Anterior Segment Imaging - FA, ICGA, OCT and more…

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Comfort Zone….

Anterior segment angiography – major attractions

- Cornea – avascular in health, so very little ‘angiography’ possible
- Limbus – often exhibits normal vessels ‘encroaching’ on cornea
- Conjunctiva – large variation in amount, size and tortuosity of vessels
- Iris – large ballpark with cysts, tumors, atrophy, extensive vascular circulation

Anterior segment - Iris angiography

- Most angiography of the anterior segment is aimed at the Iris
- Iris blood circulation stems from the anterior and long posterior branches of ciliary artery
- Iris – anterior part of the Uvea
- Which includes the choroid and ciliary body
- Iris angiographic circulation studies appeared some 30 years ago, and then….fizzled out
The Fascinating Circulation of the Iris

Tools of our craft:
Once upon a time -
Does this awaken* any memories?

Good ol' 30° Zeiss

Anterior segment Fluorescein Angiography?

*clue...

The internal optical path and basic design of the early fundus cameras are still the ones being used today, even though many external features have been added.
Sometime used for -

And Then Arrived the SLO Confocal Scanning Laser System

Anterior Segment High-Magnification Angiography

And in Moving Pictures, too

Anterior segment Angiography

- Arm-to-iris time – longer than to retina
- After 2-3 minutes – contrast fades, details too…
- Focus and fixation – pre IV
- Colors helpful
Cornea / Iris Focus Shift

- Note difference in focal planes
- Decide where to set initial focus
- If ‘dual pathologies’ – shift during dye arrival / dynamic stage
- Acquire ‘extra footage’ and then edit / delete as needed
- Blink ! for patient…. ( ?)
In the literature*...

The literature – a partial review

- Anterior segment angiography of tumors of the iris
- Anterior segment angiography before and after muscle surgery
- Study of A-to-I circulation time
- Anterior segment angiography after glaucoma surgery
- Often by use of fundus camera

Iris Angiography of the Anterior Segment

Ulrich Doerrler, Franz Eckardt, and Wilhelm Briansch

Angrenabzge, Zentralinstitutfür Augenheilkunde, Berlin, Federal Republic of Germany

Type III

The tumors of Type III either possess their own sustenable vascular system, or they contain so much pigment that the vessels are rendered invisible, so that the tumor itself remains dark until the later phases of the angiogram.
ICGA of the anterior segment to evaluate effect of muscle surgery on iris perfusion

**Scientific Correspondence**

Indocyanine green angiography of the anterior segment in patients undergoing strabismus surgery

Tin R I Chan, Arthur I, Rosenthalan, Raresh R., Steven D Schwartz, Pauline Santiago, Dennis Thoman

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ICGA of the iris becomes a potential diagnostic tool because of its ability to fluoresce at a wavelength not blocked by overlying pigment.

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**Iris Perfusion Evaluation using ICGA**

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**Conclusions**

Discussion

ICG angiography did not demonstrate any delay in filling after primary horizontal surgery, but did demonstrate filling defects in the immediate postoperative period in 57% (four out of 14 patients did not have immediate postoperative ICG angiograms) of both primary vertical and combined vertical/horizontal. Similar findings were observed as reported by Hayreh and Scott and Olver and Lee with fluorescein dye.

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**Conclusions & Recommendations**

Based on our late ICG angiogram findings, 12 of 13 patients who showed delayed iris perfusion early after surgery had complete iris reperfusion a mean of 10.4 weeks postoperatively (range 3–22 weeks). We recommend that further strabismus surgery should be delayed for at least 12 weeks following surgery. If high risk factors are present, ICG or fluorescein iris angiogram should be considered before contemplating further rectus surgery.

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**ICGA of anterior segment following trabeculectomy**

Original Article

Indocyanine green anterior segment angiography for studying conjunctival vascular changes after trabeculectomy

Zaheer Ahsan, PhD, MD; Paul T. Chev, MD; Olver, M.D.; Caroline K.L. Chew, PhD, MD; Sue Meng Wong, MD, PhD; and Tin Aung, MD, PhD

Evaluating Bleb and vascular integrity

Anterior segment angiography was performed on 10 patients who underwent trabeculectomy surgery at the National University Hospital, Singapore. Informed consent was obtained from all patients, and the study was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

In conclusion, we hope to introduce ICC as a promising investigatory tool in demonstrating the vascular system of the conjunctiva and episclera. This technique has potential applications both in experimental and clinical studies of glaucoma filtering surgery and other anterior segment pathologies.

Meanwhile...back at the farm...

- Anterior segment angiography mostly of patients referred for FFA
- With Spectralis / HRA 2 possible to do FFA without dilation
- Various diagnoses
- Intriguing technique and findings
- Slow gathering of cases

Drops

- Constricted pupils much more photogenic
- Possible to dilate at start of angiography, by 4-5 mins. full dilation, sufficient for FFA

How Many Recti Can Be Cut at One Operation for Strabismus Without Exposing the Eye to a Risk of Anterior Segment Ischemia?

The present study aims to suggest that tenotomy of the two vertical recti conjunctival with the lateral rectus is likely to subject the eye to the risk of anterior segment ischemia. Further supported by the very high risk of retinal vascular distribution of the eye [4]. In our series we had patients from the age of 3 to 64 years and found no appreciable difference in the circulatory disturbances with age. No doubt anterior segment hematologic and other cardiovascular disorders could increase the susceptibility to ischemia, as in the case in other vascular disorders of the eye.
Iris color….

- Iris color affects quality of angiography, especially / exclusively FA (?)
- And whence does the name ‘Iris’ come from?
- Do we really think that Greek gods / goddesses enjoyed life in ‘grey and white’?

Please meet Iris, the Goddess of the Rainbow!

More ‘to-the-point’ stuff…

- Fluorescein vs. ICGA – ICGA much ‘easier’ to image and categorize, but leakage rare
- With Fluorescein – leakage and pigmentation affect quality and visibility considerably
- ICG - hardly any leakage, plus dark pigmentation less of a hindrance
- So, how do we get ‘there’ from ‘here’?
Sometimes, the answers are right beside your nose…

- Holding lids often more important in IFA than in FFA
- Time-honored technique for easy, effective lid-holding
- So, DO practice this at home….

And sometimes…

- The widest of lid openings AND good dilation, stymie fundus angiographers….
- Especially in peripheral photography
FFA / IFA vs. ICGA

- Different wavelengths
- ICGA less affected by pigmentary obstruction
- Dye removal times vary between angiographies
- Interesting to compare Iris / Fundus findings

And in the Curio department…
Descemet's membrane folds

- Following trauma / surgery
- Diabetes (8%-33%)
- Mechanical – i.e. prolonged bandaging
- Toxic
- Idopathic
Iris Nevus

- Mostly benign, rarely transform into malignancies
- Monitoring 1-2 times a year, observing any change in size, color, texture
- Ophthalmic photography – key follow-up modality
- Anterior segment OCT - added feature
Matching Patterns

- As in iris diabetic leakage - mirrored in retinal non-perfusion and vascular leakage - matching patterns may be observed elsewhere
- Correlation, if any, not clear
- FFT

Age-related Arcus Senilis

- White, grey or blue opaque ring at the corneal margin
- Present at birth, and fades
- Common in the elderly
- Earlier in life, as a result of hypercholesterolemia
Real-Time Swirling Vitreous

In Summary…

- Iris / anterior segment angiography yields striking images and meaningful findings
- Fairly little documentation and publications
- Muscle surgery affects iris perfusion for several weeks
- A large, wide open field for future work
- Enjoy!

Thank you

Gangotri, India