COSTS OF CAESAREAN SECTION AND VAGINAL DELIVERY IN AN UPPER-MIDDLE-INCOME COUNTRY: A CASE SERIES

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TROŠKOVI CARSKOG REZA I VAGINALNOG POROĐAJA U ZEMLJI SA SREDNJE-VISOKIM PRIHODIMA: SERIJA SLUČAJEVA

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Received / Primljen: 24. 04. 2009 Accepted / Prihvaćen: 11. 06. 2009.

ABSTRACT

Background. *Elective Caesarean section is an economically favourable delivery method in some countries, but an unfavourable option in other high-income economies.*

Objective. *The aim of this study was to compare the immediate costs of Caesarean section and vaginal delivery, identifying their main determinants in the health system milieu of a higher-middle-income Balkan country.*

Methods. *The study was designed as in-depth case series study of Caesarean sections and vaginal deliveries in a tertiary care Serbian hospital within a six month period. The perspective of the Serbian Republic Institute for Health Insurance was followed, and direct costs caused by mother and newborn during the hospitalisation were registered. In total 943 pregnant patients at term entered the study. Elective Caesarean section was the method of delivery for 113 patients, while 830 patients had vaginal deliveries.*

Results. *The average total direct costs per delivery case during hospitalisation of both mother and child were significantly higher ($t = 8.187$; $p < 0.001$) in the group with Caesarean section delivery (96,992.84 ± 67,842.82 RSD), as compared with those who had a vaginal delivery (41,869.60 ± 42,843.16 RSD). The main determinants of increased costs were delivery method, length of hospitalisation, Apgar score, weight at birth and pregnancy-induced hypertension.*

Conclusions. *Within the economic settings of Balkan countries, Caesarean section bears higher immediate costs than vaginal delivery due to prolonged maternal hospitalisation, worse immediate delivery outcomes and a higher rate of complications in pregnancy.*

Key words: *Caesarean section, delivery, costs*

SAŽETAK

Uvod. *Planirani carski rez je metod porođaja čija pogodnost primene, sa ekonomskog aspekta varira u zemljama sa visokim prihodima.*

Cilj. *Upoređenje neposrednih direktnih troškova carskog reza i vaginalnog porođaja, uz identifikaciju odrednica koje u najvećoj meri utiču na njih u zdravstvenom sistemu zemlje Balkana sa srednje-visokim prihodima.*

Metode. *Studija je dizajnirana kao serija slučajeva carskih rezova i vaginalnih porođaja sa detaljnom analizom svakog od njih, u tercijarnoj zdravstvenoj ustanovi Republike Srbije u periodu od šest meseci. Korišćena je perspektiva Republičkog zavoda za zdravstveno osiguranje Srbije, a praćeni su i analizirani direktni troškovi i majke i deteta tokom perioda hospitalizacije. Istraživanje je obuhvatalo ukupno 943 trudnice u terminu za porođaj, od čega je planirani carski rez bio metod porođaja kod njih 113, dok je 830 trudnica porođeno vaginalnim putem.*

Rezultati. *Prosečni ukupni direktni troškovi i majke i deteta su, po porođaju, tokom hospitalizacije bili značajno viši ($t = 8,187$; $p < 0,001$) kod grupe učesnica u studiji koje su se porodile carskim rezom (96,992.84 ± 67,842.82 RSD) u odnosu na grupu sa vaginalnim porođajem (41,869.60 ± 42,843.16 RSD). Determinate koji su značajno uticale na porast troškova bile su metod porođaja, dužina hospitalizacije, Apgar skor, težina novorođenčeta na porođaju i hipertenzija indukovana trudnoćom.*

Zaključak. *U ekonomskim uslovima koji vladaju u zemljama Balkana, carski rez ostvaruje više neposredne troškove u odnosu na vaginalni metod porođaja usled produžene hospitalizacije majki, lošijih neposrednih postporođajnih ishoda vezanih za novorođenče kao i, uopšte učestalijih komplikacija u trudnoćama koje su završene ovim putem.*

Ključne reči: *Carski rez, porođaj, troškovi*

UDK 618.5-089.888.61:338.5 / Ser J Exp Clin Res 2009; 10 (2): 61 – 64

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INTRODUCTION

The prevalence of Caesarean section deliveries has risen across the world, with the total number of Caesarean sections continuing to rise (1). This may have a profound influence on national and regional health budgets, provided that significant differences exist in the costs of these two delivery methods. Economic studies conducted in high-income economies had shown conflicting results when comparing costs of Caesarean section and vaginal delivery. While in Canada, Caesarean delivery during labour for the first delivery was associated with increased cumulative costs (2), in the USA the average total costs of vaginal deliveries (maternal plus total baby costs) is higher than the average total costs of Caesarean section (1). However, the results of such comparisons are highly dependent on the scope of the costs that are taken into account (e.g., whether the cost of newborns were included or not, and whether only immediate costs were considered or both immediate and delayed costs were included) (3), on the type of Caesarean delivery itself (4) (with or without labour) and on foetal presentation during vaginal delivery (5) (breech of cephalic).

