RESEARCH ARTICLE

Factors affecting elective cesarean section in women with multiple pregnancy in Caruban, Indonesia [version 1; peer review: 1 approved with reservations]

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Abstract

Background: Caesarean sections have become the most popular method for delivering twin babies because of the safety concerns associated with a natural birth. This study aims to identify the maternal characteristics and obstetric parameters that serve as risk factors influencing caesarean delivery in twin pregnancies by comparing women delivering via caesarean section and vaginal birth.

Methods: A retrospective chart review design was used to analyse 47 women with multiple pregnancies from the medical records at a primary referral hospital in East Java, Indonesia. Women delivering vaginally were then compared with women who underwent a caesarean section to identify any differences between the groups.

Results: More women delivered by caesarean section than by vaginal birth. In this study, women were more likely to undergo a caesarean section if they had a previous history of undergoing a caesarean section or if there were no foetal malpresentations during their pregnancy. There was a significant difference in maternal age between groups. We found that foetal malpresentation did not significantly increase the likelihood of caesarean delivery in women with multiple pregnancies.

Conclusions: The percentage of multiple pregnancies delivered via caesarean section is quite high. Similar to previous studies, we identified a few factors including foetal malpresentation and labour augmentation that did not significantly increase the risk of caesarean delivery. However, we suggest that there is more than one reason responsible for the increase in caesarean sections in multiple pregnancies.

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Any reports and responses or comments on the article can be found at the end of the article.

Keywords

cesarean section, complication, multiple pregnancy, vaginal birth

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Introduction

Multiple pregnancies are currently much more common than in the past as a result of older maternal age and pregnancies resulting from assisted reproductive technologies¹. Multiple pregnancy accounts for 1% to 4% of total births, with a prevalence ranging from 0.9% to 1.4% in England and Wales and 0.9% to 2.4% in Brazil². The lowest incidence rate of multiple pregnancy is in East Asia (fewer than eight twin births in 1000)³. Multiple pregnancy is associated with higher maternal and perinatal risks than singleton pregnancy, including pre-eclampsia, hypertension, hyperemesis, postpartum haemorrhage, premature rupture of the membranes and anaemia^{2,4}. The rate of perinatal mortality is 2–3 times higher in multiple pregnancy than in singleton newborns. Multiple pregnancy can increase preterm birth, foetal growth restriction, low birth weight and intrapartum anoxia⁵.

A case complicated by multiple pregnancy has the same delivery options as a singleton pregnancy: caesarean or vaginal delivery. This choice depends on multiple factors and remains controversial in numerous studies. Many important factors are involved when determining the delivery method, including women's parity, foetal weight, foetal presentation, gestational weight and maternal clinical conditions⁶. Some studies have explained that if both foetuses are in a cephalic presentation, the vaginal mode is preferred⁷. Vaginal delivery is possible if the foetus weighs more than 1500 grams. Caesarean delivery is the best choice when the first foetus is non-cephalic. Another large retrospective population study found that compared with caesarean delivery, increased neonatal morbidity and mortality were observed for the second twin when vaginal delivery was performed. That study also indicated that elective caesarean delivery is safer than vaginal delivery and results in the best maternal and perinatal outcomes⁸. However, although evidence for the preference of an elective caesarean section for multiple pregnancy is lacking, the rates of elective caesarean section for multiple pregnancy have increased throughout the world⁹. The main objective of this study was to evaluate and provide reliable information on the contributing risk factors such as maternal characteristics, obstetric histories and recorded pregnancy complications that influenced the decision to undertake a caesarean section or vaginal birth in multiple pregnancy cases.

Methods

Study settings

This retrospective chart review investigated secondary data that were obtained from written medical records at Caruban General Hospital in Caruban, East Java, which has become one of the main primary referral hospitals that receives many high-risk pregnancy cases from the primary health centres and antenatal clinics in the region of Madiun.

