

Original Article

Lithium Monitoring in a VA Hospital : A Quality Improvement Project

Anindita Chakraborty¹, Musa Yilanli², Nicole Stromberg³

Background : Lithium has established efficacy in the treatment of bipolar affective disorder and is one of the few medications known to reduce the risk of suicide. Due to its narrow therapeutic index, drug levels are needed to monitor for toxicity. Long term lithium treatment increases risk of hypothyroidism, hyperparathyroidism and progressive renal insufficiency. As per VA/DoD clinical practice guidelines for management and treatment of bipolar disorder, maintenance therapy requires serum lithium monitoring every 6 months as well as annual Creatinines, TSH and CBCs with differential counts.

Aims : To develop a program to improve the blood monitoring of patients who are on lithium to 75% over an 8-month period at the VA Hospital in Detroit.

Methods : A retrospective audit was conducted in August 2016 of blood monitoring for all patients who were taking lithium at the VA hospital in Detroit and compared it to published guidelines. We then implemented a series of educational programs and reminders to improve the adherence rate. A re-audit was completed in March 2017.

Results : A significant improvement in all suggested monitoring was observed after the reminders and informative educational materials had been delivered. Serum lithium monitoring went up by 28% and overall maintenance monitoring standards went up by 31%.

Conclusions : We were able to demonstrate improvement in the level of adherence in all of the Guideline recommended monitoring parameters at one VA Hospital with the use of educational material and reminders. This program may be practical for dissemination to other hospitals.

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Key words : Lithium, Quality Improvement, Bipolar Disorder.

Bipolar affective disorder is a chronic, recurrent disorder with a lifetime prevalence of approximately 1-3%, it affects men and women equally with a mean age of onset of 19 years¹.

The hallmark of bipolar disorder is episodes of mood elevation and/or depression. The main subtypes of bipolar disorder include bipolar I and bipolar II. Type I with mania and usually recurrent major depression and type II with recurrent major depression and hypomania. Bipolar disorder has an episodic course with varying degrees of intensity and severity, often with prolonged periods of depression and associated comorbid anxiety and substance use. The suicide rate for bipolar disorder is phenomenally high, and patients are at risk of premature death due to medical illness². Treatment of bipolar disorder was revolutionized with the introduction

¹MD, Department of Child and Adolescent Psychiatry, Wayne State University School of Medicine and Corresponding author

²MD, Department of Child and Adolescent Psychiatry, University of Arkansas for Medical Sciences

³MD, Clinical Assistant Professor, Wayne State University School of Medicine. John D Dingell VA Medical Center, Detroit, Michigan

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Editor's Comment :

- Lithium has established efficacy in the treatment of bipolar disorder as well as in preventing suicidality in affective disorders.
- Lithium has a narrow therapeutic index (0.6-1.2 mEq/L) and can lead to acute toxicity with symptoms such as confusion, ataxia, fasciculations, cardiovascular collapse and death.
- Chronic use has been linked to deterioration in renal function as evidenced by decreasing glomerular filtration rate. The incidence hypothyroidism is six-fold higher in patients on lithium as compared to the general population.
- Per the VA/DoD clinical practice guidelines safe and effective treatment with lithium requires monitoring lithium levels every 6 months, as well as annual creatinines, TSHs and CBCs with differential counts.
- Inadequate monitoring could be due to physicians not placing laboratory orders or patients failing to get their blood drawn.
- Adherence to monitoring guidelines may be improved with simple targeted interventions such as EMR reminders and physician and patient education programs.

of lithium in the 1970s and since then, it remains standard of care in the treatment of acute mania and prophylaxis of both bipolar mania and depression. Long term treatment with lithium has also shown to reduce

the risk of both completed suicide and lethality of suicide³. However, since lithium has a narrow therapeutic index (0.6-1.2 mEq/L), drug levels are needed to monitor for toxicity. Chronic use has been linked to deterioration in renal function as evidenced by decreasing glomerular filtration rate. The incidence of hypothyroidism is six-fold higher in patients on lithium as compared to the general population. Lithium is associated with hypercalcemia/hyperparathyroidism⁴. It can also cause increase in white cell lines and platelets⁵. To ensure safe and effective use of lithium, clinical practice guidelines (Table 1) recommend periodic, routine serum monitoring of lithium levels, thyroid stimulating hormone (TSH), and renal function⁶.

