Effect of Modified Post-surgical Care Techniques on Outcomes of Ahmed Glaucoma Valve (AGV) and Baerveldt Glaucoma Implant (BGI) in Neovascular Glaucoma (NVG).

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PURPOSE

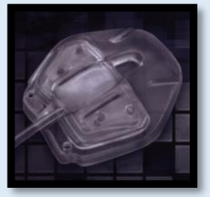
To report postoperative care techniques and long time outcomes of AGV and BGI for NVG in Sensho-kai Eye institute, Japan.

PATIENTS AND METHOD

We retrospectively reviewed the medical records of NVG patients who underwent AGV and BGI in our institute.
Nineteen eyes of 18 patients underwent AGV from January 2006 to February 2018 and 39 eyes of 34 patients underwent BGI from January 2012 to February 2019 were evaluated. All patients were followed up for more than 3months.
The outcome was compared with that of the Ahmed Baerveldt Comparison study (ABC study)[1].
We used modifications such as absorbable suture to ligate tube, Sherwood slit,combination of the stent and ripcord, stepwise release of ligation, and massage.

HISTORY OF LONG TUBE SURGERY

AGV



1993-approved In the United States → 2006- ABC study (5years) → **2001- started In Sensho-kai** → 2014-approved In Japan

BGI

1991-approved In the United States → 2006- ABC study (5years) → **2010- started In Sensho-kai** → 2012- approved In Japan

MAIN OUTCOME MEASURES

Intraocular pressure (IOP), Visual acuity(VA*), Rate of failure.

*Based on previous report, we replaced the VA of very low vision for logMARVA as follows[2)3)].
counting fingers=1.85, hand motion=2.3, light perception=2.8

Definition of failure

IOP>21mmHg or IOP≤5mmHg on 2 consecutive visits after 3 months, Loss of light perception, Reoperation for glaucoma, Explantation of implant

Table1.Follow-up period and Baseline Characteristics

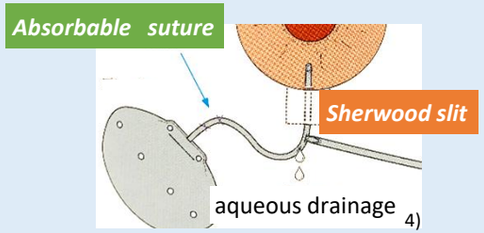
	AGV (n=19)	BGI (n=39)	P Value*
Follow-up period,mean±SD	54.7±48.5	33.7±23.2	
Age (years), mean±SD	62.1±16.2	64.3±12.4	0.57
Sex,n (%)			
Male	13 (68)	28 (72)	
Female	6 (32)	11 (28)	
Diagnosis, n (%)			
PDR	15 (79)	31 (79)	
CRVO	4 (21)	6 (15)	
Ocular ischemic syndrome	0	2 (5)	
IOP (mmHg),mean±SD	37.4±16.5	37.0±11.1	0.90
logMARVA,mean±SD	1.39±0.90	1.43±1.01	0.86
Previous surgery,mean±SD	2.3±1.6	1.9±1.7	0.36
Glaucoma surgery,n (%)	11 (58)	18 (46)	
TLE	11 (58)	12 (31)	
TLE with Express shunt	2 (11)	1 (3)	
D-lect	0	5 (13)	
NPT	0	3 (8)	
VCS	0	2 (5)	
Cataract surgery,n (%)	9 (47)	21 (53)	
Vitreous surgery,n (%)	11 (58)	22 (56)	

SD=standard deviation; PDR=proliferative diabetic retinopathy; CRVO=central retinal vein occlusion; IOP=intraocular pressure; logMARVA=logarithm of the minimum angle of resolution; TLE=trabeculectomy; D-lect=Deep sclerectomy; NPT=Non-penetrating trabeculectomy; VCS=viscocanalostomy
*Student t test.

Method: 2 step release of ligations

Absorbable suture and Sherwood slit in the BGI

Use absorbable suture (7-0 Polysorb®) to ligate tube. The suture dissolves within 5 to 6 weeks. To treat postoperative high IOP ,we create 3 Sherwood slits, and when necessary pull out the ripcord leaving the stent, thereafter the stent is removed as 2nd step.

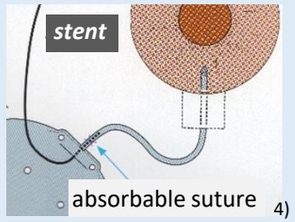


Making Sherwood slits by needle in the tube between tube insertion point and absorbable suture.

