Macular hole secondary to Valsalva retinopathy after Push-up exercise

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Abstract

**Background:** Although neither Valsalva retinopathy nor traumatic macular hole is uncommon, macular hole secondary to Valsalva retinopathy is rarely reported.

**Case presentation:** A 34-year-old healthy man suffered from Valsalva retinopathy after Push-up exercise. During follow-up, best-corrected visual acuity, fundus examination and spectral-domain optical coherence tomography (SD-OCT) outcomes were documented. Three months later, premacular hemorrhage was obviously absorbed with visual acuity improvement. Nine months after first visit, his vision acuity was 20/25. Fundus examination showed complete absorption of macular hemorrhage. SD-OCT showed a lamellar macular hole with intact but thickened and tractional internal limiting membrane on the top of macular.

**Conclusions:** SD-OCT can be used to observe the development of Valsalva retinopathy. Suitable treatments should be adopted timely to prevent complication.

**Keywords:** Optical coherence tomography, Valsalva retinopathy, Macular hole
Background

Valsalva retinopathy was first described in 1972 by Duane as a pre-retinal hemorrhagic retinopathy secondary to a sudden increase in intrathoracic pressure. Following a Valsalva maneuver, a sudden rise in intraocular venous pressure causes retinal capillaries to spontaneously rupture \[1\]. The prognosis is generally good, with spontaneous resolving of the hemorrhage in most cases, though it may take several months \[2\]. Observation, vitrectomy or neodymium:YAG (Nd:YAG) laser membranotomy are the current treatment options\[3,4\]. We reported a case of Valsalva retinopathy combined with spontaneous lamellar macular hole.

Case presentation

A 34-year-old healthy man presented with a sudden visual loss in his left eye after Push-up exercise. His medical history was unremarkable. Best-corrected visual acuity (BCVA) on presentation was counting fingers in the left eye and 20/20 in the right eye. The findings of ocular motility, external and anterior segment examination were unremarkable in both eyes. Intraocular pressure was normal bilateral. Fundus examination showed a massive well-circumscribed pre-macular hemorrhage with a fluid level underneath a transparent membrane in the left eye (Figure 1a). The spectral-domain optic coherence tomography
(SD-OCT) (Carl Zeiss, Cirrus HD-OCT, Germany) revealed a dome-shaped elevated lesion with a hyper-reflective surface and a hypo-reflective area beneath (Figure 1b).

Management options including observation, laser membranotomy, and vitrectomy were discussed with the patient. The patient preferred observation. Three months after the initial visit, his visual acuity in the left eye was improved to 20/160. Dilated funduscopic examination showed remarkable absorption of hemorrhage leaving a dome-shaped preretinal membrane. SD-OCT revealed thickened hyper-reflective internal limiting membrane (ILM) and nerve fiber layer (NFL) with intraretinal cystic change at fovea (Figure 2a, b). Vertical OCT scan demonstrated a tangential traction on the fovea by the elevated and thickened ILM. The posterior hyaloid membrane was detected above the ILM without complete posterior vitreous detachment (Figure 2c). Nine months after first visit, visual acuity was further improved to 20/25 with complete resolution of macular hemorrhage. SD-OCT showed a lamellar macular hole with thickened ILM on the top (Figure 3a, b). Since the patient experienced no metamorphopsia and was satisfied to his visual acuity, no interventional treatments were performed. On his most recent visit, 17 months after the onset, BCVA remained at the level of 20/25 in the affected eye. The fundus examination and OCT findings were stable as well.
Conclusions

Valsalva retinopathy may occur during various activities including severe coughing, blowing nose hardly, suffocating crying, weightlifting, tug-of-war, vomiting, military training, hard blowing, straining hardly, thoraco abdominal extrusion, pregnancy, forced childbirth, sexual activity, and colonoscopy etc \[^5\]. In this case, the patient had a sudden vision lose after Push-up exercise. Fundus and OCT examination revealed sub-ILM premacular discoid fresh hemorrhage. We speculate that forced suffocation, while doing Push-up exercise, increased intra-thoracic or intra-abdominal pressure, which induced rupture of capillaries around macular leading to sub-ILM hemorrhage.

The exact anatomic location of premacular hemorrhage in Valsalva retinopathy, either sub-ILM or subhyaloid or a combination of both, is disputed in the literature \[^6\]. We believe that the exact location of premacular hemorrhage cannot be accurately determined by ophthalmoscopy. Kwok et al \[^7\] provided a histologic evidence of sub-ILM location in Valsalva hematoma. With the advent of OCT, it has been found that sub-ILM hemorrhage is more common than subhyaloid hemorrhage \[^8,9\]. Only if both the ILM and posterior hyaloid membrane are visible on OCT can the location of hematoma be ascertained. We believe that this peculiar case is an example of sub-ILM hemorrhage,
since OCT demonstrated ILM and posterior hyaloid membrane as two distinct layers. Nine months later, the hemorrhage was completely resolved with a dramatic improvement of visual acuity. However, OCT scan revealed a discontinuity of neurosensory retina except ILM in the fovea. There are two possible explanations for his good visual acuity outcome. First, it is an outer retinal lamellar macular hole rather than a full-thickness macular hole. Patients may preserve good vision in lamellar hole. Secondly, the patient may have developed a “VERY NEAR FOVEA” paracentraleccentric fixation, which is very close to the center of the fovea. This eccentric fixation should be confirmed with microperimetry, however, we did not have this technology during our data collection.

