Diabetes Review

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Objectives

1. Review updated diagnostic criteria of diabetes
2. Review the updated A1c targets for diabetics
3. Brief Review of oral medications used to lower A1c
4. Brief Review of mechanisms and role of insulin based therapy
5. Case Discussions
Quickly...

- **Type I Diabetes (Insulin Dependant)** is a global deficiency of insulin production by pancreatic beta-cells
  - Usually antibody mediated
  - Insulin levels **LOW**

- **Type II Diabetes (Non-Insulin Dependant)** is a metabolic condition where there is systemic insulin resistance
  - Associated with obesity, hypertension, & hyperlipidemia
  - Insulin levels **HIGH**
Criteria for the Diagnosis of Diabetes

A1C ≥6.5%

OR

Fasting plasma glucose (FPG) ≥126 mg/dL (7.0 mmol/L)

OR

2-h plasma glucose ≥200 mg/dL (11.1 mmol/L) during an OGTT

OR

A random plasma glucose ≥200 mg/dL (11.1 mmol/L)*
Type 1 Diabetes: Recommendations

- Plasma blood glucose rather than A1C should be used to diagnose type 1 diabetes in individuals with symptoms of hyperglycemia. E

- Screening for type 1 diabetes with a panel of autoantibodies is currently recommended only in the setting of a research trial study or in first-degree family members of a proband with type 1 diabetes. B

- Persistence of two or more autoantibodies predicts clinical diabetes and may serve as an indication for intervention in the setting of a clinical trial. B

www.DiabetesTrialNet.org
**Prediabetes: IFG, IGT, Increased A1C**

**Categories of increased risk for diabetes (prediabetes)**

FPG 100–125 mg/dL (5.6–6.9 mmol/L): IFG

OR

2-h plasma glucose in the 75-g OGTT

140–199 mg/dL (7.8–11.0 mmol/L): IGT

OR

A1C 5.5–6.4%

*For all three tests, risk is continuous, extending below the lower limit of a range and becoming disproportionately greater at higher ends of the range.*
Criteria for Testing for Diabetes in Asymptomatic Adult Individuals (1)

1. Testing should be considered in all adults who are overweight (BMI ≥ 25 kg/m²*) and have additional risk factors:

   - Physical inactivity
   - First-degree relative with diabetes
   - High-risk race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander)
   - Women who delivered a baby weighing > 9 lb or were diagnosed with GDM
   - Hypertension (≥ 140/90 mmHg or on therapy for hypertension)
   - HDL cholesterol level < 35 mg/dL (0.90 mmol/L) and/or a triglyceride level > 250 mg/dL (2.82 mmol/L)
   - Women with polycystic ovary syndrome (PCOS)
   - A1C ≥ 5.7%, IGT, or IFG on previous testing
   - Other clinical conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans)
   - History of CVD

*At-risk BMI may be lower in some ethnic groups.
2. In the *absence of criteria* (risk factors on previous slide), testing for diabetes should begin *at age 45 years*.

3. If results are normal, testing should be repeated at least at 3-year intervals, with consideration of more frequent testing depending on initial results (e.g., those with prediabetes should be tested yearly), and risk status.
### Correlation of A1C with Average Glucose (AG)

These estimates are based on ADAG data of ~2,700 glucose measurements over 3 months per A1C measurement in 507 adults with type 1, type 2, and no diabetes. The correlation between A1C and average glucose was 0.92. A calculator for converting A1C results into estimated average glucose (eAG), in either mg/dL or mmol/L, is available at http://professional.diabetes.org/eAG.

<table>
<thead>
<tr>
<th>A1C (%)</th>
<th>Mean plasma glucose (mg/dL)</th>
<th>Mean plasma glucose (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>126</td>
<td>7.0</td>
</tr>
<tr>
<td>7</td>
<td>154</td>
<td>8.6</td>
</tr>
<tr>
<td>8</td>
<td>183</td>
<td>10.2</td>
</tr>
<tr>
<td>9</td>
<td>212</td>
<td>11.8</td>
</tr>
<tr>
<td>10</td>
<td>240</td>
<td>13.4</td>
</tr>
<tr>
<td>11</td>
<td>269</td>
<td>14.9</td>
</tr>
<tr>
<td>12</td>
<td>298</td>
<td>16.5</td>
</tr>
</tbody>
</table>
A1c = 7.8
A1C: New Recommendations

