IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 1 Ser.17 (January. 2020), PP 62-67
www.iosrjournals.org

Role of MDCT in the Evaluation of Orbital Trauma

Dr.K.Sambasivarao[1] Dr.B.Ushalatha[2]

[1.] *Associate Professor,Radio Diagnosis, Rangaraya Medical college, Kakinada.*
[2.] *Corresponding author , Designated AssociateProfessor in Ophthalmology ,RMC,Kakinada*

Abstract:
Objectives: *To evaluate the role of MDCT in the evaluation of orbital trauma.*
Material And Methods: *50 patients presenting with orbital injuries were evaluated. All patients were subjected to full history taking, clinical evaluation, and radiological assessment using MDCT of head including facial bones and orbit . Images were acquired helically with 1.25 mm slice thicknessand subjected to MPR and 3D reformations in axial, coronal and sagittal planes . Cases were classified into four groups according to the anatomic site of lesions – orbital fractures, ocular lesions, adnexal lesions, and retrobulbar lesions.*
Results: *Diminution of vision was the most common presenting symptom (90%), and orbital fracture was the most common eye injury following trauma . CT showed positive findings including orbital fractures, ruptured globe, foreign bodies, and retrobulbar edema.*
Conclusion: *CT is the optimal imaging modality for revealing traumatic orbital injury. In an emergency setting, CT completes the clinical examination and allows appropriate care to be given for a wide range of traumatic lesions such as bony orbital fracture, lens traumatic complications, and posterior chamber sequels. Computed tomography is the simple, cost effective technique in the evaluation of orbital trauma.*
Keywords: *Computed Tomography, trauma, orbit.*

Date of Submission: 14-01-2020 Date of Acceptance: 28-01-2020

I. Introduction

Ocular injuries account for approximately 3-5% of emergency casualty visits with most of the patients presenting with either head or facial injuries rather than ocular injuries alone . Eye injuries result in blindness in about 1.6 million people and with decreased vision in almost 19 million people each year. Ocular injuries are a significant cause of disability, especially in young men, in whom ocular trauma is predominant . Common mechanisms of ocular injury include motor vehicle accidents, sports injuries, industrial accidents, falls and assaults. Patients with blunt facial injuries are at an increased risk for associated eye injuries, and the incidence of vision loss and blindness related to facial fractures is about 7-12%. Ocular involvement may also be seen in as many as 74% of patients with head injuries .

The most common eye injuries among polytrauma patients are orbital wall fractures, periorbital swelling, hematoma, subconjunctival hemorrhage, ocular adnexal injuries, optic nerve injuries, penetrating globe injuries and Blow-out fracture of the orbit is the commonest injury which needs early intervention. Early ophthalmologic examination is important for appropriate and prompt management of ocular injuries. In the setting of acute trauma with irritable, unconscious and non cooperative patients evaluation of eye is limited. Hence in such situations the role of imaging is utmost important for evaluation of injuries to brain, skull, facial bones and to the orbit.

CT is the imaging modality of choice in evaluating acute orbital trauma as it can demonstrate orbital bone, ocular contents and other soft tissue lesions. Thus CT because of its rapidity in acquisition is crucial in making accurate diagnoses and to guide proper patient treatment. Computed tomography (CT) orbit can often detect certain types of foreign bodies, lens dislocation, ruptured globe, choroidal or retinal detachments and thus can complement a bedside ophthalmic examination that can sometimes be limited in the setting of trauma.

Ultrasonography can be very useful for evaluating the globe and its contents; however, ultrasonography is contraindicated if a ruptured globe is suspected. MRI may be difficult to perform emergently; it is contraindicated if there is a possibility that a metallic intra orbital foreign body is present. CT is considered to be the top choice for evaluating orbital trauma.

