Diabetic care initiatives to prevent blindness from diabetic retinopathy in India

GVS Murthy[1,2], Taraprasad Das[3]

It is estimated that 65 million (17%) of 382 million persons with diabetes mellitus (DM) globally reside in India. While globally 35% persons with DM have diabetic retinopathy (DR), this proportion is reportedly lower in India, other countries in South Asia and China. We reviewed published data from 2008 onwards from PubMed, which ascertained DR in population-based representative samples. We also reviewed the risk factors for DR, on awareness regarding eye complications and on accessing an eye examination. Thirteen research studies have reported on the prevalence of DR among persons with DM; this prevalence was lower than the global level in China, India, and Nepal. Eleven studies reported DR risk factors association. The duration of diabetes and level of glycemic control were universally acknowledged DR risk factors. We identified 7 studies in the Asia region that researched the level of awareness about diabetes eye complications and the practice of accessing an eye examination. Excepting 1 study in China, others reported a significant proportion being aware that diabetes leads to eye complications. But the awareness was not translated into a positive practice-most studies reported only 20–50% of the persons with diabetes actually having had their eyes examined. The present review highlights the observation that the risk factors for DR need an integrated diabetic care pathway where the eye care team has to work in close collaboration and partnership with a diabetic care team has to reduce the risk of blindness from DR.

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Magnitude of Diabetes

The International Diabetes Federation (IDF) estimated that globally there were 382 million people living with diabetes in 2013 which is likely to increase by 155% to 592 million by 2035.[1] These figures highlight that by 2035, one out of every 10 individuals living in the world would be a person with diabetes. The IDF estimates also show that contrary to popular belief, 80% of the people with diabetes live in low- and middle-income countries (LMICs). The IDF report also shows that the "hot-spots" of diabetes are countries in the Middle-East, Western Pacific, sub-Saharan Africa, and South East Asia where economic development has impacted lifestyles.[1] The 66th World Health Assembly in 2013 adopted a unanimous resolution of a voluntary global action plan for the prevention and control of noncommunicable diseases.[1]

Diabetes contributed to 5.1 million deaths in 2013 which means that 8.4% of global all-cause mortality among adults aged 20–79 years was attributed to diabetes as the underlying cause.[2] Compounding the global challenge further is the fact that 45.8% (175 million) of all persons with diabetes are estimated to be undiagnosed and therefore not aware of their health condition.[3] Four out of every five (83.8%) of the undetected persons with diabetes are in the LMICs.[3]

Over the past two decades, the South Asia region has seen a sharp increase in the magnitude of diabetes and this region is currently home to 72 million adults with diabetes which is projected to increase to 123 million by 2035.[4] The Indian Council for Medical Research supported a study across multiple locations in India (ICMR-INDIAB) which showed a wide variation in the prevalence of diabetes across the country.[5] The weighted prevalence of diabetes (both known and newly detected) was 10.4% in Tamil Nadu, 8.4% in Maharashtra, 5.3% in Jharkhand, and 13.6% in Chandigarh.[5] This study concluded that the projected magnitude for the country would be 62.4 million persons with diabetes and 77.2 million with prediabetes in 2010.[5] The ICMR figures are consistent with IDF estimates for 2013. The IDF estimated that there were 65 million persons with diabetes in India in 2013 and that the number would increase to 109 million by 2035.[6]

Magnitude of Diabetic Retinopathy

Diabetic retinopathy (DR) is a potentially blinding complication of diabetes.[7] It has been documented that the risk of retinal complications increases with increasing duration of diabetes.

[1]Indian Institute of Public Health, Public Health Foundation of India, [3]L. V. Prasad Eye Institute, Hyderabad, Telangana, India, [2]Department of Clinical Research, Public Health Eye Care and Disability, International Centre for Eye Health, London School of Hygiene and Tropical Medicine, London, UK

Correspondence to: Prof. GVS Murthy, Indian Institute of Public Health, Public Health Foundation of India, ANV Arcade, 1 Amar Cooperative Society, Kavuri Hills, Madhapur, Hyderabad - 500 033, Telangana, India. E-mail: gvsmurthy1956@gmail.com

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Available evidence shows that up to 50% of persons with Type 1 diabetes and 30% with Type 2 diabetes develop potentially vision threatening retinal changes over a period of time during a phase when persons with diabetes are not even aware of the early retinal changes.[8] The proportion of global blindness due to DR has increased from 2.1% in 1990 to 2.6% in 2010.[9] This is a 123% increase in just two decades.

Recently, a pooled analysis of 35 population-based studies including data for 22,896 individuals was undertaken.[10] The pooled analysis estimated that the overall prevalence of any DR was 34.6% (95% confidence interval [CI]: 34.5–34.8), while the prevalence for proliferative DR was 6.96% (95% CI: 6.87–7.04) and for diabetic macular edema was 6.81% (95% CI: 6.74–6.89). The overall prevalence of vision-threatening DR (VTDR) was computed to be 10.2% (95% CI: 10.1–10.3).[10] This translates to 93 million persons with DR and 28 million with VTDR in a global context.[10]

This paper reports the prevalence of DR among persons with diabetes from population-based studies in Asia and Africa and looks at the reported risk factors for DR. This will help in identifying specific care pathways for persons with diabetes to prevent blindness due to diabetes.

