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Radiodiagnosis

COMPUTED TOMOGRAPHY EVALUATION OF PROPTOSIS

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ABSTRACT Proptosis is defined as forward abnormal orbital globe protrusion. We evaluated total 40 cases of proptosis with various age group ranging from 3 years to 75 years, Male comprising 27 cases and Female comprising 13 cases. Most common cause of proptosis was neoplastic seen in 20 patients (50%), followed by inflammatory in 8 cases (20%), infection in 6 cases (15%), trauma in 4 cases (10%), and vascular in 2 cases (5%). Unilateral proptosis was seen in 35 patients (87%), and bilateral in 5 patients (13%). Extraconal compartment involvement seen in 21 cases (52.5%). Enlarged extraocular muscles were seen in 20 cases (50%). Bone destruction was seen in 10 cases (25%). Intracranial extension was seen in 6 cases (15%). CT detected calcifications in 10 cases (25%). CT accuracy rate was 87.5% in diagnosing cause of proptosis. CT is reliable, cost-effective, non-invasive imaging modality in diagnosis of orbital lesion causing proptosis.

KEYWORDS : orbit, proptosis, computed tomography.

INTRODUCTION:

Proptosis is defined as forward abnormal orbital globe protrusion. Endocrine related proptosis is known as exophthalmos. Proptosis can results from various intra-orbital pathologies or para-orbital pathologies with intra-orbital or intracranial extension. The Various causes of proptosis can be categorized under tumor, inflammation, infection, trauma and vascular causes. Proptosis needs detailed evaluation in terms of clinical history, examination, laboratory investigations and imaging studies. Computed Tomography (CT) is superior to plain radiograph and ultrasonography in diagnosis of orbital pathologies as it shows superior lesion characterization apart from localization, extension and bony destruction. CT is superior to MRI in detection of calcification and bony destruction apart from the cost-effectiveness and availability.

Methodology:

This was a descriptive study carried out from July 2004 to December 2007. The study was approved by institute review board. All the patients presented clinically with proptosis irrespective of age and sex and came to Radiology department for CT-orbit were included in the study. Failure in making confirmatory diagnosis were excluded from the study. A brief clinically history of all patients was taken before CT Scan.

CT Scan protocol:

All the CT were performed in SOMATOM AR. TX (Siemens, Germany). Patients were kept on supine with a slightly hyperextended position of the head. Initially after positioning of the patient a scanogram or the tomogram was taken. Thin Sections were obtained in axial and coronal plane. The entire orbit along with the adjacent portions of the brain, the cavernous sinus and portions of the paranasal sinuses and facial and pharyngeal soft tissues were encompassed. The axial scans were taken at an angulation of -10 degree to the orbitomeatal baseline. Coronal imaging was performed perpendicular to the baseline. Contiguous thin sections, 2mm thick in axial and 3mm thick in the coronal plane were obtained routinely. Contrast was used only in selected cases for further characterization of lesion such as; vascular lesion, neoplastic or inflammatory lesion, optic nerve thickening, retrobulbar masses etc. This was followed by additional 5 mm axial sections of head region were usually obtained. Patients showing > 21mm of perpendicular distance from the interzygomatic line at the level of lens were included under the study (Figure 1A).

Image Analysis:

All the images were analyzed in workstation (Siemens). CT findings like unilateral/bilateral, location of the lesion, EOM enlargement, bone destruction, calcification and intracranial extension were evaluated. A CT diagnosis was made based on the imaging finding of each patients. Confirmation of the diagnosis: The diagnosis of the lesions was confirmed by fine needle aspiration, histopathology after surgery or after treatment response.

Statistical analysis:

All the data were plotted on Microsoft excel sheets. The accuracy rate of the CT diagnosis was evaluated.

RESULTS:

A total of 47 patients presenting with proptosis were evaluated using Computed Tomography. Out of which, 7 patients failed in getting the confirmation of diagnosis were excluded from the study. Remaining 40 cases were included in the study. The mean age of the patients was 24 years with ranging from 3 years to 75 years and of which 27 patients were Male and 13 were Female.

