Advances in Medical Sciences 64 (2019) 100–103

Contents lists available at ScienceDirect

Advances in Medical Sciences

journal homepage: www.elsevier.com/locate/advms

Original research article

The implantation of the scleral-fixated posterior chamber intraocular lens with 9/0 polypropylene sutures – Long-term visual outcomes and complications

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ARTICLE INFO

Keywords:
Suture breakage
Polypropylene suture
IOL dislocation

ABSTRACT

Purpose: To analyze long-term visual outcomes and complications of the implantation of a scleralfixated posterior chamber intraocular lens (PC-IOL) in patients with the lack of adequate capsular support, and to verify if the procedure can be performed with 9-0 polypropylene sutures.

Methods: The study was designed as a long-term retrospective analysis. Patients after the implantation of a scleralfixated PC-IOL were evaluated for the best corrected visual acuity (BCVA), intraocular pressure and occurrence of postoperative complications.

Results: The analysis included 29 eyes from 28 patients. Indications for the IOL implantation included ocular trauma (89.7%) and previous complicated cataract surgery (10.3%). A postoperative improvement of BCVA was observed in 25 eyes (86.2%). Mean follow-up time was 63.9 months (range 50–83 months). During this time, six patients (21.4%) were diagnosed with glaucoma (21.4%), and retinal detachment was found in one eye (3.4%). A total of six suture breakages were recorded in four eyes from four patients (13.8%); one breakage was precipitated by a trauma, and another five, involving three eyes from three patients, were spontaneous. Mean time to the spontaneous suture breakage was 40.8 months.

Conclusions: Scleral fixation of the PC-IOL provides satisfactory visual outcomes. However, this procedure is associated with a considerable risk of postoperative complications. The incidence of postoperative suture breakage in our series was similar as in previous studies in which the PC-IOL was fixated with 10-0 polypropylene suture. A superiority of 9-0 polypropylene suture needs to be verified in larger series of consecutive patients.

1. Introduction

Implantation of an intraocular lens (IOL) to the capsular bag after removal of the crystalline lens is the most physiological and the safest procedure, providing stable fixation of the implant. If the capsular support is lacking, the most common treatment options include implantation of an iris- or angle-supported anterior chamber IOL (AC-IOL), suturing of a posterior chamber IOL (PC-IOL) to the iris or sclera, implantation of a retropupillary iris claw lens [1–3], and sutureless fixation of PC-IOL's haptics in scleral tunnels as proposed by Scharioth et al. [4].

The lack of adequate capsular support typically results from an ocular trauma or complicated ocular surgery, or is a consequence of lens zonular weakness, e.g. during the course of Marfan syndrome or pseudoexfoliation syndrome. Implantation of an AC-IOL may be associated with various complications, such as progressive endothelial cell loss with resultant corneal edema, development of secondary glaucoma, peripheral anterior synechiae, anterior segment disruption, neovascular glaucoma and intraocular inflammation which may become chronic and treatment-resistant [1–3,5].

Due to these potential risks, implantation of a scleralfixated PC-IOL is often a preferred treatment modality, even despite technical difficulties and longer operative time. Implantation of scleral fixated PC-IOL does not disrupt eye's anatomy, protects integrity of the anterior chamber, minimizes uveal contact, and its outcome is independent of the presence of iris tissue [1–3]. Complications, such as suture knot erosion, tilting and decentration of the lens, hypotony, vitreous hemorrhage, suprachoroidal hemorrhage, retinal detachment and endophthalmitis, typically occur during the first few weeks after the procedure [1–3,6]. The most common late complication, usually

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https://doi.org/10.1016/j.advms.2018.08.005
Received 2 October 2017; Accepted 31 August 2018
Available online 21 December 2018

observed months after the procedure, is dislocation of the IOL due to suture breakage [6–11].

The aim of this study was to analyze long-term visual outcomes and complications in patients subjected to the implantation of a scleralfixated PC-IOL stabilized with 9-0 polypropylene sutures.

