

Short Term Outcome of Goniotomy with Kahook Dual Blade in the Management of Primary Open Angle Glaucoma-A Retrospective Interventional Case Series

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Abstract

Objectives: To describe short-term efficacy of goniotomy with trabecular meshwork excision using the Kahook Dual Blade (KDB, New World Medical Inc., Rancho Cucamonga, CA) in patients with Primary Open Angle Glaucoma, (POAG) either as a standalone or plus Phacoemulsification (phaco).

Method and Patients: A retrospective review of 12 eyes of 9 patients who had goniotomy with Kahook dual blade either as a standalone or combined with cataract surgery by phacoemulsification from April 2017 to July 2018 at Eye Foundation Hospital, Ikeja, Lagos. The patients were follow-up for a minimum of 6 months.

Results: The mean age of the patients was 66.4±8.8 years. Mean preoperative intraocular pressure (IOP) for all eyes was 18.58±5.42mmHg. From day 1 through the 6th Month of postoperative follow-up, the mean IOP ranged from 18.58±9.26mmHg to 12.27±1.68mmHg representing reductions of 0-6.31mmHg (0-34%; p<0.05 at each time point versus baseline except for day 1). For the Phaco+KDB group, the baseline mean IOP was 19.25±4.56mmHg while the mean IOP postoperatively from day 1 to 6 months ranged from 19.13±8.99mmHg to 12.13±1.89mmHg representing reductions of 0.12mmHg to 5.13mmHg (0.6-30.2%; p<0.05 only from 1 month to 6 months). At baseline, the mean IOP for the eyes that had KDB goniotomy as a standalone was 17.25±7.45mmHg and postoperatively ranged from 17.50±11.09mmHg to 12.67±1.67mmHg representing reductions of -0.25-9.08mmHg (-1.45%-41.7%; p<0.05 at one week, 3 and 6 months only versus baseline).

Conclusion: KDB either as a standalone or with phaco recorded at least 30% reduction in IOP after 6 months of follow-up in these series.

Introduction

The management of glaucoma is lifelong and the challenges of achieving objectives of treatment are enormous. Many times a combination of medical, laser and surgery is needed to achieve target pressure and retard progression [1]. Traditionally, pharmacologic and laser treatment have been the mainstays of therapy of primary open angle glaucoma (POAG) until the disease progresses to a stage that warrants the need for incisional surgery. The traditional incisional surgery which includes trabeculectomy and the aqueous tube shunts are generally considered the most effective IOP-lowering treatments available [1]. It has been reported that they maintain intraocular pressure in the low teens for longer period [2]. These procedures are typically reserved for those with moderate to advanced cases of glaucoma due to the invasiveness of the procedure and possible complications [1]. The associated complications such as bleb-related infection including endophthalmitis, scarring of the bleb, hypotony, cataract which inevitably interfere with quality of life of the patients [3]. Minimally invasive glaucoma surgery (MIGS) are surgical

options for mild-to-moderate POAG. These procedures have a higher safety profile with fewer complications and a more rapid recovery time than other invasive techniques. They have been shown to be effective in decreasing IOP as well as a patient's need for medications, which is important given a typically low compliance rate for medication adherence [1].

The juxtacanalicular part of the trabecular meshwork is known as the site of greatest resistance to aqueous outflow [4]. Incision and/or removal of the trabecular meshwork has been successfully used to lower IOP in congenital glaucoma for years and more recently has been shown to be advantageous in adult patients as well [5,6]. Goniotomy using Kahook Dual Blade (KDB) as a type of MIGS is one of the novel methods use in removing perceived trabecular obstruction and thereby enhanced conventional outflow pathway [7,8]. So far there are few studies on its outcome and efficacy in the management of Primary Open Angle Glaucoma (POAG). To our knowledge, there is no reported experience on goniotomy using

Kahook Dual Blade in sub-Saharan Africa in general and Nigeria in particular. These interventional case series are our initial experience with this novel surgical method.

