ORIGINAL ARTICLE

The Pattern of Orbital Tumors on B-scan in Suspected Cases of Orbital Masses

SAEED AKHTAR MALIK, HASSAN MAHMOOD TABASSUM*, SALAH UD DIN ARBI**

ABSTRACT

Objectives: To find out the pattern of orbital tumors on B-scan in suspected cases of orbital masses in our set up.
Study design: It is prospective study.
Place and duration of study: This hospital base study was conducted at the Eye and Radiology Departments Mayo Hospital/ K.E. M. U. for a period of six months (Aug. 3, 2004 to Feb. 3, 2005).
Patients and methodology: this study includes 50 patients with orbital swellings in which 10 MHZ linear probe was used on Closed Eyelids. Eye was scanned by placing probe transversely and than longitudinally. Both eyes scanned thoroughly for comparison. Findings noted and data fed in Performa.
Results: 26(52%) patients were male while 24(47%) were female. Orbital inflammation was diagnosed in 10 patients (20%). Ten (20%) were found to be vascular tumors. Cystic tumors were in six (12%) and Retinoblastoma was in 6 i.e., 12%. Three patients (6%) of melanoma and other three (6%) were diagnosed as infiltrating malignant tumors. Four (8%) patients were neurogenic tumors. Two (4%) patients were of Lacrimal Glands tumors.
Conclusion: Different diseases have different appearance on B-scan. This study concluded that B-Scan is a helpful tool in diagnosing orbital masses like vascular tumors, solid and cystic tumors, neurogenic tumors and inflammatory conditions with significant accuracy.
Keywords: B-scan, Orbital Mass, Ultrasound in eye Tumors

INTRODUCTION

Ultrasound was first used in ophthalmology in 1956 by two American ophthalmologists, Mundt and Hughes[1]. In the early 1970's Coleman and associates[2] developed the first commercially available immersion B-scan instrument. In the late 1980s, Color Doppler imaging (CDI) began to be used for the assessment of ocular and orbital disorders.

Ultrasonography of eye in which sound waves are transmitted and received through probe is B-Scan. Change in organ size, shape and echogenicity are easily depicted by B-Scan. It is not only used to evaluate intra-orbital tumors but also for anterior chamber evaluation, vitreous, retina, optic nerve and extraocular musculature can be evaluated on echogram.

Orbital tumors are tumors, which primarily originate from orbital contents or extension from cranial cavity and nasal sinuses. These tumors can cause different problems like visual disturbance, may be cosmetically unacceptable and even may become life threatening, when intracranial extension or metastasis is there. Primary requirement is to diagnose as early as possible. B-Scan and when required CT Scan are needed to detect nasal or intracranial extension. B-scan is used to localize tumor whether intra-Ocular or intra-Orbital, in anterior or posterior segment. Commonest Eye tumor in children is Retinoblastoma[3]; other tumors can be accurately diagnosed by B-Scan e.g. Melanoma, Dermoid Cysts[4]; Orbital Haemangiopericystoma etc. Incidence of Orbital Masses 2-3 person per million of population require orbital surgery for orbital tumors[5].

My aim was to make early diagnosis of orbital tumors by B-Scan, which is cheaper and everywhere available modality; as compared to other modalities such as multislice Computerize Tomography (CT) or Magnetic Resonance Imaging (MRI). More over B-Scan can also make clear cut differentiation between inflammatory intraorbital lesion with orbital and retrobulbar masses.

MATERIALS AND METHODS

This Study was carried out in Mayo hospital; King Edward Medical College / King Edward Medical University Radiology and Eye Patients referred by OPD and eye wards were included in this study. It includes Purposive Non-probability sampling of fifty patients of orbital masses diagnosed on B-mode ultrasound including all positive cases of orbital tumors diagnosed during the study period.

Department of Radiology, Surgery, and Ophthalmology**, Sheikh Zayed Medical College/Hospital. Rahim Yar Khan.*
Correspondence to Dr. Saeed Akhtar Malik, Assistant Professor Radiology , Sh. Z. Medical Collegel. R Y Khan.

