·Opinion·

Urrets-Zavalia syndrome in different methods of keratoplasty

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INTRODUCTION

Urrets-Zavalia was first described as a syndrome consisting of a fixed, dilated pupil with iris atrophy following penetrating keratoplasty (PKP) in 1963 and back then it was thought that this syndrome was only related to keratoconus patients [1]. Other findings that were not essential for the diagnosis were posterior synechiae, ectropion uvea, pigment dispersion, anterior subcapsular lens opacities and secondary glaucoma syndrome [1]. Subsequently, this syndrome was described after PKP for corneal dystrophy, deep anterior lamellar keratoplasty (DALK), descemet stripping endothelial keratoplasty (DSEK), goniotomy, laser iridoplasty, iatrogenic mydriasis and after implantation of phakic intraocular lenses[2-8].

The present study was undertaken to report the prevalence of Urrets-Zavalia syndrome in different methods of keratoplasty.

SUBJECTS AND METHODS

This study was a single center retrospective study. We reviewed eyes that underwent PKP, DSEK and DALK from 2008 until 2012. Informed consent was obtained from each patient who participated in our study. The study adhered to the tenets of the Declaration of Helsinki and was approved by the institutional review board and ethics committee of the Tehran University of Medical Sciences.

Eyes with preoperative pupil that was not regular, round and reactive; or eyes with any intraoperative condition that caused any change in pupil were excluded from the study. Also all eyes with glaucoma were excluded. Eyes with a documented postoperative fixed dilated pupil following surgery were considered as Urrets-Zavalia syndrome. Demographic data, ocular and drug history including mydriatics, miotics and mannitol usage pre- and postoperatively were recorded. Pre- and post-operative examinations were performed including visual acuity, fibrin reaction in the anterior chamber, cataract formation, intraocular pressure (IOP), and iris and pupil abnormalities were documented. In addition, all intraoperative complications were also recorded. We used povidone-iodine 5% for scraping and all of the reusable instruments were sterilized using the autoclave system. Disposable suction trephination and manual punch were used in recipient and donor corneas, respectively. Viscoelastic devices were used in all cases of PKP. For DALK, two common techniques (Melles manual dissection and Anwar's big-bubble techniques) were used[9]. For DSEK procedure, after inserting and unfolding lamellar donor disc in the anterior chamber, an air bubble was injected up to 2/3 of the anterior chamber volume. We did not perform an iridectomy for DSEK cases. The amount of air was the same for micoperforations after DALK.

RESULTS

There were eight eyes (from seven patients) developing Urrets-Zavalia syndrome during the course of the study. The demographic data for patients is summarized in Table 1. Five of eight eyes developed Urrets-Zavalia syndrome after DALK procedure (out of 263 patients), 1 patient after DSEK and 2 patients after PKP, with no statistically significant difference between three groups of patients (P=0.164) (Table 2). For all patients, the surgery had been performed under general anesthesia. Four eyes with keratoconus and one eye with macular dystrophy in DALK group, one pseudophakic eye in DSEK group (who underwent DSEK for pseudophakic bullous keratopathy) and two eyes in PKP group developed Urrets-Zavalia syndrome. No eyes had a history of intraoperative mannitol injection and there was not any history of iris prolapse during the surgery. There was a history of gas injection in six (75%) of eight cases (five DALKs and one DSEK patient).

All five patients who developed Urrets-Zavalia after DALK were associated with intracameral air injection. Interestingly, case number eight was not associated with intraoperative

Table 1 Characteristics of the patients

Patient	Age (a)	Sex	Type of surgery	Indication	Intraoperative mannitol	Miotics\ Mydriatics	Type of anesthesia	History of complications	Time of detection (d)
1	36	F	DALK	KCN	-	-	GA	Micro perforation during the surgery and air injection	2
2	58	M	DSEK	PBK	-	-	GA	-	1
3	18	F	DALK	KCN	-	-	GA	Micro perforation during the surgery and SF6 injection	4
4	22	F	DALK	KCN	-	-	GA	Micro perforation during the surgery and air injection	2
5	32	M	DALK	MD	-	-	GA	Micro perforation during the surgery and air injection	1
6 (1^{st} eye)	22	F	PKP	KCN	-	-	GA	-	1
6 (2^{nd} eye)	24	F	PKP	KCN	-	-	GA	-	1
7	19	M	DALK	KCN	-	-	GA	Air injection for double anterior chamber	5

F: Female; M: Male; DALK: Deep anterior lamellar keratoplasty; DSEK: Descemet stripping endothelial keratoplasty; PKP: Penetrating keratoplasty; KCN: Keratoconus; PBK: Pseudophakic bullous keratopathy; MD: Macular dystrophy; GA: General anesthesia; SF6: Sulfur hexafluoride.

