Cataracts

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Introduction

Cataracts are a leading cause of blindness worldwide and remain an important cause of visual impairment and blindness in the United States accounting for approximately 50 % of visual impairment in adults over the age of 40 [1]. By age 80, over 50 % of all Americans will have cataracts [2]. Cataracts are a common complication associated with uveitis as the intraocular inflammation and the most commonly used therapy for the management of the disorder, corticosteroids, can both induce lenticular opacification. In a large retrospective study from the UK evaluating complications associated with uveitis management and following these patients for 22 years, the most common reported complication was the development of cataract (35 % of patients) [3]. Other case series have documented the incidence of cataracts in patients with uveitis ranges from 30 to 78 % (more common in patients with Fuchs heterochromic iridocyclitis and juvenile idiopathic arthritis and uveitis syndrome). The development of lenticular changes is influenced by the chronicity and severity of intraocular inflammation, the frequency and duration of steroid use, and the underlying diagnosis.

Risk Factors

The risk factors for the development of cataracts have been well described and include: advanced age, diabetes, steroid use (inhaled, systemic, periocular, intraocular, topical ophthalmic), family history of cataracts, UV light exposure, ionizing radiation, ocular trauma, prior intraocular surgery, intraocular inflammation, and tobacco use [4–6]. Patients who develop uveitic cataracts often have multiple mechanisms that may contribute to cataractogenesis and progression. The two most commonly implicated predisposing factors for uveitic cataracts include the presence of intraocular inflammation and the use of corticosteroids.

Decision to Operate

The decision to operate on a patient with a uveitic cataract is not a simple determination. There are multiple considerations that must be assessed and discussed with the patient. Objective measures such as visual acuity, the status of

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the inflammatory disease, and the presence of lenticular opacification can be evaluated via clinical exam. Equally important are the patient's subjective symptoms including blurry vision at distance/intermediate/near, glare with bright lights and oncoming headlights while driving and specific limitations that impair quality of life (e.g. avoiding night driving, difficulty reading, inability to play sports, etc.). Foster and Rashid have described 4 clinical indications for cataract surgery in patients with uveitis including: phacoantigenic uveitis, visually significant cataract in a quiet eye with good visual prognosis, cataract impairing posterior segment examination, and cataract impairing the ability to perform posterior segment surgery [7]. The benefits of cataract surgery have been extensively studied including improvement in visual acuity, improvement in the performance of activities of daily living, reduction of risk of injury from falls, improved mental health, and general sense of well-being. In observational studies after cataract surgery, up to 90 % of patients undergoing first eye cataract surgery noted improvement in functional status and satisfaction with vision [8].

Perioperative Management

The recommendations for perioperative management are based on cohort studies demonstrating successful surgical outcomes with uveitic cataracts [9]. The following are general principles extrapolated from these sources:

- for elective procedures like cataract surgery, the patient should have no evidence of active uveitis by standard criteria for 3 months preceding the surgery
- if immunosuppressive medications were required for disease control, these should be continued through the perioperative period
- prophylactic topical steroids initiated one week prior to surgery are associated with decreased post-operative inflammation (the frequency of administration ranges from QID to q 1 h while awake as dictated by severity of ocular inflammatory disease); some surgeons have advocated for prophylactic topical NSAIDs for one week prior to surgery to reduce incidence of cystoid macular edema (but the data is less compelling)
- for patients with severe, difficult to control ocular inflammatory disease (Behcet's, juvenile idiopathic arthritis and uveitis syndrome), prophylactic systemic corticosteroids (Prednisone one mg/kg/day) can be prescribed for one week prior to surgery and tapered after the procedure as guided by the degree of ocular inflammation
- intravenous methylprednisolone in doses of 500–1000 mg administered at the time of surgery has also demonstrated efficacy in reduction of post-operative inflammation
- intraocular triamcinolone (0.05–0.1 cc of 40 mg/ml concentration) injected in the vitreous or anterior chamber has been correlated with reduction of post-operative cystoid macular edema and intraocular inflammation
- post-operative regimens vary considerably but generally include a topical steroid, topical non-steroidal anti-inflammatory agent, and topical antibiotic.

Surgery

Surgical procedures for cataract removal have tremendously improved over the last 60 years and continue to evolve. With the advent of phacoemulsification, injectable intraocular lens implants and small incision cataract surgery, patients can appreciate rapid visual rehabilitation, restoration of excellent visual acuity, and few post-operative restrictions. Multiple studies have demonstrated that cataract extraction via phacoemulsification causes less overall inflammation and fewer complications compared to traditional extracapsular cataract extraction in uveitic cataracts [10]. The goals of the surgical procedure include:

- construction of a small incision wound that allows for adequate fluidically stable anterior chamber during surgery [11]
- minimal manipulation of the iris if avoidable (in patients with posterior synechiae this may not be possible as synechialysis and placement of iris retraction instruments may be required for adequate visualization of the lens)
- complete removal of all lens material (any residual lens particles may induce post-operative inflammation)
- implantation of a posterior chamber intraocular lens within the capsular bag (lens implants in the sulcus and anterior chamber are associated with greater degree of intraocular inflammation)
- a secure, watertight incision that does not induce surgical astigmatism and may reduce pre-existing corneal astigmatism.

