Eye Care Skills: Presentations for Physicians and Other Health Care Professionals Version 3.0

Diabetes and Eye Disease

Speaker Notes

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A GUIDE TO PRESENTING
Diabetes and Eye Disease

Diabetes and Eye Disease is a slide-script program for primary care physicians and other medical professionals who care for patients with diabetes.

Although diabetic retinopathy, a serious vision-threatening complication of diabetes, is the leading cause of new blindness in adults aged 20-74, it is estimated that blindness can be prevented in most of these cases. For this reason, the early diagnosis and referral of patients with diabetic retinopathy is essential.

The goal of this program is to enhance primary care physicians' awareness and knowledge of diabetic retinopathy as well as their diagnostic and management skills. The program provides information on the epidemiology, pathophysiology, diagnosis, and management of diabetic retinopathy. Specific referral guidelines are given, and a section on therapy is included to allow the health practitioner to more effectively describe laser surgery and vitrectomy to the patient. The management principles outlined in this slide-script are based in large measure on NIH-sponsored multicenter prospective trials.

Approximate Running Time

45-75 minutes

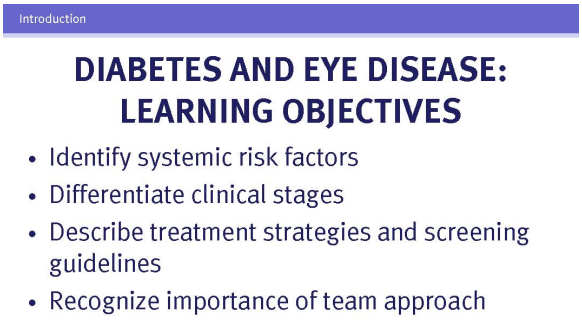
Suggested Audience

- Medical students
- Family physicians
- Internists
- Diabetologists (adult and pediatric)
- First-year ophthalmology residents
- American Association of Diabetes Educators (member organization)
- Physicians' assistants
- Nurses and nurse practitioners

INTRODUCTION

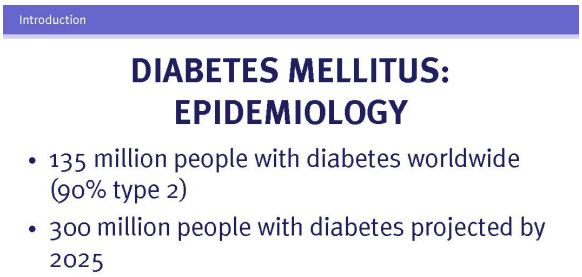
SLIDE 1

The goal of this presentation is to strengthen the role of the primary care physician and other medical professionals in preventing vision loss from diabetic retinopathy. At the end of this presentation, the participant should be able to identify systemic risk factors of diabetic retinopathy, distinguish among the various stages of retinal disease, describe treatment strategies and screening guidelines for diabetic patients, and recognize the importance of communication between primary care physicians and ophthalmologists.



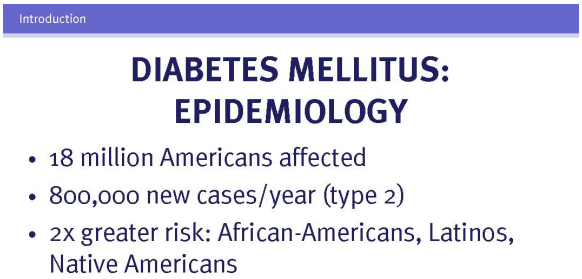
SLIDE 2

Diabetes mellitus is a ubiquitous disease of enormous proportion. Worldwide, 135 million people are affected, a number expected to increase to 300 million by 2025. Ninety percent of these patients have type 2 (non–insulin-dependent) diabetes. The disease has reached epidemic numbers in many developing nations.



