

Role of Nursing in the Continuum of Inpatient Diabetes Care



Overview

- Hyperglycemia in the hospital setting
 - Common
 - Costly
 - Associated with poor clinical outcomes
- Glycemic targets have been modified
 - 140-180 mg/dL
- Insulin is the treatment of choice to manage hyperglycemia
- Hyperglycemia management requires multidisciplinary collaboration

Nursing role is critical throughout hospitalization

Importance of Nursing Care for Improving Glycemic Control

- 24-hour coverage by nursing
- Nursing often coordinates, and is aware of, the multiple services required by patient
 - Travel off unit, (eg, physical therapy, X-ray)
 - Amount of food eaten (carbohydrates)
 - Patient's day-to-day concerns
 - Order changes (by various providers)



Inpatient Glycemic Control Recommendations

- Identify elevated blood glucose in all hospitalized patients
- Implement structured protocols for control of blood glucose throughout the hospital
 - Glucose targets:
 - ICU: 140-180 mg/dL for most patients
 - Noncritically ill: Fasting BG <140 mg/dL; random BG <180 mg/dL
- Create educational programs for all hospital personnel caring for people with diabetes
- Plan for a smooth transition to outpatient care with appropriate diabetes management

Factors Affecting Blood Glucose Levels in the Hospital Setting

- Increased counter-regulatory hormones
- Changing IV glucose rates
- TPN and enteral feedings
- Lack of physical activity
- Unusual timing of insulin injections
- Use of glucocorticoids
- Unpredictable or inconsistent food intake
- Fear of hypoglycemia
- Cultural acceptance of hyperglycemia

TPN, total parenteral nutrition.

Carter L. *Oklahoma Nutrition Manual*, 12th ed. Owasso, OK: Oklahoma Dietetic Association; 2006.

AACE Inpatient Glycemic Control Resource Center



Glucose Control Deteriorates During Hospitalization

Hyperglycemic Influences

- “Stress” hyperglycemia
- Concomitant therapy
- Decreased physical activity
- Medication omissions
- Medication errors
- Fear of hypoglycemia

Hypoglycemic Influences

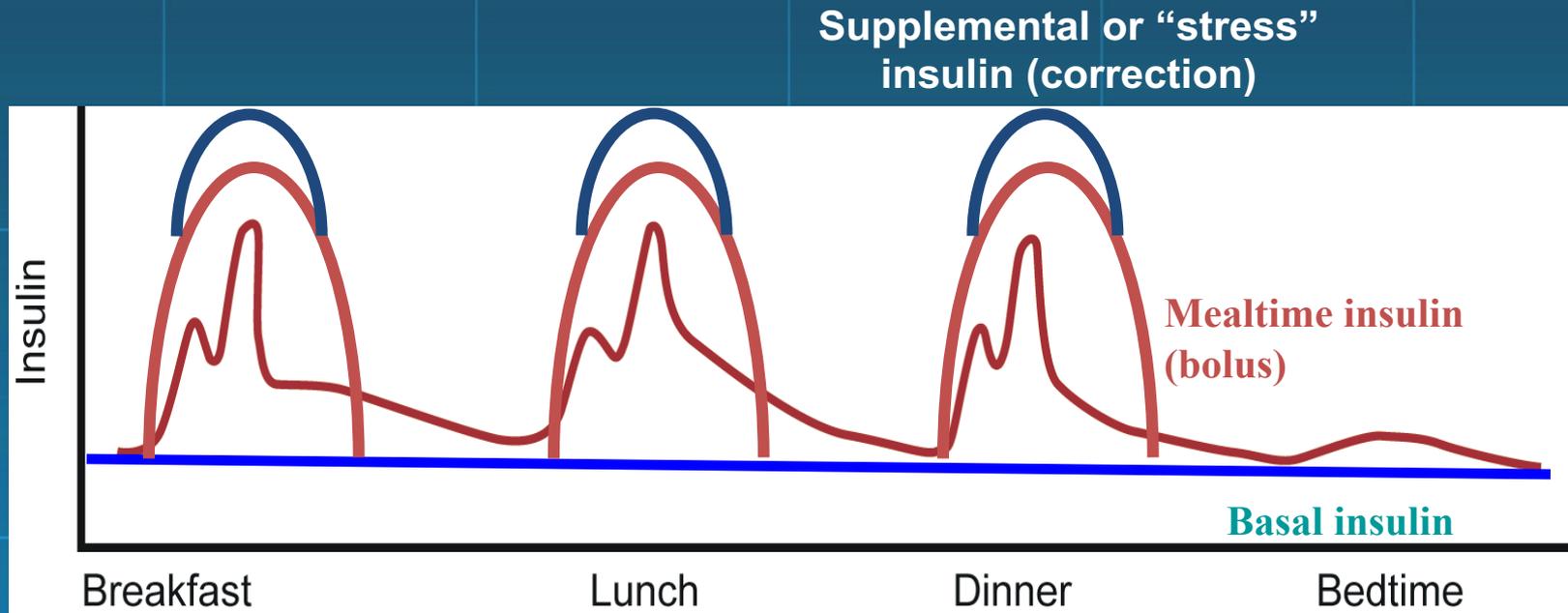
- Decreased caloric intake
- Gastrointestinal illness
- Monitored compliance
- Medication errors
- Altered cognition



