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Leukemia Blast Crisis: A Simulation Case for Residents

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Abstract

Introduction: Oncologic emergencies are life-threatening and often require advanced team-management skills as well as a mastery of disease processes and therapeutic interventions. Simulation of an oncologic emergency case is a useful way to experience, reflect on, and practice these skills. This case involving a simulated patient in blast crisis was created as part of our Emergency Medicine (EM) Resident Simulation Curriculum at the Perelman School of Medicine at the University of Pennsylvania. **Methods:** This case is based on an actual patient seen in our emergency department and highlights specific teaching points and potential pitfalls in treatment algorithms. It details a 40-year-old female with history of acute myeloid leukemia presenting with fatigue for 2 days, tachycardia, and labored breathing. The patient develops worsening respiratory distress if not intervened upon and progresses to pulseless electrical activity arrest. Lab work is notable for markedly elevated white blood cell count and acidosis. A SimMan or SimMan3G is required for the simulation. The associated debriefing materials are Included in this educational resource. Evaluation of learner performance is mapped to the EM Milestones. **Results:** Eighteen of the 20 (90%) EM residents that participated in this simulation, responded to the Likert-scale postsession survey. Of those who responded, 83% agreed or strongly agreed that the case was realistic and 89% agreed or strongly agreed that the case was useful. **Discussion:** The simulation venue offers a unique opportunity to address team dynamics as well as provide a forum for didactic learning as it is often difficult to debrief a critical case while working in real-time patient care settings.

Keywords

Simulation, Emergency Medicine, Leukemia, Graduate, Blast Crisis

Appendices

A. Simulation Case.docx
B. Visual Stimuli.docx
C. Competency Assessment .docx
D. Instructor Discussion Guide .docx
E. Supply List.docx

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

Educational Objectives

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

1. Organize a patient care team.
2. Recognize life-threatening complications of a patient with blast crisis.
3. Manage a critically ill patient in terms of airway, breathing, and circulation.
4. Discuss the approach to blast crisis treatment.
5. Demonstrate knowledge of complications of transfusion in patients.

Introduction

Although advances in chemotherapeutic agents have reduced the incidence of blast crisis among chronic myeloid leukemia patients, an increasing number of patients suffering from oncologic disease visit our emergency department every year.[1] Acute myeloid leukemia comprises about 40% of leukemias in the Western world and can lead to blast crisis in certain patients.[2] This disease process is a medical emergency, and knowledge of how to manage it is critical.[3] Because of this need, we developed a simulation case based on an actual patient seen in our emergency department to increase awareness of blast crisis management. Simulation offers a unique educational opportunity through experiential learning, as well as the chance to reflect on performance through debriefing.

We have not identified another blast crisis simulation case available for reproduction. A simulation case of a patient with neutropenic fever is also available on MedEdPORTAL to complement this case within an oncology module.[4]

This case is similar in format to other cases published on MedEdPORTAL by the first author and by others,[5-10] and they can be used together to educate graduate medical trainees on varying medical diseases.

Methods

Because our simulation time coincides with weekly emergency medicine (EM) resident conferences, we targeted EM residents. Weekly conference time occurs over a 4-hour block from 8:00 a.m. to 12:00 p.m. on Wednesday mornings. Four cases are run simultaneously on simulation conference days. At the start of the day, the residents are divided into four groups (A, B, C, and D) and scheduled to participate in four simulation cases throughout the morning. See the Table for a sample schedule.

Table. Sample Schedule

	Case			
Time	**1**	**2**	**3**	**4**
8:00-8:55 a.m.	A	B	C	D
8:55-9:50 a.m.	D	A	B	C
10:00-10:55 a.m.	C	D	A	B
10:55-11:50 a.m.	B	C	D	A

A-D indicate the four groups of residents participating in the cases.

