

SIMULATION

High Fidelity In Situ Shoulder Dystocia Simulation

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ABSTRACT:

Audience: Resident physicians, emergency department (ED) staff

Introduction: Precipitous deliveries are high acuity, low occurrence in most emergency departments. Shoulder dystocia is a rare but potentially fatal complication of labor that can be relieved by specific maneuvers that must be implemented in a timely manner. This simulation is designed to educate resident learners on the critical management steps in a shoulder dystocia presenting to the emergency department. A special aspect of this simulation is the unique utilization of the “Noelle” model with an instructing physician at bedside maneuvering the fetus through the stations of labor and providing subtle adjustments to fetal positioning not possible through a mechanized model. A literature search of “shoulder dystocia simulation” consists primarily of obstetrics and mid-wife journals, many of which utilize various mannequin models. None of the reviewed articles utilized a bedside provider maneuvering the fetus with the Noelle model, making this method unique. While the Noelle model is equipped with a remote-controlled motor that automatically rotates and delivers the baby either to the head or to the shoulders and can produce a turtle sign and which will prevent delivery of the baby until signaled to do so by the instructor, using the bedside instructor method allows this simulation to be reproduced with less mechanistically advanced and lower cost models.¹⁻⁵

Objectives: At the end of this simulation, learners will:

1. Recognize impending delivery and mobilize appropriate resources (ie, both obstetrics [OB] and NICU/pediatrics)
2. Identify risk factors for shoulder dystocia based on history and physical
3. Recognize shoulder dystocia during delivery
4. Demonstrate maneuvers to relieve shoulder dystocia
5. Communicate with team members and nursing staff during resuscitation of a critically ill patient

Method: High-fidelity simulation.

Topics: High fidelity, in situ, Noelle model, precipitous delivery, shoulder dystocia.



USER GUIDE

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Learner Audience:

Medical students, interns, junior residents, senior residents

Time Required for Implementation:

Instructor Preparation: 1-2 hours to review subject materials, set up mannequin

Time for case: 15-20 minutes for single case

Time for debriefing: 10-30 minutes per case

Recommended Number of Learners per Instructor:

3-4

Topics:

High fidelity, in situ, Noelle model, precipitous delivery, shoulder dystocia.

Objectives:

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

1. Recognize impending delivery and mobilize appropriate resources (ie, both obstetrics [OB] and NICU/pediatrics)
2. Identify risk factors for shoulder dystocia based on history and physical
3. Recognize shoulder dystocia during delivery
4. Demonstrate maneuvers to relieve shoulder dystocia
5. Communicate with team members and nursing staff during resuscitation of a critically ill patient

Linked objectives and methods:

Precipitous deliveries in the emergency department are low frequency and potentially high-acuity scenarios that require appropriate resource mobilization and specific skill sets not often practiced on a day to day basis. With prompt recognition of shoulder dystocia and appropriate maneuvers, infant morbidity and mortality are greatly reduced.^{6,7} If done *in situ* in the physical emergency department, this will serve to educate and prepare ancillary staff as well. This simulation enables learners to fortify vital though seldom used skills in a safe and structured environment with subsequent feedback and debriefing, further engraining the lessons learned.

Recommended pre-reading for instructor:

- Video of the actual simulation with edits explaining maneuvers in real time. This video was created in the simulation center of the author's home institution:
 - University of Missouri-Columbia Department of Emergency Medicine. Shoulder dystocia simulation [Video]. YouTube. https://youtu.be/neW_CuJQSEo. Published Jan 29, 2018. Accessed Mar 17, 2018.
 - Special thanks to Joseph D. Pauly for his help with the video on this project.
- Animated video with great detail demonstrating the anatomy of a shoulder dystocia:
- Trial Exhibits, Inc. Shoulder dystocia medical animation [Video]. YouTube. https://www.youtube.com/watch?v=j_bibDLPW98. Published Mar 11, 2011. Accessed Mar 17, 2018.
- Video showing live birth with maneuvers to overcome dystocia, also gives background information on epidemiology, evidence behind techniques to relieve dystocia, salvage techniques if all else fails:
- Martínez Ó. Steps to overcome shoulder dystocia [Video]. YouTube. https://www.youtube.com/watch?v=t45V_WonEn8. Published Mar 25, 2014. Accessed Mar 17, 2018.
- Great review with up-to-date references to help the presenter be ready to run the case well and answer any questions. Also reviews various difficult birth situations (breech, cord prolapse). Also, for learners who enjoy written explanations with diagrams, this is a great resource that can also be sent out after the simulation is completed to solidify the learning points:
 - Linker J, Tems C, Scott KR. The complicated delivery: what do you do? In: emDocs. <http://www.emdocs.net/the-complicated-delivery-what-do-you-do/>. Updated September 29, 2016. Accessed March 17, 2018.

