

# Role of Nd:YAG Laser in the Management of Premacular Subhyloid Hemorrhage

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**Purpose:** To evaluate the role of early Nd:YAG laser hyaloidotomy in the management of premacular subhyloid hemorrhage.

**Study Design:** prospective interventional case series.

**Place and Duration of Study:** Ophthalmology department, King Edward medical university and Mayo hospital, Lahore from 1st July, 2015 to 31st December, 2015.

**Material and Methods:** There were total 20 patients of premacular subhyaloid hemorrhage who underwent Nd:YAG laser hyaloidotomy. All were followed up on 2<sup>nd</sup> day, 1<sup>st</sup> week and 2<sup>nd</sup> week. Detailed examination was done to note the improvement of vision, clearance of macula, absorption of hemorrhage and any complication occurred. Data was analyzed by SPSS version 20 and presented in the form of tables.

**Results:** Among included patients, 8 were males (40%) and 12 were females (60%). Mean and standard deviation for patients' age was  $36.55 \pm 14.50$  with range of 20-65 years. Maximum patients (50%) were from the younger age group of 20-35 years. Most common etiology of hemorrhage was PDR (40%). Macula was cleared in 15 patients (75%) but visual acuity was improved in only 13 patients (65%) because of underlying maculopathies. The mean amount of energy of laser used was  $7.67 \pm 2.55$  with a range of 4-12 mJ. The hemorrhage took 4 weeks on average to be absorbed from vitreous. Complication in the form of taut epimacular membrane was noted in only one patient.

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**Conclusion:** Nd:YAG laser hyaloidotomy is a safe, cheap, non-invasive and early visual rehabilitative procedure.

**Key words:** Nd:YAG laser, hyaloidotomy, premacular subhyaloid hemorrhage.

**P**remacular subhyaloid hemorrhage is an ocular condition in which blood accumulates in front of macula behind the posterior vitreous face. It can be caused by proliferative diabetic retinopathy (PDR), hypertensive retinopathy, retinal artery macroaneurysm, blood dyscrasias, age-related macular degeneration (AMD) and valsalva maculopathy<sup>1</sup>. It causes profound sudden loss of vision.

It is a self-limiting condition and can resolve on its own. However spontaneous resorption of the blood entrapped in the subhyaloid space is slow and may result in long-lasting visual hampering<sup>2</sup>. If it persists for longer period, can lead to pigmentary damage to the macula, toxic damage to the retina due to the prolonged contact with iron and haemoglobin, epimacular membrane formation or even macular traction<sup>3</sup>.

Various management options for this entity include observation, Neodymium:YAG (Nd:YAG) laser hyaloidotomy and pars plana vitrectomy.<sup>4</sup> As it is associated with permanent macular changes before the hemorrhage gets spontaneously resolved and management of underlying cause with potential risks of damage to ocular structures is instituted, early intervention becomes crucial. Although pars plana vitrectomy is likely to have the best anatomic outcome, the well known complications limit its immediate adoption in the majority of scenarios. Nd:YAG laser hyaloidotomy is a non-invasive, cheap, and safe method, which enables the drainage of the premacular subhyaloid haemorrhage into the vitreous, facilitates absorption of blood cells and improves the vision immediately by the clearance of the obstructed premacular area<sup>5</sup>. It is found to be efficacious in 93.33% cases<sup>6</sup>.

The rationale of this study was to establish the early role of Nd:YAG laser in the management of premacular subhyaloid hemorrhage so as to avoid the permanent macular damages which may occur in case of conservative observational approach.

## MATERIALS AND METHODS

This prospective interventional case series was carried out in Ophthalmology department, King Edward medical university and Mayo hospital, Lahore from 1st July, 2015 to 31st December, 2015. There were total 20 patients of premacular subhyaloid hemorrhage. They were selected with the help of non probability purposive sampling technique. Inclusion criteria were onset of symptoms within 2 weeks, 3-5 disc diameters of hemorrhage and phakic patients with excellent posterior segment view. While exclusion criteria was previous treatment for any maculopathy, associated vitreous hemorrhage and visual acuity better than 6/60.

