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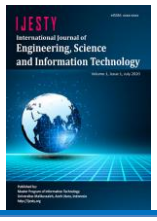

The Relation between Body Mass Index and Hypotension Incidence in Caesarean Section Patients with Spinal Anesthesia Procedure

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Abstract

One of the adverse consequences of spinal anesthesia is hypotension. Previous investigations regarding the correlation between post-spinal anesthetic hypotension and body mass index have yielded inconsistent results. This investigation predicted the Indonesian population using the body mass index computed according to the Asia-Pacific categorization. This investigation aimed to determine the correlation between body mass index and the frequency of hypotension following spinal anesthetic interventions for cesarean sections—quantitatively based on analytical observational research. 111 samples met the inclusion and exclusion criteria used in the study between May and August of 2022. An observation sheet is employed to obtain measurements of the patient's height, weight, and systolic blood pressure before and after spinal anesthesia. Type I obesity is associated with the greatest incidence of hypotension (25–30 kg/m2). Out of the 75 samples (67.6%) that were free of hypotension, 36 samples (32.4%) were affected by it. p-value of 0.322 for the Kruskal-Wallis test. In individuals who undergo spinal anesthetic treatments through cesarean sections, there is no significant correlation between body mass index and the frequency of hypotension. The results demonstrated that 36 samples (32.4%) experienced hypotension, while 75 samples (67.6%) did not. In individuals with a high body mass index and type I obesity (25–30 kg/m2), hypotension is most prevalent. There is no significant correlation between the frequency of hypotension following spinal anesthetic treatments and body mass index.

Keywords: *Body Mass Index, Hypotension, Caesarean Section, Spinal Anesthesia*.

1. Introduction

Body mass index (BMI) is determined by dividing body weight by squared height (kg/m2). The following categories are used to categorize Asia Pacific: underweight (BMI < 18.5 kg/m2), normal weight (18.5-22.9 kg/m2), overweight (23-24.9 kg/m2), obesity I (BMI 25-29.9 kg/m2), and obesity II (BMI ≥ 30 kg/m2) [1]. Pregnancy weight should be taken into account using the body mass index. This is significant because a pregnant woman's body weight can affect her risk of morbidity and death during her pregnancy [2]. One type of localized anesthesia is spinal anesthesia, often known as subarachnoid block (SAB). Spinal anesthetic has been used extensively for patients undergoing cesarean sections. Mothers in labor can experience less adverse effects when using effective anesthetic techniques [3].[4]. The pregnant woman's condition may be impacted by hypotension, or a drop in blood pressure, which can occur from the administration of spinal anesthetic during a caesarean section. Following spinal anesthesia, hypotension results from the total blocking impact on the sympathetic nervous system, which controls vascular smooth muscle tone. Blocking preganglionic sympathetic nerve fibers can help to lower blood pressure. This can lead to venous vasodilation, which increases venous capacity and lowers systemic vascular resistance [5][6]. Hypotension is one of the most frequent early complications, with a percentage of 16–33%, and occurs in around 80% of patients [7]. According to Rustini (2016), there are numerous factors that can elevate the likelihood of low blood pressure following spinal anesthesia in expectant women who undergo cesarean sections. Some of these factors include age, body mass index (BMI), prehydration fluids, the duration of the injection, the location of the spinal anesthesia, the position during the procedure, and the quantity of local anesthetic used [8]. Numerous prior research investigations have investigated the influence of body mass index on spinal anesthesia; however, the results have not always been dependable. At present, there is no appropriate standard guide for determining the body mass index of expectant

women. Consequently, the frequency of spinal anesthetic hypotension is not yet understood in relation to body mass index. Zhafirah's (2019) research indicates that there is no correlation between body mass index and the probability of hypotension in patients who undergo a cesarean section while sedated [10]. A correlation between the occurrence of hypotension and body mass index was reported by Elmeliegy (2020) [11]. The body mass index of the Asia-Pacific classification is employed to predict post-spinal anesthetic hypotension in the Indonesian population, as there is a scarcity of research on this subject in Indonesia. We anticipate that the research findings can serve as a practical guide for the reduction of hypotension, given the information obtained from this study. The objective of the investigation was to determine whether hypotension and body mass index were associated in patients who underwent spinal anesthesia following cesarean sections.

2. Research Method

This study employs quantitative methodologies in an analytical observational research design. All pregnant patients who satisfied the requirements for spinal anesthetic operations during caesarean sections at UKRIDA Hospital Jakarta from May to August 2022 comprised the study's population. Patients with a body mass index between < 18.5 kg/m2 and > 30 kg/m2, term pregnancy (37–40 weeks), and pregnant patients aged 25–40 years are classified as inclusion criteria in the Asia-Pacific classification. This investigation excluded patients with comorbidities and contraindications to spinal anesthesia, in addition to those who had a pregnancy diagnosis. The unpaired categorical analytical formula was employed to determine the sample size, resulting in 111 samples for our study, in order to account for the 10% attrition frequency. The Medical and Health Research Ethics Committee of the Faculty of Medicine and Health Sciences at Kristen Krida Wacana University (UKRIDA) endorsed the research conducted in a hospital environment. Additionally, a letter was provided to confirm the successful conclusion of the ethical evaluation. The intraoperative observation document of the patient was employed by the researcher to gather data.

