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Shoulder Dystocia and Neonatal Resuscitation: An Integrated Obstetrics and Neonatology Simulation Case for Medical Students

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Abstract

Introduction: The new model in medical education of longitudinal clinical clerkships can be complemented by high-technology simulation, which provides a safe space for learners to consolidate clinical knowledge and practice decision-making skills, teamwork, and communication. We developed an interdisciplinary training intervention including a simulation case and structured debriefing to link clinical content between pediatrics and obstetrics at a major academic medical center. **Methods:** In this case, a 38-year-old female at 38 weeks gestation presents with onset of labor complicated by shoulder dystocia. After the appropriate maneuvers, a depressed neonate is delivered and requires resuscitation. Major equipment needed includes a high- or low-technology birthing mannequin and an infant mannequin. **Results:** Fifty-four third-year medical students participated in this simulation-based intervention at the completion of their integrated pediatrics and obstetrics clerkship. Ninety-one percent of students agreed that the shoulder dystocia simulation was designed appropriately for their learning level and enhanced their ability to handle a risky delivery. Ninety-four percent agreed that the neonatal resuscitation simulation was designed appropriately for their learning level, and 89% reported an enhanced ability to handle a similar situation in the clinic following the intervention. The average overall ratings were 4.24 ($SD = 0.61$) and 4.06 ($SD = 0.89$) on a 5-point scale (1 = *poor*, 5 = *excellent*) for the obstetrics and pediatrics simulations, respectively. **Discussion:** The integrated obstetrics and pediatrics scenario is feasible to run and clinically accurate. Two distinct areas of medicine in the third-year curriculum are logically incorporated into one cohesive simulation-based training intervention that students found positive and realistic.

Keywords

Shoulder Dystocia, Handoffs, Pediatrics, Neonatal Resuscitation, Obstetrics, Gynecology, OB/Gyn

Educational Objectives

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

1. Evaluate an emergent obstetric or a pediatric clinical scenario.
2. Establish a plan to manage labor and perform delivery maneuvers in an obstetric scenario complicated by shoulder dystocia or to manage the resuscitation of a depressed newborn infant.
3. Demonstrate communication skills with team members of similar and different disciplines.
4. Synthesize clinical information to convey an appropriate message to a patient's family.

Introduction

Longitudinal integrated clerkships are emerging as a new model for medical education.^{1,2} As compared to traditional discipline-specific block rotations, a curriculum that emphasizes continuity among different learning experiences is thought to better prepare students for the modern health care setting, which demands increasing levels of professionalism, communication, and teamwork across disciplines.^{3,4} Linking

Appendices

- A. Student Instruction Sheet .docx
- B. Patient Chart Note.docx
- C. Prebrief and Debriefing Materials.docx
- D. Simulation Image.pdf
- E. Critical Actions Checklists .docx
- F. Shoulder Dystocia Simulation Guide.docx
- G. Neonatal Resuscitation Simulation Guide.docx

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

clinical content across multiple disciplines also allows students to encounter key clinical scenarios multiple times and to strengthen core competencies over time.

As medical schools redesign their curricula to become more collaborative and interdisciplinary, high-technology (high-fidelity) simulation can be used to complement clinical training in several ways. First, simulation allows learners to consolidate clinical knowledge, reasoning, and skills in a realistic and immersive environment. Second, learners can be exposed to critical care experiences in a safe and protected space. Finally, learners are able to practice teamwork and shared responsibility for accomplishing a common goal in patient care and management. This includes practice of commonly used but seldom taught skills, including intraprofessional and intrateam communication with verbal handoff and transition of care.

An interdisciplinary simulation-based training intervention involving a simulation exercise and structured, faculty-led debriefing was developed as an opportunity to link curricular content between pediatrics and obstetrics. The simulation content and organization were based on previous clinical experience and feedback from medical students in our institution's integrated women and children's health clerkship, which includes both obstetrics/gynecology and pediatrics rotations. Students expressed interest in having a more integrated exercise that involved both specialties.

