

Episcleral Venous Fluid Wave: Intraoperative Evaluation of the Trabecular Outflow Pathway

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Financial disclosures

- Aerie Pharm: S
- Allergan: C, S, R
- CATS: M
- MicroOptx: M
- New World Medical: C, S, R
- Nova Eye Medical: S, E
- Olleyes: C, E
- Reichert: C, S
- Sanoculis: M
- Santen: C
- Surgical Specialties: S
- C: consultant
- E: equity
- M: medical advisory board
- R: research support
- S: speaker



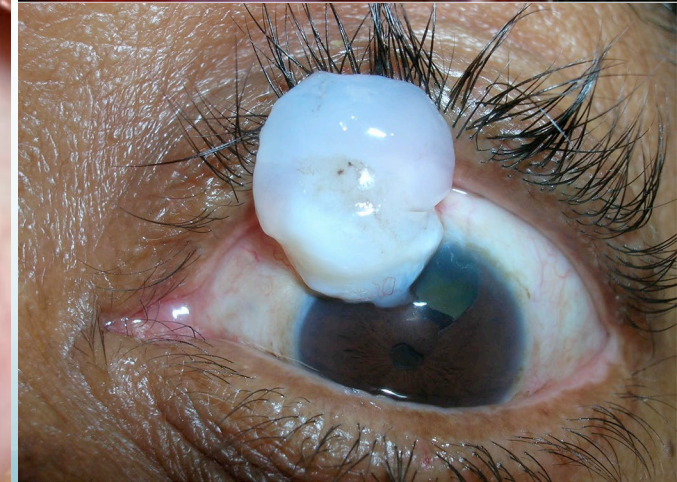
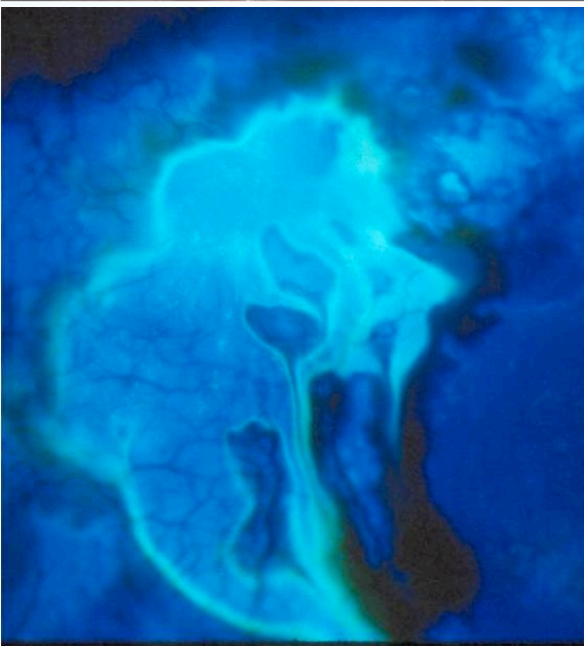
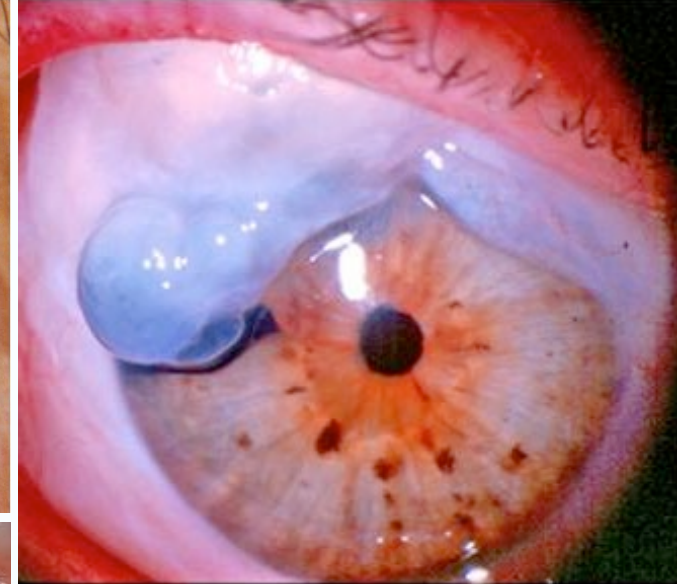
Outline

- Overview of my Glaucoma Surgical Algorithm
- Review Angle and Collector System Anatomy
- Demonstration of the Episcleral Venous Fluid Wave
- Correlation of Fluid Wave to IOP Lowering Post Ab Interno Trabeculotomy
- Conclusion and Future Implications

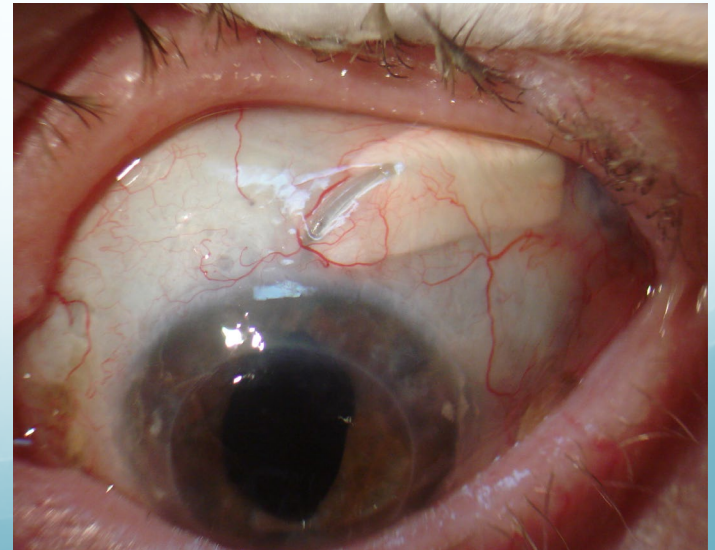
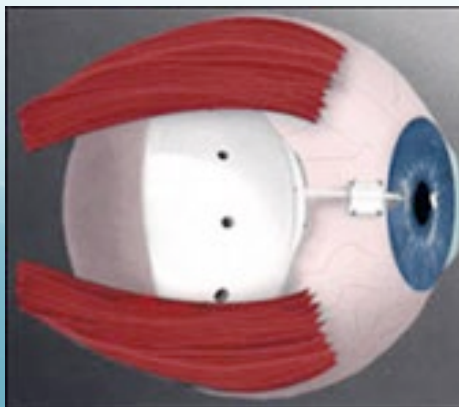
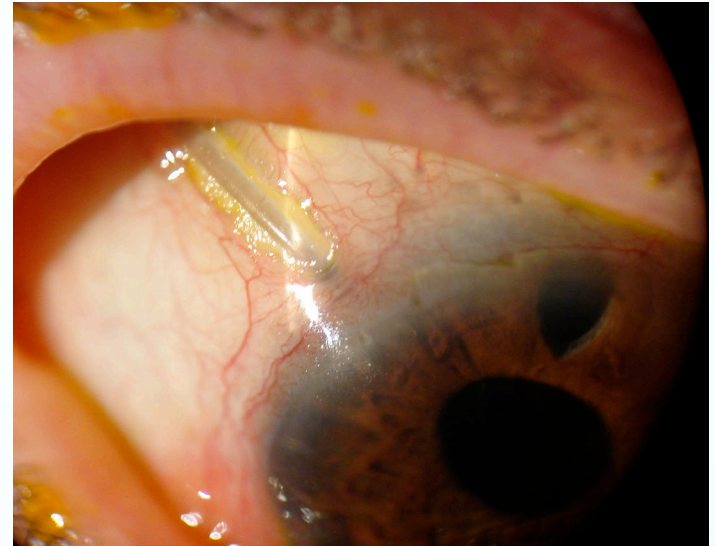
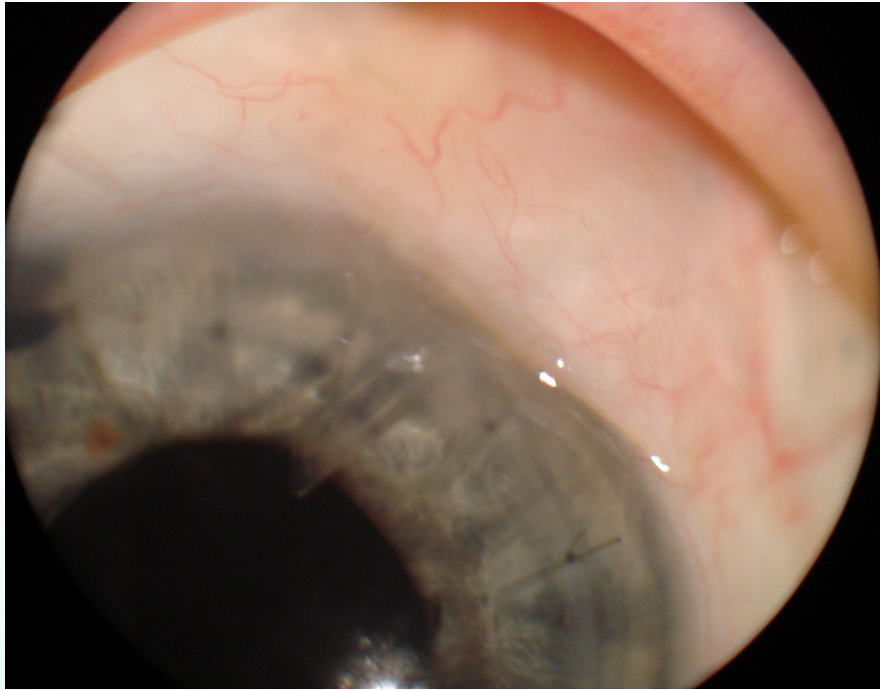


