

Neonatal resuscitation guidelines update: A case-based review

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The sixth edition of the Neonatal Resuscitation Program (NRP) textbook and the new instructor manual, published this year, are based on the International Liaison Committee on Resuscitation (ILCOR) guidelines for both clinical and educational practice (1,2). Using four practical examples to guide the reader, the present article describes the major changes to the guidelines, and their impact on learners and instructors.

CASE 1

I am an NRP instructor in a level 1 centre. How do I prepare for the changes in resuscitation practice outlined in the 2011 NRP guidelines?

Fortunately, many of the changes in resuscitation practice described in the sixth edition were introduced in the 2006 Canadian recommendations, particularly changes related to the use of supplemental oxygen.

Rapid assessment

The previous resuscitation guidelines included five and, later, four rapid assessment questions (3). The 2011 algorithm asks three questions regarding the status of the infant: "Is the infant of term gestation?", "Is the infant crying or breathing?" and "Is there good muscle tone?". Notably, there is no longer a question regarding the presence of meconium-stained amniotic fluid (MSAF) because vigorous term babies born through MSAF may be managed without resuscitative intervention. Nevertheless, intubation and suction below the cords is still recommended in nonvigorous babies born through MSAF. Learners should be made aware of the need to assess the appearance of the amniotic fluid and the condition of the infant so a decision about suctioning can be made.

Initial steps, evaluation and positive pressure ventilation

Practitioners will need to complete the initial steps (warm, clear the airway as necessary, dry and stimulate), re-evaluate the infant's condition (heart rate [HR] and breathing) and begin positive pressure ventilation (PPV), as indicated, within the 'Golden Minute' (American Academy of Pediatrics) (4). A rise in HR remains the most important indicator of PPV effectiveness, and is best determined by auscultating the precordial pulse. The new algorithm reinforces the importance of establishing effective ventilation before providing chest compressions – tools to achieve this include a checklist of corrective actions (see Case 3), and the use of laryngeal mask and endotracheal airways.

Resuscitation gases and oximetry

Preductal (right upper limb) oxygen saturation should be monitored whenever PPV is required. Air (21% oxygen) is recommended as the initial gas for all babies, with the exception of

very preterm babies in whom supplemental oxygen (between 30% and 90%), guided by pulse oximetry, may be preferable until clinical trials provide firm direction. Regardless of the initial resuscitation gas mixture, pulse oximetry in association with blended air and oxygen should be available to titrate oxygen therapy; this will minimize the risk of hyperoxemia, hypoxemia or fluctuations between both. A chart with preductal saturation targets in the first 10 min after birth is provided to guide practitioners when titrating supplemental oxygen. Units and practitioners should develop capacity to measure oxygen saturation while providing blended air and oxygen. Self-inflating resuscitation bags, even without a reservoir, can deliver higher concentrations of oxygen than previously suggested (5). These devices also require blended gases for reliable delivery of intended oxygen concentrations (5).

Chest compressions

Babies who experience persistent bradycardia (HR of less than 60 beats/min), despite 30 s of effective ventilation, should receive chest compressions and 100% oxygen. The recommended chest compression to ventilation ratio in the NRP textbook is 3:1. However, in rare cases of neonates for whom the arrest is known to be of cardiac etiology, a higher compression to ventilation ratio should be considered. This will facilitate less frequent interruption of chest compressions for the purpose of ventilation and/or assessment.

Postresuscitation care

It should be noted that central cyanosis is normally present in the first few minutes after birth. Continuous positive airway pressure may be considered, particularly for preterm infants with laboured respirations or persistent cyanosis; however, if their cardiorespiratory status fails to improve, oxygen, PPV and intubation should be considered. As described in the NRP textbook, postresuscitation care includes temperature control, close monitoring of vital signs (eg, HR, oxygen saturation and blood pressure), awareness of potential complications and provision of the necessary support. It cannot be assumed that a baby who has been successfully resuscitated is healthy and requires only routine care; further stabilization may be necessary as a component of postresuscitation care. For example, the new guidelines provide guidance for the management of newborns considered to be at risk for hypoxic-ischemic encephalopathy. Specific recommendations when signs of moderate to severe hypoxic-ischemic encephalopathy are present within 6 h of age include consideration of therapeutic hypothermia according to an evidence-based protocol, with referral to and follow-up by a regional perinatal centre.

