Rishi P Singh
Editor

Managing Diabetic Eye Disease in Clinical Practice

Adis

Managing Diabetic Eye Disease in Clinical Practice

Editor
Rishi P Singh

Managing Diabetic Eye Disease in Clinical Practice

Adis

Editor
Rishi P Singh
Cole Eye Institute
Cleveland Clinic
Case Western Reserve University
Cleveland, Ohio USA

ISBN 978-3-319-08328-5 ISBN 978-3-319-08329-2 (eBook)

DOI 10.1007/978-3-319-08329-2

Springer Cham Heidelberg New York Dordrecht London

Printed on acid-free paper

Adis is a brand of Springer
Springer is part of Springer Science+Business Media (www.springer.com)

Project editor: Katrina Dorn

Contents

Contributors

Rumneek Bedi
Cole Eye Institute
Cleveland Clinic Foundation
Cleveland, OH

Anjum Cheema
Milan Eye Center
Atlanta, GA, USA

Diana V Do
Truhlsen Eye Institute
University of Nebraska Medical Center
Omaha, NE

William J Dupps
Cole Eye Institute
Cleveland Clinic Foundation
Cleveland, OH

Karishma Habbu
Case Western Reserve Medical School
Cleveland, OH, USA

Andrew M Hendrick
Emory Eye Center
Atlanta, GA

Michael S Ip
University of Wisconsin-Madison
School of Medicine and Public Health
Madison, WI

Viral Juthani
Montefiore Medical Center
Albert Einstein College of Medicine
Bronx, NY

Peter K Kaiser
Cole Eye Institute
Cleveland Clinic Foundation
Cleveland, OH

Carolyn Kloek
Massachusetts Eye and Ear
Harvard Medical School
Boston, MA

Kristine Lo
Massachusetts Eye and Ear
Harvard Medical School
Boston, MA

Yasha S Modi
Cole Eye Institute
Cleveland Clinic Foundation
Cleveland, OH

Paula E Pecen
Cole Eye Institute
Cleveland Clinic Foundation
Cleveland, OH

Elias Reichel
New England Eye Center
Tufts University School of Medicine
Boston, MA

Andrew P Schachat
Cole Eye Institute
Cleveland Clinic Foundation
Cleveland, OH

David Salz
New England Eye Center
Tufts University School of Medicine
Boston, MA

Nathaniel Sears
Cole Eye Institute
Cleveland Clinic Foundation
Cleveland, OH

Kuldev Singh
Department of Ophthalmology
Stanford University School of Medicine
Palo Alto, CA

Samuel L Thomsen
Truhlsen Eye Institute
University of Nebraska Medical Center
Omaha, NE

R Joel Welch
Truhlsen Eye Institute
University of Nebraska Medical Center
Omaha, NE

Alex Yuan
Cole Eye Institute
Cleveland Clinic Foundation
Cleveland, OH

Editor biography

Dr Rishi Singh MD is a staff surgeon at the Cole Eye Institute, Cleveland Clinic and Assistant Professor of Ophthalmology at the Lerner College of Medicine in Cleveland Ohio. He also currently serves as the medical director of informatics at the Cleveland Clinic. He received his medical degree from Boston University in the prestigious accelerated medical program and completed his residency at the Massachusetts Eye and Infirmary Harvard Combined Program in Boston, Massachusetts. Dr Singh then completed a medical and surgical fellowship at the Cole Eye Institute in Cleveland, Ohio. He specializes in the treatment of medical and surgical retinal disease such as diabetic retinopathy and age-related macular degeneration. Dr Singh has authored greater than 60 peer reviewed publications, books, and book chapters and serves as the principal investigator of numerous national clinical trials advancing the treatment of retinal disease. He is frequently invited to speak at national and international meetings, as well as continuing medical education seminars. Dr Singh is also a reviewer for various ophthalmology and diabetes medical publications including *Archives of Ophthalmology*, *American Journal of Ophthalmology*, *Investigative Ophthalmology & Visual Science (IOVS)*, and *Ophthalmology*. He maintains a strong relationship with drug development and commercial entities by serving on scientific advisory boards. Dr. Singh's current work focuses on the electronic medical records implementation, lean process improvement, and decision support modules for clinical practice. He operates the Cleveland Clinic Electronic Health Record Consulting program. Dr Singh has been honored with several research recognitions such as the Alpha Omega Alpha Research Award and American Society of Retina Specialists Senior Honor Award.

