Incidence and Risk Factors of Hypotension and Bradycardia During Spinal Anesthesia

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ABSTRACT

Objective: Hypotension and bradycardia during spinal anesthesia are common and may relate to severe adverse events such as cardiac arrest or death. Knowledge of the incidence and risk factors as well as their patho-physiology processes will improve management, planning for anesthesia, training and practice guidelines for the patients receiving spinal anesthesia.

Methods: We retrospectively reviewed anesthetic records of 1,698 patients who received spinal anesthesia at Siriraj Hospital from 1 January 2004 to 30 June 2004. The collected parameters were patient demographic data (sex, age, body weight, height, ASA status), operative data (type of operation, emergency status, position and duration of operation),anesthetic data (type and dosage of local anesthetic agents used, intravenous fluid, vasoactive and sedative agents, sensory level of spinal blockage, usage and doses of spinal opioids as well as oxygen supplementation). The lowest systolic, diastolic blood pressure, heart rate and onset of the incidence were collected and analyzed for correlation by appropriate statistical analysis. Bradycardia was defined when heart rate is 50 beat/min or lower and hypotension when systolic blood pressure decreases to 20% or more of the baseline pressure.

Results: Incidence of hypotension in this study was 54.4% at 19.4 min. The correlated parameter with increased incidence of hypotension included female (crude odd ratio = 2.005; 95% CI 1.63-2.48), age more than 40 years (adjusted odd ratio = 3.06-6.88; 95%CI 1.55-15.74 upon age group), level of blockage higher than T5 (adjusted odd ratio =1.23; 95%CI 1.15-1.31) and finally type of operation. Operation of hip and femur and cesarean section had adjusted odd ratio = 2.13; 95%CI 1.04-4.38 and 2.32; 95%CI 1.28-4.21, respectively. Incidence of bradycardia in our study was 0.06% which was too low to analyze for correlated parameter. There was no cardiac arrest nor death reported in this study.

Conclusion: Level of blockage higher than T5 was the only one modifiable risk factor associated with hypotension during spinal anesthesia that could be identified from this study. Avoidance of high block is the only factor that can be controlled to decrease the incidence and severity of hypotension.

Keywords: Spinal anesthesia; Side effects; Incidence

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Hypotension and bradycardia are common side effects of spinal anesthesia. They can lead to serious complications, i.e., cardiac arrest or death. However, the latest review of incidence and potential risk factor of hypotension and bradycardia during spinal anesthesia were reported in 1992 (33% and 13%, respectively).[1,2] Changing in anesthetic practice in the last decade such as usage of spinal opioid, type and usage of vasoactive agents may modify the incidences of these events. We would like to reevaluate the incidence and risk factors of both side effects of spinal anesthesia.

MATERIALS AND METHODS

We retrospectively reviewed anesthetic records of patients who received spinal anesthesia and underwent surgery in four surgical units (orthopedics, urology, general, and obstetrics and gynecology, surgery) at Siriraj Hospital from 1 January 2004 to 30 June 2004. All patients signed their consent form for surgery and anesthesia. They were visited by anesthetic residents in the evening prior to anesthesia and surgery. All patients had postoperative visit by trained anesthetist nurses.

We selected only cases when spinal anesthesia could be used as a sole anesthetic technique. Combinations of spinal block with other type of anesthesia (epidural block, inhalation or intravenous sedation and general anesthesia) were excluded. We also excluded cases when the supplementation of high dose opioids (morphine more than 0.1 mg/Kg or pethidine more than 50 mg or fentanyl more than 1 microgram/ Kg) or sedative agents (midazolam more than 2 mg or ketamine more than 1 mg/kg or propofol more than 1.5 mg/kg) were used within 60 minutes after spinal block.

