Research Article

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Core Secret of Preventing Diabetic Retinopathy!

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ABSTRACT

It is estimated that around 101 million adults lived with diabetes worldwide, in 2020 and this number is projected to be 150 million in 2025. While Macrovascular complications involve damage to large blood vessels due to chronic hyperglycaemia and insulin resistance, significantly increasing risks of coronary artery disease, stroke, and peripheral arterial disease, Microvascular complications of diabetes are long-term, chronic damage to small blood vessels caused by high blood sugar, affecting eyes, kidneys, and nerves. The primary complications include retinopathy, nephropathy, Neuropathy.

Among the diabetics, nearly 5–7%, approximately 4 to 6 million individuals have either lost their sight or are already at risk of sight-threatening diabetic retinopathy (STDR). Diabetic Retinopathy (DR) is often a silent yet steadily rising cause of avoidable blindness in India. As the prevalence of diabetes continues to rise, its ocular complications are emerging as a major public health concern. The concept of "metabolic memory." highlights that early & intensive sugar control can lead to significant long-term benefits, including reduced risks for microvascular & macrovascular complications.

Maintaining good blood sugar control early in the disease course decreases the risk of severe complications Like Diabetic Retinopathy, Neuropathy and Nephropathy in the future. As there is no single magic pill, comprehensive strategy advocated to minimize the risk includes i) Maintaining good blood sugar control, right from the beginning at T2D onset is critical due to metabolic memory ii) Annual screenings for diabetic retinopathy and nephropathy for early detection and management iii) Effective prevention of complications through a holistic approach including lifestyle modifications & medication adherence iv) Access to emerging therapies like Intraocular steroids & SGLT2 inhibitors, promise results.

Materials & Methods: This article is based on three anecdotal cases of DR, two needing interventions and an autobiography of this author successfully preventing DR for 35 years

Outcomes: Two of the cases are benefitted one with vitrectomy and laser photocoagulation, second with Ayurvedic treatment. This author the third case has been successfully preventing Retinopathy even after 35 years of onset of diabetes through comprehensive management advocated.

Abbreviations

VTDR	:	Vision-threatening diabetic retinopathy (VTDR)
DME	:	Diabetic macular oedema
PDR	:	Proliferative diabetic retinopathy

Introduction

Microvascular complications of diabetes are long-term, chronic damage to small blood vessels caused by high blood sugar, affecting eyes, kidneys, and nerves. Macrovascular complications involve damage to large blood vessels due to chronic hyperglycaemia and insulin resistance, significantly increasing risks of coronary artery disease, stroke, and peripheral arterial disease The primary complications include retinopathy, nephropathy, Neuropathy. Chronic Hyperglycaemia, directly cause endothelial damage. Development of disease is driven by increased oxidative stress & the production of advanced glycation end-products (AGEs). The basement membrane of capillaries thickens & becomes "leaky," reducing blood flow and damaging surrounding tissues. Managing blood glucose, blood pressure, and lipids is crucial to delay or prevent these conditions [1-4].

The concept of "metabolic memory." highlights that early & intensive sugar control can lead to significant long-term benefits, including reduced risks for microvascular & macrovascular complications. Maintaining good blood sugar control early in the disease course decreases the risk of severe complications Like Diabetic Retinopathy, Neuropathy and Nephropathy in the future [1]. As there is no single magic pill, comprehensive strategy advocated includes i) Maintaining good blood sugar control, right from the beginning at T2D onset is critical

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due to metabolic memory ii) Annual screenings for diabetic retinopathy and nephropathy are essential for early detection and management iii) Effective prevention of complications requires a holistic approach including lifestyle modifications & medication adherence iv) Intraocular steroids & SGLT2 inhibitors, the emerging therapies show promise in effectively managing complications v) Effective management must commence at T2D onset [1-3].

Diabetic Retinopathy (DR) is a rapidly growing global health crisis and the leading cause of vision impairment and blindness in working-age adults worldwide. As diabetes continues to spread worldwide, the population affected by diabetic retinopathy has increased from 103 million in 2020 to 150 million in 2025 and is projected to go up to 160 million by 2045. Duration of the Diabetes is the strongest predictor as after 20 years of diabetes, 99% of type 1 and 60% of type 2 patients have some degree of retinopathy. Uncontrolled hyperglycaemia (HbA1c > 7) and high blood pressure are primary drivers of progression. Females have a higher disease burden and higher rates of DR-related blindness than males, especially in low-income regions. Limited access to trained ophthalmologists and Fundoscopy in rural and low-income settings, low levels of annual thorough eye exams contribute to the status [5-7].

