DIABETES MELLITUS

AGS Geriatrics Evaluation and Management Tools (Geriatrics E&M Tools) support clinicians and systems that are caring for older adults with common geriatric conditions.

From the AMERICAN GERIATRICS SOCIETY

Geriatrics Evaluation & Management Tools

DIAGNOSIS

Test (confirm with repeat testing)	**Diabetes mellitus (DM)**
HbA_{1c}	≥6.5%
Random plasma glucose concentration	≥200 mg/dL (11.1 mmol/L) *plus* symptoms (polyuria, polydipsia, weight loss)
Fasting plasma glucose concentration (8-hour fast)	≥126 mg/dL (7 mmol/L)
Plasma glucose concentration 2 hours after ingestion of 75 mg of glucose in 300 mL of water administered after overnight fast	≥200 mg/dL (11.1 mmol/L)

PREVENTION

- Lifestyle changes (diet, exercise, weight loss) can delay/prevent DM in those with impaired glucose tolerance more effectively than metformin, valsartan, and acarbose

HISTORY OF PRESENT ILLNESS

- Symptoms of DM (polyuria, polydipsia, weight loss)
- Symptoms of hypoglycemia if on medication therapy

PAST MEDICAL HISTORY/ REVIEW OF SYMPTOMS

Inquire about medical problems that are common in older adults with DM:

- Medical eye disease (eg, retinopathy)
- Cerebrovascular disease
- Coronary artery disease
- Chronic kidney disease
- Urinary incontinence
- Peripheral vascular disease
- Neuropathy and foot problems
- Falls
- Functional impairment
- Pain
- Depression
- Cognitive impairment

SOCIAL HISTORY

Ask about alcohol and tobacco use, ability to afford medications, and social support for medication management if needed.

PHYSICAL EXAMINATION

Perform comprehensive geriatric examination (may be done over several visits).

- Blood pressure at each visit
- BMI
- Ophthalmologist evaluation at diagnosis and yearly if retinopathy or every 2 years if not.
- Annual foot examination, including inspection, monofilament testing at 4 plantar sites plus any one of tuning fork, pinprick sensation, ankle reflexes, or vibration threshold; insensate feet should be inspected every 3–6 months. Refer those with sensory and structural abnormalities to foot care specialists.
- Check pedal pulses to assess for peripheral vascular disease.

MEDICATIONS

Medications such as diuretics, sympathomimetics, glucocorticoids, antipsychotics, and niacin can increase glucose concentrations.

NONPHARMACOLOGIC MANAGEMENT

- Smoking cessation: Reduces mortality more than blood pressure or lipid control.
- Nutrition changes: Diet plus exercise are more effective than diet alone.
  - Decrease carbohydrates and total and saturated fat.
  - Limit alcohol to <1 drink/day in women, <2 drinks/day in men.
  - High-fiber diet (25 g insoluble and 25 g soluble/day).
  - Limit protein intake to ≤0.8 g/kg/day if any chronic kidney disease.
- Weight loss
  - Target 7% weight loss if overweight or obese.
  - Consider bariatric surgery for healthier older adults with uncontrolled DM type 2 and BMI >35 kg/m^2.
- Physical activity
  - ≥150 min/week of moderate activity (walking); resistance training 3x/week if no contraindication.
- Education
  - Yearly management training (by DM educator) covered under Medicare Part B.

MANAGEMENT OF COMORBID CONDITIONS

- Blood pressure: Gradual titration to prevent adverse reaction to therapy.
  - If orthostatic hypotension develops, blood pressure target may need to be relaxed.
  - Begin with ACE inhibitor or angiotensin II receptor blocker (ARB).
  - If patient is black, calcium channel blocker or diuretic is preferred as initial treatment.
- Albuminuria: Measure albumin:Cr ratio at diagnosis and annually.
  - No need to continue screening for albuminuria if taking an ACE inhibitor or angiotensin II receptor blocker.
- CV protection: Aspirin 75–162 mg/d if heart disease; if allergic, clopidogrel 75 mg/d.
  - Unclear if aspirin should be used for primary prevention of CV disease in DM.
  - Consider if 10-year CV risk >10% (http://hp2010.nhlbihin.net/atpiii/calculator).
- Vaccinations: Recommend influenza and pneumococcal; consider hepatitis B vaccination.
- Lipids: Conflicting data whether hyperlipidemia primary prevention decreases cardiovascular (CV) events in patients with diabetes.