Materials and Methods

This was a retrospective analysis of data collected from medical records of patients with primary open angle glaucoma of varying severity who had goniotomy with Kahook Dual Blade (KDB, New World Medical Inc., Rancho Cucamonga, CA) either as a standalone or with cataract surgery using phacoemulsification at Eye Foundation Hospital, Ikeja Lagos Nigeria, from April 2017 to July 2018. The procedures carried out in this study involving human subjects followed the ethical standards of the hospital and the tenets of the Helsinki Declaration. Informed consent for the study was taken from every individual in this study.

Preoperative data collected included patient demographic information (age, gender), glaucoma type and severity, current IOP lowering medications, past ocular surgical history, relevant systemic medical history, and baseline visual acuity and IOP. Postoperative data collected included, type of surgery, postoperative visits, ocular and systemic medications, visual acuity, IOP, any new adverse events, and any secondary surgical interventions for IOP control. Data from day 1 to 6 months of follow-up are included in this analysis. Means were reported \pm standard deviation (SD).

The surgeries were performed by an experienced Glaucoma surgeon (OA) and a Glaucoma fellow (GIN). The surgical technique used in this study was as reported by Sieck EG, et al. [9]. Postoperatively, patients who had combined KDB and phacoemulsification were started on Guttae Maxitriol 2hourly, Guttae Ciloxan (norvatis) 4hourly, Maxitriol ointment nocte daily which were tapered over an 8-week period. Guttae Pilocarpine 2% 4 times a day was given for one week. For the standalone KDB, the eyes were placed on Guttae Maxitriol 6 hourly and Guttae Ciloxan 6 hourly which were tapered down within 4 weeks. Guttae Pilocarpine 2% 4 times also given for one week. The primary efficacy outcome measure was a $\geq 20\%$ decrease in intraocular pressure (IOP) from baseline. The secondary outcome was IOP-lowering medical regimen reduced by ≥ 1 medication compared with preoperative therapy.

Results

A total of 12 eyes of 9 patients included in the study. The mean age of the patients was 66.4 ± 8.8 years. Eight eyes had goniotomy with KDB plus phacoemulsification with posterior intraocular lens implantation while four eyes had goniotomy with KDB as standalone. The other

demographic and clinical characteristics are as shown in table 1 below. Majority of the eyes (7, 58.3%) has severe Primary Open Angle Glaucoma (POAG).

Table 1: Demographic and clinical characteristics of the patients

Characteristics	Type of surgery	
	KDB	Phaco + KDB
Age (years)		
Mean \pm SD	68.0 \pm 8.83	64.5 \pm 8.23
Range	63-77	54-82
Gender		
Male	2 (22.2%)	3 (33.3%)
Female	1 (11.1%)	3 (33.3%)
Eye		
Right	3 (25%)	4 (33.3%)
Left	1 (8.3%)	4 (33.3%)
Glaucoma severity		
Mild	2	0
Moderate	1	2
Severe	1	6

The mean IOP at baseline for the eyes was 18.58 ± 5.8 mmHg. From day 1 through the 6th Month of postoperative follow-up, the mean IOP ranged from 18.58 ± 9.26 mmHg to 12.27 ± 1.68 mmHg representing reductions of $0-6.31$ mmHg (0-34%; $p < 0.05$ at each time point versus baseline except for day 1) as seen in table 2. For the Phaco+KDB group, the baseline mean IOP was 19.25 ± 4.56 mmHg while the mean IOP postoperatively from day 1 to 6 months ranged from 19.13 ± 8.99 mmHg to 12.13 ± 1.89 mmHg representing reductions of 0.12 mmHg to 5.13 mmHg (0.6-30.2%; $p < 0.05$ only from 1 month to 6 months). The mean IOP at baseline for the eyes that had KDB goniotomy as a standalone was 17.25 ± 7.45 mmHg. From day 1 through 6 months follow-up, the mean IOP ranged from 17.50 ± 11.09 mmHg to 12.67 ± 1.67 mmHg which represented reductions of $-0.25-9.08$ mmHg (-1.45%-41.7%; $p < 0.05$ at one week, 3 and 6 months only versus baseline (Table 2).

