Original Article

Severity of diabetic retinopathy and its relationship with age at onset of diabetes mellitus in India: A multicentric study

Deepika C Parameswarappa, Ramachandran Rajalakshmi[1], Ashik Mohamed[2], Sanagavarapu Kavya, Haripriya Munirathnam[3], George Manayath[3], Mathangi Ashok Kumar[4], Rajiv Raman[4], TP Vignesh[5], Kim Ramasamy[5], Sheena Mani[6], Alankrita Muralidhar[7], Manisha Agarwal[7], Giridhar Anantharaman[8], Neha Bijlani[9], Gajendra Chawla[9], Alok Sen[10], Sucheta Kulkarni[11], Umesh C Behera[12], Sobha Sivaprasad[13,14], Taraprasad Das, Padmaja Kumari Rani, on behalf of India Retinal Disease Study group

Purpose: To present clinical profile and risk factors of sight-threatening diabetic retinopathy (STDR) among people with age of onset of diabetes (AOD) <25 versus ≥25 years. **Methods:** A retrospective chart analysis of consecutive patients with diabetic retinopathy (DR) *n* = 654) treated at 14 eye care centers across India between 2018 and 2019 was performed. Patients were divided into two groups, Group 1: AOD <25 years and Group 2: AOD ≥25 years. DR and diabetic macular edema (DME) were classified using the International Clinical Classification of DR severity scale. STDR included severe nonproliferative DR (NPDR), proliferative DR (PDR), and moderate to severe DME. A multilevel mixed-effects model was used for comparison between two groups: 1) Patients with DR and AOD <25 years and 2) Patients with DR and AOD ≥25 years. Bivariate and multivariate regression analyses were used to evaluate risk factors between the two groups. **Results:** A total of 654 patients were included, 161 (307 eyes) in AOD <25 and 493 (927 eyes) in AOD >25 group. There was a higher prevalence of PDR with high-risk characteristics in AOD <25 group (24% vs. 12%) at baseline and 12-month follow-up (25% vs. 6%); $P < 0.001$. Systolic hypertension and poor glycemic control were risk factors in both groups, with no difference in these modifiable risk factors between groups. **Conclusion:** People with youth-onset DM are likely to present with severer form of STDR despite similar modifiable risk factors. Therefore, strict control of systolic blood pressure, glycemic status, and regular screening for DR are recommended to reduce the risk of STDR irrespective of the age of onset of diabetes.

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Duration of diabetes and systemic risk factors impact the severity of diabetic retinopathy (DR) in people with diabetes mellitus (DM).[1] Youth-onset diabetes may not always be due to type 1 diabetes especially with the rising prevalence of early-onset type 2 diabetes mellitus (T2 DM), which was earlier considered as a disorder occurring only in the middle-aged or elderly.[2,3] In India, these data are collected by the Youth Diabetes Registry (YDR). The YDR collates data of people diagnosed with diabetes under 25 years of age. The registry is a multicenter clinic-based database of physician-diagnosed diabetes with the objectives of understanding the disease pattern and geographical variations in India and estimating the burden of diabetes complications. The YDR defined diabetes in youth as the onset of any type of diabetes in persons less than 25 years of age.[2,3] In the USA, the SEARCH for Diabetes in Youth (SEARCH) study, 2000, in five sites across the country, included youth diagnosed with diabetes under age 20 years.[4] It also assessed the natural history and risk factors for acute and chronic diabetes-related complications, quality of care, and quality of life. In YDR, there are more males, and compared to SEARCH, a higher proportion of individuals had high blood pressure (BP) and poor glycemic control.[1] In the SEARCH study, the prevalence of DR in youth was 17% with type 1 DM and 42% with type 2 DM.[4] The YDR has

