Understanding and Treating Diabetes in the Post-Transplant Patient

Brannan U. Cole MSN, RN, FNP-BC

Glucose Management Service

Ann Hackett, APRN

James Mills, APRN

Blake Salmony, APRN

Brannan Cole, APRN

Tiffanie Marksbury, APRN

Jennifer Prager, APRN

GMS 1

GMS 2

Disclosures

- None to disclose.

Diabetes in the Transplant Patient

- Risk Factors, Screening, Diagnosis
- Inpatient Management
- Outpatient Management

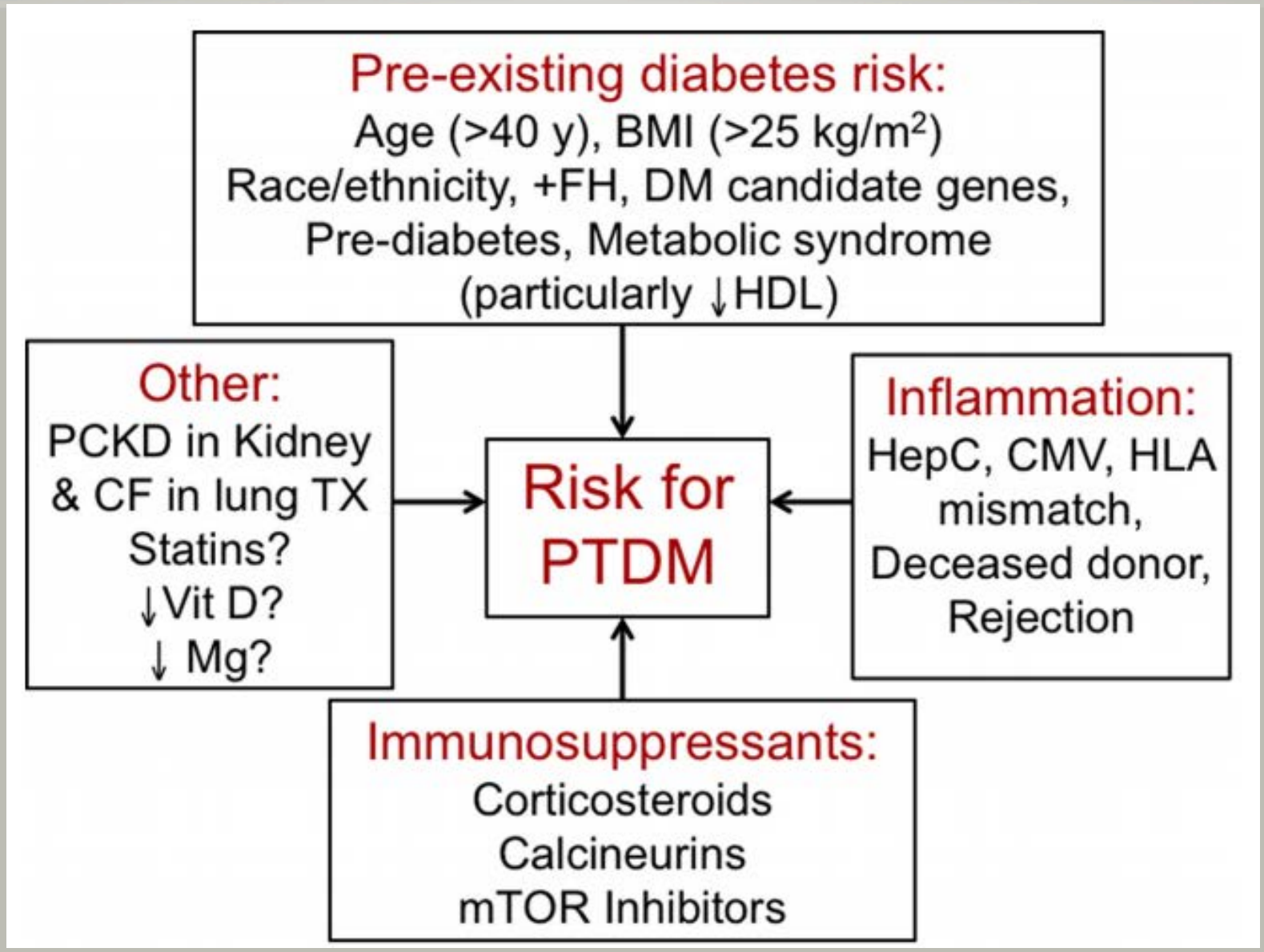
Diabetes in the Transplant Patient

- Risk Factors, Screening, Diagnosis
- Inpatient Management
- Outpatient Management

Risk Factors

- Meds: Chemotherapeutic agents, Immunosuppressants
- Nutrition: TPN, TF
- Infection
- Stress
- Age >40-45
- Obesity
- AA, Hispanic Races
- Family History
- Hepatitis C, CMV
- Polycystic Kidney Ds
- Certain Genetic Mutations

Post-transplant Diabetes Mellitus in Renal Transplant Recipients. Tobin, G et al, UpToDate, May 31, 2008.



Shivaswamy et. Al. *Endocr Rev*. 2016 Feb;37(1):37-61.

Rates of Occurrence

- Diabetes occurs post-transplant at
  - Kidney Transplant: 10-74%
  - Heart Transplant: 11-38%
  - Liver Transplant: 7-30%
  - Lung Transplant: 32%

Screening

Outpatient Monitoring:

- Monitor blood sugar **prior** to transplant, typically fasting qam. Alert provider to BG >126 mg/dL.

- Monitor blood sugar **post** transplant with FBS weekly X4, recheck in 3 months, 6 months and annually thereafter if no abnormality presents

Inpatient Initiation of Monitoring:

- Check blood sugar ACHS and begin treatment with BG >140 mg/dL.

Diagnosis

Diagnosis	Test
Prediabetes: Impaired Fasting Glucose	Fasting plasma glucose of 100-125 mg/dL No clear A1c criteria for Prediabetes, although >5.7% has been suggested
Prediabetes: Inpaired Glucose Tolerance	75-g OGTT 2 hr plasma glucose of 140-199 mg/dL Fasting plasma glucose >/= 126 mg/dL
Diabetes	Fasting plasma glucose >/= 126 mg/dL OR random plasma glucose >/= 200 mg/dL with symptoms OR 75-g OGTT 2 hr plasma glucose >/= 200 mg/dL OR A1c >6.5%

*A diagnosis of diabetes must be confirmed on a subsequent day, by measurement of FPG, 2-h PG, or random plasma glucose (if symptoms are present).

American Diabetes Association: Executive Summary from the American Diabetes Association Standards of medical care in Diabetes 2009. *Diabetes Care.* 2009; 32 (suppl 1): S6-S12.

