

# Blood Glucose Measuring Devices in the Pre-Hospital Setting



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# Purpose

**To prepare currently certified EMT-Basics to utilize a Blood Glucose measuring device when operating under an approved EMS agency and in accordance with NYS DOH Policy Statement 05-04 and regional protocols.**



# Objectives

- **History of program**
- **Understanding Diabetes Mellitus**
- **Physiology of hypoglycemia and hyperglycemia**
- **Individual EMT skills**
  - **Indications for use**
  - **Demonstrate use of device**
  - **Act appropriately to findings**
  - **Sharps safety**
  - **Additional patient care**
- **Agency responsibility**





## Note

***Information within this presentation should be tailored to the Blood Glucose Measuring Device used by the service and should include a review of the manufacturer's instructions.***



# History

	 New York State Department of Health Bureau of Emergency Medical Services  <b>POLICY STATEMENT</b> <i>Supersedes/Updates: New</i>	No. 05-04 Date: Sept. 23, 2005  Re: Blood Glucometry for Basic Life Support EMS Agencies  Page 1 of 2
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## BACKGROUND

At the January, 2005 meeting of the New York State Emergency Medical Advisory Committee (SEMACE), the use of glucometers by Emergency Medical Technicians (EMT) in Basic Life Support (BLS) EMS agencies was approved. The SEMACE approval was granted with the specific condition that the EMS service wishing to use a glucometer at the BLS level, be granted approval by the local Regional Emergency Medical Advisory Committee (REMACE), each EMT complete an approved training program and the service apply and be granted a Limited Laboratory Registration.

The purpose of this policy is to explain the approval process for agencies wishing to implement a glucometry program. The addition of prehospital blood sugar evaluation is intended to assist in the recognition of hypoglycemia and improve the speed with which proper treatment is received.

## AUTHORIZATION

Each REMACE, interested in allowing their BLS EMS agencies to participate, will adopt protocols which will allow a basic EMT to obtain a blood sample using a lancet device



# Agency Responsibility

- **Any local or regional approvals**
- **CLIA Waiver**
- **Equipment acquisition**
- **Training and retention**
- **Equipment calibration and maintenance**

# History



- **Pilot Program with Albany FD.**
- **Basic EMT's independently used the glucometer 778 times during the study period**
- **No blood borne pathogen exposures or sharps injuries occurred**
- **Physician Medical Control available 24/7**
- **No requests for Medical Control**

# Other States



- **Wisconsin**
- **Massachusetts**
- **Nebraska**
- **Virginia**
- **Oklahoma**
- **South Carolina**
- **Arizona**

Allow BLS Glucometer use



# Albany FD Learning & Retention



- **Practical Skill Evaluation**
  - 111 Basic EMT's
  - Pretest pass rate 100%
  - Post-test pass rate 100%
- **Protocol Evaluation Exam**
  - 111 Basic EMT's
  - Pretest pass rate 100%
  - Post-test pass rate 100%



# Study Results

**Can a EMT/B properly do a BG?**

**Of course they can do it**



# Physiology

- **The body uses glucose and oxygen to create energy**
- **Glucagon functions to stimulate the liver to release stored glucose into the bloodstream**
- **The bloodstream distributes hormones throughout the body**
- **The endocrine system maintains homeostasis and responds to environmental stress**
- **Without a proper glucose level, organs can malfunction**
- **The brain is very sensitive to glucose levels**
- **Abnormal levels may result in permanent brain cell death**
- **Diabetes is a disease that affects more than 10 million Americans**

