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Cataract Surgery in Retina Patients

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1. Introduction

Cataract surgery accounts for a significant part of the surgical load of ophthalmologists and it continues to be the commonest surgical procedure on the world. It has a high level of efficacy, has lower rate of complications and is convenient for the patients. Combined with the age-related demographic shift, advances in instrumentation and surgical techniques has led the cataract surgery to become more frequent and easier.

A large portion of cataract patients have coexisting retinal diseases such as diabetic retinopathy, epiretinal membrane and age-related macular degeneration etc. Surgery is necessary for postoperative visual acuity improvement, for a better view of the retina intraoperatively, and for visualization of the retina postoperatively in these patients. Retinal diseases may also influence the cataract surgery including timing of surgery, the surgical technique, the type of intraocular lenses implanted or final visual outcome. In addition, previous vitreoretinal surgery is a risk factor for cataract surgery due to many factors, such as intraocular lens power of a silicone filled eye, abnormal fluctuations in anterior chamber depth, zonular weakness etc.

This chapter will focus mainly on two subjects; cataract surgery in the presence of coexisting retinal diseases and cataract surgery with retinal surgery.

2. Cataract surgery and retinal diseases

Certain retinal diseases like diabetic retinopathy, age-related macular degeneration, epiretinal membrane and retinal vein occlusions may be exacerbated by cataract surgery. Therefore, retinal diseases with the potential for progression should be evaluated and treated prior to cataract surgery. With careful preoperative planning, attention to details during surgery and close postoperative follow up, these eyes may have visual improvement following cataract surgery.

2.1 Age-related macular degeneration

The true risk of progression of age-related macular degeneration following cataract surgery is controversial. Multiple epidemiological studies suggest that cataract surgery accelerates the progression of age-related macular degeneration. The Beaver Dam Eye Study reported an association between cataract surgery and early age-related macular degeneration; Freeman et al found an association between cataract surgery and late age-related macular degeneration (Freeman et al, 2003); the Blue Mountains Eye Study did not find an association between cataract surgery and either early or late age-related macular degeneration and the Rotterdam Study found an association between cataract surgery and early age-related macular degeneration but not wet age-related macular degeneration.

A recent prospective study of 71 patients with non-exudative age-related macular degeneration found that, at 12 months following cataract surgery, the rate of progression to neovascular age-related macular degeneration was not higher than what would have been expected without the surgery (Dong et al, 2009). Another study looked at the 10-year incidence of age-related macular degeneration and its association with both cataract and cataract surgery (Klein et al, 2002). It was found that cataract at baseline was associated with early age-related macular degeneration, but not with late age-related macular degeneration. At 10 years after cataract surgery, there was an increased incidence of late age-related macular degeneration. The authors conclude that cataract surgery increased the risk for late age-related macular degeneration.

Pollack et al. studied a group of patients with bilateral, nonexudative age-related macular degeneration who underwent extracapsular cataract extraction. In these patients, subsequent choroidal neovascular membrane was more prevalent in pseudophakic eyes than in control eyes (Pollack et, 1996). In another report, Van de Schaft et al. showed a higher prevalence of disciform macular degeneration in pseudophakic eyes compared with phakic control eyes by postmortem histopathologic examination (Van de Schaft et al, 1994)). Shuttleworth et al. retrospectively reviewed the charts of 99 patients with age-related macular degeneration who had received cataract surgery. Visual acuity was noted to improve in the postoperative period. Most patients (66%) experienced an improvement in visual acuity postoperatively. Progression of age-related macular degeneration was identified in 10% of patients, while choroidal neovascular membrane was seen in 2.0% (Shuttleworth et al, 1998)).

Prior to cataract extraction, it is very important to examine the macular region in detail to detect the presence of age-related macular degeneration. If cataract surgery is performed in the presence of age-related macular degeneration, special care should be taken to reduce the possibility of inflammation even if it would require immediate use of antiinflammatory drugs. Cystoid macular edema should be aggressively treated, with careful follow-up emphasized. Delaying cataract surgery, until the optical coherence tomography indicates improvement of macular edema and/or subretinal fluid is usually recommended. Cataract surgery should not be performed on the patient with active "wet" macular degeneration until it has been brought to a dry stage. If there is bleeding from a neovascular membrane, cataract surgery should be delayed until at least six months after the blood has completely reabsorbed and there has been no recurrence of the bleeding has been present. In patients with macular scars and dense cataracts, surgical removal of the opacified lens with intraocular lens implantation may be of benefit in recovering some degree of pericentral or peripheral vision. No cataract surgery should be performed unless the cataract is opaque enough so that when it is removed, the patient will probably perceive the benefit of the operation.

In patients with age-related macular degeneration, the Age-related Eye Disease Study (AREDS) report showed that the AREDS nutritional supplement did not affect visual acuity outcomes in patients who had cataract surgery. Improved visual acuity was seen in the group receiving either the AREDS supplement or placebo after surgery. The long-term benefits of the AREDS supplement in patients with age-related macular degeneration are, however, well established, and it is recommended that those who fit the criteria of the AREDS study for risk of age-related macular degeneration progression take these supplements and continue to do so after surgery. Ultraviolet light and sun exposure are commonly thought to be risk factors for age-related macular degeneration. Surgeons may consider a choice of a ultraviolet light-blocking intraocular lens in patients with age-related macular degeneration who are undergoing cataract surgery. It is also important to advise patients to get ultraviolet light protection by wearing glasses and hats on sunny days postoperatively.

