Shooting Pearls:
SLT, LPI, and YAG Capsulotomy

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Selective Laser Trabeculoplasty

Selective Laser Trabeculoplasty

- Indications:
  - Ocular Hypertension (can SLT be used as first-line therapy?)
  - Desire to reduce number of topical medications
  - Topical medications not effective
  - Non-compliance with topical medications

Selective Laser Trabeculoplasty

- Determining who is a good candidate:
  - Higher vs. lower pre-treatment IOP
  - Current topical regimen

Selective Laser Trabeculoplasty

- Major Studies on SLT vs. drops:

- 2004 Lai, et. al.
- 2005 Nagar, et. al.
- 2006 McIlraith, et. al.
- 2009 Nagar, et. al.
- 2012 Katz, et. al.
- 2019 Gazzard, et. al.

Selective Laser Trabeculoplasty

- Five studies were analyzed by Li, et. al. and published in 2015

- “Conclusions: Both SLT and topical medication demonstrate similar success rates and effectiveness in lowering intraocular pressure in patients with open-angle glaucoma.”

Selective Laser Trabeculoplasty

- Gazzard et. al., 2019, *Selective laser trabeculoplasty versus eye drops for first-line treatment of ocular hypertension and glaucoma (LiGHT)*

- At 36 months, 74.2% of patients in the selective laser trabeculoplasty group required no drops to maintain intraocular pressure at target

- Glaucoma surgery was required in 11 patients in the eye drop group, but none in the SLT group

Selective Laser Trabeculoplasty

- Gazzard et. al., *Selective laser trabeculoplasty versus eye drops for first-line treatment of ocular hypertension and glaucoma (LiGHT)*

- "Interpretation: Selective laser trabeculoplasty should be offered as a first-line treatment for open angle glaucoma and ocular hypertension, supporting a change in clinical practice."

Selective Laser Trabeculoplasty

- At the 2018 ARVO Meeting, Gandolfi et. al. presented the long term results of their low power SLT vs conventional SLT and ALT study

- Group 1: 360° low power SLT (0.4 mJ, 50-60 spots), repeated annually

- Group 2: 360° conventional SLT, (70-80 spots, power increased from 0.5 mJ stepwise until an “air-bubble” was obtained; then, the power was lowered by one energy step) to be repeated PRN

- Group 3: 360° ALT, (50 m spot, 0.5 – 0.8 W, 70-90 spots) performed once, with no re-treatments allowed

Selective Laser Trabeculoplasty

- Gandolfi et. al.:

- 10 years after treatment, percentage of each group that did not require medication:
  - 58% (Group A)
  - 25% (Group B)
  - 23% (Group C)

Selective Laser Trabeculoplasty

- Gandolfi et. al.:
- Meantime to medication was:
  - 6.2 years (Group A)
  - 3.2 years (Group B)
  - 2.8 years (Group C)

Selective Laser Trabeculoplasty

- Gandolfi et. al.:

- Conclusions: An SLT low-power treatment / re-treatment schedule, timed yearly, performed better than both a conventional SLT PRN schedule and an ALT in

  - (a) delaying the need for medications and

  - (b) medication requirement to control IOP in OAG eyes

Selective Laser Trabeculoplasty

- In light of these finding, a pair of multicenter randomized trials to evaluate outcomes of SLT performed annually at low energy are currently in the pre-enrollment phase

- These trials—collectively named the Clarifying the Optimal Application of SLT Therapy (COAST) trial—were funded in late 2020 by NEI to compare standard versus low-energy primary SLT and annual versus pro re nata (PRN) repeat SLT

Selective Laser Trabeculoplasty

- Advantages of SLT as a first-line treatment
  - Better compliance, leading to less IOP fluctuation
  - Patient convenience
  - Overall cost to the healthcare system

Selective Laser Trabeculoplasty

- SLT vs. Latanoprost 1 year cost comparison:
- CPT 65855, bilateral code, Medicare reimbursement: $250.53
- Latanoprost 2.5 ml: $61.99
- Approximately 14.6 bottles per year for bilateral therapy: $905.05