# Glucose / Insulin Balance

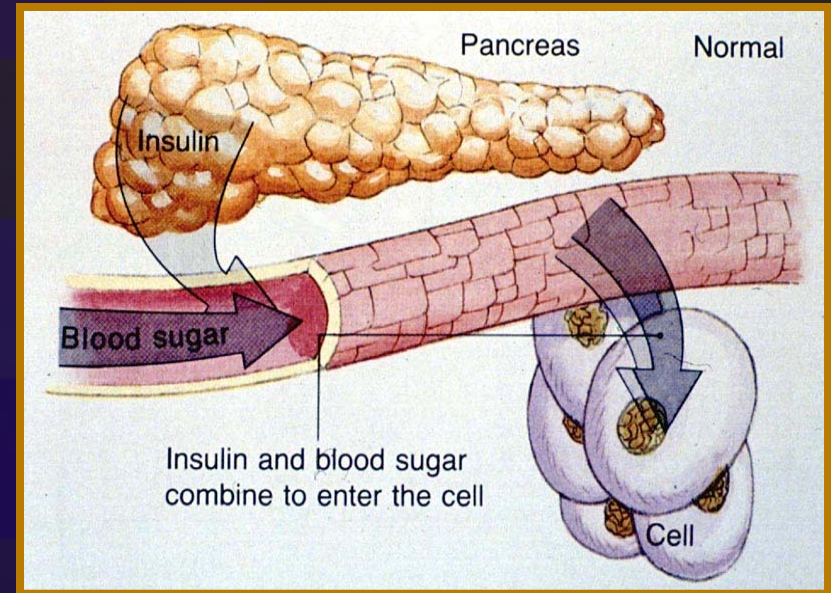


- **When normally balanced, body uses glucose for energy.**
- **Fats and proteins are less efficient fuels.**
- **Insulin is released by the beta cells of the pancreas.**
- **When insulin decreases, cells cannot use all glucose.**
- **Insulin is a hormone.**
- **Glucose spills into urine.**
- **Urine output increases.**
- **Patient becomes thirsty.**



# What is a “Diabetic”?

- The condition where the pancreas produces insufficient insulin is “*diabetes mellitus*”.
- A patient suffering from this condition is “*diabetic*”.





# Brain Cell Metabolism

- **Brain cells do not need insulin to utilize glucose.**
- **They do, however, need adequate levels of glucose in order to function properly!**
- **When glucose levels drop too low, the brain cells cease to function normally and changes in behavior and LOC follow.**
- **There is no “set” level at which patients show S/S of low blood glucose as it differs from person to person**



# Normal Blood Glucose Levels

- **Normal ranges for blood glucose levels:**
  - **Infant** (40 – 90 mg/dl)
  - **Child < 2 years** (60 – 100 mg/dl)
  - **Child > 2 years to Adult** (70 – 105 mg/dl)
  - **Adult** (70 – 105 mg/dl)
  - **Elderly patients (50 y/o +)** often have a slightly elevated blood glucose level, but should not normally exceed 126 mg/dl.
- **These readings will be altered by time of day and last oral intake. Values reflected are fasting values.**



# Decreased Blood Glucose Levels

- **Indicative of several potential processes:**
  - **Insulinoma**
  - **Hypothyroidism**
  - **Addison's disease**
  - **Extensive liver disease**
  - **Hypopituitarism**
  - **Pancreatic disease or cancer**
- **If untreated can lead to**
  - **Insulin Shock**
  - **Unconsciousness**
  - **Permanent brain damage**



# Resulting from

- **Too much insulin, wrong dose**
- **Took regular dose of insulin but didn't eat enough food**
- **Had an unusual amount of activity or vigorous exercise**
- **Sick, feverish**



