Prevalence and Associated Factors of Diabetic Retinopathy in Chandrubeksa Hospital, Directorate of Medical Services, Royal Thai Air Force

Sukhum Silpa-archa MD*,
Roongthip Sukhawarn MD, MSc, PhD*

** Department of Ophthalmology, Bhumibol Adulyadej Hospital, Directorate of Medical Services, Royal Thai Air Force, Bangkok, Thailand*

Objective: *To evaluate the prevalence and associated factors of diabetic retinopathy (DR) in patients with type 2 diabetes in the diabetes clinic at Chandrubeksa Hospital.*
Material and Method: *A cross-sectional study was performed on 261 type 2 diabetic patients at Chandrubeksa Hospital on January 2011. They all underwent fundus examination by ophthalmologists using indirect ophthalmoscope to check for any signs of DR.*
Results: *Retinopathy was presented in 67 (25.7%) patients who were categorized into non-proliferative and proliferative types, 23.4% and 2.3% respectively. The patients who received insulin treatment were more likely to have DR than those who had not (OR 3.95, 95% CI 1.86, 8.39). Those who had had diabetes for more than 5 years were more likely to have diabetic retinopathy than those with diabetes for a lesser amount of time (OR 2.36, 95% CI 1.28, 4.33).*
Conclusion: *Insulin treatment and the duration of diabetes are the significant associated factors for developing diabetic retinopathy in type 2 diabetic patients. The authors emphasize the necessity of regular eye check-ups which can provide the patients with early detection so that treatment can begin before much damage occurs.*

Keywords: *Diabetic retinopathy (DR), Insulin, Prevalence*

J Med Assoc Thai 2012; 95 (Suppl. 4): S43-S49
Full text. e-Journal: *http://www.jmat.mat.or.th*

Nowadays, more than 220 million people worldwide have diabetes[1,2]. In Thailand, a growing number of diabetic patients, more than 3.4 million (6.9%), was recently reported in 2009[3]. One of the renowned major ocular complications of diabetes is diabetic retinopathy. This is the leading cause of global blindness[4]. Blindness from diabetic retinopathy can be due to macular edema and retinal neovascularization which brings about vitreous hemorrhage and devastating tractional retinal detachment. The previously reported risk factors of diabetic retinopathy were longer duration of diabetes, younger age at diagnosis, use of insulin, higher glycosylated hemoglobin, presence of proteinuria and higher systolic blood pressure[5-19].

The present study was performed at Chandrubeksa Hospital, the second largest hospital of the Directorate of Medical Service, Royal Thai Air Force. The diabetic clinic here has lacked an ophthalmologist for many years. Thus, many patients have not received diabetic retinopathy screening. The presented screening process was set up not only to fulfill the eye check-up programs and give proper laser treatment for advanced diabetic patients, but it also was to evaluate the prevalence and associated factors of the population.

Material and Method

The present cross-sectional stud1y was performed on patients with type 2 diabetes in the diabetes clinic at Chandrubeksa Hospital on January 2011. The present study was approved by the Research Ethical Committee of Bhumibol Adulyadej Hospital, Royal Thai Air Force. The research team consisted of five ophthalmologists and five ophthalmic assistants to perform clinical assessments. Patients with very

Correspondence to:
Silpa-archa S, Department of Ophthalmology, Bhumibol Adulyadej Hospital,Directorate of Medical Services, Royal Thai Air Force, Bangkok 10220, Thailand.
Mobile: 08-9203-7797, Fax: 0-2534-7349
E-mail: sukhumsilp@gmail.com

opaque ocular media such as corneal scar or mature cataract, which prevented them from fundus examination, were excluded. The collected data included: demographic data, history of alcoholic drinking/smoking, duration of diabetes, associated systemic diseases, treatment modality of the diseases, laboratory investigation, best corrected visual acuity, intraocular pressure by non-contact tonometer and eye examination by indirect ophthalmoscopy. The patients who met the standard treatment criteria had obtained laser treatment in this setting while the others with dense cataract or glaucoma suspects were referred to a nearby regional hospital. The worst stage of retinopathy from individual both eyes was chosen for analysis.

