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Original Research Article

To Compare the Effectiveness of Prophylactic Intramuscular Bolus Dose And Intermittent Intravenous Doses Of Injection Ephedrine On Subarachnoid Block Induced Hypotension.

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Abstract-

Background- Subarachnoid block is a preferred mode of anesthesia for various lower abdominal, pelvic and lower limb orthopedic surgeries owing to its multiple advantages. However, it is not devoid of complications like hypotension and bradycardia. These hemodynamic complications result in significant morbidity and mortality. One of the ways to overcome hypotension is use of vasopressors, out of which Ephedrine is most commonly used vasopressor over the years. Dilemma exists on the better mode of administration. In this observational study, we compared the effectiveness of 30 mg prophylactic intramuscular ephedrine given 15 minutes before giving subarachnoid block with 6 mg intermittent intravenous doses given for treating subarachnoid block induced hypotension and side effects associated with both during routine surgeries performed under subarachnoid block.

Results- Hemodynamic monitoring was done vital parameters (NIBP, PR, Spo2) were corelated with amount and duration of Injection Ephedrine administration. There was significant rise in Blood pressure and pulse rate after 15 minutes in patients who received prophylactic 30 mg Injection Ephedrine intramuscularly. Although, after giving subarachnoid block, both groups experienced a fall in average blood pressures, maximum fall being at 3 minutes and 5 minutes after administration, the fall was significantly higher in patients who did not receive the prophylactic bolus dose. These patients were supplemented with intravenous 6 mg doses of Injection Ephedrine whenever mean arterial pressure dropped below 20% of baseline values. 19 patients (59.38 %) developed clinically significant hypotension at 5 minutes after giving SAB and required 6 mg injection Ephedrine administration followed by 10 patients (31.25%) at 3 minutes after SAB, 6 patients (18.75%) at 10 minutes and 20 minutes after SAB and so on. Also, 15 patients required only 1 dose (6 mg) Injection ephedrine administration, 15 patients required 2 doses (12mg), 1 patient required 3 doses(18 mg) and 1 patient required 4 doses(24 mg) injection Ephedrine over the course of surgery.

Conclusion- We concluded that, in patients who were given prophylactic intramuscular 30 mg ephedrine 15 minutes before giving subarachnoid block:

1. Intramuscular prophylactic ephedrine reduces or eliminates the possibility of hypotension after subarachnoid block, thus also avoiding side effects such as nausea and vomiting.
2. Majority of patients did not have any side effects such as hypertension and tachycardia and even those who had, settled uneventfully and conservatively.

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3. So, intramuscular ephedrine given to ASA grade 1 and 2 patients is advisable and can improve patient's safety and outcome.

In the patients who were given 6 mg injection ephedrine intravenous whenever mean arterial pressure dropped below 20% of preoperative values after giving the subarachnoid block:

1. The intravenous dose of ephedrine successfully treats hypotension after subarachnoid block.
2. This as per need dosing method of giving intravenous ephedrine, treats hypotension by minimally required drug amount, thus avoiding extra drug and its complications.
3. Especially in ASA grade 3 and above patients and patients with known history of hypertension or cardiac diseases can be considered for intravenous dosing regimen, thus optimizing the drug doses as per the condition of the patient.

Keywords- Subarachnoid block, Hypotension, Ephedrine, Intramuscular, Intravenous

1. BACKGROUND

Subarachnoid block is a mode of regional anesthesia which is achieved by administration of local anesthetic agent into the subarachnoid space. subarachnoid block is a preferred mode of anesthesia for various lower abdominal, pelvic and lower limb orthopedic surgeries owing to its advantages like avoidance of airway manipulation, reduced blood loss and better pain control as it gives good intensity of sensory, motor and sympathetic blockade. However, it is not devoid of complications like hypotension and bradycardia. These hemodynamic complications result in significant morbidity and mortality. [(1)] Many factors have been found to result in hypotension after subarachnoid block like [(2)] sympathetic blockade (leads to decrease in systemic vascular resistance by dilatation of both resistance and capacitance vessels leading to venous pooling causing decrease in venous return and subsequently, to fall in stroke volume and cardiac output causing hypotension), Increased venous capacitance (along with block of muscular propulsive forces reduces the venous return and leads to hypotension), Bradycardia (loss of chronotropic and inotropic drive to heart due to block of T1 to T4 sympathetic fibres further leads to decrease in cardiac output and hence, hypotension). Therefore, treating the subarachnoid block induced hypotension is of grave importance. Several strategies are available and tried over years. Some of them include:

Fluid loading (Volume preloading and co-loading can be done. Co- loading is considered superior to preloading. [(3)] Also, studies have shown that patients who received volume pre-load or co-load required almost similar amounts of vasopressors, disputing their individual role in managing subarachnoid block induced hypotension), Positioning (Foot end elevation is and effective and simple way to aid venous return to the heart, but care should be taken that the position should not exceed 20 degrees), Pneumatic stockings (Use of pneumatic stockings is a good strategy for recruiting blood from lower extremities), Vasopressors (Use of vasopressors like ephedrine, mephentermine sulphate, phenylephrine, norepinephrine, cafedrine and theodrenaline.) [(4)] Of the vasopressors used, ephedrine is most commonly used vasopressor over the years as it is cheap and readily available. It is used especially in patients with sympathetic hyperactivity i.e in patients who develop bradycardia associated with hypotension. Ephedrine is a sympathomimetic amine which acts on both alpha and beta adrenergic receptors. Thus, benefitting cases with both bradycardia and hypotension. It also indirectly increases the release of endogenous catecholamine. [(5)] It can be given orally as well as parenteral. Parenteral prophylactic intramuscular route and therapeutic intravenous route of administration of ephedrine in subarachnoid block induced hypotension have been

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extensively studied individually. Both the routes of administration possess merits as well as demerits. So, controversies still exist on the best regimen to be used. The purpose of conducting this study was to compare the effectiveness of the two parenteral regimens (intramuscular and intravascular) of the use of injection ephedrine on perioperative management of subarachnoid block induced hypotension and side effects associated with both during routine non- obstetric surgeries performed under subarachnoid block in patients belonging to ASA 1 and 2 categories.