Despite the recognized need and availability of guidelines local audits tend to find lithium monitoring inadequate. For instance, one retrospective audit⁷ found that that 7% of patients did not have a lithium level measured, for over a year after lithium was started, and another retrospective audit⁸ showed that 1/3 of the patients had no record of results for urea and electrolytes or TSH in the last year. In 2016, the American Association of Poison Control Centers cited 6,901 reports of lithium toxicity cases; 157 were considered to have major medical outcomes and 3 deaths occurred⁸. In the same year, the Veterans Health Administration (VHA) in America, released a bulletin¹⁰, after a patient who had not had serum lithium level drawn for years and was admitted to the intensive care unit with lithium toxicity. The bulletin noted that 24% of patients prescribed lithium at a local Veterans Affairs (VA) Hospital had not had a lithium level drawn in the past year. The bulletin highlighted the use of VA/DoD

(Veterans Affairs/Department of Defense) guidelines for lithium monitoring, where patients must have a documented serum lithium level in the past 6 months, and an evaluation of renal function, thyroid function and complete blood count (CBC) in the past year¹¹.

This prompted us to examine our lithium monitoring habits at our VA hospital in Detroit. Upon reviewing the National VA Psychotropic medication safety database, we found that adherence to lithium monitoring guidelines at the Detroit VA, was below the national average. This prompted us to initiate a Quality improvement (QI) project aimed at improving lithium monitoring habits at the Detroit VA.

AIMS

We aimed to increase adherence to serum monitoring guidelines in patients on lithium to 75% over a 8-month period at the VA Hospital in Detroit, Michigan, USA.

MATERIALS AND METHODS

Our project is based on the “Plan, Do, Study, Act” framework¹³, which is a cyclical 4 step problem solving model, widely implemented in quality improvement projects (Fig 1).

Our project was conducted between August 2016 and March 2017, at the VA Hospital in Detroit, Michigan. Of note, the VA Hospital system is the largest integrated health care system in the United States, serving Veterans or persons who have served in the United States military.

First, a retrospective Electronic Medical Record (EMR) audit was done on all patients with prescribed lithium over the past year. Each patient’s last lithium levels, TSH, creatinine and CBCs were checked to see if they were completed per VA/DoD monitoring

guidelines. This was recorded categorically as “completed” or “not completed” on Microsoft excel. Since our project was based at a VA Hospital, we chose to apply the VA/DoD guidelines.

Failure to adhere to guidelines was defined as being prescribed lithium but with incomplete implementation of lithium monitoring

Table 1 — Clinical Practice Guidelines for safe and effective use of Lithium

Guideline	Serum Lithium	Renal	Endocrine	Tests
APA	Every 6 months	During first 6 months: every 2-3 months Thereafter every 6-12 months	During first 6 months: once or twice thereafter every 6-12 months	Urea, Creatinine, TFT, ECG
BAP	Every 3-6 months	Every 12 months	Every 12 months	Creatinine, eGFR, TSH
NICE	First year : Every 3 months Thereafter Every 6 months	Every 6 months	Every 6 months	BMI, Urea, Electrolytes, Calcium, eGFR, TSH
ISBD	Every 3-6 months	Every 3-6 months	At 6 months and thereafter yearly	TSH, serum calcium, urea, creatinine, weight
CANMAT	Every 3-6 months	Every 3-6 months	At 6 months and thereafter yearly	TSH, serum calcium, urea, creatinine, weight
VA/DOD	Every 6 months	Every 12 months	Every 12 months	CBC, TSH, Creatinine