Most common cause of proptosis was neoplastic seen in 20 patients (50%), followed by inflammatory cause in 8 cases (20%), infection in 6 cases (15%), trauma in 4 cases (10%), and vascular in 2 cases (5%). (Table 1) Most common tumor in 0-5year age group was retinoblastoma constituting 5 cases followed by 1 case of rhabdomyosarcoma and pseudotumour. (Figure 1B & 1D)

Table 1: Causes of Proptosis

Orbital pathologies	No of cases	Percentage
Retinoblastoma	5	12.5
Sinonasal mass	3	7.5
Lacrimal gland mass	2	5
Dermoid/Epidermoid	2	5
Optic nerve meningioma	1	2.5
Fibrous dysplasia	1	2.5
Rhabdomyosarcoma	1	2.5
Lymphoma	1	2.5
Chondrosarcoma	1	2.5
AML	1	2.5
Malignant Fibrous histiocytoma	1	2.5
Plexiform neurofibroma	1	2.5
Orbital abscess	4	10
Myocysticercosis	1	2.5
Scrofuloderma	1	2.5
Pseudotumor	8	20
Orbital trauma	4	10
Cavernous hemangioma	1	2.5
Lymphangioma	1	2.5

Computed Tomography Findings

1. Unilateral/Bilateral Causes of Proptosis:

The Incidence of Unilateral proptosis was seen in 35 patients (87%), and Bilateral proptosis in 5 patients (13%). The pathologies causing bilateral proptosis were Scrofuloderma, Retinoblastoma, Orbital trauma, Lymphoma and AML each constituting 1 case. Pseudotumour was the most common cause of unilateral proptosis. (Figure 2A)

2. Location of Orbital Mass Lesion

It was observed that proptosis due to lesion in the extraconal compartment seen in 21 cases (52.5%), followed by intraconal lesion in 7 cases (17.5%), within globe in 5 cases (12.5 %), preseptal in 6 cases (15%) and subperiosteal lesion in 1 case (2.5%).

3. Enlarged Extraocular Muscles:

Enlarged extra-ocular muscles were seen in 20 cases (50%). Out of which, Pseudotumor comprised of 8 cases (20%), Tumor infiltrating the extraocular muscles were 11 cases (27.5%) and Myocysticercosis in 1 case (2.5%).

4. Bone destruction:

Bone destruction was seen in 10 cases (25%). Majority of them were sinonasal masses (Figure 2C) comprising 3 cases (7.5%), followed by lacrimal gland mass comprising 2 cases (5 %). Other causes were single case of Scrofuloderma, chondrosarcoma, malignant fibrous histiocytoma and AML and plexiform neurofibroma.

5. Orbital Lesions with Intracranial Extension:

Intracranial extension was seen in 6 cases (15%) where 5 cases were of tumor and single case was of scrofuloderma. Amongst the tumor with intracranial extension, sinonasal mass was the most common constituting 2 cases followed by one case each of Lacrimal gland mass (Figure 2D), chondrosarcoma and malignant fibrous histiocytoma.

6. Orbital lesions with Calcifications:

CT detected calcifications in 10 cases (25%). Retinoblastoma was the most common orbital lesion showing calcification constituting 4 cases followed by one case each of Dermoid, Lymphangioma, Abscess, Meningioma (Figure 2B), Hemangioma and Chondrosarcoma.

CT accuracy:

CT accuracy rate was 87.5% in diagnosing cause of proptosis.

