

# Impact of Delivery Mode on Neonatal Serum Bilirubin Levels and Jaundice Risk at Melati Husada Women and Children Hospital in Malang

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ARTICLE INFO	ABSTRACT
<b>ORCHID ID</b> Author 1: 0000-0002-9837-4160 Author 2: 0000-0002-6050-0467	It is anticipated that between 60 and 80 percent of healthy, full-term newborns would exhibit idiopathic neonatal jaundice. Mode of delivery has recently been associated with idiopathic neonatal jaundice. As seen at Melati Husada Women and Children Hospital in Malang, the increasing number of caesarean section was followed by increased frequency of neonatal hyperbilirubinemia. This hyperbilirubinemia should be resolved within two weeks, therefore, prolonged jaundice should be deeply investigated. This research aimed to investigate the relationship between mode of delivery and neonatal serum bilirubin at 48 hours after birth at Melati Husada Women and Children Hospital in Malang. During observational cross-sectional study from August 2016 to February 2017, 167 newborns were enrolled and classified into two groups based on the delivery method (caesarean section and vaginal delivery). The 48 hours total bilirubin levels were measured and compared. The data was analyzed using Independent T-Test. Subjects (n is 167) from this study were 51.5 percent male and 48.5% female. About 64.1 percent subjects were delivered by caesarean section and 35.9 percent by vaginal delivery. While 4.8% subjects had total bilirubin more than 15mg/dL, 68.3 percent had total bilirubin 10-15 mg/dL, and 26.9 percent had total bilirubin less than 10mg/dL. The cesarean section group showed a significant increase in total bilirubin. The group who had a caesarean section had a higher mean value (11.509) than the group that had a vaginal delivery (9.846). The two groups' mean differences are statistically significant (p is 0.000). Caesarean section corelated with an elevated risk of infant jaundice, potentially generated by maternal anesthetic, particularly bupivacaine.
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## 1. Introduction

About 60–80% of healthy, full-term infants experience neonatal jaundice, a common physiological condition marked by high serum bilirubin levels (Yang et al., 2013). While typically transient and benign, severe hyperbilirubinemia can lead to potentially serious neurological complications if left untreated (Bilgin et al., 2013). Recent studies have explored various risk factors associated with neonatal jaundice, including maternal and neonatal characteristics, and increasingly, the mode of delivery. Infants born by caesarean section showed a higher risk of hyperbilirubinemia when compared to infants born through normal

delivery. This is associated with impaired physiological processes related to metabolism and bilirubin clearance, resulting in higher levels of bilirubin in newborns. Caesarean section might cause delayed gut transit time and decrease gut motility, which increase bilirubin enterohepatic circulation. Conjugated bilirubin will be excreted into gastrointestinal tract and deconjugated by beta-glucuronidase enzyme, reabsorbed into the systemic circulation, thereby increasing total serum bilirubin levels (Gupta et al., 2016). Therefore, it is hypothesized that the method of delivery will affect the levels of bilirubin in newborns.

Newborns can physiologically experience jaundice, but it will improve on its own within two weeks after birth. If jaundice appears in a severe degree at an early age after birth or does not improve within two weeks, it needs to be identified as pathological jaundice (Bhutani et al., 2017). Melati Husada Women and Children Hospital is a secondary health service that specifically handles mothers and children, with a high volume of deliveries and thorough neonatal service coverage, thus providing a representative research population for the study of neonatal jaundice. Various risk factors such as prematurity, blood type incompatibility, and exclusive breastfeeding have been known to play a role in increasing the incidence of neonatal jaundice. However, another perinatal aspect that has not been explored in depth is the influence of the mode of delivery on the incidence of hyperbilirubinemia. The correlation between the method of delivery and neonatal blood bilirubin concentration is interesting to analyze in newborns with clinical jaundice. Therefore, the purpose of this study was to determine how the method of delivery affects the risk of jaundice and blood bilirubin levels in infants at the Melati Husada Women and Children Hospital in Malang.