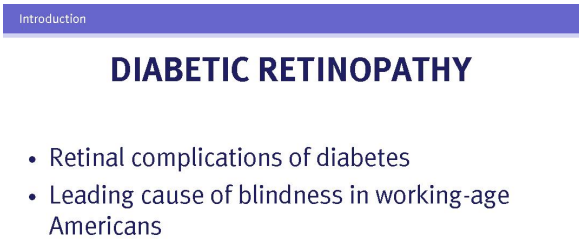
SLIDE 3

Diabetes affects nearly 18 million Americans, at least one third of whom have not yet been diagnosed. Each year, 800,000 new cases of type 2 diabetes are diagnosed in the United States. Minority communities are particularly at risk. African-Americans, Latinos, and native Americans are roughly twice as likely as Caucasians to be affected.



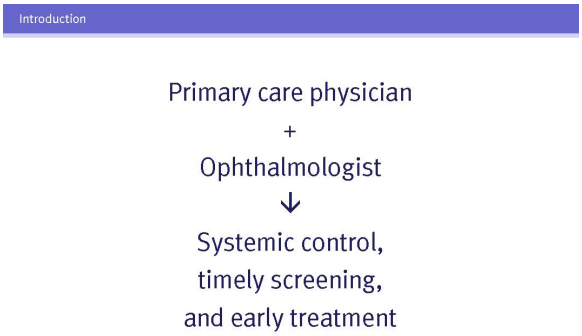
SLIDE 4

The retinal complications of diabetes, called *diabetic retinopathy*, are the leading cause of blindness in working-age Americans. The American Diabetes Association reports that 12,000 to 24,000 people with diabetes lose their sight each year.



SLIDE 5

Patients who have retinopathy and who are under the care of an ophthalmologist should adhere to a follow-up examination schedule determined by the ophthalmologist in cooperation with the primary care physician. A team approach to achieving tight glycemic control, timely screening, and early treatment will maximize the patient's ocular and systemic prognosis.

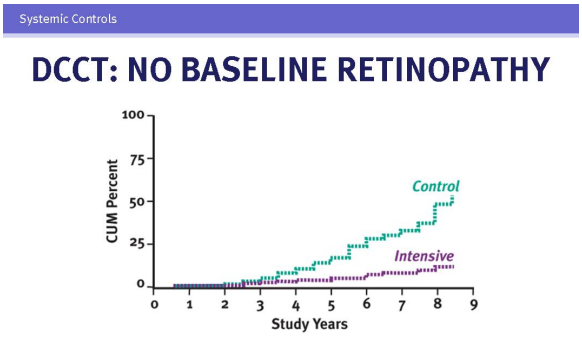


SYSTEMIC CONTROLS

Glucose

SLIDE 6

The Diabetes Control and Complications Trial (DCCT), a prospective clinical trial sponsored by the NIH, recruited 1400 patients with insulin-dependent (type 1) diabetes in the United States and Canada. Patients with no baseline retinopathy and patients with mild to moderate nonproliferative diabetic retinopathy (NPDR) were randomized between two treatment groups—conventional or intensive therapy. The DCCT demonstrated that intensive glucose control reduces the rate of development and progression of diabetic retinopathy in type 1 patients with and without baseline retinopathy.

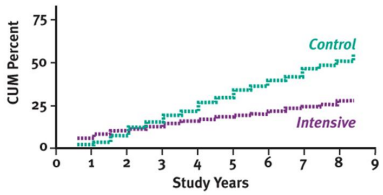


SLIDE 7

Intensive glucose control also reduces the development and progression of diabetic retinopathy in patients with mild to moderate retinopathy at baseline.

Systemic Controls

DCCT: MILD TO MODERATE RETINOPATHY



SLIDE 8

Patients in the intensive treatment group achieved glycemic control with insulin pumps or three or more daily insulin injections and frequent home blood glucose monitoring. Those in the conventional group received no more than two daily insulin shots and less frequent glucose monitoring. Both groups were observed for an average of 6.5 years. Patients with no baseline retinopathy who used intensive therapy showed a 27% reduction in developing retinopathy and a 76% reduction in developing more progressive retinopathy.