Proper permission was taken from institutional ethical committee to conduct this study. Patients were selected from out-door patient department (OPD) of Ophthalmology department of Mayo hospital, Lahore. A formal informed consent was taken from the patients after brief description of method, duration and possible outcome failure of treatment. They were ensured about the safety of procedure and also that the confidentiality of data would be maintained. After fulfilling the inclusion and exclusion criteria, patients were enrolled in this study. After enrollment, the detailed history was taken about the onset of reduced vision. Systemic inquiry was carried out in detail. Pre and post-treatment best corrected visual acuity, slit-lamp examination, intraocular pressure and funduscopy were done. Special attention was paid to note any possible etiology. Once diagnosis was made, patients underwent Nd:YAG laser hyaloidotomy with the help of triple-mirror contact lens. Initially energy was set at 3 milli joules (mJ) and was increased depending upon the reaction. Laser was applied at anterior dependent surface of hemorrhage away from fovea. End point was when anterior surface of hemorrhage was ruptured and blood trickled into the vitreous.

Patients were called for follow ups on 2<sup>nd</sup> day, 1<sup>st</sup> week and 2<sup>nd</sup> week. On each visit, visual acuity was assessed and detailed fundus examination was done to find out underlying pathology and any complication occurred during procedure.

All the recordings were made in the proforma designed (copy attached).

All the data was entered and analyzed with the help of computer software SPSS version 20 to find out frequencies and percentages of study variables i.e. gender, etiology of haemorrhage. Descriptive statistics were applied to calculate mean and standard deviation for the age of the patients and amount of energy of laser applied.

Confounding variables like age, gender and etiology were controlled by stratification.

## RESULTS

Total 20 patients were included in study. The mean and standard deviation of age was  $36.55 \pm 14.50$  while the age range was 20-65 years. Patients were divided into three different age groups. This division and its effect on the final outcome are shown in table 1. This table shows that most of the patients belonged to younger age group and the patients who didn't showed improvement were from the older age group.

**Table 1:** Age of patients and its effect on outcome.

Age Group	No. of Patients	Improvement of Visual Acuity	Clearance of Macula
20-35 years	10 (50%)	8 (80%)	8 (80%)
36-50 years	8 (40%)	4 (50%)	6 (75%)
51-65 years	2 (10%)	1 (50%)	1 (50%)

**Table 2:** Gender distribution and its effect on outcome.

Gender	No. of Patients	Improvement of Visual Acuity	Clearance of Macula
Male	8 (40%)	5 (62.5%)	6 (75%)
Female	12 (60%)	8 (66.67%)	9 (75%)

**Table 3:** Etiology of hemorrhage and its effect on outcome.

Etiology	No. of Patients	Improvement of Visual Acuity	Clearance of Macula
PDR	8 (40%)	4 (50%)	6 (75%)
Valsalva maneuver	4 (20%)	4 (100%)	4 (100%)
Trauma	3 (15%)	2 (66.67%)	2 (66.67%)
Blood dyscrasias	2 (10%)	1 (50%)	1 (50%)
AMD	1 (5%)	0 (0%)	0 (0%)
CRVO	1 (5%)	1 (100%)	1 (100%)
Idiopathic	1 (5%)	1 (100%)	1 (100%)

Gender distribution of patients is shown in table 2 with its effect on final outcome. Male:female ratio in this study was 1:1.5. Visual acuity was labeled as improved when there was at least 3 steps improvement according to Snellen's system of visual acuity assessment. Percentage of improvement of

visual acuity was better in females but macular clearance was equal in both genders.

Table 3 describes in detail the etiology of subhyaloid hemorrhage and its response to the Nd:YAG laser. PDR was the most common etiology. Only 50% patients of PDR showed improvement of

visually acuity. Other maculopathies were found in the remaining cases. They were managed according to the nature of maculopathy. Cases of valsalva maneuver, CRVO and idiopathic etiology gave excellent response.

Efficacy of procedure was defined in terms of macular clearance of hemorrhage and it's trickling in to the vitreous. According to this definition, procedure was found effective in 15 out of 20 (75%) cases. Surprisingly the dispersed hemorrhage took very late i.e. 4 weeks on average to be cleared from vitreous.

Complication was noted in only one case of trauma where hemorrhage dispersed into vitreous and led to formation of taut membrane. This case was then dealt surgically.

