sciendo

10.2478/sjph-2019-0010 Zdr Varst. 2019;58(2):78-83

Korenč M, Štern K, Verdenik I, Lučovnik M. Classification of primary caesarean sections in labor and its usefulness for analysis of Slovenian perinatal data. Zdr Varst. 2019;58(2):78-83. doi: 10.2478/sjph-2019-0010.

CLASSIFICATION OF PRIMARY CAESAREAN SECTIONS IN LABOR AND ITS USEFULNESS FOR ANALYSIS OF SLOVENIAN PERINATAL DATA

KLASIFIKACIJA PRIMARNIH CARSKIH REZOV IN NJENA UPORABNOST ZA ANALIZO SLOVENSKIH PERINATALNIH PODATKOV

Monika KORENČ[1*], Katja ŠTERN[2], Ivan VERDENIK[1], Miha LUČOVNIK[1]

[1]University Medical Centre Ljubljana, Department of Perinatology, Division of Obstetrics and Gynecology, Šlajmerjeva 4, 1000 Ljubljana, Slovenia
[2]General Hospital Jesenice, Department of Obstetrics and Gynecology, Cesta maršala Tita 112, 4270 Jesenice, Slovenia

Received: Jul 6, 2018
Accepted: Mar 20, 2019

Original scientific article

ABSTRACT

Keywords:
caesarean sections, dystocia, cephalopelvic disproportion

Objective: To determine the usefulness of a novel classification of indications for caesarean section (CS) in labour in recognizing differences in clinical practice in different maternity units.

Methods: Data from the National Perinatal Information System (NPIS) for 2013 and 2014 were used to classify indications for CS in nulliparous women with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses within 14 Slovenian maternity units into foetal distress and different sub-groups of dystocia according to use and dosage of oxytocin. Chi-square test was used for statistical comparison between units (P≤0.05 significant).

Results: There were 13,572 deliveries and 1,567 (12.0%) CS in nulliparous patients with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses in Slovenia during the study period. Rates of CS in this group of women differed significantly among different maternity units (from 4.1% to 20.9%; P<0.001) suggesting significant differences in clinical practice. The most common indication for CS was cephalopelvic disproportion, which was diagnosed with different frequency in different units (from 11.2% to 45.9%; odds ratio 6.72; 95% confidence interval 3.10– 14.71; P<0.001).

Conclusions: It is possible to use NPIS data to retrospectively classify indications for CS. Such classification reveals significant differences among maternity units and could allow for a meaningful analysis of CS rates in different hospitals leading to evidence-based initiatives to decrease the incidence of primary CS.

IZVLEČEK

Ključne besede:
carski rezi, distocija, kefalopelvinska disproporca

Cilji: *Ugotoviti uporabnost nove klasifikacije indikacij za urgentni carski rez za analizo razlik v klinični praksi v različnih porodnišnicah.*

Metode: *Podatke iz Nacionalnega perinatalnega informacijskega sistema (NPIS) za leti 2013 in 2014 o urgentnih carskih rezih pri prvorodnicah ob roku po spontanem začetku poroda s plodom v glavični vstavi smo klasificirali glede na indikacijo za carski rez v fetalni distres in podskupine distocije glede na uporabo in odmerek oksitocina. Za statistično primerjavo med porodnišnicami smo uporabili hi kvadrat test (P ≤ 0,05 statistično pomembno).*

Rezultati: *V vključeni skupini porodnic je bilo v Sloveniji v preučevanem obdobju 13.572 porodov, od tega 1567 (12,0 %) carskih rezov. Delež carskih rezov se je med porodnišnicami pomembno razlikoval (od 4,1 % do 20,9 %, P < 0,001), kar nakazuje na pomembne razlike v klinični praksi med porodnišnicami. Najpogostejša indikacija za urgentni carski rez je bila kefalopelvinska disproporca, delež katere pa se je prav tako pomembno razlikoval med porodnišnicami (od 11,2 % do 45,9 %; razmerje obetov 6,72; 95 % interval zaupanja 3,10-14,71; P < 0,001).*

