COBB COUNTY COMMUNITY SERVICES BOARD

Policy # 9000	Monitoring of Therapeutic Blood Levels
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Related Policies	
Approved: Foster Norman **Foster Norman, Executive Director**	

POLICY:

It is the policy of the Cobb County Community Services Board to ensure that safe and therapeutic drug levels in the blood stream are maintained, measured, and recorded as ordered by the MD/APRN/PA, to aid in the prompt diagnosis, treatment, and maintenance of individual's health. Blood monitoring will be conducted through venipuncture procedure.

PROCEDURE:

A. BLOOD MONITORING:

1. Explain procedure and its purpose to client.
2. Gather equipment needed.
3. Maintain standard/universal precautions throughout the procedure.
4. Obtain blood sample in accordance with Policy # 9019 Venipuncture.

Carbamazepine (Tegretol)

Clinical use:

Carbamazepine is an anticonvulsant. It works by decreasing nerve impulses that cause seizures and pain. Carbamazepine is used to treat seizures and nerve pain such as trigeminal neuralgia and diabetic neuropathy. Carbamazepine is also used to treat bipolar disorder.

Required lab testing:

Liver function tests, TSH and CMP with differential are required pretreatment and should be repeated about 1 month after initiating treatment and at 3 months, 6 months, and yearly. Other periodic tests that should be included are electrolytes, blood urea nitrogen, thyroid function tests, urinalysis, eye examinations, height and weight.

Routine Monitoring Carbamazepine level:

1. Testing should be done 2-5 days after initiation and after every change of dose or formulation or interacting drug. Monthly monitoring is required until patient is stabilized at the target level and then every 6 months.
2. Levels need to be taken 30 minutes before morning dose and should always be taken at the same time to give consistent results.
3. Therapeutic range for Carbamazepine is 4-12 mg/L. Monitor carefully for symptoms of toxicity.

4. If Concentration is low (less than 4): 1. Assess for compliance 2. Recheck in 2-5 days 3. Re-adjust dose if appropriate.
5. If Concentration is high (greater than 12 mg/L): 1. Assess for signs of toxicity 2. Stop medication administration and Send individual/client to Emergency Department for medical clearance when signs of toxicity are present or Level >15 mg/L. 3. Readjust medication
6. Signs of Carbamazepine toxicity: Double vision, seizures, ataxia, headache, nausea, dizziness, stupor, disorientation, urinary retention, vomiting, cardiovascular shock, coma, respiratory depression, tachycardia, hypotension, or hypertension.
7. Monitor for rashes and skin reactions. May indicate hypersensitivity. If toxic epidermal necrolysis or Stevens-Johnson syndrome is suspected, **Stop medication administration and send individual/client to Emergency Department for medical clearance.**

Dilantin (Phenytoin)

Clinical use:
Dilantin is indicated for the treatment of tonic-clonic (grand mal) and psychomotor (temporal lobe) seizures and prevention and treatment of seizures occurring during or following neurosurgery.

Required lab testing:
Monitor CBC, serum Ca, albumin, Vitamin D status, and liver function and kidney function tests prior to initiation and monthly for first seven months, then periodically during therapy.

Routine Monitoring Dilantin Level:
1. Testing should be done 3-4 days after initiation and after every change of dose or formulation or interacting drug.
2. Levels need to be taken 30 minutes before morning dose and should always be taken at the same time to give consistent results. Depending on the state of the individual/client, Dilantin levels are generally monitored at 3- to 12-months intervals.
3. Therapeutic range for total phenytoin is 10- 20 mg/L. Therapeutic range for free phenytoin is 1 - 2 mg/L. Monitor carefully for symptoms of Dilantin toxicity.
4. If Concentration is low (less than 10):
    a. Assess for compliance
    b. Recheck in 5 days 3. Re-adjust dose if appropriate.
5. If Concentration is high (greater than 30):
    a. Assess for signs of toxicity or DRESS 2. **Stop medication administration and send individual/client to Emergency Department for medical clearance when signs of toxicity are present or if level is > 30 mg/L.** 3. Readjust medication 4. **Level at 100 mg/L is Lethal: Activate Emergency protocol, call 911, notify MD/APRN**
6. Signs of Dilantin toxicity: Ataxia, confusion, nausea, nystagmus, slurred speech, hyperflexia, hypoflexia, abnormal gait, tremors, coma, agitation, priapism, mydriasis and dizziness.
7. Assess individual/client for signs of DRESS syndrome: Fever, rash, lymphadenopathy, hepatitis, myocarditis, and Eosinophilia

Lithium

Clinical use:
Lithium is used to treat manic-depressive disorders and the manic phase of affective disorders, including mania. The therapeutic window is relatively small. Therapeutic drug monitoring is useful to optimize dose and avoid toxicity.

