

Hospital Diabetes Management


*An Opportunity for
Nursing Excellence!*

January 2009





Objectives

- State the ADA goal for HbA1C
 - Recognize hypoglycemia signs, symptoms, and treatment
 - Discuss insulin deficiency and the need for basal insulin
 - Explains correct use of the IV insulin calculator
- 



What we know

“Diabetes is the fourth most common co-morbid condition complicating all hospital discharges.”

American Association of Clinical Endocrinologists (AAACE), 2003

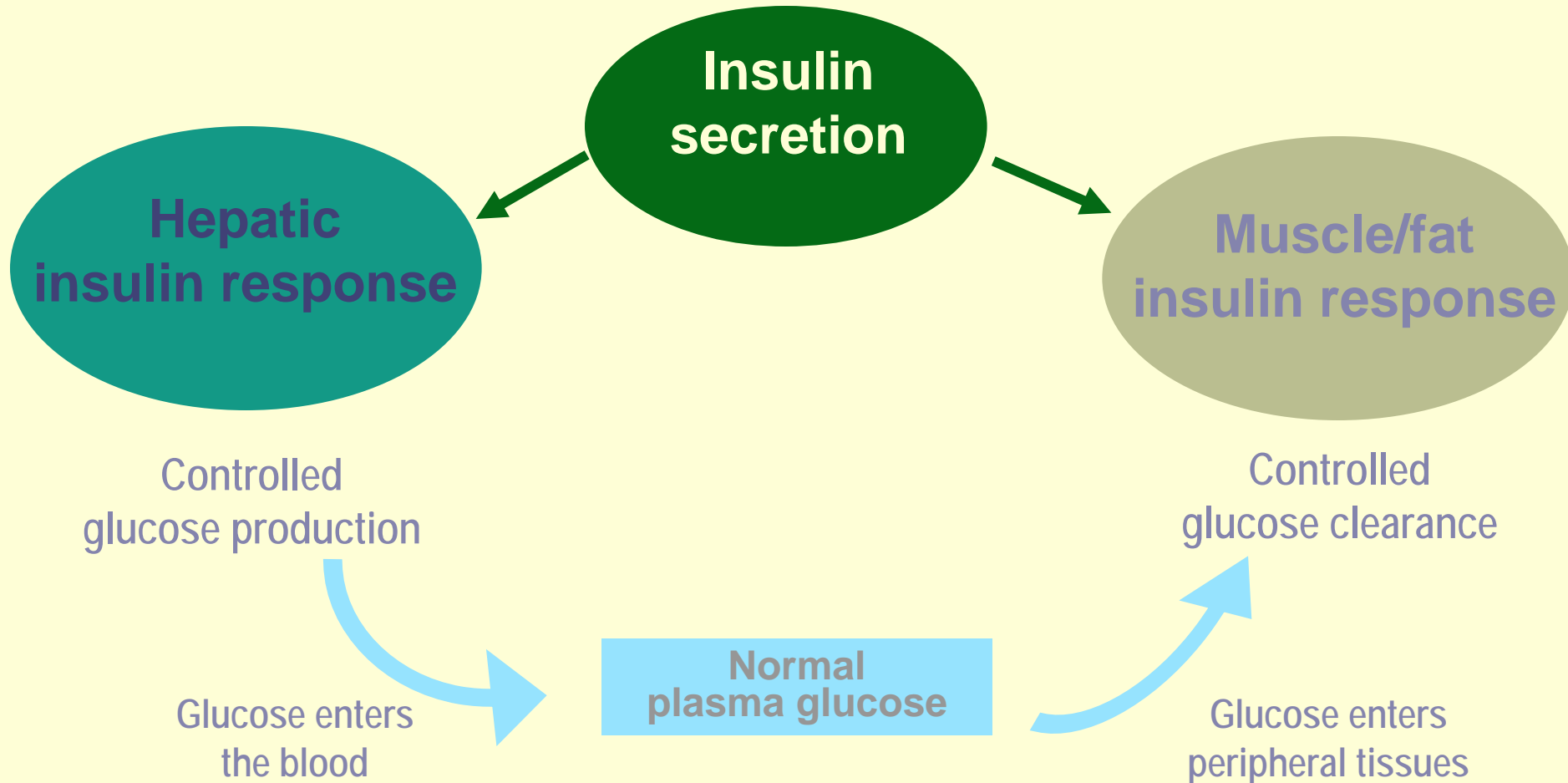


The Bottom Line

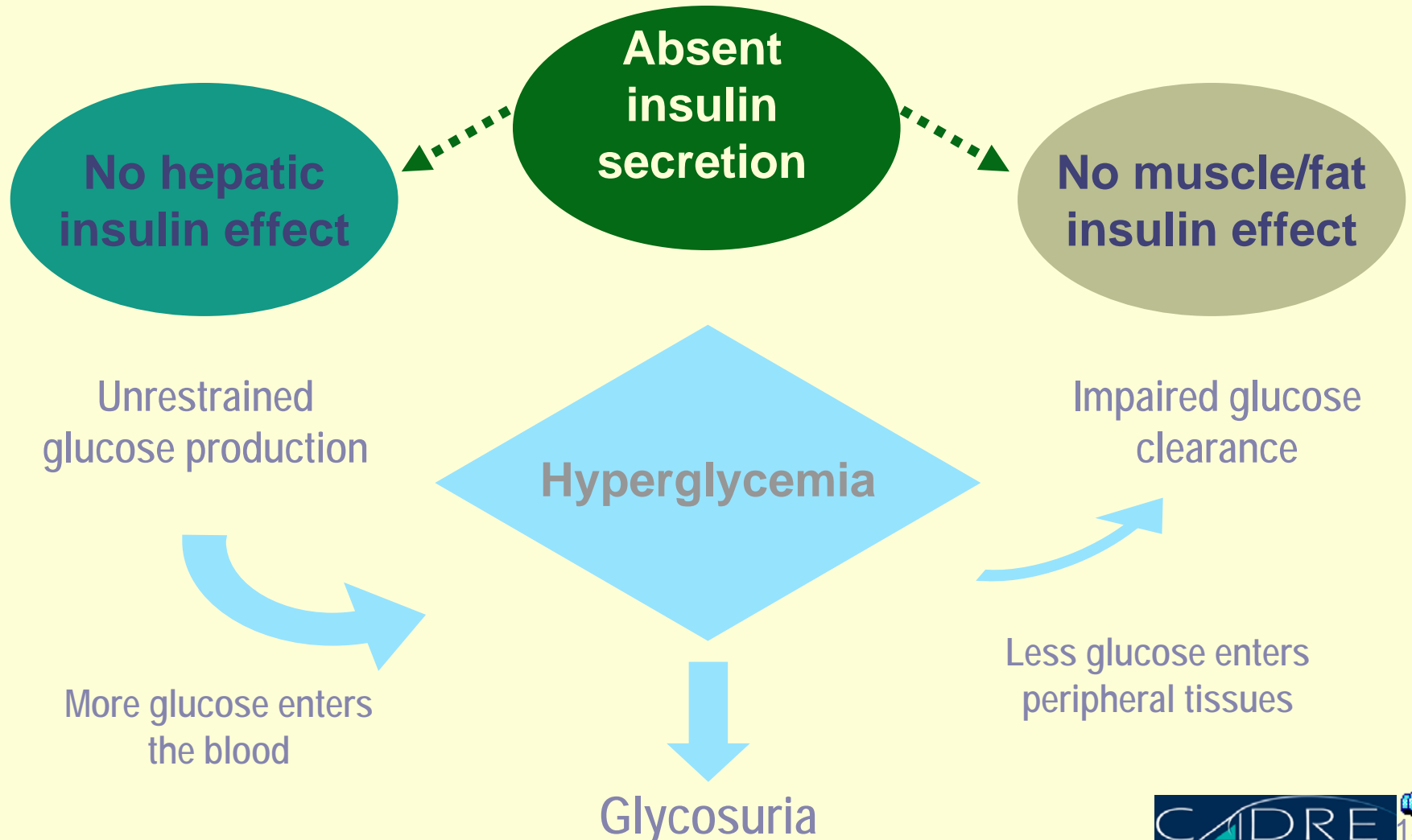
**Tight blood sugar control saves
lives!**