Zaključek: *Podatke NPIS lahko uporabimo za retrospektivno analizo indikacij za urgentne carske reze, ki omogoča primerjavo kliničnih praks med porodnišnicami in izdelavo strategij za zmanjšanje naraščanja pojavnosti primarnih carskih rezov.*

***Corresponding author:** Tel. + 386 31 556 959; E-mail: mony.korencek@gmail.com

1 INTRODUCTION

Caesarean section (CS) rates have increased significantly worldwide during the last decades without a concomitant decrease in neonatal morbidity or mortality (1–4). With growing knowledge of short- and long-term complications associated with CS, many efforts have been made to control the rise in CS rates (2, 3). The safest and most effective approach to achieve this is to avoid the first, i.e. primary CS (3).

Variation in rates of CS in nulliparous women with cephalic foetuses presenting in spontaneous labour at term indicate that differences in clinical practice affect the number of CS significantly (5, 6). A classification that would allow transforming crude numbers of primary CS into useful information on differences in clinical practice patterns could be used to design individualized approaches required to safely reduce the rates of primary CS.

In 2013, Robson et al. proposed a classification of CS in labour shown in Table 1 (7). They classified indications for CS in labour into foetal distress and dystocia. Primary CS for foetal distress was defined as a CS in labour for foetal distress when no oxytocin is used. All other CS were classified as a form of dystocia. Sub-groups of dystocia depend on whether progress of labour (cervical dilatation) is less than 1 cm/h (inefficient uterine action) or more than 1 cm/h (efficient uterine action). Inefficient uterine action was then subdivided into poor response (despite maximum treatment with oxytocin), inability to treat adequately (for foetal reasons), inability to treat adequately (because of the uterus over-contracting), or no treatment (oxytocin not given for other reasons).

The aim of our study was to determine whether this classification of indications for CS in labour can be retrospectively applied using data from a national perinatal database and whether this could help recognizing differences in clinical practice in different maternity units that could explain different CS rates.

Adapted from ref. 7: Robson M, Hartigan L, Murphy M. Methods of achieving and maintaining an appropriate caesarean section rate. Best Pract Res Clin Obstet Gynaecol. 2013;27:297–308; * maximum dose of oxytocin refers to individual unit's protocol.

2 METHODS

We evaluated NPIS data for the period 2013 through 2014. Since 1987, NPIS registers all deliveries in Slovenia at ≥22 weeks of pregnancy or when birth weight is equal to 500 g or above. Registration is mandatory by law in the country's 14 maternity units and more than 140 variables are entered into a computerized database by the attending midwife and doctor. Patient demographics, family, medical, gynaecologic and obstetric history, data on current pregnancy, labour and delivery, postpartum period, and neonatal data are collected. The complete list of variables with definitions and methodological guidelines has been published online by the Slovenian Institute of Public Health (8). To assure quality of data collected, controls are built in the computerized system, data is audited periodically, and comparisons are made with international databases, such as the Vermont Oxford network in which Slovenia participates.

A 2-year period was chosen for the present analysis to avoid changes in clinical practice that may occur over a longer time and long enough to provide a meaningful analysis due to small number of deliveries in some units. All nulliparous patients with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses (Group 1 according to the Robson's Ten Group Classification System) were classified into the seven categories according to classification in Table 1 (9). We also compared rates of several maternal outcomes (3rd or 4th perineal tear, postpartum haemorrhage >500 ml, need for transfusion) and neonatal outcomes corrected for lethal anomalies (neonatal mortality of live born babies who died within 28 completed days from birth), Apgar score <7 at 5 minutes of life, perinatal asphyxia and severe perinatal asphyxia (diagnosed according to criteria of Sarnat and Sarnat (10), and Erb's palsy).

Table 1. Classification of caesarean section in labour.

Foetal distress (no oxytocin)		
Dystocia	Inefficient uterine action (cervical dilatation <1 cm/h)	Poor response (maximum dose reached) *
		Inability to reach maximum dose due to foetal intolerance
		Inability to reach maximum dose because of over-contracting or not following unit protocol
	Efficient uterine action (cervical dilatation >1cm/h)	Cephalopelvic disproportion
		Malposition (e.g. occipito posterior)

Chi-square test was used for statistical comparison between units. A P value ≤0.05 was considered statistically significant. The software used for statistical analysis was IBM SPSS Statistics for Windows Version 21.0 (Armonk, NY: IBM Corp.).

