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Controversies, consensuses, and guidelines for acute primary angle closure attack (APACA) by the Asia-Pacific Glaucoma Society (APGS) and the Academy of Asia-Pacific Professors of Ophthalmology (AAPPO)

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ABSTRACT

The Asia-Pacific Glaucoma Society (APGS), in collaboration with the Academy of Asia-Pacific Professors of Ophthalmology (AAPPO), convened a panel of 18 international experts from 10 countries/territories to identify areas of controversy and establish consensus on diagnosing and managing Acute Primary Angle Closure Attack (APACA). APACA is a relatively common and potentially vision-threatening ocular emergency, particularly in

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Chinese and Asian populations. With timely and appropriate intervention, favorable outcomes could be achieved. However, with the current treatment protocol, two areas need to be improved: 1) more rapid and consistent reduction of intraocular pressure (IOP), and 2) reducing the proportion of patients who develop chronic IOP elevation after resolution of an acute attack and successful laser peripheral iridotomy. The international panel of experts systematically revisited and debated alternative treatments to address the above issues. Consensus was evaluated using a five-point Likert scale (strongly agree, agree, neutral, disagree, and strongly disagree), in which each expert considered and voted anonymously and independently on each consensus statement. A statement consensus is established when the summation of votes for "agree" and "strongly agree" reaches a 75 % threshold. Argon laser peripheral iridoplasty, anterior chamber paracentesis, and laser pupilloplasty are considered appropriate and suitable options for rapid IOP reduction. Earlier phacoemulsification is effective in preventing further retinal ganglion cell loss and disease progression after APACA and is worth considering, provided adequate facilities and expertise are available. Further studies are warranted to evaluate the safety and efficacy of corneal indentation as a rapid and immediate treatment to lower IOP.

Introduction

Acute primary angle closure attack (APACA) is one of the few ophthalmic emergencies that can cause irreversible vision loss or blindness within hours if not promptly and appropriately treated. The abrupt closure of the trabecular meshwork (TM) leads to a rapid and dramatic rise in intraocular pressure (IOP), causing irreversible damage to the optic nerve and other ocular tissues, and debilitating symptoms. Patients experience extreme pain, blurred vision, seeing halos around lights, nausea, and vomiting. Chinese and Asians, which account for nearly 60 % of the world's population, have the highest incidentce of APACA, ranging from 6 to 16 cases per 100,000 per year,[1,2] compared to the lower incidences among the Caucasian populations (2 to 4.1 cases per 100,000 people per year).[3–6] Furthermore, Asians with APACA tend to have a worse visual prognosis than Caucasians.[7] With advanced phacoemulsification technology and healthcare, cataract surgery is increasingly performed at a younger age in developed and developing countries.[8] This trend of earlier cataract operation should significantly reduce the incidence of APACA. Scientific and clinical research also advances our understanding of APACA, allowing the establishment of treatment guidelines – notably by the American Academy of Ophthalmology,[9] the World Glaucoma Association,[10] the European Glaucoma Society,[11] and the Asia Pacific Glaucoma Society (APGS).[12]

However, the treatment of APACA still faces several challenges. First, it takes time for the IOP to reduce to a safe level. Some cases may not respond promptly enough to IOP-lowering measures, leading to significant optic nerve damage and blindness. Second, up to 58 % of APACA developed chronic ocular hypertension after successful abortion of the attack and effective laser peripheral iridotomy (LPI) to prevent recurrence of the acute attack. Understanding the importance of APACA enables better patient education, earlier recognition of symptoms, faster treatment response, and the exploration of safer and more effective alternative treatments to rapidly reduce the IOP, prevent further optic nerve damage, and prevent the development of chronic primary angle closure glaucoma (CACG). Against this background, the Asia-Pacific Glaucoma Society (APGS) and the Academy of Asia-Pacific Professors of Ophthalmology (AAOPPO) have chosen "diagnosing and managing APACA" as the topic for identifying controversies and establishing consensus for 2025. A senior author (CCYT) was appointed to coordinate this consensus project. The consensus statements aim to synthesize evidence-based and real-world practice recommendations from leading global experts to guide the diagnosis and managemnet of APACA.

Methodology

Following the appointment of the coordinator, 2 additional glaucoma experts (PPC and XLZ) were invited to join as members of the core group. Meanwhile, an international panel of experts (IPE) was formed, comprising of 19 panelists from 10 countries/territories. The core group was responsible for conducting an extensive literature search, critically reviewing and analyzing published contents related to APACA, and preparing the first draft of the consensus statements, along with explanations and elaborations. These statements were organized into four categories: 1) disease entity and diagnosis, 2) current and alternative treatments for rapid IOP reduction, 3) preventing further optic nerve damage and development of CACG after successful abortion of APACA and patent LPI, and 4) future developments. Each panel member independently and anonymously reviewed each statement and provided comments to the core group. The core group then evaluated the feedback and comments, revised the document, and disseminated the second draft for further opinions. The process was repeated until the statements were finalized. Subsequently, each panel member voted anonymously on each statement for the final draft using a five-point Likert scale, ranging from "strongly agree", "agree", "neutral", "disagree", to "strongly disagree". A consensus was reached when at least 75 % of the experts voted either "agree" or "strongly agree" for a statement.[13]

Controversies and consensus statements

Section 1: Disease entity and diagnosis

Various terms have been used to describe the acute symptomatic IOP elevation due to angle closure, including acute angle closure (AAC),[12] acute angle-closure attacks (AACA),[14] acute angle-closure glaucoma (AACG), acute angle-closure crisis (AACC),[9] and acute primary angle closure (APAC).[15] The inconsistency reflects the need for a unified terminology. We consider acute primary angle closure attack (APACA) a suitable designation because it emphasizes the acute nature and urgency of the condition. It also differentiates primary angle closure from secondary causes, such as anterior lens subluxation. The term "glaucoma" is intentionally excluded, as prompt treatment of the acute episode may prevent permanent glaucomatous damage. Nevertheless, we should be aware that progressive retinal ganglion cell (RGC) loss may still occur after IOP is controlled due to ischemia-reperfusion injury.[16,17]

The symptoms of APACA stem from acute IOP elevation. The clinical signs reflect the underlying mechanism of angle closure and the consequence of acutely raised IOP. A shallow anterior chamber reflects the anatomical predisposition. A mid-dilated pupil indicates relative pupillary block and iris ischemia. Elevated IOP leads to corneal endothelial dysfunction and stromal fluid accumulation, resulting in corneal edema and, consequently, blurred vision and the halo effect. Glaucomflecken is a manifestation of ischemic necrosis of the lens epithelium. However, these signs and symptoms may not be present in all cases. Clinicians unfamiliar with APACA may misdiagnose or confuse it with other causes of acute IOP elevation. For instance, systemic symptoms – such as severe headache, nausea, and vomiting – are important diagnostic clues. They are often pronounced and may be misdiagnosed as neurological or gastrointestinal disorders.

Atypical presentations could also confuse clinicians. For instance, bilateral APACA has been reported.[18–30] However, it remains rare and may represent a late presentation of CACG or underlying systemic or medication-related mechanisms. An eye with markedly elevated IOP

and a relatively clear cornea may suggest alternative diagnoses, such as uveitic glaucoma and Posner-Schlossman syndrome. A shallow anterior chamber in the affected eye compared to a deep chamber with an open angle in the unaffected fellow eye may suggest anterior lens subluxation. Differential diagnoses should also include other secondary angle closure mechanisms and neovascular etiology (e.g., central retinal vein occlusion and inflammatory conditions), especially in the presence of rubeosis iridis. APAPC refractory to medical and laser treatment may sometimes be due to posterior segment pathologies, such as ciliochoroidal effusion, vitreous hemorrhage, and suprachoroidal hemorrhage. In such cases, imaging modalities (e.g., B scan ultrasound and ultrasound biomicroscopy [UBM]) are warranted, as invasive surgical interventions may exacerbate the condition. For example, massive choroidal hemorrhage can displace the lens-iris diaphragm anteriorly, and lens extraction in the context may lead to devastating complications.[15]

Systemic medication and topical eye drops that induce mydriasis (e.g., mydriatic eye drops,[4] tricyclic antidepressants, and selective serotonin reuptake inhibitors [SSRIs] [31,32]) can trigger APACA in susceptible individuals. Cold and flu medications containing nasal decongestants (e.g., phenylephrine) are also known to precipitate adverse effects.[2,33,34] These factors are often overlooked in clinical practice but are valuable diagnostic clues during history-taking.