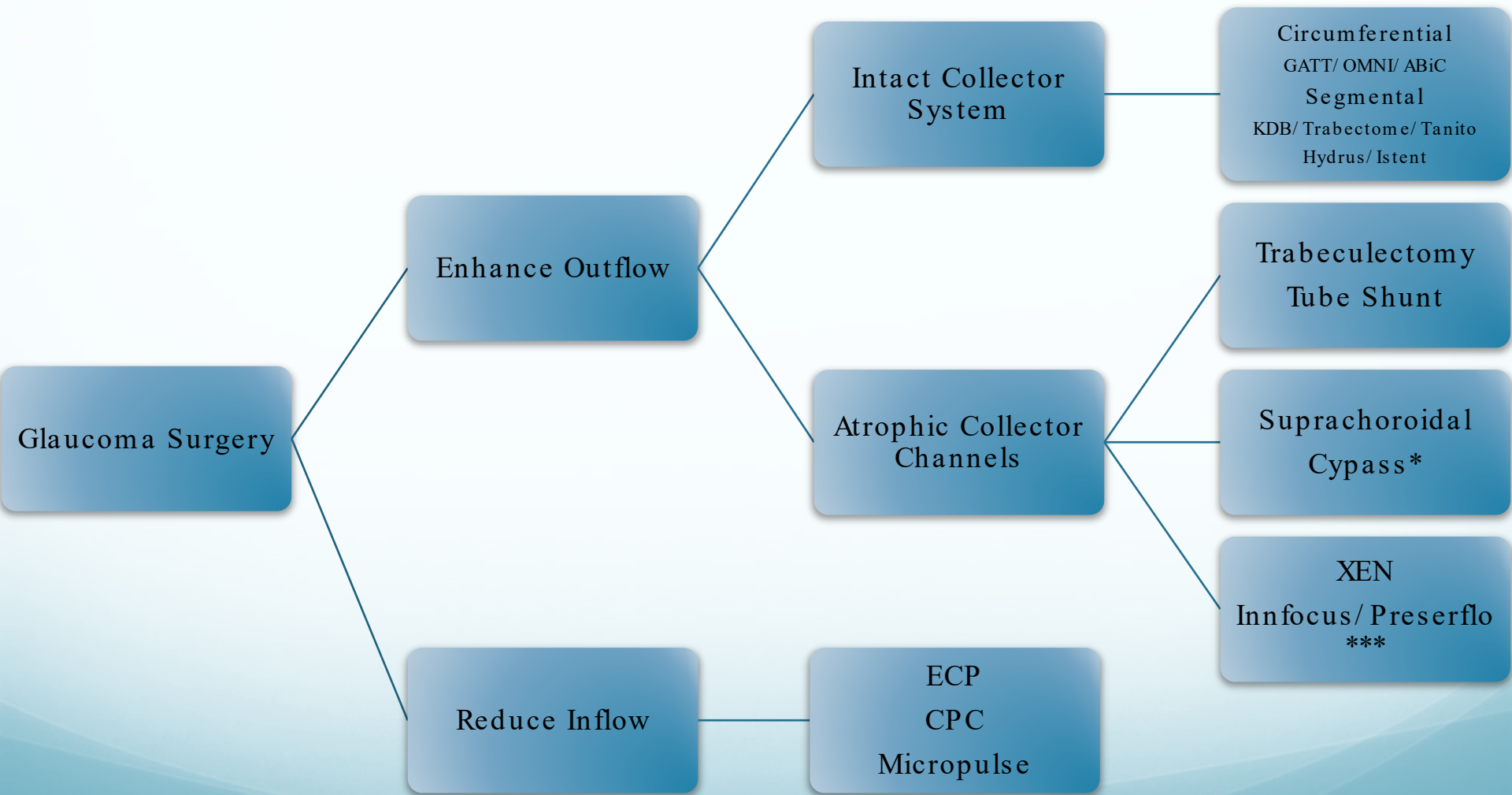
What's wrong with the Current Standard of Care?

Bad Blebs



Bad Tubes





Controversy with Angle Based Surgery



- Question:
 - When is Minimally Invasive Glaucoma Surgery (MIGS) actually Minimally Effective Glaucoma Surgery (MEGS)
- Answer:
 - When the patient's inherent drainage system is not functional

Problem: There is no preop test for aqueous venous channel capacity

Normal

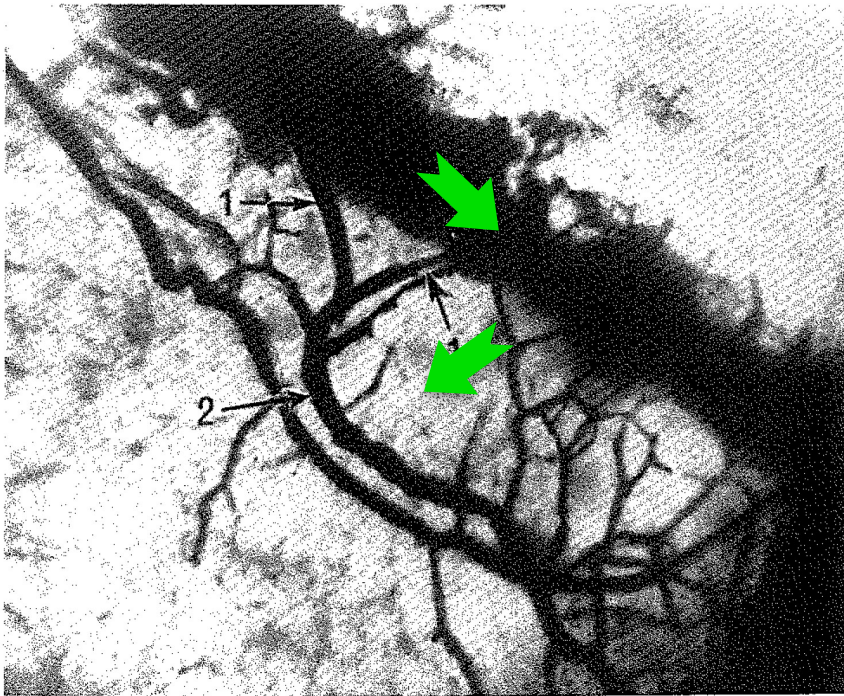
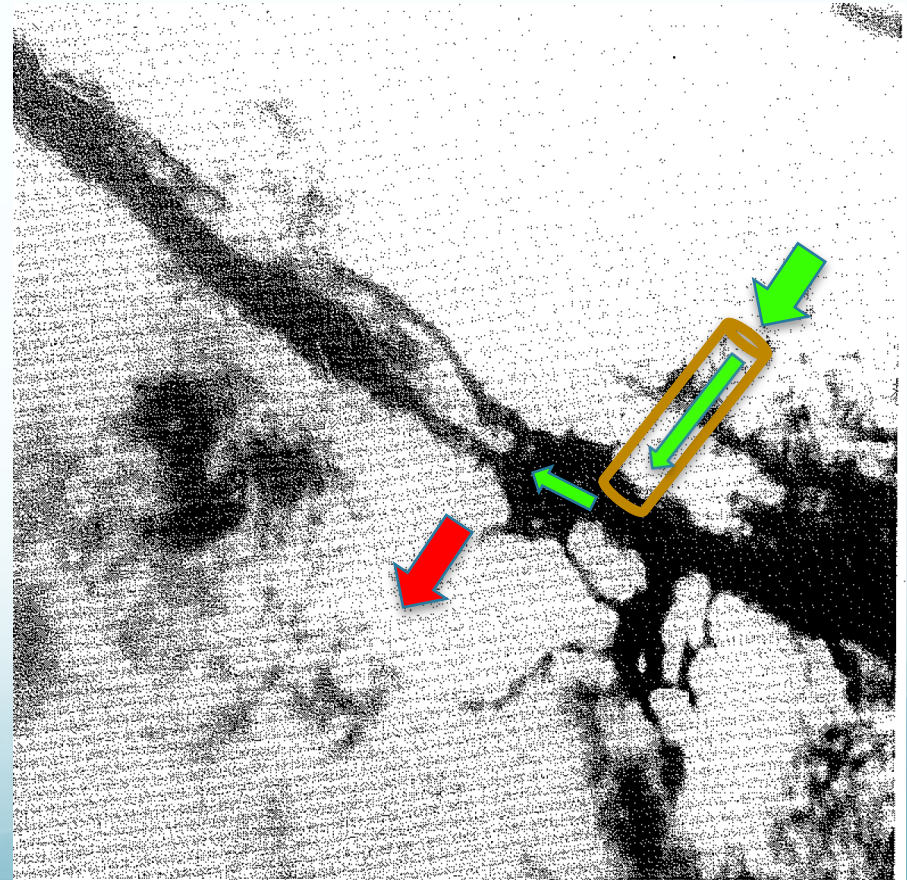
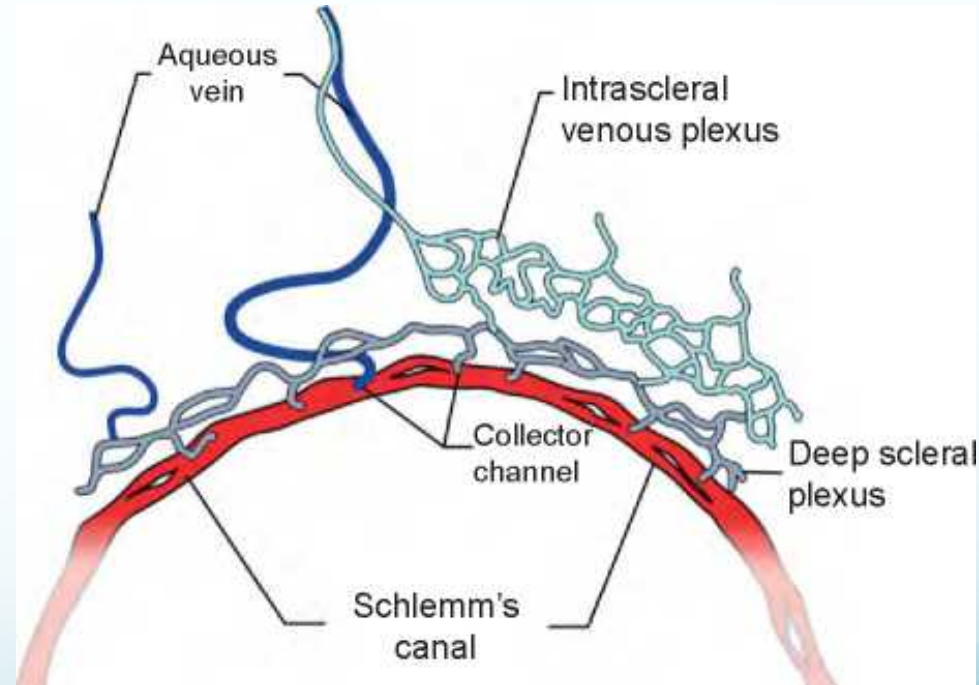
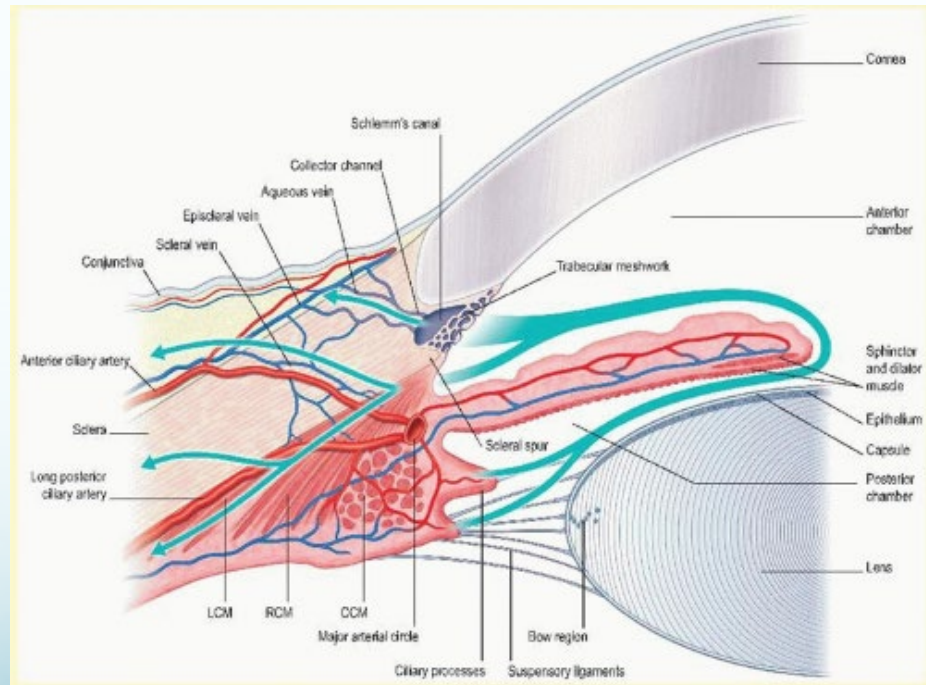


