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Ocular Manifestations of Valsalva Maneuver

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Abstract

***Background*: The Valsalva maneuver is classically described as an increase in intrathoracic pressure against the closed glottis, which causes a subsequent increase in venous pressure above the neck. Veins anterior to the heart use gravity to maintain proper circulation and thus lack valves that are normally required to prevent backflow. This unique mechanism potentially allows blood to surge backwards into the ocular circulation and damage the capillary vessels. Clinical ocular manifestations include hemorrhages within the periorbital skin, conjunctiva, retina, or in the vitreous. Patients experiencing Valsalva retinopathy may complain of sudden and painless vision loss. We present three cases that demonstrate the myriad ways in which Valsalva maneuver can present clinically within or around the eye. *Case Reports*: The first case is a 57-year-old male patient with a history of self-induced emesis who presented with petechial hemorrhages located on his periorbital skin and conjunctiva. The second case is a 38-year-old female patient with a history of recent laproscopic surgery that resulted in deep intraretinal hemorrhages in the posterior pole of both eyes. The third case is a 34-year-old male who engaged in power exercising including strenuous weightlifting noticed within hours a leaf shaped floater in front of his central vision which paralleled a similarly shaped intraretinal hemorrhage juxtaposition to the macula. *Conclusion*: The optometrist should be aware of Valsalva maneuver as a possible cause for periorbital, conjunctival or retinal hemorrhages. One must keep in mind that Valsalva retinopathy is a diagnosis of exclusion and should be considered only after confirming a history of induced Valsalva and ruling out any underlying retinal or systemic diseases. Spontaneous resolution is the treatment of choice, but other options, such as Nd:YAG laser hyaloidotomy and vitrectomy are also utilized if warranted.**

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Introduction

Valsalva maneuver is named after Antonio Maria Valsalva, an Italian anatomist of the 17th century.[1] The Valsalva maneuver occurs when a person forcibly exhales against a closed glottis, which in turn causes an increase in intrathoracic and intra-abdominal pressure.[2,3] Increased pressure in these cavities compresses the vena cava, which decreases venous return to the right side of the heart. Subsequently, there is a decrease in cardiac output. Intrathoracic and intra-abdominal pressure returns to baseline when the glottis is released causing a rapid rise in venous return and a subsequent rise in cardiac output. This, in turn, leads to a sudden rise in peripheral arterial and venous pressure.[4] Elevated venous pressure transmits to the head and neck, where the blood vessels lack valves.[2,3,5,6,7] Consequently, circulation unobtrusively gets channeled to the fine parafoveal capillary nets above the heart, resulting in hemorrhages located in or around the eye.[1,2,8,9] A Valsalva event involves a centripetal force that moves superior to inferior; that is, the force moves in the head-to-toe or toe-to-head direction.[2] Activities that generate pressure gradients in this way are coughing; strenuous exercise; weight-lifting; vomiting; sexual activity; end-stage labor; colonoscopy procedures; fiber optic gastroenteroscopy; blowing high-resistance musical instruments; inflating balloons; compressive surgeries; and endotracheal intubation.[2,10] Playing wind instruments, more specifically trumpet playing, involves repeated and prolonged Valsalva maneuvers.[11] Additionally, laser-assisted in situ keratomileusis (LASIK) with a microkeratome suction ring replicates a Valsalva maneuver by

