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Research Article

The study of maternal spinal anesthesia-induced hypotension during Cesarean section at Tu Du Maternal Hospital, Vietnam - the incidence and related risks

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ABSTRACT

Background and Aims: This study aimed to identify the incidence of spinal anesthesia (SA)-induced hypotension in those mothers who underwent cesarean section (CS) and evaluate associated factors (related to pregnant women, fetus, and operation process).

Methods: This prospective cohort study was conducted on 319 pregnant women between January and March 2022 at Tu Du Maternal Hospital, Ho Chi Minh City, Vietnam. The data were collected with the permission of candidates and then analyzed by using R program (4.4.1 edition). The multivariable logistic regression was done on related variables and p<0.05 was defined as the level of statistical significance.

Results: The incidence of SA-induced hypotension was 68.03%, in which blood pressure (BP) in about two-thirds of these cases (142/217) begins dropping in the first 10 minutes after anesthetic injection, and severe hypotension (defined as BP decreased more than 40% compared with the baseline BP) was found in 63/217 (29%) cases. The women aged ≥35 (OR 2.85, 95% CI: 1.57-5.47), height <155 cm (OR 2.15, 95% CI: 1.26-3.79), gravidity ≥3 (OR 3.20, 95% CI: 1.73-6.04), history of CS ≥2 (OR 6.71, 95% CI: 2.53-23.7), overweight (OR 3.43, 95% CI: 1.07-12.0) and baseline heart rate ≥90 beats/minute (OR 1.82, 95% CI: 1.13-2.94) were found to be associated with increased risk of hypotension.

Conclusions: The proportion of hypotension after spinal anesthesia for elective CS remained comparatively high, so the need of a comprehensive pre-surgical preparation to minimize the negative impact of hypotension on those women and their children.

Key words: Cesarean section, hypotension, spinal anesthesia, pregnancy

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INTRODUCTION

In the world, the rate of cesarean section is increasing rapidly, and Vietnam is not out of that trend. In 2018, Ties Boerma et al. compiled data from 169 countries with total fertility rates accounting for 98.4% of the global fertility rate, showing that the rate of women receiving cesarean sections in 2015 was 21.1% (29.7 million caesarean sections), doubling from 12.1% in 2000[1]. Spinal anesthesia is allowed to be used in obstetrics with the advantage of avoiding dangerous complications associated with general anesthesia such as aspiration, difficult intubation and the negative effects of general anesthesia on the fetus. Mehmet Aksoy et al. surveyed 9,049 cesarean sections between 2003 and 2012 and found that spinal anesthesia was used in 34 percent of all cesarean sections (2003) and 41 percent of all caesarean sections (2012), accounting for the highest usage rate compared to other insensitive methods[2].

Hypotension is the most common complication after spinal anesthesia, which is the leading cause of serious complications related to spinal anesthesia during cesarean section if not detected and treated early and promptly. Uncontrolled hypotension can lead to nausea, vomiting, decreased uterine-placental perfusion flow, fetal acidosis, and can cause cardiovascular collapse in rare cases[3,4]. Spinal anesthesia causes a rapid and extensive sympathetic blockade, hence, the three main mechanisms associated with hypotension in spinal anesthesia are: (i) systemic vasodilation, (ii) decreased cardiac activity, which decreased venous return and cardiac output, (iii) parasympathetic hyperresponsiveness due to decreased sympathetic activity[5].

Hypotension can occur immediately after spinal anesthesia injection and there are many risk factors such as maternal age, weight changes during pregnancy, number of previous pregnancies, history of hypotension, dose of anesthetics; the type of anesthetic drug,

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the level of blockage, and the amount of blood loss during the operation [6–11]. The height of the woman <155cm, the high dose of anesthetics and the baby born with a high weight are also risk factors for hypotension in pregnant women [12]. The degree of hypotension is directly proportional to the dose of the drug, the type of drug injected into the subarachnoid cavity and directly proportional to the level of the medullary oblongata that the anesthetic needle injected. Anesthetic drug has a greater density than the density of cerebrospinal fluid, so the low head position makes the anesthetic spread higher and is more likely to cause severe hypotension [13–15]. Pregnant women, especially in the last trimester, due to the uterus pressing on the inferior vena cava, reduces blood circulation to the heart, causing a decrease in load, decreased cardiac output, along with sympathetic nerve inhibition mechanisms that make hypotension more likely to occur. Preoperative anxiety in mothers also increases the rate of hypotension after spinal anesthesia. The higher the anesthesia needle puncture site, the higher the level of sympathetic nerve inhibition, leading to more blockage and more hypotension. The position in which spinal anesthesia is performed is also associated with intraoperative hypotension in pregnant women, specifically that performing spinal anesthesia in a sitting position is technically easier and less likely to cause hypotension. Raising awareness of these risk factors will increase the anaesthetist's caution in deciding to use techniques, prophylaxis or treatments to prevent adverse effects to the newborn because of maternal hypotension [16–22].

There have been many studies on the incidence of hypotension in pregnant women after spinal anesthesia for cesarean section, but the reported rates of hypotension are not uniform between studies due to differences in the definition of hypotension of each study [23]. In Vietnam, there are not any studies on post-spinal anesthesia hypotension in women undergoing cesarean section along with differences in race, genes, physical status and nutrition between Vietnamese and other populations, so a study with a sample population of Vietnamese is required. This study will provide basic data to serve as a premise for further research on the effectiveness of prevention and treatment of hypotension after spinal anesthesia in women undergoing cesarean section in Vietnam. The objective of the study was to determine the incidence of hypotension after spinal anesthesia and to investigate the association between risk factors from the mother, the fetus and from the operational process in women who received a cesarean section at Tu Du Maternal Hospital from January 2022 to the end of March 2022.

MATERIALS AND METHODS

The prospective cohort study described over 319 women who underwent spinal anesthesia for cesarean section and agreed to participate in the study at the Department of Anesthesiology and Resuscitation at Tu Du Maternal Hospital, Ho Chi Minh City, Vietnam from January 2022 to the end of March 2022.

Inclusion Criteria

All pregnant women with single pregnancies, term (37-41 weeks), are indicated for cesarean section to actively use spinal anesthesia.

