

**Quick Reference Guide:**  
**Evidence-Based Clinical Practice Guideline**  
*First edition, 2014*

**Eye Care of the Patient With**

# **DIABETES MELLITUS**



American Optometric Association

## 1. DISEASE DEFINITION

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects of insulin secretion and/or increased cellular resistance to insulin. It is a chronic disease with long-term macrovascular and microvascular complications, including diabetic nephropathy, neuropathy, and retinopathy.

Diabetes mellitus can affect all structures of the eye and many aspects of visual function. Because it can lead to blindness, diabetic retinopathy is the most significant vision-threatening complication of diabetes.

## 2. DESCRIPTION AND CLASSIFICATION OF DIABETES MELLITUS

**a. Type 1 Diabetes Mellitus** – Results from cell-mediated autoimmune destruction of the beta-cells of the pancreas. (Formerly referred to as insulin dependent diabetes mellitus [IDDM] or juvenile diabetes)

Type 1 diabetes mellitus can occur at any age, but is more common in children and young adults. It has acute, symptomatic onset (e.g. polydipsia, polyphagia, polyuria, unexplained weight loss, dry mouth) and requires absolute dependency on exogenous insulin to prevent profound hyperglycemia and ketoacidosis.

**b. Type 2 Diabetes Mellitus** - Occurs when the body does not produce enough insulin (relative insulin deficiency) or cannot use the insulin it makes effectively (insulin resistance). (Formerly referred to as non-insulin dependent diabetes mellitus [NIDDM] or adult-onset diabetes)

Type 2 diabetes mellitus is the most common form of diabetes, with insidious, asymptomatic onset over many years. It develops more frequently in adults, however, the prevalence is increasing in children.

**c. Pre-Diabetes** - Occurs when blood glucose levels do not meet the criteria for diabetes, but are higher than considered normal. Persons with pre-diabetes have either:

- Impaired Glucose Tolerance (IGT): 2-hour plasma glucose value (75-g Oral Glucose Tolerance Test) of 140 mg/dl to 199 mg/dl,
- or
- Impaired Fasting Glucose (IFG): Fasting glucose levels of 100 mg/dl to 125 mg/dl.

**d. Gestational Diabetes Mellitus (GDM)** - Results from glucose intolerance during pregnancy, usually diagnosed during the second or third trimester.

**e. Other Types of Diabetes** - Occur secondary to genetic defects in beta-cell function or insulin action, pancreatic disease or other endocrinopathies, medications, toxic chemicals, infections, or immune-mediated diabetes.

## 3. DIAGNOSTIC CRITERIA

Plasma glucose estimation is the basis for diagnosis of diabetes. Cutoff glycemic levels are based on the association between glucose levels and increased prevalence of microvascular complications.

The current American Diabetes Association diagnostic criteria for diabetes are:

- A1C  $\geq$  6.5 percent\*, or
- A random plasma glucose level  $\geq$  200 mg/dl in a person with classic symptoms of hyperglycemia or hyperglycemic crisis, or
- Fasting plasma glucose level  $\geq$  126 mg/dl\*, or
- Two-hour plasma glucose level  $\geq$  200 mg/dl during an Oral Glucose Tolerance Test.\*

*\*In the absence of unequivocal hyperglycemia, these results should be confirmed by repeat testing.*

## **4. RISK FACTORS FOR DIABETES MELLITUS**

### **a. Type 1 Diabetes Mellitus**

- **Family history** – Parent or sibling with type 1 diabetes.
- **Viral exposure** - Epstein-Barr virus, coxsackie virus, mumps virus, or cytomegalovirus.
- **Autoimmune conditions** - Graves disease, Addison's disease, celiac disease, Crohn's disease, rheumatoid arthritis.

