



THE RELATIONSHIP BETWEEN MATERNAL CHARACTERISTICS AND INTRAOPERATIVE HYPOTENSION DURING CESAREAN SECTION USING SPINAL ANESTHESIA

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ABSTRACT

Background: The incidence of hypotension as a complication of spinal anesthesia in mothers who gave birth by cesarean section can occur due to various factors such as height, age, weight. The incidence rate in Indonesia in 2017 was 983 cases. In the preliminary study, there were 352 deliveries, of which 108 were delivered by cesarean section using spinal anesthesia techniques.

Objective: to determine the relationship between maternal characteristics and the incidence of intraoperative hypotension for sectio caesarea using spinal anesthesia at Hospital "A".

Research Methods: this study used cross-sectional. The research population of sectio caesarea patients with spinal technique was collected with a total sampling of 46 respondents. The research instrument used medical records. Analysis of the data used in the form of chi-square test at a significance of 5%.

Results: The results of the bivariate test showed that there was no relationship between early adulthood (20-29 years) (OR= 0.38; (95% CI= 0.10 to 1.44; p= 0.259); multipara parity (OR= 0.44; (95% CI) = 0.11 to 1.67; p = 0.365) and obesity BMI (OR = 1.59; (95% CI = 0.48 to 5.35; p = 0.650) on the incidence of hypotension in caesarean section

Conclusion: There is no relationship between early adulthood (20-29 years), parity and obesity BMI are risk factors for hypotension in cesarean section.

Keywords: *maternal characteristics, hypotension, sectio caesarea, spinal anesthesia*

INTRODUCTION

Childbirth is the finalization of the pregnancy process. There are two pathways for delivery: vaginal delivery or normal delivery; however, when vaginal delivery is unsuccessful or poses a high risk to the mother and baby, a cesarean section (sectio caesarea) is required^[1]. The method of sectio caesarea involves delivering the fetus by making an incision in the uterine wall through the anterior abdominal wall or vagina^[2]. During the incision, especially in sectio caesarea, an anesthetic agent is required to eliminate pain without losing consciousness, which is achieved through spinal anesthesia^[3].

According to data from the World Health Organization (WHO) in 2017, the incidence of sectio caesarea worldwide reached 10% to 15% of all deliveries. In developing countries like Canada, the rate of sectio caesarea is 21% of total deliveries, whereas in developed countries, the rate has increased from 5% to 15%^[4]. Based on the National Health Department of Indonesia, in 2016, there were 609 cases of sectio caesarea (21.20%), in 2017 there were 983 cases (34.22%), and in 2018 there were 1281 cases (44.59%). From 401 government and local hospitals in Indonesia, there were a total of 642,632 cases of sectio caesarea^[5]. The Basic Health Research (Riskesdas) in 2018 indicated that the prevalence of sectio caesarea during delivery was 17.6%, with the highest rate in DKI Jakarta (31.3%) and the lowest in Papua (6.7%).

During the incision, an anesthetic agent is required to eliminate pain without losing consciousness, which is achieved through spinal anesthesia^[3]. The American Society of Anesthesiologists (ASA) (2015) reported that out of 102 mothers who delivered full-term without complications via sectio caesarea using spinal anesthesia, 53% experienced complications in the form of hypotension^[6]. The incidence of hypotension due to spinal anesthesia also

occurs in several hospitals in Indonesia. This is supported by a study conducted by Latupeirissa and Angkejaya (2020), where 26% of 1,800 patients who underwent spinal anesthesia experienced complications, with 16% experiencing hypotension^[7]. Additionally, in RSUPN dr. Cipto Mangunkusumo, a study of 293 mothers who delivered via sectio caesarea using spinal anesthesia found an incidence of hypotension at 54.21%^[8].

Hypotension as a complication of spinal anesthesia in mothers delivering via sectio caesarea can occur due to various factors such as height, age, and body weight^[9]. This is supported by a study by Tanambel et al. (2017)^[10] involving 15 mothers who delivered via sectio caesarea using spinal anesthesia at RSUP Prof. Dr. R. D. Kandou Manado, which showed a significant relationship between age and the occurrence of hypotension, with one patient (6.66%) in the <20 age group, 11 patients (73.33%) in the 20-35 age group, and three patients (20%) in the >35 age group. Hypotension occurs because spinal anesthesia can block the sympathetic nerves that regulate vascular smooth muscle tone. Negative Impacts of Hypotension on Mothers

Hypotension during Caesarean section poses several serious risks to the mother, which are:

Cardiovascular Complications: Severe hypotension can result in reduced blood flow to vital organs, including the brain and heart. This may lead to decreased consciousness, cardiac dysfunction, or in extreme cases, even cardiac arrest.

