



Diabetes Mellitus Masterclass  
Chapter 9

# SPECIAL POPULATIONS



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# THE ELDERLY



## Adjust treatment goals

- An appropriate A1c goal for many older patients is 7.0–8.0%
- This minimizes risks of hypoglycemia and avoids symptomatic hyperglycemia

## Avoid hypoglycemia

- Medications may mask symptoms of hypoglycemia
- Decreased glomerular filtration rate (GFR) with age slows clearance of diabetes medications
- Increased morbidity from hypoglycemia due to fall risk and fractures
- Avoid medications that cause hypoglycemia

## Avoid medication side effects

- Elderly patients may be more sensitive to medication side effects
- Avoid medications that increase risk of hypoglycemia
- Avoid medications that increase fall risk
- Avoid medications that cause decreased appetite and weight loss

## Choosing medications for elderly patients

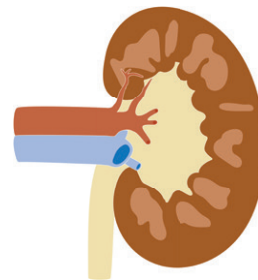
### Good options

- Metformin
- Sulfonylureas (glipizide or glimepiride—avoid glyburide)
- DPP-4 inhibitors
- Basal insulin at low dose

### Bad options

- TZDs (due to increased risk of osteoporosis)
- GLP-1 agonists (due to increased risk of nausea, decreased appetite, and weight loss)
- SGLT-2 inhibitors (due to polyuria and increased risk of genital and urinary tract infections)

# CHRONIC KIDNEY DISEASE



Many diabetes medications need a decrease in dose as kidney function declines, since they are renally cleared and drug levels may accumulate with declining renal function.

## Metformin

- GFR > 45 mL / min—no dose adjustment needed
- GFR 30–45 mL / min—decrease maximum dose to 1000 mg daily
- GFR < 30 mL / min—discontinue

## DPP-4 inhibitors

### Sitagliptin

- GFR 30–45 mL / min—decrease to 50 mg daily
- GFR < 30 mL / min—decrease to 25 mg daily

### Saxagliptin

- GFR < 45 mL / min—decrease to 2.5 mg daily

### Vildagliptin

- Creatinine clearance (CrCl) < 50 mL / min—decrease to 50 mg daily

### Linagliptin

- No dose adjustment necessary

### Alogliptin

- CrCl 30–60 mL / min—decrease to 12.5 mg daily
- CrCl < 30 mL / min—decrease to 6.25 mg daily

## GLP-1 agonists

### Exenatide

- Contraindicated for CrCl < 30 mL / min

### Lixisenatide

- Contraindicated for GFR < 30 mL / min

### Liraglutide

- No dose adjustment necessary (limited data in end-stage renal disease)

### Dulaglutide

- No dose adjustment necessary

### Semaglutide

- No dose adjustment necessary

Patients with declining renal function are at higher risk of hypoglycemia due to decreased insulin clearance. Doses of other medications may need to be adjusted to avoid hypoglycemia.

### Sulfonylureas

- Require dose reduction
- Avoid glyburide

### Insulin

- May also require dose reduction

Certain medications should not be used in patients with renal dysfunction.

### TZDs

- Increase fluid retention and osteoporosis (both can be significantly worse with CKD)

### SGLT-2 inhibitors

- Require renal filtration for their effect on glucose lowering
- Not recommended for patients with significant renal impairment