### **b. Type 2 Diabetes Mellitus**

- **Family history** - First-degree relatives with type 2 diabetes.
- **Overweight** - Body mass index (BMI)  $\geq 25$  kg/m<sup>2</sup> (at-risk BMI may be lower in some ethnic groups).
- **Age** -  $> 45$  years old.
- **Ethnicity** - African American, Hispanic/Latino, American Indian, Alaska Native, Asian American, or Pacific Islander.
- **History of gestational diabetes or delivering a baby weighting  $> 9$  pounds.**
- **Pre-diabetes.**
- **Hypertension** - Blood pressure  $\geq 140/90$  mm Hg.
- **Abnormal cholesterol levels** - HDL level  $< 35$  mg/dl and/or a triglyceride level  $> 250$  mg/dl.

## **5. EARLY DETECTION AND PREVENTION**

Weight loss and increased physical activity may delay and even prevent type 2 diabetes. Early detection and treatment of diabetes, including improved glycemic control and controlling hypertension, can reduce the risk of complications in people with either type 1 or type 2 diabetes.

## **6. DIABETIC RETINAL DISEASE**

**a. Diabetic Retinopathy** - A highly specific retinal vascular complication of diabetes mellitus. It is often asymptomatic early in the disease, and visual loss is primarily due to the development of macular edema, vitreous hemorrhage, or traction retinal detachment. The major risk factors for the development of diabetic retinopathy are diabetes duration and sustained hyperglycemia.

Diabetic retinopathy may progress from mild non-proliferative diabetic retinopathy (NPDR), characterized by increased vascular permeability, to moderate and severe NPDR, with vascular closure, to proliferative diabetic retinopathy (PDR), with the growth of new blood vessels on the retina and the posterior surface of the vitreous.

Clinical signs of retinopathy may appear early in the natural history of the disease. Identifying the severity level of diabetic retinopathy is important for determining the risk of progression and the appropriate care for preservation of vision.

**b. Diabetic Macular Edema** - The accumulation of intraretinal fluid in the macular area of the retina, with or without lipid exudates or cystoid changes. It is the most common cause of vision loss in persons with diabetes and may be present at any level of retinopathy.

*See "APPENDIX TABLE 1: Comparison of ETDRS and International Clinical Diabetic Retinopathy and Macular Edema Severity Scale"*

## **7. NON-RETINAL OCULAR COMPLICATIONS**

All structures of the eye and many aspects of visual function are susceptible to the deleterious effects of diabetes. Possible non-retinal ocular and visual complications include:

- Loss of visual acuity, refractive error changes, and accommodative dysfunction
- Changes in color vision and visual fields

- Eye movement anomalies
- Sluggish pupillary reflexes
- Conjunctival microaneurysms
- Tear film abnormalities
- Slower corneal wound healing and reduced corneal sensitivity
- Increased risk of contact lens related microbial keratitis
- Depigmentation of the iris
- Neovascular and open angle glaucoma
- Cataracts
- Vitreous degeneration
- Papillopathy and ischemic optic neuropathy

## **8. DIAGNOSIS OF OCULAR COMPLICATIONS OF DIABETES MELLITUS**

The ocular examination of an individual suspected of or having a diagnosis of diabetes should include all aspects of a comprehensive eye and vision examination, with supplemental testing, as needed.

**a. Patient History** - A review of both the ocular and systemic status of the patient:

- Quality of the patient's vision, including symptoms
- Ocular history, including previous ocular trauma, disease, or surgery
- Medical history, including obesity, pregnancy, and medications
- Duration of the diabetes
- Recent values for their A1C, blood pressure and cholesterol levels, and smoking history
- Patient's prescribed management of diabetes.

**b. Ocular Examination** - The initial ocular examination should include, but is not limited to, the following:

- Best corrected visual acuity
- Pupillary reflexes
- Ocular motility
- Refractive status
- Confrontation visual field testing or visual field evaluation
- Slit lamp biomicroscopy
- Tonometry
- Dilated retinal examination

Persons, without a diagnosis of diabetes, who present with signs suggestive of diabetes during the initial examination, should be referred to their primary care physician for evaluation, or an A1C test or fasting blood glucose analysis may be ordered.

