ORIGINAL ARTICLE

SUCCESSFUL RATE OF GLAUCOMA SURGERY IN SECONDARY GLAUCOMA AFTER VITRECTOMY IN KARIADI HOSPITAL SEMARANG 2020-2022

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ABSTRACT

Introduction*: Glaucoma is one of the most frequent complications of vitrectomy surgery. It can cause a significant rise in intraocular pressure (IOP). Glaucoma surgery can be planned in medically uncontrolled glaucoma. Trabeculectomy and Glaucoma Drainage Device (GDD) implantation are the most frequent filtering surgeries used in these cases. This study aims to define the success rate of glaucoma surgery in secondary glaucoma after vitrectomy*.

Methods*: This study is an analytical observational study with retrospective data collection held from medical records of patients with secondary glaucoma after vitrectomy who underwent glaucoma surgery in Kariadi General Hospital Semarang from 2020-2022. Surgical success defined by postoperative IOP reduced by>20% from baseline, with or without anti-glaucoma medication.*

Result*: There were 16 eyes of trabeculectomy with 5-fluorouracil (5-FU), and 8 eyes of GDD implants. The mean preoperative IOP was 43.76+6.77 mmhg for trabeculectomy 5-FU, and 42.43+4.02 mmhg for GDD implant. IOP levels in both groups varied significantly after one day, one week, one month, and three months after surgery (p<0.05). The success rate for the trabeculectomy 5-FU group was 75% and the GDD implant group was 87.5% in 3 months. There was no statistically significant difference in the success rate between the trabeculectomy 5-FU and GDD implant groups (p=0.069). The complication were 18.75% and 25% for trabeculectomy group and GDD implant group, respectively.*

Conclusion: *There was no significant difference in the success rate between trabeculectomy 5-FU and the GDD implant group. Both groups are viable for glaucoma surgery in secondary glaucoma after vitrectomy surgery.*

Keywords: *Secondary Glaucoma, Trabeculectomy, GDD Implant*

INTRODUCTION

Pars plana vitrectomy (PPV) is a common technique in vitreoretinal surgery that enables access to the posterior segment for treating vitreoretinal disorder. The purpose of a vitrectomy is to remove the vitreous gel and replace it with different substances known as tampons, such as Silicone Oil (SO) and gases.[1]

Glaucoma is one of the most frequent complications of vitrectomy surgery. It can cause a significant increase in Intraocular Pressure (IOP). Glaucoma surgery may be considered as a viable option for managing patients who are refractory to medical therapy. Primary trabeculectomy with antifibrotic agent and Glaucoma Drainage Device (GDD) implantation are the most frequent filtering surgeries used in these cases with variable success rate.[1,2] The

successful rate for secondary glaucoma after vitrectomy patients treated with either procedure have been described.The aim of this study was to define the success rate of glaucoma surgery in secondary glaucoma after vitrectomy.

METHODS

This study is an analytical observational study with retrospective data collection held from medical records of patients with secondary glaucoma after vitrectomy who underwent glaucoma surgery in Kariadi General Hospital Semarang from January 2020 to December 2022. Inclusion criteria were patients with secondary glaucoma after vitrectomy who underwent glaucoma surgery and followed up until 3 months after surgery. Exclusion criteria was previous history of glaucoma before vitrectomy surgery, reoperation glaucoma surgery, and lost to follow up patients.

Preoperative information included age, sex, type of tamponade, and baseline IOP. The outcome measures were, IOP, methode of glaucoma surgery, surgical success, number of postoperative glaucoma medications, and complication. Postoperative data regarding IOP, use of antiglaucoma medications, and complications were obtained on 1 day, 1 week, and 1 month, and 3 months after glaucoma surgery.

Criteria for success were defined before reviewing the data. Definition of secondary glaucoma is increase IOP > 21 mmHg after vitrectomy procedure. Surgical success defined by postoperative IOP reduced by>20% from baseline, with or without anti-glaucoma medication and without reoperation of glaucoma surgery. Failure was defined as IOP>21 mmHg, <20% reduction below baseline IOP, or reoperation of glaucoma surgery. Potential postoperative complications for either procedure, including hyphema, choroidal effusions, tube erosion, early hypotony, bleb leak, strabismus, and suprachoroidal hemorrhage, were assessed.

The data is then analyzed using a computerized system. The two groups were compared using Mann-Whitney and Independent t-test for numeric variables, and Chi square for categorical data. P values of <0.05 were considered statistically significant.