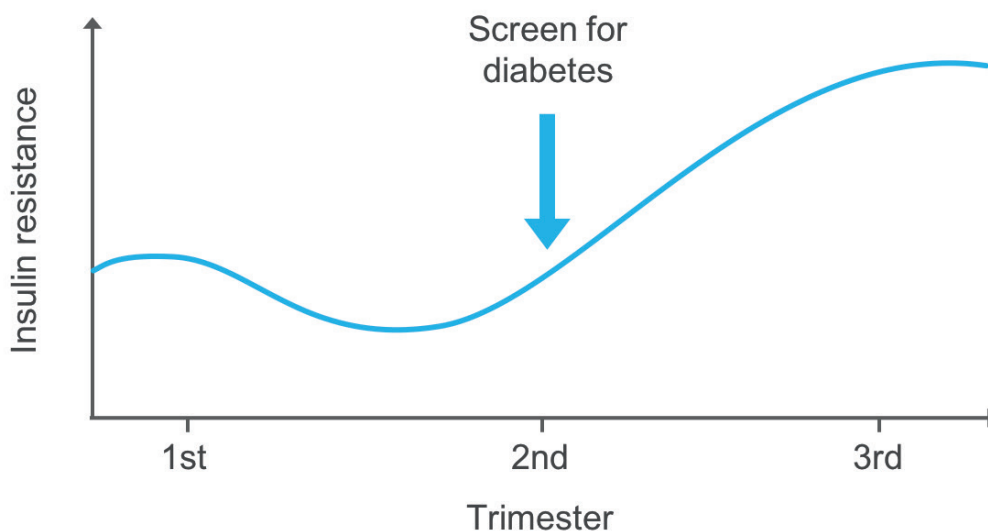
# DIABETES IN PREGNANCY



Pregnancy is a state of increased insulin resistance. This can cause trouble with hyperglycemia for patients without previously diagnosed diabetes, and necessitates adjustment of treatment regimens for those patients who have diabetes prior to pregnancy.

## Changes in insulin resistance with pregnancy

- Decreased in first trimester
- Increased in second and third trimesters



## Monitoring blood glucose in pregnancy

A1c is correlated with complications, but may miss post-meal hyperglycemia. Self-monitoring of blood glucose, with pre- and post-meal checks, is critical for minimizing pregnancy complications.

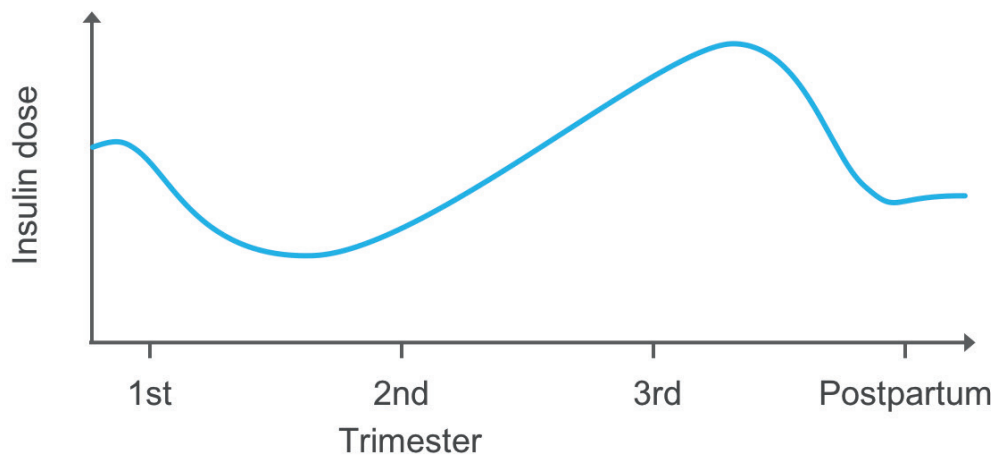
### Blood glucose goals in pregnancy

- Fasting: < 95 mg / dL (5.3 mmol / L)
- 1 hour post-meal: < 140 mg / dL (7.8 mmol / L)
- 2 hours post-meal: < 120 mg / dL (6.7 mmol / L)

## Treatment of diabetes in pregnancy

For patients with gestational diabetes, lifestyle is often enough to control post-meal blood sugars. If medication is needed, **insulin** is the best option.

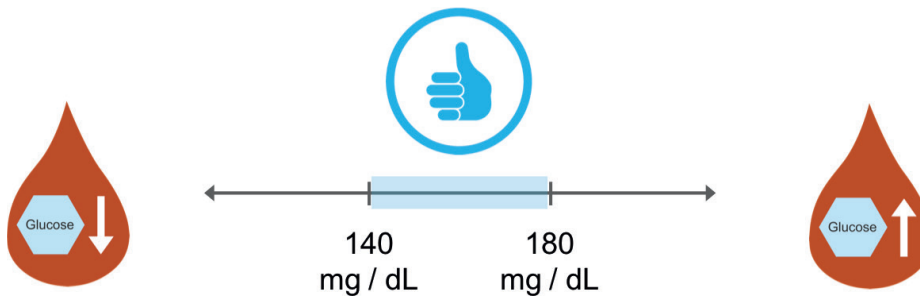
- Patients on insulin prior to pregnancy may need insulin dose decrease in first trimester
- May need insulin dose increases throughout second and third trimesters (as insulin resistance increases)



# HOSPITALIZED PATIENTS



Blood sugars between 140–180 mg / dL are optimal to prevent adverse outcomes from hyperglycemia, while avoiding severe hypoglycemia.



