

Diabetes 101

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Disclosures

- ▶ No conflict of interest

Outline

- ▶ Diabetic Kidney Disease
- ▶ ABC's of Diabetes
- ▶ Diabetes Medications Overview
- ▶ Counseling Tips for Patients with DKD

Statistics

- ▶ According to the National Diabetes Statistic Report 2020:
 - ▶ 37% of diabetics have chronic kidney disease stages 1-4
 - ▶ 52.5% of these above cases are moderate to severe at stages 3-4
 - ▶ Per 2017, 38.6% of people with end stage kidney disease reported diabetes as the primary cause
 - ▶ Diabetes is the #1 reported cause of end stage kidney disease followed by hypertension at 25%

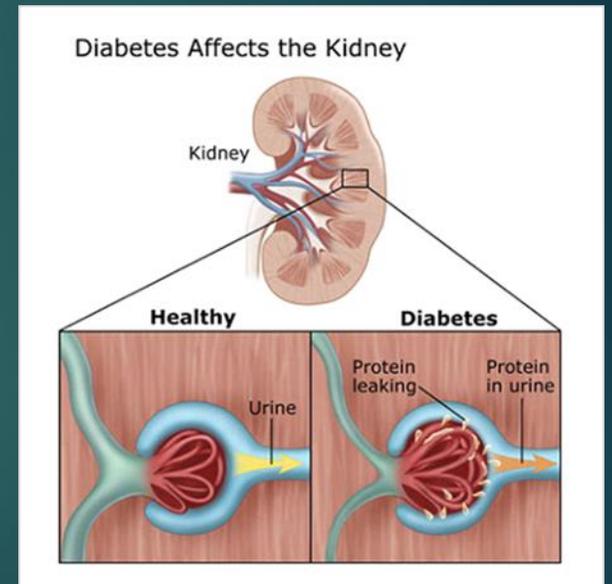
Diabetic Kidney Disease-DKD

- ▶ High blood sugars can damage the vessels in the kidneys
- ▶ Blood pressure that is not controlled can also damage the kidneys
- ▶ Other factors that can lead to DKD for those with diabetes:
 - ▶ Smoking
 - ▶ Not following meal plan
 - ▶ High sodium diet
 - ▶ Inactivity
 - ▶ Overweight or obesity
 - ▶ Heart Disease
 - ▶ Family history of kidney disease

<https://www.niddk.nih.gov/health-information/diabetes/overview/preventing-problems/diabetic-kidney-disease>

DKD Symptoms

- ▶ Many do not have symptoms or do not get symptoms for many years
- ▶ Later stages:
 - ▶ Uncontrolled blood pressure
 - ▶ Protein in the urine
 - ▶ Swelling in feet and hands
 - ▶ Confusion
 - ▶ Lack of appetite
 - ▶ Nausea or vomiting
 - ▶ Fatigue

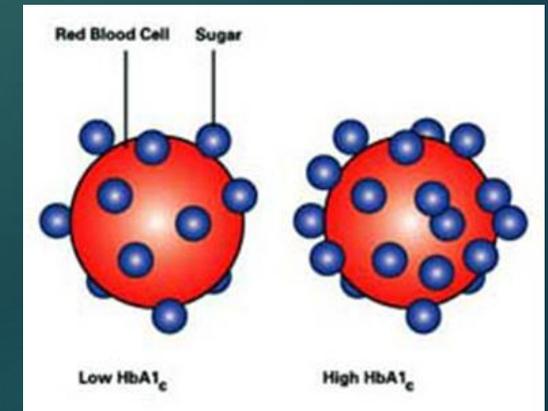


ABC's of Diabetes Management

- ▶ A1c
- ▶ Blood Pressure
- ▶ Cholesterol

What is A1c Exactly?

- ▶ Sugar enters bloodstream and attaches to hemoglobin
- ▶ Measures the amount of sugar stuck to hemoglobin in percentage
- ▶ 3 month average
- ▶ Tells the whole story
- ▶ Need to dig deeper if blood sugars and A1c do not match up
- ▶ Confusion with patients on why to test blood sugars when getting A1c tested anyways



| A1c (%) | eAG (mg/dL) Estimated Average Glucose |
|---------|--|
| 6.0 | 126 |
| 6.5 | 140 |
| 7.0 | 154 |
| 7.5 | 169 |
| 8.0 | 183 |
| 8.5 | 197 |
| 9.0 | 212 |
| 9.5 | 226 |
| 10.0 | 240 |

American Diabetes Association: www.diabetes.org/professional/eAG

A1c Goals

- ▶ <7.0% for general diabetes population
- ▶ <6.5% if it can be achieved safely
- ▶ <8.0% for those with other health ailments, poor health, not a long life expectancy, older adults
- ▶ Possible harm with A1c too low
 - ▶ Some older patient cannot feel signs and symptoms of hypoglycemia
 - ▶ Symptoms can be masked with side effects from hemodialysis
- ▶ Elevated values at higher risk for complications to diabetes
 - ▶ Important to tell diabetic patient early on with diagnosis if young

A1c Too Low?

