



Incidence of Hypotension, Bradycardia, and Post-operative Nausea and Vomiting with Spinal Anesthesia in Cesarean Section Patient

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Abstract

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BACKGROUND: Cesarean section is performed through an open abdominal incision (laparotomy) and an incision through the uterus (hysterotomy). In general, cesarean section is performed with regional anesthesia techniques, with spinal anesthesia being the primary choice. Complications that often occur after the administration of spinal anesthesia include hypotension, bradycardia, and post-operative nausea and vomiting.

AIM: The aim of this study was thus to identify the incidence of hypotension, bradycardia, and post-operative nausea and vomiting caused by spinal anesthesia during cesarean section procedures.

METHODS: This was a cross-sectional study with a descriptive, quantitative design. Data were obtained from the medical records of patients undergoing cesarean section procedures. Univariate analysis was performed to analyze data using IBM SPSS software version 28.

RESULTS: Univariate results showed that of the 297 samples, the incidence of hypotension based on mean arterial pressure was 1.7%, the incidence of bradycardia was 0.7%, and the incidence of post-operative nausea and vomiting was 3%.

CONCLUSIONS: This study showed that the incidences of hypotension and bradycardia in this study were lower than in other studies. We recommend, in future studies, to include factors that may predispose to hypotension, bradycardia, and post-operative vomiting and nausea.

Introduction

Cesarean section is performed through an open abdominal incision (laparotomy) and an incision through the uterus (hysterotomy) [1]. In general, the cesarean section is performed with regional anesthesia techniques, with spinal anesthesia being the primary choice [2]. Complications that often occur after the administration of spinal anesthesia include hypotension, bradycardia, and post-operative nausea and vomiting [3].

The incidence of hypotension is influenced by several factors, such as a blockade height above the fifth thoracic level, the patient's positioning as it affects venous return, and the patient's condition, including the severity of blood loss. The diagnosis of hypotension as a complication of cesarean section under spinal anesthesia can be determined by mean arterial pressure (MAP) [4].

Bradycardia after spinal anesthesia is a condition in which the heart rate falls below 60 beats per minute [5]. The primary cause of bradycardia is a decrease in preload. In pregnant women, patient

position and its effect on aortocaval compression greatly affect venous return during spinal anesthesia. In addition, hypovolemia can cause insufficient venous return, resulting in an impaired preload and subsequent bradycardia [5], [6].

Post-operative nausea and vomiting usually appear 24 to 48 h after surgery [3], [7], [8]. Post-operative nausea and vomiting are influenced by several factors including drug side effects; higher blockade height, which can be caused by not anticipating patient movements immediately after the drug is administered; a history of previous post-operative nausea and vomiting; female gender; and leftover food in the gastrointestinal tract at the time of surgery, which can be caused by delayed gastric emptying, a common occurrence in pregnant women [3], [9], [10].

Shitemaw *et al.*'s research in Ethiopia determined that the prevalence of cesarean section was 32.5%, and 68.2% of cesarean sections were performed using spinal anesthesia. The incidence of hypotension ranged from 25% to 75% in the general population and was even higher in women who delivered by cesarean section because of the physiological changes caused by pregnancy that lead to compression of the

inferior vena cava by the hypertrophic uterus and the development of collateral venous plexus circulation in the epidural space [11]. Rustini *et al.* conducted a study at Dr. Hasan Sadikin Bandung Hospital in Indonesia and showed that of the 90 patients studied, 49% experienced hypotension after spinal anesthesia for cesarean section [12].

Park Ji-Hyoung *et al.* reported an incidence of bradycardia in patients with spinal anesthesia of 30% [13]. Meanwhile, a retrospective study in Indonesia found a 33% incidence of hypotension and bradycardia in obstetric patients [14].

A systematic review by Amirshahi *et al.* of four databases (PubMed, Web of Science, Scopus, and Google Scholar) that included 23 studies conducted on 22,683 people from 11 countries revealed that the prevalence of post-operative nausea and vomiting was 27.7%, with a higher prevalence during the first 24 h in European countries [15]. In Indonesia, the incidence of postoperative nausea and vomiting has not been clearly recorded. Based on the results of a study conducted by Hayati *et al.* on 47 patients, the incidence of post-operative nausea and vomiting from spinal anesthesia during cesarean section was 13.4% (6 patients) on the first day post-surgery and 4% (2 patients) on the third day post-surgery [16]. The aim of this study was to identify the incidence of hypotension, bradycardia, and post-operative nausea and vomiting from spinal anesthesia during cesarean section.

Materials and Methods

A cross-sectional study was conducted to determine incidence of hypotension, bradycardia, and postoperative nausea and vomiting among parturient who delivered with caesarean section under spinal anesthesia.