## DISCUSSION

Premacular subhyaloid hemorrhage results in an acute and profound decrease in vision<sup>7,8,9</sup>. Different etiologies including vasoproliferative diseases (e.g., diabetic retinopathy), vascular anomalies (e.g., retinal macroaneurysms), or rare conditions like valsalva maneuver, terson syndrome and leukemias can cause these hemorrhages<sup>2,10,11,12</sup>. Each cause can lead to a hemorrhage into the vitreoretinal interface. Still attached, posterior hyaloid membrane results in formation of a premacular hemorrhagic bubble, which will cause decreased vision and/or a central scotoma. It can resolve on its own but observation may result in unwanted sequelae leading to permanent damage to macula. That is why, early removal of the hemorrhage is important<sup>13</sup>. Various therapeutic options include the intravitreal administration of SF<sub>6</sub> gas, Nd:YAG laser hyaloidotomy or a pars plana vitrectomy<sup>14,15,16</sup>. Opening the posterior hyaloid membrane by laser (referred to as hyaloidotomy) presents a minimally invasive technique introduced for the first time in 1988 by Faulborn<sup>17</sup>. One year later it was also used by Gabel. Since that, it has become a popular method due to its non-invasiveness. We also used this in our study.

In this study, we performed this method on 20 patients of premacular subhyaloid hemorrhage. Etiologies included PDR, trauma, valsalva maneuver and miscellaneous causes. The percentage of these etiologies is almost similar to those found in study of Murtaza et al<sup>6</sup> with exception of trauma. This is possible as both these studies were performed in same country.

The hyaloidotomy was successful and blood trickled into vitreous from where it was cleared within 4 weeks. Our final follow up of study was at 2<sup>nd</sup> week.

That is why, our results are contrary to findings of Ahmedabadi<sup>18</sup> and Murtaza, et al<sup>6</sup>. Other possible reason may be relatively younger ages of our patients in which blood dispersed into vitreous is absorbed slowly because of less liquefaction. More number of diabetic patients in our study can also make the difference as blood is absorbed very slowly in diabetic patients due to aggressive nature of disease process.

Visual acuity was found to be improved in 13 cases (65%) according to the defined criterion. It is lower than that (75%) found in study of Ulbig et al<sup>19</sup>. It is because the final follow-up of patients in their study was longer than that in our study. One patient had visual acuity of 6/6 (5%) while vision of 10 patients (50%) was between 6/9-6/12. This is similar to that of Faisal and colleagues<sup>6</sup> (56.66%) and Renni et al<sup>10</sup> (66.67%). This is however in comparison to results of study of Shashidhar et al<sup>20</sup> (92.85%). This comparison has emerged due to the difference in etiologies of premacular subhyaloid hemorrhage. Most of patients in our study were that of PDR and trauma where as these were the least common etiologies in Shashidhar's study. There were other macular changes besides subhyaloid hemorrhage in our patients which had limited the final visual acuity.

Final outcome was assessed on the basis of displacement of hemorrhage away from the macula and its clear visualization which may or may not be associated with improved vision. Our results are less than other studies<sup>6,10,12,16</sup>. The only possible reason is the shorter duration of study and earlier follow up than those of others.

This short duration study showed that Nd:YAG laser hyaloidotomy is effective in macular clearance and improvement of vision if no associated maculopathy is present.

## CONCLUSIONS

Early Nd:YAG laser treatment should be considered for recent premacular subhyaloid hemorrhages. Its benefits include early visual rehabilitation, visualization of the underlying fundus, early access for macular photocoagulation, the avoidance of surgical vitrectomy and avoidance of potential toxic macular changes. Long term follow ups of laser treated cases are important. Randomization with deferral of procedure or vitrectomy can exactly map out merits and demerits. Additionally, comparison with intravitreal anti-VEGF (vascular endothelial growth

factors) injections can also highlight its marvelous effects.

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#### Role of Authors

Dr. Irum Raza

Patients' selection, data collection and analysis.

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Research design and research supervision.