2.2 Diabetic retinopathy

Many patients undergoing cataract surgery have preexisting diabetic retinopathy which may put additional stress on the eye and can lead to macular edema, progressive retinopathy and limited vision. Diabetic patients tend to develop cataracts at an earlier age and may be more prone to developing posterior subcapsular cataracts than other patients. It is important to establish that the degree of cataract seen corresponds to the patients' visual acuity and reported visual dysfunction. Diabetics at any stage of retinopathy are susceptible to macular edema, which is one of the main causes of central visual loss in these patients. A detailed dilated fundus examination can reveal many of these pathologies, but additional tests including optical coherence tomography or fluorescein angiography can reveal more subtle lesions.

Significant diabetic ocular pathology should be treated before cataract surgery is considered. This involves argon laser panretinal photocoagulation as the primary treatment for proliferative retinopathy and focal macular laser for clinically significant macular edema. Additional treatment involves intravitreal injection of vascular endothelial growth factor inhibiting medications and steroids (Cheema et al, 2009; Lam et al, 2005). The patient should also achieve a tight control of systemic blood glucose, and this should be demonstrated in the patient's hemoglobin A1c levels (Suto et al, 2006). For patients with significant diabetic retinopathy, it is better to work with a retinal specialist. The anterior segment can also be inversely affected by poorly controlled diabetes. These are neovascularization of the iris and angle, which often leads to neovascular glaucoma. Aggressive treatment of neovascular glaucoma must take priority over cataract treatment because prolonged increase in intraocular pressure can cause permanent damage to the optic nerve and severe visual loss. Working with a retinal colleague may be the best approach in these complicated patients.

Once the diabetic retinopathy is quiescent and the macula is dry, cataract surgery can be planned. Intraocular lens preference should lean to monofocal, toric, or sometimes accommodating intraocular lenses. Multifocal intraocular lenses should be avoided in eyes with a history of macular lesions or the likelihood of developing macular pathology. Acrylic intraocular lenses are preferred for patients who are likely to undergo vitrectomy for proliferative diabetic retinopathy in the future, whereas silicone intraocular lenses may be a reasonable choice in patients with well-controlled diabetes and mild retinopathy. Steps to make cataract surgery less traumatic include minimizing phaco energy, running less fluid through the eye, and avoiding contact with the iris. These complex patients do better when surgery is performed by a more experienced surgeon rather than a novice. Diabetic eyes often have poor pupillary dilation, particularly when active rubeosis iridis or even regressed neovascularization is present. Pupil stretching should be avoided because these vessels can rupture and cause intracameral bleeding. In some cases, intravitreal injection of triamcinolone or vascular endothelial growth factor inhibiting medications is given at the time of or before cataract surgery. For diabetic patients with nonclearing vitreous hemorrhages or tractional retinal detachments, cataract surgery can be combined with a pars plana vitrectomy.

In eyes with advanced diabetic retinopathy, cataract surgery may lead to progression and worsening of retinopathy, which can have detrimental effects on vision (Dowler et al, 1992). In eyes with minimal diabetic changes, cataract surgery is not as likely to cause progression of retinopathy (Wagner et al, 1996; Krepler et al, 2002; Flesner et al, 2002; Kim et al, 2007). Therefore, performing cataract surgery at an earlier stage may be beneficial for diabetic patients because it is associated with fewer complications and better postoperative recovery of vision. Postoperatively, topical steroids and nonsteroidal antiinflammatory drugs are prescribed because they control inflammation and may play a role in the prevention and treatment of macular edema. Macular thickness can be evaluated at serial postoperative visits via optical coherence tomography before the topical medications are stopped. Development of posterior capsular opacification and persistent postoperative inflammation may be more common in diabetics. Consideration should be given to the use of a larger diameter optic in conjunction with a larger capsulotomy for patients with diabetes (Kato et al, 2001).

Despite an uneventful cataract surgery, diabetic retinopathy can become exacerbated in the postoperative period, so patients should be monitored closely with serial dilated funduscopic examinations and referred to retinal colleagues as needed.

2.3 Retinal vein occlusion

Retinal vein occlusion is the second most common retinal vascular disease of the eye after diabetic retinopathy. Many of the patients are elderly and have cataracts, and a common treatment of retinal vein occlusion, an intravitreal steroid injection, increases the risk of cataract formation or progression. Unfortunately, small or resolved branch retinal vein occlusions may go unnoticed and only manifest as unexplained visual loss. A careful preoperative evaluation with close attention to unexplained visual loss (out of proportion to the degree of cataract) is critical to detect deficits that will not improve with cataract surgery and to recognize any cystoid macular edema risk.