A new advance to cataract surgery, the femtosecond laser, can be used to construct corneal incisions, perform anterior capsulotomy, and fragment the nucleus. At the time of this publication, there is inadequate data in patients with uveitic cataracts who have used this modality of augmented cataract surgery to determine superiority versus traditional phacoemulsification.

Complications of Cataract Surgery

In general, complications of cataract surgery are relatively uncommon and patients have a high expectation of visual improvement after surgery. Stein et al. reviewed cataract surgery in Medicare recipients in 2005–2006 and found that the overall rate of severe complications (defined as endophthalmitis, suprachoroidal hemorrhage and retinal detachment) was 0.4 % [12]. The uveitic cataract poses greater challenge and has been associated with higher complication rates.

Yamane et al. published one of the largest retrospective case series of 242 uveitic eyes who underwent cataract surgery by phacoemulsification. Recurrence of uveitis was the most common postoperative complication seen in 73 eyes (30.16 %). Other postoperative complications included iris atrophy (28.51 %), ocular hypertension (28.09 %), epiretinal membrane (26.44 %), posterior capsule opacification (19 %), cystoid macular edema (13.63 %), ocular hypotony (12.80 %), optic disc atrophy (8.67 %) and posterior synechiae (6.61 %) [13]. Of note, 10.7 % of patients in this study lost vision compared to pre-operative visual acuity with the presence of the cataract [13].

Despite these issues, cataract surgery remains highly successful in this patient population. Mehta et al. published a meta-analysis of uveitic cataract surgical series and reported that 68 % of uveitis patients who underwent phacoemulsification and had quiet or nearly quiet disease prior to surgery had 20/40 visual acuity or better following the procedure [14].

Lens Implant Selection

The decision regarding selection of lens implant material and style to achieve superior surgical results in uveitis patients is complicated and remains largely unresolved. Proponents of hydrophilic lens implant materials argue that these lenses can be inserted through a smaller incision reducing tissue trauma but have a higher propensity to induce posterior capsular opacification compared to hydrophobic lens implants. Hydrophobic lens implants have good uveal and excellent capsular biocompatibility but may require a larger incision for insertion.

Heparin surface modification (HSM) of lens implant materials has been demonstrated in multiple studies to be associated with reduced intraocular inflammation [15, 16]. The binding of heparin to the lens implant is thought to prevent attachment of bacteria, corneal endothelial cells, and lens epithelial cells. Lin et al. performed cataract surgery in high risk patients (defined as having a diagnosis of either diabetes, glaucoma or uveitis) and randomized the study participants into 1 of 2 groups: heparin surface modified intraocular lens versus traditional PMMA lens implant. Short term clinical follow up demonstrated significantly less anterior chamber cell in

the HSM IOL group compared to the traditional PMMA group. When these patients were followed long term, there was no statistically significant difference between the 2 groups in visual acuity, corneal edema, anterior chamber reaction, and amount of posterior synechia formation and IOL deposits [16].

Silicone was the first material available for foldable intraocular lens implants. While silicone has a very low rate of posterior capsular opacification compared to others [17], the use of this implant material has steadily declined over the last 10 years. There are multiple reasons this implant material has become less popular despite the excellent biocompatibility profile. In the era of small incision cataract surgery (wound size less than 2.8 mm) and preloaded lens injectors, there is a risk of tearing of the optic at the optic—haptic junction or kinking of the haptics. Additionally, if the patient develops a retinal detachment in the future requiring silicone oil, there have been case reports of silicone oil droplets adherent to the posterior surface of the silicone lens implant [18].

Leung et al. pooled data from 4 randomized control trials comparing hydrophilic or hydrophobic acrylic lenses, silicone lenses, polymethyl methacrylate (PMMA) lens implants with or without HSM. The review included 216 patients with substantial heterogeneity with respect to ages of participants and etiology of uveitis. Patient outcome measures included visual acuity, posterior capsular opacification, cystoid macular edema, corneal edema, and lens decentration. Based on this review, the authors concluded that it is still uncertain which implant material provided the best visual and clinical outcomes in patients with uveitis undergoing cataract surgery [19].

Conclusion

The development of cataract is the most common complication in patients with uveitis as both intraocular inflammation and corticosteroids (the most frequently employed treatment) can induce progressive opacification of the lens. The surgical procedure can be technically difficult given multiple potentially challenging issues including corneal opacities, poor dilation, posterior synechiae, unstable zonules, capsular abnormalities, etc. Aside from navigating these demanding surgical problems, the resultant post-operative inflammation can negate any potential visual improvement that may be derived by the removal of the lens. Despite these limitations, cataract surgery remains highly successful even in patients with uveitis.

There are many unresolved controversies including:

1. What is the best intraocular lens material with lowest rates of posterior capsular opacification, biocompatibility, and macular edema?
2. Should intraocular lens implants be used in all uveitis patients including those with Behcet's disease and juvenile idiopathic arthritis and uveitis syndrome?
3. Are multifocal intraocular lens implants appropriate for uveitis patients?
4. Is the femtosecond laser a less traumatic and thus safer manner to assist with lens removal in uveitis patients?
5. What is the most effective perioperative and postoperative management strategy to avoid significant post operative inflammation?

In an effort to practice evidence based medicine, there is continued need for large cohort studies and/or randomized clinical trials to scientifically address these issues.

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