

Cataract extraction as primary treatment for narrow angle glaucoma

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Abstract

Purpose: To compare the increase in anterior chamber depth (ACD) after cataract extraction/ lensectomy (CE) vs. laser peripheral iridotomy (LPI) in patients with narrow angles (NA) and narrow angle glaucoma (NAG). Effect on intraocular pressure (IOP) and cost was also evaluated.

Materials and methods: The Lenstar was used to measure ACD prior to and after cataract extraction and prior to and after LPI in patients with narrow angles. Fifty-four (54) eyes with narrow angles underwent CE and eighteen (18) eyes underwent LPI. Three (3) eyes had LPI with subsequent CE. Pre- and post-surgical IOP were also measured.

Results: The mean ACD in eyes undergoing LPI was 2.74 mm before and 2.81 mm after surgery. Mean ACD in eyes undergoing CE was 2.54 mm before and 4.12 mm after surgery. In patients undergoing LPI and subsequent CE mean ACD measured 2.65 mm before LPI, 2.67mm after LPI and 3.92mm after CE. Mean IOP was 21 mmHg before LPI and 18 mmHg after LPI. Mean IOP was 17 mmHg before CE and 15mmHg after C.E.

Conclusion: Mean ACD increases significantly more after CE than LPI and should be considered as a primary treatment for patients with NAG and NA in danger of closure.

Introduction

Anatomical narrow angle is a precursor to acute and/or chronic angle closure and angle closure glaucoma. Acute angle closure is an ocular emergency that may be stabilized medically but is ultimately a surgical disease. Patients in acute angle closure (AAC) may have painful red eyes, tearing, blurred vision from corneal edema, halos around lights, circumferential injection, nausea, vomiting, headache, and fixed mid-dilated pupil [1]. A patient at the local Veteran's Affairs medical center described the pain from AAC to be more severe than the combination of being shot and stabbed. ACG is more common with increasing age and in females, hyperopes, Asians, East Indians, and the Inuit Eskimo population [1].

ACG is a surgical disease and has historically been treated with Laser peripheral iridoplasty (LPI). Laser iridoplasty or goniotomy may be used as a temporary measure and lower IOP but are not considered primary standard of care. In emergency situations where IOP is severely elevated and unresponsive to medications anterior chamber paracentesis may also be performed. Trabeculectomy may be required after failed LPI or with uncontrolled glaucoma with patent LPI [1].

Materials and methods

Patients with narrow angles were reviewed pre-and post LPI as well as pre and post cataract extraction. Van Herrick method via slit lamp examination was used initially to determine if patients had narrow angles. Gonioscopy and anterior chamber angle OCT was performed to confirm the narrowness of the angle. Patients were considered to have narrow angles if trabecular meshwork or scleral spur was not noted in any quadrant.

The Lenstar was used to measure Anterior Chamber depth (ACD) prior to and after cataract extraction (CE) and prior to and after LPI in

patients with narrow angles. Fifty-four (54) eyes with narrow angles underwent CE and eighteen (18) eyes underwent LPI. Three (3) eyes had LPI with subsequent CE. Pre and post- surgical IOP were also measured.

Results

We reviewed the outcomes of 54 eyes with narrow angle that underwent CE (Table 1) and compared them to 18 similar eyes that had the traditional treatment of LPI in our office (Table 2). We also looked at 3 eyes that had LPI and later underwent CE (Table 3).

ACD in the 18 LPI eyes ranged from 2.31mm to 3.13mm pre-LPI and from 2.39mm to 3.16mm post-LPI. Mean ACD was 2.74 mm pre-LPI and 2.81 mm post-LPI. ACD was increased 0.07 mm in this group. IOP ranged from 11 mmHg to 46 mmHg pre-LPI to 11 to 32mmHg post-LPI. Mean IOP was 21 mmHg pre-LPI and 18mmHg post-LPI.

ACD in the 54 CE eyes ranged from 2.16mm to 3.37mm pre-CE to 2.97mm to 5.32mm post-CE. Mean ACD was increased from 2.47 mm pre-CE to 4.10 mm post-CE. ACD was increased 1.58 mm in this group. IOP ranged from 10mmHg to 31mmHg pre-CE to 9mmHg to 23mmHg post-CE. Mean IOP was 17mmHg pre-and 15mmHg post-CE.

