Al-Mustaqbal University
College of Health and Medical Technologies
Radiological Techniques Department

# Magnetic Resonance Imaging

## First Semester

### Lecture 14 : MRI of the orbits and Sella turcica

By

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## Introduction :

MRI Technologist need to learn the specific protocols and techniques for performing different magnetic resonance imaging exams. These examinations can **help technologist for understanding anatomy and pathology of eye, pituitary fossa, and surrounding structures.**

## Anatomical overview : -

**The bony orbits (or eye sockets) are bilateral and symmetrical cavities in the head. They enclose the eyeball and its associated structures.** The orbit can be thought of as a pyramidal structure, with the apex pointing posteriorly and the base situated anteriorly. The boundaries of the orbit are formed by seven bones. (fig.1)

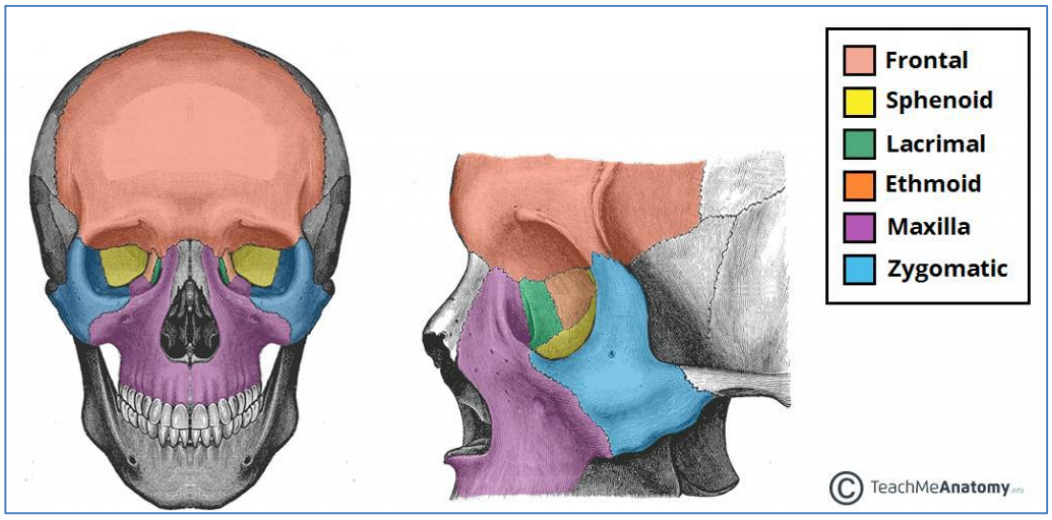



Fig (1) the anterior and lateral views of the bony orbit.

## •Roof (superior wall)

Formed by the frontal bone and the lesser wing of the sphenoid. **The frontal bone separates the orbit from the anterior cranial fossa.**

## • Floor (inferior wall)

Formed by the maxilla, palatine and zygomatic bones. **The maxilla separates the orbit from the underlying maxillary sinus.**

## • Medial wall

Formed by the ethmoid, maxilla, lacrimal and sphenoid bones. **The ethmoid bone separates the orbit from the ethmoid sinus.**

## • Lateral wall

Formed by the zygomatic bone and greater wing of the sphenoid.

-**The bony orbit** contains the eyeballs and their associated structures which include: **extra-ocular muscles, eyelids, nerves, and blood vessels.**

**Orbits protocol** is an MRI protocol comprising a group of MRI sequences as a useful approach to routinely assess the orbits and their related conditions.