Retinal vein occlusions may lower the threshold for blood retina barrier breakdown. Both central retinal vein occlusion and branch retinal vein occlusion are risk factors. Patients with retinal vein occlusion who undergo cataract surgery have an increased risk of postoperative cystoid macular edema. In a large study by Henderson et al conducted between 2001 and 2006, the risk of postoperative cystoid macular edema in uncomplicated cataract surgery was 30 times higher if the operated eye had a history of retinal vein occlusion (Henderson et al, 2007). This risk persisted even in eyes without preoperative macular edema. Intravitreal triamcinolone acetonide and vascular endothelial growth factor inhibiting medications seem to be an effective primary treatment option for macular edema due to retinal vein occlusions and may be given at the time of or before cataract surgery (Jonas et al, 2005, Rensch et al, 2009). Topical nonsteroidal anti-inflammatory drops may be used to prevent the development of cystoid macular edema in patients with retinal vein occlusion (Henderson et al, 2007).

Rare retinal vascular diseases may also increase the risk of cystoid macular edema in cataract patients. These include retinal telangiectasis (Coats' disease, radiation retinopathy, and idiopathic retinal telangiectasia) and several forms of retinal vasculitis (Eales' disease, Behçet's syndrome, sarcoidosis, necrotizing angiitis, multiple sclerosis).

2.4 Epiretinal membrane

It is well known that idiopathic epiretinal membrane occurs typically after posterior vitreous detachment, and gradually progresses with aging. A previous retrospective study suggested that extracapsular cataract extraction is the most common surgical cause of epiretinal membrane (Appiah et al, 1988). A more recent prospective study also showed that the prevalence of idiopathic epiretinal membrane increased from 14.8% preoperatively to 25.3% at 6 months after extracapsular cataract extraction (Jahn et al, 2001). The risk of post–cataract surgery cystoid macular edema is also increased in patients with epiretinal membrane (Henderson et al, 2007).

Idiopathic epiretinal membrane surgery has been reported to improve visual acuity in between 67% and 82% of cases (Margherio et al, 1985). However, subsequent development of progressive nuclear sclerosis occurs in 12.5% to 63% of post vitrectomy patients (Margherio et al, 1985). Ando and associates compared visual outcomes of the combined vitrectomy and cataract procedure to simple vitrectomy in idiopathic epiretinal membrane cases (Ando et al, 1998). Preoperative visual acuities and other patient characteristics were similar in the two study groups. Although more postoperative complications were noted in the combined group with two cases of fibrin formation, one case of macular edema, and four cases of anterior chamber inflammation, the visual outcomes were similar. Post-operatively, both groups showed initial visual improvement; 73% of combined procedure group compared to 88% of the simple vitrectomy group. However, within two years, cataracts formed in 70% of the simple vitrectomy group. The authors recommend the combined procedure for phakic patients older than 55 years undergoing vitrectomy for epiretinal membrane. Alexandrakis et al. described the surgical outcomes of combined cataract surgery and pars plana vitrectomy in eight cases of idiopathic epiretinal membrane formation (Alexandrakis et al, 1999). No intraoperative complications were observed, and at a mean follow-up visit of 22 months, visual acuity had improved in seven patients (88%. Median pre-operative and post-operative visual acuity were 20/200 and 20/50, respectively. Other studies that use the combined procedure to remove epiretinal membranes have reported favorable results as well (Koenig et al, 1992; Demetriades et al, 2003). Cataract surgery seems to be essential in phakic eyes to achieve long-term improvement in visual acuities in eyes with epiretinal membranes and good preoperative acuities.

In a study, the progression of idiopathic epiretinal membrane is not accelerated by small-incision phacoemulsification cataract surgery. Furthermore, visual acuity is not impaired markedly at least for the following year (Hayashi and Hayashi, 2009). However, it is still unclear whether or not a secondary epiretinal membrane progresses after cataract surgery in eyes with other retinal morbidity such as retinal detachment surgery or retinal pathology.

2.5 Peripheral retinal breaks and retinal detachment

The preoperative treatment of the retinal breaks and retinal degenerations has traditionally come into consideration as a possible means of preventing retinal detachments after cataract extraction, especially in myopic eyes. Specifically, flap retinal tears (even when asymptomatic) are usually treated. Round retinal holes, lattice degeneration, white without pressure, and other peripheral retinal abnormalities are typically observed.

There is an increasing tendency to support the concept that retinal detachments generally are associated with recent retinal breaks. Reports supporting the prophylactic treatment of preexisting retinal breaks prior to cataract surgery is lacking. Most of the eyes with lattice degeneration do not detach after small incision cataract extraction even when YAG laser capsulotomy is performed later. Those that do develop a retinal detachment frequently do not detach from retinal breaks adjacent to or within the lattice lesions, but from unrelated areas which previously looked clinically normal. If a patient has a history of retinal detachment in one eye and lattice degeneration with retinal holes in the other eye, cryosurgery or laser surgery is needed to close the holes in the second eye. Usually cryosurgery is required because the cataract may preclude the use of laser. The type of tear present and other factors including the location of the tear and the existence of high myopia would influence the ophthalmologist's judgment in deciding when to treat. Since seven to eight percent of the population has lattice degeneration, it is obvious that not all patients with lattice degeneration should be treated. Regardless of whether the patient is treated prior to cataract surgery, those patients should be followed closely with careful examination of the peripheral retina postoperatively following cataract removal.

Girard and Saade reported a 3.5% incidence of simultaneous primary rhegmatogenous retinal detachment and visually significant cataract (Girard and Sade, 1997). In such cases, they advocate a combined procedure including phacoemulsification, intraocular lens implantation and scleral buckling surgery. Cataract formation is a common occurrence after retinal detachment repair, especially when gas tamponade is employed. For this reason, recurrent retinal detachment may be found in eyes with cataracts, which may make repair more difficult. Options available to the retinal surgeon include cataract surgery followed by pars plana vitrectomy or combined cataract surgery and vitrectomy.