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Table 1. Pre and post CE

Patient No.	Eye	ACD _{Before}	ACD _{After}	IOP _{Before}	IOP _{After}
66502	OD	3.01	3.06	16	20
66502	OS	2.89	2.97	19	17
68839	OD	2.6	4.64	12	12
82176	OS	2.23	3.77	22	20
77530	OD	2.43	4.1	11	14
77530	OS	2.44	4.4	15	13
66318	OS	2.67	3.77	20	19
68438	OD	2.23	5.32	12	9
68438	OS	2.32	5.08	10	10
77861	OD	2.45	4.14	28	14
77861	OS	2.25	5.02	31	22
67943	OD	2.29	3.8	16	14
67943	OS	2.39	3.7	17	14
68554	OD	2.4	4.33	27	13
68554	OS	2.36	4.3	24	13
67381	OD	2.18	3.99	11	11
13500	OS	2.76	4.62	14	12
68832	OD	2.26	4.01	17	16
68832	OS	2.36	3.64	17	16
28047	OD	3.07	4.25	18	14
28047	OS	3.06	4.72	19	17
38015	OD	2.65	3.34	15	18
38015	OS	2.74	2.97	18	19
60462	OD	2.66	3.27	22	22
60462	OS	2.67	4.03	21	22
78044	OD	2.44	3.13	16	13
67784	OD	2.27	4.12	15	11
67784	OS	2.31	4.04	14	11
80258	OS	2.47	3.96	15	13
79267	OS	2.26	4.17	15	12
80218	OS	2.16	4.43	15	10
78868	OS	2.41	3.82	13	21
78208	OD	2.55	4.37	14	10
78208	OS	2.62	4.42	15	10
80954	OS	2.41	4.01	18	18
83731	OD	2.31	5.09	25	16
82211	OD	2.59	4.2	14	15
82266	OD	3.08	4.08	15	18
54034	OS	2.5	4.77	16	13
81565	OD	2.45	3.58	11	12
66922	OS	2.48	4.47	24	16
67943	OD	2.29	3.8	16	14
67943	OS	2.39	3.77	17	14
66791	OD	2.41	4.8	16	12
66791	OS	2.83	4.17	16	12
66252	OD	2.37	3.92	17	16
63046	OD	2.82	5.29	15	12
63046	OS	2.58	5.2	20	14
67900	OD	2.53	3.41	10	11
67900	OS	2.58	3.53	15	12
65967	OD	2.48	3.34	20	18
66628	OD	3.37	4.72	23	21
66628	OS	3.34	4.5	23	23
66178	OD	2.86	4.14	12	10

In patients undergoing LPI and later CE, the mean ACD was 2.65mm pre-LPI to 2.67mm post-LPI to 3.92mm post CE in the 3 eyes that underwent both procedures. IOP was 14 mmHg pre-LPI, 17mmHg post-LPI and 15mmHg post-CE.

Discussion

Acute angle closure is an ocular emergency that may be stabilized medically but is ultimately a surgical disease. Historically, it has been treated with IOP lowering drops, LPI, or goniotomy.

However, LPI is not always successful or without an occasional complication. Some studies show that one-third (1/3) of argon and 9% of YAG LPIs close requiring a repeat LPI. IOP is elevated higher than 21 mmHg one to three years after LPI in 64% of eyes. Anterior lens opacities are also noted in up to 45% of eyes after LPI [2]. An article in Review of Ophthalmology reported that about 30% of eyes still have narrow or closed angles after LPI [3]. Also, some patients report bothersome streaks of light in their vision after LPI [4].

According to Adler's, the physiological lens changes thickness from 4.0mm at age 20 to 4.7mm at 60 years of age [5]. As it increases in thickness it pushes the iris forward resulting in a shallower anterior chamber with narrowing or occluding of the anatomical angle. An LPI may create a "by-pass" to the angle but does not significantly deepen the chamber (Figures 1 and 2). Angles may remain narrow or occluded. Exchanging a thicker physiological lens for a thinner IOL via lensectomy definitively deepens the angle, as shown by our study (Figure 3). It eliminates the need for a LPI now and cataract surgery later reducing the total number of surgeries on a given eye. It has the additional benefit of improving visual acuity and reducing ametropia.

