Comparison between 20MHz ultrasound & OCT in macular holes & cystoid macular oedema

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Introduction

- Ocular Coherence Tomography is a new technology providing high resolution images of nanometre resolution of the retina. This technique readily identifies the presence of macular holes and sub retinal fluid and or cysts. [1]
- Grading and identification of macular holes can be difficult and frequently confused with cystoid macular oedema. [2-4]
- Recent advances in B scan ocular echography have resulted in the development of high resolution, high frequency ultrasound probes. The 20 MHz probe has a focal length of 20mm and is therefore ideal for viewing the posterior pole. The resolution compared to the 10 MHz probe is improved by 10 times i..e. a tenth of a millimetre to one hundredth of a millimetre. With modern analogue imaging this resolution can be further enhanced.
- Although the OCT clearly has the greater resolution it relies on light energy and therefore can not be used in the presence of corneal, lens or vitreous opacities. No such restriction is posed for ultrasound and therefore potentially it may have uses in the presence of opaque media. Indeed, Kokane[5] and others [6,7] have shown that the USG is useful in the presence of macular holes in determining the existence of vitreal traction, and can also identify the presence of an operculum.
- This study compares the OCT with 20 MHz imaging of the macula in order to evaluate its use in patients with macular holes or cystoid macular oedema.

Methods

- Fifteen patients (23 eyes) eleven females, 4males age range 32- 71 with macular hole. 3 Grade 1A, 6 Grade 2, 8 grade 3 and 6 Grade 4. Fifteen patients (21 eyes, 9 females, 6 males age range 37-66) with cystoid macular oedema underwent Zeiss OCT 3 retinal imaging and echographic imaging of the posterior pole (axial view) using a Quantel ™ Cinescan analogue B scanner with a 20 MHz probe.
- The OCT and USG images were assessed by two independent observers who were unaware of the diagnosis. The presence of macular holes was noted and these were graded from 1 to 4. Any evidence of CMO was noted as were the presence or absence of a PVD.

Results

- The OCT identified the macular in all 23 eyes, and correctly graded 20 of them. The OCT also identified all 21 eyes with CMO. The 20 MHz USG identified and correctly graded 19/ 23 yes eyes (835) with macular hole,but failed to identify 2 eyes with grade 1a and 2 eyes with grade 2 holes. The USG identified a PVD in all 6 eyes with CMO, but the OCT identified only 4 of these. The USG identified a PVD in all 6 eyes with grade 4 hole, but the OCT identified only 3 of these.

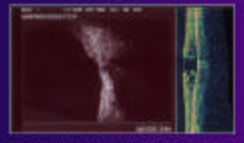


Fig 1 20 MHz & OCT of grade 3 macular hole RE & grade1 macular hole LE

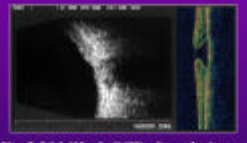
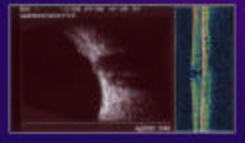


Fig 2 20 MHz & OCT of grade 4 macular hole. Note the similar 'hour glass' appearance noted on OCT & 20MHz



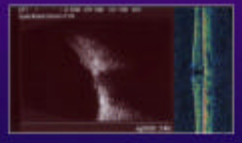


Fig 3 Grade 3 macular hole R & L, note similarity with OCT

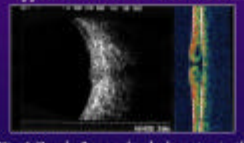


Fig 4 Grade 3 macular hole note similar cystic changes on OCT & 20 MHz

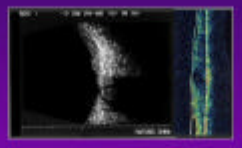


Fig 5 CMO in OCT & 20 MHz . Note the well defined 20 MHz image. Epi-retinal membrane seen on both OCT & USG

Fig 6 CMO with an epi-retinal membrane. The OCT is confusing because of the high reflectivity of the epi-retinal membrane. Giving the retina an artificial thickened appearance

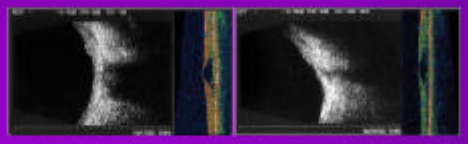


Fig 7 Bilateral grade 2 macular holes seen on 20 MHz but not obvious holes seen on OCT – misdiagnosed as CMO.

Fig 8 Patient with dense L cataract known to have a Grade 1 macular hole before the cataract developed. OCT not possible – Grade 3 macular hole seen on 20 MHz. Note the absence of PVD and no macular hole seen on 10 MHz

Conclusions

- This study confirms the value of high frequency long focal length ultrasound in the detection of macular holes and cystoid macular oedema.
- Although the detection of pseudo holes or lamellar holes is poor, grade 2-4 macular holes and all cases of cystoid macular oedema can be readily identified.
- Although lacking the extremely high resolution of the OCT the 20 MHz USG analogue image is of sufficiently high resolution to identify small cysts or holes at the macula down to the size of 0.01 mm.
- In cases of opaque media such as in patients with uveitis where CMO is common, and where vitreous opacities are frequently present, the use of USG is of great advantage. Previous studies[5-7] have shown that using 10-12 MHz probes only full thickness macular holes can be readily identified, early hole formation being shown as depressions only. The combination of 10 and 20 MHz USG not only defines the relationship between vitreous and macula, but also gives a clear structural representation of the macular hole itself.
- Where macular holes are present being able to identify and grade macular holes in the case of opaque media is also of great value. This is particularly so when differentiating between grade 3 (no PVD) and grade 4 (PVD) holes.
- This study therefore supports the findings of Kokane,[5] and others [6, 7] but suggests that as well as identifying the presence or absence of vitreal traction the 20 MHz probe can also aid in the differential diagnosis and grading of macular holes.

References

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