Post-Transplant DM Diagnosis

- October, 2013 → 2nd International Consensus Panel enacted key changes:
  - Change terminology from New Onset Diabetes After Transplant (NODAT) to Post-Transplant DM (PTDM)
  - Recommend evaluation/diagnosis outpatient, stable, and on long-term maintenance immunosuppression doses
  - HbA1c can be used to diagnose DM if elevated (>6.5%) but should not be used alone as a screen for PTDM (particularly in 1st year)
- Unclear full significance of timing of DM diagnosis (1 vs. 5 vs. 20 years post-transplant)

Types of Diabetes

- Pre-Existing Type 1 or Type 2
- Post-Transplant DM

Pre-Existing Diabetes

- Type 1:
  - Steroids increase insulin requirement and dose. Consider starting with double prandial and ss coverage if pt is well controlled at baseline.
- Type 2:
  - Cannot use all oral agents. Mostly consider SFU for postprandial hyperglycemia.
  - Usually requires insulin, at least short-term.
- Both: Insulin and/or oral agent dose will increase from ESRD to having a working kidney

Post-Transplant Diabetes Mellitus

- Insulin resistant phenotype
- Usually requires some insulin, at least short-term
- May be possible to taper to oral agents or monitor with lifestyle modifications alone
- Adjustments in regimen may be necessary at any time based on steroids and other factors

Diabetes in the Transplant Patient

- Risk Factors, Screening, Diagnosis
- Inpatient Management
- Outpatient Management

Diabetes in the Transplant Patient

- Risk Factors, Screening, Diagnosis
- Inpatient Management:
  - Goals and Factors to Consider
  - Weight-Based Dosing
  - Transitioning from Drip to SQ
  - Making Adjustments to Your Regimen
  - When to involve Endocrine
- Outpatient Management

Guidelines From Professional Organizations on the Management of Glucose Levels in the ICU

Year	Organization	Patient Population	Treatment Threshold	Target Glucose Level	Definition of Hypoglycemia	Updated since NICE-SUGAR Trial, 2009
2009	AACE and ADA	ICU patients	180	140-180	<70	Yes
2009	Surviving Sepsis Campaign	ICU patients	180	150	Not stated	Yes
2009	Institute for Healthcare Improvement	ICU patients	180	<180	<40	Yes
2008	American Heart Association	ICU patients w/ ACS	180	90-140	Not stated	No

Goals

- Goal: BG 140-180 mg/dL
- Treatment should be started initially with insulin
- Several studies have assessed the benefit of tight control in hospitalized patients, but findings are not consistently positive.
- Tighter control (such as 80-110 mg/dL) increases risk of hypoglycemia.
- Know when to adjust your target BG or A1c.

Inzucchi, S. N Engl J Med 2006;355:1903-11

Factors to Consider

- **Medications** (pressors and glucocorticoids) and severity of illness impact insulin secretion and insulin resistance.
- **Food intake** can be unpredictable
- **Tests and procedures** interrupt meals and medication dosing
- **Prior history** of DM and type if pre-existing as well as degree of prior control (A1c)
- **Nutritional status** (NPO, enteral, parenteral)

Inzucchi, S. N Engl J Med 2006;355:1903-11

PRODUCT (Chemical Name)	mg/ml	Dosage	POTENCY (When compared w/ Hydrocortisone mg to mg)	Hydrocortisone Equivalency	Route of Admin.	Type	Contains Benzyl Alcohol
Solu-Cortef® (Hydrocortisone Sodium Succinate)	50	See insert	1	50	IM or IV	Rapid Acting Short Duration	NO
Aristospan® (Triamcinolone Hexacetonide)	20	0.25-2 ml	5	100	IA & Soft Tissue	Long Acting	YES
Celestone Soluspan® (Betamethasone Sodium Phosphate & Betamethasone Acetate)	3+3	0.25-2 ml	25	150	IM, IA, IL & Soft Tissue	Both Rapid & Long Acting	NO
Kenalog®-40 (Triamcinolone Acetonide)	40	0.25-2 ml	5	200	IM, IA, IL & Soft Tissue	Long Acting	YES
Depo-Medrol®-40 (Methylprednisolone Acetate)	40	0.25-2 ml	5	200	IM, IA & Soft Tissue	Long Acting	SDV-NO MDV-YES
Depo-Medrol®-80 (Methylprednisolone Acetate)	80	0.25-2 ml	5	400	IM, IA & Soft Tissue	Long Acting	SDV-NO MDV-YES
Dexamethasone Sodium Phosphate	4	See insert	25	100	IM, IV, IA, IL & Soft Tissue	Rapid Acting Short Duration	YES
Dexamethasone Sodium Phosphate PF	10	See insert	25	250	IM or IV	Rapid Acting Short Duration	NO
Solu-Medrol® (Methylprednisolone Sodium Succinate)	40	See insert	5	200	IM or IV	Rapid Acting Short Duration	NO

Steroid Potency

- Consider strength of steroid when adjusting insulin.
- All steroids are not the same!

Weight-Based Dosing

- Stop all orals and non-insulin injectables
- Calculated starting Total Daily Dose (TDD)
  - 0.2-0.3 unit/kg if ≥70 yo or GFR <60 ml/min
  - 0.4 unit/kg if BG 140-200
  - 0.5 unit/kg if BG 201-400
- Divide TDD:
  - 50% as basal
  - 50% as nutritional (equally divided)

-Inzucchi, S. N Engl J Med 2006;355:1903-11
-Lien, Lillian F., Mary E. Cox, Mark N. Feinglos, and Leonor Corsino. *Glycemic Control in the Hospitalized Patient*. New York: Springer, 2010. Print.
-Modified from J Clin Endocrinol Metab, January 2012, 97(1):16 –38

Sliding Scale

- If patient able and expected to eat: usual
- If patient not able to eat: sensitive Q6H
- If fasting and pre-meal BG persistently >140 without hypoglycemia: resistant
- **Alternatively** you may use **5% of the TDD** per 50 pts

BG (mg/dl)	Insulin-sensitive	Usual	Insulin-resistant
>141–180	2	4	6
181–220	4	6	8
221–260	6	8	10
261–300	8	10	12
301–350	10	12	14
351–400	12	14	16
>400	14	16	18

Modified from J Clin Endocrinol Metab, January 2012, 97(1):16 –38

Example #1

- Snow White is a 40 yo F who presents following DDKT, now stable on POD 1.
- Home regimen is Linagliptin (Tradjenta) 5 mg qday, Glucotrol (Glipizide) 5 mg BID. Pt states compliance. A1c is 9.0%.
- No additional pressors, IV dextrose.
- Wt is 100 kg.
- Taking Methylprednisolone 500 mg today x1 dose with scheduled taper.

Example #1 Cont.

- Weight:100 kg x 0.5 un/kg = 50 un TDD
- Basal Dose: 25 un basal daily. Give first dose at least 2 hours prior to stopping drip.
- Bolus Dose: 8 un rapid or short acting insulin with meals. Given high dose steroid, may consider starting at double → 16 un meal coverage.
  - May want to hold this order until pt is eating at least 50% of meal trays consistently.
- Sliding Scale: Standard dosing requirements with no complicating factors: 2 or 3 un/50>150 ACHS. May choose to double for 5/50>160 ACHS due to steroids.
- ACHS BG checks
- Diabetic Diet as tolerated.

Insulin Drip

- **IV insulin infusion** is ideal (IV insulin half-life=5-9 min.) following standard, validated protocol for at least first 24 hrs.
- **BG monitoring q1-2h** is imperative to avoiding hypoglycemia while on drip. Check more frequently with change in IV meds or nutrition.
- As status improves, **transition to subcutaneous** insulin based on most recent IV insulin infusion rate while pt is fasting. Use rates that have maintained euglycemia only.
- Be sure to **overlap IV and subcutaneous insulin** by at least 2 hrs to avoid rebound hyperglycemia after stopping insulin drip.
- Type 2 DM with <2un/h IV insulin requirement may do well on a **non-intensive subcutaneous regimen** or scheduled insulin. Can try sliding scale only at first.

