

A critical review of the 2015 International Liaison Committee on Resuscitation treatment recommendations for resuscitating the newly born infant

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The recommendations from the International Liaison Committee on Resuscitation (ILCOR), which have been embodied in various worldwide neonatal resuscitation programmes, have been very important in establishing the successful evidence-based resuscitation of newborn infants. The 2015 ILCOR treatment recommendations on neonatal resuscitation (1) make some improvements to the algorithm the organisation published in 2010 (2) and summarise recent evidence-based knowledge and gaps in newborn resuscitation. However, they include some recommendations that are not evidence based and might have negative effects, especially in low-resource settings. The 2015 guidelines are probably not as unifying as the previous guidelines and this may create an important debate.

Although the 2015 recommendations are more thorough in some ways, they are also less complete because the unchanged 2010 recommendations are not included in the text. This means that the 2015 version does not contain all the information in just one document needed for carrying out newborn resuscitation.

In order to reach a consensus, 26 six relevant questions about the Population, Intervention, Comparator, Outcomes (PICO) format were discussed, after they were refined using the Grades of Recommendation, Assessment, Development and Evaluation approach. In addition, the detection of a heart rate immediately after birth was introduced as a late-breaking PICO question. When the committee feels a strong recommendation is justified they use the word *recommend* by contrast to *suggest* which is a weaker recommendation.

The golden 60 seconds and time of birth

An important change to the algorithm is the removal of the 30-second time point from the timeline. This emphasizes the golden minute after birth. Therefore it is critical to define time of birth precisely (3). However, ILCOR 2015 does not state when the

clock should be started: when the whole body is out - and practice varies around the world. The first seconds are important and the birth moment should have been defined accurately, as this is also important for uniform Apgar scoring and discussions on the optimal time of cord clamping.

Heart rate assessment

Heart rate and respiration are the two vital signs that are used to assess the success and progress of resuscitation. Heart rate is commonly assessed by auscultation and, or, pulse oximetry, but both of these are inaccurate, especially when they are carried out immediately after birth. An electrocardiogram (ECG) may, therefore, be a better way to monitor heart rate. In spite of the fact that no randomised studies have been published on this, ILCOR provides a weak recommendation that suggests that ECG can be used to provide a rapid and accurate estimation of the neonate's heart rate. We are concerned that, despite a lack of evidence in favour of ECGs, auscultation of the precordium is no longer mentioned in the 2015 recommendations as the primary means of heart rate assessment. This suggestion may have significant negative effects on resuscitation because many areas in the world do not have access to ECG devices.

Cord clamping

Cord clamping is recommended to be delayed (DCC) for those preterm infants not requiring immediate resuscitation at birth. Recent data regarding DCC indicate some advantages compared to early clamping also for the most immature infants. However, the definition of delayed cord clamping (DCC) seems to be missing from

the 2015 recommendations and is presumably still > 60 seconds, as described in 2010 for both term and preterm infants.

Katheria et al performed a randomised study on umbilical cord milking (UCM) versus DCC in premature infants born by Caesarean section with a gestational age of less than 32 weeks and concluded that UCM may be a more efficient way of improving blood volume in premature infants (4). However, the 2015 treatment recommendations suggest against the routine use of UCM for infants born at 28 weeks of gestation or less.

Temperature control

The 2015 algorithm introduces a running line reminding providers to maintain thermoregulation. Applying occlusive wraps to very preterm infants immediately after birth results in greater mean body temperature but does not reduce mortality (5). However, the admission temperature of newly born, non-asphyxiated infants is a strong predictor of morbidity and mortality. The strong recommendation is that the body temperature of non-asphyxiated infants at all gestational ages should be maintained between 36.5°C and 37.5°C. To maintain the infant's temperature during delivery room interventions, preterm infants of less than 32 weeks of gestation should be kept under radiant warmers in a room where the temperature should be between 23°C and 25°C (previously recommendation was 26°C for infants of less than 28 weeks of gestation). One issue is that ILCOR suggests using warm blankets, plastic wrapping without drying, cap and thermal mattresses, despite the fact that thermal mattresses have been shown to increase the risk of hyperthermia (6), which the ILCOR itself warns against.

Ventilation and suctioning

The resuscitation algorithms in both 2010 and 2015 advise clinicians to consider using continuous positive airway pressure (CPAP) if there is laboured breathing or persistent cyanosis. No differentiation is made between term or preterm infants, in spite of the fact that the use of CPAP in term infants who need resuscitation is not evidence based. A study by Hishikawa et al from September 2015 indicated that the 2010 recommendation might have contributed to an increase in respiratory problems in term babies (7).

The ILCOR committee did not find sufficient evidence that newborn infants receiving ventilation during resuscitation achieved spontaneous breathing sooner using a T-piece resuscitator with positive end expiratory pressure (PEEP) than using a self-inflating bag without PEEP. For some reason, flow-inflating bags are not mentioned in the 2015 recommendations. Initial sustained inflation of more than five seconds is not recommended for preterm infants without spontaneous respiration immediately after birth.