Criteria to grade diabetic retinopathy were cited from "International Clinical Diabetic Retinopathy and Diabetic Macular Edema Disease Severity Scales"[5], ranging from no apparent retinopathy to proliferative diabetic retinopathy.

Statistical analysis

The possible associated factors of diabetic retinopathy was statistically analyzed by Chi-square test with crude odds ratio (OR), 95% confidence interval (95%CI). Afterwards, the multiple, logistic regression model was used to explore the possible associated factors. All statistical analyses were carried out using the SPSS statistic software version 16.

Results

Of the 263 type 2 diabetic patients enrolled in the present study, 2 patients were excluded due to very dense cataracts that precluded detailed fundus examination. Ninety-nine were men (37.9%), 162 were women (62.1%). The mean age was 62 $\pm$ 10.1 years (range, 35-92). The group with visual acuity was classified into 6/6 to 6/12, 6/18 to 6/60, 5/60 to 1/60, counting finger to light perception and were 62.1%, 25.7%, 3.1%, 3.1%, respectively. Mean intraocular pressure was 15.9 $\pm$ 3.5 mmHg (range, 7-26). Sixty-seven (25.7%) patients were diagnosed as diabetic retinopathy. These patients were categorized into non-proliferative and proliferative types, which were 23.4% and 2.3%, respectively. Among the ten patients who had received laser treatment, 5 had been treated by pan-retinal laser photocoagulation, 3 by focal retinal laser photocoagulation and 2 by concurrent pan-retinal and focal retinal laser photocoagulation. Table 1 shows selected demographic data for the 2 groups in detail.

The correlation of associated factors to diabetic retinopathy were gathered and contemplated. Those were demographic data, history of diabetes and associated illness, treatment modalities of diabetes and related laboratory investigations. In view of univariate analysis, duration of diabetes, diabetic foot ulcer and insulin treatment, the cases were significantly associated with diabetic retinopathy (Table 2).

Multiple, logistic regression analysis showed retinopathy to be significantly associated with insulin treatment and the duration of diabetes ($p < 0.01$) (Table 3).

Patients who received insulin treatment were more likely to have diabetic retinopathy than those who had not (OR 3.95, 95% CI 1.86, 8.39). Besides, patients who had had diabetes for more than 5 years were more likely to have diabetic retinopathy than those with diabetes for a lesser amount of time (OR 2.36, 95% CI 1.28, 4.33).

Discussion

The prevalence of diabetic retinopathy presented in the present study was 25.7%, which was classified into non-proliferative diabetic retinopathy 23.4% and proliferative diabetic retinopathy 2.3%. These results were similar to many studies performed with type 2 diabetic patients[8-10]. Nevertheless, the study from community hospitals in Nakhon Ratchasima Province of Thailand performed with the same method of fundus examination reported less prevalence of diabetic retinopathy[20]. While some studies showed more prevalence of diabetic retinopathy[11,19]. The cause of this is likely to be the variability of the population according to race, geographic area and living conditions.

Many studies have reported the associated risk factors for diabetic retinopathy[6,8-19]. The associated factors of diabetic retinopathy from the present study are insulin treatment and longer duration of diabetes. For insulin treatment factor, the odds ratio was 3.95. This is consistent with previous studies[8,11-13]. The role and relationship of insulin administration and higher level of insulin-like growth factors in causing retinal ischemia were previously proposed[21-23]. Besides, this is probably because insulin therapy for type 2 diabetic patients indicates the refractory stage of the disease. However, a few studies[14,19] presented the significant risk of treatment including oral hypoglycemic agents. Also, one report[12] revealed that insulin treatment was not the only factor independently associated with diabetic retinopathy. Rather, it was also a factor associated with coronary

Table 1. The selected characteristics of diabetes patients classified by retinopathy level

