



Clinical indicators associated with the mode of twin delivery: an analysis of 22,712 twin pairs



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ABSTRACT

Objective: To identify clinical indicators associated with the planned and actual mode of delivery in women with a twin pregnancy.

Study design: We performed a retrospective cohort study in women with a twin pregnancy who delivered at a gestational age of 32+0–41+0 weeks and days between 2000 and 2008 in the Netherlands. Data were obtained from a nationwide database. We identified maternal, pregnancy-related, fetal, neonatal and hospital-related indicators that were associated with planned cesarean section (CS) and, for women with planned vaginal delivery (VD), for intrapartum CS. The associations between indicators and mode of delivery were studied with uni- and multivariate logistic regression analyses.

Results: We included 22,712 women with a twin pregnancy, of whom 4,310 women (19.0%) had a planned CS. Of the 18,402 women who had a planned VD, 14,034 (76.3%) delivered vaginally, 3,545 (19.3%) had an intrapartum CS, while 823 (4.5%) delivered twin A vaginally and twin B by intrapartum CS. The clinical indicators for a planned CS and an intrapartum CS were comparable: non-cephalic position of both twins (aOR 25.32; 95% CI 22.50–28.50, and aOR 21.94; 95% CI 18.67–25.78, respectively), non-cephalic position of twin A only (aOR 21.67 95% CI 19.12–24.34, and aOR 13.71; 95% CI 11.75–16.00, respectively), previous CS (aOR 3.69; 95% CI 3.12–4.36, and aOR 7.00; 95% CI 5.77–8.49, respectively), nulliparity (aOR 1.51; 95% CI 1.32–1.72, and aOR 4.20; 95% CI 3.67–4.81, respectively), maternal age ≥ 41 years (aOR 3.00; 95% CI 2.14–4.22, and aOR 2.50; 95% CI 1.75–3.59, respectively), and pre-eclampsia (aOR 2.12; 95% CI 1.83–2.46, and aOR 1.34; 95% CI 1.16–1.56, respectively).

Conclusion: Both planned and intrapartum CS in twins had comparable predictors: non-cephalic position of both twins or twin A only, previous CS, nulliparity, advanced maternal age, and pre-eclampsia.

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Introduction

To make a balanced shared decision on the mode of delivery in women with a twin pregnancy beyond a gestational age of 32 weeks, information on clinical indicators associated with a cesarean section (CS) is relevant. Presentation of twin A is such a well-known indicator. In case of a cephalic presenting twin A, the

pregnant woman is counseled that, generally, planned CS has comparable safety as planned vaginal delivery (VD) [1–3]. Although there is no firm evidence to suggest benefit of cesarean over vaginal delivery in case of non-cephalic position of the first twin, she is counseled as is usual for non-cephalic presentation of a singleton, frequently resulting in an elective CS [4,5]. However, many other clinical indicators may be involved, like maternal age, mode of conception, parity, Body Mass Index, diabetes, previous CS, chorionicity, sex concordance, fetal intrauterine growth retardation, fetal weight, and birth weight discordance [2,6–11].

Ideally, an intrapartum CS, i.e. a CS during active labor, should not be necessary. Especially a combined delivery, i.e. twin A

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delivered vaginally and twin B by CS, should be prevented, as it is associated with the highest neonatal and maternal morbidity in twin births [1,12]. For women with a very high risk on a combined delivery, a planned CS may be the optimal mode of delivery [12–14].

In most national guidelines, no clear recommendations on planning the mode of delivery are expressed [15–18]. So, the planned and actual mode of delivery might differ depending on maternal, professional, hospital, fetal and environmental circumstances.

The purpose of this study was to identify the most important maternal, pregnancy-related, fetal, neonatal and hospital-related indicators associated with the planned and actual mode of delivery for twin pregnancies in the Netherlands.

Materials and methods

We used data of our nationwide registry on pregnancy and delivery. In The Netherlands, data on pregnancy, birth and neonates are routinely collected in four separate registries: the LVR1-registry for primary midwife-led care, the LVRh-registry for care led by general practitioners, the LVR2-registry for obstetrician-led care and the LNR-registry for neonatal care. These separate registries are linked into one database, The Netherlands Perinatal Registry (PRN) [19]. Approximately 96% of all births in The Netherlands are entered into this registry.

We included all women with a twin pregnancy and a gestational age of 32 + 0–41 + 0 weeks at delivery, as registered in the PRN database from January 1st, 2000 until January 1st, 2008. We excluded pregnancies with one or both twins weighing <500 g at birth or having lethal congenital anomalies, and pregnancies with a fetal demise before start of delivery. Cases with incomplete twin data sets (records with only one neonate registered) were also excluded. Because of these incomplete data sets, the total number of twin babies registered initially could be unequal.