Normal Regulation of Plasma Glucose

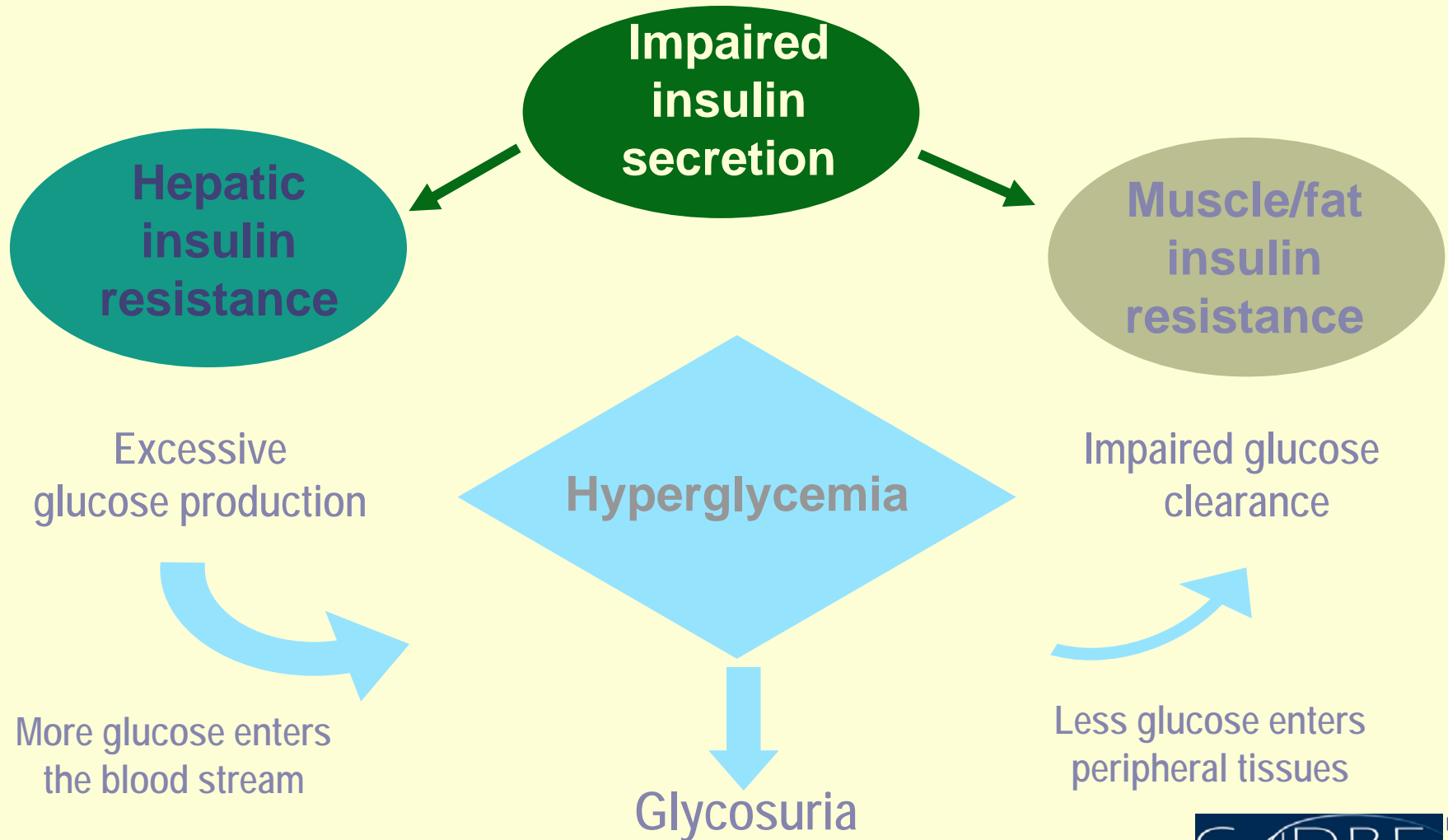


Pathogenesis of Type 1 Diabetes One Defect



Pathogenesis of Type 2 Diabetes

Two Defects



Remember the “ABCs”

 A1C

 Blood Pressure

 Cholesterol





A1C (glycemic control)

- **A1C measures average blood sugar over 3 months:**
 - The higher the number, the greater the risk of complications.
 - Aim for **‘7%’** or lower (average blood sugar 150mg/dL).
- **Monitoring post-prandial blood sugars provide additional information on how well carbohydrates are handled:**
 - Aim for a maximum of 180mg/dL 1-2 hours after meals.





ADA Standards of Care 2004

Goals of Therapy

Glycemic control

- A_1C <7.0%
- Preprandial plasma glucose 90-130 mg/dL
- Postprandial plasma glucose <180 mg/dL

Blood pressure <130/80 mm/Hg

Lipids


- LDL <100 mg/dL
- Triglycerides <150 mg/dL
- HDL >40 mg/dL





Question 1

The American Diabetes Association goal for the Hemoglobin A1c or A1c is:

- A. 10% or more
 - B. 7% or less
 - C. 9.5%
 - D. 25%
- 



Diabetes Management Service (DMS)

- Concurrent diabetes management.
- Primary team activates consult.
- Pager #20106.
- Contact your Certified Diabetes Educator with questions or concerns.