The ethical review committee of the college of medicine and health sciences gave its approval. We calculated the sample size using a 50% proportion and included 297 consecutive parturient operated on during the study period. Exclusion criteria were patients who refused to participate, had a failed spinal that required conversion to general anesthetic, was uncooperative, or had eclampsia. During pre-operative evaluation, all patients were informed about the possibility of intra-operative problems. Each study participant gave written and verbal informed permission after a thorough discussion of the study's benefits and drawbacks.

In the sitting position, 1.5–2.5 mL of isobaric bupivacaine was given for spinal anesthesia, and no opioid was used intrathecally because it was not accessible during the data collecting period. To reduce the risk of intraoperative hypotension, all patients were

co-loaded with crystalloid and positioned in a slight left lateral position. The severity of nausea and vomiting was assessed using a numerical rating system. Patients were monitored until the procedure was completed, and the responsible anesthetist was notified if nausea or vomiting required intervention.

Univariate analysis was performed during data analysis using IBM SPSS software version 28 (IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp.) [17], [18], [19].

Results

As presented in Table 1, blood pressure measured before anesthesia was administered was < 90/60 mmHg (hypotension) in 1 patient (0.3%), < 130 mmHg for systolic, and < 85 mmHg for diastolic (normal) in 128 patients (43.1%), 130–139 mmHg for systolic and/or 85–89 mmHg for diastolic (normal-high) in 68 patients (22.9%), 140–159 mmHg for systolic and/or 90–99 mmHg for diastolic (hypertension grade 1) in 63 patients (21.2%), and ≥ 160 mmHg for systolic and/or ≥ 100 mmHg for diastolic (hypertension grade 2) in 37 patients (12.5%).

Table 1: Blood pressure frequency and percentage distribution

Category	Total (n = 297)		Percentage (%)	
	Before Anesthesia	After Anesthesia	Before Anesthesia	After Anesthesia
< 90/60 mmHg (hypotension)	1	24	0.3	8.1
< 130 mmHg and <85 mmHg (normal)	128	206	43.1	69.4
130–139 mmHg and/or 85–89 mmHg (high-normal)	68	29	22.9	9.8
140–159 mmHg and/or 90–99 mmHg (hypertension Grade 1)	63	27	21.2	9.1
≥ 160 mmHg and/or ≥100 mmHg (hypertension Grade 2)	37	11	12.5	3.7
Total	297	297	100	100

Post-anesthesia blood pressure (measured 20 minutes after anesthesia was given) was < 90/60 mmHg (hypotension) in 24 patients (8.1%), < 130 mmHg for systolic and < 85 mmHg for diastolic (normal) in 206 patients (69.4%), 130–139 mmHg for systolic and/or 85–89 mmHg for diastolic (normal-high) in 29 patients (9.8%), 140–159 mmHg for systolic and/or 90–99 mmHg for diastolic (hypertension grade 1) in 27 patients (9.1%), and ≥ 160 mmHg for systolic and/or ≥ 100 mmHg for diastolic (hypertension grade 2) in 11 patients (3.7%).

Table 2 displays the distribution of patient MAP measurements. MAP before anesthesia administration

Table 2: Mean arterial pressure frequency and percentage distribution

Category	Total (n = 297)		Percentage (%)	
	Before anesthesia	After anesthesia	Before anesthesia	After anesthesia
< 60 mmHg (low)	0	5	0	1.7
60–100 mmHg (normal)	187	257	63	86.5
> 100 mmHg (high)	110	35	37	11.8
Total	297	297	100	100

was < 60 mmHg (low) in none of the patients (0%), 60–100 mmHg (normal) in 187 patients (63%), and > 100 mmHg (high) in 110 patients (37%).

After administration of anesthesia, MAP was < 60 mmHg (low) in 5 patients (1.7%), 60–100 mmHg (normal) in 257 patients (86.5%), and > 100 mmHg (high) in 35 patients (11.8%).

As illustrated in Table 3, the incidence of hypotension in cesarean section patients after spinal anesthesia based on their MAP measurement was 1.7% (5 patients).

Table 3: Hypotension based on mean arterial pressure frequency and percentage distribution

Mean arterial pressure category	Incidence of hypotension		
	Yes	No	Percentage (%)
< 60 mmHg (low)	5	0	1.7
60–100 mmHg (normal)	0	257	0
> 100 mmHg (high)	0	35	0

As shown in Table 4, heart rate before administration of anesthesia was < 60 beats per minute (bradycardia) in none of the patients (0%), 60–100 beats per minute (normal) in 246 patients (82.8%), and > 100 beats per minute (tachycardia) in 51 patients (17.2%).

Table 4: Heart rate frequency and percentage distribution

Category	Total (n = 297)		Percentage (%)	
	Before anesthesia	After anesthesia	Before anesthesia	After anesthesia
< 60 beats/min (bradycardia)	0	2	0	0.7
60–100 beats/min (normal)	246	276	82.8	92.9
> 100 beats/min (tachycardia)	51	19	17.2	6.4
Total	297	297	100	100

Post-anesthesia heart rate (measured 20 min after anesthesia was administered) was < 60 beats per minute (bradycardia) in two patients (0.7%), 60–100 beats per minute (normal) in 276 patients (92.9%), and > 100 beats per minute (tachycardia) in 19 patients (6.4%).