Smt Kanuri Santhamma Center for Vitreo-Retina Diseases, L V Prasad Eye Institute, Hyderabad, Telangana, [1]Department of Ophthalmology, Madras Diabetes Research Foundation and Dr. Mohan's Diabetes Specialities Centre, Chennai, Tamil Nadu, [2]Ophthalmic Biophysics, L V Prasad Eye Institute, Hyderabad, Telangana, [3]Aravind Eye Hospital, Coimbatore, Tamil Nadu, [4]Sankara Nethralaya, Chennai, Tamil Nadu, [5]Aravind Eye Hospital, Madurai, Tamil Nadu, [6]Dr. Tony Fernandez Eye Hospital, Aluva, Kerala, [7]Dr Shroff's Charity Eye Hospital, Delhi, [8]Giridhar Eye Institute, Kerala, [9]Vision Care And Research Centre, Bhopal, Madhya Pradesh, [10]Sadguru Netra Chikitsalaya, Chitrakot, Madhya Pradesh, [11]PBMA's H V Desai Eye Hospital, Pune, Maharashtra, [12]Retina Vitreous Service, Mithu Tulsi Chanrai campus, L V Prasad Eye Institute, Bhubaneswar, Odisha, India, [13]NIHR Biomedical Research Centre, Moorfields Eye Hospital NHS Foundation Trust, London, [14]Vision Sciences, UCL Institute of Ophthalmology, London, UK

Correspondence to: Dr. Padmaja Kumari Rani, Network Head, Teleophthalmology, L V Prasad Eye Institute, Kallam Anji Reddy Campus, Hyderabad, Telangana - 500 034, India. E-mail: rpk@lvpei.org

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not reported the prevalence of DR youth in India. The rising prevalence in adolescents and young adults is attributed to childhood obesity in the Youth Diabetes Registry (YDR) data of people diagnosed with diabetes under 25 years of age.[2,3] An analogous study in the USA noted younger subjects with high BP and poorly controlled diabetes.[4] Unlike the American study where the prevalence of DR in youth was 17%, the YDR has not documented the prevalence of DR in their people cohort.[2,3] Isolated single-center studies have reported an incidence of 52.9/1000 person years in youth-onset diabetes.[5]

Apart from strict glycemic control, other factors that significantly influence the severity of DR include age, hypertension, obesity, anemia, nephropathy, neuropathy, cardiopathy, and blood dyscrasias.[6-8] The prevalence of DR and its association with duration of DM, high systolic BP (SBP), dyslipidemia, diabetic kidney disease, and anemia have been studied in people with T2 DM in India.[6,9-13] The burden of systemic risk factors for DR in youth-onset diabetes and older–adult-onset diabetes is not yet studied. The present study aims to compare demographics, clinical features, DR severity, and treatment characteristics between people diagnosed with DM under and after the age of 25 years. The study also aims to evaluate the risk factors associated with sight-threatening diabetic retinopathy (STDR) with respect to the age of onset of DM.

Methods

This is a retrospective, multicenter comparative study across 14 tertiary centers in India. A retrospective review of records of consecutive patients diagnosed with diabetes and DR in the hospital electronic register or case records between January 2018 and December 2019 were collected. Local Institutional Review Boards provided the ethics approval for the study. The study followed the tenets of the Declaration of Helsinki.

Systemic data collected included age at presentation, age of onset of diabetes (AOD), duration of diabetes, duration of hypertension (if present), glycated hemoglobin (HbA1c), and treatment details for DM. Systemic history, AOD, duration of DM, and treatment history were evaluated through medical record files and review of physician records. The collected ocular data included presenting best-corrected Snellen visual acuity, the severity of the DR, DME grade when present, and DR treatment modalities in both eyes. Undilated anterior segment examination was performed. Fundus assessment was performed by slit-lamp biomicroscopy and indirect ophthalmoscopy. Optical coherence tomography (OCT) images were acquired using Heidelberg Spectralis HRA and OCT (Heidelberg Engineering, Heidelberg, Germany), Triton SS-OCT device (Topcon Corporation, Tokyo, Japan), and Cirrus HD-OCT (Carl Zeiss Meditec, Dublin, CA). The central macular thickness (CMT) was measured manually as the distance between internal limiting membrane and anterior border of RPE-Bruch's membrane complex at the fovea.