2013 ACC/AHA indications for statin treatment to reduce CV risk:

Age	Risk factors	Statin Recommendation
40-75	CVD* or LDL ≥ 190 mg /dL	High intensity statin
40-75	Diabetes AND LDL 70-189 AND 10-year CV risk ≥7.5%**	High intensity statin
40-75	Diabetes AND LDL 70-189 AND 10-year CV risk <7.5%**	Moderate intensity statin
>75	CVD*	Moderate intensity statin
>75	Diabetes but no CVD*	There are no data for those without CVD*. Continuation of statins beyond age 75 may be warranted. It is unclear whether starting statins for primary prevention is beneficial for those over 75. Consider potential risk/benefit of primary prevention based on individual CVD* risk, comorbidities, and goals of care.

*CVD (prior MI, angina, ACS, coronary revasulcarization, stroke, TIA, or PAD)
** Risk calculator at my.americanheart.org/cvriskcalculator. Some experts are concerned that the risk calculator designates many more older adults as being eligible for primary prevention with statin treatment than previous guidelines. For example the calculator assesses a 10 year CVD* risk of ≥7.5% in all men 63–75 and all women 71–75 years old with optimal values for other risk factors.

TREATMENT GOALS

- Goals of DM management should be individualized according to:
  - Patient goals and preferences
  - Functional status
  - Patient health and expected prognosis
  - Quality of life
  - Evaluation and treatment of DM complications
  - Control of hyperglycemia and its symptoms
  - Avoiding hypoglycemia.
- Glycemic control: If HbA_{1c} not at goal in 6 months with diet/exercise, consider medication.
  - Monitor blood glucose 3 × day if multiple daily insulin injections or insulin pump; may be unnecessary with medications that do not cause hypoglycemia.
  - Check HbA_{1c} every 6 months with stable glycemic control; quarterly if poor control.

Goals of Treatment for Older Adults with Diabetes Mellitus

Patient Health	HbA_{1c} Goal	FPG or PPG (mg/dL)	Bedtime Glucose (mg/dL)	Blood Pressure Goal (mmHg)
Healthy	7%–7.5%	90–130	90–150	<140/80
Complex/intermediate[a]	7.5%–8.5%	90–150	100–180	<140/80
Very complex/poor health[b]	8.5%–9%	100–180	110–200	<150/90

FPG=fasting plasma glucose, PPG=postprandial glucose
[a] ≥3 comorbid chronic illnesses, ≥2 IADL impairments, or mild-to-moderate cognitive impairment
[b] Long-term care, end-stage chronic illness, moderate-to-severe cognitive impairment, or ≥2 ADL dependencies

NON-INSULIN PHARMACOLOGIC MANAGEMENT

Oral Agents	Comments/Adverse Effects
Biguanide (K) Metformin* (first choice)	Decreases hepatic glucose production. 1%–2% HbA_{1c} reduction. Does not cause hypoglycemia, may cause weight loss. Avoid if eGFR <30 mL/1.73 m^2, heart failure, COPD, ↑liver function tests. Hold before contrast radiologic studies. Start 500 mg q12h or q24h; may titrate q5–7d to max 2,550 mg/d divided (long-acting: max 2,000 mg/d).
Second-Generation Sulfonylureas Glipizide* (L, K)	Increases insulin secretion. 1%–2% HbA_{1c} reduction. Can cause hypoglycemia and weight gain. Glipizide 2.5–40 mg q12–24h (max dose = 40 mg/d) Other sulfonylureas: glimepiride has numerous drug interactions and is long acting; glyburide not recommended in older adults because of hypoglycemia risk.
α-Glucosidase Inhibitor Acarbose (gut, K) Miglitol (L, K)	Delays glucose absorption. 0.5%–1% HbA_{1c} reduction. Can cause hypoglycemia and weight gain. GI adverse events common. Avoid if Cr >2 mg/dL. Acarbose: start with 25 mg tid; max 50–100 mg tid. ▪ Monitor liver enzymes. ▪ Take with first bite of meal. Miglitol: start with 25 mg tid; max 25–100 mg tid.
DPP-4 Enzyme Inhibitors Alogliptin (K) Saxagliptin (K) Sitagliptin (K) Linagliptin (L)	Protect and enhance incretin hormones. 0.5%–1% HbA_{1c} reduction. Do not cause hypoglycemia; weight neutral. Alogliptin: 25 mg; 12.5 mg if CrCl 30–59 mL/min; 6.25 mg if CrCl 15–29 mL/min Saxagliptin 5 mg; 2.5 mg if CrCl <50 mL/min Sitagliptin: 100 mg; 50 mg/d if CrCl <31–50 mL/min; 25 mg/d if CrCl <30 mL/min Linagliptin: 5 mg, no dose adjustment for renal or liver impairment
Meglitinides Nateglinide(K, L) Repaglinide (L)	Increases insulin secretion. 1%–2% HbA_{1c} reduction. Nateglinide: 60–120 mg tid with meals. ▪ Can cause hypoglycemia and weight gain. Regaglinide: 0.5–4 mg tid with meals. Adjust dose weekly, potential for drug interactions, caution in renal or hepatic insufficiency. Avoid if CrCl <20 mL/min.
Thiazolidinediones Pioglitazone (L, K) Rosiglitazone (L, K)	Insulin resistance reduction. 0.5%–1.5% HbA_{1c} reduction. Risk of CHF, avoid if NYHA Class III or IV. Stop if decline in cardiac status. Pioglitazone: 15–45 mg/d. Max dose 30 mg/d if used in combination therapy. ▪ Can cause weight gain; may increase fracture risk in women. Rosiglitazone: 4–8 mg/d. ▪ Check liver function tests at start, every 2 months during first year, then periodically. ▪ Avoid if clinical evidence of liver disease or if serum ALT levels >2.5 times upper limit of normal.
SGLT2 Inhibitors Canagliflozin (L) Dapaglifozin (L) Empagliflozin (L)	Decreases glucose reabsorption from kidney. 0.5%–1.5% HbA_{1c} reduction. Risk of urinary tract infections and ketoacidosis (can occur with blood glucose levels lower than those typically seen with diabetic ketoacidosis). Possible risk of dehydration, increased cholesterol, and yeast infections. Canagliflozin: 100 mg/d, avoid if CrCl ≤45mL/min. Dapagliflozin: 5–10 mg/d, avoid if CrCl <60 mL/min. Empagliflozin: 10–25 mg/d, avoid if CrCl <45 mL/min.