The economic aspects of Caesarean section delivery in upper-middle-income economies have not been studied. The majority of the Balkan countries (Serbia, Montenegro, Bulgaria and Romania) have made rapid socio-economic transitions during the last decade from planned economies of the socialist type to liberal, market-driven economies, resulting in their shift from the lower- to the higher-middle-income countries group (2007 gross national income per capita from $3,706 to $11,455) (6). These countries also have similar annual health budget per capita, which are as follows: Bulgaria $272, Serbia $212, Montenegro $212 and Romania $250 (7). While drug and medical device costs in Balkan countries are similar to costs in developed European countries, the cost of health care services is much lower (8). This creates a different economic environment in health care, and could produce different cost relations between the same pair of medical procedures in high-income European countries and higher-middle-income Balkan countries.

The aim of our study was to compare the immediate costs of Caesarean section and vaginal delivery, identifying their main determinants in the health system milieu of the higher-middle-income Serbian economy.

MATERIALS AND METHODS

Our study was designed as a detailed, in-depth case series study (9) of Caesarean sections and vaginal deliveries in a tertiary care Serbian hospital.

The perspective and the time frame

In Serbia, the Republic Institute for Health Insurance (RIHI) is the institution that makes contracts with health facilities and controls the prices of services, drugs and materials. Our study was carried out within this framework. Only services, drugs and materials endorsed by RIHI were taken into account when calculating costs. The observations of costs occurred during the periods for which the mother and newborn were hospitalised.

The patients

The study was conducted among patients of the Gynaecology-Obstetrics Clinic, Clinical Centre "Kragujevac", in Kragujevac, Serbia. All pregnant patients of the Clinic who came for a delivery during the period January the 1st, 2008 – June the 30th, 2008 were enroled in the study. In total, 943 pregnant patients at term entered the study; none was lost to follow-up. The investigators did not interfere with the clinical decision of choosing Caesarean section or vaginal delivery by the obstetricians. Elective Caesarean section was the method of delivery in 113 patients, while 830 patients had a vaginal delivery. The characteristics of the patients are shown in Table 1.

The costs

Only direct costs made during the stay of mother and child in the hospital were taken into account in this study. The costs of hospital days, services, materials and drugs used were collected from invoices sent to the Republic Institute for Health Insurance by the Clinical Centre "Kragujevac" for each mother and newborn studied. The hospital day cost is a flat-rate cost, which includes only bed and food (1,255.31 RSD/day). The following services and materials were invoiced separately: physical examination (284.01 RSD), Caesarean section delivery (7,726.25 RSD), vaginal delivery (898.19 RSD), intravenous injection (93.49 RSD), intramuscular or subcutaneous (48.51 RSD) injection, blood sample collection (48.51 RSD), ECG (195.26 RSD), blood count (241.40 RSD), blood chemistry (593.72), wound dressing (93.49 RSD), etc. (services), and infusion sets, needles (surgical and syringe), syringes, surgical gloves, catheters, urine bags, dressings, etc. (materials). The drugs used were also invoiced separately. The costs are expressed in Serbian official currency, the dinar (RSD); the average exchange rate in June 2008 was 1 Euro = 77 RSD.

Statistics

The costs are presented as mean values, with standard deviations (SD). Statistically significant differences between the treatment groups were tested by Student's t-value for differences between small, independent groups, or by chi-square contingency tables with Yates' continuity correction (for comparing frequencies). The difference was considered significant if the probability of null hypothesis was less than 0.05 ($p < 0.05$). The main determinants of costs were identified by means of multiple linear regression (10); all calculations were made using SPSS-10 statistical software for Windows.

RESULTS

The average total direct costs per delivery case during hospitalisation of both mother and child were significantly higher ($t = 8.187$; $p < 0.001$) in the group who had a Caesarean section delivery (96,992.84 ± 67,842.82 RSD), as compared with those who had a vaginal delivery (41,869.60 ± 42,843.16 RSD).

The average total direct costs per delivery case during hospitalisation of the mother alone were also significantly higher ($t = 20.112$; $p < 0.001$) in the group who had a Caesarean section delivery (55,785.04 ± 15,436.11 RSD), as compared to those who had a vaginal delivery (24,910.34 ± 11,124.80 RSD).