As obtained directly from the OCT, the records with incomplete information were excluded. Baseline data were collected for all patients. Follow-up visits at 3, 6, and 12 months were included, if available. A ±2 months visit window was allowed for each time point.

Patients with DM were stratified into two groups based on the AOD; Group 1: <25 years and Group 2: ≥25 years. DR and DME were graded according to the International Clinical DR Classification severity scale.[14] PDR with high-risk characteristics (HRC) was defined as the presence of vitreous hemorrhage, new vessels at the disc ≥1/4-1/3 disc area in size, or new vessels elsewhere ≥1/2 disc area in size if associated with vitreous hemorrhage. Patients were also further grouped into STDR and non-STDR (N-STDR) groups. The presence of severe nonproliferative diabetic retinopathy (NPDR), proliferative diabetic retinopathy (PDR), PDR with HRC, moderate DME, and severe DME were grouped under STDR. The presence of mild NPDR, moderate NPDR, and mild DME were grouped under N-STDR. The risk factors for DR were analyzed in both groups. Number of laser sittings, intravitreal injections, and vitreoretinal interventions required in both groups were also analyzed.

The statistical analysis was performed using software STATA v14.2 (StataCorp, College Station, TX, USA). A multilevel mixed-effects model, using maximum likelihood estimation, with random intercepts at the levels of the region (north/south India) and subject (right/left eye) was used in the comparison between patients with AOD <25 years and ≥25 years, and between N-STDR and STDR groups. Bivariate and multivariate mixed-effects regression analyses were used to evaluate risk factors for STDR in both groups. Odds ratio (OR) and 95% confidence intervals (CIs) were estimated by multilevel logistic regression. A P value of < 0.05 was considered statistically significant.

Results

A total of 654 individuals with DR were included in the study: 161 people (307 eyes) in Group 1 (AOD <25 years) and 493 people (927 eyes) in Group 2 (AOD ≥25 years).

Demography and DM status

The median age at the time of the study was significantly lower in Group 1 (33 years with interquartile range, IQR, 28–36 years, mean 32.3 ± 6 years) than in Group 2 (50 years with IQR 39–61 years, 50.5 ± 12.3 years). Median AOD was 18 years (IQR, 13.3–22.2 years, mean 17.4 ± 6 years) in Group 1 and 37 years (IQR, 31.1–46 years, mean 39.4 ± 10.1 years) in Group 2 [Table 1]. Median duration of diabetes was 15 years (IQR, 10–18.6 years) in youth-onset diabetes group and 10 years (IQR, 5–15 years) in the adult-onset diabetes group. The gender distribution was comparable between the groups. Diabetes was not controlled in either group, and median HbA1c was significantly higher in Group 2 (8.4% in Group 1 vs 9.1% in Group 2; $P = 0.01$). While a significantly higher proportion of individuals in Group 1 were on insulin therapy (97 patients [61.8%]), a higher proportion of patients in Group 2 were on oral antidiabetic medications (276 patients [57.7%]; $P < 0.0001$).

Diabetic retinopathy

In AOD <25 group, PDR ($n = 55$, 34%), PDR with HRC ($n = 39$, 24%), and moderate NPDR ($n = 37$, 23%) were common presentations. In AOD ≥ 25 group, PDR ($n = 165$, 33%), moderate ($n = 119$, 25%), and severe NPDR ($n = 78$, 16%) were common presentations. At the last follow-up of 12 months, majority of patients in both the groups had PDR (59%, 42/71 in Group 1 and 52%, 106/204 in Group 2; $P < 0.001$) [Fig. 1]. Almost half of the patients did not have DME in either eye at

presentation (60% and 49% in Groups 1 and 2, respectively). Moderate DME (8% vs 14%; $P = 0.043$) and severe DME (15% vs 23%; $P = 0.043$) were significantly common in Group 2. DR and DME distributions in both groups at baseline and 12-month follow-up are shown in Table 2.