Uteroplacental Hypoperfusion: Hypotension may reduce blood flow to the placenta, which can increase the risk of fetal hypoxia or intrauterine growth restriction. If not managed properly, fetal hypoxia can result in perinatal morbidity or mortality.

Increased Risk of Postpartum Hemorrhage: Hypotension can impair the body's ability to maintain proper

hemostasis, increasing the likelihood of postpartum hemorrhage. In severe cases, this can lead to emergency interventions such as a hysterectomy or other critical procedures.

Prolonged Recovery: Prolonged hypotension during or after surgery may delay the mother's recovery and heighten the risk of postoperative complications, including infection or thrombosis.

Neurological Effects: Prolonged hypotension can cause cerebral insufficiency, potentially leading to symptoms such as dizziness, nausea, and in severe cases, loss of consciousness^[7].

This study aims to analyze the relationship between intraoperative hypotension and maternal characteristics, including age, parity, and body mass index (BMI) in cesarean operations using spinal anesthesia at Hospital "A."

METHODS

Research Design

Research methods This study employs a quantitative approach with a descriptive correlational and retrospective design, focusing on patients who underwent surgery from July 2021 to February 2022 at Hospital "A" using non-probability sampling techniques. The inclusion criteria for the subjects were patients who underwent cesarean section with characteristics including meeting ASA 1 to ASA 2 criteria and receiving spinal anesthesia. The exclusion criteria included patients with comorbidities such as hypertension and preeclampsia, as well as incomplete medical records. The researchers ensured the confidentiality of the subjects and obtained ethical approval for the research from ITS PKU Muhammadiyah Surakarta with the number: 075/LPPM/ITS.PKU/III/2022.

Variables

Data collection was conducted through medical records from March 1 to April 30, 2022, resulting in 46 subjects meeting the criteria. The independent variables in this study were age, parity,

and body mass index (BMI), while the dependent variable was hypotension.

1. Age

Measured based on data from the Identity Card (KTP). Age was categorized into middle adulthood: >30 years and early adulthood: 20-29 years^[1].

2. Parity

Defined as the number of births a mother has undergone based on the Healthy Journey Card (KMS). Parity was categorized into multipara and primipara^[2].

3. Body Mass Index (BMI)

Represents the nutritional status of pregnant women measured through weight and height. BMI was categorized as obesity (BMI ≥ 25) and normal (BMI < 25)^[3].

4. Hypotension

Defined as a systolic blood pressure measurement below 100 mmHg taken immediately after spinal anesthesia was completed. Subjects were categorized as hypotensive if systolic < 100 mmHg and not hypotensive if systolic ≥ 100 mmHg^[4].

RESULT

A. Respondent Characteristics

The majority of respondents were aged >30 years, totaling 29 individuals (63.0%), with an education level of bachelor's degree (S1) held by 27 individuals (58.7%), and employed as private sector workers, totaling 21 individuals (45.7%). Most respondents opted for elective cesarean section, with 35 individuals (76.1%). A significant portion of respondents had obesity, comprising 25 individuals (54.3%), with parity categorized as primipara in 30 individuals (65.2%), and 29 individuals (63.0%) did not experience hypotension during cesarean section. The

characteristics of the respondents in this study are summarized in Table 1 below:

Table 1. Respondent Characteristics

| Characteristics | F (n) | % |
|--------------------|-------|------|
| Age | | |
| >30 Years | 17 | 37.0 |
| 20-29 Years | 29 | 63.0 |
| Level of education | | |
| High School | 8 | 17.4 |
| Diploma | 10 | 21.7 |
| Bachelor | 27 | 58.7 |
| Master | 1 | 2.2 |
| Job status | | |
| Self-employed | 2 | 4.3 |
| civil servant | 4 | 8.7 |
| Housewife | 19 | 41.3 |
| Private | 21 | 45.7 |
| Parity | | |
| Multipara | 16 | 34.8 |
| Primipara | 30 | 65.2 |
| IMT | | |
| Obesity | 21 | 45.7 |
| Normal | 25 | 54.3 |
| SC | | |
| Cito | 11 | 23.9 |
| Elective | 35 | 76.1 |
| Hypotension | | |
| Yes | 17 | 37.0 |
| No | 29 | 63.0 |

B. Univariate Analysis

Univariate analysis is used to provide an overview of each variable being studied, as it generates frequency distributions and percentages for each variable. The majority of respondents were aged 20-29 years (63.0%), with parity classified as primipara (65.2%), did not have obesity (54.3%), and did not experience hypotension during cesarean section (Table 2).