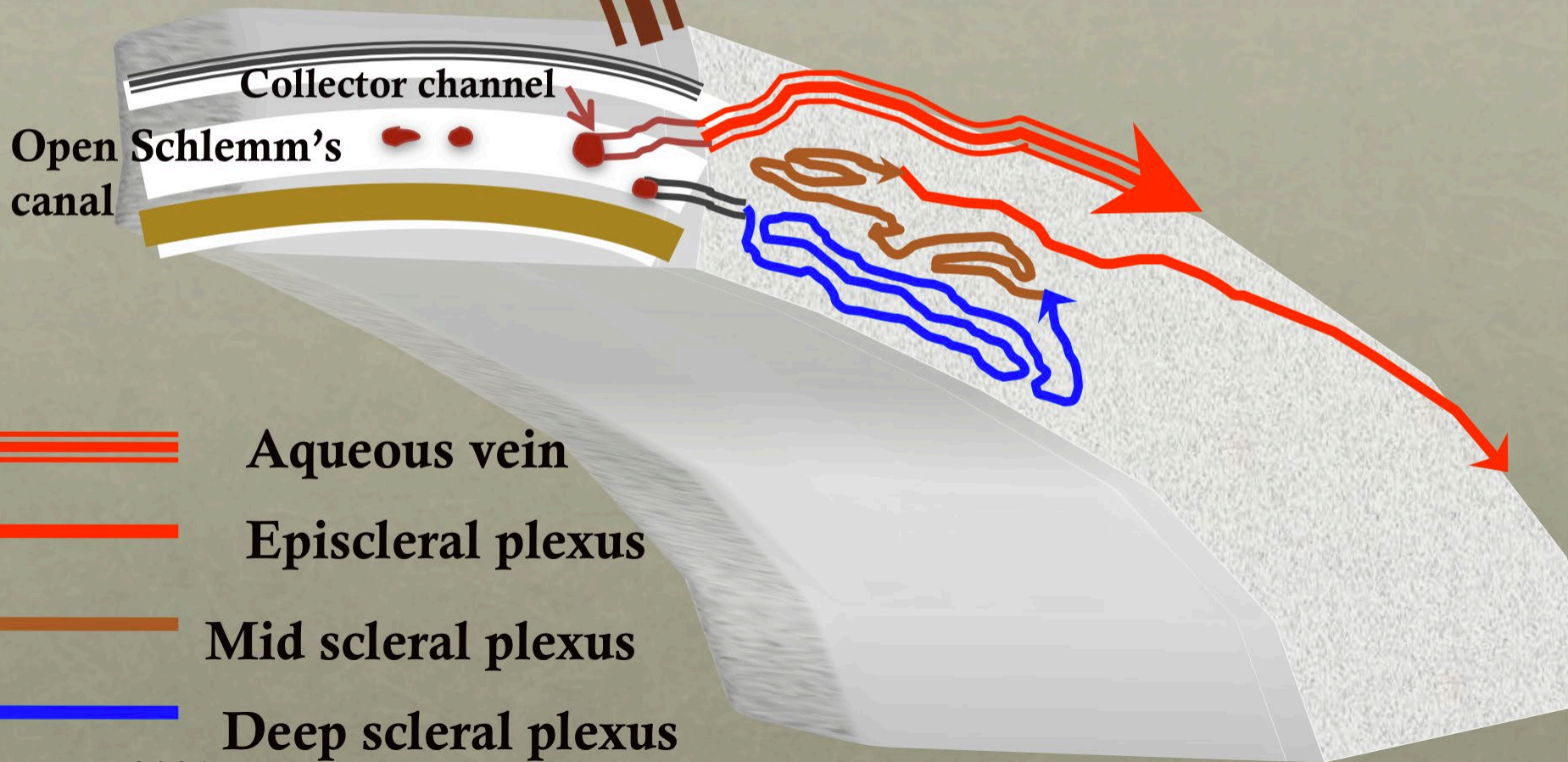
Figure 17-6. Schlemm's canal, collector channels (1) and scleral vessels (2) in a normal human eye, perfused with Indian ink solution, $\times 50$. No signs of the intrascleral block can be detected (From Nesterov *et al.*, 1978, reproduced with permission)