The mean baseline presenting best-corrected visual acuity in Group 1 patients was logMAR 0.52 ± 0.09 (Snellen equivalent 6/18) and logMAR 0.47 ± 0.05 (Snellen equivalent 6/15) in Group 2 patients. Over one year follow-up, there was two-line loss of vision ($P = 0.008$) in the eyes of Group 1 to logMAR 0.79 ± 0.21 (Snellen equivalent 6/24). The vision was stable ($P = 0.23$) in Group 2: logMAR 0.51 ± 0.04 (Snellen equivalent 6/18) at 12-month follow-up. Mean baseline CMT was higher in Group 2 patients (344 ± 9 μm) than in Group 1 patients (310 ± 17 μm), but the difference was statistically not significant ($P = 0.07$). Mean CMT measurements at 12-month follow-up were higher in Group 2 (332 ± 13 μm) than in Group 1 patients (289 ± 13 μm); however, these differences were not statistically significant [Table 2]. The mean number of laser sittings in each eye in both groups was comparable (2.2 ± 0.4 in Group 1 and 2.2 ± 0.3 in Group 2). Mean number of intravitreal injections were 1.2 ± 0.1 and 1.6 ± 0.3 ($P = 0.04$) and number of vitreoretinal interventions at 1.2 ± 0.1 and 1.2 ± 0.04 ($P = 0.22$), respectively, were comparable.

Intra- and Intergroup group analysis

Intragroup analysis showed that both the groups with STDR showed longer duration of DM (Group 1 AOD <25: 14.9 ± 0.6 years and Group 2 AOD ≥25: 11.4 ± 0.7 years). Both the groups with STDR had significantly higher SBP (Group 1 AOD < 25: 134.7 ± 2.3 mmHg and Group 2 AOD ≥25: 142.0 ± 1.3 mmHg. Current age, gender, age at diagnosis, and diastolic BP did not have any significant correlation [Table 3].

Further, the bivariate analysis showed a significant association of higher SBP with STDR (odds ratio (OR)

Table 1: Baseline characteristics of individuals with diabetic retinopathy in young and older onset diabetes mellitus

Variables	Group 1: AOD <25 years (*n*=161)	Group 2: AOD ≥25 years (*n*=493)	*P*
Age at time of study (years), median (IQR)	33 (28-36)	50 (39-61)	<0.0001
Gender Male:Female	98:53 (65%:35%)	348:127 (73%:27%)	0.06
Age at diagnosis of DM (years), median (IQR)	18 (13.3-22.2)	37 (31.1-46)	<0.0001
Duration of DM (years), median (IQR)	15 (10-18.6)	10 (5-15)	<0.0001
Duration of hypertension (months), median (IQR)	20.5 (6-48)	20 (10-84)	0.005
HbA1c (%), median (IQR)	8.4 (7.3-9.8)	9.1 (8-10.2)	0.01
Systolic blood pressure (mmHg), median (IQR)	128 (120-140)	140 (130-150)	<0.0001
Diastolic blood pressure (mmHg), median (IQR)	80 (70-90)	80 (80-90)	0.03

AOD: age of diabetes; DM: diabetes mellitus; IQR: inter-quartile range

Table 2: Baseline and follow-up data on disease severity, visual acuity, and optical coherence tomography parameters of individuals with diabetic retinopathy in young and older onset diabetes mellitus