Another study described experiences using the combined procedure to treat 16 cases of recurrent retinal detachments (Chaudhry et al, 2000). Eyes were selected for inclusion in the study based on presence of a dense cataract and a recurrent rhegmatogenous retinal detachment with mild proliferative vitreoretinopathy following primary surgical repair using encircling scleral buckle. In nine eyes (56%), visual acuity improved to 20/200 or better post-operatively. In 13 eyes (81%), the initial reoperation was successful in retinal reattachment. Two additional eyes achieved retinal reattachment with a second pars plana vitrectomy, increasing the anatomic success rate to 94%. The study had a selection bias in that the eyes with more severe proliferative vitreoretinopathy were not found suitable for the combined procedure. However for primary rhegmatogenous retinal detachment and recurrent retinal detachment with mild proliferative vitreoretinopathy, the combined procedure appears to be well tolerated.

2.6 Macular hole

Macular holes are commonly found in older patients. Some eyes have concurrent macular hole and cataract, making internal limiting membrane peeling more difficult during vitrectomy because of blurred media. The incidence of cataract development following macular hole surgery is also extremely high. Thompson et al. reported visually significant cataract formation in 76% of the study eyes following vitrectomy for macular hole (Thompson et al, 1995). Consecutive and combined surgeries for macular hole and cataract extraction are both effective procedures.

Various studies found that the functional and anatomic results of combined surgery were equivalent to consecutive procedures (Theocharis et al, 2005; Simcock and Scalia, 2001; Kotecha et al, 2000; Muselier et al, 2010). Nevertheless, combining cataract surgery with vitrectomy may prevent a second operation to correct post-vitrectomy cataract formation. In the largest series, Lahey and associates described combined procedure to treat 89 cases of macular holes (Lahey et al, 2002). These patients received combined phacoemulsification, implantation of posterior chamber intraocular lens and pars plana vitrectomy. Additionally, to prevent posterior capsule opacification and post-operative vision loss, the authors included a posterior capsulotomy as part of the procedure. Post-operatively, 61 patients (65%) had improved to 20/40 or better. Closure of the macular hole after the initial surgery occurred in 80 patients (89%). Four holes closed with an additional operation. After nine months or more, three patients experienced reopening of the macular hole, which was successfully managed with repeat vitrectomy. Reported complications included eight (9%) post-operative cases of cystoid macular edema, all of which were resolved by topical and sub-Tenon's steroid application. Another eight patients (9%) developed small, segmental synechiae of the anterior capsule iris. Post-operative retinal detachments occurred in only three patients (3%). The combined procedure also allows for a more complete vitrectomy that includes removal of the anterior vitreous without the risk of lens injury. Thus, a better gas fill can be achieved which may provide longer tamponade and an increased closure rate for macular holes (Thompson et al, 1996).

Simcock and Scalia reported the results of combined phacoemulsification cataract removal and vitrectomy in 13 consecutive eyes with full thickness macular holes. Mild preoperative lens opacity was present in all 13 patients. Each eye underwent phacoemulsification followed by pars plana vitrectomy and finally intraocular lens implantation. Twelve of the 13 patients had visual improvement in the postoperative period. None of the eyes developed cystoid macular edema (Simcock and Scalia, 2000). There have been concerns regarding the incidence of cystoid macular edema following combined procedure for macular hole. Sheidow and Gonder reported a 43% incidence of both clinical and angiographical evidence of cystoid macular edema in a study of seven eyes undergoing combined procedure for macular hole (Sheidow and Gonder, 1998). However, other studies have not confirmed this observation and macular hole appears to be an acceptable indication for combined procedure.

In combined surgeries, intraoperative aphakia provided maximum visibility for posterior vitreous peeling and peripheral visualization. Scleral ports could be placed more anteriorly reducing the risk of a retinal tear. The risk of vitrectomy induced cataract was eliminated and a more complete vitrectomy could be performed leading to greater gas fill and therefore a better postoperative tamponade.

2.7 High myopia

Cataract development is more frequent in patients with high myopia than in the general population. Reports have shown that the mean age for cataract surgery in patients with high myopia is 65 years. However, in eyes with an axial length greater than 29mm, the incidence is significant at age 50 years. Nuclear cataract is most typical in high myopia and in its earliest stage, increases the optical power of the lens and thus the optical power of the myopic eye. In these patients, nuclear cataract may be difficult to recognize, because in some cases nuclear sclerosis is the initial step in nuclear cataract development. Middle-aged patients who developed cataract might have had early nuclear sclerosis without evidence of cataract. The earliest manifestation may be an increase in the dioptric correction of myopia (Metge and Pichot de Champfleury, 1994; Wong et al, 2001; Leske et al, 2002; Younan et al, 2002).