- ▶ Many factors can play into a decline in A1c or rapid decline
- ▶ Before we praise the patient for getting down values, we need to evaluate and ask questions:
 - ▶ Does this patient have a recent decrease in appetite?
 - ▶ Asking the patient if they have been feeling weak, low energy
 - ▶ How often do they check blood sugars?
 - ▶ Do they check blood sugars when they feel weak or low energy ever (it could be due to dialysis, diabetes, blood pressure issues, etc)
 - ▶ Is this patient on an oral diabetic medication that can cause blood sugars to go too low or insulin (which can also make blood sugars go too low)
 - ▶ If A1c is too low, physician or endocrinologist needs to adjust/decrease diabetes medication

Low A1c Values with CKD patients

- ▶ With CKD, shortened red blood cell lifespan
- ▶ A1c can get less accurate as closer to ESRD
- ▶ Uremia toxin present
- ▶ Anemia

<https://pubmed.ncbi.nlm.nih.gov/26138753/>

Blood Glucose Goals

- ▶ 80-130mg/dl fasting
- ▶ <180mg/dl 2 hours after the start of meals
- ▶ General and should be customized to individual
- ▶ Amount of times being tested individualized as well
 - ▶ Insulin vs oral agents
 - ▶ Long acting vs basal/bolus
 - ▶ Higher A1c testing more frequently

Blood Pressure Goals

- ▶ Less than 140/90 mm Hg
- ▶ Those with diabetes and HTN and at higher cardiovascular risk, <130/80 mm Hg more appropriate
- ▶ Individualized based on patient
- ▶ Recommended for patients with diabetes and HTN to monitor blood pressure at home regularly



Cholesterol Goals for Diabetics

- ▶ Goal LDL <100mg/dl
- ▶ HDL goals: >40mg/dl
 - ▶ Women even higher
- ▶ Nutrition interventions:
 - ▶ Unsaturated fats vs Saturated
 - ▶ Higher Fiber Foods
 - ▶ Plant sterols

Triglycerides and Diabetes

- ▶ Goal of under 150mg/dl
- ▶ Sometimes elevated triglycerides are seen with elevated A1c results
 - ▶ Insulin helps convert glucose into glycogen and helps to store in the liver
 - ▶ When the liver has too much glycogen, glucose creates fatty acids released in the bloodstream
 - ▶ These fatty acids are used to make triglycerides
- ▶ High levels can cause arteriosclerosis and pancreatitis
- ▶ Can increase risk for stroke, heart disease, metabolic syndrome

