Original Article

Diabetic Retinopathy in Children with Type I Diabetes Mellitus at A Tertiary Care Center Karachi, Pakistan

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ABSTRACT

OBJECTIVE: To estimate the frequency of diabetic retinopathy in children with type 1 diabetes mellitus visiting diabetic clinic, National Institute of Child Health, Karachi.

METHODOLOGY: A retrospective cross sectional study was designed in which 100 children of T1DM were enrolled from Paediatrics endocrinology out-patient department of National Institute of Child Health (NICH) Karachi. Patients between the age of 10-17 years of either gender with duration of T1DM for more than 5 years and no previous known eye or systemic disease other than T1DM were included. The medical records of eye examination of 100 children from January to December 2017 were reviewed and analyzed. Patients were selected through non probability consecutive sampling technique and SPSS version 16 was used to analyze data.

RESULTS: One hundred patients of T1DM were enrolled, 82 were male and 18 were females. Mean age of the patients were 11.70±2.38 years (10-17 years) and 59% were <15 years. Mean duration diagnosis of T1DM was 7.05±0.7 years. Mild non proliferative Diabetic retinopathy (NPDR) was found in 17% patients and none had proliferative diabetic retinopathy.

CONCLUSION: Mild Non Proliferative Retinopathy is quite high in our study population which could later on Progresses Proliferative Retinopathy. Screening for all the children should be mandatory for early diagnosis, management and future of eye complications. The screening for eye complications for all children Type I diabetes mellitus should be initiated annually after 5 years of diagnosis and in the children who are 10 years are older.

KEYWORDS: Type 1 IDDM, Diabetic Retinopathy (DR), Mild non proliferative diabetic retinopathy (NPDR).

This article may be cited as: Gulab S, Khoso ZA, Ibrahim MN, Laghari TM, Ahmed SH, Raza J. Diabetic Retinopathy in Children with Type I Diabetes Mellitus at A Tertiary Care Center Karachi, Pakistan. J Liaquat Uni Med Health Sci. 2020;19(04):257-60.
doi: 10.22442/jlumhs.201940701

INTRODUCTION

Type 1 diabetes mellitus (T1DM) is well known and the 3rd most prevalent chronic disease in the Paediatric population[1], along with systemic complications or manifestations including retinopathy, nephropathy and neuropathy. Though the likelihood of diabetic retinopathy (DR) is very low but still some children and adolescents may develop significant retinopathy. The shortest duration of DM prior to the development of DR was 5 to 6 years in different studies. American academy of Ophthalmology guidelines recommends annual screening of 3 to 5 years after DM diagnosis or after the age of 9 years whichever comes later.

There are different stages of diabetic retinopathy (DR) stages of i.e. mild non-proliferative diabetic retinopathy (NDPR) only microaneurysms, Moderate (NDPR) more than just microaneurysms but less than severe NDPR, severe NDPR is with intraretinal hemorrhage, venous beading, and prominent intraretinal microvascular abnormalities. PDR (Proliferative diabetic retinopathy is neovascularization and vitreous/pre-retinal hemorrhage[2] Stage 1 DR which is also known as very mild non-proliferative Diabetic retinopathy (NPDR) is more common[3]. The prevalence of diabetic retinopathy in peadiatric population is variable ranging from 10-35% in different studies though the risk increases from the teenage[4].

DR is initially asymptomatic but may lead to vision threatening disease.[5,6] For the diagnosis and early management of these micro vascular complications, there is need of appropriate and timely screening[4]. Early screening for DR is important for prevention of blindness; as its incidence is lower in settings where eye screening programs are well established[7]. Most common factor for predicting DR is duration of diabetes moreover it is less common in first decade of diabetic life[8]. Globally there is rise in incidence ofT1DM, and there is also an association of risk at micro vascular complications of DR in children because of long duration of hyperglycemic period or poor control[9]. The reported youngest child with vision threatening DR is 11.3 years[7]. Retina provides opportunity for direct, non-invasive and repeated micro vascular bed visualization and allows for evaluation of early micro

vascular changes[10,11].
Indirect ophthalmoscopy and photography of fundus by dilated pupils is common practice worldwide with more precision of diagnosis of DR[17].
Although there is a lot of data available on DR in adult diabetics, in children it is over looked due to in assumption of that these complications take time to develop and are rare in peadiatric population. The rationale of this study was to screen T1DM children for diabetic retinopathy so that early diagnosis and timely intervention can be made and to prevent long term visual impairment and blindness.

