IMAGING OF OPTIC DISC DRUSEN: A COMPARATIVE STUDY

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SUMMARY

The choice of imaging technique to identify the presence of optic disc drusen has not been well established. We performed computed tomography (CT), magnetic resonance imaging (MRI), fundus fluorescein angiography and B-mode ultrasonography (B-USG) on four patients with optic disc drusen as the sole identifiable pathological process. CT, MRI and examination for autofluorescence demonstrated the presence of drusen in only one case each. B-USG showed characteristic features of optic disc drusen in all cases. We suggest that B-USG, a non-invasive and inexpensive technique, may be the imaging method of choice in identifying the presence of disc drusen.

Buried drusen of the optic disc are often difficult to distinguish from disc swelling due to other causes such as papilloedema or ischaemic optic papillopathy. Investigations such as fundus fluorescein angiography (FFA), B-mode ultrasonography (B-USG) and computed tomography (CT) are used to examine such patients. No comparative study of these techniques, or of magnetic resonance imaging (MRI), has been reported. We present the investigation results of four patients who underwent neuro-ophthalmological investigation with FFA, B-USG, CT and MRI. The only demonstrable pathological process found in all patients was optic disc drusen. Only B-USG was able to demonstrate the presence of optic disc drusen in every case. We also present the first magnetic resonance image of optic disc drusen.

METHODS

Four patients with swollen optic discs underwent neuro-ophthalmological investigation with B-USG, FFA, CT and MRI. Resolution details were as follows:

B mode ultrasonography: Digital B2000; 10 MHz frequency; 0.15 mm resolution.

Computed tomography: GE 8800 scanner; 1.5 mm slice thickness; 0.5 mm in-plane resolution.

Magnetic resonance imaging: Picker 0.5 T superconducting magnet and surface coil. (1) axial/coronal T1-weighted spin echo images [TR 540, TE 20, FOV 20 cm, matrix 192 × 200]; 3 mm slice thickness and 1 mm in-plane resolution. (2) Axial 3DFT gradient echo T1-weighted images [TR 100, TE 18, FOV 20 cm]; 2 mm slice thickness and 1 mm × 0.8 mm in-plane resolution.

All patients had optic disc drusen as their primary diagnosis. No invasive investigations were performed for the purpose of the study.

RESULTS

The results are shown in Table I.

The presence of autofluorescence was demonstrated in only one case (Fig. 1). CT demonstrated characteristic superficial calcification consistent with the presence of drusen in one case also (Fig. 2). MRI, using a high-resolution coil, was able to detect a surface disc transparency in one patient (Fig. 3). B-USG demonstrated high reflectivity characteristic of drusen in all four cases (Fig. 4). No other underlying pathology was found in any patient.

DISCUSSION

Drusen of the optic disc are deposits of calcium within disrupted optic nerve axonal mitochondria. They were first described clinically in 1868 by Liebrich[1] and histopathologically by Müller in 1858.[2] They occur almost exclusively in the Caucasian population with a prevalence of 0.3%. Seventy per cent of drusen are bilateral and may occur as a dominant trait with incomplete penetrance. Associations with retinitis pigmentosa and angioid streaks have been described but no other associated systemic features are known.[3] Abnormal metabolism is

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Table I. Results of four imaging techniques for the identification of optic disc drusen

Case no.	Referred as	FFA	B-USG	CT	MRI
1	Giant cell arteritis?	Disc normal	Drusen	Disc normal	Disc normal
2	Giant cell arteritis?	Disc normal	Drusen	Disc normal	Disc normal
3	Late onset migraine. ?Intracranial lesion	Autofluorescence	Drusen	Disc normal	Drusen
4	Recurrent bilateral branch vein occlusion	Disc normal	Drusen	Drusen	Disc normal

FFA, fundus fluorescein angiography; B-USG, B-mode ultrasonography; CT, computed tomography; MRI, magnetic resonance imaging.

thought to lead to the deposition of calcium within optic nerve axonal mitochondria. The axons are disrupted and mitochondria extruded. Further calcium deposition in these extracellular mitochondrial groups occurs forming drusen which lead to disc swelling.[4] Up to 87% of patients with drusen have visual field loss of varying nature.[5] Superficial, subretinal and intravitreal haemorrhages may also occur. Other complications include vascular occlusion of which ischaemic optic neuropathy is the most common type.[6]

Mustonen *et al.*[7] examined the eyes of 180 patients with clinically evident optic disc drusen. Fundus photography demonstrated autofluorescence in 140 (75%) cases. Many of the remainder were buried drusen in children. Two forms of autofluorescence were described: an early bright form and a late uptake of fluorescein occurring with buried drusen.[7] Boldt *et al.*[8] found that 39 of 48 (81%) cases of drusen demonstrated with B-USG were visible clinically. B-USG may elicit the presence of drusen in 43% of patients with optic disc swelling. Frisen *et al.*[9] examined five patients with high-resolution CT and noted that calcified drusen produced an increased attenuation visible at the optic nerve head. Recent discussion has indicated the possible