II. Material And Methods

The present study was conducted on 50 patients between the ages 10 to 70 years with oculo orbital trauma presenting to the casualty room and on patients referred to the Department of Ophthalmology and Radio diagnosis, Government General Hospital, Rangaraya Medical College, Kakinada between January 2018 to

December 2018 . After taking consent the patients were subjected to routine clinical history and evaluation of the traumatic and non traumatic eyes were done.

Each patient was asked about the type, mechanism and duration of trauma. History of ocular or systemic diseases was also taken to exclude non traumatic eye symptoms. General examination included evaluation of blood pressure, pulse, and temperature. Local examination of the eyes was performed by an ophthalmologist and included assessment of visual acuity, pupillary testing, fundus examination, and slit-lamp examination to assess injury of the anterior chamber, cornea, iris, and lens.

After the ocular examination was done all the patients with suspicious head injury, facial injury and oculo orbital injuries were evaluated by a 16 slice GE ACTIVE MDCT scanner. At our institution, CT images of the brain, facial bones including orbits were acquired helically with the patient supine using the following parameters: 120 kVp, 100 mAs, 1.25- mm section thickness with 1.25-mm intervals, and a pitch of 0.969 with a scan time of 2-3 minutes . Images are reconstructed with MPR and 3D reconstruction in soft tissue and bone kernels in axial, sagittal and coronal planes. Iterative reconstruction techniques are applied for further dose reduction, with resulting CT dose index values of 20 mGy or less. An un-enhanced orbital CT scan is the first choice to evaluate orbital trauma and then if vascular injuries are suspected an enhanced CT scan is indicated.

The best protocol is to obtain thin-section axial CT scans and then perform multiplanar reformation. When evaluating a patient with an orbital injury, the radiologist should do the following:

(a) Evaluate the bony orbit for fractures, note any herniation of orbital contents and injuries to the orbital apex

(b) Evaluate the anterior chamber

(c) Evaluate the position of the lens (the lens may be dislocated/subluxated)

(d) Evaluate the posterior segment of the globe, look for bleeds or abnormal fluid collections and evaluate for radiopaque or radiolucent foreign bodies; and

(e) Evaluate the ophthalmic veins and the optic nerve complex, especially the orbital apex .

Patients with ocular traumatic lesions with or with out orbit fractures were included in the study. All patients with bilateral orbital injuries and patients with intra cerebral hematoma, extra dural, subdural hematomas which needed immediate neuro surgical interventions were excluded from the study.

III. Observation & Results

The present study was conducted on 50 patients between the ages 10 to 70 years with oculo orbital trauma with a mean age of 28 years. There were 9 female and 41 male patients, with a male to female ratio of about 4 : 1. Oculo orbital injuries occurred in the right eye in 30 patients (60%) and in left eye in 20 cases. Patients with bilateral Oculo orbital injuries were excluded from the study.

The most common cause of eye trauma was road traffic accidents, seen in 35 patients (70%), followed by assaults and accidental falls in 6 patients each (12%),and work accidents in 3 patients (6%). 33 of the 35 patients with road traffic accidents were males with an incidence of 94.3%, pronouncing the fact that road traffic accidents were the commonest cause of oculo orbital trauma. 28 of the 35 patients with road traffic accidents were in the age group of 20-40 years with an incidence of 80%. 5 of the 6 cases of assault were females with an incidence of 83%. 4 out of the 6 cases (66.7%) of accidental falls were seen in patients above 50 years.

CAUSES OF OCULO ORBITAL TRAUMA

SL.NO	CAUSE	NO.OF PATIENTS
1	ROAD TRAFFIC ACCIDENTS	35
2	ASSAULTS	6
3	ACCIDENTAL FALLS	6
4	WORK ACCIDENTS	3
	TOTAL PATIENTS	50

40 out of the 50 patients (80%) had swelling of the eye. 6 (12%) patients had proptosis , and 4 (8%) patients had abnormal ocular motility. 45 out of the 50 patients (90%) complained of diminished visual acuity. Both the complaints of swelling of the eye and diminished vision were seen in 35 out of the 50 patients (70%) making them the most commonest presentation.

