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(CASE REPORT)

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Synergistic Effects of Diabetic and Hypertensive Retinopathy in a Middle-Aged Patient: Case Report

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Abstract

Background: Diabetes mellitus (DM) and hypertension (HTN) are key drivers of microvascular retinal damage. Coexisting diabetic retinopathy (DR) and hypertensive retinopathy (HR) synergistically exacerbate retinal pathology, increasing the risk of irreversible vision loss. This Case Report details the management of severe proliferative diabetic retinopathy (PDR) and high-grade hypertensive retinopathy.

Methods: A 55-year-old male with a 12-year history of poorly controlled type 2 DM (HbA1c 9.1%) and chronic HTN (≈170/100 mmHg) presented with progressive bilateral vision loss. Managed at Dr. Jawahar Lal Rohtagi Memorial Eye Hospital, Kanpur, from 2018 to 2025, his ophthalmic evaluation showed best-corrected visual acuity of 6/18 OD and 6/24 OS. Dilated fundus examination, fundus photography, and fluorescein angiography confirmed active PDR with high-risk neovascularization and Grade III hypertensive retinopathy, characterized by severe arteriolar narrowing, arterio-venous nicking, haemorrhages, and cotton-wool spots. Spectral-domain optical coherence tomography verified centre-involving diabetic macular oedema (DME) with elevated central retinal thickness.

Results: A multidisciplinary approach was employed, including intensified insulin therapy for glycaemic control, an optimized antihypertensive regimen (ACE inhibitor, calcium channel blocker, diuretic), and ocular interventions. Pan-retinal photocoagulation addressed PDR, while intravitreal ranibizumab injections treated DME. Over 7 years, stabilization of proliferative changes, reduction of DME and systemic improvements preserved functional vision.

Conclusion: Coexisting PDR and HR require urgent, coordinated intervention. Evidence-based ocular therapies (anti-VEGF, PRP) and rigorous systemic control of glycaemia and blood pressure are critical for vision preservation and mitigating vascular risks.

Keywords: Diabetes mellitus; Hypertension; Diabetic retinopathy; Hypertensive retinopathy; Optical coherence tomography; Pan-retinal photocoagulation; Anti-VEGF; Multidisciplinary care

1. Introduction

Diabetes Mellitus (DM) and systemic hypertension (HTN) are prevalent global diseases, frequently coexisting, and are the two most significant modifiable risk factors for microvascular dysfunction [1, 2]. Retinal manifestations, diabetic retinopathy (DR) and hypertensive retinopathy (HR), serve as accessible biomarkers reflecting systemic vascular damage [3].

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Diabetic retinopathy, particularly in its proliferative stage (PDR), results from chronic hyperglycaemia leading to retinal ischemia, increased vascular endothelial growth factor (VEGF) production, neovascularization, and potentially tractional retinal detachment [4]. Conversely, HR is a direct result of increased systemic pressure, manifesting as arteriolar changes, ischemia (cotton-wool spots), and exudation [5].

Critically, HTN is an independent and potent risk factor for the incidence and accelerated progression of DR [6, 7]. When both conditions are poorly controlled, the underlying pathology involving chronic inflammation, endothelial dysfunction, and basement membrane thickening is exponentially amplified, leading to severe and rapid retinopathy that is often refractory to standard treatment unless systemic control is achieved [8, 9].

This case report details the management of a 55-year-old male with a 12-year history of poorly controlled type 2 DM (HbA1c 9.1%) and chronic HTN (≈170/100 mmHg), who presented with progressive bilateral vision loss. Treated at Dr. Jawahar Lal Rohtagi Memorial Eye Hospital, Kanpur, from 2018 to 2025, his case exemplifies the clinical challenges of managing concomitant high-grade PDR and severe HR. It underscores the necessity of integrated systemic and ocular therapeutic strategies to stabilize sight-threatening complications and preserve vision.