Required lab testing:
Evaluate renal and thyroid function, Urinalysis, CBC with differential, CMP, serum electrolytes, and glucose prior to initiation and periodically during therapy.

Routine Monitoring - Lithium Level:

1. Testing should be done 5-7 days after initiation and after every change of dose or formulation or interacting drug. Weekly monitoring is required until patient is stabilized at the target level (usually 4 to 5 weeks) and then every 3 months.
2. Levels need to be taken 12 hours post dose and should always be taken at the same time to give consistent results.
3. Therapeutic range is 0.6 – 1.2mmol/L normally, or 0.8 – 1.0mmol/L (Elderly patients are more sensitive to undesirable effects. Aim for a lower range). Monitor carefully for symptoms of lithium toxicity.
4. If Concentration is low (less than 0.6): 1. Assess for compliance 2. Recheck in 5 days 3. Re-adjust dose if appropriate
5. If Concentration is high (greater than 1.2): 1. Assess for signs of toxicity 2. Assess for dehydration, monitor specific gravity and encourage fluids 3. **Stop medication administration and send individual/client to Emergency Department for medical clearance when signs of toxicity are present.** 4. Readjust the dosage
6. **Signs Lithium toxicity:** Vomiting, diarrhea, slurred speech, decreased coordination, drowsiness, muscle weakness, twitching, confusion, blurry vision, or unsteady gait.

Valproic Acid (Depakote)

Clinical use:
Depakote is used to treat various types of seizure disorders. It is sometimes used together with other seizure medications. Depakote is also used to treat manic episodes related to bipolar disorder (manic depression), and to prevent migraine headaches.

Required lab testing:
Monitor hepatic function, CMP, CBC with differential, and serum ammonia concentration prior to and periodically during therapy. Monitor weight and height if patient gains weight rapidly.

Routine Monitoring - Valproic Acid level:

1. Testing should be done 2-3 days after initiation and after every change of dose or formulation or interacting drug. Weekly monitoring is required until patient is stabilized at the target level and then every 6 months.
2. Levels need to be taken 30 minutes before morning dose.
3. Therapeutic range is 50 – 125 mcg/ml. Monitor for Valproic Acid Toxicity.
4. If Concentration is low (less than 50):
    a. Assess for compliance
    b. 2. Recheck in 5 days
    c. 3. Re-adjust dose if appropriate

5. If Concentration is high (greater than 150):
    d. Assess for signs of toxicity
    a. Re-adjust dose if appropriate
    b. Stop medication administration and send individual/client to Emergency Department for medical clearance when signs of toxicity are preset.
    c. Readjust the dosage
6. **Signs of Hepatotoxicity:**
   Abdominal pain, nausea and vomiting.
7. **Signs of Valproic Acid Toxicity:** Double vision, ataxia, headache, nausea, dizziness, stupor, disorientation, urinary retention, vomiting, cardiovascular shock, coma, respiratory depression, tachycardia, hypotension, or hypertension. **Spontaneous bruising or bleeding indicates the need for a Full Blood Count with Bleeding time and coagulation tests.**

B. LIVER AND KIDNEY FUNCTION MONITORING

PURPOSE:
Liver function tests (LFTs) measure the concentrations of different types of proteins and enzymes in the blood that are either produced by liver cells or released when liver cells are damaged. LFTs can help monitor individual/client response to drugs and other treatments. Kidney function tests screen the blood and urine to assess how well the kidneys are removing wastes and excess fluids from the blood or if the kidneys are damaged. These tests are used to ensure that safe liver and kidney levels are maintained, measured, and recorded as ordered by the MD/APRN/PA, to aid in the prompt diagnosis, treatment, and maintenance of individual/client health. Liver function monitoring will be conducted through venipuncture procedure. Kidney function monitoring will be conducted through venipuncture procedure and urine collection.

Testing Procedure:
1. Explain procedure and its purpose to individual/client.
2. Gather equipment needed.
3. Maintain standard/universal precautions throughout the procedure.
4. Obtain blood sample in accordance with Policy # 9019 Venipuncture.

Routine Monitoring of Liver (Hepatic) Function level:
1. Total Protein: Range should be between 63 – 80 g/L
2. Bilirubin: Range 0.1 – 1.0 mg/dL
3. AST: Range 5 – 40 U/L
4. ALT: Range 7 – 56 U/L
5. LDH: Range 122 -222 U/L
6. Ammonia: Range 15 – 45 u/dL
7. GGT: Range 9 – 48 U/L
8. PT/INR: Range 9.5 -13.8 seconds
9. Albumin: Range 3.5 – 5 g/dL

Routine Monitoring of Kidney (Renal) Function level:
1. Serum Creatinine: Range should be between 0.5 – 1.2 mg/dL
2. BUN (Blood urea nitrogen: Range should be between 10 – 20 mg/dL

3. 24 Hour Urine test
4. Urinalysis

C. BLOOD GLUCOSE MONITORING

PURPOSE:

To ensure that accurate glucose levels are measured and recorded as ordered by the MD/APRN/PA, to aid in prompt diagnosis, treatment, and maintenance of individual/client health. Blood glucose will be checked by using a blood glucose monitoring system.