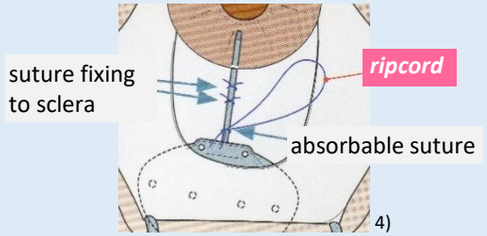
Tube and absorbable suture under scleral flap

Combination of the stent and ripcord in the BGI

We use stent (3-0 nylon®), ripcord (7-0 nylon®) and releasable suture to occlude tube and plan stepwise opening to control IOP.



Insertion of stent from the plate side



Putting ripcord between absorbable suture and tube.

Stent and ripcord are accessible at the slit lamp and easily removed when IOP is high.

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RESULT (1)

Table3. Mean Intraocular Pressure and Visual Acuity

	AGV	BGI	P Value*
Baseline			
IOP (mmHg)	37.4±16.5 (n=19)	37.0±11.1 (n=39)	0.92
logMARVA	1.39±0.90 (n=19)	1.43±1.01 (n=39)	0.86
3months			
IOP (mmHg)	18.6±11.3 (n=19)	15.2±5.8 (n=39)	0.13
6months			
IOP (mmHg)	16.9±3.4 (n=19)	13.3±4.6 (n=36)	0.004
1year			
IOP (mmHg)	15.5±4.4 (n=14)	13.4±4.3 (n=32)	0.13
logMARVA	1.03±0.68 (n=14)	1.13±1.06 (n=32)	0.76
2year			
IOP (mmHg)	16.5±2.2 (n=11)	14.2±3.1 (n=23)	0.003
logMARVA	1.11±0.71 (n=9)	1.03±1.06 (n=19)	0.84
3year			
IOP (mmHg)	14.6±2.6 (n=10)	14.1±4.9 (n=15)	0.79
logMARVA	1.40±0.67 (n=10)	1.13±1.13 (n=15)	0.50
4year			
IOP (mmHg)	16.3±3.0 (n=9)	13.8±3.5 (n=12)	0.09
logMARVA	1.50±0.31 (n=8)	0.93±1.15 (n=10)	0.26
5year			
IOP (mmHg)	16.5±2.8 (n=7)	13.0±4.0 (n=7)	0.08
logMARVA	1.46±0.62 (n=7)	0.86±1.03 (n=7)	0.20
6year			
IOP (mmHg)	15.9±3.1 (n=7)	14.0±3.6 (n=3)	
logMARVA	1.56±0.70 (n=7)	0.17±0.13 (n=3)	
7year			
IOP (mmHg)	14.6±3.0 (n=7)	10.0 (n=1)	
logMARVA	1.35±0.66 (n=7)	0.15 (n=1)	
8year			
IOP (mmHg)	14.4±0.9 (n=5)		
logMARVA	1.21±0.63 (n=5)		
9year			
IOP (mmHg)	13.2±2.2 (n=5)		
logMARVA	1.22±0.62 (n=5)		
10year			
IOP (mmHg)	14.5±0.7 (n=2)		
logMARVA	0.70±0.43 (n=2)		
11year			
IOP (mmHg)	16.0 (n=1)		
logMARVA	1.0 (n=1)		

IOP=intraocular pressure; logMARVA=logarithm of the minimum angle of resolution. Data are presented as mean±standard deviation
*Student t test