Myopic eyes have a higher risk of retinal complications compared with emmetropic eyes. During the preoperative evaluation, a careful examination should be done for any retinal breaks, holes or degenerations, as well as any macular pathology. The highly myopic patients may also have myopic macular degeneration, epiretinal membranes or other significant changes. These may limit the postoperative visual acuity and may influence the development of postoperative complications such as cystoid macular edema. If any posterior segment issues are detected, referral to a vitreoretinal colleague for treatment is recommended before cataract surgery. In addition to the typical cataract evaluation, care must be taken to accurately assess the retinal status and measure the axial length of the eye. Highly myopic eyes often have a posterior staphyloma, which can give an erroneously long axial length when measured with the standard A-scan ultrasound. Using an optical method for measurement tends to be more accurate, as it measures directly at the fovea. The intraocular lens calculation formulae are less accurate at the extremes, and this is particularly true for highly myopic eyes. Of the two-variable formulae, the SRK/T tends to perform particularly well, as do more complex formulae such as the Haigis and Holladay 2 (Wang et al, 2008). The selection of the intraocular lens depends on each patient's ocular status and needs.

The advantage of cataract surgery in myopic patients is the larger anterior chamber depth, which allows more working room during phacoemulsification. However, the infusion pressure from the phaco handpiece can cause over-inflation of the anterior chamber and a tendency to push the entire lens-iris diaphragm posteriorly. To overcome this, the infusion pressure can be decreased by lowering the bottle height; however, this will result in less inflow of fluid and a higher tendency for surge. Another solution is to break the reverse pupillary block by making sure that there is fluid flow under the iris to equalize the anterior and posterior chamber pressures. By neutralizing this pressure gradient, the cataract will not be pushed so deeply within the eye, and adequate infusion pressure can be used. The postoperative refraction in myopes can take time to stabilize due to the variation in effective lens position as the capsular bag shrink-wraps around the intraocular lens. During this period, inflammation can be controlled using topical steroids and nonsteroidal anti inflammatory drugs. During the postoperative period, repeat dilated fundus examinations are mandatory in order to search for possible retinal breaks that may have been created during surgery (Alio et al, 2000; Tosi et al, 2003; Güell et al, 2003).

2.8 Retinoblastoma

Cataract formation is one of the most common ocular complications of external beam radiotherapy for retinoblastoma, which typically occurs in three years following treatment (Schipper et al, 1985; Miller et al 2005). Studies have shown that cataract surgery in patients who have previously received radiation therapy for retinoblastoma is generally not associated with tumor recurrence or spread (Brooks et al, 1990; Portellos and Buckley, 1998).

Controversies in cataract management include the surgical approach, the management of the posterior capsule and anterior vitreous. In the setting of prior treatment for retinoblastoma, these decisions take on even greater importance with the added concern for reactivation or metastasis of the tumor. Both clear corneal and pars plana approaches have been used with success in children undergoing cataract surgery following treatment for retinoblastoma. Although Brooks et al advised against pars plana approachs based on their experience of tumor recurrence, other series have not reported tumor recurrences with pars plana insicions (Brooks et al, 1990). Miller and associates reported a series of 16 eyes, all of which underwent a combined pars plana vitrectomy and cataract extraction, and showed no evidence of tumor recurrence in their series (Miller et al 2005). Payne et al have also shown that limbal approach was not associated with tumor recurrence or metastasis (Payne et al, 2009).

Management of the posterior capsule is controversial in the setting of previous treatment for retinoblastoma. Theoretically, the posterior capsule may act as a barrier to tumor spread if viable tumor cells are present in the eye, therefore, the posterior capsule should be kept intact whenever possible. Nevertheless, it is frequently necessary to perform a primary posterior capsulotomy and anterior vitrectomy in pediatric cataracts, even in the setting of prior treatment for retinoblastoma. Since posterior capsular opacity is common after external beam radiotherapy, it is sometimes necessary to remove the posterior capsule to clear the visual axis. The risks and benefits of primary posterior capsulotomy and anterior vitrectomy should be considered on a case-by-case basis, taking into account the location of the cataract, the age of the patient, the availability of the YAG laser, the length of the quiescent period, and the location and stage of the tumor (Payne et al, 2009).

2.9 Retinitis pigmentosa

Cataract is a well-recognised complication of all types of retinitis pigmentosa. When compared with patients with age related cataract, patients with retinitis pigmentosa develop lens opacities earlier (Pruett, 1983; Fishman et al, 1985; Heckenlively, 1982). In addition, a relatively minor lens opacity may cause significant functional symptoms in these patients. Apart from the general risks of cataract surgery, there are specific additional factors that may result in a poor visual outcome after cataract extraction in the presence of retinitis pigmentosa. These include, retinal atrophy at the macula, macular edema occurring in approximately 10–15% of patients and phototoxic retinal damage in normal patients undergoing cataract extraction (Grover et al, 1997; Spalton et al, 1978; Newsome, 1986; Lee and Sternberg, 1993). The threshold for light damage is probably lower in retinitis pigmentosa, which could adversely affect visual outcome. Posterior capsular opacification and anterior capsular contraction is more aggressive in the presence of retinitis pigmentosa, (Nishi and Nishi, 1993; Hayashi et al, 1998). The reason for the increased cellular proliferation on the capsular remnant in retinal dystrophies is unknown, although the cellular nature of the posterior capsule in retinal dystrophies may account for this (Fishman et al, 1985).

