

A MODIFIED STAINING STRATEGY IN STAIN-ASSISTED VITRECTOMY

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Abstract

The objective of this study is to assess pros and cons of intraoperative Brilliant Blue G dye (BBG) injection in the early phase of Pars Plana Vitrectomy.

This is a prospective non-consecutive case series study, a modification in timing for dye injection during vitrectomy. A single injection of 0.1 ml of Brilliant Blue G (BBG dye) was used in the early phase of pars plana vitrectomy (PPV) promptly after an initial small core vitrectomy, and continued directly in completing vitrectomy; including induction of posterior vitreous detachment and peripheral vitrectomy +/- vitreous base shaving. View of the underlying retina is initially obscured immediately after dye injection, however dye density fade gradually with continuation of vitrectomy.

Fluid Turbulence caused by vitrectomy and continuous fluid infusion enhance dye dissemination within vitreous cavity and stain transparent tissues and also increase colour contrast between blue hued retina and underlying naturally red coloured choroid. Early staining technique will remove necessity for Air-Fluid Exchange for staining at end of vitrectomy.

This study was conducted in the Ophthalmology department at Hamad General Hospital in Doha, Qatar in 2016 and General Port Hospital in Basrah, Iraq in 2017. Patients requiring vitrectomy for various indications were included.

Thirty four eyes (34 patients) were involved in this study: 20 men and 14 women, average age 56 was years. Indications for surgery were variable, diabetic vitrectomy (20 cases, 5/16= Macular Epiretinal Membrane), Rhegmatogenous Retinal Detachment (10 cases), Full Thickness Macular hole (2 case), Penetrating Injury with Posterior IOFB (2 cases). Single case required additional re-injection of dye to augment staining. Non-diathermy drainage Retinotomy was done by soft tipped cannula in 5 cases of retinal detachment. No single case has developed a surgically significant discolouration of lens posterior capsule or seepage of dye to the subretinal space.

In conclusion, this modified staining technique allows better visualization of the various vitreoretinal tissues during all steps of PPV and improve surgical techniques.

Introduction

The use of vital dyes in the vitrectomy procedure allows visualisation of the transparent pre-retinal tissues and membranes.

Improper visualization of different vitreoretinal tissue layers can lead to incomplete vitreous removal, iatrogenic breaks, long surgical time, and gliosis¹. Various methods of staining vitreoretinal tissues, particularly the Internal Limiting Membrane (ILM) and Epiretinal Membrane (ERM), have been described¹⁻³ to aid visualization of ILM and ERM.

Chromovitrectomy is the use of chemicals to stain semi-transparent

preretinal structures as an aid in successful vitreoretinal surgery. Several different dyes have been tried including indocyanine green (ICG), trypan blue (TB) and Triamcinolone (TA)⁴.

Dye administration usually done by 2 techniques at late stage of Pars Plana Vitrectomy (PPV). The "dry" or "air-filled" technique, where only the macular region receives the dye, and mostly no staining of the extra-macular tissue. The "wet" or "fluid-filled" technique results in low intensity staining due to dilution effect⁵. This study aimed to assess intraoperative advantages of modification

in staining technique of single injection of dual membrane blue (BBG dye) in the early stage of Pars Plana Vitrectomy (PPV) rather than standard late injection after complete vitrectomy, and this modification allows staining of all transparent tissues within vitreous cavity.

Brilliant Blue G (BBG) stain was used in this study due to its efficacy, safety and affinity for both ILM and ERM^{1,2}.

Patients and methods

This Prospective non-consecutive case series analysis was conducted in the Ophthalmology Department at Hamad General Hospital in Doha, Qatar in 2016 and General Port Hospital in Basrah, Iraq in 2017. Patients requiring vitrectomy for various indications were included.

All patients have been consented for this modification in the vitrectomy surgical technique. All patients underwent pars plana vitrectomy, a single dose of 0.1 ml of Brilliant Blue G (BBG) 0.025% was quickly injected in the central vitreous space in early phase of PPV just after a simple a core vitrectomy, and the tip of the syringe is positioned above the optic

disc. The turbulence in the intravitreal fluid caused by the vitreous cutter increases dissemination of the dye around the vitreous cavity and stain transparent tissues within the vitreous cavity; include vitreous, membranes, internal limiting membrane and epiretinal membranes.

Results

Thirty four eyes (34 patients) were involved in this study: 20 men and 14 women, average age 56 years. Indications for surgery were variable, diabetic vitrectomy (20 cases, 5/20 Macular Epiretinal Membrane), Rhegmatogenous Retinal Detachment (10 cases), Macular hole (2 case), Penetrating Injury with Posterior IOFB (2 case) as demonstrated in table I.

One case required additional re-injection of dye to enhance staining. All cases who required drainage retinotomy in retinal detachment cases were done by non-diathermy technique with soft tipped cannula. No single case has developed a surgically significant discolouration of lens posterior capsule or seepage of dye to subretinal space.

Table I: Characteristic of patients participating in this study.

Mean Age	56 Years
Gender M/F	20/14
Indications	
Diabetic Retinopathy	20
Retinal Detachment	10
Macular Hole	2
Penetrating Ocular Injury	2

Discussion

Substances such as indocyanine green (ICG), trypan blue (TB) and brilliant blue G (BBG) have been used in vitrectomy with confirmed staining capabilities. In this study BBG dye was selected as it is safe and effective and has a double staining of (ILM and ERM) which could be helpful in ensure that membranes of interest would be thoroughly removed during vitrectomy^{6,7}. A modification of the staining technique of Pars Plana

Vitrectomy in only change timing of dye injection was done. In standard staining procedure, dye injection is usually done late in vitrectomy after full or nearly full removal of vitreous, in this modified technique, dye injection was done early in Vitrectomy.