Exclusion Criteria

- Pregnant women who are only given partial spinal anesthesia or failed to spinal anesthesia using another method.
- Women at high risk of hypotension in surgery unrelated to spinal anesthesia (diagnosed fetal failure, preeclampsia or eclampsia, intrauterine growth retardation, birth defects, stillbirths and multiple pregnancies; women at risk of losing a lot of blood during surgery as in the case of placenta previa, placenta with comb teeth; pregnant women with a history of postoperative bleeding, noncoagulation, taking therapeutic doses of anticoagulants, prolonged operation time).
- Other confounding factors include the addition of high doses of opioid analgesics (morphine >0.1 mg/kg or pethidine >50 mg or fentanyl >1 g/kg) or high doses of sedatives (midazolam >2 mg or ketamine >1 mg/kg or propofol >1.5 mg/kg) for 60 minutes after spinal anesthesia.

Definition of hypotension

In this study, we agreed on the definition of hypotension according to the guidelines of the Vietnam Association of Anesthesiology and Resuscitation in 2020, with hypotension when (1) Systolic blood pressure is <90 mmHg or (2) Systolic blood pressure decreases by >20% of the baseline value measured before spinal anesthesia.

Data collection process

Each member of the research team will collect data independently using a pre-prepared questionnaire with the support of anesthesiologists at the Anesthesiology and Resuscitation Department of Tu Du Maternal Hospital and the collected information includes age, height, pre-pregnancy weight and current weight, number of pregnancies, number of normal births, number of cesarean sections with spinal anesthesia,

history of hypertension. The amount of preoperative infusion will be extracted from the woman's medical record. When the woman is stable on the operating table but has not received spinal anesthesia, the vital sign monitor will record the values of systolic blood pressure, diastolic blood pressure and the mother's heart rate every 3 minutes. These blood pressure and heart rate values are recorded as baseline values. When the spinal anesthetic injection begins, information related to the spinal anesthesia technique (size of the medullary needle, location of the needle, anesthetic drug) will be recorded directly. After spinal anesthesia, when the woman is lying firmly on the operating table, the time from the injection of anesthetic to the start of the skin incision will be recorded. From the time of anesthetic injection, the systolic blood pressure will be recorded continuously once a minute until the time that the fetus is brought outside the uterus.

Data Processing

Encoding, entering data using Excel, extracting xlsx files. The data are processed and analyzed using R 4.4.1 software. Descriptive analysis is represented by the mean value ± standard deviation for the variable of continuous variables, qualitative variables will be described by frequency (percentage, %), and variance. All parametric and non-parametric distributions are tested for standard distribution before further analysis is conducted. Multivariate and univariate logistic regression models are used to analyze the effects of prognostic variables on dependent variables. No hypotension is used as a reference value. Use the Student t-test and Mann-Whitney U to compare the quantitative variables. Examine the Chi-squared ($\chi 2$) to compare the differences in the proportions of the two groups. Test Fisher accuracy if the test $\chi 2$ does not meet the conditions. Use the Pearson correlation test to find correlations if the standard delivery conditions are met. The tests were performed with a 95% confidence interval, a statistically significant difference of $p<0.05$.

Medical ethics issues

The pregnant women were informed about the study prior to data collection, provided their informed consent and had the right to refuse or stop participating in the study at any time. The study only collects data through medical records or directly asks about the woman's condition, the research results serve scientific work and do not interfere with the treatment of pregnant women at Tu Du Maternal Hospital. Research does not infringe on the mental, physical and material nature of the research subjects. The research is carried out in the spirit of respect and confidentiality for the research subjects. The study was conducted with permission of the Ethics Council in Biomedical Research of the University of Health Sciences, Vietnam National University Ho Chi Minh City and Tu Du Maternal Hospital.

RESULTS

Characteristics of the study sample

Table 1: General characteristics of the study sample (N=319)

	Overall (N=319)
Mother's age	
Mean (SD)	31.4 (5.26)
Median [Min, Max]	32.0 [19.0, 44.0]
Classification of maternal age (years)	
<35	232 (72.7%)
≥35	87 (27.3%)
Career	
Worker	44 (13.8%)
Teacher	21 (6.6%)
Accounting	25 (7.8%)
Business	43 (13.5%)
Employee	96 (30.1%)
Domestic	90 (28.2%)
People	
Kinh	312 (97.8%)
Other	7 (2.2%)
Address	
Province	179 (56.1%)
Ho Chi Minh City	140 (43.9%)
Body Mass Index (BMI)	
<18.5 kg/m^2	26 (8.2%)
18.5-24.9 kg/m^2	198 (62.1%)
25-29.9 kg/m^2	60 (18.8%)
≥30 kg/m^2	35 (11.0%)
Gradivity	
1	93 (29.2%)
2	114 (35.7%)
≥3	112 (35.1%)
No. of vaginal delivery	
0	268 (84.0%)
1	41 (12.9%)
≥2	10 (3.1%)
No. of cesarean section	
0	153 (48.0%)
1	121 (37.9%)
≥2	45 (14.1%)
No. of spinal anesthesia	
0	160 (50.2%)
1	115 (36.1%)
≥2	44 (13.8%)
Gestation	
Early term	124 (38.9%)
Full term	194 (60.8%)
Late term	1 (0.3%)
Presentation	
Cephalic	274 (85.9%)
Breech	35 (11.0%)
Shoulder	10 (3.1%)

Continued on next page

Table 1 continued

Gestational diabetes	81 (25.4%)
Weight gain during gestation	
Not enough recommendations	76 (23.8%)
Sufficient recommendations	131 (41.1%)
Exceed recommendations	112 (35.1%)
Fetal weight	
Mean (SD)	3380 (394)
Median [Min, Max]	3300 [2450, 5630]
Macrosomia ($\geq$3500g)	111 (34.8%)
Time from beginning SA to baby delivery (min)	
Mean (SD)	24.4 (6.18)
Median [Min, Max]	23.0 [13.0, 60.0]

The average age of the 319 women was 31.4 (± 5.26) years, the youngest was 19 years old, and the oldest was 44 years old. The majority of women did not have diabetes during pregnancy (74.6%), and the majority were normal BMI (62.1%), with only 29.8% of the women in the study sample being overweight and obese. The rate of multiple pregnancies for the third time or more is 35.1%, of which 84% of women have never experienced a viginal birth. Regarding the history of cesarean section, 48% of women have never had a cesarean section, 37.9% of women have had a cesarean section once and 14.1% of women have had a cesarean section 2 or more times, more than half of these women have had spinal anesthesia. The average time from the time a woman receives spinal anesthesia to the time the baby is removed is 24.4 (±6.18) minutes, the fastest is 13 minutes and the latest is 60 minutes (Table 1).