APA: American Psychiatric Association; BAP : British Association for Psychopharmacology; NICE : National Institute for Health and Care Excellence; ISBD : The International Society for Bipolar Disorders; CANMAT: Canadian Network for Mood and Anxiety Treatments; VA/DOD: Veteran Affairs / Department of Defense [Table Modified from Malhi et al. (2017)]

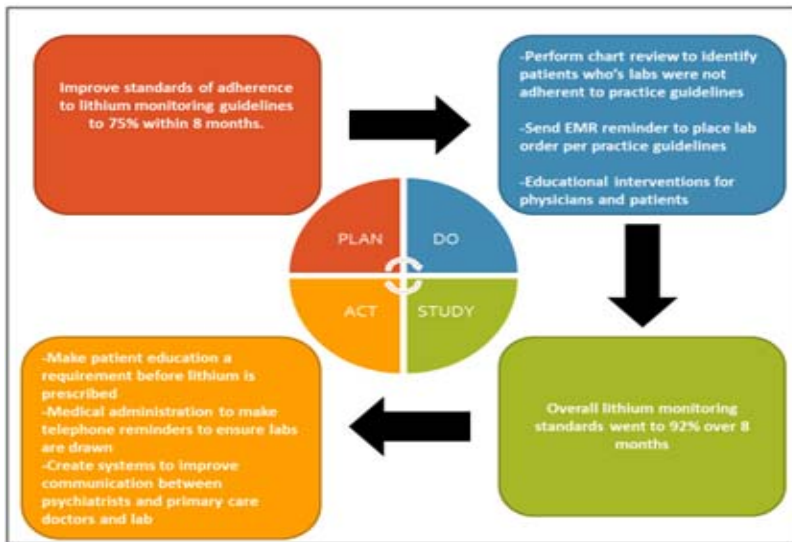


Fig 1

guidelines. Based on EMR review, our QI team determined that barriers to adherence were either physician related, patient related, or procedure related. Patient related barriers included failure to get blood drawn following physician lab orders and failure to attend follow up appointments. Physician related barriers included failure to order laboratory studies per guidelines. (Physicians refer to Psychiatrists as well as primary care physicians (PCPs). Procedural barriers refer to either inadequate communication of test results between labs as well as inadequate communication about lithium monitoring between clinical teams.

As physician and patient barriers were more common and easier to address, we designed the following interventions: an electronic notification reminding physicians that patients' labs were due. These notifications were added manually to the patients' electronic chart, essentially "flagging" certain patients that were delinquent on their labs. Physicians were also provided paper educational materials on VA/DoD guidelines. Interventions for patients included mailing paper educational information, with information on lithium toxicity as well as monitoring schedules with emphasis on getting lab tests in a timely manner. Interventions were placed once, and then after 8 months, and post-audit data was recorded from the EMR. Procedural barriers were not addressed at this time. This project did not require any funding and therefore, there was

no conflict of interest.

RESULTS

Of 107 patients, prescribed lithium, 42 (39.3%) did not have adequate lithium monitoring. Of these 42 patients, 61% had completed all recommended labs per guidelines, 65% had a lithium level drawn, 80% had a TSH, 86% had a creatinine, 86% had a CBC per guidelines. While our pre-intervention analysis included 42 patients, over the span of the project, 7 patients (17%) were dropped ie, 5 stopped receiving lithium, 1 was incarcerated and 1 was transferred to another VA Hospital. Therefore, post audit analysis was conducted on 35 patients only.

Post intervention, adherence to all VA/DoD guidelines increased from 61% to 92%. Specifically, TSH increased to 96%, CBC increased to 98% and serum creatinine increased to 100% (Fig 2). The disparity in the above numbers is because, while some physicians ordered all labs at once, some did not. That would account for the disparity reflected in Fig 2. Of note, this did not affect the analysis of our data.

