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A Comparative Study Between Intravitreal Bevacizumab and Nd: YAG Laser for Treatment Outcomes of Retinopathy of Prematurity

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Abstract **Original Research Article**

Background: Retinopathy of prematurity (ROP) is a leading cause of childhood blindness, particularly in preterm infants. Panretinal photocoagulation using Nd: YAG laser has long been a standard treatment, though associated with complications such as myopia and retinal scarring. Intravitreal bevacizumab (IVB), an anti-VEGF agent, offers a newer alternative with potential benefits and risks. This study aimed to compare treatment outcomes between intravitreal bevacizumab and Nd: YAG laser in infants with type 1 and aggressive posterior ROP. ***Methods:*** This prospective observational study was conducted at the Department of Vitreo-Retina and Pediatric Ophthalmology of the National Institute of Ophthalmology and Hospital, and in the Special Care Baby Unit (SCABU) and Intensive Care Unit (ICU) at Dhaka Shishu Hospital, Bangladesh, from January to December 2018. A total of 61 infants (122 eyes) with type 1 or AP-ROP were treated with either IVB or Nd: YAG laser. Data on regression rates and treatment-related complications were collected and analyzed using SPSS v20, with significance set at $p < 0.05$. ***Results*:** Retinopathy regression occurred in 82.8% of IVB-treated eyes and 90.6% of laser-treated eyes ($p = 0.826$). Vitreous hemorrhage was noted in 18.2% of IVB cases and 28.2% of laser cases ($p = 0.672$), while tractional retinal detachment occurred in 18% of IVB-treated eyes and 24.7% of laser-treated eyes ($p = 0.556$). No cases of endophthalmitis were observed in either group. ***Conclusion:*** Both IVB and Nd: YAG lasers are effective for ROP treatment with low complication rates. Treatment choice should consider clinical context, resource availability, and follow-up capacity.

Keywords: Retinopathy of prematurity, intravitreal bevacizumab, Nd: YAG laser, treatment outcomes.

INTRODUCTION

Retinopathy of prematurity (ROP) is a neovascular retinal disorder of childhood that causes loss of vision by means of macular dragging and retinal detachment. It is a leading cause of childhood blindness in the United States and other highly industrialized nations, occurring primarily in infants of low birth weight (≤1250 g; mean, 700 g) [1,2]. The incidence of blindness in infants due to ROP is relatively low, about 1 case in 820 infants, because of good neonatal care and appropriate screening and treatment [1,3]. The disorder is a major cause of childhood blindness in developing countries, manifesting in larger premature infants (birth weight ≤2000 g; mean, 1400 g). The worldwide prevalence of blindness due to ROP is 50,000 [1,4].

Retinal vascularization on the internal retinal surface begins at the optic nerve at 16 weeks' gestation and proceeds anteriorly, reaching the edge of the temporal retina at 40 weeks' gestation. One of the major causative factors for developing ROP is dysregulation of vascular endothelial growth factor (VEGF) [5], which leads to abnormal vasculogenesis and neovascularization [6,7]. Treatment of ROP consists of destroying the portion of the retina that is unvascularized to preserve the rest of it. The avascular retina is a source of growth factors that promote abnormal neovascularization. When the avascular retina is destroyed, the release of growth factors ceases, and neovascularization regresses.

In the late 1960s, xenon arc photocoagulation and transscleral cryotherapy were introduced for the

treatment of acute ROP [8]. The multicenter Trial of Cryotherapy for ROP (CRYO-ROP) established the beneficial effect of cryoablation of the peripheral avascular retina [9]. However, cryotherapy requires general anesthesia or sedation and ventilation, and is associated with complications including conjunctivitis, eyelid swelling, hypotony, and various forms of hemorrhage.

Head-mounted lasers rapidly became an alternative to cryotherapy [10]. Pan retinal photocoagulation (PRP) has been used for the last two decades to treat ROP. PRP reduces VEGF production by ablating ischemic peripheral retina [5,11]. However, PRP carries risks of permanent peripheral retinal destruction, visual field loss, and high myopia [12,13]. Despite treatment, some eyes still progress to retinal detachment.