Selective Laser Trabeculoplasty

- Consider:
  - SLT as first-line therapy
  - Low-power SLT repeated annually

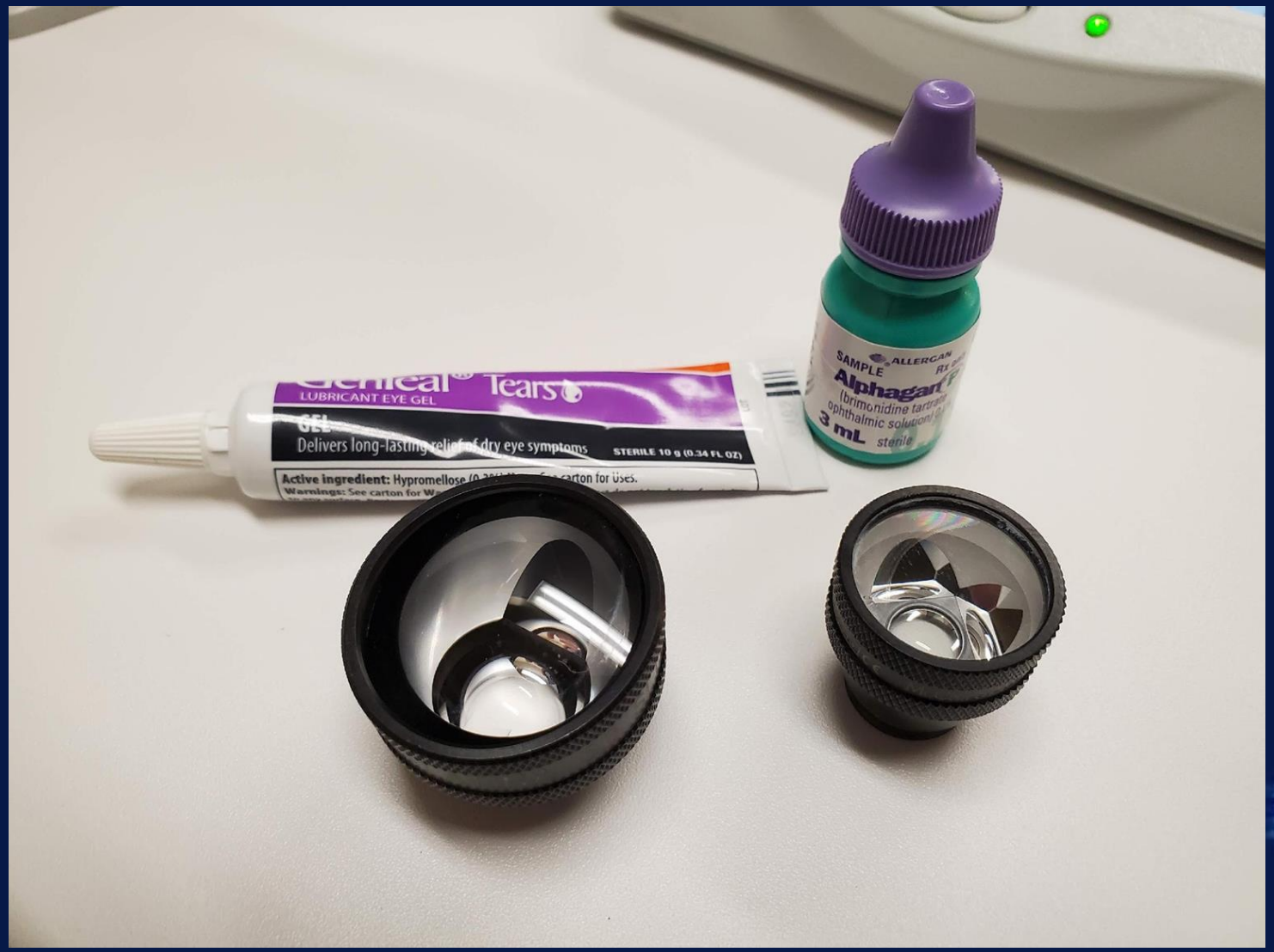
Selective Laser Trabeculoplasty

- Pre-procedure
  - IOP
  - Gonioscopy with focus on:
    - Most posterior structure seen in each quadrant
    - Degree of pigment in the trabecular meshwork
  - Brimonidine ~ 20 min prior to procedure

Selective Laser Trabeculoplasty

Selective Laser Trabeculoplasty

Selective Laser Trabeculoplasty



Selective Laser Trabeculoplasty

Selective Laser Trabeculoplasty

Selective Laser Trabeculoplasty

- Procedure
  - Traditional
    - 0.5-1.0 mJ titrated to first seen “champagne bubbles”, 100-120 shots, 360 degrees OU
    - Repeat PRN
  - Low Power
    - 0.4 mJ, 50-60 shots, 360 degrees OU
    - Repeat annually

