

# Influence of different factors to prolonged adaptation of the neonate

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## ABSTRACT

The neonate must make a transition after birth from intrauterine continuous transplacental supply of oxygen and glucose to different extra uterine conditions. In healthy neonate the period of adaptation almost finished in the perinatal period and newborn can be safely discharged after this time. Retrospective study in the NICU, Clinical Hospital Osijek, during the year 2016 was done. Almost 26% of neonates were admitted in NICU because of the prolonged adaptation to extra uterine life. It was their main diagnosis. The majority of them have been polycytemic, had early jaundice and a part of them had bradycardia. Mother's illnesses as a possible cause of prolonged neonatal adaptation were found in 21.7%. About 58.3% of newborns with prolonged adaptation have had problems during mother's pregnancy and delivery. Hypertrophic as well as hypotrophic neonates were risk neonates for prolonged postnatal adaptation, as well as newborns gender. Mode of delivery takes a big role in the neonatal adaptation. Induction and augmentation of the labor acts as a possibly stress factor. Main symptoms among those newborns were: plethora, cyanotic crises, bradycardia, dystonia, irritability, jaundice and respiratory distress. Most of the investigated newborns need oxygen 6-10 days. The majority of them stay in the hospital up to 10 days. Prolonged adaptation has almost equally been found in the first, second and third pregnancy.

Key words: neonatal adaptation, perinatal stress, pregnancy complications, delivery mode, induction and augmentation of labor, polycythemia, bradycardia

## INTRODUCTION

Adaptation of an organism to the environment occurs through numerous processes beginning in the prenatal period and continuing through the neonatal time. The neonatal period is full of rapid physiological changes. Upon leaving the womb, the neonate must initiate novel behaviors. It enters a natal habitat which differs markedly from the womb. The transition from fetus to newborn is a universal event in mammalian development. (1) Many factors have been reported to initiate continuous breathing, such as umbilical cord occlusion, somatic stimulation, hyperoxia and cutaneous cooling. Extra uterine conditions provide the necessary and sufficient conditions for initiating sustained postpartum behavior. Human babies show a surge of plasma catecholamine associated with the "stress of being born, a physiological response to labor and squeezing through the birth canal which has been strongly implicated in the neonate's adaptation to the postpartum world". (2, 3) Normal term infant accomplishes the transition through a series of well-coordinated metabolic and hormonal adaptive changes. (4)

The status of cervix is the most important predictor of the ability to reach the active phase of labor and achieve vaginal delivery. The benefits of labor augmentation and induction may increase the likelihood of neonatal complications or may lead in unnecessary caesarean section. Amnioscopy and oxytocin or prepidil gel is used for labor induction when the cervix is considered ripe or favorable for induction. Augmentation of labor may be necessary when there is a failure of cervical dilatation or fetal descent with spontaneous uterine contractions. Contractions occurring less

than 3 minutes in a 10 minute window, or with an intensity of less than 25 mm Hg above baseline, or both, may indicate insufficient labor requiring augmentation. (5) Induction of labor has several medical indications including diabetes, premature rupture of membranes after 34 weeks, post-term pregnancies, intrauterine growth restriction and pregnancy related hypertension. (6) After vaginal spontaneous delivery majority of neonates can be discharged after three days and after caesarian section after seven days. After this period of time newborn can breathe spontaneously, heart rate is stable, as well as temperature, and jaundice is, if it exists, physiological. Many external factors can prolong this extrauterine adaptation of the neonate.

## MATERIALS AND METHODS

A retrospective study has been conducted, included neonates with prolonged after birth adaptation. Study covers all admitted neonates in the Neonatal intensive care unit in Osijek of University hospital Osijek in the period of one year, 2016. Included neonates have been born spontaneously, by induced or augmentation labor, or by caesarian section. No one diagnose has been found except "prolonged after-birth adaptation". Medical records of the department and nursing lists were used as a source of data. The following parameters were analyzed: mother's chronic (hypertension, diabetes mellitus, hypothyroidism, infections) and acute illnesses connected with pregnancy (gestational diabetes mellitus, preeclampsia), other chronic mothers illnesses, previous complicated pregnancies (IVF or abortions), complications during

labor (with umbilical cord, color of amniotic fluid), gender of the neonate, birth weight, order of pregnancy, duration of oxygen therapy and length of the hospitalization. Clinical features of newborns were analyzed and described. Incidence of neonates with prolonged after birth adaptation has been carrying out. We tried to point out factors which have been connected with prolonged after birth adaptation. All newborns with any other causes of bradycardia (defined as pulls lower than 100/minute which lasted 3 minutes and more), cyanotic crises, jaundice, irritability, dystonia and respiratory distress (congenital heart diseases, lung or brain causes) have been excluded. Statistical analysis was performed using SPSS software system, along with the chosen level of significance of  $p=0.05$ . Comparison of variables was tested by X2 test with Yates's correction.