Researchers include a procedure explanation sheet and an informed consent statement for potential participants in the implementation process. Participants who are willing to participate in an interview will be asked to provide their name, age, pregnancy diagnosis, height, weight, and any contraindications for spinal anesthesia. Before performing spinal anesthesia, take a noninvasive blood pressure reading. The operating room fits the patient with a device to monitor vital signs upon arrival. Within 15 minutes of the cesarean section, the patient was given a 500 cc Ringer lactate liquid loading, a 0.5% dose of hyperbaric bupivacaine, 12.5 mg of anesthesia, a puncture in the L3-L4 area, and was placed in a lateral-decubitus position. Monitor the patient's blood pressure two minutes after spinal anesthesia. If the blood pressure drops to less than 25% of the basal blood pressure, observe the patient for an additional two minutes. If the blood pressure drops to more than 25% of the basal blood pressure, administer 10 mg of vasopressor ephedrine. Collect data using observation sheets, and record the decrease in systolic blood pressure for up to 10 minutes. A computer program processed the data, performed univariate analysis, and presented the results in frequency and percentage tables. We conduct a normality test on multivariate data to determine whether to use the ANOVA or Kruskal-Wallis test for analyzing more than two independent variables and their correlations.

3. Result and Discussions

111 samples met the requirements after conducting cross-sectional study. Under spinal anesthesia, UKRIDA Hospital studied caesarean section patients from May to August 2022 in the surgical installation room.

Table 1. Body Mass Index Data Results (Asia-Pacific)

BMI (kg/m2)	N	(%)	(%) Cumulative
< 18,5	1	.9	.9
18,5-22,9	5	4.5	5.4
23-24,9	7	6.3	11.7
25-30	49	44.1	55.9
> 30	49	44.1	100.0
Total	111	100.0	

Table 2. Decrease in Systolic Blood Pressure

	N	(%)	(%) Cumulative
Hypotension	36	32.4	32.4
No Hypotension	75	67.6	100.0
Total	111	100.0	

We can determine the incidence of hypotension by measuring the decrease in systolic blood pressure from the basal value of >25% using both pre- and post-treatment systolic blood pressure data. From the data obtained, hypotension occurred in 36 samples (32.4%), while 75 samples (67.6%) did not have low blood pressure.

Table 3. Comparison of the incidence of hypotension according to body mass index

	Hypotension		
BMI (kg/m^2)	Hypotension	No Hypotension	Total
< 18,5	0	1	1
18,5-22,9	1	4	5
23-24,5	2	5	7
25-30	21	28	49
> 30	12	37	49
Total	36	75	111

Type I obesity has 21 hypotensive samples and 28 non-hypotensive samples, for a total of 49 samples. Therefore, those with a high body mass index and type I obesity (25–30 kg/m2) had the highest incidence of hypotension in this study.

Table 4. Normality Test Results

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
	N	111
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	.46999819
Most Extreme Differences	Absolute	.422
	Positive	.236
	Negative	-.422
Test Statistic		.422
Asymp. Sig. (2-tailed)		.000[c]

Since the normalcy test findings show that p = 0.000 (<0.05), indicating that the data are not normally distributed, an additional test called the Kruskal-Wallis analysis is performed.

Table 5. Kruskal-Wallis Test Results (Mean Rank)

	BMI (kg/m^2)	N	*Mean Rank*
Hypotension	< 18,5	1	74.00
	18,5-22,9	5	62.90
	23-24,5	7	58.14
	25-30	49	50.21
	> 30	49	60.41
	Total	111	

Overall, to determine significance, a statistical p-value is required. You can present the Kruskal-Wallis data results in tabular form for ranking-based comparisons. Type I obesity (mean = 50.21), overweight (mean = 58.14), type II obesity (mean = 60.41), normal weight (mean = 62.90), and underweight (mean = 74.00) had the strongest correlation between body mass index and the occurrence of hypotension.

Table 6. Kruskal-Wallis Test Results

	Hypotension
Kruskal-Wallis H	4.678
Df	4
Asymp. Sig.	.322

We can conclude that there is no significant link between the occurrence of hypotension and body mass index because the result is p = 0.322 (>0.05).

Discussion

The results of Angga Aditya Wirawan's (2022) thesis research in Yogyakarta, which utilized 72 samples, revealed a robust correlation between hypotension and body mass index (p = 0.000). The study revealed that the BMI of 32.7 kg/m2 was associated with the highest incidence of hypotension, which accounted for 61.1% of cases [12].