<https://pubmed.ncbi.nlm.nih.gov/31784746/>

<https://pubmed.ncbi.nlm.nih.gov/26721018/>

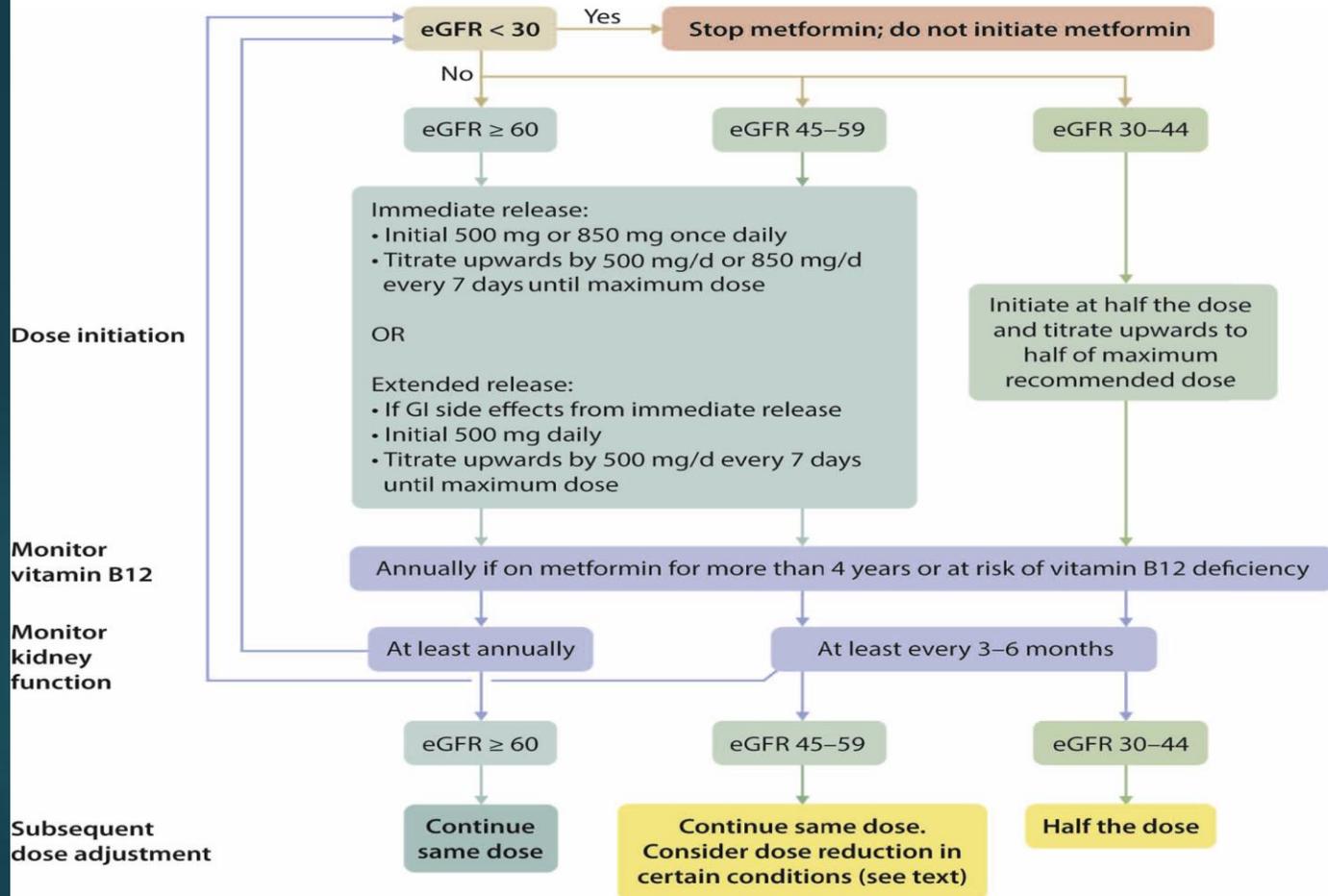
Diabetes Medication with Considerations DKD patients

- ▶ Metformin:
 - ▶ Used to focus on creatinine levels and now GFR used
 - ▶ Can be started if GFR above 45 and can be used until down to 30

Practice Points may also have accompanying algorithms to aid in implementation

For example:

Practice Point 2. Monitor eGFR in patients treated with metformin. Increase the frequency of monitoring when eGFR is < 60 ml/min per 1.73 m²



Why was this formatted as a practice point?

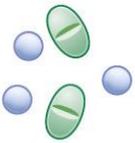
- Limited evidence to support the guidance but monitoring eGFR in these patients is necessary.
- No systematic review was conducted.
- The Work Group believes a graphic would be more useful to the reader since an algorithm offers a clearer visual presentation of the approach to monitoring than a series of statements.

[https://www.kidney-international.org/article/S0085-2538\(20\)30718-3/fulltext#secsectitle0010](https://www.kidney-international.org/article/S0085-2538(20)30718-3/fulltext#secsectitle0010)



Lifestyle therapy

Physical activity
Nutrition
Weight loss



First-line therapy

Metformin

| | | |
|---|---|--|
|  eGFR < 45 |  eGFR < 30 |  Dialysis |
| Reduce dose | Discontinue | Discontinue |

+

SGLT2 inhibitor

| | |
|---|--|
|  eGFR < 30 |  Dialysis |
| Do not initiate | Discontinue |



GLP-1 receptor agonist (preferred)