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TABLE 1. Demographics data of 1698 cases of spinal anesthesia and variation of incidence of hypotension to definition of hypotension and group of operation (% of cases in each group)

Parameter	N (%)	Range	Mean/SD
Gender			
Male	525 (30.9)		
Female	1,112 (69.1)		
Age (yr)		14-99	41.7/18.3
Body weight (kg)		38-144	64.4/11.9
Height (cm)		140-190	158.6/7.9
BMI (kg/m^2)		15.39-48.76	25.92/4.6
ASA classification			
1	796 (46.8)		
2	816 (48)		
3	64 (5.2)		
Emergency : yes	535 (31.5)		
Spinal drug (Bupivacaine)			
Hyperbaric	1,580 (93.1)		
Isobaric	118 (6.9)		
Add morphine: yes	993 (58.8)		

Operation	Total cases	> 20% of control	> 30% of control	< 100 mmHg	< 90 mmHg
Total cases	1,698	54.4	26.1	60.3	36.5
Peri-anal	114	36	12.3	42.1	23.7
TUR,TUI*	158	48.7	25.9	36.7	20.3
Knee and leg*	410	44.9	21.2	46.1	27.1
Hip and femur*	117	66.7	38.5	64.1	41.0
Lower abdomen*	134	59.7	27.6	53.7	36.5
C/S*	765	60.7	28.8	76.1	47.2

*Incidence of hypotension were higher in every group of operation compared to "peri-anal" ($p<0.005$)

The detailed parameters of surgery (type of operation, surgical position, duration and emergency situation), patient demographic data (sex, age, body weight, height, ASA physical status), anesthetic data (type and amount of local anesthetic agent, presence and doses of spinal opioids, level of sensory blockage, intravenous fluid, vasoactive and sedative agent) were recorded. The standard practices of oxygen supplementation and digital monitoring of oxygen saturation, EKG and NIBP were performed.

The first systolic, diastolic blood pressure and heart rate were used as reference control values. The lowest systolic, diastolic pressure, heart rate and onset of those incidences were recorded in details. Treatment of hypotension and bradycadia depended on individual clinical judgments of responsible anesthesiologists and all vasoactive agents used were recorded in data processing.

All parameters were coded and recorded in SPSS 10.0. Bradycardia were count only when heart rate was equal to or lower than 50 beat per minute in the patient who had control heart rate more than 50 beat per minute.

Descriptive statistics were presented as mean, standard deviation (SD), minimum, maximum or number (%) as appropriate. All parametric and non-parametric parameters were tested of normal distribution before further appropriated statistically analysis. P-value of 0.05 was used to identify statistical significance. To assess the association between two categorical variables in a univariable analysis, chi-square test was used along with odds ratio (OR) and its 95% confidence interval (CI). Multivariable analysis via multiple logistic regressions was employed to determine the effect of each independent variable on binary dependent variable after adjusting the other independent variables. Results were displayed as crude and adjusted OR together with 95% CI for OR.

RESULTS

Demographic Data: A total of 1,698 patients, aged between 14 to 99 years old were eligible for this study. The patients were from the Division of Orthopedics 31%, Obstetrics 45%, Urology 9.3% and General Surgery 14.6%. The ratio of male and female was 31:69 percent. Ninety-five percent of them were classified in ASA class 1 and 2. Ninety-six percent had body mass index lower than 35, and thirty-two percent were emergency cases (Table 1).

Hyperbaric bupivacaine was used as spinal local anesthetic agent in 93.1% in this study. In the analysis, related use of local anesthetic agents such as the amount of spinal drug, cases of isobaric bupivacaine were excluded.

We divided dose range of 0.5% heavy bupivacaine into three groups by 25 and 75 percentile of number of patient in each operation. "low dose", "average dose" and "high dose" represented equal or lower than 25 percentile, more than 25 percentile to lower than 75 percentile and 75 percentile or more, respectively.

Incidence of hypotension: The incidence of hypotension varied according to its definition and its cut point. The incidence was 54.4% when hypotension was defined as reduction of systolic blood pressure to 20% or more of the controlled systolic pressure. This incidence was reduced to 26.1% when 30% reduction of the controlled value was used instead of 20%. The incidences also varied from one operation to another. The incidence was highest in cesarean sections according to definition. The incidence of hypotension was lower in peri-anal operations. Hence, we used peri-anal operation as reference for further analysis.