Systemic Controls

DCCT: INTENSIVE GLUCOSE CONTROL, NO BASELINE RETINOPATHY

- 27% reduction in developing retinopathy
- 76% reduction in risk of developing progressive retinopathy

SLIDE 9

Patients with baseline (mild to moderate NPDR) retinopathy who received intensive treatment showed a 54% reduction in the progression of retinopathy, a 47% reduction in the development of severe NPDR or proliferative diabetic retinopathy (PDR), and a 59% reduction in the need for laser surgery. It should be noted that during the early stages of intensive management, pre-existing retinopathy may worsen.

Systemic Controls

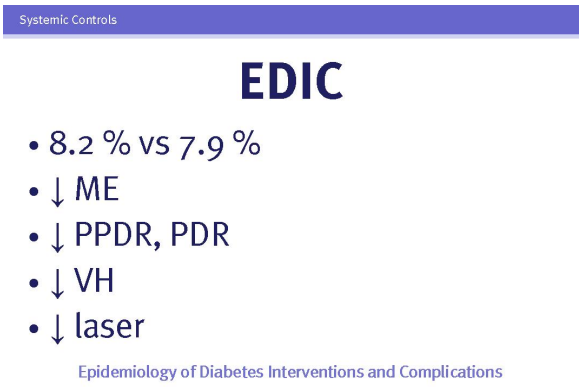
DCCT: INTENSIVE GLUCOSE CONTROL, MILD TO MODERATE NPDR

- 54% reduction in progression of retinopathy
- 47% reduction in development of severe NPDR or PDR
- 59% reduction in need for laser surgery
- Pre-existing retinopathy may worsen in early stages of treatment

Hypertension

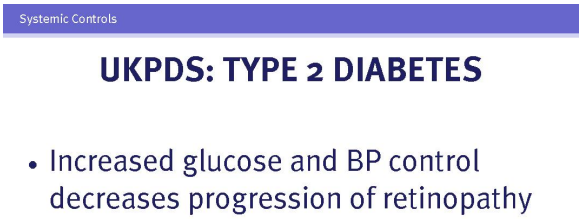
SLIDE 10

This study is an extension of the DCCT that showed that initial glycemic control has long term benefit. After completion of the DCCT the intensive and standard control groups were followed for an additional 2 to 3 years. Even though the A1C median leveled out there was a statistically decreased risk of macular edema and vitreous hemorrhage and progression of retinopathy in the initial tight-control group.



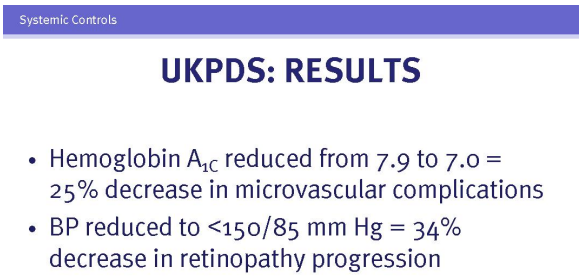
SLIDE 11

The United Kingdom Prospective Diabetes Study (UKPDS) was a prospective, randomized trial of patients with type 2 diabetes. Intensive glucose control with insulin or oral hypoglycemic agents was compared to conventional therapy in which patients were initially treated with diet alone. In addition, intensive blood pressure control was compared to conventional management. Reduction of both glucose and blood pressure with intensive control was found to decrease the rate of progression of diabetic retinopathy.



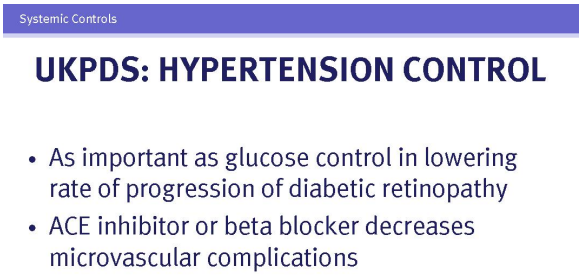
SLIDE 12

The UKPDS demonstrated that reducing hemoglobin A_{1C} from 7.9 to 7.0 with intensive therapy was associated with a 25% decrease in microvascular complications (as exemplified by a corresponding decrease in the need for retinal laser surgery) and that reducing blood pressure to less than 150/85 mm Hg was associated with a 34% reduction in the progression of retinopathy.



