

# Clear Lens Extraction in Glaucoma (Is It Still a Controversy?)

Syed Shoeb Ahmad<sup>1</sup>

<sup>1</sup>*Ibn-e-Sina Academy, Dodhpur, Aligarh-202001, India*

The lens appears to play a strategic role in the etiopathogenesis of glaucoma. This is not a new concept. In 1891 Priestley Smith had noted that some patients diagnosed with glaucoma demonstrated shallow anterior chambers even before the development of the disease (glaucoma). He concluded that this feature could be attributed to the disproportion between the size of the eyeball and the lens.<sup>1</sup> Lowe (1969) mentioned that the anatomical basis of primary angle closure glaucoma (PACG) lies in two important “constitutional” factors (lens position and thickness) and two other factors of lesser importance related to advanced age (increase in lens thickness and anterior lens displacement).<sup>2</sup>

Recently it has been mentioned that apart from age-related progressive growth in lens volume, another factor called lens vault is involved in the pathogenesis of angle closure, especially in women in the 3<sup>rd</sup> or 4<sup>th</sup> decade.<sup>3</sup> Lens vault is defined as the part of the lens situated anterior to a plane drawn across the scleral spurs. In cases where the part of the lens anterior to its normal position becomes more protruded, in other words increased lens vault, there is direct narrowing of the anterior chamber angle. It also aggravates iridolenticular contact, which may eventually worsen pupillary block. Studies have shown that after a successful peripheral iridotomy (PI), there can be a gradual increment in lens vault which can

cause re-closure of the PI.<sup>4</sup> In certain eyes the thickened lens may cause pupillary/angle closure through intumescence, even though it could be a clear lens. Other clear lens related factors such as subluxed lenses and spherophakia may also contribute to glaucoma.<sup>5</sup> Therefore, identification of these clinical features in a patient with glaucoma/ocular hypertension (OHT) may help decide the best course of action. With this understanding of the lens as a strategic factor in the development of glaucoma there is wider acceptance of lens-based surgeries for the management of certain forms of primary angle closure disease (PACD).

A number of studies have been performed previously to assess the role of cataract extraction in glaucoma. It was probably Guyton (1945) who first gave the concept of lens extraction in glaucoma.<sup>6</sup> Subsequently, a number of clinicians reported good control of IOP, reduction in glaucoma medications, better visual gains and lesser complications using this modality. In a report published by the American Academy of Ophthalmology, the authors accessed PubMed and Cochrane databases to review the effect of phacoemulsification on IOP in glaucoma patients. The study reported the procedure was successful in reducing IOP by 13% in primary open angle glaucoma patients, by 20% in pseudoexfoliative glaucoma, in acute PACG by 71% and in chronic PACG by 30%.<sup>7</sup>

While cataract extraction for management of glaucoma is already an established mode of treatment, it is the new “avatar” of this procedure which finds itself in a storm of controversy. This technique is “clear lens extraction” (CLE) for glaucoma. These patients have no visual symptoms, there are inherent risks of intra- and post-operative complications, loss of accommodation following the procedure and the increased costs of surgery. These factors have opened CLE as a subject of debate.

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*Correspondence: Syed Shoeb Ahmad  
Ibn-e-Sina Academy, Dodhpur, Aligarh-202001, India  
Email: syedshoebahmad@yahoo.com*