2. METHODS

This observational study was approved by our institute's ethics committee and written consent was obtained. This study was designed with the aim of assessing the effectiveness of different modes of Injection ephedrine administration on subarachnoid block induced hypotension and the primary objective of comparing the effectiveness of prophylactic intramuscular ephedrine 30 mg given 15 minutes before giving subarachnoid block with intermittent intravenous doses of 6 mg ephedrine for treating subarachnoid block induced hypotension. This observational study was carried out on ASA 1 and 2 patients who underwent routine surgeries under subarachnoid block in our institute. Records of patients were screened as inclusion criteria as ASA 1 and 2, between 18 to 60 years of age of either sex undergoing routine surgeries under subarachnoid block. Vital data such as age, sex, weight, diagnosis and surgery planned were noted. The selected patient's records were divided into two groups, Group A, who received prophylactic intramuscular 30 mg injection ephedrine 15 minutes before giving subarachnoid block and group B, who received intravenous 6 mg doses of injection Ephedrine when Mean arterial pressure dropped below 20% of baseline values. Both groups contained 32 patients each.

The sample size was based on the 20% reduction in Mean arterial pressure with 99 % confidence level by using the following calculation- Proportion in control- 70%, Proportion in case- 100%, Significance level- 0.010, Power- 0.800. Sample size-32 in each group.

All patients in both groups were connected with a multipara monitor and the baseline values of pulse rate, non-invasive blood pressure and spo2 were rechecked. The patients were started with crystalloid infusion at 20 ml/kg of body weight. The subarachnoid block was then performed with the patient in sitting position, under strict aseptic precautions at L2-3 or L3-4 intervertebral space with 4 ml of 0.5% bupivacaine(heavy) after confirmation of free flow of cerebrospinal fluid with a 26 Gauze Quincke Babcock Spinal needle. Patients were then immediately put in supine position with a 15° head low tilt till the desired level of subarachnoid block is obtained.

Although the patient monitoring was carried out continuously but the heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, spo2, and ECG changes (if any) were recorded and collected at 15 minutes before subarachnoid block and thereafter at 1, 3, 5, 10, 15, 20, 25, 30, 40, 60, 80, 100, 120 minutes (as per procedure time) after giving the subarachnoid block. Nausea, vomiting, headache or any other side effects were noted

The patients who received either of the two drug regimens were observed.

Prophylactic intramuscular injection ephedrine- Patient was injected with 30 mg ephedrine intramuscularly in anterolateral aspect of thigh 15 minutes before giving the subarachnoid block.

Intravenous injection ephedrine- Patients who received intermittent intravenous doses were given ephedrine prepared by diluting 1 ml (30 mg) ephedrine to 5 ml of which 1 ml (6mg) was given when mean arterial pressure dropped below 20 % of baseline values. The data was collected from their observation charts and the patients were divided into 2 groups based on

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the regimen of ephedrine which was used to treat subarachnoid block induced hypotension. This data was then scrutinized and patients were included in the study based on inclusion and exclusion criteria and divided into 2 groups:

Group A- Patients who received intramuscular 30 mg ephedrine 15 minutes before giving subarachnoid block.

Group B- Patients who received intravenous 6 mg of ephedrine when mean arterial pressure dropped below 20% of preoperative values.

Collected data was analyzed by means of statistical software SPSS.

Independent t test was used for comparison between two groups for continuous variables like age, weight, heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, first dose of rescue analgesic.

Chi square test was used for ASA and gender.

Continuous variables were presented as mean ± SD.

Results were considered statistically significant if P value < 0.05.

3. RESULTS

No Statistically significant variation is present in the demographic characteristics and types of procedures in both groups (P>0.05). (Table 1, Fig 1)

There was no significant difference in average systolic, diastolic and mean arterial blood pressures among both groups 15 minutes before giving subarachnoid block. There was a significant rise in average blood pressures in patients who received prophylactic ephedrine (Group A). Thereafter, both groups show a fall in average blood pressures, but the fall is significantly higher in patients who did not receive prophylactic ephedrine and were supplemented with intravenous 6 mg doses of injection ephedrine when clinically significant hypotension developed (fall of mean arterial pressure below 20% of preoperative values) (Table 2,3,4 and Fig 2,3,4). There was no statistically significant difference in pulse rate among both groups at different time intervals (Table 5, Fig 5). Peak fall in blood pressure occurred at 5 minutes after giving subarachnoid block in maximum patients (Table 6, Fig 6). 6-12 mg (1-2 doses) of intravenous injection ephedrine was sufficient in maximum patients (46.9% each) in group B (who did not receive prophylactic 30 mg injection ephedrine (Table 7, Fig 7). Maximum patients experienced a fall in blood pressure at 5 minutes after giving subarachnoid block (59.38%) followed by 3 minutes after subarachnoid block (31.25%) requiring intravenous 6 mg rescue doses of injection ephedrine. (Table 8, Fig 8)

No patients suffered any adverse effects like nausea or vomiting in both groups. Hypertension and tachycardia were seen in group A and hypotension in group B, which when clinically significant was treated with 6 mg doses of injection ephedrine.

Table 1: Age and sex distribution among study groups

		Groups				**Chi-square**	**p**
		Group A		**Group B**			
		N	**%**	**N**	**%**		
Age Groups (years)	<= 20 years	3	9.4%	1	3.1%	3.740	0.442
	21 – 30 years	5	15.6%	8	25.0%		

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	31 – 40 years	12	37.5%	9	28.1%		
	41 – 50 years	8	25.0%	6	18.8%		
	> 50 years	4	12.5%	8	25.0%		
Sex	Male	21	65.6%	21	65.6%	0.000	1.000
	Female	11	34.4%	11	34.4%		

