Nanophthalmos refers to an eyeball of short axial length, usually less than 20 mm which leads to angle closure glaucoma due to relatively large lens. Intra-ocular lens extraction relieves the angle closure in nanophthalmos. Cataract surgery in a nanophthalmic eye is technically difficult with high risk of complications such as posterior capsular rupture, uveal effusion, choroidal haemorrhage, vitreous haemorrhage, malignant glaucoma, retinal detachment and aequous misdirection. Various options are explained in the literature to perform cataract surgery in nanophthalmos, like extracapsular cataract extraction with or without sclerostomy; small-incision cataract extraction by phacoemulsification which not only helps maintain the anterior chamber during surgery but also reduces the incidence of complications due to less fluctuation of intraocular pressure (IOP) during the surgery. Cataract surgery deepens and widens the anterior chamber angle in nanophthalmic eyes and has beneficial effects on IOP in eyes with nanophthalmos but is associated with a high incidence of complications.

**METHODOLOGY**

Review of the literature and journal articles was conducted to find out the success of cataract surgery in nanophthalmos and to suggest ways to avoid complications in nanophthalmic eyes while performing cataract surgery.

**DISCUSSION**

Challenges of intervention: The size of the crystalline lens in nanophthalmic eyes is within the normal range; therefore, the crystalline lens/globe volumetric ratio, which is 4% for normal eyes, increases up to the pathological level of 10 – 30% in nanophthalmics leading to chronic, painless glaucoma in these patients at an early age due to the natural increase in the size of the lens with age.12-14

The intraocular pressure (IOP) lowering response to conventional medical treatment in nanophthalmic glaucoma is usually poor due to the structural change within the drainage mechanism.15,16 Miotics may make the raised IOP worse by relaxing the lens zonule and producing relative pupillary block. Laser iridotomy and iridoplasty are moderately successful initially but later due to peripheral anterior synechia; it becomes ineffective in keeping the IOP lower. Fistulizing glaucoma surgery like trabeculectomy could lead to malignant glaucoma due to postoperative ciliary block and choroidal effusion, due to changes in the dynamic of IOP during and after the surgery.15,16

Removal of the intraocular lens could relieve the obstruction of the filtration meshwork and keep the angles open, avoiding potential glaucoma and helps to have better control of intra-ocular pressure post-operatively.15,16

Eyes with nanophthalmos seemed to pose a significant challenge during cataract extraction because of the
reduced working space, due to shallow anterior chamber and a small corneal diameter.

Nanophthalmic eyes have a high incidence of intraoperative and postoperative complications, including uveal effusion, retinal detachment, vitreous haemorrhage, or malignant glaucoma, suprachoroidal haemorrhage, iris prolapse, persistent corneal oedema, and cystoid maculopathy.7,16-19 Surgical manipulation in a narrow and crowded anterior chamber with increased vitreous pressure, tends to cause papillary blockage which is the most challenging situation to manage in the nanophthalmic patients.17-19 The reduction of intraocular lens size after cataract surgery not only opens-up the drainage angle20 but also helps to reduce the intraocular pressure in eyes with nanophthalmos.

Pentacam and ultrasound biomicroscopy have shown an increase in anterior chamber volume, depth, and opening of the angles after extraction of cataracts from nanophthalmic patients; strongly suggesting the morphological change following cataract extraction.20

Pre-operative workout: Before planning any surgery in nanophthalmics, it is prudent to do careful pre-operative workout. Ultrasound B scan to assess retinal-choroidal-scleral thickness in nanophthalmic eyes allow physicians to do careful pre-operative assessment and plan appropriate operative procedures to prevent subsequent complications like choroidal effusion.7

Accurate intraocular lens (IOL) power calculation is the most important aspect of cataract surgery outcome to avoid unnecessary refractive surprises. Calculation of IOL powers remains the major challenge in nanophthalmic eyes and has an impact on poor postoperative refractive outcome due to shallow anterior chamber depth, the short axial length (AL), the small corneal diameter and relatively high power IOL.1,21 No formula for calculation of IOL power is accurate; Inatomi and associates suggested Hoffer Q and Holladay-II formulas for calculation of IOL power is accurate; Inatomi and morphological change following cataract extraction.20 and a small corneal diameter.18 Therefore, full thickness lamellar sclerectomy should be kept reserved for patients with established choroidal effusion.27