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CASE 2

I have heard a lot of discussion about high- and low-fidelity simulation and immersive learning. I am not sure what some of these concepts mean, let alone how to incorporate them into my NRP workshops. I need to organize a workshop for colleagues in the birthing unit – where should I start?

Instructor training

The skills required to create an effective immersive learning environment, including the use of simulation techniques and debriefing, require both training and practice, and will grow with time and experience. The new instructor manual is a key resource and will be essential reading before face-to-face instructor training. The goal for Canadian NRP instructors is to develop the necessary skills to facilitate an immersive learning environment over the coming years. Through the Canadian Paediatric Society website, regional workshops and its network of regional NRPs, the Canadian NRP Steering Committee will provide guidance and support to instructors in developing these skills during this period of transition. The transition to new training methods should occur by July 1, 2012.

Provider training

To maximize the effectiveness of time spent at NRP provider workshops, participants are expected to review the NRP textbook and successfully complete an online evaluation before attending.

NRP provider workshops will have three essential components: performance skills stations, integrated skills stations and simulated scenarios with debriefing. Participants should initially practice skills integral to their roles (eg, equipment checks, initial steps and provision of PPV). Participants should be familiar with equipment recommended in the new guidelines, particularly equipment required for delivery of supplemental oxygen. Those with airway management responsibilities need to practice skills such as endotracheal tube and laryngeal mask airway placement. An 'integrated skills station', similar to the megacode evaluation, will enable participants to practice the sequence of the NRP algorithm. Note that for all NRP providers, the new algorithm reinforces the need to ensure effective ventilation. Finally, learners should participate in real-time scenarios using simulation and debriefing, which will reinforce cognitive, technical and behavioural skills. A workshop for labour and delivery practitioners may also focus on behavioural aspects including anticipation and planning, resource use, assignment of roles, team communication and situational awareness.

Simulation

"Simulations are scenarios or environments designed to closely approximate real-world situations" (6). ILCOR endorses the use of simulation during training, although the most effective techniques have yet to be identified. As an NRP instructor, you have already used simulation in your workshops during the skills sessions, performance checklists and the megacode evaluation. If you wish to demonstrate the more advanced skills of resuscitation, you may decide to include practitioners who perform these skills in your workshop. This will create more realistic scenarios and approximate the case-room team in 'real-life' resuscitations. Skills such as teamwork and communication are best cultivated in a 'safe' environment such as a simulated scenario.

Fidelity

The term 'fidelity' is generally used to refer to the degree of realism of a simulation, but the technical fidelity of the equipment may vary

according to the learning objectives for a given scenario, and contribute to this 'realism'. The essential component of an effective simulation is the 'suspension of disbelief', which enables immersive learning – this is achieved by setting a relevant context. Simulation does not require expensive, highly technological equipment. For your participants, you will require a manikin that can be used to practice PPV and compressions. The use of aids, such as pea soup to mimic meconium, simulated blood, and monitors to provide auditory and visual cues, are all simple ways to enhance the contextual fidelity of a scenario. Scenarios should be conducted with the aim of achieving clear, predetermined learning objectives related to performance of NRP procedures – complex technology or improbable scenarios may detract from this goal.

CASE 3

Within your birthing unit, a term infant with an atypical fetal heart tracing is born apneic and bradycardic. What do you do?

Critical steps involve preparation of equipment and personnel for immediate resuscitation. The NRP recommends that at every delivery, at least one person who is responsible for the care of the newborn, capable of initiating resuscitation, and skilled in the provision of PPV and chest compressions must be present. A second person skilled in more advanced resuscitation procedures should be readily available to assist. When the need for resuscitation has been identified, team roles should be assigned to ensure clarification of roles and responsibility. A team leader should also be clearly designated and additional support should be requested if advanced resuscitation is likely.