Inzucchi, S. N Engl J Med 2006;355:1903-11

Transitioning from Drip to SQ Insulin

- Patients without a history of DM
  - If <1 unit/hour: may not require scheduled insulin
    - Treat with scheduled insulin to determine if scheduled insulin is required
- All patients with T1DM and most with T2DM
  - Require SQ long- and short-acting insulin
  - Give basal insulin 1-2 hours before discontinuation of IV insulin

Transitioning from Drip to SQ Insulin

- Extrapolate insulin requirement over preceding 6 to 8 hours to a 24-hour period
- Various approaches:
  - Surgical patients not eating:
    - 60-80% of the TDD as basal demonstrated to be safe and effective in surgical patients (Clement 2004, Schmeltz 2006)
  - Medical patients:
    - 75-80% of TDD divided between basal and bolus (Schmeltz 2006, Yeldandi 2006, Bode 2004)

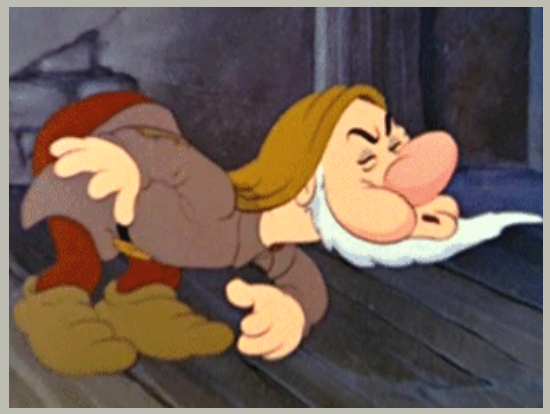
Example #2:

- Sneezy Dwarf is a 50 yo M who presents following liver transplant, now POD 4.
- Euglycemia is maintained with insulin drip with rates of 2.5 un/hr on average.
- No complicating factors such as pressors or IV dextrose.
- Diet: Clear liquids. PO intake is poor.
- No current steroids.
- Wt: 100 kg

BG in mg/dL	Drip Rate in un/hr
90	1.5
110	2.5
100	2.0
140	3.0
150	3.5
120	2.5
200	5.0

Example #2 Cont:

- Take average drip rate of 2.5 un/hr and multiply by 24 hrs.
  - 2.5 x 24 = 60
- Reduce by 20%.
  - 60 x 0.8 = 50
- Use this dose to calculate TDD.
  - 50 un TDD
    - 25 un for basal coverage
    - 25 un for bolus coverage (8 un with meals)
    - Moderate insulin requirements ss: 2 or 3/50>150 ACHS



Impact of Nutrition

- No Food Intake:
  - Give continuous insulin infusion via IV (insulin drip)
  - Alternatively give basal insulin + sliding scale
  - Give basal coverage twice/day if requirements >60 un/day or pt is highly insulin sensitive.
- Continuous Enteral Feeding: Basal insulin + TF coverage + correction dose q4h or q6h.
  - *If feeding interrupted, give IV glucose to prevent hypoglycemia.*
- Total Parenteral Nutrition: Add regular insulin to IV bag and titrate dose in increments of 5-10un/liter.
- Reassess insulin requirement with any change in nutritional status.

Inzucchi, S. N Engl J Med 2006;355:1903-11

Confounding Variables

- Changes in caloric or carbohydrate intake
- Change in clinical status or medications (corticosteroids, vasopressors)
- Make adjustments based on daily BG patterns
- Poor coordination of BG testing and administration of insulin with meals
- Errors during patient transfer
- Renal or liver insufficiency

Adjusting Goal Targets

- Consider elevating goal target in the following situations:
  - Elderly >60 yo
  - ESRD, liver disease, partial or total pancreatectomy
  - CAD, CVA
  - Reduced hypoglycemic awareness
  - Recurrent hypoglycemia
- Watch for IV fluids with Dextrose, vasopressors, edema, snacking which can falsely increase your daily dosing.
- Be more aggressive with insulin dosing when pt has elevated TDD or BMI >35 kg/m2.

When to Involve Endocrine

- U500 insulin or High Dose Requirements
- Low Dose Requirements
- Erratic Inpatient or Outpatient Control
- Insulin Pump
- Anytime!

Watch Out!

- Common Med Errors with Insulin:
  - Insulin to Carb mismatch: Providing meal or TF insulin without meal/TF
  - Holding SS or Long-acting insulin for NPO
  - Using meal coverage when pt isn't eating to bring down a high BG
  - "Pt refused" when it seems like too much or too little.
  - Poor communication between teams and nurses
  - Overtreating Hypoglycemia. Remember Rule of 15.

Diabetes in the Transplant Patient

- Risk Factors, Screening, Diagnosis
- Inpatient Management
- Outpatient Management

Diabetes in the Transplant Patient

- Risk Factors, Screening, Diagnosis
- Inpatient Management
- Outpatient Management:
  - Assessment
  - Lifestyle Modification
  - Oral Agents
  - Non-Insulin SQ Agents
  - Insulin
  - Hypoglycemia

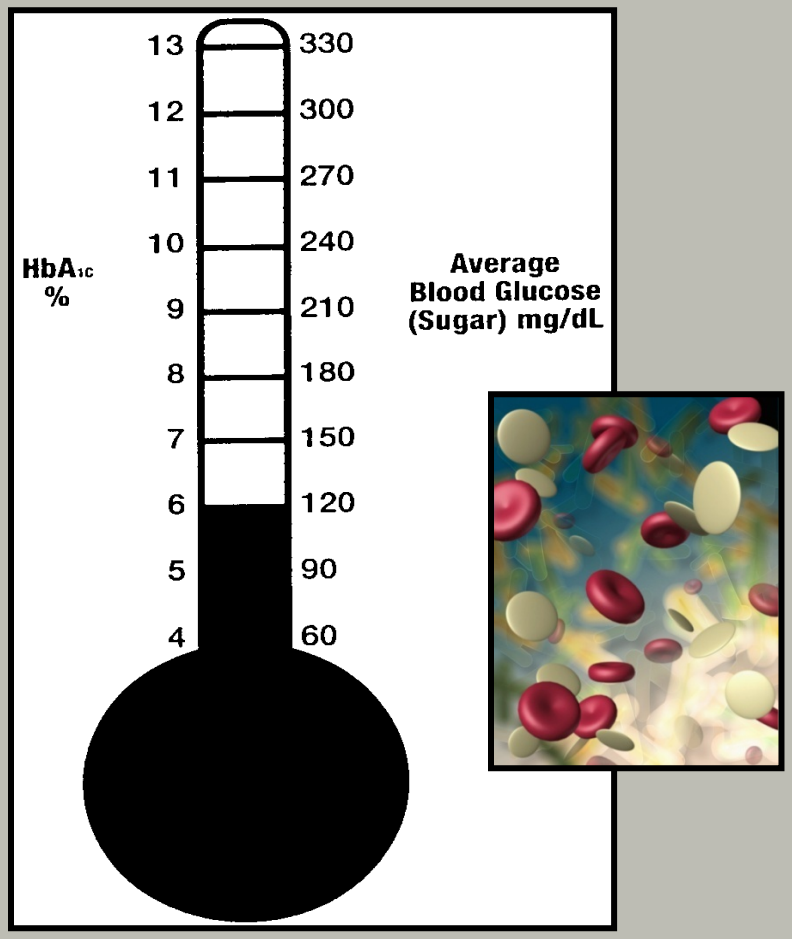
ADA Goals of Care

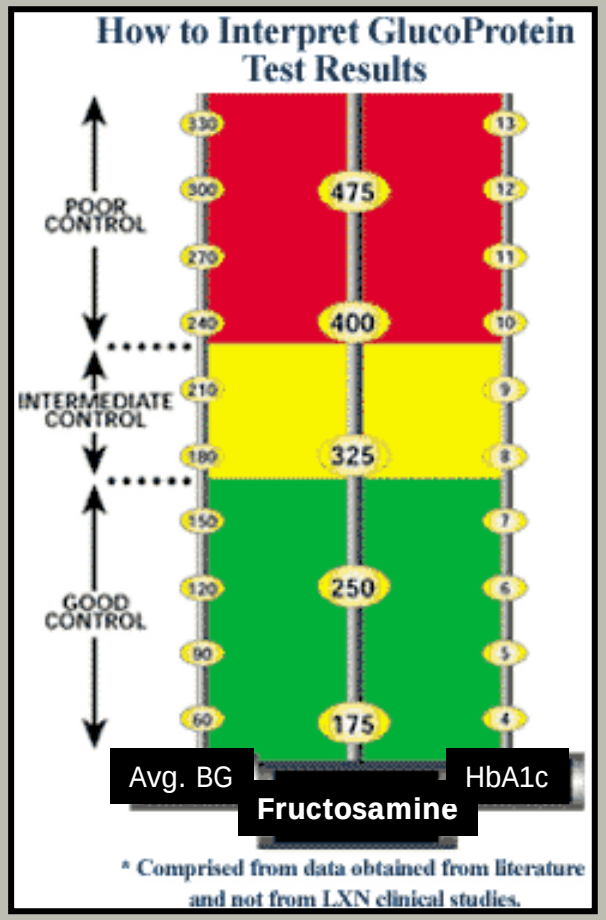
	Normal	Goal
HbA1c	4-6%	<7% *
Pre-prandial Blood Sugar	70-100 mg/dl	90-130 mg/dl (70-120)
Post-prandial Blood sugar	<140 mg/dl	<180 mg/dl (<160)

