Simulation Patient Design:
Case of High Neuraxial Block in L+D Suite
Ronak Shah, Elvera Baron, Daniel Katz

Introduction
It is important to recognize that a high neuraxial block or total spinal can occur following a spinal or an epidural placement. Thus, a high neuraxial block can occur regardless of the location of an epidural or spinal placement along the vertebral column. It is vital to recognize and appropriately manage a high neuraxial block, as it can be detrimental to both the mother and the fetus.

A high neuraxial block in obstetric anesthesia is defined as the spread of local anesthesia above T4 level. The symptoms and degree of severity vary based on how high up the spine the local anesthetic spreads. If left untreated, a high neuraxial block can progress to a total spinal. The term “total spinal” is used whenever there is loss of consciousness secondary to the intracranial spread of local anesthetic via the CSF.¹

As compared to a standard operating room environment, labor and delivery suites may be suboptimally prepared for emergency medical and airway management. Development of high neuraxial level or a total spinal simulation therefore, could lead to early recognition and appropriate treatment of this potentially life-threatening condition.

Educational Rationale: To teach team skills for early recognition and correct management of an obstetric patient who develops symptoms of high neuraxial block or total spinal

Target Audiences: Nursing teams, Obstetricians, Anesthesiologists, labor and delivery supporting personnel

Learning Objectives: As per Accreditation Council for Graduate Medical Education (ACGME) Core Competencies
Upon completion of this simulation (including the debrief) learners will be able to:

- **Medical knowledge**: Describe common signs and symptoms of high neuraxial block/total spinal in an obstetric patient
- **Patient care**: Describe events that could predispose a specific patient to development of a high neuraxial block/total spinal
- **Practice-based learning and improvement**: Identify the equipment and skills necessary to recognize and medically manage an obstetric patient who developed high neuraxial block/total spinal.
- **Interpersonal and communication skills**: Successfully designate an appropriate team leader, effectively and clearly communicate with labor and delivery teams to keep an obstetric patient and her baby safe
- **Professionalism**: Demonstrate mutual respect for the expertise of other team members
- **Systems-based practice**: Identify the location of the nearest bag-valve device, airway box, back-up airway equipment (e.g. video laryngoscope and fiberoptic scope), and code cart with defibrillator. Name the contents of the airway box and recognize additional support personnel
needed. Recognize existing barriers within the system (such as shortages of equipment, personnel, knowledge gaps, institution specific protocols) that need to be developed or modified to improve patient outcomes.

Questions to ask after the scenario:

- What was the response like during this crisis?
- Did each member of the team have well-defined roles?
- Were the steps that needed to be taken by the team clear?
- Was all of the necessary equipment readily available, and was it able to fit into the room?
- What were some of the barriers to caring for this patient?
- If the patient had a difficult airway, how would that be managed?
- In the event that the patient required emergent cesarean delivery, how would that be organized?
- How was the management of the partner?

Assessment Instruments:

1. Learner Knowledge Assessment form (Appendix 1)
2. Simulation Activity Evaluation form (Appendix 2)

Equipment needed and set up:

In-situ labor and delivery suite setup
- Mannequin set up in left lateral decubitus position with fetal monitoring in place
- 18 Gauge IV in hand with Normal saline (that should contain an access port)
- Epidural catheter in-situ, currently connected to an ongoing epidural PCEA pump (does not have to be in the simulator, can be simply laid behind, or for full effect, can place the catheter tip in a small bag or container of clear fluid)

Simulation Scenario set up:

The case
Mrs. Dayna Demor is a healthy 32-year-old G1P0, who had her epidural placed in the seated position 45 minutes ago. Negative aspiration and test dose were documented in the medical record without any complications. The patient did not achieve complete relief with the initial medication bolus, and was given a second clinician bolus through the PCEA pump just prior to your arrival to “catch up”. The patient is now laying in the left lateral decubitus position.

Simulation pre-brief
- Read the scenario and instruct team members on their role during the simulation
- The learners take their places inside and outside the labor and delivery room
- One nurse is at the bed side with the rest of the team outside
- Simulation driver plays the patient
- Confederate plays the partner
## Total Spinal Scenario

<table>
<thead>
<tr>
<th>Trigger</th>
<th>Patient Condition</th>
<th>Action</th>
<th>Done</th>
<th>Time</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>In L+D suite, epidural has been placed and bolus is ongoing through PCEA pump.</td>
<td>Lateral, table</td>
<td>1. Nurse is monitoring blood pressure q2 minutes</td>
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<tr>
<td></td>
<td></td>
<td>2. Nurse is monitoring fetal tracing</td>
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</tbody>
</table>
| Middle of epidural bolus | Lateral, unstable, extreme anxiety (partner also displays anxiety), blood pressure is trending down and patient is complaining of weakness and significant shortness of breath | 1. Alert or activate emergency protocol  
   Notify anesthesiology team of maternal collapse  
   Notify obstetrical team of maternal collapse  
   Allocate team member to inform partner about situation |  |  |  |
| | | 2. Monitor patient and optimize room set up  
   Place patient on full monitors  
   Organize room to allow for easy entry of personnel and equipment |  |  |  |
| | | 3. Treat hypotension  
   Turn off epidural pump  
   Open fluids wide open/vasopressors  
   Obtain additional large bore IV access |  |  |  |
| | | 4. Treat shortness of breath  
   Elevate head of the bed  
   Place oxygen mask on patient with high-flow (10-15 L/min) oxygen  
   Assess for weakness in the hands |  |  |  |
| Impending airway collapse | Patient progresses to unresponsiveness, dilated pupils | Airway and cardiovascular intervention if necessary  
   Obtain airway box/backup airway equipment  
   Obtain code cart  
   Assist ventilation with bag-valve mask if necessary  
   Intubate with RSI when respiratory failure imminent  
   Continue to monitor for fetal distress |  |  |  |

