



## Comparative Evaluation of Real Time B Scan Ultrasound and Computed Tomography in Management of Penetrating Ocular and Orbital Trauma

Dr V K Baranwal

Senior Adviser (ophthalmology), Department of ophthalmology, Base Hospital Delhi Cantt

### ABSTRACT

139 patients with penetrating missile injuries to eye & orbit were managed in a forward hospital. These injuries were caused by fragments of improvised explosive devices, artillery shells & by bullets. They were evaluated clinically, by real time B scan ultrasound & CT Scan. The comparison of these two modern modalities of investigations were additive to one another as it was noted that ultrasound was more sensitive for diagnosing intraocular damage where as CT Scan was better for diagnosing orbital & intracranial damage. These were essential investigations for scientific management of penetrating ocular & orbital injuries.

**KEYWORDS :** Penetrating ocular trauma, ultrasound, CT scan

### INTRODUCTION

Penetrating ocular & orbital injuries due to missile are potentially dangerous as the fragments can involve any part of eye, orbit or optic pathway. The extent of damage may not be accurately assessed by clinical examination or conventional X-rays. Real time B Scan ultrasonography & CT Scan are better & more informative diagnostic modalities for investigation. They not only accurately localize the foreign body but also demonstrate the extent of damage.

This has vital therapeutic implication as precise anatomical localization is mandatory prior to their attempt at removal. Removal of foreign bodies from orbit is difficult & their accurate localization is helpful in judgment to remove them by balancing the risk form additional trauma with surgery against the existing loss of function & potential for further damage from future reaction. The purpose of this study is to know the additional information gained by use of modern modalities of non-invasive investigations.

### MATERIALS & METHODS

We performed a retrospective study of 89 cases of penetrating missile injuries to eyes & orbit received in a forward hospital between 2009 & 2015. The patients often had multiple injuries & prioritization for treatment was done as per standard protocols [1, 2]. Neurological assessment was done as per Glasgow coma scale. Only stable patients with evidence of penetrating trauma to eye & orbit were evaluated by real time B scan ultrasound & /or CT Scan. All cases evaluated by CT Scan were also evaluated by ultrasound. Ultrasound was followed by CT scanning done by similar protocol as described by Kazuhiro et al [3].

### RESULTS

The mean age of patients was 25 years (Range 18-52 years). All patients were male. Gun shoot wounds were seen in 22 patients (16 %) & splinter injuries in the remaining 117(84%). A total of 52 & 89 patients underwent CT Scan & ultrasound respectively. All patients who underwent CT Scan were also evaluated by ultrasound (Table 1,2). 5 patients with associated multiple injuries died before they could be operated. Post-operative mortality occurred in 4 patients due to associated injuries.

Serial postoperative CT Scans were done in 10 patients having associated head injuries. 3-D reconstruction of badly mutilated cases was done. It was noted that vitreous haemorrhage, retinal detachment, dislocation of lens, disorganization of eye ball and intraocular foreign body could be detected with equal sensitivities by Ocular ultrasound and CT scan. Retinal detachment is well demonstrated by ultrasound as well as sometimes by CT as a 'V' or a 'sunset sign' [4]. (Table 3). However PVD & choroidal detachment were better visualized by ocular ultrasound (Fig 1). In fact orbital fractures, intraorbital foreign bodies, optic nerve transaction, injury to visual pathway could only be evaluated in most cases by CT Scan One patient was referred for CT Scan after eye evisceration as a big splinter seen on plain X-ray of orbit could not be felt & removed during evisceration. CT Scan revealed a deep seated splinter partly in the orbit & partly intracranially( Fig 2).

Ocular ultrasound was difficult & sometimes could not be done im-

mediately in cases with lid injuries & cases with severe pain in eyes. Similarly CT Scan was difficult in cases who were restless & could not maintain steady posture as imagining was not good.

### DISCUSSION

Studies have shown that ultrasound and CT scan are highly accurate in detection of ocular pathologies [5-11]. Ultrasound is inexpensive and readily available in most eye and radiology departments. Ultrasound provides good visualization of ocular anatomy that allows evaluation of intraocular foreign body and related lesions such as vitreous hemorrhage and retinal detachment. The examination of the globe is exhaustive and patient is asked to perform ocular movements to find the exact ultrasound incidence angle to visualize the foreign body. Computed tomography is considered as having advantage due to its ability of performing useful coronal and sagittal reconstruction and multiplanar reformation, evaluating intraorbital structures with simultaneous imaging the bony orbit for fractures and any herniations of orbital contents. However the biggest disadvantage of CT scan is the radiation dose delivered to the body. Real time B scan ultrasound & CT Scan are indispensable non invasive investigative modalities essentially required for evaluation of ocular injuries caused by bullets & splinters. In fact, in no other area has CT a greater role in patient management than in case of traumatized patient. Whereas ultrasound proves to be a handy bedside investigation for providing accurate information about ocular injury, CT scan is a must for orbital wall & orbital injuries. CT has been shown to be an excellent tool in haemodynamically stable patients. It provides accurate information about injury delineates extent and severity of associated bony injuries and precisely localizes splinters and bullets. Thus preoperative information is vital to critical decision-making. CT scan assumes greater role in evaluation of these injuries as MRI is contraindicated in presence of metal projectiles.