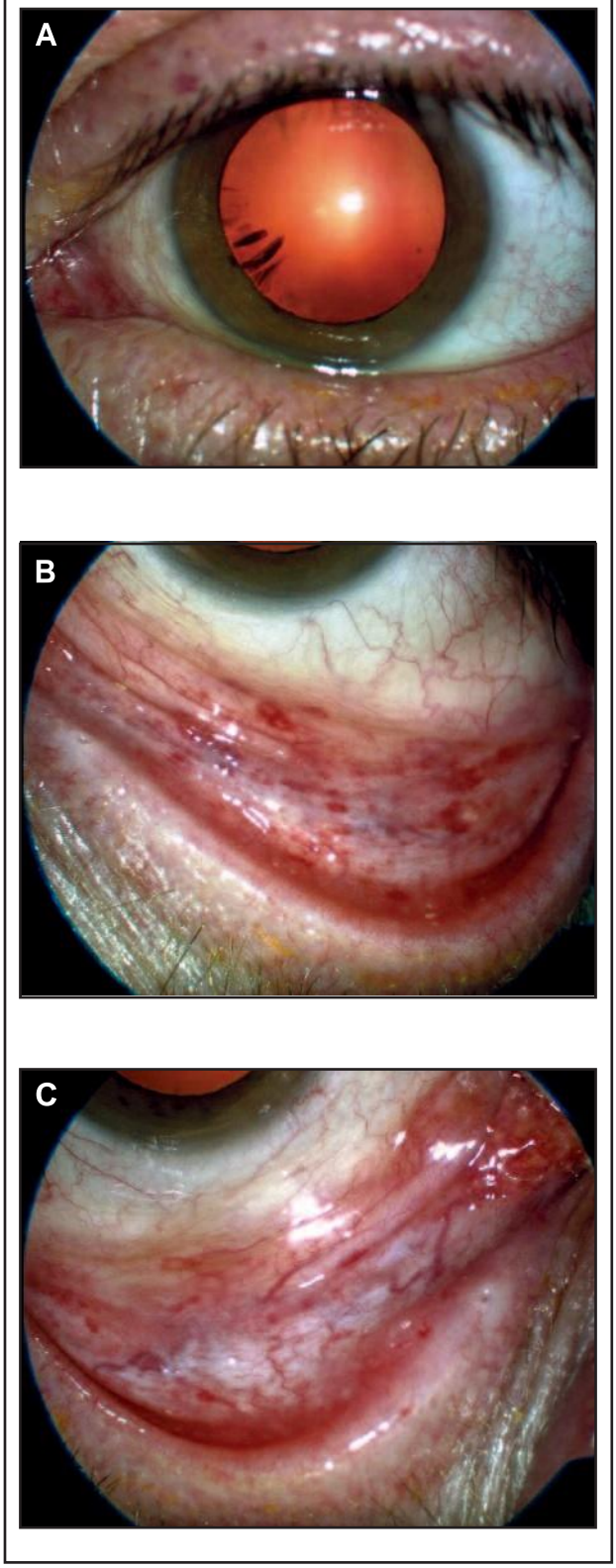

Fig. 1 (A) Petechial hemorrhages on upper and lower lid OS resulting from self-induced vomiting **(B)** petechial hemorrhages on inferior palpebral conjunctiva OS **(C)** petechial hemorrhages on inferior palpebral conjunctiva OD

causing a rapid increase in IOP as high as 65 mmHg.[12] Weightlifters who hold their breath or athletes who are unaware of exerting intense physical exertion are also at a higher risk for Valsalva retinopathy.[13]

Valsalva retinopathy is a term used to characterize retinal hemorrhages caused by a Valsalva maneuver.[1] It was first described by Thomas Duane in 1972 and is noted to present infrequently. As a result, there is no reported epidemiological data in ophthalmic literature.[2,3,6] We present three patients with varied ocular manifestations of the Valsalva maneuver, the first induced by vomiting, second by intra-abdominal laproscopic surgery, and last by strenuous repetitive weightlifting.

Case Reports

Case 1

A 57-year-old male new to the eye clinic reported a black spot in his vision for the past few months in both eyes. There was no decrease in his vision and he denied any associated flashes. There were no complaints of eye pain, itching and no history of trauma. His medical history was remarkable for asthma and post-traumatic stress syndrome. Additionally, he smoked half a pack of cigarettes per day for the past thirty years and had a history of alcoholism. The patient was taking trazodone (Desyrel®, Bristol-Myers Squibb, Montreal, QC) for sleep and using an albuterol inhaler for his asthma. He denied taking any herbal supplements.