The Role of the Diabetes Educator: Support & Resource


Call us when your patient:

- Has a new diagnosis of diabetes.
- Is consistently hyperglycemic.
- Has blood glucoses $<70\text{mg/dL}$ or $>250\text{mg/dL}$ on more than one occasion.





The Role of the Diabetes Educator; Support & Resource Call us when:

- You have any questions about diabetes or caring for your patient with diabetes.
 - If your patient is new on insulin while in the hospital.
- 



Managing Diabetes Care:

Examining the Blood Glucose Pattern over TIME

- Relationship of blood glucose to insulin doses and carbohydrate intake:
 - Per Os (by mouth)
 - Intravenous (IV)
 - Enteral Nutrition (EN)
 - Parenteral Nutrition (PN)





Nursing Flowsheet

- A “**Diabetes Overview**” at the bedside for every patient with diabetes
 - Care team can look at one document to learn everything they need to know for successful management.





Diabetes Monitoring and Insulin MAR Flowsheet

Flowsheet components:

- Hypoglycemia Protocol
- Reference definitions
- Blood glucose record
- Nutrition information (carbohydrate intake)
- Insulin MAR
 - **The only place to document insulin dosages**

Patient Education Record for Diabetes



DIABETES Monitoring and Insulin MAR Flowsheet

2004 ALL RIGHTS RESERVED

Page 2 of 6

Form Origination Date: 10/04

Version: 2

Version Date: 12/04

* Place a check in box to indicate a note was recorded in the 24 Hour Patient Record

KEY: Gla – Glargine (Lantus®) **NPH** –NPH (Novolin® or Humulin®) **Uit** – Ultralente

Reg – Regular (Novolin® or Humulin®) **Asp** – Aspart (Novolog®) **Lis** - Lispro (Humalog®)

70/30 – 70/30 (Novolin® or Humulin®) **NPA** - 70/30 (NPA/Asp) **NPL** - 75/25 (NPL/Lis)


Patient Name _____

MRN _____

STAMP PLATE AREA

DATE _____ TIME ACROSS												
FINGER STICK BLOOD GLUCOSE / Serum Glucose	/	/	/	/	/	/	/	/	/	/	/	/
BASAL INSULIN DOSE												
PRANDIAL INSULIN DOSE												
CORRECTION INSULIN DOSE												
INJECTION SITE												
IV DEXTROSE DOSE GRAMS												
GLUCAGON GIVEN MG												
CHO SERVED / EATEN GRAMS	/	/	/	/	/	/	/	/	/	/	/	/
CHO IN EN OR PN GRAMS												
ANION GAP												
Nursing Progress Note*												
INITIALS	/	/	/	/	/	/	/	/	/	/	/	/





2006 American Diabetes Association Clinical Practice Recommendations for critically ill patients

- Maintain blood glucose close to 110 mg/dl
 - Generally < 180 mg/dl



ADULT HYPOGLYCEMIA PROTOCOL:

Sequence of Interventions:

1. Check blood glucose with hospital standardized blood glucose monitor according to procedure
2. Initiate adult hypoglycemia protocol for blood glucose less than 70 mg/dL
3. Treat hypoglycemia using the following table:

PATIENT CHARACTERISTICS	ACTION TO BE TAKEN
<p>The patient is unable to eat or swallow safely The patient is NPO Or The patient is unconscious And The patient has intravenous access</p>	<ol style="list-style-type: none"> 1. Administer dextrose 50% by intravenous push as follows: 15 mL (7.5 grams) for blood glucose 60 mg/dL – 69 mg/dL 20 mL (10 grams) for blood glucose 50 mg/dL – 59 mg/dL 25 mL (12.5 grams) for blood glucose 30 mg/dL – 49 mg/dL 30 mL (15 grams) for blood glucose less than 30 mg/dL 2. Assess unconscious patient for adequate airway, breathing, and circulation 3. If possible place patient in a lateral recumbent position to decrease aspiration 4. Place patient on seizure precautions 5. Re-check blood glucose every 15 minutes and repeat treatment until blood glucose is greater than 70 mg/dL
<p>The patient is unable to eat or swallow safely The patient is NPO Or The patient is unconscious And The patient does not have intravenous access</p>	<ol style="list-style-type: none"> 1. Administer 1 mg glucagon intramuscularly 2. Assess patient for adequate airway, breathing, and circulation 3. Place patient in a lateral recumbent position to decrease aspiration 4. Place patient on seizure precautions 5. Establish intravenous access 6. Re-check blood glucose and consciousness every 5 minutes and repeat treatment until blood glucose is greater than 70 and patient is awake
<p>The patient is able to eat and swallow safely Or The patient has a patent nasogastric tube</p>	<ol style="list-style-type: none"> 1. Feed with 15 grams of carbohydrate in order of preference from the following: "Fast Fifteen" : 3 glucose tablets 1 tablespoon of sugar (3 packets) 4 oz (120 mL) of regular soda 4 oz (120 mL) of juice 2. Re-check blood glucose in 15 minutes and repeat treatment until blood glucose is greater than 70 mg/dL 3. It will be necessary to give the patient extra food after blood glucose is greater than 70 mg/dL if hypoglycemia occurs greater than one hour from meal or occurs during sleeping hours. Feed the patient one of the following: 8 oz (1 cup) of whole milk 6 saltine crackers with 2 tablespoons of peanut butter 6 saltine crackers with 1 oz cheese 1 package of cheese or peanut butter nabs