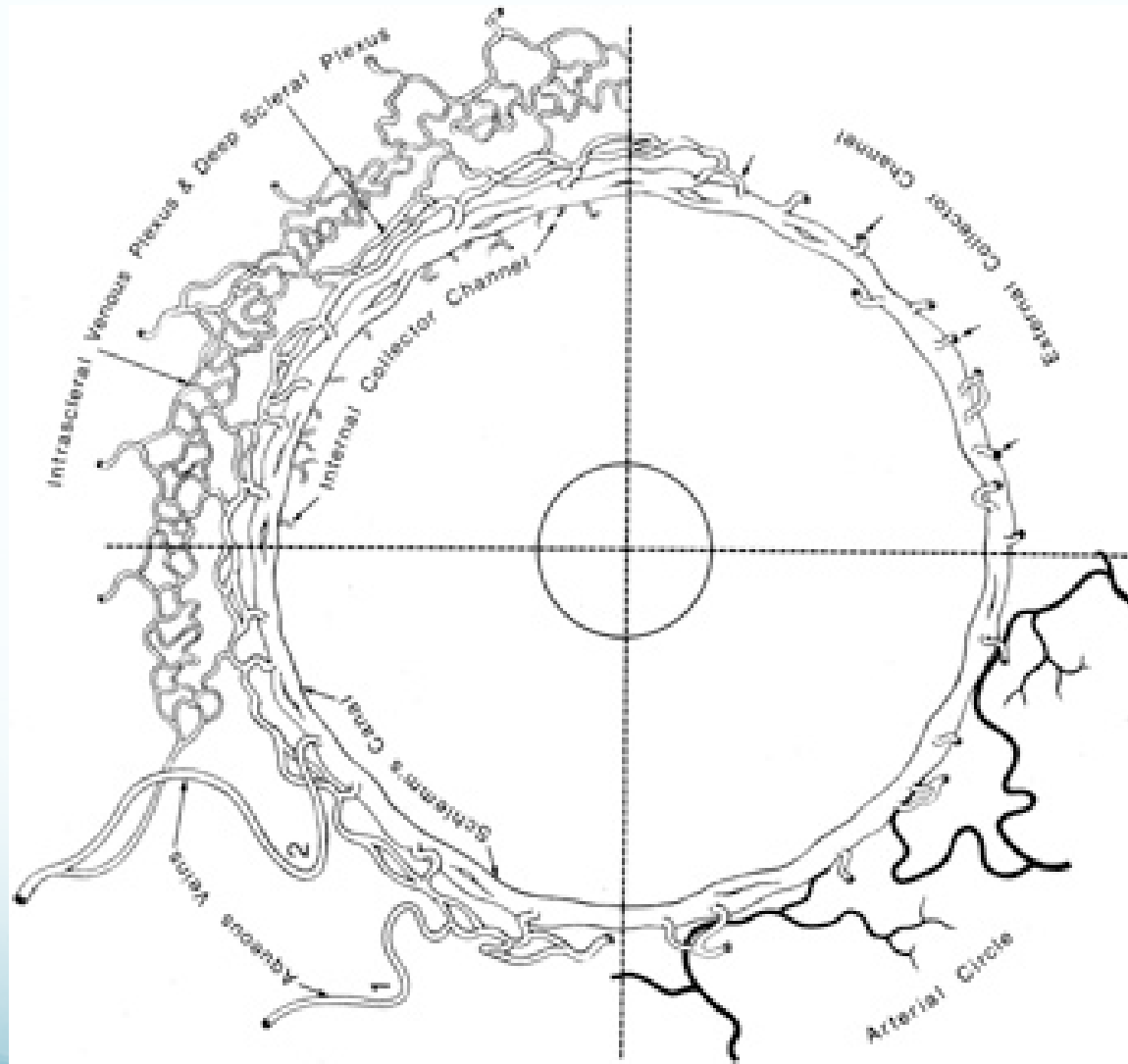
Advanced Glaucoma





Scleral venous outflow network and Aqueous vein







Is there a way to clinically assess a patient's inherent collector system?



Episcleral Venous Fluid Wave (EVFW)

Episcleral Venous Fluid Wave: Intraoperative Evidence for Patency of the Conventional Outflow System

Ronald L. Fellman, MD and Davinder S. Grover, MD, MPH

J Glaucoma • Volume 00, Number 00, ■■ 2012

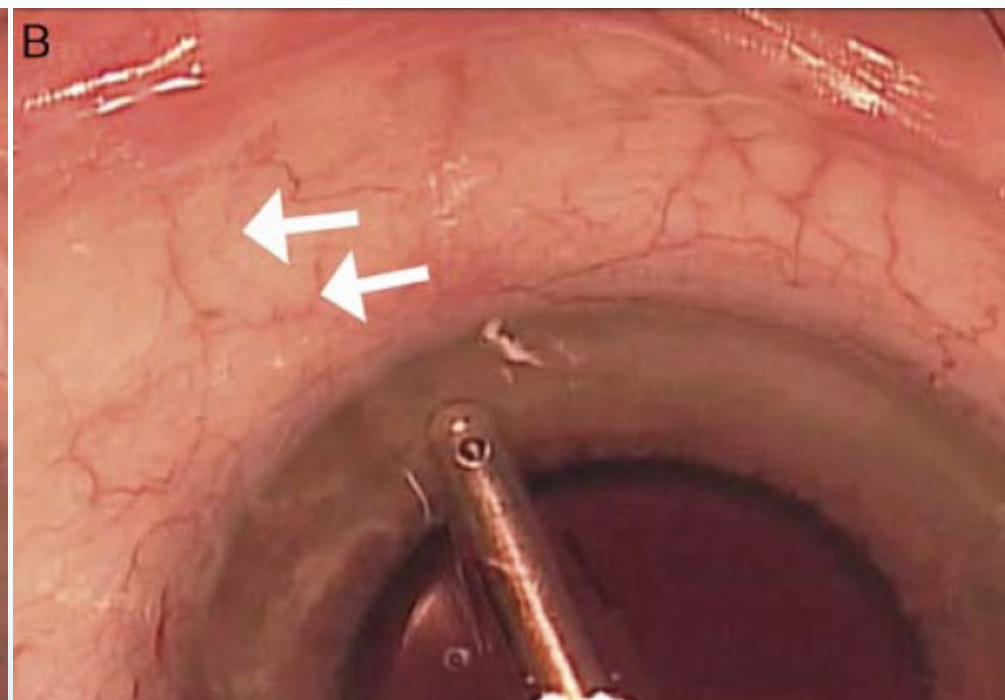
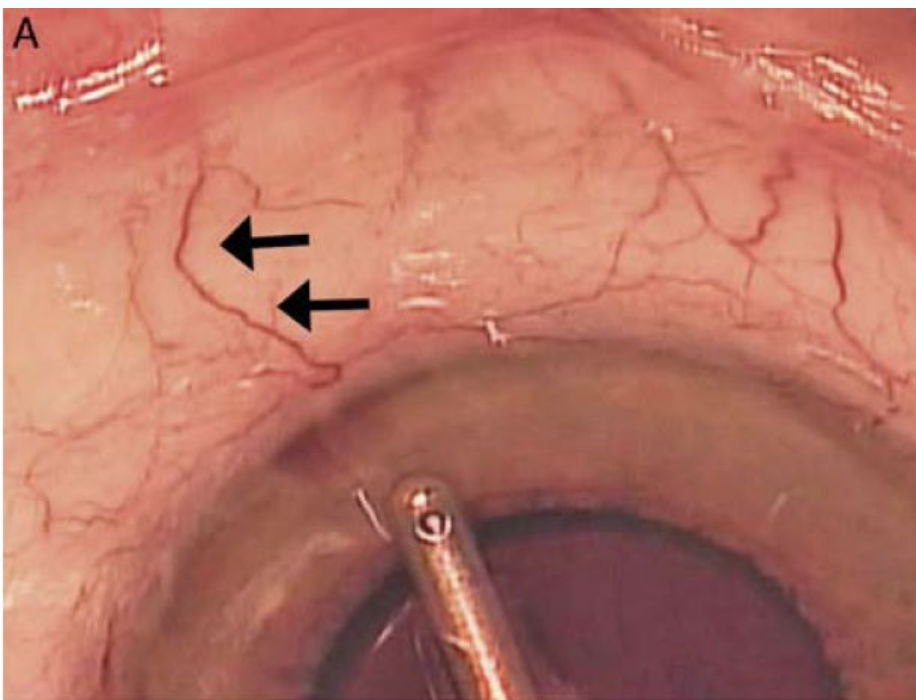
- EVFW is seen during I/ A
- Transient blanching of episcleral vessels caused by flow of BSS through collector channels near canal-based surgical sites

Episcleral Venous Fluid Wave: Intraoperative Evidence for Patency of the Conventional Outflow System

