

Treating Diabetes Mellitus with assistance from Blood Glucose Measuring Devices in the Pre-Hospital Setting



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Purpose

To prepare currently certified LMVRS EMTs to assess a patient with a potential Diabetic illness

Utilize a Blood Glucose measuring device when operating under agency and TJEMS regional protocols.



Objectives

- **Understand Diabetes and basic treatment per TJEMS Protocols**
- **Understand the importance of a full patient assessment in conjunction with test results**
- **Know when blood glucose measuring is indicated**
- **Normal vs. abnormal blood glucose readings**
- **Know the LMVRS guidelines for use of glucometers.**
- **Know what is in the glucometer kit**
- **Know appropriate procedures for measuring blood glucose including BSI and sharps safety**
- **Know procedures for daily and weekly checks of glucometer kits and documentation requirements**
- **Understand proper maintenance, care & storage**

Diabetes mellitus



- Diabetes mellitus, or simply diabetes, is a group of metabolic diseases in which a person has high blood sugar, either because the pancreas does not produce enough insulin, or because cells do not respond to the insulin that is produced. This high blood sugar produces the classical symptoms of polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger).

Diabetes mellitus



- There are three main types of diabetes mellitus (DM).
- Type 1 DM results from the body's failure to produce insulin, and presently requires the person to inject insulin or wear an insulin pump. This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes".

Diabetes mellitus



- **Type 2 DM** results from **insulin resistance**, a condition in which cells fail to use insulin properly, sometimes combined with an absolute insulin deficiency. This form was previously referred to as non insulin-dependent diabetes mellitus (NIDDM) or "adult-onset diabetes".

Diabetes mellitus



- The third main form, gestational diabetes occurs when pregnant women without a previous diagnosis of diabetes develop a high blood glucose level. It may precede development of type 2 DM.



Hyperglycemia (**High Blood Sugar**)

- Hyperglycemia, or high blood sugar is a condition in which an excessive amount of glucose circulates in the blood plasma.
- This is generally a glucose level higher than (200 mg/dl), but symptoms may not start to become noticeable until even higher values such as 250–300 mg/dl.
- A subject with a consistent range between 100 and 126 (American Diabetes Association guidelines) is considered hyperglycemic, while above 126 mg/dl generally held to have Diabetes.
- Chronic levels exceeding (125 mg/dl) can produce organ damage.

Clinical Presentation



Hyperglycemia (BG > 200 mg/dl)

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



Hypoglycemia (**Low Blood Sugar**)

- Hypoglycemia is an abnormally diminished content of glucose in the blood. The term literally means “low sugar blood”
- It can produce a variety of symptoms and effects but the principal problems arise from an inadequate supply of glucose to the brain, resulting in impairment of function (neuroglycopenia).
- Effects can range from mild dysphoria to more serious issues such as seizures, unconsciousness, and (rarely) permanent brain damage or death.



Clinical Presentation

Hypoglycemia (BG < Normal)

- Altered mental status
- Anxious or combative
- Unresponsive (**Rapid Onset**)
- Normal or Rapid Respirations
- Pale, moist skin
- Diaphoresis
- Dizziness, headache
- Rapid pulse
- Normal or low BP
- Seizure or fainting
- Coma
- Weakness simulating CVA

“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
- Hyperglycemia**

Hyper (high) glycemia (blood sugar)

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

Hypo vs Hyper



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



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 (80 – 105 mg/dl)
 - Adult (80 – 105 mg/dl)
 - Elderly patients (50 y/o +) often have a slightly elevated blood glucose level, but should not normally exceed 126 mg/dl.
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- These readings will be altered by time of day and last oral intake. **Values reflected are fasting values.**

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!



Altered Mental Status – Common Causes AEIOU-TIPS

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



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?) **(Are they taking Insulin?)**

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

Last oral intake? **(Did they take their Insulin?)**

[When did they last take their meds?]

Events leading to illness/injury



BLS Pre-Hospital Care

Focused history & physical exam, cont.