- To avoid misdiagnosis or missed diagnosis, the A1C test should be performed using a method that is certified by the NGSP and standardized to the Diabetes Control and Complications Trial (DCCT) assay. B

- Marked discordance between measured A1C and plasma glucose levels should raise the possibility of A1C assay interference due to hemoglobin variants (i.e., hemoglobinopathies) and consideration of using an assay without interference or plasma blood glucose criteria to diagnose diabetes. B

- In conditions associated with increased red blood cell turnover, such as sickle cell disease, pregnancy (second and third trimesters), hemodialysis, recent blood loss or transfusion, or erythropoietin therapy, only plasma blood glucose criteria should be used to diagnose diabetes. B
Prevention/Delay of Type 2 Diabetes
Recommendations: Prevention/Delay of Type 2 Diabetes

- Refer patients with IGT (A), IFG (E), or A1C 5.5%–6.4% (E) to ongoing support program
  - Targeting weight loss of 7% of body weight
  - At least 150 min/week moderate physical activity

- Follow-up counseling important for success (B)

- Based on cost-effectiveness of diabetes prevention, third-party payers should cover such programs (E)

ADA. IV. Prevention/Delay of Type 2 Diabetes. Diabetes Care 2013;36(suppl 1):S16.
Recommendations: Prevention/Delay of Type 2 Diabetes

- Consider metformin for prevention of type 2 diabetes if IGT (A), IFG (E), or A1C 5.5–6.4% (E)
  - Especially for those with BMI >35 kg/m², age <60 years, and women with prior GDM (A)
  - Existing CAD or PAD
  - OSA

- In those with prediabetes, monitor for development of diabetes annually (E)

- Screen for and treat modifiable risk factors for CVD (B)
Targets: One Size Does Not Fit All
Lowering A1C to below or around 7% has been shown to reduce microvascular complications and, if implemented soon after the diagnosis of diabetes, is associated with long-term reduction in macrovascular disease (B).

Therefore, a reasonable A1C goal for many nonpregnant adults is <7% (B).
Providers might reasonably suggest more stringent A1C goals (such as <6.5%) for selected individual patients, if this can be achieved without significant hypoglycemia or other adverse effects of treatment ©
Recommendations: Glycemic Goals in Adults (3)

- Less stringent A1C goals (such as <8%) may be appropriate for patients with (B)
  - History of severe hypoglycemia, limited life expectancy, advanced microvascular or macrovascular complications, extensive comorbid conditions
  - Those with longstanding diabetes in whom the general goal is difficult to attain despite diabetes self-management education, appropriate glucose monitoring, and effective doses of multiple glucose lowering agents including insulin
Primary Outcome: Nonfatal MI, nonfatal stroke, CVD death

HR = 0.90 (0.78-1.04)
Primary Outcome: Microvascular plus macrovascular (nonfatal MI, nonfatal stroke, CVD death)

HR = 0.90 (0.82 - 0.98)

No. at Risk
Intensive: 5570 5457 5369 5256 5100 4957 4867 4756 4599 4044 1883 447
Standard: 5569 5448 5342 5240 5065 4903 4808 4703 4545 3992 1921 470


Intensive Glycemic Control and Cardiovascular Outcomes: VADT

Primary Outcome: Nonfatal MI, nonfatal stroke, CVD death, hospitalization for heart failure, revascularization

HR = 0.88 (0.74-1.05)


# Glycemic Recommendations for Nonpregnant Adults with Diabetes (1)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C</td>
<td>&lt;7.0%*</td>
</tr>
<tr>
<td>Preprandial capillary plasma glucose</td>
<td>80–130 mg/dL*</td>
</tr>
<tr>
<td>2-hr Peak postprandial capillary plasma glucose†</td>
<td>&lt;140 mg/dL*</td>
</tr>
</tbody>
</table>

*Individualize goals based on these values.
†Postprandial glucose measurements should be made 1–2 h after the beginning of the meal, generally peak levels in patients with diabetes.
Glycemic Recommendations for Nonpregnant Adults with Diabetes (2)