3 RESULTS

There were 41,246 deliveries in Slovenia during the study period. Of these, 8,332 (20.2%) were CS. In Group 1, according to the Robson's Ten Group Classification System (nulliparous patients with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses) there were 13,572 deliveries and 1,567 (12.0%) CS.

Group 1 contributed 19.1% to the overall CS rate. Table 2 presents numbers and percentages of CS in Group 1 classified according to the proposed classification of CS in labour for every delivery unit in Slovenia.

Table 2. Distribution of categories of caesarean sections in labour in nulliparous women with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses (Group 1 according to the Robson's Ten Group Classification System) in 14 maternity units in Slovenia in years 2013 and 2014.

Category	Maternity unit														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	over all
Total number of deliveries in Group 1 in each maternity unit	323	1366	567	514	1138	3629	1421	720	418	824	1161	608	529	354	13572
Number of CS in Group 1 (% of CS in Group 1)*	32 (9.9%)	141 (10.3%)	23 (4.1%)	61 (11.9%)	198 (17.4%)	397 (10.9%)	107 (7.5%)	90 (12.5%)	74 (17.7%)	96 (11.7%)	109 (9.4%)	80 (13.2%)	85 (14.4%)	74 (20.9%)	1567 (12.0%)
Foetal distress + no oxytocin*	6 (18.8%)	35 (24.8%)	7 (30.4%)	4 (6.6%)	30 (15.2%)	30 (7.6%)	7 (6.5%)	4 (4.4%)	7 (9.5%)	16 (16.7%)	8 (7.3%)	7 (8.8%)	1 (1.2%)	5 (6.8%)	167 (10.7%)
Poor response (maximum dose reached)*	0 (0.0%)	2 (1.4%)	0 (0.0%)	4 (6.6%)	0 (0.0%)	5 (1.3%)	2 (1.9%)	1 (1.1%)	7 (9.5%)	1 (1.0%)	0 (0.0%)	7 (8.8%)	0 (0.0%)	2 (2.7%)	31 (2.0%)
Inability to reach maximum dose due to foetal intolerance*	0 (0.0%)	4 (2.8%)	0 (0.0%)	0 (0.0%)	5 (2.5%)	15 (3.8%)	1 (0.9%)	6 (6.7%)	0 (0.0%)	1 (1.0%)	1 (0.9%)	0 (0.0%)	3 (3.5%)	2 (2.7%)	38 (2.4%)
Inability to reach maximum dose because of over-contracting or not following units protocol*	12 (37.5%)	12 (8.5%)	6 (26.1%)	14 (23.0%)	46 (23.2%)	114 (28.7%)	23 (21.5%)	23 (25.6%)	5 (6.8%)	24 (25.0%)	41 (37.6%)	0 (0.0%)	39 (45.9%)	10 (13.5%)	369 (23.5%)
Cephalopelvic disproportion*	6 (18.8%)	37 (26.2%)	5 (21.7%)	28 (45.9%)	50 (25.3%)	121 (30.5%)	12 (11.2%)	22 (24.4%)	12 (16.2%)	27 (28.1%)	24 (22.0%)	23 (28.7%)	21 (24.7%)	27 (36.5%)	415 (26.5%)
Malposition (e.g. occipito posterior)*	4 (12.5%)	22 (15.6%)	2 (8.7%)	3 (4.9%)	24 (12.1%)	23 (5.8%)	3 (2.8%)	10 (11.1%)	19 (25.7%)	13 (13.5%)	6 (5.5%)	9 (11.3%)	8 (9.4%)	10 (13.5%)	156 (10.0%)
Impossible to classify*	4 (12.5%)	29 (20.6%)	3 (13.0%)	8 (13.1%)	43 (21.7%)	89 (22.4%)	59 (55.1%)	24 (26.7%)	24 (32.4%)	14 (14.6%)	29 (26.6%)	34 (42.5%)	13 (15.3%)	18 (24.3%)	391 (25.0%)

* represents statistically significant differences between units (P≤0.05); percentages are related to total numbers of caesarean sections in Group 1 in each maternity unit.