TABLE SHOWING VARIOUS LESIONS ON CT

SL.NO	TYPE OF LESIONS ON CT	NO.OF PATIENTS (50)
1	OPEN GLOBE INJURIES	22
2	CLOSED GLOBE INJURIES	28
3	OCULAR ADNEXAL LESIONS	40
4	ORBITAL FRACTURES	30

Open globe injuries on MDCT were seen in 22 out of 50 patients. Ruptured globe was seen in 10 eyes (20%), vitreous hemorrhage in five eyes (10%), intraocular foreign bodies in four eyes (8%), and intra orbital foreign bodies in three eyes (6%).

Closed globe injuries on MDCT were seen in 28 out of 50 patients. Periorbital Edema is the commonest lesion in 16 cases, followed by isolated vitreous hemorrhage in 7 eyes (14%) and lens displacement in 5 cases.

Ocular adnexal lesions on MDCT were seen in 40 out of 50 patients. These include periorbital soft tissue hematoma in 30 (75%) cases. Most of the adnexal injuries were combined lesions. Conjunctival lesions were seen in 12 cases, orbital emphysema in 6 cases, foreign bodies in 5 cases and 4 cases had extraocular muscle injuries. Isolated periorbital soft tissue hematoma in 18 cases was seen.

Orbital fractures on MDCT are seen in 30 out of 50 patients (60%). Isolated single wall fractures were seen in 18 cases (60%) and complex fractures involving orbital wall were seen in 12 cases (40%). In isolated fractures, 7 cases involved the floor, five cases involved the lateral wall, four cases involved the medial wall, and two cases involved the roof of orbit. Associated other facial fractures were seen in 20 patients out of thirty patients who had orbital fractures.

IV. Discussion

The present study "***ROLE OF MDCT IN THE EVALUATION OF ORBITAL TRAUMA*** **"** was conducted on 50 patients who attended the Government General Hospital, Kakinada between January 2018 to December 2018. The present study was conducted to evaluate if MDCT SCAN is the first-line modality for radiologic evaluation of the orbit in acute oculo orbital trauma patients, especially when clinical examination is not possible or when the ophthalmologist does not reach a final diagnosis to manage and avoid permanent vision loss.

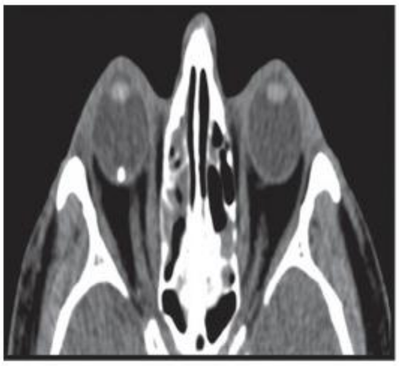
The present study was conducted on 50 patients between the ages 10 to 70 years with oculo orbital trauma with a mean age of 28 years. There were 41 male patients and 9 female patients , with a male to female ratio of about 4 : 1. Emphasizing the lack of traffic conscious and the need for traffic awareness among males. Other studies on trauma epidemiology confirm the male predominance, with a male to female ratio varying between 1.25 and 5.5.

The most common cause of oculo orbital trauma was road traffic accidents, seen in 35 patients (70%), These findings agreed with those of previous studies by Poon et al. and Georgouli et al. Assaults and accidental falls were seen in 6 patients each (12%). This was in agreement with previous studies by

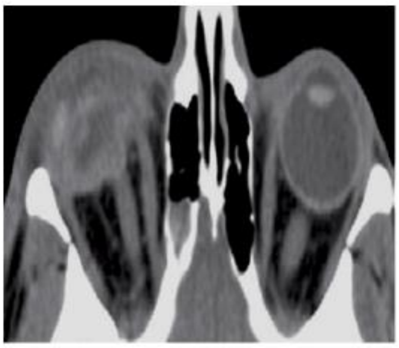
May et al. and Georgouli et al. Road traffic accidents were the commonest cause of oculo orbital trauma. 28 of the 35 patients with road traffic accidents were in the age group of 20-40 years with an incidence of 80%.

