

Management of Diabetes	1
I. Morbidity and mortality in diabetes is related to its acute and chronic complications:	1
A. Acute.....	1
B. Chronic.....	2
II. Initial Evaluation	2
A. History.....	2
B. Examination	3
C. Lab and Other Diagnostic Studies	3
III.Treatment.....	3
IV. Goals of Therapy	7
A. HgbA ₁ C < 7.0%.....	7
B. Fingerstick Blood Sugar	8
C. Blood Pressure	8
D. Lipids.....	8
E. Patient Education.....	8
V. Routine Follow-Up	8
A. Chronic Clinic Visit	8
B. Annually	9
VI. Foot Care in Diabetics.....	10
A. Exam.....	10
B. Prevention of High-Risk Conditions	10
C. Management of High-Risk Conditions.....	10
VII. References.....	10
VIII.Action	11
Referenced Forms.....	12
Attachments	12

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Management of Diabetes	ACA Standards: 4-4359M, 4-4367		
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Management of Diabetes

Diabetes is a metabolic disorder characterized by abnormal glucose metabolism. This generally results from either inadequate insulin production, target tissue resistance to insulin, or a combination of both. The essential manifestation of diabetes is elevated blood glucose.

- I. Morbidity and mortality in diabetes is related to its acute and chronic complications:
 - A. Acute
 1. Diabetic ketoacidosis
 2. Hyperosmolar non-ketotic state
 3. Hypoglycemia

- B. Chronic
1. Retinopathy
 2. Nephropathy
 3. Neuropathy (peripheral and autonomic)
 4. Macrovascular disease (peripheral vascular disease, coronary artery disease, cerebrovascular disease)
 5. Foot complications (resulting from microvascular and macrovascular disease and neuropathy)
- C. Diabetes is classified as Type 1 or Type 2 based on the presence or absence of endogenous insulin production. Diagnosis of diabetes is accomplished by one of four methods:
1. Random plasma glucose ≥ 200 plus symptoms of diabetes (polyuria, polydipsia, unexplained weight loss)
 2. Fasting plasma glucose ≥ 126 (fasting means no caloric intake for 8 hours)
 3. A1C equal to or greater than 6.5%
 4. Two – hour plasma glucose > 200 during an oral glucose tolerance Test (OGTT) performed under World Health Organization (WHO) standards with a glucose load containing 75 g anhydrous glucose dissolved in water.

Methods 2 through 4 must be confirmed with a second reading on a subsequent day. It is preferable to use the same method for the second test. **The diagnosis of Impaired Fasting Glucose is made on the basis of a fasting Glucose of 100 to 125, or by A1C of 5.7 to 6.4%. These individuals should be re-tested for diabetes annually.**

II. Initial Evaluation

The initial evaluation should determine previous and current treatments, level of blood glucose control, the presence of diabetic complications, and the patients understanding of the disease. Documentation of the chronic illness will be documented in accordance with [OP 140137](#) entitled “Chronic Illness Management” and utilizing the “Chronic Illness Note/Physical Examination” form [DOC 140137A](#).

- A. History
1. Previous and current medications

2. Diet
3. Exercise
4. Acute and chronic complications
5. Cardiovascular disease risk factors
6. Current symptoms

B. Examination

1. Complete set of vital signs (weight, temperature, pulse, respiration, blood pressure)
2. Dilated retinal examination
3. Thyroid palpation
4. Cardiovascular exam, including pulse
5. Foot exam (see section on foot evaluation)
6. Neurologic exam