The average total direct costs per delivery case during hospitalization of the child alone were significantly higher ($t = 3.671$; $p < 0.05$) in the group who had a Caesarean section delivery (41,679.45 ± 67,215.23 RSD), as compared with those who had a vaginal delivery (17,146.37 ± 40,845.37 RSD).

Characteristic	Caesarean section delivery (n=113)	Vaginal delivery (n=830)	Test value and significance of difference
Age (years)	30.4 ± 5.5	27.6 ± 5.4	t = 5.018; p < 0.001*
Length of mother stay in days	7.4 ± 1.2	4.5 ± 1.8	t = 22.771; p < 0.001*
Length of child stay in days	12.3 ± 14.7	5.5 ± 8.5	t = 4.788; p < 0.001*
Apgar score (0 – 10)	8.2 ± 1.8	8.8 ± 1.4	t = 3.483; p < 0.001*
Weight at birth (grams)	3096.4 ± 831.0	3370.4 ± 631.6	t = 3.376; p < 0.001*
Tocolysis during pregnancy, n (%)	14 (12.2%)	109 (13.1%)	chi-square = 0.011; p > 0.05
Pregnancy-induced hypertension, n (%)	19 (16.8%)	49 (5.9%)	chi-square = 16.102; p < 0.001*
Cerclage, for incompetent cervix, n (%)	4 (3.5%)	24 (2.9%)	chi-square = 0.006; p > 0.05
Urinary tract infection, n (%)	3 (2.6%)	53 (6.4%)	chi-square = 1.855; p > 0.05
Colpitis in pregnancy, n (%)	1 (0.9%)	95 (11.4%)	chi-square = 11.004; p < 0.001*
In vitro fertilization, n (%)	3 (2.7%)	2 (0.2%)	chi-square = 6.888; p < 0.01*
Diabetes mellitus, gestational, n (%)	4 (3.5%)	22 (2.7%)	chi-square = 0.055; p > 0.05
Anti-phospholipid syndrome, n (%)	2 (1.8%)	6 (0.7%)	chi-square = 0.350; p > 0.05
Premature rupture of the membranes, n (%)	2 (1.8%)	18 (2.2%)	chi-square = 0.005; p > 0.05
Vacuum extraction, n (%)	0 (0%)	4 (0.5%)	chi-square = 0.001; p > 0.05
Placenta praevia, n (%)	2 (1.8%)	0 (0%)	chi-square = 7.546; p < 0.01*
Premature detachment of placenta, n (%)	2 (1.8%)	1 (0.1%)	chi-square = 4.124; p < 0.05*
Pregnancy followed-up by a gynecologist, n (%)	112 (99%)	813 (97.9%)	chi-square = 0.232; p > 0.05

* Significant difference

Table 1. The characteristics of Caesarean section and vaginal delivery cases

When total direct costs per delivery case during hospitalisation of both the mother and child were taken as dependent variable, and delivery method (Caesarean section or vaginal), length of mother stay in days, length of child stay in days, Apgar score, weight at birth (grams), tocolysis during pregnancy, pregnancy-induced hypertension, cerclage for incompetent cervix, urinary tract infection, colpitis in pregnancy, in vitro fertilization, gestational diabetes mellitus, anti-phospholipid syndrome, premature rupture of the membranes, vacuum extraction, placenta praevia, premature detachment of placenta, and pregnancy follow-up by a gynaecologist, as independent variables, the results of multiple regression showed that only delivery method, length of newborn stay (in days), Apgar score, weight at birth and pregnancy-induced hypertension had a significant influence on the total costs (Table 2).

When total direct costs per delivery case during hospitalisation of the mother alone were taken as the dependent variable, and the delivery method (Caesarean section or vaginal), length of mother stay in days, length of child stay in days, Apgar score, weight at birth (grams), tocolysis during pregnancy, pregnancy-induced hypertension, cerclage, for incompetent cervix, urinary tract infection, colpitis in pregnancy, in vitro fertilization, gestational diabetes mellitus, anti-phospholipid syndrome, premature rupture of the membranes, vacuum extraction, placenta praevia, premature detachment of placenta and pregnancy follow-up by a gynaecologist, as independent variables, the results of multiple regression showed that only delivery method, length of mother stay in days, Apgar score, weight at birth, vacuum extraction, pregnancy-induced hypertension, urinary tract infection and diabetes mellitus, gestational, had a significant influence on the total costs (Table 3).