Lately, researchers and clinicians have been investigating CE as a primary treatment for ACG [6]. An article by Pachimkul et. al. published in the Thai Medical Journal discussed the results of phacoemulsification in patients with acute and chronic ACG. They reported 58 eyes with a mean drop in IOP from 23.3 mmHg pre-op to 14.8 mmHg post-op. Improved visual acuity and lesser peripheral anterior synechiae (PAS) were also observed. They concluded CE helps reduce IOP, reduce PAS, relieve pupillary block, and increased angle depth [7]. A recent publication in Medscape by Laurie Barclay, M.D. "Clear-Lens Extraction May Be Best for Primary Glaucoma" pointed out that clear lens extraction was more effective and more cost-effective than LPI [8]. Liam et.al. reported a study of 31 patients with acute primary angle closure glaucoma who were randomized to cataract extraction by phacoemulsification vs. LPI. LPI eyes experienced higher

Table 2. Pre and Post LPI

Patient No.	EYE	ACD _{Before}	ACD _{After}	IOP _{Before}	IOP _{After}
68100	OD	3.09	3.14	18	20
68620	OD	3.13	3.04	46	20
68620	OS	3.1	3.16	28	20
66447	OD	2.5	2.67	22	18
66447	OS	2.47	2.6	25	18
77399	OD	2.31	2.39	18	16
77399	OS	2.35	2.41	25	18
82799	OD	2.85	2.87	14	15
81857	OS	2.85	2.87	16	13
82719	OS	2.73	2.77	13	18
66864	OD	2.66	3	14	12
66821	OS	2.64	2.78	17	19
67241	OD	2.55	2.61	14	11
37717	OD	3.01	3.11	28	32
37717	OS	3.06	3.16	30	28
59750	OD	2.59	2.6	21	17
59750	OS	2.7	2.71	20	17
83069	OD	2.69	2.69	11	20

Table 3. Pre LPI, Post LPI and post CE

Patient No.	EYE	ACD _{Before LPI}	ACD _{After LPI/Before CE}	ACD _{After CE}	IOP _{Before LPI}	IOP _{After LPI/Before CE}	IOP _{After CE}
29802	OD	2.61	2.64	3.59	16	16	15
29802	OS	2.51	2.62	3.69	14	16	15
77740	OD	2.82	2.75	4.48	13	18	16

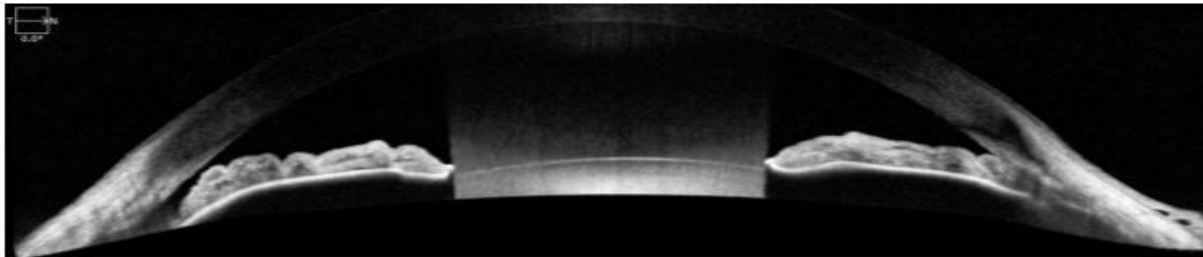


Figure 1. OCT of a narrow angle before LPI. Note PAS in the nasal angle

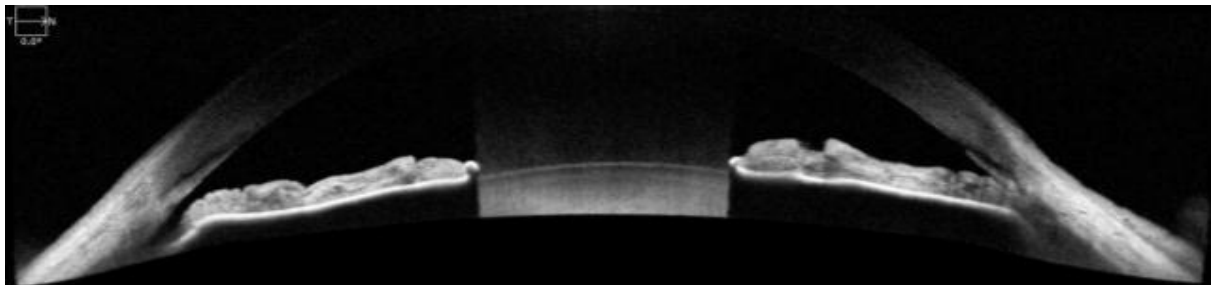


Figure 2. OCT of narrow angle after LPI. Little change in anterior chamber or angle. PAS remains.