# Increased Blood Glucose Levels

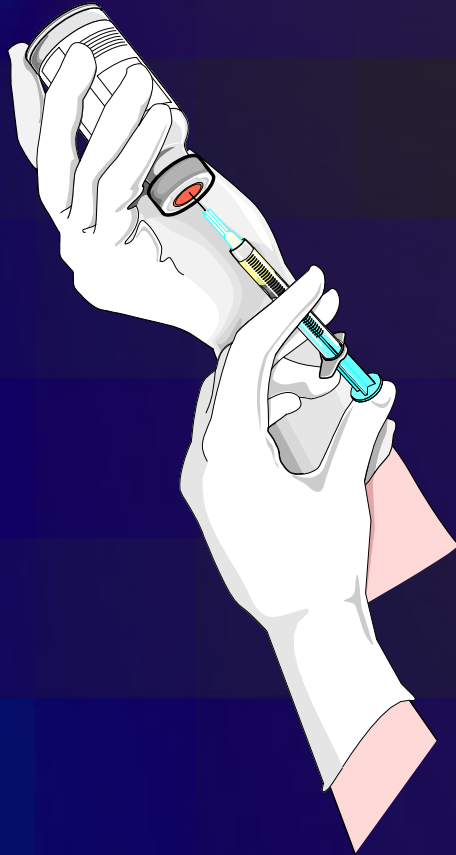
- **Indicative of several potential processes:**
  - **Diabetes mellitus**
  - **Acute stress response**
  - **Cushing's disease**
  - **Diuretic therapy**
  - **Corticosteroid therapy**
- **If untreated can lead to**
  - **Diabetic Ketoacidosis (DKA)**
  - **Dehydration Diabetic Coma**
    - **Dehydration results from a process called osmotic diuresis**
  - **Death or brain damage**



# Resulting from

- Too little a dose of insulin
- Dose no longer controls levels
- Too much sugar intake
- Enough food was eaten but forgot to take insulin

# Diabetes Type I



- Usually juvenile onset
- May have onset after pancreatic trauma / disease
- Insulin is not produced
- Usually take Insulin injections

# Diabetes – Type II



- Usually adult onset...
- Produce insulin – but not enough
- Usually take oral meds to stimulate insulin production
- If severe enough, insulin injections may be necessary
- Changes in diet necessary
- Less likely to experience hypoglycemic episodes





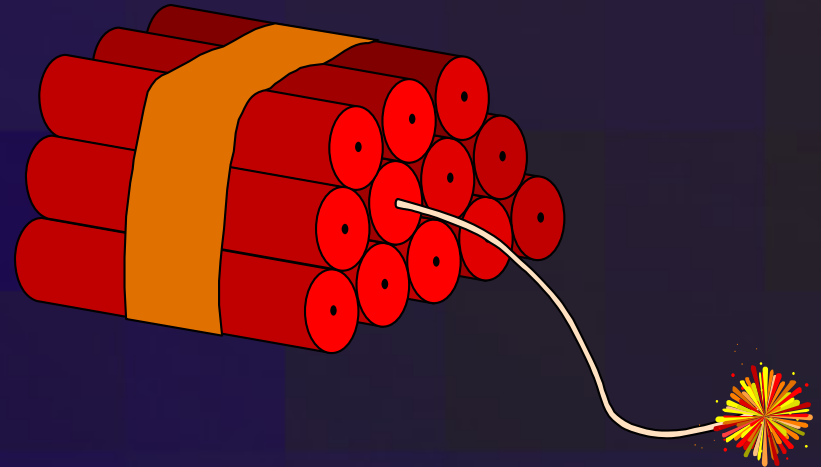
# Gestational Diabetes

- **Definition: Onset of diabetes with pregnancy.**
- **Most women need two to three times more insulin when they are pregnant than they usually do.**
- **In gestational diabetes, there are often no warning symptoms. All pregnant women need to be tested for diabetes during the second trimester. This is especially important for women who are already at risk.**
- **After the baby is born, blood glucose levels usually return to normal. A woman who has had gestational diabetes is at risk for developing type 2 diabetes later in life.**

# Unrecognized or Untreated...



- **Diabetes is a time bomb!**
- **Diabetes leads to:**
  - **Weakness**
  - **Weight Loss**
  - **Heart Disease**
  - **Kidney Disease**
  - **Blindness**
  - **Death....**



# Insulin Pump



# **“So what makes diabetes a medical emergency?”**



## **Hypo (low) glycemia (blood sugar)**

- **Hypo (low) glycemia (blood sugar)**
- **Too much insulin in blood.**
- **Not enough sugar for brain**

## **Hyper (high) glycemia (blood sugar)**

- **Too much sugar in blood.**
- **Not enough insulin in system to let glucose into cells.**