Components of Insulin Therapy

- **Basal insulin:** the amount of insulin necessary to regulate glucose levels between meals and overnight
 - Detemir (Levemir), glargine (Lantus), NPH
- **Nutritional insulin:** insulin required to cover meals, IV dextrose, enteral nutrition, total parenteral nutrition (TPN), or other nutritional supplements
 - Rapid-acting: aspart (NovoLog), glulisine (Apidra), lispro (Humalog)
 - Short-acting: regular (Humulin, Novolin)
- **Correction insulin:** supplemental doses of short- or rapid-acting insulin given to correct blood glucose elevations that occur despite use of basal and nutritional insulin
 - Usually administered before meals together with nutritional insulin

Maintaining Physiologic Insulin Delivery in the Hospital



Subcutaneous Basal-Bolus Insulin

A combination of basal, nutritional (prandial), and correction (supplemental) insulin given to maintain target glucose levels

- Nutritional/prandial bolus doses of rapid- or short-acting insulin may be titrated based on the CHO content of the meal, or fixed doses may be ordered if consistent CHO meal plans are used
- Correction bolus doses of rapid- or short-acting insulin may be added to the nutritional/prandial dose to correct hyperglycemia
- Treat hypoglycemia with oral CHO or D50 IV per hypoglycemia guidelines or protocol

Prolonged therapy using sliding scale regular insulin is not recommended

Sliding Scale Insulin Is Associated With Higher Glucose Levels and Poorer Clinical Outcomes

- Patients receiving a sliding scale had mean in-hospital glucose values of 213 mg/dL vs 130 mg/dL ($P < 0.0001$)
- Sliding scale insulin was associated with higher odds ratios of the following outcomes:
 - Cardiovascular complications or death (OR=1.86; 95% CI 0.99-3.49)
 - Sepsis or ICU admission (OR=4.98; 95% CI 2.38-10.42)



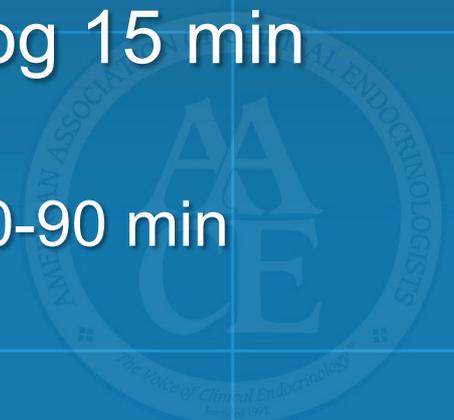
Insulin Time Action Profile

Insulin	Onset	Peak	Duration
Basal			
Detemir	2 hours	Relatively peakless	16-24 hours
Glargine	2-4 hours	Relatively peakless	20-24 hours
NPH	2-4 hours	4-10 hours	12-18 hours
Nutritional (prandial)			
Rapid-acting analog (aspart, glulisine, lispro)	5-15 min	1-2 hours	4-6 hours
Regular	30-60 min	2-3 hours	6-10 hours

Hirsch I. *N Engl J Med.* 2005;352:174-183.
 Porcellati F, et al. *Diabetes Care.* 2007;30:2447-2552.

Point of Care Glucose Testing and Insulin Administration

- Proper timing of glucose testing and insulin administration can reduce the risk of hypoglycemia and hyperglycemia
- Administer short-acting regular insulin 30 min before meals
 - Regular insulin peaks in 2-4 hours
- Administer rapid-acting insulin analog 15 min before meals
 - Rapid-acting insulin analogs peak in 60-90 min



CONTROLLING HYPOGLYCEMIA



What Is Hypoglycemia?