For all eyes and eyes that had KDB goniotomy as a standalone, IOP reduction was not evident on day 1 whereas for the eyes that had phaco cataract surgery plus KDB goniotomy, reduction of IOP was evident from day 1 and maintained throughout follow-up period.

Table 2: Intraocular pressure at baseline and follow-up for all eyes, eyes with phacoemulsification cataract surgery and Kahook Dual Blade goniotomy and standalone Kahook Dual Blade goniotomy eyes

Preoperative	Day1	WK1	MO 1	MO 3	M06	
All patients						
Eye, n	12	12	12	12	12	
IOP, mean (SD)	18.58±5.42	18.58±9.26	15.55±5.65	14.75±3.75	13.0±1.34	12.27±1.68
P value		0.864	0.01*	0.01*	0.02*	0.001*
Phaco/KDB						
Eye, n	8	8	8	8	8	
IOP, mean (SD)	19.25±4.56	19.13±8.99	15.88±6.33	13.63±2.62	13.0±1.51	12.13±1.89
P value		0.910	0.002*	0.001*	0.001*	0.001*
KDB alone						
Eye, n	4	4	4	4	4	
IOP, mean (SD)	17.25±7.45	17.50±11.09	14.67±4.16	17.0±4.97	13.0±1.0	12.67±1.15
P value		0.842	0.001*	0.808	0.04*	0.04*

WK-WEEK, MO-MONTH, Phaco/KDB-Kahook Dual Blade combined with phacoemulsification, KDB-Kahook Dual Blade

*statistically significant (p<0.05)

The number of topical antiglaucoma usage showed an increase for all eyes, Phaco +KDB and KDB standalone at week 1 (-2.09, -1.0 and -1.25) respectively. For all eyes, the number of antiglaucoma medication usage decline ranged from 1.27 to 1.52 (52.5-62.8%; p<0.05) at each time point from 1 month to 6 months. Similarly, for the Phaco+KDB group, antiglaucoma usage declined in the range of 1.39 to 1.62 (55.6-64.8%; p<0.05), while in the KDB group, the decline ranged from 0.75 to 1.25 (33.3-55.5%; p<0.05) each time point from 1 month to 6 months (Table 3). After 6 months of follow-up, the use of antiglaucoma medication declined at least by one in all the groups in this study.

Table 3: Mean number of antiglaucoma medications usage at baseline and follow-up for all eyes, eyes with phacoemulsification cataract surgery and Kahook Dual Blade goniotomy and standalone Kahook Dual Blade goniotomy eyes

Preoperative	WK1	MO 1	MO 3	M06	
All patients					
Eye, n	12	12	12	12	
No. of meds, mean (SD)	2.42±0.90	3.33±0.58	1.15±1.07	1.08±0.79	0.90±0.57
P value		0.02*	0.006*	0.002*	0.01*
Phaco/KDB					
Eye, n	8	8	8	8	
No. of meds, mean (SD)	2.50±0.93	3.50±0.71	1.11±1.05	0.88±0.35	0.88±0.35
P value		0.02*	0.003*	0.001*	0.001*
KDB alone					
Eye, n	4	4	4	4	
No. of meds, mean (SD)	2.25±0.96	3.0±0.11	1.0±1.22	1.50±1.29	1.0±1.41
P value		0.146	0.01*	0.11	0.01*

WK-WEEK, MO-MONTH, Phaco/KDB-Kahook Dual Blade combined with phacoemulsification, KDB-Kahook Dual Blade, meds-medications

*statistically significant (p<0.05)

Ten eyes achieved at least 20% reduction in the mean intraocular pressure from baseline as shown in Table 4. Therefore 10 eyes (83.3%) achieved primary objective of $\geq 20\%$ reduction in intraocular pressure from baseline. For the KDB standalone group, 3(75%) of the 4 eyes achieved $\geq 20\%$ reduction and Phaco+KDB group, 7(87.5%) achieved $\geq 20\%$ reduction in IOP from baseline.