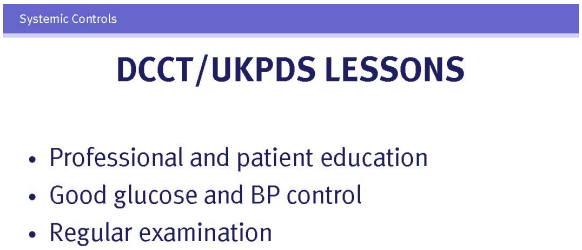
SLIDE 13

The UKPDS found that control of hypertension in type 2 diabetes is just as important as glucose control in delaying the onset or progression of diabetic retinopathy. Angiotensin-converting enzyme (ACE) inhibitors and beta blockers were equally effective in lowering blood pressure and decreasing the risk of progression of retinopathy.



SLIDE 14

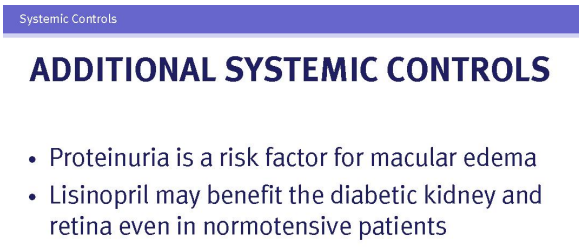
To help realize the benefits demonstrated by the DCCT and the UKPDS, all physicians should familiarize themselves and their patients with diabetic ocular complications, the benefits of maintaining strict glycemic and blood pressure control, and the need for appropriate examination schedules.



Additional Systemic Controls

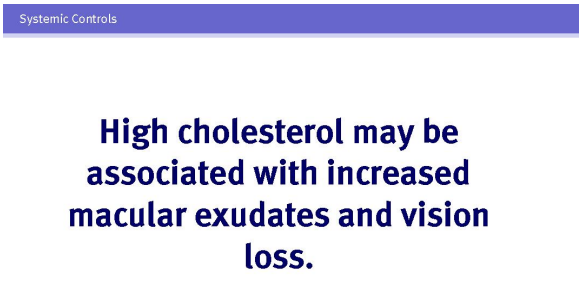
SLIDE 15

Diabetic nephropathy and proteinuria have been associated with more advanced retinopathy and macular edema. Optimizing the kidney status may be beneficial to the retina. ACE inhibitors such as lisinopril are known to be of benefit to the diabetic kidney. The EUCLID study (European Controlled Trial of Lisinopril in Insulin-dependent Diabetes) found that lisinopril decreases the progression of retinopathy in normotensive patients with type 1 diabetes.



SLIDE 16

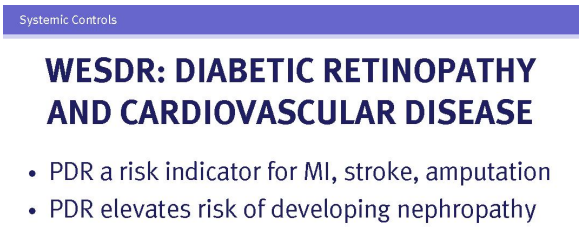
Data suggest that elevated total cholesterol is directly associated with the presence or development of hard exudates, an adverse feature of macular edema. It remains to be seen if lowering serum cholesterol will decrease hard exudates and improve the visual prognosis of diabetic macular edema.



Diabetic Retinopathy and Cardiovascular Disease

SLIDE 17

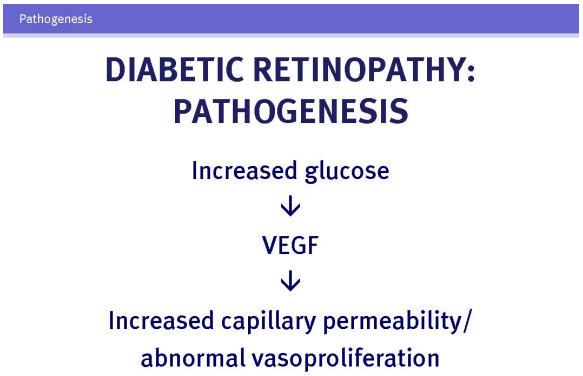
Findings of the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR) show special interrelationships between proliferative diabetic retinopathy and cardiovascular disease. The presence of PDR was observed to be an important risk indicator for the development of myocardial infarction, stroke, and amputation. These findings were noted after controlling for age and duration of diabetes. In addition, patients with PDR were at higher risk of developing diabetic nephropathy.