## 2. Method

This study was a cross-sectional study, conducted at Melati Husada Women and Children Hospital in Malang, East Java, Indonesia between August 2016 and February 2017. The sample for this study was taken from neonatal ward, recruited all newborns delivered at Melati Husada Women and Children Hospital during the study period. Selected newborns were enrolled in the study based on the following inclusion criteria: singleton live births, gestational age  $\geq 37$  weeks, and availability of 48-hour total serum bilirubin (TSB) measurements. Exclusion criteria included newborns with congenital anomalies, hemolytic diseases, and those transferred to other hospitals before the 48-hour TSB measurement. Consecutive sampling was performed in this research.

Data on mode of delivery (vaginal delivery or caesarean section) and 48-hour TSB levels were retrieved from the hospital's medical records. Based on their delivery method, newborns were divided into two groups: those who were delivered vaginally and those who were delivered via caesarean section. Total serum bilirubin (TSB) levels were measured at 48 hours after birth. When the molecule breaks down the tetrapyrrole into two azodipyrroles by a reaction with diazo reagents, serum bilirubin is detected using spectrophotometry. The test results were interpreted according to Bhutani nomogram curve

The medical ethical committee of the Faculty of Medicine, Universitas Brawijaya, Malang, approved the study protocol (No. 187/EC/KEPK/04/2016). As this was a retrospective study utilizing existing medical records, informed consent was not obtained. However, patient confidentiality was strictly maintained throughout the study. All data was anonymized prior to analysis. The Helsinki Declaration and Good Clinical Practice guidelines were followed in the conduct of this study. IBM SPSS Statistics was used to examine the data.

The study population's characteristics and TSB levels were summed up using descriptive statistics, such as mean and standard deviation. The normality of data distribution was assessed using the Shapiro-Wilk test. An independent t-test was used to compare the mean 48-hour TSB levels between the vaginal delivery and caesarean section groups. A p-value of < 0.05 was considered statistically significant.

### 3. Result and Discussion

A total of 167 newborns were included in the study. The gender distribution was nearly equal, with 51.5% (n=86) males and 48.5% (n=81) females. The majority of deliveries were performed via caesarean section, accounting for 64.1% (n=107) of the total, while 35.9% (n=60) were vaginal deliveries. The distribution of total serum bilirubin (TSB) levels at 48 hours post-delivery revealed that 4.8% (n=8) of newborns had TSB levels exceeding 15 mg/dL, indicating significant hyperbilirubinemia. A large proportion, 68.3% (n=114), had TSB levels between 10 and 15 mg/dL, while 26.9% (n=45) had TSB levels below 10 mg/dL. In comparison to the vaginal delivery group ( $9.846 \pm 0.543$  mg/dL), the caesarean section group had a considerably higher mean TSB level ( $11.509 \pm 0.612$  mg/dL) (Table 1).

**Table 1. Characteristics of Patients**

Category	Subcategorical	n	(%)
Sex	Male	86	51,5
	Female	81	48,5
Mode of Delivery	Caesarean Section	107	64,1
	Vaginal Delivery	60	35,9
Total Serum Bilirubin	>15 mg/dL	8	4,8
	10-15 mg/dL	114	68,3
	<10 mg/dL	45	26,9

Source: Primary Data, 2017

A statistically significant difference between the two groups was found using an independent t-test ( $p=0.000$ ). These results indicate a correlation between higher total serum bilirubin levels and caesarean section delivery (Table 2).

**Table 2. Relationship Between Mode of Delivery and Total Serum Bilirubin**

Mode of delivery	Mean TSB (mg/dL)	SD	p-value
Caesarean Section	11,509	0,612	0.000
Vaginal Delivery	9,846	0,543	-

Source: Primary Data, 2017

Physiologically, newborns can experience jaundice at the early age, which is characterized by increased total serum bilirubin levels. Although most cases are physiological and transient, severe hyperbilirubinemia can cause serious neurological complications, including kernicterus. The mode of delivery, both normal delivery and caesarean section, is thought to affect the levels of bilirubin in newborns. Several studies have explored the relationship between caesarean section and an increased risk of neonatal hyperbilirubinemia, in relation to delayed intestinal transit and decreased intestinal motility, which potentially increases enterohepatic circulation of bilirubin

(Smith et al., 2018). Results from this study showed an elevation of total serum bilirubin levels in infants born by caesarean section. They were statistically higher when compared to infants born by normal vaginal delivery. Moreover, an increase in the number of caesarean sections was also associated with an increase in the frequency of hyperbilirubinemia cases (Nakeeb et al., 2006).