Selective Laser Trabeculoplasty

- Post-procedure
  - Brimonidine immediately following procedure
  - IOP check, 20-60 minutes post procedure
  - Oral nsaids prn
  - 1 week – check for inflammation and elevated IOP
  - 6 weeks – monitor treatment efficacy

Laser Peripheral Iridotomy

Laser Peripheral Iridotomy

- Indication
  - Acute angle closure
  - History of angle closure
  - Anatomically narrow angles
    - (1) Gonioscopy - trabecular meshwork not visible in 2 or more quadrants
    - (2) Angle measurement with anterior segment OCT is < 15 degrees

Laser Peripheral Iridotomy

Therapeutic **Review**

Reconsidering LPI

It remains the go-to treatment for chronic angle-closure glaucoma, but are others worth looking into? **By Joseph W. Sowka, OD**

A 78-year-old Caucasian female came in for a routine comprehensive eye examination. She was only correctable to 20/100 OD and 20/60 OS. The main culprit, as had been noted the year prior, was cataracts. She was scheduled for cataract surgery last year but had cancelled since she felt that she didn't need it. Indeed, she still felt fine and had no problems with her vision despite the reduced acuity. Her refraction was essentially unchanged and didn't improve her acuity.

Notably, she was a moderate hyperope in the +2.75D range in each eye with mild astigmatism. Her intraocular pressures (IOP) were

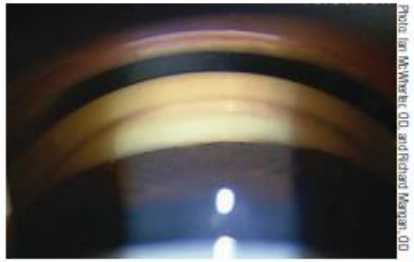


Photo: Ian McWherter, OD, and Richard Mangan, OD

This semi-narrow angle patient is a candidate for LPI.

The Angle Closure Spectrum

Historically, the term narrow angle glaucoma has been used to connote eyes either at risk of impending angle closure or those actually experiencing it. Though this term is still used today, it is more appropriate to speak in current

contrast to the suspect, these eyes will have either PAS, elevated IOP or both. But there still is no disc damage or visual field loss. In these eyes, LPI is recommended.

The third category is primary angle-closure glaucoma that has all the features mentioned previously for primary angle closure but, additionally, has progressed to involve glaucomatous neuropathy and often visual field loss as well. In this situation, LPI is also recommended.

The final category is the well-known primary angle-closure attack, with near complete apposition of the iris to the pigmented trabecular meshwork. Its classic signs and symptoms include redness, vision loss, nausea, emesis, halos, corneal

Sowka, Review of Optometry, Dec 2020

Laser Peripheral Iridotomy

- “Historically, the term narrow angle glaucoma has been used to connote eyes either at risk of impending angle closure or those actually experiencing it. Though this term is still used today, it is more appropriate to speak in current terms of angle closure and assign eyes to one of four categories.”

Sowka, Review of Optometry, Dec 2020

Laser Peripheral Iridotomy

- Category I: pigmented TM not visible for 180^{o}, no PAS, normal IOP, ONH, and VF
- Category II: pigmented TM not visible for 180^{o}, PAS and/or elevated IOP, ONH, and VF
- Category III: pigmented TM not visible for 180^{o}, PAS and/or elevated IOP, ONH damage and/or VF loss
- Category IV: primary angle-closure attack

Sowka, Review of Optometry, Dec 2020

Laser Peripheral Iridotomy

- Category I: LPI or observation?
- Category II: LPI recommended
- Category III: LPI recommended
- Category IV: LPI recommended

Sowka, Review of Optometry, Dec 2020

Laser Peripheral Iridotomy

He, et. al., *Lancet* 2019

Laser peripheral iridotomy for the prevention of angle closure: a single-centre, randomised controlled trial

Mingguang He, Yuzhen Jiang, Shengsong Huang, Dolly S Chang, Beatriz Munoz, Tin Aung, Paul J Foster, David S Friedman**

Summary

Background Primary angle-closure glaucoma affects 20 million people worldwide. People classified as primary angle closure suspects have a higher but poorly quantified risk of developing glaucoma. We aimed to assess efficacy and safety of laser peripheral iridotomy prophylaxis against primary angle-closure glaucoma in Chinese people classified as primary angle closure suspects.