Fig 1: Age and sex distribution among both groups

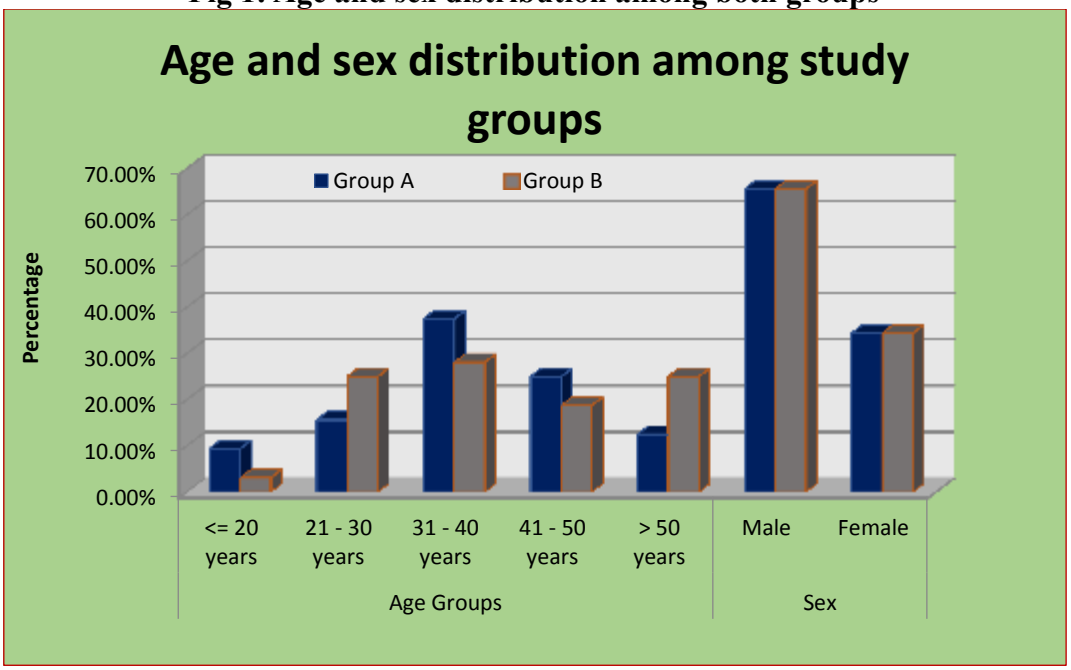

Table 2: Mean Systolic blood pressure comparison among study groups at different time intervals

Group		N	Mean SBP (mmhg)	Std. Deviation	T	p
15 min before SAB	Group A	32	118.38	± 8.69	0.768	0.445 Not significant
	Group B	32	120.31	± 11.31		
1 min after SAB	Group A	32	134.56	± 10.19	6.645	0.000
	Group B	32	116.75	± 11.23		
3 min after SAB	Group A	32	136.81	± 11.98	12.273	0.000
	Group B	32	101.31	± 11.15		
5 min after SAB	Group A	32	130.94	± 9.42	12.566	0.000
	Group B	32	94.81	± 13.26		
10 min after SAB	Group A	32	127.13	± 9.89	9.054	0.000
	Group B	32	104.69	± 9.94		
15 min after SAB	Group A	32	123.94	± 9.14	7.376	0.000
	Group B	32	105.19	± 11.10		
20 min after	Group A	32	121.50	± 8.70	6.371	0.000

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SAB	Group B	32	106.00	± 10.67		
25 min after SAB	Group A	32	119.25	± 9.38	3.830	0.000
	Group B	32	109.69	± 10.56		
30 min after SAB	Group A	32	119.31	± 8.34	4.245	0.000
	Group B	32	110.19	± 8.85		
40 min after SAB	Group A	32	118.94	± 8.30	3.797	0.000
	Group B	32	110.38	± 9.68		
60 min after SAB	Group A	31	119.23	± 9.50	4.203	0.000
	Group B	26	109.92	± 6.63		
80 min after SAB	Group A	20	118.10	± 8.74	3.063	0.004

Fig 2: Mean Systolic Blood Pressure comparison among study groups at different time intervals

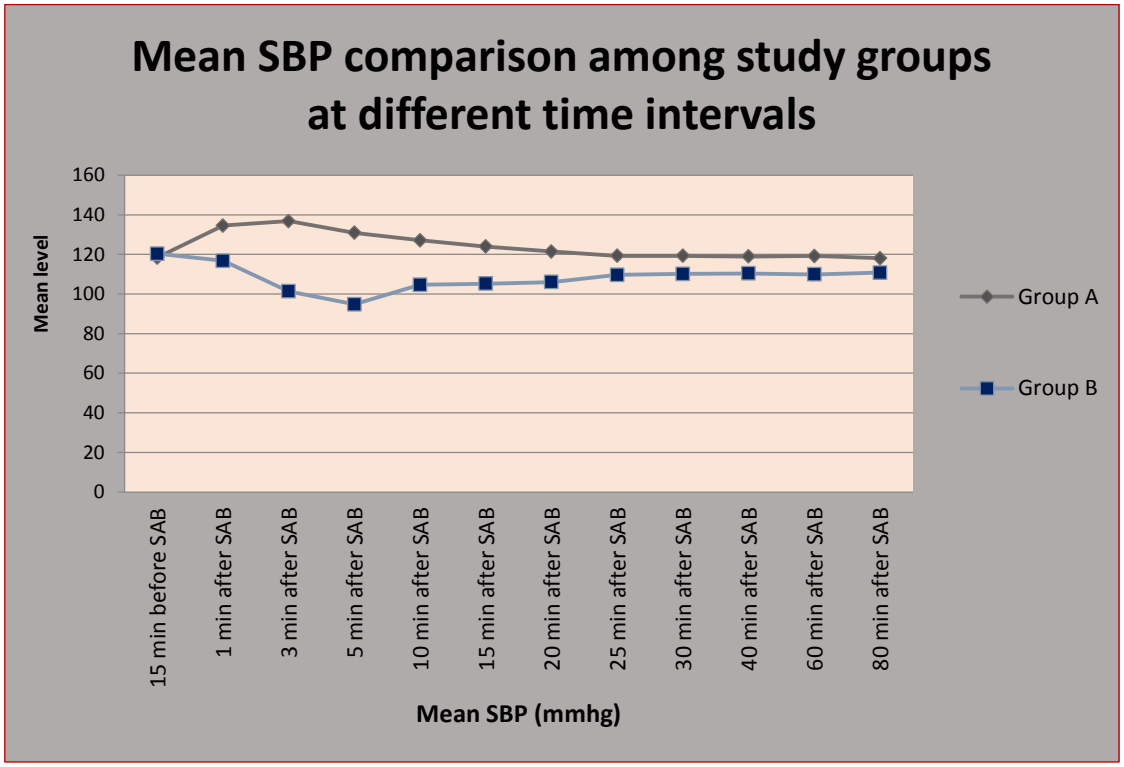

Table 3: Mean Diastolic Blood Pressure comparison among study groups at different time intervals

