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Maternal and infant outcome after caesarean section without recorded medical indication: findings from a Swedish case–control study

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Objective To compare maternal complications and infant outcomes for women undergoing elective caesarean sections based on a maternal request and without recorded medical indication with those of women who underwent spontaneous onset of labour with the intention to have a vaginal birth.

Design Retrospective register study.

Setting Sweden; Medical Birth Register used for data collection.

Methods A case–control study of 5877 birth records of women undergoing caesarean sections without medical indication and a control group of 13 774 women undergoing births through spontaneous onset of labour. The control group was further divided into women who actually had a vaginal birth and women who ended up with an emergency caesarean section.

Results Maternal complications occurred more frequently among women undergoing caesarean section with odds ratios (OR) for bleeding complications of 2.5 (95% CI 2.1–3.0) in the elective caesarean group and 2.0 (95% CI 1.5–2.6) in the emergency caesarean group. The OR for infections was 2.6 in both groups. Breastfeeding complications were most common in women having an elective caesarean section: 6.8 (95% CI 3.2–14.5). Infant outcomes showed a higher incidence of respiratory distress with an OR of 2.7 (95% CI 1.8–3.9) in the elective caesarean section group compared with infants born by emergency caesarean section. The risk of hypoglycaemia was at least twice as high for infants in the caesarean group.

Conclusions Caesarean sections without medical indication as well as emergency caesarean sections were associated with higher risks for maternal and infant morbidity.

Keywords Caesarean section on maternal request, maternal and infant outcome, register study.

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Introduction

Caesarean section is to an increasing extent performed without an obstetric or medical indication.[1,2] In the Swedish obstetric context, the diagnostic code O828 (Other single delivery by caesarean section) in the International Classification, 10th Revision (ICD-10),[3] is commonly used for caesarean sections when no medical indication is present.[4] This type of caesarean section is predominantly elective surgery.

In the absence of a medical indication for a specific procedure, the excess risk associated with the procedure itself must be considered. Risks of short-term and long-term maternal and infant morbidity associated with elective caesarean section are higher than those associated with vaginal birth.[5–7] Elective caesarean section in a low-risk population has been shown to be associated with a significant increase in maternal morbidity. Overall rates of severe morbidity were reported at 27.3 per 1000 in a planned caesarean section group compared with 9.0 per 1000 in a vaginal birth group.[6] However, the ability to compare maternal and neonatal outcomes between these two groups is disputed because of a lack of randomised controlled studies. Women undergoing elective primary caesarean section for breech presentation have been used as a surrogate variable for planned caesarean sections in the absence of randomised trials,[6,8] and some studies have incorporated the application of an intention-to-treat model.[6,7] Furthermore, caesarean section based on maternal request is not an accurately reported condition and has no explicit code in the

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ICD-10,[3] which makes it more difficult to study in terms of risks and benefits.[9,10] Yet, morbidity associated with elective caesarean section is most likely higher than that associated with vaginal birth. Most evident is the short-term risk of postpartum infection,[11,12] haemorrhage,[13,14] and thromboembolic complications.[15] However, no differences in short-term medical outcomes were found between Swedish primiparous women undergoing elective caesarean section and those undergoing vaginal delivery.[16]

Infant outcome is affected by mode of delivery. The most common complication is respiratory problems, which are estimated to increase by two to three times after elective surgery.[17–19] The timing of the caesarean section is also important. Recommendations suggest that elective caesarean sections (i.e. neither the mother nor the child is at risk) should not be performed before week 39 of pregnancy.[20,21] Other negative consequences for newborns delivered via elective caesarean section are hypoglycaemia and low temperature.[22,23] Moreover, studies have indicated that caesarean sections may lead to delayed breastfeeding, shorter period of breastfeeding, and difficulties in maternal bonding with the newborn.[24] However, findings related to maternal attachment to infants are inconclusive. A Swedish study recently reported that contact with a newborn was not affected by mode of delivery.[25]

In conclusion, birth by caesarean section is associated with several short-term and long-term risks for both the mother and the infant. The potential hazard of vaginal birth also poses risks to maternal and infant health, and whether caesarean section is appropriate for low-risk births is of concern for both the public and professionals. The objective of this study was to compare maternal complications and infant outcomes for women undergoing elective caesarean sections based on a maternal request and without recorded medical indication with that of women who underwent spontaneous onset of labour with the intention to have a vaginal birth.

