

BLINDNESS AND VISUAL IMPAIRMENT IN DIABETIC PATIENTS IN CROATIA

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SUMMARY – New estimates show reduction in the number of people who are blind or suffer from vision impairment as a sequel of infectious diseases, while there is an increase in the number of people who are blind due to conditions related to longer life span and diabetes. Diabetic retinopathy is the leading cause of blindness in active population in developed countries. Epidemiological studies evaluated the incidence and describe many facets of this disease the incidence of which is being followed in most countries. The aim of this paper is to present some epidemiological data on diabetic retinopathy caused by type 1 diabetes in Croatia, to compare them with other countries, and to evaluate its importance in causing severe visual impairments and blindness. These data are considered highly relevant because they are changing constantly and require continuous monitoring in spite of all advances in understanding the distribution, causes and severity of diabetic retinopathy. It is of great importance because the increasing burden of diabetes will pose ever greater burden on the population at large and on healthcare systems providing care for these patients.

Key words: *Diabetic retinopathy – etiology; Diabetes mellitus, type 1 – complications; Diabetic retinopathy – epidemiology; Croatia*

Introduction

Although the number of people who are blind due to infectious diseases is on a decline according to World Health Organization reports, there is a growing problem of the increasing number of people affected with blindness in association with longevity. There are more than 37 million blind people and over 161 million people with impaired vision in the world¹. Most of these blind people (90%) live in developing and underdeveloped countries. It should be noted that blindness could have been avoided in 75% of these cases¹. However, it is also true that the number comes down to 50% in children¹. As shown in Figure 1, cataract is the most common cause of blindness, accounting for

47.8% of cases, while diabetic retinopathy with 5% is the fifth leading cause of blindness worldwide¹.

Diabetes and its complications are a major cause of morbidity and mortality in industrialized countries and contribute substantially to healthcare costs. Although the prevalence of diabetes is high in the world,

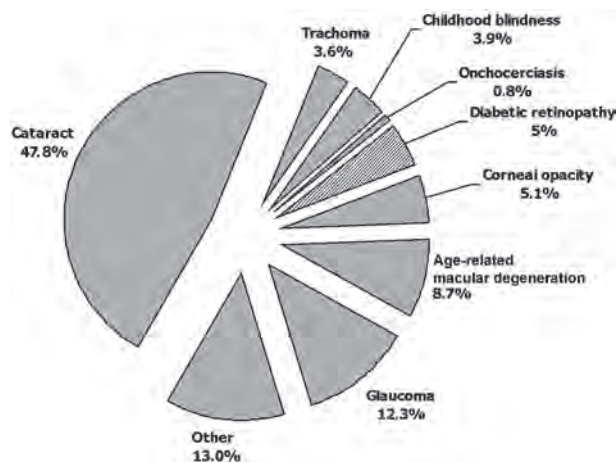


Fig. 1. Causes of blindness in the world.

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its incidence can be expected to rise continually with aging of the population and growing rate of obesity in both adults and children. In addition, diabetes in children and young adults has become an increasingly serious health problem, which will result in more people having and managing diabetes for most of their lives.

Although most of diabetes burden in the world is due to type 2 diabetes, due understanding of the different types of diabetes and their health impact is warranted.

This article reviews the literature on the epidemiology of diabetes and compares some epidemiological data from the Split-Dalmatia County (Croatia) with available data from the rest of the world (Africa, North America, South-Central America, Europe, Middle East and Thailand).

The Pathophysiology of Diabetes

Diabetes mellitus is a group of chronic metabolic conditions, all of which are characterized by elevated blood glucose levels resulting from the body's inability to produce insulin, or resistance to insulin action, or both². This group of conditions can be subdivided into 4 clinically distinct types; 1) type 1 diabetes, which results from autoimmune beta cell destruction in the pancreas; 2) type 2 diabetes, which develops when there is an abnormally increased resistance to the action of insulin and the body cannot produce enough insulin to overcome the resistance; 3) gestational diabetes, which is a form of glucose intolerance that affects some women during pregnancy; and 4) a group of other types of diabetes caused by specific genetic defects of beta cell function or insulin action, diseases of the pancreas, or drugs or chemicals².

