

The influence of obesity on abdominal cesarean section delivery

M. Trisovic¹, O. Kontic², I. Babovic³, D. Plecas⁴, D. Kisic Tepavcevic⁵

¹ Hospital for Gynecology and Obstetrics, KBC Zvezdara, Belgrade; ² Sports Academy, Belgrade University, Belgrade

³ Institute of Gynecology and Obstetrics Clinical Center of Serbia, Serbia; Faculty of Medicine, University of Belgrade, Belgrade

⁴ Institute for Hygiene and Medicine Ecology, Faculty of Medicine, University of Belgrade, Belgrade

⁵ Institute of Epidemiology, Faculty of Medicine, University of Belgrade, Belgrade (Serbia)

Summary

Aim: The analyze the potential influence between obesity in pregnancy and the abdominal delivery- cesarean section and to establish the possibility of its prevention. **Materials and Methods:** A prospective study examined 200 patients, delivered by cesarean section in a one-year period. The study included a structured questionnaire; the body weight at the end of pregnancy was measured and it was analyzed against all available medicine documentation. Statistical analysis included: χ^2 test, Student's t-test, and Fisher's test, as well the Pearson's and Spearman's test of correlation rank. **Results:** From all 200 (100%) patients delivered by cesarean section, 67 (33.5%) were overweight and obese. Body mass index at the beginning of pregnancy was significantly associated with cesarean section ($\chi^2 = 69.141$; $p < 0.001$), along with the appearance of eventual pregnancy complications, and also with the neonatal birth weight ($p = 0.224$; $p < 0.001$). **Conclusion:** The nutritive status, both at the beginning and at the end of pregnancy is the important factor for the pregnancy outcome.

Key words: Body mass index; Obesity; Overweight; Cesarean section.

Introduction

Obesity is defined as a pathological state, characterized by excessive fat accumulation until that level when it begins to be a health risk. Today, obesity is a serious health problem in many countries, especially in North America, as in many European countries [1].

Body mass index (BMI) is the ratio between weight in kilograms and the square of the height in meters and according to the National Health and Nutrition Examination Survey (NHANES) is usually used as parameter to define nutritional status [2]. Normal weight is with a BMI from 18.5 to 24.9. BMI between 25 and 29.9 is considered overweight and BMI over 30 indicates obesity. BMI over 35 is defined as malignant or pathological obesity.

Over the last decade, nutritional status has been recognized as one of the most important factors of the reproductive health [3]. Therefore, excessive body weight and obesity become one of the most challenging issues in the field of gynecology and obstetrics [3]. The results of numerous studies have shown that this group of women were at higher risk for the development of wide range of gynecological diseases such as: polycystic ovary syndrome (PCOS), irregular menstrual cycle, endometrial cancer, etc [4, 5]. Furthermore, it was also noticed that females with increased body weight are the risk group for developing a number of complications during pregnancy and childbirth (hypertensive syndrome in pregnancy, gestational diabetes,

thrombosis, prolonged labor, stimulation/induction of labor, feto-pelvic disproportion, and cesarean section [4, 5].

In modern obstetrics era, cesarean section has become one of the most common modes of delivery, and gradually tends to take the leading role worldwide. The prevalence of cesarean section in different countries varies from 5% to 30% of the total number of deliveries [6]. The results from the studies that have examined the factors associated with this mode of delivery showed that overweight pregnant women appeared as an important factor which are mostly included in the high-rate of cesarean sections.

The aim of this study was to investigate the effect of overweight and obesity in pregnancy on the obstetrician's decision to complete delivery by cesarean section in the representative sample of females in the population of Belgrade (Serbia).

Materials and Methods

The study was undertaken at the Institute of Gynecology and Obstetrics, Clinical Center Serbia (IGA KCS) in Belgrade, and in the Hospital for Gynecology and Obstetrics, Clinical Hospital Centre "Zvezdara" (KBC) in Belgrade.

The study was designed as a cross-sectional study and included 200 patients. The sample was created using consecutive sampling design comprising women who had cesarean section during the period from the January 1st, 2008 until July 30th, 2008. This study used a specially formed, structured questionnaire, composed on the basis of literature data [7]. BMI was calculated according to

Table 1. — *Nutritional status of pregnant women, depending on the urgency of cesarean section.*

Type of cesarean section	Underweight N (%)	Normal weight N (%)	Overweight N (%)	Obese class I N (%)	Obese class II N (%)	Obese class III N (%)	Total
Emergency	2 (2.3)	28 (32.6)	29 (33.7)	24 (27.9)	2 (2.3)	1 (1.2)	100 (100)
Planned	15 (18.2)	88 (77.2)	7 (6.1)	4 (3.5)	/	/	100 (100)
Total	17 (8.5)	116 (58)	36 (18)	28 (14)	2 (1)	1 (0.5)	200 (100)

method proposed in 1985 by Garrow (originally called the Quetelet's index (QI)), and was determined by the formula: $BMI = TM (kg) / TV^2 (m^2)$ [8].

