Nd:YAG laser therapy for non-resolving premacular subhyaloid hemorrhage in Saudi patients

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Abstract

Purpose: To report anatomical and visual outcomes of Nd:YAG laser posterior hyaloidotomy (NYPH) in Saudi patients affected by premacular subhyaloid hemorrhage (PMSHH).

Methods: 8 eyes from 8 patients (7 males and one female) were treated with NYPH when no spontaneous resolution of PMSHH was noticed. The cause of PMSHH was proliferative diabetic retinopathy (PDR) in 3 cases, Central retinal vein occlusion (CRVO) in 2 cases, Valsalva retinopathy in 2 cases, and laser pointer injury in one case. The YAG laser was delivered using a Q switched mode and 3 mirrors contact lens. One attempt of laser delivery was enough in 6 cases and 2 cases needed 2 attempts. The laser power needed ranged between 2 and 4 mJ.

Results: Anatomical success was achieved in all cases. The mean LogMAR VA improved from 1.5 before treatment to 0.3 post-treatment. The difference is statistically significant (p = 0.012). No complications related to Nd:YAG laser therapy was reported in any of the study cases until the last follow up.

Conclusion: To our knowledge, this is the first study to report the outcomes of NYPH for non-resolving PMSHH in Saudi cases. In this small cases series, the procedure seems to be safe, effective, simple, cheap, and non-invasive treatment modality for this disorder that is conducted in the outpatient setting. We think it should be considered as a first option for cases of SHH covering the fovea due to various aetiologies.

Keywords: Subhyaloid haemorrhage, Nd:YAG laser, Posterior hyaloidotomy

Introduction

Premacular subhyaloid haemorrhage (PMSHH) is not an uncommon cause for sudden loss of vision that is associated with localized accumulation of blood in the subhyaloid space at the macular region. It can happen due to various causes including Valsalva retinopathy, trauma, proliferative diabetic retinopathy (PDR), retinal vein occlusion (RVO), arterial macro aneurysms, hematologic disorders, Terson syndrome, and Eales’ disease among others. The haemorrhage is usually dome shaped, circumscribed in appearance that can be under the internal limiting membrane (ILM) (sub-ILM) or between the ILM and the posterior hyaloid (sub-hyaloid). Haemorrhage may resolve spontaneously, but this...
may take weeks to occur depending on the amount and thickness of the blood. If it stays for a long time, it may cause irreversible damage to the retinal surface with epiretinal membrane (ERM) formation due to the prolonged exposure to iron (from lysed haemoglobin) and may not be tolerated by patients when the vision is severely reduced that could be down to light perception in some cases. In addition, it can hide any underlying macular pathology.

If resolution of the bleeding does not happen, an intervention is needed to drain the blood, improve vision, allow visualization of the macula, and prevent complications of it. Various treatment modalities exist, such as pneumatic dissection with intravitreal gas with/without administration of tissue plasminogen activator, and pars plana vitrectomy. One of the simple treatment options for PMSHH is Nd:YAG (Neodymium-Doped Yttrium Aluminium Garnet) laser posterior hyloidotomy (NYPH). It aims to drain the trapped blood into the vitreous cavity by creating a puncture in the posterior hyaloid membrane and/or ILM by using the photo-disruptive effect of YAG laser. Some previous studies reported favourable outcomes of NYPH in cases of PMSHH. We noticed that many retina specialists do vitrectomy surgery as a primary intervention for the condition. That is why we conducted this study to evaluate the outcomes of NYPH first to solve the problem if there is no spontaneous resolution. To our knowledge, this treatment modality has not been investigated previously in Saudi population. We hereby present its results in 8 affected Saudi cases due to various aetiologies.

Patients and methods

This is a prospective study on 8 Saudi patients (7 males and one female) conducted in King Khalid Eye Specialist Hospital (KKESH) between May 2016 and May 2018. Institutional Review Board (IRB)/Ethics Committee approval was obtained. The research adhered to the tenets of the Declaration of Helsinki. Informed consent for inclusion in the study was obtained from the study subjects.

All cases presented to the retina emergency service in KKESH with acute painless loss of vision in the affected eye. In all of them, medical and ophthalmic history was taken to know the cause of bleeding. Complete ophthalmic examination was conducted including VA testing, IOP measurement, anterior segment examination with slit lamp, and fundus examination with biomicroscopy and indirect ophthalmoscopy. Once the diagnosis of PMSHH obscuring the foveal center was made, patients were given a follow up appointment in 2 weeks time in anticipation of spontaneous resolution. If this was not the case, treatment options were discussed with them, and if they were happy to have YAG laser treatment for that, they were included in the study after obtaining their consent and explaining the risks and benefits of the procedure.