NON-INSULIN PHARMACOLOGIC MANAGEMENT

Injectable Agents	Comments/Adverse Effects
Albiglutide (L) Dulaglutide (L) Exenatide* (K) Liraglutide (L)	Glucagon-like peptide-1 receptor agonists. 0.7%–1% HbA_{1c} reduction Hypoglycemia common if used with sulfonylurea or insulin; less likely to cause hypoglycemia than insulin or sulfonylurea. Can cause weight loss. Avoid if CrCl <30 mL/min. Risk of acute pancreatitis and possibly medullary thyroid cancer. Albiglutide: 30–50 mg SC once weekly Dulaglutide: 0.75–1.5 mg SC once weekly Exenatide: 5–10 mcg SC bid or 2 mg SC once weekly Liraglutide: 0.6–1.8 mg SC once daily
Pramlintide (K)	Amylin analogue. 0.4%–0.7% HbA_{1c} reduction Nausea common; reduce pre-meal dose of short-acting insulin by 50%. Type 1 DM: 15 mcg before each major meal; may increase to 30–60 mcg. Type 2 DM: 60 mcg before each major meal; may increase to 120 mcg.

(K) = renal elimination; (L) = hepatic elimination * Available as short- or long-acting forms

INSULIN PHARMACOLOGIC MANAGEMENT

Basal insulin (intermediate at bedtime or long-acting at bedtime or morning).

- Stop sulfonylureas and meglinitides when starting insulin.
- Start with 10 units (U) or 0.2 U/kg, can increase by 2–4 U every 3 days depending on fasting blood glucose (FBG).
- When FBG at goal, recheck HbA1c in 2–3 months. If above target HbA_{1c}, add rapid or intermediate-acting insulin.
- If hypoglycemia or FBG <70 mg/dL, reduce dose by 4 U or 10%, whichever is greater.
- Do not use sliding scale insulin chronically as a solo insulin therapy in long-term care.

Insulin Preparations	Onset	Peak (hours)	Duration (hours)	Doses/ day
Rapid-acting				
Insulin glulisine (Apidra)	20 min	0.5–1.5	3–4	3
Insulin lispro (HumaLog)	15 min	0.5–1.5	3–4	3
Insulin aspart (NovoLog)	30 min	1–3	3–5	3
Inhaled (Afrezza)	15 min	1	3–4	3
Regular (eg, Humulin, Novolin)	0.5–1 h	2–3	5–8	1–3
Intermediate or long-acting				
NPH (neutral protamine hagedorn) insulin (eg, Humulin N, Novolin N)	1–1.5 h	4–12	24	1–2
Insulin detemir (Levemir)	3–4 h	6–8	6–24 (dose dependent)	1–2
Insulin glargine[a] (Lantus)[a]	2–4 h	—	24	1
Combinations				
Isophane insulin and regular insulin, premixed (Novolin 70/30)	See individual drugs	2–12	24	1–2
Insulin lispro protamine and insulin lispro (HumaLog Mix 50/50; 75/25)	See individual drugs			

[a] To convert from NPH dosing, give same number of units once a day. For patients taking NPH q12h, decrease the total daily units by 20% and titrate on basis of response.

CHOOSING WISELY

- Avoid using medications other than metformin to achieve hemoglobin A_{1c} <7.5% in most older adults; moderate control is generally better.