Rates of CS in Group 1 differed significantly among different maternity units (from 4.1% (unit 3) to 20.9% (unit 14)). The most common indication for CS was cephalopelvic disproportion. Overall, 26.5% of all primary CS in Group 1 were performed for cephalopelvic disproportion (dystocia with efficient uterine action and without foetal malposition). However, incidences of diagnosis of cephalopelvic disproportion differed significantly among units: from 11.2% in unit 7 to 45.9% in unit 4 (odds ratio (OR) 6.72; 95% confidence interval (CI) 3.10–14.71; P<0.001).

Significant differences were seen in other groups of CS in labour as well. Foetal distress without labour augmentation was the indication for CS in 10.7% of primary CS overall, ranging from 1.2% in unit 13 to 30.4% in unit 3 (OR 36.75; 95% CI 4.23–319.44; P<0.001). There were also significant differences in ranges of CS for inability to reach the maximum dose of oxytocin due to foetal intolerance (no such cases recorded in units 1, 3, 4, 9, and 12 and 6.7% of primary CS in unit 8).

Significant differences were also observed in proportions of CS in Group 1 due to an inability to reach maximum oxytocin dose because of the uterus over-contracting or not following unit's protocols. Proportion of all primary CS in Group 1 in this sub-group ranged from 0% in unit 12 to 45.9% in unit 13.

When comparing unit 3 (the unit with lowest overall CS rate in Group 1, i.e. 4.1%) and unit 14 (the unit with highest overall CS rate in Group 1, i.e. 20.9%), the proportion of primary CS for foetal distress without oxytocin was significantly higher in unit 3 (30.4% vs. 6.8%, OR 6.04; 95% CI 1.70–21.50; P=0.003). Different types of dystocia were, therefore, diagnosed relatively less frequently in unit 3, as was also the case with other units with lower overall primary CS rates.

A significant proportion of cases could not be classified (overall 25.0%, range 12.5% to 55.1% among units). The reasons for inability to classify a case were that either the dose of oxytocin reached, or foetal presentation were not entered in the database.

Table 3 presents maternal and neonatal outcomes in each maternity unit in the Robson's Ten Group Classification System Group 1. There were statistically significant differences in all outcomes studied except neonatal mortality. Unit 3 (the unit with lowest CS rate) had higher rates of maternal morbidity, however, neonatal mortality and morbidity were higher in some other units. Neonatal or maternal morbidity were not lower in unit 14, the unit with highest CS rate.

Table 3. Maternal and neonatal outcomes (corrected for lethal congenital malformations) in Group 1 (Robson's Ten Group Classification System – nulliparous women with spontaneous onset of labour at ≥37 weeks with single cephalic foetuses) in 14 maternity units in Slovenia in years 2013 and 2014.

