Orbital Sonography with it’s Clinico - Surgical Correlation

OP SHARMA

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Key words : - Orbital, USG, Retinal

Introduction of ultrasound, non-invasive and non-ionizing imaging modality provides all informations, not obtainable by any other means. The first diagnostic application of ultrasound in ophthalmology was by Mundt and Hughes (1956). The experience about cross-sectional B-scan display of the eye was reported by Baum and Greenwood (1958). Coleman and colleagues defined techniques for accurate measurement of eye length, anterior chamber length & lens - thickness (1992). Routine ocular scanning is performed using 10 MHz probe and advantages of ocular sonography are (1) non-invasive (2) non-ionization (3) Real-time display of moving organ (4) based upon geometric optics of reflection, refraction, diffraction and absorption (5) cost effective.

The indications for ocular sonography are :-
(1) Evaluation of intra-ocular details obscured by the opacities of cornea, aqueous, papillary spaces, lens or vitreous.
(2) Identification of solid or non-homogenous tissue from cystic or homogenous masses.
(3) Biometry (determination of size, length or thickness of ocular components).
(4) Examination of retrobulbar soft tissue masses as in presence of exophthalmos.
(5) Identification, localization and measurement of non-radio-opaque foreign bodies.
(6) Prior to vitreoretinal surgery, ultrasound assessment of globe is mandatory as it evaluate -
(a) Status of vitreous 
(b) Position and extent of any intra ocular lesion visible by ultrasound.
(c) Condition of retina and macula 
(d) Motility of contents of globe 
(e) Relation between vitreous and retina mapping out any vitreoretinal adhesions.

Color Doppler imaging is a recent advance making possible the study of ocular and orbital blood flow.

AIMS :
(1) To evaluate the role of USG in orbital diseases, in differentiating ocular and extraocular diseases.
(2) To evaluate orbital trauma 
(3) Localization of intraocular foreign body 
(4) To establish etiology of proptosis 
(5) To assess tumor location, configuration, extent and relationship to adjacent structure. 
(6) To evaluate the role of USG in cases with opaque light conducting media where direct vision by ophthalmoscopy is impossible.

OBSERVATIONS :
122 cases have been evaluated on Logiq 500 MD & Logiq 400 using 7.5 - 10 MHz. The contralateral normal eye, was used as control to provide optimal gray scale information. In all cases, the clinical and USG diagnosis were correlated with final diagnosis to infer the accuracy, sensitivity and specificity. The formulae for evaluating different values has been utilized, which was quoted by Fowler et al in 1987.

\[
\text{Accuracy} \% = \frac{\text{True '+ve' + True '-ve'}}{\text{Total no. of cases}} \times 100
\]

\[
\text{Specificity} \% = \frac{\text{True '-ve' + False '+ve'}}{\text{True '-ve'}} \times 100
\]

\[
\text{Sensitivity} \% = \frac{\text{True '+ve' + False '-ve'}}{\text{True '+ve'}} \times 100
\]

Though maximum cases were in 4th & 5th decade of life, the age incidence has been reported in Table 1.

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Age distribution of orbital diseases

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Total Patients (n=100)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>13</td>
<td>13%</td>
</tr>
<tr>
<td>11-20</td>
<td>14</td>
<td>14%</td>
</tr>
<tr>
<td>21-30</td>
<td>09</td>
<td>09%</td>
</tr>
<tr>
<td>31-40</td>
<td>20</td>
<td>20%</td>
</tr>
<tr>
<td>41-50</td>
<td>17</td>
<td>17%</td>
</tr>
<tr>
<td>51-60</td>
<td>11</td>
<td>11%</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>16</td>
<td>16%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

There were 76 males and 46 females. Right eye, left eye was affected in 36 and 58 cases while 28 cases showed both eye involvement. There clinical presentation has been detailed in Table No. 2.