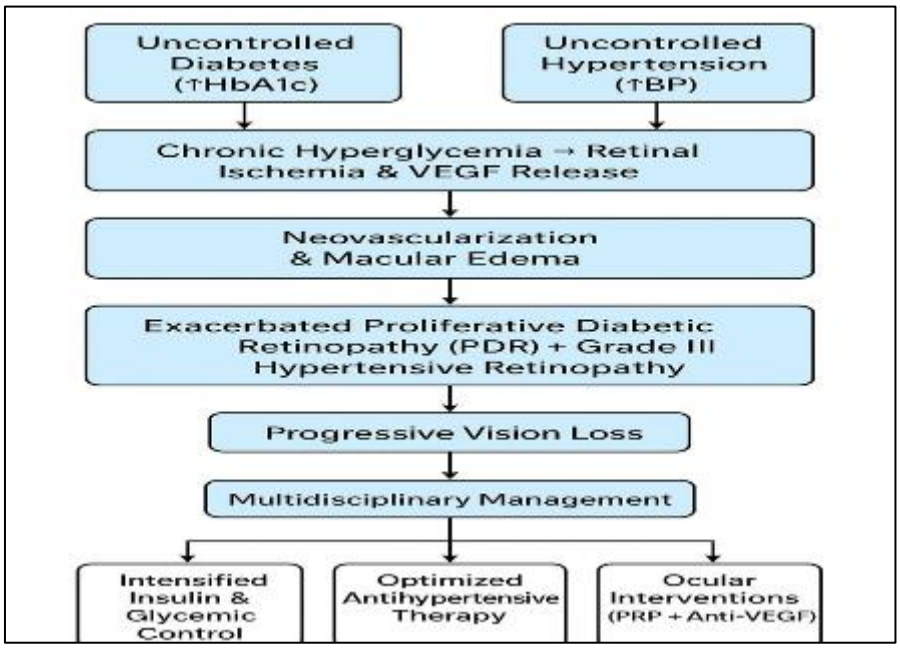

Figure 1 Flow Chart: Synergistic Mechanism & Management of DR + HR

2. Case presentation and methods

2.1. Patient History and Initial Assessment (2018)

A 55-year-old male presented to the Dr. Jawahar Lal Rohtagi Memorial Eye Hospital in 2018 reporting progressive, painless blurring of vision bilaterally over the preceding six months. His medical history included type 2 DM for 12 years and essential HTN for approximately 10 years.

Systemic evaluation revealed consistently poor control:

- Glycaemic status: HbA1c 9.1% (Target <7.0%).
- Blood Pressure (BP): Averaged 170/100 mmHg across multiple readings (Target <140/90 mmHg, ideally lower in DM [10]).
- Current medication adherence was inconsistent, comprising oral hypoglycaemic and a single, low-dose antihypertensive (thiazide diuretic).

2.2. Ophthalmic Examination and Diagnosis

2.2.1. Visual Acuity

Best-Corrected Visual Acuity (BCVA): 6/18 OD (Right Eye), 6/24 OS (Left Eye).

- Anterior Segment: Unremarkable, clear crystalline lenses.

2.3. Fundus Examination (Dilated):

- Diabetic Retinopathy Findings: Both eyes showed features consistent with High-Risk Proliferative Diabetic Retinopathy (PDR), including extensive intraretinal hemorrhages, numerous hard exudates, cotton-wool spots, venous beading, and significant neovascularization of the disc (NVD) and neovascularization elsewhere (NVE).
- Hypertensive Retinopathy Findings: Features corresponded to Keith-Wagener Grade III retinopathy [5]: prominent arteriolar narrowing, diffuse retinal haemorrhages, severe arterio-venous (A-V) nicking, and multiple cotton-wool spots (suggesting acute ischemia due to severe HTN).
- Macula: Thickening and oedema were clinically apparent bilaterally.