Patients with retinitis pigmentosa benefit from early cataract surgery, and that the vast majority have a subjective improvement in their symptoms of glare. The benefit of surgery for patients with a poor preoperative visual acuity is less marked, usually because of preexisting macular disease, but postoperative macular edema was less common than expected. Patients with retinitis pigmentosa appear to be susceptible to anterior capsule contraction and therefore a small capsulorhexis should be avoided. It would appear to be sensible to avoid silicone intraocular lenses because of the risk of their dislocation if an early capsulotomy is required (Jackson et al, 2001).

2.10 Retinopathy of prematurity

Cataracts occur more commonly in retinopathy of prematurity patients compared to general population. Low birth weight and prematurity are risk factors for both retinopathy of prematurity and cataracts (San Giovanni et al, 2002; Repka et al, 1998). Cataracts develop at a greater frequency over time, as current treatment modalities have preserved vision in eyes that would have otherwise been lost. Transpupillary laser photocoagulation is now the standard treatment for threshold retinopathy of prematurity. However, laser-treated eyes have a higher incidence of secondary cataracts than cryo-treated eyes (Christiansen and Bradford, 1995; Christiansen and Bradford, 1997; Kaiser and Trese, 1995). Lens opacities associated with retinopathy of prematurity appears in three types. First, focal punctuate or vacuolated opacities may occur at the subcapsular level. These are usually transient and visually insignificant. Second, progressive lens opacities may occur in patients without retinal detachment. Most of these eyes have had transpupillary laser treatment or "lens sparing" vitrectomy. These cataracts may progress rapidly or much more slowly, but they almost always eventually obstruct the entire visual axis and require surgery (Alden et al, 1973; Drack et al, 1992).

A visually significant cataract after laser treatment or vitrectomy for retinopathy of prematurity is approached much like childhood cataracts in children without retinopathy of prematurity (Wilson et al, 2005). At times the anterior capsule can be fibrotic, but a vitrectorhexis can still be easily performed. Intraocular lens calculations can be performed using an immersion A-scan ultrasound unit and a portable keratometer in the operating room, after the child is under general anesthesia for cataract surgery. Intraocular lenses are implanted routinely, unless the child is in the early months of life and has microphthalmia. Most commonly, a single-piece hydrophobic acrylic intraocular lens is implanted in children. In anticipation of myopic shift of refraction, the intraocular lens power for a child undergoing cataract surgery should be customized based on many characteristics – especially age, laterality (one eye or both), amblyopia status (mild or severe), likely compliance with glasses, and family history of myopia. For a child with retinopathy of prematurity and cataract, slightly higher hypermetropia may be considered in anticipation of developing more myopia, especially if treated with cryotherapy (Trivedi et al, 2007). A primary posterior capsulectomy and anterior vitrectomy is performed for children who are younger than 6 years ofage. If previous vitrectomy has been performed as part of the retinopathy of prematurity treatment, the surgeon must be aware that the posterior capsule may have been violated during the previous surgery.

The two surgical approaches in stage V retinopathy of prematurity are pars plana lensectomy versus lensectomy via the limbal approach. A pars plana lensectomy can be combined with an attempt to repair retinal pathology. The limbal approach is easier and more consistent, as the pars plana entry may be difficult in these immature eyes with retinal detachment. Even when the anterior chamber is extremely shallow, an anterior corneal entry can usually be made with the assistance of a viscous ophthalmic viscosurgical device.

Although cataract extraction in eyes with regressed retinopathy of prematurity may present challenges, such as high myopia, monocularity, glaucoma, and previous ocular surgery, phacoemulsification in these eyes proved to be relatively safe as well as visually rehabilitating. The surgeon should be aware of the special considerations in this population, alert to potential zonular weakness intraoperatively, and careful of increased postoperative risks, including retinal detachment (Farr et al, 2001).

3. Cataract surgery and retinal surgery

Cataract and vitreoretinal diseases often occur simultaneously. The surgical management of patients with vitreoretinal diseases and cataract has always been a unique situation for vitreoretinal surgeons. The major difficulty is not only visual interference created by lens opacification, but also deciding on a patient-by patient basis whether cataract extraction should be combined or approached as a two-step procedure.

The patient's history is particularly important to determine the onset of symptoms and the development of the cataract. After most pars plana vitrectomy surgeries, cataracts develop slowly, over the course of months or years after retinal surgery, in the form of increased nuclear sclerosis and often posterior subcapsular opacities. The use of intraocular gas or silicone oil as a retinal tamponade may induce cataract changes at a somewhat more rapid rate, but it is still typically months before the patient notices a visual decline. If the patient reports a history of quickly developing a cataract, such as a white cataract, days or weeks after the vitrectomy, then iatrogenic damage to the lens capsule should be suspected. While it is uncommon, it is possible for the pars plana vitrectomy instruments to damage the posterior lens capsule, which can rupture and then cause the lens to opacify very quickly.

Clinical examination should include careful evaluation of the posterior capsule by either slit lamp or ultrasound, if direct visualization is not possible. If the ultrasound shows an abnormally large lens thickness or an out-pouching of the posterior lens surface, a defect in the posterior lens capsule likely exists. Intraocular lens calculations may be somewhat less accurate due to difficulty in estimating the postop effective lens position. The absence of vitreous and possible prior damage to zonules may cause the intraocular lens to sit more posterior than predicted, resulting in a hyperopic surprise. This is why aiming for a mild degree of postop myopia by using a slightly higher-powered intraocular lens tends to give better results. Three-piece monofocal acrylic intraocular lenses in these eyes may have more options for lens fixation, such as in-the-bag, in-the-sulcus and sulcus placement of the haptics with optic capture through the capsulorrhexis. In addition, the acrylic material minimizes condensation on the optic and adhesion to silicone oil if a repeat vitrectomy is needed in the future.

