ORIGINAL ARTICLE

Immediate Haemodynamic Complications of Spinal Anaesthesia in patients with cardiovascular disease

IRAM ALIA, MUHAMMAD ASLAM, MAHMOOD UL HAQ FAROOQI

ABSTRACT

Objective: To determine the frequency of immediate haemodynamic complications of spinal anaesthesia in patients with cardiovascular diseases.
Study design: Cross sectional study.
Setting: Department of Anaesthesia, Mayo Hospital Lahore.
Duration with dates: Six months from November 2007 to May 2008.
Subjects and methods: Sixty patients fulfilling the inclusion criteria were selected for this study. Baseline heart rate, blood pressure, oxygen saturation and ECG were recorded Using aseptic technique spinal anaesthesia was given in sittingposition in L3-4 interspaces with 2ml of 7.5 mg/ml of hyperbaric bupivacaine with 25G spinal needle. Patient was kept in supine position with head elevation for spinal block to be fully established. Heart rate, blood pressure and oxygen saturation were monitored every 10 minutes from baseline to two hours.
Results: In our study the common haemodynamic complications after spinal anaesthesia were hypotension occurred in 21.7% patients, bradycardia occurred in 10% patients, bradycardia and hypotension occurred in 5% patients, bradycardia, hypotension and hypoexemia occurred in 10% patients and hypotension and hypoexemia occurred in 5% patients. The hypertension did not occur in any patient. Tachycardia and hypertension did not occur in any patient. While in 48.3% patients there was no haemodynamic complication after application of spinal anaesthesia.
Conclusion: The frequency of haemodynamic complications with occurred after spinal anaesthesia in our patients with cardiovascular diseases to suggest the safety of spinal anaesthesia under controlled condition.
Key words: Immediate haemodynamic complications, spinal anaesthesia, cardiovascular diseases.

INTRODUCTION

It is generally believed that morbidity is increased after spinal anaesthesia in patients with cardiovascular diseases as immediate haemodynamic effects of spinal anaesthesia such as hypotension, baradycardia and hypoxaemia may pose special problems in these patients. Cardiovascular responses to spinal anaesthesia occur immediately and are determined by combined effects of sympathetic denervation, level of neural block and vagal reaction[1].

Spinal anaesthesia is appropriate and safe inpatients with many forms of cardiovascular diseases provided these cardiovascular responses are clearly understood and proper preoperative assessment, patient selection and timely intervention is done. In stable angina pectoris, spinal anaesthesia greatly modifies the stress response and can be applied after having adequate left ventricular preload in patients undergoing lower extremity surgery[2].

Department of Anaesthesia & Surgery, Mayo Hospital, Lahore
Correspondence to Dr. Iram Alia, Assistant Professor Anaesthesia
Email: drirumalia_1@yahoo.com

In controlled hypertensive patients the risks are similar to non hypertensivepatients[3]. Ventricular hypertrophy, autoregulation of brain and kidney and cerebrovascular diseases in hypertensive patients should be kept in mind before applying spinal anaesthesia[4].

In congestive cardiac failure a careful balance to fluid and vasopressor therapy is necessary[5]. In dysrrhythmias, assessment of patient risk and avoidance of hypovolaemia may help to reduce the morbidity.

Hypotension, the commonest side-effect of spinal anaesthesia, results from sympathetic denervation.

Epidural and spinal anaesthesia are the preferred mode of anaesthesia for caesarean section. Volume preloading is recommended to prevent maternal hypotension and a reduction in uteroplacental blood flow, although positive effects of volume preloading on maternal cardiac output and arterial pressure are debatable. The effectiveness of volume preloading may therefore be better described by changes in maximum uterine blood flow velocity

than by pulsatility indices or maternal arterial pressure[6].

It is commonly taught than patients with multiple gestation pregnancy are prone to more severe hypotension during spinal and epidural anaesthesia compared to those with singleton pregnancy. The vasopressor requirement and haemodynamic changes in patients with multiple gestations versus singleton pregnancy during spinal anaesthesia for elective cesarean delivery were compared. Patients with multiple gestation pregnancy do not exhibit greater haemodynamic instability during spinal anaesthesia for cesarean delivery compared to those with singleton pregnancy[7].