	No. of no DR(%)	No. of NPDR(%)	No. of PDR(%)	Total
DR level	194 (74.3)	61 (23.4)	6 (2.3)	261
Age (years)				
30-50	21 (75.0)	6 (21.4)	1 (3.6)	28
51-70	134 (76.1)	37 (21.0)	5 (2.9)	176
>70	39 (68.4)	18 (31.6)	0	57
Gender				
Male	77 (77.8)	22 (22.2)	0	99
Female	117 (72.2)	39 (24.1)	6 (3.7)	162
VA				
6/6-6/12	130 (80.3)	31 (19.1)	1 (0.6)	162
6/18-6/60	45 (67.2)	20 (29.9)	2 (2.9)	67
5/60-1/60	6 (75.0)	1 (12.5)	1 (12.5)	8
CF-PL	5 (62.5)	2 (25.0)	1 (12.5)	8
NA	8 (50.0)	7 (43.8)	1 (6.2)	16
Duration of diabetes (years)				
<1	15 (83.3)	3 (16.7)	0	18
1-5	86 (82.7)	18 (17.3)	0	104
6-10	42 (82.3)	9 (17.7)	0	51
>10	43 (54.4)	30 (38.0)	6 (7.6)	79
NA	8 (88.9)	1 (11.1)	0	9
Coronary artery disease				
Absent	176 (73.0)	59 (24.5)	6 (2.5)	241
Present	18 (90.0)	2 (10.0)	0	20
Hypertension				
Absent	23 (69.7)	9 (27.3)	1 (3.0)	33
Present	171 (75.0)	52 (22.8)	5 (2.2)	228
Diabetic foot ulcer				
Absent	191 (75.8)	56 (22.2)	5 (2.0)	252
Present	3 (33.3)	5 (55.6)	1 (11.1)	9
DM treatment				
OHA	159 (77.2)	44 (21.4)	3 (1.4)	206
Insulin	6 (50.0)	5 (41.7)	1 (8.3)	12
OHA and Insulin	11 (45.8)	11 (45.8)	2 (8.4)	24
Diet control	18 (94.7)	1 (5.3)	0	19

DR = Diabetic retinopathy, NPDR = Non-proliferative diabetic retinopathy, PDR = Proliferative diabetic retinopathy, CF = Counting finger, PL = Light perception, NA = Not available, OHA = Oral hypoglycemic agents

heart disease and albuminuria. The odds ratio was 3.3, 3.4 and 5.3 for diabetic retinopathy, coronary heart disease and albuminuria, respectively.

The longer duration of diabetes is the factor proven by several studies[6,8-11,13,15-19]. The Wisconsin Epidemiologic Study of Diabetic Retinopathy revealed the longer duration of diabetes was related to an increasing frequency of retinopathy. It also showed the prevalence of diabetic retinopathy in type 2 diabetic patients who had had the disease for less than 5 years and those who had had it for more than or equal to 15 years were 28.8% and 77.8%, respectively. The present study revealed that the odds ratio of duration of diabetes for more than 5 years compared to less than or equal to 5 years, is 2.36. This emphasizes the important role of the duration of diabetes.

There are a few limitations in the current study. Firstly, possible bias could have occurred due to a variation in fundus assessments among the 5 ophthalmologists, which depended on individual concentration and meticulousity. Furthermore, of the 450 patients in the diabetes clinic, only 351 diabetes patients (78%) with poorly controlled diseases were qualified. This could possibly cause more prevalent

Table 2. Univariate analysis shows significant factors associated with diabetic retinopathy

