Recommendations for specific modifications in the Canadian context

A subcommittee of the Canadian Neonatal Resuscitation Program (NRP) Steering Committee was convened to review the recent changes to the 6th edition NRP textbook as they may apply within the Canadian context. The 2010 International Liaison Committee on Resuscitation (ILCOR) guidelines and worksheets and the 2010 American Heart Association (AHA) guidelines were used as the primary source documents. The composition of the subcommittee included representation from the Canadian NRP Steering Committee, the Canadian NRP Executive Committee and invited experts.

The mandate of the subcommittee was as follows: a) Review of ILCOR neonatal worksheets and guidelines, the AHA guidelines and the American Academy of Pediatrics (AAP) NRP 6th edition textbook.

b) Assess and determine if any of the content in the AAP NRP 6th edition textbook, AHA or ILCOR documents was not applicable or may be interpreted differently in Canada, therein requiring adaptation within the Canadian neonatal community.

c) Provide recommendations on any specific modifications and communicate these to NRP instructors and parent institutions as an addendum to the 6th edition of the NRP textbook

All recommendations from this subcommittee have been approved by the Canadian NRP Steering Committee.

Recommendations

These treatment recommendations reflect the ILCOR consensus as applied in the Canadian context. They are limited to changes that narrow, broaden or further clarify management options.

A. Delayed Cord Clamping

ILCOR commentary: Cord clamping should be delayed for at least 1 minute in infants who do not require resuscitation. Evidence is insufficient to recommend a time for clamping in those who require resuscitation.

Recommendation for delayed cord clamping:

1. The available evidence does not support or refute delayed cord clamping in those neonates who require active resuscitation. It is preferable to delay cord clamping in well neonates who do not require resuscitation.

B. Attendance at Elective Caesarean Section Deliveries

ILCOR Commentary: When an infant without antenatally identified risk factors is delivered at term by caesarean section under regional anaesthesia, evidence suggests that the need for intubation during resuscitation is low.

Recommendation for attendance at elective caesarean section deliveries:

1. At a caesarean section for term delivery under regional anaesthesia with no antenatally identified risk factors, a provider capable of performing assisted ventilation should be present. This provider does not necessarily need to be skilled in neonatal intubation.

C. MeconiumStained Amniotic Fluid (Lessons 1, 2)

ILCOR Commentary: The available evidence does not support or refute the routine endotracheal suctioning of infants born through meconium-stained amniotic fluid, even when the newborn is depressed.

The rapid assessment questions no longer include asking whether there was a history of meconium stained amniotic fluid (MSAF). Consequently, a vigorous infant who is born through MSAF would not enter the resuscitation sequence and would receive routine care with the mother. Until additional evidence is available, the American Heart Association recommends the management of the non-vigorous infant born through MSAF still includes tracheal suction as part of the initial steps of resuscitation.

Recommendation for management of nonvigorous infants born through MSAF:

1. The current practice of intubation and suction below the cords should be continued when a non-vigorous infant is born with a history of meconium-stained amniotic fluid.

D. The Use of Pulse Oximetry (Lessons 2, 3, 5, 6)

American Heart Association (AHA) NRP 2010 commentary: The algorithm recommends saturation monitoring when resuscitation can be anticipated and for all infants receiving supplemental oxygen or positive pressure ventilation (PPV).

It is recommended that oximetry be used when resuscitation can be anticipated,[2] when positive pressure is administered for more than a few breaths, when cyanosis is persistent, or when supplementary oxygen is administered (Class I, LOE B).

(AHA, 2010, p. S912)

Recommendations for the routine use of pulse oximetry during resuscitation:

1 Pulse oximetry should be used for all infants who require PPV, appear cyanotic at 5 minutes or more of age or have laboured respirations.

2 Every delivery area should have access to a pulse oximeter, set to manufacturer's specified mode for neonatal resuscitation, with an appropriately sized probe for newborn infants.

3 The probe should be applied on the right hand or wrist first and then attached to the pulse oximeter in order to achieve the fastest readings.

Refer to the NRP Flow Diagram for a table of appropriate pre-ductal (right wrist/hand) saturation targets to guide supplemental oxygen therapy.