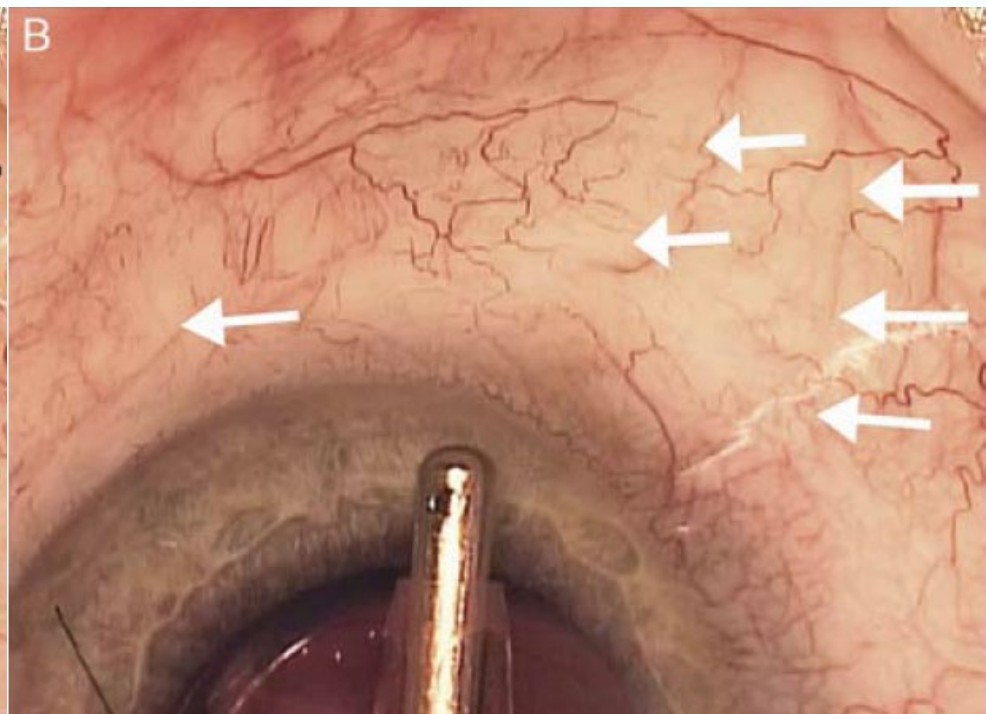
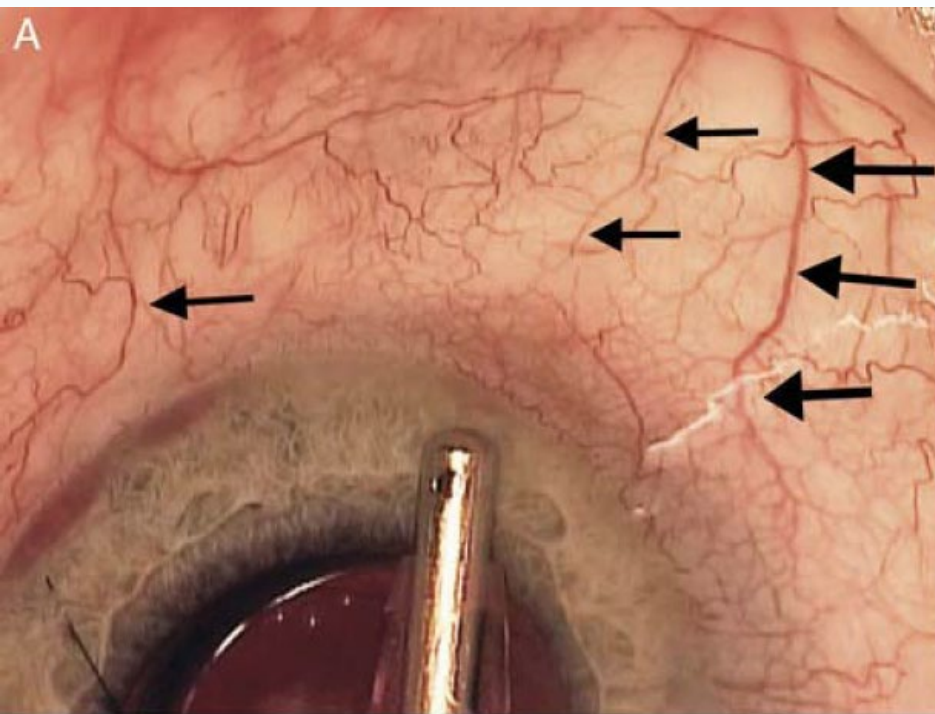