- Blood glucose <70 mg/dL in the hospitalized patient
- Also referred to as “low blood sugar”
- Classified as mild, moderate, or severe



Signs and Symptoms of Hypoglycemia (Blood Glucose <70 mg/dL)

- Tachycardia
- Hunger
- Restlessness
- Weakness/fatigue
- Diaphoresis
- Pallor
- Shakiness
- Irritability
- Anxiousness
- Light-headedness
- Change in mental status (eg, confusion)
- Impaired vision or dilated pupils
- Headache



Counter-regulatory Hormones Combating Hypoglycemia

- Glucagon
 - Produced in the alpha cells of the pancreas
- Epinephrine and norepinephrine
 - Responsible for many of the autonomic signs and symptoms of hypoglycemia
- Growth hormone
- Cortisol
- Counter-regulatory hormones increase blood glucose
 - During stress
 - In the early morning (circadian rhythm)
- Patients with type 1 diabetes have less counter-regulatory glucagon hormone reserves (within 2-5 years of diagnosis) than those with type 2 diabetes

Hypoglycemia

- Hypoglycemia can be life-threatening
- Common causes of hypoglycemia in the hospital include:
 - Too much insulin or insulin given out of sync with meals
 - Inadequate food intake, vomiting
 - Continuation of oral hypoglycemic agents, with or without insulin
 - Changes in eating status (eg, NPO)
 - Unexpected transport off unit after insulin given



Glucose Testing and Insulin Administration

- Timing is important
- Proper timing of glucose testing and insulin administration can reduce the risk of hypoglycemia



Blood Glucose Check—Too Early

- Patient requires regular insulin coverage
- Blood glucose checked at 0610
- Insulin is given at 0620
- Breakfast arrives at 0740
- Potential harm: hypoglycemia
- Ideally regular insulin should be given 30 min before meal
 - If necessary, regular insulin may be given with the meal
- Insulin should not be given more than 30 min before the meal

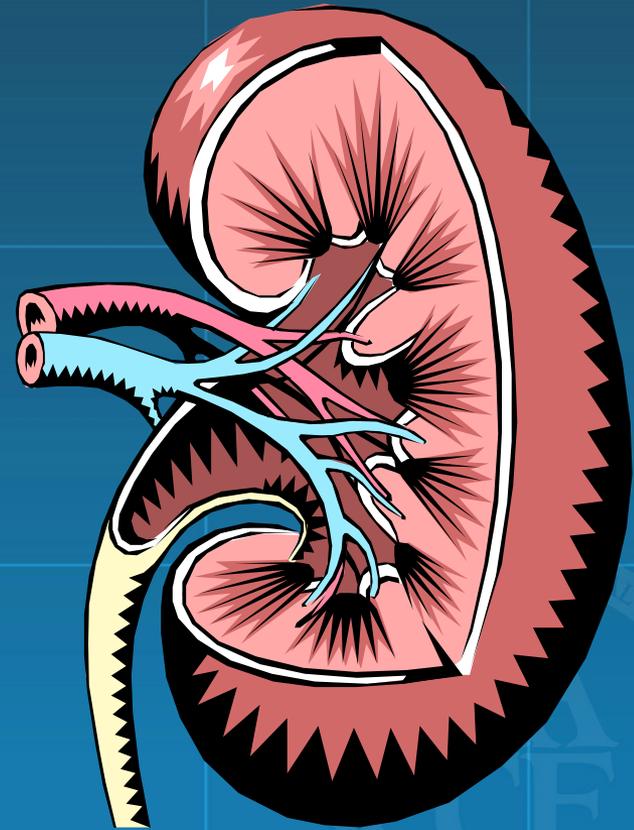
Hypoglycemia Is Serious but Treatable

- Institute a “Hypoglycemia Order Set” or “Hypoglycemia Protocol”
- Know the peak time of the different types of insulin
- Remember that more activity (energy output) or less carbohydrate (energy intake) can cause hypoglycemia



Hypoglycemia in Renal/Liver Disease

- Rising serum creatinine can contribute to hypoglycemia
- Liver disease can cause a depletion of glucose reserves for treatment of hypoglycemia



Essential Part of Any Insulin Use: A Hypoglycemia Protocol

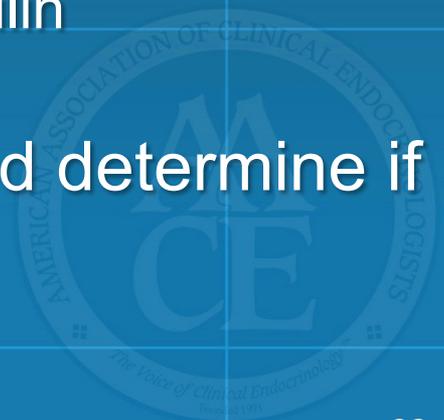
- Clear definition of hypoglycemia
 - BG <70 mg/dL
- Nursing order to treat without delay
 - Stop insulin infusion (if applicable)
 - Oral glucose (if patient is able to take oral)
 - IV dextrose or glucagon (if patient is unable to take oral)
 - Repeat BG monitoring 15 min after treatment for hypoglycemia and repeat treatment if BG not up to target
 - Directions for when and how to restart insulin
- Document the incident
- Look for the cause of hypoglycemia and determine if other treatment changes are needed

BG, blood glucose.