Diabetes Care 29:S4-S42, 2006

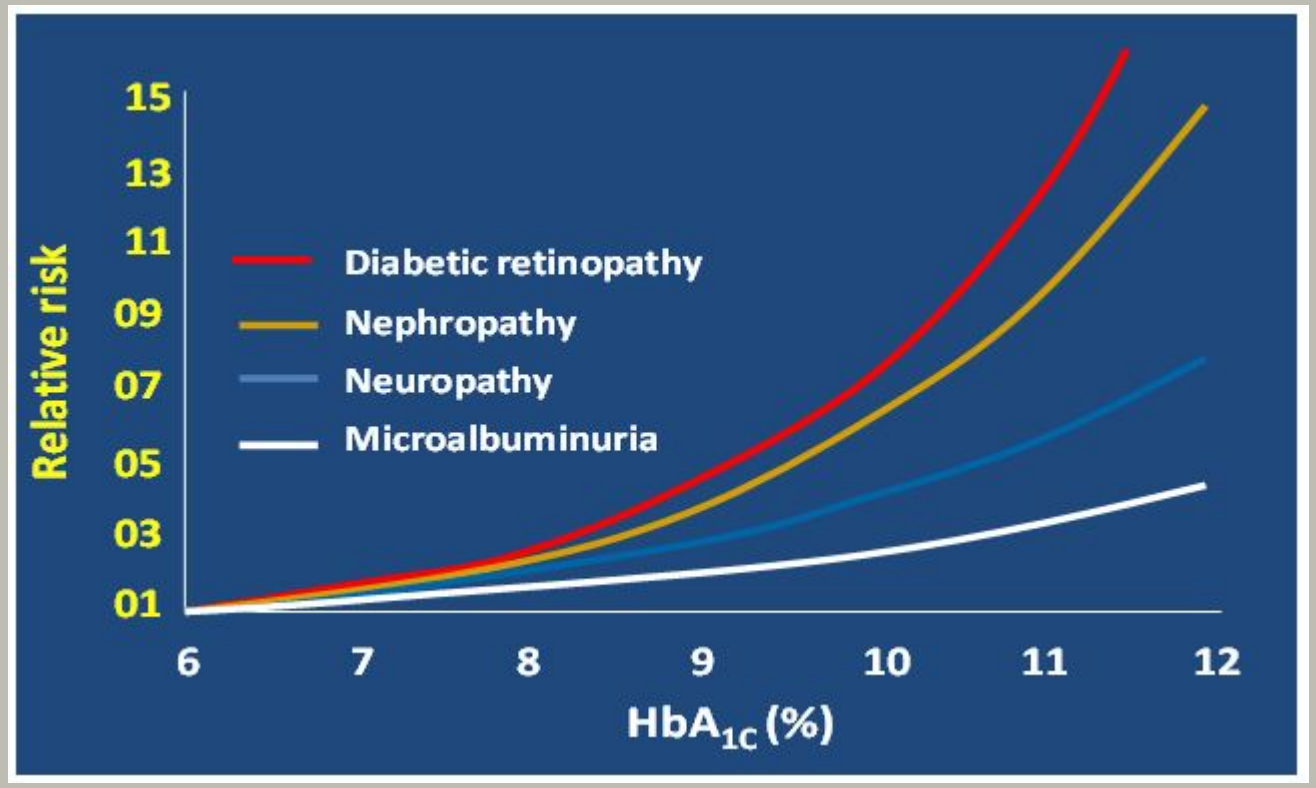
ADA Recommendation: Check A1c at least 2 x/yr if in target and stable; q 3 months if therapy has changed or not meeting goals. *Diabetes Care* 29:S4-S42, 2006

Assessment of Glycemic Control





A1c and Risk of Complications



The relative risk is exponential!

Blood Glucose Monitoring

- Provides vital data for clinical decision making
- Provides patient with accountability and feedback about his/her behavior
- Advise patient about:

-Appropriate meter

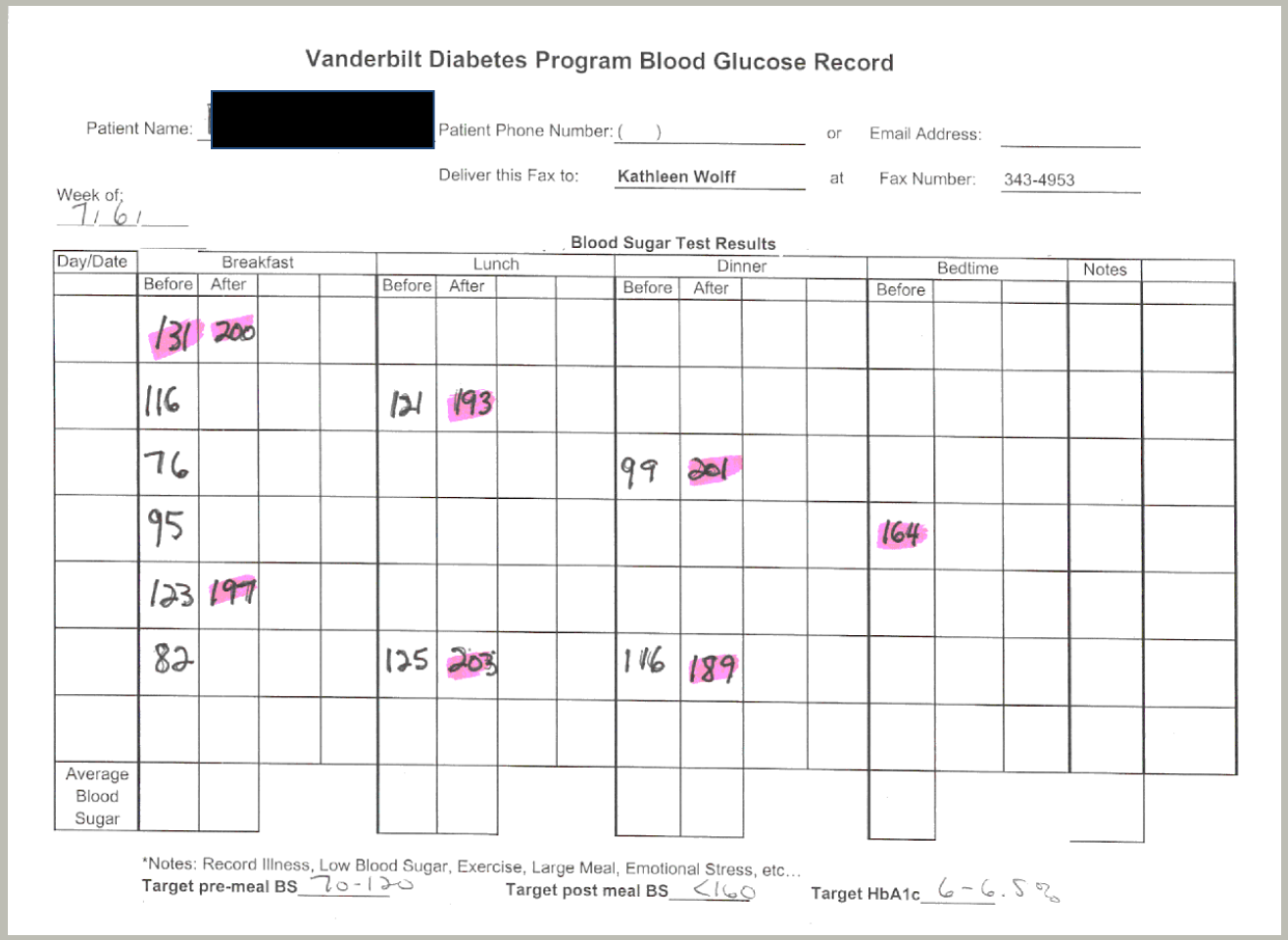
-When to test

-How to record results

-How to interpret and respond to results

-Insurance/financial issues, prescription required for reimbursement

Record Keeping



Vanderbilt Diabetes Program Blood Glucose Record

Patient Name: [redacted] Patient Phone Number: ( ) or Email Address:

Deliver this Fax to: Kathleen Wolff at Fax Number: 343-4953

Week of: 7/6/

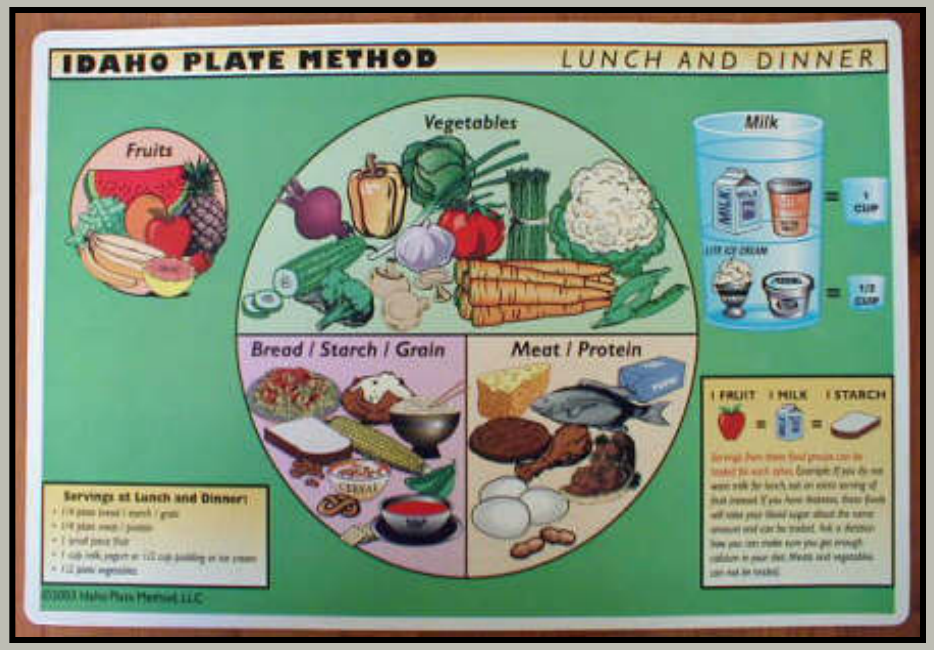
Blood Sugar Test Results

Day/Date	Breakfast				Lunch				Dinner				Bedtime			Notes	
	Before	After			Before	After			Before	After			Before				
	131	200															
	116				121	193											
	76								99	201							
	95												164				
	123	197															
	82				125	203			116	189							
Average Blood Sugar																	

*Notes: Record Illness, Low Blood Sugar, Exercise, Large Meal, Emotional Stress, etc…

Target pre-meal BS 70-120 Target post meal BS <160 Target HbA1c 6-6.5%

Diet: The Plate Method

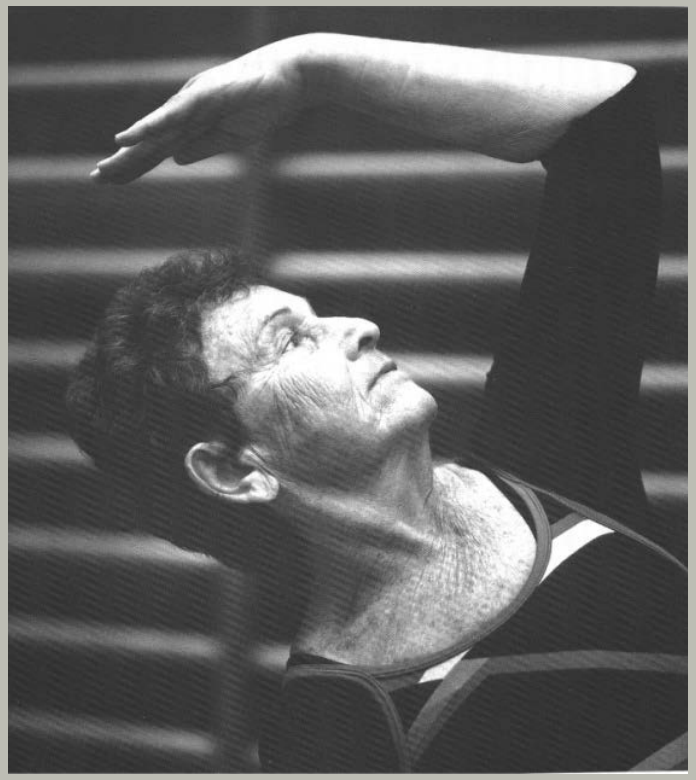


Resources

- App and Websites
  - My Fitness Pal
  - Calorie King (Also available in a book)
  - Live Strong
  - Spark People (Look for Meal Plan, Grocery List)

Physical Activity

- Set small, reasonable goals: **Something is better than nothing!**
- Aim for **30 minutes** of moderate-to-vigorous intensity aerobic exercise **at least 5 days a week** or a total of **150 minutes per week**.

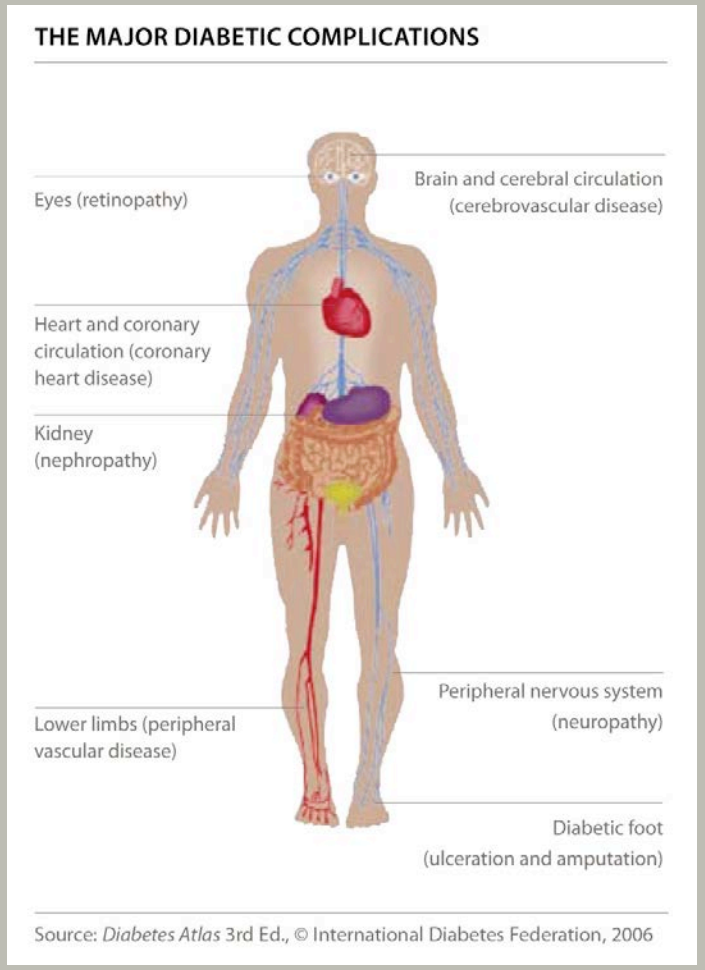


"What We Recommend." American Diabetes Association, 19 May 2015. Web. 15 Aug. 2016.