- Goals should be individualized based on
  - Duration of diabetes
  - Age/life expectancy
  - Comorbid conditions
  - Known CVD or advanced microvascular complications
  - Hypoglycemia unawareness
  - Individual patient considerations
Approach to management of hyperglycemia:

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>More Stringent</th>
<th>Less Stringent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risks potentially associated with hypoglycemia, other adverse events</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Disease duration</td>
<td>Newly diagnosed</td>
<td>Long-standing</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>Long</td>
<td>Short</td>
</tr>
<tr>
<td>Important comorbidities</td>
<td>Absent</td>
<td>Few / mild</td>
</tr>
<tr>
<td>Established vascular complications</td>
<td>Absent</td>
<td>Few / mild</td>
</tr>
<tr>
<td>Resources, support system</td>
<td>Readily available</td>
<td>Limited</td>
</tr>
<tr>
<td>Parameter</td>
<td>High Risk Target</td>
<td>Moderate Risk Target</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>LDL-c</td>
<td>&lt; 70</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Non-HDL-c</td>
<td>&lt; 100</td>
<td>&lt; 130</td>
</tr>
<tr>
<td>Trig</td>
<td>&lt; 150</td>
<td>&lt; 150</td>
</tr>
<tr>
<td>Apo B</td>
<td>&lt; 80</td>
<td>&lt; 90</td>
</tr>
<tr>
<td>LDL-Particle Number</td>
<td>&lt; 1000</td>
<td>&lt; 1200</td>
</tr>
<tr>
<td>Aspirin*</td>
<td>+ secondary prevention</td>
<td>Primary prevention if risk &gt; 6% in 10 years for event</td>
</tr>
</tbody>
</table>
Table 9.2—Recommendations for statin and combination treatment in adults with diabetes

<table>
<thead>
<tr>
<th>Age</th>
<th>ASCVD</th>
<th>Recommended statin intensity and combination treatment*</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40 years</td>
<td>No</td>
<td>None†</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If LDL cholesterol $\geq 70$ mg/dL despite maximally tolerated statin dose, consider adding additional LDL-lowering therapy (such as ezetimibe or PCSK9 inhibitor)#</td>
</tr>
<tr>
<td>$\geq 40$ years</td>
<td>No</td>
<td>Moderate‡</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If LDL cholesterol $\geq 70$ mg/dL despite maximally tolerated statin dose, consider adding additional LDL-lowering therapy (such as ezetimibe or PCSK9 inhibitor)</td>
</tr>
</tbody>
</table>

*In addition to lifestyle therapy. †For patients who do not tolerate the intended intensity of statin, the maximally tolerated statin dose should be used. ‡Moderate-intensity statin may be considered based on risk-benefit profile and presence of ASCVD risk factors. ASCVD risk factors include LDL cholesterol $\geq 100$ mg/dL (2.6 mmol/L), high blood pressure, smoking, chronic kidney disease, albuminuria, and family history of premature ASCVD. †High-intensity statin may be considered based on risk-benefit profile and presence of ASCVD risk factors. #Adults aged $<40$ years with prevalent ASCVD were not well represented in clinical trials of non-statin–based LDL reduction. Before initiating combination lipid-lowering therapy, consider the potential for further ASCVD risk reduction, drug-specific adverse effects, and patient preferences.
# High- and Moderate-Intensity Statin Therapy

<table>
<thead>
<tr>
<th>High-intensity statin therapy (lowers LDL cholesterol by ≥50%)</th>
<th>Moderate-intensity statin therapy (lowers LDL cholesterol by 30% to 50%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atorvastatin 40–80 mg</td>
<td>Atorvastatin 10–20 mg</td>
</tr>
<tr>
<td>Rosuvastatin 20–40 mg</td>
<td>Rosuvastatin 5–10 mg</td>
</tr>
<tr>
<td></td>
<td>Simvastatin 20–40 mg</td>
</tr>
<tr>
<td></td>
<td>Pravastatin 40–80 mg</td>
</tr>
<tr>
<td></td>
<td>Lovastatin 40 mg</td>
</tr>
<tr>
<td></td>
<td>Fluvastatin XL 80 mg</td>
</tr>
<tr>
<td></td>
<td>Pitavastatin 2–4 mg</td>
</tr>
</tbody>
</table>