Best-corrected visual acuity was 6/6 (20/20) OD and 6/6 (20/20) OS. Extraocular muscle testing revealed full versions and cover testing demonstrated 2 exophoria at distance and near. The pupils were round, 4+ reactive to light, and there was no afferent pupillary defect. Amsler grid was unremarkable for metamorphopsia OD and OS. Slit lamp biomicroscopy revealed multiple pinpoint hemorrhages on the periorbital skin as well as on the palpebral and bulbar subconjunctiva OS>OD (Fig. 1A-C). In addition, slit lamp biomicroscopy was remarkable for cortical cataracts and nuclear sclerosis in both eyes. The intraocular pressure was 16 mmHg OD and OS by Goldmann applanation tonometry. Fundoscopic examination revealed cup-to-disc ratios of 0.30 OD and OS with pink neuroretinal rims and distinct disc margins. There was vitreous syneresis, but no Weiss ring, mild vessel tortuosity and nicking, and trace retinal pigment epithelium mottling with pinpoint soft drusen in both eyes. The periphery was unremarkable for holes, tears, or breaks in both eyes. A review of recent laboratory testing indicated the following: hemoglobin was 14.5 gm/dL (normal range: 13.3-17.7 gm/dL); hematocrit 42.5% (normal range: 39-52%); platelet count 244 k/uL (normal range 150-440 k/uL); serum glucose of 108 mg/dL (normal range: 70-110 mg/dL); hemoglobin A1c 5.6%

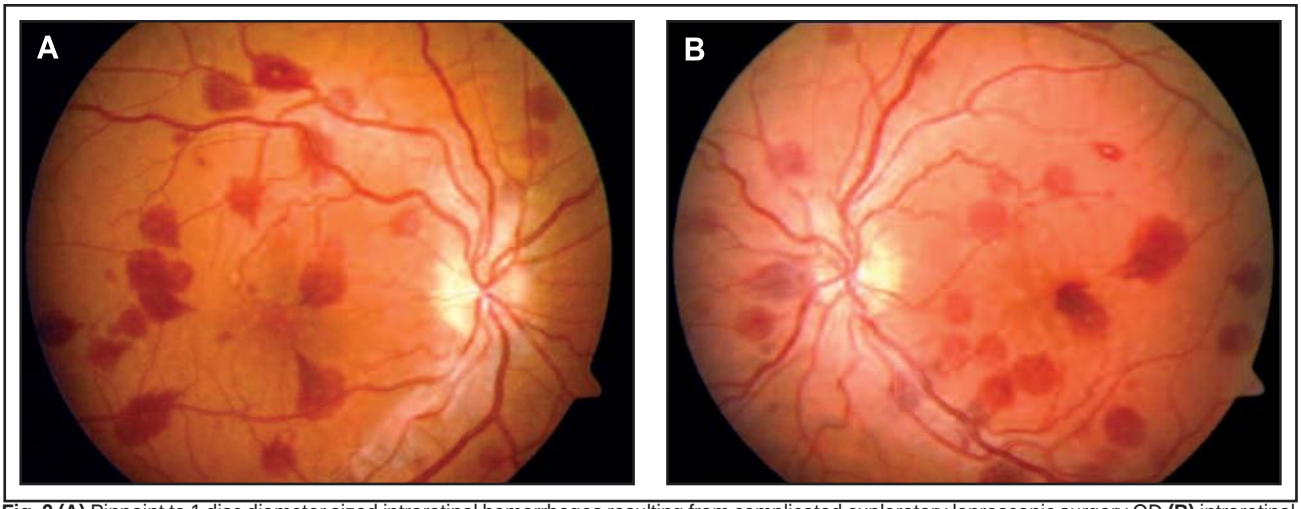

Fig. 2 (A) Pinpoint to 1 disc diameter sized intraretinal hemorrhages resulting from complicated exploratory laproscopic surgery OD **(B)** intraretinal hemorrhages resulting from complicated exploratory laproscopic surgery OS

(normal range: 4.2-5.8%); cholesterol 196 mg/dL, high density lipoprotein 57 mg/dL; and low density lipoprotein of 127 mg/dL. The urine microalbumin level was 0.2 mg/dL (normal range: 0.0-1.8 mg/dL); and urine creatinine was 56 mg/dL. Urinalysis was negative for protein, glucose, ketones, and bilirubin. His most recent blood pressure measurement at our facility was 122/83 mmHg; the patient reported monitoring his blood pressure at home.