At present, an estimated 27–35% of individuals with diabetes are affected by some form of diabetic retinopathy (DR). Vision-threatening diabetic retinopathy (VTDR), resulting from macular oedema (DME) and proliferative diabetic retinopathy (PDR), occurs in approximately 10% of people with diabetes. VTDR cases are projected to reach 56.3 million by 2030 if the National and Provincial Governments do not take urgent action [7].

This article is based on three anecdotal cases of DR, two needing interventions and an autobiography of this author successfully preventing DR even after 35 years of diabetes.

Case Reports

Case 1: A Case of Proliferative DR Needing Photocoagulation (2025)

A 67-year-old female with a 12-year history of diabetes and hypothyroidism, reported to me with sudden bilateral visual blurring. Referral to a private dedicated eye hospital diagnosed the case as Proliferative Diabetic Retinopathy PDR. She underwent intravitreal injections, which improved a bit but not to her satisfaction. Later she required vitrectomy and laser photocoagulation to manage tractional retinal detachment after which she is stable for last 3 months.

Case 2: A case of DR & Ayurvedic Treatment

A 67-year-old female patient having history of T2 DM for 10 years, reported with bilateral signs of i) Blurry or fluctuating vision ii) Difficulty seeing at night iii) Floaters iv) Distorted vision in Right eye v) Sudden partial vision loss in both eyes. Clinical assessment and Fundoscopy diagnosed it as a case of PDR and Diabetic Macular oedema in both eyes, and she was treated with Ayurvedic medications Amapachana, Nithya virechana, Nasya, topical ocular procedures which included Seka, Bidalaka, Tarpana, Putapaka and Anjana. All above procedures were done for 3 sittings and follow up every 3 months for 2 years The treatment improved visual acuity in the right eye from hand movement to 3/60 and left eye from 6/24 to 6/12(P), showcasing the potential of Ayurvedic approaches in managing DR. The holistic approach aims to promote healing, offering hope for patients with this debilitating condition.

Case 3: Comprehensive Metabolic Control- Autobiography of the Author preventing DR

This author was diagnosed as a diabetic in 1991 in a routine annual health check-up. It's more than 35 years of Diabetes and has been able to minimize the development of Diabetic Retinopathy. What I did meticulously year after are 1) made all out efforts to keep my Fasting Blood sugar under 130mg/Dl and Hb1Ac under 7% most of the years since 1991. The initial oral antibiotics included Metformin 500 mg twice a day after main meals, Acarbose (50mg) (Tab Glucobay) just before Breakfast and Lunch and 25 mg just before dinner and Amaryl (sulfonylureas) 2 mg half an hour before lunch & dinner. Only once it went up to 8% in 2017, when expert endocrinologist in Delhi added EMPAGLIFLOZIN-10 MG which is increased to 25 mg since 2024. which works by blocking the sodium-glucose co-transporter-2 (SGLT-2) enzyme. EMPAGLIFLOZIN lowers renal glucose reabsorption and increases glucose excretion in the urine by inhibiting SGLT2. As a result, it lowers blood sugar levels in people with diabetes. 2) Avoided rapid fluctuations with splitting diet intake in 5-6 helpings in day and rapid reduction of Hb1 AC throughout 3) I had to undergo CABG in August 2005 and since then managing BP below 130/80 4) Similarly, have been able to maintain Cholesterol and LDL within upper limits and improving HDL consuming dry fruits 5) Annual dilated Fundal check-ups for diabetic retinopathy 6) Life style changes opted include regular walking of 4-5 km 6 days a week and adding Gym since 2018 and Meditation and Yoga since 2024, a total of 2 hrs on self-discipline and resetting Circadian Rhythm 7)Vit D supplementation once a month and Vit B12 on alternated since 2010. So, after there are no revelation of DR signs.

Discussions

Diabetic retinopathy (DR) affects 12.5% to 16.9% of people with diabetes in India, with an estimated 3 to 4 million people suffering from vision-threatening DR (VTDR). While Long-standing, poorly controlled and fluctuating Hyperglycaemias are the strongest modifiable risk factor, Hypertension, Anaemia, also contribute to the incidence and progression of DR and therefore, comprehensive management of all three risk factors is important [2,3].

Minimizing the risk of diabetic retinopathy (DR) after 25-30 years of diabetes is heavily dependent on maintaining a "metabolic memory" of good control, focusing on blood sugar, blood pressure, and lipid levels, rather than any single "magic pill." The key secret lies in strict, long-term glycaemic control (HbA1c < 7%) combined with annual comprehensive dilated eye exams to detect and manage damage before it causes irreversible vision loss.

