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Mini Observational Study : Fluid Air Exchange for Recurrent Diabetic Vitreous Hemorrhages After Pars Plana Vitrectomy For Diabetic Retinopathy  
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# FLUID AIR EXCHANGE FOR RECURRENT VITREOUS HEMORRHAGE AFTER PARS PLANA VITRECTOMY FOR DIABETIC RETINOPATHY

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## **Abstract**

### **Introduction**

Diabetic vitreous hemorrhage secondary to Proliferative Diabetic Retinopathy (PDR) is a cause of severe vision loss in diabetic patient. Vitreous cavity hemorrhage after vitrectomy for proliferative diabetic retinopathy is a common cause of post operative morbidity. Management of recurrent vitreous hemorrhage include observation and surgery. Fluid air exchange is commonly performed for treating non clearing recurrent vitreous hemorrhages.

### **Objective**

The study will describe patients undergo fluid air exchange for recurrent vitreous hemorrhages after PPV for diabetic retinopathy.

### **Methods**

This was retrospective study which data was obtain from patient's medical records who underwent Fluid Air Exchange at National Cicendo Eye Hospital from December 2017 until December 2018.

### **Results**

This study asses 26 eyes from 26 patients . Subjects were predominantly female (53.85%) with mean age of 50.73 years. The time interval from onset of rebleeding to FAE is mostly more than 3 month from the onset of rebleeding. Mean visual acuity post FAE 1 month was  $1.76 \pm 0.82$  LogMar in VH with TRD patients and  $1.53 \pm 0.75$  in VH without TRD patient. Nine patient has rebleeding post FAE with 1 patient underwent second FAE and 1 patient underwent surgical revision.

### **Conclusions :**

Fluid air exchange can delay surgical intervention and could sucesfully inducing the clearing of vitreous cavity.

**Keywords :** Fluid air exchange, Rebleeding

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## **INTRODUCTION**

Diabetic vitreous hemorrhage secondary to Proliferative Diabetic Retinopathy (PDR) is a cause of severe vision loss in diabetic patient. Laser photocoagulation remain the chosen treatment when the view allow. Pars plana vitrectomy (PPV) with endolaser pan retinal photocoagulation remain the treatment chosen for non clearing vitreous hemorrhage (NCVH). Anti

VEGF (vascular endothelial growth factor) may have a role as adjuvant to surgery.<sup>1-3</sup>

Common complication after PPV for VH include, cataract, elevated intraocular pressure (IOP), retinal detachment, neovascular glaucoma and recurrent vitreous cavity hemorrhage. Vitreous cavity hemorrhage (VH) after PPV has been reported in 7-63% patient. VH can be present from the first post operative day (persistent), or the

first 4-6 weeks (early) or 2- 6 months after surgery (delayed).<sup>2,4</sup>

In cases where the hemorrhage obscures the fundus and persists for more than 2 weeks another intervention maybe required. The first priority is to ensure there is no retinal detachment, if retina is stable we can observe the bleeding. Surgery is needed approximately one third to one half of those experienced with vitreous hemorrhage after PPV.<sup>3,4</sup>

Fluid air exchange is commonly performed. Fluid air exchange is to clear visual axis to improve visual acuity, to improve visualization of posterior pole for better post operative treatment and to facilitate additional laser photocoagulation when required. Because fluid air exchange did not directly address the source of bleeding, we interested to know the impact of the procedure and how frequently FAE was the final procedure for eyes with postvitrectomy diabetic vitreous hemorrhage or another surgical revision is required.<sup>4,5</sup>

The study will describe patients undergo fluid air exchange for vitreous cavity hemorrhage after PPV for diabetic retinopathy.

## **METHODS**

This was a retrospective observational study involving patient who visit and underwent surgery from Vitreo Retina Unit Cicendo Eye Hospital, Bandung, Indonesia, between December 2017 to December 2018.

Inclusion criteria were patient underwent fluid air exchange (FAE) for recurrent vitreous cavity hemorrhage after underwent PPV before for vitreous

hemorrhage or tractional retinal detachment because of proliferative diabetic retinopathy. Exclusion criteria were combine retinal detachment, documented follow up less than 1 month, and persistent vitreous hemorrhage. Persistent post vitrectomy diabetic vitreous hemorrhage was define as residual hemorrhage that failed to clear in the immediate post operative period.

In retrospective chart research, We obtained patients characteristic, duration of diabetes, indication for vitrectomy, tamponade used for fluid air exchange, pre FAE anti vascular endothelial growth factor injection, uncorrected visual acuity pre FAE, post FAE visual acuity, incidence of recurrent hemorrhage after FAE, additional endolaser photocoagulation intra operative FAE, and another FAE or surgical revision. Visual acuity examination was done using snellen chart that converted into LogMar using LogMar- Snellen conversion calculator, indirect ophthalmoscope with +20D lens was used to evaluate the detailed fundus.