My study will highlight the frequency of different haemodynamic complications of spinal anaesthesia in patients with cardiovascular diseases to suggest that spinal anaesthesia is appropriate and safe in many forms of such diseases. There should be more emphasis on the cardiovascular diseases and mechanisms of complications with spinal anaesthesia and their prevention.

OBJECTIVE

The objective of this study was to determine the frequency of immediate haemodynamic complications of spinal anaesthesia in patients with cardiovascular diseases.

MATERIAL AND METHODS

This study was conducted in the Department of Anaesthesia, Mayo Hospital, Lahore from November 2007 to May 2008. Total 60 patients with cardiovascular diseases undergoing lower abdominal and lower limb surgery under spinal anaesthesia were studied. This study was cross section. All patients under spinal anaesthesia in patients with cardiovascular diseases like stable angina pectoris, hypertension and treated congestive cardiac failure, lower abdominal and lower extremity surgery were included in the study. Patients less than 30 years of age, with valvular heart diseases, with history of bleeding diathesis were excluded.

RESULTS

A total of 60 patients with cardiovascular diseases undergone lower abdominal and lower limb surgery under spinal anaesthesia were selected for this study.

The mean age of the patients was 53.47±10.22 years. The majority of the patients i.e. 38 (63.3% were between 41-60 years of age. There were 15 (25%) patients in the age group of 61-70 years of age and there was only one (1.7%) patient in the age group of more than 70 years of age (Table 1). There were 41(68.3%) males and 19(31.7%) females patients (Table 2).

Table 1: Distribution of patients by age (n=60)

Age (Years)	No.	%age
Upto 40	6	10.0
41-50	20	33.3
51.60	18	30.0
61.70	15	25.0
>70	1	1.7
Mean±SD	53.47±10.22	

P=0.84 Key:SD Standard deviation

In the cardiovascular diseases, there were 21(35%) patients of stable angina and 21(35%) patients of treated hypertension and 18(30%) patients of treated congestive cardiac failure (Table 3).

While in the types of complications, there were 6 (10%) patients of bradycardia, 3(5%) patients of bradycardia and hypotension, 6(10%) patients of bradycardia, hypotension and hypoexemia, 13 (2`.7%) patients of hypotension, 3(5%) patients of hypotension & hypoexemia and 29(48.3%) patients of no complication (Table 4).

Table 2: Distribution of patients by sex (n=60)

Sex	No.	%age
Male	41	68.3
Female	19	31.7
Total	60	100.0
61.70	15	25.0

Table 3: Distribution of patients by cardiovascular diseases (n=60)

Cardiovascular diseases	No.	%age
Stable angina	21	35.0
Treated hypertension	21	35.0
Treated congestive cardiac disease	18	30.0

X2 = 0.3, P= 0.81

Table 4: Distribution of patients by types of complications (n=60)

Types of complications	No.	%age
Bradycardia	6	10.0
Hypotension	13	21.7
Bradycardia + hypotenstion	3	5.0
Bradycardia + hypotension + Hypoexemia	6	10.0
Hypotension+Hypoexemia	3	5.0
No complication	29	48.33

X2= 50, P=0.001

The pulse rate was monitored after every 10 minutes from baseline to two hours. The mean pulse

rate at baseline was 77.5±8.9 per minutes; at 10 minutes the mean pulse rate was 77.2±12.7 per minutes, at 20 minutes the mean pulse rate was 76.1±14.4 per minutes, at 30 minutes it was 75.6±13.6 per minutes, at 40 minutes the mean pulse rate was 75.6±13.6 per minutes, at 50 minutes it was 75.8±12.9 per minutes, at 60 minutes the mean pulse rate was 75.9±12.4 per minutes, at 70 minutes it was 75.7±12.0 per minutes, at 80 minutes the mean pulse rate was 76.2±11.9 per minutes, at 90 minutes it was 75.8±11.6 per minutes, at 100 minutes it was 76.2±11.3 per minutes, at 110 minutes the mean pulse rate was 76.2±11.4 per minutes and at 120 minutes it was 75.9±11.3 per minutes (Table 5).