Incidence of presenting complaints of patients
Total number of cases : 122

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Presenting complaints</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Diminution of vision</td>
<td>60</td>
<td>49.18%</td>
</tr>
<tr>
<td>2.</td>
<td>Pain</td>
<td>15</td>
<td>12.29%</td>
</tr>
<tr>
<td>3.</td>
<td>Proptosis</td>
<td>15</td>
<td>12.29%</td>
</tr>
<tr>
<td>4.</td>
<td>Trauma</td>
<td>34</td>
<td>27.86%</td>
</tr>
<tr>
<td>5.</td>
<td>Discharge from the eye</td>
<td>10</td>
<td>08.19%</td>
</tr>
<tr>
<td>6.</td>
<td>Swelling of eyelid</td>
<td>07</td>
<td>05.73%</td>
</tr>
<tr>
<td>7.</td>
<td>Squint</td>
<td>05</td>
<td>04.09%</td>
</tr>
</tbody>
</table>

Indication for orbital sonogram have been enlisted in Table No. 3.

Indication for orbital ultrasound

<table>
<thead>
<tr>
<th>S. No.</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Opaque Media</td>
<td>90</td>
</tr>
<tr>
<td>(i)</td>
<td>Corneal opacity</td>
<td>02</td>
</tr>
<tr>
<td>(ii)</td>
<td>Anterior chamber opacity</td>
<td>02</td>
</tr>
<tr>
<td>(iii)</td>
<td>Lens opacity (Cataract)</td>
<td>41</td>
</tr>
<tr>
<td>(iv)</td>
<td>Vitreous opacity</td>
<td>45</td>
</tr>
<tr>
<td>2.</td>
<td>Suspected orbital mass</td>
<td>17</td>
</tr>
<tr>
<td>3.</td>
<td>Vitreous evaluation</td>
<td>05</td>
</tr>
<tr>
<td>4.</td>
<td>Foreign body (suspected)</td>
<td>04</td>
</tr>
<tr>
<td>5.</td>
<td>Proptosis</td>
<td>06</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>122</td>
</tr>
</tbody>
</table>

Intraocular disease was observed in 100 cases while extraocular disease was noted in 22 cases.

Incidence of various intraocular pathologies (Total - 100)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Disease</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ocular</td>
<td>73</td>
<td>73%</td>
</tr>
<tr>
<td>II</td>
<td>Extra Ocular</td>
<td>25</td>
<td>25%</td>
</tr>
<tr>
<td>1.</td>
<td>Retinoblastoma</td>
<td>01</td>
<td>6.66%</td>
</tr>
<tr>
<td>2.</td>
<td>Thyroid Orbitopathy</td>
<td>03</td>
<td>20.00%</td>
</tr>
<tr>
<td>3.</td>
<td>Pseudotumour</td>
<td>03</td>
<td>20.00%</td>
</tr>
<tr>
<td>4.</td>
<td>Optic Nerve Tumour</td>
<td>01</td>
<td>6.66%</td>
</tr>
<tr>
<td>5.</td>
<td>Lacrimal Gland Tumours</td>
<td>02</td>
<td>13.33%</td>
</tr>
<tr>
<td>6.</td>
<td>Sinus Carcinoma</td>
<td>02</td>
<td>13.33%</td>
</tr>
<tr>
<td>7.</td>
<td>Metastatic Tumours</td>
<td>01</td>
<td>6.66%</td>
</tr>
<tr>
<td>8.</td>
<td>Soft Tissue Haematoma</td>
<td>02</td>
<td>9.09%</td>
</tr>
</tbody>
</table>

15 cases had evidence of Proptosis, the details have again expressed in Table No. 6.

Distribution of diseases causing 'Proptosis' (Total - 15)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Disease</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Ocular</td>
<td>73</td>
<td>73%</td>
</tr>
<tr>
<td>II</td>
<td>Extra Ocular</td>
<td>25</td>
<td>25%</td>
</tr>
<tr>
<td>1.</td>
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<td>01</td>
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</tr>
<tr>
<td>7.</td>
<td>Metastatic Tumours</td>
<td>01</td>
<td>6.66%</td>
</tr>
<tr>
<td>8.</td>
<td>Soft Tissue Haematoma</td>
<td>02</td>
<td>9.09%</td>
</tr>
</tbody>
</table>
Diffuse vitreous echoes (vitreous haemorrhage)- convex band of detachment (CD) not attached to optic disc.

1) Y-shaped band of retinal detachment showing attachment at optic disc.

b) Y-shaped band.

c) Old retinal detachment with cyst formation.
Partial retinal detachment (Fig 1), complete retinal detachment (Fig 2 a & b & c) are observed in cases. Choroidal detachment in cases (Fig 3), Posterior vitreous detachment (Fig 4) are noticed in cases.

