Comparison between 10 & 20 MHz ultrasound in the assessment of patients with optic disc drusen

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Introduction

- High frequency ultrasound provides high quality images of the anterior segment. However recent advances in ultrasound technology have resulted in the development of a long focal length high frequency (20 MHz) probe which provides high resolution images of the posterior segment.
- The differential diagnosis of pseudo-papilloedema and papilloedema can present difficulties, but needs to be made at the earliest opportunity. Pseudo-papilloedema can be caused by congenital disc anomaly, hypoplastic or small crowded discs, axial hypermetropia and optic disc drusen.[1]
- Traditionally the most useful and sensitive diagnostic technique is ultrasonography.[2-5] However this only applies when the drusen is buried and where it is more than 0.5 mm in diameter conventional 10 MHz B-scan ultrasound of the optic disc area is affected by the high reflectivity of the optic disc and the peri-papillary retina.[4, 5] Such that even at a low gain false positives can occur.
- High frequency 20 MHz echography allows for high-resolution images of the posterior pole including the optic disc. This gives resolution down to 20 microseces or 0.005 mm as a result small areas of surface or buried drusen can be identified & differentiated from artefact. This study compares 10 and 20 MHz B scan ultrasound in-patients with pseudo-papilloedema and aids the diagnosis.

Methods

Patients

Thirty patients, 60 eyes, 24 females and 6 males, with a provisional diagnosis of disc drusen.

Standardised Echography

Patients underwent 10 & 20 MHz B scan & vector A scan ultrasound using a Quantel ™ Cinescan Standardised ultrasound system.

The scans were performed axially in order to image the optic disc, but avoiding the lens. The 10 MHz was used with 85 dB gain, and the long focal 20 MHz probe with a gain of 100 dB. In some cases the gain was reduced below these levels in order to highlight the highly reflective drusen.

Vector A scan was positioned through any hyper reflective areas of the disc in order to quantify the reflectivity. Discs were imaged vertically and horizontally.

Measurements of the optic nerve diameter were made using the technique described by Ossoing.[3] Essentially A & B scan probes were placed at the lateral canthus of either eye and aimed towards the orbital apex. Scanning (with 10MHz) in a 12-6 transverse mode resulted in a perfect cross-sectional image of the retro-scleral optic nerve.

Statistics

Cohen's Kappa statistics were used to evaluate inter and intra observer repeatability.

Results

Table 1 Comparing the number of eyes with buried drusen, surface drusen or papilloedema correctly identified by the 10 & 20 MHz probes. Cohen's kappa statistics for inter-observer repeatability k= 0.84 for intra-observer repeatability k= 0.94.

	10 MHz	20 MHz
Buried drusen	30	41
Surface drusen	3	14
Papilloedema	2	2

Fig 1 Classical buried drusen RE more affected than the LE. Note well defined borders of the calcified bodies

Fig 2 Bilateral surface drusen (buried on the LE). 10 MHz ultrasound did not identify the buried drusen on the LE

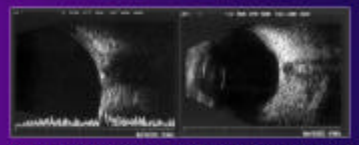

Fig 3 10 & 20 MHz images of the patient with buried disc drusen. Note 10 MHz image shows no clear evidence of drusen whereas the 20MHz image shows buried drusen without disc elevation. Note the absence of the fluid distension of the nerve sheath.

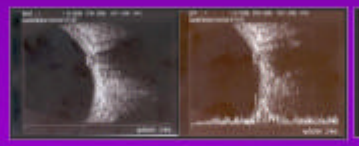

Fig 4 Bilateral surface disc drusen with buried drusen on RE. The provisional diagnosis was papilloedema due to the field loss of the RE: negative LP, no fluid distension of the optic nerve sheaths

Fig 5 Surface drusen – note the irregular flattish shape of the disc. 10 MHz ultrasound shows a small calibre nerve without the fluid distension of the nerve sheath

Fig 5 Buried drusen with temporal elevation of the disc

Fig 7 Classical Papilloedema. Note dome shaped elevation of the discs to 20 MHz and fluid distension of the nerve sheaths to 10 MHz

Conclusions

- In this study the use of 20 MHz ultrasound increases the sensitivity of buried drusen by 37 % i.e. 73% to 100 %. The increase for surface drusen was even more notable using the 20 MHz probe – as it identified three times more patients with surface drusen compared to the 10 MHz probe. Using the 10 MHz probe alone the false-negative error for disc drusen was 36 %.
- The reason for the improved diagnostic rate is the much higher resolution provided by the 20 MHz probe as can be seen in figure 3 comparing the 10 & 20 MHz scans shows that the artefact produced by the optic disc obscures the small hyaloid bodies seen on the 20 MHz scan. This feature is even more notable in cases of surface drusen where the 10 MHz images of the drusen are impossible to differentiate with normal disc tissue due to the highly reflective nature of the surface of the normal disc. Using 20MHz imaging the surface irregularity produced by the drusen can be clearly seen in comparison to the regular dome shaped of the papilloedemic disc.
- The use of the long focal length 20 MHz probe to image the optic disc readily differentiates papilloedema from pseudo-papilloedema and therefore is invaluable in the early diagnosis and management of papilloedema. Particularly when used with 10 MHz cross-sectional imaging of the nerve to identify fluid distension of the optic nerve sheath.

References

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