By using high resolution linear 10MHz probe; called B-Scan both eyes scanned. Making patient lie down on couch in supine position. Placing ultrasound machine on Rt. side of patient and sat beside the patient and asked the patient to close his / her eyes. Applying gel on closed eyes linear probe placed on eyes and anterior and posterior chambers of eyes thoroughly scanned. Retrobulbar space; optic nerve and orbital muscles also scanned. Patients of both sexes, all ages and having orbital masses on B mode were included in the study. Patients with lid tuours and already operated for eye diseases were excluded. Demographic and clinical data of the patients was recorded including Name, Age, Sex, Occupation, Address, Presenting complaints and Clinical findings by referring ophthalmologist. The collected information was entered in SPSS version 10 and analyzed. Since this study was a descriptive type of case series, no association or statistical significance tests were found necessary.

RESULTS

Out of 50 patients diagnosed with orbital masses on B-scan. 24(48.0%) cases were females and 26 (52.0%) were males. This difference in sex was not statistically significant. Orbital masses were found in all ages, ranging from 2 months to 65 years with a mean and standard deviation of 22.4±8.5 yrs. The major proportion of cases (50%) was found in 1-20 years of age. (Table I).

Left eyes were involved in more than half of the patients while the right eye involvement was slightly lesser (46%). Both eyes were involved in 2(4%) cases. The difference was not statistically significant. Patients Headache and red eye were present in 6 (12%) of cases; affected eye was found to be red in 9 (18%) cases; 21(42%) cases complained of pain in eye. Vision deterioration was detected in (48%) cases. Discharging eye in 8(16%) cases. Proptosis was seen in 13(26%) cases and not seen in 37(74%) cases. Extraocular tumors were seen in forty (80%) cases while in ten (20%) cases tumors were intraocular. Calcification was seen only in two (4%) cases. Color Doppler Imaging showed Neovascularization in 12(24%) cases. 38(76%) of cases were showing no abnormal flow in tumor mass. Retrobulbar muscle abnormality was seen in 14(28%) cases. Extraocular muscular involvement is shown in 29% cases. Bony involvement seen in 4% cases more precise on CT scan. Brain Extension noted in 2 (4%) cases, diagnosed on orbital and brain CT scan with contrast. Patients came with headache; red eye; discharging eye; painful eye; detoriation of vision or proptosis. Some of the complaints overlapped.

Table 1: Demographic, clinical and pathological data for patients who had surgery or stoma reversal

Variable	No./%age of patients	
Age		
<1	01	02.0
1 – 10	15	30.0
11 – 20	10	20.0
21 – 30	8	16.0
41 – 50	7	14.0
51 – 60 2 04.0	204.0	04.0
> 60 1 02.0	1	02.0
Sex ratio (M: F)	24:26	
Side of eye involved		
Right	23	46
Left	25	50
Both	02	04
Presenting complaints		
Headache	10	20.0
Painful eye	23	46.0
Discharge	12	24.0
Irritation	8	16.0
Redness 14 28.0	14	28.0
Fever 7 14.0	714.0	14.0
Vomiting	1	02.0
Affects on vision		
Normal 6x6/6 24 48.00	2448.00	48.00
Decreased/blind 26 52.00	26	52.00
Causes of orbital masses		
Orbital Inflammation (Pseudo)	10	20 %
Vascular tumors	10	20 %
Cystic tumors	6	12 %
Retinoblastoma	6	12 %
Grave's Disease	5	10 %
Neurogenic tumors	4	8 %
Lacrimal gland tumors	2	4 %
Osteoma	1	2 %
Infiltrating malignant tumors	3	6 %
Melanoma	3	6 %

N.B of some of the complaints overlapped

In present study characterization of tumor types is as under: Number of cases, according to percentage.

10 cases Orbital Inflammation (Pseudotumor) 20 %
10 cases vascular tumors 20 %
6 cases Cystic tumors 12 %
6 cases Retinoblastoma 2 %
5 cases Graves Disease 0 %
4 cases Neurogenic tumors 08 %
2 cases Lacrimal Gland tumors 04 %
1 cases Osteoma 2 %
3 cases Infiltrating malignant tumors 06 %
3 cases Malanoma 06 %

Three of such cases seen making 6% out of total fifty cases; By B scan we can diagnose malignant mass with confidence with local infiltration; CT brain is more sensitive in diagnosing brain extension.