PATHOGENESIS

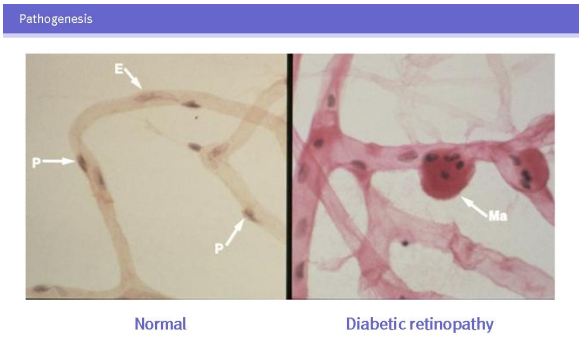
SLIDE 18

Elevated glucose levels may result in various metabolic abnormalities, leading to an increased production of multiple growth factors, especially vascular endothelial growth factor (VEGF). VEGF causes increased capillary permeability and abnormal vasoproliferation.



SLIDE 19

The trypsin digest—a light microscopic study of retinal blood vessels—on the right highlights an early change of diabetic retinopathy: loss of pericytes, the supportive cells of the retinal vasculature, which are more numerous in the normal digest on the left. Endothelial cells are lost later. These abnormalities are followed by the formation of microaneurysms, leaky outpouchings of the capillary walls that represent the first clinically detectable evidence of diabetic retinopathy. Other sequelae include abnormal permeability, capillary nonperfusion, and neovascularization.



CLINICAL STAGES OF RETINOPATHY

SLIDE 20

The effects of diabetes on the retina are manifested in progressive stages that are defined by ophthalmoscopic criteria. In the first stage, termed *nonproliferative diabetic retinopathy* (NPDR), features that reflect retinal capillary damage and breakdown in the blood-ocular barrier are noted. In the second stage, called *preproliferative diabetic retinopathy* (also referred to as *severe NPDR*), ischemic retinopathy is more prominent. In the third stage, proliferative diabetic retinopathy (PDR), progressive retinal ischemia promotes the growth of fragile new blood vessels, or neovascularization.

Nonproliferative Diabetic Retinopathy

SLIDE 21

Ophthalmoscopy reveals microaneurysms, hard exudates, and intraretinal hemorrhages with mild to moderate NPDR. Each of these abnormalities may occur in isolation or in combination. Patients may be asymptomatic at this stage, even as their disease is causing severe retinal damage.

Clinical Stages of Retinopathy

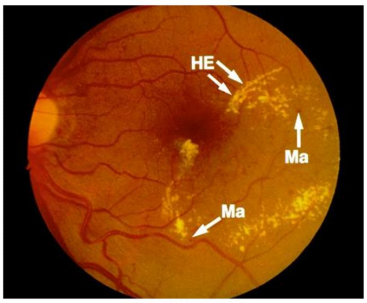
MILD TO MODERATE NPDR

- Microaneurysms
- Hard exudates
- Intraretinal hemorrhages
- Patients may be asymptomatic.

SLIDE 22

Microaneurysms are usually the earliest visible manifestation of diabetic retinopathy. They appear as tiny red dots scattered in the retina posteriorly (single arrows). They may be surrounded by a ring of yellow lipid, or hard, exudates (double arrow). Exudates are the result of vascular leakage, but the specific leaking microaneurysm may not be visible ophthalmoscopically.