guy & rOdd
STUPID HAMSTER.
CARTOONSTOCK
Search ID: gra050311
© Guy & Rodd/Distributed by Universal Uclick via CartoonStock.com

Chronic Effects of Diabetes

- Macrovascular
- Microvascular
- Consider short-term risks in the post-op setting



Oral Diabetes Meds

Drug Class	Action	Names
Insulin Secretagogues	Increase Glucose Secretion	**Sulfonylureas:** Glipizide, Glyburide, Glimepiride (Amaryl®) **Meglitinides:** Nateglinide (Starlix®) Repaglinide (Prandin®)
Biguanides	Increase insulin sensitivity, decrease hepatic glucose output	Metformin (Glucophage®)
Alphaglucosidase Inhibitors (AGI's)	Inhibit absorption of glucose from the gut	Acarbose (Precose®) Miglitol (Glyset®)
Thiazoladindiones (TZD's)	Increase insulin sensitivity	Rosiglitazone (Actos®) Pioglitazone (Avandia®)
DPP-4 Inhibitors	Increase insulin secretion, decrease glucagon secretion	Sitagliptin (Januvia®) Saxagliptin (Onglyza®)
SGLT2 Inhibitors *NEW CLASS!*	Increase glucose reabsorption in kidney	Canagliflozin (Invokana®) Dapagliflozin (Farxiga®) Empagliflozin (Jardiance®)
Bile Acid Resins	Cholesterol-lowering med that also reduces BG by binding bile acids in the digestive tract	Colesevelam (Welchol®)

Non-Insulin Injectables

Drug Class	Action	Names
GLP-1 Receptor Agonists	stimulate insulin production while suppressing the liver's glucose output, slows gastric emptying	· Albiglutide (Tanzeum) weekly · Dulaglutide (Trulicity) daily · Exenatide (Byetta) twice daily · Exenatide Extended Release (Bydureon) weekly · Liraglutide (Victoza) daily
Amylin Analogue	slows food from moving too quickly through the stomach and helps keep after-meal glucose levels from going too high, also reduces glucose production from liver.	Pramlintide (Symlin)

Table 4. Non-Insulin Diabetes Treatments: Potential Considerations for Use in the Solid Organ Transplant Patient

Agent	Safety or Efficacy Studies in Transplant Patients	Potential Considerations in Organ Transplant Patient
Metformin	Effective in stable KTX patients but contraindicated for many other TX groups, including during acute hospitalizations (177, 214)	Should not be used during acute hospitalization, with ↓ GFR, ↑ LFTs, CHF, or active, significant infection; and should be held for planned iv contrast procedure
Sulfonylureas	Efficacy is not well documented in transplant patients. Did not alter cyclosporine pharmacokinetics in a small study of KTX recipients with PTDM (215–218)	Increased risk of more frequent and more prolonged hypoglycemia with ↓ GFR
Repaglinide	Effective and safe with no interaction with CNIs in a small study of KTX recipients with PTDM (180)	Less risk of hypoglycemia with ↓ GFR than sulfonylureas
Thiazolidinediones (eg, pioglitazone)	Effective and safe in small studies of KTX recipients (177, 180, 183, 219, 220)	Known risk for weight gain, edema, heart failure, and reduced bone mass, contraindicated with known elevated liver function tests with the exception for known fatty liver disease including after liver transplant; contraindicated with known heart failure; unknown impact on risk for heart failure risk after transplant

Shivaswamy et. Al. *Endocr Rev*. 2016 Feb;37(1):37-61.

Table 4. Non-Insulin Diabetes Treatments: Potential Considerations for Use in the Solid Organ Transplant Patient

Agent	Safety or Efficacy Studies in Transplant Patients	Potential Considerations in Organ Transplant Patient
α-Glucosidase inhibitors	No studies of safety or efficacy to date in organ transplant populations	Avoid with ↓ GFR; unlikely to be an effective single agent
GLP-1 agonists (exenatide, liraglutide, lixisenatide)	Liraglutide did not affect tacrolimus concentration in a very small study of KTX recipients (185)	Decreases bowel motility, which may impact absorption of immune suppression agents and has not yet been studied; should not use if GFR < 40 mL/min
DPP-4 inhibitors (sitagliptin, vildagliptin, saxagliptin, linagliptin, allogliptin)	Retrospective and small random controlled trials of KTX recipients show safety of several DPP-4 inhibitors (8, 181–184)	Reduce dose of all but linagliptin with ↓ GFR
SGLT-2 inhibitors (dapagliflozin, canagliflozin, empagliflozin)	Known to increase risk of genitourinary infections in those with previous history, which is a concern in immunocompromised transplant patients, known to cause volume dehydration and hypotension, which may also be a concern in these patients as well as recent reports of diabetic ketoacidosis raise concerns of safety for most transplant populations (186, 187)	Avoid until safety studies are performed

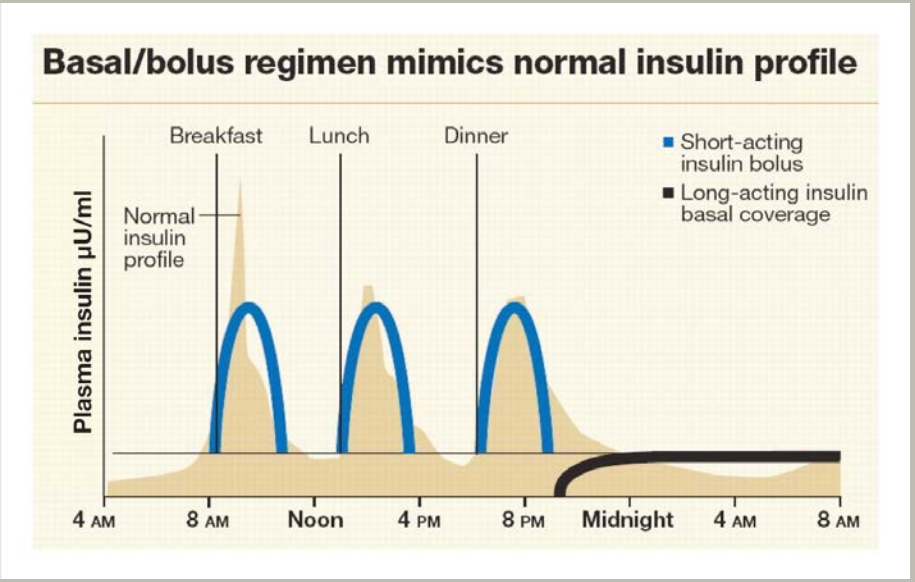
Shivaswamy et. Al. *Endocr Rev*. 2016 Feb;37(1):37-61.

Insulin

- Maintenance Insulin (Basal) – NPH, Levemir, Lantus
  - 50% of daily needs
  - Suppresses glucose production while fasting
- Prandial and SS Coverage (Bolus)
  - Limits hyperglycemia after meals
  - Immediate risk and sharp peak at 1-2 hrs
  - 10-20% of total daily insulin requirement at each meal

Normal Endogenous Insulin Secretion

- Guidelines just a starting point.
- When correction is required before most meals, ↑ basal
- When BG remains consistently elevated at one time point, ↑ preceding bolus
- Fasting BG also a good measure of basal insulin dose but be wary of the bedtime snack!