The target participants were third-year medical students at the completion of their obstetrics and pediatrics clerkship components. Shoulder dystocia and neonatal resuscitation were chosen as the clinical scenarios for simulation as these are high-risk, critical situations across both disciplines. Many students will not have been exposed to these scenarios during the 3-month clerkship experience due to their relative infrequency. Also, when the critical events do occur, students more typically assume the role of an observer and are seldom in leadership or decision-making roles.

Simulation has been used extensively to improve learner clinical competency and teamwork behavior in scenarios of labor and delivery⁵⁻⁸ and in neonatal resuscitation.⁹⁻¹¹ Published obstetric simulation interventions have separately addressed labor and delivery,¹² shoulder dystocia,¹³ and obstetrics handoffs.¹⁴ Published pediatric simulation interventions have addressed respiratory distress¹⁵ and pediatric resuscitation¹⁶ but have been targeted towards management of infants beyond the perinatal period. There are currently no published simulation-based interventions that bridge the gap between obstetrics and pediatrics, disciplines that uniquely overlap and require shared skill sets during acute and rapidly evolving clinical situations. Our simulation-based intervention fills this void by providing a multidisciplinary simulation-based training intervention for practicing skills learned in both obstetrics and pediatrics clerkships. Additionally, our intervention provides a unique opportunity to practice the full spectrum of professional communication. Learners communicate within a team using specialty-specific vocabulary and then synthesize clinical information to communicate with members of a different specialty as well as with family members.

Methods

The integrated simulation-based training intervention is designed for a small group of four to six third-year medical student learners divided into two teams of two to three students each. The training intervention spans 1 hour, allowing for a 15-minute prebrief to establish expectations and standards, a 15-minute simulation exercise, and a 30-minute small-group debriefing. Prior to the session, students should be informed of the topics of simulation (i.e., labor and delivery, neonatal resuscitation), learning objectives, and schedule. However, students should not be made aware of their assigned group until arrival at the simulation center. Students are expected to prepare by reviewing general didactic material from the clerkships, clinical skills learned from a prior simulation session focusing on shoulder dystocia and overall delivery maneuvers, and a preassigned reading on neonatal resuscitation guidelines.¹⁷

Upon arrival, participants are assigned to either the obstetrics or the pediatrics team and review the corresponding student instruction sheet (Appendix A) and patient chart note (Appendix B). During a

prebrief discussion (Appendix C), faculty facilitators introduce expectations for working in the simulated environment and logistics for the training intervention. Faculty facilitators then give students a hands-on introduction to the simulator, and the students are permitted a brief time to familiarize themselves with the simulation room, including the mannequin, room setup, and other equipment. When the simulation exercise is ready to begin, students assigned to the pediatrics team leave the simulation room and observe the labor scenario from the control room. The simulation begins with students on the obstetrics team receiving a report from the nurse. The students then interview the patient and manage the obstetrics clinical scenario. Relevant simulation images for the obstetrics scenario are provided in Appendix D.

After the delivery of the baby, the students give a formal verbal handoff in transition of care to the pediatrics team members, who have been called to enter the scenario. The entering pediatrics team assumes care of the neonate and manages the clinical scenario, with communication to both the obstetrics team and the parent about the neonate's status signaling the end of the simulation. This design allows learners to practice a comprehensive, patient-centered, and team-based approach to patient care from receiving a handoff to managing a clinical problem, as well as summarizing clinical care to members of a different discipline, patients, and family members.

Prior to the session, faculty facilitators are provided with debriefing materials (Appendix C), a critical actions checklist (Appendix E), and simulation guides (Appendices F-G) with complete simulation details. Information in these documents is designed to help faculty guide students through the simulation and debriefing discussion.

Equipment/Environment

Shoulder dystocia: The simulation may be completed with a high-technology birthing mannequin or, if that is unavailable, a part-task birthing pelvis. The mannequin should be dressed in a hospital gown and placed supine on a single delivery bed so that students can practice bed breakdown. Two monitors are required—one for maternal telemetry monitoring (e.g., blood pressure, heart rate, respiratory rate) and one for fetal tracing (e.g., fetal heart rate and tocometry for contraction monitoring). Other supplies include IV fluids and tubing, bed sheets, gloves, and a stool for the McRoberts maneuver.