Small shrunken globe with calcification, characteristics of Pthysis bulbi (Fig 5) was observed in cases. Macrophthalmos revealed larger eye ball than normal side (Fig 6).

Vitreous haemorrhages (Fig 7 a,b,c,d) revealed localized / diffuse vitreous echoes, thickened choroidal layers. Fig 8 a & b revealed idiopathic orbital inflammatory pseudo-tumor.

Different cases of orbital trauma have been demonstrated in Fig. 9 a-g. It involved 34 cases and they revealed various interesting findings like hyphema, lens injury, dislocation of lens, vitreous haemorrhage, retinal detachment, ruptured Globe, Foreign body, haematoma (retrobulbar, soft tissue), Pthysis Bulbi, endophthalmities, Posterior vitreous detachment, choroidal detachment & evidence of scleritis. Optic nerve tumor are described in Fig 10 a & b.
Fig. 7: ABNORMAL ECHOES IN VITREOUS

a) Vitreous haemorrhage showing localized vitreous echoes.

b) Vitreous haemorrhage showing diffuse vitreous echoes.

c) Vitreous degeneration in a diabetic patient showing localized vitreous echoes in the vicinity of optic nerve head.

d) Endophthalmitis showing diffuse vitreous echoes with retinal detachment and thickened choroidal layers.
a) Myositis-Transverse scan of left orbit shows diffusely enlarged MR muscle 7.1mm, confirmed by CT scan.

b) Perineuritis with myositis- showing hypoechoic outline of optic nerve with "T" sign due to fluid in tenon's capsule; enlarged MR muscle.
a) Structural lens injury in form of disruption of anterior lens capsule.

b) Posterior dislocation of lens.

c) Foreign body in the eye with vitreous haemorrhage.

d) Foreign body showing acoustic shadow.

e) Ruptured globe- Diffuse vitreous echoes, bands; distorted globe; posterior scleral rupture; air within the orbit.
Cases of Retinoblastoma have been analysed in Fig 11 a & b where ultrasonic findings are confirmed on CT (Fig 11 b).

Ethmoid sinus cancer invading the orbit has been noticed in Fig 12. Another case of Pleomorphic adenoma of lacrimal gland are noticed in Fig 13a & b.

Adenocarcinoma of Lacrimal gland is seen on Fig 14 a, confirmed on CT Scan (Fig 14 b). Mucocele of Lacrimal sac is exhibited in Fig 15 & Fig 16 show Dermoid cyst. Metastatic tumor from Follicular carcinoma of Thyroid are illustrated in X-ray skull (Fig 17 a), USG findings on Fig 17 b & c.

Fig 18 showed a case of Lid Carcinoma (a b c), and Lid haemangoima in Fig 19.

Accuracy of ultrasonography in orbital diagnosis (intraocular diseases in 100 cases - Table No. & extraocular diseases in 22 cases - Table No. ) have been depicted.

Discussion:

Coleman (1972) classified the patients into 5 general categories for their ocular problems:

- Retinal detachment
- Intraocular mass
Fig. 11: **RETINOBLASTOMA**

a) A solid mass within the globe with calcification.

b) CT film showing perineural, retrobulbar and intracranial extension not shown on ultrasound.

Fig. 12: **ETHMOID SINUS CARCINOMA INVADING THE ORBIT**

Ill defined, infiltrative mass, medial to the globe which is itself pushed laterally with destruction of medial wall of orbit.
Vitreous hemorrhage
Trauma & Foreign body
Miscellaneous condition i.e. Choroidal detachment

Retinal detachment -
Retinal detachment is of two types (Fielding 1994) -
a. Rhegmatogenous (arising from retinal break or tear)
b. Non-rhegmatogenous (or secondary retinal detachment)

Rhegmatogenous retinal detachment appears as thin continuous acoustically opaque (white) line of echoes separate from and anterior to the echoes from the wall of the globe (Choroid-Scleral Complex). Partial retinal detachment is a relatively flat band which has a narrow acoustically empty space between detached retina and globe wall. A retinal detachment elevated as little as 1 mm can be detected.