This particular case (Appendix A) was run consecutively four times in our simulation center using Laerdal SimMan. Standard supplies (defibrillator, IV supplies, code medications, IV fluids, etc.) were available, as well as lab work and a chest X-ray (Appendix B) for learner use. Besides configuring the mannequin to appear female, no specific moulage was needed. Each case evaluated four to five EM residents per session, for a total of about 20 residents. In our sessions, a PGY3 resident ran the simulator while an EM faculty member observed training from inside the simulation room. The resident, technician, or faculty member running the simulator has to have some knowledge of manipulating the SimMan mannequin. Prior to the session, an EM faculty member experienced in the technical operation of the mannequin met with the PGY3 resident for 1 hour to orient the resident to the mannequin. For our simulations, the faculty member was present in the simulation room to evaluate team performance. No confederates were used; the PGY3 resident played the role of the consultant, and the faculty member provided any additional information from the family. While we chose to run the case along with other simulated cases on a single day, it can easily be performed as a single case with either a single resident or a group of three to five residents.

Supply lists (Appendix E) were prepared in advance for the simulation center staff to facilitate organization. Also included is an instructor discussion guide (Appendix D) that outlines case objectives, team roles, debriefing questions, and more. As mentioned previously, either a resident, technician, or faculty member needs to have experience operating a mannequin; this should be achieved prior to the actual simulation.

Team leader performance was evaluated based upon completion of critical actions as well as the EM Milestones competency assessment form (Appendix C). Both the PGY3 resident and the EM faculty member co-led the debriefing session utilizing advocacy-inquiry questioning and three-phase debriefing.[11] Following discussion about team performance, additional information regarding appropriate medical management of blast crisis was discussed.

Results

This case was run consecutively four times in our simulation center; each case evaluated four to five EM residents per session, for a total of 20 residents. Only EM residents experienced this case. Case evaluations completed by learners were generally positive about the realistic nature of the case, as well as its usefulness. The survey was distributed to the 20 EM residents participating in the simulation to determine their perceptions of the blast crisis simulation case using a Likert scale. We received 18 responses, for a 90% response rate. The responses were anonymous, and participation was voluntary.

Eighty-three percent (83%) of the residents agreed or strongly agreed that the case was realistic. Eighty-nine percent (89%) of the residents agreed or strongly agreed that the case was useful. Select comments made by residents are outlined below:

- "I felt overwhelmed running this case and relied on my team members a lot"—PGY1 resident.
- "I've never seen a patient in blast crisis so this was useful"—PGY2 resident.
- "I liked the discussion of the patho-physiology"—PGY1 resident.
- "I would have liked to run the case with nurses instead of other residents"—PGY4 resident.

In gathering this feedback, we thought that perhaps, for future iterations, it would be helpful to have a more senior resident function in the role of team leader for this case. If possible, incorporating other members of the patient care team (nurses, technicians, etc.) may make the case more realistic.

Debriefing with the two faculty members following this case led to overall positive reactions for the ease of following the debriefing materials and the topics covered. One faculty member stated, "The residents were really engaged and asked a lot of questions." The other faculty member commented on the length of debriefing being a bit too long. Both appreciated not having to run the mannequin.

This case has not been used by other programs in our institution but could be a valuable resource for other residents who rotate through the emergency department.

The competency-based assessments of team leader performance have been incorporated into each resident's portfolio. The assessments have been deemed a valuable rating method by the clinical competency committee, as well as by the individual learners, who can access their assessments through our online data-management system, MedHub.

Discussion

This simulation case was well received by both learners and faculty and is likely a valuable resource for other EM residency programs as well as any residency program that has its learners rotate through an emergency department. The case, along with other EM-based simulation cases published on MedEdPORTAL, contributes to providing a collection of high-acuity, low-frequency cases for a simulation curriculum.

This case has not been used to formally evaluate residents for promotion. The evaluation form is mapped to the EM Milestones based on performance of critical actions. Information has been collected about team dynamics as well as completion of critical actions in an effort to target debriefing strategies. Perhaps, in the future, we can use simulation to target areas of weakness in participants and tailor education to meet their needs.

This case has not been used in situ and would potentially be a good case to run within the hospital environment with actual staff (nurses, technicians, residents, etc.). Simulation training in situ offers the unique benefit of targeting team dynamics among team members who actually work together in the clinical environment.

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