When vitreous hemorrhage prevents adequate visualization of the retina, prompt referral to an ophthalmologist experienced in the management of diabetic retinal disease should be made for further evaluation.

The individual's primary care physician should be informed of eye examination results following each examination, even when retinopathy is minimal or not present.

**c. Supplemental Testing** - The use of additional procedures in diagnosing and evaluating diabetic retinopathy or other ocular abnormalities may be indicated.

## 9. OCULAR EXAMINATION SCHEDULE

Early diagnosis and treatment of diabetic retinal disease are effective in preserving vision. The following individuals diagnosed with diabetes should be examined for eye disease:

- As diabetes may go undiagnosed for many years, any individual with type 2 diabetes should have a comprehensive dilated eye examination soon after the diagnosis of diabetes.
- Individuals with diabetes should receive at least annual dilated eye examinations. More frequent examination may be needed depending on changes in vision and the severity and progression of the diabetic retinopathy.
- Women with pre-existing diabetes who are planning pregnancy or who become pregnant should have a comprehensive eye examination prior to a planned pregnancy or during the first trimester, with follow-up during each trimester of pregnancy.
- Examination of persons with non-retinal ocular complications should be consistent with current recommendations of care for each condition.

See *"Table 4: Frequency and Composition of Evaluation and Management Visits for Retinal Complications of Diabetes Mellitus"*

## 10. TREATMENT AND MANAGEMENT

### a. Persons with Non-retinal Ocular

**Complications** - Treatment protocols for patients with non-retinal ocular complications should follow current recommendations for care and include patient education and recommendations for follow-up visits.

As part of the proper management of diabetes, the optometrist should make referrals for concurrent care when indicated.

See *"Table 5: Management of Non-retinal Ocular Complications of Diabetes"*

### b. Persons with Retinal Complications -

The current management options for diabetic retinopathy and diabetic macular edema include:

- Careful retinal examination and follow-up
- Timely laser photocoagulation for eyes at or approaching high-risk proliferative diabetic retinopathy or with diabetic macular edema, as indicated
- Monitored regimens of intravitreal injections (anti-VEGF) for diabetic macular edema
- Appropriate use of vitrectomy surgery in clearing vitreous hemorrhage, removing fibrous tissue, and relieving tractional retinal detachment

### Non-proliferative Diabetic Retinopathy -

Panretinal photocoagulation may be considered in patients with severe or very severe non-proliferative diabetic retinopathy (NPDR) or early proliferative diabetic retinopathy (PDR), with a high risk of progression (e.g. pregnancy, poor glycemic control, inability to follow-up, initiation of intensive glycemic control, impending ocular surgery, renal impairment, rapid progression of retinopathy).

**Proliferative Diabetic Retinopathy** - Patients with high-risk PDR should receive referral to an ophthalmologist experienced in the management of diabetic retinal disease for prompt panretinal photocoagulation.

Eyes in which PDR has not advanced to the high-risk stage should also be referred for consultation with an ophthalmologist experienced in the management of diabetic retinal disease.

Following successful treatment with panretinal photocoagulation, patients should be re-examined every 2- to 4- months. The follow-up interval may be extended based on disease severity and stability.

**Diabetic Macular Edema** - Individuals with diabetic macular edema (DME), but without clinically significant macular edema (CSME), should be re-examined at 4- to 6-month intervals. Once CSME develops, treatment with focal laser photocoagulation or intravitreal anti-VEGF injection is indicated. Following focal photocoagulation for DME, reexamination should be scheduled in 3 to 4 months.

Patients with center-involved diabetic macular edema (DME) should be referred to an ophthalmologist experienced in the management of diabetic retinal disease for possible treatment.

Vitrectomy - Eyes with vitreous hemorrhage (VH), traction retinal detachment (TRD), macular traction or an epiretinal membrane should be referred to an ophthalmologist experienced in the management of diabetic retinal disease for evaluation for possible vitrectomy.

