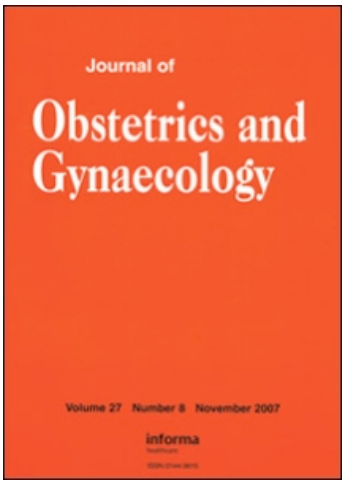


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# Comparing complications in intended vaginal and caesarean deliveries

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**Summary**
A hospital-based, prospective cohort study was conducted at the tertiary care university hospital in southern Thailand, between 1 November 2001 and 31 December 2003. The purpose of this study was to compare the various complications found in vaginal and caesarean deliveries based on the original elected intended mode of delivery. There were a total of 1,429 cases, 1,242 intended vaginal deliveries and 187 intended caesarean deliveries. Major and minor complication rates were found to be significantly lower in the intended vaginal delivery group compared with the intended caesarean delivery group (2.3% and 1.3% vs 4.8% and 3.7%; $p < 0.05$). The most common major complication was haemorrhage, which was found more frequently in the intended caesarean delivery group (OR 7.5, 95% CI 2.6–21.5). After statistical adjustment, an intended caesarean delivery was found to be an independent risk factor for complications.

**Keywords**
Caesarean delivery, vaginal delivery, complications



## Introduction

Caesarean delivery is the most common major surgical procedure used that has helped decrease maternal and fetal mortality and morbidity in appropriate cases (cases of difficult deliveries) (Lee-Parritz 2004). From a literature review covering the past 10 years, it has been found that most papers that compared complication rates in vaginal and caesarean delivery were in fact only observational studies and did not consider the original intended mode of delivery. Thus, there is a need to make a serious examination of evidence based on an intention-to-treat analysis. As a part of the WHO 'Collaborative Study on Caesarean Section in Asia', our study was carried out in the major tertiary care centre and teaching hospital in southern Thailand. The objectives of our study were to compare the rates and types of complications occurring in vaginal delivery and caesarean delivery, while noting the original planned mode of delivery, and also to determine if the intention to deliver by caesarean section was an independent risk factor for complications.

## Patients and methods

Our study examined selected cases between 1 November 2001 and 31 December 2003 in Songklanagarind Hospital, a tertiary university hospital, in Hat Yai, southern Thailand. The procedure was approved by the Ethics Committee of the Faculty of Medicine, Prince of Songkla University, Thailand.

All women admitted for delivery were invited to participate if they resided within a catchment area of 5 km radius of the hospital. The subjects included in the study were subsequently identified and their consent was obtained.

The classification of the intended mode of delivery was carried out as follows:

1. All elective caesarean deliveries were classified as intended caesarean delivery (ICD).
2. All women who had had a previous caesarean delivery were also classified as ICD, as vaginal birth after caesarean section was not a routine practice because of limited facilities.
3. Caesarean deliveries following a trial or induced labour were classified as an intended vaginal delivery (IVD).

For the actual mode of delivery, an elective caesarean delivery was defined as a scheduled caesarean performed with a well-prepared patient and surgical team.

All women having a caesarean delivery received an intraoperative prophylactic antibiotic after clamping the umbilical cord.

The data collection included the patient's demographic characteristics, previous obstetric history, antepartum complications, and intra-partum care. The nursing staff interviewed and examined the patients, emphasis on clinical details of postpartum complications on day 2 and between days 5 and 7. If the patient was discharged before day 5, they made a home visit. The types of complications in the checklists were grouped according to the mode of delivery and were identified by yes–no choices. The major maternal complications included surgical and anaesthetic complications, intraoperative haemorrhage requiring transfusion, postoperative haemorrhage, haemorrhage requiring hysterectomy, haemorrhage requiring hypogastric artery ligation, endometritis, wound disruption and perineal haematoma. The surgical complications included injury

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to adjacent organs and sub-rectus sheath haematoma. The standard criterion for postoperative febrile morbidity was an oral temperature of at least 38°C on any two of the first 10 days postpartum, excluding the first 24 h (Cunningham et al. 2005). Postoperative infections were diagnosed by using the Center for Disease Control and Prevention (CDC) definitions (Horan et al. 1992). Endometritis was defined as at least two of the followings three symptoms: a foul-smelling lochia, sub-involution of the uterus and febrile morbidity. The minor maternal complication noted was superficial wound infection. Newborn complications were low Apgar scores of $\leq 6$ at 5 min, admission to the newborn intensive care unit or requiring other treatments.