Upon further questioning, the patient denied taking any non-steroidal anti-inflammatory drugs, aspirin or other blood thinners. He suffered from a chronic cough and reported that he self-induced vomiting 2 to 3 times each month to help relieve indigestion and heartburn after his evening meals. As a precaution, a prothrombin time and international normalized ratio (PT/INR) was ordered to rule out other blood disorders as the cause for the periorbital and subjconjunctival hemorrhages; a complete blood count (CBC) was not ordered since it had been done recently and was normal. The patient was also referred to gastroenterology for evaluation and management of his heartburn. He was asked to return in 6 weeks.

At his 6-week follow-up, all hemorrhages had resolved and the patient reported he had not vomited since his prior visit. Given his history of self-induced vomiting and the normal PT/INR and CBC, Valsalva maneuver was determined to be the primary cause for the hemorrhages.

Case 2

A 38-year-old Caucasian female presented with complaints of bilateral, diffuse, non-moving "rings and feathers" in her vision immediately following exploratory laproscopic surgery in her abdomen the previous afternoon. As a complication of the procedure, excessive gas was placed into her abdominal cavity resulting in pneumothorax or the collapsing of her lungs. Emergency treatment protocol required immediate endotracheal intubation of the patient, during which she struggled to breathe for several minutes. When she awoke, she noted the presence of the floaters. The patient's medical history was otherwise significant for depression, gastrointestinal distress, and post-surgical pain. She was taking fluoxetine (Prozac®, Eli Lilly, Montreal, QC), esomeprazole (Nexium®, AstraZeneca), and acetaminophen/hydrocodone (Norco). There was no significant family medical or ocular history.

Best corrected visual acuities were 6/6- (20/20-), 6/6- (20/20-) in the right and left eyes, respectively. Pupils were equal, round and 4+ reactive to light and there was no afferent pupillary defect. There were no misses OD or OS with Dvorine color plates. Extraocular muscles were full and unrestricted in both eyes. Biomicroscopy revealed an unremarkable anterior segment OU and deep anterior chamber angles. No signs of anterior segment hemorrhaging were noted in the periorbital skin or conjunctiva. Goldmann applanation tonometry readings were 13 mmHg OD and OS. She reported multiple scotomas scattered across the Amsler grid OD and OS. The blood pressure measured 138/82 mmHg (right arm sitting). Dilated fundus examination revealed multiple bilateral well-circumscribed deep intraretinal hemorrhages in the posterior pole of both eyes. The hemorrhages were pinwheel in shape, some white-centered, and ranged in size from 1/8 to 1 disc diameter (Fig. 2A,B). Previously documented macular drusen changes were also present. The optic nerve and choroid appeared undisturbed OD and OS. The cup to disc ratios were 0.15 round OU. The

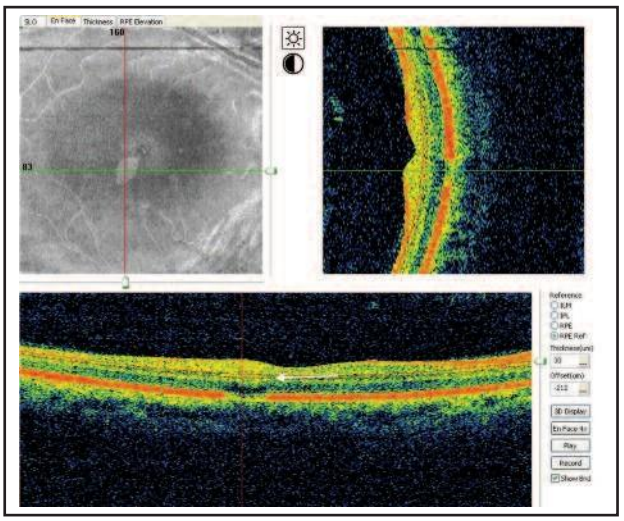

Fig. 3 OCT of the macula OD. The white arrow designates where the hemorrhage is located.

vitreous was clear and there was no sign of intravitreal hemorrhage in either eye. The patient was instructed to avoid strenuous activities and use of nonsteroidal anti-inflammatory drugs or aspirin. She was scheduled for follow-up evaluations but failed to keep multiple appointments due to her current medical condition and diagnostic testing. However, she reported via a telephone conversation 1 month later that her visual symptoms had resolved.

