Original Research Article

Adequate position and recommended time for initial steps of neonatal resuscitation.

ABSTRACT

Background: The Neonatal Resuscitation Program highlights the importance of a newborn's first minute, the "Golden Minute", during which the pediatrician determines if a newborn requires, and initiates advanced resuscitation. From birth to the first neonatal evaluation, we detect periods that we call "Lost Time", that delay advanced resuscitation because it is not controlled: The "adequate position" in which gynecologists must "pass" and pediatricians "receive" the newborn; The transfer time to the radiant warmer and; The duration of the initial steps.

Objectives of the study: 1. Present and propose what we consider the "adequate position" to "pass" and "receive" the newborn at each birth. 2. Expose “LT” detected, and how to eliminate them; 3. Establish the adequate time for each initial step of neonatal resuscitation.

Methodology: Observational, descriptive, comparative, triple-blind study. We recorded the position in which gynecologists pass to the newborn, and pediatricians receive, the transfer time to the radiant warmer, and the duration of the initial steps, in 150 deliveries and 150 cesarean sections. Results were analyzed with descriptive statistics, X^2, T-test.

Results: The position to pass and receive the newborn was incorrect and delayed. The transfer time to the radiant warmer was long. The duration of the initial steps was longer than expected. Without differences between both groups.

Conclusions: Planning and accelerating the "adequate position" to "pass and receive" the neonate at each birth, reducing the transfer time to the radiant warmer and shortening the duration of the initial steps, allow us to eliminate lost time, optimize the golden minute of resuscitation and improve neonatal outcomes.

Keywords: Neonatal Cardiopulmonary Resuscitation; Golden Minute of Neonatal Resuscitation; Perinatal asphyxia; Initial steps of resuscitation.

1. INTRODUCTION

The Neonatal Resuscitation Program (NRP) of the American Academy of Pediatrics (AAP) and the American Heart Association (AHA) began in the USA in 1985 and in Mexico in 1995 (1). The basic and advanced maneuvers of neonatal

cardiopulmonary resuscitation (NCR) are described in the Textbook on Neonatal Resuscitation (TNR). This program has improved the outcomes and prognosis of neonates requiring advanced NCR (aNCR), highlighting the importance of the "Golden Minute" of resuscitation, during which the pediatrician determines if a newborn (NB) requires, and initiates, aNCR (2,3). However, it does not address issues such as a. The "adequate or correct position" in which gynecologists must "pass" and pediatricians "receive" the NB; b. The adequate time to transfer it to the radiant warmer (RW); c. The recommended or adequate time for each initial step or basic NCR (bNCR) in the initial stabilization period (ISP), defined as the first 30 seconds (s or sec) after birth (4). If we do not control these issues, we prolong the ISP, giving rise to what we call "Lost Time" (LT), which delays the start of aNCR by more than 60 s, in non-vigorous newborns (depressed).
It is recommended, for vigorous newborns, bNCR on your mother's abdomen, favoring skin-to-skin contact and retarded umbilical cord clamping (RUCC).
For depressed, term, and preterm newborns, who will receive positive pressure ventilation (PPV), there is not enough evidence to recommend RUCC and bNCR over their mother (2-5). According to the international NCR guidelines, a severely depressed newborn can be ventilated, intubated, and undergoing chest compressions 90 s after birth (4,5).
Due to the importance of the NCR's “Golden Minute”; Lack of the "correct position" in which gynecologists must "pass" and pediatricians "receive" the NB at each birth; Prolonged transfer of the NB to the RW; Longed duration for each bNCR step and; LT that delays the initiation of aNCR; Our objectives were:
1. Present and propose what we consider the "correct position" to "pass" and "receive" the newborn at each birth. 2. Expose “LT” detected, and how to eliminate them; 3. Establish the adequate time for each initial step of neonatal resuscitation.

2. MATERIAL AND METHODS

Descriptive, observational, prospective, comparative, and triple-blind study. We analyzed a non-probabilistic and convenience sample of 300 births, 150 deliveries, and 150 cesarean sections, in two second-level hospitals (public and private), from January to June 2017, in Cuernavaca, Morelos. Mexico. We recorded the position in which the gynecologists pass, and the pediatricians receive to the NB, the transfer time to the RW and the time to perform bNCR.

