Tales of the Unexpected:
Incidental Findings in Ophthalmic Imaging

Key Words
Incidental findings, ophthalmic imaging, optical coherence tomography, screening scans

Introduction
In the course of carrying out their work, ophthalmic photographers may come across unusual or unexpected findings. An incidental finding is defined as “a chance discovery in a patient which may warrant further investigation.”

This paper reports on a series of eleven cases of patients referred for ophthalmic imaging in which incidental findings were observed by the photographer, with the aim of determining: (a) the significance for the patient, (b) the factors that led to the photographer discovering them, and (c) issues that were raised in reporting the findings.

Method
The 11 cases were observed by the photographer (AC) over a period of 12 years and include photographic, optical coherence tomography (OCT), and verbal incidental findings.

Results
Case Report 1
An 83 year old male normal control patient for a glaucoma research study was referred for optic disc imaging. Disc photography revealed a retinal embolus, not previously noted (Figure 1). Study investigators were emailed to bring it their attention and enquire about its significance. The patient was investigated to evaluate his carotid arteries with ultrasound. He was already on aspirin, and interestingly he subsequently had a cerebrovascular accident (stroke) approximately three months later but made a good recovery.

This case shows that normal control patients in an eye study may have significant pathologies detected at the time of routine imaging. In this case the incidental finding warranted further investigation and was significant for the patient’s general health.

One previously reported study of patients with asymptomatic retinal embolus found a 22% rate of significant carotid stenosis (>70% stenosis) on ultrasound, however the study population consisted entirely of diabetic patients. In a normal population it has been shown that the presence of an asymptomatic retinal embolus is a risk factor for stroke.

Case Report 2
An 81 year old female patient in a cataract study was referred for lens imaging. Slit lamp photography revealed peeling deposits on the anterior lens surface around the pupil margin characteristic of pseudoexfoliation (PEX) of the lens capsule (Figure 2). PEX was subsequently confirmed by the study investigator when
he examined the patient after imaging had been carried out. He explained that PEX indicated this patient was at risk of secondary glaucoma and would need regular review, and also that there would be increased risks for cataract surgery.

This case shows doctor workflow arrangements may mean eye examination is completed after a patient’s pupils are dilated and ophthalmic imaging has been performed.

**Case Reports 3 and 4**

A 78 year old female was referred for fundus fluorescein angiogram (FFA) to investigate the possibility of post-operative cystoid macula edema. An 88 year old female was also referred for FFA with age-related macular degeneration and distorted vision. Both patients were observed to have the same incidental finding of disc drusen indicated by autofluorescence (Figures 3 and 4). In case 3 the drusen were obvious and a review of casenotes revealed drusen had been previously noted, but not cited on the imaging request form. In case 4, the autofluorescence was more subtle, and this was brought to the attention of the doctor since the photographer felt it could easily be overlooked, being visible only on pre-injection and very early phase of the angiogram. The treating doctor explained that this information regarding diagnosis is useful, as in some cases disc drusen may be confused with disc swelling.

Case 3 illustrates that doctors do not always put all the eye findings on the imaging request, probably because they are not considered to be of primary importance. Case 4 shows the importance of taking the pre-injection or control photo on FFA which may be the only time subtle autofluorescence of disc drusen is revealed.

**Case Report 5**

An 81 year old male was referred for FFA to investigate the possibility of peripapillary choroidal neovascularisation. The distinctive appearance of the disc in the angiogram revealed choroidal neovascularisation secondary to Angioid Streaks (Figure 5a). Pattern recognition of this rare condition occurred because the photographer had seen another five examples over a period of twelve years. Angioid Streaks may be associated with connective tissue diseases and have systemic connotations. In this instance the priority of the

![Figure 2](image1.png)

**Figure 2:** (Case 2) Red reflex photo with arrows indicating previously undiagnosed PEX of the lens capsule.

![Figure 3](image2.png)

**Figure 3:** (Case 3) FFA 2-up view (a) showing obvious disc autofluorescence pre dye filling and (b) early phase of FFA.

![Figure 4](image3.png)

**Figure 4:** (Case 4) FFA 2-up view (a) showing subtle disc autofluorescence pre dye filling and (b) early phase of FFA with no visible disc autofluorescence.
doctor was to treat the patient’s uncontrolled glaucoma, which required urgent surgery.

This case shows how doctors triage clinical treatment of their patient, and treat the most important eye condition first. It also shows that experienced photographers may readily recognise some rare eye conditions.