*Once-daily dosing. XL, extended release.*
Lifestyle Intervention

For patients with BP >120/80, lifestyle intervention consists of weight loss if overweight or obese; a Dietary Approaches to Stop Hypertension-style dietary pattern including reducing sodium and increasing potassium intake; moderation of alcohol intake; and increased physical activity. B
Pharmacologic Interventions

- Patients with confirmed office-based blood pressure $\geq 140/90$ mmHg should, in addition to lifestyle therapy, have prompt initiation and timely titration of pharmacologic therapy to achieve BP goals. A

- Patients with confirmed office-based blood pressure $\geq 160/100$ mmHg should, in addition to lifestyle therapy, have prompt initiation and timely titration of two drugs or a single-pill combination of drugs demonstrated to reduce CV events in patients with diabetes. A
Recommendations for the Treatment of Confirmed Hypertension in People With Diabetes

1. Initial BP between 140/90 mmHg and 160/100 mmHg
   - Start one agent
     - Albuminuria
       - No: Start one drug: ACEi, ARB, CCB, Diuretic
       - Yes: Start: ACEi or ARB

2. Initial BP ≥ 160/100 mmHg
   - Start two agents
     - Albuminuria
       - No: Start drug from 2 of 3 options: ACEi or ARB, CCB, Diuretic
       - Yes: Start: ACEi or ARB and CCB, or Diuretic

Assess BP Control and Adverse Effects

- Treatment tolerated and target achieved: Continue therapy
- Not meeting target: Add agent from complementary drug class: ACEi or ARB, CCB, Diuretic
- Adverse effects: Consider change to alternative medication: ACEi or ARB, CCB, Diuretic

Assess BP Control and Adverse Effects

- Treatment tolerated and target achieved: Continue therapy
- Not meeting target or adverse effects using a drug from each of three classes: Consider Addition of Mineralocorticoid Receptor Antagonist; Refer to Specialist With Expertise in BP Management
Treatment Options
Recommendations: Insulin Therapy for Type 1 Diabetes (1)

- Most people with type 1 diabetes
  - Should be treated with MDI injections (3–4 injections per day of basal and prandial insulin) or continuous subcutaneous insulin infusion (CSII) (A)
  - Should be educated in how to match prandial insulin dose to carbohydrate intake, premeal blood glucose, and anticipated activity (E)
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**Review**

![Diagram showing glucose metabolism and drug effects.](Image from p. 284)

- **Liver** (glucose production)
  - Metformin Glitazones (inhibit production)
- **Muscle**
  - Glitazones Metformin (enhance uptake)
  - OSU* repaglinide (increase release)
- **Pancreas** (insulin production)
- **Blood**
  - Glucose
- **GI Tract**
  - Starch
  - α-glucosidase
  - Acarbose (inhibits enzyme)

* osu = oral sulfonylureas
Metformin, if not contraindicated and if tolerated, is the preferred initial pharmacological agent for type 2 diabetes (A)
Biguanides: Mechanism

- Decreased Hepatic Gluconeogenesis
- Decreased Intestinal Absorption
- Increased Peripheral Insulin Sensitivity

Effects:
- ✓ decrease in basal and post-prandial glucose levels
- ✓ weight loss
If noninsulin monotherapy at maximal tolerated dose does not achieve or maintain the A1C target over 3–6 months, add a second oral agent, a GLP-1 receptor agonist, or insulin (A)
Incretin Analogues: Mechanism

- Small Intestine
- GLP-1
- Pancreas
  - Insulin Secretion
  - Glucagon
- Stomach
  - Slow Gastric Emptying
- Inhibitor
  - Early Satiety
  - DPP-IV
Sodium-Glucose Transport Inhibition
Sodium-Glucose Transport Inhibition

- **Members:**
  - Canagliflozin
  - Empagliflozin
  - Dapagliflozin

- **Side effects:**
  - Vaginal/Perineal infections
  - Candidiasis
  - UTI
  - *Ketoacidosis*
In newly diagnosed type 2 diabetic patients with markedly symptomatic and/or elevated blood glucose levels or A1C, consider insulin therapy, with or without additional agents, from the outset (E)
Insulin: Mechanism

