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Original article:

Role of MDCT in orbital pathology

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ABSTRACT:

Background: The orbit is an anatomically complex structure containing the globe; extra ocular muscles; fat; vascular, nerve, glandular, and connective tissues. It consists of roof, floor, lateral and medial walls, and apex. Lesions can be broadly subdivided into two groups: ocular (limited to globe) and orbital (rest of the orbit excluding globe). Computed Tomography (CT) is the first-line modality for radiologic evaluation of the orbit in the acute setting.

Aim and objective: To determine the role of multi detector CT in orbital pathologies.

Material and methods: The study was conducted in Department of Radiology, College of medical sciences, Bharatpur, Chitwan Nepal. Patients with complaints related to traumatic and various non-traumatic pathologies were included in our study. All CT examinations were performed using helical CT (160 slice Toshiba CT) and reconstructed in appropriate planes. A prospective cross-sectional study was conducted on 60 patients in college of medical science**,** Bharatpur, over the period of one year (from December 2016 to December 2017). All the patients with clinical suspicion of ocular and orbital lesions, referred for CT scan were included in this study**.**

Results: Among 60 patients included in our study, non-trauma constituted the most common. Among the non-traumatic affected eye most of them had orbital involvement rather than ocular lesions. Spectrum of the pathologies among the non-traumatic lesions were neoplastic followed by infective, inflammatory, congenital, parasitic and vascular lesions. Retinoblastoma was the most common malignant lesion. Among the traumatic cases most common was foreign body followed blunt and penetrating injury were seen in equal cases.

Conclusion: CT gives excellent details about bony anatomy in fractures and helps assessing presence or absence of foreign bodies. CT describes the extent of lesions in inflammatory and neoplastic etiologies, accurately assess bony destruction in neoplasms helping in the surgical planning of the orbital lesions.

Key words: MDCT, MRI, orbital pathology

INTRODUCTION

There are different modalities of the orbital imaging ranging from plain films, ocular ultrasound, CT and MRI. In current practice plain films are rarely performed which are reserved for the detection of the radiopaque foreign bodies prior to obtaining an MRI. Radiography has a sensitivity of 64%–78% for a fracture, but it has very low sensitivity for soft-tissue injuries to the orbital contents.[1] Ocular ultrasound is excellent for the evaluation of intraocular and orbital abnormalities but has very limited applications for intracranial lesions. In addition, the quality of an ultrasound scan is operator-dependent and affected by strong ultrasound reflectors such as air, calcifications and bone that obscure the view of deeper structures. Therefore, the majority of patients with neuro-ophthalmological symptoms requiring radiological evaluation undergo a CT or MRI examination. In general, CT is preferred for the acutely sick patient because it is widely available, easily accessible, and facilitates rapid detection of significantly debilitating or life-threatening disease processes such as an intracranial hemorrhage, tension orbit, orbital fracture, or an intraorbital abscess.CT has been shown to be more accurate than radiography in detecting fractures. When fractures are present, three-dimensional reformation is a useful tool to guide treatment.[2] Abundance of intraorbital fat provides good intrinsic soft tissue contrast on CT. CT is also valuable in the follow up of tumor regression after surgery, radiotherapy or chemotherapy. CT guided fine needle aspiration biopsy has been used in various orbital lesions. Other applications for orbital CT include ocular motility studies and lacrimal drainage apparatus imaging. The advances of MDCT technology now make high resolution CT imaging possible. The study is aimed to evaluate the role of CT in orbital pathology and characterize the different traumatic and non-traumatic disease process and detection of the common orbital pathologic condition in the mid part of the Nepal.

MATERIALS AND METHODS

The present study was a cross sectional analytic study conducted in Department of Radiology of College of medical sciences, Bharatpur, Chitwan Nepal during a period of 1 year (from December 2016 to December 2017) on 60 patients who had h/o orbital trauma, proptosis, pain, visual impairment with or without ophthalmoplegia, orbital mass. They were subjected to ophthalmological examination and CT orbit. CT findings were correlated with final diagnosis based on clinical, laboratory, operative findings, histopathological study or response to treatment.

All CT examinations were performed using 160 slice Toshiba MDCT. Thin section (<1mm) were taken with multi planner reformat in coronal and sagittal planes. IV contrast are used depending upon the condition if necessary. The study protocol was approved by the ethical committee of College of Medical Science and Teaching Hospital, Bharatpur.