Disease severity	Baseline			At 12-month follow-up		
	Group 1: AOD <25 years	Group 2: AOD ≥25 years	*P*	Group 1: AOD <25 years	Group 2: AOD ≥25 years	*P*
DR Grade	*n*=160 (%)	*n*=486 (%)		n=71 (%)	n=204 (%)	
Mild NPDR	14 (9)	68 (14)	0.08	5 (7)	22 (11)	0.49
Moderate NPDR	37 (23)	119 (25)	0.77	12 (17)	38 (19)	0.97
Severe NPDR	15 (9)	78 (16)	0.036	12 (17)	38 (19)	0.97
PDR	55 (34)	165 (34)	0.92	24 (34)	94 (46)	0.045
PDR with HRC	39 (24)	56 (12)	0.0001	18 (25)	12 (6)	0.0001
DME grade	*n*=144 (%)	*n*=464 (%)		n=50 (%)	n=204 (%)	
No DME	87 (60)	227 (49)	0.013	20 (40)	86 (44)	0.63
Mild DME	23 (16)	69 (15)	0.75	14 (28)	52 (27)	0.84
Moderate DME	12 (8)	63 (14)	0.09	10 (20)	30 (15)	0.43
Severe DME	22 (15)	105 (23)	0.043	6 (12)	27 (14)	0.61
STDR patients	122 (76)	358 (73)	0.57	56 (78)	169 (77)	1.00
BCVA (logMAR), mean±SE						
Baseline	0.52±0.09	0.47±0.05	0.55	0.79±0.21	0.51±0.04	0.14
OCT CMT (μm), mean±SE						
Baseline	310±17	344±9	0.07	289±13	332±13	0.09

AOD: age of diabetes; BCVA: best-corrected visual acuity, CMT: central macular thickness; DR: diabetic retinopathy; DME: diabetic macular edema; HRC: high-risk characteristics; NPDR: nonproliferative diabetic retinopathy, OCT: optical coherence tomography; PDR: proliferative diabetic retinopathy; STDR: sight-threatening diabetic retinopathy; SE: standard error

Table 3: Characteristics of demographic and systemic risk factors with severity of diabetic retinopathy in individuals with young and older onset diabetes mellitus

Variable	Group 1: AOD <25			Group 2: AOD ≥25		
	N-STDR *n*=39 24%	STDR *n*=122 76%	*P*	N-STDR *n*=132 27%	STDR *n*=358 73%	*P*
Age (years), mean±SE	32.0±1.0	32.4±0.6	0.69	50.9±1.1	50.3±0.7	0.63
Male (%)	65%	67%	0.78	75%	72%	0.69
Age at DM diagnosis (years), mean±SE	17.3±1.0	17.4±0.5	0.9	40.9±0.9	38.8±0.5	0.04
Duration of DM (years), mean±SE	14.9±1.0	14.9±0.6	0.99	9.3±0.9	11.4±0.7	0.01
HbA1c (%), mean±SE	9.2±0.4	9.4±0.3	0.67	8.8±0.4	9.0±0.4	0.48
Treatment						
OHA	29%	28%	0.87	64%	58%	0.22
Insulin	53%	66%	0.13	18%	22%	0.41
OHA + Insulin	18%	6%	0.02	11%	14%	0.43
Systolic BP (mmHg), mean±SE	119.7±3.6	134.7±2.3	0.0005	132.1±2.4	142.0±1.3	0.0003
Diastolic BP (mmHg), mean±SE	78.2±2.0	81.9±1.3	0.12	81.7±1.3	83.6±0.7	0.21

AOD: age of diabetes; BP: blood pressure; DM: diabetes mellitus; N-STDR: non-sight threatening diabetic retinopathy; OHA: oral hypoglycemic drugs; STDR: sight threatening diabetic retinopathy; SE: standard error