2.1 Triple-blind

1. Gynecologists and pediatricians, blinded to the record of the “position” in which they “pass and receive” to the NB.
2. Pediatricians blinded to the recording of transfer time to the RW and to perform bNCR.
3. Investigators, blinded to risk factors at each birth.

We formed two groups: Group I (GI). Professional (Gynecologist, pediatrician, general practitioner, nurse, etc.) who attends the birth and passes to the NB; Group II (GII). Professional who receives to the RN and provides NCR.

2.2 Variables studied

GI:
1. Professional who attends the delivery and passes to the NB.
2. Time it takes to vacuum the mouth and nose.
3. Time it takes for umbilical cord clamping.
4. Time it takes to pass to the RN.
5. The position in which passes to the RN.
6. Birth way (delivery or cesarean section).

GII:
1. Professional who receives to the NB and provides NCR.
2. The position in which receive to the NB.
3. Transfer time to the RW.
4. Time it takes to perform bNCR.
5. Time it takes to perform the first neonatal evaluation and start aNCR.
6. Percentage of newborns who required aNCR and their diagnosis.

2.3 Inclusion criteria

1. Term NB, >37 Weeks of Gestational Age (WGA).
2. NB without congenital malformations.
3. Mothers without diabetes or gestational hypertension.
4. Births without risk of sepsis.

We excluded neonates without these criteria.

The variables studied and the results werehandled confidentially and anonymously, with verbal consent from the participants in the care of the NB as "yes, I agree to participate in this study", without the names or images of the participants. Statistical analysis: Descriptive data were presented as means and percentages. For the analysis of the results, T-test, X^2, Microsoft Word and SPSS were used. A p value of 0.05 or less was considered for statistical significance.

3. RESULTS

The position in which gynecologists pass and pediatricians receive to the NB was not planned in 100% of both groups and the time required was 5-10 s, average 7.5 s.
Positions found: Prone and transverse (62%); Prone position with the newborn's head towards the person passing it (23%); Supine and transverse position (10%): Supine position with the head towards the recipient (5%). The last one is what we consider the "correct position".
Mouth and nose were suctioned 100%, with a rubber bulb, in 5-10 s, average 7.5 s, until the baby was completely born.
Umbilical cord clamping was performed in 15-24 s, average 19.5 s.
The pediatrician took 8-13 s to transfer and place the newborn in the RW, average 11.5 s. The distance traveled was 2-12 meters (m), average 7 m.
Until here, the sum of the times is 33-57 s, average 46 s. In the best of cases, 46 s to start bNCR under the RW.
bNCR was performed in 40-55 s, average 47.5 s. If we add the time to start the bNCR 33-57 s, average 46 s, the first neonatal evaluation was performed between 73 and 112 s, average 93.5 s, in the best of cases. Therefore, the aNCR started after the golden minute. (Tables 1 and 2)

Table 1. GI. Professional who attends the birth and "passes" to the NB.

GI Results.									
1. Professional who passes to the NB.									
Private setting.					**Public setting.**				
	Gynecologist	Physician	Nurse	Pediatrician	Gynecologist	Physician	Nurse	UMI	Pediatrician
Cesarean	100%				100%				
Partum		90%	10%		7%		3%	90%	
Maneuver / Time (Sec)		Low rank.			High rank.			Average	
2. Mouth/nose aspiration		15			24			19.5	
3. Umbilical cord clampin		5			10			7.5	
4. Time to pass to NB		5			10			7.5	
5. Position to pass to NB		Unplanned 100%			Correct 5% (Fig. 1)			Uncorrect 95%	
6. Birth way									
Cesarean		40%			68%				
Partum		60%			32%				
7. Diagnosis									
Cesarean sections		Oligohydramnios + Prematurity 61%. Preeclampcia + Prematurity 30%. Fetal tachycardia 9%							
Partum		Fetal tachycardia 70%. Prolonged expulsive 22%. Fetal bradycardia 8%							
NB with advanced NCR		12 (4%)							

Table 2. GII. Professional who "receives" to the NB and provide NCR.