2. Material and methods

All cases included in the study (29 eyes from 28 patients) were operated and followed-up at the Medical University of Bialystok Clinical Hospital (Poland) between 2008 and 2012. The study included only patients whose observation period at our center was at least 50 months after the procedure. We had to exclude patients who did not meet this criterion and did not show up for follow-up visits in our outpatient clinic for so long, with incomplete medical records. Small number of patients with a sufficiently long follow-up period is a limitation of this study.

Preoperative data included demographics, information about best corrected visual acuity (BCVA), intraocular pressure, lens status, previous surgeries, preexisting ocular pathologies and history of ocular trauma. The list of analyzed postoperative outcome measures comprised BCVA, pupil shape, intraocular pressure, and complications, such as retinal detachment (RD), uveitis, cystoid macular edema and suture breakage with subsequent reoperation.

The surgeries were performed under general or retrobulbar anesthesia. All patients were operated on by the same surgeon, using a similar technique. The procedure involved pars plana vitrectomy and, whenever required, also lensectomy. One patient was subjected to anterior vitrectomy. All study subjects were implanted with an Eye-O-Care IOL. The suture was tied to the loop of the IOL's haptic with three knots. Fixating sutures were placed at 3 and 9 o'clock positions, 1 mm posterior to the limbus, through the ciliary sulcus. External sutures were applied with a knotless Z-suture technique proposed by Szurman et al. [12]. All sutures were made of 9-0 polypropylene (Prolene®, Ethicon).

2.1. Ethical issues

This study was approved by the Ethics Committee of the Medical University of Bialystok (approval number R-I-002/198/2018) and was performed in accordance with the 1964 Helsinki Declaration and its later amendments.

3. Results

The analysis included 29 eyes from28 patients subjected to the implantation of scleralfixated PC-IOL. The study subjects were qualified for the implantation due to aphakia, subluxation or dislocation of the crystalline lens or previously implanted PC-IOL. The lack of an adequate capsular support resulted from a blunt or penetrating ocular trauma, or previous complicated cataract surgery. Mean follow-up time was 63.9 months (range 50–83 months). Basic characteristics of the study patients, information about their lens status, ophthalmic history and indications for the surgery are presented in Table 1.

A postoperative improvement of BCVA was observed in 25 eyes (86.2%). The BCVA in the remaining four eyes deteriorated postoperatively; one of patients with the postoperative deterioration of BCVA experienced a stroke, two were diagnosed with age-related macular degeneration, and one presented with a significant astigmatism (+4.0 Dcyl) and had distorted, dilated pupil. Mean preoperative BCVA for the study group was 0.5 ± 0.47 logMAR units (6/18 Snellen equivalent), and mean BCVA after the procedure amounted to 0.22 ± 0.32 logMAR units (6/10 Snellen equivalent). Mean spherical refractive equivalent (the sum of spherical power and half of cylindrical power) at the last follow-up visit was -0.61 ± 0.54 D.The refractive astigmatism ranged from 0.5 to 5.75 Dcyl (mean 2.35 Dcyl). Low levels of astigmatism, up to 2.5 Dcyl, were found in 16 eyes (55%), and moderate-degree astigmatism (2.5–4 Dcyl) in 9 (31%).

Table 1
Summary of patients characteristics.

Age	
Range	31-89
Mean ± standard deviation (SD)	61.8 ± 12.4
Gender	
Males	18 (64.3%)
Females	10 (35.7%)
Lens status	
Aphakic	9 (31%)
Phakic - lens subluxation	9 (31%)
Phakic - total dislocation of lens	7 (24.1%)
IOL dislocation	4 (13.8%)
Relevant preoperative ophthalmic history	
Head and ocular trauma	26 (89.7%)
Posttraumatic ocular hypertension	9 (31%)
Complicated cataract surgery	3 (10.3%)
Glaucoma	3 (10.3%)
Pseudoexfoliation syndrome	2 (6.9%)
Retinal detachment - previous surgery	1 (3.4%)
Congenital cataract - previous surgery	1 (3.4%)
Macular hole	1 (3.4%)
Retinitis pigmentosa	1 (3.4%)
High degenerative myopia	1 (3.4%)
Keratoconus	1 (3.4%)
Duration of follow-up (mths)	
Range	50-83
Mean ± standard deviation (SD)	64 ± 10.4