E. Use of Supplemental Oxygen (Lessons 3, 4)

ILCOR Commentary: For infants born at term, it is best to begin resuscitation with air rather than 100% oxygen. Administration of supplementary oxygen should be regulated by blending oxygen and air, and the concentration delivered should be guided by oximetry. Infants less than 32 weeks' gestation are less likely to achieve the gradual rise in oxygen saturations seen in healthy term infants if either room air or 100% oxygen is used during initial resuscitation: blended oxygen may be given judiciously, guided by pulse oximetry.

Recommendations for the use of supplemental oxygen:

1 Blended gases should be available in the delivery room and during transport to the SCN/NICU.

2 In infants 32 weeks' and greater who require PPV, the initial gas should be 21% oxygen (room air).

3 Until further evidence is available for the optimal initial oxygen concentration in infants less than 32 weeks' gestation who require PPV, use of supplemental oxygen should be guided by institutional or referral centre protocols.

4 In all gestational ages, supplemental oxygen should be titrated using pulse oximetry to achieve saturation targets.

F. Persistent Cyanosis and/or Laboured Respirations (Lessons 2, 7)

Infants who, after the initial steps of resuscitation, have a heart rate over 100 beats per minute, yet have persistent cyanosis or laboured respirations exit the resuscitation algorithm and proceed to post-resuscitation care. For these infants, the algorithm recommends clearing the airway, applying pulse oximetry and providing continuous positive airway pressure (CPAP). In the context of persistent cyanosis and laboured respirations, despite implementation of the aforementioned strategies, the use of PPV should be also considered.

Recommendations for management of persisting cyanosis and/or laboured respirations:

1 Post-resuscitation care needs to include ongoing monitoring of vital signs, management of temperature and close observation for complications and deterioration or improvement in status.

2 If infants have persistent cyanosis (as evidenced by oxygen saturations, measured by pulse oximetry, less than targeted levels) despite supplemental oxygen and/or CPAP, positive pressure ventilation should be considered.

G. Use of Continuous Positive Airway Pressure (CPAP) in Resuscitation (Lessons 1, 8)

ILCOR Commentary: There is some evidence that the use of CPAP in the delivery room may decrease the need for intubation and the use of mechanical ventilation in premature infants.

There is no evidence to support or refute the use of CPAP in the term infant.

Recommendation for the use of CPAP in neonatal resuscitation:

1 CPAP may be considered as a post-resuscitation care strategy for infants with persistent cyanosis (as evidenced by oxygen saturations less than targeted levels) and/or laboured respirations.

2 Mask or endotracheal ventilation must be considered for all infants who fail to respond to CPAP. Consider consultation with local experts and/or protocols.

H. Assisted Ventilation Devices (Lessons 3, 4)

ILCOR Commentary: The three resuscitation devices—the self-inflating bag, the flow-inflating bag, the T-piece resuscitator—are all acceptable options for providing positive pressure ventilation in the neonate. Initial inflation pressures should be the minimal pressure needed to achieve an increase in heart rate. When a pressure manometer is being used, initial inflation pressures of 20 to 25 cm of H_2O are often sufficient for premature infants. Term infants may require initial inflation pressures of 30 to 40 cm H_2O.

Recommendations for the assisted ventilation devices in neonatal resuscitation:

1. PPV may be delivered using a self-inflating bag, flow-inflating bag or T-piece resuscitator. Choice of device should be based on familiarity and experience with the given device.

I. Laryngeal Mask Airway (Lesson 5)

ILCOR Commentary: Evidence suggests that a laryngeal mask airway has comparable efficacy to intubation or face mask when ventilating newborns during resuscitation. There is, however limited evidence to evaluate the effectiveness of using the laryngeal mask airway in the following settings: newborns less than 2000 grams or born at less than 34 weeks' gestation; in the presence of meconium-stained amniotic fluid; during chest compressions or for the delivery of intratracheal medications.

Recommendations for the laryngeal mask airway in neonatal resuscitation:

1 The laryngeal mask airway should be considered in neonatal resuscitation when PPV with a face mask is ineffective and when attempts at endotracheal intubation are not feasible or have not been successful.