GII Results.									
1. Professional who receives the NB.									
Private setting.					**Public setting.**				
	Gynecologist	Physician	Nurse	Pediatrician	Gynecologist	Physician	Nurse	UMI	Pediatrician
Cesarean			10%	90%				20%	80%
Partum		25%	70%	5%			2%	90%	8%
2. Position to receive to the NB		Unplanned 100%			Correct 5% (Fig. 1)			Uncorrect 95%	
Maneuver / Time (Sec)		Low rank			High rank			Average	
3. take him to the RHC		8			13			11.5	

4. Time it takes to position it	15	25	18
5. Time it takes to start basic NCR	40	55	47.5
6. Time it takes to start advanced NCR	53	97	76

3.1 LT lapses found, which can and should be removed

1. Mouth and noseaspiration until the babywascompletelydelivered, average 7.5 s. We wouldsave time and avoidaspiration of amniotic fluid, with and without meconium, if we perform this action routinely in 3-5 s, when the baby's head is born, beforeits first spontaneousventilation, in deliveries and caesareansections.
2. To pass the NB in any position in 5-10 s, causes the pediatrician to waste time turning, rotating, placing and positioning to the NB under the RW. Passinghim in the correct position eliminates at least 5 s of LT.
3. The TNR does notmention in howlong and in what position to receive to the NB. The pediatricianshouldreceivehim in 2-3 s, with a preheatedblanketoverhisarms extended in front, in such a way that the newbornremains as he receivedit, in the correct position.
4. We avoid LT if the RW is close, just two or threestepsfrom the birthbed or operatingtable, so that the pediatrician can arrive in 3-5 seconds. (Figure 1)

Figure 1. From left to right. Correct position to pass, receive and place to the NB under the RW.

5. With the neonate in that position, under the RW, startbNCR.
   Recommendedsequence in the 7th Edition of the TNR (2):
   a. Positioning the airway.
   b. Vacuum or clearsecretionsifnecessary.
   c. Drying the baby.
   d. Stimulateitifnotventilatingspontaneously.
   With this sequence, we have 2 LT. One. To position airwaybefore of suctionsecretionsifnecessary, and dry and removewetblanket. Two. Repositioningairway, afterpreviousssteps.
   Recommendedsequence in the 8th Edition of the TNR (3):
   a. Provide continuousheat, with drying.
   b. Stimulate the baby to facilitaterespiratoryeffort.
   c. Positioning the head and neck to open the airway and, finally,
   d. Aspiratesecretionsfrom the airways, ifnecessary.
   With this sequence, we also have 2 LT. One. Stimulatingitbeforepositioning the head and neck to open the airway without suctioningit, if required, can cause bronchialaspiration. Two. Stimulateitagain, after the stepsabove
   No edition of the TNR indicates the adequate time for eachinitialstep.
   We suggest the followingsequence and the adequate time for each action basedon the fact that 85% of newborns initiatespontaneousventilation in 10 to 30 sec, another 10% itwill do with drying and stimulation, 5% willrequireassistedventilation (6):
   a. Receive the NB with a preheatedblanket in the correct position, transfer it and place under the RW, 3-5 s.
   b. Gentlydryit without rubbing, 5-10 s.

c. Remove the wetblanket, 3-5 s.
d. Position the airway, 3 s.
e. Aspirateitifnecessary, 3 s.
f. Stimulatehimif does notventilate, 3-4 s.
Allsteps in 20-30 s.

6. The TNR does notrecommendhow to dryit and in howlong. We recommenddryingit in the cephalo-caudal direction in 5-10 s.
   a. Head and face; b. Neck; c. Chest, armpits and arms; d. abdomen and groin; and. thighs; f. Legs and feet.
   This orderbecauseitgoesfromareas of greater to lesserbloodcirculation, thereforeareas of greater to lesserloss of heat.
7. Removing the wetblanket without technique generates LT. The TNR does notsayhow or in howlong. We recommend doing it in 5 seconds, without lifting the NB, with the beddingchange technique: a) Turn the NB to one side and roll up half of the wetblanket, as close to his back as possible, and at the same time, place, rolled up, half of a clean, warm and dryblanketon that same side. Then, b) Turn the NB to hisothersidebypassinghimover the two rolledblankets in his back to remove the wetblanket and spread the clean, warm, and dryblanketon the otherside, c) Return to the NB to the supine position to continue with bNCR. (Figure 2)

Figure 2. From left to right. Removal of wet blanket and placement of dry, clean and warm blanket.