Most problems observed during the early postoperative period (up to 7 days post-procedure) were minor complications, such as a transient corneal edema and mild inflammatory response in the anterior chamber. The pupils in four eyes (13.8%) were dilated and distorted, and in another two (6.9%), a spontaneous partial displacement of the optical part of the IOL to the anterior chamber was observed at 2 weeks and 2 months, respectively. Both those patients underwent a successful surgical repositioning of the IOL under topical anesthesia. Mean intraocular pressure at the last follow-up visit was 17.7 mmHg (range 10–32 mmHg). Six patients (21.4%) were diagnosed with glaucoma during the late postoperative period, and received a topical treatment. Approximately two months after the surgery, RD occurred in one eye (3.4%) with a history of previous blunt ocular trauma; the complication was successfully managed by pars plana vitrectomy. No other morbidities, such as endophthalmitis, uveitis, corneal compromise and cystoid macular edema, were recorded during the follow-up period.

Dislocation of the IOL due to the suture breakage occurred in 4 eyes (13.8%); all those patients required reoperations. The dislocation resulted in an immediate visual impairment. In three patients, one out of two fixating sutures broke off, leaving the IOL hanging on the another one. Two spontaneous IOL dislocations took place at 24 and 50 months post-procedure, respectively. In one case, the dislocation was precipitated by a trauma 12 months after the PC-IOL implantation. One patient experienced a complete dislocation due to spontaneous breakage of both sutures at 52 months. None of the dislocations seemed to result from an accidental removal of the suture, its erosion through the tissue or loosening of the knot. All sutures broke off in the intrascleral parts, and the knots on the IOL's haptics remained intact (Figs. 1, 2). In none case, the subluxated and displaced IOL did not cause damage to the retina and other intraocular tissues.

The patient who experienced the post-traumatic suture breakage underwent a refixation of the IOL with the same method. However, the procedure was interrupted and postponed for a week due to a bleeding to the vitreous cavity during fixation of one of the sutures.The suture again broke off spontaneously 26 months later, and eventually the patient was implanted with a retropupillary iris claw lens. The refixation procedures in the remaining three patients were uneventful; one person was implanted with an iris-sutured PC-IOL, and two with

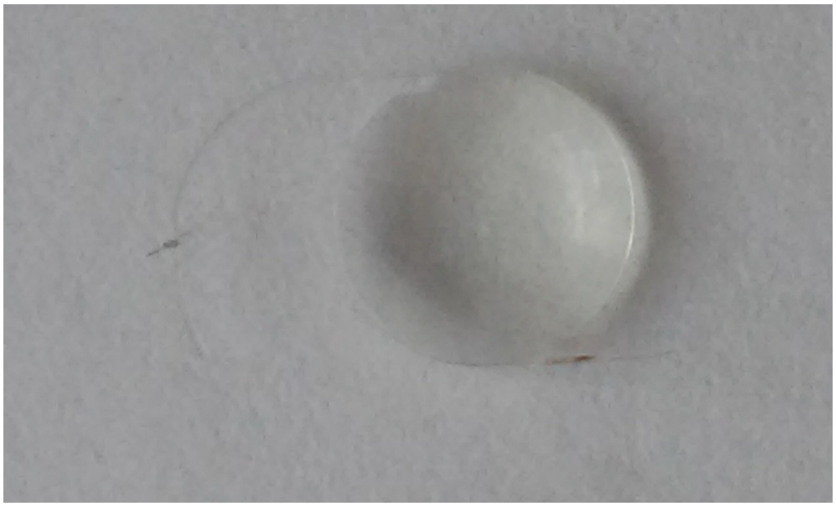

Fig. 1. The photograph of the explanted IOL. One haptic has been damaged during the surgery.

retropupillary iris claw lenses.