Insulin Level

Bolus

24-Hours

Basal

Diabetes Care 2018 Jan; 41
# Insulin: Pharmacokinetics

<table>
<thead>
<tr>
<th>Form</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lispro</td>
<td>0.3-0.5 hours</td>
<td>1-2 hours</td>
<td>3-4 hours</td>
</tr>
<tr>
<td>Asparte</td>
<td>0.3-0.5 hours</td>
<td>1-2 hours</td>
<td>3-4 hours</td>
</tr>
<tr>
<td>Glulisine</td>
<td>0.3-0.5 hours</td>
<td>2 hours</td>
<td>3-4 hours</td>
</tr>
<tr>
<td>Regular</td>
<td>0.5-1 hours</td>
<td>2-4 hours</td>
<td>5-7 hours</td>
</tr>
<tr>
<td>Detemir</td>
<td>1-2 hours</td>
<td>None</td>
<td>16-18 hours</td>
</tr>
<tr>
<td>Glargine</td>
<td>1-2 hours</td>
<td>None</td>
<td>18-24 hours</td>
</tr>
</tbody>
</table>
At diagnosis, initiate lifestyle management, set A1C target, and initiate pharmacologic therapy based on A1C:

- **A1C is less than 9%**, consider Monotherapy.
- **A1C is greater than or equal to 9%**, consider Dual Therapy.
- **A1C is greater than or equal to 10%**, blood glucose is greater than or equal to 300 mg/dL, or patient is markedly symptomatic, consider Combination Injectable Therapy (See Figure 8.2).

### Monotherapy (Lifestyle Management + Metformin)

Initiate metformin therapy if no contraindications* (See Table 8.1)

**A1C at target after 3 months of monotherapy?**

- **Yes**: - Monitor A1C every 3–6 months
  - Assess medication-taking behavior
  - Consider Dual Therapy

### Dual Therapy (Lifestyle Management + Metformin + Additional Agent)

**ASCVD?**

- **Yes**: - Add agent proven to reduce major adverse cardiovascular events and/or cardiovascular mortality (see recommendations with * on p. S73 and Table 8.1)
- **No**: - Add second agent after consideration of drug-specific effects and patient factors (See Table 8.1)

**A1C at target after 3 months of dual therapy?**

- **Yes**: - Monitor A1C every 3–6 months
- **No**: - Assess medication-taking behavior
  - Consider Triple Therapy

### Triple Therapy (Lifestyle Management + Metformin + Two Additional Agents)

Add third agent based on drug-specific effects and patient factors† (See Table 8.1)

**A1C at target after 3 months of triple therapy?**

- **Yes**: - Monitor A1C every 3–6 months
- **No**: - Assess medication-taking behavior
  - Consider Combination Injectable Therapy (See Figure 8.2)

---

* See Table 8.1 for contraindications

† See Table 8.1 for patient factors
At diagnosis, initiate lifestyle management, set A1C target, and initiate pharmacologic therapy based on A1C:

- **A1C is less than 9%, consider Monotherapy.**

- **A1C is greater than or equal to 9%, consider Dual Therapy.**

- **A1C is greater than or equal to 10%, blood glucose is greater than or equal to 300 mg/dL, or patient is markedly symptomatic, consider Combination Injectable Therapy** (See Figure 8.2).

**Monotherapy**

- Lifestyle Management + Metformin

  Initiate metformin therapy if no contraindications* (See Table 8.1)

- **A1C at target after 3 months of monotherapy?**
  - **Yes:** Monitor A1C every 3–6 months
  - **No:** Assess medication-taking behavior
    - Consider Dual Therapy

**Dual Therapy**

- Lifestyle Management + Metformin + Additional Agent
**Diabetes Care** 2018 Jan; 41 (Suppl. 1): S73–S85

### Dual Therapy
**Lifestyle Management + Metformin + Additional Agent**

**ASCVD?**
- **Yes:** Add agent proven to reduce major adverse cardiovascular events and/or cardiovascular mortality (see recommendations with * on p. S75 and **Table 8.1**)
- **No:** Add second agent after consideration of drug-specific effects and patient factors (See Table 8.1)