Variables	Number at risk	Retinopathy prevalence Number (%)	Odds ratio	95% Confidence interval
Duration of diabetes (years)				
0-5	122	21 (17.2)	2.55	1.41-4.61
>5	130	45 (34.6)		
Current smoker				
No	238	62 (26.1)	0.79	0.28-2.21
Yes	23	5 (21.7)		
Current alcoholic drinking				
No	219	59 (26.9)	0.64	0.28-1.46
Yes	42	8 (19.0)		
Diabetic foot ulcer				
Absent	252	61 (24.2)	6.26	1.52-25.79
Present	9	6 (66.7)		
Systolic blood pressure (mmHg)				
<130	60	15 (25.0)	1.05	0.54-2.05
>130	200	52 (26.0)		
Body mass index (kg/m^2)				
≤25	92	27 (29.3)	0.69	0.39-1.24
>25	157	35 (22.3)		
Coronary artery disease				
No	241	65 (26.9)	0.30	0.07-1.33
Yes	20	2 (10.0)		
Stroke				
No	255	64 (25.1)	2.98	0.59-15.16
Yes	6	3 (50.0)		
Dyslipidemia				
No	34	8 (23.5)	1.14	0.49-2.66
Yes	227	59 (26.0)		
Hypertension				
No	33	10 (30.3)	0.77	0.34-1.71
Yes	228	57 (25.0)		
Chronic kidney disease				
No	257	64 (24.9)	9.05	0.93-88.52
Yes	4	3 (75.0)		
Hemodialysis				
No	257	66 (25.7)	0.97	0.10-9.44
Yes	4	1 (25.0)		
Insulin treatment				
No	225	48 (21.3)	4.12	1.99-8.53
Yes	36	19 (52.8)		
ACEIs use				
No	136	28 (20.6)	1.72	0.98-3.03
Yes	123	38 (30.9)		
ARBs use				
No	210	55 (26.2)	0.82	0.39-1.71
Yes	49	11 (22.4)		
CCBs use				
No	182	43 (23.6)	1.38	0.76-2.50
Yes	77	23 (29.9)		

Table 2. Univariate analysis shows significant factors associated with diabetic retinopathy

Variables	Number at risk	Retinopathy prevalence Number (%)	Odds ratio	95% Confidence interval
Beta blockers use				
No	200	51 (25.5)	1.00	0.51-1.94
Yes	59	15 (25.4)		
Diuretics use				
No	201	47 (23.4)	1.60	0.84-3.02
Yes	58	19 (32.8)		
Fasting plasma glucose (mmol/l)				
<110	58	15 (25.9)	1.00	0.51-1.95
≥110	201	52 (25.9)		
HbA_{1c} level (%)				
≤6.5	48	9 (18.8)	1.46	0.652-3.25
>6.5	171	43 (25.1)		
Creatinine level (mg/dl)				
≤2.0	209	55 (26.3)	0.75	0.32-1.73
>2.0	38	8 (21.1)		
Total Cholesterol level (mg/dl)				
≤200	183	47 (25.7)	1.36	0.68-2.72
>200	47	15 (31.9)		
LDL Cholesterol level (mg/dl)				
<100	117	29 (24.8)	1.24	0.69-2.24
>100	107	31 (29.0)		
Triglyceride level (mg/dl)				
≤150	162	43 (26.5)	0.92	0.49-1.76
>150	72	18 (25.0)		
HDL level (mg/dl)				
>50 (man) or >40 (woman)	152	40 (26.3)	0.93	0.49-1.78
<50 (man) or <40 (woman)	72	18 (25.0)		

$p < 0.01$, $p < 0.05$, ACEIs = angiotensin-converting enzyme inhibitors, ARBs = angiotensin receptor blockers, CCBs = calcium channel blockers, LDL = plasma low density lipoprotein, HDL = high density lipoprotein cholesterol

Table 3. Multiple logistic regression analysis shows significant factors associated with diabetic retinopathy

Variables	Odds ratio	95% Confidence interval	p-value
Insulin treatment(yes vs no)	3.95	1.86-8.39	< 0.001
Duration of diabetes (>5 years vs ≤5 years)	2.36	1.28-4.33	0.006

data of diabetic retinopathy, including the proliferative type. Of those patients, about 25% of missed diabetes patients are likely to impact the interpretation of results. Those patients had missed an appointment for many reasons; for instance, a problem contacting them, their being tied up with work or a caretaker not being available. Finally, the scheduled period of the program may be too short and inconvenient for some diabetic cases.

The present study indicates insulin treatment and longer duration of diabetes could possibly pose great concern for ophthalmologists during diabetic retinopathy screening.

Conclusion

Insulin treatment and the duration of diabetes

are the significant, associated factors for developing diabetic retinopathy in type 2 diabetic patients. The authors emphasize the necessity of regular eye check-ups which can provide the patients with early detection so that treatment can begin before much damage occurs.

