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Characteristics of secondary glaucoma post vitreoretinal surgery at national eye center cicendo eye hospital from January 2010 to December 2011



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ABSTRACT

Objective: To describe the characteristic of secondary glaucoma after vitreoretinal surgery at Cicendo Eye Hospital Bandung, Indonesia.

Method: An observational retrospective study was undertaken from medical record of the patient following vitreoretinal surgery, referred to glaucoma division at period January 2010 to December 2011 at Cicendo Eye Hospital Bandung. Patient age, gender, clinical features, Intra Ocular Pressure (IOP), type of surgery, onset of glaucoma, compliance and their treatment were documented. Total 39 patients fulfilled the inclusion criteria.

Result: There were 76 patients referred to glaucoma division who have to increase IOP following vitreoretinal surgery and 39 patients were included in this study. Thirty-five patients (89.7%) with a rhegmatogenous retinal detachment as an indication for surgery, 2 patients (5.1%) with diabetic retinopathy and 2 patients (5.1%) with Age Related Macular Degeneration (ARMD). Twenty-six patients

(66.7%) in phakic status of the eye. Eighteen patients (46.2%) was treated by Pars Plana Vitrectomy (PPV) with scleral buckle procedure and silicone oil tamponade. There were 16 patients (41%) developed elevated IOP within first 3 months of surgery. Silicone oil 5000 Centistokes used in 26 patients (66.7%). Fifteen patients (38.5%) removed the silicone oil later than 3 months. There were 39 patients (100%) frequent visits during the first 3 weeks. Sixteen patients (41%) treated with three anti glaucoma drugs. Surgical management is required in 14 patients (35.9%). An average IOP was 14 ± 4 mmHg after surgical intervention.

Conclusion: Patients with secondary glaucoma had a condition related to rhegmatogenous retinal detachment, PPV with a scleral buckle and silicone oil tamponade, secondary angle closure without pupillary block, IOP was well controlled by three medication and surgical treatment with trabeculectomy.

Keywords: secondary glaucoma, vitreoretinal surgery

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INTRODUCTION

Glaucoma is the second leading cause of blindness based on World Health Organization (WHO) data in 2002, which accounted 12.3% of all cases of blindness worldwide and about 15% of these cases were in developing countries.¹ Gadia et al reported as many as 21.84 % of all glaucoma and glaucoma suspected patients are secondary glaucoma and 14% of all patients with secondary glaucoma diagnoses are due to vitreoretinal surgery.¹ Secondary glaucoma may occur after vitreoretinal external (Scleral Buckle) and internal (Pars Plana Vitrectomy: PPV) surgery with/without tamponad or intra-vitreous steroid injection and anti-vascular endothelial growth factor (anti-VEGF) injection.^{1,2,3,4,5}

Based on the Indera Health Survey 1993-1996, 1.5% of Indonesian's population experiencing blindness and glaucoma as the second leading cause of blindness (0.20%).⁶ Secondary glaucoma is a condition associated with an ocular or systemic disorder which causes decreased outflow of aqueous humor. Secondary open angle glaucoma consist of increasing the resistance of trabecular webbing flow, while in

the secondary closed-angle glaucoma a mechanism occurs mechanism due to impulse lens-iris diaphragm or iris withdrawal due to anterior synechia.³

Considering the number of previous studies reported the occurrence of secondary glaucoma due to silicone oil (polydimethylsiloxane) use and the absence of research on secondary glaucoma after undergoing various types of vitreoretinal surgery,^{4,5} the authors want to give an overview of the characteristics of secondary glaucoma post vitreoretinal surgery examined in the Glaucoma unit, National Eye Center, Cicendo Eye Hospital.

METHOD

This study was an observational descriptive retrospective study, based on patient's medical records referred to glaucoma unit of National Eye Center in Cicendo Eye Hospital, Bandung within period 1st January 2010 to 31st December 2011. Patients collected after undergoing vitreoretinal surgery and had diagnosed with secondary glaucoma. The vitreoretinal surgery was performed at National Eye Center, Cicendo Eye Hospital and other related hospital.

