SCIENTIFIC REPORT

Use of optical coherence tomography, fluorescein angiography and indocyanine green angiography in a screening clinic for wet age-related macular degeneration

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Aims: To assess the utility of optical coherence tomography (OCT) in a nurse-led, fast-track clinic for new age-related macular degeneration (AMD) referrals, and to see how often indocyanine green angiography (ICGA) led to an additional diagnosis to that provided by fundus fluorescein angiography (FFA).

Method: Retrospective audit of a consecutive series of 134 new patients referred with suspected wet AMD. When visual acuity was $\geq 6/60$ an OCT was performed. If the OCT was consistent with “wet” AMD, the patient underwent simultaneous FFA/ICGA. The sensitivity and specificity of this clinic was calculated. The number of additional diagnoses made using ICGA was recorded.

Results: 23/134 (17.16%) patients had OCT only and were not subsequently found to have wet AMD. FFA/ICGA was performed in 111 patients, showing wet AMD in 90 (81%) patients. OCT as used in our clinic had a sensitivity of 1 and a specificity of 0.65 for detecting wet AMD. ICGA provided additional diagnoses in 19 (14.17%) patients. ICGA detected a specific vascular abnormality in 58% of the occult lesions.

Conclusions: OCT proved to be an effective screening tool for wet AMD in this clinic, with excellent sensitivity and reasonable specificity. ICGA provided an additional diagnosis in a significant number of cases, but did not define a vascular abnormality in all occult cases.

The aim of this study was to assess the effectiveness of a nurse-led “wet” age-related macular degeneration (AMD) clinic for new referrals, using optical coherence tomography (OCT) as the initial screening tool. We also reviewed how often indocyanine green angiography (ICGA) provided additional information to fundus fluorescein angiography (FFA) if used in all new cases of wet AMD. We had previously shown that OCT is good at detecting choroidal neovascularisation.¹ The use of ICGA was thought to be potentially an efficient use of time and resources as we are using simultaneous FFA/ICGA.^{2–4} ICGA has been shown to be more sensitive than FFA in detecting polypoidal choroidopathy and retinal angiomatous proliferation, which may appear as an occult choroidal neovascular membrane (CNV) on FFA.^{5–6}

AMD forms a significant proportion of the caseload in ophthalmic clinics and benefits from early management. It is therefore important to be able to establish fast-track referral and assessment systems.

OCT was used as the first examination technique for the retina, rather than training the nurses to examine the retina, as OCT should provide an objective sensitive method of recording retinal findings.^{8–12} A technician can also be trained to interpret and advise on further imaging.

We also hoped that, with the higher resolution obtainable with the scanning laser ophthalmoscope-based Heidelberg retina angiograph (HRA) II ICGA, in occult CNV lesions as defined on FFA, we would be able to see the CNV or another vascular abnormality. Occult choroidal neovascularisation, as defined on FFA is a late leak of undetermined origin or a vascularised pigment epithelial detachment (PED). These could be polypoidal choroidal vasculopathy (PCV), retinal angiomatous proliferation (RAP) or true occult lesions. ICGA on high-resolution systems such as the HRA II can provide greater detail and look through the retinal pigment epithelium to render occult lesions visible.^{2–4}

MATERIALS AND METHODS

A retrospective audit was conducted on 134 new patients referred with wet AMD to a nurse-led, fast-track screening clinic in a centre offering photodynamic therapy (PDT). All the patients had been referred from their optometrists and/or general practitioner so they had had an initial assessment. The information obtained from these letters was used to book patients into the nurse-led clinic. The information looked for was symptoms suggestive of wet AMD, such as blurring and distortion of central vision, and signs recorded, such as macular exudates, haemorrhage and/or subretinal fluid.

Appropriately trained nurses and an ophthalmic photographer, who consulted an ophthalmologist when in doubt, conducted the screening visit. At the screening clinic, a short history was taken and visual acuity recorded. If the visual acuity was $< 6/60$ no further assessment was made and a clinic review was organised. If the visual acuity was $\geq 6/60$ an OCT (Zeiss OCT3) was performed. If dry AMD or other retinal pathology was seen, the patient was referred for management appropriate to their condition but no further imaging was performed. The remaining patients underwent simultaneous FFA and ICGA (Heidelberg Engineering-HRA II, Dossenheim, Germany). The images were taken using standard protocols by an ophthalmic photographer accredited for clinical trials of AMD treatments and included stereo FFA and ICGA pairs and 10 min late shots. The ophthalmologist (JT) reviewed the images the next day and, if appropriate, the patient was referred to the PDT clinic for treatment later that week. For the purposes of this audit, the images were reviewed a second time on screen, including stereoscopic assessment.