Consensus Statement 1.1: *The terms acute angle closure (AAC), acute angle-closure attacks (AACA), acute angle-closure glaucoma (AACG), acute angle-closure crisis (AACC), and acute primary angle closure (APAC) have been used to describe a sudden symptomatic rise in IOP caused by angle closure. The term acute primary angle closure attack (APACA) is the most suitable and preferred term to be used for such a condition because the term emphasizes the primary cause of angle closure and the urgency of the condition. (Consensus score: 94.11 % [strongly agree: 35.29 %; agree: 58.82 %; neutral: 0 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 1.2: *APACA is more prevalent in Chinese and Asians than Caucasians. (Consensus score: 100 % [strongly agree: 82.35 %; agree: 17.65 %; neutral: 0 %; disagree: 0 %; strongly disagree: 0 %])*

Consensus Statement 1.3: *APACA is an ocular emergency and immediate attention to lower the IOP is mandatory. (Consensus score: 100 % [strongly agree: 88.24 %; agree: 11.76 %; neutral: 0 %; disagree: 0 %; strongly disagree: 0 %])*

Consensus Statement 1.4: *APACA is due to primary angle closure attack – pupillary block (complete or relative) with some degree of angle crowding, which is the most common mechanism and cause. (Consensus score: 88.23 % [strongly agree: 52.94 %; agree: 35.29 %; neutral: 0 %; disagree: 11.76 %; strongly disagree: 0 %])*

Consensus Statement 1.5: *Choroid expansion is considered a key initiating factor of APACA. (Consensus score: 41.17 % [strongly agree: 5.88 %; agree: 35.29 %; neutral: 47.06 %; disagree: 11.76 %; strongly disagree: 0 %])*

Beyond the anatomical risk factors, imaging studies suggest that dynamic changes in the uveal tract may play a role in the development of primary angle closure.[35] Specifically, choroidal expansion increases posterior chamber pressure, pushing the lens-iris diaphragm anteriorly, narrowing the anterior chamber angle, and precipitating an APACA.[36–39]

Consensus Statement 1.6: *APACA is primarily a clinical diagnosis based on symptoms and signs. Symptoms include sudden onset of unilateral severe eye pain, redness, headache, nausea, blurred vision, and seeing a halo around lights. Clinical signs include markedly elevated IOP, a fixed mid-dilated pupil, corneal edema, a shallow anterior chamber, glaucomflecken on the lens, and conjunctival vascular congestion. These signs and symptoms may not all appear in every case. IOP should be measured and documented by Goldmann applanation tonometry. (Consensus score: 94.11 % [strongly agree: 52.94 %; agree: 41.18 %; neutral: 0 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 1.7: *Always be aware of the possibility of secondary causes that could lead to acute and severe IOP elevation. Clinical signs such as an open angle with deep anterior chamber in the fellow eye, a relatively clear cornea of the affected eye, and presence of rubeosis iridis should also be looked for. (Consensus score: 94.11 % [strongly agree: 58.82 %; agree: 35.29 %; neutral: 0 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 1.8: *Drugs with mydriatic and cycloplegic effects could precipitate the onset of APACA in eyes with anatomical predispositions, such as shallow anterior chamber and thicker lens. This is because mydriasis could aggregate the pupillary block and angle crowding condition. These drugs include mydriatic eye drops, tricyclic or selective serotonin reuptake inhibitor (SSRI) antidepressants, and nasal decongestants (which contain antihistamines), anticholinergics, sympathomimetics, and antiemetics. (Consensus score: 88.24 % [strongly agree: 64.71 %; agree: 23.53 %; neutral: 5.88 %; disagree: 5.88 %; strongly disagree: 0 %])*

A thorough drug history could be a valuable diagnostic clue for APACA. At-risk individuals should also be advised to avoid these medications.

Consensus Statement 1.9: *While an accurate diagnosis is important, rapid IOP reduction should be the priority for patients with a clinical picture of APACA, in order to prevent further irreversible glaucomatous damage as much as possible. (Consensus score: 100 % [strongly agree: 82.35 %; agree: 17.65 %; neutral: 0 %; disagree: 0 %; strongly disagree: 0 %])*

Consensus Statement 1.10: *Gonioscopy should be routinely performed on both eyes. Although corneal edema can render gonioscopy difficult for the APACA eye, findings of the fellow eye are valuable. Anterior segment optical coherence tomography (AS-OCT) and ultrasound biomicroscopy (UBM) can provide detailed visualization of the anterior chamber angle and enhanced diagnostic acumen. B-scan ultrasound helps rule out posterior segment pathologies. However, these investigations should not delay the primary objective of IOP reduction. (Consensus score: 100 % [strongly agree: 58.82 %; agree: 41.18 %; neutral: 0 %; disagree: 0 %; strongly disagree: 0 %])*

Section 2: Current and alternative treatments in rapid IOP reduction

The conventional APACA treatment approach follows the principle of escalating treatment from lower-risk to higher-risk modalities (Fig. 1). Topical and/or systemic steroid and IOP-lowering medications are administrated immediately upon diagnosis (phase I: initial rapid IOP reduction to limit optic nerve damage). If IOP remains uncontrolled with medication, more invasive interventions, such as urgent trabeculectomy or phacoemulsification, may be considered. Once IOP is stabilized, LPI is performed to prevent recurrence (phase II: prevention of recurrent attack and risk of progression to CACG).

However, such an approach is likely suboptimal. First, patients who present late with severe APACA are more refractory to conventional treatment. The effect of IOP-lowering medication is not immediate because the drug actions do not directly act on the drainage angle mechanisms.[40] Second, systemic medications (e.g., acetazolamide or intravenous mannitol) may cause serious side effects – ranging from paresthesia and confusion, to potentially life-threatening pulmonary edema and acute renal failure – especially in elderly patients or those with comorbidities.[41–45] Third, performing trabeculectomy or phacoemulsification for APACA eyes that failed to achieve initial optimal IOP control is not desirable. Unlike early phacoemulsification on medically-aborted APACA eyes that could provide favorable outcomes,[46–48] emergency phacoemulsification on a medically uncontrolled APACA eye is technically demanding, carries a high risk of surgical complication, induces more inflammation, and leads to further damage to the intraocular structures. Trabeculectomy lowers the IOP by providing an alternative aqueous drainage pathway through the sclerotomy to the subconjunctival space rather than reversing the underlying angle closure mechanism that causes the IOP elevation.[49,50] Emergency trabeculectomy could shallow the anterior chamber further and aggravate the angle closure condition. Indeed, trabeculectomy on medically uncontrolled APACA eye has a low success rate – qualified and complete success rates of trabeculectomy alone were only 56.2 % and 9.4 %, respectively[51] – mainly due to bleb fibrosis, which is likely related to

