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Spinocan 27G with Trendelenburg 15º Position Post Induction Anesthesia Can Reduce the Incidence of Hypotension in Subarachnoid Block Anesthesia

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ABSTRACT

The surgery requires anesthesia, one of which uses the subarachnoid block anesthesia technique. Hypotension is a complication of subarachnoid block anesthesia which ranks highest in 70,7% of 82 respondents in one study. The prevalence of hypotension was reported in the last five years with different result each year starting 32,69%-76,9%. Hypotension can lead to reduces conditions consciousness, pulmonary aspiration, hypoventilation, tissue hypoxia and even death. This study to determine the comparison of the use of spinocan size and post anesthesia induction position on the incidence of hypotension in patients with subarachnoid block at RSUD Bendan Kota Pekalongan. Analytical observation with cross sectional design. The research was conducted in February - March 2024 with samples were 148 respondents with sampling using consecutive sampling technique based on inclusion and exclusion criteria. Anesthesia used spinocan size 27G and 25G, blood pressure was measured by bedside monitor. Data were analyzed using the Mann Whitney statistical test. The result showed that 84/144 respondents (56.8%) experienced hypotension. Data normality test showed that the data not normally distributed. The result of statistic test were obtained with p value 0.028 in the supine and trendelenburg groups with spinocan 27G. The statistical test results were p value 0.010 in in the supine and trendelenburg 15º groups with spinocan 25G. Obtained statistical test results p value 0.000 between the spinocan 27G and spinocan 25G groups in the incidence of hypotension. The Conclusion of the study, the size of the spinocan 27G and trendelenburg 15º position group significantly reduced the incidence of hypotension compared to the spinocan 25G and supine position group.

Keywords: *Hypotension; Spinocan size; Subarachnoid block; Supine; Trendelenburg 15º*

ABSTRAK

Tindakan operasi memerlukan pembiusan, salah satunya menggunakan teknik anestesi *subarachnoid block.* Hipotensi merupakan komplikasi anestesi *subarachnoid block* yang menempati urutan tertinggi sebanyak 70,7% dari 82 responden dalam sebuah penelitian. Prevalensi kejadian hipotensi dilaporkan dalam lima tahun terkahir dengan hasil yang berbeda tiap tahunnya mulai 32,69%-76,9%. Hipotensi dapat mengakibatkan kondisi penurunan kesadaran, aspirasi pulmonal, hipoventilasi, hipoksia jaringan hingga kematian. Penelitian ini untuk membandingkan penggunaan ukuran *spinocan* dan posisi *post* induksi anestesi terhadap kejadian hipotensi pada pasien dengan *Subarachnoid Block* di RSUD Bendan Kota Pekalongan. Observasi analitik dengan *cross sectional design.* Penelitian dilakukan pada Februari-Maret 2024 dengan sampel sebanyak 148 responden menggunakan teknik *consecutive sampling* berdasarkan kriteria inklusi dan eksklusi. Pembiusan menggunakan *spinocan* ukuran 27G dan 25G, tekanan darah diukur menggunakan *Bedside Monitor*. Data dianalisis menggunakan uji statistik *Mann Whitney*. Hasil Penelitian Menunjukkan 84/148 responden (56.8%) mengalami hipotensi. Uji normalitas data didapatkan data berdistribusi tidak normal. Didapatkan hasil uji statistik dengan *p value* 0.028 pada kelompok *supine* dan *trendelenburg* dengan spinocan 27G. Hasil uji statistik *p value* 0.010 pada kelompok *supine* dan *trendelenburg* dengan spinocan 25G. Didapatkan hasil uji statistik *p value* 0.000 antara kelompok spinocan 27G dan *spinocan* 25G terhadap kejadian hipotensi. Kesimpulan penelitian ukuran *spinocan* ukuran 27G dan kelompok posisi *trendelenburg 15*° secara signifikan menekan angka kejadian hipotensi dibandingkan dengan *spinocan* ukuran 25G dan kelompok posisi *supine.*

Kata Kunci: Hipotensi; *Subarachnoid Block, Supine, Trendelenburg 15*°, Ukuran *Spinocan*.

