Surgical Technique

Indocyanine Green–Assisted Internal Limiting Membrane Peeling to Induce Posterior Vitreous Detachment in the Cases With Strong Vitreoretinal Adhesion

Successful induction of a complete posterior vitreous detachment (PVD) is one of critical steps in the pars plana vitrectomy (PPV) for vitreoretinal interface disorders including macular hole, vitreous macular traction syndrome, proliferative diabetic retinopathy, proliferative vitreoretinopathy, and so on. In most cases, a PVD can be successfully induced by aspiration of nasal vitreous hyaloid with a vitrector or a silicone-tipped extrusion needle. During surgery, the triamcinolone acetonide is injected into the vitreous cavity, and it can visualize the transparent vitreous hyaloid, helping induction of PVD. However, in some cases, the vitreous adheres to the retina strongly, and PVD cannot be induced by using conventional techniques. If we aggressively separate the posterior vitreous hyaloid from the retina, the retinal break and even retinal detachment may occur. Because the instrument diameter of 23-gauge or 25-gauge system becomes smaller and smaller, the grasping strength they caused is much weaker than the 20-gauge system, and it may cause some difficulties for induction of PVD. At present, there is no standard protocol of induction of PVD for strong vitreoretinal adhesion. Here, we describe a novel technique: indocyanine green (ICG)-assistant internal limiting membrane (ILM) peeling to induce PVD. Interestingly, we find it is very useful for cases in whom the vitreous quite adherent to the retina.

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The standard 3-port pars plana vitrectomy was performed. When the cortical vitreous was removed, we determined whether the real PVD occurred. If the PVD did not occur, we mechanically induced it. The conventional method was first used. The triamcinolone acetonide was injected into the vitreous cavity to visualize the transparent vitreous hyaloid, and then the vitrector or silicone-tipped extrusion needle was used to gently aspirate the vitreous hyaloid at the nasal site of the optic disk. Once the vitreous hyaloid was grasped strongly, we gently lifted the instrument upward and separated the vitreous hyaloid from the retina surface until the Weiss ring presented. If the conventional method did not work, we converted to use diamond-dusted scraper to induce PVD by scraping the vitreous hyaloid. If we failed again, we adopted our surgical technique described in this article. After complete fluid–air exchange (the intraocular pressure was 35 mmHg) was performed, about 0.5-mL ICG-diluted solution (0.25%) was injected into the vitreous cavity to stain the ILM. About 10 seconds later, the ICG solution was removed completely with a flute, and then the balanced salt solution filled. Under the contact lens or wide-field viewing system (RESIGHT, Zeiss, Germany), the green ILM was observed clearly, and the ILM forceps was used to peel partial ILM until the vitreous hyaloid rim elevated. Then, the vitrector was adopted to suck the vitreous hyaloid to extend the PVD area and the Weiss ring presented (Figure 1). The vitreous hyaloid was removed while it was strongly aspirated. We repeated these procedures until the whole vitreous was removed completely (see Video, Supplemental Digital Content 1, http://links.lww.com/IAE/A989). At the same time, attention should...
also be paid to the peripheral retina to prevent retinal break and even retinal detachment occurring.

Comment

In some cases, it is not easy to induce PVD when the vitreous strongly adhere to the retina, especially in the extraordinary cases, and retinal injury may occur when we aggressively separate the vitreous hyaloid by force. Surgeons have reported several surgical techniques to manage this. Vander and Kleiner described a method by using an intraocular coaxial bipolar diathermy to induce PVD. In their method, the vitreous hyaloid adhered to the tip of diathermy instrument and a gap of posterior vitreous hyaloid formed by lifting the instrument, through which the vitreous liquid conveniently flowed into the posterior precortical vitreous pocket. Desai et al directly separated the vitreous cortex from the papillary disk rim using a modified microvitreoretinal blade and a Weiss ring presented which indicated a complete PVD. Takeuchi et al adopted diamond-dusted scraper to scrape the vitreous hyaloid to create a hole without using aspiration, and it facilitated the PVD progress. All these methods need more experienced skills and may fail to induce a complete PVD when the vitreous attaches to the retina extraordinary tightly. Enzyme-assistant PVD induction has also been reported, that is, tissue plasminogen activator is intravitreally injected before vitrectomy to facilitate PVD during the pars plana vitrectomy, but its dosage, timing, and potential side effects remain unclear. So, we present the novel surgical technique to resolve this problem, that is, ICG-assistant ILM peeling to induce PVD. Once the conventional methods do not work, we take our technique. Just as described in other lectures, the vitreous hyaloids can be stained by triamcinolone acetonide and the ILM by ICG specifically. In our surgical practice, we find that ICG can penetrate posterior vitreous hyaloid to stain the ILM efficiently. When the ILM was peeled to some extent, the vitreous hyaloid rim was lifted and vitreous cutter could be adopted to extend the PVD area. Currently, the chromodissection technique is conventional, and the damage it caused is much less than the damage caused by forced separation. In our technique, the aspiration strength is very gentle, and it may be very suit for the smaller vitrectomy systems such as 23 G, 25 G, and even 27 G.

So far, we have successfully induced complete PVD in more than 20 cases, especially in proliferative diabetic retinopathy and in young patients with severe ocular trauma, with no severe complications including retinal break, retinal detachment, etc. Perhaps, our technique has two main risk factors including the retinal toxicity exerted by ICG and the potential mild morphological and functional damages by ILM peeling. Thus, we will observe the long-term disadvantages of this method further. Because of this, we first adopt vitrector suction and diamond-dusted scraper to induce PVD, but when we encounter the cases with quite strong vitreoretinal adhesion and if all these methods do not work, we have to convert to our technique. Especially, when diabetic macular edema or macular hole exists, we prefer select this surgical method because the macular ILM is planned to be

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**Fig. 1. Procedures to induce PVD with ICG-assisted ILM peeling.** A. The triamcinolone acetonide was injected into the vitreous cavity to visualize the transparent vitreous hyaloid, and then the vitrector or silicone-tip ped extrusion needle was used to gently aspirate the vitreous hyaloid at the nasal site of the optic disk. But this method did not work, and we converted to use diamond-dusted scraper to induce PVD by scraping the vitreous hyaloid. Unfortunately, we failed again. B. After complete fluid–air exchange, about 0.5-mL ICG-diluted solution (0.25%) was injected into the vitreous cavity to stain the ILM. About 10 seconds later, the ICG solution was removed completely with a flute, and then the balanced salt solution filled. The green ILM was observed clearly. C. The ILM forceps was used to peel partial ILM. D. The vitreous hyaloid rim elevated. E. The vitrector was adopted to suck the vitreous hyaloid to extend the PVD area.
peeled. In summary, ICG-assisted ILM peeling to induction of PVD is a safe and effective method in the cases with quite adherent posterior hyaloids by which we can avoid the severe retina damage caused by forced separation.

**Key words:** posterior vitreous detachment, internal limiting membrane, indocyanine green, vitrectomy.

References

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