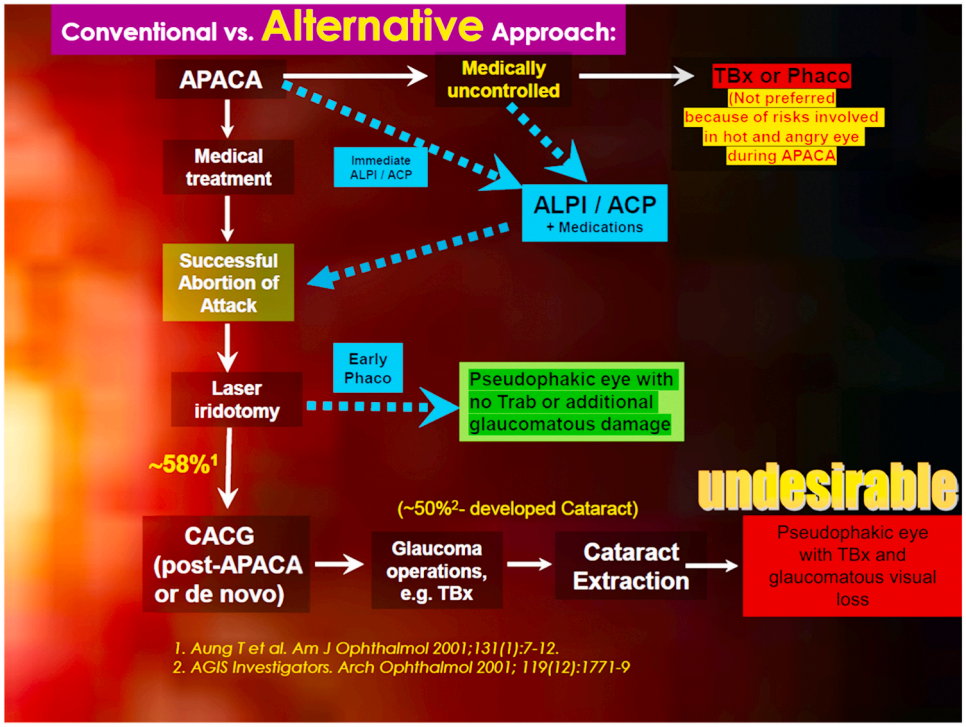

Fig. 1. Conventional Versus Alternative Approach in Treating APACA.
Conventionally, IOP-lowering medications (topical +/- systemic) are administered immediately after an acute primary angle closure attack (APACA) is diagnosed. If intraocular pressure (IOP) remains uncontrolled and consistently high, urgent trabeculectomy or phacoemulsification will be considered. However, the procedures are technically demanding and may compromise the outcomes because the eye is "hot and angry" during the attack. Alternative treatments include immediate argon laser peripheral iridoplasty (ALPI), anterior chamber paracentesis (ACP), and/or laser pupilloplasty (LPP), which could promptly reduce IOP to a safe level. Laser peripheral iridotomy (LPI) will be performed to minimize the risk of recurrence of the attack. Subsequently, up to 58 % of cases will develop chronic primary angle closure glaucoma (CACG) in due course, requiring medical treatment or trabeculectomy. Since cataract formation is accelerated in these eyes, many would eventually require phacoemulsification, resulting in an undesirable condition of pseudophakia, often accompanied by trabeculectomy and glaucomatous visual loss. For alternative treatments, ALPI, ACP, and LPP will enable a prompt reduction of IOP, while earlier phacoemulsification will substantially reduce the risk of IOP spike and CACG conversion. This alternative treatment algorithm is worth considering.
Abbreviations: APACA, acute primary angle closure attack; TBx, trabeculectomy; phaco, phacoemulsification; ALPI, argon laser peripheral iridoplasty, ACP, anterior chamber paracentesis; CACG, chronic primary angle closure glaucoma.

inadequate preoperative control of inflammation. In addition, APACA *per se*, trabeculectomy, and post-operative steroid accelerate cataract formation; approximately 50 % of these eyes developed cataracts within a few years.[52] As a result, many post-APACA eyes will become pseudophakic with suboptimal visual function due to irreversible glaucomatous optic nerve damage.

These limitations of the conventional treatment approach are especially relevant to patients in suburban and rural areas of developing countries. Their demographics are likely different from those involved in clinical studies due to their likely omission from clinical studies for various reasons (e.g., lack of comprehensive medical records, not being treated in territory centers that conduct the clinical studies).[53] Given the less accessibility to medical care or lower disease awareness, patients tend to present late with more severe APACA and higher IOP. They tend to be less responsive to conventional medical therapy. Delayed presentation, older age, and longer time to break the attack were identified as adverse prognostic factors even in developed countries.[54–57] Lower education level, longer time from symptom to treatment, and higher presenting IOP level were risk factors for blindness i patients treated with this conventional protocol.[53] A longer time to abort the attack could lead to further, irreversible damage. Indeed, *in vivo* studies on owl monkies demonstrated that elevated IOP of >50 mmHg for >12 h causes enduring damage to retinal nerve fibers, ganglion cells, and optic nerve.[58]

Younger APACA patients who present soon after the onset of symptoms may readily respond and tolerate the conventional medical treatment with desirable outcomes despite the known slower onset of medication-induced IOP reduction in the first 2 h.[40,59,60] However, older APACA patients with multiple medical comorbidities, who present late with high IOP and are highly likely to have substantial glaucomatous damage at presentation, could not afford further irreversible damage. In this situation, medical therapy as first-line treatment is far from ideal, given the slower onset, the risk of treatment failure, and the potential systemic complications. There is a pressing need to explore effective, safe, and reliable alternative first-line treatment that has a high chance of achieving rapid IOP lowering, preventing further irreversible glaucomatous damage, avoiding systemic adverse effects, and prompting the eye to be in better condition for phacoemulsification. ALPI, LPP, and ACP are likely alternative approaches for rapid IOP reduction.

ALPI, LPP, and ACP as Alternative Treatments for Rapid IOP Reduction

Argon laser peripheral iridoplasty (ALPI)

ALPI involves placing circumferential and contractional laser burn (long duration, low power, and large spot size) in the extreme peripheral iris and mechanically opening the angle. (Video 1) A randomized controlled trial (RCT) demonstrated that it is safer, quicker (lower the IOP to a safe or normal level in less than 30 min) (Fig. 2), and more effective in lowering IOP in APACA within the first 2 h than systemic medication.[40,59,60] This is especially useful for eyes with corneal edema where LPI cannot be effectively performed. However, some ophthalmologists may not be familiar with the ALPI techniques. This could

reduce the effectiveness of the procedure.

Laser pupilloplasty (LPP)

LPP uses a frequency-doubled 532 nm laser to cauterize and shrink the pupillary margin of the iris, turning it outward (Video 2) to relieve pupillary block and allow aqueous humor to flow freely from the posterior chamber into the anterior chamber.[61,62] Studies demonstrate that LPP with or without ALPI achieves effective IOP reduction in APACA patients, with significant improvement in IOP within two hours of treatment.[62] LPP offers several advantages: it requires less corneal clarity, making it suitable for APACA patients with corneal edema; the procedure is performed at the 3 and 9 o'clock positions, facilitating easier laser operation even in uncooperative patients experiencing ocular pain and nausea; and it provides rapid IOP reduction while avoiding medication side effects and surgical complications.[61,62]

Anterior chamber paracentesis (ACP) (Video 3)

ACP can immediately, effectively, and safely reduce IOP.[63–65] A previous study that compared the outcome of APACA eye treated by ACP or mannitol infusion showed that ACP more effectively improved vision in APACA eye with an initial IOP $<$ 60 mmHg. Additionally, the study did not reveal any severe complications (e.g., injury to the iris, lens, or cornea, malignant glaucoma, choroidal problems, endophthalmitis).[66] ACP is particularly beneficial for ophthalmologists unfamiliar with the ALPI technique or in regions where laser facilities are not readily available.