DPP-4 inhibitor

Insulin

Sulfonylurea

TZD

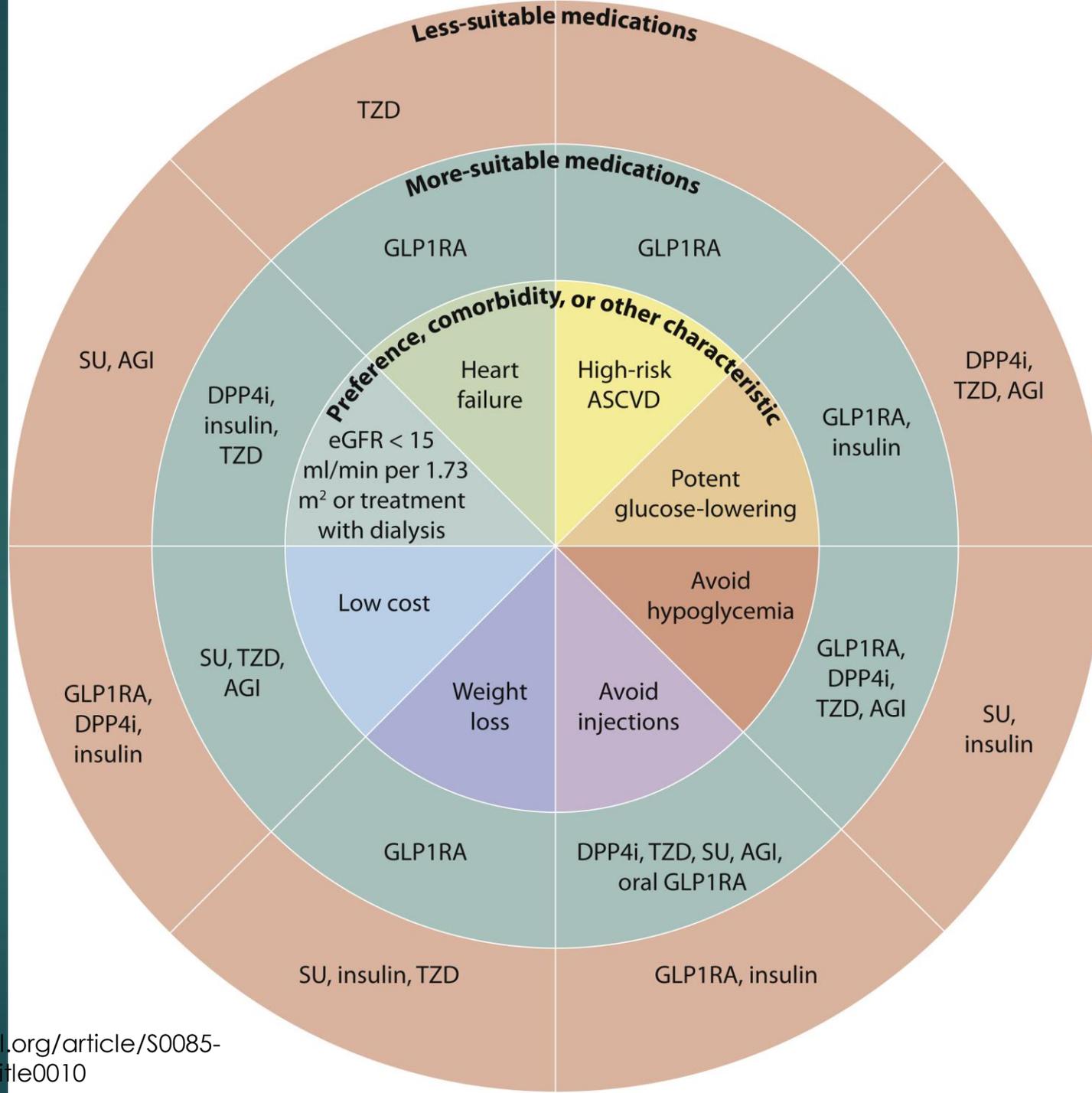
Alpha-glucosidase inhibitor

- Guided by patient preferences, comorbidities, eGFR, and cost
- Includes patients with eGFR < 30 ml/min per 1.73 m² or treated with dialysis
- See Figure 20

Additional drug therapy as needed for glycemic control



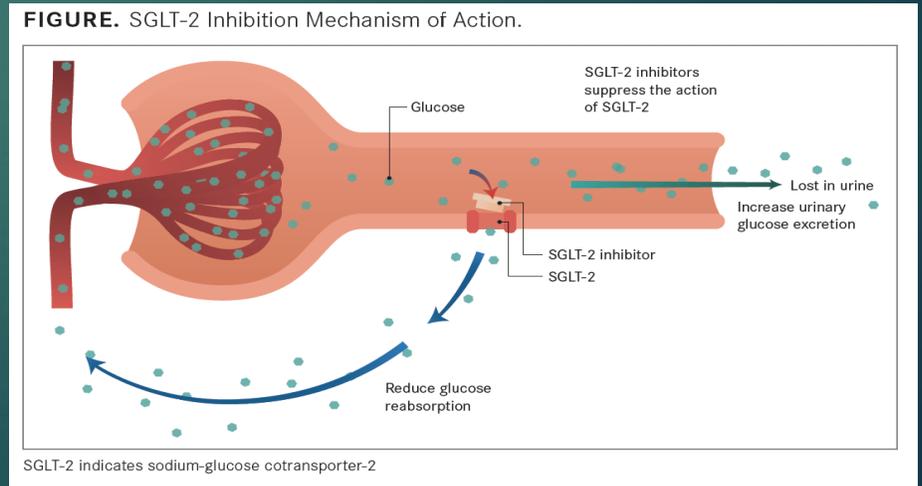
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SGLT2 Inhibitor