**A1C at target after 3 months of dual therapy?**
- **Yes:** Monitor A1C every 3–6 months
- **No:** Assess medication-taking behavior
  - Consider Triple Therapy

### Triple Therapy
**Lifestyle Management + Metformin + Two Additional Agents**

Add third agent based on drug-specific effects and patient factors *(See Table 8.1)*

**A1C at target after 3 months of triple therapy?**
- **Yes:** Monitor A1C every 3–6 months
- **No:** Assess medication-taking behavior
  - Consider Combination Injectable Therapy *(See Figure 8.2)*

### Combination Injectable Therapy
*(See Figure 8.2)*
Pharmacologic Approaches to Glycemic Treatment: Standards of Medical Care in Diabetes - 2018.

**Initiate Basal Insulin**
- Usually with metformin +/- other noninsulin agent

- **Start:** 10 U/day or 0.1–0.2 U/kg/day
- **Adjust:** 10–15% or 2–4 units once or twice weekly to reach FBG target
- **For hypo:** Determine & address cause; if no clear reason for hypo, ↓ dose by 4 units or 10–20%

- **If A1C not controlled, consider combination injectable therapy**

**Add 1 rapid-acting insulin injection before largest meal**
- **Start:** 4 units, 0.1 U/kg, or 10% basal dose. If A1C <8%, consider ↓ basal by same amount
- **Adjust:** ↑ dose by 1–2 units or 10–15% once or twice weekly until SMBG target reached
- **For hypo:** Determine and address cause; if no clear reason for hypo, ↓ corresponding dose by 2–4 units or 10–20%

- **If A1C not controlled, advance to basal-bolus**

**Add ≥2 rapid-acting insulin injections before meals (‘basal-bolus’)**
- **Start:** 4 units, 0.1 U/kg, or 10% basal dose/meal. If A1C <8%, consider ↓ basal by same amount
- **Adjust:** ↑ dose(s) by 1–2 units or 10–15% once or twice weekly to achieve SMBG target
- **For hypo:** Determine and address cause; if no clear reason for hypo, ↓ corresponding dose by 2–4 units or 10–20%

- **If goals not met, consider changing to alternative insulin regimen**

**Add GLP-1 RA**
- If not tolerated or A1C target not reached, change to 2 injection insulin regimen

- **If goals not met, consider changing to alternative insulin regimen**

**Change to premixed insulin twice daily (before breakfast and supper)**
- **Start:** Divide current basal dose into ½ AM, ½ PM or ⅛ AM, ⅞ PM
- **Adjust:** ↑ dose by 1–2 units or 10–15% once or twice weekly until SMBG target reached
- **For hypo:** Determine and address cause; if no clear reason for hypo, ↓ corresponding dose by 2–4 units or 10–20%

- **If A1C not controlled, advance to 3rd injection**

**Change to premixed analog insulin 3 times daily (breakfast, lunch, supper)**
- **Start:** Add additional injection before lunch
- **Adjust:** ↑ doses by 1–2 units or 10–15% once or twice weekly to achieve SMBG target
- **For hypo:** Determine and address cause; if no clear reason for hypo, ↓ corresponding dose by 2–4 units or 10–20%

- **If A1C not controlled, advance to basal-bolus**
Multi-System Approach
Diabetic Kidney Disease (DKD): Recommendations

Screening

- At least once a year, assess urinary albumin (e.g., spot urinary albumin-to-creatinine ratio) and estimated glomerular filtration rate (eGFR):
  - In patients with type 1 diabetes with duration of ≥5 years **B**
  - In all patients with type 2 diabetes **B**
  - In all patients with comorbid hypertension **B**
Diabetic Kidney Disease (DKD): Recommendations (2)

Treatment

- Optimize glucose control to reduce the risk or slow progression of DKD. A
- Optimize blood pressure control to reduce the risk or slow progression of DKD. A
- For people with nondialysis-dependent DKD, dietary protein intake should be ~0.8 g/kg body weight per day (the recommended daily allowance). For patients on dialysis, higher levels of dietary protein intake should be considered. B
Diabetic Kidney Disease (DKD): Recommendations (3)