INTRODUCTION

The operation requires anesthesia, one of which uses the subarachnoid block anesthesia technique. Surgery using the subarachnoid block anesthesia procedure also has side effects such as nausea, vomiting, bradycardia, arrhythmia, shivering, post dural puncture headache and hypotension (Puspitasari, 2019). Hypotension is a complication of subarachnoid block anesthesia which ranks highest at 70.7% of 82 respondents (Kusumastuti, 2021).

Data on patients who underwent surgical procedures with subarachnoid block anesthesia and experienced hypotension are reported with different results each year. Puspitasari's research (2019) showed that 56.26% experienced hypotension. According to Yuniar and Mutia (2020), the prevalence of hypotension is 42-63%. Pratiwi noted that 73.3% of respondents experienced hypotension (Pratiwi et al., 2021). In Subhan's research, 76.9% of respondents experienced hypotension post induction of subarachnoid block anesthesia (Subhan, 2022).

This indicates that hypotension resulting from subarachnoid block anesthesia techniques still occurs frequently. These inconsistent results may be caused by differences in characteristics that can

influence the decrease in blood pressure after induction of subarachnoid block anesthesia. The incidence of hypotension in patients with subarachnoid block anesthesia is influenced by several factors such as duration of fasting, BMI, prehydration fluids, puncture location, duration of surgery, length of puncture, age, anesthetic agents/drugs, use of vasopressors, surgical manipulation and patient position (Puspitasari, 2019).

Hypotension, if not treated properly, can result in decreased consciousness, pulmonary aspiration, hypoventilation and tissue hypoxia. Severe hypotension can cause cardiac arrest which represents a serious complication of subarachnoid block anesthesia (Chusnah et al., 2021).

Several studies have looked at the scale of pain and the incidence of post dural puncture headache, but there has been no research regarding the incidence of hypotension caused by choosing the size of the spinocan. The use of spinocan sizes 27G, 26G and 25G at RSUD Bendan Kota Pekalongan is still used because it has a very good success rate for subarachnoid block anesthesia. Description of the incidence of hypotension post induction of subarachnoid block anesthesia at RSUD Bendan Kota Pekalongan, reaching 75% in September 2023 with an average number ofpatients of 155 patients per month.

The aim of this study was to determine the comparison of the use of spinocan size and post-anesthesia induction position on the incidence of hypotension in patients with subarachnoid block at Bendan Hospital, Pekalongan City. The use of appropriate spinocan size and position post induction of anesthesia can increase the incidence of hypotension during subarachnoid block anesthesia.

METHOD

This research is an observational analytical study using quantitative methods with cross-sectional design. The population in this study were all patients who underwent anesthesia with Subarachnoid Block at IBS RSUD Bendan Kota Pekalongan. The sample was determined using consecutive sampling technique, each group consisted of 37 respondents (a total of 148 respondents) based on the criteria (1) elective or emergency with ASA I – ASA III, (2) aged ≥17 years, (3) Spinocan puncture a maximum of three times (4) patients cooperative and able to communicate.

The research was carried out from the 3rd week of February to the 3rd week of March 2024. The instruments used were bedside

monitors and observation sheets used to collect research blood pressure data. The components contained in the observation sheet are: characteristics of the respondent regarding the characteristics of the respondent, pre-induction assessment consisting of type of operation, anesthetic agent, spinocan size, and pre-induction blood pressure (baseline), then post induction of anesthesia assessment consisting of patient position and pressure measurement blood post induction of anesthesia.

The way this study works, subjects who meet the criteria to participate in the study undergo surgical preparation procedures, and non-invasive blood pressure measurements are taken before and during anesthesia. All subarachnoid block anesthesia procedures are performed by a senior anesthetist using a Quincke type spinocan. Spinocan 27G in group I and group II; and Spinocan 25G in group III and group IV which was performed in the L3- L4 interspace area in a sitting position. Bupivacaine heavy 0.5% is injected approximately 12 seconds with one barbotage. After the spinocan needle is removed, the blood pressure is measured again.

Supine position is given to group I and group III. Meanwhile, the Trendelenburg 15° position was given to group II and group IV, held for 3 minutes then returned to the supine position. Observe changes in blood pressure from baseline, 1st minute, 3rd minute, 6th minute, 9th minute and 12th minute post induction of anesthesia which are recorded in the observation sheet. Hypotension criteria are determined if the systolic blood pressure was adecrease ≥30 mmHg from the pre- induction blood pressure (baseline).