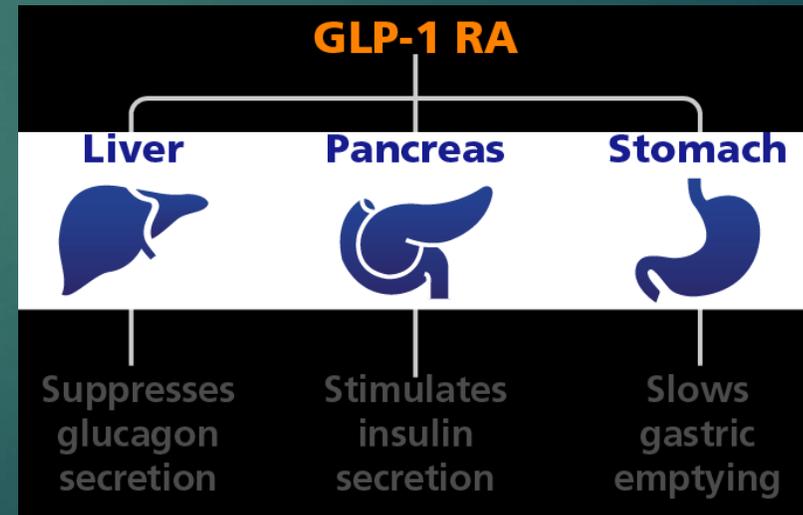
- ▶ Sodium Glucose Cotransporter-2 Inhibitor
 - ▶ Inhibits SGLT-2 proteins located in renal tubules of kidney where glucose reabsorbed in the blood
 - ▶ This results in glucose being excreted in the urine
 - ▶ Helps lower blood pressure, decrease weight and decrease A1c
 - ▶ Caution to urinate as soon as needed to prevent UTI and yeast infections
 - ▶ Jardiance, Invokana, Farxiga

<https://diabetes.diabetesjournals.org/content/diabetes/70/1/1.full.pdf>



GLP-1 Receptor Agonist

- ▶ Mimics the actions of GLP-1 in the body
- ▶ Activates GLP-1 receptors
- ▶ Increase the glucose dependent secretions of insulin from functioning beta cells
- ▶ Causes delayed gastric emptying and decrease in appetite
- ▶ Caution with overeating, can cause nausea
- ▶ Aids with weight loss



GLP-1 RA Options

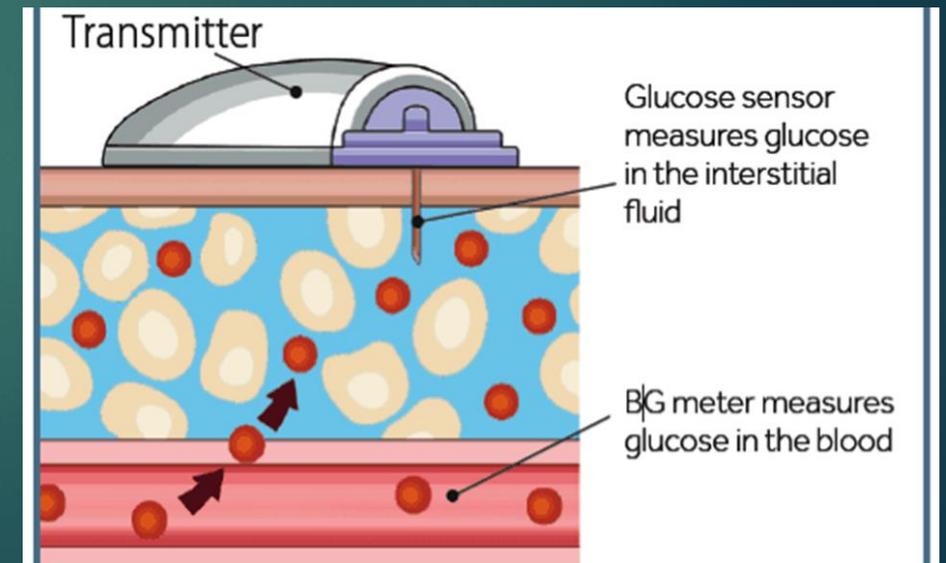
- ▶ Can be a daily injectable (Victoza)
- ▶ Twice a day injectable (Byetta)
- ▶ Can be a once a week injectable (Trulicity, Bydureon, Ozempic)
- ▶ Now comes in an oral pill form (Rybelsus)
- ▶ Comes in a combo of GLP-1 RA and long acting insulin
 - ▶ Xultophy (maximum dose of 50 units)
 - ▶ Soliqua (maximum dose of 60units)