4. Check the patient's blood pressure, pulse, respirations, and neurological status
5. Call the house officer after treatment has been administered
6. Send a serum sample to the lab for verification if blood glucose is less than 40 mg/dL
7. Check the patient's blood pressure, pulse, respirations and neurological status every 15 minutes until within stated physician parameters or until physician assessment occurs
8. Check the patient for hypoglycemia symptoms every 30 minutes until a meal is consumed or a physician assessment occurs
9. If a meal is scheduled within one hour after the patient's blood glucose reaches 70 mg/dL, feed the meal immediately and treat with scheduled insulin





Which patients are at risk for hypoglycemia?

- Heart failure
- Altered nutritional status
- Renal or liver disease
- Malignancy
- Infection
- Sepsis





Keeping your patient safe! Look for:


- Reduction in corticosteroid dose
- Sudden NPO status
- Reduction in oral intake
- Reduction or discontinuation of enteral or parenteral nutrition
- Changes in intravenous dextrose concentration or rates
- Pre-meal insulin given and meal not eaten
- Unexpected transport from unit after rapid-acting insulin administered





Question 2


Any adult patient is considered to be hypoglycemic if their blood glucose drops below the following level:

- A. 70 mg/dl
 - B. 90 mg/dl
 - C. 120 mg/dl
 - D. 150 mg/dl
- 



Question 3

If your patient becomes hypoglycemic, is unresponsive and does not have IV access, you would administer which of the following:

- A. 25 units Lantus SC
 - B. 1 mg Glucagon IM
 - C. 3 Glucose tablets PO
 - D. None of the above
- 

Is my patient insulin deficient?

- Known type 1 DM
- H/O pancreatectomy or pancreatic dysfunction
- H/O wide BG fluctuations
- H/O Ketoacidosis
- H/O insulin use > 5 years and/or H/O diabetes > 10 years
 - If “Yes,” then Always provide basal insulin

Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 2003; 26: S5-S20



Insulin Concepts





Basal Insulin Needs

- Amount of exogenous insulin which is required to prevent gluconeogenesis & ketogenesis.
- **DO NOT HOLD WITHOUT A PHYSICIAN ORDER!**
- If the patient is insulin deficient and there is no basal insulin coverage, the blood glucose increases 45 (mg/dl/hr) after insulin withdrawal.
 - Clement et. al. Diab Tech Therapeutics 4: 459-466, 2002



Example of Poor Outcome from Lack of Basal Insulin

● **BG at midnight: 248 mg/dl**

- HCO₃ 27, AG 10

● **BG at 8 AM: 616 mg/dl**

- HCO₃ 11, AG 24

+46 mg/dL/hr





Prandial Insulin Requirement

- Amount of insulin needed to cover intravenous dextrose, parenteral nutrition (PN), enteral “tube” feedings (EN), nutritional supplements &/or meals.