Inclusion criteria: Patients with orbital complains in traumatic and non-traumatic patients

Exclusion criteria: Patients who are contraindicated to CT examination who had h/o severe contrast allergy, orbital post-operative history and pregnant women.

The data analysis consist of classification and tabulation of the data into meaningful groups, presentation of the data in the form of concise diagram and groups. Statistical package for social science (SPSS) 16 version was used for data analysis. For descriptive statistics proportion and percentage were calculated and also graphical and tubular presentation was made. P value was calculated using chi-square test and values of less than 0.005 was considered statistically significant.

RESULTS:

On the basis of inclusion criteria a total of 60 patients with clinical suspicion of ocular and orbital lesions were enrolled in the study.

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Table I. Distribution of traumatic and non-traumatic cases

Type	Frequency (n=60)	Percentage
Non traumatic	56	93.33
Traumatic	4	6.67

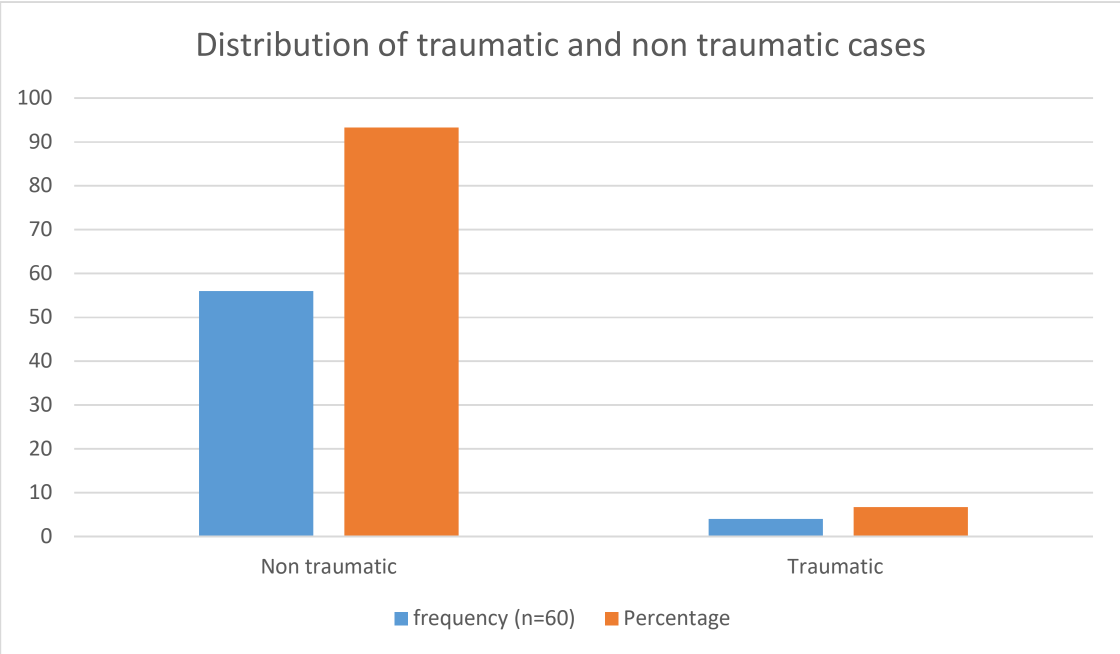

Fig 1. Distribution of traumatic and non traumatic cases

Table II. Distribution of non-traumatic orbital and ocular lesions on MDCT

Category	**Frequency (n=56)**	**Percentage**
Neoplasm	27	48.21
malignant	20	
Benign	7	
Infective and inflammatory	20	35.71
Congenital and developmental lesions	3	5.3
Parasitic	2	3.57
Vascular lesions	1	1.78
Miscellaneous (bone and PNS lesions)	3	5.3

