

## Neuroimaging

## PICTORIAL ESSAY

# Ophthalmology Findings on Brain Scans: A Pictorial Essay

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## ABSTRACT

The aim of this paper is to highlight some of the ophthalmological findings on brain scans. This paper will present uncommon findings that must be noticed during interpreting radiology scans. The eye

balls or orbits generally, are in the blind spot during reading a brain scan. The prevalence of these findings is low among all patients, but still seen in a few cases.



### KEY WORDS

Ophthalmology; Imaging; Brain; Scan; Blind Spot

### Pictorial Essay

This essay will highlight some ophthalmological findings on brain scans. Since the orbits are in the blind spot of brain scans, some ophthalmology findings could be missed. Here are some cases with low prevalence that could be missed or confused when interpreting brain scans.

#### 1-Prosthetic Eye

##### Case Presentation

This is a case of a 74-year-old female patient who came to the ER complaining of headache and weak left arm. A CT brain was requested to rule out stroke. The patient has an artificial eye on the left side as seen (Fig. 1).

Prosthetic or artificial eyes are implanted in 0.1% of the population<sup>[1]</sup>. In the UK, for example, 60,000 to 70,000 people have a prosthetic eye of all the population<sup>[2]</sup>. It appears as a round hyper-dense sphere. Sometimes it does not appear round, but a concave eye attached to the orbital muscles. Now, a new trend of 3D printers can make a prosthetic eye<sup>[1,2]</sup>. In some cases, the patient is blind in both eyes and they undergo a bilateral oculoplasty.

#### 2- Phthisis Bulbi

##### Case Presentation

This is a case of a 73-year-old male patient who came to the ER with dizziness and loss of balance. A brain MRI was

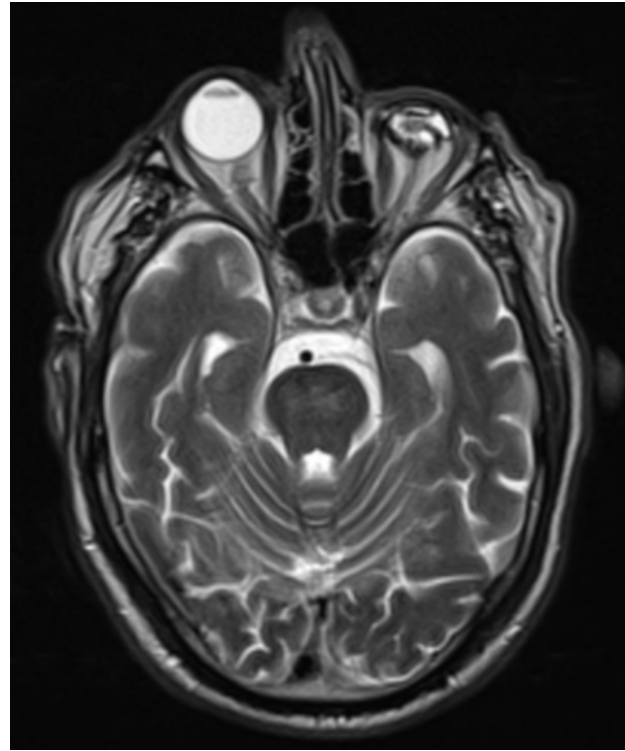


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**Figure 1.** An Axial CT of the brain shows a hyper-dense round eye ball on the left side which indicates an artificial eye ball. Post hydroxyapatite sphere implantation after enucleation of the eyeball.



**Figure 2.** An axial MRI T2 sequence of the brain shows phthisis bulbi in the left eye ball.

requested to rule out any changes in the cerebellum. The left eye is affected with phthisis bulbi see (Fig. 2).

Phthisis bulbi is the end stage or atrophied eye ball due to a severe insult. The prevalence of phthisis bulbi, for example, in one hospital in Nigeria is 0.45% out of 19,852 patients [3]. The most common age group with phthisis bulbi is 65-85 years [4], meanwhile in younger ages, phthisis bulbi is rare and it happens due to malformations [4]. The eye ball usually is reduced in size by 20 mm with posterior folded sclera. This intraocular fibrosis and shrinkage lead to an intraocular hypotension. Dystrophic calcification is seen in some cases which known as intraocular bones. Having calcification in the eye should not be confused with phthisis bulbi because calcification of the eye could happen for different reasons. The calcification could reach the globe, sclera, optic nerve, etc. The etiology of phthisis bulbi includes the following; infection, inflammation, trauma, retinoblastoma, chronic retinal detachment, persistent hyperplastic primary vitreous, etc.