Methods In this randomised controlled trial, bilateral primary angle closure suspects aged 50–70 years were enrolled at the Zhongshan Ophthalmic Center, a tertiary specialised hospital in Guangzhou, China. Eligible patients received laser peripheral iridotomy in one randomly selected eye, with the other remaining untreated. The primary outcome was incident primary angle closure disease as a composite endpoint of elevation of intraocular pressure, peripheral anterior synechiae, or acute angle-closure during 72 months of follow-up in an intention-to-treat analysis between treated eyes and contralateral controls. This trial is registered with the ISRCTN registry, number ISRCTN45213099.

Findings Of 11991 screened individuals, 889 individuals were randomly assigned from June 19, 2008 (889 treated and 889 untreated eyes). Incidence of the primary outcome was 4·19 per 1000 eye-years in treated eyes compared with 7·97 per 1000 eye-years in untreated eyes (hazard ratio 0·53; 95% CI 0·30–0·92; p=0·024). A primary outcome event occurred in 19 treated eyes and 36 untreated eyes with a statistically significant difference using pair-wise analysis (p=0·0041). No serious adverse events were observed during follow-up.

Interpretation Incidence of angle-closure disease was very low among individuals classified as primary angle closure suspects identified through community-based screening. Laser peripheral iridotomy had a modest, albeit significant, prophylactic effect. In view of the low incidence rate of outcomes that have no immediate threat to vision, the benefit of prophylactic laser peripheral iridotomy is limited; therefore, widespread prophylactic laser peripheral iridotomy for primary angle-closure suspects is not recommended.

Lancet 2019; 393: 1609–18

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Laser Peripheral Iridotomy

He, et. al., *Lancet* 2019

- 889 bilateral primary angle closure suspects aged 50-70 years were enrolled

- One eye of each patient was selected for treatment, and the other remaining untreated

Laser Peripheral Iridotomy

He, et. al., *Lancet* 2019

- The primary outcome was the incidence of primary angle closure by eyes by 72 months, defined as the composite of three study endpoints:
- (1) intraocular pressure measurements above 24 mm Hg on two separate occasions; or
- (2) development of at least one clock hour of peripheral anterior synechiae in any quadrant; or
- (3) an episode of acute angle closure

Laser Peripheral Iridotomy

He, et. al., *Lancet* 2019

- Incidence of an angle closure event:

- 4.19 per 1000 eye-years in treated eyes
- 7.97 per 1000 eye-years in untreated eyes

- This correlates to a 47% risk reduction in treated eyes, however:

- The rate of developing any angle closure endpoint in primary angle closure suspects' eyes was 1% per year

The impact of pharmacological dilation on intraocular pressure in primary angle closure suspects

Article in Press: Accepted Manuscript

Lanhua Wang MD, Wenyong Huang MD, Xiaotong Han MD, Chimei Liao MD, Ling Jin MS and Mingguang He MD, PhD

ABSTRACT

Purpose

: To assess changes in intraocular pressure (IOP) 1 hour after pharmacological dilation in eyes treated with laser peripheral iridotomy (LPI) and untreated fellow eyes of primary angle closure suspects (PACS).

Design

: Randomized, fellow-eye controlled trial

Methods

: A total of 889 PACS participants aged 50 to 70 years with LPI in one randomly selected eye and a fellow untreated eye were included. All participants underwent comprehensive examinations before and at 2 weeks, 6 m, 18 m, 36 m, 54 m, and 72 m after LPI. IOP was measured using Goldmann applanation tonometry before and 1 hour after pharmacological dilation.

Results

: The mean pre-dilation IOP in the untreated eyes was 14.8±2.7 mmHg, which increased to 16.4±2.7 mmHg after pharmacological dilation (p <0.001). The treated and untreated eyes had similar pre-dilation and post-dilation IOP (all p >0.05). The average post-dilation IOP elevation was 1.5 mmHg in the treated eyes and 1.6 mmHg in the untreated eye without significant differences (p =0.802). Lower pre-dilation IOP (p <0.001), smaller AOD500 (p =0.001), smaller ARA500 (p =0.030), smaller TISA500 (p =0.043), and larger Iarea(p <0.001) were associated with post-dilation IOP elevation 5 mmHg and greater. Three untreated (1.04 per 1000 pupil dilation) and one treated eye (0.34 per 1000 pupil dilation) developed acute angle closure (AAC) after dilation during the 72 m follow-up.