ACP can be safely performed under topical anesthesia with aseptic technique under a slit lamp. This can be done by using a 15-degree stab knife or a 30-G needle, entering the AC through the peripheral cornea at the 3 or 9 o'clock region, and directing it towards the 6 o'clock direction to avoid puncturing the lens. The mechanics (friction within the walls of the needle) of the 30-G needle will make the IOP in the range of 12–15 mmHg when the needle is still inside the anterior chamber. This avoids the risk of over-drainage or hypotony.[67] Based on its effectiveness and safety, ACP may be a treatment of choice in selected cases.

Consensus Statement 2.1: *The conventional first-line approach for rapid IOP reduction employs topical and systemic IOP-lowering medication. However, it could be suboptimal in some patients, especially those who present late and with $>$ 50 mmHg presenting IOP. (Consensus score: 94.12 % [strongly agree: 47.06 %; agree: 47.06 %; neutral: 0 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 2.2: *Given that an APACA eye is heavily inflamed, topical ± systemic anti-inflammatory therapy should also be given. (Consensus score: 100 % [strongly agree: 58.82 %; agree: 41.18 %; neutral: 0 %; disagree: 0 %; strongly disagree: 0 %])*

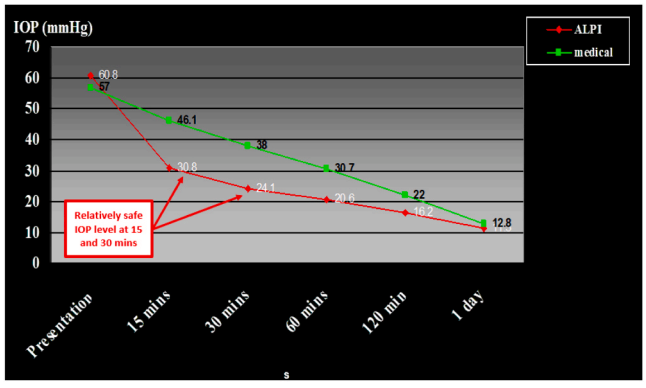

Fig. 2. The randomized controlled trial of argon laser peripheral iridoplasty (ALPI) versus medical treatment showed that the average intraocular pressure (IOP) after ALPI dropped to safe levels (30.8 mmHg and 24.1 mmHg) at 15 and 30 min, respectively.

Consensus Statement 2.3: *While the APACA eye is being treated, the fellow eye is likely at risk of developing an acute attack, especially if gonioscopy reveals a narrow angle. Pilocarpine eye drops can be started in the fellow eye until LPI can be done. (Consensus score: 100 % [strongly agree: 52.94 %; agree: 47.06 %; neutral: 0 %; disagree: 0 %; strongly disagree: 0 %])*

Consensus Statement 2.4: *It is most desirable to abort the APACA as soon as possible to limit the irreversible damage caused by elevated IOP (including glaucomatous optic neuropathy, corneal endothelium, iris, and lens zonules). Medical therapy alone may not be ideal because of a slow onset of the IOP reduction effect and the presence of refractory cases. It is worth exploring effective and safe treatments as alternatives to the traditional medical treatment alone to rapidly lower the IOP. (Consensus score: 64.7 % [strongly agree: 29.41 %; agree: 35.29 %; neutral: 29.41 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 2.5: *Argon laser peripheral iridoplasty (ALPI), used as an immediate measure, could be an alternative to traditional medical treatment, although traditionally used safely and effectively for cases that failed traditional medical therapy. Studies have demonstrated its usefulness as an immediate measure and it can bring the IOP down to a relatively safe level in 15–30min. (Consensus score: 94.12 % [strongly agree: 41.18 %; agree: 52.94 %; neutral: 5.88 %; disagree: 0 %; strongly disagree: 0 %])*

Consensus Statement 2.6: *Laser pupilloplasty (LPP) could be an effective and quick adjunctive treatment to relieve pupillary block and can be combined with ALPI to control IOP in APACA. (Consensus score: 88.23 % [strongly agree: 35.29 %; agree: 52.29 %; neutral: 5.88 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 2.7: *Anterior chamber paracentesis (ACP) can provide immediate IOP normalization and may be a decent alternative option, especially if argon laser machine and doctor with such expertise are not available. (Consensus score: 94.12 % [strongly agree: 47.06 %; agree: 47.06 %; neutral: 0 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 2.8: *Emergency trabeculectomy, intended as a treatment for medically uncontrolled APACA, is generally best avoided. Performing trabeculectomy on an inflamed eye and under severe pressure can lead to further shallowing of the anterior chamber, an increased likelihood of failure, and a heightened risk of adverse outcomes. (Consensus score: 82.35 % [strongly agree: 35.29 %; agree: 47.06 %; neutral: 11.76 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 2.9: *Emergency phacoemulsification as a treatment for medically uncontrolled APACA is best avoided. Emergency phacoemulsification in a "hot and angry" eye carries additional risks arising from undesirable eye conditions, such as a poor surgical view due to corneal edema, a shallow anterior chamber, a small and distorted pupil, an atonic iris prone to iris prolapse, and an inflamed intraocular condition. (Consensus score: 100 % [strongly agree: 50 %; agree: 50 %; neutral: 0 %; disagree: 0 %; strongly disagree: 0 %])*

Consensus Statement 2.10: *With the availability of ALPI and ACP, there should be few cases of uncontrolled IOP, and thus, emergency trabeculectomy and phacoemulsification could be safely avoided. (Consensus score: 100 % [strongly agree: 37.5 %; agree: 62.5 %; neutral: 0 %; disagree: 0 %; strongly disagree: 0 %]).*

Section 3: Preventing further optic nerve damage and development of CACG after APACA and successful peripheral laser iridotomy

Limitations of LPI in APACA management

Despite successful LPI after APACA abortion, long-term outcomes remain suboptimal for Asian patients. Studies have shown that up to 58 % of these patients developed CACG, necessitating further intervention, including medication trabeculectomy and, eventually, phacoemulsification.[7,47,48,54,55,68–70] A cross-sectional observational case series showed that 17.8 % of Asian patients were blind in the attacked eye (with glaucoma responsible for half of these cases), 47.8 % had glaucomatous optic neuropathy, and 57 % had best-corrected visual

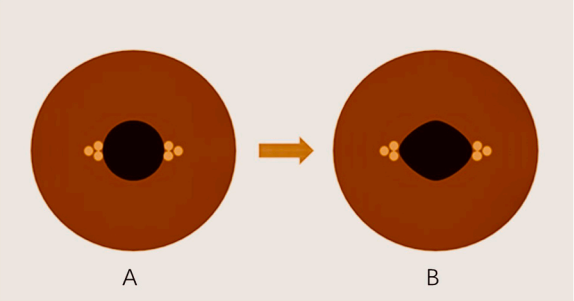

Fig. 3. Schematic diagram of laser pupilloplasty (LPP). A: the light brown-colored circles indicate the laser sites of LPP; B: the changes in the pupil after LPP.[61,62].

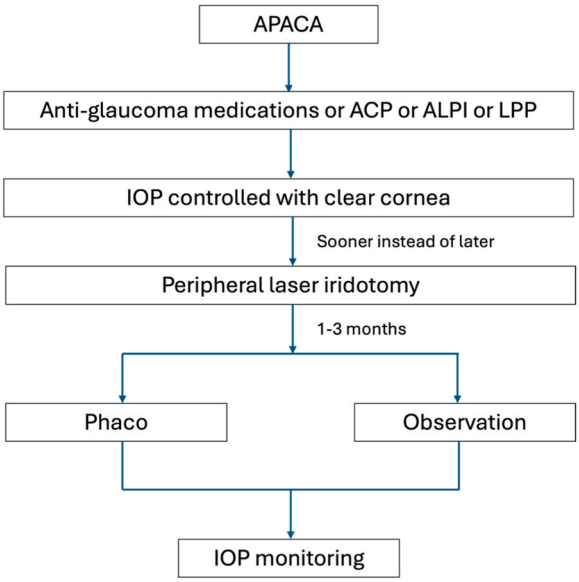

Fig. 4. Management algorithm for APACA. Abbreviations: APACA, acute primary angle closure attack; ACP, anterior chamber paracentesis; ALPI, argon laser peripheral iridoplasty; LPP, laser pupilloplasty; phaco, phacoemulsification.

acuity of worse than 6/9 Snellen (cataract being a major contributor to the poor vision), after a follow-up period of 4–10 years.[7] In another retrospective case series involving 110 APACA eyes treated with successful LPI, 64 eyes (58.1 %) experienced elevated IOP. Of these, 26 (40.6 % of 64) were controlled by medication, 36 (56.3 %) required trabeculectomy, and 2 (1.8 %) progressed to blindness.[54] These findings underscore that LPI alone is insufficient as a long-term treatment, and a more definitive treatment should be considered early.

