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

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 and geriatric syndromes that are common in older adults with DM:
- Medical eye disease (eg, retinopathy, cataracts)
- Cerebrovascular disease
- Coronary artery disease
- Chronic kidney disease
- Urinary incontinence
- Peripheral vascular disease/claudication
- Hypertension
- Hyperlipidemia
- Polypharmacy
- Neuropathy and foot problems
- Falls and fractures
- Functional impairment
- Pain
- Depression
- Cognitive impairment
- Periodontal diseases

SOCIAL AND FAMILY HISTORY
- Ask about diet, exercise, alcohol and tobacco use, ability to afford medications, and social support for medication management if needed.
- Family history of cardiovascular disease

PHYSICAL EXAMINATION

Perform comprehensive geriatric examination (may be done over several visits).
- Height, weight, BMI at every visit
- Blood pressure at each visit
- Fundoscopic exam annually, including referral to eye specialist
- Foot examination annually, or at every visit in those with sensory loss, previous foot ulcer, or amputations. Inspection of skin integrity, callous, deformity, ulcer, toenails. Assessment of pedal pulses for peripheral vascular disease. Sensory exam on temperature, vibration/pinprick, and 10-g monofilament testing. Refer those with sensory and structural abnormalities to foot care specialists.

MEDICATIONS

Complete best possible medication history and assess challenges to medication management. Medications such as diuretics, sympathomimetics, glucocorticoids, antipsychotics, and niacin can increase glucose concentrations.

NONPHARMA-COLOGIC MANAGEMENT
- Smoking cessation: Reduces mortality more than blood pressure or lipid control.
- Nutrition changes: Diet plus exercise are more effective than diet alone. Refer to registered dietitians.
    - Individualized medical nutrition therapy program.
    - Mediterranean diet rich in mono- and polyunsaturated fats and long-chain n-3 fatty acids
    - Limit alcohol to ≤1 drink/day in women, ≤2 drinks/day in men.
- Weight loss:
    - Target 7% weight loss.
    - Consider bariatric surgery for healthier older adults with uncontrolled DM type 2 and BMI ≥35 kg/m².
- Physical activity
    - ≥150 min/week of moderate activity (e.g. brisk walking); resistance training 3x/week.
- Education
    - Yearly self-management education (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.
    - Use angiotensin-converting enzyme inhibitor (ACEi), angiotensin II receptor blocker (ARB), calcium-channel blocker (CCB), or diuretics if no albuminuria. If has albuminuria, start with ACEi or ARB.
- Renal: Measure serum creatinine and urine albumin:Cr ratio at diagnosis and annually.
    - No need to continue screening for albuminuria if taking an ACE inhibitor or ARB.
- Cardiovascular (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 (CVD) in DM.
    - Consider 10-year atherosclerotic cardiovascular disease (ASCVD) risk ≥10% (http://tools.acc.org/ASCVD-Risk-Estimator-Plus/#!/calculate/estimate/).
- Vaccinations: Recommend influenza and pneumococcal; consider hepatitis B vaccination.
- Lipids: Conflicting data whether hyperlipidemia primary prevention decreases cardiovascular (CV) events in patients with diabetes.

2019 ACC/AHA Guideline on Statin for those with DM		
Age	Risk Factors	Statin Recommendation
40-75	DM AND multiple ASCVD risk factors	High intensity statin
40-75	DM, regardless of 10-year ASCVD risk*	Moderate intensity statin, and assess risk to consider high-intensity statin
>75	DM but no CVD**	It is unclear whether starting statins for primary prevention is beneficial for those >75 years old. Consider potential risk/benefit of primary prevention based on individual CVD** risk, comorbidities, and goals of care.

*Risk calculator at http://tools.acc.org/ASCVD-Risk-Estimator-Plus/#!/calculate/estimate/)
** CVD (prior MI, angina, ACS, coronary revascularization, stroke, TIA, or PAD)

TREATMENT GOALS

- Goals of DM management should be individualized according to:
    - Life expectancy
    - Patient goals and preferences
    - Duration of diabetes
    - Multimorbidities and functional status
    - Risk of hypoglycemia
    - Self-care capacity and motivation
    - Availability of support system
- Glycemic control: If HbA$_{1c}$ not at goal in 6 months with diet/exercise, consider adding medication, generally starting with metformin.
    - Check HbA$_{1c}$ every 3–6 months if not at target and every 6-12 months if at target. If HbA$_{1c}$ is above goal, consider adding a second medication or reassessing goals.
    - Monitor blood glucose 3 × day if multiple daily insulin injections or insulin pump; may be unnecessary with medications that do not cause hypoglycemia.

