Neonatal Resuscitation - Neonatal resuscitation, Hypoxia, Bradycardia, Umbilical vein catheterization

1. Neonatal Resuscitation
2. Target Audience: Emergency Medicine and Family Medicine Residents
3. Scenario Goals and Objectives
   1. Goal – The resident will lead a resuscitation team in the evaluation and management of a neonatal patient presenting as a precipitous delivery, with hypoxia and bradycardia
   2. Learning objectives
      1. Demonstrate an appropriate primary assessment of a post delivery neonate per the American Heart Association/American Academy of Pediatrics Neonatal Resuscitation Course guidelines.
      2. Complete an appropriately timed secondary assessment.
      3. Recognize and treat hypoxia.
      4. Recognize and appropriately treat bradycardia.
      5. Demonstrate correct placement of an umbilical vein catheter.
      6. Obtain appropriate laboratory and radiology studies.
      7. Initiate a timely Neonatal intensive care unit (NICU) consult.
   3. Assessment objectives/Critical actions
      1. During case
         1. The leader must quickly complete a primary survey within 2 minutes of delivery
         2. Umbilical cord must be clamped and cut
         3. AMPLE history must be obtained from mother or an alternate reliable historian if the mother is unable to communicate
         4. Patient must be warmed, dried, and stimulated
         5. The neonate must be positioned with the neck slightly extended and the airway must be suctioned
         6. Leader must recognize hypoxia and initiate appropriate and escalating oxygen therapy, bag-mask ventilation (BVM) and intubation based on response
         7. The leader must order and interpret bedside blood glucose test
         8. The leader must recognize bradycardia and respond with oxygen and then chest compressions and eventually epinephrine
         9. The leader must direct the team assertively and delegate tasks appropriately
         10. NICU consult must be obtained. This can occur either early (soon after the patient arrives) and/or after patient has been resuscitated
      2. During Debriefing
         1. Review quick assessment of ABCs per the Neonatal Resuscitation Course guidelines and IV, oxygen and monitor placement
         2. List signs of neonatal hypoxia, hypoglycemia and their treatments
         3. Discuss management of neonatal bradycardia
4. Environment
   1. Lab set up – A SimNewB or modified PediaSim will be placed on an ED stretcher. The scenario takes place in a tertiary care pediatric-capable emergency department
   2. Manikin Set up – The SimNewB or modified PediaSim (with umbilical cord attached and femoral pulse diverted into the cord) will be lying on a stretcher unclothed.
   3. Props - A stethoscope will be needed. A neonatal warmer/isolet. A cardiac monitor with leads, blood pressure cuff, pulse oximeter, supplemental oxygen by nasal cannula. An umbilical vein cath kit and/or intraosseous line, and supplies for neonatal intubation. In addition, medications for resuscitation and a length based resuscitation tape should be readily available along with a full spectrum of emergency airway equipment.
   4. Audiovisual: A normal neonatal chest x-ray, normal complete blood count (CBC), normal basic metabolic panel (BMP), normal accucheck.
   5. Distracters – Any distracters can be used including family members.
5. Actors
   1. Roles
      1. One physician leader
      2. One nurse to administer medications
      3. One medical technician to assist
      4. Other participants can help as directed by the leader
      5. One instructor to control the scenario
   2. Who can play them – The leader should be played by a resident. The instructor should be familiar with the SimNewB or PediaSim. Other roles can be played by residents, students, or other people as appropriate
   3. Action Role
      1. Physician leader – The leader must coordinate and direct the team, obtain a focused history, perform a pertinent physical exam, order and interpret labs and radiological studies, order treatments and perform/direct advanced procedures.
      2. Nurse, medical technician and other participants as appropriate – All team members will complete all ordered actions to the best of their ability. If asked to perform an action beyond the scope of practice for the role they are playing, they will identify that fact to the team leader.
6. Case Narrative
   1. Scenario given to participants
      1. Chief Complaint – near-term precipitous delivery with unresponsive neonate
      2. The physician leader will be given a triage note stating that a 22 y/o F has just arrived by EMS after complaining of “her water breaking”. Just prior to arrival the pt delivered a minimally responsive neonate. EMS has hastily clamped and cut umbilical cord. Vital signs: HR 58 BP RR 54, Sp02 75%, weight 3 kg.
      3. History of present illness (Must be requested): Provided by EMS- Patient: the neonate was delivered in ambulance bay, just seconds before arrival. The neonate has not been crying or dried, but is wrapped in towels. Mother (provided by Mom): G1 now P1 at about 35 weeks. Scant prenatal care, but with no complications to date. Abdominal pain with some bleeding last night. Gush of water just prior to calling EMS. No trauma.