RESULTS

Base on inclusion and exclusion criteria the number of subjects were included in this study was 24 eyes. The preoperative data for the two groups are shown in Table 1. There were no significant differences in sex, mean age, type of tampons, and baseline IOP between the two groups.

Medication and surgery can be used to treat secondary glaucoma. All patients with secondary glaucoma were given antiglaucoma medications first to lower their IOP. Table 2 shows a total of 22 patients (91.67%) with SO implant were performed evacuation SO before glaucoma surgery. Trabeculectomy using 5 Fluorouracil (5-FU) was performed in 16 eyes (66.67%) and GDD implantation was performed in 8 eyes (33.33%). The mean IOP in 3 months after treatment was 22.7 mmHg in trabeculectomy group, and 23.4 mmHg in GDD implantation group. The mean number of glaucoma medication use 3 months after surgery was 1.69 in trabeculectomy group and 1.62 in GDD implantation group.

Table 1. Preoperative characteristics of patients

	Trabeculectomy (N=16)	**GDD Implantation (N=8)**	**P value**
Sex (Male:Female)	8:8	3:5	0.597
Age (y)			
Mean ± SD	40.37±17.48	42.88±7.66	0.470
Types of Tampon			
Gas	1	1	0.504
Silicone Oil	15	7	
Baseline IOP (mmHg, mean ± SD)	43.77±6.77	42.44±4.03	0.616

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Table 2. Treatment

	Trabeculectomy (N=16)	**GDD Implantation (N=8)**
Evacuation SO	15	7
IOP (mmHg, mean ± SD)		
1 day	9.98±7.30	16.37±14.30
1 week	16.00±9.78	21.06±16.20
1 month	29.52±9.89	26.32±8.37
3 months	22.70±8.23	23.40±7.00
Amount of Drug 3 Month After Surgery (mean ± SD)	1.69±1.14	1.62±1.06

The mean IOP before and after surgery is shown in Figure 1 for both trabeculectomy with 5-FU and GDD implantation groups. At all follow-up time points, the mean postoperative IOP in both groups was lower than the mean preoperative IOP. The mean IOP did not differ statistically between the two groups at any postoperative time point.

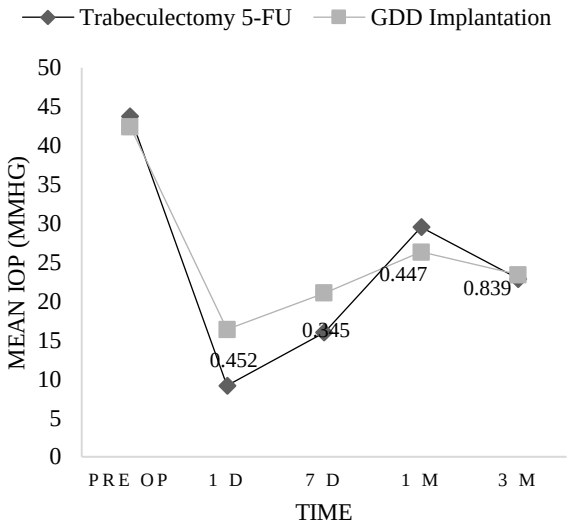

Figure 1. Mean IOP before and after glaucoma surgery in both groups. The mean IOP did not differ statistically between the two groups at any postoperative time point. Abbreviations: D, day(s); M, month(s); Pre Op, preoperative.

Figure 2 shows the success rate for both groups. The success rates were 87.5% and 75% at 1 week, 75% and 62.5% at 1 month, 75% and 87.5% at 3 months in the trabeculectomy with 5-FU and GDD implantation groups, respectively.

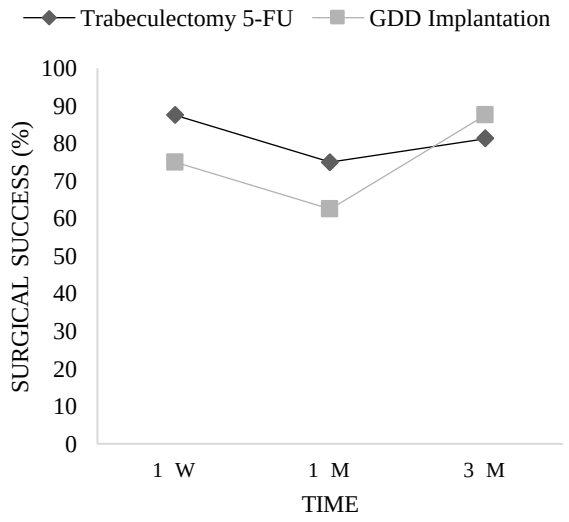

Figure 2. Success rate following trabeculectomy with 5-FU and GDD Implantation group

Comparisons of success rate between both groups are shown in Table 3. There was no statistically significant difference between groups in terms of IOP or success rate three months after surgery.