### 3-Dislocated Lens

#### Case Presentation

This is a case of an 86-year-old female patient who under-

went a brain MRI to rule out any morphological changes in the pituitary gland. She has an old trauma which caused her a dislocated lens before 30 years ago and the patient did not want a surgery for her eye see (Figs. from 3 to 5).

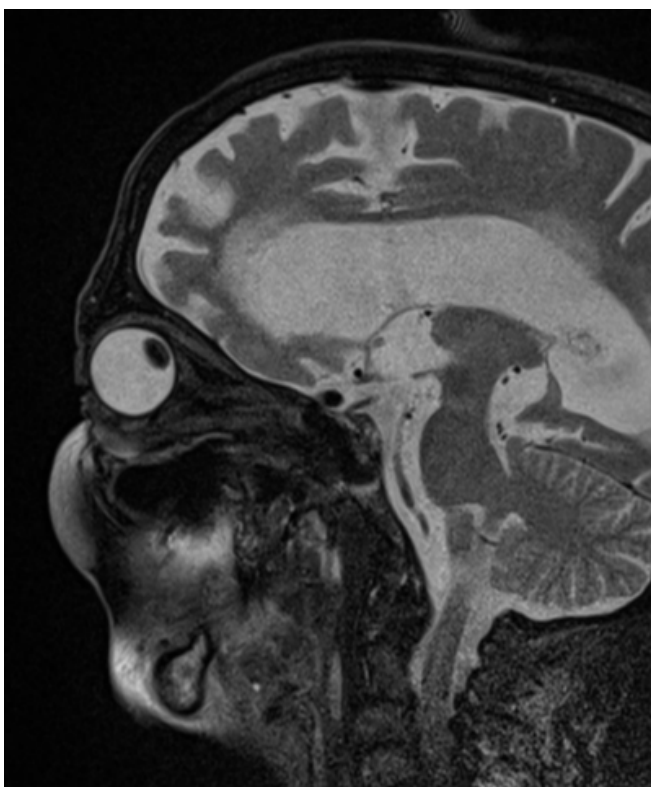
The prevalence of the dislocated lens is 0.2% to 0.3% of the population [5]. Dislocated lens or ectopia lentis occurs due to trauma, Weil-Marchesani syndrome, Ehlers-Danlos syndrome, homocystinuria, aniridia, syphilis, intraocular tumors, and Marfan syndrome.

### 4-Orbital Infection

#### Case Presentation

This is a case of a 12-year-old female patient who underwent a root canal treatment and the treatment had some complications which resulted in cellulites on the left side of her face. A CT scan was done to rule out any bone infiltration and extraocular muscles involvement which might be an orbital lymphoma or a mass which came back negative see (Figs. From 6 to 10).

Left eye proptosis due to post-septal orbital cellulitis (infection causing bulging eye). This type of infection usually treated with oral antibiotics. In this case, root canal re-treatment and antibiotics were recommended. Orbital