Study design and population

This analysis used a purposive sampling method from the records of pregnant women with multiple pregnancies in the hospital's data registry from 1 December 2014, to 15 December 2019. We identified 95 medical records of pregnant women based on several criteria. We obtained the data of women who had

experienced multiple pregnancy and undergone elective caesarean section or vaginal delivery in the Caruban and Madiun regions of East Java, Indonesia. The inclusion criteria were as follows: women older than 18 years without mental disorders and who were medically stable (oxygen level > 93%, heart rate 60–100 bpm, blood pressure less than 80/60 mmHg). The exclusion criteria were as follows: emergency caesarean section, medically unstable (oxygen level < 93%, heart rate below 60 or above 100 bpm, women with altered mental status), death of the newborn and death of the mother. However, there were no cases of neonatal or maternal death or injury. Medical records with incomplete and unclear information on maternal characteristics were not included. The final sample consisted of 47 women.

Data collection and analysis

Using a data extraction form (see extended data¹⁰), information on maternal characteristics including age, educational background and occupational status and information on obstetric histories such as previous history of caesarean section and parity status, were obtained. We decided to categorise educational background into graduates and unqualified degree. Occupational status was subcategorised into unemployed, civil servant, private employee and entrepreneur. Parity status was classified into nulliparous, primiparous and multiparous. Data on perinatal events including foetal malpresentation, labour augmentation, prenatal haemoglobin levels and gestational hypertension were also recorded (see underlying data for the full dataset¹¹).

The analyses were performed using the **Statistical Package for the Social Sciences** (SPSS) version 16 for Windows. Quantitative data are presented as odds ratios (ORs) with confidence intervals (CIs) and means with the standard deviation. Chi-square tests were used to compare the caesarean and vaginal birth groups, and normal probability plots were generated to evaluate the data distribution. We then used an ANOVA for the normally-distributed data and the Kruskal–Wallis test for the non-normally-distributed data. A P-value of <0.05 was considered significant.

Ethics

This analysis was approved by the ethics committee of Caruban General Hospital (No. 800/ 4532/ 402.102.110/ 2020). The requirement to obtain informed consent was waived by the ethics committee of Caruban General Hospital before the study was conducted. The study was conducted according to the relevant guidelines. The patient data records were coded and anonymised. The information recorded is confidential and was used only for the study purpose.

Results

As shown in **Table 1**¹¹, among the 47 mothers who met our inclusion criteria, more than half were between 21 and 35 years old, and most had a low educational status and worked as private employees. Additionally, 12 women underwent a vaginal delivery whereas the other 35 women birthed their babies abdominally. Thus, more women underwent a caesarean section

Table 1. Demographic and obstetrical data.

