B-scan ultrasonography of orbital lymphangiomas

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Unilateral exophthalmos is an important clinical ophthalmic problem. A clinical diagnosis of the cause of the exophthalmos is often very difficult. B-scan ultrasonography is an important new diagnostic modality with great potential in determination of the nature of orbital pathology. The earliest ophthalmic applications of ultrasound were reported by Mundt and Hughes (1956). A-scan ultrasound, as described by Oksala and Lehtinen (1957), Gernet (1963), and Ossoinig (1969), is now widely used. B-scan ultrasound was initially utilized in only a few laboratories (Baum and Greenwood, 1958; Purnell, 1965) because of the high cost and complexity of early B-scan instrumentation. B-scan equipment has recently become more readily available (Coleman, Konig, and Katz, 1969). B-scan ultrasound yields two-dimensional "acoustic sections" of the eye and orbit and is the technique of choice for orbital diagnosis. The difference between ultrasonic A- and B-scans is shown diagrammatically in Fig. 1.

FIG. 1 Schematic diagram comparing A- and B-scan ocular ultrasonograms. The B-scan is an intensity-modulated A-scan moved through space, producing a two-dimensional "acoustic section" of the eye. T—ultrasonic transducer

The present paper is intended to demonstrate the value of ultrasonography in the diagnosis of lymphangiomas of the orbit. These are congenital, benign, slowly progressive tumours of the lymph-vascular system (Jones, 1959), occurring usually in childhood or youth. The B-scan ultrasonographic appearance of these orbital tumours has not previously been described.

Materials and methods

The cases presented in this communication are those cases of lymphangiomas of the orbit examined in a series of over 1,000 ocular and orbital B-scan ultrasonograms performed at the Ultrasound Laboratory of the Edward S. Harkness Eye Institute. The clinical material consists of five cases, all occurring in children aged from 6 months to 15 years. Operations were performed on all patients by the Kronlein approach, and all final diagnoses were made by tissue examination in the surgical pathology laboratory. Four lymphangiomas were of the diffuse type and one was cystic. The high-resolution B-scan ultrasound instrumentation employed in this study has been described by Coleman and others (1969).

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Results

(1) NORMAL ORBIT

A high-resolution B-scan ultrasonogram of the normal orbit (Fig. 2) demonstrates the characteristic acoustically dense (white) W-shaped retrobulbar fat pattern. An acoustically empty (black) triangular area widening towards the orbital apex represents the optic nerve and associated structures.

FIG. 2(a) B-scan ultrasonogram of normal orbit. The retrobulbar fat lying behind the globe is acoustically opaque (white), and it is indented by the optic nerve, which is acoustically clear (dark)

FIG. 2(b) Schematic diagram of ultrasonogram, indicating structures giving rise to normal orbital ultrasonic pattern

(2) DIFFUSE LYMPHANGIOMAS

All four orbits involved by diffuse lymphangioma demonstrated markedly abnormal orbital B-scan patterns. These patterns indicate the presence of orbital mass lesions. B-scan ultrasonography of the orbit accurately demonstrates the location, size, and outline of the orbital mass lesion (as shown in Fig. 3). Secondary changes, such as indentation of the retrobulbar fat pattern (Fig. 4) and deformation of the globe, are well shown by ultrasonography. All tumours in this group exhibit a highly irregular outline (Figs 3, 4, 5) because the tumour is not encapsulated and extends diffusely through the orbit. Numerous finger-like or lobate projections of the tumour into the retrobulbar fat pattern are seen ultrasonically (Figs 3, 4). Occasionally these projections are sectioned transversely by the examining ultrasound beam, giving the appearance of a tiny cyst in the retrobulbar fat pattern (Fig. 5). The acoustic borders of these diffuse lymphangiomas are moderately well defined (Figs 4, 5), and they are acoustically well demarcated from surrounding orbital structures, because of the abrupt acoustic discontinuity between fat and muscle tissue and the fluid-filled lymphangioma. All lymphangiomas in this series demonstrate definite acoustic hollowiness. Sound transmission through these fluid masses is good, and little sound absorption occurs. As a result, the posterior extent of the tumour is well outlined acoustically (Figs 3, 5).

A 12-year-old girl with unilateral exophthalmos presented recently at the clinic. There was no clinical indication of the aetiology of the condition, but B-scan ultrasonography (Fig. 5) clearly showed that an orbital tumour was present, that it was nonencapsulated,

FIG. 3(a) B-scan ultrasonogram, diffuse lymphangioma of the orbit. This irregular tumour (T) lies between the optic nerve and the nasal orbital wall. Projections of the tumour extend into the retrobulbar fat

FIG. 3(b) Schematic diagram of ultrasonogram, same case

FIG. 4(a) B-scan ultrasonogram, diffuse lymphangioma of the orbit. This large irregular tumour (T) lies temporal to the optic nerve and compresses and indents the temporal retrobulbar fat

FIG. 4(b) Schematic diagram of ultrasonogram, same case

diffuse, and fluid-filled, and that lymphangioma was the probable diagnosis. A histopathological section is shown in Fig. 6 (opposite). This tumour was a diffuse lymphangioma.