**Figure 3.** A sagittal MRI T2 sequence of the pituitary gland shows a dislocated lens on the left eye ball.

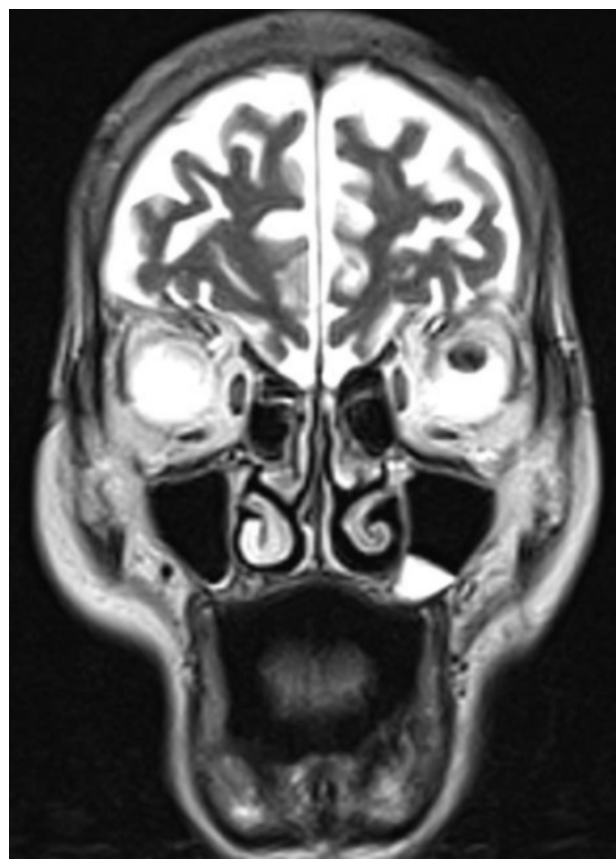
infection count half of the primary orbital disease processes. Such infections can lead to proptosis, orbital apex syndrome, compressive optic neuropathy, orbital compartment syndrome, and irreversible visual loss. The patient usually presents with proptosis, chemosis, reduced visual acuity, and painful ophthalmoplegia. Orbital cellulitis happens as an extension of paranasal sinusitis. The orbital cellulitis appears on CT as poor definition of orbital planes, soft tissue mass, edema, intraconal fat stranding (inflammation), and abscess in advanced cases. When abscess present, a drainage of the content will be a necessity.

### 5-Tortious Optic Nerves in Idiopathic Intracranial Hypertension (IIH)

#### Case Presentation

This is a case of a 19-year-old female patient came to the ER with a severe headache and episodes of visual blurriness. A brain MRI was requested and it revealed bilateral optic nerves tortuosity due to an increased IIH see (Figs. From 11 to 13).

IIH is a syndrome where signs and symptoms of increased intracranial pressure is present with no mass or hydrocephalus. The IIH could result in a rapid visual loss,



**Figure 4.** A coronal MRI T2 sequence shows a dislocated lens in the left eye ball.

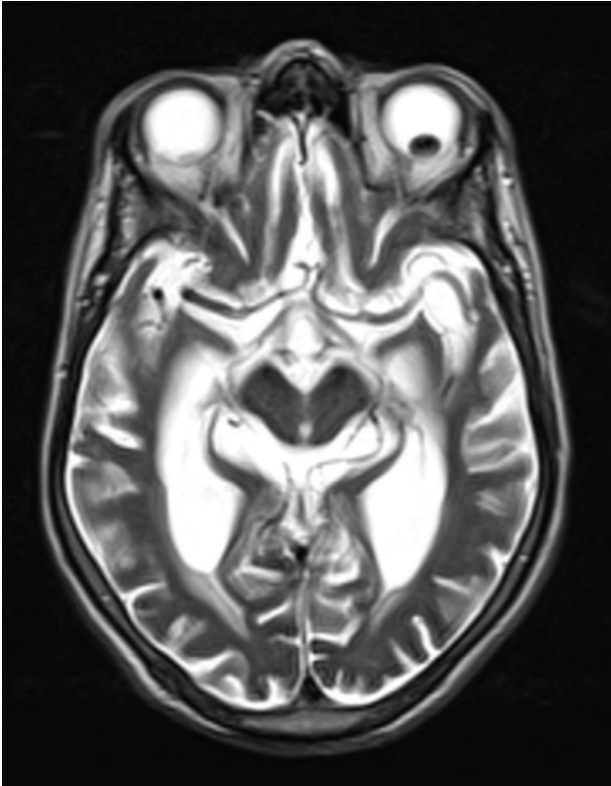
therefore, the term benign intracranial hypertension is frowned upon. Some cases of IIH is caused by venous stenosis, therefore, some authors call to use the term “pseudotumor cerebri” which eliminates the idiopathic part, meanwhile others call to use the term Secondary Intracranial Hypertension [6].

### 6-Intraocular Lens Implants (pseudophakia)

#### Case Presentation

A 76-year-old female patient complained of headaches and dizziness. A brain MRI shows a normal brain, but the left eye has an artificial lens implanted see (Fig. 14).