Hypotension was defined as a reduction of systolic blood pressure equal to or more than 20% of control value. When compared between patient with hypotension and without hypotension, when each variable was considered alone as in univariable analysis of five non-modifiable and two modifiable risk factors were identified. Female gender, increase of age, ASA classification from I to II, type of operation and emergency surgery were five non-modifiable risk factors that increased the incidence of hypotension in the varying range of crude odds ratio from 1.69 to 4.48 with narrow 95% CI for OR. The level of sensory analgesia equal to or higher than T5 and the adding of morphine were the only two modifiable risk factors that increased the incidence of hypotension with relatively high crude odds ratio and narrow 95% CI for OR (Table 2).

The amount of local anesthetic agents in low, average and high dose group did not make any difference of the outcomes. Patients in "hypotensive group" had controlled systolic blood pressure equal to or higher than 120 mmHg with higher frequency than those in "non hypotensive group". Control systolic blood pressure (SBP) over 120 mmHg provided ODD ratio 4.626, 95%CI 3.554-6.021 which was the highest ODD ratio in this study. Most patients who had control SBP below 120 mmHg were treated before their systolic blood pressure decreased to the study's criteria. In the same manner, if the control systolic pressure was high such as 150 mmHg, the treatment was considered only when the systolic pressure

TABLE 2. Univariated analysis of risk factor of hypotension (reduction of systolic blood pressure equal to or more than 20% of controlled pressure)

Variable	Hypotension, N (%) No	Yes	Crude OR	95% CI for OR
Gender				
Male	299 (57.0)	226 (43)	1	
Female	442 (39.7)	670 (60.3)	2.005	1.63,2.48
Age group (year)				
< 20	62 (68.1)	29 (31.9)	1	
20-29	213 (49.0)	222 (51.0)	2.23	1.38, 3.60
30-39	214 (45.0)	262 (55.0)	2.62	1.63, 4.22
40-49	86 (48.3)	92 (51.7)	2.29	1.35, 3.89
50-59	60 (42.6)	81 (57.4)	2.89	1.66, 5.02
60-74	108 (38.4)	173 (61.6)	3.43	2.1, 5.66
> 74	31 (32.3)	65 (67.7)	4.48	2.43, 8.29
Body mass index(kg/m^2)*				
< 25	299 (51.9)	277 (48.1)	1	
25-35	261 (38.8)	411 (61.2)	1.7	1.36, 2.13
> 35	13 (27.7)	34 (72.3)	2.8	1.46, 5.46
ASA				
Class 1	417 (52.4)	379 (47.6)	1	
Class 2	314 (38.5)	502 (61.5)	1.76	1.44, 2.14
Class 3-4	31 (48.4)	33 (51.6)	- 1.17	0.7, 1.9
Emergency: yes	241 (45.0)	294 (55.0)	1.029	0.84, 1.27
Operation				
Peri-anal	73 (64.0)	41 (36.0)	1	
TUR/TUI	81 (51.3)	77 (48.7)	1.69	1.03, 2.77
Knee/leg	226 (55.1)	184 (44.9)	1.45	0.94, 2.22
Hip/femur	39 (33.3)	78 (66.7)	3.56	2.07, 6.13
Lower abdomen	54 (40.3)	80 (59.7)	2.64	1.58, 4.41
C/S	301 (39.3)	464 (60.7)	2.75	1.82, 4.13
Dose spinal drug				
Low dose	247 (41.7)	346 (58.3)	1	
Average	271 (47.4)	301 (52.6)	0.79	0.63, 0.99
High dose	256 (48.0)	277 (52.0)	0.77	0.61, 0.98
Add morphine* yes	390 (39.3)	603 (60.7)	1.87	1.53, 2.27
Sensory level T5*or higher	181 (29.9)	424 (70.1)	3.03	2.43, 3.79
Systolic 120 mmHg or higher	306 (31.5)	665 (68.5)	3.93	3.20, 4.80
Total volume (ml)				
< 500	116 (67.4)	56 (32.6)	1	
501-1,000	248 (50.0)	248 (50.0)	2.07	1.44, 2.98
1,001-1,500	262 (41.7)	366 (58.3)	2.89	2.03, 4.13
>1,500 ml	148 (36.8)	254 (63.2)	3.5	2.44, 5.19

Crude OR = crude odds ratio.