8. Place the newborn in the sniffing position to open the airway and aspiratesecretionsifnecessary, with a rubberbulb in 5 s.
9. Stimulatehim, if he does notventilate, byrubbinghis back or the sole of one foot in 2-3 seconds.
10. Carryout the first neonatal evaluation and startaNCRifnecessary, before 60 s. 5% willrequireassistedventilation. 2% willrequireendotrachealintubation, 0.1% willrequire “cardiocompressions” and 0.05% willrequirecardiocompressions with adrenaline (6).
11. Carryingout the sequence of bNCRsteps that we recommend, as soon as fast with a manikin in NCR courses and, in teachinghospitals, in allNBs, bydelivery or bycesareansection, would help reduce LT and achieveenough training to that, so that, in emergency cases, we can complete them quickly and efficiently in a maximum of 30 s, perform the first evaluation, and startaNCRwithin 60 s.
12. Once the newborn is stabilized, carryout the first physicalexamination and the initialroutinecare, until leavingit with itsmom or, eventually, admittingit to the NICU.

4. DISCUSSION

Since the beginning of the NRP in Mexico, we have observed that, in the course and in the TNR, they do not mention the "correct position" in which gynecologists must "pass" and pediatricians "receive" the newborn in each birth, nor in how much time, nor the adequate time to transport it to the RW and for each step of the bNCR.
During the initial steps, it is where we detect most of the LT lapses that we highlight and suggest eliminating to really perform bNCR in 30 seconds, evaluate and start without delay, and efficiently aNCR within “the golden minute”, as recommended (2,3).
It is desirable that a gynecologist attends the birth and passes to the NB and that, a pediatrician or neonatologist receives the NB, all duly trained, and that, in the absence of both, other professionals equally trained and experienced in bNCR and aNCR intervene, to improve the prognosis of 4% of neonates who will require aNCR (2-6). It is also desirable that, between the two, they form a team informing the details of the labor or the indication of the cesarean section, to anticipate the NCR process, optimizing "the golden minute" that is of great importance for the future life of the baby (7,8), and that another person trained in aNCR is contactable for each birth (9,10).