Outcome	Maternity unit														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	over all
3rd or 4th degree perineal tear*	1 (0.3%)	3 (0.2%)	10 (1.8%)	1 (0.2%)	5 (0.4%)	3.9 (1.1%)	11 (0.8%)	3 (0.4%)	1 (0.2%)	6 (0.7%)	4 (0.3%)	1 (0.2%)	2 (0.3%)	3 (0.8%)	90 (0.7%)
PPH >500ml*	9 (2.8%)	6 (0.4%)	41 (7.2%)	3 (0.6%)	4 (0.4%)	227 (6.2%)	9 (0.6%)	3 (0.4%)	4 (1.0%)	20 (2.4%)	42 (3.6%	8 (1.3%)	36 (6.1%)	3 (0.8%)	415 (3.0%)
Transfusion*	2 (0.6%)	0 (0.0%)	2 (0.4%)	0 (0.0%)	0 (0.0%)	18 (0.5%)	1 (0.1%)	1 (0.1%)	0 (0.0%)	1 (0.1%)	0 (0.0%)	3 (0.5%)	0 (0.0%)	0 (0.0%)	28 (0.2%)
Neonatal mortality	0 (0.0%)	0 (0.0%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.3%)	3 (0.0%)
Apgar <7 at 5'*	1 (0.3%)	0 (0.0%)	1 (0.2%)	1 (0.2%)	6 (0.5%)	19 (0.5%)	8 (0.6%)	1 (0.1%)	5 (1.2%)	2 (0.2%)	2 (0.2%)	1 (0.2%)	2 (0.3%)	3 (0.8%)	52 (0.4%)
Perinatal asphyxia*	8 (2.4%)	5 (0.4%)	1 (0.2%)	0 (0.0%)	16 (1.4%)	30 (0.8%)	1 (0.1%)	2 (0.3%)	12 (2.9%)	3 (0.4%)	14 (1.2%)	4 (0.7%)	28 (4.7%)	3 (0.8%)	127 (0.9%)
Severe asphyxia*	1 (0.3%)	0 (0.0%)	1 (0.2%)	0 (0.0%)	2 (0.2%)	1 (0.0%)	0 (0.0%)	1 (0.1%)	3 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	9 (0.1%)
Erb's palsy*	0 (0.0%)	0 (0.0%)	1 (0.2%)	0 (0.0%)	2 (0.2%)	3 (0.1%)	1 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.1%)	0 (0.0%)	3 (0.5%)	1 (0.3%)	12 (0.1%)

PPH postpartum haemorrhage; * represents statistically significant differences between units (P≤0.05); percentages are related to total numbers of deliveries in Group 1 in each maternity unit.

4 DISCUSSION

The main finding of the present study is that classifying primary CS into foetal distress and several dystocia sub-groups reveals significant differences among maternity units. Such classification could, especially when supported by evaluation of perinatal outcomes, allow a meaningful analysis of CS rates in different hospitals leading to evidence-based initiatives to improve clinical practice.
Various forms of dystocia are diagnosed less frequently in units with lower rates of primary CS, while the proportion of primary CS for foetal distress without labour augmentation is relatively larger in such units. One of the forms of dystocia is the inability to achieve efficient uterine action due to foetal distress with oxytocin augmentation. Such cases were significantly less frequent in units with lower primary CS rates compared to units with higher rates. Since units with lower CS rates did not have higher rates of neonatal mortality and morbidity, it can be argued that primary CS could be safely reduced in certain units with better training in foetal heart rate interpretation (11). However, maternal adverse outcomes, such as incidence of severe perineal trauma and postpartum haemorrhage, were higher in units with lower CS rates and this has to be taken into account when designing strategies for reduction of CS rates. There also seem to be significant differences in diagnosing cephalopelvic disproportion and uterine hyperstimulation. Better training and/or supervision could, again, have an important impact on rates of primary CS in certain units.

A high-dose regimen for labour induction and augmentation with oxytocin has been recommended for all maternity units in Slovenia (12). It includes an initial oxytocin infusion of 2 to 5mU/min with increments every 20–30 min until a maximum dose of 40mU/min is reached (12). Results of the present study indicate that a significant number of maternity units do not follow the proposed regimen (different proportions of CS in which maximum oxytocin dose has not been reached despite inefficient uterine action and no foetal distress). Although conflicting results have been reported from trials comparing low- to high-dose oxytocin regimens, some authors have found that high-dose oxytocin for labour augmentation is associated with a decrease in CS (13–15). Some units could, therefore, potentially reduce their CS rates with a stricter adherence to the proposed oxytocin regimen.
The study has several limitations. Small numbers in certain sub-groups make comparisons between units difficult. The main limitation is, however, the inability to classify a significant proportion of CS. Nevertheless, we showed that classification of CS in labour using NPIS data can yield important information for future perinatal audit in the country. Moreover, one of the purposes of using classification systems is also to analyse the quality of data collection. Our results indicate that future efforts to improve collection of data on maximum oxytocin dose reached during labour should be undertaken. This is even more important when considering the significant differences in proportions of CS that could not be classified in different units, suggesting different standards of data collection. Differences in sub-groups of primary CS between units found in our study should, therefore, be interpreted with caution. Still, even when only comparing units with similar proportions of non-classified cases, differences are still apparent.