### *Statistical methods*

We used Student's *t*-test to compare the mean ages and birth weight between the two groups. Either a $\chi^2$-test or Fisher's exact test was used to compare the frequencies of the variables and any of the associations between the intended mode of delivery and complications. The Mann-Whitney *U*-test was used to compare the non-parametric outcomes. Odds ratios (OR) were calculated to evaluate the increased risks of adverse outcomes. Multiple logistic regression was used to determine if the intended caesarean delivery was an independent risk factor of serious complications by controlling for potential confounders, which included maternal age ($<35$ vs $\geq 35$ years), parity (nulliparous vs multiparous), educational level (degree vs non-degree), and type of service (private vs public).

## Results

Based on the requirement to reside near the hospital in order to allow for postpartum follow-up, only 1,429 of the 5,633 deliveries in the study period were eligible for this study. Of the studied group, 187 cases were ICD and 1,242 cases were IVD. However, it should be noted that the actual modes of delivery were different from those planned as seen in Figure 1. In the final analysis, 75 of the 187 planned for caesarean group ended up with an unscheduled caesarean, while 18 of 1,242 planned for vaginal delivery had an unscheduled caesarean without trial of labour, and of the remaining 1,224 patients 198 failed the trial for vaginal delivery and had an unscheduled caesarean delivery. A total of 18 cases in the IVD group that resulted in an unscheduled caesarean delivery had undiagnosed indications before labour, such as *placenta praevia*, malpresentation and *abruptio placentae*. The rate of unscheduled caesareans was 17.4% in those planned for vaginal delivery compared with 40% for those planned for caesarean delivery ($p < 0.001$). The ICD group had a significantly higher mean age, higher percentage of multiparity, higher level of education as shown in Table I.

A comparison of the complication rates between the two groups are shown in Table II. Two maternal deaths occurred during the period of this study; both were in the IVD group that had required an unscheduled caesarean delivery. The causes of the deaths were amniotic fluid embolism and intracerebral haemorrhage. In the latter case of the intracerebral haemorrhage, the patient had eclampsia with very high blood pressure and died postoperatively.

The study found that patients in the ICD group were more likely to have major complications (4.8% vs 2.3%, $p = 0.027$). The most common major complication found in all the births was haemorrhage, with a tendency to be more common in those who finally received an unscheduled caesarean delivery. Hysterectomies occurred more frequently in the ICD group. Two cases of uterine atony were reported, one from the IVD group and one from the ICD group, from the unscheduled caesarean deliveries. However, these were successfully treated by hypogastric artery ligation.

For other complications, 13 cases were identified in the IVD group with successful vaginal deliveries. The problems included the manual removal of the placenta in 11 cases and evacuation of haematoma with re-suturing of the birth canal in two cases. For the ICD group, one case required evacuation of a sub-rectus sheath haematoma. The minor