Table 5: Distribution of patients by mean pulse rate (n=60)

Time of recording	Pulse rate	
	Mean±SD	P value
Baseline	77.5±8.9	0.69
10 minutes	77.2±12.7	0.46
20 minutes	76.1±14.4	0.18
30 minutes	75.4±14.0	0.26
40 minutes	75.6±13.6	0.13
50 minutes	75.8±12.9	0.23
60 minutes	75.9±12.4	0.06
70 minutes	75.7±12.0	0.06
80 minutes	76.2±11.9	0.15
90 minutes	75.8±11.6	0.10
100 minutes	76.2±11.3	0.11
110 minutes	76.2±11.4	0.15
120 minutes	75.9±11.3	0.06

Key: SD Standard deviation

Table 6: Distribution of patients by mean systolic blood pressure (n=60)

Time of recording	Systolic blood pressure	
	Mean±SD	P value
Baseline	131.5±10.7	0.01
10 minutes	107.7±1934	0.14
20 minutes	102.3±19.9	0.13
30 minutes	104.5±19.5	0.08
40 minutes	108.7±15.4	0.03
50 minutes	111.2±14.7	0.03
60 minutes	113.9±12.5	0.03
70 minutes	113.2±11.8	0.01
80 minutes	115.6±10.4	0.01
90 minutes	115.7±9.4	0.002
100 minutes	117.4±9.3	0.004
110 minutes	116.9±9.4	0.005
120 minutes	117.7±8.5	0.01

Key: SD Standard deviation

The blood pressure was also monitored after every 10 minutes from baseline to two hours. The mean systolic blood pressure at baseline was 131. 5±10.7 mmHg; at 10 minutes the mean systolic blood pressure was 107.7±19.4 mmHg, at 20 minutes the mean systolic blood pressure was 102.3±19.9 mmHg, at 30 minutes it was 104.5±19.5 mmHg, at 40 minutes the mean systolic blood pressure was 108.7±15.4 mmHg, at 50 minutes it was 111.2±14.7 mmHg, at 60 minutes the mean systolic blood pressure was 113.9±12.5 mmHg, at 70 minutes it was 113.2±11.8 mmHg, at 80 minutes the mean systolic blood pressure was 115.6±10.5 mmHg, at 90 minutes it was 115.7V9.4 mmHg, at 100 minutes it was 117.4±9.3 mmHg, at 110 minutes the mean systolic blood pressure was 116.9±9.4 mmHg and at 120 minutes it was 117.7±8.5 mmHg (Table 6).

Table 7: Distribution of patients by mean diastolic blood pressure (=60)

Time of recording	Diastolic blood pressure	
	Mean±SD	P value
Baseline	80.8±11.2	0.008
10 minutes	68.7±10.8	0.008
20 minutes	66.6±12.5	0.069
30 minutes	68.7±11.6	0.020
40 minutes	69.7±10.2	0.020
50 minutes	70.4±10.4	0.003
60 minutes	71.7±8.9	0.010
70 minutes	73.3±7.3	0.001
80 minutes	72.3±7.7	0.001
90 minutes	73.0±7.6	0.001
100 minutes	73.5±7.1	0.001
110 minutes	72.3±8.3	0.002
120 minutes	72.9±8.3	0.003

Key: D Standard deviation

Table 8: Distribution of patients by mean oxygen saturation (n=60)

Time of recording	Diastolic blood pressure	
	Mean±SD	P value
Baseline	94.8±0.8	0.001
10 minutes	94.6±1.4	0.001
20 minutes	94.3±1.7	0.001
30 minutes	94.4±1.6	0.001
40 minutes	94.7±1.4	0.002
50 minutes	94.8±1.2	0.001
60 minutes	95.0±1.3	0.021
70 minutes	95.1±1.2	0.005
80 minutes	95.3±1.1	0.035
90 minutes	95.3±1.07	0.033
100 minutes	95.4±1.2	0.032
110 minutes	94.4±1.0	0.002
120 minutes	95.5±0.87	0.002

Key: SD Standard deviation

The mean diastolic blood pressure at baseline was 80.8±11.2 mmHg, at 10 minutes the mean diastolic blood pressure was 68.7±10.8 mmHg, at 20 minutes the mean diastolic blood pressure was 66.6±12.5 mmHg, at 30 minutes it was 68.7±11.6 mmHg, at 40 minutes the mean diastolic blood pressure was 69.7±11.2 mmHg, at 50 minutes it was

70.4±10.4 mmHg, at 60 minutes the mean diastolic blood pressure was 71.7±8.9 mmHg, at 70 minutes it was 73.3±7.3 mmHg, at 80 minutes the mean diastolic blood pressure was 72.3±7.7 mmHg, at 90 minutes it was 73.0±7.6 mmHg, at 100 minutes it was 73.5±7.1 mmHg, at 110 minutes the mean diastolic blood pressure was 72.3±8.3 mmHg and at 120 minutes it was 72.9±8.3 mmHg (Table 7).