C. Lab and Other Diagnostic Studies

1. HgbA₁C
2. Lipid profile
3. Complete metabolic profile
4. UA with urine albumin – to – creatinine ratio
5. EKG

III. Treatment

A. Indication for immediate Insulin therapy in Type II Diabetes:

1. Pregnancy
2. Surgery, infection, steroids
3. Marked weight loss and/or ketonuria with glucose >300 mg/dl

4. Hyperosmolar, non – ketotic state with glucose >600 mg/dl
 5. * Diabetic Ketoacidosis requires hospitalization and fluid resuscitation.
- B. Nutrition – In most people with Type 2 Diabetes, dietary recommendations are similar to those of the general population. Flexibility and achievable goals are the keys to dietary compliance. The Diet for Health from the state diet manual is adequate for most people.
 - C. Physical activity – unless contraindicated; 30 minutes of activity, most days of the week.
 - D. Aspirin 81 mg. p.o. daily, unless contraindicated – for primary prevention in patients at increased cardiovascular risk (10 year risk > 10%) which includes men > 50 years of age and women > 60 years of age with at least one (1) additional major risk factor (family history of CVD, HTN, smoking, dyslipidemia or albuminuria) – or as secondary prevention in patients with a history of CVD.
 - E. Control of blood pressure and lipids – refer to Medical Services Resource Manual (MSRM) 140137-04 entitled “Management of Hypertension”.
 - F. Eye care referral – for annual dilated retinal exam and treatment as indicated
 - G. Oral antidiabetic agents are preferred for Type II DM unless the A1C > 11%, when insulin may be necessary, or when adequate control cannot be achieved with oral agents.

Metformin is a consensus first-line agent, (in the absence of recognized Contraindications).

Sulfonylureas, such as Glipizide and Glyburide, are considered second-line agents in the absence of recognized contraindications.

Other less validated second-line agents include Pioglitazone and Sitagliptin. These may also be used as third-line agents in addition to Metformin and Sulfonylurea. The choice of agent is dependent on specific patient Characteristics.

Name	Usual starting dose	Maximum dose	Comments
<u>Metformin</u> (Glucophage)	<u>500 mg</u> <u>BID</u>	<u>2500 mg/day</u> (in divided doses)	<u>1-2% A1C lowering</u> <u>Does not cause hypoglycemia</u> <u>GI side effects, which typically</u> <u>Resolve within 2 weeks.</u> <u>Caution with CHF</u> <u>Can promote beneficial weight</u>

			<u>loss.</u>
<u>Glipizide (Glucotrol)</u>	<u>5 mg/day</u>	<u>40 mg/day</u>	<u>1-2% A1C lowering</u> <u>Risk of hypoglycemia</u> <u>Weight gain</u>
<u>Glyburide (DiaBeta, Micronase)</u>	<u>2.5 mg/day</u>	<u>20 mg/day</u>	<u>1-2% A1C lowering</u> <u>High risk of hypoglycemia</u> <u>Weight gain</u>
<u>Pioglitazone (Actos)</u>	<u>15-30mg daily</u>	<u>45mg daily</u>	<u>0.5 – 1.4% A1C lowering</u> <u>Fluid retention</u> <u>Potentially leads to heart failure</u> <u>Contraindicated in NYHA heart failure class III and IV</u> <u>Slow onset of action taking 6-12 weeks to see full effects</u> <u>Weight gain</u>
<u>Sitagliptin (Januvia)</u>	<u>100 mg/day</u>	<u>100 mg/day</u>	<u>0.5 – 0.8% A1C lowering</u> <u>Minimal side effects</u> <u>Potential to cause pancreatitis</u>

1. Insulin is the only antidiabetic agent approved for use in pregnancy. Metformin and Sitagliptin are pregnancy category B. Glipizide, glyburide, and pioglitazone are pregnancy category C.
2. Renal and Hepatic Dosing Adjustments:

<u>Name</u>	<u>Renal Dosing</u>	<u>Hepatic Dosing</u>
<u>Metformin</u>	<u>Contraindicated in serum creatinine > 1.5 in men and > 1.4 in women.</u> <u>Some practitioners use a GFR < 30 as Contraindication for use of Metformin.</u>	<u>Contraindicated in hepatic failure due to risk of lactic acidosis.</u>
<u>Glipizide</u>	<u>Not recommended when creatinine clearance (CrCl) < 10</u>	<u>Initial dosage should be 2.5 mg/day in the presence of hepatic impairment.</u>
<u>Glyburide</u>	<u>Not recommended if CrCl is < 50.</u>	<u>Use conservative initial and maintenance doses.</u> <u>Avoid use in severe disease.</u>