The data analysis process in this study in four groups began with a normality test using the Kolmogrov-Smirnov normality test. The results of the normality test using spinocan size and position post induction of anesthesia with the incidence of hypotension were abnormally distributed, the results show p value = 0.000. So, the data analysis used was non-parametric statistical test, namely using the Man Whitney test with a confidence level of 95% or a significance level of $p<0.05$. Research ethical suitability test at KEPK Poltekkes Kemenkes Yogyakarta with ethical suitability letter No.DP.04.03/e-KEPK.1/157/2024.

RESULT

Univariate Analysis

1. Systolic Blood Pressure (SBP)

   Based on the table 1, it shows that the pre- induction systolic blood pressure

(baseline) of respondents who were given spinocan 27G with supine position, spinocan 27G in the trendelenburg 15° position, and spinocan 25G with supine position was mostly 120-139 mmHg which was included in the pre-hypertension category. Meanwhile, the majority of the pre-induction SBP in respondents who were given spinocan 25G with trendelenburg 15° position, were in the hypertension category.

Table 1. Systolic Blood Pressure (Baseline) in Respondents with Subarachnoid Block Anesthesia at RSUD Bendan Kota Pekalongan in 2024 (n=148)

Groups / Initial SBP	Spinocan 27G with Supine Position		Spinocan 27G with Trendelenburg Position		Spinocan 25G with Supine Position		Spinocan 25G with Trendelenburg Position	
	f	(%)	*F*	(%)	*f*	(%)	*f*	(%)
<90 mmHg	0	0	0	0	0	0	0	0
90-119 mmHg	4	10.8	4	10.8	2	5.4	3	8.1
120-139 mmHg	19	51.4	14	37.8	10	27.1	7	18.9
140-159 mmHg	6	16.2	10	27.1	8	21.6	5	13.5
160-179 mmHg	5	13.5	6	16.2	8	21.6	10	27.1
>180 mmHg	3	8.1	3	8.1	9	24.3	12	32.4

Source: Primary Data for February-March 2024

Table 2. Decrease of Systolic Blood Pressure in Respondents with Subarachnoid Block Anesthesia at RSUD Bendan Kota Pekalongan in 2024 (n=148)

Groups / Decrease in SBP	Spinocan 27G with Supine Position		Spinocan 27G with Trendelenburg Position		Spinocan 25G with Supine Position		Spinocan 25G with Trendelenburg Position	
	F	(%)	*F*	(%)	*f*	(%)	*f*	(%)
No decline	0	0	0	0	0	0	0	0
Decrease of 1-10 mmHg	0	0	8	21.6	0	0	0	0
Decrease of 11-20 mmHg	7	18.9	19	51.4	0	0	2	5.4
Decrease of 21-30 mmHg	13	35.2	2	5.4	3	8.1	10	27
Decrease of 31-40 mmHg	15	40.5	8	21.6	9	24.3	5	13.5
Decrease of 41-50 mmHg	1	2.7	0	0	9	13.5	4	10.8
Decrease ≥51 mmHg	1	2.7	0	0	16	43.3	16	43.3

Source: Primary Data for February-March 2024

Based on the table 2, it was found that all groups experienced a decrease in systolic blood pressure after induction of anesthesia. The difference between before and after subarachnoid block anesthesia experienced a decrease in blood pressure varied in each group. Recording the difference in the systolic blood pressure of pre-induction (baseline) and post induction of anesthesia to determine whether the respondent experienced a decrease of ≤30 mmHg (not hypotensive) or >30mmHg (hypotension).

2. Incidence of Hypotension in Subarachnoid Block Anesthesia

Table 3. Frequency Distribution of the Incidence of Hypotension at RSUD Bendan Kota Pekalongan in 2024 (n=148)

Respondent Groups	Incidence of Hypotension				Total	
	Not Hypotension		Hypotension			
	F	(%)	*f*	(%)	*f*	(%)
Spinocan 27G with Supine Position	20	54	17	46	37	100
Spinocan 27G Trendelenburg Position	29	78.4	8	21.6	37	100
Spinocan 25G with Supine Position	3	8.1	34	91.9	37	100
Spinocan 25G Trendelenburg Position	12	32.4	25	67.6	37	100
Total	64	43.2	84	56.8	148	100

Source: Primary Data for February-March 2024

Table 3 shows that the majority of respondents to subarachnoid block anesthesia at RSUD Bendan Kota Pekalongan experienced hypotension post induction of anesthesia. Respondents who were given spinocan 27G with supine position experienced hypotension as many as 17 respondents (46%). Meanwhile, 8 respondents who were given spinocan 27G with trendelenburg 15° position experienced hypotension (21.6%).