Results and tips for successful implementation:

This simulation has been run twice with a total of approximately 20 learners (in groups of 2-3 at a time). It has been well received by all participants. As we ran the simulation during shift change to improve the "buy in" and realism, there was initially some discontent from night shift residents, but after the simulation they reported it felt more real than other simulations. Increased "buy in" and realism can help encourage intended learning points to stick.

We recommend doing this simulation in ED with the help of ED staff (ie, nursing and technicians) as this increases case fidelity and helps with "buy in."



USER GUIDE

- In order to make this as close to reality as possible, we performed this at shift change in order to maximize participants. We ran the case twice, once for the night shift and the other for the day shift.
 - We discussed the case with the charge nurse ahead of time so she could make sure we had a room available and could assist as a confederate in providing an EMS prehospital call.
 - We had the charge nurse serve as a confederate with the EMS report of impending precipitous delivery with 5 min estimated time of arrival (ETA).
 - In setting the case this way, learners were forced to evaluate what resources we had available, what tools were needed, who should be called, and where necessary equipment (such as the infant radiant warmer) could be found.
8. Politi S, D'Emidio L, Cignini P, Giorlandino M, Giorlandino C. Shoulder dystocia: an evidence-based approach. *J Prenat Med.* 2010;4(3):35-42.
 9. Akangire G, Carter B. Birth injuries in neonates. *Pediatrics in Review.* 2016;37(11):451-462. doi: 10.1542/pir.2015-0125
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References/suggestions for further reading:

1. Crofts JF, Barlett C, Ellis D, Hunt LP, Fox R, Draycott TJ. Training for shoulder dystocia: a trial of simulation using low-fidelity and high-fidelity mannequins. *Obstet Gynecol.* 2006;108(6):1477-1845. doi: 10.1097/01.AOG.0000246801.45977.c8
2. Vaughn J, Lister M, Shaw R. Piloting Augmented reality technology to enhance realism in clinical simulation. *Comput Inform Nurs.* 2016;34(9):402-405. doi: 10.1097/CIN0000000000000251
3. Miller L, Avery J, Larson K, Woll A, VonAchen A, Mortenson A. Emergency birth hybrid simulation with standardized patients in midwifery education: implementation and evaluation. *J Midwifery Women's Health.* 2016;60(3):298-303. doi: 10.1111/jmwh.12276
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6. Leung TY, Stuart O, Sahota DS, Suen SS, Lau TK, Lao TT. Head-to-body delivery interval and risk of fetal acidosis and hypoxic ischaemic encephalopathy in shoulder dystocia: a retrospective review. *BJOG.* 2011;118(4):474-479. doi: 10.1111/j.1471-0528.2010.02834.x
7. Leung TY, Stuart O, Suen SS, Sahota DS, Lau TK, Lao TT. Comparison of perinatal outcomes of shoulder dystocia alleviated by different type and sequence of maneuvers: a retrospective review. *BJOG.* 2011;118(4):985-990. doi: 10.1111/j.1471-0528.2011.02968.x



INSTRUCTOR MATERIALS

Case Title: High Fidelity In Situ Shoulder Dystocia Simulation

Case Description & Diagnosis (short synopsis): This case is a precipitous delivery in the emergency department complicated by shoulder dystocia, requiring the participants to perform maneuvers to deliver the fetus. There may need to be two operators, as one will be needed to “drive” the infant in the Noelle model, holding the infant inside the model mimicking the cardinal movements of labor and “turtling” after the head is delivered.

Equipment or Props Needed: Noelle Simulation model, or any simulation model that allows an operator to guide the delivery and mimic shoulder dystocia.