TABLE 3. Usage of vasoactive drugs

Vasoactive drugs	Total cases	Hypotension group	Non-hypotension group	P-value
Ephedrine (mg)				
Yes	34.9%	46.1%	21.7%	P = 0.000
Range	3-60	3-60	3-56	
Mean±SD	11.8±8.5	12.5±7.6	10.1±5.7	
≤ 10 mg	46.2%	42.3%	56.5%	
10-19 mg	42.2%	20.9%	36.9%	
≥ 20 mg	11.6%	36.8%	6.6%	
Levophed (microgm)				
Yes	19.8%	28.2%	9.7%	P = 0.000
Range	2-56	2-52	2-56	
Mean±SD	10.6±13.5	10.98±8.1	9.4±9.1	
≤ 8 microgm	59.2%	55.5%	72%	
>8-20 microgm	31.5%	34.1%	22.6%	
>20 microgm	9.3%	10.4%	5.4%	
Atropine (mg)				
Yes	1.7 %	1.9%	1.5%	P = 0.49
Range	0.3-1.2	0.3-1.2	0.3-1.2	

was lower than 110 mmHg (reduction of 20% of control). This is the reason that not all patients in the "hypotensive group" received vasoactive drugs. Only 74.3% of them received at least one dose of ephedrine or norepinephrine (Table 3).

A total volume of fluid replacement was significantly higher in the hypotensive group with an increasing trend of odds ratio from lower than 500 ml to more than 1,500 ml. The increased total volume replacements were the results of the treatment of hypotension by fluid loading. The more severe the hypotension, the more amount of fluid was used to compensate venous pooling after the block and to maintain adequate venous return and blood pressure.

Not all positive parameters were included for further analysis of regression model. Gender and "added morphine" were omitted from regression model because the distribution of gender was not balanced in every group of operation. Even the "added morphine" had odd ratio of 1.87, but 80% of these patients were cases of caesarean section. Taking into account of all factors together in multiple logistic regression analysis, the age groups and total volume replacement had step-by-step increase in odds ratios in every increase of age of 10 years and 500 ml of volume replacement. Age group of 40-49 years had significant increase in both adjusted OR and 95% CI for OR. The type of operation, whether it was a caesarean section and operation of the femur were operations that increased the risk of hypotensive response to spinal block. The sensory level of T5 or higher increased the incidence of hypotension in OR 1.23 (1.15, 1.31).

Incidence of bradycardia: We found only 105 records that heart rate was equal to or lower than 50 beats/min and the incidence was only 0.06%. Even we could compare and calculate crude OR more than one in some parameter such as gender, age group and ASA classification. But the 95% CI for OR were wide. No further statistic analysis was done.

Usage of vasoactive agents: Ephedrine was the most common vasoactive agents used in the treatment of hypotension after spinal block. Thirty-five and twenty percent of all records received at least one dose of ephedrine and Levophed, respectively. Number of patient and dosage of vasoactive agents (ephedrine and Levophed) were higher in the "hypotensive group". We found that 21.7% of the "non-hypotensive group" received ephedrine, mostly in the dose of lower than 10 mg. This confirmed that in real situation the decision to use vasoactive agent could be made before the systolic blood pressure was reduced to the criteria in this study.

Onset of peak hypotension and bradycardia: The peak onset of hypotension and bradycardia after spinal block were as early as one and five minutes, respectively. Even in some cases, the lowest blood pressure occurred 30 minutes after the block. But 50% and 75% of all cases, the lowest blood pressures were recorded at 15 and 25 minutes, respectively.