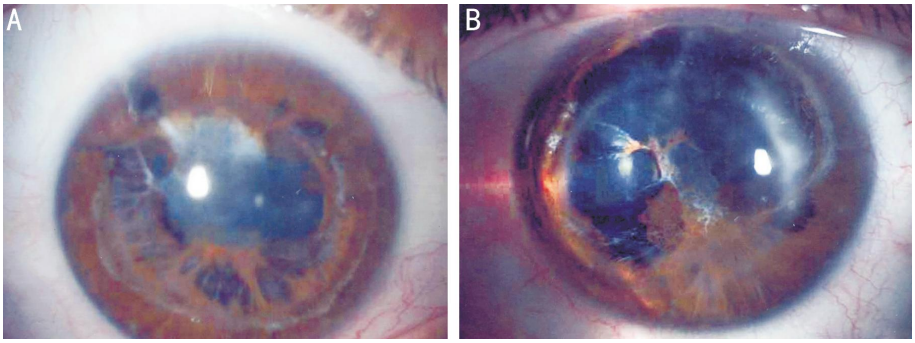

Figure 1 Eyes in a patient with bilateral Urrets-Zavalia syndrome after PKP A: Right eye; B: Left eye.

Table 2 Distribution of patients according to the type of surgery and indication

Type of operation	No.	Indication
PKP	437	KCN (401) MD (31) GD (5)
DALK	263	KCN (255) MD (8)
DSEK	111	BK (111)

No: Number of eyes; PKP: Penetrating keratoplasty; DALK: Deep anterior lamellar keratoplasty; DSEK: Descemet striping endothelial keratoplasty; KCN: Keratoconus; MD: Macular dystrophy; GD: Granular dystrophy; BK: Bullous keratopathy.

Table 3 Characteristics of eyes showing Urrets-Zavalia syndrome in the study

Patient	IOP elevation	Fibrin reaction	PS	PAS
1	-	-	-	-
2	-	-	-	-
3	-	-	+	-
4	-	-	+	-
5	-	-	-	-
6 (1^{st} eye)	-	+	+	-
6 (2^{nd} eye)	-	+	+	-
7	+	+	+	+

IOP: Intraocular pressure; PS: Posterior synechia; PAS: Peripheral anterior synechia.

descemet rupture but underwent intracameral air injection on the third postoperative day because of double anterior chamber. IOP was elevated at the time of Urrets-Zavalia syndrome detection in one eye. Incidence of fibrin reaction, posterior synechiae formation and peripheral anterior synechiae formation is reported in Table 3. Anterior subcapsular cataract formation was present in both cases undergoing PK (Figure 1A, 1B), and in two patients undergoing DALK. There was not any history of mydriatics or miotics usage before, during or after the operation. None of the eyes underwent vitreous tap or another surgery after the operation for each of the adverse effects of Urrets-Zavalia syndrome (synechiae, cataract, glaucoma, pupillary dilation). None of the cases regained pupillary reactivity.

DISCUSSION

The incidence of Urrets-Zavalia syndrome was estimated to be from 2.2% to 17.2%[1-8]. However in some recent studies, there has been no report of this syndrome among study population[10]. Urrets-Zavalia[1] supported the role of atropine in developing fixed dilation of pupil and iris atrophy (Urrets-Zavalia syndrome). He suggested that either fibrin exudates collected at the peripheral cornea or mechanical flattening effect of tight sutures was associated with the peripheral synechiae and late secondary glaucoma [1]. He also believed that mydriatics aggravated the condition by peripheral movement and apposition of the iris and reported white blood cells and fibrin in the anterior chamber to support a role for inflammation in this syndrome [1,11]. It is suggested that injury to the radial nerve fibers of the parasympathetic innervation system will cause denervation of the constrictor pupillary muscle and dilation of the pupil by the dominant effect of dilator muscle[10] . The other suggested

etiology for this syndrome is ischemic trauma to the iris vessel. Iris ischemia may be related to strangulation of iris vessel due to pupillary dilation or high IOP[11-12].

It has been suggested that the air/gas tamponade may cause papillary block and raise IOP leading to iris ischemia and fixed dilated pupi [11]. The interesting point is the difference between Urrets-Zavalia syndrome caused by PKP from other causes especially DALK patients that possibly induced by air-pupillary block. The role of other above mentioned causes could be bolder in PKP cases. Although the surgeon may not detect signs of pupillary block (shallow postoperative anterior chamber), there may be other mechanisms such as undetected pupillary block (for example during the first postoperative night) leading to this complication. These points emphasize the possible role of pupillary block in Urrets-Zavalia syndrome. The other etiology may be related to the air injection in some of these procedures and the toxic effect of the oxygen on the crystalline lens leading to anterior subcapsular cataract either by altering the molecular structure of the crystalline lens, or by inactivation of metabolic enzymes [12-14]. Also toxic effect of the oxygen could lead to iris ischemia and pupil dilation. It has been proposed that Urrets-Zavalia syndrome could be established by a mechanism like toxic anterior segment syndrome (TASS). Nizamani *et al* [13] reported 15 consecutive TASS cases following uncomplicated cataract surgery and considered Urrets-Zavalia syndrome as a possible sequel of TASS.

Urrets-Zavalia syndrome could occur in all three types of keratoplasty especially in patients with intracameral gas injection. Although the incidence was low in our study (1%), it necessitates pre-, intra- and post-operative managements in susceptible patients. We need more data and more controlled conditions to report the association between this relatively rare complication and different types of keratoplasty.

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