The incidence of hypotension and related factors

There are 217 of the 319 women who underwent cesarean section with spinal anesthesia at Tu Du Maternal Hospital from January 2022 to March 2022 have hypotension after spinal anesthesia, which accounted for 68.03%. We found that the mother's age, height, BMI, gravidity, number of previous CS, and baseline heart rate were the main risk factors for SA-induced hypotension during CS.

The ≥35-year-old group and a baseline heart rate of ≥90 beat/minute had a higher rate of hypotension than the pregnant women aged <35 and a baseline heart rate of <90 beat/minute (p <0.05). In addition, pregnant women with a height of less than 155 cm, gradivity ≥3 and a history of at least two previous cesarean sections had a higher risk of hypotension than pregnant women with a height of ≥155 cm (OR 2.15; 95% CI : 1.26-3.79), nulliparity (OR 3.20; 95% CI: 1.73-6.04) and have never had a cesarean section before (OR 6.71; 95% CI: 2.53-23.70). Hypotension after spinal anesthesia in women undergoing cesarean section is common in women with BMI range of 18.5-24.9 kg/cm2. The overweight woman tend to have higher rate of hypotention (13.4% compared to 6.91% in BMI <18.5 kg/m^2 group, p=0,037). The majority of women with hypotension after spinal anesthesia have been pregnant at least twice, have no viginal birth before and have a history of cesarean section at least once. Baseline blood pressure readings ≥ 120 mmHg will be common in women who have cesarean section with hypotension after spinal anesthesia and the time from the anesthetic injection to baby delivery has shown no significant difference among two groups (Table 2).

In particular, we found that there was a linear association between the mother's baseline heart rate and the severity of hypotension, each increase in the rate of baseline heart, the rate of hypotension increased by 0.176% (± 0.056) and this association was statistically significant (P = 0.002). The monovariate linear regression model showed that the mother's baseline heart rate was a prognostic factor that helped explain the change in the degree of hypotension in 43.4% of cases (Figure 1).

Characteristics of pregnant women with hypotension after spinal anesthesia

The results of the study showed that in 217 cases of cesarean section women with hypotension after spinal anesthesia, the number of hypotension appeared repeatedly during the operation included 1 time of 43.3% (94/217), 2 times of 23.5% (21/217), 3 times of 16.1% (35/217) and 4 times or more of 17.1% (37/217) (Table 3). Regarding the severity of hypotension, lower blood pressure from 30 to 39% baseline blood pressure accounting for the highest rate (42.4%, Figure 2). The mean time of onset of hypotension is 8.33 minutes (± 5.12) after spinal anesthesia, the earliest is 1 minute and the latest is 26 minutes after spinal anesthesia, in which the majority of women who have a cesarean section have hypotension after spinal anesthesia within the first 10 minutes of spinal anesthesia (65.4%, Figure 3).

DISCUSSION

The indicence of hypotension after spinal anesthesia in women undergoing cesarean section ranged from 7.4% to 74.1% depending on the definition of hypotension in each study[23]. According to our research, we recorded that 217 pregnant women had hypotension after spinal anesthesia, accounting for 68.03%. This rate is relatively high compared to the general rate, which can be explained by differences in the definition of hypotension, differences in geographical areas, sample characteristics, and the time when the study was conducted. Compared to other studies, our finding was lower than that reported by Saowapark Chumpathong (76.7%; Thailand) and Atousa Fakherpour (75.15%; Iran) (6,8). On the other hand, our study recorded a higher rate of hypotension after spinal anesthesia than the study by authors Pitchya Ohpasanon (65.1%; Thailand), Wanna Somboonviboon (52.6%; Thailand), F. Brenck (56.5%; Germany), Ayala Maayan-Metzger (46.5%; Israel), Khalid

Table 2: Factors associated with hypotension after spinal anesthesia in pregnant women.

	Without hypotention N=102	With hypotension N=217	OR	P-value
Mother's age	30.1 (4.46)	32.1 (5.48)	1.08 [1.03; 1.13]	0.001
Age Classification				
<35 years old	87 (37.5%)	145 (62.5%)	Ref.	Ref.
≥35 years old	15 (17.2%)	72 (82.8%)	2.85 [1.57; 5.47]	<0.001
Height	158 (5.14)	156 (5.34)	0.95 [0.91; 0.99]	0.027
Height classification				
<155 cm	22 (21.4%)	81 (78.6%)	2.15 [1.26; 3.79]	0.005
≥155 cm	80 (37.0%)	136 (63.0%)	Ref.	Ref.
Body Mass Index (BMI)				
<18.5 kg/m^2	11 (42.3%)	15 (57.7%)	Ref.	Ref.
18.5-24.9 kg/m^2	66 (33.3%)	132 (66.7%)	1.47 [0.62; 3.39]	0.374
25-29.9 kg/m^2	19 (31.7%)	41 (68.3%)	1.58 [0.60; 4.12]	0.355
≥30 kg/m^2	6 (17.1%)	29 (82.9%)	3.43 [1.07; 12.0]	0.037
Gradivity				
1	41 (44.1%)	52 (55.9%)	Ref.	Ref.
2	39 (34.2%)	75 (65.8%)	1.51 [0.86; 2.67]	0.151
≥3	22 (19.6%)	90 (80.4%)	3.20 [1.73; 6.04]	<0.001
No. of vaginal delivery				
0	88 (32.8%)	180 (67.2%)	Ref.	Ref.
1	11 (26.8%)	30 (73.2%)	1.32 [0.65; 2.89]	0.454
≥2	3 (30.0%)	7 (70.0%)	1.11 [0.29; 5.54]	0.885
No. of cesarean section				
0	62 (40.5%)	91 (59.5%)	Ref.	Ref.
1	36 (29.8%)	85 (70.2%)	1.60 [0.97; 2.68]	0.066
≥2	4 (8.9%)	41 (91.1%)	6.71 [2.53; 23.7]	<0.001
Baseline blood pressure				
<120 mmHg	25 (30.9%)	56 (69.1%)	Ref.	Ref.
≥120 mmHg	77 (32.4%)	161 (67.6%)	0.94 [0.54; 1.60]	0.812
Baseline heart rate				
<90 times/minute	57 (39.0%)	89 (61.0%)	Ref.	Ref.
≥90 times/minute	45 (26.0%)	128 (74.0%)	1.82 [1.13; 2.94]	0.014
Time from beginning SA to baby delivery (min)	23.6 (6.10)	24.7 (6.20)	1.03 [0.99; 1.08]	0.134
Fetal weight (gram)	3350 (403)	3391 (389)	1.00 [1.00; 1.00]	0.386
Macrosomia (≥3500g)				
Yes	30 (27.0%)	81 (73.0%)	Ref.	Ref.
No	72 (34.6%)	136 (65.4%)	0.70 [0.42; 1.16]	0.168