Acknowledgement

The authors wish to thank Dr. Krailert Thiennukul MD, Dr. Jermjai Amarit MD and Dr. Ronakorn Panjaphongse MD. Also, the authors wish to thank all ophthalmic assistances from Bhumibol Adulyadej Hospital and Chandrubeksa Hospital for their excellent support.

Potential conflicts of interest

None.

References

1. WHO Media Centre. Diabetes. Fact sheet no.312 [database on the Internet]. January 2011 [cited 2011 Jan 27]. Available from: http://www.who.int/mediacentre/factsheets/fs312/en/index.html.
2. International Diabetes Federation. Diabetes prevention [database on the Internet]. 2007-2011 [cited 2011 Jan 27]. Available from: http://www.worlddiabetesday.org/en/the-campaign/diabetes-education-and-prevention/diabetes-prevention.
3. Aekplakorn W, editor. Fourth National Health Examination survey 2009. Nonthaburi: Graphico Systems; 2010.
4. Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, Pokharel GP, et al. Global data on visual impairment in the year 2002. Bull World Health Organ 2004; 82: 844-51.
5. Wilkinson CP, Ferris FL III, Klein RE, Lee PP, Agardh CD, Davis M, et al. Proposed international clinical diabetic retinopathy and diabetic macular edema disease severity scales. Ophthalmology 2003; 110: 1677-82.
6. Phamonvaechavan P, Patanonta U. Prevalence and risk factor for diabetic retinopathy in Prachuabkirikan Hospital. Thai J Ophthalmol 2004; 18: 77-85.
7. Nilkumhang S. Prevalence and risk factors for diabetic retinopathy at Mukdahan Hospital. Thai J Ophthalmol 2009; 23: 116-24.
8. Narendran V, John RK, Raghuram A, Ravindran RD, Nirmalan PK, Thulasiraj RD. Diabetic retinopathy among self reported diabetics in southern India: a population based assessment. Br J Ophthalmol 2002; 86: 1014-8.
9. Elshafei M, Gamra H, Khandekar R, Al Hashimi M, Pai A, Ahmed MF. Prevalence and determinants of diabetic retinopathy among persons >/= 40 years of age with diabetes in Qatar: a community-based survey. Eur J Ophthalmol 2011; 21: 39-47.
10. Tapp RJ, Shaw JE, Harper CA, de Courten MP, Balkau B, McCarty DJ, et al. The prevalence of and factors associated with diabetic retinopathy in the Australian population. Diabetes Care 2003; 26: 1731-7.
11. Jost BS, Hilgemberg E, Rodrigues EB, Daniotti AF, Bonamigo EL. Prevalence of diabetic retinopathy in patients affected by type 2 diabetes mellitus in the city of Luzerna—SC. Arq Bras Oftalmol 2010; 73: 259-65.
12. Weitzman S, Maislos M, Bodner-Fishman B, Rosen S. Association of diabetic retinopathy, ischemic heart disease, and albuminuria with diabetic treatment in type 2 diabetic patients. A population-based study. Acta Diabetol 1997; 34: 275-9.
13. Zhang X, Saaddine JB, Chou CF, Cotch MF, Cheng YJ, Geiss LS, et al. Prevalence of diabetic retinopathy in the United States, 2005-2008. JAMA 2010; 304: 649-56.
14. Giuffre G, Lodato G, Dardanoni G. Prevalence and risk factors of diabetic retinopathy in adult and elderly subjects: The Casteldaccia Eye Study. Graefes Arch Clin Exp Ophthalmol 2004; 242: 535-40.
15. Klein R, Klein BE, Moss SE, Davis MD, DeMets DL. The Wisconsin epidemiologic study of diabetic retinopathy. III. Prevalence and risk of diabetic retinopathy when age at diagnosis is 30 or more years. Arch Ophthalmol 1984; 102: 527-32.
16. Sparrow JM, McLeod BK, Smith TD, Birch MK, Rosenthal AR. The prevalence of diabetic retinopathy and maculopathy and their risk factors in the non-insulin-treated diabetic patients of an English town. Eye (Lond) 1993; 7 (Pt 1): 158-63.
17. Wang FH, Liang YB, Peng XY, Wang JJ, Zhang F, Wei WB, et al. Risk factors for diabetic retinopathy in a rural Chinese population with type 2 diabetes: the Handan Eye Study. Acta Ophthalmol 2011; 89: e336-43.
18. Wong TY, Cheung N, Tay WT, Wang JJ, Aung T, Saw SM, et al. Prevalence and risk factors for diabetic retinopathy: the Singapore Malay Eye Study. Ophthalmology 2008; 115: 1869-75.
19. Javadi MA, Katibeh M, Rafati N, Dehghan MH, Zayeri F, Yaseri M, et al. Prevalence of diabetic