<u>Pioglitazone</u>	<u>No adjustment necessary.</u>	<u>Do not start pioglitazone if the patient exhibits active liver disease or if ALT > 2.5 times the upper limit of normal. Discontinue pioglitazone if ALT > 3 times the upper limit of normal of if jaundice is present.</u>
<u>Sitagliptin</u>	<u>No adjustment required if CrCL > 50.</u> <u>50 mg. once daily if CrCl > 30 to < 50 or if serum creatinine > 1.7 to < 3 in males, and > 1.5 to < 2.5 in females.</u> <u>25 mg once daily if CrCl < 30 or if serum Creatinine > 3 in males or > 2.5 in females.</u> <u>25 mg once daily (without regard to timing of dialysis), if Patient on hemodialysis or peritoneal dialysis.</u>	<u>No adjustment required if mild to moderate impairment (Child – Pugh score 7-9).</u> <u>Not studied in severe impairment. (Child-Pugh score >9)</u>

3. The dose should be increased every 1 – 2 weeks for Metformin, Glipizide, and Glyburide and every 6 – 12 weeks for Pioglitazone until satisfactory glycemic control or maximum dose is reached.
 4. If glycemic control is not achieved on maximum monotherapy, add an agent from the other class (sulfonylurea, metformin, or actos).
- H. Insulin – In Type 2 Diabetics, if glycemic control is not achieved with maximum doses of oral agents, or if the baseline A1C is > 11%, it is necessary to begin insulin therapy. Insulin can be used alone or as an adjunct to oral agents with the exception of insulin secretagogues, such as sulfonylureas.

1. A bedtime dose of insulin, starting at 0.1 u/kg, can be added to metformin without changing the dose of metformin.
2. **Frequent use of “sliding scale” insulin is problematic and indicates a need to adjust routine diabetes therapy. Short acting sliding scale insulin’s should be used only briefly for acute dynamic concurrent illness management, and have no role in chronic dosing regimens.**
3. Insulin choices are several, and include long acting or basal insulin (Lantus), intermediate acting insulin’s (NPH), short acting insulin’s (regular), rapid acting insulin’s (Humalog), and combinations (NPH + Regular, Lantus + regular or Humalog, and 70/30 NPH/Regular. Practitioners should have familiarity with the advantages of each. **Waiting times for insulin and meals should be considered with the use of rapid acting insulin (Humalog).**

I. Management of Complications

1. Nephropathy - treatment of microalbuminuria includes aggressive glycemic and blood pressure control, and use of an ACE inhibitor or ARB. In patients with creatinine > 1.5 or nephrotic range proteinuria (> 3gm/day) nephrology consult is indicated.
2. Retinopathy – Optometry referral for regular exams. Early laser treatment of retinopathy can prevent vision loss. Intensify glycemic and blood pressure control.
3. Foot lesions – see Section VI.
4. Neuropathy – see Section VI.

IV. Goals of Therapy

A. HgbA₁C < 7.0%

Correlation between A1C level and mean plasma glucose levels

AIC (%)	Mean plasma glucose mg/dl
6	126
7	154
8	183
9	212
10	240
11	269
12	298

For most DM 2 patients, A1C is superior to FSBS for monitoring of glycemic control.

B. Fingerstick Blood Sugar

1. Before meals – 70 to 130

2 hour PC - < 180

FSBS Monitoring is most useful for patients with insulin dependent DM 2, who are experiencing labile glycemic control or symptomatic hypoglycemia.

C. Blood Pressure

1. <130/80 (<130 systolic and <80 diastolic)
2. Aggressive blood pressure control has an impact on renal preservation which is comparable to or greater than good glycemic control.

