

Original Publication

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Alcohol Withdrawal and Lithium Toxicity: A Novel Psychiatric Mannequin-Based Simulation Case for Medical Students

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Abstract

Introduction: High-fidelity mannequin-based simulation is frequently used to compliment medical student education during clinical clerkships. However, psychiatric educators have not broadly adopted this modality, focusing rather on standardized patient actors. We developed and delivered a simulation case involving a patient with alcohol withdrawal and lithium toxicity followed by a debriefing session to medical students at the end of their psychiatric clerkship. **Methods:** The case involves a 40-year-old male truck driver with a history of bipolar disorder who presents to the emergency room after a truck accident. The patient is in alcohol withdrawal, which responds to benzodiazepines. A workup reveals that the patient also has lithium toxicity related to the co-ingestion of lithium and naproxen for pain. Participants learn to evaluate and treat alcohol withdrawal, consider medical comorbidities and legal consequences, and complete a brief intervention for substance use. This case requires a simulation mannequin. **Results:** To date, 150 second-, third-, and fourth-year medical students have participated in this case and 76 have been surveyed. Participants have provided a postsession rating of 4.49 on a 5-point Likert scale (1 = *strongly disagree* and 5 = *strongly agree*) on a question about enjoyment, and 3.93 on a question about confidence with evaluation and treatment of patients in alcohol withdrawal. **Discussion:** Psychiatric education currently underutilizes mannequin-based simulation compared to other medical disciplines. Mannequin simulation is feasible and effective in psychiatric education, especially in cases involving medical complexity, as shown in this novel case involving a patient with alcohol withdrawal and lithium toxicity.

Keywords

Psychiatry, Alcohol Use Disorder, Mannequin Simulation, Lithium Toxicity

Appendices

- A. Simulation Case File.docx
- B. Laboratory Studies.docx
- C. Collateral.docx
- D. Differential Diagnosis.docx
- E. Debriefing.docx

All appendices are peer reviewed as integral parts of the Original Publication.

Educational Objectives

By the end of this session, learners will be able to:

1. Evaluate a patient with a complex psychiatric presentation in an emergency setting.
2. Formulate an initial work-up and treatment plan for a patient with alcohol withdrawal and lithium toxicity.
3. Describe the pharmacokinetics of both lithium and alcohol, including how these drug-drug interactions can present clinically.
4. Communicate effectively with team members by working together to collectively complete the simulation.
5. Employ a brief intervention for alcohol use disorder by gathering history and clarifying jargon regarding the nature of alcohol use.
6. Discuss legal and ethical ramifications of maintaining confidentiality versus public safety.

Introduction

High fidelity mannequin-based simulation technology has been shown to be effective in teaching health care practice and delivery in various medical disciplines, including anesthesia and emergency medicine.¹⁻³ As a specialty that relies on thorough history-taking, mental status examinations, and nonverbal cues such as body language and facial expressions, psychiatry continues to prefer the use of standardized patient actors rather than mannequin simulation in educational design.⁴ However, mannequin simulators can represent the physiologic aspects of a patient's illness where live actors cannot, and can allow for the demonstration of real-time autonomous reactions to interventions and therapies.⁵ Full-scale, high-fidelity simulated environments using mannequin simulators can be uniquely effective when complex, rare, or potentially dangerous clinical scenarios need to be accurately portrayed in an immersive clinical setting.⁶ There is some evidence, in fact, that supports the effectiveness of mannequin-based simulation in psychiatry, though there is not a significant amount of literature on the subject.^{7,8}

Patients with psychiatric illness and addiction often have comorbid medical problems or medication side effects that should be carefully considered, especially in emergency settings. Not all medical students are given the opportunity to evaluate and treat patients with such comorbidities in an emergency room during their psychiatry clerkship. Medical simulators are generally available at U.S. medical schools and often underutilized by psychiatry. Thus, we designed a case utilizing a mannequin to simulate an emergency department encounter of a patient with bipolar disorder, alcohol-use disorder, and lithium-induced acute kidney injury to allow students to explore the diagnosis and management of a psychiatric patient with ongoing medical complications. We chose to develop a case that emphasizes overlap between medical and psychiatric conditions to challenge students to think broadly about medical problems that may arise in patients with psychiatric problems.

A search of *MedEdPORTAL* did not find any other psychiatric case that utilized high-fidelity mannequin technology. As previously stated, our case involves a common, yet complex, presentation of a patient experiencing comorbid alcohol use and medical complications. While this is a common clinical scenario encountered by physicians, not all medical students have the opportunity to care for such patients during their brief rotation on psychiatry. We hope that this will be the first of many psychiatric cases utilizing high-fidelity mannequin technology.

The case was delivered as a component of a half-day teaching session at the end of a 12-week integrated primary care/psychiatry clerkship. Our overall goal was to provide an opportunity for experiential learning where students manage psychiatric diagnoses in the broader context of a medically complex patient who concurrently requires therapeutic intervention for both metabolic and behavioral health issues. During their psychiatry clerkship, students have learned about how to employ a brief intervention for hazardous alcohol use, which they are later encouraged to use during this case. All students participated in an introduction to simulation session, which oriented them to the simulation mannequin, the simulation environment, and its capabilities prior to the start of their clerkships.

Methods

Equipment/Environment

This simulation took place within an on-site medical school affiliated simulation center, in an immersive simulation room designed to function as a large adult emergency department patient care room. A SimMan 3G high-fidelity mannequin by Laerdal Medical served as the patient, connected to an adjacent vital sign monitor that simulated real-time physiologic parameters such as heart rate, cardiac rhythm strip, blood pressure monitoring, pulse oximetry, and temperature. The case was preprogrammed and the scenario program was run by a trained simulation technician. A facilitator sat in a room behind a one-way mirror and played the voice of the patient. An initial triage note and other available clinical information (e.g., laboratory results, imaging studies, and collateral information) was displayed in the room on an adjacent monitor as it became available.