# Clinical Presentation

## Hypoglycemia (BG < Normal)

- Normal or rapid respirations
- Pale, moist skin
- Diaphoresis
- Dizziness, headache
- Rapid pulse
- Normal or low BP
- Altered mental status
- Anxious or combative
- Seizure or fainting
- Coma
- Weakness simulating CVA

## Hyperglycemia (BG > 200 mg/dl)

- Kussmaul respirations
- Dehydration with dry, warm skin and sunken eyes
- Polydipsia: excessive thirst
- A sweet or fruity (acetone) odor to breath
- Polyphagia: excessive hunger
- Poor wound healing
- Rapid and weak pulse
- Polyuria: excessive urination
- Blurred vision, fatigue
- Normal or slightly low BP
- Varying degrees of unresponsiveness that onsets more slowly than in hypoglycemia



# Glucometry


- **Indications to perform glucose test**
- **How to obtain blood sample**
- **Instruction on glucometer operation**
- **What to do with test result?**
- **Proper disposal of sharps / contaminants**
- **Proper action for blood borne pathogen exposure**



# Indications for BG Measuring

## Signs and Symptoms consistent with

- **Acute Stroke**
  - Weakness, slurred speech
- **Altered Mental Status**
  - Confusion, disorientation
- **Diabetic Emergencies**



# Altered Mental Status – Common Causes AEIOU-TIPS

- Alcoholism
- Epilepsy
- Insulin
- Overdose
- Underdose
- Trauma
- Infection
- Psychiatric
- Stroke/Seizure

# But First!!!!



- **ABC's**
- **Vitals Signs**
- **O2 Administration**
- **SPO2 if available**
- **Complete SAMPLE history**
- **Good BLS Comes First.....**



# BLS Pre-Hospital Care

**Scene Safety/Survey**

**Perform initial assessment**

*May require airway control, definitely oxygen*

**Ensure cervical spine immobilization as indicated**

**Activate ALS!**



# BLS Pre-Hospital Care

**Perform focused history and physical exam**

## **SAMPLE history**

**Signs/Symptoms (when did they start?; how long did they last?)**

**Allergies**

**Medications (When last taken?)**

**Prior Medical History (diabetes?, seizure disorder?)**

**Last oral intake (When did patient last eat)?**

**Events leading to illness/injury**



# BLS Pre-Hospital Care

**Focused history & physical exam, cont.**

**Take base line vital signs**

**Determine blood glucose level**

**Evidence of hypothermia or hyperthermia?**

**Can the patient swallow normally?**



# On-Going Assessment

**Is the patient's mental status improving?**

**Reassess ABCs,**

**Monitor VS every 5 minutes if unstable; every 15 minutes if stable.**

**Carefully document your assessment findings.**

**Notify incoming ALS unit or receiving hospital as soon as possible**



# Common Diabetic Emergencies

- Hypoglycemia
- Hyperglycemia

# Hypo vs Hyper



	<b>Hyper</b>	<b>Hypo</b>
<b>Onset</b>	<b>12-48 hours</b>	<b>&lt;1 hour</b>
<b>LOC</b>	<b>Confused</b>	<b>Confused</b>
<b>Skin</b>	<b>Warm / Dry</b>	<b>Diaphoretic/Pale</b>
<b>Pupils</b>	<b>Normal</b>	<b>Dilated</b>
<b>BP</b>	<b>Normal</b>	<b>Slightly Elevated</b>
<b>Respirations</b>	<b>Deep</b>	<b>Rapid / Shallow</b>



# Hypoglycemia

- **“Looks Shocky” used to be called Insulin shock. Pale, diaphoretic, altered mental status. May Vomit.**
- **BG <80mg/dl**
- **Reality is this is a hypoglycemic state, not a shock state.**