Case 3

A 34-year-old Latino male presented with a complaint of a "leaf" shaped floater in the central vision of his right eye that developed 2 days prior. It had remained unchanged and appeared to move with his eye. The patient reported that the previous evening, he had performed strenuous exercise involving hundreds of repetition of pushups and jumping jacks, and weightlifting. He reported good health and was not on any current medications. He had a history of renal lithiasis 1 year prior, which had completely resolved. There was a maternal history of diabetes and paternal history of heart disease. Entering acuities were 6/7.5 (20/25) and 6/4- (20/15-) in the right and left eyes, respectively, through his habitual spectacles. Pupil responses were 4+ reactive to light without an afferent pupillary defect. Extraocular muscles were unrestricted in all fields of gaze. Biomicroscopy of the anterior segment showed no signs of petechial or subconjunctival hemorrhages, the anterior chambers were deep and quiet and the corneas were clear. Intraocular pressure measured by Goldmann applanation was 13 mmHg and 14 mmHg in the right and left eyes, respectively. Blood pressure was measured at 128/88 on the right arm, sitting. Funduscopic examination revealed a 1/3 disc diameter intraretinal hemorrhage, inferior temporal to the fovea of the right eye in the shape of a leaf. The cup to disc ratios were 0.5 round in the right eye and 0.45 round in the left. The vasculature showed a slight arteriovenous compression in the superior arcade in each eye. OCT of the macula revealed an area of intraretinal thickening adjacent to the fovea in the right eye (Fig. 3). En Face (anterior to posterior) analysis of the hemorrhage lies at the level of approximately the outer plexiform layer (Fig. 3). The dense nature of the hemorrhage creates a shadow below this area in the scan, appearing as if there is an absence of tissue. The patient was instructed to refrain from weightlifting or strenuous activities and avoid anti- coagulants and non-steroidal anti-inflammatory agents until the follow-up visit. The patient was instructed to return in 2 weeks for re-evaluation. Since his symptoms had markedly improved, the patient failed to show up for his follow up visit since his symptoms markedly improved and because of financial hardship.

Discussion

Ocular Pathology Precipitated by Valsalva Maneuver

The various ocular manifestations of Valsalva maneuver are summarized in Table I. Of greatest visual consequence is Valsalva retinopathy, which is a rare condition that is usually found in healthy individuals.[36] The sudden increase in venous pressure experienced during a Valsalva event disrupts the retinal vessels creating intraretinal or preretinal hemorrhages located in the posterior pole and macula.[3,6,10,14] In general, they are located below the inner limiting membrane (ILM), subhyaloid area, or both and range in size from a punctate spot to more than 1 disc diameter.[2,3,16,17,18] As time passes, the blood will slowly settle due to gravity and create the classic boat-keel or dome appearance.[8,10] Increased venous pressure not only affects the fine capillaries within the eye, but also travels to the periorbital vessels as well.[1] Thus, ocular manifestations may include subconjunctival hemorrhages and superficial petechiae of the skin of the head and neck.[1,2,19]

Ocular Signs and Symptoms

Classic symptomatology of Valsalva retinopathy have been previously described as sudden, painless vision loss, a central scotoma ocular pain , and nausea resulting from increased IOP.[8,20,22] There are three ways vision loss can occur: by detachment of the ILM, vitreous hemorrhage, or preretinal hemorrhage at the macula.[2,8,14] Increased IOP can result from a suprachoroidal hemorrhage, which occurs when blood gathers in the space between the sclera and choroid and evolves into massive areas of

Table I Ocular manifestations of Valsalva maneuver[2, 5, 15, 22, 32]

- Superficial petechial hemorrhages on the head and neck
- Subconjunctival hemorrhage
- Preretinal macular hemorrhages
- Superchoroidal hemorrhage
- Vitreous hemorrhage
- Increased IOP
- Detachment of the inner limiting membrane (ILM)
- Globe protrusion

choroidal effusion and secondary flattening of the anterior chamber.[21,22]

In cases involving repeated Valsalva maneuvers, as seen with trumpet or other high resistance wind instrument musicians, the patient is at a higher risk for Valsalva retinopathy and transient increases in IOP.[23] Although rare, transient increases in IOP may cause long-term damage to the eye such as glaucomatous visual field loss with significant optic nerve head cupping.[23] Schuman states this scenario could be misdiagnosed as normal-tension glaucoma and should instead be named "intermittent high pressure glaucoma." Additionally, the increased cumulative lifetime hours of playing high wind instruments also factors into the degree of presentation.