Because this simulation is meant to be done in situ (in the ED), all other necessary supplies should be readily accessible. For planning purposes and in cases where this simulation is performed outside the ED, the following materials will be needed:

Gown and gloves

Clamps for the umbilical cord

Scalpel/scissors for cutting umbilical cord

Blankets

Bulb suction

Neonatal airway supplies

Infant warmer

Intravenous (IV) line equipment

Oxygen tubing

Monitor

Tocomonitor

Confederates needed:

We recommend using ED nursing staff; however, if they are not available a confederate to act as the nurse will be needed.

Background and brief information: Patient is brought in via EMS in active labor.

Initial presentation: A G2P1 female presents to ED at 40 weeks in active labor; she reports her water broke and she is having contractions every 4-5 minutes. The patient is saying “the baby is coming,” and there is concern for a precipitous delivery in ED.



INSTRUCTOR MATERIALS

How the scenario unfolds: Case will progress like a normal uncomplicated birth until head is delivered and “turtles.” Participants will then have to recognize and relieve shoulder dystocia. The instructor will need to hold infant inside as learners explain what they are doing (i.e. specific maneuvers) and may release/deliver infant after posterior arm is released with concurrent explanation of maneuver.

Critical Actions:

1. Prepare for imminent delivery by paging OB and NICU/pediatric team (institution dependent)
2. Recognize symptoms of shoulder dystocia
3. Perform maneuvers to relieve dystocia (relieved after posterior arm is delivered)
4. Keep mother updated on progress
5. Divide team into two teams to resuscitate neonate and mother



INSTRUCTOR MATERIALS

Case Title: High Fidelity In Situ Shoulder Dystocia Simulation

Chief Complaint: “I think the baby is coming”

Vitals: *Heart Rate (HR)* 105 *Blood Pressure (BP)* 100/80 *Respiratory Rate (RR)* 20
Temperature (T) 37.0 *Oxygen Saturation (O₂Sat)* 100% on room air

General Appearance: Anxious

Primary Survey:

- **Airway:** speaking in full sentences
- **Breathing:** bilateral breath sounds
- **Circulation:** strong peripheral pulses, tachycardic

History:

- **History of present illness:** G2P1 female presents to ED at 40 weeks in active labor. Water broke five hours ago; she is having contractions every 4-5 minutes. She was in town visiting a relative and reports uncomplicated pregnancy followed with OB in other city.
- **Past medical history:** type 1 diabetes, previous shoulder dystocia with first child (must ask)
- **Past surgical history:** none
- **Patients medications:** insulin
- **Allergies:** none
- **Social history:** lives with husband, one child at home (2 years old)
- **Family history:** hypertension

Secondary Survey/Physical Examination:

- **General appearance:** gravid female, mild distress
- **Head, ears, eyes, nose and throat (HEENT):** within normal limits
- **Neck:** within normal limits
- **Heart:** tachycardic, otherwise normal
- **Lungs:** within normal limits
- **Abdominal/GI:** gravid
- **Genitourinary:** 8cm dilated, 100% effaced, 1+ station



INSTRUCTOR MATERIALS

- **Extremities:** within normal limits
- **Back:** within normal limits
- **Neuro:** within normal limits
- **Skin:** within normal limits
- **Lymph:** within normal limits
- **Psych:** within normal limits



OPERATOR MATERIALS

SIMULATION EVENTS TABLE:

Minute (state)	Participant action/ trigger	Patient status (simulator response) & operator prompts	Monitor display (vital signs)
0:00 (Baseline)	<ul style="list-style-type: none"> Establish IV access Call for OB and pediatrics/ NICU Get supplies ready for emergent delivery Establish that the patient is in active labor by checking the cervix 	<ul style="list-style-type: none"> Mannequin: Speak in full sentences, able to provide history Bedside instructor: Hold fetus at 0/+1 station 	<p>T: 37 HR: 105 BP: 105/80 RR: 22 O2: 100%</p>
02:00	<ul style="list-style-type: none"> Prepare for imminent delivery Inform patient of progress Assess fetal wellbeing with monitor, variable decelerations Recognize shoulder dystocia 	<ul style="list-style-type: none"> Mannequin: Speak in full sentences, active labor Bedside instructor: Mimic “Turtling” of fetal head; routine traction doesn’t deliver shoulder 	<p>T: 37 HR: 105 BP: 105/80 RR: 22 O2: 100%</p>
03:00	<ul style="list-style-type: none"> Call for help McRoberts and suprapubic pressure 	<ul style="list-style-type: none"> Mannequin: Continue active labor, increasingly distressed, concerned about baby (especially if not informed on progress by simulation participants) Bedside instructor: Allow fetus to be manipulated if learners attempt maneuvers; maintain fetus shoulders inside mannequin. Prompt learner to explain what the diagnosis is and what maneuvers they are doing (steps and names) to deliver the baby 	<p>T: 37 HR: 115 BP: 105/80 RR: 22 O2: 100%</p>