Take base line vital signs

Evidence of hypothermia or hyperthermia?

Determine the need to do a blood glucose level

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



Emergency Treatment

- **Hypoglycemia**
 - **Scene size up & BSI**
 - **Initial Assessment with O₂**
 - **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 O₂ and determine need for rapid transport
 - Focused H&P Medical with vitals (**What was his last BG Level**)
 - 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



Indications for BG Measuring

Signs and Symptoms consistent with

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



LMVRS Standard Operating Guideline 1.13

- **Purpose:**
 - **SOG describes the departmental management of glucometers, glucometer quality control plan, pre-hospital field usage, required training prior to glucometer usage, and authorized personnel.**



SOG: Pre-hospital Field Usage

- Prior to using a LMVRS glucometer in the field, authorized providers must successfully complete the LMVRS glucometer training course and be approved by the LMVRS training officer.
- Authorized providers are active BLS and ALS personnel that have been recognized by the Operational Medical Director of LMVRS.
- Providers will treat the patient per the currently approved TJEMS Regional Patient Care Guidelines based on assessment of the patient in conjunction with the glucometer reading. **Never treat a patient based solely on the glucometer results.**

SOG: Training



- **A qualified instructor, approved by the LMVRS training officer shall conduct the LMVRS glucometer training.**



SOG: Glucometer Quality Control Plan

- **A LMVRS weekly control document will be maintained for each glucometer, including date of test, LMVRS device number, glucometer serial number, test strip lot number, strip expiration date, normal control range, normal control solution lot, control solution expiration date, test result, pass/fail, repeated test result (if any), pass/fail.**
- **Providers who incorrectly use the glucometer or it's reading in the treatment of a patient will be referred to the Patient Care Quality Committee for remedial training and will not be allowed to use the glucometer until that training is completed. If there are repeated or multiple offenses, the provider will no longer be allowed to use the glucometer.**



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**



Glucose Measuring Device

- Used to check Blood Sugar Levels.
- Bayer Ascensia Contour





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**

Patient Preparation

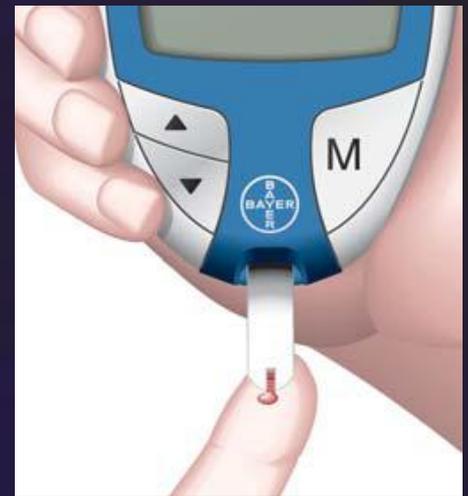


- Clean the site;
- Use a finger tip on the non-dominant hand

Cleanse skin with alcohol prep



BG Procedure



What Now?



Treat the Patient
Document Results
Proper disposal of sharps



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**

LMRS Glucometer Checks



- **Daily ambulance checkout includes**
 - **Glucometer kit is present**
 - **Kit includes glucometer, test strips, lancets, alcohol prep pads, band-aids, control solution**
 - **Battery check**
- **Weekly ambulance checkout includes**
 - **Glucometer Control Solution Testing**
 - **Control Solution Testing Documentation**



Glucometer Control Solution Testing

- Test per Bayer Ascencia Contour glucometer user guide



1. Gently rock the control bottle to ensure the control solution is mixed well
2. Verify control solution not past expiration date or discard date
3. Squeeze a small drop of control solution on a clean nonabsorbent surface
4. Touch tip of the test strip to the drop
5. Wait 5 seconds
6. Compare results to control range



Weekly Control Logging



LMVRS Glucometer Weekly Control Log
Bayer Ascensia Contour Blood Glucose Monitoring System
 (8 weeks per sheet)