Protrusion of the globe during Valsalva maneuver is rare; however, Elfar et al suggested inquiring about past Valsalva events with patients who present with significant exophthalmos.[24] In particular, individuals who perform yoga headstands and forward bending moves may experience globe propulsion due to increased orbital venous pressure associated with these positions.[5]

Differential Diagnosis

One must determine the underlying cause for retinal hemorrhages in order to appropriately manage the patient.[3,8] There are three possible types of etiologies to consider: retinal disease, systemic disease and physical stress.[3,6,18] Valsalva retinopathy is a diagnosis of exclusion and requires a positive history of "Valsalva stress;" therefore, a thorough case history is key.[1,10,20] The optometrist must also keep in mind that patients may elect not to report embarrassing yet crucial behaviors or activities in their case history.[25] In the absence of a past Valsalva event, underlying retinal and systemic diseases that might cause retinopathy must be ruled out.[13,25,28] Fluorescein angiography is an essential test used to detect neovascularization and reveal retinal diseases such as macroaneurysm; branch or central retinal vein occlusion; sickle cell retinopathy; radiation retinopathy; Terson syndrome; hypertensive retinopathy; anemic retinopathy; or proliferative diabetic retinopathy.[3,6,8,20,26,27] Optical coherence tomography (OCT) is another important tool used to confirm the location of bleeding and offers additional clues to help confirm Valsalva retinopathy.[3,7,20] Hemorrhages associated with Valsalva have historically been observed in the subhyaloid or ILM spaces, but the exact location cannot be determined unless both the ILM and subhyaloid face are visible on the OCT.[16,18] In our patient, the ability of the RTVue OCT (Optovue, Inc., Fremont, CA) software to identify the level of the hemorrhage within the retina places the blood posterior to where previous reports have described.

Systemic diseases in question are diabetes, hypertension, sickle cell disease, anemia, coagulopathy, and blood dyscrasias.[28,29] Blood tests should be ordered in order to further investigate the presence of these diseases, which include: CBC; prothrombin time; partial thromboplastin time and platelet count; glycosylated hemoglobin (HbA1C); hemoglobin solubility; hemoglobin fractionation (electrophoresis); and peripheral blood smear.[13,20,25] As far as physical stress is concerned, Purtscher's retinopathy is an important differential to consider and is caused by a major trauma, pancreatitis, childbirth, and renal failure.[30,31] It is different from Valsalva maneuver in that it involves a centrifugal force that moves in the ventral-dorsal direction (e.g., a chest compression injury) instead of the centripetal force associated with a Valsalva event.[2] It always results in reduction of vision and one may observe multiple bilateral hemorrhages greater than 1 disc diameter in size, which are confined to the posterior pole.[18] Unlike Valsalva retinopathy, Purtscher's retinopathy has no predilection for the macula and is accompanied by soft exudates and capillary infarction.[18] Purtscher's retinopathy usually resolves within weeks, and it is rare to have Valsalva and Purtscher's occur together after trauma.[30,31] Another differential are hemorrhages that result from exposure to high altitudes. They present in the peripapillary region throughout the fundus and spare the macula.[32] The hemorrhages are described as diffuse, punctate or flame-shaped, and confluent.[32]

Interestingly, underlying retinal or systemic diseases are not only considered differentials, but are also important risk factors to take into account. Weak retinal vessels leave a patient at a higher risk for developing Valsalva retinopathy than a patient who is without preexisting retinal or systemic diseases.[2,20,29] One suggestion by Carlson et al described performing hypertension screening for those who are avid weight lifters or wind-instrument musicians to better detect those at a higher risk.