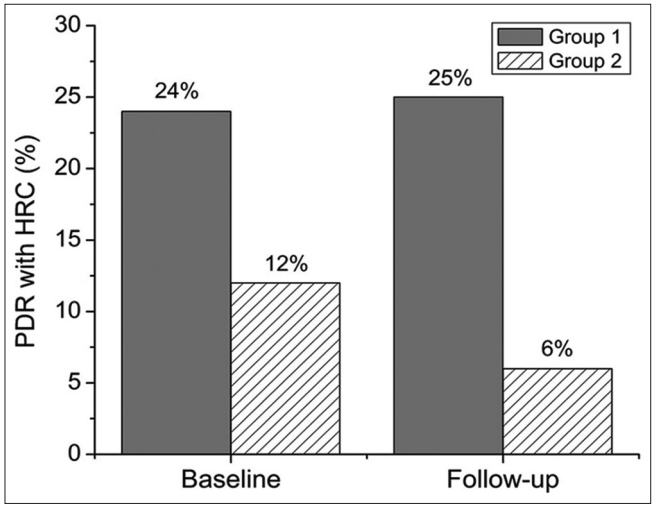

Figure 1: Bar graph depicting higher proportion of patients in Group 1 (age of onset of diabetes < 25 years) with PDR (proliferative diabetic retinopathy) and HRC (high-risk characteristics) at baseline as well as follow-up when compared to Group 2 (age of onset of diabetes ≥25 years)

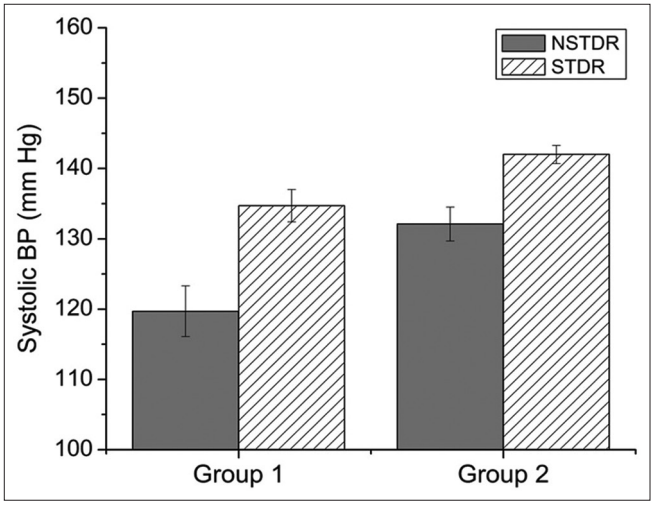

Figure 2: Bar graph depicting higher systolic blood pressure (SBP) in STDR (sight-threatening diabetic retinopathy) patients in both the groups (Group 1: age of onset of diabetes <25 years and Group 2: age of onset of diabetes ≥25 years) when compared to patients with N-STDR (non-sight threatening diabetic retinopathy)

1.053 ± 0.018; *P* = 0.002) in Group 1 patients. In Group 2 patients, the bivariate analysis showed a significant association of lower age at diagnosis of DM, longer duration of DM, and higher SBP with STDR, but on multivariate analysis, only longer duration of diabetes (OR 1.073 ± 0.023; *P* = 0.001) and higher SBP (OR 1.029 ± 0.010; *P* = 0.002) were significant risk factors [Fig. 2]. Table 4 compares the significance of the association of risk factors for STDR in Group 2 compared to Group 1. Multivariate analysis showed that the only difference between the groups was that Group 2 patients were older, and the duration of diabetes was shorter.

Discussion

People with young onset of diabetes live with a longer duration of hyperglycemia and are therefore predisposed to a greater risk for microvascular complications of diabetes.[2,3] This study found poor glycemic control in either group, PDR with HRC in younger onset DM group, and severe DME in adult-onset DM group. An association of higher SBP with STDR in both groups and longer duration of diabetes with STDR in adult-onset DM was noted. Both groups have a male preponderance (65% and 73%). This is different from the female predominance observed in the SEARCH (USA) cohort.[4]

In our cohort, irrespective of the age of onset of diabetes, higher HbA1c predisposed to STDR. The importance of HbA1C association with DR has been highlighted in numerous studies. The severity of DR is shown to increase with an increase in HbA1c levels.[15-18] In this study, all individuals had varying severity of DR. As shown in earlier studies, a longer duration of DM along with uncontrolled blood sugar has predisposed

