

Retinal Detachments in Eyes After Boston Keratoprosthesis Type 1

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INTRODUCTION

The Boston Keratoprosthesis Type I (KPro) is the most common keratoprosthesis used in the United States. The most frequent posterior segment complications include rhegmatogenous retinal detachment (RD), choroidal detachment, cystoid macular edema, and epiretinal membrane. RD has been reported in 5-16.9% of KPro patients.¹⁻² In this study, we report the frequency, timing, visual significance, contributing factors, management, and surgical outcomes of RD after successful KPro implantation.

METHODS

A retrospective chart review was conducted of consecutive KPro implantations at a single institution by multiple surgeons over a 5 year period. For inclusion in this series, patients must have a minimum of 6 months of follow up after initial KPro surgery. For every patient, age, lens status, indication for KPro, concomitant surgeries at time of KPro, prior retinal or other eye disease were recorded. Preoperative and postoperative best-corrected visual acuity (BCVA), ocular comorbidities, type of RD, type and number of surgical interventions, anatomic outcomes, and complications were analyzed.

RESULTS

One hundred and three KPros were implanted into 95 eyes of 94 patients over a 5 year period. Fourteen of the 95 eyes (14.7%) developed RDs during a median follow-up of 27.5 months (range 12-58). Eleven of the 14 eyes had failed at least one prior PK and ten of 14 eyes had concomitant surgery at the time of initial KPro. Seven of the 14 eyes were pseudophakic prior to KPro, and 6 underwent concomitant lens removal under open sky. The median time from KPro placement to occurrence of RD was 9 months (range 0.5-40 months). Thirteen of 14 (92.9%) eyes underwent PPVx; only 3 eyes required KPro removal during RD repair. One patient chose observation instead of surgery for RD. Ten of 13 eyes (77%) undergoing PPVx for RD achieved initial reattachment. However, 7 of these 10 eyes (70%) developed recurrent RDs and required a median of 2 PPVxs. At final follow up, 7 of 14 eyes achieved attached retinas, with 6 requiring silicone oil. Complications after KPro suspected to contribute to RD include proliferative vitreoretinopathy (PVR) (7), retroprosthetic membranes (RPM) (7), hypotony (6), choroidal detachment (4), epithelial downgrowth (3), and endophthalmitis (3). VA results are presented in table 3.



FIGURE 1
Endophthalmitis, Rhegmatogenous retinal detachment (RRD)

Baseline Characteristics

Patient	Age	Aphakia vs Pseudophakia at time of KPro	Indications for KPRO	Concomitant surgery	Comorbidities/Prior Eye Disease
1	74	Pseudophakic	Fuchs dystrophy	IOL removal	Glaucoma- cpc*2
2	3	Aphakic	Infantile glaucoma, corneal opacification	None	Glaucoma- cpc, baerveldt
3	76	Pseudophakic	End stage glaucoma	IOL removal, fibrous tissue removal from ant. segment	Glaucoma- baerveldt
4	57	Aphakic	Congenital rubella	None	Congenital cataract, aphakia, glaucoma- ahmed
5	23	Aphakic	Congenital glaucoma	PPVx, SO fill	Hypotony and multiple PKs
6	56	Pseudophakic	HSV keratitis	None	HSV keratitis s/p 2 PKPs, ERM
7	12	Aphakic	Aniridia, corneal scar, anterior fibrosis syndrome	PPVx, Ahmed tube	Familial aniridia and secondary glaucoma- baerveldt
8	63	Pseudophakic	Corneal decompensation with anterior PVR enveloping IOL	Temporary KPro, IOL removal, PPVx, SO exchange	Anterior PVR enveloping pseudophakic lens, prephthical on B scan
9	83	Aphakic	Chronic AKC with corneal opacity and leukoma, LSCD	Permanent tarsorrhaphy, PPVx, Ahmed tube	Glaucoma
10	67	Pseudophakic	Cicatricial conjunctivitis, LSCD	IOL removal, iridotomy	None
11	52	Pseudophakic	HSV keratitis	IOL removal	Glaucoma- multiple tube shunts, prior PPV for unknown reason, hypotony, choroidal effusion
12	84	Aphakic	LSCD	Pupilloplasty	None
13	62	Pseudophakic	Fuchs dystrophy	IOL removal	Glaucoma- cpc
14	1	Aphakic	Peter's anomaly	None	Peter's anomaly