DISCUSSION

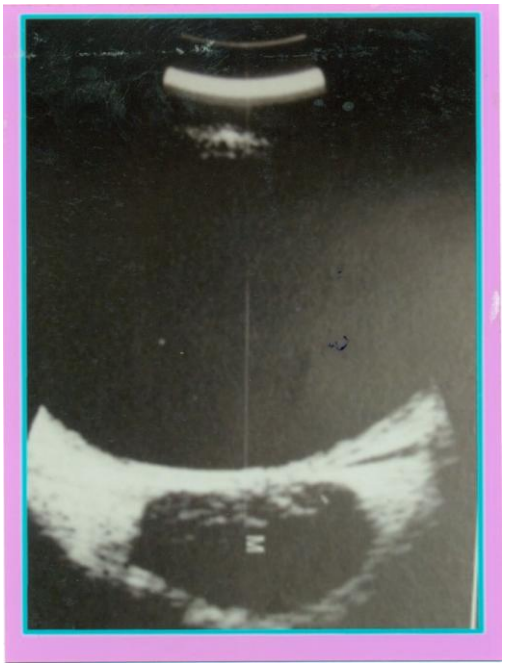
Fifty cases of orbital masses were diagnosed on B Scan in six months study in radiology and eye departments in Mayo Hospital Lahore. Different categories of orbital masses discussed separately as under

1. **Orbital Inflammation behaving like Pseudotumors**

a. Myositis Orbital myositis was seen in the presence or absence of a mass lesion. I had 5(50%) cases in which only one muscle was enlarged. These muscles showed echo-solidity with feeble internal echoes. 5 cases 50% in which extraocular muscles were enlarged showed enlargement of either whole of the muscle mass or the anterior half of their muscle mass as acoustic sign of inflammatory edema are found[7].

b. Optic neuritis Two cases showed inflammatory change around the optic nerve. These were seen as chain of echoes within the substance of optic nerve or around the margins of the optic nerve. The meningioma and the optic nerve glioma, that meningioma are usually smoother on outline than the optic nerve glioma[8].

Fig. 1: Retrobulbar Abscess



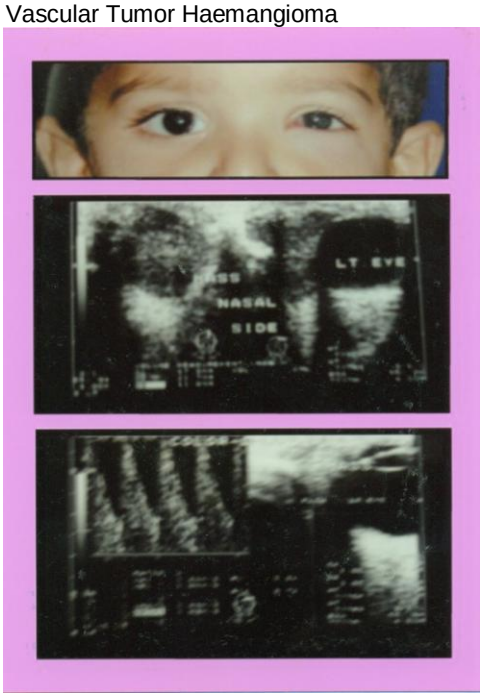
The optic nerve abnormalities seen acoustically have all resolved with regression of the inflammatory disease, and mo pathologic optic nerve has been available for study. In one (10%) case these findings in the optic nerve was seen in association with an orbital abscess. Whereas the other patients showed enlargement in the size of optic nerve has also documented that in rare cases gas may be seen in retrobulbar area which leads to poor transmission of sound. In my study, I had no such case, in which I have detected an element of gas in the orbit. Orbital abscess. We had detected one patient in which a large orbital abscess was found in extra-conal area. In this case the optic nerve outline was normal.

Orbital Abscess (Fig. 1) We had detected one patient in which a large orbital abscess was found in extra-conal area. In this case the optic nerve outline was normal orbital adnexal sign i.e., sclerotenonitis was surely present. According to Moseley[9] in the appropriate clinical contrast, a well defined fluid filled, cystic intra orbital mass is probably and abscess, if other orbital adnexal sign are also present along with this abscess.