Material and methods

A case–control study was performed to compare complications in women who had a caesarean section without medical indication with those in women with spontaneous onset of labour. This study used data from the Swedish Medical Birth Register, which is available from the National Board of Health and Welfare. The register has been in use since 1973 and covers 97 to 99% of all births.[26] All hospitals in Sweden are obligated to provide copies of their prenatal and delivery records to the register. The register also contains sociodemographic variables for the mother, such as age, parity, family situation, country of birth, smoking, weight and height; this information is collected from the antenatal records. The antenatal record is merged with the birth record when the woman is admitted to a hospital for labour or a caesarean section. The birth records include information such as the onset of labour, mode of delivery, ICD-10 diagnostic codes, Apgar score, weight and height of the newborn, and pain relief used.

Birth records of 5877 full-term caesarean sections where no medical indication was present (code O828 in the register) during the period from 1997 to 2006 were investigated. Only elective caesarean sections with singleton babies in the vertex position were included.

For comparison, two control groups were established from birth records for 13 774 women with full-term, singleton babies who presented in the vertex position with spontaneous onset of labour and the intention of a vaginal birth. The control groups were composed depending on the actual mode of delivery and were divided into those women who actually had a vaginal birth and those who ended up with an emergency caesarean section. Women whose labour was induced were excluded. The birth records of the control groups were retrieved from the same time period. This study was approved by the Research Ethics Committee at Umeå University in Umeå, Sweden (07-140M).

Analyses

The data were analysed using the Student's *t*-test and multinomial regression with unadjusted and adjusted odds ratios with a 95% confidence interval (CI). Birth records from women with elective, maternally requested caesarean sections and those for women with deliveries after spontaneous onset of labour were compared for the different categories of the explanatory variables. In the regression analysis, women with a vaginal birth after spontaneous onset of labour constituted the reference group, and the two caesarean section groups (elective/emergency) composed the controls. The analysis was conducted using the Statistical Package for Social Sciences (SPSS Inc. Version 17.0., Chicago, Illinois, USA).

Results

Of the 19,651 birth records used, 29.9% were caesarean sections without recorded medical indication/maternal request, resulting in 2.34 controls per case. The majority of women who started labour spontaneously gave birth vaginally. However, 838 women (6.1%) ended up with emergency caesarean sections.

Socio-demographic background

Table 1 contains a summary of the socio-demographic characteristics of the women in this study. Women who had an elective caesarean section were older than the women who had a spontaneous onset to labour, and a dose-response effect was observed in the older age group with a four-fold likelihood to be in the caesarean section group if the woman was more than 35 years of age. The caesarean section group

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Table 1. Maternal characteristics in women with the diagnostic code O828 or spontaneous onset of labour

	Women with O828 (n = 5877) n (%)	Women with spontaneous onset (n = 13 774) n (%)	OR/t-test (95% CI)
Age			
<25 years	465 (7.9)	2467 (17.9)	1.0 Ref.
25–35 years	3599 (61.2)	9199 (66.8)	2.05 (1.84–2.27)***
>35 years	1813 (30.8)	2106 (15.3)	4.42 (3.93–4.96)***
Parity			
Primiparas	1405 (23.9)	7843 (56.9)	1.0 Ref.
Multiparas	4472 (76.1)	5931 (43.1)	4.25 (3.96–4.55)***
Civil status			
Married/cohabiting	4863 (94.5)	11 850 (94.0)	1.0 Ref.
Other family situation	281 (5.5)	761 (6.0)	0.90 (0.78–1.04)
Smoking in early pregnancy			
Yes	550 (10.8)	1387 (11.1)	0.97 (0.87–1.01)
No	4539 (89.2)	11 113 (88.9)	1.0 Ref.
Country of birth			
Sweden	5331 (90.7)	11 031 (86.8)	1.0 Ref.
Other country	546 (9.3)	1708 (13.4)	0.66 (0.60–0.73)***
Body mass index			
<20	421 (9.4)	1247 (11.3)	0.92 (0.81–1.03)
20–25	2365 (52.9)	6429 (58.4)	1.0 Ref.
25–30	1165 (26.0)	2501 (22.7)	1.27 (1.16–1.37)***
30–35	370 (8.3)	620 (5.6)	1.62 (1.41–1.86)***
>35	153 (3.4)	211 (1.9)	1.97 (1.59–2.44)***
Infertility problems, year (mean, SD)	1.55 (2.45)	1.92 (2.48)	<0.000
Women with infertility problems	1049 (17.8)	1310 (9.4)	2.10 (1.92–2.29)***
Women without infertility problems	4828 (82.2)	12 660 (90.6)	1.0 Ref.