PROCEDURE:

1. Testing Procedure

1. Assess the individual//client's understanding and ability to perform the procedure.
2. Explain procedure to individual/client as needed and assist/monitor individual/client to complete testing.
3. Gather equipment needed: glucometer, test strips, lancet, lance device, cotton balls/tissues, alcohol pad, results diary or Blood Glucose Tracking Log. (Attachment A)
4. Instruct the individual/client to wash own hands. Staff assisting the individual/client will wash hands and apply gloves.
5. Complete quality control calibration per manual and document on Glucometer Quality Control Form. (Attachment B)
6. Perform blood glucose monitoring as instructed in user manual.
7. Discard lancet in puncture proof container with lid.
8. Staff assisting will remove gloves and wash hands.
9. Document procedure and record findings in individual/client clinical record and on the Diabetic Management Record Form. For abnormal/elevated results, notify site nurse immediately.
10. Wipe Accu-check with 70% isopropyl alcohol and allow to air dry after each use.

2 Glucose Testing at Outpatient Services

a. If a individual/client served at an outpatient site has need for a stat glucose level, the individual/client will be sent to his/her private physician or an emergency room or MD/CNS may order stat glucose to be drawn on-site.
b. In day services and outpatient sites during a nursing assessment the MD/CNS may order a blood glucose on site based upon the individual/client's history and presenting symptoms.

3. Glucose Testing at the Behavioral Health Crisis Center/Crisis Stabilization,(BHCC/CSU)

Individuals/Clients may be placed on routine blood glucose monitoring by order of MD/APRN. Nursing staff will conduct blood glucose monitoring procedure at the intervals ordered by the MD/APRN. Nurses will document the results of the blood glucose monitoring daily. If individual/client is in need of a stat glucose level the MD/APRN may order a stat glucose to be drawn on-site.

4.. Routine Monitoring of Blood Glucose Levels:

1. Levels need to be taken before meals daily at intervals ordered by MD/APRN.
2. Therapeutic range is 70 – 100 mg/dL.

i. If Concentration is low (less than 70 mg/dL):
   a. Assess for signs of Hypoglycemia
   b. Recheck glucose level

ii. If level less than 50 mg/dL:
   c. then Activate Code Blue Medical emergency precautions and call 911.
   d. Notify **MD/APRN immediately**

iii. If Concentration is high (greater than 250 mg/dL):
   a. Assess for signs of Hyperglycemia 2.
   b. Recheck glucose level 3.
   c. If level greater than 400 mg/dL and signs of hyperglycemia are present then activate Code Blue Medical emergency precautions and call 911.
   d. Notify **MD/APRN immediately**

4. **Signs of Hypoglycemia:** Unconsciousness, heavy sweating, weakness, confusion, tremors, coma, incoherent speech, hunger, fatigue, headache, irritability, nervousness, rapid breathing.

5. **Signs of Hyperglycemia:** Frequent or increased urination, thirst, and hunger (classic symptoms of hyperglycemia), dehydration, flushed face, blurred vision, headache, lethargy, fruity breath, Kussmall breathing (Rapid respiration), coma, tachycardia, confusion, nausea, vomiting, decreased level of consciousness, and irritability.

5. Quality control/calibration of glucometer

Material Used

Glucose Control Solutions- 2 levels (High & Low)

Preparation/Storage of Control Reagents

Store between 4-30oC with vials capped. When opening new vial, write date, initials and new expiration date on the vial. Vial expires 90 days after opening. Controls must be at room temperature prior to use.

Frequency

Two levels of QC (High & Low) should be performed in the following situations:

- Every 24 hours
- After a meter has been dropped or damaged.
- When the patient's result contradicts the patient's condition.

How to Test Control Solution /Quality Control

Use **ONLY** Control Solution with Self-Monitoring Meter and Test Strips.

1. Check dates on control solution label and test strip vial label. Do not use control solution or test strips if expiration dates have passed (Control solution - 3 months after first opening or date next to **EXP** on label; test strips - 4 months after first opening or date next to **EXP** on labels.) Discard expired products and use new products.
2. Allow control solution, vial of test strips and meter to adjust to room temperature. Write date first opened on both control solution bottle label and test strip vial label when using for the first time.
3. Gently swirl or invert control solution bottle to mix. **DO NOT SHAKE!**
4. Remove one test strip from vial. Close test strip vial immediately. Use test strip quickly after removal from vial.
5. Insert test strip into Test Port. Meter turns on.

