



# Ocular Echography in Papilloedema

Rizwana Siddiqi, Peter A Good, Marie A Tsaloumas

Birmingham & Midland Eye Centre, City Hospital NHS Trust, UK



## Introduction

- A swollen optic nerve head particularly when the swelling is mild or appears to be unilateral, can be a great challenge for the clinician<sup>1</sup>
- Clarification of its underlying cause may require a battery of expensive or invasive tests ranging from neuro-imaging, fluorescein angiography to lumbar puncture, some of these may be unnecessary.
- By easily and quickly answering the one question that arises first in these cases i.e. whether or not a swollen disc represents true papilloedema, echography is of great help.
- By simply measuring the inner dural diameter, echography indicates whether subarachnoid fluid is or is not abnormally increased and thus clarifies whether the disc elevation is true papilloedema or is caused by a local condition like buried drusen, ischaemia or a congenital disc anomaly<sup>2</sup>
- Bilateral fluid distension of the optic nerve sheath in the presence of disc elevation is an echographic sign of papilloedema. However, false positives can occur because fluid distension of the optic nerve sheath is present in individuals who have no elevation of intracranial pressure ICP.
- The aim of this study is to compare individuals with flat discs, those with pseudopapilloedema due to disc drusen and those with clinically proven benign intracranial hypertension (BIH).

## Methods

- 50 normal adults with flat or slightly cupped discs underwent echographic cross-sectional imaging of the optic nerve, and were compared to 20 patients with disc drusen and 40 patients with BIH.
- Standardised A and B scan echography was performed on each eye using a Quantel Cine Scan analogue long focal length scanner.
- Measurements of optic nerve diameter (OND) were made using the technique described by Ossoinig<sup>2</sup> Essentially A or B Scan probes were placed at the lateral canthus of either eye and aimed towards the orbital apex. Scanning in a vertical transverse mode resulted in a perfect cross-sectional image of the optic nerve approximately one cm behind the disc.
- This scanner has the advantage of giving high resolution images of the optic disc and proximal optic nerve, and because of its unique Time Gain Control features can give accurate imaging of the anterior chamber. This meant that accurate measurements can also be obtained in young children without the need to resort to anaesthesia, as measurements could be made through the closed eye lid.
- Performance Indices were calculated<sup>3</sup>.

## Results

- Of the 100 eyes with flat or slightly cupped discs only 7 (7%) showed any evidence of distension of the dural sheath with a mean inner dural diameter IDD of 2.7 cm and a mean IPD/IDD ratio of 0.97.
- Of the 40 eyes with buried disc drusen 5 eyes (12.5%) had fluid distension of the nerve sheath with a mean IDD of 2.5 cm and IPD/IDD ratio of 0.96.
- In the group with BIH 76 eyes showed fluid distension of the sheath (95%) with a mean IDD of 4.53 and a mean IPD/IDD ratio of 0.55. The mean CSF opening pressure in those patients was 32.8 cms H<sub>2</sub>O.
- Performance Indices may be seen in Table 2.

Table 1: Group mean parameters (standard deviation in parenthesis) \* p < 0.001

	Control	Drusen	BIH
IPD (mm)	2.64 (0.31)	2.58 (0.53)	2.62 (0.27)
IDD (mm)	2.80 (0.30)	2.75 (0.28)	4.83 (0.22) *
IPD/IDD ratio	0.97 (0.10)	0.96 (0.08)	0.55 (0.03) *