## RESULTS

The study included 60 neonates, all full term with prolonged after birth adaptation as a first diagnose. Total number of admitted newborns to NICU during 2016 has been 228. Frequency among all admitted because of prolonged after birth adaptation has been about 26.3%. There have been 63.3% boys and 36.7% girls. Among all live born males in 2016 – 3.7% had prolonged adaptation, and among females 2.1%. Boys

have been in the bigger risk for prolonged adaptation ( $p<0.05$ ). The percentage of neonates with prolonged adaptation among all live born has been 3. Hypotrophic and hypertrophic newborns had also bigger risk for prolonged adaptation. Neonates from first, second, from third and more labor have been in risk equally ( $p>0.05$ ). We wanted to point out importance of mother's chronic illnesses (hypertension, diabetes mellitus, hypothyroidism, and chronic infections) as well as complications during pregnancy and labor (sustained pregnancy, green or meconial amniotic fluid, problems with umbilical cord) and compare those importance. Difference has not been found (Table 1)

About 25% of neonates in the group have been born by cesarean section, 25% spontaneously, and in 50% labor has been induced or augmented. Mode of delivery has been found as an important factor in the newborns adaptation. Neonates delivered by caesarean section, or spontaneously were in the lower risk than those born by induction or augmentation of the labor ( $p<0.05$ ). The risk for those born spontaneously or by the caesarean section has been almost equal. The main symptoms among the investigated neonates have been: plethora, cyanotic crises, dystony, irritability, jaundice, bradycardia and respiratory distress. Plethora was the most often symptom, it happened more often than respiratory distress ( $p<0.05$ ). Cyanotic cri-

ses were more often than dystony and irritability ( $p<0.05$ ). Jaundice as a symptom has been closely connected with prolonged adaptation than bradycardia ( $p<0.05$ ). A big amount of neonates had need oxygen in the prolonged adaptation period (83, 3%). Majority of them needed it for 6 – 10 days ( $p<0.05$ ). Most of neonates were hospitalized for 6 to 10 days ( $p<0.05$ ) (Table 2).

## DISCUSSION

Newborn baby is very sensitive to extra uterine conditions. It leaves security of his mother and begins to breathe and to live independently. We saw immediate adaptations of some organ systems and consequent gradual maturation of the other organ functions. Its autonomic nervous systems react to environmental factors differently than adult. It is maladaptive and not enough mature and it takes a period of time to act as a mature autonomic system. We investigated which factors were associated with neonatal autonomic development as indicated by neonatal heart rate variability and newborn behavior. Many other authors investigated similar connection. (7) Heart rate variability is considered as a reliable indicator of the interplay between the sympathetic and parasympathetic systems. (8, 9) Newborns with prolonged after birth adaptation (without

Table 1. Main characteristics of neonates with prolonged adaptation (PA)

|   | Newborns with PAN (%) | Live born born | %    | p        |          |
|---|-----------------------|----------------|------|----------|----------|
| Gender                                    | Male                  | 38 (63.3)      | 1004 | 3.7      | $p<0.05$ |
|   | Female                | 22 (36.7)      | 1029 | 2.1      |          |
| Birth weight                              | Hypotrophic           | 9 (15.0)       | 85   | 10.6     | $p<0.05$ |
|   | Eutrophic             | 42 (70.0)      | 1867 | 2.2      |          |
|   | Hypertrophic          | 9 (15.0)       | 81   | 11.1     |          |
| Total number of neonates admitted to NICU | 60 (100)              | 2033           | 3    |          |          |
| Admitted to NICU                          | 228 (100)             |                | 26.3 |          |          |
| Labor                                     | First                 | 23 (38.3)      | 911  | 2.5      | $p>0.05$ |
|   | Second                | 25 (41.7)      | 691  | 3.6      |          |
|   | Third and more        | 12 (20.0)      | 402  | 3        |          |
| Sustained pregnancies                     | 7 (11.7)              |                |      | $p>0.05$ |          |
| Mothers chronic illnesses                 | 13 (21.7)             |                |      |          |          |
| Green amniotic fluid                      | 5 (8.2)               |                |      |          |          |
| Problems with umbilical cord              | 10 (16.7)             |                |      |          |          |
| N with complications                      | 35 (58.3)             |                |      |          |          |
| N without complications                   | 25 (41.7)             |                |      |          |          |
| Number of deliveries in 2016              | 2004                  |                |      |          |          |

