Section: Anesthesiology

Original Research Article

COMPARATIVE STUDY OF 6% HETASTARCH SOLUTION AND POLYGELINE SOLUTION AS PRE LOADING FLUID FOR THE PREVENTION OF HYPOTENSION FOLLOWING SPINAL ANESTHESIA IN LOWER LIMB SURGERIES

S. Anjaneya Vara Prasad[1], Olugumanu Srinivas Kumar[2], T. Swathi Priyadarshini[3], M. Raghupraveen[4]

[1-2]*Associate Professor, Department of Anesthesiology, Government Medical College/GGH, Nandyal, Andhra Pradesh, India.*
[3]*Assistant Professor, Department of Anesthesiology, Kurnool Medical College, Kurnool, Andhra Pradesh, India.*
[4]*Professor, Department of Anesthesiology, Great Eastern Medical School, Ragolu, Srikakulam, Andhra Pradesh, India.*

Received *: 20/11/2023*
Received in revised form *: 25/12/2023*
Accepted *: 09/01/2024*

Corresponding Author:
Dr. T. Swathi Priyadarshini
Assistant Professor, Department of Anesthesiology, Kurnool Medical College, Kurnool, Andhra Pradesh, India.
Email: swathi.talikota@gmail.com.

DOI: 10.5530/ijmedph.2024.1.3

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (1); 13-19

ABSTRACT

Background: The present study is conducted to evaluate the hemodynamic changes during spinal anaesthesia after preloading with infusion fluids as follows. A) 500ml of 6% Hydroxyethyl starch /Hetastarch B) 500ml of polygeline / Haemaccel.

Materials and Methods: This is a comparison study and the study will be conducted in 60 ASA I & II adult patients of either sex scheduled to undergo elective daycare surgeries under spinal anaesthesia at Kurnool Medical College, Kurnool. The study will be conducted for a period of 1 year at Department of Anaesthesia in Kurnool Medical College, Kurnool and Government Medical College/GGH, Nandyal. **Results:** Sixty patients in the age group of 25 - 60 years of ASA Grade I and II scheduled for elective lower limb surgeries were randomly allocated into two groups. Group 1 received 10 ml/kg of Haemaccel, Group 2 received 10 ml/kg of HES 6%, 15 minutes prior to spinal anaesthesia. After a detailed preanaesthetic evaluation and obtaining informed consent, all the patients were premedicated with oral diazepam. Baseline heart rate, systolic blood pressure and diastolic blood pressure were measured in supine position using a mercury sphygmomanometer. All patients were preloaded. After preloading the PR, SBP, DBP and MAP were recorded and all patients were administered spinal anaesthesia under strict aseptic precautions with 3.2 ml of 0.5% of heavy Bupivacaine. The level of analgesia was achieved up to T8 to T10. Pulse rate, systolic, diastolic and mean arterial blood pressure was recorded every 2 minutes for the first 10 minutes, every 5minutes for the next 50 minutes and every 10 minutes till the end of surgery after subarachnoid block. Hypotension - defined as decrease in systolic blood pressure to less than 90 mm of Hg and 70% of the baseline value whichever is greater. Hypotension was treated by vasopressor, repeated as necessary until the blood pressure was increased to >70 % of the baseline value. Bradycardia when encountered was treated with vagolytic agent. The incidence of hypotension in group 1 was 9% and in group 2 was 4%. The requirement of vasopressor ephedrine to counter hypotension was less in group 2 when compared to group 1.

Conclusion: Colloids by increasing the plasma oncotic pressure help to expand the plasma volume by remaining intravascularly for a longer time and it also draws fluid into the intravascular space, offset spinal anaesthesia induced hypotension. Present study confirms that 6% HES is better colloid than Haemaccel in preventing hypotension in patients undergoing surgeries under SAB.

Keywords: Spinal Anesthesia, Colloids, HES, Hypotension, Arterial Blood Pressure.

INTRODUCTION

Hypotension is one of the most frequent side effects of spinal anaesthesia.[1] Large volumes of IV fluids prior to spinal anaesthesia for prevention of hypotension has become common in practice.[1,2]

Spinal hypotension is mainly because of preganglionic sympathetic block with an increase in the capacity of the intravascular space due to vasodilatation Also is decreased vascular resistance and increased compliance of capacitance vessels. Among the neural structures in the sub arachnoid space, affected by local anaesthetic agent introduced are the preganglionic fibers in the thoracolumbar segment going to the sympathetic ganglia and chain. This preganglionic sympathetic block produces paralysis of vasoconstrictor fibers contained in the arterioles, capillaries and veins.