Table 2. Frequency Distribution of Respondents Based on Age, Parity, BMI, and Hypotension

| Variable | F (n) | (%) |
|-------------|-------|------|
| Age | | |
| ≥30 Years | 17 | 37.0 |
| 20-29 Years | 29 | 63.0 |
| Parity | | |
| Multipara | 16 | 34.8 |
| Primipara | 30 | 65.2 |
| IMT | | |
| Obesity | 21 | 45.7 |
| Normal | 25 | 54.3 |
| Hypotension | | |
| Yes | 17 | 37.0 |
| No | 29 | 63.0 |

C. Bivariate Analysis

Bivariate analysis utilizes cross-tabulation to examine the relationship between independent and dependent variables based on the distribution of the cells. The statistical test used to evaluate the hypothesis is the chi-square test, as the conditions for the chi-square test are met with no expected counts <5% in any cell. The confidence interval (CI) used is 95% with a significance level of $p < 0.05$ to determine relationships, and the odds ratio (OR) is used to assess risk factors.

The results of the bivariate analysis in Table 2 indicate that there is no relationship between age and the occurrence of hypotension during cesarean section, and this result is not statistically significant (OR= 0.38; 95% CI= 0.10 to 1.14; $p = 0.259$). Table 2 also shows that there is no relationship between parity and the occurrence of hypotension during cesarean section, and this result is not statistically significant (OR= 0.44; 95% CI= 0.11 to 1.67; $p = 0.365$). The BMI variable indicates that there is no relationship between BMI and the occurrence of hypotension during cesarean section, and this result is also not statistically significant (OR= 1.59; 95% CI= 0.48 to 5.35; $p = 0.650$) (Table 3).

Table 3. Bivariate Analysis Results of Age, Parity, and BMI on Hypotension

| Independent Variables | Hypotension | | Total N (%) | OR (95% CI) | p-value |
|-----------------------|-------------|--------------|----------------|-----------------------|---------|
| | Yes | No | | | |
| | N (%) | N (%) | | | |
| Age | | | | | |
| ≥30 Years | 4 (23.5%) | 13 (44.8%) | 17 (37.0%) | 0.38 (0.10 – 1.44) | 0.259 |
| 20-29 Years | 13 (10.7%) | 16 (29.0%) | 29 (63.0%) | | |
| Parity | | | | | |
| Multipara | 4 (23.5%) | 12 (41.4%) | 16 (34.8%) | 0.44 (0.11 – 1.67) | 0.365 |
| Primipara | 13 (11.1%) | 18.9 (58.6%) | 30 (65.2%) | | |
| IMT | | | | | |
| Obesity | 9 (52.9%) | 12 (41.4%) | 21 (45.7%) | 1.59 (0.48 – 5.32) | 0.650 |
| Normal | 8 (47.1%) | 17 (58.6%) | 25 (54.3%) | | |

DISCUSSION

The The univariate analysis results in Table 1 show that the majority of respondents were aged 20-29 years (63.0%). A study by Tanambel et al. (2017)^[10] involving 15 mothers undergoing cesarean section with spinal anesthesia at RSUP Prof. Dr. R. D. Kandou Manado indicated a relationship between age and the incidence of hypotension, with the age group <20 years comprising 1 patient (6.66%), 20-35 years comprising 11 patients (73.33%), and >35 years comprising 3 patients (20%).

Most respondents were primiparous (65.2%). Multiparous women have a higher maternal mortality rate compared to primiparous women, influenced by the maturation and declining organ function^[11]. A significant number of respondents had a normal Body Mass Index (BMI) (54.3%). As maternal obesity increases, the incidence of hypotension also rises^[3]. This is related to the compression of the epidural space due to excess weight, dilation of the epidural veins, and greater fat deposits in the

epidural cavity, leading to a reduced volume of cerebrospinal fluid^[12].

The majority of respondents did not experience hypotension during cesarean section. A similar study by Zhafirah (2019)^[14] found a hypotension incidence of 14.5%, consisting of mild hypotension (11.3%), moderate hypotension (3.2%), and no hypotension (85.5%). Mulyono et al. (2017)^[13] conducted research at RSUPN dr. Cipto Mangunkusumo involving 293 mothers undergoing cesarean sections with spinal anesthesia, finding an incidence of hypotension at 54.21%. Statistical analysis revealed that hypertension, BMI over 25 kg/m², and positive Passive Leg Raising tests did not have a significant relationship with hypotension in pregnant women undergoing cesarean section with spinal anesthesia. However, predicting birth weight over 2300 grams and positive supine stress tests showed a significant relationship with hypotension in this population^[13].