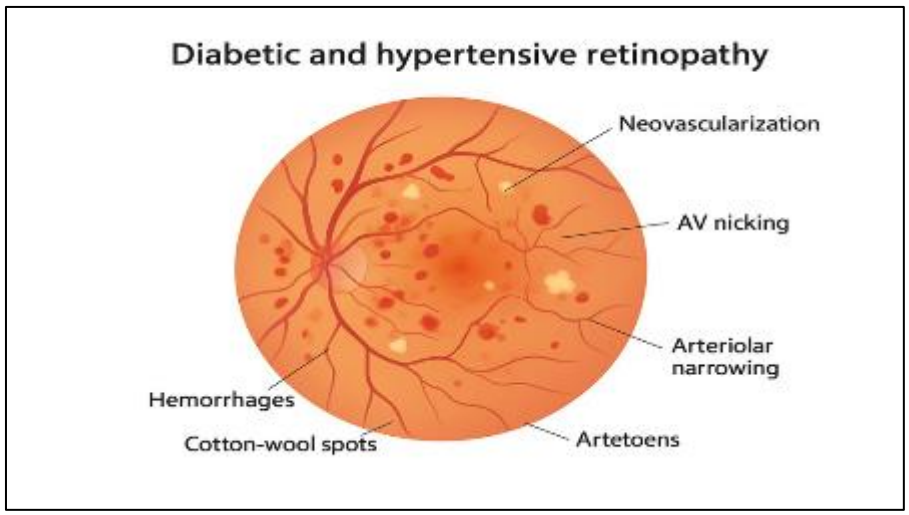

Figure 2 Overlapping Retinal Changes in Diabetes and Hypertension

2.4. Diagnostic Imaging

- Fundus Photography and Fluorescein Angiography (FA): FA confirmed widespread non-perfusion areas (retinal ischemia), extensive leakage from active PDR neovascularization (NVD/NVE), and diffuse capillary leakage in the macula. It also highlighted the extensive vascular irregularities characteristic of severe HTN.
- Spectral-Domain Optical Coherence Tomography (SD-OCT): SD-OCT confirmed the presence of centre-involving Diabetic Macular Oedema (DME) in both eyes.
  - OD Central Retinal Thickness (CRT): 510 µm
  - OS CRT: 555 µm The OCT scans showed intraretinal cysts and subretinal fluid, consistent with chronic vascular leakage [11, 12].
- Final Diagnosis: High-Risk Proliferative Diabetic Retinopathy with Centre-Involving Diabetic Macular Oedema, coexisting with Grade III Hypertensive Retinopathy, bilaterally.

3. Results

Treatment and Follow-up: 2018–2025

3.1. Systemic Intervention

The patient was immediately referred for comprehensive endocrinology and cardiology consultations. The synergistic nature of the retinal damage was emphasized as a reflection of high cardiovascular risk [13].

- Glycaemic Control: Oral hypoglycaemics were discontinued and replaced with an intensified insulin regimen. HbA1c improved gradually, stabilizing at ~7.2% by the second year of comprehensive treatment.

- Hypertension Management: The antihypertensive regimen was escalated to include an ACE inhibitor (Lisinopril), a calcium channel blocker (Amlodipine), and optimization of diuretic therapy. BP targets were achieved and maintained below 132/84 mmHg (vs baseline 170/100 mmHg) within 12 months [10, 14].
- Lipid Management: Statin therapy was initiated to manage associated hyperlipidaemia.

3.2. Ocular Management

Ocular treatment was initiated promptly to control the active proliferation and macular oedema:

Table 1 Treatment Interventions and Rationales for PDR and DME/PDR Activity

Intervention	Treatment Protocol	Rationale
PDR	Pan-Retinal Photocoagulation (PRP)	Reduction of ischemic drive and regression of neovascularization [15].
DME/PDR Activity	Intravitreal Ranibizumab (Anti-VEGF)	Loading phase (3 monthly injections) followed by PRN/treat-and-extend regimen.

3.3. Timeline and Outcomes:

- Year 1 (Initial Management): The patient received three sessions of sectoral PRP (to complete the periphery) and the three initial loading doses of ranibizumab bilaterally.
- Macular Response: CRT decreased significantly post-loading phase (OD: 320 µm, OS: 350 µm). BCVA improved slightly (OD: 6/12, OS: 6/18).
- PDR Response: Regression of NVD/NVE was noted on subsequent FA, confirming treatment efficacy.
- Years 2–7 (Maintenance and Stabilization): The patient continued with a PRN regimen of anti-VEGF injections (averaging 3–4 injections per year per eye initially, reducing to 1–2 by Year 5) coupled with sustained systemic control.