Table 3. Success rate of glaucoma surgery

	Trabeculectomy (N=16)	GDD Implantation (N=8)	P value
Surgical Outcome 3 Month After Surgery			
Success	12 (75%)	7 (87.5%)	0.069
Failed	4 (25%%)	1 (12.5%)	

In the trabeculectomy group, a total of four eyes were classified as failures: two eye required GDD implantation for control of intraocular pressure, two eyes had <20% reduction below baseline IOP and decreased visual acuity to NLP at final examination. In the GDD implantation group, one eye was classified as failures because the final IOP reduction was <20% from the baseline.

Postoperative complications in both groups are summarized in Table 4. Early postoperative hypotony occurred in the trabeculectomy group in three eyes (18.75%). One eye (25%) in the GDD implantation group had a flat anterior chamber complication at final examination and required anterior chamber reformation. There was no occurrence of hyphema, choroidal effusion, suprachoroidal haemorrhage, late wound leak, hypotony maculopathy, endophthalmitis, tube occlusion, tube corneal touch, or exposure in either group.

Table 4. Complication in glaucoma surgery

	Trabeculectomy (N=16)	GDD Implantation (N=8)
Hyphema	0	0
Flat anterior chamber	0	1
Choroidal effusion	0	0
Suprachoroidal haemorrhage	0	0
Early hypotony	3	0
Endophthalmitis	0	0
Tube occlusion	0	0
Tube corneal touch/exposure	0	0

DISCUSSION

Elevation of IOP has been reported with all types of vitreoretinal surgeries. This can happen in the immediate, early, and late post-operative phases. Several internal tamponade agents, such as expanding gases and silicone oils, are used in vitreoretinal surgery and can limit aqueous outflow in a variety of ways, resulting in secondary glaucoma.[1] Several studies have

found an 8.4%-14.8% incidence of secondary glaucoma after vitreoretinal surgery, which included scleral buckling and pars plana vitrectomy with silicone oil or gas tamponade.[2]
Patients that underwent pars plana vitrectomy with silicone oil are the most refractory ones to medical treatment.[1] Of all post-vitrectomy patients that presented with glaucoma, 73% had silicone oil tamponade.[3] Pillai et al. reported that 34.9% of patients developed a rise in IOP with silicone oil tamponade compared to 11.94% with air or gas tamponade.[4] In this study, the incidence of secondary glaucoma is higher in eyes with SO tamponade (91.67%) compare to eyes with gas tamponade (8.33%). Acute glaucoma after silicone oil injection can be caused by overfill of the vitreous cavity, pupillary block, inflammation, preexisting glaucoma, or emulsified SO.[1,2] An acute increase in IOP occurs as a result of SO migration into the anterior chamber and occlusion of the trabecular meshwork, which is mainly caused by SO overfill. Chronic IOP elevation mostly refers to the accumulation of SO that cannot be phagocyted by macrophages, leading to trabeculitis and trabecular meshwork damage, especially in the upper quadrant.[5-7]

Two samples (8.33%) were using gas tamponade in this study. Incidence of IOP elevation after intravitreal gas injection can range from 6% to 65%.[2] Xu et al. reported that the incidence of IOP elevation with intraocular tamponade of C3F8 was significantly higher than simple vitrectomy.[8] Sulfur hexafluoride (SF6) and perfluoropropane (C3F8) are the two long-acting gases used for intraocular tamponade.[2] These gases achieve retinal tamponade by expanding within the vitreous cavity. When injected into the eye undiluted, these gases immediately expand to approximately two and four times their original volume, potentially causing severe pressure increases. On the other hand, intraocular pressure elevations have been observed less frequently, with nonexpansile concentrations of 20% for SF6 and 12% for C3F8. The most significant increase in pressure occurs when the volume expansion is at a peak. The expansion of these two gases is highest during the first 6 hours. These gases can remain in the eye for 10–14 days in the case of SF6 and 55–65 days in the case of C3F8.[1,2,5] Secondary glaucoma develops by both open and closed angle mechanisms. Angle closure can occur with or without pupillary block. Angle closure with pupillary block occurs when the lens-iris diaphragm anterior displacement causes iris bombe and iridocorneal contact. Open angle glaucoma develops when the rate of gas expansion surpasses the rate of aqueous humor outflow via the trabecular meshwork.[1,5] Changes in atmospheric pressure can result in expansion of intraocular gas volume and result in an acute increase of IOP.[2]