#### REFERENCES

1. **Dağlioğlu MC, Coşkun M, İlhan N, Tuzcu EA, Ari M, Ayıntap E, et al.** Posterior hyaloidotomy by Nd:YAG laser application in a patient with postpartum depression caused by valsalva retinopathy. *Case Rep Ophthalmol.* 2013 Jan-Apr; 4 (1): 64-8.
2. **O'Hanley GP, Canny CL.** Diabetic dense premacular hemorrhage. A possible indication for prompt vitrectomy. *Ophthalmology*, 1985; 92 (4): 507-11.
3. **Rathor MK, Tirkey E, Chandravanshi SL, Shivdas J.** Premacular subhyaloid hemorrhage drainage by frequency-doubled (532nm) Nd: YAG laser. *Delhi J Ophthalmol.* 2012 Jul-Sep; 23 (1): 29-33.
4. **Kuruvilla O, Munie M, Shah M, Desai U, Miller JA, Ober MD.** Nd:YAG membranotomy for preretinal hemorrhage secondary to valsalva retinopathy. *Saudi J Ophthalmol.* 2014 Apr; 28 (2): 145-51.
5. **Abouzeid H, Wolfensberger TJ.** Nd:YAG laser for treatment of premacular subhyaloid hemorrhage. *Klin Monbl Augenheilkd.* 2011 Apr; 228 (4): 389-90.
6. **Murtaza F, Rizvi SF, Bokhari SA, Kamil Z.** Management of macular pre-retinal subhyaloid hemorrhage by Nd:Yag laser hyaloidotomy. *Pak J Med Sci.* 2014 Mar; 30 (2): 339-42.
7. **Heichel J, Kuehn E, Eichhorst A, Hammer T, Winter I.** Nd:YAG laser hyaloidotomy for the treatment of acute subhyaloid hemorrhage: a comparison of two cases. *Ophthalmol Ther.* 2016 Jun; 5 (1): 111-20.
8. **Khairallah M, Ladjimi A, Messaoud R, Ben Yahia S, Hmidi K, Jenzeri S.** Retinal venous macroaneurysm associated with premacular hemorrhage. *Ophthalmic Surg Lasers*, 1999; 30: 226-8.
9. **Duane TD.** Valsalva hemorrhagic retinopathy. *Trans Am Ophthalmol Soc.* 1972; 70: 298-313.
10. **Rennie CA, Newman DK, Snead MP, Flanagan DW.** Nd:YAG laser treatment for premacular subhyaloid haemorrhage. *Eye (Lond).* 2001; 15: 519-24.
11. **Khadka D, Sharma AK, Shrestha JK, Pant B, Pant S, Shrestha A.** Nd:Yag laser treatment for sub-hyaloid hemorrhage in childhood acute leukemia. *Nepal J Ophthalmol.* 2012 Jan-Jun; 4 (1): 102-7.
12. **Khadka D, Bhandari S, Bajimaya S, Thapa R, Paudyal G, Pradhan E.** Nd:YAG laser hyaloidotomy in the management of premacular subhyaloid hemorrhage. *BMC Ophthalmol.* 2016 Apr 18; 16: 41.

13. **Matonti F, Donadieu V, Hoffart L, Dornadin A, Nadeau S, Roux S, et al.** Early treatment with Nd:YAG laser for valsalva retinopathy: results of five cases and literature review. *J Fr Ophthalmol.* 2013 Sep; 36 (7): 604-9.
14. **Campos J, Campos A, Mendes S, Neves A, Violante L, Castro Sousa JP.** Premacular hemorrhage treatment with Nd:YAG laser: a clinical case. *Arch Soc Esp Oftalmol.* 2015 Jan; 90 (1): 44-6.
15. **Gao L, Dong C.** Sub-inner limiting membrane haemorrhages. *Lancet.* 2013 Aug 10; 382 (9891): 535.
16. **Liu Z, Pan X, Bi H.** Treatment of valsalva retinopathy. *Optom Vis Sci.* 2014 Nov; 91 (11): e278-81.
17. **Faulborn J.** Behandlung einer diabetischen praemaculaeren Blutung mit dem Q-switched Neodym:YAG laser. *Spektrum Augenheilkd.* 1988; 2: 33-5.
18. **Ahmadabadi MN, Lashay AR, Karkhaneh R, Manaviat MR, Amini A, Razaghi A, et al.** Nd:YAG laser application in premacular subhyaloid hemorrhage. *Arch Iranian Med.* 2004; 7 (3): 206-9.
19. **Ulbig MW, Mangouritsas G, Rothbacher HH, Hamilton AM, McHugh JD.** Long-term results after drainage of premacular subhyaloid hemorrhage into the vitreous with a pulsed Nd:YAG laser. *Arch Ophthalmol.* 1998; 116 (11): 1465-9.
20. **Shashidar, BN Vishwanath, Shujatha S.** Effectiveness of drainage of pre-macular sub-hyaloid hemorrhage into vitreous cavity with Nd:YAG laser. *Inter J of Gen Med & Pharm.* 2014 Sep; 3 (5): 29-32.