Clinical Stages of Retinopathy

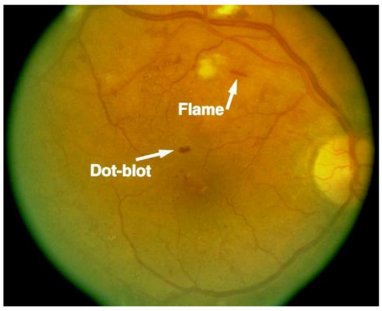


Microaneurysms

SLIDE 23

Intraretinal hemorrhages appear either as red dots or blots, sometimes indistinguishable from microaneurysms, or as flame-shaped hemorrhages.

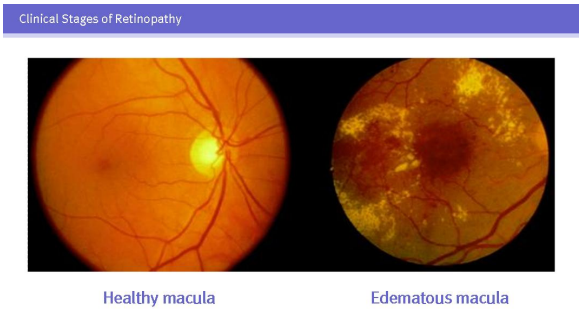
Clinical Stages of Retinopathy



Intraretinal hemorrhages

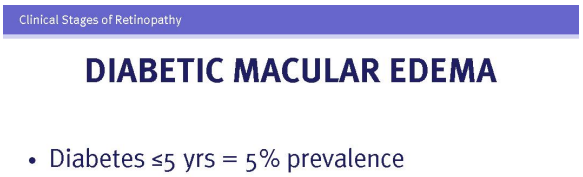
SLIDE 24

Vascular leakage, fluid, and/or exudate in the macula is referred to as diabetic macular edema (DME). Compare the healthy macula on the left with the edematous macula, caused by leaking microaneurysms, on the right. When diabetic macular edema involves or threatens the fovea, it is termed clinically significant macular edema (CSME). DME is the most frequent cause of moderate visual loss that may occur at any stage of retinopathy, although it is more common and severe in the later stages. It also may be associated with normal vision and may be difficult to appreciate ophthalmoscopically.



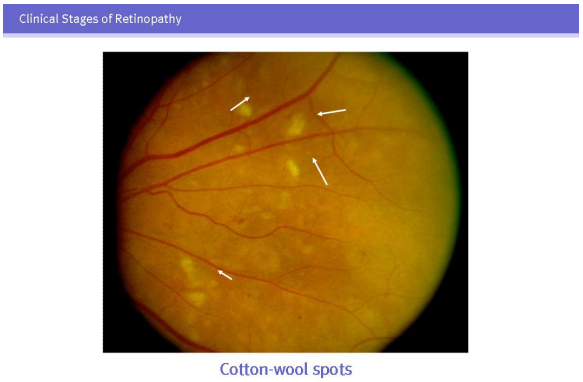
SLIDE 25

The prevalence of diabetic macular edema is strongly associated with the duration of diabetes, according to the Wisconsin Epidemiologic Study of Diabetic Retinopathy (Klein et al, 1989b). Macular edema was present in about 5% of patients who had diabetes for 5 years or less. However, the prevalence of edema rose to about 15% among patients who had had diabetes for 15 years or more. The prevalence was slightly lower for diabetic patients not using insulin. The study also found that higher glycosylated hemoglobin levels were associated with a higher prevalence of macular edema (Klein et al, 1988).



SLIDE 26

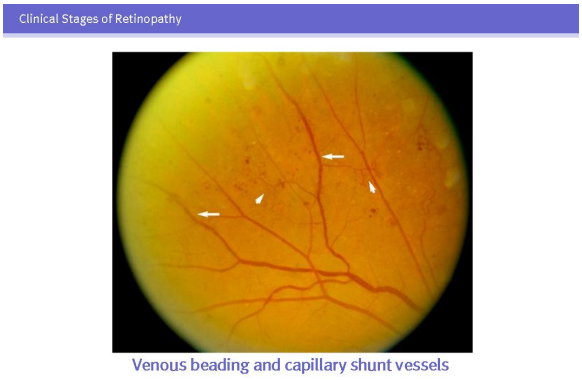
NPDR may also be associated with cotton-wool spots, superficial white lesions with feathery edges due to infarction of the nerve fiber layer of the retina causing axoplasmic stasis.