Table 4: Proportion of eyes with $\geq 20\%$ reduction in intraocular pressure

Type of Surgery	$\geq 20\%$ drop in IOP from Pre to Post		Total	Fisher's Exact p
	Yes Freq (%)	No Freq (%)		
Kahook	3 (30.0)	1 (50.0)	4 (33.33)	0.576 ^μ
Kahook+phaco	7 (70.0)	1 (50.0)	8 (66.67)	
All (Total)	10	2	12	

μ =Fisher's exact p

The log MAR visual acuity for all eyes dropped from 0.51 ± 0.25 to 0.67 ± 0.43 from baseline. This drop was not statistically significant ($p=0.29$). For the KDB as a standalone, the mean LogMAR visual acuity of 0.00 ± 0.00 did not change from baseline to the last follow-up visit while the VA of the phaco+KDB group changed from 0.51 ± 0.25 at baseline to 0.67 ± 0.43 at the last follow up visit. This drop in LogMAR acuity was as a result of posterior capsular opacity in one eye.

Complications consisted of transient hyphaema in 2 (16.7%) eyes. None of the eyes had an additional intervention to reduce the IOP.

Discussion

Kahook Dual Blade only recently became a tool for anterior chamber angle surgery [6-9]. These eyes showed our first experience with this novel procedure. In these series, 83.3% of the eyes achieved success with or without topical antiglaucoma medications. The success rate for phacoemulsification plus KDB group was 87.5% while the success rate for the KDB as a standalone was 75%. Sieck EG, et al. reported success rate of 71.8% for phaco-KDB and 68.8% for KDB as a standalone after 12 months follow-up [9]. Salinas, et al. reported mean IOP decrease of 23.5% from baseline (18.4 ± 6.1 to 13.9 ± 3.5) at 6 months follow up in their multicenter retrospective review of 53 eyes with refractory glaucoma that underwent KDB alone [10]. Topical antiglaucoma medications reduced by 1.2 ± 1.3 (36.6%). In our study, the KDB group as a standalone procedure recorded a 41.7% drop in mean IOP from baseline (17.25 ± 7.45 to 12.67 ± 1.15 mmHg) while topical medications reduced by 1.25 (55.5%). This group has 50% of eyes with moderate-to-severe POAG.

Dorairaj, et al. in prospective study also multicenter reported mean IOP reduction from baseline of above 20% at 12 months [11]. Mean IOP decreased from 16.8 ± 0.6 to 12.4 ± 0.3 ($p < 0.001$), a 26.2% reduction. Use of antiglaucoma medications reduced by 50%, from 1.6 ± 0.2 to 0.8 ± 0.1 ($p < 0.05$). Proportion of patients whose IOP decrease by $> 20\%$ was 57.7% and 63.5% were on ≥ 1 fewer IOP-lowering drops. Abdullah, et al. study showed an average decrease in IOP of 5mmHg at 9 months for patients that underwent phacoemulsification in combination with KDB. We reported a mean IOP drop for the similar group of 5.13mmHg after also 6 months follow-up. Additionally, Abdullah, et al. reported that 80% of their

patients had a reduction of at least one medication [6].

One eye in the phaco+KDB group in our study developed significant posterior capsular opacity which resulted in the drop in the mean LogMAR visual acuity noted. The complications reported in this study were essentially like those reported by the studies mentioned above.

The major drawback of this study is the limited number of eyes involved in the analysis. However, our findings will help to enrich the body of knowledge concerning this relatively new procedure.

Conclusion

Goniotomy with Kahook Dual Blade either as a standalone procedure or in conjunction with cataract surgery using phacoemulsification achieved greater than 20% reduction in intraocular pressure in these series with transient postoperative complications.

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