The 2010 recommendations stated that the available evidence did not support or refute the routine endotracheal suctioning of depressed infants born through meconium-stained amniotic fluid. In the 2015 recommendations, routine suctioning of even depressed, non-vigorous infants born through meconium stained amniotic fluid is not suggested.

Oxygenation

There are no new recommendations regarding the oxygenation of term babies in need of resuscitation and it is still best to start with air rather than 100% oxygen. The 2010 guidelines recommended that blended oxygen and air could be given

judiciously to babies born at less than 32 weeks of gestation and that ideally this should be guided by pulse oximetry. These guidelines implied that resuscitation should be started with air in infants who were at least 32 weeks of gestation. In 2015 it is recommended starting with 21-30% oxygen for premature infants, which is in accordance with our recent meta-analysis on infants born at less than 33 weeks of gestational age (8). However, new information from the Targeted Oxygen in the Resuscitation of Preterm Infants and their Developmental Outcomes (TORPIDO) trial suggests increased mortality in preterm infants born at less than 29 weeks of gestation when using air compared to 100% oxygen. Data from this study was published late in 2015 (9) and was not included in the 2015 guidelines. It is confusing that ILCOR 2015 recommends starting with 30% oxygen at up to 35 weeks of gestational age without new data to support this.

Circulatory support

Chest compressions should still preferably be carried out by using the two-thumb technique, with hands encircling the chest, and delivered over the lower third of the sternum. The recommended chest compression to ventilation ratio is still 3:1. In 2010 there was a consideration for applying a compression to ventilation ratio of 15:2 if the arrest was known to be of cardiac aetiology, but this is not mentioned in the new guidelines.

Assisted ventilation devices, cardiopulmonary resuscitation feedback devices and devices to assess respiratory function

If ventilation using a facemask is unsuccessful, a laryngeal mask may be used as an alternative to tracheal intubation during the resuscitation of late-preterm infants of more than 34 weeks.

ILCOR underlines the need for more evidence and suggests against the routine use of flow and volume monitoring and capnography for babies who receive positive pressure ventilation at birth. It also states that any advantages of measuring increases in end-tidal carbon dioxide in asystolic/bradycardic infants to detect the return of spontaneous circulation has been poorly investigated and it suggests against routine reliance on such a device or on pulse oximeters.

Therapeutic hypothermia in resource-limited countries

One of the more worrying issues is that ILCOR 2015 suggests that term infants with moderate or severe hypoxic ischaemic encephalopathy who live in resource-limited settings should be treated with therapeutic hypothermia, with a core temperature of approximately 33.5°C, for 72 hours. The recommendation is that hypothermia could be induced passively or by ice packs. The use of ice packs is surprising as in such settings it has been reported that asphyxiated babies have an endogenous cooling response for at least for the first 16 hours (10). They cool easily with water bottles at room temperature and are at risk of over-cooling with the use of ice packs. It is known that overcooling can be harmful and therefore this recommendation is of concern (11). Therapeutic hypothermia is suggested in spite of the fact that there have been no large studies in mid-resource and low-resource settings and, importantly, that studies in low-resource settings have so far shown no definite benefit from cooling (12). Indeed, one pilot study found increased mortality in cooled babies in a hospital in sub-Saharan Africa where intensive care support, namely

ventilation and blood gases, and monitoring was not available (13). ILCOR 2015 suggests that treatment should be carried out in neonatal care facilities with capabilities for multidisciplinary care and the availability of adequate resources. It is vital that basic antenatal and neonatal care is optimised before diverting resources to added therapies such as cooling.

Discontinuing resuscitation

The 2015 recommendation clearly underlines that there is insufficient evidence to support the prospective use of any delivery room prognostic score in preterm infants under 25 weeks of gestational age. An estimation of the prognosis should be based on the accuracy of the assigned gestational age, the presence or absence of chorioamnionitis and the level of care available. The recommendations could also have included antenatal steroids, gender and plurality among these risk factors.

CONCLUSION

The ILCOR 2015 consensus on science with treatment recommendations for the resuscitation of newly born infants represent an impressive summary of present research and knowledge in the field. Our summary of the knowledge gaps in each of the questions we have discussed in this editorial provides a direction for future research. We feel that the thorough grading system of all the issues the ILCOR committee discussed, which is provided in the 2015 treatment recommendations, is also helpful for the reader who wants to go into the recommendations in depth and who seeks to understand the basis for each recommendation. However, a weakness is that the 2015 treatment recommendations are not complete and the reader also

needs to consult the 2010 version to get a complete picture of the ILCOR recommendations.

The new suggestion that routine suctioning might be unnecessary of even depressed, non-vigorous infants born through meconium stained amniotic fluid is exciting. However, we are deeply concerned that auscultation to assess heart rate is not mentioned in 2015, only the suggestion to apply ECG, that thermal mattresses are suggested in combination with other heat preserving techniques and that therapeutic hypothermia is suggested in low-resource settings. It appears that the ILCOR committee did not take some of the recent, relevant literature into consideration. These issues might contribute to less confidence in the 2015 recommendations than in the previous ones.

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