The majority of hypotension incidents were found in respondents who were given spinocan 25G with supine position was 34 respondents (91.9%), while 25 respondents (67.6%) who were given spinocan 25G trendelenburg 15° position experienced hypotension.

Bivariate Analysis

Referring to the research objectives, to determine whether there is a difference in the use of spinocan size and post-anesthesia induction position on the incidence of hypotension in patients with subarachnoid block, the Mann Whitney test was used.

Based on table 4, the results show that the incidence of hypotension in respondents who were given spinocan 27G with trendelenburg 15° position was less than half. The incidence of hypotension was higher in the group of respondents who were given spinocan 27G with supine position compared to the group of respondents who were given spinocan 27G with trendelenburg 15° position. The results of the analysis using the Man Whitney statistical test showed that the p value = 0.028 (0.028<0.05). There is a

significant difference in the incidence of hypotension after induction of subarachnoid block anesthesia with 27G spinocan with supine position and trendelenburg 15° position.

Meanwhile, in table 5 it can be seen that the majority of respondents who were given spinocan 25G with supine position and respondents who were given spinocan 25G with trendelenburg 15° position experienced hypotension. The results of the analysis using the Man Whitney statistical test showed that the p value = 0.010 (0.010<0.05). There is a significant difference in the incidence of hypotension after induction of subarachnoid block anesthesia with spinocan 25G in the supine position and trendelenburg 15° position.

Based on table 6, the results showed that the incidence of hypotension was quite high in respondents who were given spinocan 25G as many as 59/74 respondents (79.7%). Meanwhile, 25/74 respondents (33.8%) who were given spinocan 27G experienced hypotension after induction of subarachnoid block anesthesia. The results of the analysis using the Man Whitney statistical test showed that the significance value of p value = 0.000 (0.000<0.05). There was a significant difference in the incidence of hypotension post induction of subarachnoid block anesthesia with Spinocan 27G and Spinocan 25G.

Table 4. Mann Whitney Test for Hypotension with Spinocan 27G with Supine dan Trendelenburg 15º Positions (n=74)

Spinocan 27G and Position	Incidence of Hypotension				Total		*p value*
	Not Hypotension		Hypotension				
	f	(%)	*f*	(%)	*f*	(%)	
Supine	20	54	17	46	37	100	0.028
Trendelenburg	29	78.4	8	21.6	37	100	

Table 5. Mann Whitney Test for Hypotension with Spinocan 25G with Supine dan Trendelenburg 15º Positions (n=74)

Spinocan 25G and Position	Incidence of Hypotension				Total		*p value*
	Not Hypotension		Hypotension				
	f	(%)	*F*	(%)	*F*	(%)	
Supine	3	8.1	34	91.9	37	100	0.010
Trendelenburg	12	32.4	25	67.6	37	100	

Table 6. Mann Whitney Test Incidence of Hypotension between Spinocan 27G and Spinocan 25G (n=148)

Spinocan Size	Incidence of Hypotension				Total		*p value*
	Not Hypotension		Hypotension				
	f	(%)	*f*	(%)	*F*	(%)	
Spinocan 27G	49	66.2	25	33.8	74	100	0.000
Spinocan 25G	15	20.3	59	79.7	74	100	

DISCUSSION

Decrease of Systolic Blood Pressure in patients with subarachnoid block anesthesia at RSUD Bendan Kota Pekalongan

Based on table 1 regarding the pre-induction systolic blood pressure (baseline) of respondents, it was found that the majority of respondents' systolic bloodpressure was in the pre-hypertension category and also in the hypertension category. High blood pressure is associated with preoperative anxiety (Saputra, 2024).

Research conducted by Fajar (2023) at RSUD Bendan Kota Pekalongan showed that all subarachnoid block respondents experienced anxiety with the majority experiencing moderate anxiety. Respondents felt afraid or anxious about the operation, so the patient was not calm during anesthesia. This is supported by the statement by Romanik et al (2019) that patients who have never experienced surgery will experience increased anxiety.