45 out of 50 patients (90%) complained of diminished visual acuity. The complaints of swelling of the eye and diminished vision were seen in 35 out of the 50 patients (70%) making them the most commonest presentation in patients with oculo orbital trauma.

Open globe injuries on MDCT were seen in 22 (44%) out of 50 patients. The percentage of open globe injuries is less than that reported by Salvolini (72%) and Soliman (80%). Ruptured globe was seen in 10 eyes (20%), in our present study. Open-globe injuries, also known as globe rupture, are a major cause of blindness. Blunt trauma to the globe disrupt the integrity of the sclera and result in globe rupture. CT is the initial imaging modality of choice in the setting of ocular trauma with a suspected open-globe injury . Its sensitivity for depicting an open-globe injury is approximately 56%–75% when the injury is clinically suspected and 56%–68% when it is clinically occult .Direct imaging findings of open-globe injuries include alteration of the globe contour or volume and evidence of scleral discontinuity. Indirect finding of open-globe injuries is an intraocular foreign body or air, which implies penetration through the sclera in the setting of a traumatic injury.



INTRAOCULAR FOREIGN BODY ON RIGHT



RUPTURED RIGHT GLOBE

Intraocular foreign bodies in four eyes (8%) and intra orbital foreign bodies in three eyes (6%)were encountered in the present study. Intra orbital foreign bodies appear as iso to hypodense lesions on plain CT and are most commonly seen in the posterior segment in open globe injuries. CT is the imaging modality of choice when intraorbital or intraocular foreign bodies are suspected . Its sensitivity for depicting foreign bodies varies widely depending on the type and size of foreign bodies present, but it may be as high as 100%. MR imaging is contraindicated in the presence of a metallic foreign body but is more sensitive than CT in depicting organic material . In general, the sensitivity of radiographs for depicting intraocular foreign bodies is lower than that of CT; however, it may be as high as 96% when there is clinical evidence of a penetrating ocular injury . Radiographs play a limited role in the setting of acute trauma because they provide little information about the orbital soft tissues.

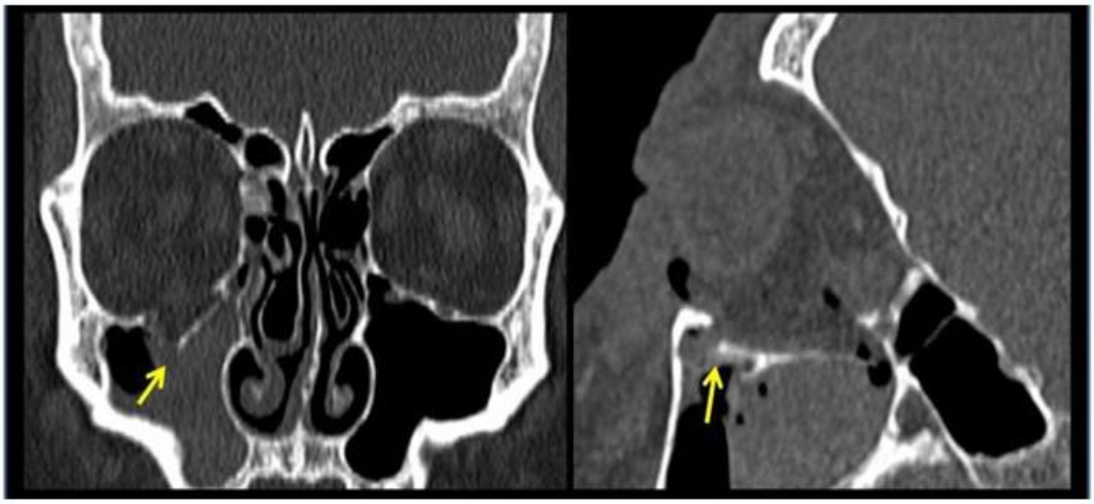
Closed globe injuries on MDCT were seen in 28 out of 50 patients. Periorbital Edema is the commonest lesion in 16 cases, followed by isolated vitreous hemorrhage in 7 eyes (14%) and lens displacement in 5 cases. Majority of the lesions of anterior chamber like corneal lacerations and hyphema are usually not identified on CT.