TABLE 1 – Baseline characteristics of Kpro patients who developed retinal detachments

Retinal Detachment Analysis

Patient	Prior Retinal Disease	Complications after KPro	Time to RD (months)	Type of RD	Surgery to fix RD	Anatomic outcome after surgery	Recurrent RD
1	None	VH, cyclitic membrane rem. at KPro removal	0.5	TRD	PPVx/SB/EL/Cryo	Attached	Yes
2	None, but prior 2 PPV for PP tube	RPM, leak from KPro, extruding KPro, PVR, epithelial downgrowth	7	Total RD, TRD	PPV/SB/Mx/EL/SO	Attached	Yes
3	Pigmented macular scar	Melt of KPro, thick RPM	11	RRD with cyst	N/A	N/A (opted for observation)	No
4	None	Chor. detach., hypotony, PVR, RPM	4	RRD	PPV/Mx/Rx/PFO/EL/SO	Attached	Yes
5	Hx of unknown retina surgery 2 5 years prior to PK	PVR	Complex	5 RRD/TRD	PPV/Mx/SO removal/EL/SB/Rx/SO	Attached	No
6	Hx of ERM	Endophthalmitis, PVR	16	RRD/TRD	PPV/Mx/Rx/EL/SO	Attached	No
7	None	RPM, epithelial downgrowth, hypotony	6	TRD	PPV/Mx/RPM removal/PFO/EL/C3F8	Attached	Yes
8	Hx of ROP and prior RD s/p PPV 8 and SO	iatrogenic retinal tear	Complex	0.5 RRD/TRD	SO removal/PPVx/Mx/Rx/EL/SO	Attached	Dragged retinal fold
9	Hx of CME, ERM	Corn. infiltrate, endophthalmitis, chor. detach., RPM, PVR, SRH	Complex	15 RRD/TRD	PPVx/Mx/Rx/PFO/EL/SO	Phthisis	N/A
10	Hx of CME, ERM	Chor. detach., hypotony	31	RRD	PPVx/PFO/EL/Rx	Attached	No
11	Prior PPV- unknown reason	Hypotony, choroidal effusion (present prior to KPro surgery)	0.5	TRD	Chor drain/PPVx/RPM Mx/Rx/EL/SO	Attached	Yes
12	None	RPM, corneal melt, hypotony, epi. downgrowth	Complex	40 RRD/TRD	PPVx/SB/Mx/Rx/PFO/EL/SO	Not attached	No
13	Hx of ERM	Hypotony, anterior PVR, endophthalmitis	Complex	32 RRD/TRD	SB/PPVx/Mx/Rx/PFO/EL/SO	Not attached	No
14	None	RPM, extruded kpro, RPM and extruded kpro *2, anterior PVR	Complex	38 RRD/TRD	PPVx/PFO/SB/EL/SO	Attached	Yes

TABLE 2 - Retinal detachments after KPro surgery were found by clinical examination and/or B-scan ultrasonography. Mean time to RD - 14.75 months, Median - 9 months

