The incidence of wound gape or iris prolapse after cataract extraction reportedly ranges from 0% to 1.6% with phacoemulsification and 0% to 3% with extracapsular cataract extraction. Contemporary cataract surgery is most commonly performed through sutureless clear corneal incisions with a wound width of 3.2 mm or less. These small wounds improve surgical safety, cause fewer complications, decrease trauma to ocular structures, lower induced astigmatism, and require less surgical time compared with larger incisions. There have been few isolated reports of iris prolapse following small clear corneal incision cataract surgery. Postoperative iris prolapse warrants further surgical intervention such as wound reconstruction and iris repositioning or iridectomy to avoid persistent wound leakage, endophthalmitis, and epithelial ingrowth. In this article, we describe a case of external cystic epithelial ingrowth complicating traumatic wound failure with long-standing iris prolapse 4 months after small self-sealing clear corneal incision phacoemulsification. We review treatment and prevention of this new and rare complication of modern phacoemulsification.

CASE REPORT

A 71-year-old woman underwent uneventful phacoemulsification with posterior chamber IOL implantation in the left eye and then in the right eye 4 months later. Both eyes received a foldable acrylic IOL through a clear corneal incision (temporal in the left eye and superior in the right). A 3.2-mm blade was used, and the wound was extended slightly for IOL insertion. The main incision was sutured with 10-0 vicryl in both eyes.

First postoperative assessment of the right eye was done 11 weeks after the procedure because the patient missed her first appointment due to a stay in the intensive care unit after a fall. She had no recollection of direct trauma to the eye. Visual acuity in the right eye was 6/9, and the intraocular pressure (IOP) was 10 mm Hg. A small iris prolapse through the superior incision with peaked pupil was observed. The exposed iris was fully covered by epithelium and did not stain with fluorescein dye. The anterior chamber was quiet, the IOL was still positioned in the capsular bag, and the fundus was normal. The traumatic iris prolapse was considered related to the fall. The patient was managed conservatively with no further treatment and was asked to return if pain was felt in the eye.

Three months later, the patient complained of discomfort in her right eye and noted the presence of a blister for a couple of days. Visual acuity in the affected eye was still 6/9, and the IOP was 9 mm Hg. A superior epithelial cystic pseudobleb formation was noted, extending from the iris prolapse through the main wound (Figure 1). The pupil was peaked significantly superiorly, but the anterior chamber was relatively calm with only a few cells observed. As indicated by the still-formed anterior chamber, the wound was tamponaded by iris tissue. We assumed the pseudobleb resulted from prolonged iris prolapse with proliferation of epithelial cells on the surface of the exposed iris, forming an epithelial cyst.

Treatment consisted initially of excision of the pseudobleb followed by debridement of necrotic tissue and wound closure with three interrupted 10-0 nylon
sutures. The iris sphincter was also incarcerated, and thus the resection resulted in a total superior coloboma with both iris wings retreating back into the eye (Figure 2). Given the superior position of the coloboma, the decision was made to avoid treatment at this stage because the upper lid appeared to cover the iris defect. Histopathologic examination disclosed folded stratified epithelium without goblet cells.

Four months later, the patient returned complaining of glare. We treated the iris defect with a black pseudoiris prosthetic device (Morcher 96F; Morcher GmbH, Stuttgart, Germany; Figure 3). The iris was blue, so we simultaneously performed a cosmetic pupilloplasty with a 10-0 polypropylene suture. When examined 6 months later, the patient reported major improvement in glare; her visual acuity was still 6/9. No recurring epithelial ingrowth was noticed, and the iris defect was well covered (Figure 4).

**TREATMENT**

A few specific guidelines should be followed for proper management of asymptomatic, long-standing iris prolapse. First, tissue that was prolapsed for more than 24 hours or appears badly traumatized or contaminated is suspected to be necrotic. In such cases, it is best to excise and culture the tissue to avoid infection. Second, any epithelium apparent on slit-lamp examination must be removed from the iris surface to avoid epithelial ingrowth. If it can be completely removed, the iris may be repositioned; if not, the involved iris should be excised. In our case, the patient’s delay in seeking care for her eye injury resulted in epithelialization of the iris surface. The tissue was clean, without sign of infection and with a patent blood supply. Endophthalmitis and tissue viability were not a significant concern. Hindsight supports the conclusion that by not treating the initial iris prolapse we may have underestimated the risk of epithelial ingrowth, and earlier excision would have been the preferable strategy.

Epithelial downgrowth, or ingrowth, is an uncommon but potentially sight-threatening complication that has been described after penetrating trauma or intraocular surgery. Predisposing conditions for the invasion of corneal or conjunctival epithelium into the anterior chamber include multiple intraocular surgeries, incomplete or delayed wound healing, wound fistulas, iris incarceration, vitreous in the wound, implantation of epithelial cells with instruments, and suture track leaks. Epithelial cells carried into the eye during surgery may proliferate to form an epithelial cyst, located on the iris surface or in the anterior chamber. Epithelium growing through the wound and onto the posterior surface of the cornea proliferates in opaque sheets that may extend across the iris and anterior chamber angle, inducing secondary glaucoma.