Table 4: Comparison of risk factors for sight-threatening diabetic retinopathy between the groups: age of diabetes under and above 25

Variable	Group 1: AOD <25 STDR *n*=122 patients (39.7%)	Group 2: AOD ≥25 STDR *n*=358 patients (38.6%)	*P*
Age at presentation (years), mean±SE	32.4±1.0	50.30±0.6	<0.0001
Male (%)	66%	73%	0.15
Age at DM diagnosis (years), mean±SE	17.4±0.8	38.8±0.5	<0.0001
Duration of DM (years), mean±SE	14.4±1.2	11.0±1.0	0.0001
HbA1c (%), mean±SE	9.4±0.3	8.8±0.2	0.046
Treatment			
OHA	28%	58%	<0.0001
Insulin	66%	22%	<0.0001
OHA + Insulin	2%	16%	0.0006
Systolic BP (mmHg), mean±SE	134.7±2.5	142.0±1.4	0.01
Diastolic BP (mmHg), mean±SE	81.9±1.2	83.6±0.7	0.23

AOD: age of diabetes; BP: blood pressure; DM: diabetes mellitus; OHA: oral hypoglycemic drugs; STDR: sight threatening diabetic retinopathy; SE: standard error

to DR and STDR.[7,18,19] This indicates strict control of sugars is needed to reduce the severity of DR and its vision-threatening complications.[20]

Strict blood sugar control is key to reduce the incidence of diabetic retinopathy.[15] Glycated hemoglobin of ≤7% is recommended and needs 3 monthly testing to monitor the status of diabetes control.[21] Poor diabetes control in Indian subjects is not a new observation; in a recent large hospital-based study across India (SPEED study; 11,390 people known diabetes), only 32.1% people had satisfactory diabetes control, and only 11.1% people were regular in testing HbA1c.[22] Thus, it requires greater advocacy among the people with diabetes in India for good control of diabetes and use the proper test to assess the status of diabetes control.

DME is an important cause of visual impairment in people with diabetes. Some of the important risk factors are longer duration of diabetes, poor glycemic control, and elevated BP.[23] In the current study, people with AOD above 25 had a higher prevalence of severe DME than people in the AOD under 25 (23% vs. 15%). They had a longer duration of diabetes and higher SBP than the people AOD under 25 group. The trend is similar to earlier studies.[24-26] Study by Klein *et al*. had shown that the incidence of DME was higher in patients with age at DM diagnosis after 30 years (39.3%) when compared to patients diagnosed before age 30 years (20.1%).[27] The proportion of eyes with STDR was similar in both groups. Our study has shown that there were significant differences in the duration of diabetes and treatment for diabetes, SBP, and hyperglycemia in those with STDR in both groups. However, there were no differences between the groups in the modifiable risk factors. Young-onset type 2 diabetes could be as aggressive as type 1 diabetes in causing STDR.[28] Among individuals with young-onset diabetes (AOD below 25 years) with a longer duration of diabetes (over 15 years), 44% of individuals with type 1 diabetes and 52% of individuals with youth-onset type 2 DM had STDR.[29] The study by Rajalakshmi *et al*. showed that young-onset type 2 diabetes is as aggressive as type 1 diabetes in causing STDR.[28] In the same study, individuals with duration of diabetes over 15 years STDR was present in 44% of young-onset type 1 diabetes and 52% of individuals with young-onset type 2 diabetes. The SPEED study, a multicentric study done across 14 eye care facilities in India, also reported that in individuals with adult-onset diabetes with duration of diabetes over 15 years, STDR was reported in 34%.[28] Longer duration of diabetes is the key nonmodifiable risk factor. It again emphasizes the regular screening of DM patients for early detection of DR and DME to avoid vision loss.[29,30]