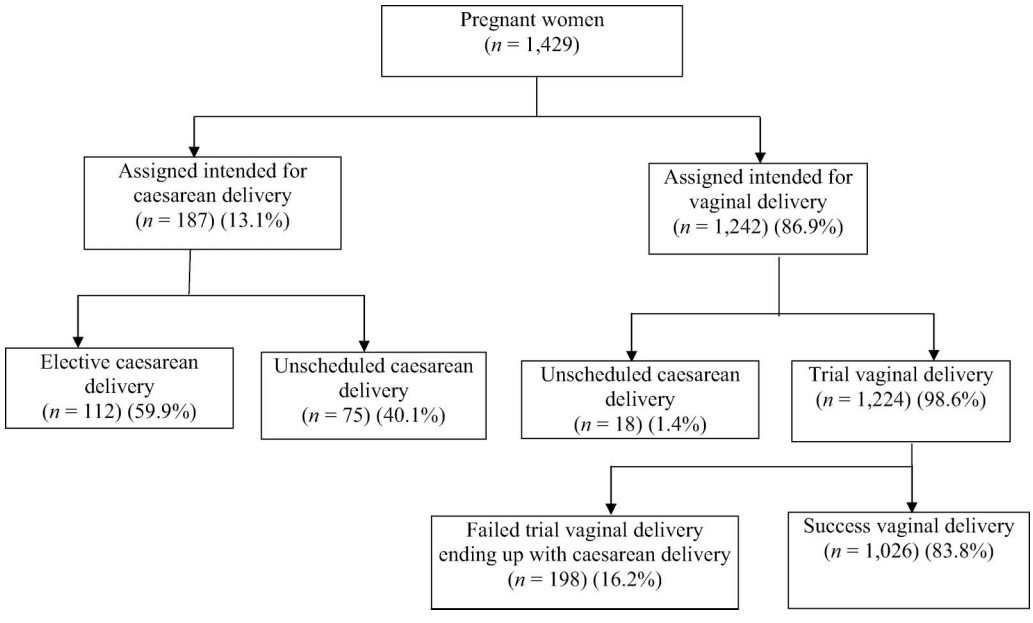


Figure 1. Flowchart – mode of delivery.

wound infection rate was 1.3% in the IVD group and 3.7% in the ICD group ($p < 0.001$).

The anaesthetic complication rate was 0.6% in the IVD group and 4.8% in the ICD group ($p < 0.001$). The most common anaesthetic complications were hypotension and post- spinal block headache but no serious complications from the anesthesia were recorded and only one failure for a spinal block was reported.

Hospital stay was significantly longer in the ICD group compared with the IVD group with a median of 4 days vs 6 days ($p < 0.001$, Table II).

The newborn complications are summarised in Table III. The ICD group showed no difference from the IVD group in the rate of admission to the neonatal intensive care unit or to the complications requiring treatment.

The causes of stillbirths that were observed in five cases in the IVD group cases were from *abruptio placentae* (three cases) and severe congenital anomaly (two cases).

The result of the multiple logistic regression for the complications are summarised in Table IV. After making adjustments for the maternal age, parity, educational level and type of services, it was found that overall the ICD group had a significant increase in the risk of complications from haemorrhage, hysterectomy, wound infection, and was also subject to a longer stay in hospital.

## Discussion

This study found that the actual mode of delivery was quite different from that which had been planned in a large number of pregnancies. The planned vaginal delivery

Table I. Baseline characteristics

| | Intended vaginal delivery ($n = 1,242$) | | Intended caesarean delivery ($n = 187$) | | |
|---|---|---|---|---|---|
| | *n* | (%) | *n* | (%) | *p* value |
| Maternal age (years) (Mean ± SD) | 28.6 ± 5.7 | | 32.2 ± 4.5 | | <0.001* |
| <35 | 1057 | 85.1 | 136 | 72.7 | <0.001** |
| ≥35 | 185 | 14.9 | 51 | 27.3 | |
| Parity | | | | | |
| Nulliparity | 700 | 56.4 | 73 | 39.0 | <0.001** |
| Multiparity | 542 | 53.6 | 114 | 61.0 | |
| Education | | | | | |
| Non-degree | 693 | 55.8 | 59 | 31.6 | <0.001** |
| Degree | 549 | 44.2 | 128 | 68.4 | |
| Type of service | | | | | |
| Public | 747 | 60.1 | 61 | 32.6 | <0.001** |
| Private | 495 | 39.9 | 126 | 67.4 | |
| Unscheduled caesarean delivery | 216 | 17.4 | 75 | 40 | <0.001** |

*Student's *t*-test, **$\chi^2$-test.

