

# NEONATAL SHORT TERM PROGNOSIS ASSOCIATED WITH CESAREAN SECTION COMPARED TO VAGINAL BIRTH

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**Keywords:** delivery, newborn, vaginal birth, cesarean section, prognosis

**Abstract:** Increased rates of cesarean section, as seen currently worldwide, are associated with negative consequences on maternal and child health. Purpose: to evaluate the rate and neonatal short term prognosis after cesarean section versus vaginal delivery. Materials and methods: The retrospective, cohort study included all neonates admitted in the Neonatology I Department, Maternity Hospital Sibiu, between 01.01.2011-30.12.2012. Neonatal data was collected from the electronic database and the outcomes of the infants delivered operatively were compared to those of the vaginally born infants. Results: Newborns delivered by cesarean section, compared to those vaginally born, had significantly lower gestational age, Apgar scores at 1 minute, and increased risk for transient tachypnea, persistent pulmonary hypertension, and hypoglycemia. Conclusion: Most of the results are similar with data reported in the literature but a larger study and stratified analysis may help a better identification of the risk factors associated with cesarean delivery at different gestational age.

## INTRODUCTION

Cesarean section occurred as a rescue surgical intervention for saving mother's or newborn's life and, for centuries, vaginal delivery was the unquestioned mode of birth. In the latest decades both parental and professional opinions have changed and the rate of cesarean section delivery is increasing gradually worldwide.(1-3) Different cesarean section rates are reported worldwide - 30-40% (2,4,5), the highest rates being reported by middle and high incomes countries.(6) In Europe, in 2010, Cyprus had the highest rate of cesarean section births - 52.2% -, followed by Italy - 38.0% - and Romania - 36.9%.(7) Multiple factors have been cited as possible causes of the increasing surgical deliveries: population changes (increased maternal age, increased rate of multiple pregnancies, increased use of assisted reproductive techniques);(3,8-10) changes in the obstetrical management (more cesarean sections for breech, multiple gestation, previous delivery by cesarean section, increased number of pregnancies terminated without maternal or fetal medical indication for obstetrician's or maternal convenience, better fetal monitoring and increased detection of fetal distress, fear of litigation);(1,3,6-8,10-20) changes of the parental perception on maternal and fetal risks.(7,21)

World Health Organization, after analyzing the risks and benefits of c-section delivery, has recommended a rate of 10-15% for deliveries performed by cesarean section.(22) Healthy People, in 2010, recommended a cesarean rate of 15% for primiparous women.(23) Lower rates of cesarean section deliveries are associated with increased maternal and perinatal mortality (5,23) while increased rates have negative consequences on maternal and child health.(5,23-24) Maternal consequences of the increased rates of cesarean rates are elevated risks for infections, antibiotic therapy, hemorrhages, thromboembolism, surgical lesions, blood transfusions, postoperative pain, admission in the intensive care units, death, and for the future reproductive health (due to increased risk for abortion, ectopic pregnancies, placental praevia, placenta accreta, hysterectomy, need of repeated operative

delivery).(11,25-29) Increased respiratory morbidities, depression at birth, admission in the neonatal intensive care units, hypoglycemia, neonatal sepsis, jaundice, death, and breastfeeding difficulties are cited by many authors as the main neonatal risks associated with cesarean section delivery compared to vaginal birth.(3,14,30-40)

In some specific cases, the need for cesarean section delivery is clear and without debate but in other situations, due to lack of consensus and conflicting results of the studies, the need for operative delivery must be evaluated individually, taking into account the maternal, obstetrical, and fetal circumstances in the best maternal and fetal interest. Understanding of the impact of the delivery mode on maternal and neonatal morbidity and mortality is essential in the actual context of continuous increase of the cesarean section delivery rates.

## PURPOSE

The purpose of the study was to evaluate the rate and short term prognosis of infants delivered by cesarean section compared to those born vaginally in 2012, short time after the release of new guidelines for obstetrical care and management.