Continuous Glucose Monitoring- CGM

- ▶ Further testing and studies currently being conducted with patients on dialysis
- ▶ Major CGM companies list in disclaimers
- ▶ Some compelling research studies about positive results
- ▶ KDIGO 2020 guidelines recommend use of CGM's
- ▶ Test with glucometer if feeling symptoms of hypoglycemia
- ▶ Test with glucometer if low or high outliers on CGM

CGM-How It Works

- ▶ Filament placed under the skin into the interstitial space
 - ▶ Area based on the different CGM: arm and stomach most common
- ▶ Measures interstitial fluid not blood glucose
 - ▶ Interstitial fluid can be affected with patient on dialysis



CGM-Lag Time

- ▶ Tells where the blood glucose levels have been
 - ▶ Gives arrows to indicate this to patients on receiver or phone
 - ▶ 5-20 minute difference
 - ▶ Patient may set lower level alarms closer to 80-100 due to this
- ▶ Larger differences in blood and interstitial fluid during exercise, carbohydrate intake and insulin delivery



AGP Report

Name

MRN

GLUCOSE STATISTICS AND TARGETS

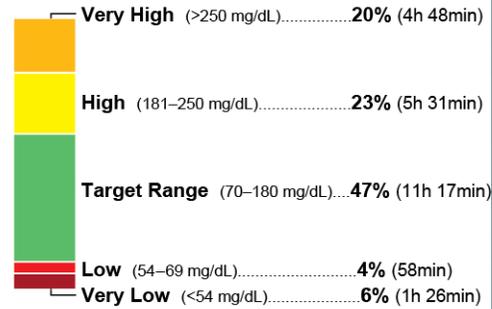
26 Feb 2019 - 10 Mar 2019 **13 days**
 % Time CGM is Active **99.9%**

Glucose Ranges **Targets** [% of Readings (Time/Day)]
 Target Range 70-180 mg/dL.....Greater than 70% (16h 48min)
 Below 70 mg/dLLess than 4% (58min)
 Below 54 mg/dLLess than 1% (14min)
 Above 250 mg/dLLess than 5% (1h 12min)
 Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose **173 mg/dL**
Glucose Management Indicator (GMI) **7.6%**
Glucose Variability **49.5%**

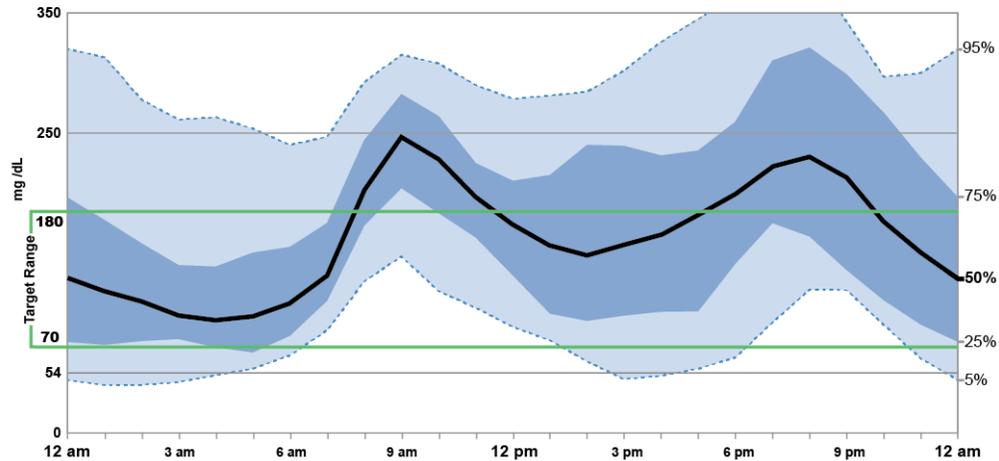
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

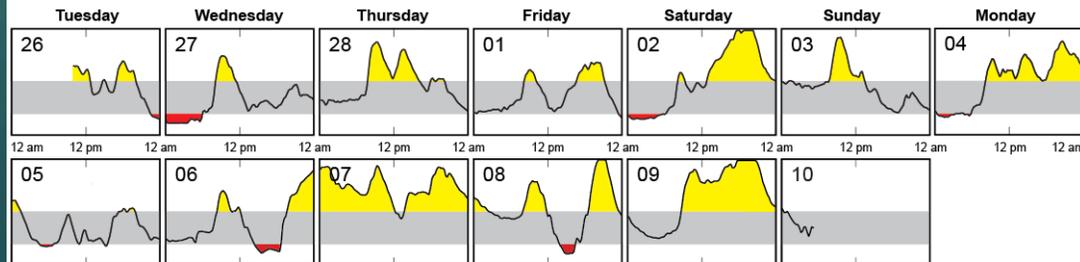


AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES



Each daily profile represents a midnight to midnight period.