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The inclusion criteria in this study: i) all patients with secondary glaucoma after undergoing vitreoretinal surgery with an increase in Intra Ocular Pressure (IOP) above 21 (mmHg) as measured by Goldmann applanation tonometer, ii) examination of the chamber angle using the last 3 weeks of gonioscopy result, and iii) control in the glaucoma unit. Vitreoretinal surgery is all types of vitreoretinal surgery both external (Sclera Buckel) and internal (PPV with/without the use of tamponade), intra vitreal steroid injections, anti-VEGF injection and pneumatic retinopexy (PR), while exclusion criteria: did not find any other causes of secondary glaucoma such as Uveitis, retinopathy of prematurity, corneo-iridic scar, post penetrating keratoplasty glaucoma, lens-induced glaucoma, secondary glaucoma from tumors, pseudoexfoliation syndrome, glaucoma pigment dispersing, steroid-induced glaucoma, iridocorneal endothelial syndrome and chemical trauma.

Data of all variables analyzed descriptively using Microsoft Office Excel 2010 program and displayed in table to show the baseline characteristics and presentation.

RESULT

During the period of 1st January 2010 to 31st December 2011, there were 587 patients undergoing vitreoretinal surgery, 76 were referred to the National Eye Center Glaucoma unit of Cicendo Eye Hospital with a secondary glaucoma. Total of 39 patients were included in the study.

Table 1 shows the basic patient's characteristics data. Most of the patients (59%) were male. The patient's age range was 21-65 years with 45 years of median age. Patients with age range 41-60 years old were 20 patients (51.3%). Table 2 shows the history of the disease prior to the vitreoretinal surgery procedure, namely the Rhegmatogenous Retinal Detachment (RRD). There were 35 (89.7%) patients experienced RRD after the procedure.

The characteristics of secondary glaucoma post vitreoretinal surgery based on several variables (front angle, lens state, onset of IOP increase after surgery, and patient's adherence to control time for at least 3 weeks after receiving anti-glaucoma therapy) showed in Table 3. Examination result of the eye chamber shows as many as 26 patients (66.7%) with closed-angle eye chamber without pupillary block and one patient (2.6%) with pupillary block. The presence of 26 Phakic lenses (66.7%). Onset of the highest IOP increasing in the time span > 1 week to ≤ 3 months was found in 16 patients (41%). The mean initial ICI score measured by Goldmann applanation tonometer was 35±8.7 mmHg. All of the patients (100%) were good compliance in control time ≤ 3 weeks after receiving glaucoma therapy.

Table 4 shows the characteristics of vitreoretinal surgery performed to the patients. Vitreoretinal surgery in this study was PPV with silicone oil tamponade of 13 patients (33.3%), PPV with sclera buckle and silicone oil as much as 18 patient (46,2%). Silicone oil 5000 centistokes (cSt) was

Table 1 Baseline Characteristics of the Sample

Characteristics	Amount (n=39)	Percentage (%)
Gender		
Man	23	59
Women	16	41
Age		
1-20	0	0
21-40	13	33,3
41-60	20	51,3
>60	6	15,4

Table 2 Disease History of the Patients pre-Vitreoretinal Intervention

Characteristic	RRD*	Diabetic Retinopathy	
	N = 39 (%)	N = 39 (%)	ARMD** (%)
Ages			
1-20	0	0	0
21-40	13(33,3)	0	0
41-60	19(48,7)	1(2,6)	0
>61	3(7,7)	1(2,6)	2(5,1)

*Rhegmatogenous Retinal Detachment

**ARMD:Age-Related Macular Degeneration

Table 3 Secondary Glaucoma and Patient's Compliance

Characteristics	Amount (n=39)	Percentage (%)
Angle of Glaucoma		
Open Angle	12	30,8
Angel Closure		
Without Pupillary block	26	66,7
With Pupillary block	1	2,6
Lens		
Phakic	26	66,7
Aphakic	9	23,1
Pseudophakic	4	10,3
Onset of increased IOP after surgery		
1 Day	2	5,1
1 Week	7	17,9
>1 Week - ≤ 3 Month	16	41,0
> 3 Month	14	35,9
Time control		
≤ 3 Weeks	39	100
> 3 Weeks - ≤ 3 Weeks	15	38,5
> 3 Month - ≤ 6 Month	9	23,1