2 Infants with a complex airway and respiratory distress should be considered for an laryngeal mask airway as the primary strategy, particularly when the resuscitator is not skilled at advanced airway support.

J. Ensuring Adequate Ventilation (Lessons 3, 4)

Adequate ventilation is essential for successful resuscitation of the newborn. The NRP textbook recommends that corrective steps (using the acronym "MR SOPA") should be done before starting chest compressions on an infant who is not responding to PPV.

Recommendations to ensure adequate ventilation:

Prior to commencing chest compressions, the effectiveness of positive pressure ventilation should be evaluated by performing the following corrective steps, identified by the acronym 'MR SOPA':

M Mask adjustment
R Reposition airway
S Suction mouth and nose
O Open mouth
P Pressure increase
A Airway alternative*

* The choice of alternative airway will depend on the experience of the practitioner, and should not unduly delay the institution of chest compressions.

K. Administration of Epinephrine (Lesson 6)

AAP NRP 2010 commentary: The IV route is recommended, with consideration of the endotracheal route only while IV access is being obtained. The recommended dose of epinephrine (1:10,000 solution) is 0.01 to 0.03 mg/kg IV which equates to 0.1 to 0.3 mL/kg. If giving endotracheally, consider a higher dose of 0.05 to 0.1 mg/kg which equates to 0.5 to 1 mL/kg of 1:10,000 solution.

Canadian context: The recommendations for the Canadian context remain unchanged from the previous (NRP 2006) doses. The Canadian interpretation of the science over the past 6 years is that there is no evidence to suggest consideration of a higher dose of intravenous or endotracheal epinephrine.

Recommendations for the administration of epinephrine (adrenaline):

1 **Endotracheal Tube**: The first dose of epinephrine may be given via the endotracheal tube while preparing for insertion of umbilical venous catheter (UVC). Prepare a 3 mL syringe of 1:10,000 epinephrine (dose of 1 mL/kg). (Maximum endotracheal dose is 3 mL of 1:10,000 epinephrine).

2 **Intravenous (Umbilical Venous Catheter)**: Prepare a 1 mL syringe of 1:10,000 epinephrine (dose of 0.1 mL/kg). Flush with up to 5 mL of 0.9% NaCl.

K. Postresuscitation Management: Hypothermia (Lesson 7)

ILCOR Commentary: Therapeutic hypothermia should be considered for infants born at term or near-term with evolving moderate to severe hypoxic-ischemic encephalopathy. The administration of therapeutic hypothermia should be conducted in accordance with a strict and evidence based protocol and coordinated through a regional perinatal system.

Evidence to-date from animal experimental models and human randomized controlled trials demonstrates that therapeutic hypothermia (selective head and total body) improves the outcome of selected newborns with signs of hypoxic ischemic encephalopathy. There are also observational data that suggest that overheating leading to hyperpyrexia may be detrimental to the neonatal brain. There is however, little or no evidence to suggest that cooling should begin in the first minutes of age (i.e.: during or immediately following resuscitation) or before the resuscitation has been completed. All of the studies included patients in whom cooling was only initiated in the post-resuscitation phase, and at least 60 to 90 minutes after birth. Given the need for specialized equipment and expertise to apply therapeutic hypothermia effectively and safely, infants who may benefit from this therapy should be transported to the regional tertiary care centre as soon as possible.

Recommendations for the use of therapeutic hypothermia:

1 Decisions regarding ongoing temperature management of potential candidates for induced hypothermia or targeting borderline low temperatures should be discussed with your tertiary centre.

2 Avoid causing inadvertent hyperthermia by over-warming infants. All infants (term and preterm) who remain under a radiant warmer by 10 minutes of age should have a servo control probe placed to avoid both hypo- and hyperthermia.

References

Kattwinkel, J., Perlman, J.M., Aziz, K., Colby, C., Fairchild, K., Gallagher, J., … Zaichkin, J. (2010). Part 15: Neonatal resuscitation: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation, 122,* S909-S919. doi:10.1161/circulationaha.110.971119

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