For checking the hypothesis of the existence of differences in findings between the presence of certain groups, the methods of descriptive statistics: χ^2 test and student - T- test were used. If it was not possible to apply χ^2 test, the Fisher's exact test was used.

The relationship between BMI and caesarean section, as well as between BMI and other investigated variables pregnancy-induced hypertension (PIH), gestational diabetes, urinary tract infections, and neonatal birth weight) was assessed by Spearman's rank correlation and Pearson's coefficient of linear correlation.

Results

The mean age of all women participating in the present study was 32.9 years (range 19 up to 44). Of all the women, 67 (33.5%) were older than 35 years. Most of them were nulliparas: 111 (55.5%), and educated: 117 (58.5%). The majority of women had an adequate prenatal care in their pregnancy: 179 (89.5%), while 21 (10.5%) were not subjected to any health-related check-ups during the entire period of pregnancy.

Of the total sample of 200 women who underwent cesarean section during the period of observation, 67 (33.5%) of them were overweight and obese. Based on the results obtained from the questionnaire, the authors noted that the highest number of pregnant women who reported changes in feeding regime had the normal body weight at the beginning of pregnancy were 45 (57.7%) and had a BMI between 18.50 and 24.99 kg/m².

There was a statistically significant difference in the nutritional status of pregnant women and the way of delivery ($\chi^2 = 69.141$; $p < 0.001$). Emergency cesarean section was completed in 86 (43%) patients versus planned cesarean section which was completed in 114 (57%) patients. Emergency cesarean section was the most common in patients who were overweight: 29 (33.7%), with BMI between 25.00 and 29.99 kg/m² (Table 1).

There was a statistically significant association between BMI and all the studied pregnancy complications: hypertension (PIH), gestational diabetes (GD), and urinary tract infections ($r(PIH) = 0.637$; $p < 0.001$; $r(GH) = 0.538$; $p < 0.001$; $r(urinary\ tract\ infection) = 0.289$; $p < 0.001$). All complications were most common in patients who were obese class I- BMI between 30.00 and 34.99 kg/m².

The average body weight of infants born by cesarean section in the sample was $3,524 \pm 606.48$ grams. There was a

highly significant correlation between the nutritional status of pregnant women during early pregnancy as measured by BMI and birth weight of newborns ($p = 0.224$, $p < 0.001$). The average BMI at the beginning of pregnancy was 23.88 ± 5.12 kg/m², which meant that most of women at the beginning of pregnancy were of normal weight with a BMI between 18.5 and 24.99 kg/m².

In the present study the authors observed gestational increase of body weight with 17.24 ± 5.32 kg. Gestational increase of body weight in pregnancy has proven to be one of the factors that have influenced the weight of newborns, as the authors proved statistically significant association between fetal weight and gestational weight gain ($p = 0.198$, $p < 0.005$).

Out of 200 women (100%) in this study, deliveries by caesarean section were 178; of them (89%) gained 12 kg or more in weight, which significantly deviates from the recommendations of the World Health Organization (WHO).

Discussion

During the past decades it has been recognized that excessive body weight and obesity become one of the most challenging issues in the field of in perinatology and obstetrics [9]. Namely, it was observed that body weight during the pregnancy could be a significant predictive factor for delivery mode, as well as for development of various pregnancy-related complications. In the present study, 66.5% of patients were younger than 35 years and the majority of them were educated nulliparous. The majority of women, 89.5%, had adequate prenatal care in pregnancy.

The majority of pregnant women included in the present investigation had normal body weight at the beginning of pregnancy which were in accordance with results obtained in a sample of Australian obstetric population [10]. Furthermore, the most prominent increase in body weight of pregnant women have been detected in the third trimester.

The correlation of obesity in pregnancy and emergency of cesarean sections supports the hypothesis of this study; the influence of obesity on the mode of delivery. As obesity is not classified in the absolute and relative indications for the abdominal delivery in Serbia, the majority of patients with excessive body weight have entered the active phase of vaginal delivery, and in the course of the delivery stalled further progress, because of the possible complications in mother, fetus or both, which of course, influenced the deci-

sion of the obstetrician to complete the delivery by cesarean section. Emergency cesarean section was the most common in patients who were overweight in 33.7% [11, 12].

In this study, the authors observed that in obese pregnant women have often the following complications: preeclampsia, gestational diabetes, and urinary tract infections. These complications were an important factor in the decision for cesarean section [13, 14]. Preeclampsia is most often observed in patients that were registered obese class I, in 78.57%. Gestational diabetes is also commonly diagnosed in women, that were registered obese class I, in 35.71%, and urinary tract infections were also most frequent in the group of patients that were registered obese class I, in 21.43%.