Moghissi ES, et al. *Endocrine Pract.* 2009;15:353-369.

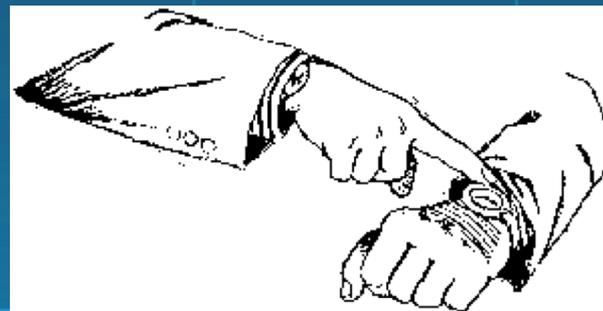
Umpierrez GE, et al. *J Clin Endocrinol Metab.* 2012;97:16-38.

AACE Inpatient Glycemic Control Resource Center

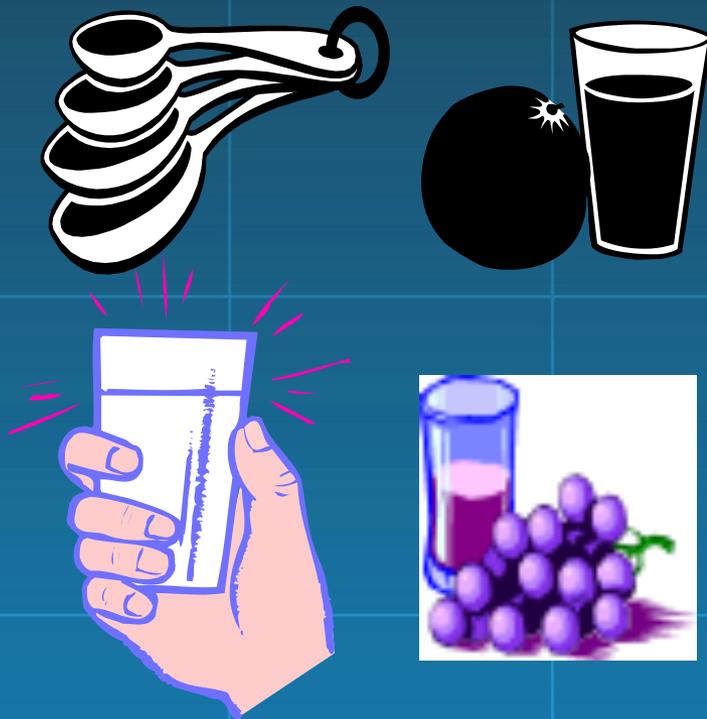


The 15-15 Rule

- Give 15 grams of fast-acting carbohydrate and wait 15 minutes
- Recheck blood glucose and then give another 15 grams of fast-acting carbohydrate, if necessary



15 Grams of Carbohydrate Raises Blood Glucose by 30-50 mg/dL



- 1 tube oral glucose gel
- 3-4 glucose tablets*
- ½ cup juice
- 1 tablespoon sugar, honey, or jelly
- 8 oz milk

* Glucose tablets may contain 4 or 5 g of glucose

Treating Hypoglycemia When the Patient Can Swallow

- 15-gram glucose tube or 3-4 glucose tablets*
- 4 oz fruit juice
- 8 oz milk



* Glucose tablets may contain 4 or 5 g of glucose

Treatment of Hypoglycemia in an Unconscious Patient

- Use an IV site to administer dextrose
OR
- Administer IM or SC glucagon



HYPERGLYCEMIA



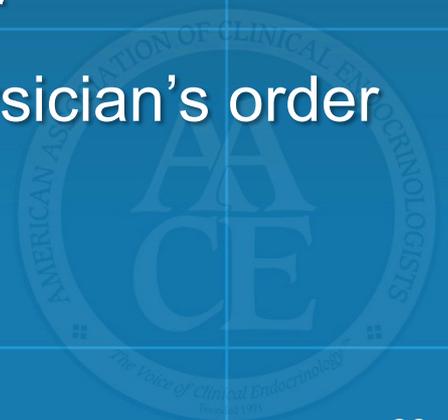
Hyperglycemia

- What is the goal for the bedside nurse?
 - Notify the physician when blood glucose levels are out of control
 - Implement the orders and notify the physician when indicated to avoid hyperglycemia and hypoglycemia