Treatment

- In nonpregnant patients with diabetes and hypertension, either an ACE inhibitor or ARB is recommended for those with modestly elevated urinary albumin-to-creatinine ratio (UACR) (30–299 mg/g creatinine) and is strongly recommended for those with UACR ≥300 mg/g creatinine and/or eGFR <60 mL/min/1.73m².
Diabetic Retinopathy: Recommendations

Screening:

- Initial dilated and comprehensive eye examination by an ophthalmologist or optometrist:
  - Adults with type 1 diabetes, within 5 years of diabetes onset. B
  - Patients with type 2 diabetes at the time of diabetes diagnosis. B
Neuropathy: Overview

Early recognition and management is important because:

1. Diabetic neuropathy (DN) is a diagnosis of exclusion.
3. Up to 50% of diabetic peripheral neuropathy (DPN) may be asymptomatic.
4. Recognition & treatment may improve symptoms, reduce sequelae, and improve quality of life.
Neuropathy: Recommendations

Screening:

○ All patients should be assessed for DPN starting at diagnosis for T2DM and 5 years after diagnosis of T1DM and at least annually thereafter. B

○ Assessment for distal symmetric polyneuropathy should include a careful history and assessment of either temperature or pinprick sensation (small-fiber function) and vibration sensation using a 128-Hz tuning fork (for large-fiber function). All patients should have annual 10-g monofilament testing to identify feet at risk for ulceration and amputation. B

○ Symptoms and signs of autonomic neuropathy should be assessed in patients with microvascular complications. E
Neuropathy: Recommendations (2)

Treatment:

- Optimize glucose control to prevent or delay the development of neuropathy in patients with T1DM A and to slow the progression in patients with T2DM. B

- Assess and treat patients to reduce pain related to DPN B and symptoms of autonomic neuropathy and to improve quality of life. E

- Either pregabalin or duloxetine are recommended as initial pharmacologic treatments for neuropathic pain in diabetes. A
Foot Care: Risk Of Ulcer and Amputation

Risk of ulcers or amputations is increased in people with the following risk factors:

- Poor glycemic control
- Peripheral neuropathy with loss of protective sensation (LOPS)
- Cigarette smoking
- Foot deformities
- Preulcerative callus or corn
- PAD
- History of foot ulcer
- Amputation
- Visual impairment
- DKD (especially patients on dialysis)
Immunization: Recommendations

- Provide routinely recommended vaccinations for children and adults with diabetes by age. C
- Annual vaccination against influenza is recommended for all people ≥6 months of age, including those with diabetes. C
- Administer 3-dose series of hepatitis B vaccine to unvaccinated adults with diabetes aged 19-59 years. C
- Consider administering 3-dose hepatitis B vaccine to unvaccinated adults with diabetes ages ≥ 60 years. C
Immunization: Recommendations (2)

Vaccination against pneumococcal disease, including pneumococcal pneumonia, with 13-valent pneumococcal conjugate vaccine (PCV13) is recommended for children before age 2 years. People with diabetes ages 2-64 years should also receive 23-valent pneumococcal polysaccharide vaccine (PPSV23). Age ≥65 years, regardless of vaccination history, additional PPSV23 vaccination is necessary. C
Common Comorbidities

- Autoimmune Diseases (T1D)
- Cancer
- Cognitive Impairment/ Dementia
- Fatty Liver Disease
- Pancreatitis
- Fractures
- Hearing Impairment
- HIV
- Low Testosterone (Men)
- Obstructive Sleep Apnea
- Periodontal Disease
- Psychosocial/Emotional Disorders
Autoimmune Diseases: Recommendation

- Consider screening patients with type 1 diabetes for autoimmune thyroid disease and celiac disease soon after diagnosis. \(B\)
Pancreatitis: New Recommendation

Islet autotransplantation should be considered for patients requiring total pancreatectomy for medically refractory chronic pancreatitis to prevent postsurgical diabetes. C
Low Testosterone in Men: Recommendation

In men with diabetes who have symptoms or signs of hypogonadism such as decreased sexual desire (libido) or activity, or erectile dysfunction, consider screening with a morning serum testosterone level. B