A 30-year-long study showed that intraocular lens implants have a prevalence of 28.4 patient per million [7]. Intraocular lens implants are safe under imaging using a 3T MRI machine [8]. A study of 21 patients on a 7T MRI machine showed no heating effect or significant torque of the lens implants, but susceptibility artifact was seen in lenses that contain platinum [9]. The artificial lens implants might be confused with cataracts, but clinically the patient had the



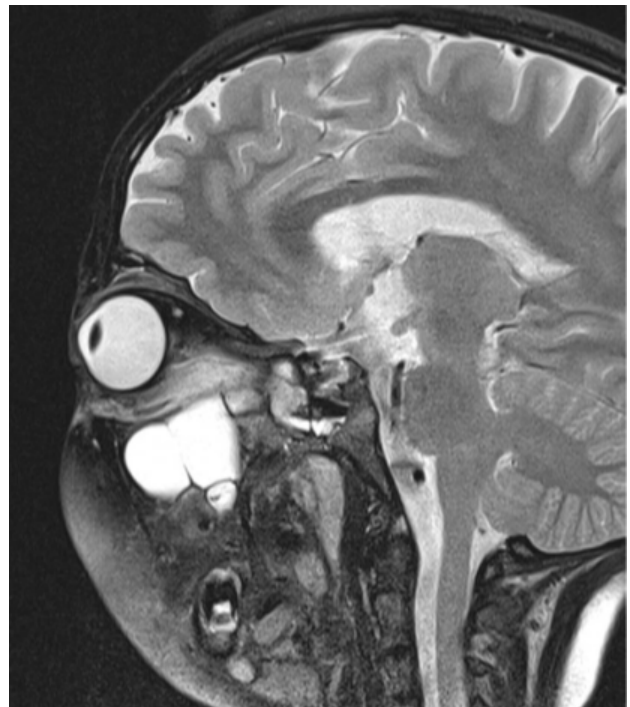
**Figure 5.** An Axial MRI T2 sequence of the pituitary gland shows a dislocated lens on the left eye ball.



**Figure 6.** A sagittal MRI T2 sequence of the orbit shows the left orbital cellulites as a complication of sinusitis due to poor root canal treatment.

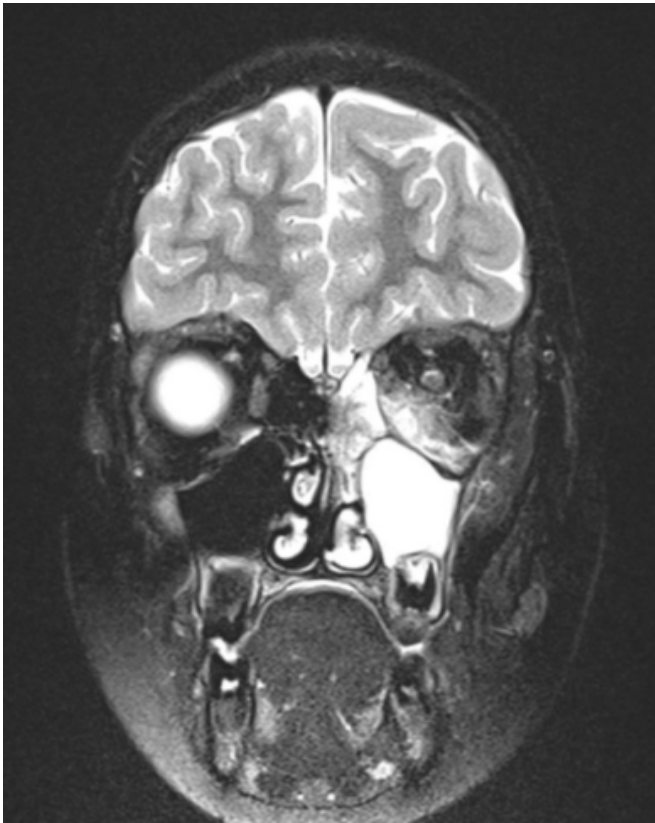


**Figure 7.** An axial MRI T2 sequence of the orbits shows a proptosis of the left eye ball due to the pressure made by the cellulitis in the left maxillary sinus.