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EVFW



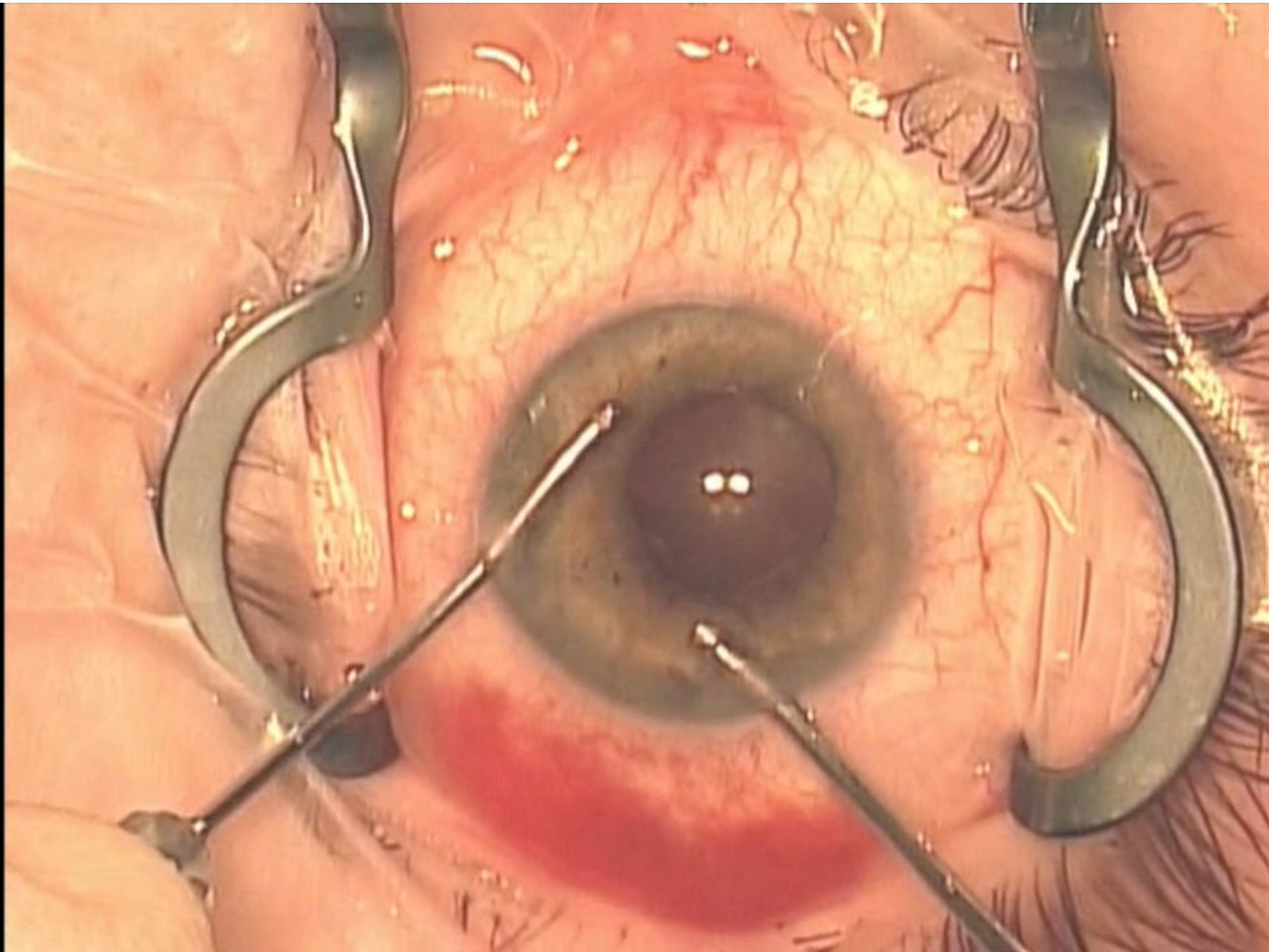


EVFW following MIGS

- GATT
- iStent G1
- iStent inject
- Hydrus
- KDB

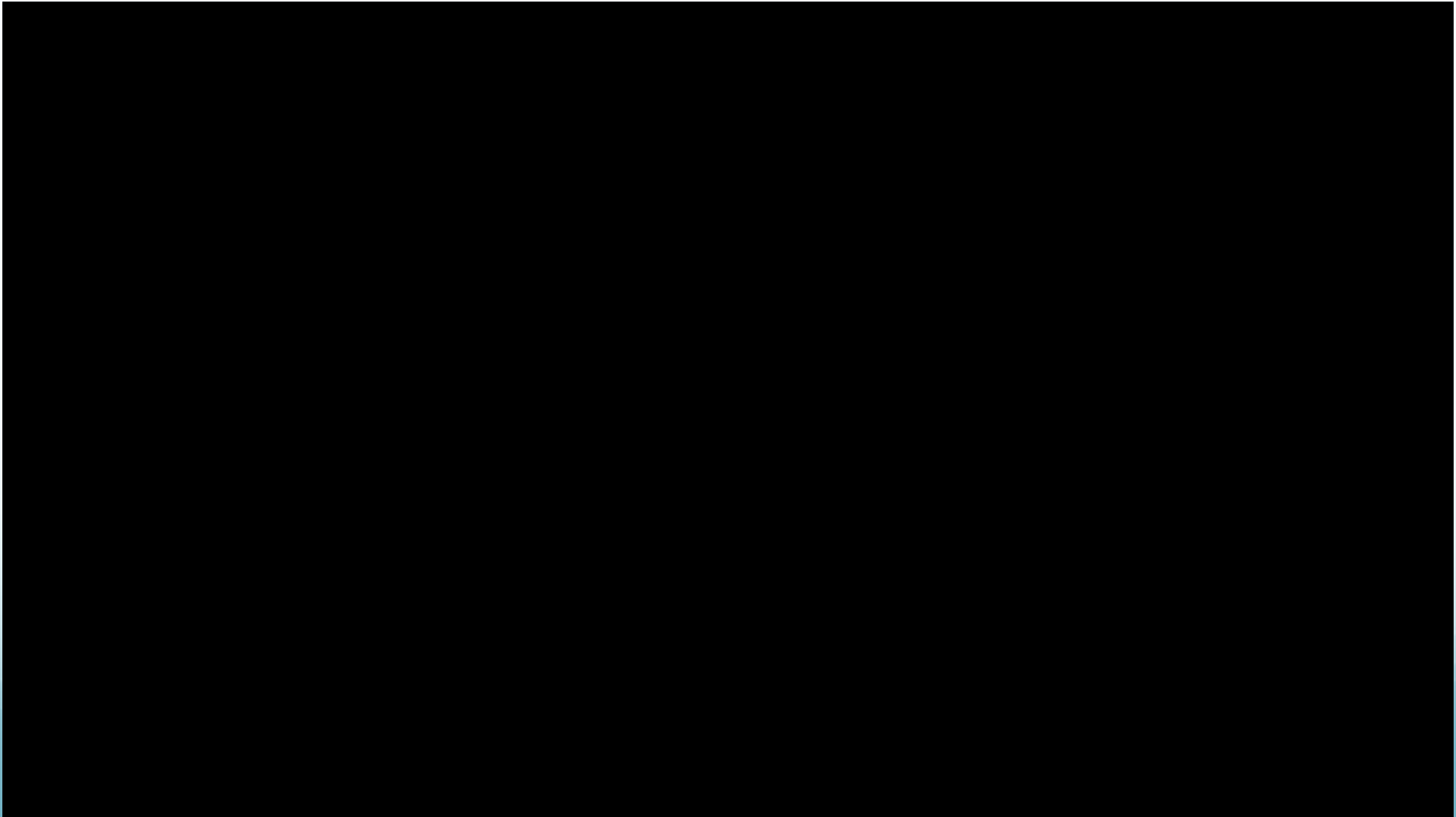


GATT wave





Wave after iStent





EVFW after iStent Inject





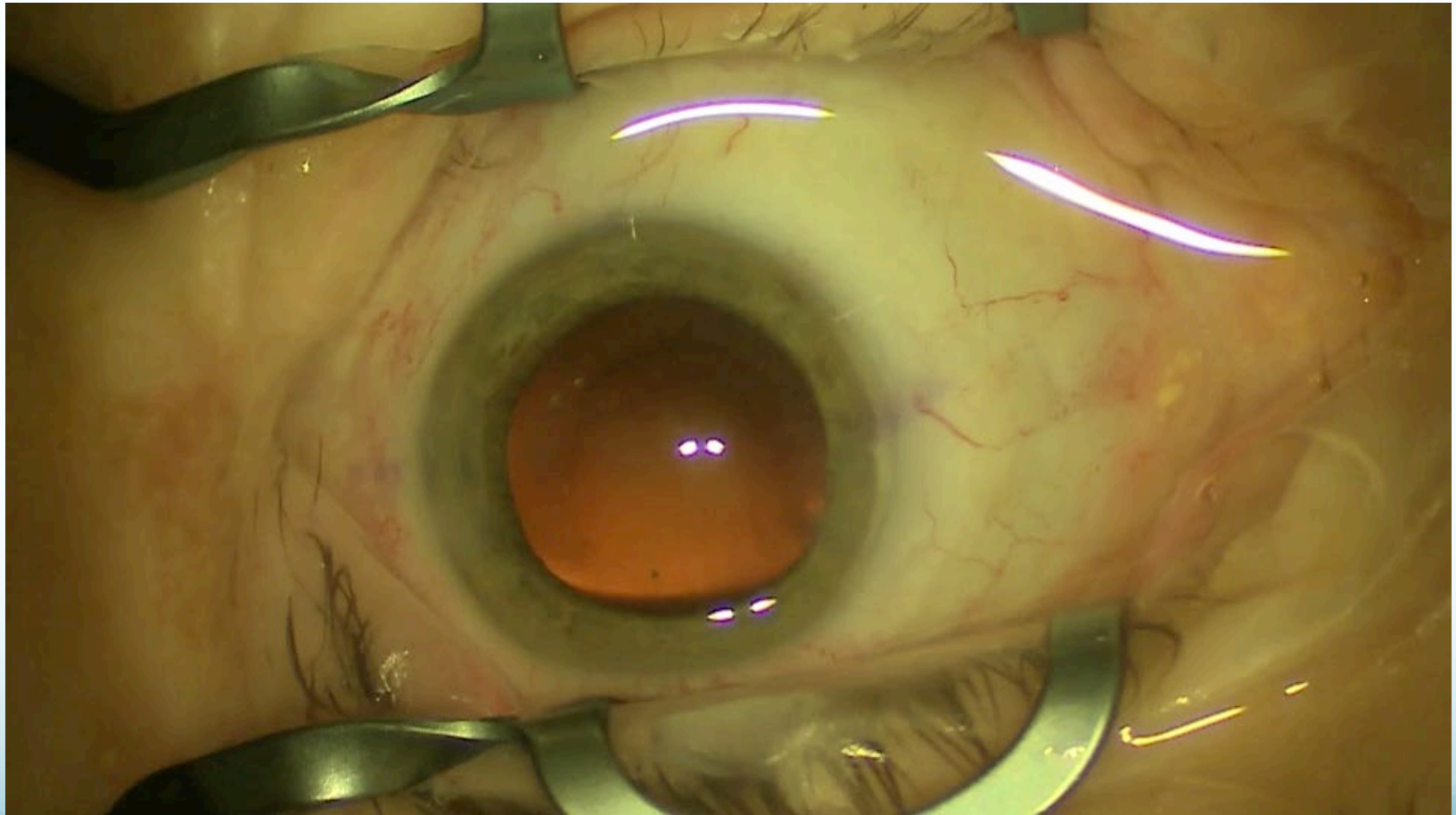
EVFW after Hydrus



EVFW after KDB Goniotomy



EVFW demonstrating Outflow patterns



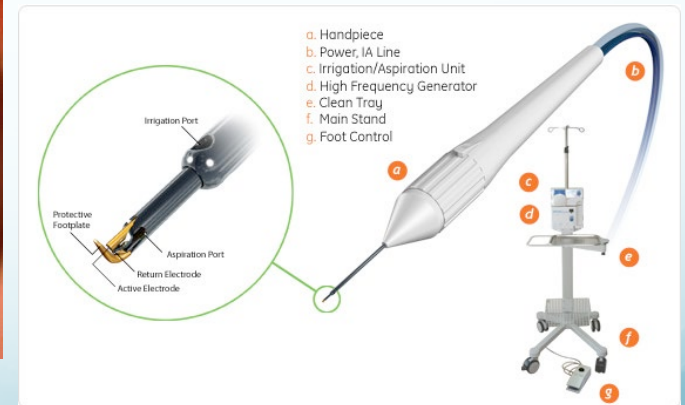
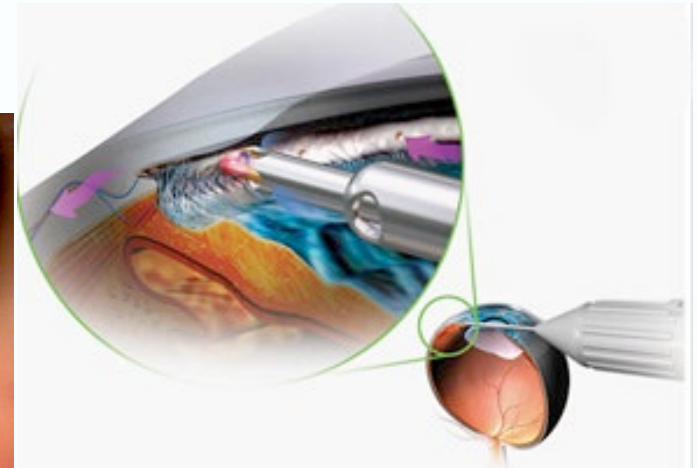
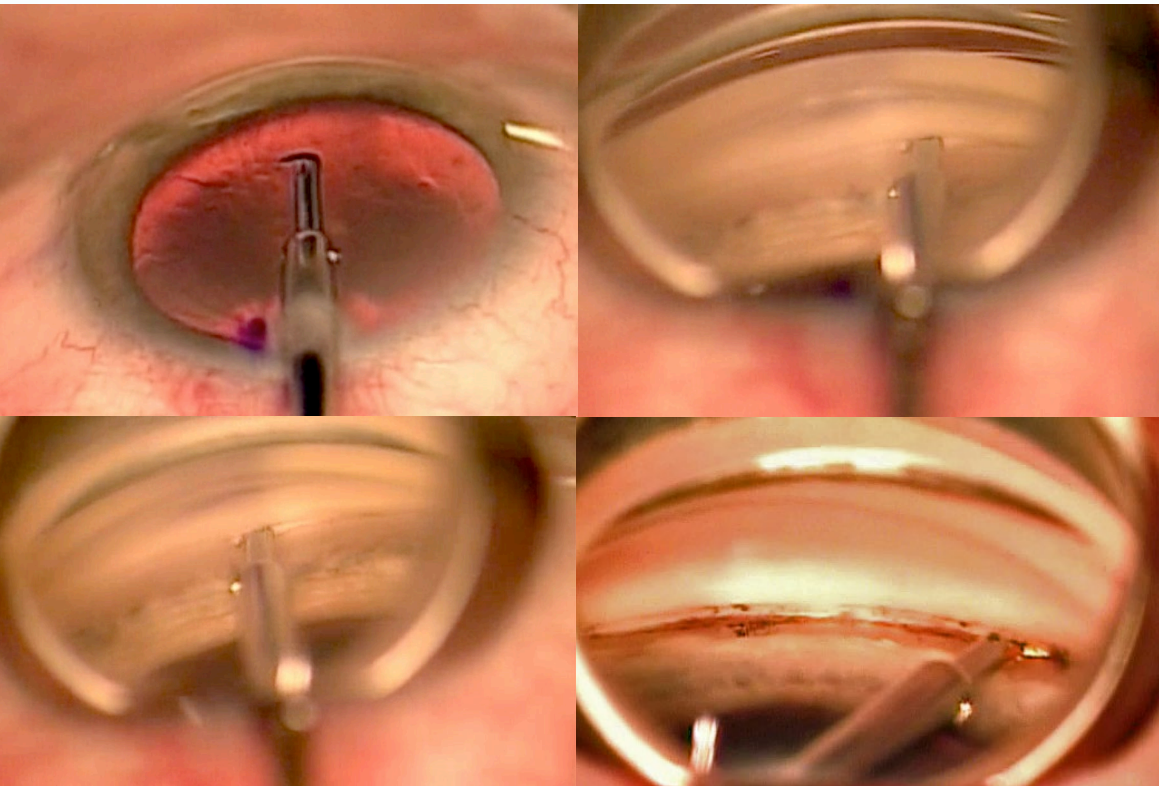


Question

Does presence or quality of EVFW correlate with surgical outcomes?