Table 4 Vitreoretinal Surgery Characteristics

Characteristics	Amount (n=39)	Percentage (%)
Vitreoretinal surgery	0	0
Sclera Buckle	6	15,4
PPV Without tamponade	13	33,3
PPV With <i>endodrainage</i> + endolaser + Silicon Oil	18	46,2
PPV with sclera buckle + endodrainage + endolaser + silicon Oil	2	5,1
IVTA	0	0
Anti-VEGF Injection		
<i>Pneumatic retinopexy</i>		
Intravitreal Tamponade		
Gas	0	0
silicon Oil 5000 centistokes	26	66,7
silicon Oil 1000 centistokes	5	12,8
Tamponade complications of silicone oil (n=39)	12	30,8
Emulsification		
Evacuate Silicon Oil		
No	12	30,8
Yes (\leq 3 Month)	4	10,3
(> 3 Month)	15	38

Table 5 Management of Secondary Glaucoma

Characteristics	Amount (n=39)	Percentage (%)
Anti glaucoma drugs last control		
0	14	35,9
1	2	5,1
2	7	17,9
3	16	41
Glaucoma Surgery		
Trabeculectomy	9	23,1
Trabeculectomy + MMC*	2	5,1
TSCPC**	1	2,6
Laser Pheripheral Iridotomy	2	5,1

*Mitomycin C

** Trans Scleral Cyclocryotherapy

the most type of intravitreal tamponade used in 26 patients (83.9%). Severe complications of silicone oil tamponade emulsification was found in 12 patients (30.8%). Patients undergoing evacuation of silicone oil over 3 months were 15 patients (38.5%).

Table 5 shows the management of secondary glaucoma, treated by both anti-glaucoma agent and glaucoma surgery. The amount of patients treated by 3 types of anti-glaucoma agent used during the last control as many as 16 patients (41%) and 9 patients (23.1%) was treated by surgical glaucoma intervention. Most of surgical procedure used was trabeculectomy. The mean IOP of patients after treated by glaucoma surgery was 14 ± 4 mmHg.

DISCUSSION

Basic characteristics data showed sample consist of more males than females as many as 23 patients (59%). Research conducted by Tranos et al. (2004) also reported from total number 70 of samples, more male patients (59%) than female.³ It can be caused by one of the diagnostic groups was retinal detachment, Men in the productive age group had a higher incidence than women.^{3,4} In the ARMD diagnosis group and Diabetic retinopathy the number of female patients greater than male.

The age range of patients in this study was 21 to 65 years with a median of 45 years. This is slightly different from the research conducted by Tranos et al with age range of 25-85 years with a median of 57 years.³ This is possible because the study was conducted in developed countries with a longer life expectancy. The results of this study indicate the history of most patients' disease before vitreoretinal intervention was RRD (89.7%). In contrast to a prospective study by Muether et al (2011), this study showed diabetic retinopathy patients had had higher post operative IOP risk (83.3%) compared with RRD patients.⁵ This was possible because the study was conducted in advanced countries, which had higher prevalence of degenerative diseases and systematic diabetic retinopathy screening system.⁷ Post-retinal secondary glaucoma in patients with RRD, severe PVR (proliferative vitreoretinopathy) and diabetic retinopathy may trigger an IOP increasing with incidence between 2.2% and 56%.^{1,4}

Miao Pin (2012) reported that 50% of patients after vitreoretinal surgery had a closed-angle glaucoma.⁸ In this study 26 patients (66.7%) had a closure-angle in the absence of pupillary block. This may be related to the onset of elevated IOP of the patients in this study, mostly in the late onset (41%), in which the front corner of the chamber may be closed due to anterior synechia, silicone oil infiltration in trabecular plaques, iridectomy by fibrin.⁹

One patient has reported with pupillary block and aphakia post PPV, sclera buckle, and lensectomy. In this patient, onset of IOP increasing within 2 days post-surgical intervention. The high IOP after vitreoretinal surgery is due to the presence of pupillary blockage in aphakic and pseudophakic condition, due to the incision of the iris-lens diaphragm toward the front of the eye chambers and trigger closed-angle glaucoma. This encouragement may also occur due to the use of gas, silicone oil, the presence of vitreous obstruction in the pupil or capsular block due to residual elastic visco or fluid in the capsule push the intraocular lense (IOL) and narrow the angle of the anterior chamber.⁵

In this study, patients with phakic condition were 26 patients (66.7%). Study conducted by Tranos showed that most of the patient's lense was pseudophakic (49%), meanwhile the results of Mohalhal et al (2012) showed no significant difference in IOP between pseudophakic and Phakic patients in less than 6 months post vitreoretinal surgery.¹⁰