      4. Past Medical history (Must be requested): Patient: None, Mother: None
      5. Past Surgical history (Must be requested): Patient: None, Mother: None
      6. Medication and allergies (Must be requested): Patient: None, Mother: Prenatal vitamins, NKDA
      7. Social and Family history (Must be requested): Mother: Denies ETOH, + smoker, No narcotics, + cocaine use
   2. Scenario initial conditions:
      1. The leader will be given the triage note above. The patient will be lying on the bed with towels wrapped around, but naked underneath. Vitals signs per triage note.
      2. General appearance: Appears in severe distress, Pale, toxic appearing, Airway intact, Breathing spontaneously, but rapid and shallow, palpable umbilical pulse, but weak
      3. HEENT: normocephalic atraumatic, flat fontenelles, Pupils equal, + red reflex, mouth and throat normal, trachea midline, peri-oral cyanosis
      4. Respiratory: Good breath sounds bilaterally, no wheezes
      5. Cardiac- bradycardic
      6. Abdomen: Soft, umbilical cord clamped and cut by EMS, leaving about 6 inches of stump.
      7. Extremities: acrocyanosis, cap refill > 3 sec
      8. Skin: As above, no bruising, rashes or abrasions
      9. Neurological: Poor suck, no cry, minimally responsive
   3. Scenario branch points
      1. Changes in clinical condition: The patient remains hypoxic and bradycardic despite non-rebreather and BVM. Patient’s hypoxia modestly improved with intubation. If no 02 given then patient becomes more hypoxic with bradycardia deteriorating to asystole.
      2. If patient not warmed – core temperature drops to 97 and bradycardia becomes more severe. If repeat bedside glucose obtained, it should be low, prompting D10W administration. If hypothermia and the resulting hypoglycemia are not addressed, then the patient may deteriorate to PEA.
      3. Responses to therapy: The patient should be given a 10cc/kg normal saline fluid bolus, but will remain unchanged
      4. No change after chest compressions. If no chest compressions initiated, then bradycardia will deteriorate to asystole. Improvement of heart rate with epinephrine IV (intraosseous (IO) not immediately available, but umbilical vein catheter kit is available).
      5. If patient’s resuscitation is delayed, the patient will become pulseless.
      6. NICU can be initially notified that a hypoxic, bradycardic neonate has presented. They will not be immediately available. After oxygen, ventilation, chest compressions, and epinephrine, and umbilical line are started, neonatology becomes available and should be notified for further care.
7. Instructor notes
   1. Tips to keep scenario flowing
      1. Prior to scenario patient should be covered, with umbilical stump under towels.
      2. History of present illness should be provided by EMS and mother.
      3. Fluids should be given in 10ml/kg, if the correct volume is not ordered, nursing can question the order.
      4. If ABCs and primary survey are not done in a timely manner the patient should decompensate quickly. If the decompensation is recognized and treated, the patient should stabilize to point of initial vitals. If the decompensation is not treated within 3 minutes, the patient will deteriorate to PEA and then asystole.
      5. IO not readily available – driving the leader toward umbilical vein cannulation.
   2. Tips to direct actors
      1. The physician leader is expected to consult NICU team. If he/she does not initiate a consultation at the appropriate time, the actors can prompt the leader by asking where the patient will be admitted.
8. Debriefing plan (Attachment 1) –
   * 1. The debriefing can occur as a group. The debriefing should start with a discussion of the main decisions made by the team leader during the resuscitation and his/her thoughts leading to each decision. Team member comments should be solicited. Feedback should include review of the initial presentation, findings on exam, and immediate actions taken. The most recent neonatal resuscitation algorithm should be reviewed. Review of umbilical vein catheter placement should be addressed as well. Early neonatal consultation can also be discussed. Any learning objectives not raised during these segments should be reviewed at the end of the debriefing.
     2. Assessment form (Attachment 2) – Completion of critical actions will be recorded on a modification of the standardized direct observation tool (SDOT).2
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10. References:
    * + 1. Kattwinkel, et Al. **Neonatal Resuscitation: 2010 American Heart Association Guidelines** **for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.** *Circulation*. 2010;122;S909-S919.
        2. Roberts: **Clinical Procedures in Emergency Medicine**, 5th ed. 2009. Ch. 19.
        3. Wiswell, TE. **Neonatal Resuscitation**. *Resp Care*. March 2003, Vol 48 NO 3.