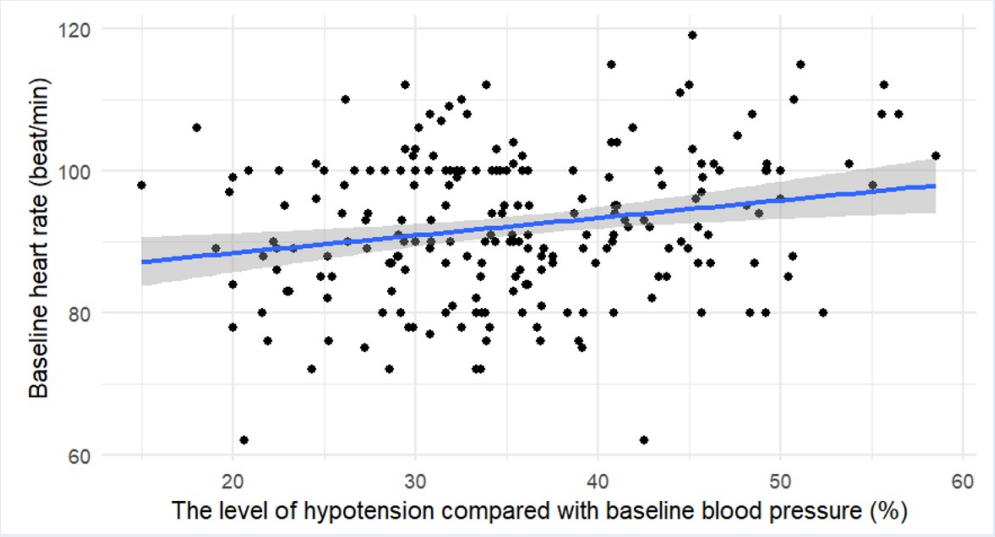

Figure 1: A linear association between maternal baseline heart rate and the degree of hypotension (N =217, R^2 = 0.434).

Table 3: Characteristics of hypotension after spinal anesthesia

	Overall (N=217)
No. of hypotension appear	
1 time	94 (43.3%)
2 times	51 (23.5%)
3 times	35 (16.1%)
4 times	37 (17.1%)
The level (%) of decrease compared to baseline BP	
≤30%	62 (28.6%)
30-39%	92 (42.4%)
≥40%	63 (29.0%)
Time from beginning SA to first hypotension (min)	
Mean (SD)	8.30 (5.12)
Median [Min, Max]	7.00 [1.00, 26.0]
Time distribution from beginning SA to first hypotension (%)	
<10 minutes	142 (65.4%)
10-19 minutes	68 (31.3%)
≥20 minutes	7 (3.2%)

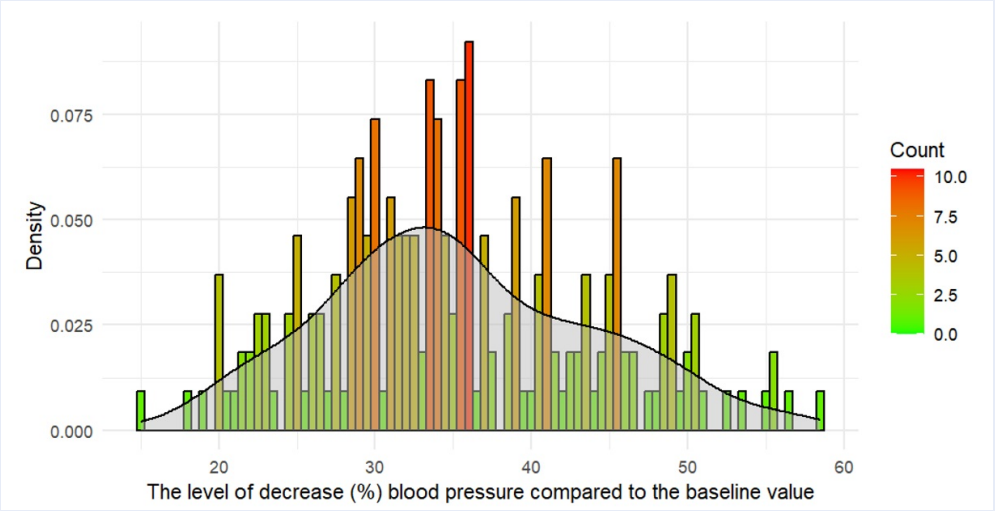

Figure 2: Distribution of the number of pregnant women by the severity of hypotension.