A total retinal detachment appears as highly elevated, convex white line extending into the globe from its attachment points at the nasal and temporal ora serrate and posteriorly at optic disc (Munk 1991) & (Vashisht & Berry 1994). Thickness of a retinal detachment gives a clue to its age as a freshly detached retina appears as a thin white line, equal in length to the scleral arc from ora to ora, whereas old retinal detachment appears as a thick membrane which often shrinks to form a chord like structure from optic disc to ora serrata thus taking a "FUNNEL-SHAPED" or "MORNING GLORY" configuration with / without cyst like structure within. A vitreous veil (hemorrhage along the posterior hyaloid face) may mimic retinal detachment. However vitreous veil does not insert into optic nerve head and it's echoes are of low amplitude than the retina (which are slightly higher to or equal to those from the sclera). Often rhegmatogenous retinal detachments result from traction of vitreous membranes or bands on the retina. Sites of vitreous membrane attachment and associated traction on the retina can indicate the "stress" site at which retinal holes may have occurred although the holes themselves can not be seen on USG. Retinal schisis (separation of two layers of retina) produce similar appearance (Bronson 1974).

An uveal effusion is distinguished from a retinal detachment by its curvature which approximates the scleral outline i.e. concave, rather than convex curvature of a retinal detachment and is usually limited to 2-3 mm elevation at the posterior pole.

Non-rhegmatogenous retinal detachment show a solid choroidal mass behind the elevated retinal detachment. Posterior to detached retina, an acoustically opaque (white) mass lesion is seen instead of an acoustically clear space. Retinal detachment may also be seen secondary to inflammatory, exudative and cicatricial condition and may mimic a rhegmatogenous detachment as sub retinal space is acoustically clear. Inflammatory changes may be detected in the overlying sclera, tenons capsule or optic nerve. An exudative condition like Coat's disease may show echoes posterior to retinal detachment. 26 cases of retinal detachment was observed in our study, out of these 18 were complete (69.23%) and 8 were partial (30.76%) detachment. Nine cases were due to trauma. Cystic changes in detached retina were seen in two case. V-shaped or Y-shaped membrane (Morning glory appearance), attached to ora serrata anterioly and optic nerve head posteriorly and restricted mobility on dynamic scanning were present.

Vitreous Haemorrhage -

In normal eye, the vitreous is acoustically clear. Fresh, unclotted blood can’t be visualized by this technique. However as cellular aggregates occurs, reflectivity increases proportionately. Small granular dot like echoes are seen on the display screen as the beam is directed at involved areas (Vashisht et al 1994). The intensity of these echoes can be eliminated by reducing the gain of the system. Vitreous veil (cellular aggregates or fibrinous changes along the posterior limiting membrane of a retracted vitreous may resemble detachment. However in veil, membrane can not be traced back to the optic disc. In addition, the echoes arc of weaker amplitude and show quick. Jerky after movements on moving the eye during dynamic testing.
Vitreous debris seen with Uveitis is similar on USG to vitreous hemorrhage and not differentiated with each other (Fischer 1979).

"Asteroid hyalosis" i.e. accumulation of calcium soaps in vitreous can mimic a dense central vitreous hemorrhage but can be differentiated by a rapid shift of gaze as the vitreous echoes show extremely fast, marked & prolonged after movements after the eye motion has stopped, otherwise the echoes of asteroid hyalosis are highly intense (Browson 1974). Vitreous hemorrhage can be seen as a part of changes in diabetic eye disease (Restori et al 1979), and it must be differentiated from epiretinal fibrosis retinitis proliferans in Diabetic retinopathy (Jack et al 1974). Retinitis proliferans appears as an echo configuration forming a stalk that arises from retina, the echoes diverging as the stalk extends forwards in vitreous humor.

Vitreous haemorrhage due to blunt trauma or subarachnoid haemorrhage "TERSON'S SYNDROME", the RBC sediment & compact near the posterior hyaloid surface giving rise to echoes of increased intensity in the posterior gel. Degenerating RBC give rise to lower level echoes along the posterior vitreous cortex known as
a) X-ray skull showing soft tissue density in the region of left orbit with destruction of its roof and lateral wall.

b) Ultrasound longitudinal scan showing infiltrative, ill defined, mass superior to the globe with destruction of the roof of the orbit.

c) Ultrasound oblique scan showing the mass in direct vicinity of frontal lobe of brain with destruction of the intervening orbital plate of frontal bone.
In our study 28% patients had vitreous haemorrhage both fresh and old with a sonographic accuracy of 97% in its diagnosis. Vitreous haemorrhage was seen as localized collection of echoes in 12 cases (42.85%), dispersed echoes in 11 cases (39.28%), diffusely scattered echoes in 5 cases (17.85%). These haemorrhages either cleared completely on follow up (2-8 weeks) or appeared in form of organized membrane sometime. Vitreous membranes formed and retract with time and if adherent to retina producing tractional retinal detachment. Retained thick echogenic membrane require vitrectomy.