Case Report 6
A 38 year old male with an herpetic eye infection was referred for slit lamp photography of a single dendritic ulcer. Photography and application of fluorescein stain revealed a second ulcer (Figure 6) which was then brought to the doctor’s attention. Although the management for the condition is the same for one or multiple ulcers, it could have confused the doctor into thinking the infection was getting worse on the patient’s next visit.

Case Report 7
A 74 year old female with previous retinal detachment surgery and an incidental choroidal naevus was referred for fundus photography of the naevus. The photographer was unable to locate the naevus in the peripheral retina, even after reviewing diagrams in the patient casenotes. The treating doctor then provided a new diagram showing the correct location, allowing the photographer to finally image the naevus (Figure 7a). The explanation for this “incidental finding” of “Migrating Naevus” (Figure 7b) was that registrars (trainee ophthalmologists) on the two previous patient visits were still learning how to double-invert (ie. turn upside-down and back-to-front) the view of the retina as seen on slit lamp or indirect ophthalmoscope and hence had presented

Figure 5: (Case 5) (a) Angiogram image (late phase) compared to angiogram images of 3 other patients (b, c, d) with Angioid Streaks, showing the distinctive staining pattern around the optic disc.

Figure 6: (Case 6) (a) Scleral scatter illumination with arrows showing dendritic ulcers in the superior and inferior cornea. (b) Cobalt blue illumination with yellow barrier filter clearly showing fluorescein staining of the two dendritic ulcers.
misleading diagrams to the photographer about the true location of the pathology.

**Case Report 8**

A 61 year old male with suspected non-arteritic anterior ischaemic optic neuropathy was referred for optical coherence tomography (OCT) of the optic disc (Figure 8a). Macular OCT revealed a full thickness macular hole (Figure 8b) not previously noted, and explained the patient’s chronic poor visual acuity in the left eye. This macular hole may have been suitable for surgery had it been picked up earlier.

This case again shows that doctor workflow arrangements may mean that an eye examination is completed after a patient’s pupils are dilated and ophthalmic imaging has been performed. Secondly, it illustrates that OCT screening scans of the macula or disc or even the other eye can easily reveal incidental findings. Thirdly, it shows OCT may be more sensitive than a cursory fundus examination, since this patient was referred from an external ophthalmologist without reference to the macular pathology.

**Case Report 9**

An 83 year old male glaucoma suspect was referred for optical coherence tomography (OCT) of the optic disc. Macular OCT was performed using a time domain OCT device (Figure 9a) and a newer spectral domain (Figure 9b) device. The latter revealed a cyst, not seen clearly with the former device. When brought to the doctor’s attention he jokingly complained the new OCT showed him more than he wanted to see and that his patient had “too many” eye problems. Later he acknowledged the OCT scan confirmed a clinical finding of a microaneurysm in that location, and that this was possibly the start of a new disease process.

This case shows that spectral domain OCT can detect findings not easily seen
on time domain OCT, because of the higher resolution image produced. Secondly, it shows that incidental findings are not always immediately welcomed by the doctor.

**Case Report 10**

An 84 year old female with macular degeneration and treated choroidal neovascularisation was referred for macular OCT. The monochrome fundus image (Figure 10a) on the OCT revealed a well-defined dark patch which was initially thought to be an artefact. However when compared to a previous colour fundus photo (Figure 10b) the area was shown to be a choroidal naevus. Enquiries to the manufacturer of the OCT device (Zeiss Stratus OCT3) revealed the illumination used on the “freeze without flash” setting is in the near infra-red region of the electromagnetic spectrum, which is ideal for detecting naevi and tumours.

This case illustrates that OCT devices which utilise near infra-red illumination on the fundus picture can help to detect naevi and tumours, as these are more distinctive than on colour fundus photography which utilise flash illumination from the visible region of the electromagnetic spectrum.

**Case Report 11**

A 23 year old visibly distressed female with thyroid eye disease causing ptosis and diplopia was referred for nine positions of gaze photography. The photographer enquired sympathetically about her problems, and realized she really needed some kind of help. Nursing staff were alerted and the doctor gave permission to arrange for the patient to see a social worker. Four days later she was admitted to the psychiatric ward with major depression.

This was an extreme case of unreported patient symptoms. In some instances when patients communicate symptoms to the photographer not reported to the doctor, the photographer may need to remind the patient to discuss these concerns with the doctor. However, this case illustrates the need for potentially life-threatening unreported symptoms to be brought to the doctor’s attention by the photographer directly.