## MATERIALS AND METHODS

The study is a retrospective, cohort study and included all neonates admitted in the Neonatology I Dpt. of the Sibiu Maternity Hospital, a regional unit (level III), between 01.01.2011-30.12.2012. All newborns admitted in the unit during the study period were included in the study, either born in the unit or submitted from lower level maternities from the assigned area according to the maternal and infant regionalization legislation. Exclusion criteria: re-admission for maternal or neonatal conditions. Data was collected from the electronic database of the unit and, when the data was incomplete, from neonatal records: gestational age, birth weight, delivery mode, Apgar score at 1 minute, respiratory morbidity, hypoglycemia, physiological weight loss, significant jaundice,

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Article received on 12.07.2015 and accepted for publication on 27.11.2015  
ACTA MEDICA TRANSILVANICA December 2015;20(4):81-85

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maternal-fetal sepsis, hypoxic-ischemic encephalopathy, seizures, and length of hospitalization. Gestational age was appreciated based on the ultrasound measurements in the first trimester of pregnancy or the date of the last menstrual cycle or using the new Ballard score. The following respiratory conditions were identified: neonatal transient tachypnea, persistent pulmonary hypertension, meconium aspiration, and air leak syndromes. Hypoglycemia was defined according to the national guidelines.(41) We defined as significant the jaundice needing phototherapy. Maternal-fetal sepsis was defined as signs and symptoms occurring in the first 72 hours after birth associated with suggestive or positive hematological, inflammatory, and bacteriological tests. Hypoxic-ischemic encephalopathy was defined according to The International Cerebral Palsy Task Force (42) and neonatal seizures were defined according to Volpe's definition (43) and clinical seizures were considered when accompanied by electric manifestations on amplitude electroencephalography monitor.

Statistical analysis was performed using SPSS 10.0 for Windows, p was considered statistically significant at values below 0.05 (confidence interval - CI - 95%). Data are reported as values, mean values, standard deviations (SD), and percentages, the Independent T-test was used to compare the scale variables and Fischer's exact test or chi square test were used (where appropriate) for the analysis of the categorial variables. Odds ratio was calculated, also using 95% confidence intervals.

### RESULTS

Between 01.01.2012 and 31.12.2012, a total number of 2625 newborns were admitted in the Neonatology I Dpt. of the Maternity Hospital Sibiu and after excluding 236 readmissions and the three deaths (due to severe congenital malformations and therefore excluded), the study group comprised 2386 neonates (90.1% of all admissions). The mean birth weight of the study group was  $3292.8 \pm 403.9$  g (2300-4990 g) and the mean gestational age of the group was  $39.3 \pm 1.3$  weeks (34-42 weeks).

Of the 2386 newborns included, 506 were delivered by cesarean section (21.2%), 29 were extracted using forceps (1.2%) and 1851 neonates were born vaginally (77.6%).

The baseline characteristics of the study group are presented in the table no. 1. We observed that the gestational age of the neonates delivered by cesarean section was significantly lower compared to those born vaginally despite the fact that there was no difference as regards their birth weights.

**Table no. 1. Baseline characteristics of the study groups**

	CS <sup>1</sup> vs. VD <sup>2</sup>	Mean $\pm$ SD	P
BW (g)	CS	$3292.9 \pm 427.3$	0,993
	VD	$3292.7 \pm 397.5$	
GA (weeks)	CS	$38.8 \pm 1.4$	0,000
	VD	$39.4 \pm 1.3$	

<sup>1</sup>CS - cesarean section; <sup>2</sup>VD - vaginal delivery

**Table no. 2. Apgar score and weight loss**

	CD <sup>1</sup> vs. VD <sup>2</sup>	Mean $\pm$ SD/no(%)	p/OR[95%]
Apgar score	CD	$8.6 \pm 1.2$	0.000
	VD	$9.6 \pm 0.9$	
Physiological weight loss (g)	CD	$185.2 \pm 65.8$	0.599
	VD	$170.9 \pm 58.4$	

Mean Apgar scores and mean physiological weight loss of the study groups are figured in table no. 2, both lower in infants delivered by cesarean section.

Short term outcome, as revealed by the neonatal conditions evaluated - respiratory (transient tachypnea,

persistent pulmonary hypertension, meconium aspiration syndrome, air leak syndromes), metabolic (jaundice and hypoglycemia), neurological (cerebral hemorrhage, hypoxic-ischemic encephalopathy, and seizures), infectious - collected from the electronic data base and neonatal records, are presented in the table no. 3.

**Table no. 3. Neonatal short term outcome**

Jaundice	CD	51 (10.1)	0.000
	VD	216 (11.5)	0.36[0.3-0.5]
Hypoglycemia	CD	4 (0.8)	0.041
	VD	2 (0.2)	4.9[1.1-22.3]
Transient tachypnea	CD	12 (2.4)	0.004
	VD	14 (0.7)	2.2[1.5-7.0]
Persistent pulmonary hypertension	CD	19 (3.7)	0.000
	VD	20 (1.1)	3.6[1.9-6.8]
Meconium Aspiration	CD	2 (0.4)	0.532
	VD	6 (0.3)	1.2[0.2-6.2]
Air leak syndromes	CD	3 (0.6)	0.169
	VD	4 (0.2)	2.9[0.6-12.5]
Maternal-fetal infections	CD	20 (3.9)	0.185
	VD	95 (5.1)	0.7[0.5-1.3]
Cerebral hemorrhage	CD	1 (0.2)	0.712
	VD	4 (0.2)	0.9[0.1-8.3]
Hypoxic-ischemic encephalopathy	CD	5 (1.0)	0.423
	VD	12 (0.6)	1.2[0.4-3.4]
Seizures	CD	1 (0.2)	0.554
	VD	6 (0.3)	0.6[0.1-5.1]
Hospitalization duration	CD	$4.3 \pm 4.2$	0.247
	VD	$3.3 \pm 4.7$	

