

RESPIRATORY MORBIDITY OF FULL-TERM INFANTS AND ELECTIVE CESAREAN SECTION

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In the article the age and gender features of physical development and respiratory function in healthy school-aged children are examined. There are pointed out the average values of height, weight, chest volume, spirometry data and their features according to the children's age and sex at the present stage.

Key words: children, physical development, respiratory function, spirometry.

Definition of Terms:

- Elective cesarean section (CR) — is scheduled CR (including at will of the pregnant woman), carried out before the onset of labor (classification of CS types proposed by the Britain's Royal College of Obstetricians and Gynecologists in 2004 y. [6]).
- Gestational terms: 37 (37+0–37+6) weeks, 38 (38+0–38+6) weeks, 39 (39+0–39+6) weeks, 40 (40+0 to 40+6) weeks, 41 (41+0 to 41+6) week.

The problem of the high frequency of CS and its growth during the past decade and also negative impact of elective CS on the health of women and children made as medical workers so the public to reframe this issue. Statistical data on different countries clearly show the tendency to increasing of the frequency of CS in the world: for example, in the USA in 2006 this index was more than 31.1% (in comparison with 1970 y. (5%), it is increased in 6.2 times) [11]; in Canada in 2000 y. — 23% in the Great Britain in 2001 y. — 21%, in Ukraine in 2008 y. — for about 16% [4,8].

It is evident to conduct CS for the reason of emergency (life) facts from the part of the mother and fetus when the threat of maternal and neonatal death or disability is greater than the risk of complications associated with surgery, and for these conditions CS is undeniable. But the general tendency is not only the growth of CS frequency but also the vast majority of planned CS at the will of pregnant and for the reason of uterine scar that is leads to deterioration of women's health and newborns. Thus, according to the data of NICE, planned CS increases the risk of women's death in 4–5 times, the risk of thromboembolism — in 3.8 times and bladder injury — in 36-times [6]. A significant number of qualitative studies, systematic reviews and meta-analysis also suggests about the negative impact of CS on children's health [3,5,11,14].

Neonatologists are worried about the increased incidence of respiratory disorders in full-term infants who were born by the way of elective CS. Today, scientific researches identified the most appropriate and safe terms for elective CS conduction for child. The prospective cohort study which was carried out in Denmark certifies about the increased incidence of respiratory disease in the group of infants who were born by the way of elective CS. The

34 458 of newborns from the pregnancies with gestational age 37–41 weeks had took part in the study for the periods 1998–2006 yy., the 2687 (7.8%) from them were born by the way of elective CS. The authors are studied the incidence of total respiratory (transient tachypnea of newborns (TTN), persistent pulmonary hypertension (PPH), respiratory distress syndrome (RDS)) and severe respiratory morbidity (need for a child to hold spontaneous breathing with continuous positive pressure (SBCPP) or artificial ventilation) as in the groups of infants born by the way of elective CS so by the way of vaginal delivery (VD). It was found that the risk of respiratory morbidity in infants born by the way of elective CS is higher than in children born through natural birth canals at the same gestational age: in 3.9 times at 37 weeks of gestation (odds ratio (OR) — 3.9; 95% confidence interval (CI) — 2.4–6.5); in 3 times at 38 weeks of gestation (OR — 3.0; 95% CI — 2.1–4.3), in 1.9 times in 39 weeks of gestation (OR — 1.9; 95% CI — 1.2–3.0), severe respiratory morbidity is much higher in the group of infants born by the way of elective CS (OR — 5.0; 95% CI — 1.6–16.0) [14].

