

CT and MRI Scans

CT and MRI scans are each useful tests for the diagnosis of orbital and craniofacial pathology. While the decision regarding which test to order in a clinical setting may be confusing, each test has specific strengths and weaknesses. Often the two studies are complementary, each providing additional information from the other.

Current CT technology allows for very rapid testing time, often less than five minutes. Noise and claustrophobia are not significant concerns for the patient. CT scanning is also 25% less costly than MRI. In addition, CT scans provide thin slice dimensions for greater resolution. CT scanning can, therefore, provide more precise topography of orbit tumors to aid in surgical planning. By adjusting window levels, bony anatomy can be nicely demonstrated, making it better for diagnosing bony pathology, trauma, and delineation of bony compartments.

The disadvantages of CT, however, include radiation exposure. One CT can give 30 to 400 times the radiation exposure as one chest X-ray, depending on the equipment and body area of scan. CT contrast medium adds the risk of allergy and/or renal impairment. CT absorption by bone degrades signals from soft tissue, especially near the orbital apex and optic canal.

MRI, based on magnetic alignment of hydrogen molecules in tissue, spares the

patient from radiation exposure. Soft tissue in the optic canal, chiasm, brain, and orbital apex is readily observed. In addition, several specific bright signals on T1 scans without gadolinium (contrast) can identify melanoma, fungus, or resolving hemorrhage specifically. MRI also provides more specific soft tissue differentiation, helpful in differentiating tumor from extraocular muscle or optic nerve.

The disadvantages of MRI include patient discomfort from high noise levels and claustrophobia, as well as increased cost of the exam. Patients are also at risk for gadolinium-induced nephrogenic systemic fibrosis, which may create long-term fibrosis of skin, orbits, joints, and internal organs. Five percent of these systemic fibrosis cases become fulminant and life-threatening. Gadolinium is contraindicated in patients who are immunosuppressed, on dialysis, or have renal failure or hepatitis C.

CT scanning is recommended for:

- 1) Trauma. (MRI is contraindicated until metallic foreign body is ruled out, and cannot adequately assess bony anatomy).
- 2) Foreign body differentiation from air in orbit. Quantitative analysis of Hounsfield units on CT can differentiate air, wood, and plastic very nicely.
- 3) Graves' disease. EOM size and apex crowding are easier to observe on CT.

- 4) Surgical planning, due to thinner slice size.
- 5) 3-D imaging for craniofacial anomalies.

MRI is recommended for:

- 1) Diagnosis of orbital melanoma, fungus, mucocoeles, and resolving blood.
- 2) T2 flow voids to assess vascularity of tumors and A-V malformations.
- 3) Differentiating optic nerve or extraocular muscles from tumor.
- 4) Soft tissue assessment of the orbital apex, optic canal, visual pathways, and brain.
- 5) Stroke and ischemia.

While both CT and MRI are useful screening tests for orbital pathology, the decision of which to order depends on the clinical diagnosis, as well as patient tolerance and cost. In the end, both tests may be necessary for maximal information to guide orbit diagnosis and surgical planning.

By William R. Nunery, MD

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