Table 5 presents the incidence of post-operative nausea and vomiting among cesarean section patients after spinal anesthesia. Post-operative nausea and vomiting (nausea and vomiting that occurred 24–48 h after surgery) were experienced by nine patients (3%), while 288 patients did not experience nausea and vomiting (97%).

Table 5: Post-operative nausea and vomiting frequency and percentage distribution

Post-operative nausea and vomiting	Total (n = 297)	Percentage (%)
Yes	9	3
No	288	97
Total	297	100

Discussion

Study conducted by Tanambel *et al.* [20] showed that patients' highest blood pressure after

anesthesia was in the normal category, as were their post-anesthesia blood pressure, MAP before anesthesia, and highest MAP after anesthesia. This is in line with the results obtained in this study, in which the majority of patients were in the normal categories.

The incidence of hypotension based on MAP in patients undergoing cesarean section after spinal anesthesia found in this study was much lower than previous study conducted at Edelande Hospital, South Africa, which was 34.4%. This difference may be due to a higher rate of risk factors in the patients of the previous study causing the frequency of hypotension to also be greater [4], while the design of this study may have allowed for better anticipation of the factors that can cause hypotension, causing the incidence to be much lower.

The incidence of bradycardia found in this study in cesarean section patients after spinal anesthesia was much lower compared to the previous study by Isfandiary *et al.*, who found an incidence of bradycardia of 30% in obstetric patients. This may be due to a higher rate of risk factors in the patients of the previous study, causing the incidence of bradycardia to also be greater [14], while the design of this study may have allowed for better anticipation of the factors that can cause hypotension, causing the incidence rate to be much lower.

The incidence of postoperative nausea and vomiting found in this study was similar to the research conducted at Ulin Hospital Banjarmasin, which revealed a 4% incidence of nausea and vomiting on the 3rd post-operative day [16].

The findings of this study are consistent with the current guidelines that state that after spinal anesthesia, the mother undergoing cesarean section may experience complications in the form of hypotension, as spinal anesthesia causes blockade of the sympathetic nerves that regulate blood vessel muscle tone. The incidence is more severe in pregnant women due to the aortocaval compression caused by the enlarged uterus, leading to a decrease in blood pressure [21].

This study's findings are also in accordance with current guidelines that state that after spinal anesthesia, the mother undergoing cesarean section may experience complications in the form of bradycardia, as spinal anesthesia causes sympathetic nerve blockade, which, in turn, causes peripheral vasodilation and a decrease in cardiac preload. A decrease in preload activates the reflex group responsible for intracardiac volume stretch, resulting in a sudden decrease in ventricular volume that can cause bradycardia. This event is more severe in pregnant women due to the aortocaval compression caused by the enlarged uterus and also affects venous return during spinal anesthesia, leading to the decrease in preload that induces bradycardia [14].

In addition, the findings of this study concur with the current consensus that after spinal anesthesia, the

mother undergoing a cesarean section may experience complications in the form of postoperative nausea and vomiting, particularly between 24 and 48 h after surgery. In cesarean section patients, in addition to blood loss, which is estimated to be several hundred milliliters in a short time, severe bleeding may also occur, causing blood pressure to decrease further and leading to a reduction in cerebral perfusion. This ischemia, in turn, activates the nausea and vomiting center in the medulla oblongata [22].

There was a 1.7% incidence of hypotension in our institution in patients undergoing cesarean section after spinal anesthesia, with 98.3% of patients not experiencing hypotension. The incidence of bradycardia was 0.7% in cesarean section patients after spinal anesthesia, with 99.3% of patients not experiencing bradycardia. The incidence of postoperative nausea and vomiting was 3% in cesarean section patients after spinal anesthesia, with 97% of patients not experiencing post-operative nausea and vomiting.

This study was limited in that we described the incidence of hypotension, bradycardia, and post-operative vomiting and nausea after spinal anesthesia in patients undergoing cesarean section regardless of the factors that influence the incidence of hypotension, bradycardia, and post-operative vomiting and nausea in this population. Factors that can affect the incidence of hypotension, bradycardia, and post-operative vomiting and nausea are, but not limited to, the amount of preloading fluid given, dose of bupivacaine, adjuvant dose of fentanyl, position during spinal anesthesia, location of spinal anesthesia insertion, duration of injection of spinal anesthetic, the height of the blockade, amount of bleeding during surgery, and the amount of ephedrine used.

Conclusions

This study showed that the incidences of hypotension and bradycardia in this study were lower than in other studies. We recommend, in future studies, to include factors that may predispose to hypotension, bradycardia, and post-operative vomiting and nausea.

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