***$P < 0.001$.

consisted of more multiparous women and more women who were born in Sweden. No differences were observed between the two groups in terms of civil status or smoking habits, but women who had a caesarean section without medical indication were more likely to have a higher Body Mass Index and infertility problems.

Maternal outcome

Women in the elective caesarean section group had a significantly shorter length of pregnancy compared with vaginally delivered women as well as women in the emergency caesarean section group (Table 2). The prevalence of bleeding complications was about 10% among women who had a caesarean section. Women in the caesarean section group where no medical indication was recorded had the highest odds for bleeding complications after adjustment for differences in socio-demographic and obstetric background factors. Caesarean section was also associated with infections, and there was no difference between the two caesarean section groups after adjustment for confounding factors. "Other" complications, including wound ruptures, haematoma, urinary retention, and unspecified complications, were more common among women who had a vaginal birth, but these did not remain statistically significant after adjusting for confounding factors. The highest odds were found in breastfeeding complications, with an adjusted odds ratio (OR) of 6.8 (95% CI 3.2–14.5) among women with caesarean sections without recorded medical indication.

Infant outcome

Most of the infants were healthy and had few reported problems, regardless of the mode of delivery. Infants born to mothers via elective, maternally requested caesarean section were less likely to have low Apgar scores (≤ 7) compared with those born vaginally or by emergency caesarean section. However, they had lower birthweight compared with infants born after the spontaneous onset of labour. Respiratory distress was the most common infant complication, with a prevalence of 2.7%, and occurred more frequently in the elective, maternally requested caesarean section group. Low blood sugar was also more common in infants born to mothers via caesarean sections and had the highest odds in

Table 2. Maternal outcome in women with diagnostic code O828, spontaneous onset of labour with vaginal birth and spontaneous onset with emergency caesarean section (CS)

	Women with O828 (*n* = 5877) *n* (%)	Women with spont. onset and vaginal birth (ref. group) (*n* = 12 936) *n* (%)	Women with spont. onset and emergency CS (*n* = 838) *n* (%)	O828		Emergency CS	
				Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
Length of pregnancy	38.40 (0.73)	39.81 (1.17)	40.01 (1.30)	*P*-value 0.000			
Bleeding complications							
Yes	579 (9.9)	644 (5.0)	291 (10.9)	2.1 (1.8–2.3)***	2.5 (2.1–3.0)***	2.3 (1.8–2.9)***	2.0 (1.5–2.6)***
No	5298 (90.1)	12 292 (95.0)	747 (89.1)	1.0 Ref.	1.0 Ref.	1.0 Ref.	1.0 Ref.
Infections							
Yes	148 (2.5)	130 (1.0)	25 (3.0)	2.5 (2.0–3.2)***	2.6 (1.8–3.8)	3.0 (2.0–4.6)***	2.6 (1.6–4.2)***
No	5729 (97.5)	12 806 (99.0)	813 (97.0)	1.0 Ref.	1.0 Ref.	1.0 Ref.	1.0 Ref.
Other complications							
Yes	46 (0.8)	203 (1.6)	10 (1.2)	0.5 (0.3–0.7)***	0.6 (0.4–1.0)	0.8 (0.4–1.4)	0.5 (0.3–1.2)
No	5831 (99.2)	12 733 (98.4)	828 (98.8)	1.0 Ref.	1.0 Ref.	1.0 Ref.	1.0 Ref.
Breastfeeding complications¤							
Yes	73 (1.2)	19 (0.1)	13(0.4)	8.5 (5.1–14.1)***	6.8 (3.2–14.5)***	2.4 (0.7–8.2)	1.4 (0.3–6.6)
No	5804 (98.08)	12 917 (99.9)	83.5 (99.6)	1.0 Ref.	1.0 Ref.	1.0 Ref.	1.0 Ref.

Adjusted OR is adjusted for age,parity, country of birth, body mass index, infertility and length of pregnancy.
***$P < 0.001$.

