

Drugs at the Bedside: Lithium

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Patient Case Study

This patient's case study was taken from Foulser et al. (2017)'s journal article from BMJ Case Reports.

Demographics

The patient presented is a 62-year-old man with bipolar disorder and prostate cancer, admitted to a psychiatric unit following concerns of a relapse in the community. He has no known drug allergies. He is regularly taking these medications: lithium 800 mg qHS, trazodone 50 mg qHS, and tadalafil 20 mg qHS (Foulser et al., 2017). He also had a long-standing tremor that started unilaterally, but later became a bilateral fine tremor. There is no family history of mental health disorders. The patient denies smoking, use of alcohol, or illicit drugs. He was living in sheltered accommodation previously, but had to relocate shelter to a train station. Shortly after, he was found by police the next morning, trying to partake in a charity dance class. He was also disorganized, as he lost the bag containing his keys, cell phone, and medication (Foulser et al., 2017).

Chief Complaint

At the emergency department, the patient was experiencing a manic episode characterized by hyperactivity, lack of sleep, agitation, and grandiosity in his thinking. This patient's case was described as a manic relapse of bipolar disorder with clinical lithium toxicity. He was determined to lack insight into his current relapse and was admitted for inpatient care under Section 2 of the Mental Health Act, enabling "patients to be detained in the hospital for a period of assessment and treatment" (Foulser et al., 2017).

History of Present Illness

With other patients and staff in the ED, he was elated in mood and overfamiliar; he was easily agitated and would use the floor of the department to perform exercises. He had not slept in three nights, was not eating well, and had poor concentration. He would appear euphoric and joking, describing himself as “jolly” and “the only way is up”; then, also becoming anxious and pace around, worrying about his belongings (Foulser et al., 2017). His bipolar disorder was first diagnosed 25 years ago and has been reported to be stable on lithium for the majority of that time. He was last admitted to a psychiatric unit due to a stress-related hypomanic relapse; he has not been seen by the community team for 1 year since. This was his first major relapse in 20 years (Foulser et al., 2017).

Review of Pertinent Systems

Review of all organ systems were normal, except for renal impairment. His eGFR ranged between 46-56 mL/min, which was unchanged from a few years ago. His low-risk prostate cancer was being managed conservatively with regular prostate-specific antigen (PSA) monitoring. Full blood count, electrolytes, and liver function tests were normal, as well (Foulser et al., 2017).

Course of Illness

Lithium was initially stopped, replaced by olanzapine 10 mg qHS, but the patient’s mania worsened after 2 weeks. The next treatment was starting sodium valproate (Depakote) and stopping the lithium completely. By stopping lithium, his tremor began improving after 2 more weeks. He remained inpatient for 3 months, with his mental state improving gradually. Olanzapine was increased to 20 mg qHS and he developed EPS such as rigidity and lip smacking; procyclidine was introduced to combat the EPS. The patient was discharged from the

hospital on olanzapine 20 mg qHS and sodium valproate 1,000 mg qHS; he is now receiving community mental health follow-up (Foulser et al., 2017).

The Drug and Administration

Drug Information

Lithium is a single inorganic ion that carries a single positive charge. Although lithium is found naturally in animal tissues, there is no known physiological function of this cation. Trade names of lithium include Lithobid, Lithmax, Lithane, and Carbolith (Burchum, 2019).

Lithium is under the therapeutic class of mood stabilizers and is still the first-line treatment option for those with bipolar disorder. Under the U.S. Food and Drug Administration guidelines, lithium is indicated as a form of treatment for acute manic episodes and maintenance therapy of bipolar disorder. In manic patients, this drug may effectively reduce euphoria and hyperactivity without causing sedative effects (Burchum, 2019). Off-label uses of lithium that are not FDA-approved include vascular headaches, major depressive disorder, and neutropenia (Chokhawala, 2020).

Mechanism of Action

The precise mechanisms of action of how lithium stabilizes mood remains unknown. In the past, research focused on three possible modes of action: (1) modified sodium transport in neurons and distribution of calcium; (2) altered synthesis and metabolism of catecholamines and serotonin; and (3) effects on second messengers like cyclic AMP that influence cascades of intracellular response (Burchum, 2019). Unfortunately, previous research has failed to conclude the exact mechanism, so current research on lithium has shifted the focus to its potential influence on glutamate reuptake and inhibition of glycogen synthase kinase-3 beta (Burchum, 2019).