DISCUSSION

The incidence of hypotension during spinal anesthesia in this study was 54.4% compared with 33% in the study of Carpenter et al., Tarkkila and Isola, 15.3% and Hartmann et al., 8.2%.[1,2,3] The factors that made it different include the criteria to define hypotension and limitation of the retrospective study in identification of the true baseline blood pressure. In our study, we defined

TABLE 4. Logistic Regression and variables associated with hypotension

	Variable	Adjusted OR	95%CI for OR	P-value
Age*(year)				
	20-29	1.57	0.85, 2.91	0.147
	30-39	1.83	0.99, 3.36	0.052
	40-49	3.06	1.55, 6.06	0.001
	50-59	3.57	1.7, 7.49	0.000
	60-74	5.03	2.48, 10.19	<.0001
	>74	6.88	3, 15.74	<.0001
BMI				
	25-35	1.2	0.91, 1.58	0.191
	>35	1.13	0.53, 2.42	0.752
ASA				
	class 2	1.09	0.82, 1.44	0.573
	≥ class 3	0.89	0.44, 1.79	0.736
Systolic pressure*				
	≤ 120 mmHg	4.63	3.55, 6.02	<0.0001
Operation*				
	TUR/TUI	0.79	0.42, 1.48	0.459
	Knee/leg	1.13	0.65, 1.94	0.665
	Hip/femur*	2.13	1.04, 4.38	0.039
	Lower abdomen	1.41	0.73, 2.72	0.308
	Cesarean section*	2.32	1.28, 4.21	0.005
Dose	Average dose	0.99	0.74, 1.34	0.975
	High dose	0.82	0.6, 1.12	0.215
Sensory level ≥ T5		1.23	1.15, 1.31	<.0001
Total volume(ml)*				
	500-1,000 ml	2.18	1.39, 3.41	0.0006
	1,001-1,500 ml	2.78	1.76, 4.39	<.0001
	>1,500 ml	3.34	2.06, 5.43	<.0001

hypotension when the systolic blood pressure was decreased to equal to or more than 20% of the baseline systolic blood pressure. The use of this definition was based on the synchronicities and predictability of non-modifiable factors for hypotensive response to spinal block. The criteria were widely used and applicable to all patients including chronic hypertensive patients and popular usage in anesthesia literature. By the limitation of this study, we realized that the first systolic pressure that was recorded in anesthetic chart might be higher than the true value. Fear, anxiety, excitement and emotional affected the patients' blood pressure.

The management of hypotension in this study was depending upon individual judgment of the responsible anesthesiologists. Ephedrine and norepinephrine (Levophed) were given to patients who were defined as non-hypotension (21.7% and 9.7%, respectively). This implied that some cases were treated before the study's criteria were met or the hypotension was recognized and treated but the lowest blood pressures were not manually recorded. It was likely that the true incidence of hypotension might be higher than the results shown in this study. Even so, when compared to other studies[1,2,3], our incidence of hypotension was higher than that of Carpenter[2] which they reported the incidence of 33% (systolic blood pressure lower than 90 mmHg). If we used the same criteria, our incidence was lower from 54.4% to 36.5% and closed to the result of the Carpenter's study.

The parameters that statistically significantly were associated with the development of hypotension in this study include feminine gender, age more than 40 years old, operation in the hip and femur, cesarean section, control systolic blood pressure above 120 mmHg, added morphine and sensory level higher than T5 (Table 4). In our study, we use adjusted odd ratio in multivariate analysis to identify statistical significance. Therefore, the esult is different when compared with other studies that used crude odd ratio to identify statistical significance.

There are multiple factors associated to the occurrences of hypotension after spinal block which include patients' characteristics, operations, amount of local anesthetic agents and anesthetic managements. Crude odd ratios from univariate analysis (analysis only one factor and ignoring others) were too crude for strong reliability. In this situation, each factor was associated to the incidence of hypotension in various degrees. Multiple logistic regression was a statistical technique that could bring every significant factor into the same equation for the explanation the degree of association.

Our results provide clear statistical confirmation of two previously identified risk factors for the development of hypotension after spinal block: the level of sensory analgesia higher than T5 and age of the patient more than 40 years old. The high level of sensory blockage can be explained by the sympathetic blockage. The mechanism of how age increases the risk has not been explained. Decrease in cardiac reserve or change in autonomic function may play certain roles. The risk of increased age outweighed the effect of type of operations.