Neonatal resuscitation: A single infant mannequin, which can be either high or low technology, should be placed on an infant warmer, with a pediatric code cart available nearby. Essential items include a radiant warmer, infant cap and blankets, neonatal facemask and bag valve mask for positive pressure ventilation, oxygen tubing, bulb suction or suction catheter, EKG monitoring leads, and a pulse oximeter. Additional items to consider may include equipment for obtaining IV access and intubation equipment such as a Miller 1 laryngoscope blade, three to five uncuffed endotracheal tubes, stylet, and a colorimetric CO₂ detector.

Personnel

The simulation requires two scripted roles—one nurse and one laboring patient—that can be played by other medical students, faculty, or staff not serving as learners. One or more faculty members are required to serve as facilitators/debriefers. Ideally, a fourth person is also available to serve as the simulation technologist to manipulate the vital sign and telemetry monitoring, as well as to alter the physiologic status of the infant mannequin based upon the scenario flow and participant actions.

The nurse gives reports, assists in carrying out orders, and prompts learners with information as needed based on the scenario flow and desired responses. The laboring patient provides the appropriate history and exam responses. If a part-task birthing mannequin is used, the patient actor holds the infant mannequin in the pelvis until all shoulder dystocia maneuvers are complete and then facilitates the delivery. Scripting is critical to ensure a standardized interaction for all learner groups. Any member of the simulation team, including nonmedical personnel familiar with the simulation, upper-level medical students, residents, fellows, or attendings, may fulfill the roles of the nurse and laboring patient.

A faculty facilitator is needed to elicit students' clinical reasoning skills and guide the interactive discussion during the debriefing to ensure that the relevant cognitive, technical, and behavioral learning objectives are achieved. In our experience, the integrated simulation is particularly valuable when each scenario is guided by a faculty facilitator from the corresponding clerkship—one from obstetrics and one from pediatrics. By participating in the simulation, facilitators are able to provide students with real-time feedback following the simulation.

Assessment

Faculty facilitators provide detailed formative assessment using the critical actions checklist as a means of guiding feedback and stimulating reflection. Learning objectives and behaviors on the critical actions checklist are thoroughly discussed with students. Items for the critical actions checklist were created based on existing published clinical guidelines¹⁸ and expertise of the faculty group and also have been adapted over several iterations. Members of the group came to a consensus to include items that were important, necessary, and within the scope of knowledge for third-year medical students. The checklist was not developed as a summative assessment tool and currently lacks sufficient validity evidence for this use.

Debriefing

The small-group debriefing session should occur immediately following the completion of the neonatal resuscitation exercise. All learners (i.e., students from both the obstetrics and pediatrics teams), faculty members, and other participants should be included in this session, which may occur in the simulation space or in a separate room. The 30-minute session is framed around a three-phase debriefing model that includes distinct phases of defusing, discovering, and deepening understanding of the key concepts.¹⁹ In this model, learners are offered a safe space to reflect on and analyze the experience as well as to highlight key learning objectives.

Faculty facilitators begin the defusing phase of debriefing by prompting the learners, "How do you think the simulation went?" Each learner should be given an opportunity to reflect on both individual and team performance, focusing on what was done well and what could have been done differently. This period of reflection is intended to allow students to consider and clarify their thinking as well as to release any emotional tension.

Following self-reflection, faculty facilitators begin the discovery phase by reviewing simulation events and reinforcing specific teaching points. Given that the simulation is intended for third-year medical students, focus should be placed on educational aspects of clinical management of obstetrics and neonatal patients. Topics for discussion of the obstetrics case should include cardinal questions for labor, recognition of the need for immediate delivery, shoulder dystocia maneuvers, and risk factors for macrosomia. The neonatal resuscitation discussion should include essential prebirth information during verbal handoffs between obstetrics and pediatrics teams, preparation of the resuscitation equipment, steps of the neonatal resuscitation algorithm, risk factors for neonatal resuscitation, and relevant procedures (i.e., technique for suctioning the oropharynx, providing tactile stimulation, providing effective bag valve mask ventilation, and incorporating ventilation corrective steps). Additional discussion should include communication between the obstetrics and pediatrics teams, as well as the relay of information to a distraught family member. Effective leadership and teamwork behaviors should also be addressed.