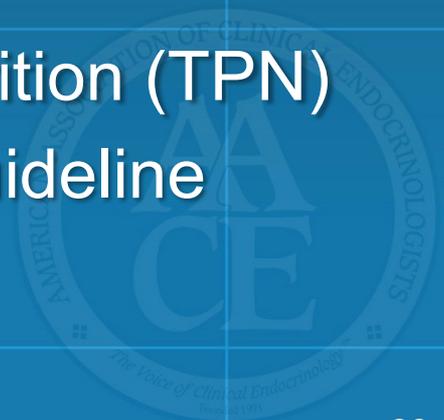
Interventions for Hyperglycemia

- Blood glucose >200 mg/dL
 - Call the physician if:
 - Blood glucose >200 mg/dL on admission
 - First time BG ≥ 200 mg/dL if not previously reported
 - Written in the physician orders: “Call if blood sugar remains out of control despite therapy or per orders”
 - Administer insulin per physician’s order
 - Hydrate the patient as indicated by physician’s order



Nursing Role in Good Glycemic Control

- Point of care testing (POCT) for all patients with diabetes and patients who present with hyperglycemia on admission
- Special situations that cause hyperglycemia
 - Steroids
 - Immunosuppressants (eg, cyclosporin)
 - Atypical antipsychotics
- Enteral nutrition or total parenteral nutrition (TPN)
- Start POCT without an order—need guideline for care or policy



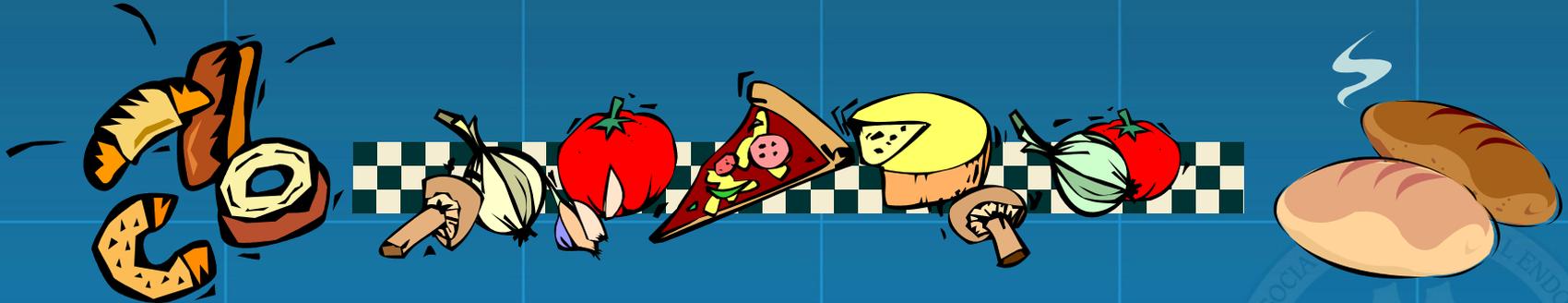
Nursing Role in Good Glycemic Control

- Appropriate timing of point of care testing/insulin administration and meal delivery
 - Document capillary blood glucose and the time
 - Document insulin dose and the time given
 - Document percentage of the carbohydrate eaten



Give Insulin as Directed— However, if a Patient Does Not Eat...

- Blood glucose can drop because the carbohydrates predicted did not match up to carbohydrates ingested



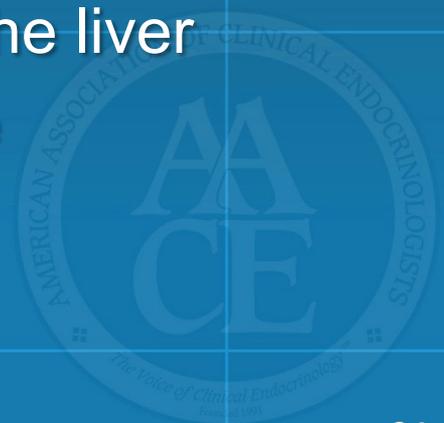
How Does Infection Affect Blood Glucose Levels?

- Increased glucocorticoids from the adrenal glands, stimulating hepatic glucose production, causing hyperglycemia
- Increased epinephrine and norepinephrine (catecholamines), causing increased hepatic glycogen breakdown into glucose, leading to hyperglycemia



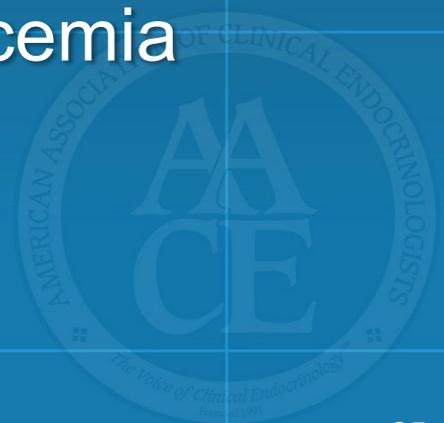
How Do Surgery and Acute Illness Affect Blood Glucose Levels?