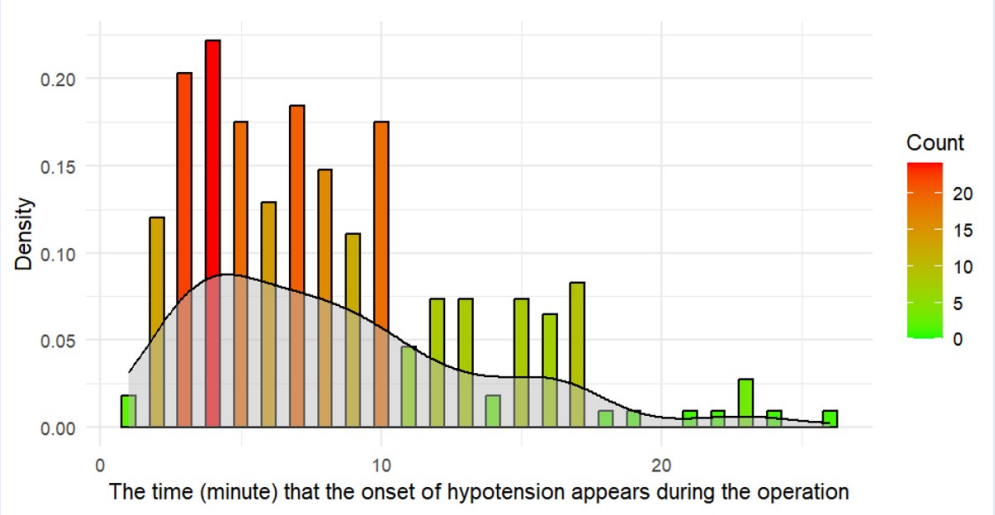

Figure 3: Distribution of the number of pregnant women by the mean time of onset of hypotension.

Maudood Siddiqui (41.67%; Pakistan) and SF Zwane (32.8%; South Africa) [9,20,24–27]. This difference can be explained by the fact that the other authors use a different definition of hypotension, Wanna Somboonviboon and Ayala Maayan-Metzger define hypotension as blood pressure dropping $\geq$ 30% from baseline blood pressure, while F. Brenck, Khalid Maudood Siddiqui and SF Zwane defines hypotension when mean blood pressure decreases > 20% compared to baseline blood pressure or systolic blood pressure < 90 mmHg.

The mean age of women who received a cesarean section with spinal anesthesia was 31.4 $\pm$ 5.26 in our study, which is roughly similar to the study by authors Pitchya Ohpasanon (30.1 $\pm$ 6.0), Saowapark Chumpathong (29.7 $\pm$ 5.7), and lower than the mean age of the women in the Ayala Maayan-Metzger study (34.3 $\pm$ 5) (8,24,25). The proportion of women $\geq$ 35 years of age who had a cesarean section with hypotension after spinal anesthesia in our study was 82.8%, significantly higher than that of women <35 years of age with hypotension (62.5%). This percentage is in line with the research of Saowapark Chumpathong (83.2% vs. 74.9%), Pitchya Ohpasanon (71.8% vs. 62.8%) and F. Brenck (64.4% vs. 52.6%) (8,20,24). The proportion of women $\geq$ 35 years of age who had

a cesarean section with hypotension after spinal anesthesia in our study was 82.8%, significantly higher than that of women <35 years of age with hypotension (62.5%). This ratio is in line with the research of the authors Saowapark Chumpathong (83.2% vs. 74.9%), Pitchya Ohpasanon (71.8% vs. 62.8%), F. Brenck (64.4% vs. 52.6%), Atousa Fakherpour (81.9% vs. 72.9%) (6,8,20,24). This finding is consistent with previous research that has highlighted the association between advanced maternal age and increased susceptibility to hypotension during spinal anesthesia. As women age, several physiological changes occur that can contribute to an increased risk of hypotension. These changes include a reduction in cardiac output and alterations in the autonomic nervous system, particularly in the sympathetic and parasympathetic balance. The sympathetic nervous system, which is crucial for maintaining vascular tone and blood pressure, may become less responsive with age. This decreased responsiveness can result in a higher likelihood of significant drops in blood pressure following the administration of spinal anesthesia [5,6,28]. The clinical implications of these findings are significant. Anesthesiologists must be particularly cautious when managing older pregnant women undergoing cesarean sections. Preoperative assessments should thoroughly evaluate cardiovascular health, and appropriate prophylactic measures should be implemented to mitigate the risk of hypotension. These measures might include preoperative fluid loading, the use of vasopressors, and careful monitoring of blood pressure throughout the procedure.

In most studies, a woman's height was usually not associated with the rate of hypotension during spinal anesthesia. However, the study by Saowapark Chumpathong et al. showed that the rate of hypotension in the group of women with a height of <155 cm was 81.2% higher than that of the group ≥155 cm was 75%, and this difference was statistically significant with p=0.008 [8]. Our study supports this difference, which shows that the incidence of hypotension in women < 155cm (78.6%) is significantly higher than in the group of ≥155cm (63%) with p=0.005. The increased risk of hypotension in shorter women can be attributed to several physiological factors. One primary reason is the dosage adjustment of anesthesia based on the patient's height. Anesthetic dosages are typically calculated to ensure adequate spread within the subarachnoid space, and shorter women may receive relatively higher concentrations of the drug per unit of spinal column length. This can lead to more extensive sympathetic blockade, resulting in greater vasodilation and a subsequent drop in blood pressure. A recent study conducted at Gandhi Memorial Hospital in Addis Ababa, Ethiopia, highlighted similar trends. The study found that maternal height was a significant factor, with shorter women showing a higher propensity for hypotension post-spinal anesthesia. This study further supports the need for height-adjusted anesthetic protocols to mitigate the risk in shorter women [29]. Further research is needed to establish standardized guidelines for height-based dosage adjustments in spinal anesthesia. Larger, multicenter studies can provide more robust data to refine these protocols and ensure better outcomes for shorter pregnant women undergoing cesarean sections.

We noticed that the rate of hypotension gradually increased as the mother's body mass index increased. Women with a BMI of 25-29.9 kg/m2 and BMI of ≥30 kg/m^2, the rate of hypotension is up to 68.3% and 82.9%, respectively. The upward trend of our study was similarly reported in the study of Pitchya Ohpasanon et al. (2008), the rate of hypotension among women with a BMI of <35 kg/m^2 was 64.0%, increasing to 81.3% in the other group [24]. In a study by F. Brenck et al. (2009), 51.5% of women with a BMI of <29 kg/m^2 were hypotensive, this rate increased to 62.3% in the BMI group ≥29 kg/m^2 [20]. As for the study by Atousa Fakherpour et al. (2018), while the group of women with a BMI of 18.5-24.9 kg/m^2 had a hypotensive rate of 91.6%, this rate increased to 94.7% in the group with a BMI of 25-29.9 kg/m^2 up to 96.2% in the other group [6]. Another study highlighted that morbidly obese women (BMI ≥40 kg/m^2) are particularly vulnerable to anesthesia complications, including hypotension, due to the pronounced physiological changes associated with obesity [29]. One explanation is that because the activity of the sympathetic nervous system in women with a high BMI is higher than in women with a low BMI, when these nerves are affected by anesthetics, it leads to a decrease in blood pressure. Practical evidence is that obese women have higher 24-hour blood pressure than normal or underweight women. Another explanation is because there is a link between the spread of bupivacaine anesthetic in the spine and BMI. A high BMI increases abdominal pressure with compression of the subarachnoid cavity and decreases the amount of cerebrospinal fluid, resulting in the spread of more bupivacaine towards the head.