Overall, six suture breakages were recorded in four eyes from four patients.

4. Discussion

Correction with contact lenses or spectacles is usually insufficient to control adult aphakia, and may contribute to a significant deterioration of patient's quality of life. Although a recommended approach in such cases is simultaneous or secondary placement of IOL, the question if this should be the treatment of choice in eyes with lacking capsular support is still a matter of debate. Some authorscompared the outcomes in patients implanted withAC-IOLs and PC-IOLs, and did not demonstrate a superiority of one modality over the another [1–3]. The sutureless method was shown to produce satisfactory intermediate outcomes and is associated with low morbidity, but to this date, these promising results have not been verified in a long-term study [4]. Hence, the choice of IOL's type is based primarily on preoperative status of the eye and surgeon's preferences. Scleralsutured PC-IOLs are often used in patients with the anterior chamber pathologies or in individuals in whom both the iris and capsule are absent or disrupted [3].

Our study documented satisfactory long-term visual outcomes of PC-IOL implantation; after a mean follow-up of 63.9 months, BCVA improvement was observed in up to 86.2% of the eyes, and final postoperative visual acuity of 5/10 or better was demonstrated in 69% (n = 20). These results are consistent with the visual outcomes of PC-IOL implantation reported previously by other authors [6–8].

Complication rate in our series was relatively low, especially taking into account that all patients had a history of an ocular trauma or complicated ocular surgery. At the last follow-up visit, nine patients (32.1%) required permanent topical treatment to reduce the intraocular pressure. The relatively high prevalence of glaucoma and ocular hypertension in our series might have been associated with the presence of some preoperative risk factors for those conditions (e.g. a history of ocular trauma or complicated ocular surgery, pseudoexfoliation syndrome, preexisting glaucoma), rather than with the procedure itself [6].

The incidence of RD after the implantation of a scleralfixated PC-IOL is higher than after the procedures involving AC-IOL or iris-sutured PC-IOL [3]. The risk is even greater in younger patients, due to the strong adherence of the vitreous body [8]. In previous long-term studies, the incidence of RD was estimated at 0–8.2% of operated eyes [6,8,10,13]. Our series included only one patient with RD (3.4%), a 41-year-old individual in whom this complication was found at 2 months after the surgery. Importantly, none of our patients developed other serious complications reported in previous studies, such as endophthalmitis, suprachoroidal hemorrhage, corneal compromise, uveitis and cystoid macular edema [6,8,10,11].

Breakage of the fixating suture with an immediate visual

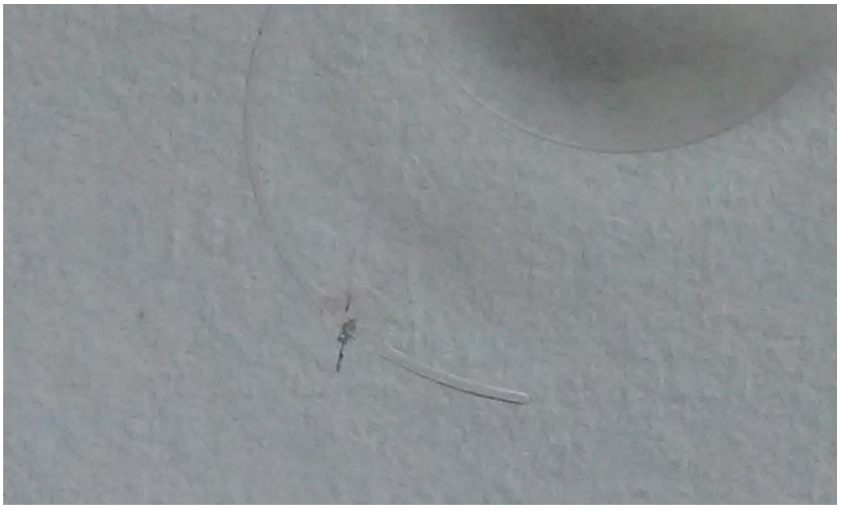

Fig. 2. The polypropylene suture remnants attached to the haptic. The knot is intact.