Table II. Maternal mortality and morbidity (*n* (%))

| | Intended vaginal delivery ($n = 1,242$) | | | Intended caesarean delivery ($n = 187$) | | | |
|---|---|---|---|---|---|---|---|
| Complications | Total | Successful vaginal delivery ($n = 1,026$) | Failed vaginal delivery and had CS ($n = 216$) | Total | Elective CS ($n = 112$) | Unscheduled CS ($n = 75$) | *p* value |
| Mortality | 2 (0.2) | 0 | 2 (0.9) | 0 | 0 | 0 | 0.056 |
| Major | 28 (2.3) | 21 (2.1) | 7 (3.2) | 9 (4.8) | 3 (2.7) | 6 (8.0) | 0.027* |
| Endometritis | 3 (0.2) | 1 (0.1) | 2 (0.9) | 0 | 0 | 0 | 0.142 |
| Haemorrhage requiring blood transfusion | 13 (1.1) | 9 (0.9) | 4 (1.9) | 7 (3.7) | 2 (1.8) | 5 (6.8) | 0.003* |
| Haemorrhage requiring hysterectomy | 3 (0.2) | 1 (0.1) | 2 (0.9) | 4 (2.1) | 2 (1.8) | 2 (2.7) | 0.007* |
| Haemorrhage requiring hypogastric artery ligation | 1 (0.1) | 0 | 1 (0.5) | 1 (0.5) | 0 | 1 (1.5) | 0.029* |
| Others | 13 (1) | 13 (1.3) | 0 | 1 (0.5) | 1 | 0 | 0.396 |
| Minor | | | | | | | |
| Wound infection | 16 (1.3) | 9 (0.9) | 7 (3.3) | 7 (3.7) | 6 (5.4) | 1 (1.3) | 0.001* |
| Anaesthetic complications | 8 (0.6) | 0 | 8 (3.8) | 9 (4.8) | 6 (5.4) | 3 (4.2) | <0.001* |
| Median (5th–95th centiles) time in hospital after delivery (days) | 4 (3–9) | 4 (3–8) | 6 (5–9) | 6 (4–18) | 7 (4–12) | 6 (4–35) | <0.001** |

*Fisher's exact test; **Mann–Whitney *U*-test; CS, caesarean section.

Table III. Neonatal mortality and morbidity (*n* (%))

| Outcome | Intended vaginal delivery ($n=1{,}244^{\dagger}$) | | | Intended caesarean delivery ($n=200^{\ddagger}$) | | | |
|---|---|---|---|---|---|---|---|
| | Total | Successful vaginal delivery ($n=1{,}028$) | Failed vaginal delivery and had CS ($n=216$) | Total | Elective CS ($n=121$) | Unscheduled CS ($n=79$) | *p* value* |
| Stillbirth | 5 (0.4) | 3 (0.3) | 2 (0.9) | 0 | 0 | 0 | 0.416 |
| Early neonatal death | 1 (0.08) | 1 (0.1) | 0 | 2 (1) | 0 | 2 (2.5) | 0.030** |
| Apgar score at 5 min | | | | | | | |
| 1–3 | 3 (0.2) | 1 (0.1) | 2 (0.9) | 1 (0.5) | 0 | 1 (1.3) | 0.413 |
| 4–6 | 5 (0.4) | 1 (0.1) | 4 (1.8) | 1 (0.5) | 0 | 1 (1.3) | |
| >6 | 1,236 (99.4) | 1,026 (99.8) | 210 (97.3) | 198 (99) | 121 (100) | 77 (97.4) | |
| Admission to NICU or required treatment | 303 (24.4) | 246 (23.9) | 57 (26.4) | 44 (22) | 21 (17.4) | 23 (29.1) | 0.182 |
| Birthweight (g) (Mean ± SD) | 3,144 ± 467 | 3117 ± 452 | 3,274 ± 515 | 3,027 ± 632 | 3,107 ± 519 | 2,905 ± 763 | <0.001*** |

$^{\dagger}$included two pairs of twins. $^{\ddagger}$included 13 pairs of twins. *Comparison between total of intended vaginal delivery and intended caesarean delivery. **Fisher's exact test, two-sided, ***Student's *t*-test. CS, caesarean section; NICU, neonatal intensive care unit.