- Increased secretion of counter-regulatory hormones, including cortisol, catecholamines, growth hormone, and glucagon
- These hormones cause hyperglycemia by:
 - Inhibiting glucose uptake by muscle tissue
 - Suppressing insulin release
 - Increasing breakdown of glycogen by the liver
 - Increasing peripheral insulin resistance



What Is the Impact of NPO Status on the Patient's Blood Glucose Levels?

- Ideally, patients will have surgery early in the morning to avoid a prolonged NPO period
- NPO patients need regular blood glucose monitoring (every 4-6 hours) and may need IV fluid
- NPO patients on oral diabetic medications with long duration are at risk for hypoglycemia



NPO Patients

- Management differs for type 1 and type 2
 - Type 1 patients still need basal insulin
- Transport with insulin on board
- Advocate for early test procedures so patients do not miss too many meals
- Solution: use insulin analogs for basal/bolus



NPO Patients

- May give half of the basal insulin dose, hold the mealtime insulin, and continue the correction dose
- Monitor BG every 6 hours and give corrective insulin as needed
- Resume the previous regimen once the patient is eating again

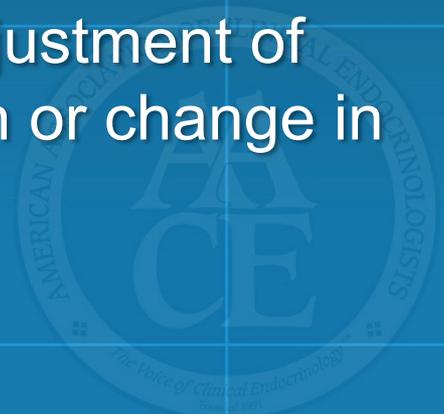


What Is the Impact of Tube Feedings on Blood Glucose Levels?

- Patients on tube feedings will usually receive a continuous flow of carbohydrates via their feeding
- Blood glucose monitoring (usually every 4 or 6 hours) and scheduled dose of insulin plus corrections are needed
- Interruption of feeding can cause hypoglycemia
 - IV dextrose may be needed while the feeding is off
 - Notify physician for IV dextrose and adjustment of insulin orders when there is interruption or change in feeding rate

What Is the Impact of Total Parenteral Nutrition (TPN) on Blood Glucose?

- Patients on total parenteral nutrition (TPN) may have insulin in the TPN or may be on SC insulin
- Blood glucose monitoring every 4-6 hours is needed
- Interruption of TPN can cause hypoglycemia
 - Initiation of IV dextrose may be needed
 - Notify physician for IV dextrose and adjustment of insulin orders when there is interruption or change in TPN



Impact of Medications on Blood Glucose Levels

- Medications used for the treatment of comorbid conditions can cause hyperglycemia
 - Corticosteroids (ie, solumedrol, solucortef, prednisone, decadron) can increase glucose production by the liver and increase insulin resistance
 - Reduction or discontinuation of the steroid can cause hypoglycemia
 - Notify physician for adjustment of insulin orders when there is a change in steroid dose



Steroids

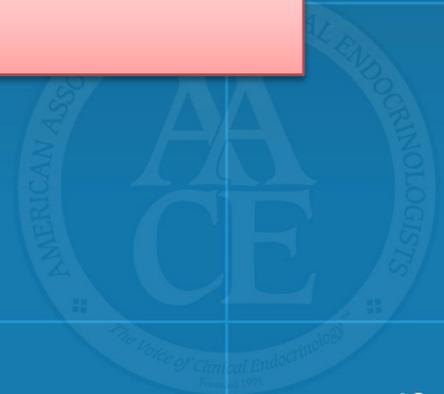
- Stimulate hepatic glucose production and inhibit peripheral glucose uptake
- Dexamethasone: half-life 48 hours
- AM prednisone:
 - Effect usually seen after meals
 - Peak effect on glycemia: 2 pm to 8 pm



Nursing Role in Good Glycemic Control

- Appropriate timing of PCT/insulin administration and meal delivery
 - Document FS blood glucose and the time
 - Document insulin dose and the time given
 - Document percentage of the carbohydrate eaten

Do not hold insulin just because blood glucose is under good control!