2. Vascular masses: Vascular tumors were the second common tumor in the study.

a. Haemangioma: (Fig. 2) on ultrasonic examination three masses (75%) were well circumscribed, where as one (25%) was ill defined. The reason for the irregular margins was probably that this tumour was cavernous haemangioma of Juvenile type.

Fig. 2: Vascular Tumor Haemangioma



In this study all cases (100%) showed good sound transmission as the structures behind the tumor were easily seen. These finding are in conformity with the general believe that cavernous haemangioma have low level of sound absorption and ultrasound energy can penetrate them well. In (25%) cases (case 22) the optic nerve was not clearly visible. This was because the tumor was lying very near to the optic nerve and was even pushing the optic nerve laterally. This fact was explained by Coleman[10] that these tumors are ultrasonically well demarcated from surrounding normal orbital

structures due to abrupt acoustic discontinuity. This study found ultrasonography for the diagnosis of the haemangioma as a most dependable diagnostic tool with 75% of accuracy in diagnosis.

b. **Lymphangioma-** In all these cases we were able to diagnose correctly about the lymphangioma, only because of the presence of these large fluid filled cystic spaces and in one (25%) case in which these cystic spaces were not seen, we were not able to diagnose the lymphangiomatic nature of the tumor. In all our cases having cystic spaces we did not saw any haemorrhage (blood) in them, rather these contained isogenic clear fluid in them again signifying the lymph in it rather than blood.

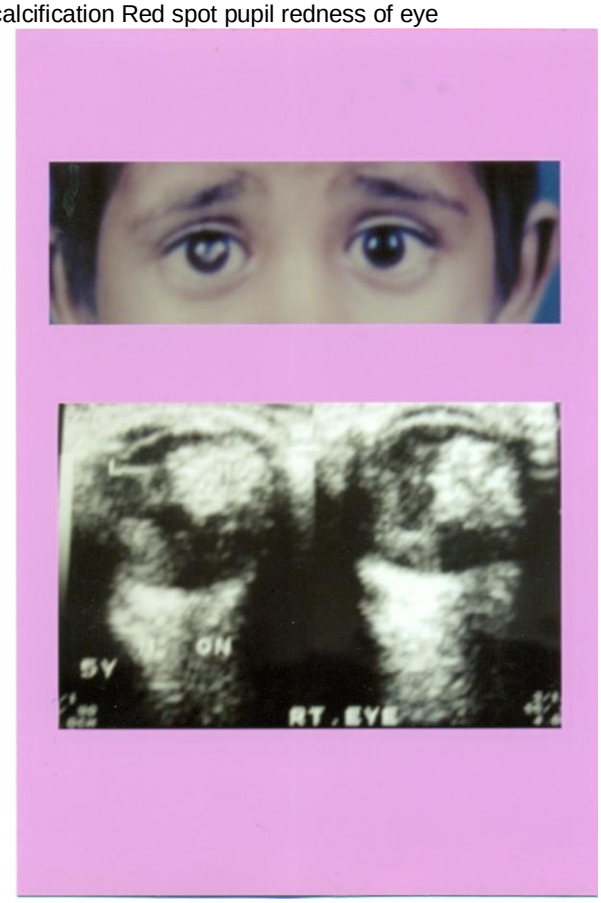
c. **Cystic Tumors:** Six cases of orbital cysts were studied and these were the third most common tumor found in our study. In two cases 33% dermoid cysts were diagnosed clinically. In two cases 33% the growth was palpable but no diagnosis was given. (Fig. 3). Hasselink[20] and Bronson have also seen mucocels transmitting sound readily as other cystic lesions. On ultrasound 100% cysts were having round contour. In 66% of cases i.e. in (four cases) the adjacent structures were affected by the presence of tumor. The diagnosis were made on ultrasound were dermoid cysts (two cases) 33% cthmoidocele (one case 17%) frontocele (one case 17%)

Fig. 3: Cystic Tumors Dermoid Cyst

4. Retinoblastoma (Fig. 4): I had 12% of the orbital tumors as Retinoblastoma, which made the third most common tumor in my study.

Clinically I was confident about diagnosis in 100% cases. The reason was that in all cases the fundal mass was visible.