The prognosis of the disease depends on the type of downgrowth. Diffuse epithelial ingrowth is more aggressive, is difficult to diagnose, and tends to recur after treatment; however, cystic epithelial ingrowth has a more benign course. It tends to grow slowly and can be detected easily in clinical examination, allowing surgical removal of the
epithelium and a better prognosis. Histologic analysis shows that the two sources of epithelial downgrowth are conjunctiva and cornea. The presence of goblet cells is diagnostic of conjunctival epithelial downgrowth; it serves as a differential between the two sources. The typical findings of any form of epithelial downgrowth are one to three layers of stratified nonkeratinized squamous epithelium. We assumed that in this case, epithelial cells proliferated to form an epithelial cyst on the surface of the prolapsed iris, eventually resulting in a pseudobleb. To the best of our knowledge, this is the first report of cystic epithelial ingrowth developing outside the eye.

Many techniques have been devised to treat cystic epithelial downgrowth, such as laser photocoagulation; surgical excision; aspiration; endodiathermy; and intralesional injection of chemicals including ethanol, iodine 1%, pure carbonic acid, trichloroacetic acid 10%, and mitomycin C. Surgical removal is more likely successful when the implanted cells are circumscribed, making complete excision easier. Among the more serious complications, a sheet-like form of downgrowth can follow surgical attempts to remove the cysts. In our case, after 6 months’ follow-up, no further signs of epithelial ingrowth were present.

PREVENTION

Wound construction plays an important role in wound strength. In our case, wound construction was probably the leading causative factor of wound failure. In a survey identifying operative and perioperative precipitating factors of iris prolapse in small incision cataract surgery, Taguri et al found that poor wound construction was the leading factor.

With clear corneal incisions, wound strength is dependent on three factors: wound width, wound length, and wound profile. Wound width and length are closely related. In cadaver eyes, squarely configured wounds are more resistant than rectangular wounds to external pressure. Square clear corneal incisions with a dimension of 3.2 mm are clinically impractical because they encroach on the visual axis. However, clear corneal incisions with a width of 3 or 3.5 mm and length of at least 2 mm demonstrated resistance to leakage comparable with similarly constructed scleral tunnel incisions. Menapace et al found even a 1.75-mm clear corneal incision to be safe, suggesting that experiments may not perfectly mimic the clinical situation.

A wound profile with a single hinge, compared with paracentesis or stepped incisions (Figure 5), seems to be more stable against external pressure. The initial incision site may also play a role in determining final wound strength. Measured with ophthalmodynamometry, temporal wounds exhibited greater stability than superior wounds in the first postoperative week.

In our case, the wound was a 3.2-mm stepped incision. The wound length was not measured, and the incision was widened at the end of surgery to facilitate lens insertion. As the incision was sutured, we can conclude that it was not self-sealing, indicating poor wound construction. Based upon the work of Ernest et al, an unsutured clear corneal stepped incision should not be more than 3.5 mm in length. Nevertheless, when enlarging a 3.2-mm incision just before lens insertion, it is easy to inadvertently enlarge it to 3.5 mm.

Steinert and Deacon showed that instrumentation during phacoemulsification led to enlargement of the wound after each step of the procedure, with an average total enlargement of 0.4 to 0.7 mm. The survey by Taguri et al found that two of 12 iris prolapses were due to intraoperative wound lengthening. Our traumatic wound dehiscence occurred because the incision was too large based on its length, stepped wound profile, and superior location.

RISK FACTORS

Patient risk factors cannot be overlooked. Chronic obstructive pulmonary disease was the probable cause in 25% to 30% of iris prolapses following extracapsular cataract extraction in two studies. The compounded effects of obesity and chronic cough may temporarily
lead to high IOP capable of precipitating iris prolapse. Digital pressure on the eye can cause wound destabilization and iris prolapse even with small clear corneal incisions, as shown by Taguri et al and Menapace, so patients should be advised not to rub their eyes and to wear a plastic protective shield at night for the first 2 weeks. As shown by our case, even minor trauma can lead to wound gape. Therefore, patients prone to fall, those who live in a high-risk environment for injury, or those who may lack insight or resources for following postoperative instructions, should be considered at-risk.

Suturing clear corneal incisions greater than 3.5 mm has been advocated. Surprisingly, the survey by Taguri et al and our case show that placement of sutures does not necessarily impede iris prolapse when the incision is bigger than 3.2 mm. Taguri et al found that the use of a single 10-0 nylon suture did not prevent iris prolapse in 42% of patients in which one was used. However, all sutured wounds reported in that survey were either limbal or seleral and measured 5.2 mm or more.

We think that all clear corneal incisions ranging from 2.2 mm to 3.5 mm should be sutured in case of any doubt about their construction or in the presence of patient risk factors for iris prolapse. Our experience with microcortical clear corneal incisions (ie, smaller than 2.2 mm) is limited, but as it is easier to achieve a square or near square incision, these incisions are more stable and could theoretically be left unsutured.

CONCLUSION
The case we have described shows that iris prolapse is a rare but possible late complication in small-incision clear corneal cataract surgery that can be easily overlooked and undertreated in cases with few symptoms. Proper wound construction remains paramount for self-sealing corneal wounds. Emphasis should be placed on wound construction during surgical training, and extra diligence should be exercised when operating on patients at risk for iris prolapse. Furthermore, if an asymptomatic iris prolapse is left untreated, it can lead to external cystic epithelial ingrowth with the consequences described above.

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