Variables	Method of delivery		OR (95%CI)	P-Value
	Section Cesarean	Vaginal Birth		
	35	12		
Parity Status, n (%)				
Nulliparous	6 (17.1%)	5 (41.7%)	0.29 (0.06,1.22)	0.11
Primiparous	21 (60.0%)	6 (50.0%)	1.50 (0.40,5.60)	0.73
Multiparous	8 (22.9%)	1 (8.3%)	3.25 (0.63, 29.23)	0.41
Age, median (min, max)	30 (20, 39)	20 (19, 37)		0.00
Educational Status, n (%)				
Unqualified degree	9 (25.7 %)	5 (41.7%)	1	0.46
Graduates	26 (74.3%)	7 (58.3%)	0.48 (0.12,1.91)	
Occupation, n (%)				
Unemployed	11 (31.4%)	3 (25.0%)	1.37 (0.31,6.09)	1.00
Civil Servant	9 (25.7%)	4 (33.3%)	0.69 (0.16,2.86)	0.71
Private employee	10 (28.6%)	4 (33.3%)	1.25 (0.30, 5.10)	0.73
Entrepreneur	5 (14.3%)	1 (8.4%)	0.54 (0.05, 5.20)	1.00
Previous History of Section, n (%)				
Yes	21 (60.0%)	1 (8.3%)	16.5 (1.91,142.49)	0.02
No	14 (40.0%)	11 (91.7%)	1	
Fetal presentation, n (%)				
Normal	15 (42.9 %)	1 (66.7 %)	8.25 (0.95, 71.09)	0.03
Malpresentation	20 (57.1%)	11 (42.9 %)	1	
Augmentation of Labor, n (%)				
Yes	10 (28.6%)	8 (66.7%)	0.20 (0.49, 0.81)	0.03
No	25 (71.4%)	4 (33.3%)	1	
Premature Rupture of the Membrane, n (%)				
Yes	6 (100 %)	0 (0.0 %)	0.82 (0.71, 0.96)	0.31
No	29 (70.7%)	12 (29.3%)	1	
Gestational Hypertensive Disorders, n (%)				
Yes	11 (31.4%)	1 (8.3%)	5.04 (0.57, 44.06)	0.14
No	24 (68.6%)	11 (91.7%)	1	
Prenatal Hemoglobin Levels, mg/dl (Mean ± SD)	11.18 ± 1.69	10.80 ± 1.11		0.48
Gestational Anemia, n (%)	9 (25.7%)	2 (16.7%)	1.73 (0.31, 9.44)	0.70
Non-anemia, n (%)	26 (74.3%)	10 (83.3%)	1	
Delivery at Gestational Age, weeks, Median (min, max)	37 (34, 37)	37 (31, 38)		0.55
< 37 weeks, n (%)	14 (40.0%)	5 (41.7%)	1	1.00
37–42 weeks, n (%)	21 (60.0%)	7 (58.3 %)	0.93 (0.24, 3.53)	

than gave birth vaginally. **Figure 1** indicates that the main indication for a caesarean section in this study was a caesarean scar, followed by malpresentation and foetal distress. Perinatal complications were principally dominated by malposition of the foetuses, which were not in the vertex position. During the labour process, 18 of the 47 women suffered prolonged labour. Six women came to the hospital with a history of premature membrane rupture without uterine contractions. Gestational hypertension was also reported in 12 women and 11 women had Hb levels below 10 g/dL in their last recorded Hb examinations in late pregnancy.

Based on the analysis, the average age at delivery differed significantly between women who underwent caesarean and vaginal delivery ($p = 0.00$). Other maternal characteristics including primiparous as the most common parity status ($p = 0.73$), educational status ($p = 0.46$) and being unemployed ($p = 1.00$) did not differ significantly between the two groups of women stratified by delivery method.

Additionally, we evaluated the obstetric history of the included mothers. In total, 21 women had a history of previous caesarean section, which was found to significantly increase the likelihood of undergoing another caesarean section (OR = 16.5, 95% CI = 1.91 to 142.29, $p = 0.02$). Women who suffered prolonged labour during their delivery were significantly less likely to undergo a caesarean delivery (OR = 0.20, 95% CI = 0.49 to 0.81, $p = 0.03$). Women who did not experience malpresentation of their foetuses during pregnancy were more likely to undergo a caesarean delivery (OR = 8.25, 95% CI = 0.95, 71.09, $p = 0.03$). However, in this study, premature rupture of the membrane, gestational hypertension and gestational anaemia did not significantly contribute to an increased likelihood of a caesarean section. Pregnancy term did not differ significantly between the women undergoing caesarean section and vaginal

birth. Neonatal outcomes including 1-minute APGAR (appearance, pulse, grimace, activity, and respiration) scores and babies' birth weights did not differ significantly for both the first and second babies between both groups of delivery methods (**Table 2¹¹**). When comparing caesarean section and vaginal delivery, both first babies ($p = 0.82$) and second babies ($p = 0.38$) had APGAR scores ≥ 7 (**Table 2¹¹**). The first babies delivered after caesarean section vs vaginal birth did not differ significantly (2114 grams $\pm$ 469.37 vs 1938.33 grams $\pm$ 562.36, $p = 0.29$) (**Table 2¹¹**). Similarly, the second babies following caesarean section vs vaginal birth also did not differ significantly (2038 $\pm$ 478.75 vs 1878.33 $\pm$ 417.45, $p = 0.31$) (**Table 2¹¹**).

