



Mini-symposium: Alveolar and Vascular Transition at Birth

Managing Preterm Infants in the First Minutes of Life



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EDUCATIONAL AIMS

The reader will appreciate that:

- Preterm infants' postnatal adaptation is a complex process that often requires the intervention of especially trained caregivers.
- The cornerstone of a successful switch from a fetal to an adult type of cardiorespiratory circulation is to provide adequate lung ventilation. Both alveolar recruitment and achievement of a functional residual capacity are essential for establishing an adequate gas exchange.
- The use of non invasive ventilation and individual oxygen titration according to oxygen saturation provide the best and less aggressive means for achieving a successful postnatal adaptation of the preterm infant.

ARTICLE INFO

Keywords:

Prematurity
Resuscitation
Oxygen
Cord clamping
Ventilation
Delivery room
Temperature

SUMMARY

Premature infants often experience difficulties adapting to postnatal life. The most relevant ones are related to establishing an adult type cardiorespiratory circulation and acquiring hemodynamic stability, aerating the lung and attaining a functional residual capacity, performing an adequate gas exchange and switching to an oxygen enriched metabolism, and keeping an adequate body temperature. In recent years a body of evidence supports a trend towards gentle management in the delivery room aiming to reduce damage especially to the lungs in the so-called first golden minutes. Herewith, we describe and update four of the most relevant interventions performed in the delivery room: delayed cord clamping, non-invasive ventilation, individualized oxygen supplementation, and maintaining an adequate body temperature so as to avoid hyperthermia and/or hypothermia.

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INTRODUCTION

Experimental and clinical studies performed in recent decades have shown that interventions performed in the first minutes after birth, especially in very preterm infants could cause structural changes but also trigger inflammatory and pro-oxidant cascades injurious to most organs of the body and that could predispose to long-term conditions [1]. The 2010 ILCOR guidelines and recent consensus guidelines have underscored the advantages of delaying

cord clamping for achieving hemodynamic stability, preventing brain damage, reducing the need of blood transfusions and improving iron status during the first year after birth [2,3]. In addition, non-invasive ventilation has been proposed to avoid or minimize possible damage to the lungs during postnatal adaptation in preterm babies who frequently need to be ventilated with positive pressure [2,3]. Of note, the use of individualized oxygen supplementation titrated according to individual response monitored using by pre-ductal pulse oximetry is a new approach that tries to avoid damage caused by hyper-and/or-hypoxia [4]. Similarly important is keeping an adequate body temperature which undoubtedly will influence mortality and morbidity of very preterm infants [3].

The aim of present review is to expand on these three newly evolving approaches meant to improve postnatal transition of very preterm babies to extra uterine life (Figure 1).

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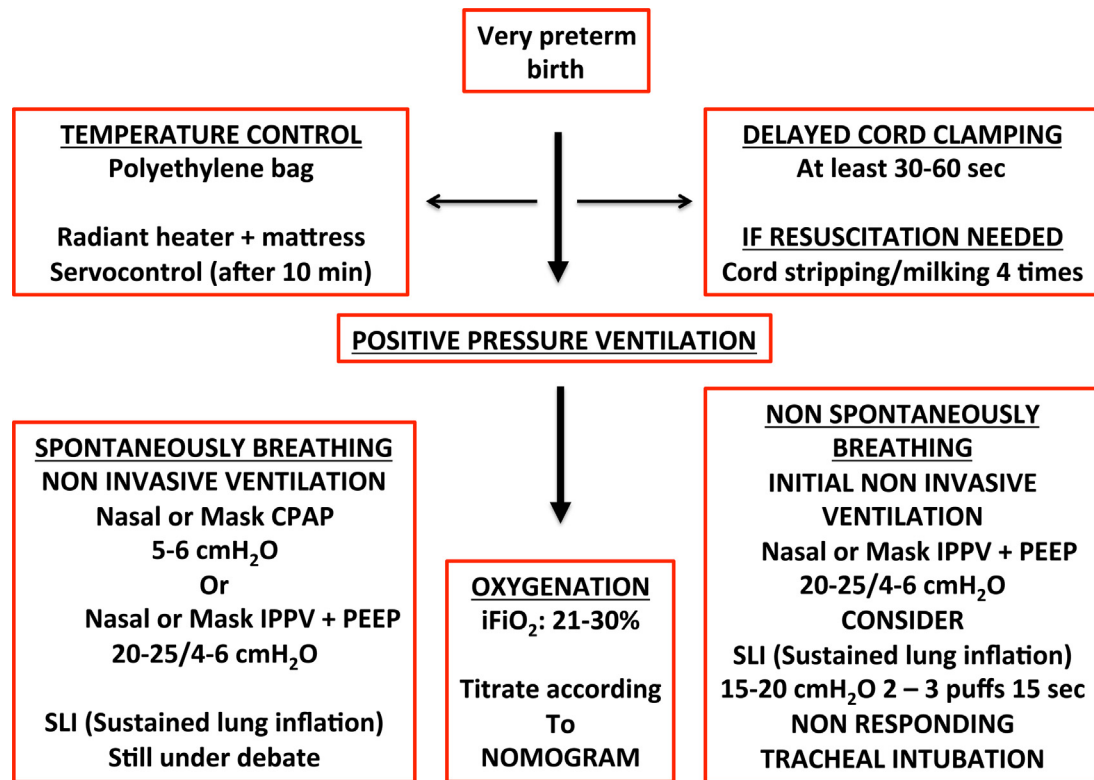