Major circulatory changes occur on venous side with actual dilatation of peripheral veins and venules leading to increased venous compliance. These changes combined with paralysis of skeletal muscle causes loss of muscular milking action on veins and the interference with thoracic respiratory pump resulting in decrease of the venous return, hence cardiac output reduces and blood pressure falls.

Crystalloid administration prior to spinal anaesthesia was practiced to reduce the incidence of hypotension.[3,4] Crystalloid solutions have a short intravascular half-life and poor plasma expanders. Colloid solutions which remain in the circulation for a longer period seem to be an effective alternative.

Increased compliance of capacitance vessels has been overcome by administration of intravenous fluids prior to the block. Colloids (Hydroxy ethyl starch, polygeline) preloading prevent hypotension and hypovolemia more effectively than crystalloid solutions in patients scheduled for elective or emergency surgeries under spinal anaesthesia. Present study is therefore conducted to evaluate the hemodynamic changes during spinal anaesthesia after preloading with infusion fluids as follows. A)500ml of 6% Hydroxyethyl starch /Hetastarch B) 500ml of polygeline / Haemaccel

Aims and Objectives

- To show that preloading with colloids reduce the incidence of hypotension from spinal anaesthesia.
- To compare the efficacy of HES 6% and Haemaccel in decreasing the incidence and severity of hypotension after subarachnoid block.

MATERIAL AND METHODS

This is a comparison study and the study will be conducted in 60 ASA I & II adult patients of either sex scheduled to undergo elective daycare surgeries under spinal anaesthesia at Kurnool Medical College, Kurnool. The study will be conducted for a period of 1 year at Department of Anaesthesia in Kurnool Medical College, Kurnool and Government Medical College/GGH, Nandyal.

Inclusion Criteria

- Elective cases with ASA physical status class I and II
- Age between 25 and 60 years.

Exclusion Criteria

- Emergency surgeries.
- Severe anemia, coagulation abnormalities and bleeding disorders.
- Previous history of surgeries on the spine.
- Spinal deformity cases
- In patients with history of backache
- Active skin lesions over lumbosacral region
- History of hypersensitivity
- Obese, chronic hypertension, diabetes and cardiac patients

Preanaesthetic Examination and Preparation

The study protocol was approved by Hospital Ethical committee & Ethical clearance obtained from the institution. Preanaesthetic check-up done one day prior to the surgery included history, clinical examination, systemic examination of cardiovascular, respiratory and central nervous system and spine examination for deformities. The procedure was explained to the patients and informed written consent obtained. Basic laboratory investigations like complete haemogram, bleeding time, clotting time, blood sugar, blood urea, serum creatinine and urine analysis were carried out routinely on all patients. ECG done in patients above 40 years of age and chest x-ray when indicated.

Premedication

To reduce anxiety and apprehension, all patients were given Tablet Diazepam 0.2mg/kg body weight the night prior to surgery. Patients were kept nil orally from previous night of surgery.

Methods

60 ASA I and II patients posted for lower limb surgeries under spinal anaesthesia were randomly allocated into

- Group 1 - received 10ml/kg of Haemaccel
- Group 2 - received 10ml/kg of 6% HES

Procedure

Patients were transported to operation theatre where IV line was secured with 18G cannula after wiping with an alcohol swab. Baseline heart rate, systolic blood pressure and diastolic blood pressure were measured in supine position using a mercury sphygmomanometer. Mean arterial blood pressure was derived from the formula, MAP = DBP + PP/3. Fluids were administered prior to spinal anaesthesia over duration of 15 minutes. After intravascular fluid administration, pulse rate and blood pressure were measured.

With all aseptic precautions and patient in lateral position, subarachnoid block was performed at L3-L4 interspace with 25G spinal needle using 3.2ml of 0.5% Bupivacaine Hcl heavy. And the patient was turned to supine position immediately and determined level of anaesthesia by pinprick method. Pulse rate, systolic, diastolic and mean arterial blood pressure was recorded at, every 2 minutes for the first 10 minutes, every 5 minutes for the next 50 minutes and every 10 minutes till the end of surgery after subarachnoid block.