Discussion

Based on the study results, a planned caesarean section appears preferable to a vaginal birth for women with multiple pregnancies when the mothers have a history of previous caesarean section and in cases of malpresentation of the foetus. The neonatal birth weight and 1-minute APGAR scores of the twin babies born by both methods of delivery in this study were similar. Adverse perinatal outcomes including perinatal mortality and transient tachypnea of the newborn, were not significantly different between groups. However, the second twin had a higher risk of suffer perinatal outcomes than the first following vaginal delivery¹². Combined vaginal/caesarean delivery is another option. However, it may be complicated by a longer interval of prolonged rupture of membranes, leading to endometritis and sepsis in the second twin.¹³ A large nationwide study of multiple pregnancy cases identified a greater risk of uterine rupture in women who delivered their babies via natural birth¹⁴. However, previous studies reported that there was no difference in the perinatal outcomes between caesarean section and vaginal birth in multiple pregnancy^{15,16}. Conversely, maternal aspects are an important consideration when choosing the delivery mode in women with a twin pregnancy. However, some

Figure 1. Cesarean section indications.

Table 2. Comparison of neonatal parameters between women undergoing cesarean section and vaginal birth.

Parameters	Method of delivery		p-value
	Cesarean Section 35	Vaginal Birth 12	
Neonatal characteristics			
Gender			
First Baby, n (%)			
Male	14 (40)	8 (66.7)	0.18
Female	21 (60)	4 (33.3)	
Second Baby			
Male	15 (42.9)	7 (58.3)	0.55
Female	20 (57.1)	5 (41.7)	
1-minute APGAR score, median (min, max)			
First Baby	8 (6, 8)	7 (7, 8)	0.82
Second Baby	7 (5, 8)	7 (7,8)	0.38
Birth Weight, (Mean ± SD) gram			
First Baby	2114 ± 469.37	1938.33 ± 562.36	0.29
Second Baby	2038 ± 478.75	1878.33 ± 417.45	0.31

APGAR: appearance, pulse, grimace, activity, and respiration

studies have reported that the use of forceps or vacuum extractions in vaginal birth could contribute to birth lacerations that may lead to gynaecologic morbidities^{17–20}.

In this comparison study between planned caesarean section and vaginal delivery, we found that there was a significant difference in the maternal age between the two groups. This finding was supported by a previous study that showed a significantly increased trend of caesarean delivery with increased maternal age²¹. However, a study from Korea found there was no significant difference caesarean section rates in women with multiple pregnancies according to maternal age²². The other difference we identified was that women undergoing caesarean section were more likely to have undergone a previous caesarean section. A similar study comparing women having caesarean sections and vaginal births reported that caesarean section was significantly more likely to occur in women with previous caesarean histories²³. Another report revealed that caesarean sections must not be considered mandatory for multiple pregnancies²⁴. However, a study from Myles (2009) demonstrated that caesarean sections had a higher success rate and a lower probability of developing uterine rupture than vaginal delivery²⁵.

This study found that women who underwent labour augmentation by using misoprostol or oxytocin did not have a higher

probability of caesarean section. Supporting our finding, a study by Arulkumaran showed that approximately 78% of women with a caesarean scar who were administered labour augmentation had safe vaginal births whereas the other women who had undergone second caesarean sections were suffering from cephalo-pelvic disproportion²⁶. Furthermore, a prospective cohort study on 153 women with caesarean scars in Saudi Arabia suggested that labour induction to promote vaginal delivery did not contribute to the increased likelihood of a second elective caesarean section or adverse effects on neonatal outcomes²⁷. By contrast, a study in Sweden reported the increased likelihood of caesarean delivery after performing labour induction using oxytocin and cervical ripening in women with multiple pregnancy²⁸. Another study also explained that labour induction or augmentation was safe for women to promote successful vaginal delivery in multiple pregnancy cases²⁹.