Preproliferative Diabetic Retinopathy

SLIDE 27

In preproliferative diabetic retinopathy (PPDR), more ominous ischemic lesions occur. These include irregular dilations of retinal veins, called venous beading (shown on the slide by the arrows), intraretinal microvascular abnormalities or capillary shunt vessels (shown on the slide by the arrowheads), and extensive retinal hemorrhages. Once these signs have appeared, approximately 50% of patients will develop proliferative retinopathy within 1 year. It may be beneficial, particularly for patients with type 2 diabetes, to begin panretinal laser therapy at this stage of disease to prevent long-term visual loss.



Venous beading and capillary shunt vessels

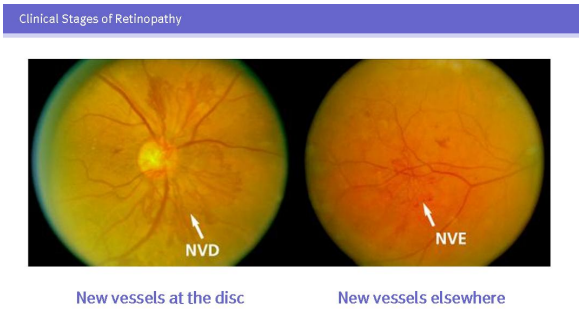
Proliferative Diabetic Retinopathy

SLIDE 28

Proliferative diabetic retinopathy (PDR) is the major cause of of blindness in diabetes. The ophthalmoscopic features include new retinal or optic disc blood vessels (neovascularization) that may be complicated by vitreous hemorrhage (the most common cause of blindness) and traction retinal detachment. Any of the nonproliferative findings, including macular edema, may also be present.

SLIDE 29

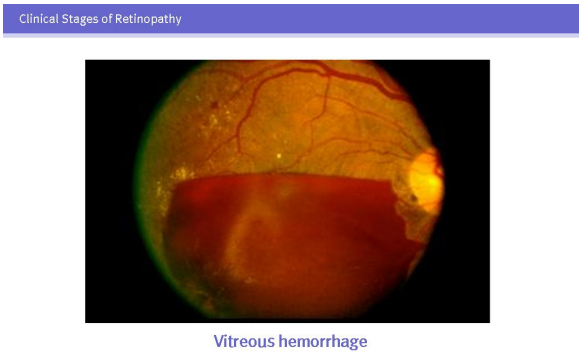
The delicate new vessels that grow on the surface of the retina resemble a tangle of hair or a fishnet. Neovascularization originating around the optic nerve head is referred to as new vessels at the disc (NVD), shown on the left. If originating elsewhere on the retina, the neovascularization is called new vessels elsewhere (NVE) shown on the right.



New vessels at the disc New vessels elsewhere

SLIDE 30

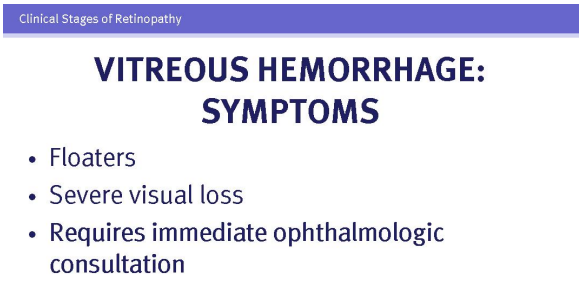
As these fragile new vessels grow, they may bleed into the vitreous cavity, a condition called vitreous hemorrhage.