### CONCLUSION

Penetrating injuries of eye & orbit are serious & pose a threat to loss of sight. Preoperative assessment is undoubtedly of utmost importance for scientific & successful management, Real time B scan ultrasonography & CT scan are additive to each other for knowing the site, extent & nature of trauma so that proper management can be done. CT scan is a unique investigative modality for non-invasive evaluation of ocular injuries caused by bullets and splinters. In fact, in no other area has CT a greater effect on patient management than in traumatized patient. CT has been shown to be an excellent tool in haemodynamically stable patients. It provides accurate information about injury, delineates extent and severity of associated bony injuries and precisely localizes splinters and bullets. Thus pre operative information is vital to critical decision-making. CT scan assumes greater role in evaluation of these injuries as MRI is contraindicated in presence of metal projectiles.

**Table 1**  
**Ultrasound findings in ocular injuries (n = 89)**

| Findings             | Number of patients |
|----------------------|--------------------|
| Vitreous haemorrhage | 38                 |

|                            |    |
|----------------------------|----|
| Retinal detachment         | 16 |
| Intraocular foreign body   | 25 |
| PVD                        | 18 |
| Choroidal detachment       | 09 |
| Dislocation of lens        | 07 |
| Disorganization of eyeball | 13 |

**Note:- Many patients had multiple findings**

**Table 2**  
**CT findings in ocular & orbital injuries (n =52)**

| Findings                          | Number of patients |
|-----------------------------------|--------------------|
| Vitreous hemorrhage               | 27                 |
| Retinal detachment                | 11                 |
| Intraocular foreign body          | 19                 |
| Dislocation of lens               | 04                 |
| Disorganization of eye ball       | 09                 |
| Maxillary fractures               | 19                 |
| Sinus involvement                 | 14                 |
| Intraorbital foreign bodies       | 21                 |
| Optic nerve transection           | 02                 |
| Associated intraorbital fragment  | 01                 |
| Foreign body injury optic chiasma | 01                 |

**Note:- Many patients had multiple findings**

**Table 3**  
**Findings of patient who were evaluated by USG & CT both (n = 52)**

| Findings                         | USG | CT Scan |
|----------------------------------|-----|---------|
| Dislocation of lens              | 04  | 04      |
| Vitreous haemorrhage             | 27  | 27      |
| Intraocular FB                   | 19  | 19      |
| PVD                              | 09  | -       |
| Choroidal detachment             | 05  | -       |
| Retinal detachment               | 11  | 11      |
| Intraorbital foreign body        | 07  | 21      |
| Orbital fracture                 | -   | 24      |
| Optic nerve transection          | -   | 02      |
| Optic chiasmal injury            | -   | 01      |
| Associated intracranial fragment | -   | 01      |

## REFERENCE

- Ramani PS, Mahapatra AK. Principles and practice of trauma care, New Delhi, Jaypee 1998: 125
- Champion HR, Sacco WI. Trauma. Norwalk, Appleton and Lange, 1988,63-67.
- Katada K, Kauczor HU, Schuzer J, et al. Multidetector CT protocol-developed for Toshiba scanner, Spring 2005.
- Pieramici DJ. Vitreo retinal trauma. Ophthalmol Clin North Am. 2002; 15: 225-4
- Blaivas M Theodor D, Sierzenski P. A study of bedside ocular ultrasonography in the emergency department. Acad Emerg Med. 2002; 9: 791-9.
- DeramoVa, Shah Gk, Baumal CR, et al. Role of ultrasound biomicroscopy in ocular trauma. Trans Am Ophthalmol Soc. 1998; 96: 355-65.
- NovellineRA, Liebig T, Jordan J, et al. Computed tomography of ocular trauma. Emerg Radiol. 1994; 1: 56-67.
- Khan BS, Khan MD; A Review of 100 cases of Ectopia lentis. Presentation, Management and visual prognosis, Pak J of Ophthalmol: 2002; 18: 3-9.
- Kim S.Lee comparison of ultrasound & intraoperative findings in patients with vitreous hemorrhage, Invest Ophthalmol Vis Sci. 2005; 46: 5436.
- Lakitas A, Prokesch R, Scholda C, et al. Orbital helical computed tomography in the diagnosis and management of eye trauma Ophthalmology. 1999; 106: 2330-5.
- Dass AB, Ferrone PJ, Chu YR, et al. Sensitivity of spiral computed tomography scanning for detecting intraocular foreign bodies. Ophthalmology. 2001; 108: 2326-8