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Table 3. Infant outcome in elective caesarean section (medical code O828), spontaneous onset of labour with vaginal birth and spontaneous onset with emergency caesarean section (CS)

	Infants born to women with O828 (*n* = 5877) *n* (%)	Infants born to women with spont. onset and vaginal birth (ref. group) (*n* = 12 936) *n* (%)	Infants born to women with spont. onset and emergency CS (*n* = 838) *n* (%)	O828		Emergency CS	
				Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
Mean birthweight (g)	3558 (448)	3665 (467)	3721 (574)				
Apgar score							
0–7	38 (0.6)	173 (1.4)	39 (4.7)	0.5 (0.3–0.7)***	0.6 (0.3–0.9)*	3.5 (2.5–5.1)***	3.1 (2.1–4.5)***
8–10	5823 (99.4)	12 591 (98.6)	790 (95.3)	1.0 Ref.		1.0 Ref.	
Respiratory problems (RDS)	159 (2.7)	132 (1.0)	21 (2.5)	2.7 (2.1–3.4)***	2.7 (1.8–3.9)***	2.5 (1.6–3.9)***	2.1 (1.3–3.6)**
Asphyxia†	3 (0.1)	48 (0.4)	30 (3.6)	0.1 (0.0–0.4)***	n.a	9.9 (6.3–15.8)***	n.a
Infections†	29 (0.5)	95 (0.7)	16 (1.9)	0.7 (0.4–1.0)*	0.7 (0.3–1.2)	2.6 (1.5–4.5)***	2.5 (1.4–4.5)**
Temperature regulation problems	3 (0.1)	5 (0)	1 (0.1)	1.3 (0.3–5.5)	0.8 (0.1–9.3)	3.1 (0.4–26.4)	n.a.
Feeding problems†	20 (0.3)	41(0.3)	3 (0.4)	1.1 (0.6–1.5)	0.6 (0.3–1.5)	1.1 (0.3–3.6)	0.7 (0.2–2.8)
Hypoglycaemia†	120 (2.0)	130 (1.0)	35 (4.2)	2.1 (1.5–2.6)***	1.8 (1.2–2.5)**	4.3 (2.9–6.3)**	4.3 (2.8–6.5)**

RDS, respiratory distress syndrome.
Adjusted OR are adjusted for age, parity, country of birth, BMI, infertility and length of pregnancy.
*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.
†Ref = Infants not exposed to the studied variable.

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the emergency caesarean section group as well as asphyxia and infections. Infections were less common in the elective caesarean section group but were no longer statistically significant when adjusted for the mother's background factors (Table 3).

Discussion

Main findings

The results of this study show that the risk for complications such as bleeding, infections and trouble breastfeeding were equal, irrespective of the mode of caesarean section. Infants born by caesarean section had more complications regardless of whether surgery was performed based on maternal request (no reported medical indication) or occurred after spontaneous onset of labour.

Strengths and limitations

A significant strength of the study was the use of the Medical Birth Register, which has a high coverage of all births in Sweden. However, incorrect classification may exist, and missing data are common for maternal characteristics such as smoking, civil status and weight. Another limitation with the register data is the retrospective design. In general, the lack of randomised controlled trials is a problem. In this study the control group comprised women planning a vaginal birth with a spontaneous onset of labour and a vaginal delivery most probably also included women with high risk. A Cochrane review[27] concludes that there is a need for alternative research methods to gather data on the outcomes associated with different ways of giving birth, because no evidence from randomised controlled trials exits.

Interpretation

Overall, maternal and infant morbidity was low irrespective of mode of delivery. The highest prevalence was related to bleeding complications. However, negative long-term effects of haemorrhage and infections have been reported. For example, blood loss of more than 1000 ml increases the risk of postpartum anaemia,[28] which can negatively affect the postpartum period in several ways. More specifically, anaemia in the postpartum period is associated with an increased prevalence of tiredness, breathlessness, palpitations and infections, particularly in the urinary tract. It also reduces cognitive performance and increases the risk of postpartum depression.[29,30] The results of our study showed that after adjustment for background characteristics, the risk of bleeding complication was more than doubled in the elective caesarean section group and doubled in the emergency caesarean section group. Bodner et al.[31] reports similar results from a comparative study between elective caesarean section and planned vaginal delivery in a low-risk population. Increased maternal morbidity included more frequent blood loss (>500 ml) and puerperal febrile morbidity with a significant increased use of antibiotics, iron supplementation and analgesics, as well as prolonged hospital stay. The Austrian study also reported more breastfeeding problems in the postpartum period, which is similar to our result. On the other hand Wiklund et al.[32] reported that women undergoing caesarean section on maternal request had a significantly more positive birth experience compared with women with a vaginal birth. No difference was found in sign of postnatal depression.

Reasons for requesting a caesarean section without a medical indication are often related to the mother's concern for the newborn.[33] This indicates a lack of information available to pregnant women, because a number of studies have shown that infants born by caesarean section are exposed to more risks compared with those born vaginally. A recent review summarises short-term as well as longer-term effects of delivery by prelabour caesarean section.[34] It is suggested that vaginal delivery initiates important physiological adaptations to postnatal life and, furthermore, is a programming event with lifelong health implications. The neonatal stress response during normal parturition is hypothesised to be a key mechanism not only in adjusting to extrauterine life but also affecting health and wellbeing in the future.