Benefits and justification for early phacoemulsification

Phacoemulsification offers several anatomical and physiological advantages.[71,72] It creates a vast space between the anterior lens surface and the iris, eliminates lens-related and relative pupillary block mechanisms, and may also mitigate some plateau iris configurations. With advancements in surgical technology and expertise, phacoemulsification could be safely performed in post-APACA eyes. Hence, the treatment threshold should be lowered.

Although no study has specifically investigated clear-lens extraction in APACA eyes after successful LPI, the lens is likely a major contributing factor to the development of APACA.[73] Indirect evidence from the EAGLE study supports favorable outcomes of clear-lens extraction performed in highly selective patients.[74] Beyond reducing the risk of CACG development, phacoemulsification improves visual acuity and reduces the need for IOP-lowering medications. This reduction in medication use enhances patient quality of life and treatment cost-effectiveness. Glaucoma patients on IOP-lowering medication often experience severe dry eye symptoms and diminished emotional quality of life independent of the degree of visual field loss.[75] Moreover, the financial burden of long-term medication use is substantial.[76] A cost-effectiveness analysis that compared phacoemulsification with combined phacotrabeculectomy for treating CACG revealed that the cost-effectiveness was sensitive to fluctuation of medication costs but insensitive to the cost of surgery.[77]

Timing and strategic considerations for phacoemulsification and combined procedures

Despite its benefit, phacoemulsification is not always performed promptly after successful LPI due to factors such as limited surgical expertise and reluctance to operate on eyes with good visual acuity and clear lenses. However, such a "watchful waiting" approach may not be justified, given the high risk of CACG development and poor IOP control.[7,47,48,54,55,68–70]

Evidence suggests that APACA eyes undergoing early phacoemulsification require less medication, exhibit less extensive peripheral anterior synechiae (PAS), and have a lower incidence of IOP elevation.[78] According to a 5-year retrospective case series in the United Kingdom, even among Caucasian patients – who generally had a higher success rate with LPI alone[56,57,79–81] – phacoemulsification significantly reduces long-term adverse outcomes, including blindness (86 % reduction), elevated IOP (93 % reduction), and need for medication treatment (69 % reduction).[57]

Given the unfavorable long-term outcomes of LPI alone, early phacoemulsification should be strongly considered. It reduces the risk of CACG development, improves visual outcomes, reduces medication dependency, and enhances overall patient well-being and cost-effectiveness. Theoretically, phacoemulsification should be performed as early as possible. However, operating on a heavily inflamed post-APACA eye should be avoided. The principle is to strike a balance between allowing adequate time for the eye to resolve to a desirable condition for phacoemulsification while lowering the risk of PAS formation and CACG development. The optimal timing remains to be determined. Our consensus suggests that the eye typically stabilizes within 1–3 months post-attack with appropriate management, making this window suitable for safe phacoemulsification.

The effectiveness of combining phacoemulsification with goniosynechialysis (GSL) versus phacoemulsification alone remains controversial.[82–84] Although RCT involving patients with primary angle closure disease (PACD) was unable to show that combining phacoemulsification with GSL provided additional IOP-lowering compared with eyes that underwent phacoemulsification alone, the RCT done by Nguyen Xuan et al. found that combined phacoemulsification with GSL yielded better postoperative visual outcomes, wider anterior chamber drainage angles, and fewer complications compared to phacotrabeculectomy.[85] Furthermore, in eyes with advanced primary angle closure glaucoma (PACG) and cataracts, combining phacoemulsification with both GSL and goniotomy achieved sustained IOP reduction, indicating it may be a valuable option in more severe cases.[86–89]

Consensus Statement 3.1: *After successful abortion of APACA, LPI is conventionally performed to eliminate the relative pupillary block mechanism (phase II). However, this may be suboptimal in the longer term because up to 58 % of the eyes that underwent successful LPI resulted in IOP elevation and developed CACG, which required medication therapy or trabeculectomy.*[54] *More definitive treatment should be considered after successful LPI. (Consensus score: 94.12 % [strongly agree: 47.06 %; agree: 47.06 %; neutral: 5.88 %; disagree: 0 %; strongly disagree: 0 %])*

Consensus Statement 3.2: *It is well-documented that early phacoemulsification following successful LPI provides better IOP control and more favorable long-term outcomes than LPI alone. Early phacoemulsification may be an effective treatment for preventing CACG, provided it is performed in an*

adequate setting that can yield favorable outcomes. (Consensus score: 94.12 % [strongly agree: 70.59 %; agree: 23.53 %; neutral: 5.88 %; disagree: 0 %; strongly disagree: 0 %])

Consensus Statement 3.3: *For APACA eye, applying a lower threshold for phacoemulsification (e.g., operating on younger patients with relatively good visual acuity) is appropriate. This is supported by the high rate of cataract development after APACA and evidence that showed phacoemulsification results in better IOP control, better visual outcomes, lower medication requirements, and lower rate of CACG development than APACA eyes that underwent LPI alone. (Consensus score: 88.24 % [strongly agree: 47.06 %; agree: 41.18 %; neutral: 5.88 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 3.4: *A good timing for phacoemulsification after APACA is likely to be between 1 and 3 months after APACA. This is because time is required for the eye to quiet down adequately before phacoemulsification, while waiting too long may increase the chance of PAS formation and CACG development. (Consensus score: 76.47 % [strongly agree: 29.41 %; agree: 47.06 %; neutral: 17.65 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 3.5: *If there is an underlying CACG component with extensive PAS, phacoemulsification combined with GSL with or without goniotomy may be considered. (Consensus score: 70.59 % [strongly agree: 29.41 %; agree: 41.18 %; neutral: 29.41 %; disagree: 0 %; strongly disagree: 0 %])*

Section 4: Future development

Angle closure in highly myopic eyes

Angle closure in highly myopic eyes is relatively uncommon.[90,91] Eyes with a longer axial length generally have a lower risk of APACA due to the larger ocular volume. However, myopia *per se* is not a definitive protective factor against APACA. A cross-sectional study by Yong et al. showed that 94 out of 427 angle-closure patients had myopia, and 11 out of these 94 patients (11.7 %) had refractive error less than −5.0 diopters.[92] The impression that a highly myopic eye with a long axial length precludes the possibility of APACA may lead to misjudgment under a low clinical suspicion, especially among Asians, where both APACA and myopia are prevalent. It is crucial to acknowledge that the risk of angle closure is primarily associated with anatomical predispositions, such as shallow anterior chamber depth, rather than the refractive status or axial length.[92,93] Further studies that explore APACA in myopic eye may offer valuable insight and help raise public awareness.

Role of steroids in APACA management

Topical steroid is liberally used in APACA, given the close association between anterior chamber inflammation and IOP elevation.[94–96] A recent RCT that included 42 patients revealed that APACA patients who underwent conventional treatment and received an additional subconjunctival dexamethasone injection achieved greater IOP reduction and a higher overall treatment success rate than patients who received conventional treatment alone.[97] Further study may be warranted on a larger scale. The route and dosage of steroids should also be explored. Whether the more aggressive application of steroids may improve the long-term outcomes (e.g., lower rate of PACG development, higher success rate of phacoemulsification and trabeculectomy) also requires further investigation.