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1. **Trigger:** In L+D suite, epidural has been placed and bolus is ongoing through PCEA pump.
2. **Patient Condition:** Lateral, table
3. **Action:**
   1. Nurse is monitoring blood pressure q2 minutes
   2. Nurse is monitoring fetal tracing
4. **Comments:**
   - Alert or activate emergency protocol
   - Notify anesthesiology team of maternal collapse
   - Notify obstetrical team of maternal collapse
   - Allocate team member to inform partner about situation
5. **Middle of epidural bolus**
   - Lateral, unstable, extreme anxiety (partner also displays anxiety), blood pressure is trending down and patient is complaining of weakness and significant shortness of breath
   - Alert or activate emergency protocol
   - Notify anesthesiology team of maternal collapse
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   - Allocate team member to inform partner about situation
   - Monitor patient and optimize room set up
   - Place patient on full monitors
   - Organize room to allow for easy entry of personnel and equipment
   - Treat hypotension
     - Turn off epidural pump
     - Open fluids wide open/vasopressors
     - Obtain additional large bore IV access
   - Treat shortness of breath
     - Elevate head of the bed
     - Place oxygen mask on patient with high-flow (10-15 L/min) oxygen
     - Assess for weakness in the hands
6. **Impending airway collapse**
   - Patient progresses to unresponsiveness, dilated pupils
   - Airway and cardiovascular intervention if necessary
   - Obtain airway box/backup airway equipment
   - Obtain code cart
   - Assist ventilation with bag-valve mask if necessary
   - Intubate with RSI when respiratory failure imminent
   - Continue to monitor for fetal distress
| Resolution | Patient stabilizes after intubation, scenario ends after discussion of next steps | Aspirate from catheter for diagnosis (may still be negative) Discuss patient disposition and need for cesarean delivery |  |  |
Appendix 1

Obstetrics Interdisciplinary Team Simulation

Name of simulation: _______________ Date: _____

OB Nursing Anes Support Personnel

Each item has two components:
The “Before the simulation” column (left side) examines your perspective at the beginning of the simulation.
The “End of Simulation” column (right side) is to evaluate your perspective at the completion of the simulation.

1. How would you rate your knowledge of signs and symptoms of high neuraxial block/total spinal?

<table>
<thead>
<tr>
<th>BEFORE THE SIMULATION</th>
<th>END OF SIMULATION</th>
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</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7 knowledgeable</td>
<td>1 2 3 4 5 6 7 knowledgeable</td>
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</table>

2. How would you rate your knowledge of the location of the emergency airway box?

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<tr>
<th>BEFORE THE SIMULATION</th>
<th>END OF SIMULATION</th>
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<tbody>
<tr>
<td>1 2 3 4 5 6 7 knowledgeable</td>
<td>1 2 3 4 5 6 7 knowledgeable</td>
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</table>

3. How would you rate your knowledge of the location of the backup airway equipment?

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<tr>
<th>BEFORE THE SIMULATION</th>
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<td>1 2 3 4 5 6 7 knowledgeable</td>
<td>1 2 3 4 5 6 7 knowledgeable</td>
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4. How would you rate your knowledge of the location of the code cart?

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<tr>
<th>BEFORE THE SIMULATION</th>
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<td>1 2 3 4 5 6 7 knowledgeable</td>
<td>1 2 3 4 5 6 7 knowledgeable</td>
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5. How would you rate your knowledge and role in the management of an obstetric patient who developed high neuraxial block/total spinal?

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<tr>
<th>BEFORE THE SIMULATION</th>
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<tr>
<td>1 2 3 4 5 6 7 knowledgeable</td>
<td>1 2 3 4 5 6 7 knowledgeable</td>
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Appendix 2

SIMULATION ACTIVITY EVALUATION FORM

DATE OF SIMULATION: ____________

OCCUPATION: Consultant  PG Yr 1 2 3 4  STUDENT  NURSE  MIDWIFE  OTHER  SPECIALTY: ______________________  YEARS IN PRACTICE: ______

Please rate the following aspects of this training program using the scale listed below:

1 = poor    2 = suboptimal    3 = adequate    4 = good    5 = excellent

Use “N/A” if you did not experience or otherwise cannot rate an item

<table>
<thead>
<tr>
<th><strong>INTRODUCTORY MATERIALS</strong></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>Orientation to the simulator</td>
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<table>
<thead>
<tr>
<th><strong>PHYSICAL SPACE</strong></th>
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<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>Realism of the simulator space</td>
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<tr>
<th><strong>EQUIPMENT</strong></th>
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<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>Satisfaction with the mannequin</td>
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<th><strong>SCENARIOS</strong></th>
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<th>2</th>
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<tbody>
<tr>
<td>Realism of the scenarios</td>
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<td>Ability of the scenarios to test technical skills</td>
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<td>Ability of the scenarios to test behavioral skills</td>
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<td>Overall quality of the debriefings</td>
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<tr>
<th><strong>DID YOU FIND THIS USEFUL?</strong></th>
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<td>To Improve Your Clinical Practice?</td>
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<td>To Improve Your Teamwork Skills?</td>
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<td>To Improve Your VERBAL Communication?</td>
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<td>To Improve your NONVERBAL Communication?</td>
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<th><strong>FACULTY</strong></th>
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<td>Quality of instructors</td>
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<td>Simulation as a teaching method</td>
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**COMMENTS**
References