Conclusions

: Post-dilation IOP elevation is similar among treated and untreated eyes, and the risk of developing AAC is very low even among PACS. Routine LPI before pupil dilation for PACS people is not recommended.

Laser Peripheral Iridotomy

Azuara-Blanco, et. al., *Lancet* 2016

Effectiveness of early lens extraction for the treatment of primary angle-closure glaucoma (EAGLE): a randomised controlled trial

Augusto Azuara-Blanco, Jennifer Burr, Craig Ramsay, David Cooper, Paul J Foster, David S Friedman, Graham Scotland, Mehdi Javanbakht, Claire Cochrane, John Norrie, for the EAGLE study group

Summary

Background Primary angle-closure glaucoma is a leading cause of irreversible blindness worldwide. In early-stage disease, intraocular pressure is raised without visual loss. Because the crystalline lens has a major mechanistic role, lens extraction might be a useful initial treatment.

Methods From Jan 8, 2009, to Dec 28, 2011, we enrolled patients from 30 hospital eye services in five countries. Randomisation was done by a web-based application. Patients were assigned to undergo clear-lens extraction or receive standard care with laser peripheral iridotomy and topical medical treatment. Eligible patients were aged 50 years or older, did not have cataracts, and had newly diagnosed primary angle closure with intraocular pressure 30 mm Hg or greater or primary angle-closure glaucoma. The co-primary endpoints were patient-reported health status, intraocular pressure, and incremental cost-effectiveness ratio per quality-adjusted life-year gained 36 months after treatment. Analysis was by intention to treat. This study is registered, number ISRCTN44464607.

Findings Of 419 participants enrolled, 155 had primary angle closure and 263 primary angle-closure glaucoma. 208 were assigned to clear-lens extraction and 211 to standard care, of whom 351 (84%) had complete data on health status and 366 (87%) on intraocular pressure. The mean health status score (0·87 [SD 0·12]), assessed with the European Quality of Life-5 Dimensions questionnaire, was 0·052 higher (95% CI 0·015–0·088, p=0·005) and mean intraocular pressure (16·6 [SD 3·5] mm Hg) 1·18 mm Hg lower (95% CI –1·99 to –0·38, p=0·004) after clear-lens extraction than after standard care. The incremental cost-effectiveness ratio was £14 284 for initial lens extraction versus standard care. Irreversible loss of vision occurred in one participant who underwent clear-lens extraction and three who received standard care. No patients had serious adverse events.

Lancet 2016; 388: 1389–97

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Centre for Public Health, Queen's University Belfast, Belfast, UK (Prof A Azuara-Blanco PhD); **School of Medicine, University of St Andrews, St Andrews, UK** (J Burr MD); **Health Services Research Unit** (Prof C Ramsay PhD, D Cooper PhD, G Scotland PhD, C Cochrane MSc, Prof J Norrie PhD), **Health Economics Research Unit** (G Scotland, M Javanbakht PhD), **and Centre for Health Care Randomised Trials** (Prof J Norrie), **University of Aberdeen, Aberdeen, UK; NIHR Biomedical Research Centre, Moorfields Eye Hospital and University College London, UK** (Prof P J Foster PhD); **and**

Laser Peripheral Iridotomy

Azuara-Blanco, et. al., *Lancet* 2016

- Eligible patients were aged 50 years or older, did not have cataracts, and had newly diagnosed primary angle closure with intraocular pressure 30 mm Hg or greater or primary angle-closure glaucoma

- Patients were assigned to undergo clear-lens extraction or receive standard care with laser peripheral iridotomy and topical medical treatment

- Interpretation: “Clear-lens extraction showed greater efficacy and was more cost-effective than laser peripheral iridotomy, and should be considered as an option for first-line treatment”

Laser Peripheral Iridotomy

- Consider:

- Monitoring patients with narrow angles and no other risk factors

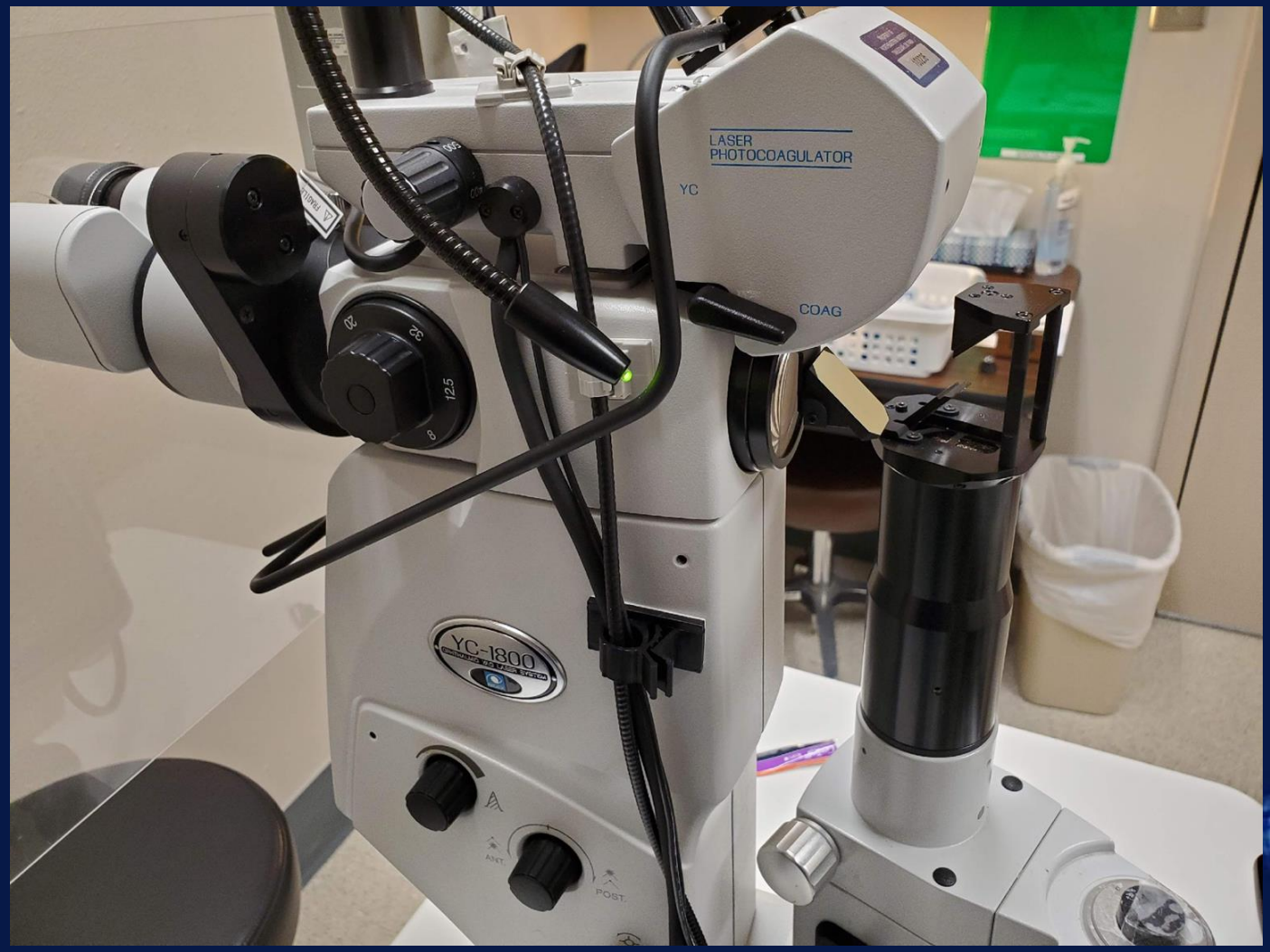
- Clear-lens extraction for older patients