In normal vaginal delivery, exposure to physiological stress during labor will stimulate catecholamines release and activate neuroendocrine system. It will accelerate the maturation of organ systems, include hepatobiliary function (Williams et al., 2012). On the other hand, infants born through elective caesarean section before onset of labor tend to undergo delayed maturation of liver function and gut motility, which increase the enterohepatic circulation of bilirubin. Decreased gut motility will make bilirubin transit in the intestinal lumen becomes slower. Therefore, enzyme  $\beta$ -glucuronidase can convert conjugated bilirubin to the fat-soluble unconjugated form, which reabsorbed into the systemic circulation, increasing the enterohepatic circulation of bilirubin (Panjaitan et al., 2025; Smith et al., 2018).

In addition, maternal anesthesia during caesarean section can potentially affect changes in infants' liver function and bilirubin metabolism. Bupivacaine, a regional anesthetic commonly used during caesarean section, has cumulative effect on conjugation and clearance of bilirubin in infants (Jones & Brown, 2020). However, the specific mechanism and clinical significance of the effects are still debatable. On the other hand, there is study that stated no significant relationship between delivery mode and bilirubin levels, highlighting the complexity of multiple factors that affect the incidence of neonatal jaundice (Lee et al., 2019; Singh et al., 2023). The combined effects of decreased intestinal motility, increased  $\beta$ -glucuronidase activity, and impaired hepatic metabolism due to anesthesia are the main biological factors explaining the significant increase in serum bilirubin levels in neonates born by caesarean section in this study.

Based on this study, there were 4.8% of newborns with total serum bilirubin levels >15 mg/dL and 68.3% of infants had levels between 10-15 mg/dL. Physiological jaundice in newborns will be expected to resolved within two weeks. Besides, prolonged hyperbilirubinemia will require further investigation to confirm the underlying cause and prevent severe complications (Maisels & McDonagh, 1996). This study had some limitations. There was difficulty in drawing causality between delivery mode and total serum bilirubin levels, given that the study design used was cross-sectional (Ansong-Assoku et al., 2024).

Furthermore, other confounding factors have not been elaborated, such as the use of other specific types of anesthesia medication, maternal comorbidities, or genetic predisposition. Further studies are needed with larger sample sizes and more detailed characteristics of other variables needed. Comprehensive understanding of the factors contributing to neonatal hyperbilirubinemia should be elaborated. This study did not elaborate the specific period of early breastfeeding initiation or breastfeeding exclusivity, which are important in reducing bilirubin levels through stimulation of gut peristalsis and meconium excretion. Maternal comorbidities such as gestational hypertension, gestational diabetes mellitus, anemia, or medication use during pregnancy can also affect the maturation of the fetal liver system, erythrocyte production, and hemolysis rate, all of which are closely related to the risk of neonatal hyperbilirubinemia (Bilgin et al., 2013). Polymorphisms in the UGT1A1 gene and G6PD deficiency will also play an important role in bilirubin metabolism (Li et al., 2025).

The clinical value of this study are important, especially in developing countries such Indonesia with high rates of caesarean delivery. Therefore, bilirubin levels examination in newborns delivered by caesarean section is very important, for hyperbilirubinemia screening

purpose (Jafari et al., 2014; Kaplan & Wong, 2020). Further research should conduct on identifying specific risk factors to reduce the impact of caesarean section on neonatal bilirubin levels.

#### 4. Conclusion

In conclusion, caesarean section is associated with a significant increase in 48-hour total serum bilirubin levels in newborns at Melati Husada Women and Children Hospital, Malang. The use of maternal anesthesia, especially bupivacaine, need to be further elaborated in relation to the hyperbilirubinemia effect. This study also emphasizes the importance of regular serum bilirubin examinations on all infants which born by caesarean section.

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