Fig. 4: Retinoblastoma: Retinoblastoma Rt. eye with calcification Red spot pupil redness of eye



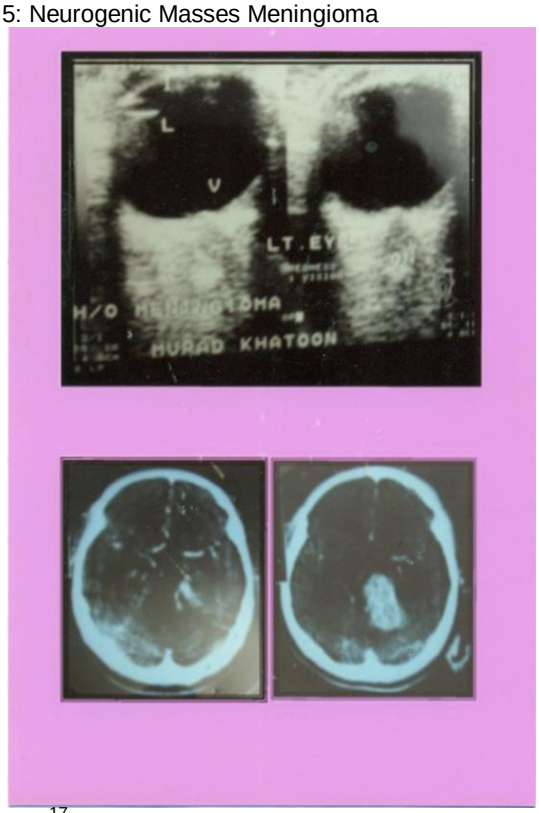
Ultrasound only one case-17%, I saw enlarge size of the eyeball and this very case had the longest duration of presentation. In 50% of the patients I saw the vitreal cavity full of retinoblastoma and in other 50% the vitreal cavity was partially occupied by retinoblastoma. All cases which the vitreal cavity was full retinoblastoma had orbital extensions. But in 17% cases the exophytum retinoblastoma had partial filling of their vitreal cavity. Nonetheless only in this case the ipsilateral lymphadenopathy was detected. These findings highlighted the fact that retinoblastoma does not come out of the sclera by pressure; rather it actively migrates to the orbit and extraorbital tissue by other means as well[12].Whereas in 66% (four cases) I also saw feeble and moderately dense echoes mixed with markedly seen echoes. Arrigg[13] had also noted two patterns of calcification in retinoblastoma. So I also found the presence of calcification as useful diagnosis even when calcification is present in both eyes.Danziger[14] has recorded calcification in 11 of 23 retinoblastoma confined to the globe and 8 of 15 tumors that had spread out of the globe. Munirulhaq[15] has noticed that in Pakistan no case of retinoblastoma survived more than the age of twelve years. In this study 17% (one) case showed optic nerve involvement. Whereas

Goldberg[16] had observed optic nerve expansion in 12.7% cases

5. Grave's Disease On ultrasound the enlargement of extra-ocular muscles was the most common finding seen. 83% patients had one and more than one muscle enlarge and this was the cause of proptosis found in these orbits. Medial rectus was involved 83% cases, lateral rectus involved in 66% cases; inferior rectus was involved 17% cases. No case had enlargement of superior rectus muscle was seen. So my findings medial and lateral rectis were most commonly involved, in correlation with the findings of all the ultrasonography based studies Whereas clinically it is known that inferior rectus muscle is involved most commonly[10]. In my study I had one case (10%) in which the only the inferior rectus muscle was involved, which was the only cause of proptosis in this case. In this study we found no patient with all the muscles involved.

6. Neurogenic tumors: Neurogenic tumors are rare causes of unilateral exophahalmos. In this study I had 8% cases of neurogenic tumors.

Fig. 5: Neurogenic Masses Meningioma



Sullivan[17] has commented about plaque meningioma as "a very difficult lesion in very difficult site". Sutherland[18] had a case with false negative diagnosis of meningioma en plaque. Only one orbitotomy meningioma en plaque was detected (Fig. 5). Even in one case who had generalized slight swelling of optic Nerve behind the globe. So I have found this increase in the angle a helpful sign to comment about the involvement of the optic nerve in a disease. Out of the three meningioma arising from the optic nerve, 66% (two) were large enough to comment upon whether they arose as uniform, bulbous or fusiform enlargement of optic nerve to start with and only one(33%) of meningioma in which the swelling was small, we saw uniform enlargement of optic nerve. So the only observation I noted was that the meningioma had smoother outline with tubular shape to arise at the start. Hilal[8] had also noted the difference between the meningioma and the optic nerve glioma, that meningioma are usually smoother on outline than the optic nerve glioma of the dura. On ultrasound I had the diagnostic accuracy of 75% with no false positive case.