**Ocular Trauma & Foreign Body -**

Orbital trauma is classified into contusion (Blunt) injury, perforating injury & foreign body. In present study, 34 patients presented with history of trauma.
Vitreous haemorrhage (41.7%) & retinal detachment (26.47%) were the commonest findings followed by lens injury in form of dislocated or subluxated lens (20.58%) and structural lens injury (17.64%), intraocular foreign body (14.7%) and Pthysis bulbi (8.82%). Other findings were ruptured globe, retrobulbar and soft tissue haematoma, posterior vitreous detachment, choroidal detachment, endophthalmitis. Clinical examination of these eyes are hampered by opaque media following trauma. Haemorrhage into anterior or vitreous chamber prevents visibility of interior of globe. The lens may become swollen and opaque following laceration of globe or penetration by of foreign body. Ultrasound is useful in the localization of intraocular foreign bodies particularly metal, glass or reflective material. The foreign bodies are seen as small bright areas with marked reverberation artifacts posteriorly. Foreign body embedded in the sclera or in retroorbital fat are more difficult to visualize than those in vitreous chamber. Traumatic eye may become mis-shapen especially in chronic injury, the globe may loose volume, show scleral thickening and/or calcification and become deformed, referred to as PTHYSIS BULBI, (Munk et al 1991.)

We have observed Hyphema, dislocated lens, vitreous haemorrhage, retinal detachment, scleral injury in CONTUSION INJURY; while lens injury, vitreous hemorrhage and scleral laceration in PERFORATING INJURY. Structural lens injury in 4 cases developed cataract and several few irregular echoes in the capsule and peripheral lens in immature cataract and completely hyperechoic lens in mature cataract. Two cases showed disruption of lens capsule, one in anterior capsule with collection of lens material in anterior chamber & other showed complete splitting of lens material.

Macrophthalmos -

One case of 8 years old female child with high myopia and other case of 50 years old male with proptosis and high myopia are observed in this study. Affected side had increased A.P. diameter than the normal side. It is most commonly caused by Juvenile glaucoma or myopia. Increased intraocular pressure results in increased size of the globe (Fig ).

Pthysis Bulbi -

Pthysis bulbi may be the end result of long standing inflammation, tumor or organized haemorrhage. They result in a small deformed shrunken globe with a calcified cataract. Present study had 7 such cases (Three due to old trauma, four due to inflammation) (Munk 1994, Fielding 1991) (Fig ).

Vitreous Degeneration -

Twelve cases of abnormal vitreous echoes due to degeneration are observed; out of these, 6 cases due to senile degeneration, 2 cases due to high myopia and 4 cases due to diabetes. Ultrasonically 7 cases presented with dispersed echoes, 4 seen as localized echoes and one as diffuse echoes. (Restori et al 1977). Restori et al in 1979 demonstrated abnormal echoes or membranes in vitreous. Diabetic patients due to epiretinal fibrosis tissue called as epiretinal fibrosis or vitreo retinitis prolifrans (Levine et al 1987) (Fig ).

Endophthalmitis -

Endophthalmitis as reported by Munk et al (1991) is a rare and dreaded post operative complication of eye where the vitreous chamber is filled with low amplitude echoes. Out of 14 cases ultrasonography detected 11 cases while 3 cases were diagnosed as vitreous haemorrhage but follow up study revealed to be of endophthalmitis. Though ultrasonic appearance of vitreous echoes was nonspecific. Generally small discrete dot like lesions with free after movements are seen (Ossoinig et al 1979).

Ruptured Globe -

One case of ruptured globe was found following severe blunt trauma, with distorted globe on USG. Anterior and posterior segment could not be made out separately, lens was dislocated posteriorly. Vitreous completely filled with haemorrhage. Sclera, was ruptured posteriorly with extrusion of vitreous body (Colman et al 1973).