Timing of phacoemulsification

Currently, the timing of phacoemulsification after the abortion of APACA is empirical. Large-scale studies are required to standardize the appropriate timing and indication for the surgery, given that phacoemulsification on a post-APACA eye is still a technically demanding and relatively high-risk operation.

Corneal indentation: a practical technique for resource-limited settings

Corneal Indentation has shown promise as an effective technique for managing APACA, although no consensus on its application is yet available.[98] It can be done under a slit lamp using a small-diameter four-mirror gonioscopy contact lens (e.g., Posner or Sussman).[99] In settings lacking ophthalmic instruments, indentation may still be feasible using a smooth, round object or even fingertips through a closed eyelid.[100] The technique could be particularly helpful in rural or underserved areas with limited access to ophthalmic care. Further study is needed to evaluate its effectiveness in such populations and to develop standardized protocols for its use.

Consensus Statement 4.1: *Although APACA is more prevalent in patients with risk factors (e.g., older age, female sex, hyperopia, and family history of angle closure) and anatomically susceptible eyes (including shallow anterior chambers and thicker lenses), myopic eyes are not exempt from APACA, despite having lower risk. (Consensus score: 94.11 % [strongly agree: 35.29 %; agree: 58.82 %; neutral: 5.88 %; disagree: 0 %; strongly disagree: 0 %])*

Consensus statement 4.2 *Topical, subconjunctival, or systemic steroid application can help reduce the inflammatory response and reduce IOP during the acute phase. Further studies are warranted. (Consensus score: 70.59 % [strongly agree: 29.41 %; agree: 41.18 %; neutral: 23.53 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus statement 4.3 *Although a lower threshold of phacoemulsification could be considered for APACA, the best timing and indication for phacoemulsification require further investigation. (Consensus score: 82.36 % [strongly agree: 41.18 %; agree: 41.18 %; neutral: 11.76 %; disagree: 5.88 %; strongly disagree: 0 %])*

Consensus Statement 4.4*: It is necessary to explore effective alternatives for treating the initial stage of APACA in rural areas inaccessible to ophthalmic facilities. Corneal indentation can lower the IOP by widening the angle and facilitating aqueous drainage, thereby protecting the eye from further glaucomatous damage and potentially reducing the need for additional management in centers equipped with the appropriate instrumentation. There are various suggested techniques, and further evaluation of the role of corneal indentation is warranted. (Consensus score: 88.23 % [strongly agree: 11.76 %; agree: 76.47 %; neutral: 5.88 %; disagree: 5.88 %; strongly disagree: 0 %])*

Results of voting and discussion

Table 1 provides a summary of the key consensus statements along with the corresponding voting results. This provides a collective opinion of APACA experts and raises several points for further discussion. The current consensus provides a collective opinion of APACA experts and stimulates several points for discussion.

The consensus that APACA is primarily diagnosed based on signs and symptoms (consensus 1.6) comes with a caveat: this was a collective opinion of seasoned glaucoma experts who mostly practiced in regions with high incidence of APACA. Ophthalmologists with less experience in diagnosing the disease may find the diagnosis challenging, especially when encountering atypical cases. Indeed, while most experts agreed with the term APACA, it mainly refers to primary angle closure; secondary causes are difficult to rule out. Therefore, we highlighted several measures to explore the possibility without disrupting the primary objective of treating APACA (i.e., prompt IOP reduction to limit irreversible optic nerve damage). These include examination of the fellow eye (open angle and deep anterior chamber may indicate anterior lens subluxation of the affected eye),[101] atypical signs of the APACA eye (a relatively clear cornea may indicate uveitis such as Posner-Schlossman syndrome, presence of rubeosis iridis indicates neovascular glaucoma) (consensus 1.7), and the use of investigative tools, such as AS-OCT and UBM (consensus 1.10). The latter is helpful in ruling out posterior segment pathologies, such as extensive vitreous hemorrhage,[102–106] which occasionally present as APACA refractory to medical treatment. Further invasive procedures (e.g., phacoemulsification) without acknowledging the presence of posterior pathology could lead to devasting complications, such as suprachoroidal hemorrhage.[15]

Table 1
Voting results of the APACA consensus statements.

Section	Consensus Statement	C Score	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Disease Entity and Diagnosis							
1.1	The terms acute angle closure (AAC), acute angle-closure attacks (AACA), acute angle-closure glaucoma (AACG), acute angle-closure crisis (AACC), and acute primary angle closure (APAC) have been used to describe a sudden rise in IOP caused by angle closure. The term acute primary angle closure attack (APACA) is the most suitable and preferred term to be used for such a condition because the term emphasizes the primary cause of angle closure and the urgency of the condition.	**94.11 %**	35.29 %	58.82 %	0 %	5.88 %	0 %
1.2	APACA is more prevalent in Chinese and Asians than Caucasians.	**100 %**	82.35 %	17.65 %	0 %	0 %	0 %
1.3	APACA is an ocular emergency and immediate attention to lower the IOP is mandatory.	**100 %**	88.24 %	11.76 %	0 %	0 %	0 %
1.4	APACA is due to primary angle closure attack – pupillary block (complete or relative) with some degree of angle crowding, which is the most common mechanism and cause.	**88.23 %**	52.94 %	35.29 %	0 %	11.76 %	0 %
1.5	Choroid expansion is considered a key initiating factor of APACA.	41.17 %	5.88 %	35.29 %	47.06 %	11.76 %	0 %
1.6	APACA is primarily a clinical diagnosis based on symptoms and signs. Symptoms include sudden onset of unilateral severe eye pain, redness, headache, nausea, blurred vision, and seeing a halo around lights. Clinical signs include markedly elevated IOP, a fixed mid-dilated pupil, corneal edema, a shallow anterior chamber, glaucomflecken on the lens, and conjunctival vascular congestion. These signs and symptoms may not all appear in every case. IOP should be measured and documented by Goldmann applanation tonometry.	**94.11 %**	52.94 %	41.18 %	0 %	5.88 %	0 %
1.7	Always be aware of the possibility of secondary causes that could lead to acute and severe IOP elevation. Clinical signs such as an open angle with deep anterior chamber in the fellow eye, a relatively clear cornea of the affected eye, and presence of rubeosis iridis should also be looked for.	**94.11 %**	58.82 %	35.29 %	0 %	5.88 %	0 %
1.8	Drugs with mydriatic and cycloplegic effects could precipitate the onset of APACA in eyes with anatomical predispositions, such as shallow anterior chamber and thicker lens. This is because mydriasis could aggregate the pupillary block and angle crowding condition. These drugs include mydriatic eye drops, tricyclic or selective serotonin reuptake inhibitor (SSRI) antidepressants, and nasal decongestants (which contain antihistamines), anticholinergics, sympathomimetics, and antiemetics.	**88.24 %**	64.71 %	23.53 %	5.88 %	5.88 %	0 %
1.9	While an accurate diagnosis is important, rapid IOP reduction should be the priority for patients with a clinical picture of APACA, in order to prevent further irreversible glaucomatous damage as much as possible.	**100 %**	82.35 %	17.65 %	0 %	0 %	0 %
1.10	Gonioscopy should be routinely performed on both eyes. Although corneal edema can render gonioscopy difficult for the APACA eye, findings of the fellow eye are valuable. Anterior segment optical coherence tomography (AS-OCT) and ultrasound biomicroscopy (UBM) can provide detailed visualization of the anterior chamber angle and enhanced diagnostic acumen. B-scan ultrasound helps rule out posterior segment pathologies. However, these investigations should not delay the primary objective of IOP reduction.	**100 %**	58.82 %	41.18 %	0 %	0 %	0 %
2. Current and Alternative Treatments in Rapid IOP Reduction							
2.1	The conventional first-line approach for rapid IOP reduction employs topical and systemic IOP-lowering medication. However, it could be suboptimal in some patients, especially those who present late and with $>$ 50 mmHg presenting IOP.	**94.12 %**	47.06 %	47.06 %	0 %	5.88 %	0 %
2.2	Given that an APACA eye is heavily inflamed, topical $\pm$ systemic anti-inflammatory therapy should also be given.	**100 %**	58.82 %	41.18 %	0 %	0 %	0 %
2.3	While the APACA eye is being treated, the fellow eye is likely at risk of developing an acute attack, especially if gonioscopy reveals narrow angle. Pilocarpine eye drops can be started in the fellow eye until LPI can be done.	**100 %**	52.94 %	47.06 %	0 %	0 %	0 %
2.4	It is most desirable to abort the APACA as soon as possible to limit the irreversible damage caused by elevated IOP (including glaucomatous optic neuropathy, corneal endothelium, iris, and lens zonules). Medical therapy alone may not be ideal because of a slow onset of the IOP reduction effect and the presence of refractory cases. It is worth exploring effective and safe treatments as alternatives to the traditional medical treatment alone to rapidly lower the IOP.	64.7 %	29.41 %	35.29 %	29.41 %	5.88 %	0 %
2.5	Argon laser peripheral iridoplasty (ALPI), used as an immediate measure, could be an alternative to traditional medical treatment, although traditionally used safely and effectively for cases that failed traditional medical therapy. Studies have demonstrated its usefulness as an immediate measure and it can bring the IOP down to a relatively safe level in 15–30 min.	**94.12 %**	41.18 %	52.94 %	5.88 %	0 %	0 %
2.6	Laser pupilloplasty (LPP) could be an effective and quick adjunctive treatment to relieve pupillary block and can be combined with ALPI to control IOP in APACA.	**88.23 %**	35.29 %	52.94 %	5.88 %	5.88 %	0 %
2.7	Anterior chamber paracentesis (ACP) can provide immediate IOP normalization and may be a decent alternative option, especially if argon laser machine and doctor with such expertise are not available.	**94.12 %**	47.06 %	47.06 %	0 %	5.88 %	0 %
2.8	Emergency trabeculectomy, intended as a treatment for medically uncontrolled APACA, is generally best avoided. Performing trabeculectomy on an inflamed eye and under severe pressure can lead to further shallowing of the anterior chamber, an increased likelihood of failure, and a heightened risk of adverse outcomes.	**82.35 %**	35.29 %	47.06 %	11.76 %	5.88 %	0 %
2.9	Emergency phacoemulsification as a treatment for medically uncontrolled APACA is best avoided. Emergency phacoemulsification in a “hot and angry” eye carries	**100 %**	50 %	50 %	0 %	0 %	0 %