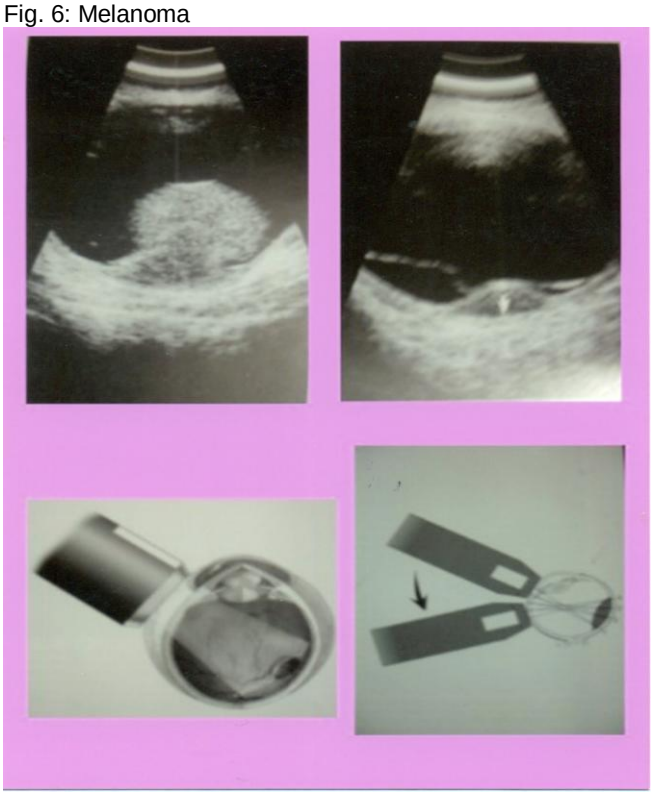
7. Lacrimal Gland Tumor Two cases i.e. 4% of the total orbital tumors were lacrimal gland tumors in this study. Wright[19] reported that 25 of 30 patients with malignant epithelial tumors had compressive or destructive changes Stewart[20] suggested that a well corticated fossa in the lacrimal region in patients along history is indicative if benign mixed tumor, whereas the presence of erosive or destructive bone changes in patients.

In this study I found the ultrasound 100% reliable to differentiate between the benign and malignant nature of the lacrimal gland tumor. The contour analysis of the soft tissue component of lacrimal fossa lesion reliable after Jakobiec[21] and Stewart[20].

8. Osteoma - Osteoma, most rare tumor in this study being only one case (2%). Where as in Munirulhaq's1 (1987) study had 3% osteoma in it. As I have also noted in this study, had supported by Rees[6] (1976), any new bone formation extending into orbit from the paranasal sinuses is most likely an osteoma. In one of my cases I diagnosed osteoma arising from the orbital wall, but because it was on the posterior part of the orbit, the wrong diagnosis was made Meningioma on histopathology after surgical excision. Regarding the role of CT scan in the diagnosis of the orbital osteoma, I have found it 100% correct.

9. Melanoma (Fig. 6): One case showing orbital masses (melanoma) with orbital inflammation[22]. B-scan with color Doppler is characteristics in diagnosing primary malignant melanoma by neovascularization. Niger[23] studied orbito-ocular diseases in Benin city, Nigeria found that intraocular melanoma gives rise to echogenic area, collar button appearance. We conclude that melanoma is 100% diagnosed on B-scan and difficult to diagnose on CT Malignant infiltrating tumor showing distant metastasis diagnosed on CT as in brain and bones. Local infiltrating diagnosed both on CT and on B-scan.

Fig. 6: Melanoma



10. Solid infiltrating malignant masses: Three cases 6% of total study cases turned out to be infiltrating metastatic tumors; one from sinus; other from melanoma on muscle and third optic nerve meningioma infiltrating into brain. DiBernardo, Pacheco & Hughes[24] evaluated melanoma and metastases to extraocular muscles by echography. Dibernardo[24] found metastasis mass infiltrating to Extraocular muscles. We recommended that after clinical diagnosis, the help of ultrasound (B-Scan) should be sought of and relied upon with full confidence for orbital masses.