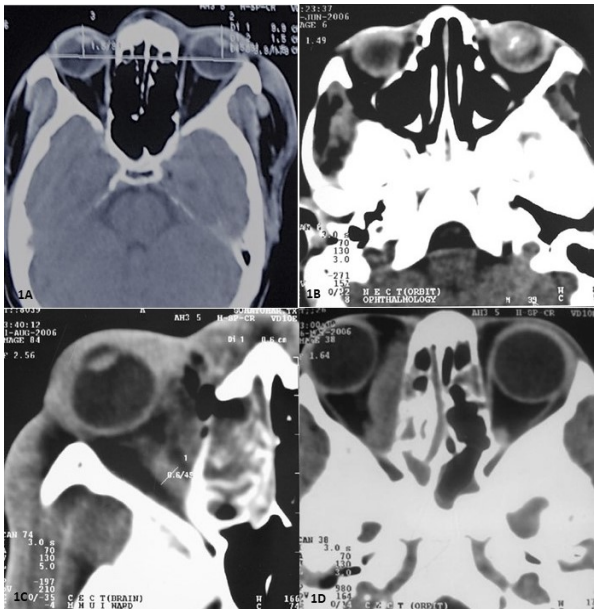

Figure 1. Axial CT images showing perpendicular distance from the interzygomatic line at the level of lens (1A), Retinoblastoma as a hyperdense mass within the left eye globe with calcifications (1B), Right Orbital cellulitis involving preseptal, extraconal and intraconal compartment along with involvement of extra-ocular muscles and optic nerve with associated right ethmoidal sinusitis (1C) and Orbital rhabdomyosarcoma of right orbit involving medial rectus muscle (1D).

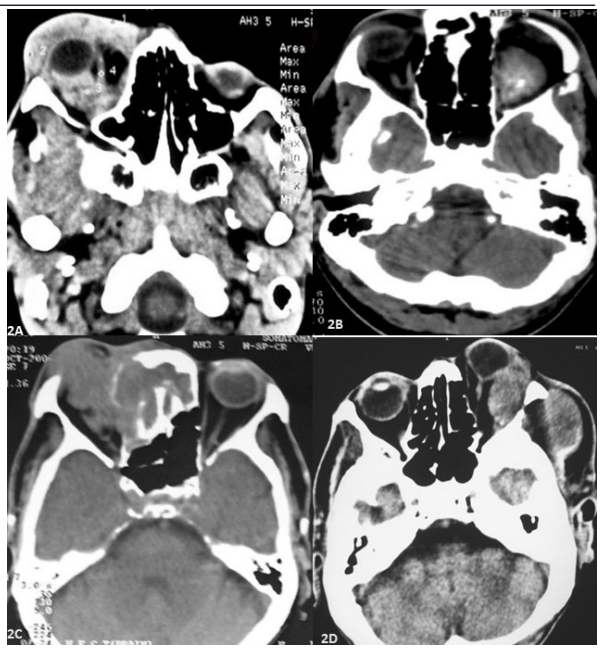

Figure 2: Axial CT images showing enlargement of the muscle belly of right superior rectus as well as their tendinous insertions with involvement of surrounding tissues including the lacrimal gland and preseptal space suggesting pseudotumour (2A), a fusiform hyperdense intraconal mass lesion around the optic nerve with calcifications representing meningioma (2B), adenocarcinoma of right maxillary sinus extending to right ethmoid sinus and the right orbit with bony destruction (2C), adenocystic carcinoma of left lacrimal gland with bony destruction (2D).

DISCUSSION:

Many studies have shown the various causes of proptosis or orbital tumors where conclusions were varying according to the source of the materials and the age group of studies, the percentages of biopsy proven entities, the geographic area encompassed, the type of researcher and scope of the diagnostic modalities used. This study is the first study conducted in the North East India, using computed tomography to evaluate the various causes of proptosis. We encountered 40 cases of proptosis with age group ranging from 3 years to 73years (mean age- 24 years) with male-female ratio of 2:1. Sabharwal et al also found varying ranges of patient from 2-80years with male female ratio of 1.08:1.(Sabharwal, Chouhan, & Jain, 2006)

In our study, most common cause of proptosis was neoplastic (50%) which is well correlating with the study by Sabharwal KK et al (46%) and Masud MZ et al (33%).(Masud et al., 2006; Sabharwal et al., 2006). However, Sharma et al has found inflammation as the most common cause of Proptosis.(Sharma, Tiwari, Ghimire, & Ghimire, 2013) Retinoblastoma was the most common tumor seen in our study whereas Lymphoma was the most common tumors causing Proptosis in the study of Sambasivarao K et al and Sabharwal KK et al.(Sabharwal et al., 2006; Sambasivarao & Ushalatha, 2015)

Inflammation (20%) was the second most common cause of Proptosis in our study which is well correlated with the Sambasivarao K et al (12.5%). All inflammatory case of proptosis were comprised of pseudotumour. Sharma P et al also found pseudotumour constituting 30 % of proptosis approximately correlating with our study and all were unilateral in presentation as seen in our study also.(Sharma et al., 2013)