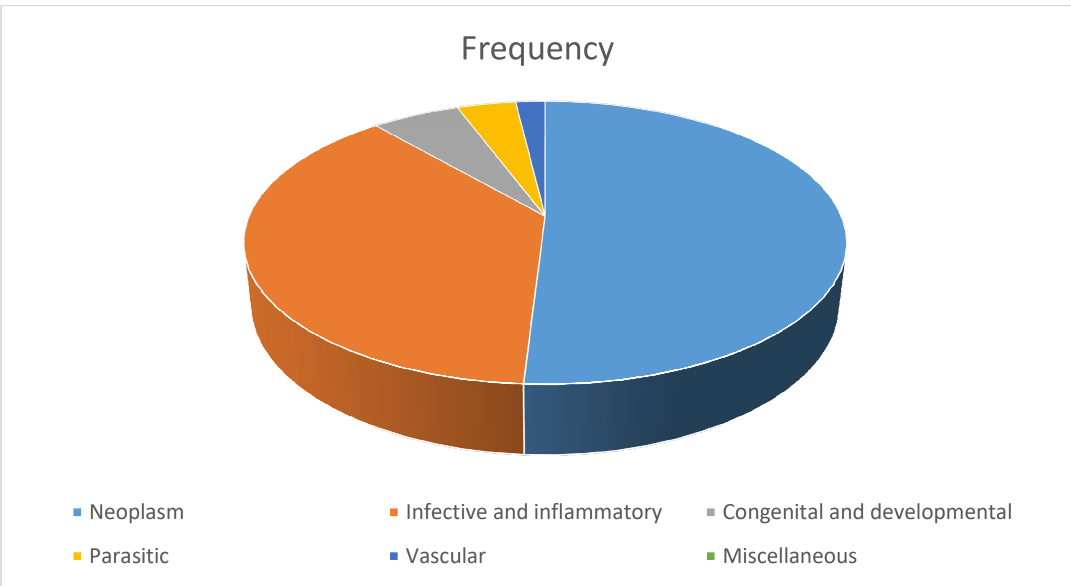

Fig. 2 Distribution of non-traumatic orbital and ocular lesions on MDCT

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Table III. Further distribution of the non-traumatic ocular and orbital lesions based on histopathology/operative findings, clinical and biochemical correlation

Disease category	**Frequency**	**Percentage**
Retinoblastoma	16	28.57
Lymphoma	2	3.5
Rhabdomyosarcoma	2	3.5
Dermoid cyst	5	8.9
Optic nerve glioma	2	3.5
Orbtal cellulitis	5	8.9
Preseptal cellulitis	5	8.9
orbital Pseudotumor	4	7.1
Endophthalmitis	2	3.5
Endocrine orbitopathy	4	7.1
PHPV	1	1.7
Staphyloma	2	3.5
Myocysticercosis	2	3.5
Hemangioma	1	1.7
CCF	1	1.7
Fronto-ethmoid mucocele	2	3.5