METHODOLOGY

This cross sectional study was done at department of pediatrics endocrinology/diabetic clinic, National institute of Child Health (NICH) Karachi during January to December 2017. A total of 100 patients of T1DM for more than five years of disease duration between the age of 10-20 years of either gender were recruited. Written informed consent was taken before examination. Sample size calculation was performed by the reported local prevalence of DR which was 15% with 95% confidence interval[10]. Before inclusion of the participants the purpose, procedure, risk and benefits of the study was explained and written informed consent was obtained from the parents. Children between 7 to 10 years of age were excluded as the chances of the diabetic retinopathy are very low among this age group.
Moreover children with known eye or systemic disease other than T1DM were also excluded. Patients of T1DM were routinely examined/ consulted for screening eye complications of DR at retina clinic, ophthalmology department of Jinnah Post Graduate Medical Center Karachi, Pakistan. Dilated funduscopic examination was done with a slit lamp examination and ophthalmoscope by an expert ophthalmologist. The demographic record of the children was recorded and analyzed through SPSS version 16.
Qualitative variables like gender and DR was estimated as frequency and percentages. Quantitative variable like age, height, weight, BMI and duration since diagnosis of Type 1 DM was estimated as mean +SDs. Chi square analysis were also performed and P -value of less than 0.05 was considered as significant. Correlation with HbA1C was not performed in this study as it has been reported as the independent risk factor for the development of diabetic retinopathy in type 1 diabetes mellitus.

RESULTS

Out of 100 patients of T1DM 82 were males and 18 were females. Mean age of the patients was 11.70±2.38 years (range 10-17 years) and 59% were <15 years. Mean BMI of the patients was 20.291±2.82 Kg/m^2 and (63%) of patients had BMI of ≤23 Kg/m^2. Mean duration diagnosis of T1DM was 6.47±0.64 years with 61% children had ≤7 years of duration of diagnosis of T1DM (Table I).
Mild non proliferative Diabetic retinopathy (NPDR) was found in 17% patients and none had proliferative DR. Cross tabulation was done to see the effect of age, gender, BMI and duration of diagnosis of T1DM on the outcome (Table II).

TABLE I: DEMOGRAPHIC FEATURES OF CHILDREN WITH TYPE 1 DIABETES MELLITUS

	Mean±SD	Age Range Years
Age (years)	12.80±2.52	10-20
BMI	20.29±2.82	15.70 - 25.23
Duration of type 1 diabetes (years)	7.05±0.70	6-8
Gender		
Male	82%	
Female	18%	

TABLE II: COMPARISON OF DIABETIC RETINOPATHY WITH AGE, GENDER AND DURATION OF DIABETES

	Diabetic reti-nopathy = n(%)	P-value
10-15 yrs	14 (82.4)	0.034
16-20 yrs	3 (17.6)	
Male	11 (64.7)	0.076
Female	6 (35.3)	
Duration of Diabetes 5-7 years	13(76.5)	0.181
Duration of diabetes >7 years	4 (23.5)	

DISCUSSION

T1DM is well known for many ocular complications including corneal pathologies, glaucoma and retinopathy[4]. Stage 1 Diabetic retinopathy very mild non-proliferative diabetic retinopathy (very mild NDPR)[3] with micro aneurysms was observed, in routine screening for DR in several centers. Different clinical guidelines have been developed for age of screening for DR in T1DM and these practices vary in different regions. Initially there are subtle changes in the caliber of arterioles and venules and predict and proceeds the onset of DR and other micro vascular complications like nephropathy and myocardial infarction[12-15]. The other risk factor predicting early complication of diabetes is poor compliance as shown by different studies, where need of ocular surgeries is two folds higher with conventional diabetes control versus intensive diabetes control[16].
According to American Academy of Ophthalmology guidelines, screening for DR[17] should be done after 5

years of onset of T1DM. By the guidelines of American Diabetes Association, screening should be done after 3-5 years of onset of T1DM in children≥10 years of age. According to American Academy of Paediatrics, guidelines are that screening should be done after 3-5 years of onset of T1DM in children but age is 9 years or older[18]. Internationally very limited studies have been executed on the prevalence of DR in children with T1DM which was found to be as low as 4.6% - 29%. In this study, we found the mild NDPR (non proliferative diabetic retinopathy) in 17% cases and no patient had proliferative DR. This is contradictory to Akil H 2016[4] who found prevalence of DR in Paediatric population as 2.4%. Difference might be due to certain factors including methods of screening, age of children screened and duration of diabetes, while other studies have reported prevalence with range from 5-50%[19].