Vascular Endothelial Growth Factor Inhibitor - The current standard of care for treatment of center-involved diabetic macular edema in persons with best corrected visual acuity of 20/32 or worse, is anti-VEGF injections.

**c. Patient Education** - Persons with diabetes should be educated about the:

- Ocular signs and symptoms of diabetic retinopathy and other non-retinal complications of diabetes.
- Value of adhering to recommendations for follow-up eye examinations and care.
- Long-term benefits of glucose control in saving sight, based on their individual medically appropriate A1C target.
- Long-term benefits of controlling blood pressure, cholesterol and other co-morbidities associated with the increased risk of onset and progression of diabetic retinopathy.

## **11. MANAGEMENT OF SYSTEMIC COMPLICATIONS AND COMORBIDITIES OF DIABETES MELLITUS**

The management of persons with diabetes includes individualized glucose targets and lifestyle modifications:

**a. Glycemic Control** - Some individuals with type 2 diabetes can achieve adequate glycemic control with weight reduction, exercise, and/or oral glucose-lowering agents and do not require insulin. Others who have only limited residual insulin secretion, often require insulin for adequate glycemic control.

Individuals with type 1 diabetes, who have extensive beta-cell destruction and therefore no residual insulin secretion, require insulin for survival. The many forms of insulin are classified by how fast they start to work and how long they last.

See *"Table 6: Diabetes Medications"*

The glycemic goal for persons with diabetes should be individualized, taking into consideration their risk of hypoglycemia, anticipated life expectancy, duration of disease and co-morbid conditions. Reducing A1C levels to less than 7 percent has been shown to reduce microvascular complications and is a reasonable goal for many non-pregnant adults.

Daily self-monitoring of blood glucose with a glucose monitor should be encouraged for all patients with diabetes.

**b. Treatment of Acute Hypoglycemia** - Optometrists should have a rapid-acting carbohydrate (e.g. glucose gel or tablets, sugar-sweetened beverage or fruit juice) in their office for use with diabetes patients who experience acute hypoglycemia during an eye examination.

**c. Blood Pressure Control** - Blood pressure <140/80 mmHg is a recommended goal for most patients with diabetes.

**d. Lipid-Lowering Treatment** - The majority of persons with diabetes are at risk of coronary heart disease and can benefit from reducing low-density lipoprotein (LDL) cholesterol levels to currently recommended targets.

**e. Physical Exercise** - Persons with diabetes should participate in at least 150 minutes per week of moderate-intensity aerobic exercise, spread over at least three days per week, unless contraindicated.

**f. Weight Management** - Being overweight or obese is associated with increased risk of developing diabetes. When indicated, overweight individuals should be referred to a qualified health care provider for assistance with weight loss.

**g. Medical Nutrition Therapy** - Individuals with diabetes should receive nutrition and dietary recommendations preferably provided by a registered dietician who is knowledgeable about diabetes management.

Educational literature and a list of support agencies and other resources should be made available to these individuals.

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*NOTE: This Quick Reference Guide should be used in conjunction with the Evidence-Based Clinical Practice Guideline on Eye Care of the Patient with Diabetes Mellitus (CPG3) (First Edition, 2014). This guide provides summary information and is not intended to stand alone in assisting the clinician in making patient care decisions.*