D. Lipids

1. Total cholesterol <200 mg/dl
3. LDL Cholesterol < 100mg/dl and HDL cholesterol >40mg/dl (men)
>50mg/dl (women)
3. Triglycerides <150mg/dl

E. Patient Education

If the patient meets A and B above without medications for diabetes for 6 months a provider can discharge them from chronic clinic enrollment.

V. Routine Follow-Up

Once goals of therapy have been reached and the patient is stable, routine follow-up in chronic clinic should be arranged as follows:

A. Chronic Clinic Visit

1. Assess treatment regimen
2. Blood sugar results / HgbA₁C results
3. Current medications – compliance, side effects

4. Hypoglycemic reactions
5. Symptoms of complications (visual, neurovascular, foot problems)
6. Physical exam
 - a. Weight, blood pressure , temperature, pulse, respiration
 - b. Foot exam
7. Categorize in accordance with “Severity Classification of Common Chronic Illness” (OP 140137, Attachment A).

B. Annually

1. History and physical exam, including funduscopic exam. Refer to optometrist as indicated
2. Laboratory
 - a. Urinalysis (or dipstick)
 - b. Urine albumin-to-creatinine ratio (for microalbuminuria), if UA protein is negative and patient is not on an ACE inhibitor.

Urine Albumin-to-Creatinine Ratio

Category	Spot collection (ug/mg creatine)
Normal	<30
Microalbuminuria	30-299
Macro (clinical) albuminuria	>300

- c. Complete metabolic profile, including lipid profile
- d. Oral exam by provider with referral to dental as needed

C. Vaccines

1. Influenza (annually)

2. Pneumovax (revaccination is recommended only if the patient received a first dose prior to age 65. Give a second dose at or after age 65 only when 5 or more years have elapsed since the previous dose).

VI. Foot Care in Diabetics

A. Exam

1. Skin exam – calluses, ulcers, pigment changes, cellulitis
2. Joint mobility and deformity
3. Vascular status – pulses, capillary refill, hair distribution
4. Neurological status – numbness, burning, stinging; sensory exam

B. Prevention of High-Risk Conditions

1. Smoking cessation
2. Glycemic control

C. Management of High-Risk Conditions

1. Neuropathy – amitriptylline, gabapentin, carbamazepine, cymbalta, well-cushioned walking shoes (available through canteen), avoidance of hazards (scalding, lacerations, puncture wounds). Intensify glycemic control.
2. Calluses – can be trimmed with scalpel by a provider or pumice stone by nursing.
3. Bony deformities – may require extra-wide or extra-depth shoe (available through property).
4. Vasculopathy – symptoms of claudication may necessitate vascular referral; mild symptoms may respond to aspirin or platelet inhibitor therapy, and smoking cessation.
5. Minor skin conditions should be treated to prevent more serious complications.

VII. References

OP-140137 entitled "Chronic Illness Management"

Based on American Diabetes Association Standards of Medical Care for Patients with Diabetes Mellitus. Diabetes Care, 2010 Jan. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care, 2004 Jan. Management of Diabetes in Correctional Institutions. Diabetes Care, 2010 Jan. Management of Type II Diabetes Institute for Clinical Systems Improvement, 2002 Sept. American Association of Clinical Endocrinologists, Update 2009, December.

VIII. Action

The chief medical officer, Office of Medical Services will be responsible for compliance with this procedure.

Any exceptions to this procedure will require prior written approval from the director.

This procedure will be effective as indicated.

Replaced: Medical Services Resource Manual 140137-02 entitled "Management of Diabetes" dated January 1, 2006.

Distribution: Office of Medical Services Resource Manual

Referenced Forms	Title	Located In
DOC 140137 A	“Chronic Illness Note/Physical Examination”	OP-140137
Attachments		
Attachment A	“Severity Classification of Common Chronic Illness”	OP-140137