In addition to previously identified risk factors, we found that female gender and type of operation, i.e., cesarean section and operation of the hip and femur, were other two risk factors that increased the risk of hypotension after spinal block. In pregnant women, multiple physiology changes made them prone to severe hypotension after spinal block. These include porto-caval compression by gravid uterus, hyper sympathetic activities of the lower limbs, high metabolic rate and demand. Lower tolerance of pregnant to sympathetic blockage was confirmed by rapid severe hypotension after spinal block. The onset of hypotension in this operation usually begins within 5 minutes after the block.

The only significant modifiable risk factor was the level of sensory blockade equal to or higher than T5. The explainable physiology is the higher the level of sensory blockade, the more autonomic blockade is causing more vasodilatation and hence more hypotension. Levels of T1-T4 are the innervations of cardio accelerated fibers. Blockade above T4 level may lead to negative inotropic and chronotropic heart function and causes more hypotension. Avoidance of unnecessary high level of blockade will lower the incidence of hypotension.

Theoretically, the amount of local anesthetic agents in milligram and total volume should affect the severity of hypotension. This could not been confirmed in this study because the narrow range of spinal drug within the same operation. This study was done within only single institute where the amounts of spinal drug use were very uniform. Such as in cesarean section, the dose of 0.5% heavy bupivacaine was almost always 11 mg or 2.2 ml. So we could not confirm the effects of the amount of local anesthetic agents on the incidence of hypotension.

Severe complication such as cardiac arrest was not found in this study. The overall frequency of cardiac arrest during neuraxial anesthesia was 1.8: 10,000 patients.[4] More cardiac arrests were, however, found in patients receiving spinal versus epidural anesthesia,[5,6,7,8] 2.9 versus 0.9 per 10,000; P=0.041.[4]

However, after the end of this study, there were 2 cases of cardiac arrest after spinal anesthesia. The first was an old man with pathological intertrochanteric

fracture of the femur undergoing dynamic hip screwing. A sudden cardiac arrest developed after completing fixation of the screw. The diagnosis of tumor tissue pulmonary embolism was confirmed by autopsy. The second case was a healthy young woman with AVM of the whole leg undergoing alcohol embolization. The same operation was done five times earlier without any complication. A sudden desaturation and apnea followed by cardiac arrest developed at 30 minutes after spinal block. She was successfully resuscitated. Two months later, she developed this episode spontaneously. The diagnosis of pulmonary embolism was confirmed by echocardiogram and lung perfusion scan.

Volume preloading is recommended for prevention of spinal block induced hypotension. The volume of blood pooling in the skeletal muscle and skin after spinal block is approximately 300 ml in adult in supine position. In adult approximate 1,200 ml should be administered before spinal block.[9] Conversely, a rapid, large infusion of fluid may be hazardous in patients with cardiac dysfunction or severe pre-eclampsia, who may be at risk of cardiac failure and pulmonary edema.[10] Colloid solution, having a longer half-life in vascular compartment which requires less volume may be used instead. Although colloid can maintain heart rate and blood pressure more effective than crystalloid in cesarean sections, but a previous study showed no different outcome in neonate.[11] In this study, a total volume of fluid replacement was significantly higher in the hypotensive group. The increase in the total volume replacement was the result of the treatment of hypotension by loading fluid and not in volume preloading.

The efficacy of prophylactic ephedrine for averting hypotension after spinal block is still controversy. A meta-analysis of prophylactic ephedrine prevention of hypotension in spinal block for cesarean delivery showed that at 14 mg of ephedrine, the number needed to treat was only 7.6, while the same number needed to harm was 7.6.[12] At a higher dose, the likelihood of hypertension was greater than the advantage of prevention of hypotension and minor decreased in umbilical arterial pH was noted.[12]

Unilateral spinal block technique can reduce the incidence of hypotension in orthopedic patients. Left lateral uterine displacement reduces incidence of hypotension and increases uteroplacental blood flow in pregnant patients.

Hypotension after spinal block was a surrogate outcome. From this study we could not correlate hypotension with other outcome such as neonatal outcome in cesarean section or postoperative myocardial infarction in the elderly. The incidence of hypotension after spinal block was high (54%) and was not lower than those of previous studies. Reduction of the incidence of hypotension by the mean of appropriated techniques and early management of mild hypotension after spinal block are keys to successful management. Ignored prevention and delayed management of bradycardia and hypotension were risks to cardiac arrest. Low successful cardiopulmonary resuscitation rate during spinal block was demonstrated by Caplan.[13] Fifty-five percent of the cases were successful and were equal to cardiac arrest out-of-hospital in cardiac patients. But spinal anesthesia was used in healthier patients and cardiac arrest also occurs even in the best-equipped hospital environment.