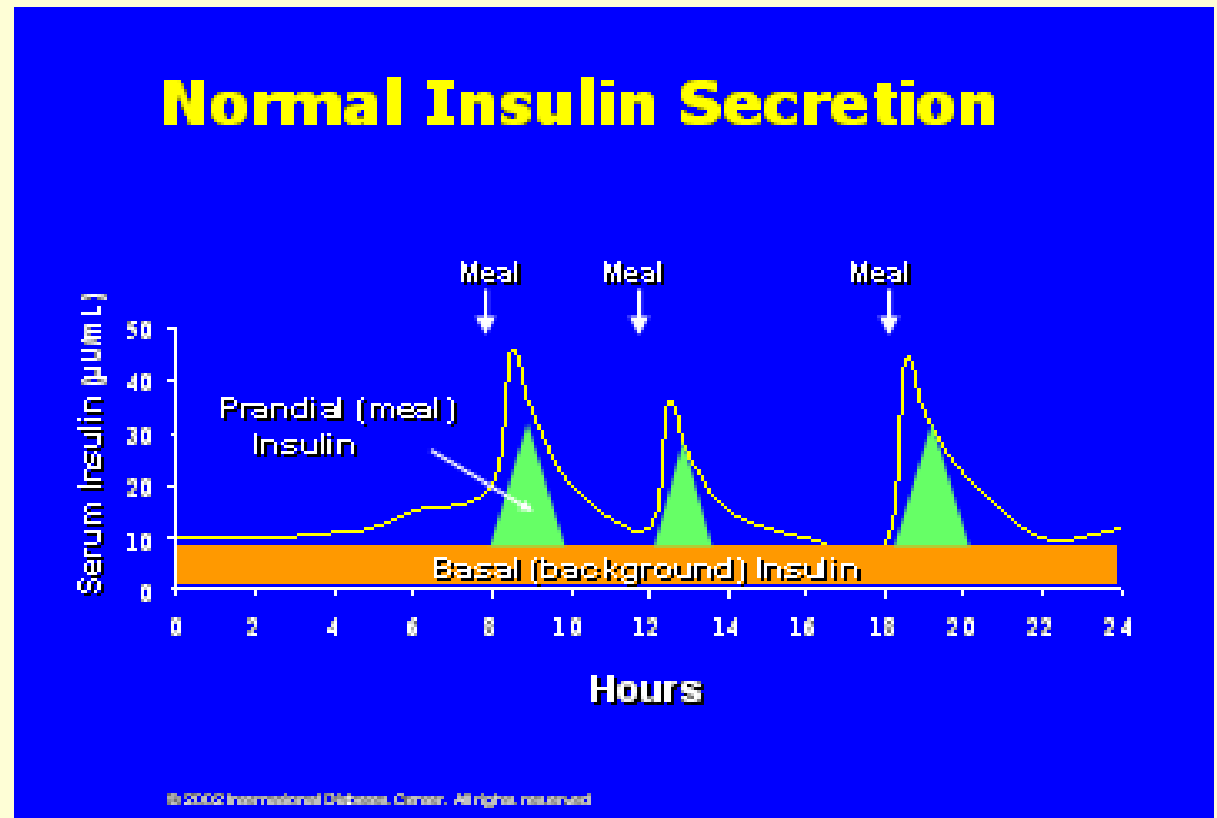
Correction Dose Insulin

- Amount of insulin needed to treat unexpected hyperglycemia.
- Administered before or between meals or when not eating discrete meals.



Insulin Concepts


- Basal
- Prandial
- Correction





Question 4

A patient may be insulin deficient if they have:

- A. A history of type 1 diabetes
 - B. A history of ketoacidosis
 - C. A history of type 2 diabetes $>$ 10 years
or on insulin $>$ 5 years
 - D. Any of the above
- 



Perioperative Insulin Requirements

● Night before surgery:

- for all type 1 DM pts and type 2 DM pts with demonstrated insulin deficiency, scheduled insulin to provide basal coverage should be administered to assure optimum FBG for the operating room.

● AM of surgery:

- for type 1 DM: give basal insulin without dose adjustment
- For type 2 DM: give 50-100% of the basal insulin

● Correction doses may be given:

- AM of surgery if the morning BG exceeds 180 mg/dL.



Intravenous Insulin Infusion Calculator





Intravenous Insulin Infusion Calculator (IVIIC) Overview

- Evidenced based medical research has identified that Medical/Surgical Patients who have their serum glucose maintained within the range of **80–110 mg/dL**:
 - develop less infection
 - have decreased complications
 - heal faster
 - survive longer
 - return to the hospital less often



Vocabulary

- **FSBG** = Finger Stick Blood Glucose
- **Target Range** = 80 – 110 mg/dL
- **Multiplier** = Adjustable numerical value used to calculate infusion rate based on a sensitivity factor.
- **Infusion Rate** = units of insulin per hour set on the IV pump as per calculator.
- **“IVIIC”** = IV Insulin Calculator





PHYSORDER

IV INSULIN INFUSION ORDER

Page 1 of 2

Form Origination Date: 10/05

Version: 1

Version Date: 10/05

This form may be completed on line. Tab or move cursor to text field and type in text.