Vitreous Detachment -

Separation of vitreous from retina could be diagnosed on ultrasound correctly in 4 out of 5 total cases in our study. Diagnostic criteria were a thin sheet of low amplitude echoes or membrane seen in posterior part of vitreous cavity which is freely mobile on dynamic scanning and not attached to optic nerve head. Failed diagnosis in one case revealed band attached to optic disc hence diagnosis of retinal detachment was entertained. Clinical & ophthalmoscopic examination both revealed a fibrovascular stalk attaching the membrane to optic disc. Poster vitreous detachment presented either a thin sheet of echoes along the posterior hyaloid interface usually inserting into retina just anterior to equator and occasionally showing attachment to optic disc or diffuse or dispersed echoes to one or other vitreous compartment (Restori et al 1977).

Choroidal Detachment -

Here the choroid is elevated and subchoroid space is filled with either fluid or blood. Two cases were found in our study. In one case, two opposite echogenic convex lines could be seen extending into the vitreous cavity. Retinal attachment was also associated. These echogenic lines did not involve the optic nerve head. In
second case, an echogenic thick convex membrane was seen in temporal field extending much anterior to the level of ora serrata (Fielding 1994).

**Intaocular Foreign Body** -

Five cases of intraocular foreign bodies associated with vitreous haemorrhage was found here. In four cases, Foreign body was accurately localized. Plain skiagram of orbit showed the presence of foreign body.

**Dislocated Lens** -

Dislocation of lens into opaque media is an perfect indication for ultrasound. The abnormally placed lens is easily detected because of it's shape and strong reflectivity. In our study, 5 cases of dislocated lens and 2 cases of subluxated lens were found amongst 34 cases of ocular trauma. Munk et al (1991) could demonstrated lens fragmentation with individual fragments distinctly discernible on ultrasound.

**Hyphema** -

Anterior chamber may show marked echogenicity with hyphema or haemorrhage. After intraocular haemorrhage normal drainage of fluid may be deranged and anterior chamber may increase in depth. At times after trauma, the chamber may collapse completely with the cornea almost opposed to anterior surface of iris plane. Hyphema "collection of blood in the anterior chamber" can usually be observed clinically itself. In our study, all the three cases of hyphema were clinically diagnosed and poorly visualized on ultrasonography because of poor visualization of anterior chamber.

**Retinoblastoma** -

In our study cases is the commonest primary intraocular tumor of childhood occurring 1 in 20,000 live births. It presents with leucocoria (white pupil) in it's late stage. 94% of reported cases were sporadic but in 6% positive family history of retinoblastoma was available with autosomal dominant incomplete penetrance. Tumor age is 18 month on average and bilateral involvement in it's one third of cases. The tumor projects from retina into vitreous compartment as a white or pinkish mass. USG shows echogenic lesion and calcium deposits with optic nerve involvement beyond the point of surgical resection is associated with a 65% mortality rate. Vashisht & Berry (1994) in their 13 patients between 2-5 years of age, ultrasonic heterogenous soft tissue mass of varying size adjacent to coats of eye ball with specks of calcification producing acoustic shadowing, thickening of anterior part of optic nerve.

**Scleritis** -

Inflammation of sclera is a painful condition. One such case of our study presented with swelling at corneoscleral junction and a convex margin inwards which was due to localized scleritis because of foreign body incarcerated in the sclera.

**Orbital Pseudotumor** -

Orbital pseudotumor is the commonest inflammatory lesion of orbit. The term pseudotumor means idopathic orbital inflammation. Middle aged disease characterized by a triad of proptosis, pain and impaired mobility. Usually it is unilateral. It is divided into following distinct entities -

- Myositis
- Dacryoadenitis
- Perineuritis
- Trochlear inflammation
- Scleritis
- Lymphoid hyperplasia

In our study, one case each of myositis, perineuritis and combination were encountered. Myositic type was characterized by thickening of extraocular muscles and was the commonest subtype in present study. Perineuritic type showed inflammation of tenon's capsule and widening of optic nerve producing characteristic 'T' sign. One case of orbital inflammation presenting with proptosis, though, did not reveal any USG findings but resolved with corticosteroid therapy as in other cases. Narula et al (1994) in their study of 36 cases proptosis was due to pseudo tumor in 11.1% of cases. Usually there is spill over of the inflammation into orbital fat bordering the muscle. This makes the muscular margin as either indistinct or irregular. T-sign presents as widened optic nerve with straightening and accentuation of its borders and appears to be continuous with a sonolucent space paralleling the posterior globe wall and thought to result from oedema along the optic nerve head that extends into space under tenon's capsule along the posterior sclera. This sign disappear with steroid therapy.

