

## Role of Computed Tomography in evaluation of Proptosis

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### ABSTRACT

**Background:** To analyze the role of Computed Tomography in the evaluation of proptosis.

**Methods:** It is a retrospective review of 30 patients with the history of proptosis who were referred to the department of radiology and imaging for computed tomography of orbit. Computed tomography of orbits was evaluated to assess the nature and extension of the lesion. Final diagnosis was made based on the histopathology, operative findings and clinical outcome. Statistical analysis was carried out with the help of SPSS - 17 to find the accuracy of Computed Tomography.

**Results:** Thirty patients ranging from three to 73 years were included in the study. Mean age was 35.4±19.6 years. Male:Female ratio was 2:1. Most common cause of proptosis was inflammation (47%) followed by tumor. Among the inflammatory causes pseudotumor was the most common type. Other causes of proptosis include tumor (37%), Vascular (10%), Infection (3%) and Trauma (3%). Accuracy of Computed Tomography in the diagnosis of etiology of proptosis was 86.6%.

**Conclusion:** Computed tomography is the simple, cost effective technique in the evaluation of proptosis with the accuracy of 86.6%. Inflammation was the most common cause of proptosis.

**Keywords:** Computed Tomography; proptosis; inflammation

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### Background:

**P**roptosis is defined as any forward displacement or bulging of an eye and is frequently used to describe a change in the position of the globe. The corneal apex is normally 15 to 18 mm anterior to the lateral orbital rim in adults, with more than 21 mm or a difference of 2 mm between the eye positions being abnormal.<sup>1</sup>

Proptosis can result from a variety of disease processes including infective, inflammatory, vascular, neoplastic, traumatic, endocrine lesions and extraorbital lesions. A meticulous history of the patient's ocular and systemic systems, detailed examination and imaging are the key factors in establishing a diagnosis. Computed Tomography (CT) remains very useful because of the inherent natural contrast provided by the presence of structures with widely

different attenuation coefficients (fat, bone, fluid, muscle, adjacent air) within a confined space.<sup>2</sup>

This retrospective review was carried out to evaluate the role of Computed Tomography in proptosis.

#### Methods:

It is a retrospective review of 30 patients with the history of proptosis that were referred to the department of radiology and imaging for computed tomography of orbit, over the period of one year three months from August 2011 to October 2012. GE spiral CT scanner was used with 3-mm sections in the axial and coronal planes being taken. Coronal sections were initiated at the lateral orbital rim (to lessen exposure to the radiosensitive lens) and continued to the posterior aspect of the optic canals, with the anterior clinoid or dorsum used as landmarks. Prone position was used for taking coronal sections. Scans were obtained both before and after injection of non ionic contrast medium. All patients with globe protrusion >21mm anterior to the interzygomatic line on axial scans at the level of lens were evaluated. Lesions were grossly classified as inflammatory, neoplastic, congenital and traumatic. Final diagnosis was made based on the histopathology/operative findings/ clinical outcome whichever applied in individual cases. Statistical analysis was carried out with the help of SPSS - 17 to find the accuracy of Computed Tomography.

#### Results:

Thirty patients between the age group three to 73 years were included in our study. Mean age of the patients was 35.4±19.6 years. There was male preponderance with M: F ratio of 2:1. Most of our patients had unilateral proptosis with right side being more predominant (Table 1)

**Table 1: Site of Involvement**

| Site      | Frequency | Percent |
|-----------|-----------|---------|
| Right     | 13        | 43      |
| Left      | 11        | 37      |
| Bilateral | 6         | 20      |
| Total     | 30        |         |

Most common cause of proptosis was inflammation followed by tumor (Table 2).

**Table 2: Etiology of proptosis**

| Causes       | Frequency | Percent |
|--------------|-----------|---------|
| Vascular     | 1         | 3       |
| Inflammation | 14        | 47      |
| Infection    | 1         | 3       |
| Tumor        | 13        | 43      |
| Trauma       | 1         | 3       |
| Total        | 30        |         |

Pseudotumor accounted for 30% of the patients with proptosis (Table 3).

**Table 3: Lesions causing proptosis**

| Causes                     | Frequency | Percent |
|----------------------------|-----------|---------|
| Pseudotumor                | 9         | 30      |
| Graves's disease           | 4         | 13      |
| Tolosa Hunt Syndrome       | 1         | 3       |
| Meningioma                 | 2         | 7       |
| Haemangioma                | 2         | 7       |
| Dermoid                    | 2         | 7       |
| Lymphoma                   | 2         | 7       |
| Retinoblastoma             | 1         | 3       |
| Rhabdomyosarcoma           | 1         | 3       |
| Leukaemia                  | 1         | 3       |
| Squamous cell carcinoma    | 1         | 3       |
| Adenocarcinoma             | 1         | 3       |
| Carotico Cavernous Fistula | 1         | 3       |
| Trauma                     | 1         | 3       |
| Hydatid Cyst               | 1         | 3       |
| Total                      | 30        |         |

Similarly Graves's disease was seen in 4 patients of proptosis (13.3%). Accuracy of Computed Tomography in the diagnosis of etiology of proptosis was 86.6% (26 out of 30 patients were diagnosed correctly by CT).