3.1 Cataract surgery and pars plana vitrectomy

Mastering in surgical techniques for cataract extraction and improvements in intraocular lens technology have increased the indications for cataract surgery. Additionally, pars plana vitrectomy is now performed for a wide variety of vitreoretinal diseases. It is widely accepted today that the most effective procedure for lens extraction is sutureless clear corneal phacoemulsification. The common approach for pars plana vitrectomy is transconjunctival small incision sutureless vitrectomy, also known as minimally invasive vitreoretinal surgery (Fujii et al, 2002; Eckardt, 2005).

Combined phacoemulsification and vitrectomy is indicated if the opacified lens interferes with the visualization of the retina, hindering the operation. However, if the cataract allows for good visualization of the posterior pole, the surgeon must decide on the best approach; a combined procedure, clear cornea phacoemulsification and then pars plana vitrectomy, both performed at the same surgical session, or a two-step procedure, pars plana vitrectomy is performed first, and then clear cornea phacoemulsification performed as a secondary procedure during a second surgical session (Pollack et al, 2004).

3.1.1 Combined procedure

A combined approach with minimally invasive vitreoretinal surgery has been rising in popularity among vitreoretinal surgeons, mainly because it has several advantages when compared with the two-step procedure. These include faster visual recovery and patient satisfaction, no suture-related astigmatism, less postoperative inflammation, less conjunctival fibrosis, easier vitreous shaving, better access to the vitreous base, and more effective postoperative tamponade (Koenig et al, 1990; Pollack et al, 2004; Axer-Siegel et al, 2006; Mochizuki et al, 2006; Treumer et al, 2006; Demetriades et al, 2003; Wensheng et al, 2009).

There are three ways to start this procedure. One option is to introduce the vitrectomy trocars, then perform phacoemulsification, complete the vitrectomy via pars plana, and leave intraocular lens implantation as the last step. A second option is to start by performing phacoemulsification and, once this is completed, introduce the vitrectomy transconjunctival trocars. Perform the vitrectomy via pars plana and, once again, leave intraocular lens implantation for the last step. A third option is to perform phacoemulsification with intraocular lens implantation first, and then perform vitreoretinal surgery. After phacoemulsification and intraocular lens implantation, a prophylactic 10-0 nylon suture is placed to avoid anterior chamber collapse, and iris prolapse. It is recommended to leave viscoelastic material in the anterior chamber during the vitrectomy procedure to maintain anterior chamber depth.

3.1.2 Two-step procedure

The vitreous body is semi-solid, thick and viscous in a healthy eye. These properties allow it to help support the cataract during surgery when the patient is supine. This results in a normal anterior chamber depth and a more routine cataract surgery. In an eye that has undergone a prior vitrectomy, saline and aqueous have replaced the vitreous, resulting in a fluid-filled eye that does not provide additional support of the cataract during phacoemulsification. This causes the anterior chamber to be overly deep during cataract surgery. To address this, the infusion pressure can be decreased by lowering the bottle height on the phacoemulsification machine. To compensate for lower infusion, the aspiration flow rate should also be dropped.

Additionally, posterior support can be increased by giving a retrobulbar block because the anesthetic bolus will tend to provide pressure to the back of the eye. If there is reverse pupillary block, caused when the iris makes a tight seal on the anterior lens capsule, this can be solved by tenting up the iris with a second instrument or even by placing a single iris hook. These eyes may also have zonular damage or laxity, which can lead to difficulties during cataract surgery. If there is a posterior capsule rupture, either from the vitrectomy or cataract surgery, the lens nucleus should be brought forward, out of the capsular bag, and viscoelastic should be placed behind it to support it. If any cataract pieces are displaced into the posterior segment, they will rapidly descend onto the retina due to the lack of vitreous. These pieces are best removed by the vitreoretinal surgeon using a pars plana approach.

Patients who undergo cataract surgery after a prior retinal surgery are at higher risk for some postoperative complications. Patients with prior macular surgery are more prone to cystoid macular edema, even after an uncomplicated cataract surgery. These patients should be treated with anti-inflammatory medications for a prolonged period, and their macular status should be monitored at postoperative visits. Patients with prior retinal detachment surgery are at a higher risk for a recurrent detachment after cataract surgery, so their retinal periphery should be checked carefully. In addition, it may take longer for these patients to heal after surgery and to achieve a stable postoperative refraction. Although total intraoperative time is shorter for a two step procedure compared with a combined approach, patients who undergo sequential surgeries may experience increasing discomfort. Another disadvantage is cost; two surgeries cost more than the combined procedure (Grusha et al, 1998; Chang et al, 2002; Ahfat et al, 2003).

There are advantages and disadvantages to each approach, but both are safe and effective. Combined surgery requires a shorter postoperative recovery time, anterior vitreous structures can be removed without risk of touching the lens, visualization of the posterior pole is good during vitrectomy, and it involves only one surgical session, which may reduce patient discomfort and decrease risks and costs. Also, patients with retinal vascular diseases frequently undergo panretinal photocoagulation during the operation, decreasing the risk of developing retinal and iris neovascularization.