**Discussion**

**Significance for Patient**

The 11 case reports highlight a wide range in the level of significance of incidental findings for the patients involved. At the lower end of the scale are the cases in which the findings were already known, or about to...
be discovered by the treating doctor. In the majority of other cases the findings, although curious to the photographer, were not significant for the patient as little or no change of patient management was required. However, in particular, the first and last cases reported incidental findings which were significant for the patients, and emphasise the importance of bringing them to the attention of the treating doctor. In Case 1 the finding of a retinal embolus led to cardiovascular investigation, and preceded a stroke. In Case 11 the finding of a distraught patient led to hospitalisation for major depression.

Factors Leading to Discovery
It would seem that the photographer is more likely to discover incidental findings when the patient referred for imaging has not yet had a complete and thorough eye examination. Reasons for this not being carried out might be; (1) inexperience or being focused on one particular part of the eye examination; (2) the patient is enrolled as a normal control in a study in which there is no perceived need for it; or (3) workflow which dictates the patient has their dilating drops instilled and is referred for imaging prior to the doctor carrying out examination of the posterior segment (as imaging such as OCT does not require a fully dilated pupil).

In other instances patients may mention some symptoms to the photographer but not the doctor, not all the eye findings/diagnoses are written on the imaging request, the photographer has enough experience to recognise something unusual, or if not, to show unusual findings to a doctor with specialised expertise for identification.

A common reason for incidental findings coming to light in OCT is the speed and ease of doing extra scans.

OCT Screening Scans
OCT has revolutionised eye imaging and become the most common imaging modality requested in the modern day eye clinic. With its fast and easily acquired detailed sections of the retina, most photographers can point to incidental findings discovered in scans not specifically requested by the doctor. So called “screening scans” have popularly been accepted as good practice by many ophthalmic photographers. Greg Hoffmeyer, former Director of Research Imaging at Duke University, is respected as a leader in the field of OCT and advocates screening scans. He made the following comment on the Optimal internet discussion forum: “With ANY patient I would do a macular

AND optic disk cube, it takes a few more seconds, why wouldn’t you?”.4

The ophthalmic photographer (AC) accepted this philosophy and had no cause to question it until discussion with doctors at Flinders Eye Clinic unexpectedly revealed some different views. It seems that the issue of screening patients has potential legal and ethical ramifications for doctors and patients.

Some points the doctors raised were; (1) The question of screening patients for other conditions without their explicit consent, (2) If screening reveals findings, it can lead to unnecessary anxiety for the patient, (3) The cost of screening adds up, for example, the time taken for extra imaging added up for an entire year may result in substantial costs for wages for the time spent doing them. The cost of printing the extra scans may also be substantial. These costs may outweigh the benefits of the findings and be better spent elsewhere.

There are guidelines for screening which doctors follow. The World Health Organisation Principles of Screening were published in 1968 but are still applicable today. These include; (a) being specific about what disease is being screened for, (b) the condition being an important health problem, and (c) having an agreed policy on who to treat. Performing OCT screening scans on every patient referred for OCT meets none of these criteria.

OCT Scan Protocol
Aside from screening scans, the discussion with doctors revealed that more scanning was being carried out than was required. For example, the doctors said for some unilateral conditions they did not even require both eyes to be scanned.

The photographer realised the need to develop a protocol for OCT scanning in her clinic, and with that in mind surveyed the ten or so doctors in regard to their

Table 1: Protocol for OCT scanning developed at Flinders Eye Clinic using Zeiss Cirrus HD-OCT device.