At unenhanced CT hyphema appears as an area of hyperattenuation in the anterior chamber. Injuries of anterior chamber are readily identified at clinical examination . Vitreous hemorrhage is readily seen at CT as hyperattenuating fluid in the posterior segment. Our study has 7 patients with vitreous hemorrhage. At CT lens displacement appears as relatively hypoattenuating compared with the nonaffected lens but in abnormal dependent position.

A traumatic tear in the retina allows vitreous fluid and blood to collect between the retina and choroid, resulting in detachment of the retinal layer. Because of the firm retinal attachments at the optic disc, retinal detachments may have a characteristic V-shaped appearance at imaging, with the apex at the optic disc .At CT the detached retina appears as an iso dense floating membrane with V-shaped apex towards the disc. choroidal detachments have a lentiform or biconvex shape at imaging and spare the posterior portion of the globe . our study did not reveal any case of retinal detachment.

Ocular adnexal lesions on MDCT were seen in 40 out of 50 patients. These include periorbital soft tissue hematoma in 30 (75%) cases. Most of the adnexal injuries were combined lesions. Conjunctival lesions were seen in 12 cases, orbital emphysema in 6 cases, foreign bodies in 5 cases and 4 cases had extraocular muscle injuries. Isolated periorbital soft tissue hematoma in 18 cases was seen. Proptosis following trauma can be attributed to a number of reasons. It may arise as a result of retrobulbar hemorrhage, swelling of the retrobulbar contents (following accumulation of air or edema), or from bony or soft tissue displacement into the retrobulbar region. Ultimately, these varied pathologies can result in a ‘final common pathway’ of ischemia to the optic nerve or retina, and, if not reversed, loss of vision will occur.

Orbital fractures on MDCT are seen in 30 out of 50 patients (60%). This percentage was in close agreement with a previous study by Georgouli *et al.and* Poon *et al.* Isolated single wall fractures were seen in 18 cases (60%) and complex fractures involving orbital wall were seen in 12 cases (40%). In isolated fractures, 7 cases involved the floor, five cases involved the lateral wall, four cases involved the medial wall, and two cases involved the roof of orbit. Associated other facial fractures were seen in 20 patients out of thirty patients who had orbital fractures.



ORBITAL FLOOR FRACTURE

Orbital fractures may occur on its roof, floor, apex, medial or lateral walls. They can be associated with muscle entrapment or soft tissue herniation, hematoma or emphysema that may produce eyeball displacement or limited ocular motility. The weakest of the orbital walls are the medial wall and floor therefore, most of the orbital fractures are seen there. Medial wall fractures are very common because of the fragility of the ethmoid bone.

Orbital fractures can be divided according to their mechanism of injury in blow-out andblow-in fractures. **Blow-out** orbital fractures are produced by direct impact on the orbit by an object larger than its circumference producing a floor fracture. This type of fracture can be associated with displacement of orbital fat and /or herniation of the inferior rectus muscle and the medial rectus muscle .Muscle entrapment must be suspected when the patient refers diplopia, pain or limited eye movement and on CT images when the muscle loses its characteristic ovoid shape, adopting a rounded morphology .