In our study, we found that non-cephalic presentations did not significantly increase the likelihood of undergoing a caesarean section. Our results supported previous studies that reported relatively similar outcomes for women with non-cephalic presentations who delivered their babies abdominally and vaginally^{30,31}. Furthermore, a caesarean section in multiple pregnancies with non-cephalic presentations is likely to occur following external cephalic attempts¹¹. A report from France

suggested that the type of presentation must not be considered the main consideration for caesarean section in multiple pregnancies¹⁰.

Our findings demonstrate that women with multiple pregnancies had a higher tendency to deliver their babies abdominally via caesarean section. Maternal age and previous history of a caesarean section should be considered when determining whether to perform a caesarean delivery in women with multiple pregnancies. However, the supporting findings are still limited. This study also noted that malpresentation and labour augmentation do not increase the likelihood of a caesarean section compared with vaginal delivery. However, this finding was rather weak due to the small size of the study population, and thus choosing between a caesarean section and vaginal delivery must be made after considering the patient's preference and the risks and benefits.

Data availability

Underlying data

Figshare: Underlying Data - Factors Affecting Elective Cesarean Section in Women with Multiple Pregnancy at a Primary Referral

Hospital in Indonesia. <https://doi.org/10.6084/m9.figshare.13166735.v1>¹¹

This project contains the following the underlying data:

- Cesarean Section VS Vaginal Birth (Maternal Factors).sav
- Cesarean Section VS Vaginal Birth (Neonatal Factors).sav

Extended data

Figshare: Data Extraction Form - Factors Affecting Elective Cesarean Section in Women with Multiple Pregnancy at a Primary Referral Hospital in Indonesia. <https://doi.org/10.6084/m9.figshare.13238534.v1>¹⁰

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](#) (CC-BY 4.0).

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Open Peer Review

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General comment:

This is a retrospective study which has the intention to identify the contributing risk factors for the decision of performing caesarean section in twin pregnancies. It is very difficult to get a reliable insight from this retrospective study about the contributing risk factors for caesarian section in multiple pregnancy. There are many reasons of the obstetricians for choosing caesarean section, which are not always necessary correlated with some real risk factors for the mother or the foetus. Possibly that some of these reasons are subjectively determined. Therefore it is not surprising to find that fetal malpresentation is not more common in the caesarean section group as compared to the group of vaginal delivery. Nevertheless, the result of this retrospective study can be used as a mirror for the obstetricians in order to think about the clear objective indications for performing of caesarean section in twin pregnancy. The authors should make an obstetrical recommendation for a reliable protocol of caesarean section indication in twin pregnancy.

Specific comments:

Abstract:

- No comment.

Introduction:

- Line 6 from the second paragraph: what is meant by gestational weight? Is this maternal weight or estimated fetal weight? The authors must clarify this.

Methods:

- No comment.

Results:

- Table 1 - This part of the table is incorrect: Under vaginal birth is 1 of 12 never 66.7% and 11 of 12 is never 42.9%. The total percentage is more than 100%. Probably the OR and p-value has to be recalculated again.
- Also in the text under the 3rd paragraph, the OR and p-value has to be checked also. I am wondering why fetal malpresentation didn't result in more cesarean section. Especially when some fetal malpresentation will result in difficult either impossible vaginal delivery.

Discussion:

- In the first line the authors make the following statement: "Based on the study results, a planned caesarean section appears preferable to vaginal birth for women with multiple pregnancies when the mothers have a history of previous caesarean section and in cases of malpresentation of the fetus". But this seems in contradiction with their results that women who did not experience malpresentation of their fetuses during pregnancy were more likely to undergo a caesarean delivery. The authors should clarify this contradiction.
- In the first paragraph the authors write: "However the second twin had a higher risk of suffer perinatal outcomes than the first following vaginal delivery". But this statement is not supported by the data of their results.
- In this chapter a discussion about the limitation of this study is missed. The authors should make a reflection about the limitations of their study. See also general comment.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Neonatology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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