Nursing Role in Good Glycemic Control

- Appropriate patient handoff when transferring patient to another area of the hospital
 - Meal plan order
 - Last capillary glucose level
 - Insulin dose and last insulin given
 - Patient teaching done and patient's response
 - Identified further educational needs of patient/family
 - Transport sheet



NURSING IS CRITICAL THROUGHOUT HOSPITALIZATION



The Standards: Supporting Patient Self-Management

- Assessing patients' self-management capabilities
- Providing support for patients in self-management activities
- Involving patients in developing the plan of care
- Educating patients in the theory and skills necessary to manage their disease(s)
- Recognizing and supporting self-management efforts

Joint Commission standards mirror those of diabetes organizations with regard to patient self-management

Admission: Diabetes Assessment

- Documentation of type, duration of diabetes, and current treatment
- Assessment of patient's need for diabetes and nutrition education
- Determination of need for meter teaching
- Assessment of patient's competency
 - To perform SMBG
 - To manage diabetes medications and/or insulin



Health Literacy

- Not the same as literacy
- More than 40% of patients with chronic illnesses are functionally illiterate
- Almost a quarter of all adult Americans read at or below a 5th-grade level, while medical information leaflets are typically written at a 10th-grade reading level or above
- An estimated 3 out of 4 patients discard the medication leaflet
- Low health literacy skills have increased our annual healthcare expenditures by \$73 billion



Addressing Health Literacy

- Use graphics/pictures
- Use variety of media
- Use “teach back” method to assess understanding
- Focus education materials on patient action and motivation
- Check for patient understanding
- Implement follow-up phone calls to reinforce instructions



Health Numeracy

- Difficulty adding and subtracting
- Effects in diabetes
 - Carbohydrate counting
 - Adding correction insulin to prandial insulin
 - Recommended example:
 - If your blood sugar is 80 to 150, take 10 units _____ insulin
 - If your blood sugar is 151 to 200, take 12 units _____ insulin
 - If your blood sugar is 201 to 250, take 15 units _____ insulin

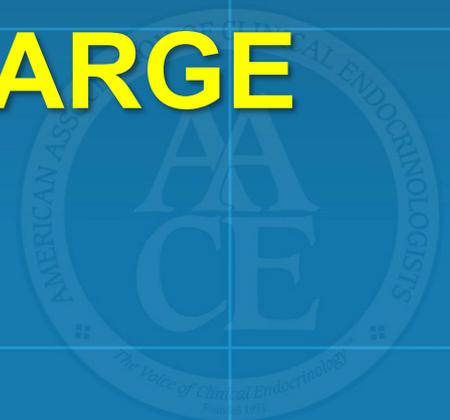


Patient/Family Education

- Review/evaluate insulin injection technique
- New to insulin
 - Instruct ASAP
 - Give own insulin as input
 - Use handouts

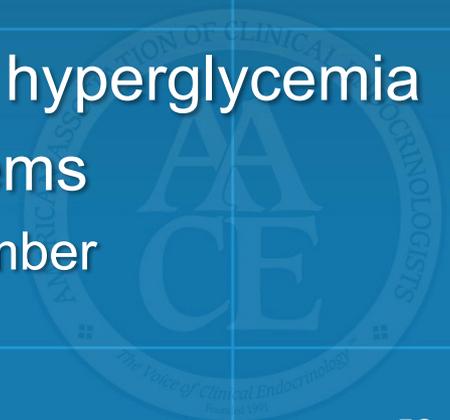


TRANSITION TO DISCHARGE



Ensuring Good Glycemic Control in Patients Being Discharged

- Ensure patient has survival skills—ie, diabetes self-management education (DSME)
 - Use of personal glucose monitor
 - Rudiments of meal plan (effect of CHO)
 - Medications
 - How and when to administer
 - Side effects
 - Symptoms and treatment of hypo- and hyperglycemia
 - When and whom to contact with problems
 - Be sure patient has a name and phone number
 - Additional education/resources



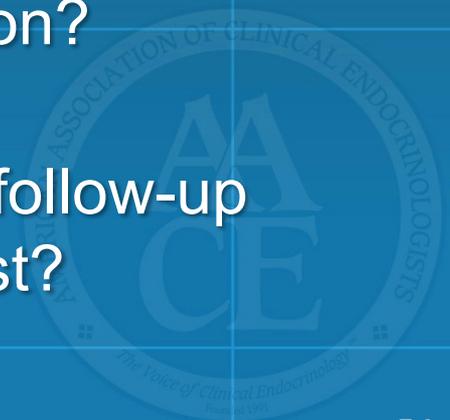
Connecting Inpatient Care to Outpatient Support

- Multidisciplinary team: bedside nurse, clinical pharmacist, registered dietitian, case manager
- High-risk patients identified at admission
- Bedside nurse does assessment using admission database form and adds 5 questions related to diabetes
- If need identified, bedside nurse contacts appropriate team member



Transition to Discharge

- Does patient have a glucose monitor for home use?
 - If not, call case manager/D/C planner or diabetes care center (DCC) to arrange for one
- Does patient know how to inject insulin and how to prevent and treat hypoglycemia?
- Does patient understand his/her diabetes therapy after discharge?
- Does patient need more diabetes education?
 - Refer to DCC for further education
- Does patient have appropriate outpatient follow-up appointment with primary care or specialist?