**Grave's Ophthalmopathy** -

All of our three cases of grave's ophthalmopathy were asymmetrical with medial rectus being the most common extraocular muscle involvement with predominant enlargement of belly of the muscle with loss of normal well defined outline. Dysthyroid orbitopathy, the other name, is most common cause of proptosis. There may be restriction of eye movements but diplopia is rare and pain is uncommon. The posterior 2/3 of muscle is usually involved compressing the optic nerve at orbital apex. The disease is bilateral with multiple muscles involvement. The inferior and medial rectus muscle are most commonly involved followed by superior rectus muscle.
complex & the lateral rectus. Unilateral involvement is uncommon. Isolated lateral rectus muscle involvement has not been reported.

**Optic Nerve Tumors -**

Optic nerve tumors include mainly glioma, meningioma and neurofibroma. In our study, one case of optic nerve tumor (meningioma) was seen as a fusiform hypoechoic mass with well defined margins encasing the optic nerve. "Tram-track sign was seen with no evidence of calcification or posterior extension. Lloyd (1982) had also recorded the case of meningioma. While Narula et al (1994) found cases of meningioma and glioma both. The later had a homogeneous echotexture with dilated subarachnoid space seen as cystic area anteriorly. Calcification was not appreciated on ultrasonography.

**Retention Cyst -**

One case of retention cyst in our study revealed small clear cyst occurring along the eyelashes in old people, due to retention of secretion of Moll's glands. There was no internal contents. Anterior wall of cyst was incised surgically & it collapsed, confirming benign retention cyst.

**Lacrimal Gland Tumor -**

In our study, two cases of lacrimal gland tumors were diagnosed and they presented with proptosis. One case showed on sonography, a rounded, hypoechoic mass with well defined margin suggestive of a lacrimal gland tumor; "Pleomorphic adenoma on histopathology. The other case was 85 years old female with an infiltrative pattern irregularly margined mass in the extraconal compartment invading the lateral rectus muscle and pushing the globe medially and inferio; with presence of calcification. CT scan showed destruction of superolateral orbital wall and intracranial extension of tumor, a finding, not seen on sonography (Byrne 1984).

**Sinus Carcinoma Invading the Orbit -**

Out of two cases of paranasal sinuses with invasion of orbit in present study, one was 75 years male with ethmoid sinus malignancy and other was 48 years male with maxillary sinus malignancy. Proptosis as presenting feature revealed infiltrative masses on sonography. Ethmoid mass on sonography showed nodular rectus muscle thickening with a hypoechoic mass having irregular margins in the retrobulbar area. But on CT Scan it showed erosion of medial orbital wall and extension of sinus tumor to orbit. Maxillary mass showed destruction of orbital floor & invasion of mass into orbit with displacement of globe superiorly. Histopathologically both cases were of squamous cell carcinoma.

**Metastasis -**

Single case of 60 years old female with proptosis and swelling in orbital region was known to have follicular carcinoma of thyroid and on sonography it showed solid appearing mass with ill defined margins was found in superolateral part of orbit with calcification. The mass was seen invading the anterior cranial fossa on angulating the probe upwards. Orbital plate of frontal bone was completely destroyed and brain tissue could be seen behind the mass suggesting intracranial extension. On histopathology, secondary deposits from follicular carcinoma was confirmed.

**Dermoid -**

Berges et al (1992) reported dermoid cyst the commonest developmental cyst. They are benign lesion occurring in the Ist decade of life. They are located supero- laterally under the lid but can be superomedial also. Retinobular location is uncommon. Dermoids usually contain fat and may contain solid epidermoid structures. Two cases of orbital dermoid of our study had one 5 years male with a hypo-echoic well defined mass located on the superolateral aspect under the upper eye lid. Other case was of 17 years and both the cases were of dermoid confirmed histologically. Some dermoid cyst contain homogeneous material whereas other contains layers of keratin, hair tuft, calcium etc. Hypodense mass with enhancing wall showing fat and calcium density on CT and mass with signal similar to orbital fat on MRI.