Trabectome

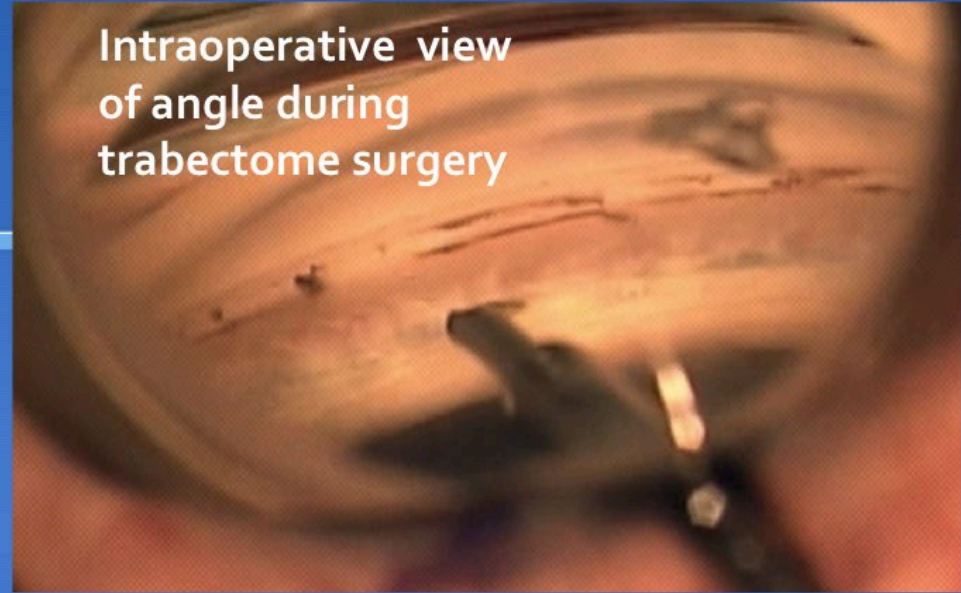


Trabectome

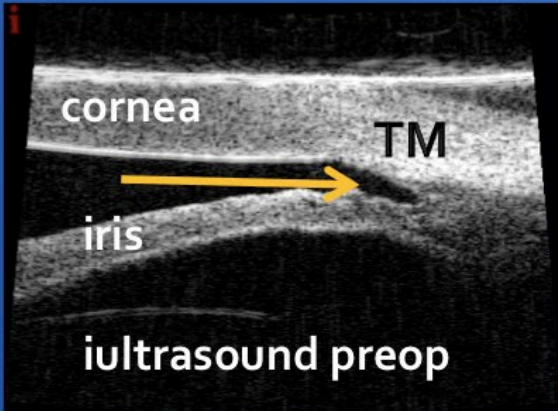
Preoperative view of angle with pigmented TM



Intraoperative view of angle during trabectome surgery

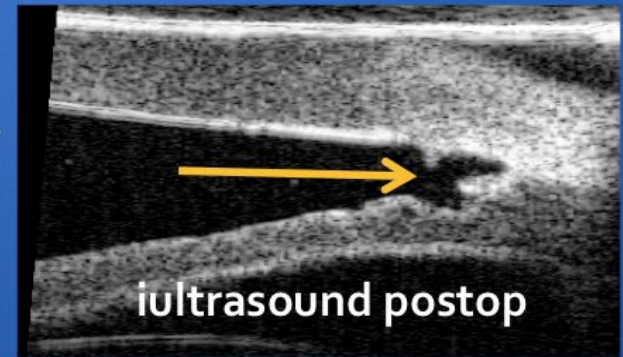


cornea
iris
ultrasound preop
TM



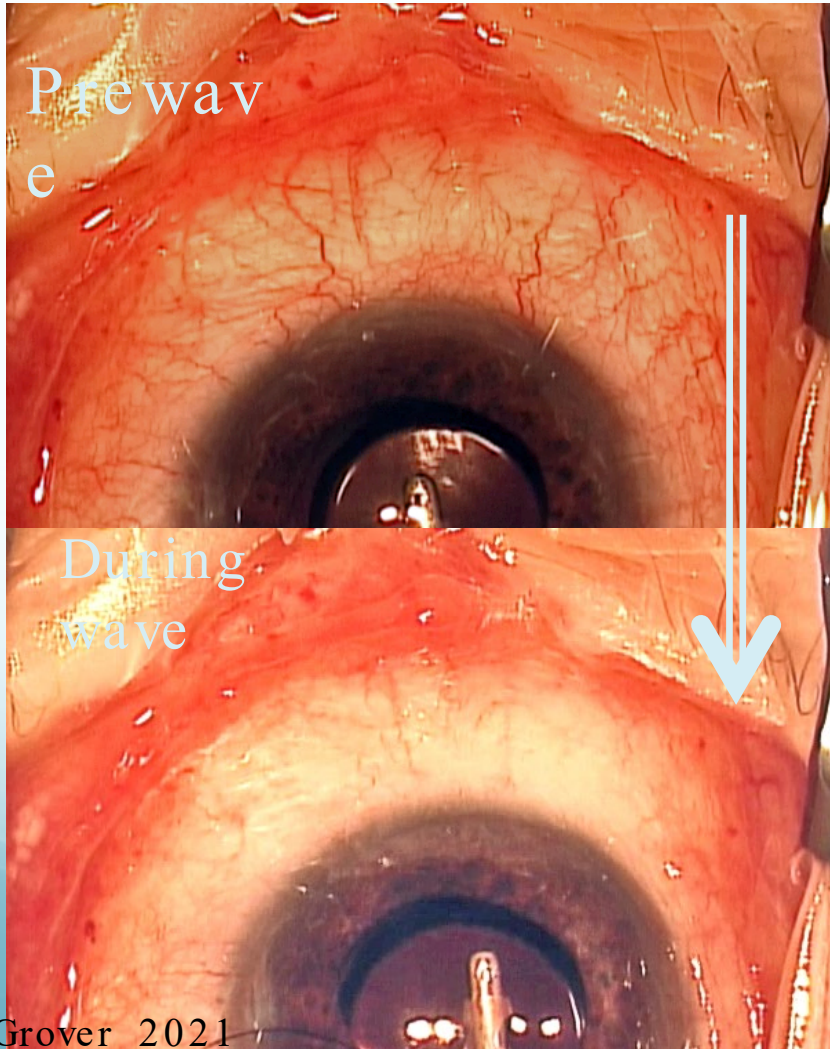
Trabectome is high frequency pulsed electro-surgery that selectively disrupts, ablates and aspirates a circumferential strip of TM and inner wall of SC.