For HIPAA Compliance reasons, this form IS NOT TO BE SAVED with patient information. Selecting the PRINT button will clear all information from the note.

Patient Name _____
MRN _____

STAMP PLATE AREA

ALLERGIES/DRUG SENSITIVITY: 1. _____ 2. _____ 3. _____ 4. _____

Target Range is the Actual FSBG: 80-120 mg/dL

1. Discontinue any previous insulin orders.
2. Give 250 units Regular insulin (Novolin®) in 250 mL 0.9% NaCl (1 unit/mL).
3. Flush line with and waste 50 mL of insulin solution for initial bag and all IV tubing changes.
4. Check Blood Glucose ONLY by finger-stick or from arterial line. Check every 1 hour until stable, (FSBG is 80-120mg/dL X three); then test every _____ hour(s).
5. Start insulin infusion on pump at rate determined by the MUSC Web-based Insulin Infusion Calculator. <http://www.musc.edu/medcenter/nursing/insulin-drip-calculator.htm>
OR
Start insulin infusion on pump at rate determined by the infusion formula using 0.03 as the Multiplier:
(FSBG – 60) X 0.03 = # of insulin units / hour
6. Use the MUSC Web-based IV Insulin Infusion Calculator to change the rate as ordered. <http://www.musc.edu/medcenter/nursing/insulin-drip-calculator.htm>
OR
Adjust the current multiplier in the infusion formula as follows:
 - A. FSBG is greater than 120 mg/dL and has decreased by >15% since last check: Keep the same Multiplier and calculate the new rate by the infusion formula (FSBG – 60) x Multiplier = Rate.
 - B. FSBG is greater than 120 mg/dL and has not decreased by >15% since last check: Increase the Multiplier by 0.01 and calculate the new rate by the infusion formula.
 - C. FSBG is less than 80 mg/dL: Decrease the Multiplier by 0.01 and calculate the new rate by the infusion formula. (Note: If the previous time period's Multiplier was 0.01: Decrease the Multiplier by 0.005 and calculate the new rate by the infusion formula.)
 - D. FSBG is within Target Range (80 -120 mg/dL): Keep the same Multiplier and calculate the new rate by the infusion formula.
 - E. If the IV insulin infusion is turned off, infiltrated, or interrupted for >20 minutes, restart the Infusion with 0.03 as the multiplier and use the current FSBG value. Check FSBG every 1 hour until stable (FSBG is 80-120mg/dL X three).

Clinician
Order Form
for the IV
Insulin
Infusion is
available on
the MUSC
Medical
Center
Intranet.



IV INSULIN INFUSION ORDER

Page 2 of 2

Form Origination Date: 10/05
Version: 1

Version Date: 10/05

For HIPAA Compliance reasons, this form
IS NOT TO BE SAVED with patient information.
Selecting the PRINT button will clear all information
from the note.

Patient Name _____
MRN _____

STAMP PLATE AREA

ALLERGIES/DRUG SENSITIVITY: 1. _____ 2. _____ 3. _____ 4. _____

- 8. Treat for hypoglycemia if FSBG is less than 70 mg/dL:
 - Give D50W by IV push using the following table:

FSBG (mg/dL)	Dextrose 50%	ACTION
60-69	15 mL IV Push	Call DMS; recheck FSBG in 15 minutes, and repeat as necessary
50-59	20 mL IV Push	Recheck FSBG in 15 minutes, and repeat as necessary
30-49	25 mL IV Push	Recheck FSBG in 15 minutes, and repeat as necessary
Under 30	30 mL IV Push	Recheck FSBG in 15 minutes, and repeat as necessary

- 9. Obtain Serum Glucose if FSBG is < 40 mg/dL or > 350 mg/dL.

- 10. Call the Service Resident/Fellow if:

- FSBG > 200 X 4 after 4 hours of IV insulin.
- If patient requires > 25 units/hour of insulin (or > _____ units/hour of insulin.)
- FSBG is below 70 mg/dL, twice in a row.
- Patient is scheduled for surgery.
- Other physicians order insulin SC, IV, or in PN.
- Feedings, PN, vasopressors, renal replacement therapy (CVVHD, hemodialysis, etc.), or steroids are started/stopped. If patient is eating PO, the Resident/Fellow will write for Subcutaneous Insulin to cover carbohydrate intake.
- Other physicians turn off insulin infusion for any reason.

Note: you must recalculate the insulin dose every time FSBG is checked with the latest Blood Glucose even if the multiplier does not change.