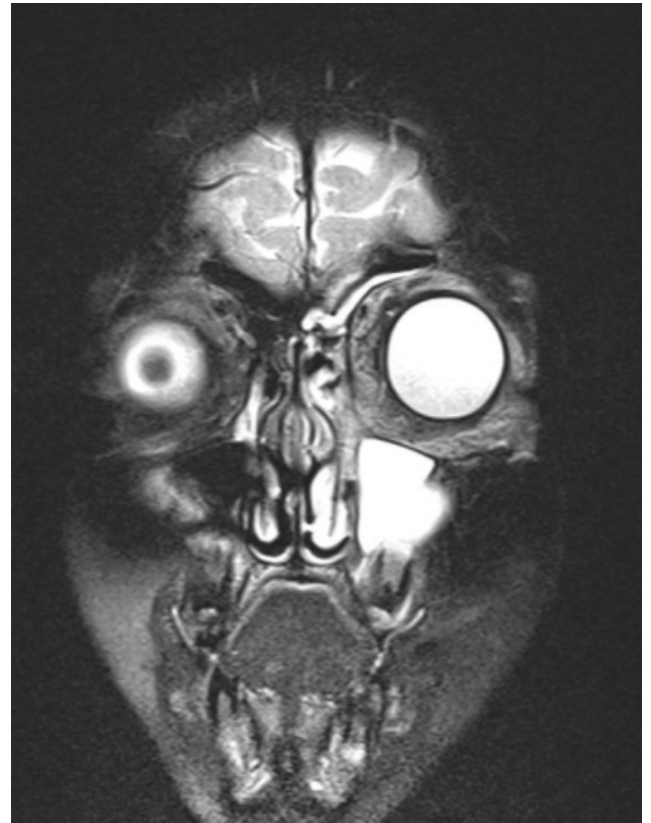


**Figure 8.** A sagittal MRI T2 sequences of the orbit shows the pressure made by the cellulitis in the left maxillary sinus.

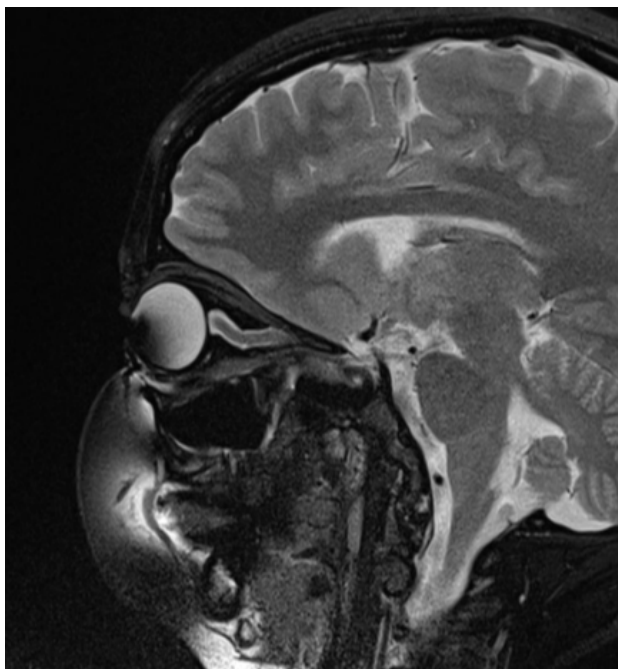




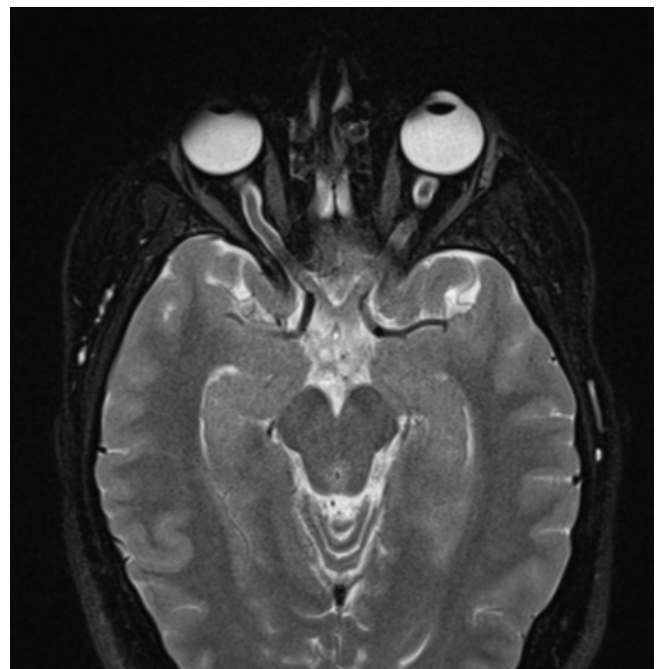
**Figure 9.** A coronal MRI T2 sequence shows the difference between eye balls level at the back of the right eye ball which indicates ptosis on the left.