In recent years, VEGF inhibitors such as bevacizumab have emerged as effective alternatives. The BEAT-ROP study demonstrated superior outcomes with intravitreal bevacizumab (IVB) in zone I ROP compared to PRP [3]. Other studies report lower post-treatment myopia with IVB [14,15]. However, IVB is associated with risks such as late recurrence and potential systemic VEGF suppression [14,16,17].

This study aims to evaluate and compare the treatment outcomes of intravitreal bevacizumab and Nd: YAG laser therapy in infants with ROP.

METHODOLOGY & MATERIALS

This prospective observational study was conducted at the Department of Vitreo-Retina and Pediatric Ophthalmology of the National Institute of Ophthalmology and Hospital, and in the Special Care Baby Unit (SCABU) and Intensive Care Unit (ICU) at Dhaka Shishu Hospital, Bangladesh, from January 2018 to December 2018. A total of 61 infants (122 eyes) diagnosed with type 1 retinopathy of prematurity (ROP) or aggressive posterior ROP (AP-ROP) were included in the study. These infants met the clinical criteria for treatment with either intravitreal bevacizumab (IVB) or Nd: YAG laser photocoagulation.

Sample Selection

Inclusion Criteria

- Infants diagnosed with type 1 ROP
- Infants diagnosed with aggressive posterior ROP (AP-ROP)

Exclusion Criteria

- Neonates who were clinically unstable or unable to tolerate procedures
- Infants with stage 5 ROP
- Infants with congenital heart disease

Data collection and study procedure:

Institutional approval was obtained from the ethical review board of the participating hospitals before initiating the study. Written informed consent was taken from all parents or legal guardians after explaining the nature, purpose, and potential risks of the procedures. Eligible infants were screened and allocated to either the IVB or laser group based on clinical indication and physician discretion.

For IVB, each infant received 0.625 mg (0.025 mL) of bevacizumab via intravitreal injection, administered 1–1.5 mm posterior to the limbus using a 30-gauge needle under aseptic conditions. For Nd: YAG laser therapy, photocoagulation was applied to the avascular peripheral retina using an indirect laser ophthalmoscope (1064 nm wavelength) under topical anesthesia. Pupil dilation and corneal clarity were ensured using standard pre-procedural drops and lubrication.

All relevant data, including patient demographics, clinical findings, treatment outcomes, and complications, were recorded using structured case sheets. Data were analyzed using SPSS version 20, applying the chi-squared test for categorical variables. A p-value < 0.05 was considered statistically significant. Confidentiality and anonymity of participants were strictly maintained throughout the study, and participants had the right to withdraw at any stage without consequences.

RESULTS

A total of 122 eyes from 61 infants diagnosed with retinopathy of prematurity (ROP) were included in this study. Both intravitreal bevacizumab (IVB) and Nd: YAG laser groups were evaluated for disease category, regression rates, and complication profiles. The key findings are summarized in the tables and figures below.

Table-1: Distribution of ROP categories among treatment groups

Treatment groups	Type 1 ROP (n, %)	AP-ROP (n, %)	Total
IVB group	29(96.7)	1(3.3)	30
Laser group	17(53.3)	14(46.7)	31

Table-2: Comparison of treatment outcomes with complications of two treatment groups at follow up

Complications		Treatment Group		P value
		Bevacizumab Group (%)	Laser Group (%)	
Retinopathy Regression	**Yes**	82.8	90.6	0.826
	No	17.2	9.4	
Vitreal Hemorrhage	**Yes**	18.2	28.2	0.672
	No	81.8	71.8	
Progression to Tractional RD	**Yes**	18	24.7	0.556
	No	82	76.3	
Endopthalmitis	**Yes**	0	0	
	No	100	100	

Table 2 compares treatment outcomes and complications between the IVB and laser groups. Retinopathy regression occurred in 82.8% of IVB-treated eyes and 90.6% of laser-treated eyes (p=0.826). Vitreous hemorrhage occurred in 18.2% of the IVB group and 28.2% of the laser group (p=0.672). Progression to tractional retinal detachment (TRD) was observed in 18% of IVB-treated eyes and 24.7% of laser-treated eyes (p=0.556). No cases of endophthalmitis were reported in either group.