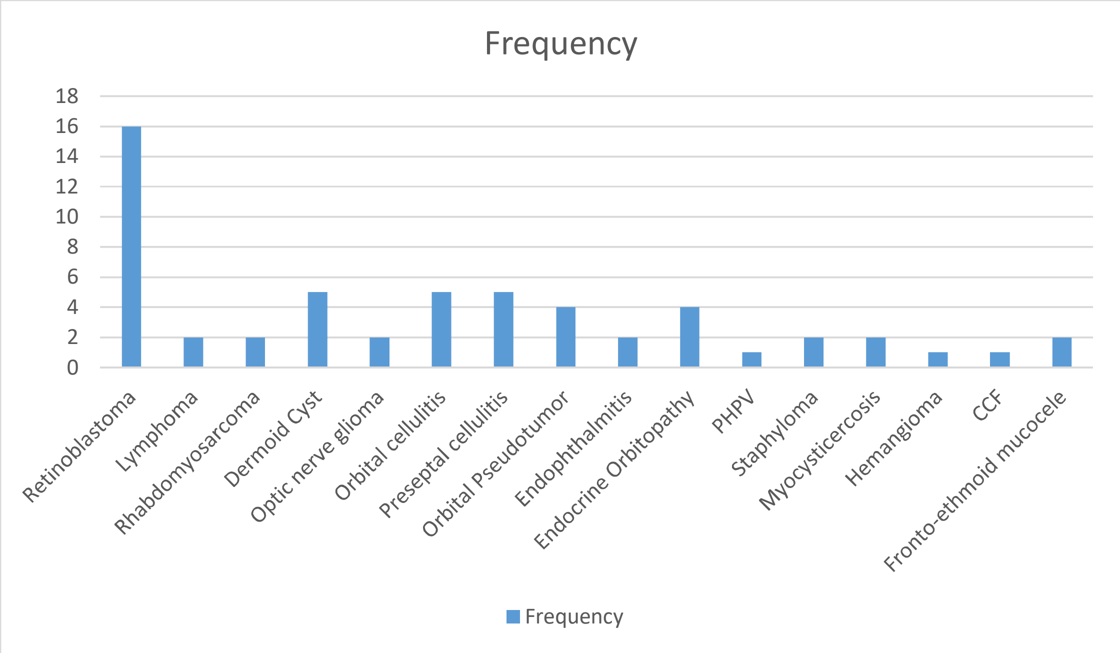

Fig III. Further distribution of the ocular and orbital lesions based on histopathology/operative findings, clinical and biochemical correlation

Table IV: Distribution of the traumatic orbital and ocular lesion in MDCT

Disease category	**Frequency (Percentage)**
Foreign body	2 (50%)
Retinal detachment	1 (25%)
Fracture	1 (25%)

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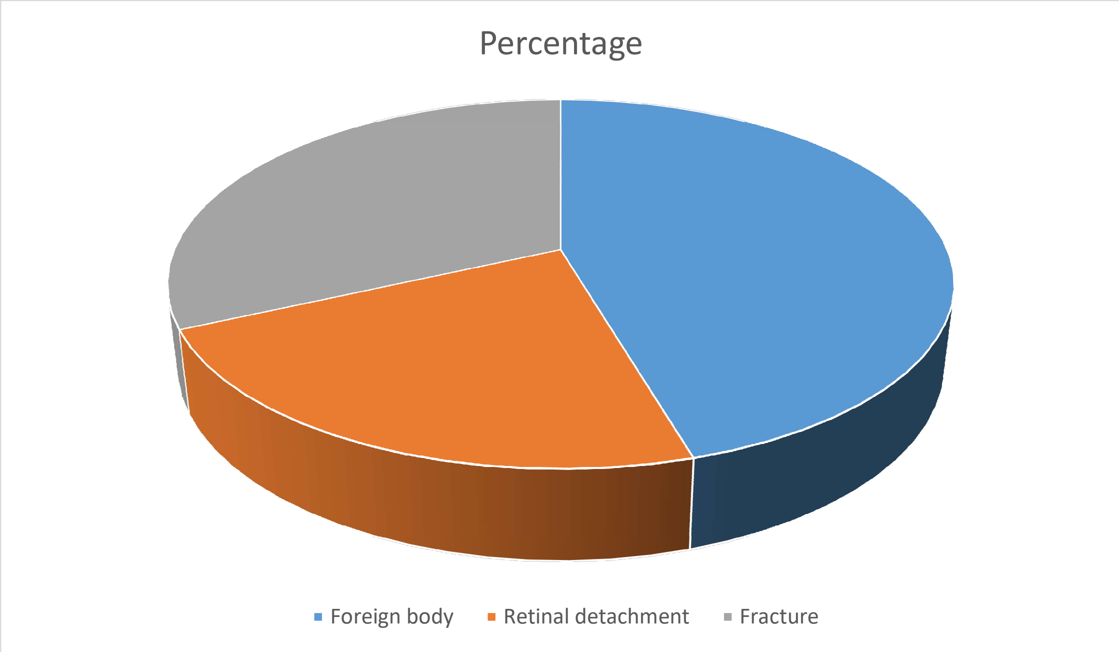

Fig IV: Distribution of the traumatic orbital and ocular lesion in MDCT

DISCUSSION

CT is the first-line modality for radiologic evaluation of the orbit in the acute setting, with MR imaging serving as a useful secondary diagnostic tool because of its excellent tissue contrast resolution. The ability of imaging to distinguish pathological entities from physiologic calcifications, post therapeutic changes, and orbital devices allows optimal management without unnecessary further diagnostic work-up. Computed tomography (CT) has revolutionized the diagnosis and management of ocular and orbital diseases. The use of thin axial sections with multiplanar reformation and three-dimensional reconstruction MDCT permits thorough evaluation of orbital pathologies Age of the patients ranged from 2 to 80 years in a study done by Durrani et al [3] to analyse the diagnostic role of CT scan in orbital masses in 26 patients. Similarly, the age range was 1.5 to 74 years in a study by Chinda et al[4] on 49 patients with orbito-ocular tumors. Age of the patients in our study ranged from 1 to 65 years which is comparable to the age range found in the studies done by Durrani et al[3] and Chinda et al.[4]