Chapter 1

Impact of diabetic retinopathy

Rumneek Bedi, Karishma Habbu, Rishi P Singh

Introduction

In 2010, there was an estimated 26 million people who had diabetes, as well as 79 million individuals older than 20 years of age with pre-diabetes [1], and the prevalence of diabetes is projected to increase significantly across the globe. In fact, the US Centers for Disease Control and Prevention (CDC) estimates that 1 in 3 people could have diabetes by the year 2050 [2]. Although many prevention strategies are available for type 2 diabetes, not many strategies are available to patients with type 1 diabetes to address the increasing prevalence and burden [3]. The encumbrance of the disease lies within the many progressive long-term microvascular and macrovascular complications and the economic implications on health care systems and the patient population-at-large.

The costs of managing diabetes and its complications are substantial. The estimated total cost of diabetes in the United States alone was estimated to be US$245 billion in 2012, almost double what it was 10 years ago ($132 billion in 2002) [4]; the cost of diabetes is expected to rise to at least $490 billion by 2030 [5]. The increasing prevalence of diabetes and its associated economic strain indicates that diabetes is an affliction that needs to be addressed [6,7].

Macrovascular and microvascular complications

Diabetes macrovascular and microvascular complications affect up to 72% of the total diabetic population. The Cost Of Diabetes in Europe – type 2

R.P. Singh (ed.), *Managing Diabetic Eye Disease in Clinical Practice*,
DOI 10.1007/978-3-319-08329-2_1

(CODE-2) study, the first Europe-wide investigation in to the health care costs associated with ype 2 diabetes, found that of patients with microvascular diabetic complications, 28% had neuropathy, 20% had renal damage, and 26% had both diabetic retinopathy (DR) and related eye complications (Figure 1.1) [8]. Among the patients with macrovascular complications, 18% had peripheral vascular disease, 17% had angina, 12% had heart failure, and 9% had myocardial infarction (Figure 1.2) [8]. The CODE-2 study demonstrated that in patients with both microvascular and macrovascular complications, the total cost of management increased by up to 250% compared to those without complications. It follows that proper prevention, screening, and management of diabetes could not only directly benefit the overall health and well-being of

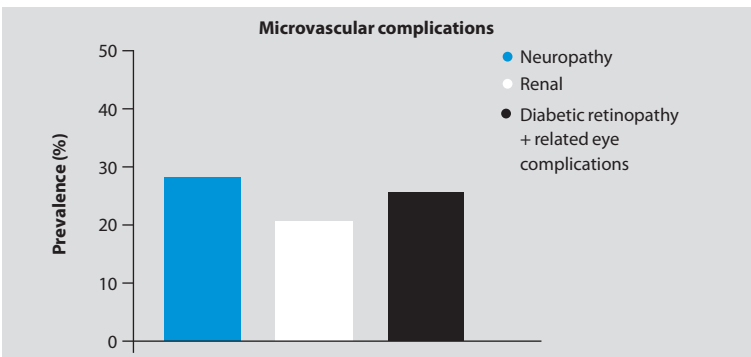

Figure 1.1 Distribution of microvascular complications due to diabetes.

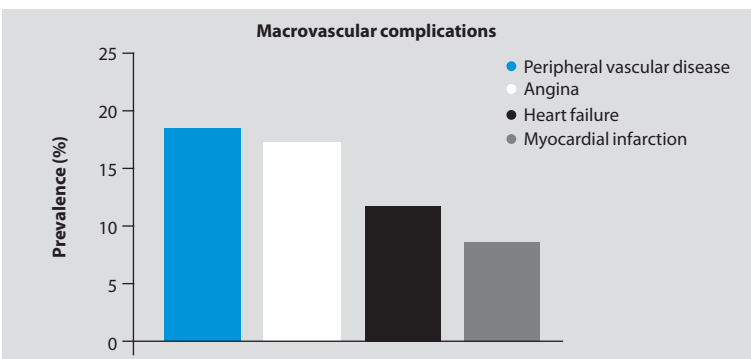

Figure 1.2 Distribution of macrovascular complications due to diabetes.

patients, but also potentially reduce the economic burden that diabetes poses to both individuals and to society [8].