The FFAs were classified into wet AMD or another diagnosis and then subdivided into predominantly classic, minimally classic or occult. Occult lesions were defined as a late leak of

Abbreviations: AMD, age-related macular degeneration; CNV, choroidal neovascular membrane; FFA, fundus fluorescein angiography; HRA, Heidelberg retina angiograph; ICGA, indocyanine green angiography; OCT, optical coherence tomography; PCV, polypoidal choroidal vasculopathy; PDT, photodynamic therapy; PED, pigment epithelial detachment; RAP, retinal angiomatous proliferation

undetermined origin or features of a vascularised PED.¹³ From the ICGA images any well-defined vascular abnormality was recorded, including PCV, RAP or a vascular network in an occult lesion seen on FFA. As this was an audit of our clinical practice, ethics committee approval was not required.

RESULTS

Data from 134 eyes of 134 patients were assessed: mean age 84.6 (range 58–97) years; 60.4% women; 56.2% right eye. All were Caucasian.

OCT was performed on 134 patients. In all, 23 patients were excluded after OCT alone owing to the following diagnoses: macular holes (n = 6), dry AMD (n = 3), central serous retinopathy (n = 2), disciform scar (n = 1), reduced vision (n = 8), no abnormality seen (n = 3). None of the patients who only had OCT were subsequently found to have active wet AMD.

FFA/ICGA was performed on 111 patients. FFA provided the following diagnoses: predominantly classic CNV (n = 22), minimally classic CNV (n = 6), serous pigment epithelial detachment (n = 8), disciform scar (n = 9), branch retinal vein occlusion (n = 2), retinal macroaneurysm (n = 1), occult CNV (n = 45; late leak 38, vascularised PED 7), dry AMD (n = 12), no abnormality (n = 6). Dry AMD was actually found in 12/111 (13.5%) patients who had FFA/ICG. The OCT images for these showed lesions that appeared like small PEDs, but were large drusen, which could account for them being interpreted as wet AMD. Such lesions could be small occult lesions, but no leak was detected on FFA. In OCTs where no abnormalities were found, the FFA was normal on further review. When using OCT as an initial screening tool, this clinic had a specificity of 0.65 and a sensitivity of 1.

ICGA provided an additional diagnosis in 19 patients with the above-mentioned occult CNV lesions. These were RAP (n = 10) and PCV (n = 9). Seven patients had significant submacular haemorrhage as part of the lesion, of which three were identified as having PCV by ICGA. A specific vascular network was revealed in seven occult lesions (four in vascularised PEDs and three in late leak occults). The presence of a PED caused a dark shadow on the ICGA, which obscured the vascular details in some cases.

PDT was provided for 34 patients. Of these, 22 had predominantly classic CNV, 8 had RAP and 4 had PCV.

DISCUSSION

OCT has been shown to be sensitive in picking up wet AMD lesions.¹ In our series, 12 patients with dry AMD, however, were passed on for FFA/ICGA. It could therefore be argued that 12/134 patients had an FFA/ICGA unnecessarily. This happened because of the high sensitivity of the OCT in detecting any structural change, and so a large drusen would look like a PED. Indeed in some cases these could represent occult CNV, but we did not detect leak on the FFA and there was no associated subretinal fluid on OCT. Future follow-up will reveal the true nature of these lesions, but treatment was not required at this point. Eight patients with low vision went on to have an OCT and six patients with normal OCT went on to have FFA/ICGA. These were deviations from the protocol. Our audit therefore suggests that we need more education and feedback for the clinic team and the photographer interpreting the OCTs.

In the screening clinic, ICG provided an additional diagnosis in 14.17% patients. These formed 42.2% of all occult lesions as diagnosed by FFA. In this series, all patients having angiography had a combined FFA/ICGA. ICGA could be used in a more targeted fashion for lesions such as those with

haemorrhagic PEDs and peripapillary lesions for PCV, and superficial haemorrhages for RAP.

A total of 30.6% patients were treated with PDT, though with anti-VEGF treatment a greater proportion could potentially undergo treatment.¹⁴

We found the nurse-led fast-track screening clinic to be effective in speeding up access to care for patients with wet AMD as well as in utilising resources more efficiently.

HRA ICGA did not find a well-defined vascular abnormality in 19 occult cases; rather, non-specific changes such as mottling of the normal pattern or plaques were seen. The possible explanations for this could be that the resolution of the HRA II is not high enough to delineate subtle vascular lesions from the choroidal circulation, or abnormalities in the outer blood-retinal barrier may be the cause for leakage rather than structural vascular changes such as CNV.

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