Patients with secondary glaucoma after vitrectomy that is refractory to medical treatment are managed with surgery. In case of secondary glaucoma caused by SO tamponade,

evacuation of SO has been performed to lower IOP.[9] Although SO removal itself may help control the IOP and should be considered in majority of the cases, it is effective in only about half of the cases. [10] Jonas et al. found that 185 of 198 eyes (93.4%) with a subsequent increase in IOP had normalization of IOP after SO evacuation.[5] However, Flaxel et al. reported that elevated IOP still persisted in all eyes (62 eyes) after SO evacuation. [5] In this study, a total of 22 eyes with SO tamponade (91.67%) had already undergone SO evacuation, and the IOP after SO evacuation is still elevated. This happen because SO evacuation itself can cause IOP elevation by splitting SO droplets into smaller bubbles, which are more likely to obstruct the trabecular meshwork.[9]

Trabeculectomy with antifibrotic agent such as mitomycin C and 5-FU, and GDD implantation are the surgical options for treating secondary glaucoma after vitrectomy.[1,3,9] Trabeculectomy in vitrectomized eye can be challenging, due to the associated conjunctival scarring from the vitreoretinal surgery. The surgical success rate of trabeculectomy still varies in several studies. Singh et al. reported the total success rate trabeculectomy with mitomycin C in patient with secondary glaucoma after vitrectomy with SO tamponade was 36.9% at the end of 1 year.[10] Errico et al. compared trabeculectomy with MMC to the Ex-PRESS glaucoma filtration device in eyes with extracted SO. At two years, the complete success rate (controlled intraocular pressure without antiglaucoma medication) was 40% and the qualified success rate (controlled IOP with glaucoma medication) was 60% in the trabeculectomy group, compared to 73% and 81.8%, respectively, in the Ex-PRESS group.[11] Our study show the success rate of trabeculectomy with 5-FU in 3 month after surgery was 75%. 4 eyes (25%) were failed, and 2 eyes required GDD implantation to control the IOP. Failure of the trabeculectomy with 5-FU surgery may be resulted from severe inflammation induced by SO droplets in the trabecular meshwork, scleral ostium, subconjunctival space after surgery, and conjunctival scarring.[3,9]

Glaucoma drainage implants is a surgical option in cases of refractory glaucoma especially in eyes with extensive conjunctival scarring.[9] Sidoti et al. reported that IOP was successfully controlled with or without medication in 11 of 13 (85%) eyes with GDD implantation.[2] Albahlal et al. reported a 94.1% success rate and a decrease in the number of antiglaucoma medications 1 year in unvalved and the Ahmed glaucoma valve.[3] Our study reported the success rate of GDD implant was 87.5%. There was no statistically significant difference between groups in terms of IOP or success rate three months after surgery in this study.

In this study, the complication that occurred in the trabeculectomy group was hypotonia (18.75%), and in the GDD group was flat anterior chamber (25%). Complications associated

with trabeculectomy and GDD implant include hyphema, hypotony, serous choroidal effusion, suprachoroidal haemorrhage, failure of filtration with persistent ocular hypertension, flat anterior chamber, tube corneal touch, exposure or occlusion, and more rarely, endophtalmitis, with hypotony being the most common complication. Flat anterior chamber occurs due to overfiltration, and requires immediate action to restrict aqueous outflow. [10,11]

There are potential sources of bias in this study. To minimize any bias, patients in each group were matched based on age, sex, types of tamponade, and baseline IOP. No major differences were observed in the preoperative characteristics of the patients. There are certain limitation in this study. First, the time for follow-up in this study is relatively short. Second, the sample size in this study is insufficient to investigate the role of factors that predict surgical success/failure.

CONCLUSION

There was similar IOP reduction and surgical success after trabeculectomy with 5-FU and GDD implantation in the treatment of secondary glaucoma after vitrectomy. Both groups are viable for glaucoma surgery in secondary glaucoma after vitrectomy surgery that is refractory to pharmacological therapy.

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