**Insulin** is the best option for hospitalized patients who need glucose treatment.

To determine appropriate treatment

- Check blood sugars before each meal
  - if patient is not eating—glucose should be checked every 4–6 hours
- If blood sugars are over 180 mg / dL—insulin should be started with goal to maintain blood sugars between 140–180 mg / dL (for most patients)

## *Insulin dosing for critically ill patients*

Intravenous (IV) insulin is the best option. Most hospitals have a protocol for adjusting insulin drip rates based on hourly blood sugars, and this is the safest option for critically ill patients.

As patients improve, they can be transitioned from IV insulin to subcutaneous insulin. To do this, calculate the total daily insulin dose given IV over the previous 24 hours. You can give 60–80% of this as basal insulin, and add prandial insulin as the patient’s food intake improves.

It is important to give the basal insulin two hours prior to discontinuing the IV insulin, as the effect of IV insulin will wear off quickly, but it will take several hours for the long-acting insulin to be effective.

## *Insulin dosing for non-critically ill patients*

If the patient is not eating, start with basal insulin. If on insulin at home, it is appropriate to start with their home dose. If not previously on insulin, start at 10 units.

If the patient is eating, treat with both basal and mealtime insulin. Total daily dose should be 0.3 units / kg, with 50% basal, and 50% mealtime insulin.

## *Insulin dosing for patients on tube feeds*

Continuous tube feeds require basal insulin at 0.1–0.2 units / kg. Mealtime insulin should be given as regular insulin, 1 unit for every 15 grams of carbohydrate every six hours.

For bolus tube feeds, give the same doses, with mealtime insulin given at the start of each bolus tube feed.

## *Minimizing risk of hypoglycemia*

### **For patients who are NPO for procedures**

- Give half the usual basal insulin dose
- Hold mealtime insulin
- Give correction insulin for hyperglycemia (if needed)

### **For patients with nausea and unpredictable food intake**

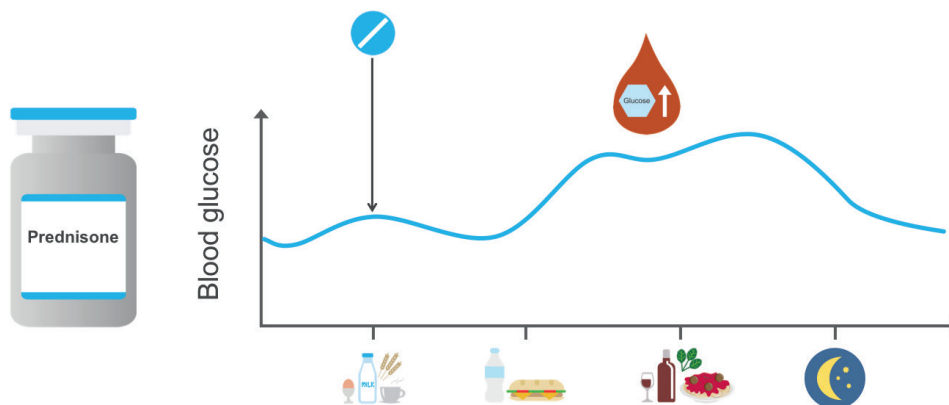
- Give the mealtime insulin **after** they eat
- Adjust dose for amount of food eaten