## •Indications of orbits MRI: -

**1- Retro-orbital lesions:** lesions occurring behind the orbit of the eye.

**2- Optic disc distortion or pallor:** It means that the optic nerve axons have been damaged in variety of disorders.

**3- Infection or inflammation** (e.g. orbital cellulitis; which is the infection of fat and muscles around the eye).

**4- Intra-ocular lesions.**

**5- Retinoblastoma:** is a type of eye cancer that starts in retina, the light sensing layer.

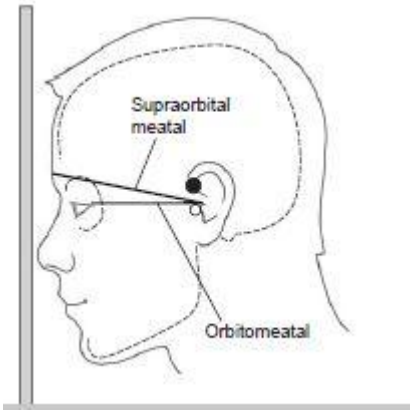
## •MRI procedure:

### •Patient position:

1- **Before you bring the patient into the scan room**, **have the patient remove all eye make-up.**

2- Patient should be in supine position **(head first).**

3- Place the chin up with the Orbital-meatal line +15 to the table top.**( It passes through the eye and the center of the external auditory meatus) This position places the optic nerve perpendicular to the table.**



4- **Turn on the alignment lights**. Place the **sagittal light** on **the mid-sagittal line of the patient's head and the axial line to pass through both outer canthus of the eyes.**

5- **Place the coils** as close as possible to the eye without touching the patient. (fig.2)

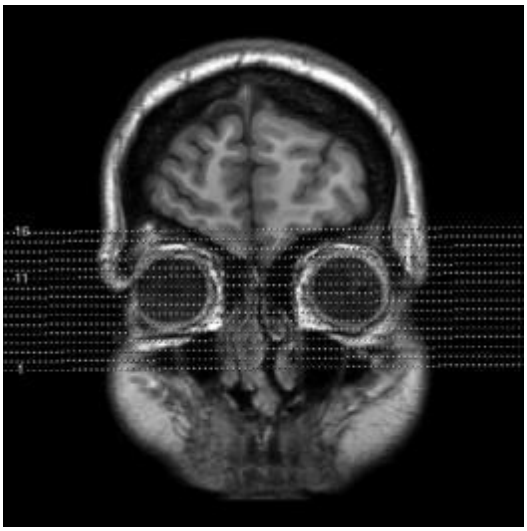
6- Immobilize the patient using sponges and straps.

7- Patients should be asked to close the eyes during image acquisition **to limit ocular movement that may degrade image quality.** The use of an eye mask may be helpful. Alternately, providing the opportunity to the patient to open the eyes between scans may suffice.

Fig.2 Patient position-surface coil

## •Scout slice placement: -

### 1- Coronal localizer to obtain axial slices.



### -Alignment:

Parallel to a line joining the inferior orbital margins.

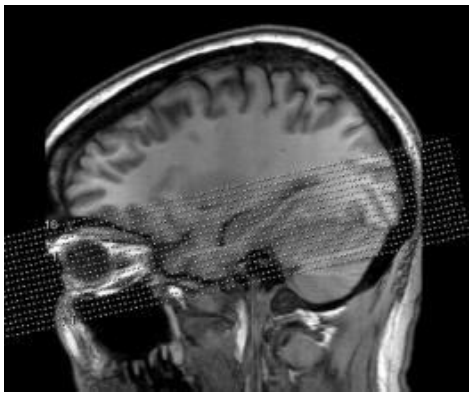
### -Coverage:

**A-Superior to inferior:** Inferior to superior orbital margin.

**B-Lateral to medial:** Zygoma on each side.

**C-Posterior to anterior:** Mid pons to anterior aspect of the globes.

**-Note: we can obtain axial slices from a parasagittal localizer but the alignment should be in plane with the optic nerve.**



**Axial slices on a parasagittal localizer, aligned to the optic nerve.**

## 2- Axial localizer to obtain coronal slices:

**-Alignment:**

Parallel to a line joining the posterior orbital margins, Perpendicular to the cribriform plate.

**- Coverage:**

As per axial scans.