Hypotension defined as decrease in systolic blood pressure less than 90 mm of Hg or 70% of the baseline values whichever is greater. Hypotension treated by intravenous titrated doses of ephedrine and repeated as necessary until the blood pressure was increased to >70 % of the baseline value. Bradycardia if encountered was treated with 0.6 mg of atropine. After preloading all patients were given RL at the rate of 1.5ml/kg/hr as maintenance fluid.

Statistical Methods[5]

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%).

RESULTS

Study design

A comparative study of two groups consisting of 30 patients each, is taken up for investigating prospectively the efficacy and efficiency of each group in preventing spinal induced hypotension.

Group 1: 30 patients who received, 10ml/kg Haemaccel 15 minutes prior to spinal anaesthesia.

Group 2: 30 patients who received Hydroxyethyl starch 6%, 10ml/kg 15 minutes prior to spinal anaesthesia. [Table 1]

Table 2 bshows the trend of mean pulse rate changes during the study. It can be observed that the baseline pulse rate values for all the two groups are similar and are statistically insignificant. It can also be seen that there is a slight increase in the pulse rate values in both the groups after preloading and in the first fifteen to twenty-five minutes after spinal anaesthesia. However, there is no statistically significant change in pulse rate values among the two groups upto sixty minutes. At 60 minutes a fall in pulse rate in Group 1 was greater than Group2 and it was statistically significant. [Table 2]

Table 5 show the trend of mean SBP changes in the two groups. It can be seen that there is no significant difference between the SBPs of the two groups in the first eight minutes. At tenth, fifteen, twenty and twenty fifth minute till forty-five minutes the fall in systolic blood pressure in Group 1 was greater than that in Group 2 and it was statistically significant. [Table 3]

Table 6 show the trend of mean DBP changes in the two groups. It can be seen that there is no significant difference between the SBPs of the two groups in the first Twenty minutes. At twenty fifth minute and ninety minutes the fall in systolic blood pressure in Group 1 was greater than that in Group 2 and it was statistically significant. [Table 4]

Table 5 show the trend of change in mean arterial pressure in the two groups. It can be seen that there is significant change in MAP in the two groups at baseline. In the 2nd, 6th minute Significant difference in MAP was seen and at 25th minute interval after SAB, it can be seen that Group 1 had a significant fall in MAP when compared to Group 2. [Table 5]

Table 6 shows with the number of patients with SBP<90mm of Hg. In both groups it can be seen that no patient had a fall in SBP<90mm of Hg in first 5 minutes. [Table 6]

During 15th minute there were 3 patients in Group 1 and 1 patient in Group 2 had SBP<90mm of Hg.

During 20th minute there were 1 patient in Group 1 and 1 patient in Group 2 had SBP<90mm of Hg.

During 25th minute there were 2 patients in Group 1 and 1 patient in Group 2 had SBP<90mm of Hg.

During 35, 60, 70, 80, 90, 100, 110 min Group 2 constantly had 1 patient less than 90mm Hg.

Table 7 shows the requirements of ephedrine boluses in treating hypotension. In Group 1, out of 30 patients 14 patients required treatment with ephedrine and 4 out of 14 patients required a repeat bolus. In Group 2, 5patients required treatment with ephedrine and 2 out of 5 patients required a repeat bolus. No complications were seen in both groups. [Table 7]

Table 1: The background characteristics of two groups

Background Characteristics	GROUP 1	GROUP 2	P value
Sex	M = 20	M = 22	P = 0.57(NS)
	F = 10	F = 08	
Age	40.2 ± 12.23	39.73 ± 11.97	P = 0.883 (NS)
Baseline Pulserate	74.2 ± 11.07	77.23 ± 12.56	P = 0.325 (NS)
Baseline SBP	119.27 ± 9.61	115.57 ± 12.06	P = 0.194 (NS)
Inference		The two samples are Age and Weight matched. Similarly samples are matched with respect to Pulse rate and SBP at baseline	

Table 2: Comparison of Pulse rate

TIME	GROU 1 Mean ± S D	GROUP 2 Mean ± S D	P value
Baseline	74.2 ± 11.07	77.23 ± 12.56	P = 0.325 (NS)
After Preloading	83.57 ± 13.31	87.93 ± 12.74	P = 0.199 (NS)