In the last few years a few studies have been published on the role of CLE in glaucoma. Tham et al. have compared CLE with trabeculectomy. They reported marginally better IOP control with trabeculectomy in comparison to CLE (36% vs. 34%). However, trabeculectomy operated eyes had more frequent surgical complications (46% vs. 4%.  $P = .0001$ ).<sup>8</sup> Dada et al. in their study performed CLE for primary angle closure (PAC) patients. They reported significant reduction in IOP and increase in the angle opening distance (AOD) as well as in trabecular-iris angle and reduction in glaucoma medications following the procedure.<sup>9</sup> In another study, CLE was compared with trabeculectomy and there was slightly better lowering of IOP in the trabeculectomy group. Finally, the most extensive analysis of CLE was performed in “The Effectiveness in Angle-closure Glaucoma of Lens Extraction” (EAGLE) study. In a large multi-center trial conducted in 30 hospitals across five countries patients with PAC/PACG underwent CLE. The procedure was performed on 208 individuals who were followed up for three years. At the end of the study, mean IOP was 1 mm Hg lower in the CLE group compared to the standard-care group (medications and PI). Further treatment was required in 21% patients who underwent CLE compared to 61% in the other group. The CLE group also reported less frequent need for surgical intervention (one vs. 24 in the standard-care group).<sup>10</sup>

While undeniably there are multiple advantages of CLE it is necessary to emphasize that this procedure is not a one-stop solution for all cases of PACG. The possibility of trabecular meshwork dysfunction and post-trabecular mechanisms for the development of glaucoma have to be kept in mind. CLE may not be effective in such cases. The management of PACD depends upon a number of aspects including the stage of the disease and correctly identifying the underlying mechanisms. The surgical option should be dictated by a holistic consideration of all factors and not just lowering of IOP.

CLE alone may possibly be an alternative to trabeculectomy as an initial surgical option in medically uncontrolled, iridotomized eyes without cataract. It is debatable if CLE can be an alternative to iridotomy. CLE can be preferred in patients prone to or who cannot accept the potential complications of trabeculectomy with anti-fibrotic agents such as mitomycin-C. In situations which require a more urgent need to reduce the number of medications it is

advisable to opt for glaucoma filtering surgery rather than CLE.<sup>11</sup> The ideal candidate for CLE is someone having only mild damage and whose IOP is within target range on well tolerated glaucoma medications. Certain factors have to be considered while deciding for CLE vs. combined surgery vs. trabeculectomy alone. These include: patient characteristics, severity of glaucoma, the potential visual outcome after lens extraction and target IOP to be achieved. In certain cases, minimally invasive glaucoma surgery (MIGS) or goniosynechialysis can be combined with CLE. Pre-existing structural trabecular damage in PACG eyes may not lead to effective lowering of IOP after lens extraction alone. Such patients would do better with combined phaco-trabeculectomy. CLE can be considered if there is increased lens thickness or lens vault and no significant trabecular dysfunction or glaucomatous optic nerve degeneration is present. In such situations CLE may prove curative.<sup>12</sup>

Lens extraction is the only surgical modality that changes the anatomy of the angle, which is a predisposing factor for angle closure. Lens removal deepens the anterior chamber and thereby relieves angle crowding.<sup>13</sup> Shingleton has mentioned that cataract extraction should not replace combined surgery in the glaucoma population; instead it can be an appropriate choice in a compliant glaucoma patient on one or two medications pre-operatively with otherwise stable visual fields and optic nerves.<sup>14</sup> CLE can be considered if topical treatment does not control IOP and PI does not have a positive effect on the angle closure. This is especially effective if there is only appositional angle closure and anterior segment imaging shows the lens contributing significantly to the angle closure. It is essential to weigh the benefits of CLE with disadvantages such as loss of accommodation, stress of surgical intervention on the patient and surgeon, technical difficulties and the intra- and post-operative complications which may occur more frequently in this group compared to normal eyes.<sup>15</sup>

In conclusion, there appears to be widening acceptance of CLE in selected cases. Glaucoma management has to be individualized and when situation demands such techniques can be successfully employed. The procedure is relatively safe, validated by our experience of clear lens exchange for refractive errors, effective and shows a positive impact on the quality of life of the individual by reducing dependence on glaucoma medications. There is need

to further develop and refine the indications for CLE so that it can be utilized as an adjunct approach for glaucoma management in the near future.

### Conflict of Interest

Author declared no conflict of interest.

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