The same tendency was observed in the studies conducted in Italy in 1998–2000 yy. among the children born from uncomplicated pregnancies at gestational age 37+0–41+6 weeks: where was carried out the analysis of the frequency of respiratory morbidity (RDS, TTN) in children. Totally for this period were 1284 cases of conducted elective CS. According to the data of this study, the incidence of respiratory morbidity was significantly higher (in 2.6 times) in newborns from elective CS group in comparison with a group of children born through the natural birth canals (OR — 2.6, 95% CI — 1.35–5.9, $p < 0.01$) due to significant increase of the risk of RDS development in children from elective CS group in 5.9 times (OR — 5.85, 95% CI — 2.27–32.4; $p < 0.01$), at the same time when the risk of TTN had no significant difference between the groups. During the analysis of the frequency of RDS in the group of infants born by the way of elective CS depending on gestational age at the moment of delivery is found that the highest risk of RDS meets deadlines 37+0–38+6, when it was increased almost in 13 times in comparison with the group of infants, born by the way of vaginal delivery

(OR – 12.9; 95% CI – 3.57–35.53; $p < 0.01$). During gestational age more than 39+0 weeks significant difference in the frequency of RDS between the groups was not found [12]. Another study also had shown a tendency to increase of severe respiratory morbidity in infants born by the way of elective CS at gestation term 37+0–38+6 weeks [10].

The authors of these studies made conclusions that infants born by the way of elective CS at gestational age up to 39 full weeks, have a much higher incidence of respiratory morbidity than infants who were born by the way of vaginal delivery. Significant reduction in the incidence of respiratory morbidity in children was recorded during the elective CS after 39+0 weeks of pregnancy. Thus, when it comes to hold elective CS the pregnant woman and her family should be informed about possible risks to the child, and in all possible cases CS needs to be postponed after 39+0 weeks of pregnancy.

But what to do when it is necessary to carry out this intervention in terms of 37 +0–38+6 weeks of pregnancy? Labor launches some adaptive mechanisms aimed at preparing the fetus to extrauterine life and especially to effectively spontaneous breathing and process of gas exchange in the lungs. Introduction of corticosteroids to pregnant woman during the danger of premature birth induces in fetus the state of stress with increased levels of relevant hormones in blood, which leads to improvement of gas exchange in the lungs of children after birth. In case of elective CS (which is carried out to the onset of labor) the inclusion of these mechanisms does not occur that is lead to the inability to provide adequate child adaptation to extrauterine life, the symptoms of which is a respiratory morbidity in full-term infants. In 2005 year in the British Medical Journal were published the results of multicenter research about a study of the impact of the course of antenatal corticosteroids on reduce of the frequency of respiratory morbidity in infants born by the way of elective CS at gestational age 37+0–41+6 weeks. A total of 998 pregnant women with uncomplicated pregnancies had took part in the study; the 503 of them were randomized to the experimental group with application of antenatal course of corticosteroids (by 12 mg of betamethasone intramuscularly twice every 24 hours prior to the intervention). The rest of (495 pregnant women) randomized to the control group that received standard care and treatment (without corticosteroids entering). The authors investigated the frequency of hospitalization of infants with respiratory disorders to the Neonatal Intensive Care Department (NICD) and the frequency of severe respiratory disorders. The results are as follows: on 54% reduced the rate of hospitalization of infants with respiratory disorders from the experimental group compared with the control group (relative risk (RR) – 0.46, 95% CI – 0.23–0.93), the frequency of TTN is also lower on 46% in

children from the experimental group (RR – 0.54, 95% CI – 0.26–1.12); the frequency of RDS lower on 79% in children from the experimental group (RR – 0.21; 95% CI – 0.03–1.32) compared with the control group [15].

A Cochrane systematic review of qualitative randomized studies (2009), in which were compared the respiratory morbidity in infants born by the way of elective CS with the course of antenatal betamethasone (467 women) and without the course of antenatal corticosteroids (475) demonstrated a statistically significant reduction on 85% of the frequency of hospitalization to NICD of infants with respiratory morbidity (RR – 0.15; 95% CI – 0.03–0.64). Reduction of the frequency of TTN, RDS and conduction of mechanical ventilation statistically are not significant [7]: reduction of the frequency of RDS – on 68% (RR – 0.32; 95% CI – 0.07–1.58), reduction of the frequency of TTN – on 48% (RR – 0.52; 95% CI – 0.25–1.11), reduction of the needs of child in mechanical ventilation in 4 times (OR – 4.07; 95% CI – 0.46–36.27); reduction of the period of hospital stay (mean number of days) (2.14 days; 95% CI – 5.58–1.30). The authors of this systematic review recommend additionally conduction of the qualitative randomized examinations for forming of definitive conclusions concerning the management of the course of antenatal betamethasone prior to elective CS at full-term pregnancy.