Type 1 diabetes accounts for 5% to 10% of all cases of diabetes. Its risk factors include autoimmune,

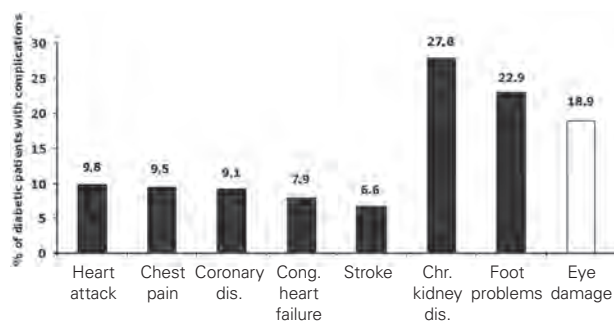


Fig. 2. Prevalence of diabetic complications.

genetic, and environmental factors. Type 2 diabetes accounts for 90% to 95% of all diagnosed diabetes cases³.

The Incidence and Prevalence of Diabetic Retinopathy

The incidence (or new cases) of diabetes describes increases in the number of people affected by the disease, while the prevalence (or existing cases) of diabetes describes the overall burden of the disease in the population. Population based sources state that the actual mean prevalence of diabetes in Europe is around 2%, with the highest prevalence reported in Malta (7.7%)⁴. Data on Croatia indicate the prevalence of diabetes to be 6.1%, with a significant age difference and the undiagnosed to diagnosed diabetes ratio of 72:100⁵. The incidence of blindness in Europe has been estimated to 50-65 *per* 100,000 diabetic individuals *per* year⁶⁻⁹.

Diabetes is associated with many complications. Eye complications are among the most common ones and usually develop earlier than other complications (Fig. 2)¹⁰. Diabetic retinopathy is by far the most common eye complication; it is the cause of blindness in 2.9% of diabetic patients in Croatia¹¹.

Type 1 diabetes is also a growing problem because 5%-10% of all diabetic patients suffer from it. The prevalence of type 1 diabetes in Europe is among highest in the world (Fig. 3)¹². Some countries, like Finland, struggle with extremely high incidences of type 1 diabetes (43.9/100,000 children aged 0-14)¹³. Finland is followed by Canada with an incidence of

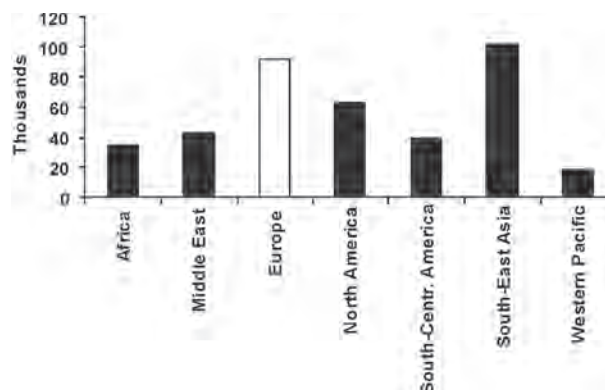


Fig. 3. Prevalence of type 1 diabetes according to world regions.

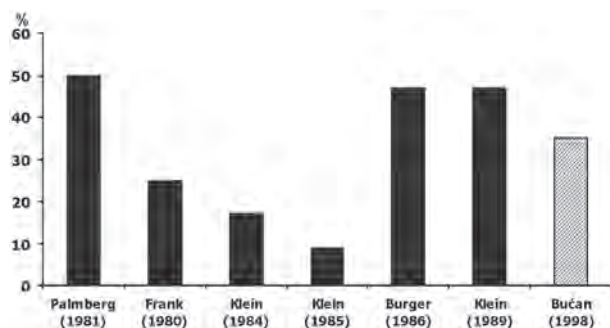


Fig. 4. Prevalence of diabetic retinopathy in children suffering from type 1 diabetes for 4-9 years.

23/100,000 children, Australia with 19.3 /100,000 children, and USA with 17/100,000 children *per year*¹³. On the other hand, other countries like United Kingdom, Hungary, Hawaii, and China are faced with a high relative increase in the incidence of type 1 diabetes¹⁴.