The Simulation Case File (Appendix A) includes details regarding the history and physical, instructor notes, and a description of the ideal case flow. Laboratory studies (Appendix B) are also included. Collateral information from the patient's wife is available for students to review (Appendix C).

Personnel

Students participated in groups of four to six individuals. There were two case facilitators; an in-room facilitator served as the moderator and a patient-voice facilitator who played the voice of the patient in an adjacent control room behind a one-way mirror using a microphone. The in-room facilitator paused the case from time to time to provide instructive feedback through broad questioning to steer the case in a direction leading to a comprehensive differential diagnosis (Appendix D). Both facilitators debriefed with students at the end of the session and provided feedback on their performance and medical management. We used senior psychiatry residents and psychiatry faculty members as facilitators. In addition, a simulation technician was also present in the control room to assist with the operation of the computerized scenario and the display of clinical information on the monitors in real time.

Assessment

Before the day began, participants were informed about the formative nature of the simulation within the end-of-clerkship session, and notified that performance did not affect their grade in the clerkship. Students completed surveys before and after the simulation to assess their level of confidence with treating alcohol withdrawal and in delivering a brief addiction intervention in an emergency setting.

Debriefing

The simulation session lasted approximately 25-30 minutes, and was followed by a 20-25-minute debriefing session. The debriefing session followed a standard semistructured script in concordance with a blended approach to maximize learner engagement.^{9,10} First, the facilitators allowed time for participants to reflect on their experience working as part of a team and with the simulation case itself. Facilitators then reviewed the learning objectives from the case and stimulated a discussion on alcohol use disorders, pathophysiology of lithium and nonsteroidal anti-inflammatory drugs (NSAIDs), and legal and ethical considerations (Appendix E).

Results

All students were given the opportunity to complete an anonymous postsession evaluation. To date, approximately 150 students have participated in a total of 30 simulation sessions using this case. Of these, 76 completed a postsession survey. After the session, students rated their enjoyment of the session as 4.49 ($SD = 0.8$), and confidence regarding their ability to identify and initiate management of a patient in alcohol withdrawal as 3.93 ($SD = 0.9$) overall on a 5-point Likert scale where 1 = *strongly disagree* and 5 = *strongly agree*. Examples of student comments from the evaluation include the following statements:

- "I thought the substance use emergency department simulation was great — very realistic, good practice making decisions under pressure."
- "Loved the simulation! It was really fun and I learned a lot. It was also interesting thinking out loud with classmates because you see how they approach patient care and their way of thinking."
- "Hands-on work always appreciated."
- "Really enjoyed the simulation. . . I found it very helpful. . . to perform the group mannequin simulation to work in groups, practice emergency management, and see how other students talk to patients. I appreciated the feedback that we received."
- "Simulation with mannequin made me realize how I was not exposed to an emergency department/consult setting."
- "It would be helpful to have smaller groups."

Discussion

Mannequin simulation is not commonly used in psychiatry education or training. We have developed a case and administered it to undergraduate medical students during an end-of-clerkship teaching session. Our case demonstrates that mannequin-based simulation can be a useful tool in undergraduate psychiatry

education. It provides students the ability to practice identifying psychiatric distress in a medical setting, to evaluate the overlap and interaction between medical and mental health disorders, and to manage psychiatric complaints medically. We have successfully utilized this mannequin-based simulator to teach high-yield topics encountered in psychiatry, which include alcohol use disorder and withdrawal, medication side effects and toxicity (e.g., acute renal failure), ethical and legal dilemmas faced by physicians, and cognitive bias in formation of differential diagnoses.¹¹ While delivering this case, we found that students prefer the challenge of treating a medically and psychiatrically complex patient with guidance from facilitators.

Limitations of our case involve the inability of the mannequin to simulate symptoms of alcohol withdrawal. For example, the mannequin can reproduce a tonic-clonic seizure, but not the mild 6 to 10 Hz alcohol withdrawal tremor. In lieu of the physical finding, facilitators simply tell the students that the patient has a slight tremor. Another limitation is that the group interview format is unrealistic in most clinical settings. However, this approach is more practical and emphasizes team-working skills. The case as described has been modified based on feedback from participants. Originally, we did not include the lithium toxicity component, and procedurally, this case originally simulated alcohol withdrawal only. Based on the feedback from facilitators and participants, we found that the case was too straight-forward. We decided to add the element of bipolar disorder to the case in order to challenge students to think beyond one differential, as many patients are more complex. We chose bipolar disorder because of the pharmacokinetics of lithium and NSAIDs. We think that other cases of psychiatric complexity could also be effectively simulated with mannequin technology.

Potential future simulation cases in psychiatry may involve altered mental status.⁷ They could also involve substance use such as overdose, intoxication, and withdrawal; or medication side effects and toxidromes including serotonin syndrome/neuroleptic malignant syndrome. Future simulation cases in psychiatry could also cover interventional psychiatry, including electroconvulsive therapy. The current literature focuses on standardized patient actors for psychiatric education, mainly through objective structured clinical examinations (OSCEs).^{12,13} This report provides preliminary evidence to show the potential for mannequin-based simulation in psychiatry. Future studies may assess the potential for mannequin-based simulation in evaluative capacities, in teaching students in psychiatry how to work and communicate effectively in teams, and in psychiatric resident education. Future studies are warranted to investigate the quantitative and qualitative efficacy of mannequin simulation in psychiatry compared to traditional standardized patients.

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Ethical Approval

This publication contains data obtained from human subjects and received ethical approval.

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