Just after a small core vitrectomy, a space was created within vitreous to accommodate injected dye, (Figure 1) although its temporarily obscure

visualization of the underlying structures (optic disc and macula), but fluid turbulence caused by the vitrector facilitates dye distribution into whole vitreous cavity and hence stain all transparent tissues and augment colour contrasts between vitreous, retina and choroid. Augmented color contrast have significant surgical advantages during whole vitrectomy.

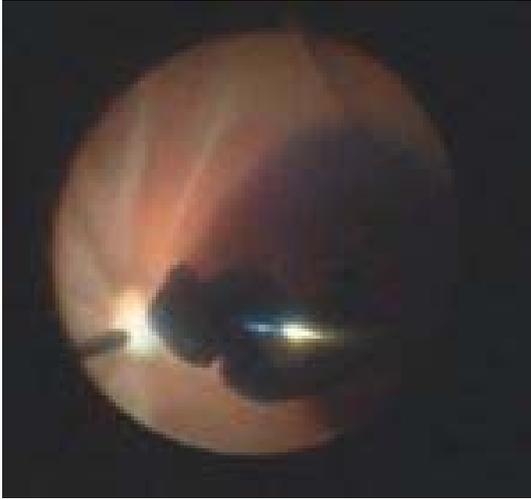


Figure 1: Brilliant blue G after simple core vitrectomy

The standard procedure for staining prerequisite Fluid-Air Exchange, and extra time interval is also required for the stain to have proper staining effects and these are an additional technique during Vitrectomy. Stain is generally injected after almost full vitrectomy in Air-filled Eye or Fluid-filled Eye^{8,9}. In this modified technique, no need for such extra time as it is combined within the vitrectomy time.

Second injection of the dye was required in one case due to faint staining effect. Surgical induction of Posterior Vitreous Detachment is usually done by high suction rate and mostly assisted by use of triamcinolone^{10,11}. This study utilize the technique of Posterior Hyaloid Ring (weiss ring) which heightened easily by color contrast between red coloured choroid and blue coloured vitreous as shown in Figure 2.



Figure 2: Posterior Hyaloid Ring (weiss ring) stained by Brilliant blue G Stain

Small and unexpected small vitreoretinal pathologies might be missed if not pre-planned to be treated. Finding the break or breaks responsible for RD is a critical step in the surgical treatment of this condition, but it can sometimes be difficult to locate small breaks in the thin, optically clear retina, Timothy L. Jackson et al used Subretinal Trypan Blue Injection to identify small tiny retinal breaks and improve surgical outcome of retinal Detachment repair¹².

In this modified staining technique, visualization of unexpected epiretinal membranes or small micro-retinal holes is improved by high colour contrast between red choroid and blue stained retina as shown in figure 3.



Figure 3: Tiny Retinal Hole (red arrow) seen clearly through high colour contrast between blue retina and red choroid

Furthermore, this modified staining strategy provides safer technique for peripheral vitreous shaving and allow surgeon to cut vitreous base in very close proximity to retina as blue coloured-vitreous is markedly distinct from underlying brown coloured ora serrata (Figure IV).



Figure 4: blue colored-vitreous is markedly distinct from underlying brown colored ora serrata.

In retinal detachment, endo-diathermy was used for drainage retinotomies and so the areas of diathermy becomes necrotic, and if a wide area is treated with diathermy, the retinotomy may enlarge during fluid-air exchange¹³. In this modified technique, a non-diathermy drainage retinotomy was created by using a passive suction pressure of soft tipped backflush cannula, and obvious colour contrast of blue retina, red choroid boost visualization of retinotomy even after fluid-air exchange (FAX) without need to mark it by diathermy, and this technique is done in all the 5 cases of retinal detachment(Figure 5).

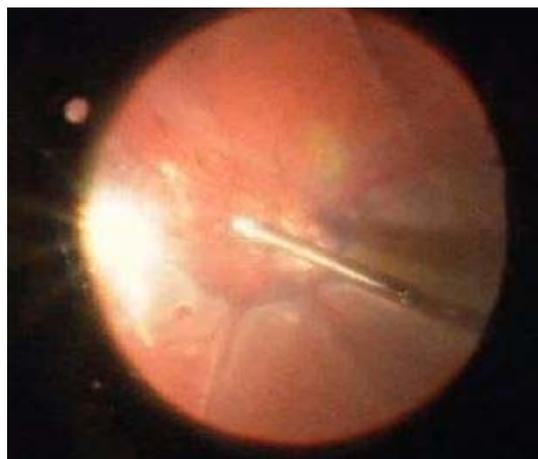


Figure 5: Drainage Retinotomy nasal to optic disc by soft tipped backflush cannula

The ILM and Pre-existing Epiretinal membrane will be stained also and may not necessitate additional step of standard staining.

Stain is diluted within vitreous, however the blue coloured vitreous reduce light intensity on the macula, and theoretically reduce macular phototoxicity.

No specific postoperative complications were recorded related to stain modification strategy.

Conclusion

Early injection of membrane blue stain improves distinguishing of all overlooked membranes and microlesions during vitrectomy so reducing surgical steps.

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