Table 2. Symptoms, duration of oxygen therapy and duration of hospitalization of newborns with prolonged adaptation (PA)

| Symptoms              |                           | N %       | N % deliveries | p      |
|-----------------------|---------------------------|-----------|----------------|--------|
| Plethora              |                           | 39 (65.0) |                | p<0.05 |
| Respiratory distress  |                           | 15 (25.0) |                |        |
| Cyanotic crisis       |                           | 19 (31.7) |                | p<0.05 |
| Dystony, irritability |                           | 5 (8.3)   |                |        |
| Jaundice              |                           | 19 (31.7) |                | p<0.05 |
| Bradikardia           |                           | 8 (13.3)  |                |        |
| Need for oxygen       | Up to 5 days              | 32 (53.3) |                |        |
|                       | 6 - 10 days               | 17 (28.3) |                | p<0.05 |
|                       | 11 - 15 days              | 3 (18.4)  |                |        |
| Hospitalization       | Up to 5 days              | 4 (6,7)   |                | p<0.05 |
|                       | 6 - 10 days               | 36 (60.0) |                |        |
|                       | 11 - 15 days              | 20 (33.3) |                |        |
| Mode of delivery      | Spontaneously             | 15 (25.0) | 838 (1.8)      | p<0.05 |
|                       | Induction or augmentation | 30 (50.0) | 547 (5.5)      | p<0.05 |
|                       | Caesarean section         | 15 (25.0) | 619 (2.4)      | p>0.05 |

other diagnoses or illness) forms a big group of admitted neonates in our neonatology unit. Higher percentage of neonates with prolonged after birth adaptations were boys. Among neonates more vulnerable were hypertrophic and hypotrophic for gestation. The same results were mentioned in the literature. (10) No differences in risk have been found between the neonates according to the order of delivery. Some maladapted newborns had suffered before birth because of problems their mothers had during the pregnancy (chronic illnesses, sustained pregnancies, and green or meconial amniotic water). Some of them had troubles during the delivery (problems with umbilical cord). Majority of maladaptive neonates have had plethora. When the hematocrit rises to >60%, there is a fall in oxygen transport. Poor perfusion increases the possibility of thrombosis. The relationship between hematocrit and viscosity is nearly linear below a hematocrit of 60%, but viscosity increases exponentially at a higher values. (10) Important difference in the percentage of newborns with prolonged adaptation has been found according to mode of

delivery. Among them the majority have been born by inducted and augmented labor. Significant differences were not found between the spontaneously and by caesarian section born neonates (11), but a bigger percent of neonates born by cesarean section was found among newborns with prolonged after birth adaptation. Similar is found in the literature. (12) The benefits of labor augmentation and induction must be weighed against the potential maternal and fetal risks associated with the procedures. These procedures may increase the likelihood of neonatal complications or result in unnecessary cesarean section. (13) Complications can be avoided and neonatal outcome improved by performing these procedures in neonate with gestation alter higher than 39 weeks. (14) Main symptom among maladapted neonates is plethora; cyanotic crises come next, as well as jaundice. We saw dystony and irritability and bradycardia at the last place but most serious. Majority of maladapted neonates spend many days oxygenated (mostly by noninvasive mechanical ventilation – high flow nasal cannula). Hospitalization lasts between 5 and 15 days, almost third of

newborns spend in the hospital between 11 and 15 days. The costs are high and superfluous.

## CONCLUSION

Mode of delivery acts an important role in the newborns after birth adaptation. Inducted or augmented labor can cause intrauterine hypoxia and provoke plethora of the neonate as a self defending mechanism. It can cause higher vascular resistance and higher blood pressure. Those can stimulate bar receptors in blood vessels and glomus caroticus and cause bradycardia of the neonate (maladaptation of the neonate). The newborn can be irritable with oscillating tonus. He/she can have cyanotic crises and jaundice (as a result of plethora). Neonate can develop respiratory distress. Oxygen must be introduced. These neonates needs longer period of hospitalization because of prolonged after birth adaptation. Additional risk factors for prolonged adaptation are male gender and low and high weight for gestation.

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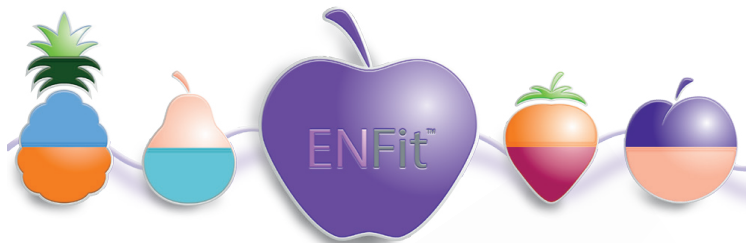
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