Another way of respiratory morbidity reduction in full-term infants is a vaginal birth after a previous CS. In the study published in 2009 year the authors compared the frequency of hospitalization to the NICD due to the respiratory morbidity and the need for supplemental oxygen in infants born as by the way of elective CS so by vaginal birth after previous cesarean section (VBACS): Infants born by the way of elective CS had a greater frequency of hospitalization to the NICD (9.3% vs. 4.9%; $p = 0.025$), higher frequency of supplemental oxygen management in the delivery room for resuscitation (41.5% vs 23.2%; $p < 0.01$) and after hospitalization to the NICD for the treatment of respiratory disorders (5.8% vs. 2.4%; $p < 0.28$). [3]

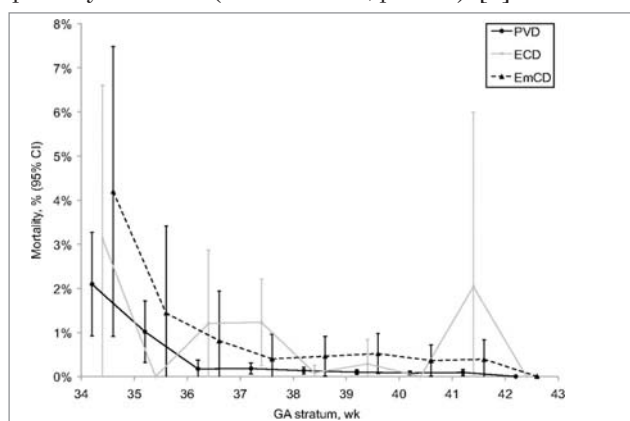


Figure. Intranatal and early neonatal mortality depending on the type of delivery

It is an interesting study of Roberta De Luca et al [9] who have studied the effect of delivery model (vaginal birth, emergency CS, elective CS and CS with the onset of labor) on neonatal mortality. They are demonstrated that the neonatal mortality rate is much higher (5.7 times) in the group of children who were born by the way of CS in comparison with children born by the way of vaginal delivery (0.57% vs. 0.10%; OR — 5.7; $p < 0.001$). The level of combined neonatal mortality of newborns (including intranatal and early neonatal mortality) is significantly higher in the group of infants born by the way of elective CS (0.54%) in comparison with children born by the way of vaginal delivery (0.14%) (OR — 3.83; 95% CI — 2.16–6.78, $p < 0.001$), the frequency of respiratory morbidity is also significantly higher in the group of infants born by elective CS (5.5%) compared with the group of children born by the way of vaginal delivery (2.1%) (OR — 2.75, 95% CI — 2.18–3.47, $p < 0.001$). The increase of the level of neonatal mortality in 3.72 time was marked in the group of full-term infants born by the way of elective CS in comparison with children born by the way of vaginal delivery (0.41% vs. 0.11%, OR — 3.72, $p < 0.001$) (Fig.)

CS conducted after the onset of labor leads to reduction of intranatal and early neonatal mortality and neonatal morbidity [9].

Taking into account recommendations for reduction of the frequency and severity of respiratory morbidity of full-term infants the approaches for tactics and terms of elective CS needs to be reviewed: in all cases, when it is possible, to postpone the period of the intervention into period after 39+0 gestation weeks or conduct CS with the onset of labor. Personnel training and organization of conditions of vaginal birth after previous CS can be also the way of direction of reducing the incidence of women's morbidity and the level of respiratory morbidity of full-term infants. In all cases, pregnant women and family members should be informed about the high risk of respiratory morbidity in newborn after elective CS in the terms up to a 39th full week of gestation.

For today, the absence of high-quality researches and meta-analysis of long-term results of use of antenatal steroid course for 48 hours before the elective CS conduction at full-term pregnancy could not recommend this practice for routine use. The decision for the appointment of antenatal courses should be based on the inability to postpone CS conduction up to the 39th week of pregnancy due to the condition of the mother and/or fetus and expectations of early spontaneous delivery with the beginning of which CS can be conducted.

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