<table>
<thead>
<tr>
<th>Eye Condition</th>
<th>OCT Scans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age-related macular degeneration</td>
<td>Initial visit = cube + line both eyes</td>
</tr>
<tr>
<td></td>
<td>Follow-up visit = cube + line Eye of Interest + cube other</td>
</tr>
<tr>
<td>Branch retinal vein occlusion</td>
<td>Cube + VERTICAL line on Eye of Interest</td>
</tr>
<tr>
<td>Central retinal vein occlusion</td>
<td>Initial visit = cube on Eye of Interest</td>
</tr>
<tr>
<td></td>
<td>Follow up = By request</td>
</tr>
<tr>
<td>Clinically significant macular edema</td>
<td>Cube both eyes (No Diabetic Retinopathy = No OCT)</td>
</tr>
<tr>
<td>Post-operative cystoid macula edema</td>
<td>Initial visit = cube on Eye of Interest</td>
</tr>
<tr>
<td></td>
<td>Follow up = By request</td>
</tr>
<tr>
<td>Macula hole</td>
<td>Initial visit = cube both eyes + line on Eye of Interest</td>
</tr>
<tr>
<td></td>
<td>Follow up = cube + line on Eye of Interest</td>
</tr>
<tr>
<td>Epiretinal membrane</td>
<td>By request</td>
</tr>
<tr>
<td>Vitreo-macular traction</td>
<td>Initial visit = cube + line both eyes</td>
</tr>
<tr>
<td></td>
<td>Follow up = by request</td>
</tr>
<tr>
<td>Central serous retinopathy</td>
<td>Initial visit = cube on both eyes</td>
</tr>
<tr>
<td></td>
<td>Follow up = cube on Eye of Interest</td>
</tr>
<tr>
<td>Glaucoma / Glaucoma suspect</td>
<td>Disc + cube both eyes</td>
</tr>
<tr>
<td>Disc swelling</td>
<td>Disc both eyes</td>
</tr>
<tr>
<td>Plaquenil (Hydroxychloroquinolone)</td>
<td>Cube both eyes</td>
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scan requirements for the most common conditions referred for OCT. The survey results were then collated and presented to a clinical meeting of these doctors, in order for them to come to a consensus about which scans should be carried out, and an OCT protocol (Table 1) was formulated. The adoption of the protocol resulted in (1) less scans being performed, (2) a corresponding reduction of printing costs, and (3) faster patient throughput.

**Reporting Incidental Findings**

With any incidental finding, the photographer has a choice of several ways to bring it to the doctor’s attention. At the time, it is simple to make a notation in the patient casenotes before sending the patient back out to the clinic to see their doctor. It is also simple to approach the doctor at this time to verbally communicate a finding and to enquire about its relevance. If the finding comes to light after completion of a patient’s imaging visit, then an email or phone call to the doctor are other options. If the photographer suspects an incidental finding may be important, in the interest of patient safety it is prudent to speak to the doctor directly as soon as possible.

Since the role of the photographer does not include making a diagnosis, it is helpful to use appropriate terminology to describe an incidental finding in the casenotes, for example, the word “abnormality” in preference to “pathology”. Also, it is not in the patient’s interest for the photographer to flag any incidental findings directly with the patient as this could result in unnecessary anxiety for them.

This photographer has developed a good rapport with the doctors she works with, having worked with some of them for many years. Even so, one doctor suggested that reporting incidental findings might be seen as telling the doctor how to do their job. A fellow photographer also suggested photographers might be wary of pointing out incidental findings to the doctors they work with, as this might not be acceptable to the doctors.

Doctors are part of a multidisciplinary team working in the eye clinic for the best interests of their eye patients. Research in hospitals shows that good communication and good teamwork leads to the best outcomes for patients. Experienced photographers have well developed observation skills, and occasionally their extra set of eyes and ears can be useful to doctors since, like their colleagues, they aim to do the best for their eye patients. So what is actually best for patient outcomes is for the ophthalmic photographer to consider it their duty to report incidental findings to doctors.

**TeamSTEPPS**

It is worth noting the Health Department of South Australia has recognised that an open, supportive environment where staff from any discipline can confidently raise concerns or ask questions without fear of criticism results in the best clinical care for patients. TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety) is a teamwork program from the US which was piloted in 2008 and later implemented throughout South Australian hospitals. The pilot program showed TeamSTEPPS led to improved quality of teamwork, communication (including flattening of hierarchies) and clinical care.

**Conclusion**

This series of case reports shows that a small proportion of incidental findings can be significant for the patient and consequently it is important they are brought to the attention of the treating doctor. If a patient has not had a thorough eye examination the photographer is more likely to encounter incidental findings. Experienced photographers may recognise rare eye conditions and unusual findings which may be overlooked by less experienced colleagues. OCT can easily detect incidental findings, but initiating screening scans may lead to potential unexpected problems, unless the doctor has agreed. We recommend doctors be surveyed in regard to their OCT requirements, in order to formulate an agreed OCT protocol. Reporting incidental findings contributes to good teamwork and communication, and to patients receiving the optimal care. Based on observations made in these eleven case studies we recommend that ophthalmic photographers report incidental findings to the treating doctor.

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