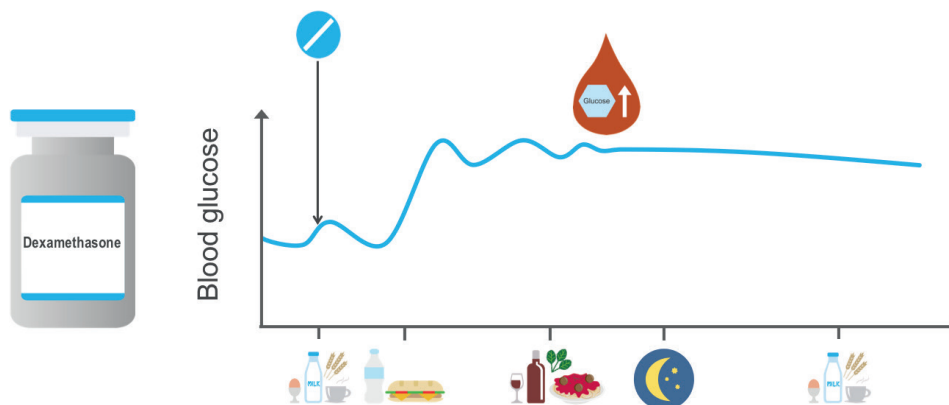
# STEROID-INDUCED HYPERGLYCEMIA



The effect of steroids on blood sugars usually occurs four hours after the dose. Thus, if patients are taking steroids with breakfast (as they are often given), they will experience hyperglycemia post-lunch. The effect will typically wear off several hours after dinner, so fasting blood sugars are not usually affected.



For patients on long-acting steroids (such as dexamethasone) the hyperglycemia can last for up to 36 hours.

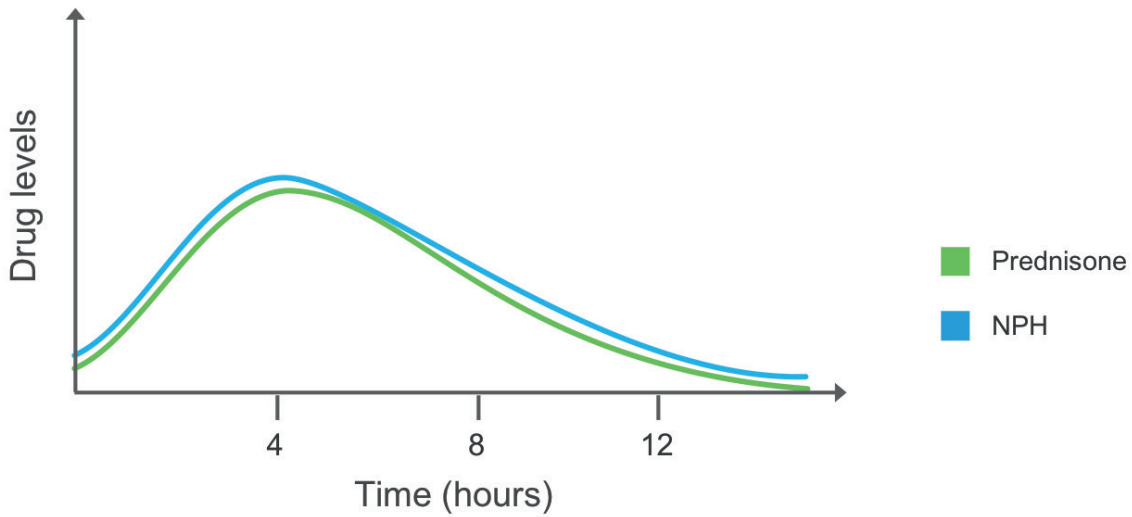


## Monitoring blood sugars on steroids

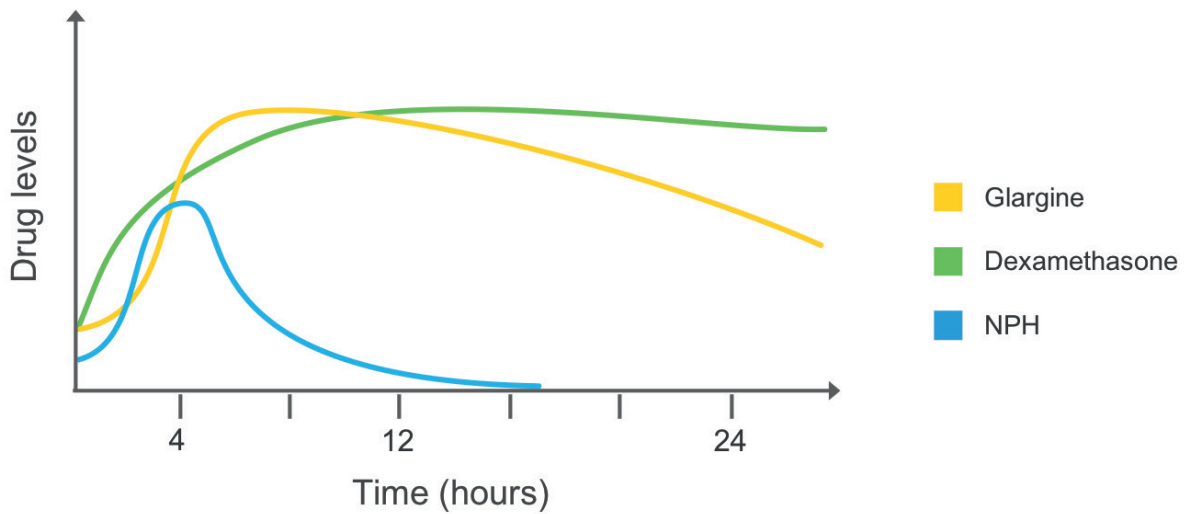
- Check blood sugars 1–2 hours after dinner
  - if  $< 180$  mg / dL (10 mmol / L)—discontinue monitoring
  - if blood sugars are  $> 200$  mg / dL (12 mmol / L)—increase testing to four times daily (before meals and at bedtime)
- Consider starting treatment for hyperglycemia if blood sugars are consistently elevated