If there is no improvement in HR or respiratory effort, PPV should be provided within the 'Golden Minute' (American Academy of Pediatrics). It is important that effective ventilation is achieved before moving further down the resuscitation algorithm. If increasing HR and chest rise are not achieved, ventilation may be improved using the MRSOPA corrective actions (Mask adjustment, Reposition airway, Suction mouth and nose, Open mouth, Pressure increase, Alternative airway).

If adequate clinical improvement is not achieved with the initial steps, alternate airway support should be considered including intubation or use of the laryngeal mask airway. The laryngeal mask airway can be effective for ventilating infants delivered at 34 weeks' gestation or later, and weighing more than 2000 g.

If the HR remains lower than 60 beats/min despite 30 s of adequate ventilation, chest compressions should be delivered using the two-thumb encircling technique. Indications for the use of adrenaline remain unchanged; the intravenous route of administration is preferred, and doses are described in the 2006 Canadian recommendations (7).

CASE 4

The team experienced a complicated resuscitation. How might they best learn from the event?

The 2010 ILCOR guidelines recommended that it is reasonable to use debriefing during learning activities, both in simulated scenarios and in clinical activities. Debriefing allows the team to review preceding events, enabling assessment of cognitive, technical and behavioural skills, and identification of potential system errors. Teams should make debriefing a regular occurrence following all resuscitations so that experiential learning can occur in a constructive manner and the interprofessional team can optimize future performance.

How does one debrief?

Debriefing, unlike feedback, is a facilitated discussion of previous events, and should occur as soon as feasible after the scenario or

event. As the facilitator, it is imperative not to dominate the discussion. Questions should be open ended, with a limited number of facilitator statements. It is generally recommended, particularly in the case of real-life events, that the debriefing take place away from the location where the scenario occurred to reduce emotional load. A 'safe' learning environment should always be maintained and debriefing performed in a constructive rather than a punitive manner. Debriefing should be objective and focus on events as they occur. The use of video recording may facilitate a thorough and objective debriefing.

The role of simulation or 'drills'

Debriefing real-life events may reveal critical errors or deficits in cognitive, technical or, most often, behavioural skills necessitating further training. As noted above, ILCOR recommends the use of simulation-based training, although optimal methods have yet to be identified. Simulation or repeated drills may be used for further training outside of the clinical environment, and have been shown to enhance performance. Simulation does not necessitate the use of high-fidelity technical equipment; therefore, all units can incorporate this training. Simulations can occur in the clinical workplace for greater realism, also enabling the identification of important system errors. Simulation-based training should encompass cognitive, technical and behavioural skills training. The interprofessional team should be involved in such training to provide greater realism and optimize nontechnical skills training.

SUMMARY OF KEY CHANGES IN NEONATAL RESUSCITATION

The summary of key changes is based on the 2010 ILCOR and American Heart Association guidelines (1,4).

- Progression to the next step following an initial evaluation is now defined by simultaneous evaluation of HR and respirations.
- Pulse oximetry should be used for evaluation of oxygenation because colour assessment is unreliable.
- Room air resuscitation should be started for all term and preterm infants (the initial gas concentration for very preterm infants is unclear).
- Administration of supplementary oxygen should be regulated by blending air and oxygen, and should be guided by oximetry.
- Available evidence does not support or refute routine endotracheal suctioning of infants born through MSAF, even when depressed. Until further information is

available, endotracheal suctioning of nonvigorous babies should be performed.

- The chest compression-ventilation ratio remains at 3:1. A higher ratio might be considered if an arrest is of cardiac etiology.
- Therapeutic hypothermia should be considered within 6 h for infants born at term or late preterm gestation with evolving moderate-severe hypoxic ischemic encephalopathy (with protocol and follow-up through a regional perinatal system).
- It is appropriate to consider discontinuing resuscitative efforts after there has been no detectable heart rate for 10 min.
- Cord clamping should be delayed for at least 1 min in babies not requiring resuscitation. There is insufficient evidence to recommend a time for clamping in babies who require resuscitation.
- Simulation should be used as a teaching methodology in resuscitation education, but the most effective methods of teaching and evaluation remain to be defined.
- It is reasonable to recommend the use of briefings and debriefings during learning activities both in simulation and in clinical activities.

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