A very important consideration includes infants with a history of vomiting who present with retinal hemorrhages.[33] The intrathoracic and intra-abdominal pressure in infants cannot be elevated high enough to rupture the retinal capillaries, so Valsalva retinopathy does not occur in infants.[33] For this reason, the optometrist should suspect child abuse (i.e., shaken baby syndrome) as the primary cause of retinal hemorrhages rather than attribute them to Valsalva maneuver from vomiting.[33]

Management

Management options for preretinal hemorrhages include observation, neodymium: yttrium-aluminum-garnet (Nd:YAG) vitreous hyaloidotomy, or vitrectomy.[3,8,15,20] Very few cases require invasive treatment at all.[8] Observation is the preferred treatment of choice, but surgical intervention may be favored depending on the size of the lesion, the age of the patient, and the health of the eye.[8,20] Patients are instructed to refrain from vigorous activity, sleep in an upright or sitting position, use stool softeners if indicated, and to avoid using unprescribed anti-coagulating agents.[3,8] Weight lifters are urged to inhale before lifting and exhale during lifting to prevent occurrence or recurrence.[34,35] Hemorrhages will typically spontaneously resolve within weeks to a few months.[3,18,20,36]

Hyaloidotomy with Nd:YAG laser drains blood into the vitreous cavity by puncturing a hole in the vitreous face.[8,14,38] There are four indications for Nd:YAG hyaloidotomy: first, rapid restoration of binocular vision is needed; second , visual acuity is poorer in the other eye; third, the patient is unwilling to have a vitrectomy; and, fourth, vitrectomy is contraindicated.[1,14,37] Nd: YAG laser hyaloidotomy is recommended for macular hemorrhages that are greater than 3 disc diameters in size and are less than 3 weeks old.[3,15,37] It is not, however, recommended for a hemorrhage that is resolving.[20] It is thought that macular hemorrhages older than 3 weeks have already formed clots and will drain less readily even with a visible vitreous puncture.[3,15,38] Therefore, it is important to adhere to these recommendations in order to obtain the best visual prognosis if treating with Nd:YAG laser.[38] Vitrectomy is a third treatment option that is considered if Nd:YAG hyaloidotomy is initially unsuccessful due to clotted blood; second, epiretinal membrane, macular hole, or retinal detachment develops after Nd:YAG; third, sub-ILM hemorrhages are not spontaneously resolving or are extensive; and fourth, for cases where blood disperses into the vitreous following Nd:YAG treatment, the latter occurring 30% of the time.[15] De Maeyer described cases in which there was excellent visual recovery after vitrectomy plus ILM peeling.[39] This is a safer alternative for quick visual recovery and has a low risk of complications.[39] When adverse events do occur, they present as are retinal tear, retinal detachment, epiretinal membrane and cataract.[15,39]

Prognosis

Overall, the visual prognosis for Valsalva retinopathy is very promising, but there are factors that guard complete visual recovery.[1,15,20,36] Macular hemorrhages approximately 1 disc diameter in size and treated conservatively generally resolve within 6 months without further complications.[3,18,20,36] On the other hand, an eye with a preexisting retinal disease has limited visual potential and prognosis is guarded.[15] Such conditions include diabetic retinopathy, retinal macroaneurysm, or branch retinal vein occlusion.[15] Whether conservative treatment is implemented or a laser procedure is carried out, a diseased retina with Valsalva retinopathy will have a poorer visual outcome than if Valsalva retinopathy presented alone.[14,15,40] In cases where a vitreous hemorrhage is present, Nd:YAG hyaloidotomy typically restores vision in 1 month.[15,38] In the absence of a vitreous hemorrhage recovery to 6/6 (20/20) visual acuity is usually achieved within 24 hours to 1 week.[15,37,40] There have been no reported complications 6 months after Nd:YAG laser hyaloidotomy treatment.[15,38] Visual prognosis for vitrectomy is very good, where 80% of patients recover to a visual acuity of 6/15 (20/50) or better.[41]