Screening for DR in diabetic children is important because we may find very mild NDPR (non proliferative diabetic retinopathy) in this age, especially in children with poor glycemic of T1DM, which is less likely to regress spontaneously. Our 17% children had mild non proliferative diabetic retinopathy (NDPR) who were advised regular ophthalmological screening by retinal photography and proper control of diabetes. Although early retinal microvascular changes not necessarily need therapy, but still it is important to diagnose retinopathy as early as possible so as to intensify diabetes control and treatment and to prevent or delay the progression of diabetic retinopathy[4].

Prolong duration of diabetes has been reported as a risk factor for development of DR[7]. Mean duration of T1DM in our study population was ±0.64. Though this is not so much prolonged, still we found 17% of DR, again emphasizing need of early screening. Regarding comparison with duration of T1DM of ≤7 years & >7 years, we didn't find significant difference, this might be because small number in >7 years group and unequal numbers in both groups.

Regarding gender distribution, DR was found in 64.7% in boys and 35.3% in girls. The results were not statistically significant. This is contradictory to study by Benitez-Aguirre P et al[20] who reported early development of DR in girls. We found statistically significant difference of DR in children 10-15 years and 15-20 years, but two groups are not comparable because of small patient number and unequal number in both groups, in age 10-15 years we had 14 patients in age 15-20 years we only had 3 patients.

We had certain limitations in our study, first HbA1c was not compared, so effect of past glycemic control over development of DR could not be seen. Secondly, it was a cross sectional retrospective study and follow-up of the patients was not done to see the effect of time duration over development of DR. Moreover, it's a single center study so results cannot be generalized. Further multi-center studies in children are needed for recommendations.

CONCLUSION

Mild Non Proliferative Retinopathy is quite high in our study population which could later on Progresses Proliferative Retinopathy. Screening for all the children should be mandatory for early diagnosis, management and future of eye complications. The screening for eye complications for all children Type I diabetes mellitus should be initiated annually after 5 years of diagnosis and in the children who are 10 years are older.

Ethical permission: National Institute of Child Health letter No. IERB 57/2019, dated 18-11-2019.

Conflict of Interest: There is no conflict of interest.

Funding: There was no any funding agency.

AUTHOR CONTRIBUTIONS

Gulab S: Data collection
Khoso ZA: Data analysis, write up
Ibrahim MN: Concept, study design
Laghari TM: Data interpretation
Ahmed SH: Literature search
Raza J: Supervision, proof reading

REFRENCES

1. Karvonen M, Viik-Kajander M, Moltchanova E, Libman I, LaPorte RO, Tuomilehto J. Incidence of childhood type 1 diabetes worldwide. Diabetes Mondiale (DiaMond) Project Group. Diabetes Care. 2000; 23(10): 1516-26. doi:10.2337/diacare.23.10.1516.
2. Geloneck MM, Forbes BJ, Shaffer J, Ying GS, Binenbaum G. Ocular complications in children with diabetes mellitus. Ophthalmology. 2015 Dec 1;122(12):2457-64. doi: 10.1016/j.ophtha.2015.07.010.
3. Kanski J, Bowling B. Kanski's clinical ophthalmology: a systematic approach. Saunders Ltd; 2015.
4. Akil H, Buluş AD, Andiran N, Alp MN. Ocular manifestations of type 1 diabetes mellitus in pediatric population. Indian J Ophthalmol. 2016; 64(9): 654-8.
5. Thomas RL, Dunstan FD, Luzio SD, Chowdhury SR, North RV, Hale SL, et al. Prevalence of diabetic retinopathy within a national diabetic retinopathy screening service. Br J Ophthalmol. 2015; 99(1): 64-8. doi: 10.1136/bjophthalmol-2013-304017.
6. Lian JX, Gangwani RA, McGhee SM, Chan CK, Lam CL, Wong DS. Systematic screening for diabetic retinopathy (DR) in Hong Kong: prevalence of DR and visual impairment among diabetic population. Br J Ophthalmol. 2016; 100 (2): 151-5. doi:10.1136/bjophthalmol-2015-307382.
7. Liew G, Michaelides M, Bunce C. A comparison of the causes of blindness certifications in England