The investigators recruited participants with a body mass index (BMI) of 25 to 35, administered bupivacaine 0.5% hyperbaric 12.5 mg to induce sleep, and documented hypotension as a decrease in systolic blood pressure of more than 20% from the initial reading. In order to

evaluate the distribution of BMI in pregnant women and the risk factors for hypotension that may arise at specific BMIs, researchers are currently employing all weight groupings according to the Asia-Pacific BMI, despite the minor differences in implementation procedures. In a similar vein, the lateral decubitus position method was used in this investigation. Previous studies found that patients felt more at ease in the lateral-decubitus position and that sitting significantly reduced systolic blood pressure, however comparable studies found no difference in the reduction between the two positions [13][14]. Table 2 shows the incidence of hypotension (32.4%) in Jakarta, according to current research. In previous studies, the incidence of hypotension in Cilacap was 55.6%. In Padang, there is an incidence of hypotension (14.5%) [10]. Therefore, researchers believe that the incidence of hypotension varies among research locations, necessitating additional research in Indonesia on this topic. Table 3 shows the highest incidence of hypotension in type I obesity (25–30 kg/m2). This is consistent with Mulyono's (2017) research, which measured systolic blood pressure >20% with the highest incidence of hypotension at a BMI of 25.9 kg/m2 [16]. Cahya Khairani (2021) also has the same reference, with the highest incidence of hypotension at a BMI > 25 kg/m2 [15]. Pregnant women with higher body mass indices also had higher rates of hypotension, according to a study. Hypotension is more prevalent among pregnant women who are overweight. This may be due to increased sympathetic blocking, which is caused by excess body fat pressing on the subarachnoid space, resulting in the accumulation of additional fat in the epidural cavity and a reduction in the volume of cerebrospinal fluid [16][17]. Additionally, the results of this analysis are in direct opposition to those of a Chinese study conducted in 2018 by Huai-Zhen Wang, Han-Wen Chen, Yan-Ting Fan, et al. The study included 405 samples that were categorized into three categories according to the World Health Organization classification: group S (BMI <25), group M (25 ≤ BMI <30), and group L (BMI ≥30). Group L exhibited a significantly higher incidence of hypotension than Groups S and M (group S: M: L = 47%; 53%: 93%) (p = 0.015) [18]. The varying outcomes of the research could have been caused by differing BMI classifications, bigger sample sizes, and the administration of 15 mg of ropivacaine at a higher BMI. On the other hand, studies indicate that ropivacaine doses between 7 and 14 mg are associated with a reduced incidence of hypotension than doses of 15 mg at a BMI of 30 kg/m2.

As an alternative to bupivacaine with minimal cardiotoxic effects, ropivacaine belongs to a group of amide local anesthetics. The difference between ropivacaine and bupivacaine is that ropivacaine's lipid solubility is lower than bupivacaine's, so the drug's ability to bind proteins is slower. At the same dose, ropivacaine has faster motor and sensory blockade results than bupivacaine.[19] Olapour's (2021) study indicates that bupivacaine causes more notable alterations in heart rate; however, the reduction in systolic and diastolic blood pressure is nearly same between ropivacaine and bupivacaine [20]. The appropriate dosage of bupivacaine is theoretically 12–15 mg. Although hypotension is rare, low dosages of bupivacaine (<8 mg) may result in insufficient anesthetic [4][21][22]. Hypotension can occur at doses less than or greater than 10 milligrams, according to Weiniger's research from 2021 [22]. The dosage of bupivacaine utilized in this investigation was 12.5 mg. The researchers came to the conclusion that, except from the BMI value being significantly higher than the average, there was minimal relationship between the ropivacaine dosage and BMI. The Asia-Pacific classification system-based sample categorization affects data interpretation in a different way when compared to the WHO's higher limit values. The researchers used the Asia-Pacific criteria, which are widely recognized. This is specifically designed to fit the Indonesian physique. Compared to European people, Asian populations have various relationships between body fat percentage, BMI, and health hazards. The weight of the unborn child was not taken into account while calculating the pregnant women's BMI in this study, which would have affected the grouping results. The only approach to calculate the ideal weight growth during pregnancy is to assess weight gain based on the pre-pregnancy BMI, as there is no particular BMI for pregnant women. As a result, the researchers believe it is necessary to conduct further reviews of the appropriate measurement of BMI for pregnant women in future research.

4. Conclusion

The results showed that 36 samples (32.4%) experienced hypotension, while 75 samples (67.6%) did not experience hypotension. Those with a high body mass index and type I obesity (25–30 kg/m2) have the highest incidence of hypotension. Body mass index and the frequency of hypotension after spinal anesthetic treatments do not significantly correlate.

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