CS - cesarean section; <sup>2</sup>VD - vaginal delivery

### DISCUSSIONS

The continuously increasing rate of the cesarean rate worldwide since 1970s in most developed countries raised concerns between the specialists since increased maternal and neonatal morbidity (3,11,29-40) are associated with operative delivery rates over 15%, the rate recommended by World Health Organization.(21) The rate of cesarean deliveries also increased steadily in Romania so that in 2010, Romania had the third highest operative delivery rate in Europe.(7) As demonstrated by our study, in 2012, the rate of cesarean section in late preterm and term neonates (34-42 weeks gestation) was significantly lower compared to the national rate - 21.2% versus 36.9%(7) - but higher than the one recommended by experts from World Health Organization.(21) The higher rate may be explained by the fact that our maternity hospital is a regional unit, offering specialized obstetrical care to an increased number of at risk pregnancies. The low rate of instrumental deliveries (1.2%) is similar with the rates reported in the literature (44) and we must mention that vacuum extraction is not used in our unit.

The baseline characteristics of our study group (table no. 1) - birth weight and gestational age - are important for the interpretation of the results of the study. The significantly lower mean gestational age of the newborns delivered by cesarean section compared to those born vaginally suggests a tendency to terminate pregnancies before term - considered at 39 weeks gestation -, contrary to the experts recommendation.(40,45,46) Also, the lower gestational age of the neonates operatively delivered suggests an increased number of late preterm infants, similar with recent published studies.(47-49) All these are speculations since a stratified analysis of the data was not performed and the results are suggesting the need for such an evaluation, most probably on a greater number of patients in order to increase the relevance of the results.

Comparison of our results with data in the literature is difficult since most of the studies are comparing outcomes after

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vaginal birth versus planned or elective or at maternal request cesarean delivery without stratification of the data based on gestational age. As shown in table no. 1, our patients were late preterm and term neonates with gestational ages between 34 and 42 weeks and cesarean deliveries were analyzed globally, without taking into account if the intervention was performed electively - in the absence of labour, during labour -, as an emergency, or at maternal request.

Consistent with the data in the literature, newborns delivered by cesarean section had a significantly mean Apgar score at 1 minute compared to those vaginally born (table no. 2). An increased risk - 6 times higher - for depression at birth was reported by Liston et al. (3) in a study comparing outcomes after planned cesarean section versus vaginal delivery at term. Another study reported that newborns delivered vaginally had lower need for use of oxygen during resuscitation at birth ( $p < 0.0001$ ) but increased number of Apgar scores  $\leq 5$  at 1 minute ( $p < 0.02$ ) compared with those delivered by planned cesarean section.(36) Increased risk for depression at birth was associated with elective cesarean section before labour compared to vaginal birth - adjusted RR 1.1 - but the risk is decreased compared to emergency cesarean section - adjusted RR 0.8 -(14)

Even though the mean physiological weight loss was greater in newborns delivered by cesarean section, the difference between groups was not significant. No reference was found in the literature as regards the weight loss but, as cesarean section is associated with more difficulties in initiating, establishing, and continuation of breastfeeding (30,39,40), an increased physiological weight loss is expected in infants delivered operatively.

Geller et al. (36) is reporting significant jaundice - defined as jaundice that needs phototherapy - occurs more frequently in infants delivered by cesarean section and some of the authors are associating significant jaundice with an increased rate of prematurity. Our data (Table no. 3) reveals that newborns delivered vaginally presented an increased incidence of significant jaundice ( $p < 0.000$ ). The interpretation of this finding is difficult since we did not differentiate jaundice according the etiology - blood type or Rh incompatibility, resorption of cephalhematoma or bruises, etc.

Hypoglycemia was found significantly more often in neonates delivered by cesarean section, the risk being almost 5 times higher than for newborn delivered vaginally. An increased risk for hypoglycemia is reported, also, by Tita et al.(35): a risk of 1.8-2.4 at 37 weeks gestation and 1.3-2.1 at 38 weeks gestation.