Blow-in orbital fractures are produced by a small object impact that produces a fracture with displacement of fragments into the orbit. This kind of trauma can produce emphysema, hematoma, muscular entrapment or optic nerve compression. Roof fractures and lateral wall fractures might be isolated fractures or associated with other fractures in different walls. Fractures of the lateral wall are produced by high-energy trauma and are frequently seen in association with other facial fractures. Tripod fracture includes maxillary, orbital floor and zygomatic arch fractures, affecting the lateral orbital wall. optical canal fractures can be related to nerve damage.During assessment of an orbital trauma it is necessary to look for eyeball, optic nerve and vascular lesions, as well as the presence of foreign bodies.

Optic nerve injuries are produced by nervecompression or loss of its vascular supply without identifying an associated fracture.Optic nerve contusion should be suspected in cases of severe visual loss without other intraocular injuries associated, however CT only detects indirect signs of optic nerve damage. Therefore MRI must be done to assess optic nerve injury which is expressed by T2 high intensity signal.

V. Conclusions

Ocular injuries are fairly common and are a significant cause of blindness and vision deficits. Urgent ophthalmologic evaluation is critical to prevent permanent visual deficits, but physical evaluation may be challenging in the acute trauma setting. Often, CT is the initial imaging modality of choice in the setting of traumatic facial injuries, and radiologists may be the first to diagnose ocular injuries. Familiarity with the various types of ocular injuries and their imaging appearances, as well those of potential mimics of injury, are crucial in making accurate diagnoses that will appropriately guide patient care. To conclude CT complements the clinical examination and allows appropriate care to be given for a wide range of traumatic lesions.

References

[1]. Dunkin JM, Crum AV, Swanger RS, Bokhari SA. Globe trauma. Semin Ultrasound CT MR 2011;32 (1):51–56.
[2]. Kubal WS. Imaging of orbital trauma. RadioGraphics 2008;28(6):1729–1739.
[3]. Koo L, Kapadia MK, Singh RP, Sheridan R, Hatton MP. Gender differences in etiology and outcome of open globe injuries. J Trauma 2005;59(1):175–178.
[4]. Amrith S, Saw SM, Lim TC, Lee TK. Ophthalmic involvement in cranio-facial trauma. J Craniomaxillofac Surg 2000;28(3):140–147.
[5]. Greven CM, Engelbrecht NE, Slusher MM, Nagy SS. Intraocular foreign bodies: management, prognostic factors, and visual outcomes. Ophthalmology 2000;107(3):608–612.
[6]. Smith D, Wrenn K, Stack LB. The epidemiology and diagnosis of penetrating eye injuries. Acad Emerg Med 2002;9(3):209–213.
[7]. Guly CM, Guly HR, Bouamra O, Gray RH, Lecky FE. Ocular injuries in patients with major trauma. Emerg Med J 2006;23(12):915–917.
[8]. Scruggs D, Scruggs R, Stukenborg G, Netland PA, Calland JF. Ocular injuries in trauma patients: an analysis of 28,340 trauma admissions in the 2003- 2007 National Trauma Data Bank National Sample Program. J Trauma Acute Care Surg 2012;73(5): 1308
[9]. Brown MS, Ky W, Lisman RD. Concomitant ocular injuries with orbital fractures. J Craniomaxillofac Trauma 1999;5(3):41–46; discussion 47–48.
[10]. Cook T. Ocular and periocular injuries from orbital fractures. J Am Coll Surg 2002;195(6):831–834.
[11]. Jamal BT, Pfahler SM, Lane KA, et al. Ophthalmic injuries in patients with zygomaticomaxillary complex fractures requiring surgical repair. J Oral Maxillofac Surg 2009;67(5):986–989.
[12]. Magarakis M, Mundinger GS, Kelamis JA, Dorafshar AH, Bojovic B, Rodriguez ED. Ocular injury, visual impairment, and blindness associated with facial fractures: a systematic literature review. Plast Reconstr Surg 2012;129(1):227–233.
[13]. Kulkarni AR, Aggarwal SP, Kulkarni RR, Deshpande MD, Walimbe PB, Labhsetwar AS. Ocular manifestations of head injury: a clinical study. Eye (Lond) 2005;19(12):1257–1263.
[14]. Malhotra A, Minja FJ, Crum A, Burrowes D. Ocular anatomy and cross-sectional imaging of the eye. Semin Ultrasound CT MR 2011;32(1):2–13.
[15]. Caranci F, Cicala D, Cappabianca S, Briganti F, Brunese L, Fonio P. Orbital fractures: role of imaging. Semin Ultrasound CT MR 2012;33(5):385–391.
[16]. Lee HJ, Jilani M, Frohman L, Baker S. CT of orbital trauma. Emerg Radiol 2004;10(4):168–172.
[17]. Fulcher TP, McNab AA, Sullivan TJ. Clinical features and management of intraorbital foreign bodies. Ophthalmology 2002;109(3):494–500.
[18]. Gor DM, Kirsch CF, Leen J, Turbin R, Von Hagen S. Radiologic differentiation of intraocular glass: evaluation of imaging techniques, glass types, size, and effect of intraocular hemorrhage. AJR Am J Roentgenol 2001;177(5):1199–1203.