Figure1.Mean Intraocular Pressure

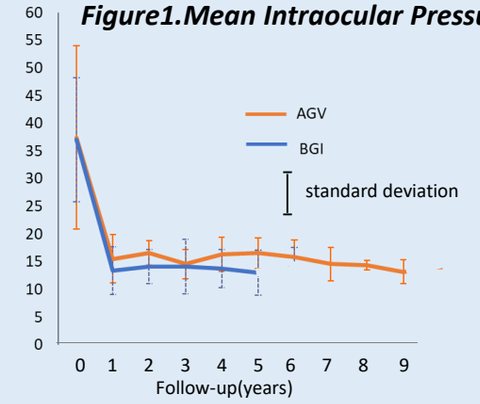

Figure2.Mean logMARVA

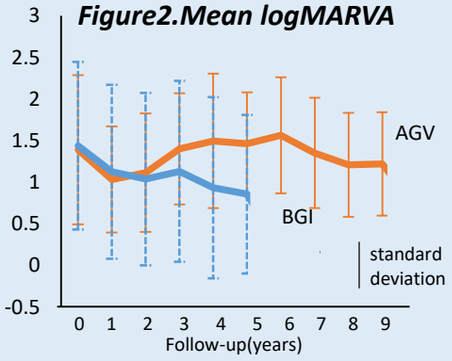

Figure3.Cumulative Rate of Failure

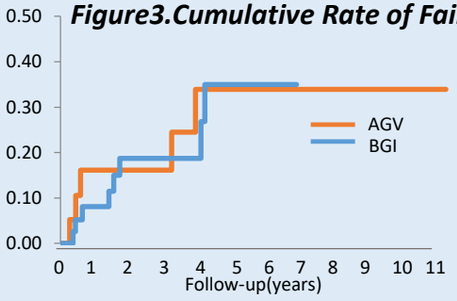

Table 4. Mean Intraocular Pressure Compared with ABC study

	AGV	BGI	P Value*
Baseline			
ABC study (n=276)	31.2±11.2 (n=143)	31.8±12.5 (n=133)	0.71
Sensho-kai (n=58)	37.4±16.5 (n=19)	37.0±11.1 (n=39)	0.92
5 years			
ABC study (n=174)	14.7±4.4 (n=87)	12.7±4.5 (n=87)	0.015
Sensho-kai (n=14)	16.6±2.8 (n=7)	13.0±4.0 (n=7)	0.08

Data are presented as mean±standard deviation
*Student t test

Table 5. Mean logMARVA Compared with ABC study

	AGV	BGI	P Value*
Baseline			
ABC study (n=276)	1.07±1.01 (n=143)	1.04±1.00 (n=133)	0.80
Sensho-kai (n=58)	1.39±0.90 (n=19)	1.43±1.01 (n=39)	0.86
5 years			
ABC study (n=174)	1.42±1.15 (n=86)	1.43±1.40 (n=87)	0.94
Sensho-kai (n=14)	1.46±0.62 (n=7)	0.86±1.03 (n=7)	0.20

logMARVA=logarithm of the minimum angle of resolution
Data are presented as mean±standard deviation
*Student t test

Table 6. Qualified and Complete success at 5-year In NVG Compared with ABC study

	AGV	BGI
Failure		
ABC study	19 (66%)	20 (71%)
Sensho-kai	5 (41%)	7 (50%)
Qualified success		
ABC study	9 (31%)	6 (21%)
Sensho-kai	5 (41%)	1 (7%)
Complete success		
ABC study	1 (3%)	2 (7%)
Sensho-kai	2 (16%)	6 (42%)

Patients who were still successful at 5 years visit were divided into complete and qualified success on the basis of the requirement for IOP-lowering medical therapy.

Data are presented as number(%)

Intraocular Pressure

Both implants were effective in lowering IOP.
IOP at 6 months and 2 years were significantly lower in the BGI than the AGV.
The IOP at baseline of both groups in our study seemed higher than those of ABC study.

Visual Acuity

There was no significant difference in logMARVA in both groups from at the baseline to at 5 year follow-up visit. When comparing with ABC study, VA at baseline of both groups in our study seemed worse than those of ABC study, but at 5 year, seemed comparable in the AGV and even better in the BGI than those of ABC study

Rate of Failure and success

The cumulative rate of failure at 5 years were 33.9% in AGV and 35.0% in BGI (P=.80), which was comparable or even better than the probability of 44.7% and 39.4% in the ABC study.
The rate of qualified and complete success in our study seemed comparable or even better than ABC study.

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Results (2)