(*continued on next page*)

Table 1 (*continued*)

Section	Consensus Statement	C Score	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	additional risks arising from undesirable eye conditions, such as a poor surgical view due to corneal edema, a shallow anterior chamber, a small and distorted pupil, an atonic iris prone to iris prolapse, and an inflamed intraocular condition.						
2.10	With the availability of ALPI and ACP, there should be few cases of uncontrolled IOP, and thus, emergency trabeculectomy and phacoemulsification could be safely avoided.	**100 %**	37.5 %	62.5 %	0 %	0 %	0 %
3. Preventing Further Optic Nerve Damage and Development of CACG after APACA and Successful Peripheral Laser Iridotomy							
3.1	After successful abortion of APACA, LPI is conventionally performed to eliminate the relative pupillary block mechanism (phase II). However, this may be suboptimal in the longer term because up to 58 % of the eyes that underwent successful LPI resulted in IOP elevation and developed CACG, which required medication therapy or trabeculectomy.[54] More definitive treatment should be considered after successful LPI.	**94.12 %**	47.06 %	47.06 %	5.88 %	0 %	0 %
3.2	It is well-documented that early phacoemulsification following successful LPI provides better IOP control and more favorable long-term outcomes than LPI alone. Early phacoemulsification may be an effective treatment for preventing CACG, provided it is performed in an adequate setting that can yield favorable outcomes.	**94.12 %**	70.59 %	23.53 %	5.88 %	0 %	0 %
3.3	For APACA eye, applying a lower threshold for phacoemulsification (e.g., operating on younger patients with relatively good visual acuity) is appropriate. This is supported by the high rate of cataract development after APACA and evidence that showed phacoemulsification results in better IOP control, better visual outcomes, lower medication requirements, and lower rate of CACG development than APACA eyes that underwent LPI alone.	**88.24 %**	47.06 %	41.18 %	5.88 %	5.88 %	0 %
3.4	A good timing for phacoemulsification after APACA is likely to be between 1 and 3 months after APACA. This is because time is required for the eye to quiet down adequately before phacoemulsification, while waiting too long may increase the chance of PAS formation and CACG development.	**76.47 %**	29.41 %	47.06 %	17.65 %	5.88 %	0 %
3.5	If there is an underlying CACG component with extensive PAS, phacoemulsification combined with GSL with or without goniotomy may be considered.	70.59 %	29.41 %	41.18 %	29.41 %	0 %	0 %
4. Future development							
4.1	Although APACA is more prevalent in patients with risk factors (e.g., older age, female sex, hyperopia, and family history of angle closure) and anatomically susceptible eyes (including shallow anterior chambers and thicker lenses), myopic eyes are not exempt from APACA, despite having lower risk.	**94.11 %**	35.29 %	58.82 %	5.88 %	0 %	0 %
4.2	Topical, subconjunctival, or systemic steroid application can help reduce the inflammatory response and reduce IOP during the acute phase. Further studies are warranted.	70.59 %	29.41 %	41.18 %	23.53 %	5.88 %	0 %
4.3	Although a lower threshold of phacoemulsification could be considered for APACA, the best timing and indication for phacoemulsification require further investigation.	**82.36 %**	41.18 %	41.18 %	11.76 %	5.88 %	0 %
4.4	It is necessary to explore effective alternatives for treating the initial stage of APACA in rural areas inaccessible to ophthalmic facilities. Corneal indentation can lower the IOP by widening the angle and facilitating aqueous drainage, thereby protecting the eye from further glaucomatous damage and potentially reducing the need for additional management in centers equipped with the appropriate instrumentation. There are various suggested techniques, and further evaluation of the role of corneal indentation is warranted.	**88.23 %**	11.76 %	76.47 %	5.88 %	5.88 %	0 %

Consensus Score (C Score) was defined as the value of the summation of the 'strongly agree', and 'agree' percentages; C Score $\geq$ 75 % was considered 'consensus achieved' and C Score $<$ 75 % was 'consensus not reached'. Four statements were 'consensus not achieved' (with the C Score underlined).

Additionally, we also raised the awareness that myopic patients are not risk-free from APACA (statement 4.1), though the risk is lower. We included the statement to urge clinicians not to "rule out" APACA based on its lower risk.

Among the secondary causes, the role of choroidal changes contributing to the initiation of APACA (statement 1.5) remains debatable, and the statement has not reached a consensus. Previous imaging studies revealed an association between choroidal expansion and narrowing of anterior chamber parameters.[37] However, it is difficult to prove their causal relationship and to measure the magnitude of the choroidal changes contributing to the APACA mechanism. Large-scale imaging studies are required to prove the proposed significant role of choroidal expansion in APACA pathogenesis.