At the conclusion of the debriefing session, students are asked to summarize one important learning point that they will take away from the simulation session. The faculty facilitators also review the major learning objectives for the simulation. This deepening phase allows learners to solidify new information or mental models learned during simulation and to connect this information to the larger clinical environment.

Results

Fifty-four third-year medical students participated in this simulation-based training intervention at the Yale Center for Medical Simulation at the conclusion of their combined clerkship in obstetrics and pediatrics.

Students were surveyed following completion of the simulation-based intervention (Figure). The anonymous survey included eight questions and utilized a 5-point Likert scale where 1 = *strongly disagree* and 5 = *strongly agree*. Two additional questions included overall rating of each simulation section and utilized a 5-point scale where 1 = *poor*, 2 = *fair*, 3 = *average*, 4 = *good*, and 5 = *excellent*. For the shoulder dystocia simulation, 91% of students agreed that the simulation was designed appropriately for their learning level and enhanced their ability to handle a risky delivery. The average overall rating was 4.24 out of 5 ($SD = 0.61$). For the neonatal resuscitation simulation, 94% of students agreed that the simulation was designed appropriately for their learning level, and 89% reported that the simulation enhanced their ability to handle a similar situation in the clinic following the intervention. The average overall rating was 4.06 out of 5 ($SD = 0.89$).

Figure. Simulation participation and survey completion. Fifty-four total students (27 in each group) completed the survey after participation in the corresponding simulation case. In addition, a crossover group of seven students completed the survey after observation of the opposite simulation case and participation in the debriefing.

Student feedback following the simulation was predominantly positive:

- “Awesome sim! Learned a lot that I didn’t necessarily see in L & D or triage of active labor. Helped solidify my lessons and made it seem very real. Feeling these nerves in a safe space makes me feel much more prepared for a real-world situation.”
- “Very useful to assume the leading role and see what it feels like.”
- “I really liked the idea of joining an ob and peds scenario. It was at our level, and I felt that I learned a lot not only about the protocol, but also about communication with patients and our classmates.”
- “Very fun and engaging. Much better than reading a book! I feel like what I learned in the sim session will stick around in my brain much longer. This also provided a safe space for something that we may not always get to do independently as medical students.”
- “I really enjoyed seeing how pediatrics and OB/Gyn came together to take care of the mother and her baby. I also appreciated the opportunity to experience both sides of taking care of a shoulder dystocia case and understanding what information is crucial during the transition from one team to another.”

Common themes for improvement included having the simulation earlier in the clerkship and having more time to complete or repeat the simulation.

- “I wish we could run through the short sim at least twice because I felt doing this for the first time, I could improve and learn a lot more by applying what I learned immediately in a second chance. I just felt it was a bit too short. But I really appreciate the high faculty:student ratio—lots of support.”
- “Move this to sometime earlier in the clerkship or cover the resuscitation material through a simulation prior to this session.”
- “I felt the actual sim session was too short. Would be great to see the entire process of resuscitation.”
- “I think re-doing the sim a second time after switching roles would be ideal, but I recognize that there are time constraints.”

- “After a practice in a safe environment like this where faculty are involved, it would be nice to do a follow up mock code so that we can continue to build our confidence in these scenarios and carry out tasks in an efficient and rapid manner.”

Seven faculty members with expertise in patient simulation, medical education, obstetrics/gynecology, and pediatrics developed this case over the course of 6 months. Facilitators implementing the case have included three obstetrics/gynecology attending physicians and two neonatal intensive care attending physicians. Preparation time for facilitators included reviewing the instructor’s guide and clarifying expectations and plan for debriefing with other facilitators. Participating faculty became well versed in checklist items through repeated observations of the simulation and found that the checklist did not require real-time completion to serve as an assessment tool. Checklist items were instead used to guide formative discussion during the debriefing session.