Anesthesia at RSUD Bendan Kota Pekalongan only uses the local anesthetic drug Bunascan 0.5% heavy (hyperbaric bupivacaine). Nugroho (2019) found that patients given hyperbaric bupivacaine experienced a decrease in systolic blood pressure in all patients. Arteries and arterioles will experience dilation in areas experiencing sympathetic denervation. The more areas that experience sympathetic denervation, such as in hyperbaric bupivacaine, the more arteries and veins will enlarge so that the incidence of hypotension can increase (Fakherpour, 2018). The data presented shows that all respondents experienced a decrease in blood pressure with the majority experiencing hypotension after induction of subarachnoid block anesthesia.

Referring to table 2 regarding blood pressure reduction, it was found that respondents who were given spinocan 27G with supine position mostly experienced a decrease in systolic blood pressure of 31-40 mmHg. Meanwhile, most of the respondents who were given spinocan 27G with trendelenburg 15° position experienced a decrease in systolic blood pressure of 11-20 mmHg.

Most of the respondents who were given spinocan 25G with supine position experienced a decrease in systolic blood pressure of more than 51 mmHg with the smallest decrease being 21-30 mmHg. Meanwhile, most of the respondents who were given spinocan 25G with trendelenburg 15° position experienced a decrease in systolic blood pressure of more than 51 mmHg with the smallest decrease being 11-20 mmHg.

The majority of the decrease in systolic blood pressure post induction of subarachnoid block anesthesia in the groupof respondents with spinocan 25G experienced a quite extreme decrease, while the decrease in systolic blood pressure after induction of subarachnoid block anesthesia in the group of respondents with spinocan 27G was still within normal limits.

People who have a history of high blood pressure are considered hypotensive if their blood pressure drops >30mmHg suddenly even though their blood pressure values are still normal. There is no standard limit for groups of people who do not have a history of high blood pressure or tend to have low blood pressure (Ramadhan, in Nurbudiman,2020).

The Incidence of Hypotension in patients with subarachnoid block anesthesia at RSUD Bendan Kota Pekalongan

Based on the data presented in table 3, the lowest incidence of hypotension was found in respondents who were given spinocan 27G with trendelenburg 15° position compared to respondents who were given spinocan 27G with supine position. Followed by respondents who were given spinocan 25G with trendelenburg 15° position in third place, while the respondents who experienced the most incidents of hypotension were found in respondents who were given spinocan 25G with supine position. The incidence of hypotension post induction of subarachnoid block anesthesia at RSUD Bendan Kota Pekalongan was 84/148 respondents (56.8%).

Hypotension can occur because vasomotor tone is influenced by sympathetic fibers from thoracic 5 to lumbar 1 which innervate smooth muscles, blocked arteries and veins. Widespread sympathetic block can cause vascular vasodilation, decreasing cardiac output (Soenarjo, in Mutia, 2020).

The incidence of hypotension during subarachnoid block anesthesia is still high and occurs frequently. Pratiwi (2021) in her research noted that 73.3% of patients experienced hypotension. This was also supported by Subhan's (2022) research,

which found that 76.9% of respondents experienced hypotension in her research. This is different from the results of this study. The incidence of hypotension post induction of subarachnoid block anesthesia decreased quitedifferently, this was due to different methods in terms of objective criteria.

The criteria for hypotension in Pratiwi's study were determined if there was a decrease in blood pressure of >20% below the pre-induction blood pressure, the criteria for hypotension in Subhan's study were determined if there was a systolic blood pressure <90 mmHg. Meanwhile, in this study, the criteria for hypotension were determined if the systolic blood pressure fell ≥30 mmHg from the pre-induction systolic blood pressure (baseline). Apart from that, the size of the spinocan and the position post induction of anesthesia can reduce the incidence of hypotension in RSUD Bendan Kota Pekalongan, which was originally 75%, which has decreased to 56.8%.

Comparison the use of spinocan size and post induction anesthesia position on the incidence of hypotension in patients with subarachnoid block at RSUD Bendan Kota Pekalongan

Researchers compared the incidence of hypotension after induction of subarachnoid block anesthesia with spinocan 27G in the supine and trendelenburg 15° positions. Next, compare the incidence of hypotension post induction of subarachnoid block anesthesia with spinocan 25G in the supine and trendelenburg 15° positions, and compare the incidence of hypotension post induction of subarachnoid block anesthesia between spinocan size 27G and spinocan size 25G.