Group		N	Mean DBP (mmhg)	SD	t	p
15 min before SAB	Group A	32	75.56	± 7.09	0.677	0.501
	Group B	32	74.25	± 8.37		
1 min after SAB	Group A	32	86.44	± 7.16	7.185	0.000
	Group B	32	73.13	± 7.65		
3 min	Group A	32	85.56	± 7.98	10.700	0.000

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after	Group B	32	64.38	± 7.86		
5 min after	Group A	32	81.88	± 7.17	10.671	0.000
	Group B	32	58.38	± 10.19		
10 min after	Group A	32	78.06	± 7.39	7.143	0.000
	Group B	32	64.19	± 8.13		
15 min after	Group A	32	76.13	± 7.40	4.929	0.000
	Group B	32	65.69	± 9.42		
20 min after	Group A	32	74.75	± 6.90	4.777	0.000
	Group B	32	64.81	± 9.53		
25 min after	Group A	32	73.44	± 6.71	3.271	0.002
	Group B	32	67.56	± 7.63		
30 min after	Group A	32	71.94	± 6.33	1.821	0.073
	Group B	32	68.56	± 8.35		
40 min after	Group A	32	72.25	± 6.15	2.397	0.020
	Group B	32	67.81	± 8.48		
60 min after	Group A	31	72.58	± 5.68	3.284	0.002
	Group B	26	68.00	± 4.66		
80 min after	Group A	20	72.80	± 5.85	3.329	0.002
	Group B	22	67.82	± 3.70		

Fig 3: Comparison of mean diastolic blood pressures among both groups at different time intervals.

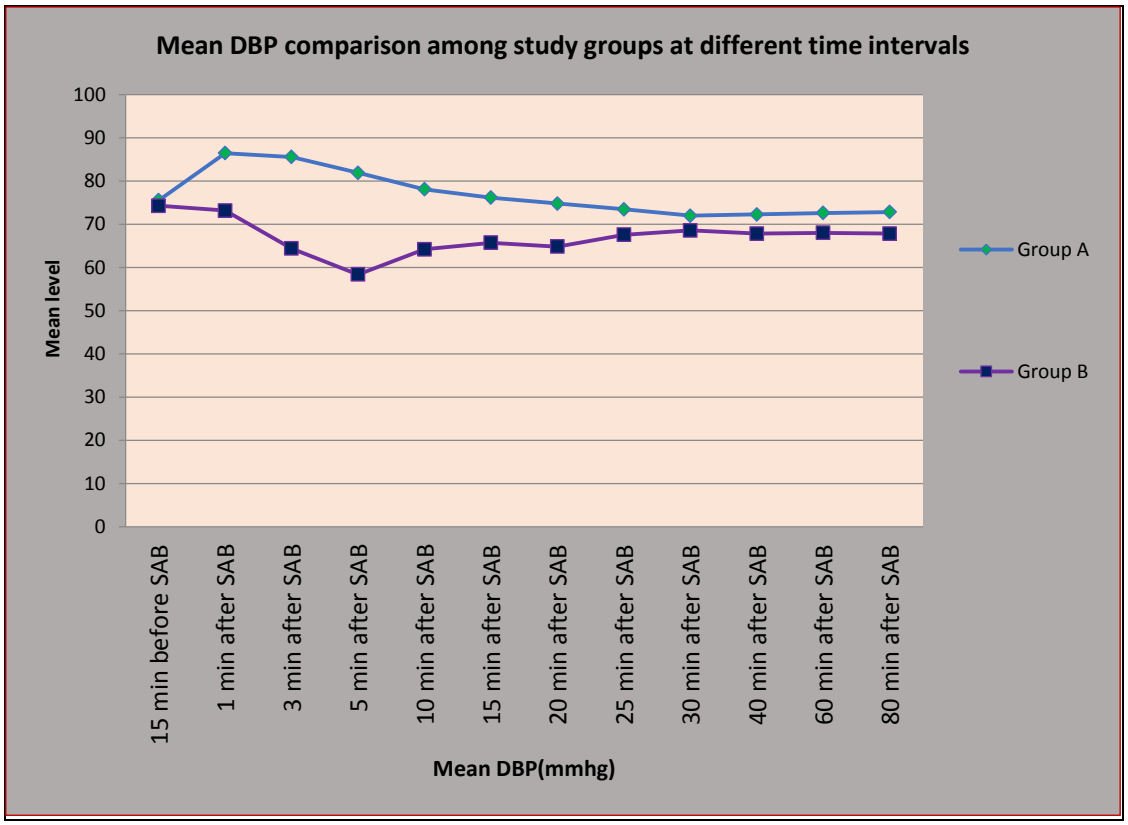

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Table 4: Mean MAP comparison among study groups at different time intervals

Group		N	Mean MAP (mmhg)	Std. Deviation	T	p
15 min before SAB	Group A	32	89.78	± 7.64	0.125	0.901
	Group B	32	90.03	± 8.38		
1 min after SAB	Group A	32	102.31	± 7.94	7.347	0.000
	Group B	32	87.75	± 7.92		
3 min after SAB	Group A	32	102.34	± 9.35	11.571	0.000
	Group B	32	76.41	± 8.57		
5 min after SAB	Group A	32	97.53	± 8.17	11.216	0.000
	Group B	32	70.50	± 10.92		
10 min after SAB	Group A	32	94.22	± 8.62	7.824	0.000
	Group B	32	77.78	± 8.19		
15 min after SAB	Group A	32	91.72	± 8.33	5.812	0.000
	Group B	32	78.84	± 9.36		
20 min after SAB	Group A	32	89.72	± 7.04	5.360	0.000
	Group B	32	78.44	± 9.60		
25 min after SAB	Group A	32	88.50	± 7.50	3.680	0.000
	Group B	32	81.25	± 8.24		
30 min after SAB	Group A	32	87.81	± 6.88	2.786	0.007
	Group B	32	82.53	± 8.23		
40 min after SAB	Group A	32	87.44	± 6.47	2.967	0.004
	Group B	32	81.72	± 8.78		
60 min after SAB	Group A	31	87.97	± 6.99	3.767	0.000
	Group B	26	81.88	± 4.74		
80 min after SAB	Group A	20	87.85	± 4.87	3.971	0.000
	Group B	22	82.18	± 4.38		

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Fig 4: Comparison of average- mean arterial blood pressures among both groups at different time intervals.