OPERATOR MATERIALS

Minute (state)	Participant action/ trigger	Patient status (simulator response) & operator prompts	Monitor display (vital signs)
05:00	<ul style="list-style-type: none"> • Attempt rotation maneuvers • Rubin II → Woods corkscrew → Reverse woods corkscrew → try to deliver the posterior arm. The infant is delivered with posterior arm 	<ul style="list-style-type: none"> • Mannequin: Continue active labor, severely agitated, concerned about baby (especially if not informed on progress by simulation participants) • Bedside instructor: Allow fetus to be manipulated if learners attempt maneuvers, maintain fetus shoulders inside mannequin. Prompt learner to explain what the diagnosis is and what maneuvers they are doing to deliver the baby. May release infant when learner delivers posterior arm 	<p>T: 37 HR: 105 BP: 105/80 RR: 22 O2: 100%</p>
7:00	<ul style="list-style-type: none"> • Pass infant to separate waiting team • Obtain cord gas • Deliver placenta • Update mother 	<ul style="list-style-type: none"> • Mannequin: Distress improved, requests update • Infant: May provide information for APGARs if desired: <ul style="list-style-type: none"> ○ 1 min: 7 (pink body blue extremities; HR 92; cry on stimulation; some flexion; strong, robust cry) ○ 5 mins: 9 (body and extremities pink; HR 120; cry on stimulation; some flexion; strong, robust cry) • Bedside instructor: ends case after placenta delivered. 	<p>T: 37 HR: 90 BP: 105/80 RR: 22 O2: 100%</p> <p>(Case Ends)</p>

Diagnosis:

Shoulder dystocia relieved by delivering posterior arm

Disposition:

Admit mother to OB



DEBRIEFING AND EVALUATION PEARLS

Shoulder Dystocia

Pearls: Please see attached “Debrief PowerPoint.” This can be done at bedside in the ED on a laptop immediately after the simulation.

If performed in situ in the emergency department, this simulation can serve to review where critical supplies for a precipitous delivery are in each ED

Other debriefing points:

Remember to emphasize that there are two patients in this scenario. Participants should prepare resources accordingly and alert the necessary staff (i.e. OB and pediatrics).

Category	0	1	2
Appearance	Blue or pale all over	Blue at extremities body pink	No cyanosis body and extremities pink
Pulse	Absent	< 100	> 100
Grimace	No response to stimulation	Grimace on suction or aggressive stimulation	Cry on stimulation
Activity	None	Some flexion	Flexed arms and legs that resist extension
Respiration	Absent	Weak, irregular, gasping	Strong, robust cry



SIMULATION ASSESSMENT

High Fidelity In Situ Shoulder Dystocia Simulation

Learner: _____

Assessment Timeline

This timeline is to help observers assess their learners. It allows observer to make notes on when learners performed various tasks, which can help guide debriefing discussion.

Critical Actions

1. Prepare for imminent delivery by paging OB and NICU/pediatric team (institution dependent)
2. Recognize symptoms of shoulder dystocia
3. Perform maneuvers to relieve dystocia (relieved after posterior arm is delivered)
4. Keep mother updated on progress
5. Divide team into two teams to resuscitate neonate and mother

0:00



SIMULATION ASSESSMENT

High Fidelity In Situ Shoulder Dystocia Simulation

Learner: _____

Critical Actions:

On initial presentation:

- Prepare for imminent delivery by paging OB and NICU/pediatric team (institution dependent)
- Recognize symptoms of shoulder dystocia
- Perform maneuvers to relieve dystocia (relieved after posterior arm is delivered)
- Keep mother updated on progress
- Divide team into two teams to resuscitate neonate and mother