Note: If test strip has been out of the vial too long before testing, an error message appears upon insertion of the test strip into the meter. Release and discard old test strip. Use new test strip for testing.

6. Wait until Drop Symbol appears in Display. Keep test strip in meter until testing is finished.
Note: If test strip is removed before testing is finished, an error message appears. Release and discard old test strip. Use new test strip for testing.

7. With cap removed, turn control solution bottle upside down. Squeeze one drop of control solution onto a clean tissue. Wipe off bottle tip and discard tissue.

8. Gently squeeze a drop of control solution onto a small piece of unused aluminum foil or clear plastic wrap. Dispose after use.

9. With test strip still in meter, touch Sample Tip of test strip to top of drop of control solution. Allow drop to be drawn into test strip. Remove test strip from drop when meter beeps.

10. Dashes appear across the Display to show meter is testing.
Note: If meter does not beep and begin testing soon after drawing up sample, release and discard test strip. Repeat test with new test strip. If problem persists, see Troubleshooting.

11. Compare meter result to Control Test range printed on test strip vial label for level of control solution you are using. If result is in range, System can be used for testing blood. If result does not fall within range, repeat test using a new test strip.
Note: Control Test result shows the Control Symbol in the Display. Test result is outside range, test again. If result is still outside range, system should not be used for testing blood. Call 1-800-803-6025.

12. After result is shown, Strip Release Button flashes. Hold meter with test strip pointing down. Press Strip Release Button to release and discard test strip into appropriate container. Meter turns off.
Note: Removing test strip before result displays cancels the test. An error message appears and the result is not stored in Memory. Retest with a new test strip and do not remove before result is displayed.

Blood Sugar Ranges

For Adults WITH Diabetes	**WITHOUT Diabetes**
Fasting < 100mg/dL	Fasting 70-100mg/dL
Before Meal 70-130mg/dL	
After a meal (1-2 hours post meal) <180mg/dL	
Before Exercise 100mg/dL	
At bedtime 100-140mg/dL	

Insulin Sliding Scale Calculations: Using Regular Insulin
Generally, to correct a high blood sugar, one unit of insulin is needed to drop the blood glucose by 50 mg/dl. This drop in blood sugar can range from 15-100 mg/dl or more, depending on individual insulin sensitivities, and other circumstances.

Correction dose =
Difference between actual and target blood glucose (100mg/dl)
÷ correction factor (50)

Standard Regular Insulin Protocol

REGULAR INSULIN (eg. Humulin-R®) SLIDING SCALE -STANDARD ORDERS
Recommended Indications:

- As a supplement to a patient's usual diabetes medications (long-acting insulin or oral agents) to treat uncontrolled high blood sugars
- For short term use (24-48 hours)

If < 70 Initiate HYPOglycemia Protocol

Blood Sugar	Low Dose	Moderate Dose	High Dose
70-130	0	0	0
131-180	2	4	8
181-240	4	8	12
241-300	6	10	16
301-350	8	12	20
351-400	10	16	24
>400 CALL MD	12	20	28

Related Policies – Policy # 9019 Venipuncture

Individual's Name: ____________________ CID Number

Blood Glucose Tracking Log

CURRENT MONITORING ORDER: Date: ______________ Order: ________________

Date	Before Breakfast		Before Noon Meal		Before Evening Meal		Before Bedtime	
	Blood Glucose	Staff Initials	Blood Glucose	Staff Initials	Blood Glucose	Staff Initials	Blood Glucose	Staff Initials

Signatures of Staff:

Initials	Full Name	Title

Initials	Full Name	Title

Glucometer Identification (Individual's name/CID/or Location/Serial #): _____

GLUCOMETER QUALITY CONTROL

Date	Time of Test	Staff Performing Test & cleaning	Chemstrip Lot #	Glucose Control Solution Lot #	Expected Control Value/Range Low/High		Control Value Obtained Low/High	

Expected control values will vary with each lot number of Chemstrip and should be entered in appropriate box on this sheet. If expected values are not obtained document on this form the corrective action taken. This record is kept for a minimum of 3 years.

Glucometer Location: _____ Month/Year: _____

(Individual's name/CID/or Location/Serial #):

Date	Time of test	Staff signature/title	Chem-strip Lot #	Solution numbers 1	2	3	Normal values 1	2	3	Control values 1	2	3

Expected control values will vary with each lot number of Chem-strip and should be entered in appropriate box on this sheet. If expected values are not obtained document on this form the corrective action taken. This record is kept for a minimum of three (3) years. Expected "normal" and "control" values will vary.