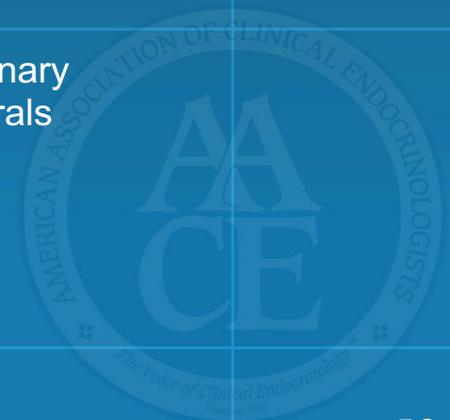
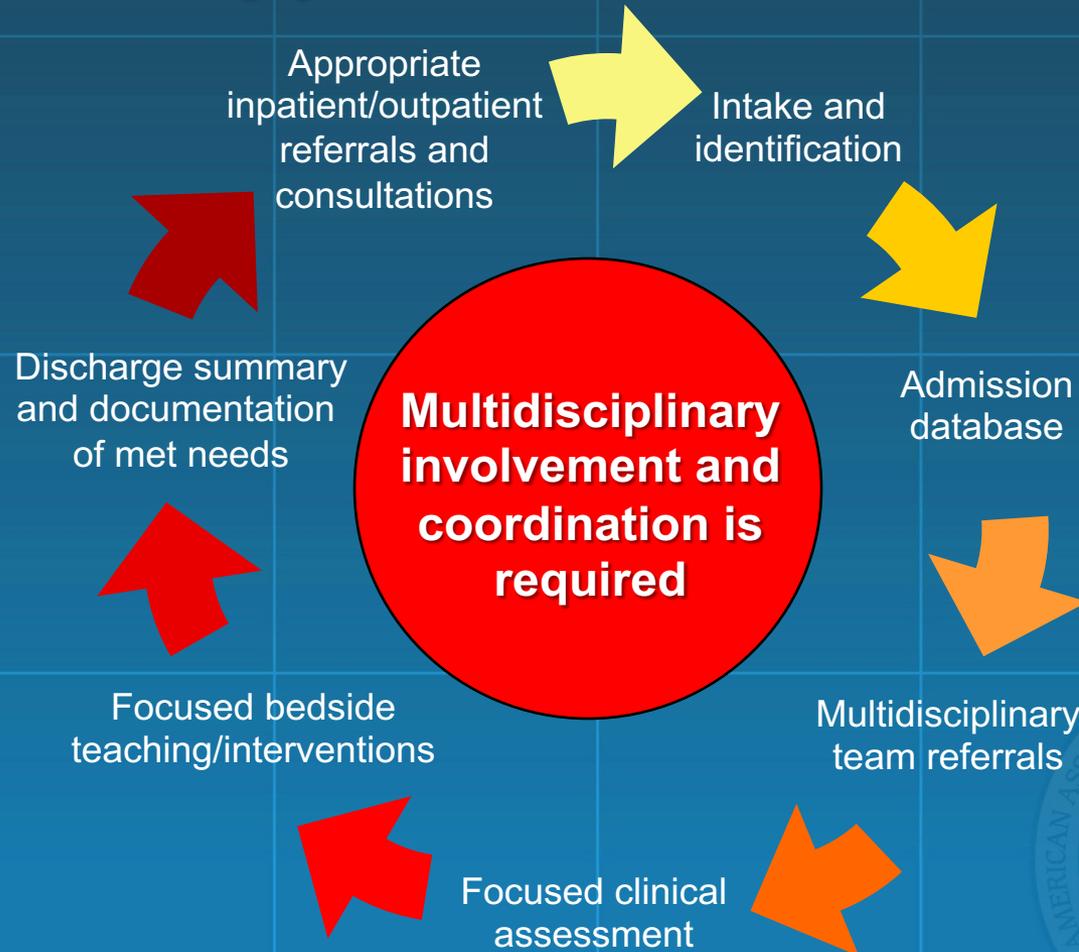


To Enhance Nurses' Knowledge

- In-services to cover all shifts
- Web-based in-services/journal clubs
 - Can be viewed at opportune times
 - Offer CEs
- Nursing champion
- Diabetes “resource nurse” on each unit
 - Receive extra education re diabetes
 - Used as “rung” on clinical ladder



Connecting Inpatient Care to Outpatient Support: Circle of Care



Summary

- To effectively manage diabetes and nutrition in the hospital setting, it's important to use a multidisciplinary team approach
- Collaboration among physicians, nurses, pharmacists, laboratory staff, and dietary staff can optimize patient care and support favorable metabolic control