impairment caused bythe lens displacement is a late complication after the implantation of scleralfixated PC-IOL. Spontaneous dislocation of the scleral fixated PC-IOL was previously reported by many authors. The incidence of this complication, typically observed 3–5 years post-procedure, is estimated at 0–28% of the eyes [6–11,14]. Published evidence suggests that most surgeons use 10-0 polypropylene sutures to fix the PC-IOL [6,8,7–11]. Sutures of this type are generally designated for sewing and ligation of soft tissues in cardiovascular, neurological and ophthalmic surgery. Polypropylene sutures are considered firm and durable, but a number of previous studies demonstrated that they do not necessarily are appropriate for the permanent fixation of the IOL. Already in 1980s, Jongebloed and Worst [15] and Altman et al. [16] reported independently that intraocular polypropylene sutures may undergo biodegradation and develop cracks within the eye; this complication was observed after various periods of time depending on the suture size. According to Price et al. [7] and Stewart and Landers [17], 9-0 polypropylene suture has a 60% greater tensile strength, 50% greater diameter and 125% greater cross-sectional area and thus, may be more appropriate for IOC fixation. In line with those findings, many authors recommend the use of 9-0 polypropylene sutures for the implantation of scleralfixated PC-IOL, to reduce the risk of the spontaneous breakage [7,7–11,17]. To the best of our knowledge, none of the published studies documented a dislocation of the IOL resulting from the absorption of 9-0 polypropylene sutures.

Although we used 9-0 polypropylene in all our patients, it did not fulfill the high expectations for stable and permanent fixation of PC-IOL, by eliminating spontaneous suture breakages. We recorded six cases of suture breakage; one breakage was precipitated by a trauma, and another five, involving three eyes from three patients, were spontaneous. Mean time to the spontaneous suture breakage was 40.8 months.

According to some authors, the risk of the postoperative suture breakage is greater in younger adults (under 40 years of age) and children; this results not only from higher levels of physical activity and more common exposure to injury in those groups [6,8,9,18,19], but also from the elevated enzymatic activity that may enhance polypropylene biodegradation [8]. However, our findings do not seem to support this theory, since mean age at the time of the spontaneous breakage in our series was 57 years.

A common concern related to the use of 9-0 polypropylene sutures is the size of the knot, which is much bigger than in the case of 10-0 suture [9,10,17]. The larger size may contribute to scleral atrophy above the knot, which results in greater risk of suture erosion and resultant endophthalmitis. To avoid these complications, creation of a scleral flap or scleral groove is recommended whenever the IOP is fixated with a 9-0 propylene. We overcame this problem, using an intrascleral Z-suture instead of the knots [12]. The zigzag-shaped suture with five intrascleral passes adequately secured the external suture in the sclera, with no need for creation of a scleral flap or groove. The fact that none of our patients developed endophthalmitis or scleral atrophy at the suture site implies that this approach was appropriate.

Two potential limitations of this study are retrospective character of the analysis and relatively small sample size. In 2009–2012, a total of 92 patients were subjected to the implantation scleralfixated PC-IOL at our center. Most of those patients were referred from other clinics and they did not report regularly to postoperative controls. The study included all patients whose observation period at our center was at least 50 months after the procedure. We had to exclude patients who did not meet this criterion and did not show up for follow-up visits in our outpatient clinic for so long, with incomplete medical records.

5. Conclusions

Scleral fixation of the PC-IOL remains a valid technique, provide satisfactory visual outcomes in many eyes without an adequate capsular support. The results in this study imply that the scleralfixated PC-IOL can be implanted safely using 9-0 polypropylene sutures. However, the procedure was still associated with a considerable risk of postoperative suture breakage. The use of multiple sutures placed on each haptic of the lens or application of a different sewing material should be considered to improve the safety of the procedure and to minimize the risk of complications associated with the suture breakage.

Conflict of interests

The authors declare no conflict of interests

Financial disclosure

The authors have no funding to disclose

The author contribution

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Funds Collection: n/a

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