Physician Signature _____ Pager ID _____ Date _____ Time _____ AM/PM
insulininfusionicu OTE 900252 10/05





Clinician Order Form

- Ordering Physician must sign order manually or by electronic signature.

Nursing may NOT accept a verbal order for an IV Insulin Infusion.

- Fax order to appropriate pharmacy



IV Insulin Infusion Calculator

Refer to [physician orders](#) on the patient's chart

To clear all the data boxes, push this button

Please enter data in the boxes and press the COMPUTE button

What is the current blood glucose (FSBG)? (e.g. 276)

What is the blood glucose from 1 hour ago? (e.g. 310)

(Leave blank only if this is the starting calculation for the IV insulin drip)

What is the Current Multiplier? (e.g. 0.03)

(Leave blank only if this is the starting calculation for the IV insulin drip, in which case a multiplier of 0.03 will be used)

New multiplier is

Insulin drip rate to be programmed into IV pump is

units of insulin hour

To clear all entered data, push this button

Version: 6

Spec: Tim Hushion

Web: Michael Irving

Date: October 2005

Int





Critical Points to Remember

- **When first starting the insulin infusion or when changing the bag and tubing;**
 - **Flush and waste 50mL of infusion mixture.**
 - Ensures that the insulin particles are saturated into the polyvinyl material of the tubing.
 - Ensures the starting amounts will provide the potency needed.





Critical Points to Remember

- If patient is receiving PN, **DO NOT** add insulin to the PN mixture.
- When the FSBG has been in the Target Range (80 - 110mg/dL) consecutively for 3 or more times, FSBG time intervals may increase to q two hours.





Critical Points to Remember


- **When the insulin infusion is interrupted or stopped (for any reason) longer than 10 minutes;**
 - Restart the insulin infusion.
- **If the current multiplier is 0 and the infusion is halted for a hypoglycemic event;**
 - Restart the infusion.
- **If the patient will be eating PO;**
 - The Resident/Fellow must write an appropriate Consistent-Carbohydrate Diet Order with a subcutaneous Aspart Insulin dose to cover prandial needs.





Question 5

When initiating an Intravenous Insulin Infusion, why is the first 50 ml wasted?

- A. To ensure that the insulin particles are saturated into the polyvinyl material of the tubing.
 - B. Because pharmacy always overfills the IV bag.
 - C. To remove preservatives from the IV tubing.
 - D. This is a requirement for JCAHO.
- 

Patients with mental health issues

Special Considerations






Diabetes and Antipsychotics

- Association between psychotropic drug treatment and hyperglycemia since the 1950s (Charactan & Bartlett, 1955.)





Suggested mechanisms to explain atypical antipsychotic use and glucose abnormalities

- Weight gain effect on glucose metabolism. (Wirshing et al., 1998)
- Alteration in leptin sensitivity increases overeating. (Kraus et al., 1999)
- Toxic effect on Beta-cells. (Wirshing et al., 1998)
- Decreased number or half-life of insulin-sensitive glucose transporters. (Goldstein & Henderson, 2000)
- Interference with transporter trafficking from the microsome to the plasma membrane. (Goldstein & Henderson, 2000)





What to expect

- Many of these drugs list hypoglycemia, hyperglycemia, weight loss, weight gain as adverse reactions.
 - Weight loss or gain will affect insulin sensitivity (patient may require more or less medication for glycemic control.)



www.musc.edu/diabetesed



MUSC Diabetes Education

Maintained by the Medical University of South Carolina
Division of Care Management, Research and Evaluation



**MUSC
home**

MUSC employees a fulltime CDE (certified Diabetes Educator)!

**MUSC
Intranet**

Staff Resources

[Podiatry List](#)

[Needs Assessment](#)

[Patient Education Record](#)

[Medication Cheat Sheet](#)

Hypoglycemia Protocol
(coming soon)

Staff links:

[Clinician Order Forms](#)

[Patient and Family
Education at MUSC](#)

[Care Management](#)

Patient Education Materials

[CDC Diabetes Book](#)

Discount and Free Medicine Program (coming soon)

Foot Care Information (coming soon)

Basics for Healthy Eating (coming soon)

Links

[American Diabetes Association](#)

[Center for Disease Control](#)

Communicare

[Diabetes Initiative of South Carolina](#)

[Project Sugar](#)

[Reach 2010](#)

[SC Vocational Rehabilitation](#)

[Tri-county Project Care](#)

Events and Happenings Calendar

FEBRUARY 2004

[Riverbanks Zoo Workshop Info](#)

News and Events



To subscribe to the
MUSC Diabetes
Education mail list
click [here](#)

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Thank you!