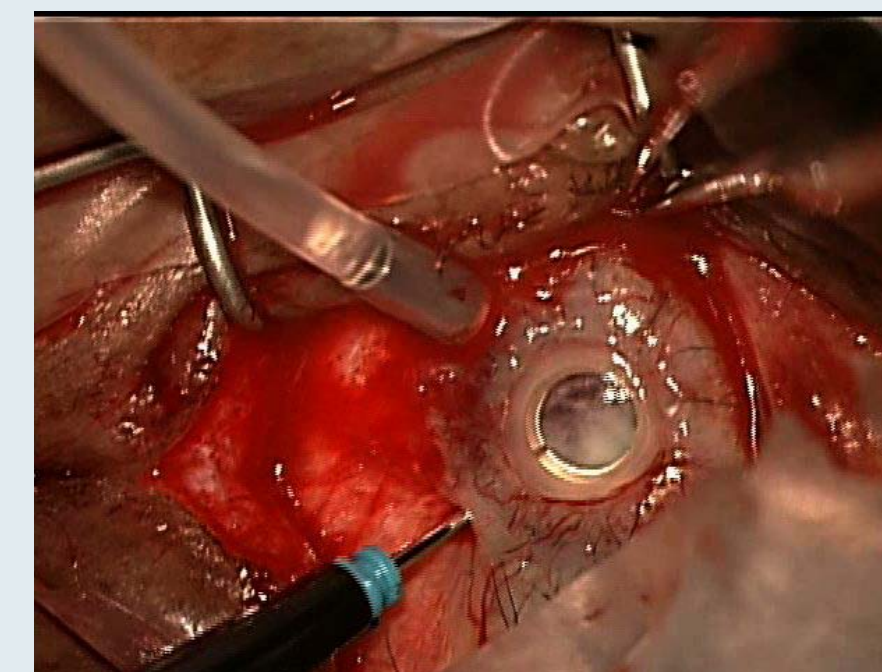


FIGURE 2- Endophthalmitis, RRD, RPM



FIGURE 3- Endophthalmitis, RRD, RPM removal

Visual Acuity and Final Outcome

Patient	VA prior to KPro	Best VA after KPro	VA at time of RD diagnosis	Best VA after PPV	VA at final F/up	Final Outcome
1	CF @ 3 inches	20/400	HM	20/400	LP	Phthisis
2	F&F	F&F	LP	LP	NLP	Phthisis
3	HM	CF @ 1.5 feet	HM	N/A	CF @ 8 inches	Open funnel RRD
4	CF @ 3 feet	20/400	HM	HM	LP	Attached retina, RPM
5	HM	CF @ 3 feet	CF @ 2 feet	CF @ 3 feet	CF @ 1 foot	Attached retina
6	CF @ 1 feet	20/100	LP	HM	20/250	Attached retina, RPM
7	HM	20/200	CF@1 feet	LP	NLP	Phthisis
8	LP	HM	HM	LP	LP	Dragged retinal fold
9	20/400	20/50	LP	NLP	NLP	Detached retina
10	HM	20/60	LP	20/60	20/60	Attached retina
11	HM	CF @ 6 inches	CF @ 6 inches	20/400	CF @ 6 inches	Attached retina, mac hole
12	HM	20/300	HM	NLP	NLP	Phthisis
13	HM	20/60	HM	HM	HM	Closed funnel RD
14	Difficult to assess	Difficult to assess	Difficult to assess	Difficult to assess	Difficult to assess	Attached retina
Average (LogMAR ± Std. Dev.)	1.91±0.28	1.23±0.58 (p<0.001)	2.08±0.31	2.02±0.75 (p=0.77); For attached retinas: 1.81±0.69 (p=0.45)	2.19±0.79; For attached retinas: 1.71±0.80	

TABLE 3
Visual acuity for counting fingers (CF), hand motions (HM), fixes and follows (F&F), light perception (LP), no light perception (NLP) were converted to logarithm of the minimum angle of resolution values as 1.7, 2.0, 2.0 2.5, and 3.0, respectively. In cases where multiple KPros were implanted, visual acuity comparisons were made from the original keratoprosthesis surgery.

DISCUSSION

Prior studies have looked into the outcomes of Boston Keratoprosthesis Type 1, but have had limited discussion with regards to posterior segment complications, such as retinal detachment.³⁻⁷ A study by Ray et al.⁸ looked into management of vitreoretinal complications in patients undergoing subsequent vitreoretinal surgery after KPro. They found that 13 of the 110 patients (11.8%) that underwent keratoprosthesis implantation developed retinal detachment. Another large study by Goldman et al.,² similarly evaluated posterior segment complications and found retinal detachments to be the most common complication occurring in 14 of 83 eyes (16.9%).

- In our analysis, fourteen of 95 eyes (14.7%) developed RDs
- The most common complications identified as suspected to contribute to RD included proliferative vitreoretinopathy (50% of eyes), retroprosthetic membranes (50%), and hypotony (43%)
- A significant number of patients (7) developed recurrent RDs secondary to the severe complications after KPro
- During follow up, 3 eyes developed endophthalmitis and 4 eyes developed phthisis, illustrating the severe disease burden present within the eyes

CONCLUSION

- RD is a significant complication after KPro surgery occurring in 14.7% of 95 eyes
- The visual acuity gain after KPro surgery is often lost when a retinal detachment occurs, despite good anatomic outcomes in a majority of eyes (77%) after RD repair
- Various ocular coexisting co-morbidities and post-KPro complications contributed to RDs and decreased visual acuity

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SUPPORT

Research to Prevent Blindness