Methods

We reviewed published data from 2008 onward from PubMed, which ascertained DR in population-based representative samples. This was because an extensive review had reported on available scientifically sound articles prior to 2008.[10] Only English language articles were reviewed by retrieving published manuscripts. Reference lists in the published articles were also searched to identify additional relevant published articles that pertained to prevalence estimates of DR among persons with diabetes. Papers were only reviewed if they reported original research findings related to prevalence at the population level. We reviewed articles, which highlighted Type 2 diabetes mellitus.

With regard to risk factors for DR, in addition to the above criteria, we also included any articles reporting original research findings from India from 2000 onward due to the paucity of research findings available from India, provided they were population-based samples of persons with diabetes and were not included in the pooled data at a global level.[10]

We also looked at original research articles published after 2000 that reported on the awareness of eye complications of diabetes among persons with diabetes. Here we considered both population-based and hospital-based studies only from Asia. We specifically considered awareness among persons with diabetes as our intention was to look at important parameters that affect the diabetes care pathway targeting the reduction of DR-related blindness and visual impairment.

Results

Thirteen research studies reported on the prevalence of DR among persons with diabetes post 2008 [Table 1]. All the studies reported findings on adults, but the age cut-off varied significantly between the studies.[11-23] Studies reporting findings on the 50+ aged population reported the much higher prevalence of DR among persons with diabetes compared to studies where the age cut-off for inclusion in the study was much lower [Table 1].[15,17,19] The only exception was a study from Sri Lanka, which reported a higher prevalence rate even with a younger cut-off for the age of the population surveyed.[22] We also observed that the reported prevalence of DR among persons with diabetes in China, India, and Nepal was significantly lower than what has been reported at a global level.[11-13,16,21,23]

Eleven studies reported on associations of risk factors for the development of DR [Table 2].[11,12,14,16-18,20-24] The risk factors included in these studies were duration of diabetes, level of glycemic control, hypertension, lipid profile, body mass index (BMI), age, gender, and socioeconomic status/literacy (a proxy indicator for socioeconomic status). Nine (81.8%) studies reported on the duration of diabetes as a risk factor for DR; 2 studies did not comment on the duration of diabetes. Therefore all the studies, which included the duration of diabetes, found that it was a significant risk factor.[11,16-18,20-24]

Ten studies included increasing age as a risk factor and only 2 (20%) found a significant association with DR.[12,23] Eight studies considered level of glycemic control as a risk factor and 6 (75%) of them found a significant association with DR.[11,12,16,18,20,23] Ten studies looked at hypertension as a risk factor, and only 3 (30%) found hypertension to a significant association with DR.[16,20,23] Very few studies found an association of literacy/socioeconomic status, BMI, lipid profile, or gender with DR. The review showed that duration of diabetes and level of glycemic control were universally acknowledged as a risk factor for DR.

The level of awareness about the eye complications of diabetes and the practice of accessing an eye examination among persons with diabetes was also reviewed [Table 3]. We could find only 7 studies in the Asia region which researched this perspective.[25-31] Excepting one study in China,[25] all the others reported a significant proportion being aware that diabetes leads to eye complications. However, this awareness was not translated into a positive practice as most studies reported 20–50% of the persons with diabetes as actually having had their eyes examined.

Discussion

It is estimated that the global magnitude of DR will increase from 126.6 million in 2010 to 191 million by 2030.[32] Most of this increase will be fueled by significant increases in Asia and sub-Saharan Africa with large population countries like India and China leading the increase.[6] The present review shows that the prevalence of DR in countries like India and China currently is significantly lower than what has been reported in a pooled global analysis from 35 studies.[10] However, since diabetes occurs at a younger age in Indians than Caucasians,[33] the improving life expectancy in India means that individuals will now live longer with diabetes than ever before.[34] Since the duration of diabetes is a major risk factor for DR, rates of DR are likely to increase over the next few decades. Planning for effective interventions needs to start much before the "epidemic" is on us and therefore strategizing the programs for prevention of blindness due to DR has to start in right earnest at the earliest.

All the available evidence shows that the modifiable risk factors for DR need a comprehensive care approach as mitigating

Table 1: Comparison of DR prevalence among persons with diabetes in population-based studies[11-23]

Country/area	Persons with diabetes (*n*)	Age (years)	Prevalence of DR (%)	Prevalence of VTDR (%)	References
China, Liaoning Province	329	20-80	11.9		[11]
India, Central India Rural	250	30+	9.6		[12]
Nepal, Bhaktapur	305	40+	10.2		[13]
Brazil, Sao Paulo	407	30+	7.6		[14]
Saudi Arabia, Jazan	740	50+	27.8	5.7	[15]
India, Kanchipuram Rural	2264	40+	10.3	3.8	[16]
Suriname	640	50+	21.6	8.0	[17]
Korea, National Health and Nutrition Survey 2009	998	19+	11.3		[18]
Republic of Moldova	444	50+	55.9	14.6	[19]
Nigeria, National	52	40+	20.5	10.0	[20]
India, Chennai Urban	1816	40+	18.0		[21]
Sri Lanka	536	18+	27.4		[22]
India, Theni	2802	30+	12.2		[23]