The proportions of traumatic and non- traumatic cases were 6% and 94% respectively in the study done by Durrani et al[3] among 26 patients presenting with proptosis. In another study done by Mahsud[7] on 50 cases of proptosis, 47 (94%) cases were non-traumatic and 3 (6%) were traumatic in nature. In our study among 60 patients with ocular and orbital lesions trauma was seen in 4 (6.67 %) and 56 (93.33%) were non-traumatic. Distribution of traumatic and non- traumatic lesion in our study was comparable to the study of Durrani et al[3] and Mahsud. [5]

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Chinda et al[4] studied 49 cases of ocular and orbital tumor and reported that retinoblastoma was the most common tumor accounting for 18 cases (46.15%) in their study. In a study, Vashisht et al[6] reported 30 (30%) cases of retinoblastoma in a series of total 100 cases of orbital mass. In our study out of 56 non traumatic cases, retinoblastoma was seen in 16 (28.57%) cases accounting for most common lesion which is comparable to the result of Chinda et al[4] and Vashisht et al. [6] Asih et al[7] studied 64 patients of retinoblastoma on CT scan to determine patient distribution and to describe CT findings. CT scan in their study detected calcification which is an important feature for distinguishing retinoblastoma. Contrast-enhanced CT imaging of the brain performed in patients with bilateral retinoblastoma showed the pineal region tumor. In our study one case of trilateral retinoblastoma was detected on MDCT in a 3 years old female child. MDCT in our study showed heterogeneous soft tissue density mass with coarse calcification in both eye along with pinealoblastoma and leptomeningeal metastasis which was similar to the study done by Rodjan F et al. [8]

In our study out of 56 non-traumatic cases 5 cases of dermoid cysts were diagnosed on MDCT. Age of the patients ranged from 11-42 years which is comparable to the age distribution of Chun min. [9] MDCT in our study showed well defined heterogeneous soft tissue density lesion with fat density within in 3 cases. With 1 of the dermoid cyst showing characteristic fat fluid level. In 2 eyes, remodeling of underlying bone was seen. Features of dermoid cyst in our study were comparable to the study of Chun min. [9] In our study all 5 dermoid cysts were located in lateral aspect of orbit which was comparable to the location in the study of Chawda SJ. [10]Idiopathic orbital pseudotumor (IOP) is a non-granulomatous inflammatory process in the orbit and is the third most common ophthalmologic disease of the orbit and accounts for approximately 8–11% of all orbital tumors. According to the study done by Chaudhry et al [11] in which they reviewed and summarized findings regarding the epidemiology, diagnosis, pathophysiology and treatment of orbital pseudotumor. In our study, 4 cases of orbital pseudotumor were diagnosed on MDCT. Age of the patients ranged from 5 to 32 years with mean age of 17.5 years and all patients were in younger age group. Among 4 cases 3 were male and 1 was female with male to female ratio 3:1. All 4 cases had unilateral eye involvement. MDCT in our study showed ill- defined enlargement of extra ocular muscle right up to its tendinous insertion in all 4 cases which was comparable to the study of Chaudhry et al.[11]Thyroid-associated orbitopathy (TAO) is an autoimmune condition of the orbit which is closely associated with Graves' hyperthyroidism. In a study done by Chan et al[12] on 41 patients with Graves ophthalmopathy 17 were male and 24 were female and mean age of disease presentation was 49.1 years. Most common CT findings in graves ophthalmopathy were proptosis, muscle swelling, thickening of optic nerve & anterior prolapse of the septum. Kahaly et al [13] reviewed imaging findings in thyroid-associated orbitopathy and found that in a series of the patient examined on CT scan symmetrical involvement of extrocular muscles was seen in 30 % cases. Most common muscle involved in their study was inferior rectus, medial rectus, superior rectus and lateral rectus in decreasing order with sparing of tendenous insertion which is similar to our study. Simon et al [14] retrospectively evaluated the configuration of extraocular muscle and tendon enlargement in 125 consecutive patients of thyroid associated orbitopathy (TAO). Eight patients with TAO in their study demonstrated tendon involvement on axial CT where as in our study all 4 cases of thyroid orbitopathy no cases showed tendon involvement.