The method for fluid air exchange is outline as follows. After peribulbar and topical anesthesia an eyelid speculum was placed and a 10% povidone iodine solution was instilled in the eye. A standard 3 port vitrectomy is used using 23 gauge instrument with canule, the infusion is inserted in inferotemporal quadrant, the hemorrhage in vitreous cavity was drained using fluid needle until the vitreous cavity is clear . Endolaser photocoagulation may or may not be performed. The power, spot size and number of shot used is noted. Air,

Sterile BSS, or gas is inserted into the vitreous cavity as tamponade. The intraocular pressure was measured and the posterior segment was inspected to assess the adequacy of exchange. Follow up visit was scheduled for one day, one week, and one month postoperatively but occasionally varied depending on patient post operative course.

Treatment of eyes with fluid air exchange alone was considered successful if the vitreous cavity has a clear period after the last exchange procedure and considered failure if rebleeding occur post FAE and surgical intervention was performed.

All patient were operated by five experienced posterior segment

surgeons and postoperative follow-ups were made at the Vitreoretinal Unit Cicendo Eye Hospital, Bandung, Indonesia. Data in this study was analyzed using Microsoft Excel 2016.

## RESULT

The total of 26 eyes of 26 patient that underwent FAE because of recurrent diabetic vitreous hemorrhage. Baseline characteristic in this study was described in Table 1. The mean age of this study were  $50.73 \pm 7.70$  years old. Sex distribution in this study was 53.85% female. Indication for initial PPV was 53.85% with vitreous hemorrhage with Tractional Retinal Detachment (TRD).

**Table 1. Baseline Characteristic**

<b>Characteristic</b>	<b>Mean ± SD</b>	<b>n(%)</b>
<b>Sex</b>		
Male		46.15%
Female		53.85%
<b>Mean Age</b>	50.73 ±7.70	
<b>Duration of Diabetes</b>		
<5 years		42.31%
5-10 years		23.07%
> 10 years		34.62%
<b>Lens Status</b>		
Phakic		100%
Pseudophakic		0%
<b>Indication for initial PPV</b>		
VH without TRD		46.15%
VH with TRD		53.85%

We also examine the interval of FAE after rebleeding. The time interval from onset of rebleeding to FAE is divided to three times, the most patient

underwent surgery more than 3 month from the onset of rebleeding which is 16 patient (61.54%).

**Table 2. Interval Rebleeding to FAE**

Interval	n (%)
< 1 month	2 (7.69%)
1-3 month	8 (30.77%)
>3 month	16 (61.54%)

In this study none of the patient receive anti VEGF injection prior to FAE. Of 26 eyes of this study 9 eyes (34.61%) receive additional endolaser photocoagulation intraoperatively. In this study 12 patient using SF6 as tamponade after FAE. There were no persistent hemorrhage after FAE. The time of rebleeding after FAE was evaluated presented in Table 5.

**Table 3. Intraoperative Status**

EndoLaser Photocoagulation (n=26)	n(%)
Yes	9(34.61%)
No	17(65.38%)

  

Endo Tamponade (n=26)	n(%)
Sterile BSS	8(30.77%)
Inert Air	6(23.08%)
SF6	12(46.15%)

The mean visual acuity pre FAE, post FAE 1 day, 1 week, and 1 month were reviewed in Table 4. Mean visual acuity post FAE 1 month was  $1.76 \pm 0.82$  LogMar in VH with TRD patients and  $1.53 \pm 0.75$  in VH without TRD patient. The visual acuity in this study maybe associated with macular status of the patient.

Nine patient had rebleeding

after FAE. Five occurred in early phase and 3 patient occurred in the late phase. Vitreous hemorrhage of 7 from 9 patient had clearing spontaneously. 1 patient underwent second FAE with lens extraction and there is no rebleeding after. One patient undergo surgical revision. Fluid air exchange alone was successful in clearing 17 eyes from 17 patient.

**Table 4. Changes of Visual Acuity**

	VH with TRD	VH without TRD
Pre FAE	$2.55 \pm 0.12$	$2.54 \pm 0.18$
Post FAE 1 day	$2.35 \pm 0.28$	$2.34 \pm 0.33$
Post FAE 1 week	$2.02 \pm 0.67$	$1.99 \pm 0.71$
Post FAE 1 month	$1.76 \pm 0.82$	$1.53 \pm 0.75$

**Table 5. Timing of Rebleeding post FAE**

Time	n (%)
1 week	5(19.23%)
1 month	1(3.85%)
$\geq 1$ month	3(11.54%)

## DISCUSSION

Vitreous cavity hemorrhage after vitrectomy for proliferative diabetic retinopathy is a common cause of post operative morbidity. Hemorrhage in the postoperative periode been grouped into the following two categories , (1) persistent or residual post vitrectomy diabetic

vitreous hemorrhage and (2) recurrent post vitrectomy diabetic vitreous hemorrhage define as rebleeding after a period of marked clearing of the vitreous cavity. Early hemorrhage can be present in up to 60% of patient, and late hemorrhage occurs in 12 to 27% patient. The degree of hemorrhage was considered mild or moderate in most cases and usually cleared rapidly within six to nine weeks. In this study 16 patient (61.54%) underwent FAE more than 3 months after onset of rebleeding. In this study 7 out of 9 patient has rebleeding after FAE and the bleeding was clearing spontaneously.<sup>4,6</sup>