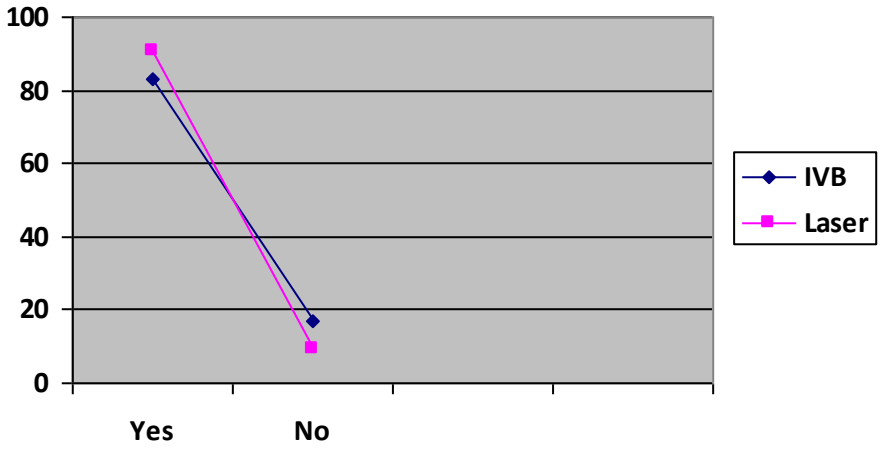

Figure-1: Statistical presentation of comparison of retinopathy regression between two treatment group (IVB treated group and laser treated group)

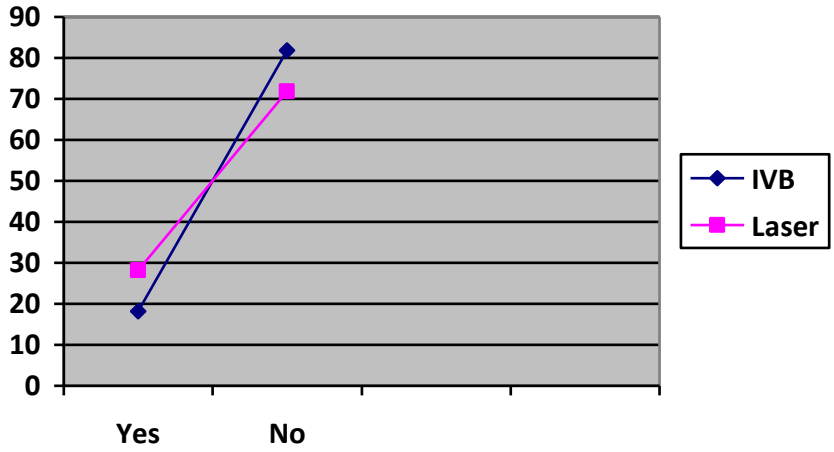

Figure-2: Statistical presentation of comparison of vitreous haemrrhage complication between two treatment group (IVB treated group and laser treated group)

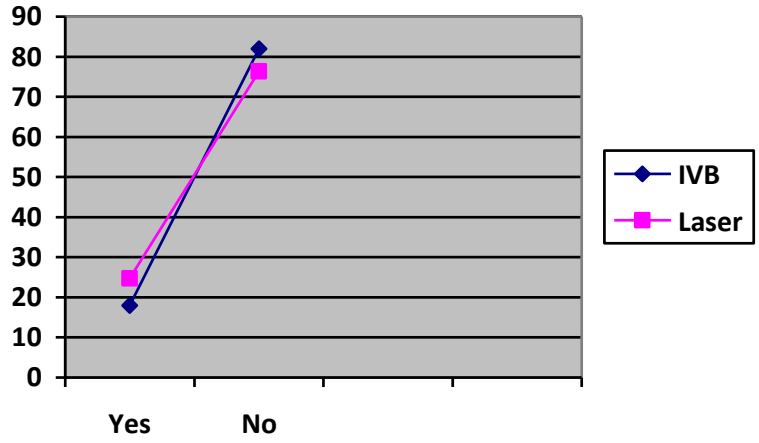

Figure-3: Statistical presentation of comparison of tractional retinal detachment complication between two treatment group (IVB treated group and laser treated group)