Pharmacokinetics and Pharmacodynamics

Lithium is well-absorbed after oral administration and becomes widely distributed to all tissues and fluids. It is important to note that lithium may cross the placenta and enter breast milk. Because there is no metabolism of lithium, this drug remains unchanged when it is excreted by the kidneys (Burchum, 2019). Lithium excretion is affected by the level of sodium because the kidneys process these two cations in the same way. Therefore, when the kidney senses low sodium level, it retains lithium in an attempt to compensate and potentially result in lithium toxicity (Burchum, 2019).

To better understand the pharmacodynamics of lithium therapy, side effects can be divided into effects that occur at therapeutic levels and effects that occur at excessive levels. Common side effects are observed at therapeutic level (below 1.5 mEq/L). About half of the patients with chronic use of lithium experience polyuria. Gastrointestinal (GI) distress including nausea, diarrhea, and abdominal pain is another common side effect that is transient and subsides over time. Patients may also develop fine hand tremors that interfere with purposeful motor actions. These tremors can be exacerbated by stress, caffeine and fatigue (Burchum, 2019). Other common side effects include weight gain, renal toxicity, electrolyte imbalances, goiter, and hypothyroidism (Burchum, 2019).

Serious side effects arise when lithium exceeds the therapeutic level 1.5 mEq/L. Early indications of lithium toxicity occur at 1.5-2.0 mEq/L; manifestations include ongoing GI distress, coarse tremors, mental confusion, poor coordination, and sedation (Burchum, 2019). Advanced indications are observed at levels ranging from 2.0 to 2.5 mEq/L, where manifestations are ataxia, extreme polyuria, tinnitus, blurred vision, severe hypotension leading to coma and possibly death. Severe lithium toxicity happens at levels greater than 2.5 mEq/L as

symptoms may progress rapidly to generalized convulsions, coma, and death (Burchum, 2019). Because lithium toxicities closely correlate to the blood serum level of the drug, plasma levels should be monitored routinely to keep it within the therapeutic range.

Patient Teaching

Patients should be instructed to take the medication as directed, even if they experience improvement of symptoms. Education on adequate fluid intake (2,000-3,000 mL) and diet with consistent sodium intake is crucial to patients on lithium therapy (Burchum, 2019). When the kidneys detect low levels of sodium, lithium accumulates as a compensatory mechanism and this may lead to toxicity. Another important point of patient teaching is to review the side effects and signs of toxicity. Patients should also be encouraged to adhere to laboratory appointments so that the provider can monitor the effectiveness of lithium therapy.

Cost of Medication

The average cost for a lithium oral tablet, extended release 300 mg is around \$16 for 100 tablets total. This price is for private-pay patients who do not have insurance coverage for the prescription (Drugs.com, n.d.). For a patient taking the maintenance dose of lithium (3-4 times/day), this cost is quite manageable, as the 100-tablet supply would last a patient for 25 days if they were to take 4 tablets/day.

Drug Administration

In administering lithium, the nurse must first assess the patient's mental status initially and periodically during the drug therapy. These lab tests should be evaluated--renal and thyroid function, WBC with differential, serum electrolytes, and glucose--during therapy. Lithium is administered PO only, in the form of tablets or capsules, and extended-release tablets. Adult dosing for tablets and capsules starts initially at 300-600 mg 3 times daily and the maintenance

dose at 300 mg 3-4 times daily (Vallerand et al., 2017). Nurses should not crush or split the medication when administering to a patient. In order to avoid shortcuts, the best way to begin administration is to assess the patient's mental status by confirming their name and DOB, and assessing their orientation, mood, and behavior for any suicidal ideas. By assessing the patient first, it will save extra steps if lithium toxicity were to occur later and/or the patient escalates their suicidal thoughts into actions.

Atypical Scenario

The case study of the 62 year old male presented at the beginning of this paper demonstrates indicated usage and adverse reaction of lithium therapy. The patient's history of bipolar disorder with manic episodes warrants the use of lithium as the first-line and long-term mood stabilizing treatment. Moreover, this case study highlights the adverse reactions that could happen when the concentration of lithium exceeds therapeutic level.

One factor that predisposes this patient to lithium toxicity is that he takes 800mg qHS as opposed to the usual maintenance dose 300 mg 3-4 times daily. His review of systems also reveals renal impairment. Because kidneys are responsible for lithium excretion, the patient's impaired renal system increases the risk of toxicity due to insufficient removal of the medication. To prevent reoccurrence, ideally, nurses would encourage the patient to follow-up with lab appointments to monitor their lithium levels. However, due to socioeconomic status, the patient might have difficult access to health care services. To assist this patient with accessing health care services, a community health resource such as Programs for Assistance in Transition from Homelessness (PATH) is available to help those with serious mental illnesses experiencing homelessness; they can provide outreach, screening and diagnostic treatment, and community mental health (SAMHSA, n.d.)

References

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