(3) CYSTIC LYMPHANGIOMAS (Fig. 7, overleaf)

Only one orbit involved by a cystic lymphangioma was examined. As in the previous cases, the location (as determined by serial acoustic sectioning) and the size of the tumour

FIG. 5(a) B-scan ultrasonogram, diffuse lymphangioma of the orbit. This tumour (T) lies adjacent to the optic nerve and shifts it nasally. A large lobe of the tumour extends through the retrobulbar fat to the temporal side of the orbit

FIG. 6 Photomicrograph, diffuse lymphangioma of the orbit, same case as Fig. 5. Large irregular endothelial lined spaces filled with fibrin and some red cells, and the presence of lymphatic follicles (LF) and small blood vessels (BV) characterize this tumour pathologically. $\times 100$

are shown by B-scan ultrasonography (Fig. 7a, b). This cystic lymphangioma differs ultrasonically from the diffuse lymphangiomas in that it has a rounded, regular acoustic outline, as would be expected with a cystic structure. The other two characteristic features of lymphangioma are present, however: good demarcation from surrounding

FIG. 7(a) *B-scan ultrasonogram, cystic lymphangioma of the orbit. This rounded tumour is approximately 15 mm. in diameter and lies directly behind the globe*

FIG. 7(b) *Schematic diagram of ultrasonogram, same case*

FIG. 7(c) *B-scan ultrasonogram, same case, higher magnification. The path of the A-scan in Fig. 7 (d) is shown by the line*

V, vitreous; CL, cystic lymphangioma

FIG. 7(d) *A-scan ultrasonogram, same case. The A-scan shows that very few echoes occur in the interior of this cystic lymphangioma*

V, vitreous; CL, cystic lymphangioma

orbital structures, and acoustic hollowness with low sound absorption and high sound transmission (Fig. 7c, d).

Discussion

Lymphangiomas in the region of the eye are uncommon (Jones, 1959). Reese (1963) described the proportion of lymphangiomas to total orbital masses as 1.8 per cent. in a histopathological study of 877 cases, and Silva (1968) found three lymphangiomas in a

series of 300 consecutive orbital masses, a proportion of 1 per cent. The clinical differentiation of lymphangiomas from other orbital tumours, which is very difficult when lid or conjunctival involvement is absent (Jones, 1959), may be aided by high resolution B-scan ultrasonography. This diagnostic technique is completely atraumatic and is easily performed. Diffuse lymphangiomas of the orbit can readily be distinguished from encapsulated orbital tumours by B-scan ultrasonography. These tumours are characterized ultrasonically by a very irregular outline with finger-like processes extending into normal orbital structures, and by definite acoustic hollowness with good sound transmission. The orbital acoustic abnormalities associated with these tumours are summarized in the Table. Cystic lymphangiomas show a rounded, regular outline ultrasonically, but also show definite acoustic hollowness with good sound transmission.

Table *Acoustic abnormalities caused by diffuse lymphangiomas of the orbit.*

(1) Deformation of normal orbital structures: Encroachment on retrobulbar fat Displacement of optic nerve	(3) Presence of orbital mass lesion with specific ultrasonic characteristics: Irregular outline Finger-like processes extending into normal orbital structures Moderately well-defined borders Acoustically hollow, with high sound transmission
(2) Ocular changes: Forward movement of globe Deformation of posterior pole	

Summary

Unilateral exophthalmos is a challenging ophthalmic problem. Determination of the aetiology of exophthalmos in a given case is difficult, but is facilitated by high resolution B-scan ultrasonography, a valuable new technique in the preoperative diagnosis of orbital pathology. Orbital lymphangiomas are an uncommon cause of unilateral exophthalmos. These tumours demonstrate certain characteristic features on B-scan ultrasonography that enable their preoperative recognition. Diffuse lymphangiomas show a jagged contour, a highly irregular outline, absence of a sharply-defined anterior acoustic border and definite acoustic hollowness. Cystic lymphangiomas are regular in contour and rounded in outline and are also acoustically hollow.

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References

- BAUM, G. and GREENWOOD, I. (1958) *A.M.A. Arch. Ophthalmol.*, **60**, 263
COLEMAN, D. J., KONIG, W. F., and KATZ, L. (1969) *Amer. J. Ophthalmol.*, **68**, 256
GERNET, H. (1963) *v. Graefes Arch. Ophthalmol.*, **166**, 402
JONES, I. S. (1959) *Trans. Amer. ophthalm. Soc.*, **57**, 602
MUNDT, G. H., and HUGHES, W. F. (1956) *Amer. J. Ophthalmol.*, **41**, 488
OKSALA, A., and LEHTINEN, A. (1957) *Ophthalmologica (Basel)*, **134**, 378
OSSOINIG, K. (1969) In "Ophthalmic Ultrasound", Proc IV int. Congr. Ultrasonography in Ophthalmology, Philadelphia, ed. K. Gitter, A. H. Keeney, L. K. Sarin, and D. Meyer, p. 282. Mosby, St. Louis
PURNELL, E. W. (1965) In "Diagnostic Ultrasound", ed. C. C. Grossman, J. W. Holmes, C. Joyner, and E. W. Purnell. Plenum Press, New York
REESE, A. B. (1963) "Tumours of the Eye", 2nd ed. Hoeber Medical Division, Harper and Row, New York
SILVA, D. (1968) *Amer. J. Ophthalmol.*, **65**, 318