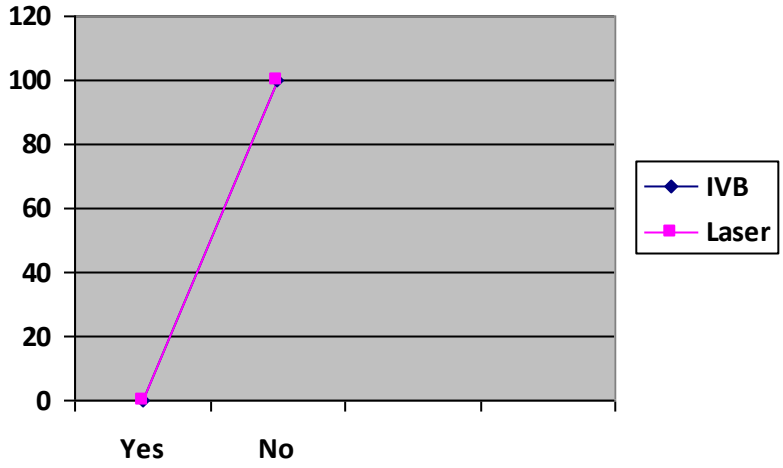

Figure-4: Statistical presentation of comparison of endophthalmitis complication between two treatment group (IVB treated group and laser treated group)

DISCUSSION

This study compared the treatment outcomes of intravitreal bevacizumab (IVB) and Nd: YAG laser photocoagulation in infants diagnosed with retinopathy of prematurity (ROP). The findings align with growing evidence that both modalities are effective in managing type 1 ROP and aggressive posterior ROP (AP-ROP), but with varying safety profiles and clinical outcomes.

The study revealed that retinopathy regression occurred in 82.8% of IVB-treated eyes and 90.6% of laser-treated eyes, with no statistically significant difference. These results are consistent with the Early Treatment for Retinopathy of Prematurity (ETROP) study, which supported the use of laser photocoagulation as the standard of care in treatment-warranted ROP [18]. However, our findings also resonate with the BEAT-ROP study, which reported better outcomes in zone I ROP using IVB compared to laser [3].

The slightly higher regression rate in the laser group might be influenced by the higher proportion of AP-ROP cases in the IVB group. Similar demographic differences have been reported to impact treatment outcomes [19]. Notably, this study observed that AP-ROP was more prevalent in the laser group (46.7%) than in the IVB group (3.3%), potentially affecting comparative interpretations.

Complications such as vitreous hemorrhage and progression to tractional retinal detachment (TRD) were more common in the laser group, though not statistically significant. This trend supports the results from studies such as Martinez-Castellanos et al. and Hwang et al., which found fewer ocular complications following anti-

VEGF therapy than laser [15,20]. Laser photocoagulation, while effective, induces greater inflammation and retinal scarring, which may increase the risk of TRD [12,13].

None of the infants in either group developed endophthalmitis, which is encouraging and underscores the procedural safety of both interventions. However, anti-VEGF agents such as bevacizumab have raised concerns regarding systemic safety due to VEGF suppression in neonates. Sato et al. and others have documented reduced serum VEGF levels post-injection, raising the possibility of systemic developmental implications [14,21]. This potential risk has led some authors to call for cautious use of IVB in premature infants [22,23].

Another noteworthy concern is the potential for late recurrence of disease following IVB therapy. Studies such as Hu et al. and Mireskandari *et al.,* have documented delayed reactivation of neovascularization, which may occur weeks or months after initial regression [16,17]. Therefore, infants treated with IVB require longer follow-up periods than those treated with laser to monitor for recurrence.

Regarding refractive outcomes, several long-term studies, including Harder et al. and Geloneck et al., have shown that IVB is associated with significantly less myopia than laser therapy [14,24]. Although refractive status was not assessed in this study, it remains an important consideration for future comparative trials.

The data collection and procedural implementation in this study reflect the real-world scenario in a tertiary-level neonatal care facility in a developing country. Unlike some randomized controlled trials, this prospective observational study reflects practical constraints and demographic diversity, which adds external validity. However, the non-randomized design may introduce selection bias, especially given the non-probabilistic sampling method.