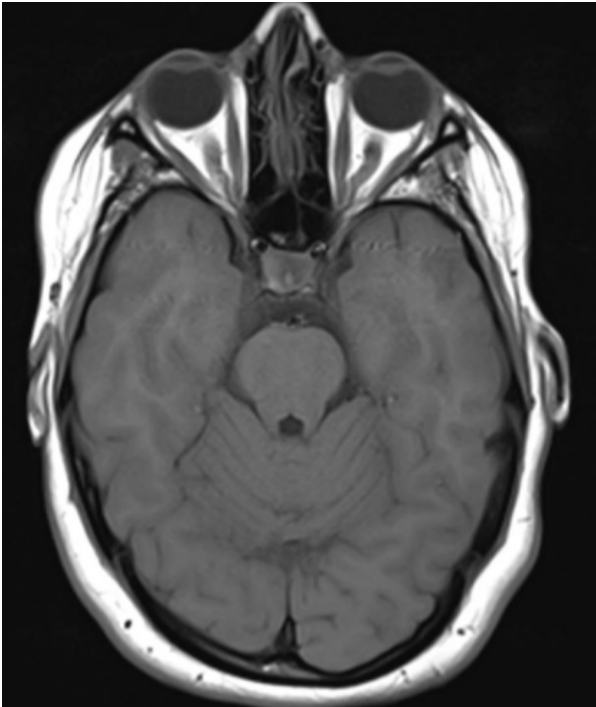
**Figure 10.** A coronal MRI T2 sequence shows the difference between eye balls level at the lens level which indicates proptosis.



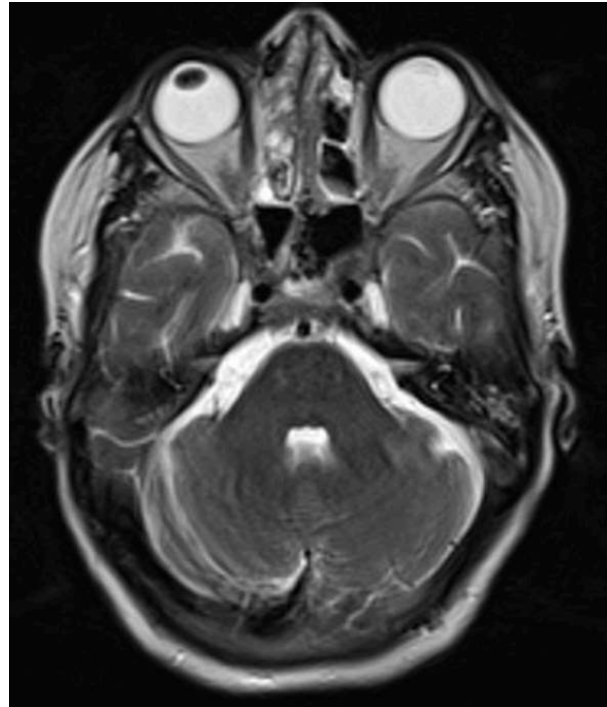
**Figure 11.** A sagittal MRI T2 sequence of the optic nerve shows a tortuous optic nerve as an indication of Idiopathic Intracranial Hypertension.



**Figure 12.** An axial MRI T2 sequence of the optic nerves show a tortuous optic nerve which indicates an Idiopathic Intracranial Hypertension.



**Figure 13.** An axial MRI T1 sequence of the optic nerves shows tortuous optic nerves bilaterally which indicates an Idiopathic Intracranial Hypertension.



**Figure 14.** An axial T2-weighted MR image shows the lens on the left side is absent with a small isointense strip found on the right side as a postoperative change due to the artificial lens implantation.

surgery many years ago which rule out the cataract.

### Ophthalmology Imaging

Ophthalmology practice uses more specialized in vivo non-invasive imaging techniques for assessment, monitoring, management and diagnosis. These techniques are: Optical Coherence Tomography (OCT) of the anterior and posterior segment, OCT angiography, corneal topography, confocal and specular microscopy, wide-field retinal imaging, and ocular ultrasonography which help in evaluating the

orbital different morphology and function<sup>[10-21]</sup>.

### Conclusion

On brain scans, the orbits are in the blind spot and some findings in the eyes could be missed. These findings must be reported. Sometimes these findings are incidental and not the indication of the scan. Some of these findings are mostly common in older patients like; phthisis bulbi and prosthetic eye. The most common etiology for dislocated lens, phthisis bulbi, and prosthetic eye is trauma. **R**

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