In this study respiratory problems were more than doubled with the highest odds in the elective caesarean group preceded by maternal request. The prevalence of hypoglycaemia was likewise higher in the caesarean section group, with the highest odds among infants delivered by emergency caesarean section. This is also in accordance with the results of previous studies.[17–19,22] Admission to the neonatal intensive care unit (NICU) because of respiratory distress is more frequent among babies born via caesarean section.[35] A review of 14 studies regarding parents' experiences after their infant was transferred to the NICU showed that the postpartum period is affected in several ways. Parents with an infant in the NICU often experience depression, anxiety, stress and feelings of loss of control.[36] Caesarean sections might expose parents and their infants to a greater risk of need for neonatal intensive care. This is most relevant when an emergency intervention is performed because of a threat to the wellbeing of the infant. The results of this study show, however, that caesarean section performed without recorded medical indication might involve medical consequences for the infant.

Women with maternally requested caesarean sections had a significantly shorter length of pregnancy compared with women with spontaneous onset of labour; clearly, length of pregnancy at birth affects the maturity of the infant. This shorter pregnancy and associated immaturity of the infant's system might have a negative effect on breastfeeding as well as respiration. The National Institutes of Health concluded that caesarean section delivery based on maternal request

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should not be performed before 39 weeks of gestation.[37] Mean birthweight was lowest in the elective caesarean group.

The results of our study showed that fewer cases of asphyxia and low Apgar scores (0–7) were found among infants delivered by elective caesarean section compared with infants born via emergency caesarean section as well as vaginally born infants. An emergency caesarean section is clearly related to poorer fetal outcome. Evidence indicates a lower risk of asphyxia, encephalopathy, and intracranial haemorrhage with elective caesarean section compared with vaginal delivery and emergency caesarean sections.[38] Nevertheless, the National Institutes of Health concluded that the evidence that favours caesarean section by maternal request is weak.

Conclusion

The results of this study indicate that greater risks for maternal and neonatal wellbeing are associated with elective caesarean sections that are performed without medical indication as compared with births that start spontaneously. More research is needed about the short-term and long-term effects of the rising caesarean section rates. Future research is also required to develop a consensus about the terminology used for both delivery routes and outcomes.

Disclosure of interest

No potential conflict of interest concerning any of the authors exists and all approved submission to *BJOG*.

Contribution to authorship

All authors have made substantial contributions to this manuscript; design (AK, HL, IH), applying for funding (IH), concept, analysis and interpretation of the data (AK, HL, IH) manuscript draft and revision (AK, HL, IH).

Details of ethics approval

The study is approved by The Ethics Committee of the Medical Faculty, Umeå University, Sweden, which is the regional Ethics Committee to which the Mid Sweden University applies for ethics approval. The approval registration number is 07-140M.

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Commentary on 'Maternal and infant outcome after caesarean section without recorded medical indication: findings from a Swedish case–control study'

Maternal and infant morbidity for elective caesarean sections without recorded medical indication when compared with that of women who underwent spontaneous onset of labour with the intention to have a vaginal birth were found to be higher in this paper. Whenever such comparisons are made, a basic question about selection bias arises. It could be argued that women who entered labour spontaneously are self selected, and are expected to experience a lower morbidity both for themselves and their babies.

It is well known that respiratory distress in babies is more common following caesarean section without labour than after intrapartum caesarean section (Gerten et al. *Am J Obstet Gynecol*; 2005;193:1061–4). A more appropriate comparison group would be all those not undergoing elective caesarean section without medical indications. This group would include those in spontaneous labour (whether or not they give birth vaginally) and those who need induction of labour for prolonged pregnancy. Should this 'control' group also include women needing elective caesarean section or induction of labour for pregnancy complications? Common sense tells us that maternal and fetal morbidity is likely to be high in this sub-group; hence the concern about selection bias. Clearly, including women with pregnancy complications in the comparison group is not appropriate. The best method for avoiding selection bias is randomisation with allocation concealment. Until now it has not been considered ethical to allocate women randomly to undergo a caesarean section for no medical indication. This situation may or may not change in the future. The current best research strategy is to use observational data and try to control for the risk of bias, which this paper has attempted.

Disclosure of interests

No conflicts of interest to declare. ■

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