CONCLUSION

Ophthalmic ultrasound (B-scan) findings are characteristic to diagnose different orbital masses. All the soft tissue contents of orbit are well seen by it. Color Doppler B-scan shows arterial and venous flow. The very peculiar picture of the tumour makes it the first line investigation for the diagnosis. Any how distant metastasis in brain multidisciplinary approach and other modalities likely CT and MRI can be fruitful.

REFERENCES

1. Mundt GH, Hunghes WF. Ultrasonic in ocular diagnosis. Am J Ophthalmol 1956; 41: 488-98.
2. Coleman DJ, Jack RL, Franzen L. High resolution B. scan ultrasonography of the orbit: V. Eye changes of Grave's disease. Arch Ophthalmol 1972; 88:465-71.
3. Jatoi SM, Memon RA, Laghari NA. Retinoblastoma family. Pak J Ophthalmol 2003; 19: 132-5.
4. Junwo G, Jun W B. Ultrasound and computed tomography scan diagnosis of 32- cases on intraorbital demoid cysts. Trop Doct. 1989;3:145-59.
5. Lin-j-Li-E, Yen- KHP. Pathological classification of 435 primary orbital tumors. 1993; 9: 66-9.
6. Reese L, Jones K. Incidence of orbital tumors, studied 230 expanding lesions of orbit. J Ophthalmol 1962:91.
7. Cherry JR. Correspondence CT Scanning in orbital cellulitis. Jr Royal Society of Medicine 1988;81:124.
8. Hilal SK, Trokkel SL. Computerized tomography of the orbit using this section Senior. Roenteuro 1977;12:137-46
9. Moseley Diagnostic value of "optic foramen views" experience from an eye hospital. Br J ophthalmol 1990;74:235-7
10. Coleman DJ, Lizzi FL,Jack RL. *Ultrasonography of the Eye and Orbit.* Philadelphia, Lea & Febiger, 1972.
11. Hesselink J, Davis K, Dallow R, Roberson G, Taveras J. computed tomography of masses in the lacrimal gland region. Radiology 1979;131;43
12. Coleman DJ, Carrol FD. A new technique for the evaluation of optic neuropathy Trans Amer Ophthalmol Soc 1972;3:234-57.
13. Arrigg PG, Hedges Tr, Char DH. Computed tomography in the diagnostic of retinoblastoma. Br J Ophthalmol 1983; 67:558-91. .
14. Danziger A and Price HI. CT findings in retinoblastoma, AJR 1979; 133: 783; -5.
15. Munirulhaq M. Orbital tumor in children. Orbit 1989;8:217.
16. Goldberg SH. Traumatic intraconal hematic cyst of the orbit. Arch Ophthalmol 1992; 110 378-80.
17. Sullivan JA, Marrms SE. Surface coil MR imaging of orbital neoplasms. AJNR 1986;7:29-34.
18. Sutherland GR, Forrester J .B.scan ultrasonography in ophthalmology. Br JR Radiology 1974;47:383-6.
19. Wright1 J Factors affecting the survival of patients with lacrimal gland tumors. Can J Ophthalmol 1982;17:3.
20. Stweart WB, Krohel G, Wright J. Lacrimal gland and fossa lesions. An approach to diagnosis and management Ophthalmology 1979;86:886
21. Jakobiec FA, Sacks E, Kronish JW. Multifocal static creamy choroidal infiltrates: An early sign of lymphoid neoplasia. Ophthalmology 1987;94:397.
22. Goh AS, Francis IC, Kappagoda MB, Filipic M. Orbital inflammation in a patient with extrascleral spread of choroidal malignant melanoma. Clin experiment Ophthalmol. 2001; 29(2):97-9.
23. Ukponmwan CU, Marchien TT. Ultrasound diagnosis of orbito-ocular diseases in Benin City, Nigeria. Niger Postgrad Med J. 2001;8(3):123-6.
24. Dibernardo C, Pacheco EM. Echographic evaluation and findings in metastatic melanoma to extraocular muscles. Ophthalmology 1996;103:179-187.