Our findings support those of Chen et al. and Ahmed et al., who also reported comparable efficacy between IVB and laser but emphasized IVB's ease of administration and reduced need for anesthesia [19,25]. This is particularly relevant in low-resource settings where access to anesthesia services and trained personnel may be limited.

The growing interest in combined therapy (laser + IVB) also warrants mention. Yoon et al. and Nazari et al. demonstrated better structural and functional outcomes using a combined approach in zone I disease and cases with hemorrhage [26,27]. While our study focused on monotherapy comparisons, future research should explore combination protocols, particularly for AP-ROP.

In summary, this study contributes to the body of evidence that both IVB and Nd: YAG lasers are effective in the treatment of ROP, with minor differences in safety and regression profiles. Given the distinct advantages and limitations of each therapy, individualized treatment decisions based on disease severity, systemic health, and resource availability remain essential.

Limitations of the study

This study's limitations include its non-randomized, observational design, potential selection bias, and single-center setting, limiting generalizability. The sample size allowed preliminary analysis but was underpowered for subgroup comparisons.

CONCLUSION

This study demonstrates that both intravitreal bevacizumab and Nd: YAG laser are effective and safe treatment options for type 1 and aggressive posterior retinopathy of prematurity. While laser therapy showed slightly higher regression rates, bevacizumab was associated with fewer complications, such as vitreous hemorrhage and tractional retinal detachment. No cases of endophthalmitis occurred in either group. These findings suggest that treatment choice should be individualized, considering disease severity, institutional resources, and patient-specific factors. Continued monitoring and long-term follow-up are essential, particularly for bevacizumab-treated infants, due to the risk of delayed recurrence and potential systemic implications.

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Conflicts of interest: There are no conflicts of interest.

Ethical approval: The study was approved by the Institutional Ethics Committee.

REFERENCES

1. Gilbert C. Retinopathy of prematurity: a global perspective of the epidemics, population of babies at risk and implications for control. Early Hum Dev. 2008;84(2):77-82.
2. Martínez-Castellanos MA, Schwartz S, Hernández-Rojas ML, Kon AC, Sánchez AV, Cabrera-Marante O, et al. Short-term outcome after intravitreal ranibizumab injections for the treatment of retinopathy of prematurity. Br J Ophthalmol. 2013;97(7):816-9.
3. Mintz-Hittner HA, Kennedy KA, Chuang AZ. Efficacy of intravitreal bevacizumab for stage 3+ retinopathy of prematurity. N Engl J Med. 2011;364(7):603-15.