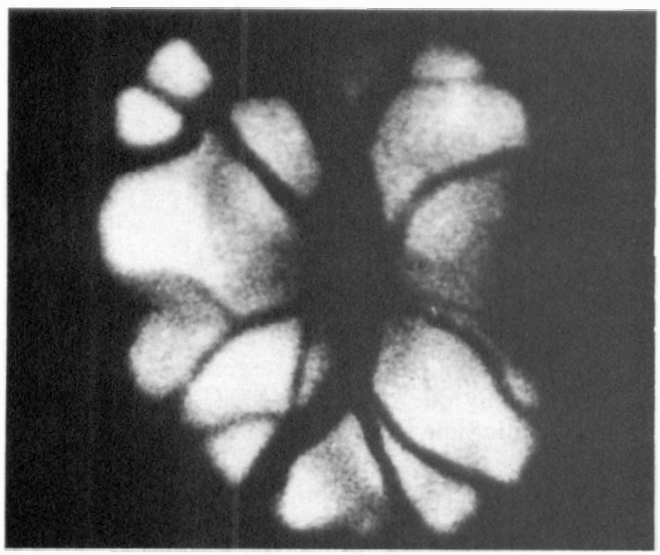

Fig. 1. *Optic disc autofluorescence.*

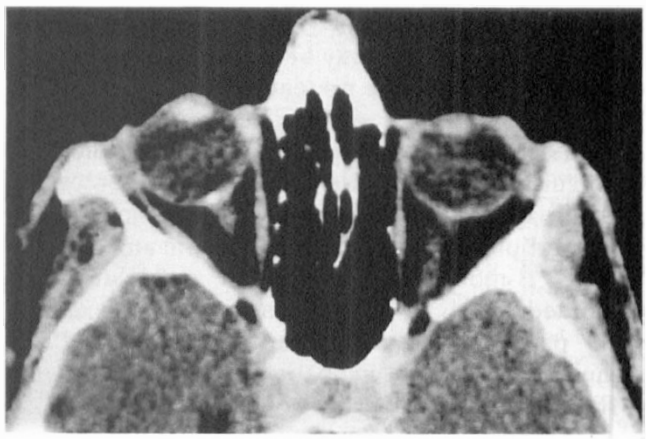

Fig. 2. *CT scan demonstrating characteristic superficial calcification consistent with the presence of drusen.*

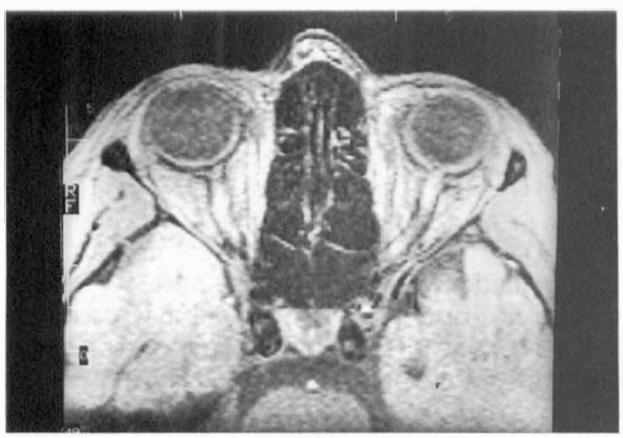

Fig. 3. *Magnetic resonance image demonstrating surface disc transparency consistent with calcification.*

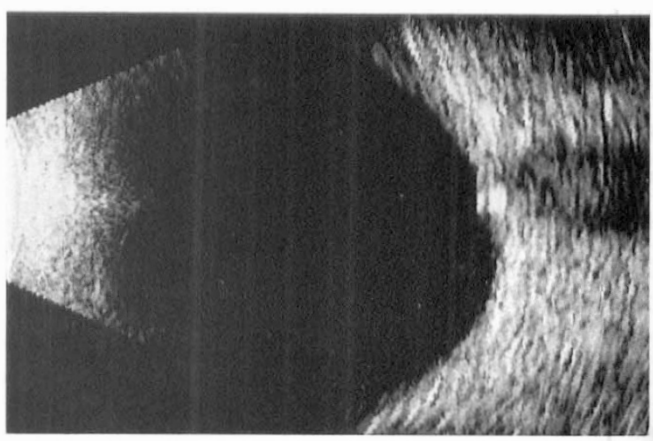

Fig. 4. *B-mode ultrasonography demonstrating high reflectivity characteristic of drusen.*

superiority of CT over B-USG in the imaging of drusen.[10] This first comparative study indicates that B-USG – which is rapid, non-invasive and inexpensive – may be more sensitive than CT. However, further investigation should be undertaken in such patients where there is clinical suspicion that there may be dual pathology.[11] MRI is expensive, requires special techniques and considerable patient cooperation and is therefore also unlikely to be the first choice of investigation in these patients.

Key words: Autofluorescence, Computed tomography, Drusen, Echography, Magnetic resonance imaging, Ultrasonography.

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