In our study, the proportion of women who had a cesarean section with hypotension after spinal anesthesia increased with the number of pregnancies. While in the group of pregnant women who were pregnant 1

time and 2 times, the rates were 55.9% and 65.8%, respectively, this rate was much higher than the group of pregnant women who were pregnant 3 times or more (80.4%). Similar to the report of Atousa Fakherpour et al. (2018), the rate of hypotension in pregnant women with 1 and 2 pregnancies was 64.89% and 66.49%, respectively, and this rate was significantly higher in 2 groups of women with 3 pregnancies and 4 or more pregnancies (84.07% and 89.38%)[6]. Multiple pregnancies lead to changes in vascular tone and autonomic regulation, making women more susceptible to hypotension. With each pregnancy, the body's cardiovascular system undergoes significant adaptations to accommodate increased blood volume and cardiac output. These changes can result in decreased vascular resistance and altered baroreceptor sensitivity, contributing to a higher likelihood of hypotension during spinal anesthesia. According to a study by Toyama and colleagues, there is a decrease in peripheral vascular tone in women who are pregnant multiple times[30].

The incidence of post-spinal anesthesia hypotension in women undergoing cesarean section in our study increased with the number of previous cesarean deliveries, 59.5% in the group of women who had never had a cesarean section, 70.2% in the group of women who had a single cesarean section, and 91.1% in women who had 2 or more caesarean sections (p<0.001). Similar to the study of Atousa Fakherpour et al. (2018), the rate of hypotension in the group of women who have never had a cesarean section and have had one previous cesarean section is 73.86% and 73.28%, respectively, and this rate is high in the group of women who have had 2 or more cesarean sections (81.08%), however, this difference is not statistically significant (P >0.05)[6]. We hypothesize that the repeated surgical intervention and associated anesthesia exposure can lead to alterations in the autonomic nervous system and vascular reactivity. Scar tissue from previous surgeries may also impact the spread of anesthetic agents, leading to unpredictable hemodynamic responses. Anesthesiologists should be particularly vigilant when managing women with multiple cesarean sections. Strategies to mitigate the risk include careful preoperative assessment, tailored anesthetic dosing, and proactive measures to maintain blood pressure stability.

Our study reported that the rate of post-spinal anesthesia hypotension in women with a baseline heart rate of <90 beats per minute was 61.0% lower than that in the group of women with a baseline heart rate of ≥90 beats per minute (74.0%), and this difference was statistically significant (p=0.014). Studies have consistently shown a correlation between higher baseline heart rates and increased incidence of hypotension during spinal anesthesia[29]. Atousa Fakherpour et al. (2018) reported that a heart rate of >100 beats/minute increased the risk of severe hypotension (>30% lower systolic blood pressure value) with a relative risk ratio of 5.1 (p = 0.02)[6]. A higher baseline heart rate is often indicative of increased sympathetic nervous system activity, which can be a response to anxiety, stress, or underlying medical conditions. When spinal anesthesia is administered, it causes a sympathetic blockade, leading to vasodilation and a drop in blood pressure. In individuals with higher baseline heart rates, the sudden removal of sympathetic tone can result in more pronounced hypotension. We hypothesize that the woman's anxiety before surgery leads to an increase in the basal heart rate, which reduces the time it takes to fill the diastolic diastolic, which reduces the load and increases the risk of hypotension after spinal anesthesia.

Limitations and future research directions

This study only conducted in one hospital, so the results found are not representative of the entire population of pregnant women, because human resources are limited, so it is not possible to conduct research in the community on multi-hospitals. There are many factors that we have not yet investigated, so we have not been able to comprehensively assess the exact rates as well as related issues. In the future, we will conduct similar research on a larger scale and survey many other factors to increase the representativeness of the population sample.

CONCLUSIONS

We recognise the importance of predicting and preventing the risk of cesarean hypotension in women who undergo cesarean section with spinal anesthesia. Therefore, anesthesiologists need to pay special attention to high-risk subjects, including women ≥ 35 years old, <155 cm in height, have been pregnant three or more, have a history of at least two cesarean sections, and have a baseline heart rate of ≥ 90 beats per minute. We recommend that on these high-risk subjects, it is necessary to coordinate many prophylactic methods for pregnant women before performing spinal anesthesia. For pregnant women with baseline systolic blood pressure <120 mmHg, fluid infusion should be given before spinal anesthesia. For pregnant women with a baseline heart rate of ≥90

beats/minute, the multidisplinary team includes obstetrician, anesthesiologist, midwives, nurses, neonatologists, and other specialists should join a hand to reduce preoperative stress for pregnant women. Calculating the precise anesthetic dosage according to the weight and height of each woman, especially those with a height of <155 cm and closely monitoring and detecting the time of hypotension early for timely treatment. In addition, we propose further studies to prove the association between baseline systolic blood pressure, maternal body mass index (BMI) and pregnancy outcomes and the rate of post-spinal anesthesia hypotension in women undergoing cesarean section.

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LIST OF ABBREVIATIONS

BMI : body mass index
BP : blood pressure
CS : cesarean section
SA : spinal anesthesia
OR : odd ratio
CI : confidence interval

COMPETING INTERESTS

The author(s) declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

The research team would like to acknowledge the contributions of the authors including Nguyen Dinh Thuong who is mainly responsible for the entire research from conceptuation, research design, data analysis, writing manuscript and journal submission. Nguyen Thi Tuyet Mai, Chu Nguyen Nhat Minh, Nguyen Thanh Minh, Do Thi Lan Vy collected data and participated in writing the manuscript. Le Trung Quoc Thanh assisted in conceptualizing and correcting the final draft.