Vitreous hemorrhage

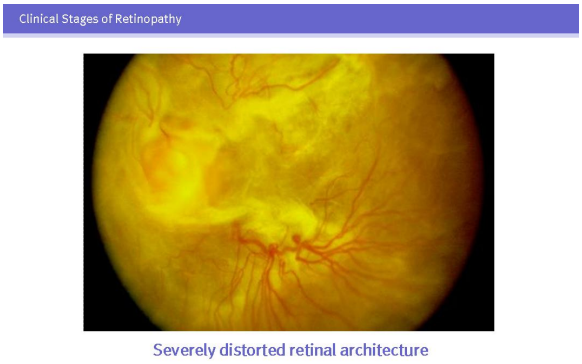
SLIDE 31

Vitreous hemorrhage may be mild, perceived by the patient as dark spots or floaters. Alternatively, vitreous hemorrhage may be more severe and may fill the vitreous compartment with blood, decreasing the patient's visual acuity to light perception only. Patients with these symptoms should be examined immediately by an ophthalmologist to rule out other causes of blindness such as retinal detachment and to assess for laser therapy.



SLIDE 32

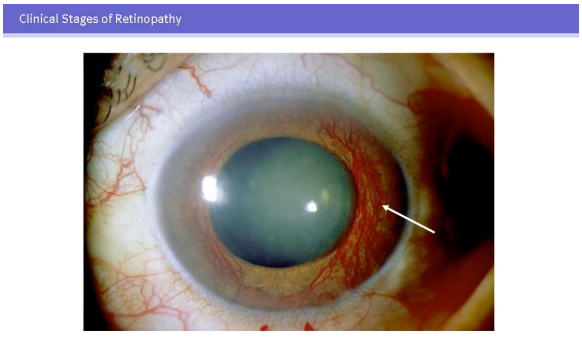
Fibrosis may accompany neovascularization. Fibrous elements may contract, causing distortion, tearing, or detachment of the retina and subsequent visual loss. Severe distortion of the retinal architecture due to fibrovascular proliferation is noted in this photograph.



Severely distorted retinal architecture

SLIDE 33

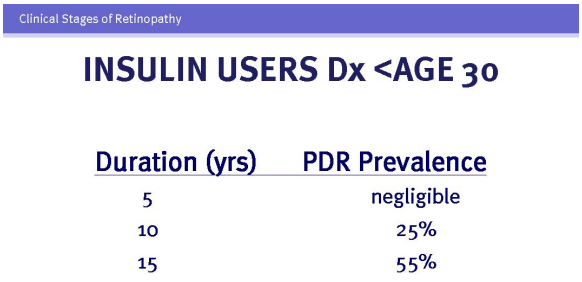
Neovascularization in diabetes is not always confined to the retina. Retinal ischemia may induce new vessel growth on the iris surface, shown by the arrow. . Iris neovascularization, or rubeosis iridis, may lead to peripheral iris adhesions blocking the normal drainage of aqueous fluid from the eye, potentially causing acute angle-closure glaucoma.



New vessel growth

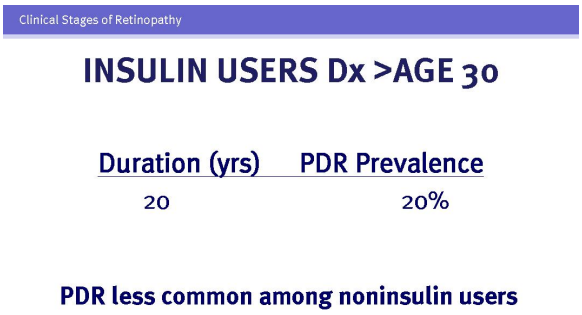
SLIDE 34

Insulin-using diabetic patients diagnosed before age 30 have a rare risk of developing PDR within the first 5 years after diagnosis. However, after 15 years' duration of DM, the prevalence rises to 25%, and to 55 % after 20 years.



SLIDE 35

In diabetic patients diagnosed after age 30, the prevalence of PDR is 20% in insulin-using patients 20 years after diagnosis, but is less common in non-insulin users.



SLIDE 36

In summary, the clinical stages of diabetic retinopathy include nonproliferative diabetic retinopathy (NPDR), in which patients may be asymptomatic; preproliferative diabetic retinopathy (PPDR), during which laser therapy may help preserve vision; and proliferative diabetic retinopathy (PDR), a major cause of severe visual loss.