ultrasound postop

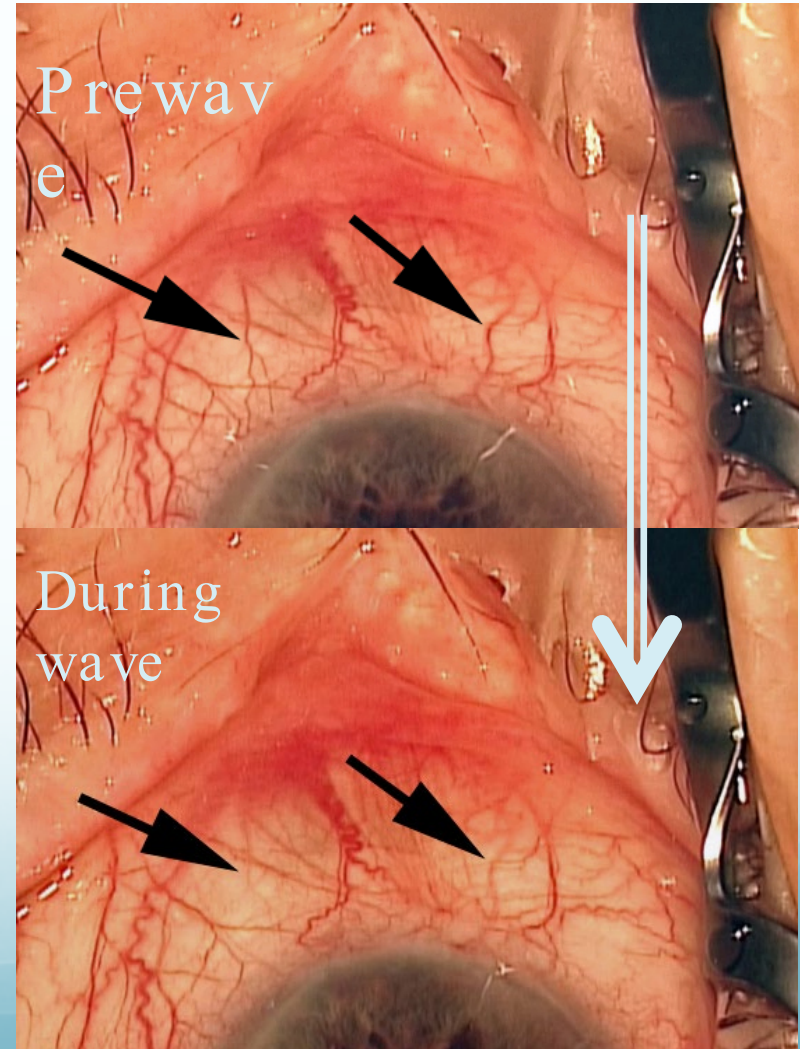


Goal: Study Patients with Diffuse vs Limited Wave after Trabectome

- Diffuse wave



- Limited Wave





Episcleral Venous Fluid Wave Correlates with Trabectome Outcomes

Intraoperative Evaluation of the Trabecular Outflow Pathway

Ronald L. Fellman, MD,¹ William J. Feuer, MS,² Davinder S. Grover, MD, MPH¹

Ophthalmology Volume 122, Number 12, December 2015



Correlation of EVFW and Trabectome Outcomes

- Purpose: To determine whether the characteristics of an intraoperative EVFW correlates with Trabectome outcomes.
- Methods: Retrospective Review of 68 eyes of 49 patients with glaucoma underwent phaco-Trabectome (63 eyes) or Trabectome alone (5 eyes).
- Main Outcome Measures: Degree and extent of EVFW, IOP and glaucoma medications.



Correlation of EVFW and Trabectome Outcomes

- Methods:
 - The EVFW was evaluated in a masked fashion for wave degree (0-4) and number of clock hours (0-6).
 - A diffuse EVFW (4,5,6 clock hours) was a near complete blanching of the episcleral vasculature and a poorly defined wave was minimal to no change in the episcleral vasculature.
 - Patients were grouped into wave categories of diffuse verses poorly defined EVFW to determine if there was a correlation with postoperative IOP.
 - Patients requiring further glaucoma surgery were considered failures.

Correlation between IOP, meds and outcomes for extensive vs minimal wave



- Baseline IOP: $19.3 \text{ mmHg} \pm 5.1$ on $2.7 \text{ meds} \pm 0.9$
- At 12 months:
 - Extensive EVFW (4,5,6 clock hours):
 - mean IOP $13.3 \text{ mmHg} \pm 2.7$ on 1.4 ± 1.2 medications
 - Poorly Defined EVFW:
 - Mean IOP $18.4 \pm 3.1 \text{ mmHg}$ on 2.9 ± 0.9 medications (both $p=0.001$).

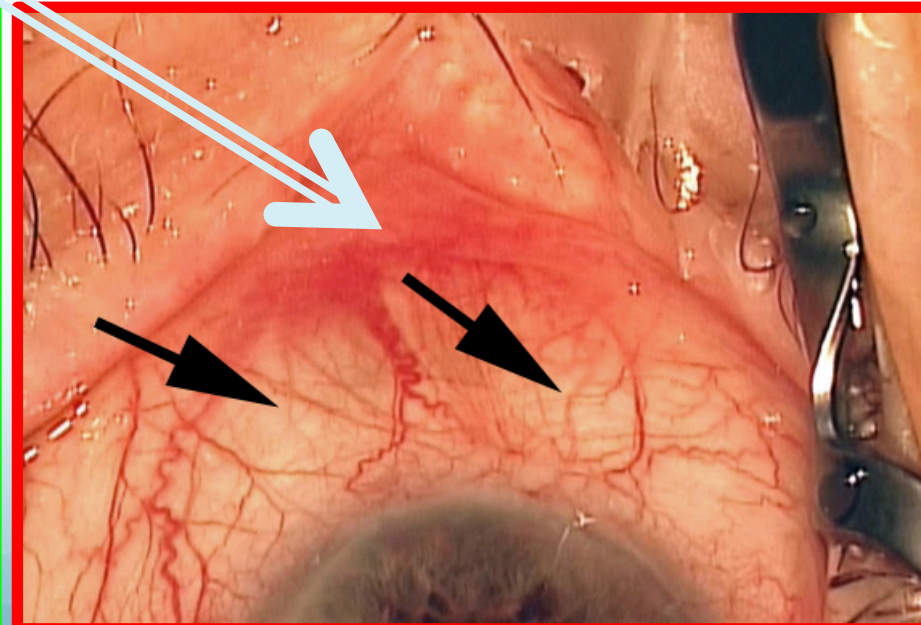
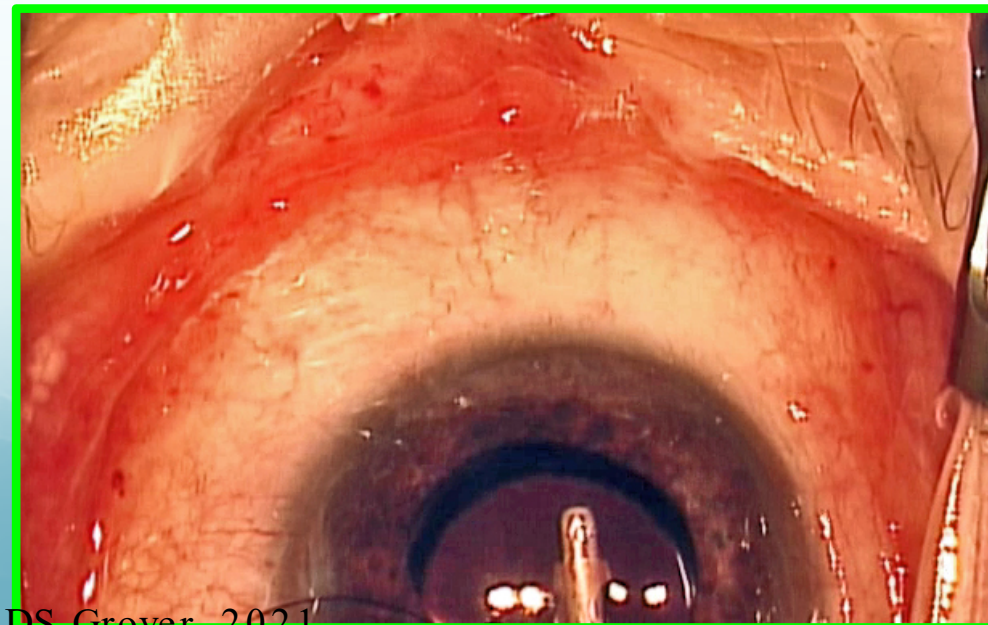
Extensive wave with marked blanching, 5 clock hours

Poorly defined wave with trace blanching, 0 to 1 clock hour



Failures

- Overall, 5/ 68 eyes (7%), required further glaucoma surgery.
- Eyes with a poorly defined EVFW had a much higher likelihood of further glaucoma surgery, 4 of 11 or 36%.





Conclusions

- EVFW is a reasonable intraoperative snapshot of the overall health of the conventional outflow system
 - correlated with an improved surgical outcome for Trabectome
- Absence of the EVFW implies obstruction in the intrascleral trabecular pathway, preventing flow to the visible episcleral veins.
 - Poor prognosis
 - the patient is more likely to require a new drainage system for the eye
- The characteristics of an EVFW may be able to prognosticate surgical outcomes following Trabectome and other angle based surgeries.



Implications

- At this time, there is no universal outcome marker for canal-based surgery, because it is difficult to visualize/measure enhanced aqueous flow into the venous collector channels
 - Perhaps the EVFW can play a role?
- Until we have the ability to reliably determine which patient would be best treated with canal-based glaucoma surgeries, glaucoma surgeons will likely continue to experience mixed results with MIGS.

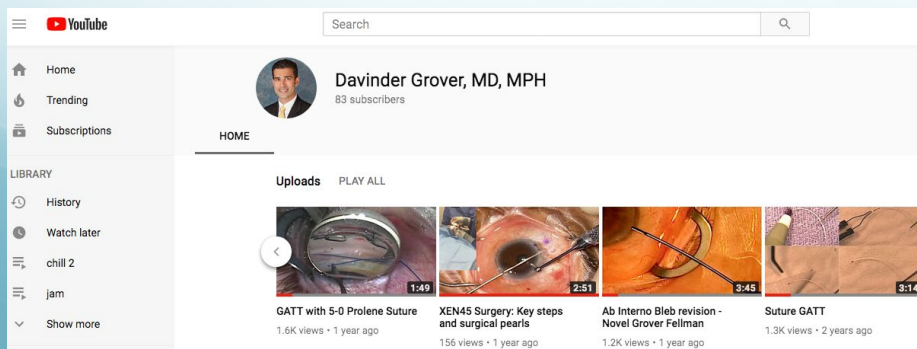


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Thank you for your time



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