Attachment 1

Pediatric Case Debriefing Points

1. What were your concerns and priorities as you initiated care of this patient?
2. How did you address your concerns and priorities?
3. What went well and what would you do differently if you were going to repeat the exercise? (Direct question to team leader first and then to team members)
4. What was your thought process for the key actions taken or not taken? (Direct question modified to address specific actions to the team leader)
5. Discuss simulation events related to the specific learning objectives (Use a group discussion format led by the instructor):
6. Which newly born infants do not require resuscitation?
   1. Term gestation?
   2. Crying or breathing?
   3. Good muscle tone?
   4. Yes to all = baby stays with mom
   5. No to any? = Initial stabilization
      1. Warmth
      2. Clear airway
      3. Dry
      4. Stimulate
      5. Ventilation – 02, BVM, continuous positive airway pressure, intubation
      6. Chest compressions – indicated for refractory bradycardia (HR < 60) after oxygen/positive pressure ventilation for 30 seconds (3:1 ratio in neonates).
      7. Administration of Epinephrine via IV/IO or ETT (0.01mg/kg) or fluids/blood (10 cc/kg) for refractory bradycardia despite the above treatment.
      8. Other medications – Narcan, Dextrose (D10W IV), Bicarbonate (1-2 meq/kg IV).
      9. Post resuscitation – Consider therapeutic hypothermia (33.5 - 34.5 C). Newborns > 36 weeks had significantly reduced mortality and neurodevelopmental disability at 18 months.
7. **Umbilical Vein Catheterization – Remember to use sterile technique, this is a central line.**
   1. Assess catheter length prior
   2. Goal for tip of the catheter to be above the diaphragm but below the right atrium - in the inferior vena cava.
   3. Most prudent in resuscitation to pass the line only 4 to 5 cm (term infant) until blood return
   4. Clean stump
   5. Anchor line
      1. Loop of umbilical tape
      2. Purse string suture is placed at the junction of the skin and the cord
   6. Cut cord
      1. Use scalpel
      2. About 1 cm from the skin
   7. ID vessels – 2 arteries, 1 vein
      1. Vein is usually located at 12 o’clock
      2. Vein thin walled with large lumen
   8. Introduce cath
      1. 3.5 French in pre-term
      2. 5.0 French in term
      3. No kit? - Red rubber cath works well
   9. Advanced only 1 to 2 cm beyond point of blood return
      1. Usually 4 to 5 cm in a term-sized infant
8. Initiate timely neonatal consult
   1. Early NICU consult for longer term management important

Attachment 2

Neonatal Resuscitation Assessment Sheet

NI = Needs Improvement ME = Meets Expectations AE = Exceeds Expectations **Core Competency Score**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Trainee: |  |  |  |  |  |
| Instructor: |  |  |  |  |  |
| **During Simulation** | **NI** | **ME** | **AE** | **N/A** | **Core**  **Competencies**  **Involved** |
| 1. Introduces self and efficiently establishes respectful and effective communication with Mother/EMS. |  |  |  |  | ICS, PR |
| 2. Gathers essential and accurate information from patient/EMS (prenatal history, history of trauma, initial vital signs in the field, symptoms, severity, duration). |  |  |  |  | PC, SBP |
| 3. Sequences critical actions in patient care: Clear airway, warm, dry, stimulate; O2, BVM, intubate; chest compressions; umbilical vein catheter, fluid bolus, IV epinephrine. |  |  |  |  | MK |
| 4. Communicates clearly, concisely, and professionally with staff regarding interventions, radiology, lab orders, and consults. |  |  |  |  | ICS, PR |
| 5. Can handle distractions while maintaining patient care priorities. |  |  |  |  | SBP |
| 6. Reevaluates patient after all interventions. |  |  |  |  | PC |
| 7. Carries out appropriate admission/transfer plan, and notifies accepting MD/DO as indicated. |  |  |  |  | PC, SBP |
| **During Debriefing** |  |  |  |  |  |
| 8. Describes indications/contraindications for each therapy and need for NICU consult. |  |  |  |  | MK |
| 9. Describes an appropriate differential, plan, and disposition. |  |  |  |  | MK, SBP |
| 10. Explains the pathologic basis for management of bradycardia. |  |  |  |  | MK |