In all cases, color fundus photos were taken using Topcon fundus camera (Top TRC-50DX) and wide field Optos camera (Optos 200TX) before treatment and at follow up visits. Retinal structure was analyzed qualitatively with transfoveal horizontal spectral domain optical coherence tomography scans (OCT, Heidelberg Engineering, Inc., Heidelberg, Germany).

Laser treatment was delivered using a slit lamp delivery system, under topical anesthesia, after pupillary dilation, using a 3-mirror contact lens and Q switched Nd:YAG laser machine (Ellex Ultra Q) with 1064 nm wavelength. The aiming beam was directed to an inferior point at the dependent part of the bleeding. Laser was fired starting at 2 mJ and the power was increased if needed till we get a burst in the posterior hyaloid face allowing drainage of blood into the vitreous cavity. The energy needed ranged between 2 and 4 mJ. One laser attempt was enough in 6 cases. In the remaining 2 cases, another laser attempt was done when drainage was not adequate in the first follow up visit after 2 weeks.

Pan retinal photocoagulation (PRP) was also performed for the 3 cases that had proliferative diabetic retinopathy before applying the YAG laser therapy for PMSHH. In the 2 cases of CRVO, previous PRP was already done previously.

The statistical analysis was done by SPSS software using Wilcoxon Signed Ranks Test, as the VA data was not normally distributed.

Results

This study was conducted on 8 eyes from 8 Saudi patients (one female and 7 males) with age ranging from 23 to 66 years (mean; 47 y). The patients’ characteristics are summarized in Table 1. The left eye was the effected eye in all of them. The cause of PMSHH was PDR in 3 cases, CRVO in 2 cases, Valsalva retinopathy in 2 cases, and laser pointer injury in one case. The duration of visual loss, at the time of treatment, ranged between 1–4 months.

Anatomically, PMSHH was successfully drained into the vitreous cavity allowing the macula centre to be uncovered in all cases at one month after treatment. Some residual pre-retinal blood at the inferior border of the macula was seen in 3 cases (case 3, 4 & 7) (37%). In the majority of cases (63%), the blood was totally drained into the vitreous. Fig. 1 shows the pre and post treatment macular appearance of the study cases. Fig. 2 shows the OCT changes in one of them (case 8).

VA (LogMAR) improved from a mean 1.5 before treatment to 0.3 post-treatment. The difference is statistically significant (p = 0.012). 50% of cases achieved 20/30 or better VA. In the remaining 4 cases, VA did not reach that level because of other macular pathology due to CRVO and Diabetic maculopathy.

Follow up ranged between 6 and 24 months (mean; 14 month). No complications related to the NYPH treatment was seen in any case till the last follow up visit. None of these cases needed vitrectomy surgery.

Discussion

Subhyaloid macular haemorrhage can cause profound loss of vision due to direct toxic damage to the retina, membrane formation, and macular detachment or surface wrinkling. Early treatment allows visual improvement for the patient, visualization of the macula and conduction of fluorescein angiography and macular laser photocoagulation if needed. Some might argue that vitrectomy is a definitive way of treatment allowing removal of the bleeding, visualiza-

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If successful, it helps to avoid the need for vitrectomy that is a big, invasive, time consuming and resources consuming procedures that takes a lot of the operating theatre time and needs special equipment and specially trained staff.

Table 1. Features of 8 cases affected by premacular subhyaloid hemorrhage.

| Case | Age | Gender | Eye | Cause | Duration of VA loss (m) | Laser sessions | FU | Drainage success | Additional treatment | VA pre-treatment | VA post-treatment | Complications |
|------|-----|--------|-----|-------|-------------------------|----------------|----|-----------------|---------------------|----------------|-----------------|---------------|
| 1    | 45  | Female | OS  | Valsalva | 1                       | 1              | 24 | Success         | None                | 20/300         | 20/20          | None          |
| 2    | 23  | Male   | OS  | Laser pointer injury | 1              | 1              | 22 | Success         | None                | 20/400         | 20/20          | None          |
| 3    | 51  | Male   | OS  | CRVO + NVEs | 2              | 2              | 18 | Success         | Previous PRP        | 20/300         | 20/100         | None          |
| 4    | 53  | Male   | OS  | PDR    | 2              | 1              | 12 | Success         | PRP                 | 20/400         | 20/80          | None          |
| 5    | 42  | Male   | OS  | PDR    | 2              | 1              | 12 | Success         | PRP                 | 20/400         | 20/30          | None          |
| 6    | 52  | Male   | OS  | PDR    | 3              | 1              | 12 | Success         | PRP, Previous PRP   | 1/200          | 20/50          | None          |
| 7    | 66  | Male   | OS  | CRVO   | 4              | 2              | 12 | Success         | Previous PRP        | CF             | 20/200         | None          |
| 8    | 41  | Male   | OS  | Valsalva | 1              | 2              | 6  | Success         | None                | HM             | 20/20          | None          |

OS = left eye. VA = visual acuity. FU = duration of follow up in months. PRP = pan retinal photocoagulation. PDR = proliferative diabetic retinopathy. CRVO = central retinal vein occlusion.