As with any surgical procedure, complications may arise following Nd:YAG hyaloidotomy or vitrectomy.[7,14,15,17,37,40] Although conservative treatment such as monitoring is noninvasive, there are complications associated with it as well.[37,40] Because it takes several months before blood is completely absorbed, the macula has prolonged exposure to hemoglobin, which may prevent complete healing.[37,40] Blood that settles over a long period of time will turn yellow, due to hemoglobin degeneration, and become toxic.[38] This in turn reduces the final visual outcome from its original baseline.[15,37] Nd:YAG laser hyaloidotomy is also associated with the development of a macular hole, retinal detachment, and epiretinal formation.[7,15,17,20] The risk of ERM formation or metamorphopsia 2 years after treatment, however, is fortunately low.[20,37] Complications associated with vitrectomy are retinal tear, retinal detachment, cataract and ERM.[20] Ulbig reports that a vitrectomy was needed in only one-third of patients who developed an ERM or macular hole from Nd:YAG hyaloidotomy.[15]

Conclusion

Valsalva retinopathy is an important differential to consider in adult patients who present with acute onset of painless vision loss and retinal hemorrhages. This diagnosis, however, should be reserved until a thorough case history is taken and an associated Valsalva event is confirmed. It is important to keep in mind that preexisting retinal diseases will prolong the time for visual recovery and may hinder vision from returning to baseline. The optometrist should remember to rule out retinal and systemic diseases by obtaining the appropriate tests such as fluorescein angiography, OCT and blood studies. ❑

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Systane® iLux®

DO MORE FOR YOUR DRY EYE PATIENTS

The MGD treatment device that heats and expresses blocked meibomian glands to provide immediate clinical and visible results.

The only portable thermal pulsation and expression device that does customizable treatments

Fast treatment in as little as **8-12 minutes**[1,2]

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- Systane iLux is **non-inferior to Lipiflow** and in a 12-month study demonstrated mean meibomian gland secretion scores change by >12 units by 2 weeks and >16 units by 12 months[3,4*†]
- **Increased average meibomian gland function by 300%** vs. baseline at 4 weeks post-treatment[5,‡]

Competitive pricing for professionals means **affordable treatment** for patients

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* Based on a prospective, randomized, parallel group, investigator-masked, multi-center, 12-month follow up study, n=299.
† LipiFlow is a trademark of Johnson & Johnson Vision Care, Inc.
‡ Based on a prospective, nonrandomized, open-label, multicentre study, n=30, $p<0.001$.

IMPORTANT PRODUCT INFORMATION

Indication: The Systane® iLUX® Device is indicated for the application of localized heat and pressure therapy in adult patients with chronic disease of the eyelids, including Meibomian Gland Dysfunction (MGD), also known as evaporative dry eye.

ATTENTION: PLEASE REFER TO THE USER MANUAL FOR A COMPLETE LIST OF CONTRAINDICATIONS, INSTRUCTIONS FOR USE, WARNINGS AND PRECAUTIONS FOR THE SYSTANE® iLUX® DEVICE.

References: 1. Tauber J, *et al.* Comparison of the iLUX and the LipiFlow for the Treatment of Meibomian Gland Dysfunction and Symptoms: A Randomized Clinical Trial. *Clin Ophthalmol.* 2020;14:405-418. Published 2020 Feb 12. **2.** Alcon Data on File, 2019. **3.** Wesley G, *et al.* Patient-reported symptoms following SYSTANE iLux and LipiFlow treatment: A 12-month, multicenter study. Investigative Ophthalmology & Visual Science June 2021, Vol.62, 1242. **4.** Alcon Data on File, 2021. **5.** Schanzlin D, *et al.* Efficacy of the Systane iLux Thermal Pulsation System for the Treatment of Meibomian Gland Dysfunction After 1 Week and 1 Month: A Prospective Study. *Eye Contact Lens.* 2021. Oct 5.

Alcon

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Remplissez le questionnaire ci-dessous et renvoyez-le soit en ligne, par courriel ou par courrier ordinaire. Le coût de la notation de chaque quiz est de 25,00 $ (plus taxes) et vous serez facturé via PayPal après avoir reçu votre certificat de crédit UFC. Ce cours expirera pour le crédit UFC le 31 mars 2024. Veuillez ne pas le soumettre après cette date.

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