The majority of the experts either strongly agreed or agreed with consensus 2.4, although the C score marginally missed the consensus threshold (64.7 % versus 75 %). For less severe APACA and patients who present soon after the onset of symptoms, medical therapy alone could achieve reasonably quick IOP reduction without additional procedures. This may not apply to more severe cases. Indeed, all panelists either strongly agreed or agreed on the need to rapidly abort APACA as soon as possible to limit irreversible damage, the inadequacy of the current first-line treatment (medical treatment) to abort APACA in some patients (especially late-presenters with IOP $>$ 50 mmHg who cannot tolerate medical treatment), and the urge to explore effective and safe alternative approaches (consensus 2.1 and 2.3).

In contrast to the conventional protocol that suggests emergency trabeculectomy or phacoemulsification for medically uncontrolled APACA (Fig. 1), most panelists were against the approach. Indeed, emergency trabeculectomy on an inflamed and high IOP APACA eye is risky and known to have a high failure rate due to early bleb fibrosis.[51] It could also further shallow the anterior chamber and aggravate the angle closure condition. Only one expert disagreed with avoiding emergency phacoemulsification. Phacoemulsification should logically revert the angle closure mechanism, widen the angle, and provide immediate IOP reduction (consensus 2.9). However, set aside that operating on a medically uncontrolled APACA eye carries a high surgical risk and

potentially leads to further intraocular structural damage, the corresponding authors found that performing phacoemulsification on eyes with medically aborted APACA eyes within 1 week of the acute attack is relatively challenging (e.g., poor view due to corneal edema and Descemet's membrane fold, loose zonules, floppy iris, inflammation). Therefore, effective and less invasive approaches should be used to lower the IOP promptly, thereby priming the eye for better conditions for subsequent, more invasive procedures.

All panelists either strongly agreed or agreed with ACP as a decent alternative. Indeed, it is an effective, safe, and readily available office procedure with which most ophthalmologists are technically familiar. It may be underutilized due to the customary practice of escalating treatment from less invasive to more invasive approaches. ACP may appear too invasive because of the shallow anterior chamber, potential risk of intraocular structural damage, and fear of over-draining the anterior chamber. However, based on our experience, these risks are minimal with our suggested technique. Rapid IOP reduction and certainty of treatment success is critical, especially in rural or underprivileged areas where APACA may present late with high IOP and the patient could not afford further irreversible visual loss due to the slower onset of medical treatment and the potential of treatment failure. In this situation, ACP may be arguably superior to medical treatment, which can quickly condition the eye to a suitable state for prompt further treatment (e.g., LPI). The role of ACP in the treatment algorithm warrants further investigation.

The rationale for applying ALPI early is similar to that of ACP and only one expert disagreed with the statement (consensus 2.5). Although level I evidence suggested that ALPI reduces IOP more rapidly than systemic medication within the first 2 h of treatment, despite corneal edema (Fig. 2),[40] the universal utilization of ALPI could be hindered because of the unfamiliarity with the technique, which renders ALPI less effective. Furthermore, laser machines may not be readily available in underprivileged regions. Using LPP as an adjunctive treatment with ALPI to relieve pupillary block also reached consensus. The principle of LPP was to cauterize and shrink the iris' pupillary margin, consequently turning the iris outward and relieving the pupillary block.[62] The technique is less commonly practiced and may lead to long-lasting mydriatic effects, causing glare and photophobia. Further study is required to explore the role of LPP.

Overall, the aims of rapid IOP reduction in the initial phase are to limit irreversible damage and condition the eye for further treatments that could revert the angle closure mechanism. Relative pupillary block is a common mechanism that is usually reversed by LPI. However, up to 58 % of the eyes with successful LPI developed CACG[54] and all panelists agreed that more definitive treatment is required to reduce this risk. Most experts agreed with the benefit of phacoemulsification and that the appropriate timing of surgery could be between 1 and 3 months after APACA. One of the experts suggested that phacoemulsification could be performed as early as 2 weeks without prior LPI. While this may be possible for medically controlled APACA eyes that recover swiftly and favorably for phacoemulsification, patients in the underprivileged regions who presented with more severe APACA requiring a longer recovery time should undergo LPI to prevent a recurrent attack during the recovery period. Future large-scale studies are needed to explore the appropriate timing for phacoemulsification.

Generally, the decision to combine glaucoma procedures with phacoemulsification comes with the issue of balancing the increased surgical complication risk and enhancing glaucoma treatment (including IOP reduction and medication requirement). Combined phacotrabeculectomy to treat chronic PACG was demonstrated to reduce medication requirements to control IOP than phacoemulsification alone but carried a higher rate of surgical complications.[107–109] Reducing medication use is essential because it implicates patient quality of life and the cost-effectiveness of treatment.[77] GSL and goniotomy could be the alternative lower-risk procedures that could be combined with phacoemulsification. Most of our experts either strongly agreed or agreed that GSL and goniotomy may be considered during phacoemulsification, although the C score of consensus 3.5 marginally missed the threshold percentage (70.59 % versus 75 %). It is possible that not all experts on the panel were familiar with the procedure, especially for post-APACA cases where the surgical view may still be obscured (e.g., the presence of Descemet's membrane fold). Further study is worthwhile to explore the potential benefits of the approach specifically for APACA eyes. Some experts also raised the issue of utilizing minimally invasive glaucoma devices in APACA eyes. However, studies related to PACG, MIGS, and minimally invasive bleb surgery (MIBS) are limited and generally small-scale.[110,111] Their role in APACA management requires verification.

The consensus has underscored some critical diagnostic and management issues. Although the prevalence of secondary angle closure and APACA in myopia are uncommon, the panels raise public awareness of these possibilities. The role of ACP, ALPI, LPP, corneal indentation, and steroid administration during the acute phase of APACA require further evaluation. Furthermore, in rural areas where laser machines are not readily available, ACP and corneal indentation are practical and cost-effective alternatives for phase I treatment. There are limited studies that explore the role of corneal indentation. Standardizing an effective and practical corneal indentation technique that does not require ophthalmic instruments would be helpful for underserved regions. The timing of phacoemulsification and the role of combined procedures (including MIGS and MIBS) could significantly improve the long-term outcome and reduce the risk of developing CACG and blindness.

There are several limitations regarding the formation of the consensus statement. Some controversial issues requiring consensus were not included. One of the issues was the role of ancillary procedures for post-APACA eyes in preventing PACG progression. For instance, despite the potential positive impact of ALPI to the anterior chamber morphology,[112–114] several small-scale, short-term RCTs (up to one year) that evaluated the role of ALPI for primary angle closure disease demonstrated that the outcomes (including IOP-lowering effect, reducing the number of additional medication or surgery) were no more clinically effective than the comparators of the studies (ALPI with LPI versus LPI alone as a primary procedure, ALPI as a secondary procedure versus no treatment or medication).[115–118] Similarly, the long-term efficacy of combining phacoemulsification and GSL with or without goniotomy for PACG has demonstrated great potential in IOP control[86–89] and needs to be specifically investigated on a large scale for post-APACA eyes. Finally, the issues of "target IOP" and consensus on how medication could be reduced for post-APACA eyes were not discussed.

Conclusion

Numerous scientific and clinical studies over the past decades have advanced our understanding of APACA and improved treatment outcomes. However, treatment non-responsiveness is common, especially for patients in underprivileged regions (e.g., rural areas of developing countries). These regions may also have limited access to advanced ophthalmic equipment. Experts from APGS and AAPPO have identified the shortcomings of the current "standard protocol" and a context mismatch for underprivileged patients. Hence, the panel has reached a consensus that ALPI, ACP, and LPP are viable alternative treatments for achieving rapid IOP control, thereby reducing irreversible damage to the optic nerve and other ocular tissues. Early phacoemulsification is effective in reducing the risk of further optic nerve damage and progression to CACG; it is worth considering where adequate facilities and expertise are available. Further studies on corneal indention as an immediate treatment to achieve rapid reduction of IOP for APACA cases are warranted.

Consent

All authors consent to be co-authors of this manuscript.

Declaration of Competing Interest

None.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.apjo.2025.100223.

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