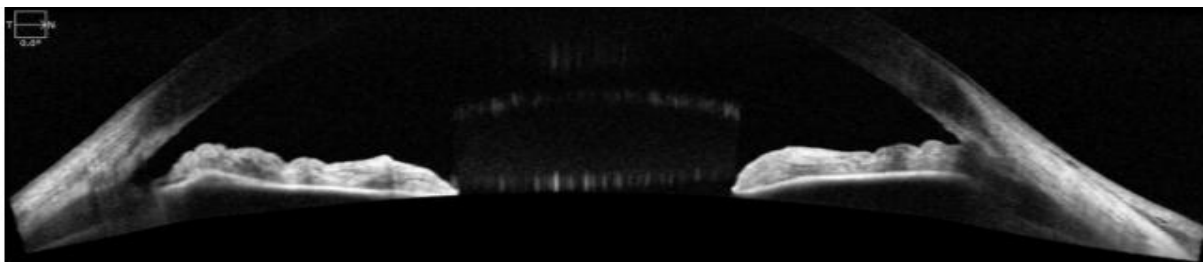


Figure 3. OCT of narrow angle after LPI and CE. Anterior chamber and angle are visibly deeper. PAS remains

IOP spikes post-op while CE eyes achieved lower IOP and deeper ACD [9,10].

Looking at our results, it can be noted that there was a similar decrease in IOP with both the CE and LPI groups. Glaucoma patients that are on prostaglandin treatment are switched to either a carbonic anhydrase inhibitor (CAI) or beta blocker due to increased risk of inflammation post cataract extraction. CAI and beta blockers are known to be less effective at reducing intra ocular pressure in comparison to prostaglandin analogues. Since most of the data for IOP was measured within 1-2 months of cataract extraction, it could play a role in similar IOP decrease in both groups of patients.

Cataract surgery like every other surgery is not without risks. Removing the crystalline lens does significantly reduce the risk of angle closure glaucoma; however, there is a rare chance that a patient may suffer from malignant glaucoma due to aqueous misdirection following ocular surgery. One of the major changes to contemplate post cataract surgery is presbyopia. However, this is easily corrected with glasses or contact lenses post cataract surgery. Patients can also consider monovision with IOL implants which would provide them with good vision at distance and near. There are new advances in multifocal lenses

that have shown great success with extended depth of focus. Attia *et. al*, published a study in the Journal of Refractive surgery in October 2017 which evaluated the extended Depth of Focus IOL. They evaluated the Tecnis Symphony IOL by Abbott Medical Optics, Inc. They looked at 30 eyes in 15 patients and found the median uncorrected distance VA to be 0.03 logMAR or Snellen 20/21.43, uncorrected near vision 0.20 logMAR or Snellen 20/31.70 and uncorrected intermediate to be -0.03 logMAR or Snellen 20/18.67 [11].

Clear lens extraction or cataract surgery should be considered as first line treatment in patients with narrow angle glaucoma. Glaucoma patients are usually on medication for the rest of their lives so cost is a very important issue that should be factored into the treatment plan and discussed with patients and their families. The Effectiveness in Angle Closure Glaucoma of Lens Extraction (EAGLE) Study, which enrolled 419 participants, 155 with primary angle closure and 263 with primary angle closure glaucoma, was recently reported. Clear-lens extraction was performed on 208 and 211 had standard care of LPI. Clear-lens extraction showed greater efficacy and was more cost-effective than LPI [12]. Medicare allowable for LPI in our ASC is \$394.93 and \$1406.13 for CE. Commercial insurance allows \$1,404.10 for LPI and \$1894.14

for CE. This represents about a \$400 savings per eye for patients having CE rather than LPI followed by CE.

As seen in our study, greater deepening of the anterior chamber and hence the anatomical angle as well as lower IOPs were achieved with CE than were achieved with LPI in patients with NAG. Removal of the physiologic lens significantly reduces the risk of angle closure and progression of glaucoma. CE in the presence of NAG should be offered as primary treatment for this population of patients.

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