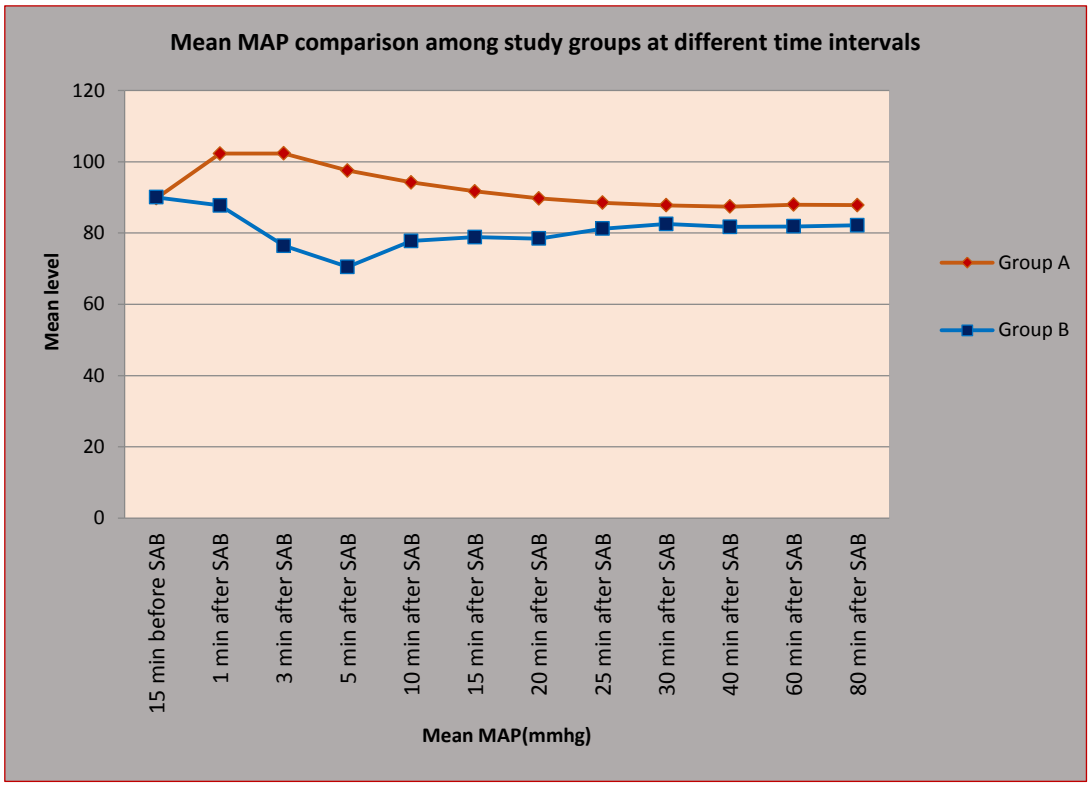

Table 5: Mean pulse rate comparison among study groups at different time intervals

Group		N	Mean Pulse rate (bpm)	Std. Deviation	t	p
15 min before SAB	Group A	32	82.78	± 12.00	0.188	0.852
	Group B	32	83.44	± 15.73		
1 min after SAB	Group A	32	88.69	± 10.38	1.423	0.160
	Group B	32	84.00	± 15.48		
3 min after SAB	Group A	32	89.72	± 9.98	1.608	0.113
	Group B	32	84.72	± 14.48		
5 min after SAB	Group A	32	87.09	± 10.50	0.857	0.395
	Group B	32	84.53	± 13.26		
10 min after SAB	Group A	32	85.06	± 11.44	0.122	0.904
	Group B	32	85.47	± 15.02		
15 min after SAB	Group A	32	83.25	± 12.10	0.635	0.528
	Group B	32	85.25	± 13.09		
20 min after SAB	Group A	32	82.41	± 11.80	0.743	0.460
	Group B	32	84.72	± 13.07		
25 min after SAB	Group A	32	81.56	± 12.06	0.439	0.662
	Group B	32	82.81	± 10.68		
30 min after SAB	Group A	32	81.28	± 12.61	0.565	0.574
	Group B	32	82.94	± 10.75		
40 min after SAB	Group A	32	81.31	± 12.05	0.649	0.519

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	Group B	31	83.13	± 10.04		
60 min after SAB	Group A	31	80.90	± 12.07	0.174	0.862
	Group B	26	81.42	± 10.07		
80 min after SAB	Group A	20	81.70	± 12.58	0.329	0.744
	Group B	22	80.55	± 10.15		