1 min	88.8 ± 16.87	84.1 ±13.7	P = 0.241 (NS)
2 min	87.8 ± 19.16	84.93 ± 15.69	P = 0.529(NS)
4 min	86.37 ± 19.99	83.33 ± 12.95	P = 0.488 (NS)
6 min	86.27 ± 18.84	79.8 ± 13.16	P = 0.129(NS)
8 min	84.00 ± 18.95	79.53 ± 13.92	P = 0.302 (NS)
10 min	81.27 ± 17.47	78.93 ±13.25	P = 0.562 (NS)
15 min	80.37 ± 18.93	76.73 ± 12.63	P = 0.386 (NS)
20 min	80.13 ± 17.68	76.50 ± 12.07	P = 0.357 (NS)
25 min	79.00 ± 16.92	76.83 ± 12.52	P = 0.575 (NS)
30 min	75.13 ± 14.46	77.73 ± 12.45	P = 0.459 (NS)
35 min	73.00 ± 12.72	76.40 ± 12.73	P = 0.305 (NS)
40 min	71.50 ± 12.10	76.20 ± 12.81	P = 0.150 (NS)
45 min	70.93 ± 12.98	76.7 ± 13.86	P = 0.102 (NS)
50 min	71.33 ± 12.35	76.30 ± 13.93	P = 0.149(NS)
55 min	70.04 ± 13.05	76.00 ± 13.53	P = 0.100 (NS)
60 min	70.19 ± 11.65	77.77 ± 15.5	P = 0.046(*)
70 min	68.7 ± 11.21	79.19 ± 17.5	P = 0.017 (**)
80 min	68.24 ±8.46	79.96 ± 15.43	P = 0.003 (**)
90 min	69.79 ± 8.25	80.76 ± 16.21	P = 0.01 (**)
100 min	70.54 ± 8.43	65.68 ± 26.22	P = 0.526 (NS)
110 min	70.91 ± 8.32	61.36 ± 28.18	P = 0.290 (NS)
120 min	73.63 ± 12.06	65.20 ± 30.53	P = 0.475 (NS)

Table 3: Comparison of Systolic Blood Pressure

TIME	GROUP 1 Mean ± S D	GROUP 2 Mean ± S D	P value
Baseline	119.27 ± 9.61	115.57± 12.06	P = 0.194 (NS)
After Preloading	125.07±7.79	124.97±9.39	P = 0.964 (NS)
1 min	127.7±9.13	119.3±11.53	P = 0.003 (**)
2 min	121.4±6.13	117.47±11.91	P = 0.113 (NS)
4 min	116.2±5.78	115.5±11.04	P = 0.760 (NS)
6 min	113.13±6.73	114.7±12.78	P = 0.555 (NS)
8 min	109.6±3.95	113.87±14.77	P = 0.132 (NS)
10 min	105.77±8.38	114.2±13.38	P = 0.005 (**)
15 min	99.1±11.19	114.4±13.52	P < 0.0001 (**)
20 min	102.13±5.16	110.23±12.8	P = 0.002 (**)
25 min	104.3±8.44	114.83±13.06	P <0.0001 (**)
30 min	106.1±5.81	115.2±13.54	P = 0.001 (**)
35 min	107.6±5.5	116.5±14.06	P = 0.002 (**)
40 min	111.23±8.77	117.5±13.10	P = 0.034 (*)
45 min	112.33±7.54	119.63±14.07	P = 0.015 (*)
50 min	113.4±6.43	116.67±10.43	P = 0.150 (NS)
55 min	112.81±6.29	116.53±12.03	P = 0.162 (NS)
60 min	113.58±10.46	114.73±12.89	P = 0.717 (NS)
70 min	113.74±7.09	115.41±13.41	P = 0.595 (NS)
80 min	115.9±8.18	117.74±12.39	P = 0.561 (NS)
90 min	114.53±6.47	117.76±13.21	P = 0.333 (NS)
100 min	115.15±9.69	118.89±12.82	P = 0.380 (NS)
110 min	117.64±8.45	119.14±16.57	P = 0.787 (NS)
120 min	115.5±12.65	122.8±13.09	P = 0.250 (NS)