4. Chung EJ, Kim JH, Ahn HS, Koh HJ. Combination of laser photocoagulation and intravitreal bevacizumab (Avastin®) for aggressive zone I retinopathy of prematurity. Graefes Arch Clin Exp Ophthalmol. 2007;245(11):1727.
5. Alon T, Hemo I, Itin A, Pe'er J, Stone J, Keshet E. Vascular endothelial growth factor acts as a survival factor for newly formed retinal vessels and has implications for retinopathy of prematurity. Nat Med. 1995;1(10):1024.
6. Kim KJ, Li B, Winer J, Armanini M, Gillett N, Phillips HS, et al. Inhibition of vascular endothelial growth factor-induced angiogenesis suppresses tumour growth in vivo. Nature. 1993;362(6423):841.
7. Hartnett ME, Penn JS. Mechanisms and management of retinopathy of prematurity. N Engl J Med. 2012;367(26):2515-26.
8. Palmer E, Biglan A, Hardy R. Retinal ablative therapy for active retinopathy of prematurity: history, current status and prospects. Contemp Issues Fetal Med Neurol. 1985; 2:207-28.
9. Cryotherapy for Retinopathy of Prematurity Cooperative Group. Multicenter trial of cryotherapy for retinopathy of prematurity: preliminary results. Pediatrics. 1988;81(5):697-706.
10. Capone A Jr, Trese MT, Williams GA, Boros LG, Fang SR. Diode-laser photocoagulation for zone 1 threshold retinopathy of prematurity. Am J Ophthalmol. 1993;116(4):444-50.
11. Smith LE. Through the eyes of a child: understanding retinopathy through ROP—the Friedenwald lecture. Invest Ophthalmol Vis Sci. 2008;49(12):5177-82.
12. White JE, Repka MX. Randomized comparison of diode laser photocoagulation versus cryotherapy for threshold retinopathy of prematurity: 3-year outcome. J Pediatr Ophthalmol Strabismus. 1997;34(2):83-7.
13. Gonzalez VH, Albini TA, Brito M, Giani A, Berrocal AM. Confluent laser photocoagulation for the treatment of retinopathy of prematurity. J Pediatr Ophthalmol Strabismus. 2010;47(2):81-5.
14. Harder BC, von Baltz S, Jonas JB, Schlichtenbrede FC. Intravitreal bevacizumab for retinopathy of prematurity: refractive error results. Am J Ophthalmol. 2013;155(6):1119-24. e1.
15. Martínez-Castellanos MA, Schwartz S, Hernández-Rojas ML, Kon-Jara VA, García-Aguirre G. Long-term effect of antiangiogenic therapy for retinopathy of prematurity up to 5 years of follow-up. Retina. 2013;33(2):329-38.
16. Hu J, Blair MP, Shapiro MJ, Lichtenstein SJ, Galasso JM. Reactivation of retinopathy of prematurity after bevacizumab injection. Arch Ophthalmol. 2012;130(8):1000-6.
17. Mireskandari K, Adams GGW, Tehrani NN. Recurrence of retinopathy of prematurity following bevacizumab monotherapy: is it only the tip of the iceberg? JAMA Ophthalmol. 2013;131(4):544-5.
18. Good WV; Early Treatment for Retinopathy of Prematurity Cooperative Group. Final results of the Early Treatment for Retinopathy of Prematurity (ETROP) randomized trial. Trans Am Ophthalmol Soc. 2004; 102:233.
19. Chen T, Schachar I, Moshfeghi DM. Outcomes of intravitreal bevacizumab and diode laser photocoagulation for treatment-warranted retinopathy of prematurity. Ophthalmic Surg Lasers Imaging Retina. 2018;49(2):126-31.
20. Hwang CK, Hubbard GB, Hutchinson AK, Lambert SR. Outcomes after intravitreal bevacizumab versus laser photocoagulation for retinopathy of prematurity: a 5-year retrospective analysis. Ophthalmology. 2015;122(5):1008-15.
21. Padhi T, Bhunia S, Shah M, Sahu S, Das T, Bhusal U, et al. Outcome of eyes treated for retinopathy of prematurity in posterior zone I. Retina. 2024; 44:1073-82.
22. Zayek M, Parker K, Rydzewska M, Rifai A, Bhat R, Eyal F. Bevacizumab for retinopathy of prematurity: 2-year neurodevelopmental follow-up. Am J Perinatol. 2020; 38:1158-66.
23. Rodriguez S, Blair M, Shapiro M, Berrocal A, Murray T, Martínez-Castellanos M, et al. Neurodevelopmental outcomes of preterm infants with retinopathy of prematurity by treatment. Pediatrics. 2019;145.
24. Geloneck MM, Chuang AZ, Clark WL, Hunt MG, Norman AA, Packwood EA, et al. Refractive outcomes following bevacizumab monotherapy compared with conventional laser treatment: a randomized clinical trial. JAMA Ophthalmol. 2014;132(11):1327-33.
25. Ahmed K, Ali A, Delwadia N, Greven M. Neurodevelopmental outcomes following intravitreal bevacizumab with laser versus laser photocoagulation alone for retinopathy of prematurity. Ophthalmic Surg Lasers Imaging Retina. 2020;51(4):220-4.
26. Yoon J, Shin D, Kim S, Ham D, Kang S, Chang Y, et al. Outcomes after laser versus combined laser and bevacizumab treatment for type 1 retinopathy of prematurity in zone I. Retina. 2017; 37:88-96.
27. Nazari H, Modarres M, Parvaresh MM, Nowroozzadeh MH, Ghasemi Falavarjani K. Intravitreal bevacizumab in combination with laser therapy for the treatment of severe retinopathy of prematurity (ROP) associated with vitreous or retinal hemorrhage. Graefes Arch Clin Exp Ophthalmol. 2010;248(12):1713-8.