To the best of our knowledge, there is no report of Valsalva retinopathy combined with a lamellar macular hole. Kwak et al [10] reported a macular hole followed vitrectomy for Valsalva retinopathy. Ulbig et al [11] reported a macular hole identified after the laser treatment. In this case, the patient did not receive any interventional treatment. The lamellar macular hole was developed spontaneously. Although the mechanism of macular hole formation in Valsalva retinopathy is not fully understood, there are several possibilities. First, the lamellar macular hole could be induced directly due to massive hemorrhage breaking through the neurosensory layers. Secondly, the thickened ILM observed after
resolution of the premacular hemorrhage was considered to create a tangential traction on the fovea. Thirdly, the massive and long-term hemorrhage put the ILM under high tension, which may make ILM hard to reattach to the retina\textsuperscript{[12]}. The partial detached ILM on the top of retina may produce traction on the surface of macula as well. Finally, SD-OCT revealed the surface of the NFL under the detached ILM had an abnormal rough appearance. Except for the acute traumatic detachment between the two layers (ILM-NFL), the toxicity of the long-lasting blood may contribute to such an abnormality\textsuperscript{[13]}.

Therapeutic options in Valsalva retinopathy include conservative management, vitrectomy, laser membranotomy. Hemorrhage could be self-absorbed in most cases and conservative treatment is commonly used. However spontaneous absorption of preretinal blood is very slow. Epiretinal membrane formation and toxic effect of dissolving hemoglobin has been suggested after long-standing contact between blood and retina\textsuperscript{[14,15]}. Therefore, laser puncturing by Nd:YAG laser is recommended to drain the entrapped blood through a focal opening into the vitreous cavity where it is absorbed more rapidly\textsuperscript{[3,11]}. Nd:YAG laser treatment for Valsalva retinopathy is generally effective and safe. However, complications may occur occasionally. The long-term complications of Nd:YAG laser membranotomy include macular hole, retinal detachment, epiretinal membrane formation, and persistent unsealed internal limiting
The patient in this case was afraid of the risks of laser treatment and vitreous surgery, so conservative treatment was taken, and it cost a longer absorption time. If YAG laser had been performed, the sub-ILM hemorrhage would have been absorbed more rapidly; the tension of the ILM might have been relieved earlier, the formation of the macular hole might have been prevented.

In conclusion, SD-OCT can be used to observe the development of Valsalva retinopathy, and suitable treatments should be adopted timely to prevent complication.

**Consent**

Written informed consent was obtained from the patient for publication of this Case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

**Abbreviations**

SD-OCT: spectral-domain optic coherence tomography; ILM: internal limiting membrane; NFL: nerve fiber layer; BCVA: best-corrected visual acuity; NFL: nerve fiber layer.

**Competing interests**

The authors declare that they have no competing interests.
Authors’ contributions
ZGX and SQY contributed to clinical management of the patient, collection of clinical information on the patient, literature search, design of the case report and writing of the article. XC and JZ performed retinal examinations and OCT evaluation etc. FC was the main physician responsible for the patient and suggested this case report and participated in manuscript writing. All authors read and approved the final manuscript.

References


**Figure legends**

**Figure 1** Fundus photograph of the left eye of this 34-year-old man with Valsalva retinopathy showed a massive well-circumscribed premacular hemorrhage of 3-disc-diameter underneath a transparent membrane (a). There was a fluid level within the hematoma. Corresponding SD-OCT revealed a dome-shaped elevated lesion with a hyper-reflective surface (white arrow) and a hypo-reflective area beneath (b).

**Figure 2** Three months after the initial visit, SD-OCT scan showed the ILM on the top of macular was still detached (a). SD-OCT examination also revealed thickened hyper-reflective ILM in macular fovea and the thickened nerve fiber layer (NFL) with cysts formed under it (b). Vertical OCT scan demonstrated a tangential traction on the fovea by detached and thickened ILM, and the posterior hyaloid membrane, characterized by hypo-reflectivity (white arrow), was detected above the ILM (c).

**Figure 3** Nine months after the initial visit, SD-OCT scan showed detached ILM on the top of macular (a), and the formation of a lamellar macular hole with thickened ILM on the top (b).