In The Netherlands, twins are delivered in a hospital by an obstetrician. As far as we know, none of the participating hospitals excluded vaginal deliveries of twins in all circumstances. In the PRN, a CS may be registered as a primary CS or a secondary CS. A primary CS is a CS in women who did not try vaginal labor. A secondary CS is defined as a CS during labor in women who were planned to try a vaginal delivery. For this study, we assumed that all primary CSs were planned, and therefore we registered them in the planned CS group, whereas women who delivered (1) both children vaginally, (2) by a secondary CS of both children, or (3) by a combined delivery, were presumed to be in the planned VD group. All CSs in the planned VD group were defined as intrapartum CSs. For analysis of both the planned CS group and the planned VD group separately, we studied maternal indicators (maternal age at delivery, parity, previous CS, socio-economic status, ethnicity, maternal diabetes mellitus, pre-existing hypertension), pregnancy-related indicators (mode of conception, pre-eclampsia, drug use during pregnancy, gestational age at delivery), fetal and neonatal indicators (fetal position, sex concordance, weight concordance, small for gestational age), and hospital-related indicators (type of hospital, mean number of twin deliveries per year), as known [1,2,5–11] or expected from a pathophysiologic perspective to be associated with the planned and actual mode of delivery.

Socioeconomic status was based on the mean household income level of the neighborhood, determined by the first 4 digits of the woman's postal code. Diabetes was defined as diabetes mellitus before a gestational age of 20 weeks or gestational diabetes. Pre-existing hypertension was defined as hypertension before a gestational age of 20 weeks. Pre-eclampsia was defined as a diastolic blood pressure ≥ 90 mmHg and proteinuria (≥ 300 mg/day). Birth weight of twin B compared to twin A was divided into

subgroups of $\leq 80\%$, 80–125% and $\geq 125\%$. Small for gestational age was defined as a birth weight <10th percentile [20].

Statistical analysis

Contingency tables were created to assess frequencies and percentages of the indicators and the outcome measures. All risk indicators mentioned above were analyzed with uni- and multivariate logistic regression analyses, calculating crude and adjusted odds ratio (OR) and 95% confidence intervals (CI). For the adjusted OR we adjusted for all risk factors mentioned in the univariate analyses. The association between mortality and the planned delivery groups was calculated with chi-square test.

Reference groups were women 21–30 years old, multiparous (≥ 2), without a previous CS, with a normal socio-economic status, Caucasian, non-diabetic, and without pre-existing hypertension; no in vitro fertilization (IVF), pre-eclampsia or drug use, gestational age at delivery between 37 and 38 weeks; cephalic-cephalic position, sex concordant, weight concordant, birth weight of both children >10th percentile; women delivering in a non-teaching hospital, and women delivering in a hospital with an annual number of twin deliveries of 25–49. Analyses were performed using SAS 9.3 (SAS Institute, Cary, NC, USA) and Microsoft Excel 2011 for Mac.

Ethics approval was not required under Dutch Law, as only anonymous data were used. A privacy committee checks all researches done in collaboration with the PRN to make sure procedures are as accurate as possible, the privacy of the participants is guaranteed and the data confidentiality is respected.

Results

The database contained 56,865 records from children born from a twin pregnancy in the study period (Fig. 1). From these, 45,424 twin babies ($n = 22,712$ women with a twin pair) fulfilled the inclusion criteria. In 4,310 women with a twin pair (19.0%) a planned CS was performed, while a VD was planned for 18,402 women with a twin pair (81.0%). Of these, 14,034 women (76.3%) delivered vaginally, 3,545 women (19.3%) delivered both children by an intrapartum CS, and 823 women (4.5%) by combined delivery.

Fig. 2 shows the distribution of the actual mode of delivery after a planned VD over the years. The percentage of actual VD in this group remained relatively stable, with a range between 75.2% and 78.3%, and the percentage of combined deliveries ranged between 3.3% and 4.9%.

Table 1 shows maternal, pregnancy related, fetal, neonatal and hospital related indicators of twins according to the planned mode of delivery, including the results of the logistic regression analyses. Most prominent indicators for a delivery by planned CS according to the univariate analysis remained prominent after multivariate analysis: non-cephalic position of both twins (adjusted (a) OR 25.32; 95% confidence interval (CI) 22.50–28.50), non-cephalic position of twin A only (aOR 21.67; 95% CI 19.12–24.34), ≥ 1 previous CS (aOR 3.69; 95% CI 3.12–4.36), maternal age ≥ 41 years (aOR 3.00; 95% CI 2.14–4.22), and pre-eclampsia (aOR 2.12; 95% CI 1.83–2.46). Minor indicators associated with delivery by planned CS were maternal age 31–40 years, nulliparity, primiparity, cephalic-non cephalic position, weight twin B $\leq 80\%$ compared to twin A, birth weight twin A or twin B <10th percentile, and delivery in a university hospital. Gestational age at delivery 32 + 0–37 + 0 and 39 + 0–41 + 0 was associated with a planned VD, as was an annual number of 75–99 twin deliveries in the hospital.

Table 2 shows indicators of twins planned for a vaginal delivery, according to the actual mode of delivery, including the results of the logistic regression analyses. Most prominent indicators

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