The treatment characteristics like mean number of PRP laser sittings, intravitreal injections, and vitreoretinal interventions were almost equal in both groups. The affection of vision was more in the youth-onset DM group over one year, whereas the older cohort showed a stable vision for one year follow-up. This goes against the observations made in the West, where visual impairment has shown recent declining trends in the individuals who have been diagnosed with DM at less than 30 years of age. This was attributed to a better implementation of clinical protocols such as dilated eye examination to detect and manage vision-threatening DR and measures to enhance glycemic control.[31,32]

To study the influence of age and other factors on the severity of DR, risk factors analysis was done in both groups. Both the groups at presentation had majority of them affected with STDR. Higher SBP found to be a significant risk for developing STDR in both youth onset and older onset DM groups. In addition, duration of DM was associated with high risk of developing STDR in older onset DM group.

Hypertension is one among the potential risk factors for the occurrence and progression of DR. Elevated BP affects hemodynamic and vascular endothelial growth factor (VEGF) induced pathways in DR. Elevated BP upregulates VEGF expression in retinal endothelial cells and worsens the DR.[33,34] United Kingdom Prospective Diabetes Study (UKPDS) had shown that patients with good control of BP (<150/85 mmHg) had a 34% reduction in severity of retinopathy and 47% decreased risk in worsening of visual acuity.[35] Similarly, in our study, SBP was uncontrolled in both groups with STDR with older onset DM having higher range of uncontrolled BP (142.0 ± 1.4 mmHg). This indicates strict control of SBP and also at lower range than what was proposed in UKPDS study before to reduce the risk of STDR. A study by Okudaira *et al*. has shown the role of elevated BP in progression to PDR

in young-onset type 2 diabetes. The findings of our study demonstrate the risk of developing STDR with higher SBP, indicating the need to control modifiable risk factors such as hypertension.[36] A lower SBP (140 mmHg) and lower DBP (70 mmHg) combined with good metabolic control has been shown to reduce the occurrence of STDR and also in reducing the progression of DR.[37,38] In the current cohort, the duration of hypertension was at least 20 months, and 56.2% (222/395) of the patients had hypertension. Hypertension was the only modifiable risk factor in Group 1 and Group 2, with no significant differences between groups. Therefore, BP control should be emphasized equally to all people with diabetes, irrespective of their age or duration of diabetes.

The strengths of our study include that it is possibly the first multicentric study from India (involving 14 tertiary care eye facilities across India with large sample size) comparing the clinical profile and risk factors associated with DR and STDR in youth onset DM versus older onset DM. This real-time data analysis of DR and DME characteristics and analysis of risk factors for STDR in relation to the age at onset of DM have provided an insight into the burden of PDR with HRC/STDR in India in individuals with young onset as well older onset diabetes.

Limitations of the study are: there has been no control arm of individuals without DR for comparison of the systemic parameters of those with and without DR. It is clinic-based data; the results cannot be extrapolated to the population. The data of patients are from tertiary eye care facilities where people might have presented with advanced DR for treatment; it is likely that the proportion of STDR is skewed. This has been a retrospective analysis with a review of medical records in eye hospitals with nonavailability of all of the biochemical parameters to support the diagnosis of the type of diabetes (type 1 DM). As the systemic parameters were not available during follow-up, a causal relationship cannot be established based on the data.

Conclusion

In this multicenter study done across various tertiary eye care facilities in India, we found that PDR and PDR with HRC were more prevalent in individuals with AOD under 25, and severe DME was more common in individuals with AOD above 25 years. Patients with young-onset diabetes had a more visual loss on follow-up with two-line reduction in visual acuity. Raised SBP and poor glycemic control increased the risk of STDR in every age group. Keeping in mind the increasing number of people with diabetes, India needs greater advocacy to control risk factors of STDR by timely screening and early treatment of STDR to avoid reversible visual impairment.

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Conflicts of interest

There are no conflicts of interest.

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