Modified from J Clin Endocrinol Metab, January 2012, 97(1):16 –38
Volume 29, Number 1, 2011 • Clinical Diabetes

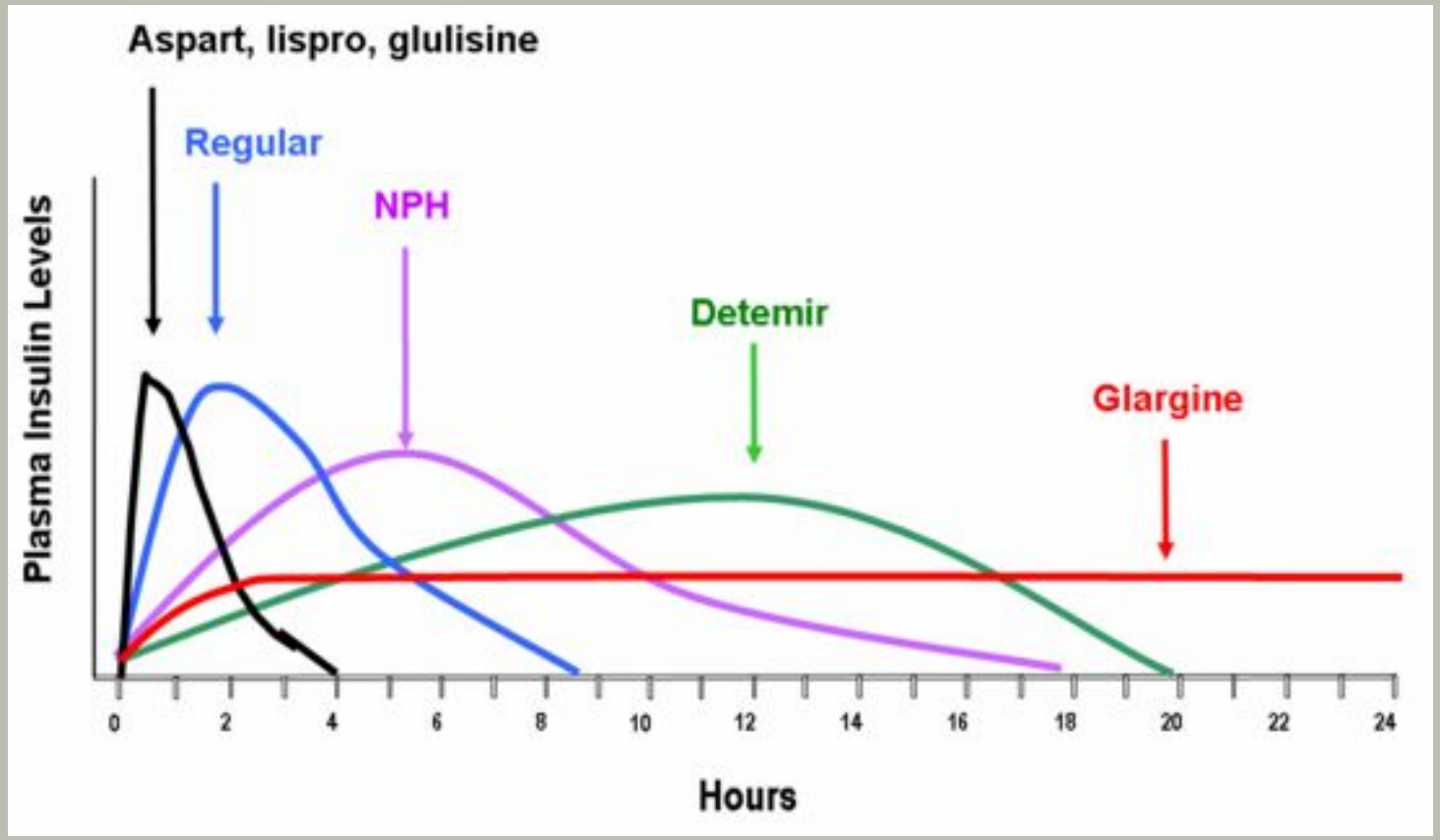
Insulin Types

Type	Generic/ Brand Name	Onset	Peak	Duration
RAPID ACTING	Glulisine/Apidra	5-15 Min.	1-2 Hours	3-4 Hours
	Lispro/Humalog	5-15 Min.	1-2 Hours	4 Hours
	Aspart/Novolog	5-15 Min.	1-2 Hours	4-6 Hours
Short Acting	Regular/Humulin R, Novolin R	½-1 hour	2-3 hours	4-8 hours

Insulin Types Continued

Type	Generic/ Brand Name	Onset	Peak	Duration
Intermediate Acting	NPH/ Humulin N Novolin N Reli-on N	1-1.5 Hours	4-12 Hours	18-25 Hours
Long Acting	Glargine/Lantus Detemir/Levemir	4-6 Hours 1-2 Hours	4-12 Hours 1-7 Hours	24+ Hours 6-23 Hours

Insulin Duration Of Action



Inhaled Insulin

- Inhaled insulin begins working within 12 to 15 minutes, peaks by 30 minutes, and is out of your system in 180 minutes.
- Types: Technosphere insulin-inhalation system (Afrezza® Human Insulin)
  - Rapid acting human insulin
  - Take prior to your meals
  - Each puff is approximately 4 un, 8 un, or 12 un. Depending on dose prescribed.
  - Similar dosing, although slightly more effective than SQ insulin.

Pre-Mixed Insulins

- Protamine + Short or Rapid-Acting Insulin
  - Novolin 70/30® = 70% NPH+30% Regular
  - Humulin 70/30®, Humulin 50/50®
  - Humalog 75/25® = 75% NPL+25% Lispro
  - Novolog 70/30® = 70% NPH + 30% Aspart
- Onset: 0.5-2.5 hours
- Time to Peak: 4-8 hours
- Duration: 17-25 hours
- Clinical Use: Elderly, cognitive or psych. impairment, multiple co-morbid illnesses, low cost, poor compliance

Insulin Sensitivity for Sliding Scale

- DM2: Rule of “1800” for Humalog, Novolog, or Apidra pre-meals
  - 1800/total daily insulin dosage = expected BG lowering (mg/dL) of 1 unit of rapid-acting analog.
- Example:
  - Breakfast 9 u, Lunch 9 u, Supper 9 u, Bedtime 9 u Lantus = 36 units total
  - 1800÷36=50
- DM1:Rule of “1500”.

Insulin Sensitivity for Sliding Scale

- DM2: Rule of "1800" for Humalog, Novolog, or Apidra pre-meals
  - 1800/total daily insulin dosage = expected BG lowering (mg/dL) of 1 unit of rapid-acting analog.
- Example:
  - Breakfast 9 u, Lunch 9 u, Supper 9 u, Bedtime 9 u Lantus = 36 units total
  - 1800÷36=50
- DM1:Rule of "1500".