REFERENCES

1. Boerma T, Ronsmans C, Melesse DY, Barros AJD, Barros FC, Juan L, et al. Global epidemiology of use of and disparities in caesarean sections. The Lancet. 2018 Oct 13;392(10155):1341–8;Available from: https://doi.org/10.1016/s0140-6736(18)31928-7.
2. Aksoy M, Aksoy AN, Dostbil A, Çelik MG, Ahıskalıoğlu A. Anaesthesia Techniques for Caesarean Operations: Retrospective Analysis of Last Decade. Turk J Anaesthesiol Reanim. 2014 Jun;42(3):128–32;Available from: https://doi.org/10.5152/tjar.2014.80774.
3. Lee JE, George RB, Habib AS. Spinal-induced hypotension: Incidence, mechanisms, prophylaxis, and management: Summarizing 20 years of research. Best Pract Res Clin Anaesthesiol. 2017 Mar;31(1):57–68;Available from: https://doi.org/10.1016/j.bpa.2017.01.001.
4. Lee A, Ngan Kee W. Effects of Vasoactive Medications and Maternal Positioning During Cesarean Delivery on Maternal Hemodynamics and Neonatal Acid-Base Status. Clin Perinatol. 2019;46(4):765–83;Available from: https://doi.org/10.1016/j.clp.2019.08.009.
5. Wüst HJ, Stanton-Hicks M d'Arcy, editors. New Aspects in Regional Anesthesia 4 [Internet]. Berlin, Heidelberg: Springer Berlin Heidelberg; 1986 [cited 2020 Nov 18];Available from: https://doi.org/10.1007/978-3-642-70807-7.
6. Fakherpour A, Ghaem H, Fattahi Z, Zaree S. Maternal and anaesthesia-related risk factors and incidence of spinal anaesthesia-induced hypotension in elective caesarean section: A multinomial logistic regression. Indian J Anaesth. 2018;62(1):36;Available from: https://doi.org/10.4103/ija.ija_416_17.
7. Nani FS, Torres MLA. Correlation between the body mass index (BMI) of pregnant women and the development of hypotension after spinal anesthesia for cesarean section. Rev Bras Anestesiol. 2011 Feb;61(1):21–30;Available from: https://doi.org/10.1016/s0034-7094(11)70003-4.
8. Chumpathong S, Chinachoti T, Visalyaputra S, Himmunngan T. Incidence and risk factors of hypotension during spinal anesthesia for cesarean section at Siriraj Hospital. J Med Assoc Thail Chotmaihet Thangphaet. 2006 Aug;89(8):1127–32;.
9. Wanna Somboonviboon, Oranuch Kyokong, Somrat Charuluxananan, Arunchai Narasethakamol. Incidence and risk factors of hypotension and bradycardia after spinal anesthesia for cesarean section. J Med Assoc Thail Chotmaihet Thangphaet. 2008 Feb;91(2):181–7;Available from: https://doi.org/10.1213/01.ane.0000066015.21364.7d.
10. Yu C, Gu J, Liao Z, Feng S. Prediction of spinal anesthesia-induced hypotension during elective cesarean section: a systematic review of prospective observational studies. Int J Obstet Anesth. 2021 Aug;47:103175;Available from: https://doi.org/10.1016/j.ijoa.2021.103175.
11. Mavridou I, Stewart A, Fernando R. Maternal Hypotension During Spinal Anesthesia for Cesarean Delivery. Curr Anesthesiol Rep. 2013 Dec 1;3(4):282–91;Available from: https://doi.org/10.1007/s40140-013-0036-3.
12. Ngan Kee WD. Prevention of maternal hypotension after regional anaesthesia for caesarean section. Curr Opin Anaesthesiol. 2010 Jun;23(3):304–9;Available from: https://doi.org/10.1097/aco.0b013e328337ffc6.
13. Chooi C, Cox JJ, Lumb RS, Middleton P, Chemali M, Emmett RS, et al. Techniques for preventing hypotension during spinal anaesthesia for caesarean section. Cochrane Database Syst Rev [Internet]. 2020 [cited 2020 Nov 16];(7);Available from: https://doi.org/10.1002/14651858.cd002251.pub4.
14. Xue X, Lv X, Ma X, Zhou Y, Yu N, Yang Z. Prevention of spinal hypotension during cesarean section: A systematic review and Bayesian network meta-analysis based on ephedrine, phenylephrine, and norepinephrine. J Obstet Gynaecol Res. 2023 Jul;49(7):1651–62;Available from: https://doi.org/10.1111/jog.15671.
15. Sr N. Evidence-Based Prevention Strategies for the Management of Spinal Anesthesia-Induced Hypotension in Healthy Parturients Undergoing Elective Cesarean Delivery. AANA J [Internet]. 2022 Aug [cited 2024 Aug 7];90(4);Available from: https://pubmed.ncbi.nlm.nih.gov/35943759/.
16. Hội Gây mê hồi sức Việt Nam (VSA). Hướng dẫn thực hành gây tê tủy sống mổ lấy thai. [Internet]. 2020 [cited 2020 Nov