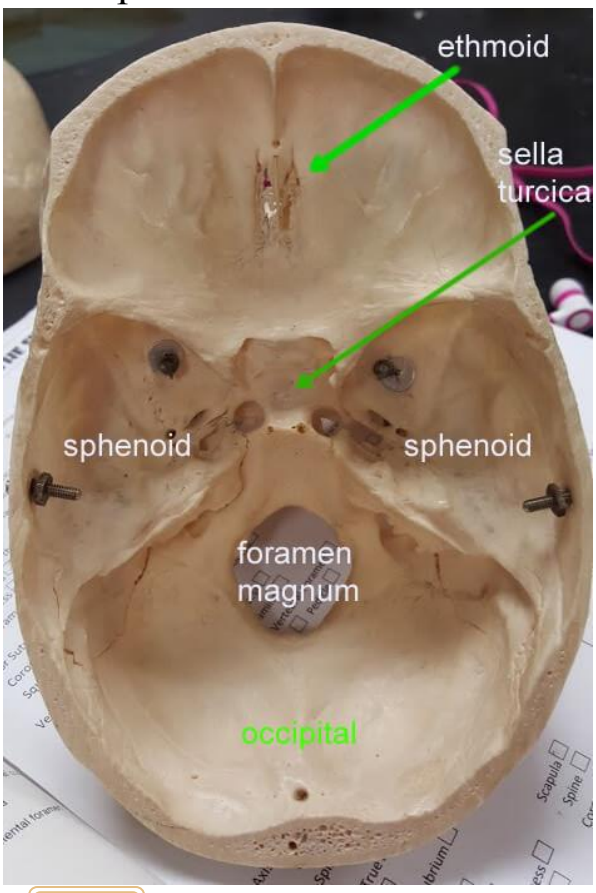
**- Note: We can use a sagittal localizer to obtain a coronal slice also.**

- **MRI sequences (orbits)**

| Sequence | TR | TE | FA | ETL | Slice thickness |
|---|---|---|---|---|---|
| Axial (T2) Flair | 9500ms | 132ms | - | 36 | 5mm, TI=2375 |
| Axial (T1) Flair (FS) | 3000ms | 17ms | - | 10 | 3mm, TI=1200 |
| Axial (T1) (Flair) (FS) (post GAD) | 3000ms | 17ms | - | 10 | 3mm, TI=1200 |
| Coronal (T1) (Flair) (FS) (post GAD) | 3000ms | 17ms | - | 10 | 3mm, TI=1200 |

## Sella turcica (Pituitary region):

- The upper surface of the body of sphenoid bone is shaped like a Turkish saddle. This area is called the **Sella turcica**. It has a raised anterior border known as the **tuberculum sellae**, a raised posterior border called the **dorsum sellae**, and a low area in the center called the **hypophyseal fossa** (a.k.a. pituitary fossa).
- **The pituitary gland**, an important part of your body's endocrine system, sits in the hypophyseal fossa. It is covered by a protective layer called the **diaphragm sellae**, which attaches to the anterior and posterior borders of the Sella turcica. (fig.3)




**(fig.3) Sella turcica**

**•MRI (pituitary region):** A systematic approach to the pituitary region is crucial as **small lesions** can have a profound impact on the patient, and can be subtle even on high-quality dedicated MRI imaging. Successful assessment of the pituitary region relies not only on a clear understanding of the local anatomy but also on the relatively wide variety of pathologies that occur in the region.