In our environment, due to a lack of personnel, only one nurse simultaneously supports the gynecologist and the pediatrician. The latter often stays alone during the NCR. At the public level, an undergraduate medical intern (UMI) provides support with functions that, eventually, he or she is unaware of due to lack of training, or because they are nursing functions, increasing LT. Nor do we have the personnel to control and notify the pediatrician of the time elapsed from birth to the first 30 s to perform the first evaluation, make decisions and start aNCR in less than 60 s.
In the most recent literature consulted, no actions are mentioned that reduce or avoid LT to optimize the golden minute, except for the recommendation that the resuscitation cradle should be located next to the mother (9) and that the umbilical cord clamping should be immediate in term and preterm NB with fetal distress, flaccid, without respiratory effort, depressed, with meconium amniotic fluid, circular cord tight around the neck, among others (5,10).
A study that compared the rapidity and reliability of the heart rate between the electrocardiogram and the pulse oximeter, mentions that in the ISP continuous positive airway pressure was established on average at 109 ± 14.53 s after birth, ventilation with intermittent positive airway pressure (IPPV) at 89.37 ± 15.32 s and orotracheal intubation at 161 ± 27.67 s (5), closely coinciding with us in that the first neonatal evaluation and the start of aNCR were performed at 93.5 s on average.
Another study to monitor the height at which it is performed and the time in which the umbilical cord is clamped reports a wide variation in clamping time, from 5-35 s (11), similar to our results, from 15-24 s, average 19.5 s.
In a simulation study, they measured the time required to intubate a manikin before starting PPV. They report that PPV started within 1 min, as recommended by ILCOR. They timed from when the manikin it was placed under the RW to perform bNCR and intubated it with a video laryngoscope (not available in all delivery rooms around the world). They suppose that it takes more time to intubate depressed NBs with airway obstruction due to meconium, compared to the dummy (12).
In another simulation study, they compared the intubation time with a video laryngoscope and with a conventional laryngoscope in different scenarios. They found that visualizing the normal or difficult airway, and intubating at the first attempt, was faster with the video laryngoscope (13-21 s) than with the conventional laryngoscope (14-38 s) (13). They do not mention whether they provided bNCR before intubation nor for how long.
Another simulated study compared endotracheal intubation (ETI) skills and time of pediatricians versus anesthetists in neonates and children. They found that for the neonatal manikin, 34 (65.4%) pediatricians were considered sufficiently able to perform the procedure, compared with 52 (100%) of the anesthetists. Pediatricians needed 47.7 s to perform ETI compared with 27.1 s by the anesthetists. They used manikins since it was impossible to perform a meticulous study in vivo. Determined that anesthetists are more successful and better qualified in intubating neonates and children compared with pediatricians in a simulated setting. However, literature shows that skills learned on manikins are no absolute guarantee for success in real-life situations (14).
Aiming to eliminate LT as much as possible, we developed a medical device called "NCR Traffic Light Tutor". It is an application (app) for smartphones and electronic tablets that controls the time, second by second, from birth, and the time of each steps of the bNCR so that, who cares for the NB, does not depend on another person responsible for this activity (15). Agreeing with us, a study mentions that the available technology and trained caregivers must be provided 24 hours a day, every day, all year (5). Another study mentions that it is imperative to use technology in medical emergency systems (16) and another study suggests that artificial intelligence should be used in pediatric emergencies (17).
The algorithm of the International Liaison Committee on Resuscitation (ILCOR) highlights ventilation as the most important step in the resuscitation of the newborn, which should be started in the first 60 s, if necessary, guided by heart rate and respiration. At each step of resuscitation, these signs should be evaluated before proceeding to the next step (18).
Establishing respiration and oxygenation after birth is vital for long-term survival and health (19). Hence, inadequate initial cardiorespiratory support to the NB can cause lung damage, lead to continuous hypoxia/ischemia, and possibly brain injury (20).
In our study, the clock was started at the moment when the whole body of the baby was out, as recommended (21,22), to the start of basic and advanced NCR, and it was longer than that recommended by international guidelines, coinciding with that mentioned by other authors (5,10-21).
Perhaps, these simple actions that we propose, seem unimportant to many, but, in our experience, from thousands of RCNs carried out and with more than 20 NCR courses as instructors since 1996, we have had success, and good neonatal outcomes, in our daily practice.
What we expose is based on the premise of the “golden minute" of resuscitation (7-9,21), because we are convinced that "every second is vital for a depressed NB".
Our descriptive study, limited by its small sample size, "bi-centric" (two hospitals), and by the scant bibliography available on these topics, had the strengths of being comparative, prospective, triple-blind, and innovative because our results provide new concepts that could improve neonatal outcomes not only in our environment, however, further studies are required to validate them, or for to prove otherwise. In any case, we feel that "the small details make the big differences".

5. CONCLUSION

Planning and accelerating the "correct position" to "pass and receive" the newborn in each birth, reducing the time of transfer to the radiant warmer and shortening the time of the initial steps, has allowed us to eliminate lost time, speed up and optimize the golden minute of resuscitation, and increase good neonatal outcomes, in our environment.

CONSENT (WHEREEVER APPLICABLE)

All authors declare that written informedconsentwasobtainedfromtheparticipants of this study including their appearance in the figures (or otherapprovedparties) for publication of thisoriginal research articleaccompanyingimages. A copy of the written consent is available for reviewby the Editorial office/Chief Editor/Editorial Board Members of this Journal.

ETHICAL APPROVAL (WHEREEVER APPLICABLE)