Test Date	LMVRS Device #	BGMD Serial #	Test Strip Lot #	Strip Exp. Date	Normal Control Range
5/12/12	1	3078148	1016950	6/2007	86-116
Control Solution Lot #	Control Solution Exp. Date	Test Result	Pass or Fail? If fail, repeat	Repeated Test Result	Fail 2 nd time? Yes, take out of service
1508	03/10	100	Pass	N/A	N/A
Team Leader or Designee: <i>Max T. Rainer</i>					
Test Date	LMVRS Device #	BGMD Serial #	Test Strip Lot #	Strip Exp. Date	Normal Control Range
Control Solution Lot #	Control Solution Exp. Date	Test Result	Pass or Fail? If fail, repeat	Repeated Test Result	Fail 2 nd time? Yes, take out of service
Team Leader or Designee:					
Test Date	LMVRS Device #	BGMD Serial #	Test Strip Lot #	Strip Exp. Date	Normal Control Range
Control Solution Lot #	Control Solution Exp. Date	Test Result	Pass or Fail? If fail, repeat	Repeated Test Result	Fail 2 nd time? Yes, take out of service
Team Leader or Designee:					
Test Date	LMVRS Device #	BGMD Serial #	Test Strip Lot #	Strip Exp. Date	Normal Control Range
Control Solution Lot #	Control Solution Exp. Date	Test Result	Pass or Fail? If fail, repeat	Repeated Test Result	Fail 2 nd time? Yes, take out of service
Team Leader or Designee:					



Control Indicator



LMVRS Glucometer Weekly Control Log
Bayer Ascensia Contour Blood Glucose Monitoring System
 (1 week, 5 Units per sheet)

Test Date	LMVRS Device #	BGMD Serial #	Test Strip #	Strip Exp. Date	
Control Solution #	Control Solution Exp. Date	Test Result	Pass or Fail? If fail, repeat	Repeated Test Result	Fail 2 nd time? Yes, take out of service

Unit: 552 Team Leader or Designee: _____

Test Date	LMVRS Device #	BGMD Serial #	Test Strip #	Strip Exp. Date	
Control Solution #	Control Solution Exp. Date	Test Result	Pass or Fail? If fail, repeat	Repeated Test Result	Fail 2 nd time? Yes, take out of service

Unit: 553 Team Leader or Designee: _____

Test Date	LMVRS Device #	BGMD Serial #	Test Strip #	Strip Exp. Date	
Control Solution #	Control Solution Exp. Date	Test Result	Pass or Fail? If fail, repeat	Repeated Test Result	Fail 2 nd time? Yes, take out of service

Unit: 554 Team Leader or Designee: _____

Test Date	LMVRS Device #	BGMD Serial #	Test Strip #	Strip Exp. Date	
Control Solution #	Control Solution Exp. Date	Test Result	Pass or Fail? If fail, repeat	Repeated Test Result	Fail 2 nd time? Yes, take out of service

Unit: 555 Team Leader or Designee: _____

Test Date	LMVRS Device #	BGMD Serial #	Test Strip #	Strip Exp. Date	
Control Solution #	Control Solution Exp. Date	Test Result	Pass or Fail? If fail, repeat	Repeated Test Result	Fail 2 nd time? Yes, take out of service

Unit: Resp 5 Team Leader or Designee: _____

Test Date	LMVRS Device #	BGMD Serial #	Test Strip #	Strip Exp. Date	



What If Test Fails

Possible Failure Causes

- Test strip or control solution is past the expiration date or is past the discard date.
- Test strip is deteriorated due to heat or exposure to moisture.
- Control solution is not at room temperature or may not be mixed well.
- Incorrect control solution was used.
- Meter could be damaged.

What You Should Do

- Check all expiration dates and discard dates. Do not use expired testing materials
- Run another control test with a new test strip and control solution
- Gently rock the control bottle to ensure the control solution is mixed well
- Make sure you are using Bayer's CONTOUR control solution
- **If result is still out of range, remove glucometer from service and contact LMRS supply officer**

Blood Glucometer Errors



Can result from:

- **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