Table 4: Comparison of Diastolic Blood Pressure

TIME	GROUP 1 Mean ± S D	GROUP 2 Mean ± S D	P value
Baseline	74.13±8.55	73.07±8.56	P = 0.631 (NS)
After Preloading	76.43±8.35	76.8±6.92	P = 0.854 (NS)
1 min	76.83±8.68	74.33±9.98	P = 0.305 (NS)
2 min	75.37±7.54	74.23±13.02	P = 0.325 (NS)
4 min	73.03±8.12	72.27±9.32	P = 0.735 (NS)
6 min	71.3±7.80	70.9±10.64	P = 0.869 (NS)
8 min	69.8±7.42	71.03±9.26	P = 0.571(NS)
10 min	67.9±8.03	70.03±10.60	P = 0.383(NS)
15 min	66.03±7.91	68.33±9.52	P = 0.313 (NS)
20 min	65.87±5.67	69.7±9.81	P = 0.069 (NS)
25 min	64.43±6.30	68.63±9.31	P = 0.045 (*)
30 min	67.03±6.16	69.9±10.66	P = 0.207 (NS)
35 min	67.97±6.83	70.87±9.65	P = 0.184 (NS)
40 min	68.87±6.61	71.53±9.5	P = 0.212 (NS)
45 min	68.53±6.85	71.17±10.02	P = 0.239(NS)
50 min	69.7±7.65	72.27±9.20	P = 0.245 (NS)
55 min	70.69±8.9	70.57±10.26	P = 0.961 (NS)
60 min	70.54±8.4	73.8±11.3	P = 0.232 (NS)

70 min	69.22±7.93	73.63±10.26	P = 0.100 (NS)
80 min	72±8.83	75.33±9.8	P = 0.229(NS)
90 min	71.11±7.9	76.96±10.5	P = 0.049 (*)
100 min	74.15±6.46	76.47±8.58	P = 0.415(NS)
110 min	73.36±8.22	73.43±6.14	P = 0.982 (NS)
120 min	74.38±9.74	78.6±9.44	P = 0.366 (NS)

Table 5: Comparison of Mean Arterial Pressure

TIME	GROUP 1 Mean ± S D	GROUP 2 Mean ± S D	P value
Baseline	87.23±8.34	81.3±7.91	P = 0.006 (**)
After Pre loading	90.73±8.01	111.33±142.5	P = 0.433(NS)
1 min	92.77±8.68	85.67±18.77	P = 0.065 (NS)
2 min	89.83±6	84.73±7.94	P = 0.007 (**)
4 min	86.43±5.76	83.7±7.63	P = 0.123 (NS)
6 min	84.13±4.97	80.07±7.92	P = 0.021 (*)
8 min	82.4±5.1	79.73±13.23	P = 0.307 (NS)
10 min	79.3±7.73	80.2±11.03	P = 0.716(NS)
15 min	76.33±8.8	79.6±9.4	P = 0.170 (NS)
20 min	77.47±5.02	80.1±8.97	P = 0.166 (NS)
25 min	77.03±6	81.67±10.48	P = 0.04 (*)
30 min	78.7±5.9	79.47±9.7	P = 0.712 (NS)
35 min	79.87±6.3	82.33±12	P = 0.320 (NS)
40 min	82.17±7.26	80.9±10.6	P = 0.590 (NS)
45 min	82.37±5.1	81.6±10.2	P = 0.715(NS)
50 min	82.93±7.7	83.3±8.8	P = 0.864(NS)
55 min	83.12±8.4	83.2±10.4	P = 0.974 (NS)
60 min	84.08±8.6	84.67±10.1	P = 0.816(NS)
70 min	83.35±7.4	84.81±9.3	P = 0.546(NS)
80 min	84.95±8.6	84.52±10.8	P = 0.881 (NS)
90 min	84.84±6.8	87.12±9.3	P = 0.374 (NS)
100 min	86.77±6.9	73.63±23.6	P = 0.061 (NS)
110 min	87.45±9.3	88.92±11	P = 0.730 (NS)
120 min	88.63±14.1	86.8±10.4	P = 0.756(NS)