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

REFERENCES

1. Fuentes-Fuentes G, Murguía-de Sierra T. Neonatal resuscitation, what's new? Bol Med Hosp Infant Mex 2006;63:418-427
2. American Academy of Pediatrics, American Heart Association. Textbook of Neonatal Resuscitation. 7th Ed. USA: AAP/AHA 2016.
3. American Academy of Pediatrics and American Heart Association; Weiner GM, Zaichkin J. Textbook of neonatal resuscitation. 8th Ed. Itasca, IL: American Academy of Pediatrics;2021.
4. Iglesias B, Rodríguez MJ, Aleo E, Criado E, Herranz G, Moro M, et al. Pulse oximetry versus electrocardiogram for heart rate assessment during resuscitation of the preterm infant. An Pediatr(Barc). 2016;84:271-277
5. Vento M, Nuñez A, Cubells E. Updating the management of preterm infants in the 1st min after birth. J ClinNeonatol 2014;3:133-8.
6. Aziz K, Lee HC, Escobedo MB, Hoover AV, Kamath-Rayne BD, Kapadia VS, et al. Part 5: Neonatal Resuscitation 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. PEDIATRICS 2021.147;s1.
7. Wyckoff MH, Weiner GM; On behalf of the Neonatal Life Support Collaborators. 2020 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. PEDIATRICS 2021.147;s1.
8. Área de Trabajo de Reanimación Neonatal–Comité de EstudiosFeto-neonatales (CEFEN). Actualizaciónenreanimacióncardiopulmonar neonatal. Arch Argent Pediatr2018;116Supl 3:S59-S70.
9. Zeballos-Sarrato G, Avila-Alvarez A, EscrigFernández R, et al.Guíaespañola de estabilización y reanimación neonatal 2021. Análisis, adaptación y consensosobre las recomendacionesinternacionales. Anales de Pediatría 2022;96:145.e1-145.e9
10. Ministerio de SaludPública y Bienestar Social, Diciembre 2016. Asunción-Paraguay. Manual de Atención Neonatal 2da. Edición. Disponibleen: https://www.mspbs.gov.py/dependencias/portal/adjunto/9fac93-MANUALDEATENCINNEONATAL.AUTORIZADOMSPBSRESOLUCINMINISTERIALSGN816.pdf
11. Rangel-Calvillo MN. Monitoring of the time of clamping and cutting of the umbilical cord. Surveillance of new strategies for childbirth care. PerinatolReprod Hum 2014; 28 (3): 134-138
12. Cavallin F, Res G, MonfrediniCh, Doglioni N, Villani PE, Weiner G, Trevisanuto D. Time needed to intubate and suction a manikin prior to instituting positive pressure ventilation: a simulation trial. Eur J Pediatr (2021);180:247–252
13. Smereka J, Madziala M, Dunder D, Makomaska-Szaroszyk E, Szarpak L. Comparison of Miller laryngoscope and UEScopevideolaryngoscope for endotracheal intubation in four pediatric airway scenarios: a randomized, crossover simulation trial. Eur J Pediatr (2019);178:937–945
14. van Sambeeck SJ, van Kuijk SMJ, Kramer BW, Vermeulen PM, Vos GD. Endotracheal intubation skills of pediatricians versus anesthetists in neonates and children. Eur J Pediatr (2019);178:1219–1227
15. Bolio-Molina LÁ. Entrega y RecepcióndelReciénNacidoen la sala de partos. Instituto Nacional del Derecho de Autor México. 2015.
16. Olasveengen TM, Semeraro F, Ristagno G, Castren M, Handley A, Kuzovlev A, et al. European Resuscitation Council Guidelines 2021: Basic Life Support. Resuscitation 2021;161:98-114
17. Saeed Abdullah Alzahrani, Abdullah Ahmad Alzahrani, Abdullah Al-Shamrani. Artificial Intelligence in Paediatric Emergencies: ANarrative Review. American Journal of Pediatrics. Vol. 8, No. 2, 2022, pp. 51-55. doi: 10.11648/j.ajp.20220802.11
18. RhishikeshThakre. Highlights of Newborn Resuscitation Science, 2020. Journal of Neonatology2021;35(1):24–28

19. O'Donnell-Colm PF, Schmölzer GM., MD, PhDe, Resuscitation of Preterm Infants Delivery Room Interventions and Their Effect on Outcomes. ClinPerinatol2012;(39):857–869
20. Binkhorst M, van de Wiel I, Draaisma JMT, van Heijst AFJ, Antonius T, Hogeveen M. Neonatal resuscitation guideline adherence: simulation study and framework for improvement. Eur J Pediatr 2020;(179):1813–1822
21. Saugstad OD, Robertson NJ, Vento M. A critical review of the 2020 International Liaison Committee on Resuscitation treatment recommendations for resuscitating the newly born infant. *Acta Paediatr*. 2021;00:1–6
22. Sweet DG, Carnielli V, Greisen G, Hallman M, Ozek E, te Pas A, Plavka R, Roehr CC, Saugstad OD, Simeoni U, Speer ChP, Vento M, Visser GHA, Halliday HL. European Consensus Guidelines on the Management of Respiratory Distress Syndrome – 2019 Update. Neonatology 2019;115:432–450 433 DOI: 10.1159/000499361