The SpO_2 was also monitored after 10 minutes from baseline to two hours. The mean SpO2 was also monitored after 10 minutes (Table 8).

DISCUSSION

It is generally believed that morbidity will increase after spinal anaesthesia in patients with cardiovascular diseases as immediate haemodynamic effects of spinal anaesthesia such as hypotension, bradycardia and hypoxaemia may pose special problems in these patients. Cardiovascular responses to spinal anaesthesia occur immediately and are determined by combined effects of sympathetic denervation, level of neural block and vagal reaction[1].

Spinal anaesthesia is appropriate and safe in patients with many forms of cardiovascular diseases provides these cardiovascular responses are clearly understood and proper preoperative assessment, patient selection and timely intervention is done. In stable angina pectoris, spinal anaesthesia greatly modifies the stress response and can be applied after having adequate left ventricular preload in patients undergoing lower extremity surgery[2].

Hypotension and bradycardia during spinal anesthesia are common and may relate to some adverse events. Incidence of hypotension (20% or more decrease in systolic blood pressure) in the present study was 57.9%. Usage of high dose of heavy bupivacaine and level of blockage higher than T5 were two modifiable risk factors associated with hypotension during spinal anesthesia[12].

As compared with our results, in our study the hypotension occurred in 21.7% patients, bradycardia in 10% patients, bradycardia and hypotension in 5% patients, bradycardia and hypotension and hypoexemia in 10% patients and hypotension and hypoexemia in 5% patients. While in 48.3% patients there was no complication in any patients.

Hypotension following spinal anaesthesia for caesarean section may result in maternal nausea and vomiting and decreased uteroplacental blood flow with possible fetal acidaemia. Numerous methods have been fried to minimize hypotension. In developing countries where resources are limited, the study aimed to compare a standard infusion of ephedrine with traditional prehydration to prevent spinal hypotension. Systolic pressure decreased 5 min after spinal block. Group 2 had higher mean values of systolic pressure throughout most of the study period than group1. Hypotension occurred in 70% of patients in group 1 and 40% of patients in group 2. Severe hypotension occurred in 40% of group 1 and 13.3% of group 2. Nausea was the most common side effect of hypotension, occurring in 39.4% of all hypotensive patients. Other complications, including hypertension, tachycardia and bradycardia were similar in the two groups[39].

While in our study the hypotension occurred in 21.7% patients, bradycardia occurred in 10% patients, bradycardia and hypotension occurred in 5% patients, bradycardia, hypotension and hypoexemia occurred in 10% patients and hypotension and hypoexemia occurred in 5% patients. The hypertension did not occurred in any patient, while no complication occurred in 48.3% patients.

Cameron AE et al[22] suggested that a slow rate of injection would induce lower incidence of hypotension induced after spinal anaesthesia. Wildsmith JAW[30] hypothesized that the incidence of hypotension during total knee replacement surgery is lower in patients given combined spinal-epidural anesthesia vs those receiving epidural anesthesia alone. The incidence of hypotension was similar in both groups (two patients in each group), as was the incidence of bradycardia (12 vs 7 patients). Combined spinal-epidural anesthesia and epidural anesthesia alone during total knee replacement surgery are associated with the same incidence of hypotension with statistically and clinically similar hemodynamic responses. As compared with our study there were 13 patients of hypotension.

In our study there were 35% patients of stable angina, 35% patients of treated hypertension and 30% patients of treated congestive cardiac failure.

CONCLUSION

It is concluded from our study that in most of the patients no immediate haemodynamic complication occurred after spinal anaesthesia in patients with cardiovascular diseases. The frequency of different haemodynamic complications occurred is in the following pattern hypotension, bradycardia and hypotension, bradycardia hypotension and hypoexemia and hypotension and hypoexemia, while tachycardia and hypertension did not occurred in our study.

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