## Treating steroid-induced hyperglycemia

- Once daily basal insulin with breakfast
- If taking once daily prednisone use NPH with breakfast



- If taking longer-acting steroids (like dexamethasone or twice daily prednisone) use glargine or detemir



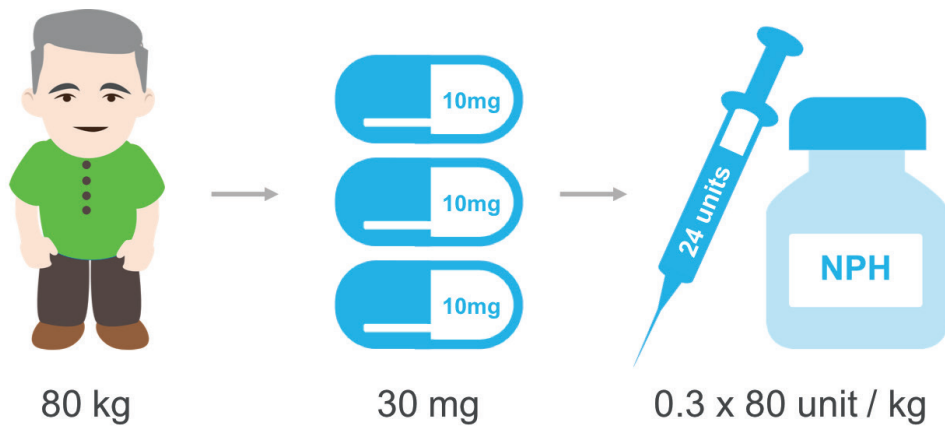
- Initial insulin dose is 0.1 unit / kg / day for each 10 mg prednisone (or equivalent) up to a maximum of 0.4 units / kg / day
- If already on insulin add this additional insulin to their home dose

### Example

An 80 kg patient is taking 30 mg prednisone daily for one week.

$0.3$  (0.1 per 10 mg prednisone)  $\times$  80 kg = 24 units NPH

If he were already on insulin, we would add this to his home dose.



### Managing steroid tapers

- Decrease basal insulin by 0.1 unit / kg / day for every 10 mg decrease in steroid dose

# READING LIST

## Reviews of diabetes management in special populations

### Elderly patients

American Diabetes Association. 2018. 11. Older Adults: Standards of Medical Care in Diabetes-2018. *Diabetes Care*. **41**: S119–S125.

<https://www.ncbi.nlm.nih.gov/pubmed/29222382>

### Pregnancy

American Diabetes Association. 2018. 13. Management of Diabetes in Pregnancy: Standards of Medical Care in Diabetes-2018. *Diabetes Care*. **41**: S137–S143.

<https://www.ncbi.nlm.nih.gov/pubmed/29222384>

### Hospitalized patients

American Diabetes Association. 2018. 14. Diabetes Care in the Hospital: Standards of Medical Care in Diabetes-2018. *Diabetes Care*. **41**: S144–S151.

<https://www.ncbi.nlm.nih.gov/pubmed/29222385>

### Renal disease

Wallace, MD and Metzger, NL. 2018. Optimizing the Treatment of Steroid-Induced Hyperglycemia. *Ann Pharmacother*. **52**: 86–90.

<https://www.ncbi.nlm.nih.gov/pubmed/28836444>

Wright, JJ and Tylee, TS. 2016. Pharmacologic Therapy of Type 2 Diabetes. *Med Clin North Am*. **100**: 647–663.

<https://www.ncbi.nlm.nih.gov/pubmed/27235609>