Is extracapsular cataract extraction (ECCE) the best option? Extracapsular cataract extraction with or without sclerostomy could be an option for management of nanophthalmos where cataract surgery with phacoemulsification is not possible due to logistic reasons and very shallow anterior chamber in the nanophthalmic patients. Thickened lens and crowded anterior chamber could make phacoemulsification difficult. Classical extracapsular cataract extraction (ECCE) with primary posterior chamber intraocular lens implant (PCIOL) could be the best option in such cases. It is important to reduce the intraocular pressure pre-operatively with medical therapy in cases of nanophthalmos.14 ECCE can prevent the serious complication of posterior capsule rupture as compared to phacoemulsification. PCIOL acts as a barrier against enormous vitreous pressure, prevents the pushing of the anterior chamber structures and keeps the drainage angles open in this way.25 Role of prophylactic sclerostomy to avoid the uveal effusion syndrome is always controversial. However, Jin et al. reported that nanophthalmic uveal effusion can be prevented or treated with an unsutured sclerotomy or sclerectomy before ECCE.26

Is phacoemulsification the best option? Small-incision cataract extraction by phacoemulsification allows the surgeon to perform well controlled surgery and helps maintain the anterior chamber during surgery which could help to reduce the incidence of complications due to less fluctuation of IOP during the surgery. The best approach in such patients for cataract surgery with phacoemulsification is the biggest dilemma faced by the ophthalmic surgeons today. Few available options are discussed below keeping in mind one or none could work for such a patient and the outcome of surgery is highly unpredictable.

Prophylactic lamellar sclerostomy with decompression of the vortex veins at the time of cataract surgery by phacoemulsification with IOL implantation could be helpful to prevent choroidal and retinal detachment post-operatively.17 However, advances in a small-incision cataract surgery technique (Phacoemulsification) are considered safe and sometimes could obviates the need for prophylactic sclerotomies in nanophthalmic patients.18 Therefore, full thickness lamellar sclerectomy should be kept reserved for patients with established choroidal effusion.27

The poor refractive outcome and poor predictability is usually due to shallow anterior chamber depth, the short axial length, the small corneal diameter, relatively high power IOL7 and high posterior capsular rupture rates with phacoemulsification in such patients.24 Nanophthalmics with intumescent lens and subsequent severe anterior chamber shallowing, could be benefited
from pars plana vitrectomy to create the space in the anterior chamber for lens extraction with phacoemulsification.  

Recently, Varma et al. suggested to perform a planned pars plana vitrectomy tap to create additional working space in the anterior chamber intraoperatively followed by phacoemulsification, insertion of capsular tension ring to help draw the IOL-capsule complex posteriorly. In the presence of Plateau iris and peripheral anterior synechiae: a modified endocyclophotocoagulation (ECP) to address Plateau iris and goniosynechialysis helped to release peripheral anterior synechiae and reported good postoperative refractive outcome.  

**How to avoid intraoperative complications?** Sudden lowering of IOP during the cataract surgery is a known risk factor to develop uveal effusion syndrome in small axial length eyes which could be prevented by oral steroids, intravenous acetazolamide, and mannitol preoperatively and operative sclerotomies to release suprachoroidal fluid.  

It is very important to avoid hypotony during surgery and maintain AC volume throughout the procedure with abundant injection of viscoelastic materials. Various techniques to prevent choroidal effusion are described; like lens extraction through pars plana vitrectomy with gas exchange, prophylactic lamellar scleral resection with decompression of the vortex veins.  

Due to small working space in the anterior chamber and high vitreous pressure; higher incidence of posterior capsular rupture is noted in patients with nanophthalmos. This can not only have a significant effect and postoperative refractive outcome but also on the long-term management of these patients for raised IOP. The reported incidence of posterior capsular rupture varies from 1 out of 8 (12.5%) to 2 out of 17 (11.7%) in nanophthalmic eyes.  

Various methods can be adopted to prevent posterior capsular rupture like controlling the IOP fluctuation during phacoemulsification by creating water tight incisions, adjustment of bottle height with the depth of anterior chamber, peroperative pars plana vitrectomy to reduce the posterior vitreous pressure and create space within the anterior chamber. Diuretics, intravenous mannitol or laser iridotomy could be helpful preoperatively. Topical anaesthesia could be safe for performing surgery as it could better reduce the posterior vitreous pressure rather than peribulbar or retrobulbar anaesthesia.  

Endothelial cell loss is a major reason for postoperative persistent corneal oedema leading to visual disappointment and poor refractive outcome. Nanophthalmic patients have greatest mean endothelial cell loss following cataract surgery as compared to micro-}

**REFERENCES**