# Emergency Treatment

- **Hypoglycemia**
  - **Scene size up & BSI**
  - **Initial Assessment with O<sub>2</sub>**
  - **Determine need for rapid transport**
  - **Focused H&P Medical with vitals**
  - **Blood glucose check**
  - **If < 80 mg/dl, give oral glucose if LOC intact**
  - **If < 80 mg/dl and LOC is ↓, activate ALS assistance**
  - **Detailed, on-going assessments with transport to appropriate facility**
  - **Supportive care as needed**



# Treatment for Hypoglycemia

- **Oral Glucose only if they can swallow on command, otherwise protect airway**
- **Never assume it is a hypoglycemic episode until BG is done.**
- **Never Assume that Hypoglycemia is only problem.**



# Emergency Treatment

- **Hyperglycemia**
  - **Scene size up and BSI**
  - **Initial Assessment with O<sub>2</sub> and determine need for rapid transport**
  - **Focused H&P Medical with vitals**
  - **Monitor blood glucose level**
  - **If blood glucose is > 200 mg/dl the patient may need re-hydration and insulin per physician direction**
  - **Consider ALS Assistance if vitals signs compromised**
  - **Detailed, on-going assessments with transport to appropriate facility**
  - **Supportive care as needed**



# Glucose Measuring Devices

- Used to check Blood Sugar Levels.
- Many different types and models.





# Use of Glucometer

- **Equipment needed:**
  - Exam gloves
  - Alcohol prep pads
  - Glucometer
  - Test strips
  - Cotton balls or gauze pads
  - Band-aid
  - Lancets
  - Sharps container and proper waste disposal container



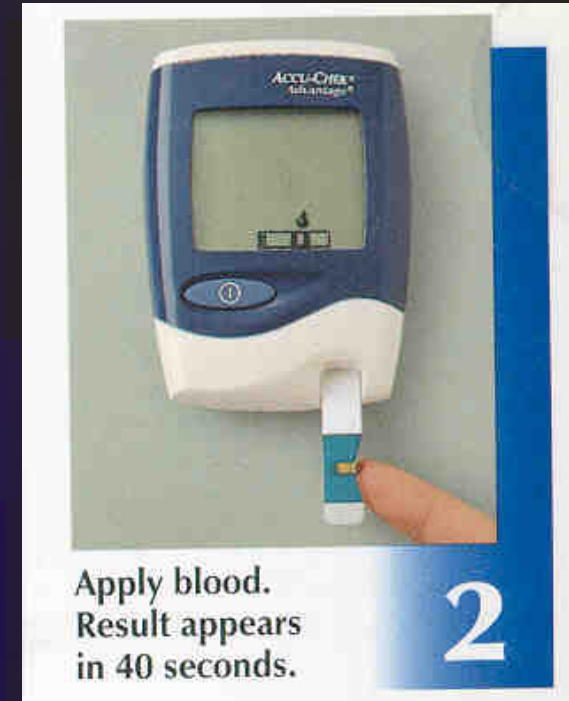


# Procedures

- **Careful attention to BSI & safety**
- **Select Finger**
- **Massage blood into distal end**
- **Clean finger with alcohol & allow to dry**
- **Use Auto-lancet device**
- **Apply drop of blood onto test strip and follow individual glucometer instructions**
- **Dispose of sharps and soiled supplies**



# Device Variations



- Some glucometers turn on automatically.
- Know the features of the glucometer your service uses.

# Patient Preparation



- Clean the site;
- Use a finger tip on the non-dominant hand



# Cleanse skin with alcohol prep



# BG Procedure



- The glucometer reading indicates the amount of glucose in the patient's blood stream.