**Discussion:**

The most common cause of proptosis in our study was inflammation. In contrast to this, Masud MZ et al<sup>3</sup> and Sabharwal KK et al<sup>4</sup> showed tumor as the most common cause of proptosis. This could be due to the small sample size or less number of tumor patient attending our hospital as most of the tumor patients are being referred to cancer hospital. Pseudotumor and Graves's disease were the two most common inflammatory lesion causing proptosis. In our study pseudotumor accounted for 30 % of the patients of proptosis which is higher than in study by Narula MK et al<sup>5</sup> where pseudotumor accounted for 11% patients of proptosis and Sabharwal KK et al<sup>4</sup> where pseudotumor accounted for 8% patients of proptosis. Pseudotumor was diagnosed based on the non specific radiological findings after excluding other potential causes. All of our patients with pseudotumor presented as unilateral disease.

In our present study, Graves's disease was seen in 13.3% patients of proptosis which is similar to study by Sabharwal KK et al<sup>4</sup> but higher than in the study performed by Narula MK et al.<sup>5</sup> All of our patients had bilateral disease with inferior rectus being the most common muscle to be involved.

Tolosa Hunt syndrome was seen in one of our patients who was suspected based on asymmetry of the cavernous sinus.

Lymphoma was seen in 6.7% of our patients of proptosis. In both the patients, lymphoma appeared as a homogeneously enhancing soft tissue density mass lesion in the extraconal compartment. Margo CE et al<sup>6</sup> reported lymphoma as the most common malignant orbital tumor. Similar to this, Sabharwal KK et al<sup>4</sup> reported lymphoma as the most common cause of proptosis.

Meningioma was seen in 6.7% of patients of proptosis as homogeneously enhancing mass arising from the optic nerve sheath and showed tram track sign on axial images. Both the patients with meningioma were diagnosed correctly. Calcification was seen in one of the lesion.

Haemangioma was seen in two of our patients with proptosis, making it 6.7% of our patients of proptosis. Similar to this, Khan et al found it to be 5.8 % of the total orbital lesions.<sup>7</sup> In contrast to this Masud ZS et al found haemangioma in only 2% of the total orbital lesion in the paediatric population.<sup>8</sup> Cavernous hemangiomas are usually discovered in young to middle-aged adults. The lesions tend to be well encapsulated with distinct margins, are usually intraconal and grow slowly.<sup>9</sup> Both the cavernous haemangiomas were well encapsulated and intraconal in location and having moderate

heterogeneous enhancement.

Rhabdomyosarcoma is the most common primary malignant orbital tumor in childhood with an average age of presentation being 7 years. In our study, patient with Rhabdomyosarcoma presented at a young age of 5 years.

Similar to Sabharwal KK et al,<sup>4</sup> the most common paraorbital tumor invading the orbit in our study was maxillary carcinoma.

Hydatid cyst was seen in one of our patients of proptosis. It appeared as a well defined cystic lesion within the extraconal compartment.

In our study 3.3% of the patients with proptosis had caroticocavernous fistula. A carotid cavernous fistula is an abnormal high flow communication between the arterial and venous circulations. They are most commonly post-traumatic in etiology.<sup>11</sup> Other causes include spontaneous fistulas, possibly related to atherosclerotic disease and rupture of an aneurysm of the intracavernous portion of the carotid artery.<sup>11</sup> In our patient there was no history of trauma. There was asymmetry and distention of the both the cavernous sinus, congestion and asymmetrical dilation of the superior ophthalmic vein bilaterally suggesting bilateral disease. Carotico cavernous fistula accounted for 2% and 7% of the patients with proptosis in studies by Sabharwal KK et<sup>4</sup> and Masud MZ et al<sup>8</sup> respectively.

Traumatic lesion accounted for 3.3% of the patients of proptosis. This is comparable with the study by Sabharwal KK et al<sup>4</sup> and Masud MZ et al<sup>8</sup> where traumatic lesion accounted for 6% and 5% of the patients of proptosis respectively. Intraorbital haematoma in the retrobulbar area was seen in one of our patient. In our study accuracy of CT in diagnosing orbital lesions causing proptosis was 86.6%. This is slightly higher than Sabharwal KK et al<sup>4</sup> and Mashud et al<sup>8</sup> (Table 4).

**Table 4: Accuracy of CT in diagnosing proptosis**

| Study                           | Accuracy | No of patients |
|---------------------------------|----------|----------------|
| Present Study                   | 86.6%    | 30             |
| Sabharwal KK et al <sup>4</sup> | 82%      | 50             |
| Mahsud et al <sup>8</sup>       | 80%      | 50             |

**Conclusion:**

CT is a simple, cost effective method used in the evaluation of proptosis with the diagnostic accuracy of 86.6%. Among

the various etiologies for proptosis, inflammation accounts for majority of the cases.

**Conflict of interest:** none

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