Respiratory morbidities are reported as the most frequent complications associated with operative deliveries.(3,14,30-32,34,35,39,50) At term, planned operative delivery during labour increased 3 times the risk for respiratory morbidities, most of the cases being transient neonatal tachypnea but the authors also registered cases of respiratory distress syndrome due to surfactant deficiency, persistent pulmonary hypertension, and aspiration syndromes.(30) In a cohort study developed in Nova Scotia, based on 142929 births, Liston et al.(3) found that cesarean section is an independent risk factor for respiratory morbidity, with an OR of 2.3 for operative deliveries and an OR of 2.6 for the cesarean sections performed in the absence of labour. Other authors (31,50-52) are describing an increased risk for neonatal respiratory conditions especially if the cesarean section is performed in the absence of labour, even in neonates with gestational ages  $\geq 37$  weeks. An increased risk for respiratory morbidities is also described in association with repeated cesarean section.(34,53) In our study group we found that newborns delivered by cesarean section presented a significantly increased risk for neonatal transient

tachypnea - OR 2.2 [95%CI 1.5-7.0] - and persistent pulmonary hypertension - OR 3.6 [95% CI 1.9-6.8] - but we have found no significant difference between the rates of meconium aspiration and air leak syndromes (table no. 3). Neonatal transient tachypnea was recently linked to an increased subsequent risk for asthma.(54)

An increased incidence of sepsis among the neonates operatively delivered is reported by Tita et al. (35) - OR between 1.8 and 4.2 at 37 weeks gestation and between 1.3 and 2.1 at 38 weeks gestation. In our cohort of patients we found that maternal-fetal infections occurred more often in newborns born vaginally (5.1% versus 3.9%) but the difference was not significant.

For some years the perception that cesarean section delivery protects against hypoxic-ischemic encephalopathy was shared both by parents and professionals but data in the literature are denying this statement. Cesarean section delivery was associated with a significantly increased risk for depression at birth - 6 times higher - in the study reported by Liston et al.(3) A meta-analysis evaluating mother requested cesarean deliveries and cesarean section deliveries without medical indication versus planned vaginal birth found that vaginal birth was associated with an increased risk for Apgar scores  $\leq 7$  but we found no studies comparing perinatal hypoxic-ischemic encephalopathy and seizures incidence between neonates delivered by cesarean section versus vaginally born infants.(29) As presented in the table no. 2, both hypoxic-ischemic encephalopathy and neonatal seizures occurred more often in newborns delivered operatively but the difference was not significant. Cerebral hemorrhage, identified by cranial ultrasound, was found in equal proportion in the study groups (table no. 3).

Despite increased neonatal morbidity and gestational age of the newborns delivered by cesarean section we found no significant difference between the duration of hospitalization between the study groups. Also, this is in contrast with other studies that found increased duration of hospitalization in association with operative deliveries.(35)

The information offered by this study must be interpreted with caution. The small number of newborns presenting neonatal morbidities diminishes the value of the statistical analysis and prompts for a larger study, comprising a greater number of patients. Also, our data suggests that a stratification of the patients based on gestational age would better separate the effect of prematurity on the incidence and structure of neonatal morbidities associated with cesarean section versus vaginal birth. The stratification based on the type of cesarean section - in the absence of labor, during labor, as emergency, with or without medical indication - could also help obstetricians and parents to make better decisions as regard pregnancy termination. We, therefore, proposed ourselves to continue the study in order to continuously evaluate the rate of cesarean sections and its impact on the neonatal outcome. The significantly lower gestational age of the preterm infants delivered by cesarean section can also be correlated with the increased incidence of transient tachypnea, persistent pulmonary hypertension, and hypoglycemia found in these infants.

## CONCLUSIONS

Concerns regarding the steadily increasing rate of cesarean section deliveries must prompt clinicians to evaluate its impact on neonatal short term outcome. Our data suggests that newborns delivered by cesarean section, compared to those vaginally born - had significantly lower gestational age, Apgar scores at 1 minute, and increased risk for neonatal transient tachypnea, persistent pulmonary hypertension, and

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hypoglycemia. A larger study and stratified analysis based on gestational age is needed in order to differentiate between the effect of gestational age and the effect of delivery mode.

Until more data are available, obstetricians and neonatologists must comply to national and international recommendations to perform cesarean sections only in the best interest of the mother and child, evaluating each case individually, together with the future parents, using evidence-based medicine where available, to administer corticosteroids before birth for lung maturation, and to perform elective operative deliveries only after 39 weeks gestation.(40,45,46)

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