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%	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 PHARMA-COLOGIC MANAGEMENT	Oral Agents	Comments/Adverse Effects
	Biguanide (K) Metformin* (first line)	Decreases hepatic gluconeogenesis, increase insulin sensitivity, and decrease intestinal glucose absorption. 1%–2% HbA1c reduction. Does not cause hypoglycemia; may cause weight loss. Avoid if eGFR <30 mL/min/1.73 m^2 Hold before and after 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).
	SGLT2 Inhibitors Canagliflozin (L) Dapaglifozin (L) Empagliflozin (L)	Promotes renal excretion of glucose. 0.5%–1.5% HbA1c reduction. Increase risk of urinary tract infections, genital mycotic infections, ketoacidosis, dehydration, hypotension, increased cholesterol, and fracture. Canagliflozin: 100 mg/d, avoid if eGFR < 30 mL/min/1.73 m^2; ASCVD and HF benefits Dapagliflozin: 5–10 mg/d, avoid if eGFR < 45 mL/min/1.73 m^2 Empagliflozin: 10–25 mg/d, avoid if eGFR <45 mL/min/1.73 m^2; ASCVD and HF benefit.
	DPP-4 Enzyme Inhibitors Alogliptin (K) Saxagliptin (K) Sitagliptin (K) Linagliptin (L)	Inhibit degradation of endogenous incretin hormones. 0.5%–1% HbA1c reduction. Do not cause hypoglycemia; weight neutral. Alogliptin: 25 mg/d; 12.5 mg if CrCl 30–59 mL/min; 6.25 mg if CrCl 15–29 mL/min Saxagliptin 5 mg/d; 2.5 mg if eGFR <45 mL/min/1.73 m^2 Sitagliptin: 100 mg/d; 50 mg/d if eGFR 30-44 mL/min/1.73m^2; 25 mg/d if eGFR <30 mL/min/1.73 m^2. Linagliptin: 5 mg/d, no adjustment for renal or liver impairment
	Second-Generation Sulfonylureas Glipizide* (L, K)	Increases insulin secretion. 1%–2% HbA1c reduction. Can cause hypoglycemia; weight gain. Glipizide 2.5–40 mg/d in 1 or 2 doses/d (max dose = 40 mg/d) Other sulfonylureas: glimepiride has numerous drug interactions and is long acting; glyburide not recommended in older adults due to hypoglycemia risk.
	α-Glucosidase Inhibitor Acarbose (gut, K) Miglitol (L, K)	Delays glucose absorption. 0.5%–1% HbA1c reduction. Can cause hypoglycemia; weight gain. GI adverse events common. Avoid if Cr >2 mg/dL. Take with first bite of meal. Acarbose: start with 25 mg tid; max 50–100 mg tid (monitor liver enzymes). Miglitol: start with 25 mg tid; max 25–100 mg tid.
	Meglitinides Nateglinide(K, L) Repaglinide (L)	Increases insulin secretion. 1%–2% HbA1c reduction. Can cause hypoglycemia; weight gain. Nateglinide: 60–120 mg tid 15–30 mins before meals. Repaglinide: 0.5–2 mg bid-qid 15–30 mins before 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)	Increase insulin sensitivity. 0.5%–1.5% HbA1c reduction. Low risk of hypoglycemia; weight gain. Risk of HF, avoid if NYHA Class III or IV. Stop if decline in cardiac status. May increase fracture risk in women; avoid in liver disease or ALT levels >2.5 times upper limit of normal. Check liver function tests at start, q 2 months during first year, then periodically. Pioglitazone: 15–45 mg/d. Max dose 30 mg/d if used in combination therapy. ■ Avoid in bladder cancer. Rosiglitazone: 4–8 mg/d.

NON-INSULIN PHARMA-COLOGIC MANAGEMENT		

Injectable Agents	Comments/Adverse Effects
GLP-1 receptor agonist Albiglutide (L) Dulaglutide (L) Exenatide* (K) Liraglutide (L) Lixisenatide (K) Semaglutide (K)	Increase insulin secretion, slow gastric emptying, reduce postprandial glucagon, reduce food intake. 0.7%–1% HbA$_{1c}$ reduction Hypoglycemia common if used with sulfonylurea or insulin; less likely to cause hypoglycemia than insulin or sulfonylurea. Causes weight loss. 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 for long-acting formulation; avoid if CrCl <30 mL/min. Liraglutide: 0.6–1.8 mg SC once daily; associated with decreased cardiovascular disease and mortality.
Amylin analogue Pramlintide (K)	Slow gastric emptying, promote satiety, reduce abnormal postprandial rise of glucagon. 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 PHARMA-COLOGIC 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, Toujeo, Basaglar)	2–4 h	—	24	1
Insulin degludec (Tresiba)	1 h	12	>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	1–6.5	14–24	1–2
Insulin degludec and insulin aspart (Ryzodeg 70/30)	See individual drugs	1	>24	1–2

[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 to achieve hemoglobin A$_{1c}$ <7.5% in most older adults; moderate control is generally better.