Diabetic retinopathy

DR is a leading cause of new cases of blindness in adults of working age (20 to 74 years old) [5]. The results of the National Health and Nutrition Examination Surveys III (NHANES) documented DR prevalence from 2005 to 2008 and reported that among persons with diabetes aged 40 years or older, 28.5% of individuals had DR [5]. Among those individuals, 4.4% developed vision-threatening DR. Retinopathy itself does not necessarily visually impair individuals; rather, the visual impairment is due to the complications that result, such as retinal detachment, preretinal or vitreous hemorrhage, neovascular glaucoma, capillary nonperfusion or, most commonly, diabetic macular edema (DME) (Figure 1.3) [5,9].

Of these secondary complications, DME is the most important cause of visual impairment in patients with diabetes [10]. The NHANES survey reported that approximately 13% of patients with DR have DME [5]. Within the Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetic Study (SN-DREAMS) report (n=1414), 31.76% of patients with diabetes had DR and DME and 5.72% of the patients had DME alone [11].

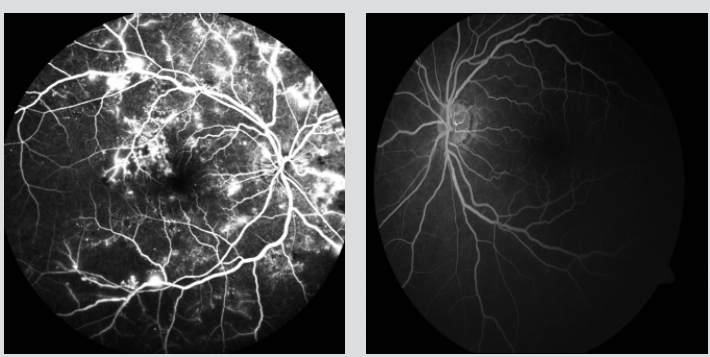

Figure 1.3 Fluorescein angiography of a patient with proliferative diabetic retinopathy. An advanced form of diabetic retinopathy in which new blood vessels grow within the retina causing bleeding, cloudy vision and retinal damage (left). A normal fluorescein angiography is shown on the right for comparison.

As DR progresses, so does the risk of developing DME; for this reason, it is important to assess the risk factors of DR in order to prevent progression toward developing the vision-threatening complications from diabetes.

Diabetic retinopathy risk factors

Disease duration

Duration of diabetes is an important factor when assessing patients' risk of developing diabetes complications, as the incidence of DR increases with greater duration of diabetes (Figure 1.4) [12]. The Australian Diabetes, obesity, and lifestyle (AusDiab) study demonstrated a relationship between disease duration, glycosylated hemoglobin (HbA1c), and increasing DR prevalence in patients with type 2 diabetes [13]. The study found that the prevalence of DR in those with known type 2 diabetes versus those with newly diagnosed type 2 diabetes was 21.9% and 6.2%, respectively.

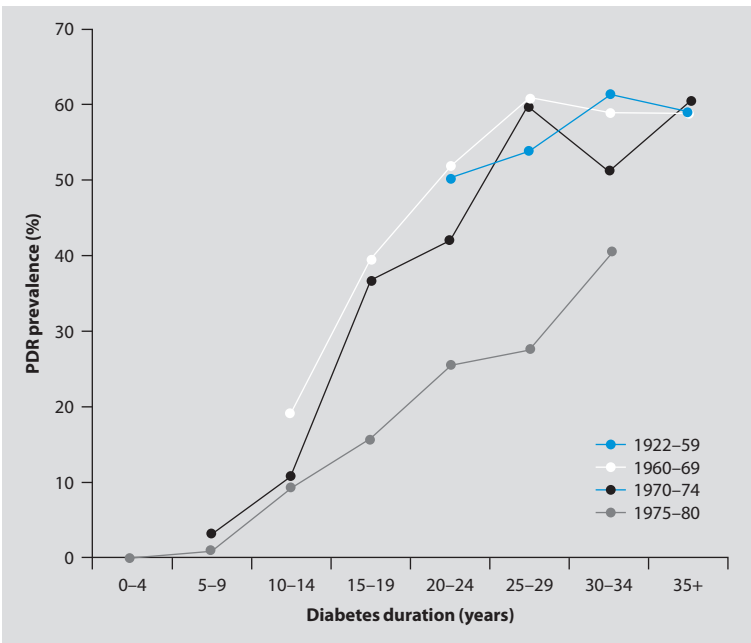

Figure 1.4 Prevalence of proliferative diabetic retinopathy (PDR) by diabetes duration and period of diagnosis. The graph depicts improvements in reducing progression to proliferative diabetic retinopathy over time. However, a significant number of patients do progress to this vision-threatening state**.** Reproduced with permission from Klein et al [9] ©ADA.