## •Indications: -

**1-Macroadenoma.**

**2-Microadenoma or prolactinoma.**

**3-Delayed onset or precocious puberty**

**4-Galactorrhoea.**

**5-Menstrual irregularity or amenorrhea.**

## •MRI procedure:

**•Patient position:**

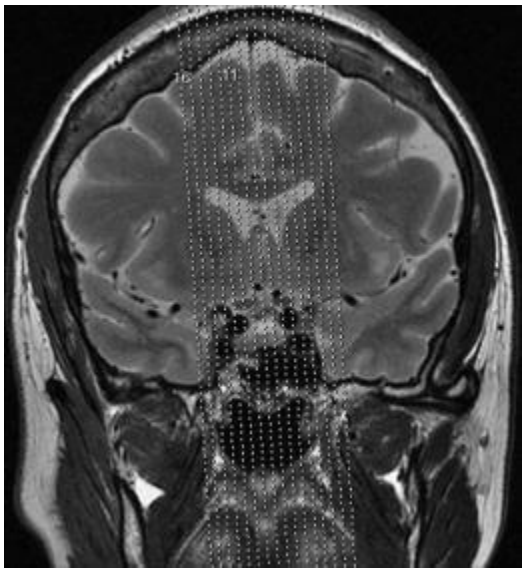
**1- Patient should be in supine-position (head first).**

**2- Place the patient in the head coil.**

**3- Immobilize the patient using sponges and straps.**

**•Scout slice placement: -**

**1- Coronal localizer to obtain sagittal slices.**



**-Alignment:**

Parallel to the falx cerebri.

**- Coverage:**

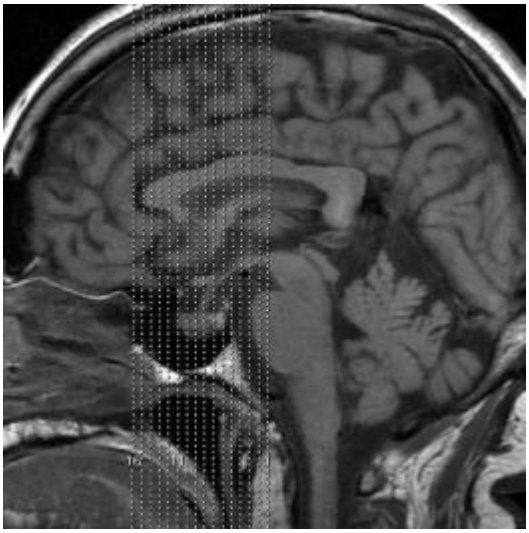
**A- Superior to inferior:** Floor of the sphenoid sinus to the genu of the corpus callosum.

**B-Lateral to medial:** Cavernous sinus on each side.

**C-Posterior to anterior:** Ventral aspect of the pons to the anterior clinoid process.

**-Note: We can use the axial localizer to obtain a sagittal slice also.**

## 2-Sagittal localizer to obtain coronal slice:



**-Alignment:**

Perpendicular to the floor of the Sella on a sagittal image.

**- Coverage:**

As for the sagittal plane.

**Note:** - We can use the axial localizer to obtain a coronal slice also but the alignment should be perpendicular to the midline of the brain.

## •MRI Sequences (pituitary region)

| Sequence | TR | TE | FA | ETL | Slice thickness |
|---|---|---|---|---|---|
| Sagittal (T1WI) SE | 500 | Min | - | - | 3mm |
| Coronal (T2WI) FSE | 4000 | 120 | - | 27 | 3mm |
| Coronal (T1WI) SE | 450 | Min | - | - | 3mm |
| Coronal (T1WI) SE (post GAD) | 450 | Min | - | - | 3mm |
| Sagittal (T1WI) SE (post GAD) | 675 | Min | - | - | 2mm |
| Coronal (T1WI)-Dyn study (post GAD) | 400 | Min | - | - | 3mm |

1. **Tl-Weighted Axial Imaging:**

**Use:** Provides anatomical details of the pituitary gland and surrounding structures. assessing their size and extension.

2. **T2-Weighted Axial Imaging:**

**Use:** Helps in identifying abnormalities with different tissue contrasts. Useful for visualizing cystic or hemorrhagic changes in pituitary lesions.

3. **Tl-Weighted Post-Contrast Imaging:**

Use: Particularly useful for detecting pituitary adenomas and assessing their characteristics.

4. **Dynamic Contrast-Enhanced Imaging:**

Use: Evaluates the vascularity and blood flow of pituitary lesions over time, aiding in distinguishing between different types of pituitary tumors.