1 unit of insulin should decrease BG approximately 50 mg/dL

Sliding Scale

Glucose	Insulin Dose
<70 mg/dL	Hold meal coverage
80 - 150 mg/dL	Usual dose
151 - 200 mg/dL	Add 1 unit
201 - 250 mg/dL	Add 2 units
251 - 300 mg/dL	Add 3 units
301 - 350 mg/dL	Add 4 units

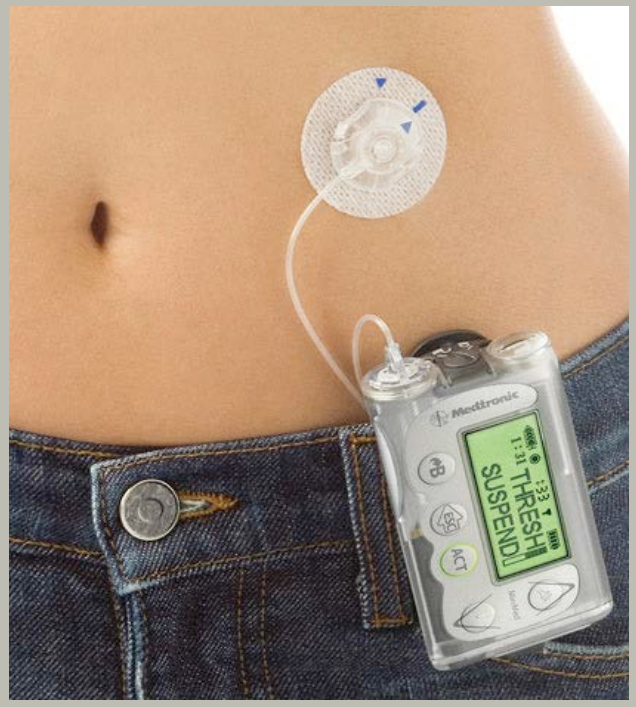
Cost Of Diabetes Medications

- Cost Effective Insulin Regimens
  - Over-the-counter insulin
  - Glucometer, Strips
- May also consider use of SFU if appropriate.
  - Other generic, low-cost oral agents include Metformin, TZD (Actos), etc although these may not typically be correct for the post-transplant setting.

Pen Delivery

- Improves Accuracy, especially with low dosing
- More Convenient
- Insulin Requires Priming and SQ Hold

Pumps



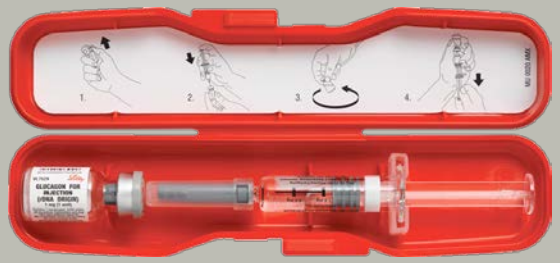
Continuous Glucose Monitoring Sensor

- Measures interstitial fluid
- Gives trends
- Alerts
- Poor Accuracy
- Medtronic, Dexcom

Freestyle Libre (CGMS)

Hypoglycemia

- Below 70: **Rule of 15**
- Causes
- Severe Hypoglycemia
- Hypoglycemia Unawareness

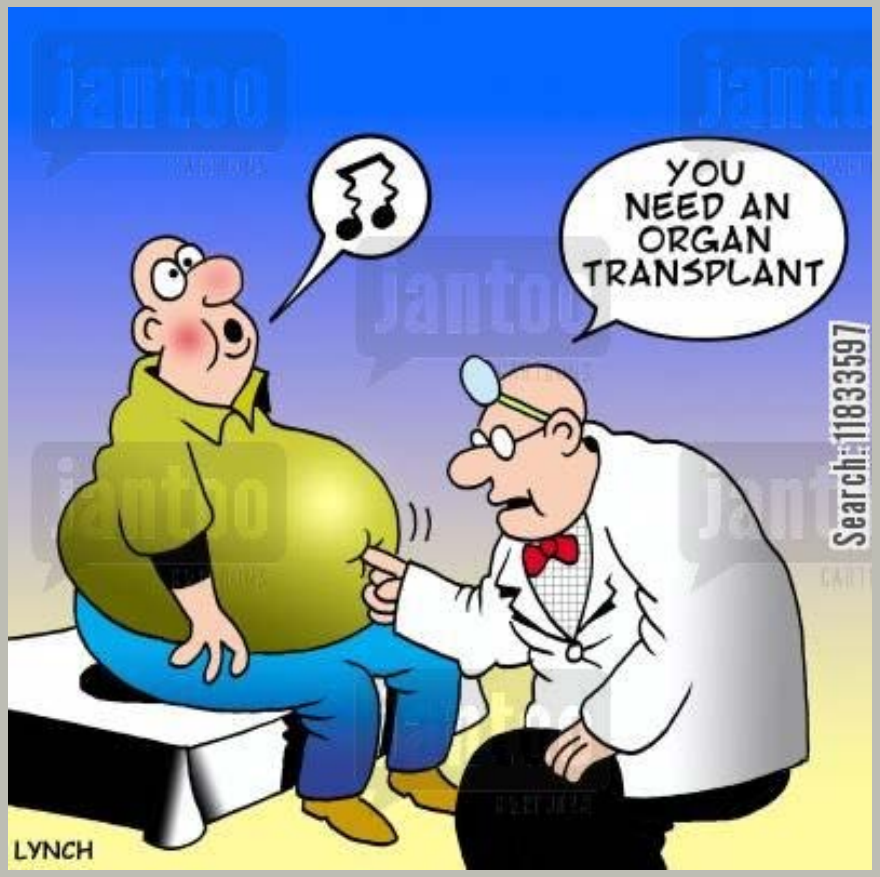


Take Home Points

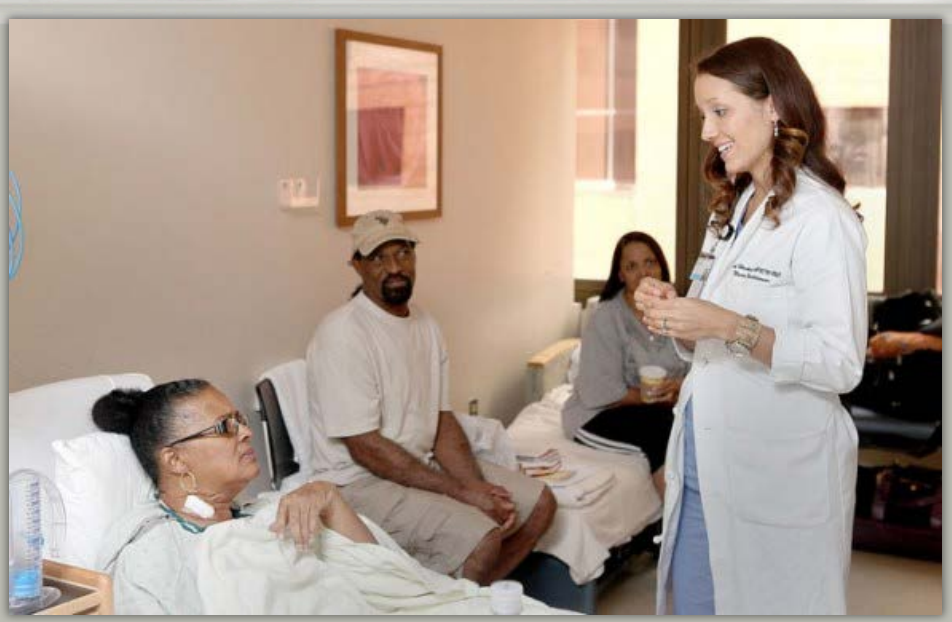
- Approach med compliance, diet, and exercise in a non-judgmental way.
- Start with Weight-Based Dosing if you need a starting place.
- Educate, educate, educate!

Test/Exam	Frequency
Wgt.	Each visit
Blood Pressure	Each visit
HbA1c	Every 3 months
Dilated eye exam	Yearly if no DR
Lipid Panel	Yearly if low risk
Foot exam	Yearly if low risk
Microalbumin	Yearly

Roll With The Punches and Enjoy The Challenge of Caring For People With Diabetes!



http://lowres.jantoo.com/health-beauty-organ_transplants-transplants-whistles-pianos-organ_transplant-11833597_low.jpg



Thank You!

Brannan U. Cole MSN, RN, FNP-BC