Fig 5: Comparison of mean pulse rate among groups at different time intervals

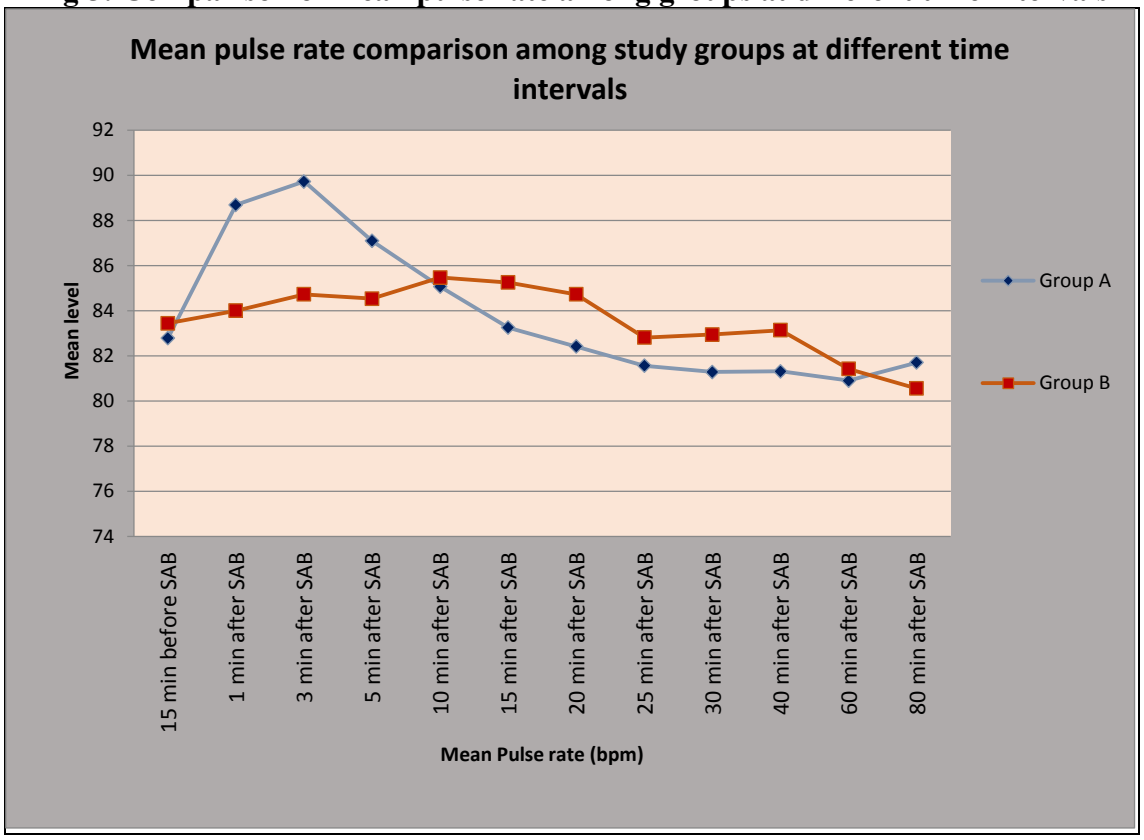

Table 6: Hypotension at 5 min after SAB

Fall in blood pressure	**Group**		**Total**
	Group A	**Group B**	
Yes	0	21	21
	0.0%	65.6%	32.8%
No	32	11	43
	100.0%	34.4%	67.2%
Total	**32**	**32**	**64**
	100.0%	**100.0%**	**100.0%**
Chi-square = 31.256, p = 0.000			

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Fig 6: Patients developing hypotension at 5 minutes after giving subarachnoid block

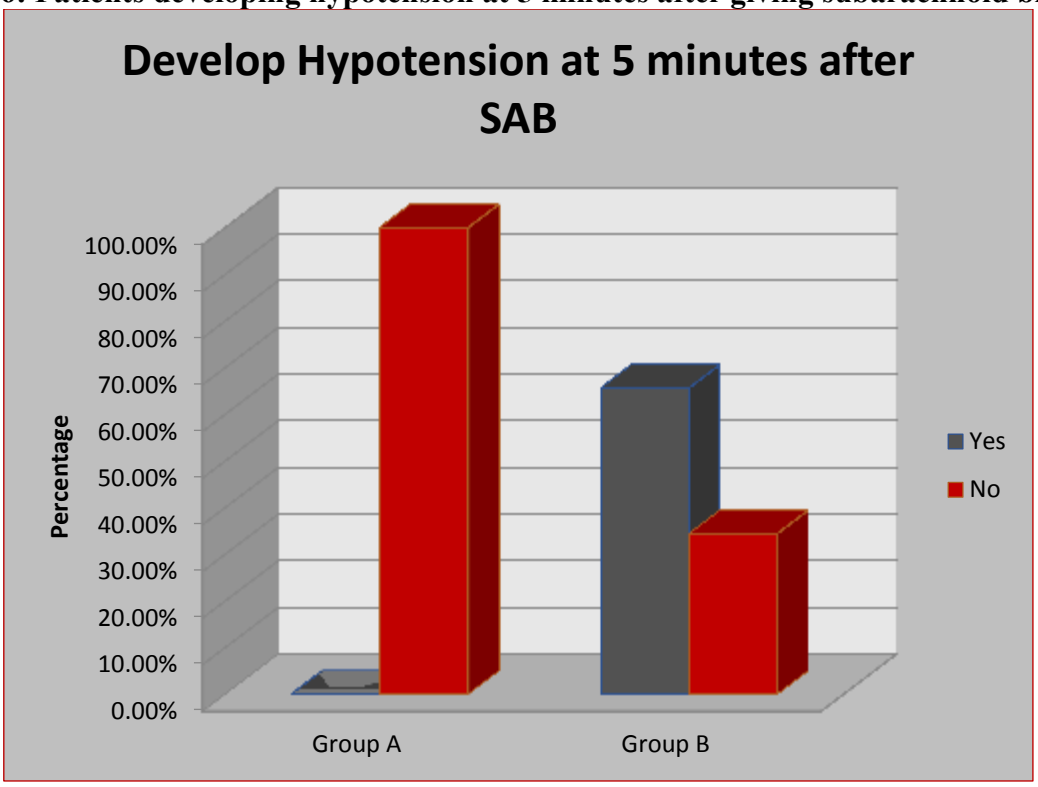

Table 7: Intravenous intermittent bolus ephedrine administration

Ephedrine bolus doses	Group				Chi-Square	p
	Group A		Group B			
	N	%	N	%		
Not given	32	100.0%	0	0.0%	64.00	0.000
1 dose (6 mg)	0	0.0%	15	46.9%		
2 doses (total 12 mg)	0	0.0%	15	46.9%		
3 doses (total 18 mg)	0	0.0%	1	3.1%		
4 doses (total 24 mg)	0	0.0%	1	3.1%		
TOTAL	**32**	**100.0%**	**32**	**100.0%**		