In our study 3 cases of myocysticercosis were diagnosed on MDCT. Age ranges from 9 to 65 years. MDCT in all cases showed thickening of extraocular muscle with peripherally enhancing cystic lesion with eccentrically located hyperdense focus (Scolex) within. MDCT features in our study is comparable to the study of Shi D et al. [15]

PHPV is rare benign developmental disorder in which embryonic hyloid artery fails to regress resulting in abnormal lenticular development and secondary changes of the retina and globe. Kaste et al [16] correlated imaging findings and pathological findings in 5 patients of PHPV. On CT in 3 cases out of 5 were diagnosed as PHPV in their study which showed irregular retrolenticular masses to linear soft tissue band coursing from the posterior lens to retina. Masses showed enhancement on post contrast study. In our study a single case of PHPV was diagnosed on MDCT. MDCT showed a triangular retrolental band of soft tissue extending from the posterior surface of lens to posterior pole of globe showing mild enhancement on post contrast study. The imaging findings in our study were comparable to Kaste et al[16] however, we couldn't performed MRI in our cases, which is different from the study done by Lameen et al. [17]

Orbital haemangioma can be either capillary haemangioma or cavernous haemangioma. Both are different lesion differing upon clinical presentation, location and age of presentation. Capillary haemangioma are commonest in childhood usually located in extraconal, situated in supero-medial quadrant. Cavernous haemangioma is the most frequent primary orbital tumor seen in adults. It is most common orbital vascular lesion followed by capillary haemangioma which mainly occur in 4th-5th decade and are usually isolated intraconal masses and may extend to extraconal spaces.[18] Kany et al [19] did CT, MR imaging of eight patients with cavernous haemangioma localized in orbit. 2 patients in their study underwent CT scan which showed hyperdense orbital masses showing homogeneous enhancement on post contrast. Hsu et al [20] retrospectively analyzed clinical feature and treatment outcomes in 42 cases with cavernous haemangioma of orbit. 90% (38/42) cases in their study were accurately diagnosed on computed tomography/magnetic resonance imaging. Out of 38 patients who underwent orbital computed tomography lesion showed oval or round shaped homogenous lesion with a well-defined margin which showed enhancement on post contrast study. In our study 2 cases of capillary haemangioma was diagnosed in a 1 years male on MDCT. On MDCT there was an ill-defined enhancing mass lesion in superomedial aspect of orbit in extraconal space displacing eye ball laterally and slightly anteriorly causing proptosis. Imaging feature in our study was comparable to Kany et al[19] and Hsu et al. [20]

CCF is an abnormal high flow communication between and arterial and venous circulation.[21] On non-contrast CT scans of the orbit, a dilated superior ophthalmic vein is usually seen.Uchino A et al [22] done a comparative study on a ten patient with dural CCF using postcontrast computed tomography (CT), magnetic resonance imaging (MRI), and selective cerebral arteriography. A dilated superior ophthalmic vein (SOV) was demonstrated in all of the involved sides, and an enlarged cavernous sinus (CS) was diagnosed in 6 of the 12 involved sides on post contrast CT. in our study single case of CCF was noted with similar CT findings of above study.

Computed tomography (CT) is considered to be the top choice for evaluating orbital trauma. Imran et al[23] **(25)** did a cross sectional observational study to identify the role of ultrasound (US) and computerized tomography (CT) scan in diagnosis of common ocular traumatic lesion on 50 patients with traumatic ocular injuries. In their study CT scan showed higher accuracy compared to ultrasound in detecting intraocular foreign body.

CT in case of fracture is the imaging method of choice for evaluation of orbital trauma. A common type of orbital fracture is blowout fracture and most often involve inferior wall and medial wall. In our study there were 4 traumatic cases out of which 2 cases were foreign body and remaining 2 were fracture and retinal detachment.

CONCLUSION

The imaging features of various ocular and orbital lesions were very characteristic on MDCT. MDCT is better for evaluation of bones and detection of calcifications and it allows us to discern the location, extent and configuration of the lesions and their effect on adjacent vital structures. The MDCT has important role in characterization and diagnosis of the lesion, surgical planning and follow up of the patient with various ocular and orbital pathologies. We recommend MDCT as an ideal radiological method for evaluation of ocular and orbital lesions which should be done prior to treatment planning and various surgical procedures.

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