The majority of vitreoretinal surgery in this study was PPV with scleral buckle and silicone oil tamponade (46,2%). These results are consistent with the Tranos et al. which found secondary glaucoma occurring 86% post-PPV surgery with sclera & silicone oil tamponade, while 14% cases occurred in patients with scleral buckle only.⁴

The secondary glaucoma in the PPV surgery with sclera and silicone oil tamponade can occur due to sclera buckle and the use of the tamponade.^{5,11} Buckle of the sclera causes compression in the vortex vein induces choroid congestion, rotation of the anterior ciliary body, and ischemia in anterior segment. The mechanisms secondary glaucoma in the presence of silicone oils: i) closure of peripheral iridotomy by fibrin, ii) blood and residual capsules, iii) pupillary block, iv) droplet migration of silicone oil, v) silicone oil emissions, vi) droplet infiltration in trabecular plaques, vii) anterior synechia, and viii) robeosis iridis.^{3,5,11}

In this study there were 2 patients (5.1%) with elevated IOP after anti-VEGF injection. Research conducted by Adelman RA et al (2012) also found the same result, an increase IOP in 4 of 116 patients (3.4%).¹² The role of anti-VEGF for management of ARMD in increasing IOP is not known clearly, some expert opinions suggest it related to the amount of fluid that enters the vitreous body through the injection. Anti-VEGF directly inhibits the flow of aqueous humor through trabecular webbing to the uveo-scleral pathway and repeated injections can trigger chronic inflammation (trabeculitis) which may also increase IOP.¹³

Mostly, onset of IOP enhancement in this study occurred in 1 Week - \leq 3 months, as many as 16 patients (41%). This is in accordance with the study by Chao WJ et al (2009). It reported in 185 patients (41%) an IOP increasing occurred after 2 weeks postoperative intervention.¹⁴ The onset of elevated IOP in the study was related to inflammation and anterior synechia.¹⁴

The most common type of intravitreal tamponade used in this study was silicone oil 5000 cSt for 26 patients (83.9%). Al Jazzaf (2005) reported an increasing of IOP in 299 patients (89%) who used 5000 cSt silicon oil and 51 patients (11%) who used 1000 cSt silicone oil. The high emulsification rate of 5000 cSt silicone oil caused the risk of secondary glaucoma.^{15,16} In this study there was emulsification of silicone oil tamponade in 12 patients (30.8%).

Silicon oil evacuation in this study mostly done after 3 months in 15 patients (38.5%). Jahangir (2012) reported 47 patients (90%) from 50 patients performed silicone oil evacuation within 12 weeks (3 months). Three patients who performed silicone oil for more than 3 months experienced an increase in IOP but a significant reduction in IOP after silicone oil evacuation in all the patients.^{1,7}

Tranos reported as many as 15 (56%) of 27 patients given silicone oil were evacuated and as many as 12 patients (30.8%) were not evacuated.³ In this study 12 patients (30.8%) refused the evacuation surgery, did not come to control or only treated medically.

Evacuation of silicone oil should be done after the retinal reattachment which mostly occurred after 3 months. Evacuation at the time can prevent complications from this tamponade. The mechanisms of silicone oil causes secondary glaucoma include pupillary block, peripheral iris closure, trabecular blockage due to migration of silicone oil to anterior ocular cameras, emulsification of silicone oil, presence of inflammation or posterior synechia.^{2,4}

Most cases of secondary glaucoma can be controlled with anti-glaucoma drug therapy and evacuation of silicone oil when retinal reattachment has occurred and in the case of migratory oil emulsions or emulsification, few cases require laser intervention or glaucoma surgery.¹⁵ Al Jazzaf, reported from 51 patients, 11 patients (22%) with uncontrolled IOP were treated by anti-glaucoma medication, then this patients treated by ahmed valve-implant surgery. IOP decreasing was observed at the last follow-up after glaucoma surgery (44 ± 11.8 mmHg before surgery and 14 ± 4.2 mmHg after surgery).¹⁵ In this study there were 14 patients (35,9%) with uncontrolled IOP after anti-glaucoma therapy. Decreasing IOP become 14 ± 4 mmHg was observed after glaucoma surgery performed to the patients. Trabeculectomy was the most widely glaucoma surgical intervention in this study (64.3%).

CONCLUSION

Patients with secondary glaucoma had a condition related to rhegmatogenous retinal detachment, PPV with a scleral buckle and silicone oil tamponade, secondary angle closure without pupillary block, IOP was well controlled by three medication and surgical treatment with trabeculectomy.

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