Table IV. Odds ratios for various complications of intended caesarean delivery vs intended vaginal delivery*

| Outcomes | Adjusted odds ratio (95% CI)$^{\dagger}$ | *p* value |
|---|---|---|
| Overall major complications | 3.6 (1.5–8.4) | 0.003 |
| Haemorrhage requiring blood transfusion | 7.5 (2.6–21.5) | <0.001 |
| Haemorrhage requiring hysterectomy | 10.1 (1.9–53) | 0.006 |
| Minor complications | | |
| Wound infection | 3.1 (1.2–8.1) | 0.022 |
| Hospital stay >7 days | 2.8 (1.8–4.2) | <0.001 |

*Intended vaginal delivery is the reference category. $^{\dagger}$Adjusted for maternal age, parity, educational level and type of services.

group had up to a 17% probability of becoming an unscheduled caesarean delivery. Elective caesarean deliveries that were planned had up to a 40% chance of not being so well prepared for an unscheduled caesarean delivery. Serious complications were more common in the ICD group. It was also identified that intended caesarean delivery was an independent risk factor for complications.

Endometritis was uncommon in our study and in fact, no endometritis cases were found in the ICD group, but in other studies, it was found to be quite a common complication of caesarean deliveries (Burrows et al. 2004; Chaim et al. 2000; Henderson and Love 1995). Additionally, a study from America reported endometritis in 2.7% of caesarean deliveries in the births that had never had trial of labour (Burrows et al. 2004). Our study applied a strict criteria with at least two out of three indicators being required to define endometritis, so our relatively low rate of detection compared with other studies, which have ranged from 6% to 25% (Chaim et al. 2000; Henderson and Love 1995), may be due to this. We routinely use prophylactic antibiotics in most of the operative deliveries and also have adopted of a policy on the use of gentle traction of the placenta; as has been suggested in western countries (Dehbashi et al. 2004; Smaill and Hofmeyr 2002). Depending on the type of caesarean delivery, i.e. repeat caesarean without trial of labour, primary caesarean without trial of labour, and primary caesarean with trial of labour; previous studies have found a rate of haemorrhage of 0.3–4% (Burrows et al. 2004; van Ham et al. 1997), which is similar to our results. Hysterectomies most commonly followed uterine atony or abnormal adherence of the placenta in our study. Previous studies show the same causes but the incidence of these problems in our study was found to be higher at 0.5% vs 0.05–0.14% from those studies (van Ham et al. 1997; Selo-Ojeme et al. 2005).

Our study had a high rate of unscheduled caesarean delivery in both groups. In the IVD group, this may have been due to the frequent use of cardiotocography in our institution, which is known to be the test that is associated with an increase in the rate of caesarean sections and instrumental vaginal births also seen in other studies (Alfirevic et al. 2006). In the ICD group, the operation was usually scheduled to take place just before the expected date of delivery (39 weeks). As labour pains can occur before the projected date and other conditions, such as *placenta praevia* and malpresentation are associated with pre-term labour, unscheduled caesarean deliveries in some cases are unavoidable.

Had our data been analysed from a basis other than the intended mode of delivery, the conclusions would be different. The complication rates based on the actual mode of delivery were generally less different (results omitted). Moher et al. suggested and our observations concur, that a naïve reader who adopts a conclusion from such an analysis would tend to end up with an attitude bias towards indifference and indeed, it is a routine practice of research to analyse the data of RCT based on the intention to treat (Moher et al. 2005). However, comparisons of vaginal delivery vs caesarean delivery, in general, cannot be properly conducted in an RCT fashion for several reasons, such as disagreement among obstetricians and the woman's right to choose (Minkoff et al. 2004).

We do note that the complication rates may have been underestimated, as the follow-up period was confined to only 7 days postpartum. Also, only one-third of the total number of cases delivered during the study period were included in the study. However, we are confident that this

did not affect the results because the characteristics of the included patients were not in any significant way different from those who were not included, based on the database of our department.

The important limitation in our study was an existing condition of pregnancy that dictated the need to have a caesarean delivery, such as *placenta praevia*, previous caesarean delivery or malpresentation. These conditions by themselves increase the risk for complication regardless of the mode of delivery. Caesarean delivery is always offered to patients with these conditions, and therefore confounding indications are inevitable. Thus, the results must be interpreted with a high level of caution.

The implication of this study is the re-emphasis of the analysis of mode of delivery based on intention-to-treat. Despite the lack of RCT and confounding by indications, obstetricians who unduly plan for elective caesarean delivery should be aware of the possible higher complication rates.

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