Counseling Tips for Those Diabetic Patients on Dialysis or CKD

- ▶ 4 Buckets of Diabetes Management
 1. Nutrition
 2. Exercise
 3. Medication Management
 4. Monitoring Blood Sugars

Bucket #1-Nutrition

1. Nutrition:

- Renal/ Diabetic Diet

- Are they following

- Carb counting or reading labels

Grains for CKD Patients

- ▶ Can whole grains be included in the DKD diet?
- ▶ Whole grains and phosphorus
 - ▶ Whole grains with high phosphorus content
 - ▶ Binds to phytate and requires phytase to be released for absorption
 - ▶ Some phytase in whole grains, but decreasing over time in food production
- ▶ Organic vs inorganic phosphorus
- ▶ Alternatively, blood sugars management can be “fixed” with alternating diabetes medication
- ▶ Pressing nutrition issues

Calorie and Protein guidelines for DKD Patients

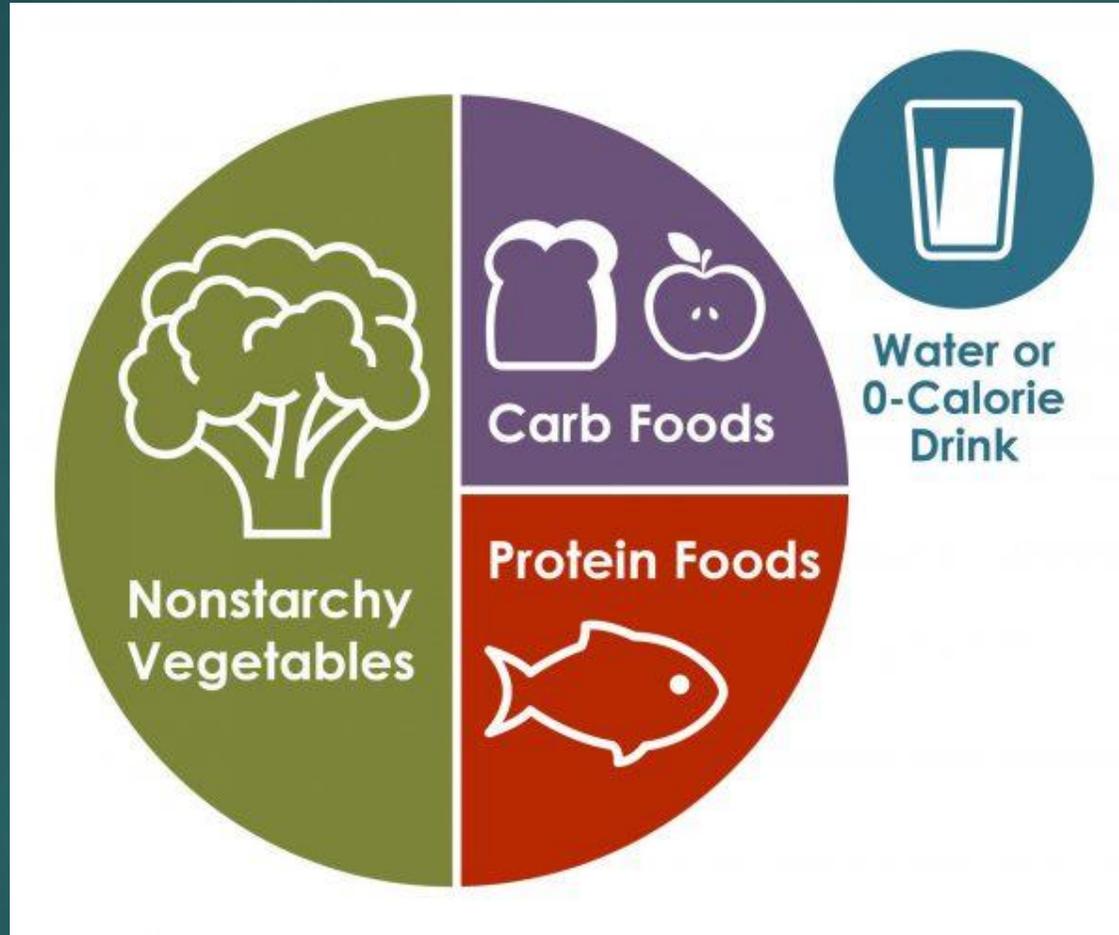
- ▶ HD/DM patients
 - ▶ Calories: 25-35 kcals/kg based on age, sex, physical activity, weight status goals, CKD stage
 - ▶ Protein: 1.0-1.2g/kg
- ▶ Predialysis DM/CKD
 - ▶ Calories: 25-35kcals/kg-same as above
 - ▶ Protein: 0.6-0.8g/kg BW
- ▶ More research with type of protein-plant vs animal