However, there are potential disadvantages to combined surgery, such as increased operating time and stress on the surgeon, difficulty visualizing the capsulorrhexis because of an absent or reduced red reflex, cataract wound dehiscence caused by globe manipulation during subsequent vitreous surgery, and intraoperative miosis after cataract extraction. Other disadvantages include bleeding from anterior structures, loss of corneal transparency from corneal edema and Descemet's folds, inadvertent exchange of anterior segment fluids with posterior segment tamponading agents, intraocular lens decentration and iris capture in eyes with gas-air or silicone oil tamponade and prismatic effects and undesirable light reflexes during vitreoretinal surgery caused by intraocular lens before posterior segment procedures.

Postsurgical complications are similar in both approaches. In the two-step procedure, it should be kept in mind that the surgeon is facing complications associated with phacoemulsification and pars plana vitrectomy, just as in the combined procedure, but during separate surgical sessions (Koenig et al, 1990). The most common intraoperative complications associated with phacoemulsification include tears during anterior capsulorrhexis, rupture of the posterior capsule with the phaco tip, and dislocation of nuclear fragments into the vitreous cavity.

3.2 Cataract surgery and scleral buckling surgery

Scleral buckling surgery is associated with a lower rate of cataract formation than pars plana vitrectomy or combined vitrectomy and buckle surgeries. Therefore, scleral buckling may be considered as the primary surgical option in the treatment of uncomplicated rhegmatogenous retinal detachments where the crystalline lens is sufficiently clear.

Haller and Kerrison reported that eyes which have undergone scleral buckling surgery have good visual outcomes after cataract surgery and a low risk of recurrent retinal detachment. The same study showed more intraoperative complications during extracapsular cataract surgery in patients who had undergone vitrectomy for retinal detachment but a low rate of intraoperative complications in patients with previous scleral buckling (Haller and Kerrison, 1997). Smiddy and associates reported no recurrent retinal tears or detachments in patients who underwent extracapsular cataract surgery after previous scleral buckling with an average follow-up period of 24 months (Smiddy et al, 1988). Ruiz and Saatci reported a favorable outcome for extracapsular cataract surgery with intraocular lens implantation in eyes that had undergone successful scleral buckling. In this study however, 3.4% of eyes developed recurrent retinal redetachment 15 months after cataract surgery (Ruiz and Saatçi, 1991) . Eshete et al demonstrated that phacoemulsification and intraocular lens implantation can be performed safely after scleral buckling surgery and excellent best-corrected visual acuity results can be attained in most eyes without any modification in surgical technique. No eye had retinal redetachment in their study (Eshete et al, 2000).

Combining phacoemulsification with scleral buckling rather than vitrectomy may be a more optimal surgical decision in selected cases. However, proper case selection (fresh rhegmatogenous retinal detachment with minimal proliferative vitreoretinopathy, etc) and familiarity with the surgical techniques is mandatory for achieving higher success rates. Conventional large incision cataract surgeries cannot be combined with scleral buckling because of the instability of the wound and inability to maintain the eyeball contour because of fluctuation in intraocular pressure (Garder et al, 1993). Also, there is an increased risk of vitreous loss and aggravation of retinal pathology. Phacoemulsification provides a better stability of the wound during the procedure because of the small incision size.

Combined scleral buckling for retinal detachment and phacoemulsification was first reported by Lazar and Bracha (Lazar and Bracha, 1977). Girard and Saade reported a case series of 15 patients who underwent a triple procedure; phacoemulsification, intraocular lens implantation and scleral buckling for recurrent rhegmatogenous retinal detachment with a significant cataract (Girard and Sade, 1997). They noted high postoperative intraocular pressure in only one of their cases, which was attributed to the use of viscoelastic. Overall anatomical success rate was 87% and functional success was 54%. They concluded that combined phacoemulsification and scleral buckling was a safe and effective procedure. Tsai and Wu confirmed the effectiveness of cataract surgery together with scleral buckling, with no significant complications. The authors believed that combined cataract surgery and scleral buckling can improve visualization for detection of peripheral retinal holes and can improve the results of the operation (Tsai and Wu, 2004).

3.3 Cataract surgery and pneumatic retinopexy

Pneumatic retinopexy is an alternative to scleral buckling for the surgical repair of selected retinal detachments. A gas bubble is injected into the vitreous cavity, and the patient is positioned so that the bubble closes the retinal break, allowing absorption of the subretinal fluid. Cryotherapy or laser photocoagulation is applied around the retinal break to form a permanent seal. Temporary gas tamponade for pneumatic retinopexy is not associated with permanent changes in lens transparency (Mougharbel et al, 1994).

4. Conclusion

Cataract surgery improves vision in patients with preexisting retinal disease and is necessary for the physician to monitor and treat the underlying pathology. However, surgeons must be cautious about certain retinal diseases and previous retinal surgeries which can make a patient more prone to complications following cataract surgery. Understanding the risk factors and applying certain methods of preventative treatment can minimize both intraoperative and postoperative effects. In addition, working closely with retina specialists in the management of patients whose cataract surgery is complicated by retinal issues may help the cataract surgeon to bring these cases to a more successful outcome.

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