



Lithium

Advancing treatment of bipolar disorder

1. What is lithium?

Lithium is a metallic element that was discovered in 1818. Because it was found in a mineral, it was called 'lithium', which is derived from the Greek word lithos, stone. Lithium is identified by the symbol Li on the periodic table at the position number 3 with an atomic mass of 6.94. Lithium is used in a range of industries, typically in the form of alloys and compounds, since it is extremely reactive. Well known lithium applications include the lithium-ion battery and lithium carbonate tablet for treatment of bipolar disorder and mood stabilization.

Lithium is administered as lithium carbonate, it is completely absorbed by the gastro-intestinal tract; peak serum levels occur 2 to 4 hours after an oral dose. The half life in serum is 48 to 72 hours and it is cleared through the kidneys (excretion parallels that of sodium). Reduced renal function can prolong clearance time. Lithium acts by enhancing the uptake of neurotransmitters, which produces a sedative effect on the central nervous system. Serum lithium concentrations are measured essentially to ensure compliance and to avoid toxicity.

In the diagnostic laboratory, lithium has traditionally been measured using flame emission photometry, atomic absorption spectrometry, or ion selective electrodes. Alborg laboratory is currently using a colorimetric method to measure serum lithium.

2. what is the Medical use of lithium?

Lithium is used as a therapeutic agent mainly for treating the following disorders:

1. Bipolar (manic depression) disorder
2. As mood stabilizing agent
3. Schizophrenia and Alzheimer's Disease

Lithium is the first modern recognized treatment for bipolar disorder and has served a unique role for this and other conditions for over 35 years. It became U.S. FDA-approved for treating acute manic episodes in 1970, and approved for maintenance therapy for patients of manic symptoms in 1974. All

clinical practice guidelines recommend lithium as the choice for acute and prophylactic treatment of manic and mixed states, bipolar depression, and rapid cycling.

3. What are the Side effects of lithium therapy?

Early symptoms of intoxication include apathy, sluggishness, drowsiness, lethargy, speech difficulties, irregular tremors, myoclonic twitchings, and muscle weakness

These symptoms usually settle as the patient's body adapts to the medication.

However, lithium, when existing in excessive amounts in the blood, can be dangerously toxic. Excess lithium can slow or stop breathing, cause seizures, coma and even death. This is because lithium has a very narrow therapeutic window and its effective dose is uncomfortably close to its toxic dose. To avoid lithium toxicity, patients must have their blood levels monitored regularly to assure that they remain within an acceptable therapeutic range. Blood lithium levels need to be monitored more frequently during the early stages of treatment. As the treatment stabilizes, monitoring can occur every two to three months.

4. Why and when are lithium blood levels tested?

Lithium has a narrow therapeutic range (0.4-1.4 mM), and too low of a dosage leads to ineffectiveness and too high leads to severe toxicity. Therefore regular monitoring of the patient's clinical state and serum lithium levels is required to:

- (1) identify and /or prevent potential toxicity associated with high levels .
- (2) assure ongoing efficacy and effectiveness .
- (3) monitor the patient's adherence to the prescribed regimen .

The lithium test may be ordered frequently (every few days) when a patient first begins taking lithium or if a patient is returning to its use after an absence. This is done to help adjust the dose to the desired blood level. The test may be ordered at regular intervals or as needed to monitor blood concentrations. One or more lithium tests may be ordered if a patient starts taking additional medications (to judge their effect, if any, on lithium levels) and may be ordered if the doctor suspects toxicity.

Once stable blood concentrations in the therapeutic range have been achieved, lithium may then be monitored at regular intervals to ensure that it remains in this range.

The test may also be ordered when a patient's condition does not appear to be responding to initial lithium dosage levels in order to determine whether concentrations are too low, the medication is ineffective, and/or to determine if the patient is complying with therapy. It may also be ordered when

a patient experiences a troublesome level of side effects and/or exhibits symptoms that the doctor suspects may be due to toxicity.

Lithium blood levels are generally performed 12-18 hours after the last dose. Since dosage timing varies and some formulations are time released, collection specifics may vary.

5. *Lithium measurement in Alborg medical laboratories*

Lithium, Serum or Plasma : test code 259

Test principle: colorimetric method

Lithium present in the sample reacts with a substituted porphyrin compound at an alkaline pH, resulting in a change in absorbance which is directly proportional to the concentration of lithium in the sample

Performed: Daily

Reported: Within 24 hours

Patient Prep: Specimens are commonly drawn approximately 12 hours after last dose of lithium taken.

Collect:

Serum

Plasma: K₂-EDTA and Na-heparin plasma.

Specimen Preparation: Allow serum to clot completely at room temperature. Separate serum from cells ASAP or within 2 hours of collection.

Storage/Transport Temperature: Frozen.

Unacceptable Conditions: Specimens collected in lithium heparin or sodium fluoride/potassium oxalate. Grossly hemolyzed specimens.

Stability (collection to initiation of testing): After separation from cells: Ambient: 1 day; Refrigerated: 7 days; Frozen: 6 months

Specimen Required:

Reference Interval:

Therapeutic.: 0.6-1.2 mmol/L

Toxic: 2.0 or greater mmol/L

References

1. Monitoring of Lithium. Tietz Fundamentals of Clinical Chemistry. Fifth Edition, Edited by Carl A. Burtis, Edward R. Ashwood, W.B. Saunders Company, 2001: 631-632 (ISBN 0-7216-8634-6).

2. Rumbelow B and Peake M. Performance of a novel spectrophotometric lithium assay on a routine biochemistry analyser. Ann Clin Biochem 2001; 38: 684-686.

3. Use of Anticoagulants in Diagnostic Investigations. WHO Publication WHO/DIL/LAB 99.1 Rev.2. Jan. 2002.

4. Reference Values for Therapeutic and Toxic Drugs. Tietz Fundamentals of Clinical Chemistry. Fifth Edition, Edited by Carl A. Burtis, Edward R. Ashwood, W.B. Saunders Company, 2001: 1023 (ISBN 0-7216-8634-6).