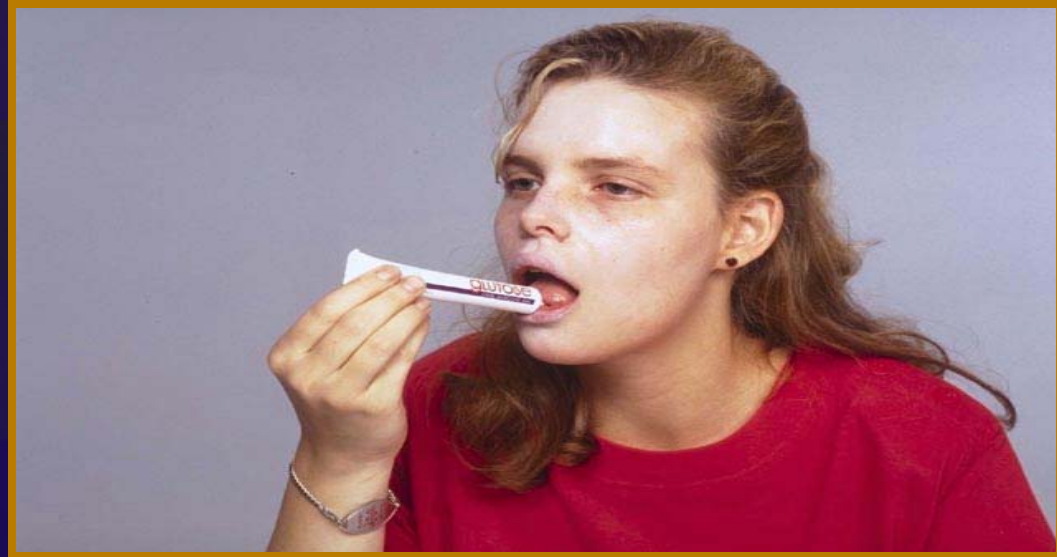
# What Now?



**Treat the Patient**  
**Document Results**  
**Proper disposal of sharps**



# Administering Glucose



- If the patient is alert enough, let them squeeze oral glucose into her mouth



# Administering Oral Glucose

- Make sure the tube is intact and has not expired.
- Squeeze a generous amount onto a bite stick.





# Administering Glucose



- Open the patient's mouth.
- Place the bite stick on the mucous membranes between the cheek and the gum with the gel side next to the cheek.
- Repeat as needed.
- Usual dose of oral glucose is one tube.



# Maintenance

- **Set up requires identification of:**
  - **Proper batch numbers for test strips**
  - **Routine control testing**
  - **Calibration when necessary**
  - **Follow CLIA guidelines**
    - **Log daily (shift) testing**
- **Follow manufacturer's directions**



# Care of the Blood Glucometer

- **Handle with care!**
- **Do NOT expose to excessive heat, humidity, cold, dust, or dirt**
- **Clean as directed by manufacturer**
- **Store the glucometer in the case provided by the manufacturer**

# Blood Glucometer Errors



**Can result from:**

- **Wrong calibration of glucometer.**
- **Lack of glucometer maintenance and cleaning.**
- **Battery failure.**
- **Test strip failure.**

**\* Proper care and maintenance of glucometers can help prevent these errors.**



# Case Study 1

- **Your unit receives a call for an insulin reaction. You find, upon arrival, a 44 year old female patient who presents giddy and nervous. The family states that she is an insulin dependent diabetic who had her insulin today and has not eaten. What are the treatment steps for this patient?**



## Case Study 2

- **Your unit receives a call for an unconscious subject. Upon arrival at the business, you find a 22 year old male patient who is supine on the floor and unresponsive. There is vomitus on the floor beside him and around his mouth. He is breathing and has a strong pulse. He has no identification or medic alert tags on him. What are your treatment steps for this patient?**



## Case Study 3

- **Your unit receives a call for a traffic crash. Upon arrival you find an elderly patient behind the wheel of a car that has gone off of the road and is up against a tree by a creek. The patient presents unresponsive, but with no specific signs of injury. Vitals are stable except for the decreased LOC, which is found to be responsive to painful stimuli. What are your treatment steps for this patient?**



## Case Study 4

• Your unit responds to a home for the report of a diabetic who is found unresponsive. You find the patient unresponsive and breathing shallow. Skin is warm and dry. Vitals are within normal limits. The patient, a 77 year old female is an insulin dependent diabetic who has eaten today, but it is unknown if she had her insulin. What are your treatment steps for this patient?

# QUESTIONS