Figure 4. Changes in Outcome Measures Compared with ABC study

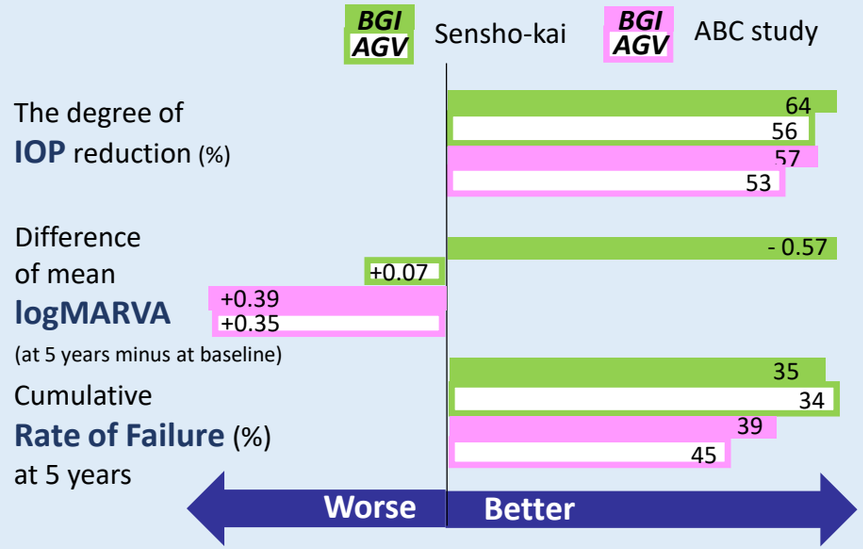

Table7.Complications in Follow-up

	AGV (n=19)	BGI (n=39)	P Value
Vitreous hemorrhage	9 (49%)	23 (57%)	0.29
Hyphema	2 (11%)	10 (26%)	0.16
Tube erosion	2 (11%)	6 (15%)	0.47
Tube obstruction	3 (16%)	1 (3%)	0.094
Bullous keratopathy	1 (5%)	0	0.33
Retinal detachment	0	5 (13%)	0.13
Shallow anterior chamber	0	2 (5%)	0.45
Endophthalmitis	0	2 (5%)	0.45
Choroidal effusion	1 (5%)	2 (5%)	0.71
Hypotony maculopathy	0	1 (3%)	

Data are presentedas number(%)
*Fisher exact test.

The incidence of vitreous hemorrhage was high. The Complications related to hypotony such as choroidal effusion and hypotony maculopathy were not common.

Table8. Reasons of Failure Compared with ABC study

	AGV	BGI
IOP>21mmHg*		
ABC study	23 (40%)	17(36%)
Sensho-kai	3 (60%)	1 (13%)
IOP≦5mmHg†		
ABC study	1 (2%)	6 (13%)
Sensho-kai	1 (20%)	3 (38%)
Loss of light perception	0	3 (8)
ABC study	7 (12%)	12 (26%)
Sensho-kai	0	3 (38%)
Reoperation for glaucoma		
ABC study	23 (40%)	8 (17%)
Sensho-kai	1 (20%)	1 (13%)
Explantation of implant		
ABC study	3 (5%)	4 (8%)
Sensho-kai	0	0
Total		
ABC study	57	47
Sensho-kai	5	8
Number followed (% of baseline)		
ABC study at 5 year	87 (61%)	87 (65%)
Sensho-kai at last follow-up ; September,2019	5 (26%)	20 (51%)

IOP=Intraocular pressure
Data are presented as number (percentage of total number of failures)
*IOP>21mmHg at 2 consecutive visits after 3 months.
† IOP≦5mmHg at 2 consecutive visits after 3 months.

References

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POST-SURGICAL CARE : PROBLEMS AND MEASURES

In case of nonvalved BGI, one of the biggest problems is early hypotony due to excessive aqueous drainage. Severe hypotension just after release of the ligation may cause vision threatening complication . This hypotension can be alleviated by stepwise release of two ligatures in the BGI.
The hypotensive events were mild in the AGV but may occur. In that case, a ripcord was effective to reduce complications. Post-surgical hypertensive phase was less severe in BGI than AGV, and may not need massage.

Stepwise release of ligation

In the BGI cases, we checked IOP and remove the ripcord and stent in 2 steps., In case of AGV only ripcord was placed and released within a week.

Massage in the AGV and BGI

When the postoperative IOP is high (mostly in the AGV eyes), we inform patients that frequent visit is needed, and do careful ocular massage.

STUDY LIMITATIONS

- Retrospective study design.
- Small sample size in comparison to the ABC study.
  In this study, because of small sample size, many of the differences in outocomes and complication between both groups at 5 years were not statistically significant, but they may be clinically relevant.
- The correlation between IOP and VA was not assessed.
  In this study, VA in both groups seemed maintained over follow-up. But there might be correlation between VA and IOP, and that could bias the results.

CONCLUSIONS

Even though we enrolled only NVG, which is known for refractory glaucoma, the outcomes were comparable or even better than ABC study. Modified techniques might have contributed to better outcome after long tube surgery for NVG.

There is no conflict of interest to be disclosed