Fig. 1. Color photos before and after Nd:YAG laser posterior hyaloidotomy in 8 Saudi cases with Premacular subhyaloid haemorrhage. (A) Post-treatment after 3 days in case 1 showing drainage of the blood inferiorly. (B) 1 month post treatment in case 1. (C) Pre-treatment in case 2. (D) 1 month post treatment in case 2. (E) Pre-treatment in case 3. (F) 1 month post treatment in case 3. (G) Pre-treatment in case 4. (H) 1 month post treatment in case 4. (I) Pre-treatment in case 5. (J) 1 month post treatment in case 5. (K) Pre-treatment in case 6. (L) 1 month post treatment in case 6. (M) Pre-treatment in case 7. (N) 1 month post treatment in case 7. (O) Pre-treatment in case 8. (P) 1 month post treatment in case 8.

Intervention in a timely manner is crucial to maximize the chance of success of the YAG displacement while the blood is still in its liquid form ensuring flowability through the posterior hyaloid opening. When the blood becomes clotted with time, the chances of it clearing out through the opening
become less, and the need to do vitrectomy increases.\textsuperscript{2} We recommend applying NYPH for PMSHH if it does not show signs of spontaneous resolution in 2 weeks. Patients who have a PMSHH of at least three disc diameters are advocated for the use of Nd:YAG laser due to its known photo-disruptive nature, with this amount of blood acting as a cushion for the laser energy to protect the retina.\textsuperscript{13} The most common cause of PMSHH in our patients was PDR (37%) followed by CRVO (25%), Valsalva retinopathy (25%), and lastly laser pointer macular injury (12.5%). NYPH was effective in all these cases in our series of patient. Accordingly, we advise using this treatment modality in PMSHH due to any cause.

In our case series, the procedure was anatomically successful in all cases. Another attempt of NYPH was needed in 2 cases when partial drainage took place after the first attempt. In a study by Ulbig and colleagues, 21 patients underwent the procedure with a successful hyaloidotomy in 16 of them.\textsuperscript{13} Ahmedabadi et al. reported a success rate of 12 out of 14 patients treated with this modality.\textsuperscript{17} The visual improvement was significant. However, substandard VA in 50\% of our cases resulted from an additional macular pathology due to diabetic retinopathy or CRVO. This is in keeping with several reports of favourable visual and anatomic results of the procedure in other populations.\textsuperscript{1–10} Khan showed a total of 11 out of 12 patients who underwent Nd-YAG had visual acuity improvement.\textsuperscript{16} Kuruvilla and colleagues reported significant visual improvement with no complications of NYPH in cases of submacular haemorrhage due to Valsalva retinopathy.\textsuperscript{14}

Complications related to NYPH have been reported such as failure of drainage, macular holes, retinal detachment, and dense vitreous haemorrhage.\textsuperscript{13} No complications were observed in our series and none of our cases needed vitrectomy surgery. However, we cannot exclude the possibility of complications to be noticed in the future with longer follow up.

Precautions should be taken to avoid such complications including; aiming at the inferior border of the bleeding (to avoid possible central macular damage) allowing the haemorrhage to drain into the vitreous by gravity, using the lowest power possible to puncture the posterior hyaloid face, and proper monitoring of the patient after laser treatment.

We acknowledge some limitations of this study including the small number of cases and the relatively short follow up in some of them.

**Conclusion**

To the best our knowledge, this is the first study to assess the outcomes of NYPH for non-resolving PMSHH in Saudi cases. In this small cases series, the procedure seems to be safe, effective, simple, cheap, and non-invasive treatment modality for this disorder that is conducted in the outpatient setting. We think it should be considered as a first option for cases of PMSHH covering the fovea due to various aetiologies. Early NYPH is recommended, if the bleeding does not resolve spontaneously in 2 weeks to avoid macular damage. If it fails, vitrectomy surgery could be considered.

**Conflict of interest**

None of the authors has conflict of interests to declare.

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