Table 2 Summary of Systemic and Ocular parameters at baseline (2018) and after 7 years of treatment (2025)

Parameter	Initial (2018)	Final (2025)	Outcome
HbA1c	9.1%	7.2%	Improved systemic control
BP	170/100 mmHg	132/84 mmHg	Controlled HTN
BCVA (OD/OS)	6/18, 6/24	6/9, 6/12	Vision preserved
CRT (OD/OS)	510 µm / 555 µm	<300 µm	Macular oedema resolved
DR Status	High-Risk PDR	Stable, regressed	PRP scars only
HR Status	Grade III	Mild, stable	Fewer haemorrhages
Ocular Interventions	PRP + Ranibizumab	Maintenance PRN	Reduced progression

Final Status (2025): The retina remains stable. PDR is regressed, and only PRP scars remain. HR signs have lessened (less haemorrhaging, stable A-V ratios). Final BCVA: 6/9 OD, 6/12 OS. CRT is maintained within normal limits (<300 µm).

4. Discussion

This case powerfully illustrates the detrimental impact of synergistic retinopathy, where uncontrolled DM and HTN combined to cause severe, rapidly progressing microvascular damage. The severity of the presenting retinopathy (PDR + Grade III HR) mirrored the patient's long-standing, poorly managed systemic disease.

4.1. Pathophysiological Synergy

The coexistence of DR and HR multiplies the risk of visual loss compared to either condition alone [9, 18]. Hypertension exacerbates the ischemia caused by diabetes in several ways:

Impaired Autoregulation: HTN damages retinal arterioles, impairing the retina's ability to regulate blood flow, which is already compromised by hyperglycaemic damage [5].

Increased Barrier Breakdown: High systemic pressure forces fluid and macromolecules across damaged endothelial tight junctions, accelerating the formation of DME [19].

Enhanced Inflammatory Cascade: The combination amplifies the release of pro-inflammatory cytokines and growth factors (like VEGF), driving both macular oedema and neovascular proliferation [4, 20]. Clinical studies confirm that prompt and strict BP control significantly reduces the risk of DR progression [10, 21].

4.2. Management Rationale

The treatment strategy necessitated a dual ophthalmic approach coupled with aggressive systemic optimization:

- Anti-VEGF Therapy: Ranibizumab was crucial for immediate control of the active PDR leakage and reduction of the vision-threatening DME. Current guidelines recommend anti-VEGF as first-line therapy for centre-involving DME, often yielding superior results to laser alone [16, 22]. Furthermore, anti-VEGF agents can stabilize PDR activity rapidly, often complementing PRP [17].
- PRP: Despite the heavy reliance on anti-VEGF, PRP remains essential for managing widespread peripheral ischemia in PDR, reducing the long-term risk of recurrent neovascularization [15]. A combination strategy was necessary to halt the high-risk proliferation driven by the severe combined microvascular insult.
- Systemic Control: The most significant factor in achieving long-term stability was the successful optimization of BP and HbA1c. Retinal stability cannot be maintained if the underlying systemic drivers (HTN and DM) are left unchecked [8]. The successful lowering of the patient's BP and HbA1c was critical in reducing the ischemic and inflammatory load on the retina [14].

4.3. Systemic Implications

The presence of Grade III Hypertensive Retinopathy in this patient is not just an ocular finding; it carries serious systemic prognostic implications. Retinal vascular changes correlate strongly with cerebrovascular and cardiovascular events, including stroke and myocardial infarction [13, 23]. Therefore, the successful treatment of his ocular disease served as an indicator of improved systemic vascular health, emphasizing the essential role of interdisciplinary coordination (Ophthalmologist, Endocrinologist, Cardiologist) [24].

Limitations

As a single case report, the generalizability of these findings may be limited. However, it serves as a powerful reminder of the complex interplay between diabetes and hypertension and the compounded challenges they pose in retinal disease management.

5. Conclusion

This case report demonstrates the synergistic retinal pathology resulting from the co-morbidities of uncontrolled diabetes and hypertension, leading to PDR with DME and Grade III HR. Comprehensive management combining aggressive systemic control via medication adherence and lifestyle changes, along with timely, evidence-based ocular intervention (PRP and intravitreal anti-VEGF therapy), successfully halted the progression of sight-threatening complications and preserved functional vision over a 7-year follow-up period. The successful outcome reinforces the clinical mandate for early screening, strict metabolic and hemodynamic control, and a coordinated multidisciplinary approach in patients suffering from complex microvascular diseases.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest concerning this case report.

Statement of ethical approval

The study was approved by the Institutional Ethics Committee.

Statement of informed consent

Informed consent was obtained from all participants included in the study

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