Anesthesia at RSUD Bendan Kota Pekalongan only uses one type of spinocan namely the Quincke type spinocan. In this study, subarachnoid block anesthesia was focused using spinocan 27G and spinocan 25G. The diameter of the needle is expressed in gauge, where the larger the gauge number means the smaller the needle diameter and lumen. The diameter of the spinocan 25G is larger than the diameter of the spinocan 27G (0.53x88mm VS 0.42x88mm). Apart from that, the spinocan 25G was observed to have faster movement of cerebrospinal fluid than the spinocan 27G.

Research conducted by Arif (2015) found that an anesthetic injection at a slower speed (0.2 mL/second) could reduce the incidence of post-anesthesia hypotension compared to an anesthetic injection with a fast injection (0.4 mL/second), there was a significant difference in systolic blood

pressure between the two group. This is in line with the results of this study, researchers linked the injection speed with the diameter of the spinocan to the impact on changes in blood pressure. The decrease in systolic blood pressure tended to be greater in the spinocan 25G group than in the 27G spinocan group. There was a significant difference (p=0.000) in the incidence of hypotension found in the spinocan 25G group which tended to be higher than in the spinocan 27G group (59/74 respondents VS 25/74 respondents).

Subarachnoid block anesthesia causes the arteries and veins around the blood vessels to enlarge, thereby reducing return flow to the heart, this can reduce cardiac output and blood pressure (Kweon, et al., 2013). Patient position affects changes in blood pressure and central venous pressure. Different positions can affect hemodynamics including the circulatory system (Cicolini, in Dwipayani, 2022).

In line with the results of the research conducted, the incidence of hypotension found in the supine position group tended to be higher compared to the trendelenburg 15° position group (51/74 respondents VS 33/74 respondents). This is supported by research conducted by Yuniar (2020), the majority of patients who were given the supine position experienced hypotension.

Hypotension in subarachnoid block anesthesia is caused by blockade of sympathetic nerves which control blood vessel tone. Blockade of sympathetic nerve fibers causes vasodilation in the veins, causing changes in blood volume, especially in the lower extremities and splanchnicus, thereby reducing blood flow back to the heart (Tanambel, 2017). Neal (2013) in Pujana Research (2021) states that patients should be given the Trendelenburg position (head down) after induction of subarachnoid block anesthesia to maintain venous return.

When in the supine position, patients are at risk of experiencing hypotension causedby venous pooling. Venous pooling refers to the accumulation of blood in the veins, especially in the lower extremities, caused by gravity, resulting in inefficient blood flow back to the heart. Providing a trendelenburg 15° position post induction of anesthesia can help blood flow from the veins to the heart in the presence of gravity. This is supported by Rustini's (2016) statement that hypotension can be treated by administering the trendelenburg position.

Thus, based on the use of spinocan size, the incidence of hypotension was more common in the spinocan size 25G group than in the spinocan size 27G group. Meanwhile, if we look at the post-

Induction anesthesia position, hypotension was more common in the supine position group than in the trendelenburg 15° position group. The highest incidence of hypotension was found in respondents who were given spinocan 25G with supine position. Meanwhile, the lowest incidence of hypotension was in respondents who were given spinocan 27G with trendelenburg 15° position.

Therefore, using spinocan 27G with Trendelenburg 15° position post induction of anesthesia can reduce the incidence of hypotension in patients with subarachnoid block anesthesia. Apart from that, the decrease in systolic blood pressure post induction of subarachnoid block anesthesia in the group of respondents who were given spinocan 27G with trendelenburg 15° position was still within normal limits. The majority experienced a decrease in systolic blood pressure of 11-20 mmHg

CONCLUSION

There is a significant difference in the incidence of hypotension post induction of subarachnoid block anesthesia with 27G spinocan with supine position and trendelenburg 15° position. There is a significant difference in the incidence of hypotension post induction of subarachnoid block anesthesia with spinocan 25G in the supine position and trendelenburg 15° Position. Respondents who were given spinocan 27G with trendelenburg 15° position experienced the least incidence of hypotension.

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