Table 2: Performance Indices of Echographic features of disc oedema

Sensitivity	Specificity	LR +	PPV	NPV
95%	91%	10.55	86.4%	97%

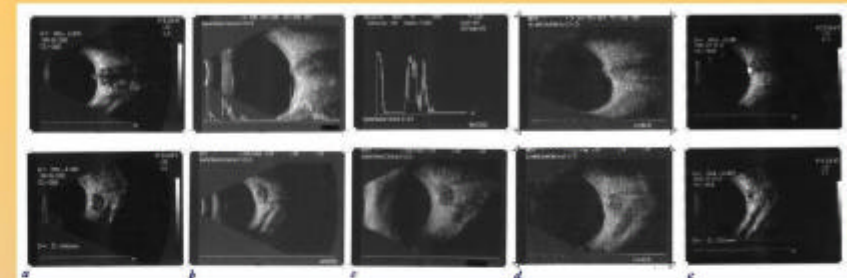


Fig a. Typical papilloedema with marked fluid distension of the sheath. Fig b. Papilloedema with some high surface reflectivity but marked fluid distension of the sheath. Fig c. A & B scan of a swollen nerve in papilloedema. Fig d. Atypical disc oedema with buried drusen & slight fluid distension of the sheath. No evidence of elevated ICP. Fig e. Pseudopapilloedema (buried drusen) with no fluid distension of the sheath.

## Conclusions

- In this study fluid distension of the nerve sheath measured echographically occurs in 95% of patients with BIH (i.e. genuine papilloedema) but in only 7% of patients with flat discs.
- In disc drusen the number of false positives were a little higher at 12.5%.
- This indicates that echographic analysis of the optic nerve is a sensitive indicator of true papilloedema, but in pseudopapilloedema false positives can occur and therefore the findings should be considered with caution.
- Fluid distension of the nerve sheath can occur in individuals with normal intracranial pressure since the optic nerve sheath, like the sheath surrounding the spinal chord acts as a cistern. If the sheaths are particularly elastic this may lead to their distension in normotensive individuals. This is particularly true of children, in whom echographic fluid distension of the sheath has been noted in up to 30% of normotensive individuals.<sup>4</sup> However, we have shown that if a fluid distension is > 50% more than the inner pial diameter is considered as a cut off value, then none of the individuals with normal discs or pseudopapilloedema would have had raised ICP. Therefore, at a IPD/IDD ratio of < 0.75, echographic analysis appears to be an entirely specific diagnostic test for true bilateral papilloedema. At higher ratios the test becomes increasingly less specific.
- Cennamo demonstrated an immediate and prompt response of the nerve sheath to changes in intracranial pressure.<sup>5</sup> Thus, provided echographic measurement of the nerve and its sheath is not made close to a lumbar puncture measurement, then echography gives a good indication of changes in intracranial pressure.<sup>6</sup> This can be used for serial review of patients with BIH as well as in the differential diagnosis of true papilloedema. However, in cases of mild fluid distension of the sheath, normal ICP may occur, and therefore as a first diagnosis, and in the presence of normal neuro-imaging, there is always a need for lumbar puncture to confirm or deny the presence of papilloedema.

## References

- Walsh & Hoyt's Clinical Ophthalmology: The Essentials, Fifth Edition, Miller NR, Newman n.
- Ossoinig KC, 1993. Chapter 1. Standardised Echography of the Optic Nerve - Jules Francois Memorial Lecture. In Ophthalmic Echography 13 pp 3-99. Ed. P.Till. Kluwer Academic Publishers.
- Sackett D, Strauss S, Richardson W, Rosenberg W, Haynes R. Diagnosis and screening. Evidence-based medicine: how to practice and teach EBM. 2nd ed: Churchill Livingstone. pp 67-93
- Good PA, Nischal K, Tsakoumas MD, Sturman S. The Use of Ocular Ultrasound in Acute Optic Nerve Disease. Invest. Ophthalmol. Vis. Sci. (Suppl) 1996.
- Cennamo G, Gangemi M, Stella L. 1987. The Correlation between endocranial pressure & Optic Nerve Diameter: an Ultrasonographic study. In: Ophthalmic Echography. Ed. K.C. Ossoinig. Docum. Ophthalmol. Proc. Series 48: 603-606. Martinus Nijhoff/ Dr. W. Junk Publishers, Dordrecht/ Boston/ Lancaster.
- Galletta S, Byrne SF, Smith JL. 1989. Echographic Correlation of Optic Nerve Sheath & CSF Pressure. J. Clin. Neuro-Ophthalmol. 9(2): 79-82.