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บทคัดย่อ

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ฐิติมา ชินะโชติ พ.บ., สมบูรณ์ แซ่เตีย พ.บ., พีรยา ชัยศิริ พ.บ., ธารา ตริตระการ พ.บ.

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วัตถุประสงค์: ภาวะความดันเลือดต่ำและอัตราการเต้นของหัวใจช้าพบได้บ่อยในการทำ spinal block โดยที่ภาวะนี้อาจนำไปสู่ภาวะแทรกซ้อนที่รุนแรง เช่น การเกิดภาวะหัวใจหยุดเต้นและการเสียชีวิตของผู้ป่วย ความรู้และความเข้าใจในกระบวนการ อัตราการเกิด และกลุ่มผู้ป่วย หรือการผ่าตัดที่มีความเสี่ยง ช่วยในการทำหัตถการนี้ให้ได้ผลสำเร็จโดยผู้ป่วยไม่เสี่ยงต่อภาวะแทรกซ้อนที่รุนแรง และสร้างแบบแผนในการดูแลผู้ป่วยระหว่างการทำ spinal block

วิธีการ: ทำการศึกษาจากใบรายงานการให้ยาระงับความรู้สึกจำนวน 1,698 รายที่ได้รับการทำ spinal block ในโรงพยาบาลศิริราช ตั้งแต่วันที่ 1 มกราคม ถึง 30 มิถุนายน 2548 โดยทำการบันทึก ข้อมูลคุณลักษณะผู้ป่วย ชนิดการผ่าตัด รายละเอียดการผ่าตัด ชนิดและปริมาณของยาชาเฉพาะที่ ปริมาณการให้สารน้ำ ชนิดและปริมาณการให้ยาเพื่อเพิ่มความดันเลือด ระดับการชา และการผสม morphine ร่วมกับการทำ spinal block ค่าความดันเลือดที่วัดครั้งแรก ความดันที่ลดลงต่ำที่สุดและระยะเวลา ทำการประเมินความสัมพันธ์ของการเกิดภาวะความดันเลือดต่ำกับข้อมูลในด้านต่าง ๆ เพื่อค้นหาภาวะเสี่ยง

ผลการศึกษา: อุบัติการณ์ของการเกิดภาวะความดันเลือดต่ำพบได้ 54.5 % ในเวลาเฉลี่ย 19.4 นาที โดยอุบัติการณ์เพิ่มมากขึ้นในผู้ป่วยที่เป็นเพศหญิง (crude odd ratio = 2.005, 95%CI 1.63-2.48), อายุมากกว่า 40 ปี (adjusted odd ratio = 3.06-6.88, 95%CI 1.55-15.74 upon age group) ระดับการชาสูงกว่า T5 (adjusted odd ratio =1.23, 95%CI 1.15-1.31) และในการผ่าตัดคลอด (adjusted odd ratio 2.32, 95% CI 1.28-4.21), การผ่าตัดข้อสะโพก (adjusted odd ratio = 2.13, 95% CI 1.04-4.38) อุบัติการณ์การเกิดภาวะหัวใจเต้นช้าพบได้น้อยมาก

สรุป: ระดับการชาที่สูงหรือต่ำกว่า T5 เป็นปัจจัยเดี่ยวที่สามารถปรับเปลี่ยนโดยวิธีและกระบวนการการทำ spinal block ที่ได้จากการศึกษานี้ การระมัดระวังไม่ให้ระดับการชาสูงกว่าความจำเป็นเพื่อการผ่าตัด และการเฝ้าระวังอย่างดีภายหลังการผ่าตัดจะช่วยลดอุบัติการณ์และความรุนแรงของการเกิดภาวะความดันเลือดต่ำและอัตราการเต้นของหัวใจช้าในระหว่างการทำ spinal block