Fig 7: Intravenous intermittent bolus ephedrine administration

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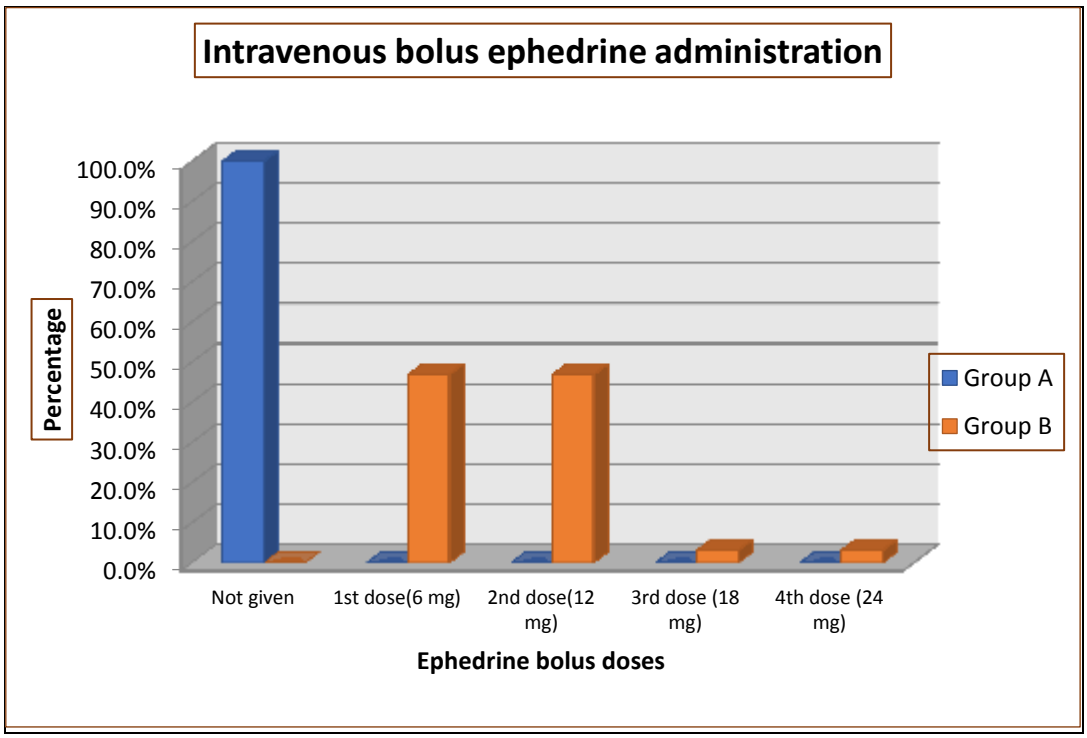

Table 8: Frequency of intermittent 6 mg doses of injection ephedrine in group B

Time	Frequency	Percentage
At 3 min after SAB	10	31.25%
At 5 min after SAB	19	59.38%
At 10 min after SAB	6	18.75%
At 15 min after SAB	5	15.63%
At 20 min after SAB	6	18.75%
At 25 min after SAB	3	9.38%
At 40 min after SAB	3	9.38%

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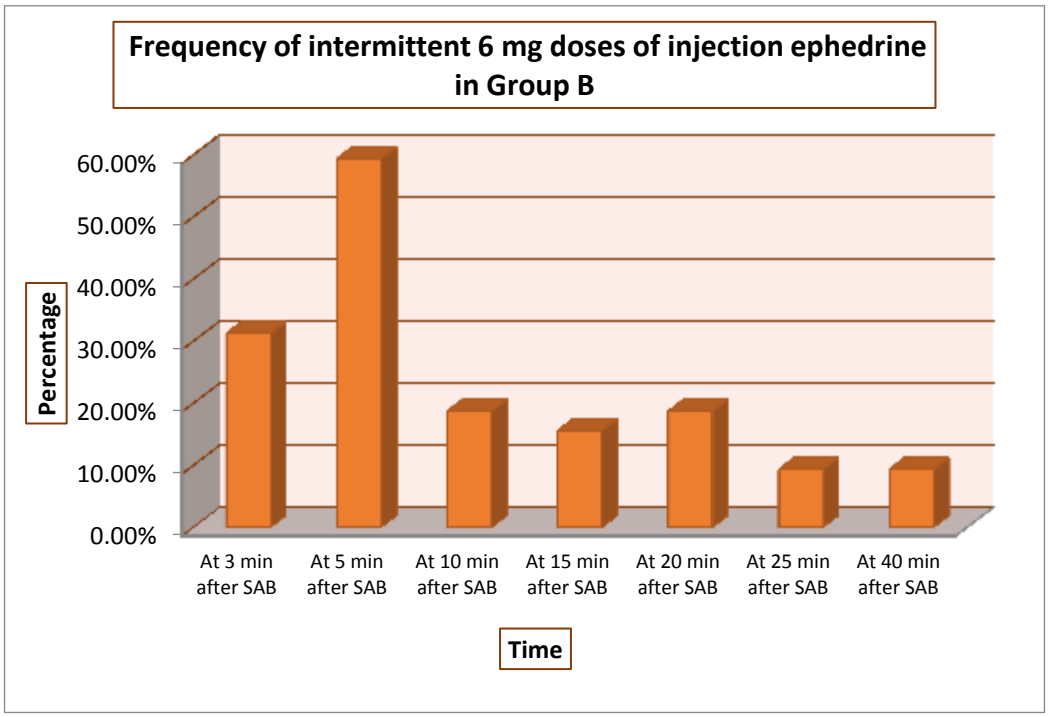
Fig 8: Frequency of intermittent 6 mg doses of injection ephedrine in group B



4. DISCUSSION

Subarachnoid block is the preferred mode of anesthesia in patients undergoing lower abdominal, pelvic and lower limb orthopedic surgeries. It poses the advantage of being associated with better operating conditions as blood loss is reduced, there is lower risk of deep vein thrombosis and better postoperative analgesia. It also avoids manipulation of airway and is the ideal mode of anesthesia in patients with difficult airway undergoing surgeries manageable with spinal anesthesia. [6,7] As discussed before hypotension is the result of sympathetic blockade following vasodilation and pooling of blood in capacitance vessels which leads to reduction in cardiac output and subsequent fall in blood pressure. There are various strategies to manage post spinal hypotension amongst which ephedrine is most commonly used vasopressor. Ephedrine is an alpha and beta stimulant, which increases both blood pressure and heart rate. The predominant beta effect of ephedrine increases arterial pressure by increasing cardiac output. [7,8,9]

This study evaluates the effectiveness of ephedrine when it is used prophylactically or interventional in the management of post spinal hypotension. In our study, we observed 64 patients belonging to ASA 1 or ASA 2 class, divided into two groups. Group A included patients who received 30 mg prophylactic ephedrine intramuscularly 15 minutes before giving subarachnoid block and group B included patients who received intravenous ephedrine 6 mg whenever mean arterial blood pressure dropped below 20 % of preoperative values. The dose of ephedrine given prophylactically was similar as given in the study conducted by

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Singh S et al although timing of administration was different. Singh S. et al administered 30 mg ephedrine intramuscularly 10 minutes prior to administration of block whereas we gave it 15 minutes before the block. [7]

Perioperative blood pressure and heart rate trends.