The rate of clearing and the incidence of total clearing was greater in aphakic eyes than in phakic eyes, probably because of the increased access of blood to the anterior chamber and trabecular outflow channels. It is not surprising, then, that phakic eyes have more frequently required therapeutic intervention. In this study all patient are phakic, which support this observation.<sup>2,4,7</sup>

Rebleeding after a period of clearing implies an increase likelihood of active neovascularization. Late vitreous hemorrhages occurs in 12 to 27% patient, maybe due to anterior hyaloid fibrovascular proliferation and most likely need surgical revision. Fluid air exchange necessarily delay surgical intervention need for the patient. In this observational study there are 3 patient (11.54%) with late rebleeding and FAE successful in inducing clearing of vitreous cavity in 17 out of 26 eyes. It is said that proliferative diabetic retinopathy may enter a stable phase after adequate photocoagulation. Nine patient who has rebleeding after FAE

did not receive additional photocoagulation which support this statement.<sup>2,4,6</sup>

Balakrishnan et al said that the use of intraocular tamponade in eyes with vitreous hemorrhage due to PDR was not found to be superior to no tamponade in reducing recurrent vitreous hemorrhage. In this study 12 patient using SF6, 6 patient using inert air and 8 patient using sterile balanced salt solution (BSS).<sup>8</sup>

Jaafar et al said that using gas tamponade can significantly reduce early recurrent of vitreous hemorrhage but has disadvantage of annoying visual perception due to gas bubble and restricted to travel. In this study 5 patient who has rebleeding post FAE was using Sf6, 3 patient using sterile BSS, and 1 patient using inert air.<sup>2</sup>

Intra vitreal Anti VEGF results in rapid regression of retinal neovascularization which is the cause of rebleeding, however the effect is transient and neovascularization tends to recur. Jaafar et al said that intravitreal Anti VEGF does not seem to have a significant role rather than preoperative adjuvant to vitrectomy. In this study no patient receive anti VEGF preoperatively. Two patient require another FAE procedure and surgical intervention. It is said that the rebleeding post exchange suggest a more aggressive disease and would not be adequately treated with fluid air exchange alone. On the basis of the result in this study our recommendation for recurrent post vitrectomy diabetic vitreous hemorrhage that fails to clear over 4 to 6 weeks is to perform fluid air exchange provided no high risk characteristic such as anterior hyaloidal

fibrovascular proliferation, progressive iris neovascularization. If clearing occur immediately after exchange but occur at later period its is recommend to perform second FAE. If the clearing does not occur immediately post exchange we recommend proceeding directly to revision of vitrectomy with maximum endolaser photocoagulation.  
3,4,6

The limitation of this study is the follow up period. Martin et al said that if the eye remains clear for nine months to two years after vitrectomy and adequate photocoagulation it would imply that the initial source of bleeding has been succsesfully treated. In the future we can make a prospective observational study with longer time of follow up.

## CONCLUSION

Fluid air exchange can delay surgical intervention and could succsessfully inducing the clearing of vitreous cavity. Additional endolaser photocoagulation maybe beneficial to reduce the rate of rebleeding post FAE.

## REFERENCES

1. Ophthalmology AA of. Retina and Vitreous. American Academy of Ophthalmology. 2014-2015.
2. El Annan J, Carvounis PE. Current management of vitreous hemorrhage due to proliferative diabetic retinopathy. *Int Ophthalmol Clin*. 2014;54(2):141–53.
3. Lo WR, Kim SJ, Aaberg TM, Bergstrom C, Srivastava SK, Yan J, et al. Visual outcomes and incidence of recurrent vitreous hemorrhage after vitrectomy in diabetic eyes pretreated with bevacizumab (Avastin). *Retina*. 2009;29(7):926–31.
4. Martin DF, McCuen BW. Efficacy of fluid-air exchange for postvitrectomy diabetic vitreous hemorrhage. *Am J Ophthalmol* [Internet]. 1992;114(4):457–63.
5. Mota SEH. Case Report An Office-Based Fluid to Fluid Exchange Technique for the Treatment of Postvitrectomy Vitreous Cavity Hemorrhage and Secondary Glaucoma. 2017;2017:2–5.
6. Cooper B, Shah GK, Grand MG, Bakal J, Sharma S. Visual outcomes and complications after multiple vitrectomies for diabetic vitreous hemorrhage. *Retina*. 2004;24(1):19–22.
7. Williamson, T. Complication of Surgery for Diabetic retinopathy. *Retina Today*. 2009;(2):263–73.
8. Balakrishnan D, Jain B, Nayaka A, Rani PK, Mukundaprasad V, Jalali S. Role of Tamponade in Vitrectomy for Proliferative Diabetic Retinopathy with Vitreous Hemorrhage. *Semin Ophthalmol*. 2017;32(4):488–91.