DR: Diabetic retinopathy, VTDR: Vision-threatening diabetic retinopathy

Table 2: Risk factors for DR

Country/area	Risk factors showing a statistically significant association								References
	Duration of diabetes	Increasing age	Poor glycemic control	Hypertension	Literacy/ socioeconomic status	BMI	Lipid profile	Gender	
China, Liaoning Province	√	X	√	X	-	√	-	X	[11]
India, Central Rural	-	√	√	X	X	X	X	X	[12]
Brazil, Sao Paulo	-	X	-	X	-	-	-	X	[14]
India, Kanchipuram Rural	√	X	√	√	-	-	-	√	[16]
Suriname	√	X	X	-	-	-	-	-	[17]
Korea, National Health and Nutrition Survey 2009	√	X	√	X	-	X	X	X	[18]
Nigeria, National	√	X	√	√	X	X	-	X	[20]
India, Chennai Urban	√	X	-	X	X	-	-	√	[21]
Sri Lanka	√	-	X	X	-	X	X	-	[22]
India, Palakkad	√	X		X	X	X			[24]
India, Theni	√	√	√	√	X	√	-	X	[23]

BMI: Body mass index, DR: Diabetic retinopathy

Table 3: Awareness and practice patterns reported by persons with diabetes

Country/area	Study location	Individuals covered (*n*)	Aware of eye complications (%)	Reporting eye examination (%)	References
China, Fengyutan	Community	475	36.6	20.0	[25]
Malaysia, Melaka	Clinic	351	87.2	50.0	[26]
Myanmar, Yangon	Clinic	480	86.0	57.0	[27]
Nepal	Clinic	210	63.0	51.4	[28]
Turkey	Clinic	437	88.1	77.3	[29]
India 11 cities	Clinic	285	73.0	67.0	[30]
India, Kochi	Clinic	1000	84.0		[31]

the risk would entail the treating physician/diabetologist takes a pivotal role in the diabetic care pathway. All the studies which were reviewed universally acknowledge that the risk of DR increases with the duration of diabetes.[11,16-23] However, this is not a modifiable risk factor and coupled with the observation that nearly 50% of the diabetics are not aware of their diabetic status,[3] programmatic inputs except increasing the awareness among persons with diabetes will not dent the

deluge of numbers at risk of DR. What is much more critical in reducing the risk of progression to blindness in DR is the level of glycemic control as glycemic control has been clearly highlighted as a major modifiable risk factor for DR.[11,12,16,18,20,23] This needs to be highlighted as the most important intervention as there is adequate evidence that intensive glycemic control can reduce the incidence and progression of DR.[35,36] Glycemic control is an excellent indicator of the awareness and behavior of persons with long-standing diabetes. Evidence from the review shows that the awareness about the eye complications in diabetes was known to a significant proportion of persons with diabetes.[25,28,29] However, this awareness is not translated into accessing eye care services in a significant proportion of persons with diabetes.[25-28] A study from Singapore demonstrated that a major proportion of persons with diabetes were unaware of eye complications and that poor level of awareness was significantly higher among those who had poor glycemic control and other risk factors for DR.[37] They were also more likely to be able to afford devices such as a glucometer, which would enable them to monitor their blood glucose frequently.

A recent multicenter study in India observed that 45% of the respondents reported that they had a visual loss when they first presented to an eye facility and before their DR was detected.[30] This is consistent with findings reported from many parts of the world that between 25% and 50% of persons with diabetes present with visual loss at the first visit to an eye facility.[28,38,39]

The present review highlights the observation that the risk factors for DR need effective management outside the eye care sector as an ophthalmologist is geared toward managing the eye consequences of DR medically or surgically but does not have the wherewithal of achieving good glycemic control, manage hypertension, or lipid levels and monitor dietary modification. Thus, there is an urgent need for a paradigm shift wherein screening for DR should be undertaken at a diabetic service rather than wait for a person with diabetes to come to an eye care facility if vision loss is to be prevented effectively. This needs an integrated approach where the eye care and diabetic care services work together toward the goal of improved quality of life of all persons with diabetes. A recent report also emphasized that both the providers and persons with diabetes strongly advocated for a one-stop integrated approach where the clients could access all diabetic care facilities under one roof.[30] The Queen Elizabeth Diamond Jubilee Trust has recently provided a grant to operationalize an integrated care pathway for diabetic care at the district level by strengthening the public-funded district health system supported by leading eye care and diabetic care nongovernmental organizations to develop sustainable models of integrated care in 10 pilot districts across the country. This may help in setting up scalable models of integrated diabetic care across the country and also be the template for service delivery in many other countries across the commonwealth.

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Conflicts of interest

There are no conflicts of interest.

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