In conclusion, our study suggests that a classification system of primary CS in labour can provide important information on different clinical practices in different units. Knowledge of these differences can lead to the development of effective strategies to safely reduce primary CS rates. In addition, our data also showed that efforts to improve collection of data are needed in order to apply this classification to all maternity units in the country.

CONFLICT OF INTEREST

The authors declare that no conflict of interest exists.

FUNDING

No funding has been received for the conduct of this study and/or preparation of this manuscript.

ETHNICAL APPROVAL

This retrospective study of anonymous entries did not require approval by the ethical committee.

REFERENCES

1. EURO-PERISTAT Project. European Perinatal Health Report 2010. Accessed July 15th, 2017 at: http://www.europeristat.com.
2. Belizan JM, Althabe F, Cafferata ML. Health consequences of the increasing caesarean section rates. Epidemiol. 2007;18:485-6. doi: 10.1097/EDE.0b013e318068646a.
3. Spong CY, Berghella V, Wenstrom KD, Mercer BM, Saade GR. Preventing the first cesarean delivery. Obstet Gynecol. 2012;120:1181-93. doi: 10.1097/AOG.0b013e3182704880.
4. Gregory KD, Jackson S, Korst L, Fridman M. Cesarean versus vaginal delivery: whose risks? Whose benefits? Am J Perinatol. 2012;29:7-18. doi: 10.1055/s-0031-1285829.
5. Bergant J, Sirc T, Lučovnik M, Verdenik I, Stopar Pintarič T. Perinatal analgesia and labour outcomes in Slovenia: a retrospective analysis of births between 2003 and 2013. Zdrav Vestn. 2016;85:83-91.
6. Fischer A, LaCoursiere DY, Barnard P, Bloebaum L, Varner M. Differences between hospitals in cesarean rates for term primigravidas with cephalic presentation. Obstet Gynecol. 2005;105:816-21. doi: 10.1097/01.AOG.0000156299.52668.e2.

7. Robson M, Hartigan L, Murphy M. Methods of achieving and maintaining an appropriate caesarean section rate. Best Pract Res Clin Obstet Gynecol. 2013;27:297-308. doi: 10.1016/j.bpobgyn.2012.09.004.
8. National Institute of Public Health. National Perinatal Information System: definitions and methodological guidelines. Accessed September 12th, 2017 at: http://www.ivz.si/podatki_metodoloska_gradiva?_5_AutoResize=false&_5_Filename=attName.png&_5_MediaId=6423&pi=5&pl=47-5.3.
9. Robson MS. Classification of cesarean sections. Fetal Matern Med Rev. 2001;12:23-39.
10. Sarnat HB, Sarnat MS. Neonatal encephalopathy following fetal distress: a clinical and electroencephalographic study. Arch Neurol. 1976;33:696-705.
11. Verdenik I, Novak Antolič Ž, Zupan J. Perinatologia Slovenica II: slovenski perinatalni rezultati za obdobje 2002–11. Ljubljana: Združenje za perinatalno medicino SZD, Ginekološka klinika, UKC, 2013.
12. Pajntar M. Sprožitev poroda. In: Pajntar M, Novak Antolič Ž, Lučovnik M, et al. Nosečnost in vodenje poroda. Ljubljana: Medicinski Razgledi, 2015:270-3.
13. Patka JH, Lodolce AE, Johnston AK. High- versus low-dose oxytocin for augmentation or induction of labor. Ann Pharmacother. 2005;39:95-101. doi: 10.1345/aph.1E037.
14. Wei SQ, Luo ZC, Qi HP, Xu H, Fraser WD. High-dose vs low-dose oxytocin for labor augmentation: a systematic review. Am J Obstet Gynecol. 2010;203:296-304. doi: 10.1016/j.ajog.2010.03.007.
15. Budden A, Chen LJ, Henry A. High-dose versus low-dose oxytocin infusion regimens for induction of labour at term. Cochrane Database Syst Rev. 2014(10):CD009701. doi: 10.1002/14651858.CD009701.