One of our previous studies can give an orientation in the situation with type 1 diabetes in Croatia. In that study, we assessed the incidence of diabetic retinopathy as the most common diabetic complication in children and young adults in the Split-Dalmatia County. Diabetic retinopathy was recorded in 66.7% of study patients. The mean time elapsed from the diagnosis of type 1 diabetes to enrolment in the study was 16.6 years for patients with diabetic retinopathy and 6.5 years for patients without diabetic retinopathy. Nonproliferative retinopathy was present in 56.7% and proliferative retinopathy in 10% of these 66.7% of patients with diabetic retinopathy. In patients with proliferative diabetic retinopathy, the mean time from the diagnosis of type 1 diabetes was 22.1 years¹⁵.

The prevalence of diabetic retinopathy in patients with type 1 diabetes varies from author to author.

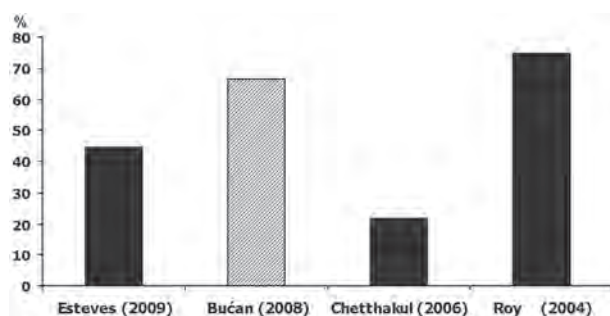


Fig. 5. Prevalence of diabetic retinopathy in children suffering from type 1 diabetes for 13-17 years.

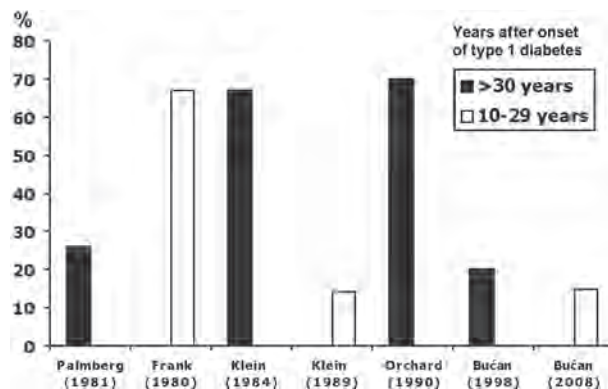


Fig. 6. Prevalence of proliferative diabetic retinopathy in patients suffering from type 1 diabetes for 10-29 or >30 years.

Figure 4 shows the prevalence of diabetic retinopathy reported only from studies that included patients having suffered from type 1 diabetes for 4-9 years¹⁶⁻²¹. The data recorded in our previous study conducted in the Split-Dalmatia County are consistent with the mean values presented in Figure 4²¹. Figure 5 illustrates the prevalence of diabetic retinopathy in patients treated for type 1 diabetes for 13-17 years^{15,22-24}. A similar relation to data reported by other authors is also seen for proliferative diabetic retinopathy, where we collected data for the Split-Dalmatia County on patients diagnosed with type 1 diabetes for less than 30 years (Fig. 6)^{16-18,21,25}.

Discussion

Diabetic retinopathy is the most common cause of vision loss in active population in industrialized countries. Therefore, better screening for sight threatening diabetic retinopathy should be systematic and regular. The increasing incidence of type 1 diabetes is an upcoming problem because if left untreated or poorly treated, it leads to serious vision loss in young active people. It is known that retinopathy is rare during the first 5 years of type 1 diabetes. Early recognition will identify patients at a high risk, who will benefit most from therapy. It is also important to sensitize these patients about the importance of good blood glucose control and annual dilated eye examinations and possibly retinal photography, which should be the standard of care implemented from the onset of type 1 diabetes and not delayed

for 3–5 years. These goals could be achieved through education, better therapeutics and evolving health-care support systems.

