



Clear lens extraction as the first line treatment of primary angle closure/primary angle closure glaucoma

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Comment on: Azuara-Blanco A, Burr J, Ramsay C, *et al.* Effectiveness of early lens extraction for the treatment of primary angle-closure glaucoma (EAGLE): a randomised controlled trial. *Lancet* 2016;388:1389-97.

Abstract: Angle closure glaucoma (ACG) is one of the major causes of blindness. Angle closure occurs from the obstruction of the trabecular meshwork by the peripheral iris, which results in increased intraocular pressure (IOP) through impaired aqueous flow. Considering pupillary block by crystalline lens is the most frequent mechanism, lens extraction is regarded as an effective therapy. Recently, to validate the effect of lens extraction, the EAGLE study was reported. In this study, subjects were 50 years or older, did not have cataracts, and had newly diagnosed primary angle closure (PAC) with intraocular pressure 30 mmHg or greater or primary angle-closure glaucoma (PACG), and were divided into clear-lens extraction group and standard care group (laser peripheral iridotomy and topical glaucoma medication). This study suggested that clear-lens extraction showed greater efficacy and was more cost-effective than laser peripheral iridotomy. Initial clear lens extraction showed better clinical course and patient-reported outcomes. This study provided evidence to support clear lens extraction as the first line treatment for PAC with high IOP or PACG patients.

Keywords: EAGLE; angle closure; glaucoma

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Angle closure glaucoma (ACG) is one of the major causes of blindness, especially in Asian populations. Angle closure occurs from the obstruction of the trabecular meshwork by the peripheral iris, which results in impaired aqueous flow. This leads to intraocular pressure (IOP) elevation and eventually glaucomatous optic neuropathy (1,2). Considering that acute sudden IOP elevation is a vision-threatening condition, timely treatment is of crucial importance (1,2). For appropriate and effective treatment, clinicians need to diagnose the principle mechanism of ACG in each patient. Several mechanisms are known to play a role in the pathogenesis of ACG. Needless to say, pupillary block is the most frequent mechanism of ACG. It is initiated by the relative resistance of aqueous flow from the posterior chamber to the anterior chamber via the pupil, which builds up pressure in the posterior chamber and

makes the iris bow out, finally prompting iridotrabecular contact. An increase in the lens vault can directly narrow the anterior chamber angle; furthermore, it can aggravate iridolenticular contact, which eventually worsens pupillary block. Lee *et al.* (3) suggested that the lens vault was the important factor for the mechanism of acute angle closure. In that study, a greater lens vault was the most prominent feature in affected eyes compared to fellow eyes within the same patient in acute primary angle closure (PAC). Usually, laser iridotomy with/without medication which can relieve pupillary block is the first line therapy in ACG. However, IOP cannot be normalized in eyes with greater lens vaults, despite successful laser iridotomy. Further, eyes that underwent laser iridotomy showed a gradual increment of the lens vault, which may lead to re-closure of the anterior chamber angle after laser iridotomy (4).

Hence, lens extraction is regarded as an effective and essential therapy, considering various mechanisms. Lam *et al.* (5) suggested that both early phacoemulsification and laser iridotomy were successful but showed lower IOP, fewer medications, and deeper angles following lens removal when compared to laser iridotomy. Dada *et al.* (6) reported that clear lens extraction induced a significant reduction in IOP with a widening of the anterior chamber angle, and a reduced need for ocular hypotensive medications in PAC eyes. Compared to trabeculectomy, Man *et al.* (7) suggested that clear lens extraction led to a significant reduction in synechial angle closure with a deepening of the anterior chamber angle in primary angle closure glaucoma (PACG) eyes without cataracts. Senthil *et al.* (8) also suggested that cataract surgery and combined surgery resulted in similar IOP control in phacomorphic glaucoma patients. Therefore, there have been some publications which advocated lens extraction as a definitive treatment for ACG. However, considering the risks of surgery and benefits of phakic status, the usefulness of clear lens extraction in PACG remains controversial.

Recently, a noteworthy study reported on the effectiveness of early lens extraction for the treatment of PACG with a randomised controlled trial (9). In this prospective multicenter study (30 hospitals in 5 countries), patients were assigned with a web-based randomized application to undergo clear-lens extraction or receive standard care with laser peripheral iridotomy and topical medical treatment. This study included patients who were aged 50 years or older without cataracts who had newly diagnosed PAC with an IOP 30 mmHg or greater or PACG. PAC was defined as iridotrabecular contact of at least 180°, either appositional or synechial, and PACG was defined when glaucomatous optic neuropathy was present. The primary endpoints were patient-reported health status, IOP, and incremental cost-effectiveness ratio per quality-adjusted life-year gained 36 months after treatment. One hundred fifty five PAC patients and 263 primary angle-closure glaucoma patients were enrolled. Among them, 208 were assigned to clear-lens extraction and 211 to standard care. The quality of life score was 0.052 higher and the mean IOP was 1.18 mmHg lower after clear-lens extraction than after standard care. Only 21% of participants in the clear-lens extraction group received any further treatment to control IOP (61% received at least one glaucoma drop in the LI group). Further need for glaucoma surgery was reduced in the initial clear-lens extraction group compared to the standard care group (1 vs. 24 operations). Patients undergoing clear-

lens extraction became emmetropic (0.08 ± 0.95 diopters), whereas the laser iridotomy group was more hyperopic (0.92 ± 2.8 diopters). The uncorrected distance and near visual acuity were better in the clear-lens extraction group. Initial cost is definitely high in the clear lens extraction group, but cost effectiveness improves when the savings associated with reduced need for subsequent procedures and medications are taken into account. This study suggested that 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. Most previous studies which explored the significance of lens extraction in PAC were for PAC patients who had sick lenses, such as cataracts or abnormalities in lens position. The EAGLE study was a multicenter international randomized controlled trial, and the result showed that initial clear lens extraction for PAC and PACG was better in terms of clinical course and patient-reported outcomes. Therefore, these approaches are likely to be effective for a public support health care system. Laser iridotomy is known to widen the anterior chamber angle, but the effect was not permanent. Jiang *et al.* reported that increased angle width after laser iridotomy remained stable for 6 months, and then decreased significantly by 18 months (10). While complications of surgery should be considered even though they are rare, this study provided evidence to support clear lens extraction as the first line treatment for PAC with high IOP or PACG patients.

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appropriately investigated and resolved.

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