and Wales in working age adults (16–64 years), 1999–2000 with 2009–2010. BMJ Open. 2014; 4 (2): 1-6. doi:10.1136/bmj-open-2013-004015.
8. Cho YH, Craig ME, Donaghue KC. Puberty as an accelerator for diabetes complications. Pediatr Diabetes. 2014; 15(1): 18-26. doi:10.1111/ pedi.12112.
9. Scanlon PH, Stratton IM, Bachmann MO, Jones C, Leese GP, Four Nations Diabetic Retinopathy Screening Study Group. Risk of diabetic retinopathy at first screen in children at 12 and 13 years of age. Diabet Med. 2016; 33(12): 1655-8. doi:10.1111/dme.13263.
10. Memon S, Ahsan S, Riaz Q, Basit A, Sheikh SA, Fawwad A, et al. Frequency, severity and risk indicators of retinopathy in patients with diabetes screened by fundus photographs: a study from primary health care. Pak J Med Sci. 2014; 30(2): 366-372.
11. Liew G, Benitez-Aguirre P, Craig ME, Jenkins AJ, Hodgson LA, Kifley A, et al. Progressive retinal vasodilation in patients with type 1 diabetes: a longitudinal study of retinal vascular geometry. Invest Ophthalmol Visual Sci. 2017; 58(5): 2503-9. Doi:10.1167/iovs.16-21015.
12. Cheung CY, Ikram MK, Klein R, Wong TY. The clinical implications of recent studies on the structure and function of the retinal microvasculature in diabetes. Diabetologia. 2015; 58(5): 871-85. doi:10.1007/s00125-015-3511-1.
13. Ikram MK, Cheung CY, Lorenzi M, Klein R, Jones TL, Wong TY. Retinal vascular caliber as a biomarker for diabetes microvascular complications. Diabetes care. 2013; 36(3): 750-9. doi:10.2337/dc12-1554.
14. Yau JW, Xie J, Kawasaki R, Kramer H, Shlipak M, Klein R, et al. Retinal arteriolar narrowing and subsequent development of CKD Stage 3: the Multi-Ethnic Study of Atherosclerosis (MESA). Am J Kidney Dis. 2011; 58(1): 39-46. doi:10.1053/ j.ajkd.2011.02.382.
15. Tsai AS, Wong TY, Lavanya R, Zhang R, Hamzah H, Tai ES, et al. Differential association of retinal arteriolar and venular caliber with diabetes and retinopathy. Diabetes Res Clin Pract. 2011; 94(2): 291-8. doi:10.1016/j. diabres.2011.07.032.
16. DCCT/EDIC Research Group. Intensive diabetes therapy and ocular surgery in type 1 diabetes. New Engl J Med. 2015; 372(18): 1722-33. doi:10.1056/NEJMoa1409463
17. Gołębiewska J, Olechowski A, Wysocka-Mincewicz M, Odrobina D, Baszyńska-Wilk M, Groszek A, et al. Optical coherence tomography angiography vessel density in children with type 1 diabetes. PLoS One. 2017; 12(10): e0186479. doi:10.1371/journal.pone.0186479.
18. Wang SY, Andrews CA, Herman WH, Gardner TW, Stein JD. Incidence and risk factors for developing diabetic retinopathy among youths with type 1 or type 2 diabetes throughout the United States. Ophthalmology. 2017 Apr 1;124 (4):424-30. doi:10.1016/j.ophtha.2016.10.031.
19. Massin P, Erginay A, Mercat-Caudal I, Robert N, Vol S, Reach G, et al. Prevalence of diabetic retin opathy in children and adolescents with type-1 diabetes attending summer camps in France. Diabetes Metab. 2007; 33(4): 284-9. doi:10.1016/ j.diabet.2007.03.004.
20. Benitez-Aguirre P, Craig ME, Cass HG, Sugden CJ, Jenkins AJ, Wang JJ, et al. Sex differences in retinal microvasculature through puberty in type 1 diabetes: are girls at greater risk of diabetic microvascular complications? Invest Ophthalmol Visual Sci. 2014; 56(1): 571-7. doi:10.1167/ iovs.14-15147.

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