After the administration of subarachnoid block, there occurred a decline of average systolic, diastolic and mean blood pressures in both groups, which is consistent with the effects of subarachnoid block. The onset of blood pressure (systolic, diastolic as well as mean arterial pressures) decline was apparent in first 5 minutes after subarachnoid block administration in both groups. In our study, we see mean arterial pressures for all purposes. Although maximum average decline in average mean arterial pressures occurred in first 40 minutes after giving subarachnoid block in group A, but the decline never reached to values below 20% of baseline throughout the surgery and hence, did not require rescue intravenous rescue doses for maintenance. Our study also shows higher pulse rates in group A in first half an hour of giving subarachnoid block. These findings are similar to the study conducted Singh S et al. [7] where the trend of fall of blood pressure was similar but 5 patients required rescue therapy in spite of prophylactic ephedrine administration.

In group B (i.e no prophylactic ephedrine was administered), the maximum fall of average mean arterial pressure occurred in first 5 minutes (in 65.6% patients in group B). This finding is consistent with the studies conducted by Hemmingsen C et al [11] and Kang YG et al [10]

The decline of blood pressure occurred in both groups but it was higher and earlier in group B i.e. who did not receive prophylactic intramuscular ephedrine before giving subarachnoid block (the difference was statistically significant among both groups throughout the duration of surgery, $p<0.05$).

Clinically significant hypotension.

Only the patients in group B developed clinically significant hypotension (MAP dropped below 20% of preoperative values) and required 6 mg intravenous ephedrine bolus administration. The difference in hypotension among both groups was statistically significant.

Intravenous intermittent ephedrine administration.

All patients in group B required rescue ephedrine 6 mg at different time intervals. Maximum patients in group B developed clinically significant hypotension at 5 minutes after giving subarachnoid block (59.38%) followed by 31.25% patients at 3 minutes after giving subarachnoid block. This is consistent with the findings of Hemmingsen C et al [11] and Kang YG et al [10]

Number of hypotensive episodes (requiring 6 mg ephedrine administration) was 1 in 15 patients and 2 in 15 patients i.e. out of 32 patients in group B, 15 patients only required 1 dose (6 mg) of injection ephedrine and 15 patients required 2 doses(12 mg) in intravenous injection ephedrine. This is similar to the findings in the study conducted by Kaur D et al [12] in which only a single hypotensive event took place which required treatment.

Hence, in our study we observed that 6-12 mg intravenous dose of ephedrine will be sufficient to treat subarachnoid block induced hypotension in majority of patients of said age group and ASA classification.

Adverse Effects

The adverse effects of ephedrine are not common but it can cause hypertension, tachycardia, nausea, vomiting, palpitations, headache etc.

In present study, in group A, 9 patients out of 32 developed BP >140/90, 15 minutes after the administration of 30 mg intramuscular ephedrine, all of whom were normotensive before the administration. Similar findings were seen in study by Singh S et al [7] but only 4 patients out

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of 50 in their study developed hypertension after administration of 30 mg ephedrine 10 minutes prior to subarachnoid block.
Similarly, 3 patients out of 32 in group A developed tachycardia (HR>100bpm) after the administration of 30 mg intramuscular ephedrine. It also corresponds with the study of Singh S et al [7] where 6 patients out of 50 developed tachycardia. Both these episodes of hypertension and tachycardia were short lived and did not require any treatment. In the study conducted by Sternlo JE et al [8] comparing the efficacy of prophylactic intramuscular ephedrine vs placebo, out of 49 patients only 2 patients developed hypertension and tachycardia.
No ECG changes and changes in Spo2 were noted.
Our study hence, demonstrated that injection ephedrine is a relatively safe drug.

After analyzing the observations from the study, we came to an opinion that prophylactic intramuscular ephedrine administration, is associated with an overall reduction in development of postspinal hypotension and reduces the need of giving rescue intermittent doses of intravenous ephedrine. We found a stable intraoperative course after administration of prophylactic ephedrine but caution should be taken in hypertensive patients and patients with known cardiac ailments. This effect was similarly noted in studies by Singh S et al [7] Kafle S et al [9], J.E. sternlo et al [8] and Fawad Ahmed Khan et al [13].
On the other hand, postspinal hypotension develops after 3-5 minutes of administration of subarachnoid block in majority of patients which can be treated with 6-12 mg of intravenous ephedrine administration. No side effects related to hypotension were noted in our study. Hypotension was treated as soon as blood pressure (MAP) dropped below 20 % of preoperative values. Similar findings were seen in the study conducted by Kaur D et al [12].

5. CONCLUSION

Hypotension is a known complication after giving subarachnoid block and there are various strategies to prevent or treat it. One of the way is the use of vasopressors such as ephedrine to counter the hypotension associated with subarachnoid block.
Intravenous injection ephedrine given in intermittent bolus doses is used to treat subarachnoid block induced hypotension.
Intramuscular prophylactic ephedrine also prevents the same.
We concluded that-
In patients who were given prophylactic intramuscular 30 mg ephedrine 15 minutes before giving subarachnoid block:

1. Intramuscular prophylactic ephedrine reduces or eliminates the possibility of hypotension after subarachnoid block, thus also avoiding side effects such as nausea and vomiting.
2. Majority of patients did not have any side effects such as hypertension and tachycardia and even those who had, settled uneventfully and conservatively.
3. So, intramuscular ephedrine given to ASA grade 1 and 2 patients is advisable and can improve patient's safety and outcome.

In the patients who were given 6 mg injection ephedrine intravenous whenever mean arterial pressure dropped below 20% of preoperative values after giving the subarachnoid block:

1. The intravenous dose of ephedrine successfully treats hypotension after subarachnoid block.

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2. This as per need dosing method of giving intravenous ephedrine, treats hypotension by minimally required drug amount, thus avoiding extra drug and its complications.
3. Especially in ASA grade 3 and above patients and patients with known history of hypertension or cardiac diseases can be considered for intravenous dosing regimen, thus optimizing the drug doses as per the condition of the patient.

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