[19]. Patel SN, Langer PD, Zarbin MA, Bhagat N. Diagnostic value of clinical examination and radiographic imaging in identification of intraocular foreign bodies in open globe injury. Eur J Ophthalmol 2012;22 (2):259–268.

[20]. Pinto A, Brunese L, Daniele S, et al. Role of computed tomography in the assessment of intraorbital foreign bodies. Semin Ultrasound CT MR 2012;33 (5):392.

[21]. Smith AB, Dillon WP, Gould R, Wintermark M. Radiation dose-reduction strategies for neuroradiology CT protocols. AJNR Am J Neuroradiol 2007;28(9): 1628

[22]. Fielding JA. The assessment of ocular injury by ultrasound. Clin Radiol 2004;59(4):301–312.

[23]. Schott ML, Pierog JE, Williams SR. Pitfalls in the use of ocular ultrasound for evaluation of acute vision loss. J Emerg Med 2013;44(6):1136–1139.

[24]. Adesanya OO, Dawkins DM. Intraorbital wooden foreign body (IOFB): mimicking air on CT. Emerg Radiol 2007;14(1):45.

[25]. John SS, Rehman TA, John D, Raju RS. Missed diagnosis of a wooden intra-orbital foreign body. Indian J Ophthalmo 2008;56(4):322–324.

[26]. Rao SK, Nunez D, Gahbauer H. MRI evaluation of an open globe injury. Emerg Radiol 2003;10(3): 144–146.

[27]. Saeed A, Cassidy L, Malone DE, Beatty S. Plain x-ray and computed tomography of the orbit in cases and suspected cases of intraocular foreign body. Eye (Lond) 2008;22(11):1373–1377.

[28]. Kim SY, Lee JH, Lee YJ, et al. Diagnostic value of the anterior chamber depth of a globe on CT for detecting open-globe injury. Eur Radiol 2010;20(5): 1079–1084.

[29]. Bron AJ, Vrensen GF, Koretz J, Maraini G, Harding JJ. The ageing lens. Ophthalmologica 2000;214(1): 86–104.

[30]. Boncoeur-Martel MP, Adenis JP, Rulfi JY, Robert PY, Dupuy JP, Maubon A. CT appearances of chronically retained wooden intraorbital foreign bodies. Neuroradiology 2001;43(2):165–168.

[31]. LeBedis CA, Sakai O. Nontraumatic orbital conditions: diagnosis with CT and MR imaging in the emergent setting. RadioGraphics 2008;28(6): 1741–1753.

[32]. The role of multidetector computedtomography in the diagnosis of traumatic orbital lesions in emergent settings .Mohamed Dawoud etal Tanta Medical Journal DOI: 10.4103/1110-1415.158054

Dr.B.Ushalatha, etal. “Role of MDCT in the Evaluation of Orbital Trauma." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(1), 2020, pp. 62-67.