Infective causes (15%) of the Proptosis in our study were Orbital abscess (10%), Myocysticercosis (2.5%) and Scrofuloderma (2.5%) (Figure 1C). Sambasivarao K et al and Masud MZ et al also found infection as a cause of proptosis in 15 and 20% cases respectively. (Masud et al., 2006; Sambasivarao & Ushalatha, 2015) Pushker N et al found proptosis as the most common presentation in orbital cysticercosis in 9 out of 20 patients.(Pushker, Bajaj, Chandra, & Chandra, 2001) We found only 1 case of orbital myocysticercosis which had been presented as proptosis.

Total 4 cases of trauma (10%) causing Proptosis seen our study.

Sabharwal et al found trauma causing proptosis in 6 % cases.(Sabharwal et al., 2006)

Amongst the vascular cause (5%), one case of each of cavernous hemangioma and lymphangioma seen in our study. Sambasivarao K et al and Sabharwal KK et al have found vascular cause as the least common cause of proptosis constituting 2.5 % and 2 % respectively.(Sabharwal et al., 2006; Sambasivarao & Ushalatha, 2015)

Commonest presentation of proptosis was seen in unilateral location (87%) and rests (13%) in bilateral. Pseudotumour was the most common cause of unilateral proptosis. Bilateral proptosis were seen in Scrofuloderma, Retinoblastoma, Orbital trauma, Lymphoma and AML. Sharma P et al has also reported unilateral proptosis in 80 % cases, bilateral proptosis in 20 % cases and pseudotumour comprised of 30 % of total cases of proptosis (Sharma et al., 2013)

In our study 52.5% of Proptosis shows orbital lesion involving extraconal compartment. Sabharwal KK et al have also reported 18 out of 50 cases (36%) of proptosis were showing extraconal compartment involvement in a study by Sabharwal KK et al.(Sabharwal et al., 2006) Amongst the 20 cases (50%) of proptosis with extraocular muscle involvement in our study, pseudotumor were found in 8 cases (20%), Tumor infiltrating the extraocular muscles were seen in 11 cases (27.5%) and Myocysticercosis in 1 case (2.5%). Sabharwal KK et al reported 8 out of 50 cases of proptosis involving the extra-ocular muscles.(Sabharwal et al., 2006)

Bone destruction was seen in 10 cases (25%), majority of them were comprising of sinonasal masses. Johnson LN et al reported maxillary carcinoma as most common paraorbital tumor invading the orbit.(Johnson, Krohel, Yeon, & Parnes, 1984)

Intracranial extension was seen in 6 cases (15%) where 5 cases were of tumor and single case was of scrofuloderma. Amongst the tumor with intracranial extension, sinonasal mass was the most common followed by Lacrimal gland mass, chondrosarcoma and malignant fibrous histiocytoma. Sambasivarao K et al has reported 2 cases (2.5%) of nasopharyngeal carcinoma showing bone destruction and intracranial extension with orbital and cavernous sinus involvement resulting proptosis.(Sambasivarao & Ushalatha, 2015)

CT detected calcifications in 10 cases (25%). Retinoblastoma was the most common orbital lesion showing calcification constituting 4 cases followed by one case of Dermoid, Lymphangioma, Abscess, Meningioma, Hemangioma and Chondrosarcoma. CT has a designated sensitivity in detecting calcifications in retinoblastoma of 81%–96%. (Beets-Tan, Hendriks, Ramos, & Tan, 1994; Weber & Mafee, 1992)

In our study, CT accuracy was seen in 87.5% in diagnosis of causes of proptosis which is well correlated with the study by Sharma P et al (86.6%), Sabharwal KK et al (82%) and Masud MZ et al (80%).(Masud et al., 2006; Sabharwal et al., 2006; Sharma et al., 2013)

CONCLUSION:

CT is reliable, cost-effective, non-invasive imaging modality in diagnosis of different causes of orbital lesion causing proptosis. CT is helpful in characterizing the lesion, its localization, lateralization and extension. Calcification and bone destruction are best evaluated with CT imaging.

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