ToxTidbits

Maryland Poison Center
UNIVERSITY OF MARYLAND SCHOOL OF PHARMACY

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The Maryland Poison Center's Monthly Update: News, Advances, Information

Extracorporeal removal of lithium

Lithium is a naturally occurring alkali metal and monovalent cation that has been used medically since the beginning of the 19th century. The mechanism of action is complex and multiple mechanisms have been proposed. Lithium has a small volume of distribution (Vd) and is cleared primarily through the kidneys. Therapeutic ranges of lithium concentrations are between 0.6 to 1.2 mmol/L.

Lithium toxicity can be broken down into 3 categories: acute, chronic, and acute-on-chronic. In acute toxicity, it is most common to see symptoms such as nausea, vomiting, and dizziness. Neurologic symptoms such as ataxia, tremors, and confusion are more common in chronic or acute on chronic toxicity. The most serious concern in lithium poisoning is SILENT (the Syndrome of Irreversible Lithium-Effectuated Neurotoxicity). It is defined as irreversible neurologic dysfunction caused by lithium that persists for at least 2 months after cessation of the drug. The prevalence of SILENT is unknown due to many confounders associated with this diagnosis; in general, older patients and patients with pre-existing neurological disease are at greater risk for SILENT (*Goldfranks' Toxicologic Emergencies*. 2019;11:1016-26).

Treatment hinges on limiting exposure either through preventing absorption or enhancing elimination. Whole bowel irrigation (WBI) started within 1 hour of ingestion showed a 67% reduction in serum concentrations. Sodium containing fluids are recommended as this may increase urine output and prevent lithium reabsorption in the kidneys.

There is much debate related to the use of extracorporeal treatment (ECTR) for lithium removal. Lithium in the blood is readily removed via ECTR. It is a small molecule that has a low Vd and does not bind to proteins. However, there are some characteristics that make hemodialysis (HD) less efficient. Lithium is localized intracellularly and diffuses slowly across the cell membrane. Hemodialysis (HD) removes lithium in the plasma, but slow diffusion from the central nervous system, the site of toxicity, limits removal. This results in rebound in lithium concentrations post HD.

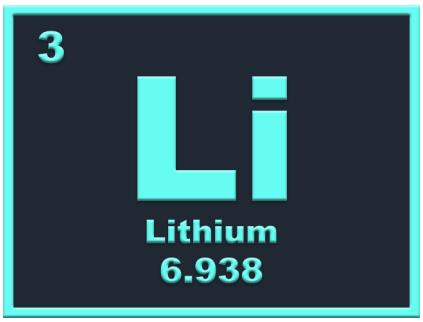
The EXtracorporeal TReatments In Poisoning (EXTRIP) (*Clin J Am Soc Nephrol*. 2015;10:875-87) workgroup recommends HD in:

- Severe lithium poisoning (defined as symptoms such as rigidity, hypotension, coma, myoclonus, seizures, or life-threatening dysrhythmias)
- Impaired kidney function with lithium concentration >4 mEq/L

ECTR is SUGGESTED if lithium concentration is > 5 mEq/L, confusion is present, or expected time to lithium concentration < 1 mEq/L is > 36 hours.

Buckley and colleagues developed a nomogram to determine which patients are at risk of lithium concentration > 1 mEq/L at 36 hours using both renal function and the lithium concentration. In a retrospective study, they reviewed 361 patients with chronic or acute on chronic lithium toxicity. In chronic poisoning the nomogram is a better predictor than acute-on-chronic poisoning. Lithium levels are poor predictors of risk for long-term symptoms when used in isolation (*Br J Clin Pharmacol.* 2020;86:999-1006).

Contact your local poison center at 1-800-222-1222 for individualized treatment recommendations for lithium poisoning.



Did you know?

Lithium concentrations will often rebound after a session of hemodialysis in a patient with chronic lithium poisoning. The rebound is due to redistribution from the central nervous system (CNS) where lithium exerts its primary toxicity. In a paper in 1969, Amdisen and Skjoldborg measured CNS and plasma lithium concentrations before, during, and after a hemodialysis session. They showed the rebound in plasma concentrations, but also that lithium concentrations continuously decreased in the CNS. Most experts recommend checking a lithium concentration approximately 6 hours after completion of a hemodialysis session to make decisions about additional sessions.

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