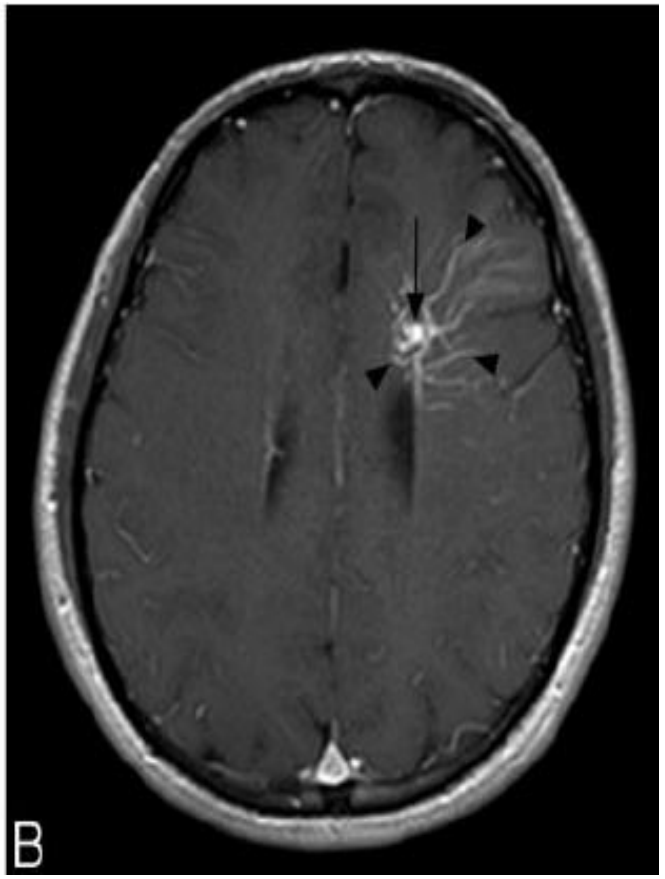
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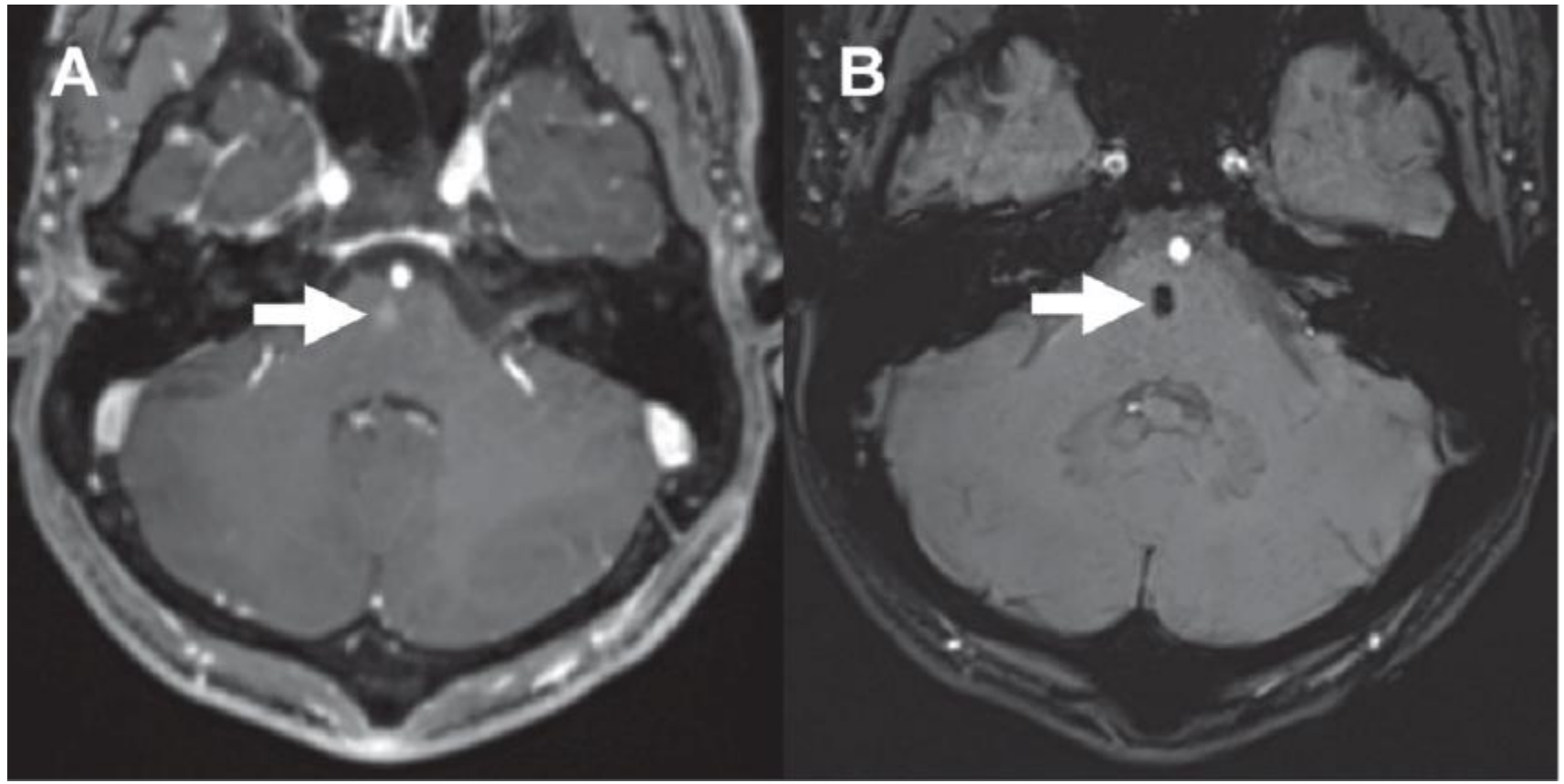
CAPILLARY TELANGIECTASIA

Synonym: capillary malformation.

- Capillary telangiectases are vascular malformations composed of dilated capillaries with normal intervening neural tissue.
- Standard MRI studies with T1 and T2 sequences are often normal and do not show evidence of the capillary telangiectasis.
- It is only with T1 with contrast, in combination with a hemosiderin-sensitive image (gradient echo or susceptibility weighted MRI), that the capillary telangiectasis is evident.
- It often appears as a brush-like area of enhancement, most commonly located in the pons.
- Some lesions demonstrate a “dot in the spot” on T1 with contrast. The “dot” is a more hyperintense area within the “spot” of the capillary telangiectasia that is likely the draining vein.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