Discussion

This simulation-based training intervention provides an opportunity for a collaborative multidisciplinary and continuity-based approach to managing a complicated maternal delivery and sick newborn. Students found the training was appropriately designed for their learning level and enhanced their ability to handle complicated obstetrics and neonatal clinical scenarios. Most students valued the exposure to a critical situation that they had not previously encountered during their 3-month clerkship. Based on feedback from students and faculty, the intervention was feasible and cohesive. The entire simulation and debriefing can be accomplished in 1 hour and accurately represent the real-life clinical flow in the delivery room.

We provided formative assessment using direct observation and real-time feedback from faculty members who served as facilitators during the simulation. Students were informed at the beginning of simulation that their performance would not be used as a competency evaluation and would not be included in their official evaluation. The understanding that the simulation was a safe space in which to make mistakes and ask questions was distinctly emphasized in the prebriefing discussion before the start of the simulation. The critical actions checklist was developed as a guide for discussion and reflection, as opposed to being a performance assessment tool. This checklist could be adapted to serve as a summative assessment of clinical skills depending on the needs of the clerkship. However, it would need further validity evidence prior to that application.

The simulation-based training intervention was held in a dedicated simulation center with high-technology mannequins and equipment. Students benefited from the realistic simulation of patient management and handoff. However, there can be a large variation in the space and availability of resources. Strategies to increase the realism of the simulation could include implementation in situ in a labor and delivery room rather than a simulation room. If possible, other members of an interprofessional team such as a registered nurse or respiratory therapist could serve as supplementary personnel during the simulation. These additional team members would likely provide further depth of feedback on communication during the debriefing session.

Two drawbacks expressed by students were the short amount of time allotted for the actual simulation and the placement of the training intervention at the end of the integrated obstetrics and pediatrics clerkships. However, we feel that the collaborative simulation-based training intervention is most useful at the end of the clerkship so that all participants have similar clinical exposure and background knowledge to complete the scenarios. Much of the utility of practicing shoulder dystocia maneuvers, for example, would be lost on a student who has not been exposed to labor and delivery. We also believe that the 15-minute duration accurately simulates the real-life clinical scenario of an obstetric emergency and a subsequent neonatal resuscitation. This time period allows students to participate in only one of the two scenarios and observe the other. We have attempted to provide comparable education to both sets of students during the comprehensive debriefing session in which knowledge and decision-making skills are reviewed from the start of the shoulder dystocia case to the end of the neonatal resuscitation case. However, we recognize the advantages of experiential learning obtained through active participation in

both simulation cases. Future iterations of the simulation may include the opportunity to run through the simulation more than once, with students switching between the obstetrics and neonatology teams should time permit.

Many students also had difficulty with appropriate verbal handoff between the obstetrics and pediatrics teams. The inclusion of the patient handoff was designed to provide students with a realistic and immersive experience requiring professional communication and teamwork. Faculty observed that some students were preoccupied with clinical decision-making. These students needed additional guidance to process the entirety of the obstetrical scenario and to transition appropriately processed information as required by the pediatrics providers. Similarly, the pediatrics team sometimes struggled with asking for information directly relevant to neonatal resuscitation. In our experience, these difficulties can be overcome by a brief clinical pause from the faculty facilitator to guide the students' actions during the case, with subsequent focus on effective handoffs during the debriefing. Reading materials, didactics, or targeted experiences related to handoff skills could also be developed for students during their rotation. Prior work has demonstrated the feasibility of simulation in the assessment of medical student handoff skills as well as showing that educational intervention can demonstrably improve these skills.²⁰⁻²²

The integrated obstetrics and pediatrics simulation is feasible to run and clinically accurate. Two distinct areas of medicine in the third-year curriculum have been logically incorporated into one simulation-based training intervention so that students can practice interdisciplinary teamwork and communication. Students appreciated the realism of the simulation as well as the formative, low-stakes approach to evaluation. Possible future directions could include development of scenarios for other combined, integrated medical student clerkships or at the graduate medical education level to incorporate simulation of patient care and communication with a variety of receivers, including inter- and intraprofessional team members, patients, and families.

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