Laser Peripheral Iridotomy

- Pre-procedure
  - Brimonidine ~ 20 min prior to procedure
  - Pilocarpine 1%

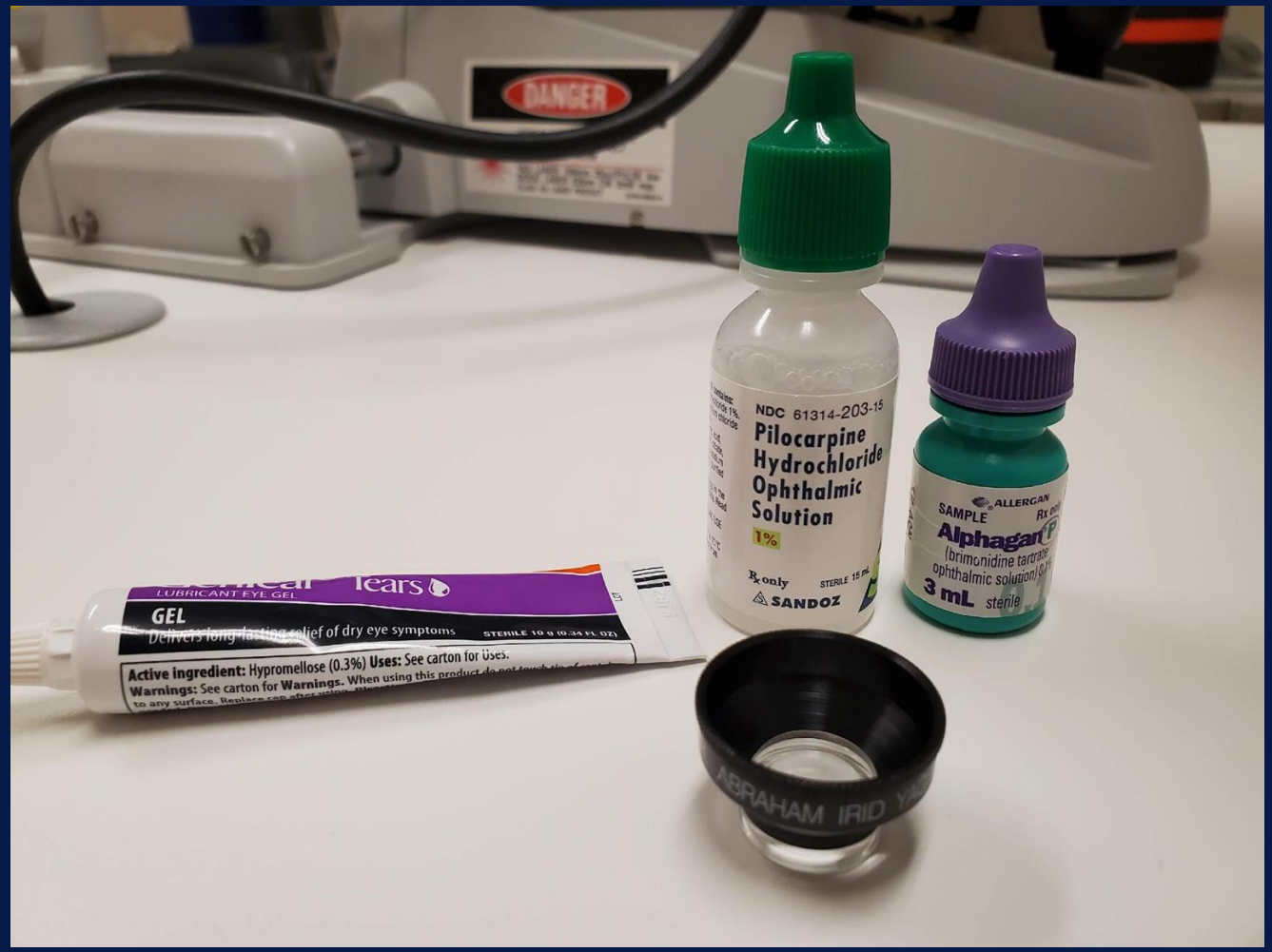
Laser Peripheral Iridotomy

Laser Peripheral Iridotomy



Laser Peripheral Iridotomy

Laser Peripheral Iridotomy



Laser Peripheral Iridotomy

Laser Peripheral Iridotomy

- Procedure
  - Pre-treat more pigmented irises with argon laser first
    - 12 shots in a petalloid pattern, total area no more than 1 mm in diameter
    - Able to get through with fewer shots and lower energy later with YAG laser
    - Reduced the risk of hemorrhage
  - PI placement 11 or 1 o'clock vs 3 or 9 o'clock
  - Power
    - 3-4 mJ single pulse
    - Can go as high as 5 mJ triple pulse

Laser Peripheral Iridotomy

- Post-procedure
  - Brimonidine immediately following procedure
  - IOP check, 20-60 minutes after procedure
  - Pred-forte qid or Durezol bid x 7 days
  - RTC 1 week
    - IOP
    - Check for patency - retroillumination
    - Anterior segment OCT

YAG Capsulotomy

YAG Capsulotomy

- Indication
  - Medicare guidelines
  - Decreased acuity
  - Patient symptoms
  - Appearance of capsule