A comprehensive breakdown of the factors to minimize DR risk in long-term diabetes are:

- **Strict & Consistent Metabolic Control (The Core Secret):** The most significant factor is keeping haemoglobin A1c (HbA1c) levels close to the target range (< 7%).
- **Avoiding Rapid Fluctuations:** While low blood sugar is

the goal, gradual, steady, and consistent control is safer and more effective for long-term retinal health. Rapid reductions in HbA1c (>1.5% in 3 months) can sometimes cause early worsening of existing retinopathy.

- **Blood Pressure Management:** Tight control of blood pressure is almost as crucial as blood sugar control, with studies indicating that maintaining healthy blood pressure (below 130/80 mmHg) can halt the progression of non-proliferative retinopathy and prevent blindness.
- **Cholesterol and Lipids:** High cholesterol can accelerate retinal vessel damage. Using statins and fenofibrate has been shown to decrease vision loss and prevent DR progression.
- **Routine, Proactive Eye Surveillance:** Even if vision feels fine, annual comprehensive dilated eye exams are non-negotiable, as DR often shows no early symptoms.
- **Specialized Screening:** Advanced diagnostic tools, such as Optical Coherence Tomography (OCT) and digital fundus photography, can identify microaneurysms, leakage, the early signs of vascular damage before they threaten sight.
- **Lifestyle and Preventative Habits:** Smoking increases inflammation and speeds up vessel damage, making it crucial to stop.
- **Dietary Choices:** A Mediterranean-style diet (rich in omega-3 fatty acids, fish, and vegetables) is associated with a 40–70% reduced likelihood of developing advanced DR.
- **Regular Physical Activity:** Engaging in regular exercise helps control blood sugar, lowers BP, and reduces inflammation, provided one does not have proliferative DR (PDR).
- **Nutrient Awareness:** Adequate Vitamin D levels prevent DR development, as Vitamin D receptors are essential in retinal vascular health.
- **Advanced Early Intervention:** If DR is detected, modern treatments like Anti-VEGF Injections, Pan-retinal Photocoagulation are highly effective at halting progression. While Anti-VEGF Injections are the standard for treating macular oedema and blocking new, weak vessel growth, Laser Therapy (Pan-retinal Photocoagulation) is used to seal leaking vessels and destroy abnormal, bleeding vessels, significantly reducing the risk of blindness.

The SMART India Study, a population-based cross-sectional study conducted between Dec 20, 2018, and March 20, 2020, across ten Indian states and one union territory. Sampling design included people aged 40 years or older. It did non-mydriatic retinal screening and assessed risk factor burden for people with diabetes. It reported an overall Prevalence of 12.5% (95% CI 11.0–14.2) for any diabetic retinopathy and 4.0% (95% CI 3.4–4.8) for VTDR. Prevalence was 15.5% in those with known diabetes, compared to 8.0% in those with undiagnosed diabetes. Higher prevalence was observed in states with higher epidemiological transition levels (ETL) and Socio-demographic Index (SDI). This study underscored the urgent need for structured, systematic retinal screening programs, particularly because many cases of retinopathy are present at the time of diagnosis.

Epidemiology of Diabetic Retinopathy

DR is a leading cause of preventable vision loss among working-age adults worldwide. Using Global Burden of Disease 2021 data, it is estimated that the population affected by diabetic retinopathy will increase from 103 million in 2020 to 160.5 million by 2045. The burden is heaviest in Asia, with South Asia the most affected region and China the single most affected country and is concentrated in middle-SDI (sociodemographic index) settings. Women consistently bear a higher burden than men.

DR Burden & Challenges in India

Diabetic Retinopathy (DR) is often a silent yet steadily rising cause of avoidable blindness in India. As the prevalence of diabetes continues to rise, its ocular complications are emerging as a major public health concern. In 2025, it is estimated that around 101 million adults live with diabetes, and this number could exceed 125 million by 2045. Among them, nearly 5–7%—approximately 4 to 6 million individuals—are already at risk of sight-threatening diabetic retinopathy (STDR) [1,6].Among adults aged ≥40 years with diabetes, the national prevalence of vision impairment is 21.1% and blindness is 2.4%, equating to 21 million people with diabetes who are visually impaired and 2.4 million who are blind in India [6]. Among diabetics, the prevalence of DR is 16.9% and sight-threatening DR (STDR) is 3.6% [1]; DR/STDR is more common in known diabetes than in undiagnosed diabetes, with no significant urban–rural difference after national stratification [6]. Critically, 6.0% of adults (≥40 years) screened had undiagnosed diabetes, and 75% of those with known diabetes had sub-optimal glycaemic control, both of which amplify DR risk and late presentation [7]. For population context, among Indians aged ≥50 years 1.99% are blind and 26.68% are visually impaired (presenting VA<6/12), underscoring the need to integrate DR screening and treatment into national avoidable blindness strategies. Forecasts indicate the absolute number of affected individuals and YLDs will continue to rise through 2035, underscoring the need for scale screening, timely treatment, and health-system strengthening in high-burden regions [1,2].