At baseline physician barriers were noted in 12 cases, patient barriers noted in 21 cases and procedural barriers noted in 9 cases. Post intervention, in 7 out of 12 cases, physicians placed orders per guidelines, and in 14 out of 21 cases patients obtained blood draws.

DISCUSSION

Although there are evidence-based guidelines for the monitoring and prevention of lithium toxicity, optimal

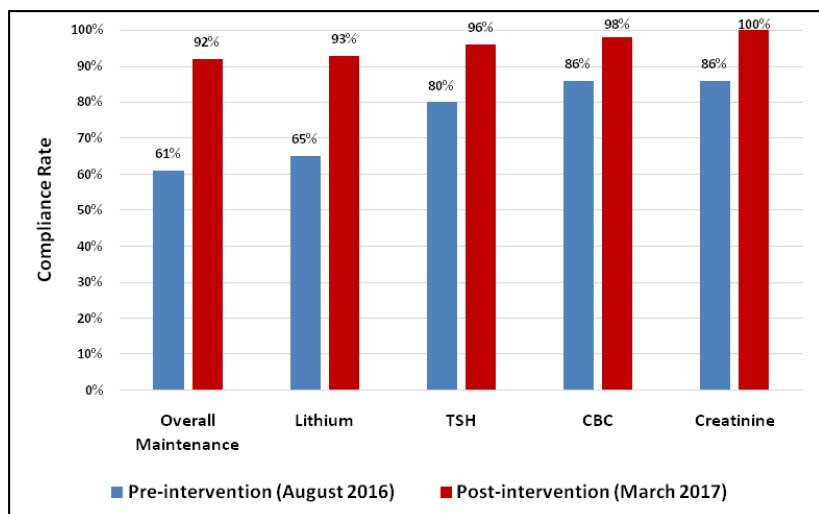


Fig 2 — Guideline Compliance Rates, Pre versus Post Interventions

serum monitoring has been a challenge. Our QI program was able to raise adherence to therapeutic drug monitoring per guidelines to 92% over a period of 8 months. Our interventions were simple and targeted towards prescribers and patients separately.

The EMR reminders and physician education were most helpful, in that, they led to lab orders being placed per guidelines. However, as they were placed simultaneously it was difficult to discern which was more effective. Due to our success, our EMR reminder was permanently embedded as an automatic pop up for all patients being prescribed lithium.

To improve current standards, future interventions will need to be introduced at every step of administering lithium, including initiation, monitoring and follow up. Patient education must be introduced at every level. Use of QI tools such as patient lithium level log-books may be beneficial. Collaboration between Psychiatrists, primary care doctors, laboratories and medical administration is key. Primary care doctors, often monitor kidney and thyroid function and may pick up lithium toxicity early. Since our patient barriers were primarily related to missing follow up, administrative staff may provide telephone reminders, asking that patients with active lithium prescriptions get their labs drawn. A central lithium registry will improve communication and help trend lithium monitoring trends in a better manner.

LIMITATIONS

Limitations to our program include a small sample that was population and locality specific (veterans only). Its setting in a VA Hospital with access to a national VA Psychotropic medication safety database and an EMR with the option of electronic notifications, make it difficult to generalize to other settings. Using our local (VA/DoD) guidelines made comparison of our findings with other audits difficult. Even though all patients had active lithium prescriptions, some had no lithium levels drawn in the past year. This made us wonder if these patients needed lithium monitoring at all. Individual factors such as psychiatric diagnosis, non-compliance, special populations may influence clinical decision making, suggesting that guidelines may not resemble real-world scenarios. In other words, although our QI project raised adherence to monitoring guidelines, this is unlikely to be associated with improved outcomes¹⁵.

CONCLUSION

In conclusion, we showed that quality of health care practice may be improved by simple, low cost interventions such as EMR reminders and education programs. However, enhancing current practices may

require better patient education programs and collaboration between physicians and other stake holders. Finally, feedback from more QI cycles is needed to see if our interventions are sustainable.

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Drs Chakraborty, Yilanli and Stromberg report no conflicts of interest.

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