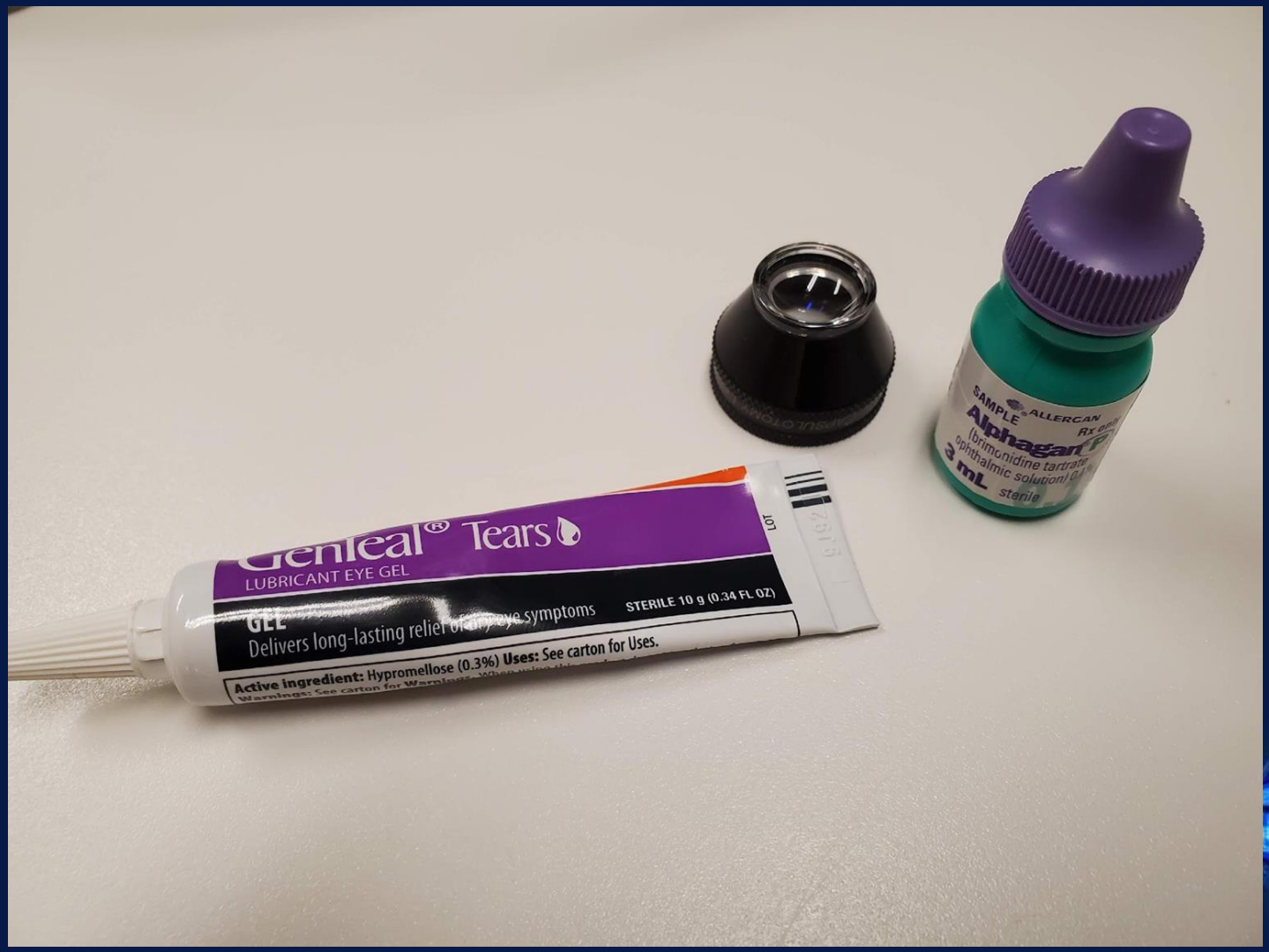
YAG Capsulotomy

- Pre-procedure
  - IOP
  - Document size and location of the pupil
  - Dilated fundus examination
  - Brimonidine ~ 20 min prior to procedure

YAG Capsulotomy

YAG Capsulotomy

YAG Capsulotomy



YAG Capsulotomy

YAG Capsulotomy

- Procedure
  - 1.0-1.3 mJ single pulse
  - Cruciate pattern

YAG Capsulotomy

- Post-procedure
  - Brimonidine immediately following procedure
  - IOP check, 20-60 minutes post procedure
  - Pred-forte qid or Durezol bid x 7 days
  - 1 week – check for inflammation and elevated IOP, dilate and check for any signs of holes, tears, or detachments, and well as ensuring capsular opening is complete

Thank You