**Mucocele of Lacrimal Sac -**

Mucocele of lacrimal sac is a cyst like enlargement of the lacrimal sac secondary to chronic dacryocystitis (Mc Card 1980). It presented with medial canthus mass lesion which could be confused with granuloma or tumor of lacrimal sac. Mucocele formation occur due to nasolacrimal duct obstruction with or without canalicular obstruction. Two cases in our series, presented with swelling on medial side of eye. On USG, both cases showed well defined cystic lesion with few internal debris or echoes. These cases also had operative confirmation.

**Lid Haemangioma -**

Haemangioma is a tumor of childhood that forms a soft bluish mass and may involve any part of the orbit including the eyelid. It has female predominance and predilection for upper lid, presents shortly after birth. In some cases there may be intraorbital extension diagnosed on USG / CT. One case of present series was 6 months old female child with involvement of upper lid. USG showed well defined soft tissue mass with irregular strong internal echoes (Honeycomb pattern) without retro-orbital extension. According to Dallow et al (1975) capillary
haemangoima like simple haemangioma, haemangio-endothelioma are poorly vascularised & consists of solid cellular tissue. CT is only indicated when the lesion has retrobulbar extension.

Lid Carcinoma -

Lid carcinoma can arise either from epithelial elements or from adnexal component of lid with basal cell carcinoma on histology. Other lesions could be sebaceous gland carcinoma, squamous cell carcinoma & malignant melanoma. One case of 45 years old male revealed, on USG, an infiltrative mass of mixed echogenicity having ill defined margin, presence of calcification in the upper eye lid. On histopathology, sebaceous gland carcinoma was confirmed. According to Ross et al, sebaceous gland carcinoma is the second most common lid malignancy arising in “meibomian glands” or glands of “zeiss”. It is more common in upper eyelid due to greater no. of meibomian gland in superior tarsus. It spreads via lymphatics. Vascular invasion with hematogenous metastasis also occur. Clinical diagnosis at an early stage is difficult. It carries a poor prognosis in cases with 10 mm diameter & duration of > 6 months.

Retrobulbar haematoma -

One case in our present study affecting left orbit in a 55 years old male following injury had evidence of proptosis & eyelid swelling. Sonography revealed a well defined hypo-echoic mass in retrobulbar area. Optic nerve and extraocular masses were not well defined. According to Bergs et al (1984) retrobulbar haematoma surrounds the optic nerve and tend to have a clover leaf appearance.

Summary & Conclusion -

Orbital pathologies were observed in this study were predominantly in 4th - 5th decade of life with 2:1 sex ratio.

The chief clinical features were diminution of vision followed by trauma.

73.77% of referrals for USG were with opaque media, whilst 36.23% had clear media in which USG was used as a complimentary diagnostic modality.

The distinction between intraocular & extraocular pathologies was made in 100% of cases, and results in 122 cases recorded in observation could well be supported by other authors as well.

Commonest intraocular pathology was vitreous hemorrhage while orbital pseudo tumor & Grave’s ophthalmopathy formed the main extraocular pathologies. 12.29% patients presented with proptosis due to Grave’s disease or orbital pseudo tumor. Retro-orbital tumor was the next common cause. In trauma cases, vitreous haemorrhage (41.17%) followed by retinal detachment (26.4%) were common findings. Presence of abnormal echoes in vitreous cavity seen in vitreous degeneration, haemorrhage or endophthalmitis. Retinal detachment showed diagnostic accuracy of 99% but specificity was slight less (98.6%), ultrasonography permits accurate localization of F.B. In case of dislocated lens, B-scan USG could graphically demonstrate the posterior of lens & associated abnormalities.

B-scan USG shows 100% accuracy in diagnosis & characterization of lacrimal gland tumors & optic nerve tumors. Though USG is of limited value in assessing periorbital masses with orbital extension & also in bony abnormalities for which CT scan is a superior diagnostic modality. Ultrasonographic findings were well correlated with clinical, operative & histological observation. Hence B-mode real time ultrasonography with high frequency probes provides non-ionizing technique cost-effective, non-radiation, non-invasive technique which can be performed in outdoor patient without any use of anesthetics or sedative therapy.

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