Clinical Presentations

Most diabetics report to Ophthalmic hospitals with the complaints of i) Blurry or fluctuating vision ii) Difficulty seeing at night iii) Floaters iv) Distorted vision in Right eye v) Sudden partial or total vision loss in both eyes.

Diagnosis

Majority of speciality hospitals in Bengaluru and other cities retina screening for diabetes is done comprehensively include following tests: i) Fundus photography ii) Optical Coherence Tomography (OCT) iii) Fluorescein angiography iv) Ultrasound imaging (in advanced cases). These tests enable specialists to determine the precise amount of retinal damage. Retina specialists differentiate Diabetic retinopathies as i) mild Non-Proliferative Diabetic Retinopathy (NPDR), ii) moderate NPDR, iii) severe NPDR, and Proliferative Diabetic Retinopathy (PDR).

A study aimed to assess the prevalence of diabetic retinopathy in type 2 diabetic patients visiting in Karnataka Institute of Endocrinology and Research, Methods, reviewed 5,363 diabetic patients attending the vitreoretinal OPD from November 1st, 2022, to October 31st, 2023. Researchers gathered basic demographic information through a questionnaire, and a thorough dilated examination done by a vitreoretinal specialist. The prevalence of diabetic retinopathy was 30.84 %. Among

5,363 patients, 812 had mild NPDR (15.14%), 438 had moderate NPDR (8.16%), 152 had severe NPDR (2.83%) and 252 patients had PDR (4.69 %). The prevalence of diabetic retinopathy was higher in males (34.82%) compared to females (25.01%). The odds ratio was 1.60. The prevalence of diabetic retinopathy was higher in the age group above 45 years [5].

Between 1970-1975, DR was the 20th cause of blindness, and today, it is the sixth most common cause of blindness in India. A recent study of 316, T2D patients through systematic random sampling. Fundus examination performed by researchers using Volk iNview iPhone fundus camera following ETDRS protocol, reported a prevalence of any grade of DR as 35.4% which included mild nonproliferative (15.5%), moderate non-proliferative (11.7%), severe non-proliferative (3.8%), proliferative (1.6%), and diabetic macular oedema (2.8%). Multivariate analysis identified i) age >60 years (adjusted OR=1.11), ii) diabetes duration >5 years (adjusted OR=1.20), iii) uncontrolled glycemia (adjusted OR=2.25), hypertension (adjusted OR=1.04), previous cataract surgery (adjusted OR=1.76), and overweight/obesity (adjusted OR=1.202) [7].

Multiple small, unorganized hospital-based studies of dedicated hospitals in Bengaluru in last decade reported that 80% of T2D patients with DR had vitamin D deficiency levels <20 ng/ml), indicating a significant association between low vitamin D, poor glycaemic control (HbA1c >8.0), and the severity of retinopathy. Another study in 2021 reported that 61.2% of patients with DR had poor sugar control (HbA1c >8.5%) & only 20.6% knew diabetes affects the eye. The Bangalore Urban Rural Epidemiology Study reported a DR prevalence of 17.6% in the urban diabetic population of Bangalore [8].

Conclusion

Microvascular complications of diabetes are long-term, chronic damage to small blood vessels caused by high blood sugar, affecting eyes, kidneys, and nerves. The primary complications include retinopathy, nephropathy, Neuropathy. Chronic Hyperglycaemia, directly cause endothelial damage. Development of disease is driven by increased oxidative stress & the production of advanced glycation end-products (AGEs). The basement membrane of capillaries thickens & becomes "leaky," reducing blood flow and damaging surrounding tissues. Diabetic Retinopathy (DR) is a rapidly growing global health crisis and the leading cause of vision impairment and blindness in working-age adults worldwide. It is often a silent yet steadily rising cause of avoidable blindness in India. As the prevalence of diabetes continues to rise, its ocular complications are emerging as a major public health concern. All studies highlight the opportunity for early intervention through community-based screening initiatives. The findings emphasize the importance of integrated diabetes management addressing multiple risk domains, particularly glycaemic control, blood pressure, lipids management, and weight optimization, for effective DR prevention and management.

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