Carbohydrates for those with DKD

- ▶ 30-75 grams of carbs per meal based on height, weight, activity, gender, stage of CKD, weight status
- ▶ Snacks 0-15 grams per snack
 - ▶ Especially important for those on insulin as not “covering” for snacks
 - ▶ Would run the risk of insulin stacking
- ▶ Should evenly distribute carbs with meals
 - ▶ Not saving all carbs for 1 meal
 - ▶ More flexibility for those on insulin with ICR and CF or pump



The Diabetes Plate Method



<https://www.cdc.gov/diabetes/managing/eat-well/meal-plan-method.html>

Food Logs

- ▶ Recommended to obtain 3 days of food logs for DKD/CKD patients
 - ▶ Food intake is very different on days when getting dialysis vs non dialysis days
 - ▶ Some don't have any hunger after and others extreme hunger
 - ▶ Eating less when sleeping more around dialysis treatments

Bucket #2-Exercise

- ▶ Do they have enough energy to exercise?
- ▶ Short, light walks
- ▶ Guided chair exercises on video or app
- ▶ Small bouts of activity can add up 5-10 minute increments

Bucket #3-Medication Management

- ▶ Many patients that have diabetes as their cause of chronic kidney disease will likely be on insulin regimen
- ▶ Are they taking their medication as prescribed?
- ▶ How many doses of insulin or certain medication missed a week?
- ▶ Do they take meal time insulin before meals or forget and do after or not at all?
 - ▶ If after can be giving too much if on a sliding scale or correction factor
- ▶ Do they take insulin and then skip meals?

Bucket #4-Monitoring

- ▶ Testing blood sugars regularly?
- ▶ If taking basal/bolus regimen, should be taking blood sugar at least 3 times a day before each meal
- ▶ Do you test blood sugars when you don't feel right?
- ▶ If A1c does not match up with reported blood sugars, patient may need to take blood sugars more often or at different times of the day

Signs and Symptoms of Hypoglycemia

- Color draining from the skin
- Feeling sleepy
- Feeling weak or having no energy
- Blurred/impaired vision
- Tingling or numbness in the lips, tongue or cheeks
- Headaches
- Coordination problems, clumsiness
- Nightmares or crying out during sleep
- Seizures
- Nausea
- Feeling shaky
- Being nervous or anxious
- Sweating, chills and clamminess
- Irritability or impatience
- Confusion
- Fast heartbeat
- Feeling lightheaded or dizzy
- Hunger

<https://www.diabetes.org/healthy-living/medication-treatments/blood-glucose-testing-and-control/hypoglycemia>

15/15 Rule

- ▶ If signs or symptoms of low blood sugar, check blood sugars
- ▶ If blood sugars below 70, ingest 15 grams of carbs
- ▶ **Recheck blood sugars in 15 minutes**
- ▶ If blood sugars not above 70, then ingest another 15 grams of carbs
- ▶ **If blood sugars started out at 50 or below, ingest 30 grams of carbs to start**

<https://www.diabetes.org/healthy-living/medication-treatments/blood-glucose-testing-and-control/hypoglycemia>

How to Increase Hypoglycemic Episodes in DKD patients

DO Use:

- ▶ Glucose tablets-4 each (roll by bed, in car, in purse or pocket)
- ▶ Clear regular soda
- ▶ Glucose gel
- ▶ ½ cup apple juice
- ▶ 1 tablespoon of sugar, honey or corn syrup
 - ▶ May be issue with consuming depending on situation
- ▶ White crackers or pretzels
- ▶ Candy without fat

Do NOT Use:

- ▶ Orange juice
- ▶ Dark soda
- ▶ Hard candies or mints
 - ▶ Can take too long to bring up
- ▶ Cookies or chocolate bars
 - ▶ Fat prolongs digestion

New Glucagon

- ▶ Brings up blood sugars when very low
- ▶ Passed out or seizures and cannot have anything oral (can choke)
- ▶ Nasal Powder



When to Refer to an Endocrinologist?

- ▶ A1c above 9.0
 - ▶ Can be less, but should consider if higher than this
- ▶ Patient is on 3 or more different diabetes medications
 - ▶ Can be on less diabetes medications and refer as well
- ▶ Patient seems to be having symptoms of hypoglycemia with a low A1c
- ▶ Patients seem to have a high variability with blood glucose readings

Dietitian Communication

- ▶ Dietitians to monitor all labs
- ▶ Refer to specialty as needed
- ▶ Asking questions and jumping in with even a few minutes of education can make a big difference
 - ▶ Easier for patient when they are already with you
- ▶ Collaboration with renal and diabetes dietitians



Questions? 10:30-11:00am

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