17];Available from: http://vnanesth.org/tai-lieu-cap-nhat/huong-dan-thuc-hanh-gay-te-tuy-song-mo-lay-thai-d97.html.
17. Orbach-Zinger S, Ginosar Y, Elliston J, Fadon C, Abu-Lil M, Raz A, et al. Influence of preoperative anxiety on hypotension after spinal anaesthesia in women undergoing Caesarean delivery. Br J Anaesth. 2012 Dec;109(6):943–9;Available from: https://doi.org/10.1093/bja/aes313.
18. Ousley R, Egan C, Dowling K, Cyna AM. Assessment of block height for satisfactory spinal anaesthesia for caesarean section: Block height for satisfactory spinal anaesthesia for caesarean section. Anaesthesia. 2012 Dec;67(12):1356–63;Available from: https://doi.org/10.1111/anae.12034.
19. Kim HY, Lee MJ, Kim MN, Kim JS, Lee WS, Lee KC. Effect of position changes after spinal anesthesia with low-dose bupivacaine in elderly patients: sensory block characteristics and hemodynamic changes. Korean J Anesthesiol. 2013 Mar;64(3):234–9;Available from: https://doi.org/10.4097/kjae.2013.64.3.234.
20. Brenck F, Hartmann B, Katzer C, Obaid R, Brüggmann D, Benson M, et al. Hypotension after spinal anesthesia for cesarean section: identification of risk factors using an anesthesia information management system. J Clin Monit Comput. 2009 Apr;23(2):85–92;Available from: https://doi.org/10.1007/s10877-009-9168-x.
21. Pirenne V, Dewinter G, Van de Velde M. Spinal anaesthesia in obstetrics. Best Pract Res Clin Anaesthesiol. 2023 Jun;37(2):101–8;Available from: https://doi.org/10.1016/j.bpa.2023.03.006.
22. Kee WDN, Khaw KS, Ng FF. Prevention of Hypotension during Spinal Anesthesia for Cesarean Delivery: An Effective Technique Using Combination Phenylephrine Infusion and Crystalloid Cohydration. Anesthesiology. 2005 Oct 1;103(4):744–50;Available from: https://doi.org/10.1097/00000542-200510000-00012.
23. Klöhr S, Roth R, Hofmann T, Rossaint R, Heesen M. Definitions of hypotension after spinal anaesthesia for caesarean section: literature search and application to parturients. Acta Anaesthesiol Scand. 2010 Sep;54(8):909–21;Available from: https://doi.org/10.1111/j.1399-6576.2010.02239.x.
24. Ohpasanon P, Chinachoti T, Sriswasdi P, Srichu S. Prospective study of hypotension after spinal anesthesia for cesarean section at Siriraj Hospital: incidence and risk factors, Part 2. J Med Assoc Thail Chotmaihet Thangphaet. 2008 May;91(5):675–80;.
25. Maayan-Metzger A, Schushan-Eisen I, Todris L, Etchin A, Kuint J. Maternal hypotension during elective cesarean section and short-term neonatal outcome. Am J Obstet Gynecol. 2010 Jan;202(1):56.e1-56.e5;.
26. Siddiqui KM, Ali MA, Ullah H. Comparison of spinal anesthesia dosage based on height and weight versus height alone in patients undergoing elective cesarean section. Korean J Anesthesiol. 2016 Apr;69(2):143–8;.
27. Zwane S, Bishop D, Rodseth R. Hypotension during spinal anaesthesia for Caesarean section in a resource-limited setting: towards a consensus definition. South Afr J Anaesth Analg. 2019 Jan 2;25(1):1–5;.
28. Bloom SL, Spong CY, Weiner SJ, Landon MB, Rouse DJ, Varner MW, et al. Complications of anesthesia for cesarean delivery. Obstet Gynecol. 2005 Aug;106(2):281–7;Available from: https://doi.org/10.1097/01.aog.0000171105.39219.55.
29. Shitemaw T, Jemal B, Mamo T, Akalu L. Incidence and associated factors for hypotension after spinal anesthesia during cesarean section at Gandhi Memorial Hospital Addis Ababa, Ethiopia. PloS One. 2020;15(8):e0236755;Available from: https://doi.org/10.1371/journal.pone.0236755.
30. Toyama S. Hypotension during spinal anaesthesia for caesarean section. Anaesthesia. 2015 Oct;70(10):1208–9;Available from: https://doi.org/10.1111/anae.13202.

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Bài nghiên cứu

Tỷ lệ hạ huyết áp sau gây tê tủy sống và các yếu tố liên quan ở sản phụ được mổ lấy thai tại bệnh viện Từ Dũ

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TÓM TẮT

Giới thiệu chung: Nghiên cứu của chúng tôi nhằm mục tiêu xác định tỷ lệ mắc mới của hạ huyết áp trong quá trình phẫu thuật ở những sản phụ được gây tê tủy sống để mổ lấy thai và xác định các yếu tố liên quan từ mẹ, từ thai nhi và từ cuộc phẫu thuật.

Phương pháp nghiên cứu: Nghiên cứu đoàn hệ tiến cứu trên 319 sản phụ trong thời gian từ tháng 01/2022 đến hết tháng 03/2022 tại Khoa Gây mê hồi sức, bệnh viện Từ Dũ. Dữ liệu thu thập sau khi được sự đồng thuận từ người bệnh, sau đó được phân tích bằng phần mềm R (phiên bản 4.4.1). Phân tích hồi quy logistic đa biến để xác định các yếu tố liên quan và giá trị P<0.05 được xem là có ý nghĩa thống kê.

Kết quả: Tỷ lệ hạ huyết áp sau gây tê tủy sống để mổ lấy thai là 68,03%, khoảng 2/3 trường hợp (142/217) có hạ huyết áp ngay trong 10 phút đầu kể từ thời điểm tiêm thuốc tê tủy sống, có 63/217 (29%) hạ huyết áp nặng (định nghĩa khi huyết áp hạ từ 40% trở lên so với giá trị huyết áp nền trước khi gây tê tủy sống). Các 06 yếu tố liên quan với tỷ lệ hạ huyết áp sau gây tê tủy sống, bao gồm: tuổi mẹ ≥35 (OR 2,85 ; KTC 95%: 1,57-5,47), chiều cao mẹ <155 cm (OR 2,15 ; KTC 95%: 1,26-3,79), số lần mang thai ≥3 (OR 3,20 ; KTC 95%: 1,73-6,04), tiền căn mổ lấy thai ≥2 (OR 6,71 ; KTC 95%: 2.53-23.7), thừa cân (OR 3,43 ; KTC 95%: 1,07-12,0) và giá trị huyết áp nền ≥90 lần/phút (OR 1,82 ; KTC 95%: 1,13-2,94).

Kết luận: Tỷ lệ hạ huyết áp sau gây tê tủy sống để mổ lấy thai khá cao, do đó ekip phẫu thuật cần có sự chuẩn bị toàn diện trước mỗi ca phẫu thuật để hạn chế những tác động xấu của hạ huyết áp lên bà mẹ và trẻ sơ sinh.

Từ khoá: mổ lấy thai, hạ huyết áp, gây tê tủy sống, mang thai

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