Figure 1. Interventions in preterm delivery after birth.

To facilitate neonatal transition and postnatal adaptation several possible interventions that should be considered: (i) maintaining an adequate body temperature; (ii) improve hemodynamics stability delaying cord clamping or if resuscitation is needed clamping the cord proximal to the placenta and stripping/milking de cord in direction to the infant; (iii) if the baby is spontaneously breathing CPAP with mask or nasal prongs can be provided. If the respiratory efforts are not sufficient to achieve an adequate FRC, intermittent positive pressure ventilation with PEEP should be provided. The use of sustained lung inflations is still under debate and should not be a routine of care; (iv) in babies who are not spontaneously breathing initial PPV + PEEP should be provided, and if not efficient intubation is required; (v) initial FiO_2 of 21% to 30% seem appropriate in most cases. FiO_2 should be titrated using an air/oxygen blender according to the response evidenced in evolving heart rate and SpO_2 .

Allowing placental transfusion immediately after birth

In general there is agreement that delaying clamping of the cord is of benefit to the term and preterm infant. Maintaining blood supply to the heart (pre-load) while the lung vascular system gets replenished contributes to keeping an adequate left ventricular output, thus avoiding reduced blood flow to the CNS, coronary arteries, kidneys and the rest of the body [5]. Recent experimental studies in a sheep model of fetal to neonatal transition have clearly shown that delaying cord clamping after the initiation of positive pressure ventilation and establishment of a functional residual capacity favours myocardial stability, carotid flow, and brain oxygenation, thus prompting a smoother foetal to neonatal transition [6]. In 2010 ILCOR guidelines stated that for the term infant after a normal delivery there is evidence of the beneficial effects of delaying the clamping of the cord for at least one minute but it might be delayed until cessation of cord pulsation. In preterm infants, for uncomplicated deliveries, cord clamping should be delayed for a minimum of 30 seconds to 3 minutes after delivery. However, in extremely preterm infants or preterm infants who are born moderately to severely “depressed” there is no evidence as to whether delaying cord clamping would be of benefit instead of initiating the resuscitation manoeuvres immediately [2]. A recent systematic review comprising the available information since the publication of the 2010 ILCOR guidelines indicates that delaying cord clamping (DCC) up to 3 min in vigorous preterm babies significantly reduces hemodynamic instability, improves cerebral circulation, reduces intraventricular hemorrhage (IVH) all grades, necrotizing enterocolitis and the need for transfusions, although peak serum bilirubin was higher in the transfused group. However,

no clear differences were found in the primary outcome of death, severe IVH or periventricular leukomalacia.

The optimal time to clamp the umbilical cord after delivery is still controversial. There are several small-randomized controlled trials (RCTs) that have compared early (20 s) to late (430 s) cord clamping following preterm birth as well as several prospective observational studies [7]. Of note, no conclusive data regarding the benefits of DCC in depressed infants and especially in very preterm infants are yet available. Although experimental studies support a positive effect on cardiorespiratory circulation, brain perfusion, and hemodynamic stability with delayed cord clamping, the setup needed to physically perform resuscitation maneuvers with an intact cord still constitutes an important impediment in most delivery rooms. In addition, in asphyxiated newborn infants there is a vasoconstriction of the placental vessels accompanied by vasodilatation of the umbilical vessels, thus increasing the circulating blood volume in the foetus. However, pulmonary vasoconstriction and reduced myocardial contractility occur, which may prompt cardiac insufficiency and compromise recovery of the spontaneous circulation [8]. Under these circumstances cord milking has been suggested as a valid alternative. This manoeuvre consists of clamping the cord near the placenta and stripping (“milking”) approximately 20 cm several times (2 to 4) from the distal (placental) to the proximal (foetal) site of the cord. It can be performed in few seconds and provides the newly born with a substantial amount of blood that at least theoretically may contribute to hemodynamic stabilization. To date only three clinical trials have been performed in preterm infants, including a total of 100 babies. Cord milking resulted in increased placental transfusion and apparently appeared to be as effective as DCC.

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