## **12. MANAGEMENT OF PERSONS WITH VISUAL IMPAIRMENT**

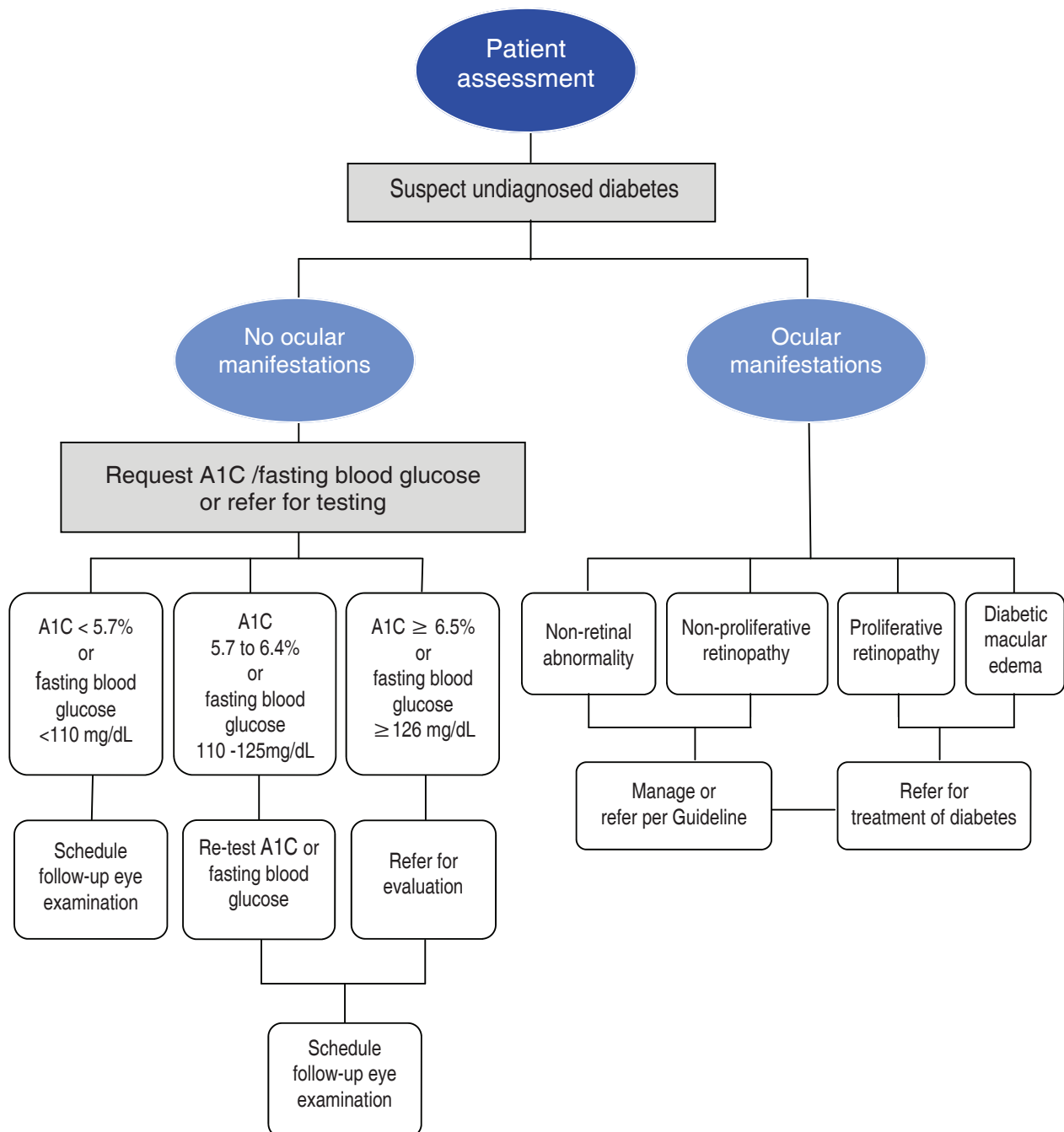
Individuals who experience vision loss from diabetes should be provided, or referred for, a comprehensive examination of their visual impairment by a practitioner trained or experienced in vision rehabilitation.

Persons with diabetes who experience visual difficulties should be counseled on the availability and scope of vision rehabilitation care and encouraged to utilize these services.

Referral for counseling is indicated for any individual experiencing difficulty dealing with vision and/or health issues associated with diabetes or diabetic retinopathy.

## APPENDIX FIGURE 1

### Optometric Management of the Patient With Undiagnosed Diabetes Mellitus: A Flowchart





APPENDIX FIGURE 2

Optometric Management of the Patient With Diagnosed Diabetes Mellitus: A Flowchart

