

Adequate Position and Recommended Time for Initial Steps of Neonatal Resuscitation

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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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

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radiant warmer, and the duration of the initial steps, in 150 deliveries and 150 cesarean sections. Results were analyzed with descriptive statistics, χ^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. MATERIALS 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 NB 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 NB.
5. The position in which passes to the NB.
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.
5. We excluded neonates without these criteria.

The variables studied and the results were handled 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).

3.1 LT lapses Found, which can and Should be Removed

1. Mouth and nose aspiration until the baby was completely delivered, average 7.5 s. We would save time and avoid aspiration of amniotic fluid, with and without meconium, if we perform this action routinely in 3-5 s, when the baby's head is born, before its first spontaneous ventilation, in deliveries and caesarean sections.
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. Passing him in the correct position eliminates at least 5 s of LT.
3. The TNR does not mention in how long and in what position to receive to the NB. The pediatrician should receive him in 2-3 s, with a preheated blanket over his arms extended in front, in such a way that the newborn remains as he received it, in the correct position.
4. We avoid LT if the RW is close, just two or three steps from the birth bed or operating table, so that the pediatrician can arrive in 3-5 seconds (Fig. 1).

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 Partum	100%	90%	10%		100%	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 Partum	40%				68%				
	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 Partum			10%	90%				20%	80%
		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 RW	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	



Fig. 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, start bNCR.

Recommended sequence in the 7th Edition of the TNR [2]:

- a. Positioning the airway.
- b. Vacuum or clear secretions if necessary.
- c. Drying the baby.
- d. Stimulate it if not ventilating spontaneously.

With this sequence, we have 2 LT. One. To position airway before of suction secretions if necessary, and dry and remove wet blanket. Two. Repositioning airway, after previous steps.

Recommended sequence in the 8th Edition of the TNR [3]:

- a. Provide continuous heat, with drying.
- b. Stimulate the baby to facilitate respiratory effort.
- c. Positioning the head and neck to open the airway and, finally,
- d. Aspirate secretions from the airways, if necessary.

With this sequence, we also have 2 LT. One. Stimulating it before positioning the head and neck to open the airway without suctioning it, if required, can cause bronchial aspiration. Two. Stimulate it again, after the steps above.

No edition of the TNR indicates the adequate time for each initial step.

We suggest the following sequence and the adequate time for each action based on the fact that 85% of newborns initiate spontaneous ventilation in 10 to 30 sec, another 10% it will do with drying and stimulation, 5% will require assisted ventilation [6]:

- a. Receive the NB with a preheated blanket in the correct position, transfer it and place under the RW, 3-5 s.
- b. Gently dry it without rubbing, 5-10 s.
- c. Remove the wet blanket, 3-5 s.
- d. Position the airway, 3 s.
- e. Aspirate it if necessary, 3 s.
- f. Stimulate him if does not ventilate, 3-4 s.

All steps in 20-30 s.

6. The TNR does not recommend how to dry it and in how long. We recommend drying it 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;
- e. Legs and feet.

This order because it goes from areas of greater to lesser blood circulation, therefore areas of greater to lesser loss of heat.

7. Removing the wet blanket without technique generates LT. The TNR does not say how or in how long. We recommend doing it in 5 seconds, without lifting the NB, with the bedding change technique: a) Turn the NB to one side and roll up half of the wet blanket, as close to his back as possible, and at the same time, place, rolled up, half of a clean, warm and dry blanket on that same side. Then, b) Turn the NB to his other side by passing him over the two rolled blankets in his back to remove the wet blanket and spread the clean, warm, and dry blanket on the other side, c) Return to the NB to the supine position to continue with bNCR (Fig. 2).



Fig. 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 aspirate secretions if necessary, with a rubber bulb in 5 s.
9. Stimulate him, if he does not ventilate, by rubbing his back or the sole of one foot in 2-3 seconds.
10. Carry out the first neonatal evaluation and start aNCR if necessary, before 60 s. 5% will require assisted ventilation. 2% will require endotracheal intubation, 0.1% will require "cardiocompressions" and 0.05% will require cardiocompressions with adrenaline [6].
11. Carrying out the sequence of bNCR steps that we recommend, as soon as fast with a manikin in NCR courses and, in teaching hospitals, in all NBs, by delivery or by cesarean section, would help reduce LT and achieve enough 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 start aNCR within 60 s.
12. Once the newborn is stabilized, carry out the first physical examination and the initial routine care, until leaving it with its mom or, eventually, admitting it 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 positive pressure ventilation (PPV) 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 NCRs 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 [7-9,22], 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

As per international standard or university standard, parents written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

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.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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