Summative and formative comments:



SIMULATION ASSESSMENT

High Fidelity In Situ Shoulder Dystocia Simulation

Learner: _____

Milestones assessment:

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
1	Emergency Stabilization (PC1)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Recognizes abnormal vital signs	<input type="checkbox"/> Recognizes an unstable patient, requiring intervention Performs primary assessment Discerns data to formulate a diagnostic impression/plan	<input type="checkbox"/> Manages and prioritizes critical actions in a critically ill patient Reassesses after implementing a stabilizing intervention
2	Performance of focused history and physical (PC2)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Performs a reliable, comprehensive history and physical exam	<input type="checkbox"/> Performs and communicates a focused history and physical exam based on chief complaint and urgent issues	<input type="checkbox"/> Prioritizes essential components of history and physical exam given dynamic circumstances
3	Diagnostic studies (PC3)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Determines the necessity of diagnostic studies	<input type="checkbox"/> Orders appropriate diagnostic studies. Performs appropriate bedside diagnostic studies/procedures	<input type="checkbox"/> Prioritizes essential testing Interprets results of diagnostic studies Reviews risks, benefits, contraindications, and alternatives to a diagnostic study or procedure
4	Diagnosis (PC4)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Considers a list of potential diagnoses	<input type="checkbox"/> Considers an appropriate list of potential diagnosis May or may not make correct diagnosis	<input type="checkbox"/> Makes the appropriate diagnosis Considers other potential diagnoses, avoiding premature closure



SIMULATION ASSESSMENT

High Fidelity In Situ Shoulder Dystocia Simulation

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
5	Pharmacotherapy (PC5)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Asks patient for drug allergies	<input type="checkbox"/> Selects an medication for therapeutic intervention, consider potential adverse effects	<input type="checkbox"/> Selects the most appropriate medication and understands mechanism of action, effect, and potential side effects Considers and recognizes drug-drug interactions
6	Observation and reassessment (PC6)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Reevaluates patient at least one time during case	<input type="checkbox"/> Reevaluates patient after most therapeutic interventions	<input type="checkbox"/> Consistently evaluates the effectiveness of therapies at appropriate intervals
7	Disposition (PC7)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Appropriately selects whether to admit or discharge the patient	<input type="checkbox"/> Appropriately selects whether to admit or discharge Involves the expertise of some of the appropriate specialists	<input type="checkbox"/> Educates the patient appropriately about their disposition Assigns patient to an appropriate level of care (ICU/Tele/Floor) Involves expertise of all appropriate specialists
9	General Approach to Procedures (PC9)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Identifies pertinent anatomy and physiology for a procedure Uses appropriate Universal Precautions	<input type="checkbox"/> Obtains informed consent Knows indications, contraindications, anatomic landmarks, equipment, anesthetic and procedural technique, and potential complications for common ED procedures	<input type="checkbox"/> Determines a back-up strategy if initial attempts are unsuccessful Correctly interprets results of diagnostic procedure



SIMULATION ASSESSMENT

High Fidelity In Situ Shoulder Dystocia Simulation

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
20	Professional Values (PROF1)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Demonstrates caring, honest behavior	<input type="checkbox"/> Exhibits compassion, respect, sensitivity and responsiveness	<input type="checkbox"/> Develops alternative care plans when patients' personal beliefs and decisions preclude standard care
22	Patient centered communication (ICS1)	<input type="checkbox"/> Did not achieve level 1	<input type="checkbox"/> Establishes rapport and demonstrates empathy to patient (and family) Listens effectively	<input type="checkbox"/> Elicits patient's reason for seeking health care	<input type="checkbox"/> Manages patient expectations in a manner that minimizes potential for stress, conflict, and misunderstanding. Effectively communicates with vulnerable populations, (at risk patients and families)
23	Team management (ICS2)	<input type="checkbox"/> Did not achieve level 1	<input type="checkbox"/> Recognizes other members of the patient care team during case (nurse, techs)	<input type="checkbox"/> Communicates pertinent information to other healthcare colleagues	<input type="checkbox"/> Communicates a clear, succinct, and appropriate handoff with specialists and other colleagues Communicates effectively with ancillary staff