Relationship Between Age and Intraoperative Hypotension During Cesarean Section with Spinal Anesthesia

The bivariate analysis in Table 2 indicates that early adulthood (20-29 years) is a protective factor against hypotension during cesarean section, although this result is not statistically significant. This finding contradicts previous research indicating risk factors closely associated with the incidence of hypotension in pregnant women after spinal anesthesia, including age, height and weight, BMI, uterine position, hydration fluid, bupivacaine dosage, spinal anesthetic adjunct dosage, position during spinal anesthesia, injection site, duration of local anesthetic administration, height of spinal block, blood loss, use of ephedrine as a vasopressor, and surgical manipulation Chumpathong et al., 2006; Salman and Yehia, 2014; Jadon, 2010; Mitra et al., 2013; Rodrigues and Brandao, 2011)^[4, 15-18].

Age is one of the risk factors for hypotension during spinal anesthesia; however, younger patients may experience less severe drops in blood pressure than older patients. This may be due to higher residual autonomic vascular tone after sympathetic denervation and more active compensatory reflexes. Cardiac output declines with age, explaining the more significant proportional drop in blood pressure among older patients following peripheral vasodilation. The incidence of hypotension progressively increases after age 50^[4, 16 and 17].

Relationship Between Parity and Intraoperative Hypotension During Cesarean Section with Spinal Anesthesia

The bivariate test results in Table 2 show that multiparity is a protective factor against hypotension during cesarean section, though this result is not statistically significant. According to the Institute of Medicine (2007), women with high-risk parity (first-time mothers with >5 births) indicate that parity is a risk factor for cesarean delivery^[19].

Research by Hartono (2011)^[20] suggests that increased risks in multiparous women are due to poor decidual vascularization resulting from repeated childbirth, leading to defective endometrium and inadequate blood flow to the placenta. The placenta may expand its surface area to seek better blood supply, often covering the birth canal, which is typically associated with placental migration.

Research by Mulyawati et al. (2011) [21] indicates a relationship between maternal parity and cesarean deliveries, with a contingency coefficient of 0.420, suggesting a strong correlation. This aligns with the theory that mothers with frequent births have an increased risk of complications in subsequent pregnancies if nutritional needs are not met. A parity greater than four often results in uterine weakening, which can prolong labor and increase bleeding risks [8].

A parity of 2-3 is considered the safest regarding postpartum bleeding, which can lead to maternal mortality. Low parity (one) can hinder a mother's ability to handle complications during pregnancy and delivery [8].

Relationship Between BMI and Intraoperative Hypotension During Cesarean Section with Spinal Anesthesia

The bivariate test results in Table 2 suggest that BMI is a protective factor against hypotension during cesarean section. This finding is consistent with

Zhafirah's (2019)^[14] research showing that BMI does not significantly affect hypotension complications during spinal anesthesia for cesarean sections at RSIA Siti Hawa Padang. Conversely, Mulyono et al. (2017)^[13] found that a BMI greater than 25 kg/m² had no significant relationship with hypotension among pregnant women undergoing cesarean section with spinal anesthesia at RSUPN dr. Cipto Mangunkusumo, RSU Tangerang, and RS Budi Kemuliaan.

However, this study contradicts findings by Hawkins et al. (2011)^[24] and Butwick and Carvalho (2015)^[3], which state that increased obesity in pregnant women correlates with higher rates of hypotension. This is linked to epidural cavity compression due to excess weight, dilation of epidural veins, and greater fat deposits in the epidural cavity, leading to reduced cerebrospinal fluid^[2,12, 22-33].

Obesity during pregnancy significantly affects physiological changes. In a supine position, cardiovascular risks emerge from changes in volume and capacity, affecting lung volumes and increasing pressure on the aorta and vena cava, heightening hypotension risk. Expansion of epidural veins reduces the subarachnoid space and cerebrospinal fluid^[16, 33-39].

The incidence and degree of hypotension after spinal anesthesia in pregnant women undergoing cesarean section are influenced by several risk factors, including age, height, weight, BMI, uterine position, hydration fluid, bupivacaine dosage, adjunct spinal anesthetic dosage, injection position, injection site, duration of local anesthetic injection, height of spinal block, blood loss, ephedrine use as a vasopressor, and surgical manipulation. However, Rustini et al. (2020)^[23] state that age is not a risk factor for hypotension in patients undergoing cesarean sections with spinal

anesthesia at Dr. Hasan Sadikin Hospital in Bandung.

This study has limitations regarding potential confounding factors due to its retrospective design, limiting control over confounding variables.

CONCLUSION

Based on the analyses conducted, it can be concluded that there is no relationship between age, parity, and BMI with the occurrence of hypotension in patients undergoing cesarean sections. Further research is needed with a larger sample size and a longer duration to explore additional risk factors for hypotension, such as the height of the sympathetic block, patient positioning, duration of surgery, hydration fluid, injection site, and vasopressor use.

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