When total direct costs per delivery case during hospitalization of the newborn alone were taken as the dependent variable, and delivery method (Caesarean section or vaginal), length of mother stay in days, length of child stay in days, Apgar score, weight at birth (grams), tocolysis during pregnancy, pregnancy-induced hypertension, cerclage, for incompetent cervix, urinary tract infection, colpitis in pregnancy, in vitro fertilization, gestational diabetes mellitus, anti-phospholipid syndrome, premature rupture of the membranes, vacuum extraction, placenta praevia, premature detachment of placenta and pregnancy follow-up by a gynaecologist, as independent variables, the results of multiple regression showed that only length of mother stay in days, length of newborn stay in days, Apgar score, weight at birth and pregnancy-induced hypertension, had a significant influence on the total costs (Table 4).

DISCUSSION

In order to be cost-effective when compared to vaginal delivery, Caesarean section delivery should be associated with a low rate of surgical complications, shorter length of stay in a hospital for both mother and newborn, and a more rapid adaptation of a newborn to extrauterine life, as measured by the Apgar score (11,12). In our study, the obstetricians chose vaginal delivery more frequently (7.3:1), with excellent results. When compared with Caesarean section, vaginal delivery was associated with significantly shorter hospitalisation of both mother and newborn, and with better average Apgar scores. In addition, the average cost of Caesarean section delivery was twice as high as that of vaginal delivery, making Caesarean section an economically less favourable delivery option in Balkan countries settings.

The multiple regression analysis showed that Caesarean section primarily increases costs caused by the mother during hospitalisation, while the costs caused by child are not directly dependent on the delivery method. The costs caused by a mother are also increased due to longer hospitalisation, worse immediate delivery outcomes (lower Apgar score and lower

Variable	Regression coefficient (B)	Standard Error	t	p - value
Delivery method	-15,796.4	3,928.7	-4.021	0.000
Length of newborn stay in days	7,468.5	192.3	38.844	0.000
Apgar score	-1,261.7	412.9	-3.056	0.002
Weight at birth	-7.6	1.9	-4.048	0.000
Pregnancy-induced hypertension	11,525.4	4,145.6	2.780	0.006

Table 2. Multiple regression of total direct costs per delivery case during hospitalisation of both mother and child

Variable	Regression coefficient (B)	Standard Error	t	p - value
Delivery method	-18,902.7	1,149.7	-16.441	0.000
Length of mother stay in days	4,058.9	185.5	21.889	0.000
Apgar score	-287.6	120.8	-2.380	0.018
Weight at birth	-1.4	0.5	-2.472	0.014
Pregnancy-induced hypertension	2738.8	1213.2	2.258	0.024
Vacuum extraction	24,328.9	4,686.1	5.192	0.000
Urinary tract infection	-2,623.4	1,313.5	-1.997	0.046
Diabetes mellitus, gestational	5,316.4	1,887.5	2.817	0.005

Table 3. Multiple regression of total direct costs per delivery case during hospitalisation of mother only

Variable	Regression coefficient (B)	Standard Error	t	p - value
Length of mother stay in days	-3,354.8	577.1	-5.813	0.000
Length of newborn stay in days	7,476.1	175.1	42.700	0.000
Apgar score	-974.1	376.0	-2.591	0.010
Weight at birth	-6.2	1.7	-3.651	0.000
Pregnancy-induced hypertension	8,786.6	3,774.9	2.328	0.020

Table 4. Multiple regression of total direct costs per delivery case during hospitalisation of newborn only

birth weight), and complications of the pregnancy (higher rate of pregnancy-induced hypertension and gestational diabetes mellitus). It seems like obstetricians chose Caesarean section as a delivery method in patients with complicated pregnancy, which led to prolonged post-delivery hospitalisation and higher costs. However, Caesarean section itself results in longer hospitalisations and postpartum maternal medical care utilization than vaginal delivery, regardless of the complications in pregnancy (13,14).

The costs caused by newborns were linked primarily to the immediate delivery outcomes (lower Apgar score and lower birth weight increased costs), longer hospitalisation and complications of pregnancy (hypertension), which could have led to worse outcomes. Higher costs caused by the newborns after Caesarean section probably reflect bias deliberately made by the obstetricians, choosing Caesarean section for complicated pregnancies, and may not be a reflection of the effects of this delivery method itself. However, our study has serious limitations due to short follow-up period, which resulted in our registering only immediate costs. The delayed costs of children with birth injuries remains unknown (15), and their potential to change the overall cost ratio of the two delivery methods is unclear.

In conclusion, within the economical settings of Balkan countries, Caesarean section bears higher immediate costs than vaginal delivery due to prolonged maternal hospitalisation, worse delivery outcomes and a higher rate of complications in pregnancy.

ACKNOWLEDGEMENTS

This study was partially funded by grant No 145005 from the Serbian Ministry of Science.

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