retinopathy in Tehran province: a population-based study. BMC Ophthalmol 2009; 9: 12.
20. Nitiapinyasakul N, Nitiapinyasakul A, Tunya C. Diabetic retinopathy screening in community hospitals. Thai J Ophthalmol 2004; 18: 103-10.
21. Kondo T, Vicent D, Suzuma K, Yanagisawa M, King GL, Holzenberger M, et al. Knockout of insulin and IGF-1 receptors on vascular endothelial cells protects against retinal neovascularization. J Clin Invest 2003; 111: 1835-42.
22. Reiter CE, Wu X, Sandirasegarane L, Nakamura M, Gilbert KA, Singh RS, et al. Diabetes reduces basal retinal insulin receptor signaling: reversal with systemic and local insulin. Diabetes 2006; 55: 1148-56.
23. Chantelau E, Kimmerle R, Meyer-Schwickerath R. Insulin, insulin analogues and diabetic retinopathy. Arch Physiol Biochem 2008; 114: 54-62.

ความชุกและปัจจัยที่เกี่ยวข้องของการเปลี่ยนแปลงที่จอตาจากเบาหวานในโรงพยาบาลจันทรุเบกษา กรมแพทย์ทหารอากาศ กองทัพอากาศ

สุขุม ศิลปอาชา, รุ่งทิพย์ สุขวรรณ์

วัตถุประสงค์*: เพื่อศึกษาความชุก และปัจจัยเสี่ยงของการเปลี่ยนแปลงที่จอตาจากเบาหวาน ในผู้ป่วยเบาหวานชนิดที่ 2 ที่มารับบริการในคลินิกเบาหวาน โรงพยาบาลจันทรุเบกษา*

วัสดุและวิธีการ*: การศึกษานี้เป็นการวิจัยแบบตัดขวาง โดยศึกษาในผู้ป่วยเบาหวานชนิดที่ 2 จำนวน 261 ราย ในเดือนมกราคม พ.ศ. 2554 ผู้ป่วยทุกรายได้รับการตรวจจอตาโดย indirect ophthalmoscope จากจักษุแพทย์*

ผลการศึกษา*: พบความชุกของการเปลี่ยนแปลงที่จอตาจากเบาหวาน 67 ราย (ร้อยละ 25.7) โดยแบ่งเป็นชนิด non-proliferative diabetic retinopathy ร้อยละ 23.4 และ proliferative diabetic retinopathy ร้อยละ 2.3 ปัจจัยที่เกี่ยวข้องกับการเปลี่ยนแปลงที่จอตา อย่างมีนัยสำคัญทางสถิติ ($p < 0.01$) ได้แก่การใช้อินซูลิน (OR 3.95, 95%CI 1.86, 8.39) และระยะเวลาการป่วยเป็นเบาหวานนานกว่า 5 ปี (OR 2.36, 95% CI 1.28, 4.33)*

สรุป*: การใช้อินซูลิน และระยะเวลาการป่วยเป็นเบาหวานนานกว่า 5 ปี เป็นปัจจัยที่เกี่ยวข้องกับการเปลี่ยนแปลงที่จอตาในผู้ป่วยเบาหวานชนิดที่ 2 ผู้นิพนธ์เน้นย้ำถึงความสำคัญของการตรวจตาโดยจักษุแพทย์อย่างสม่ำเสมอ จะช่วยให้ตรวจพบรอยโรคตั้งแต่ระยะแรก และทำการรักษาได้ทันก่อนจะเกิดภาวะสายตาพิการ*