Although diabetic retinopathy remains the leading cause of preventable blindness in working adults, there are primary and secondary interventions proven effective in limiting visual loss. The indications, efficacy, and safety of newer medical and surgical treatments, however, also require further evaluation.

It is also important to stress that systematic epidemiological studies are needed to warrant good organization of the healthcare system, which would be able to offer support to these patients.

References

- World Health Organization. Fact sheet N° 282 (2009). Available from URL: <http://www.who.int/mediacentre/factsheets/fs282/en/index.html>
- American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care* 2006;29 Suppl:43-8.
- DESHPANDE AD, HARRIS-HAYES M, SCHOOTMAN M. Epidemiology of diabetes and diabetes-related complications. *Phys Ther* 2008;88:1254-64.
- WHO European health for all database. Available from URL: <http://data.euro.who.int/hfad/>
- METELKO Ž, RENAR-PAVLIĆ I, PILJIĆANIN T, SZIROVITZA L, TUREK S. Prevalence of diabetes mellitus in Croatia. *Diabetes Res Clin Pract* 2008;81:263-7.
- ICKS A, TRAUTNER C, HAASTERT B, BERGER M, GIANI G. Blindness due to diabetes: population-based age- and sex-specific incidence rates. *Diabet Med* 1997;14:571-5.
- WEBER B, BURGER W, HARTMANN R, HOVENER G, MALCHUS R, OBERDISSE U. Risk factors for the development of retinopathy in children and adolescents with type 1 (insulin-dependent) diabetes mellitus. *Diabetologia* 1986;29:23-9.
- PORTA M, TOMALINO MG, SANTORO F, GHIGO LD, CAIRO M, AIMONE M, PIETRAGALLA GB, PASSERA P, MONTANARO M, MOLINATTI GM. Diabetic retinopathy as a cause of blindness in the province of Turin, north-west Italy, in 1967-1991. *Diabetic Med* 1995;12:355-61.
- CULLINAN TR. Diabetic retinopathy and visual disability. *Diabetologia* 1982;23:504-6.
- UK Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes. *BMJ* 1998;317:703-13.
- ŠTRIGA M, MANDIĆ Z. Blindness and visual impairment in diabetic patients. *Acta Ophthalmol Lug* 1986;24:111-20. (in Croatian)
- International Diabetes Federation. *Diabetes Atlas Second Edition Executive Summary*. Brussels: International Diabetes Federation, 2003.
- CHONG JW, CRAIG ME, CAMERON FJ, CLARKE CF, RODDA CP, DONATH SM, WERTHER GA. Marked increase in type 1 diabetes mellitus incidence in children aged 0-14 yr in Victoria, Australia, from 1999 to 2002. *Pediatr Diabetes* 2007;8:67-73.
- ONKAMO P, VAANANEN S, KARVONEN M, TOUMILEHTO J. Worldwide increase in incidence of type I diabetes – the analysis of the data on published incidence trends. *Diabetologia* 1999;42:1395-403.
- BUĆAN K. The relationship between diabetic retinopathy, microalbuminuria and asymptomatic left ventricular dysfunction in patients with type 1 diabetes mellitus. PhD dissertation. Zagreb: School of Medicine, University of Zagreb, 2008.
- PALMBERG P, SMITH M, WALTMAN S, KRUPIN T, SINGER P, BURGESS D, WENDTLANT T, ACHTENBERG J, CRYER P, SANTIAGO J, WHITE N, KILO C, DAUGHADAY W. The natural history of retinopathy in insulin-dependent juvenile-onset diabetes. *Ophthalmology* 1981;88:613-8.
- FRANK RN, HOFFMAN WH, PODGOR MJ, JOONDEPH HC, LEWIS RA, MARGHERIO RR, NACHAZEL DP Jr, WEISS H, CHRISTOPHERSON KW, CRONIN MA. Retinopathy in juvenile-onset diabetes of short duration. *Ophthalmology* 1980;87:1-9.
- KLEIN R, KLEIN BE, MOSS SE, DAVIS MD, DEMETS DL. The Wisconsin Epidemiologic Study of Diabetic Retinopathy II. Prevalence and risk of diabetic retinopathy when age at diagnosis is less than 30 years. *Arch Ophthalmol* 1984;102:520-6.
- BURGER W, HÖVENER G, DÜSTERHUS R, HARTMANN R, WEBER B. Prevalence and development of retinopathy in children and adolescents with type 1 (insulin-dependent) diabetes mellitus. A longitudinal study. *Diabetologia* 1986;29:17-22.
- KLEIN R, KLEIN BE, MOSS SE, DAVIS MD, DEMETS DL. The Wisconsin Epidemiologic Study of Diabetic Retinopathy IX. Four-year incidence and progression of diabetic retinopathy when age at diagnosis is less than 30 years. *Arch Ophthalmol* 1989;107:237-43.
- BUĆAN K. Odnos između stupnja dijabetične retinopatije i pojave dijabetične nefropatije u dijabetičnih bolesnika ovisnih o insulinu. MA thesis. Zagreb: School of Medicine, University of Zagreb, 1998.
- ESTEVEZ JF, KRAMER CK, AZEVEDO MJ, STOLZ AP, ROGGIA MF, LARANGEIRA A, MIOZZO SA, ROSA C, LAMBERT JH, PECIS M, RODRIGUES TC, CANANI LH. Prevalence of diabetic retinopathy in patients with type 1 diabetes mellitus. *Rev Assoc Med Bras* 2009;55:268-73.