As recommended by WHO, the allowed increase in body weight in singleton pregnancies should be from 11 kg to 12.5 kg by the end of pregnancy or from 16 kg to 20 kg in twin pregnancies. Obese and overweight pregnant women usually give birth to children over 4,000 g. Overweight newborn, ones with birth weight over 4,000 g could be one of the causes of dystocia (abnormal labor), vaginal delivery failure, and frequent cesarean sections.

In this study, it was observed that patients with high BMI often delivered overweight newborns, and that the average weight gain during pregnancy was 17.24 ± 5.32 kg, which roughly corresponds to the results derived from similar studies [15]. The authors proved that there is a statistically significant correlation between gestational weight gain of the mothers and newborns' body weight, which supports the theory that glucose is an essential nutritive element in intrauterine fetal nutrition, and that maternal hyperglycemia stimulates high levels of glucose in the fetal circulation and reactive hyperinsulinemia which consequently leads to increased synthesis of triglycerides and increase of fetal fat, leading to fetal macrosomia [16].

About 89% of the patients in this study gained 12 kg or more in weight during pregnancy, that is alarming and an indication for a possible adverse perinatal outcome.

Conclusion

Nutritional status both at the beginning and at the end of pregnancy significantly affects both the flow of the pregnancy and the way of delivery, as well as significantly affects the weight of newborns. Based on the above correlations, the authors conclude that obesity at the beginning and at the end of pregnancy is a significant marker of pregnancies outcome which should be seriously taken into consideration. One of the most important measures to

prevent obesity in pregnancy is to increase the activity of existing nutrition guidelines for pregnant women.

References

- [1] Jorga J.: "Gojaznost". In: Kocijančić I.R. (ed). *Higijena*. Belgrade: Zavod za udžbenike i nastavna sredstva, 2002, 437.
- [2] National Health and Nutrition Examination Survey. Available at: www.cdc.gov/nchs/data/nhanes/databriefs/adultweight.pdf
- [3] Sub-Committee on Nutrition (ACC/SCN), International Food Policy Research Institute (IFPRI): "The 4th World Nutrition Situation Report: Nutrition through the Life Cycle", 2000. Available at: <http://www.ifpri.org/sites/default/files/pubs/pubs/books/4thrtpt/4threport.pdf>
- [4] Holger S., Scheithauer S., Dornhofer N., Kramer T.: "Obesity as an obstetric risk factor: does it matter in a perinatal center?" *Int. J. Obes.*, 2006, 14, 770.
- [5] Khashan A.S., Kenny L.C.: "The effects of maternal body mass index on pregnancy outcome". *Eur J Epidemiol.*, 2009, 24, 697.
- [6] Betr  n A.P., Merialdi M., Lauer J.A., Bing-Shun W., Thomas J., Van Look P., et al.: "Rates of caesarean section: analysis of global, regional and national estimates". *Paediatr. Perinat. Epidemiol.*, 2007, 21, 98.
- [7] Barau G., Robillard P., Husley T.: "Linear association between maternal pre-pregnancy body mass index and risk of cesarean section in term deliveries". *BJOG*, 2006, 113, 1173.
- [8] "Body mass index". Available at: http://en.wikipedia.org/wiki/Body_mass_index
- [9] Leddy M.A., Power M.L., Schulkin J.: "The impact of maternal obesity on maternal and fetal health". *Rev. Obstet. Gynecol.*, 2008, 1, 170.
- [10] Callaway L.K., Chang A.M., McIntyre H.D., Prins J.B.: "The prevalence and impact of overweight and obesity in an Australian obstetric population". *Med. J. Aust.*, 2006, 184, 56.
- [11] Nuthalapaty FS, Rouse DJ, Owen J.: "The association of maternal weight with cesarean risk, labor duration, and cervical dilation rate during labor induction". *Obstet. Gynecol.*, 2004, 103, 452.
- [12] Lowe N. K, CNM.: "Factors Associated With Dystocia and Cesarean Section in Nullipares Women". *J. Midwifery Womens Health*, 2007, 5, 216.
- [13] Rode L, Nilas L, W  jdemann K, Tabor A.: "Obesity-related complications in Danish single cephalic term pregnancies". *Obstet. Gynecol.*, 2005, 105, 537.
- [14] Sebire N.J., Jolly M., Harris J.P., Wadsworth J., Joffe M., Beard R.W., et al.: "Maternal obesity and pregnancy outcome: a study of 287,213 pregnancies in London". *Int J Obes Relat Metab Disord.*, 2001, 25, 1175.
- [15] Crane J.M., White J., Murphy P., Burrage L., Hutchens D.: "The effect of gestational weight gain by body mass index on maternal and neonatal outcomes". *J. Obstet. Gynaecol. Can.*, 2009, 31, 28.
- [16] Skyler J.S., O'Sullivan M.J., Holsinger K.K.: "The Relationship Between Maternal Glycemia and Macrosomia". *Diabetes Care*, 1980, 3, 3.

Address reprint requests to:
M. TRISOVIC, M.D.
104 Sazonova St.,
Belgrade 11000 (Serbia)
e-mail: m.trisovic@gmail.com