23. CHETTHAKUL T, LIKITMASKUL S, PLENGVIDHYA N, SUWANWALAIKORN S, KOSACHUNHANUN N, DEEROCHANAWONG C, KRITTIYAWONG S, LEELAWATANA R, BENJASURATWONG Y, BUNNAG P, PRATHIPANAWATR T, NGARMUKOS C, MONGKOLSOMLIT S, RAWDAREE P. Thailand Diabetes Registry Project: Prevalence of diabetic retinopathy and associated factors in type 1 diabetes mellitus. *J Med Assoc Thai* 2006;89:S17-26.
24. ROY MS, KLEIN R, O'COLMAIN BJ, KLEIN BE, MOSS SE, KEMPEN JH. The prevalence of diabetic retinopathy among adult type 1 diabetic persons in the United States. *Arch Ophthalmol* 2004;122:546-51.
25. ORCHARD TJ, DORMAN JS, MASER RE, BECKER DJ, DRASH AL, ELLIS D, LAPORTE RE, KULLER LH. Prevalence of complications in IDDM by sex and duration. Pittsburgh Epidemiology of Diabetes Complications Study II. *Diabetes* 1990;39:1116-24.

Sažetak

SLJEPOĆA I POREMEĆAJI VIDA KOD DIJABETIČARA U HRVATSKOJ

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Najnovije procjene ukazuju na smanjenje broja slijepih osoba i osoba sa slabijim vidom uzrokovanih zaraznim bolestima, no sve je veći broj ljudi slijepih zbog bolesti vezanih za produženje životnog vijeka ljudi i dijabetes. Dijabetična retinopatija je vodeći uzrok sljepoće u radnoj populaciji u razvijenim zemljama. Mnoge epidemiološke studije su procijenile incidenciju i sagledale ovu bolest iz svih njezinih aspekata. Cilj ovoga rada je prikazati epidemiološke podatke o dijabetičnoj retinopatiji uzrokovanoj dijabetesom tip 1 u Hrvatskoj, te ih usporediti s podacima iz drugih zemalja i ocijeniti koliko ona utječe na broj slijepih osoba i osoba sa slabijim vidom. Smatramo ove podatke bitnima unatoč napretku u saznanjima o mehanizmima, raspodjeli i uzrocima bolesti. Treba također naglasiti da se ovi podatci neprestance mijenjaju i zbog toga ih valja stalno pratiti. To je osobito važno zbog toga što dijabetes uzrokuje veliko opterećenje za zajednicu i zdravstveni sustav koji se skrbi o ovim bolesnicima.

Ključne riječi: *Dijabetična retinopatija – etiologija; Diabetes melitus tip 1 – komplikacije; Dijabetična retinopatija – epidemiologija; Hrvatska*