Table 6: Number of Patients with SBP<90 in two groups of study

TIME	GROUP 1	GROUP 2
Baseline	-	-
After loading	-	-
1 min	-	-
2 min	-	-
4 min	-	-
6 min	-	1
8 min	-	-
10 min	-	-
15 min	3	-
20 min	1	1
25 min	1	1
30 min	-	-
35 min	-	1
40 min	-	-
45 min	-	-
50 min	-	-
55 min	-	-
60 min	1	1
70 min	-	1
80 min	-	1
90 min	-	1
100 min	-	1
110 min	-	1
120 min	-	-

Table 7: Ephedrine Dose requirements

Dose in mg	Number of patients GROUP 1	Number of patients GROUP 2	P Value
No Dose Requirement	16	25	Chi square: 6.411 Df: 2 P = 0.04 (*)
Single Bolus (6mg)	10	3	
>One Bolus	4	2	
Total Dose Requirement	14	5	Chi square: 6.23 Df: 1 P = 0.012 (*)
Inference	Total Dose requirement in Group 1 is significantly higherthan Group 2		

DISCUSSION

Sympathetic blockade leads to hypovolemia and decreased venous return. Prophylactic administration of crystalloids prior to regional anaesthesia has been ineffective in eliminating spinal anaesthesia-induced hypotension. Colloid solution is the more logical choice in hypotension prevention during subarachnoid block, as it‟s presence in the intravascular compartment is of longer duration and is dependent on its physical properties. Present study was conducted to compare colloid solutions- Haemaccel and hydroxyethyl starch 6% as plasma volume expanders for preloading to prevent spinal anaesthesia induced hypotension.

In our study we randomized 60patients into 2 groups with 30 patients each. Group 1 received 10ml/kg of Haemaccel and Group 2 received 10ml/kg of 6% hydroxyethyl starch. The incidence of hypotension after 8 minute of SAB was higher in Group 1 as compared to Group 2. Group 1 patients had an incidence of 9% of hypotension and Group 2 had 4%. 14 patients in Group 1 and 5 patients in Group 2 required vasopressor for the management of hypotension.

Prerana P. Shroff et al,[6] in 2007 compared the effects of polygeline Group P and HES Group H as volume preload before spinal anaesthesia. They found that the decline in haemodynamic parameters after spinal anaesthesia was less in Group H. the number of patients who developed hypotension and needed ephedrine were more in Group P. The incidence of hypotension in Group P was 12.24% and Group H was 3.77%. Requirement of ephedrine in Group P was 8.16% and Group H was 1.87%. They concluded that HES appears to be safer and more efficacious as volume preload before spinal anaesthesia to achieve optimum haemodynamic goals. Polygeline leads to the anaphylactoid reactions like rash and is associated with morefall in haemodynamic parameters

Vercauteren et al,[7] in 1996 compared HES with modified gelatin as volume preload before spinal anaesthesia for caesarean section. They studied 90 patients undergoing elective caesarean section under spinal anaesthesia who received ringer lactate (RL) 1000 ml with upto 1000 ml of modified gelatin, RL 1000 ml with upto 1000 ml of hydroxyethyl starch 6%(HES) or only up to 1000 ml of 6% HES. Lumbar puncture was performed as soon as 500 ml of the colloid was infused. The incidence of hypotension, number of patients requiring a vasopressor and doses of ephedrine required to restore arterial pressure were significantly lower in favour of those receiving the crystalloid – HES combination.

A study by Sharma et al,[8] has shown that intravenous infusion of 500 ml of 6% hetastarch is more effective than 1000 ml of lactated Ringer`s solution in attenuating spinal anaesthesia induced hypotension in women undergoing postpartum tubal ligation. Incidence of hypotension was 52% in the lactated Ringer`s solution and 16%in the hetastarch group

Karinen et al,[9] study in 1995 aimed to compare the effect of Ringer`s lactate and Hydroxyethyl starch preloading on the haemodynamic state during spinal anaesthesia on patients undergoing caesarean section. Showed high incidence of maternal hypotension in the crystalloid (62%) group as compared to the colloid group (38%).

Baraka et al,[10] study in 1994 compared intravascular administration of polymerized gelatin and isotonic saline before spinal anaesthesia for prevention of spinal anaesthesia induced hypotension. They reported a 11% incidence of hypotension afteradministration of 7 ml/kg of 3% gelatin compared with 52% after same volume of crystalloid in males undergoing transurethral resection of prostate under spinalanaesthesia.

Shapira et al,[11] study in 1991 aimed to determine different aspects concerning hypotension and its prevention following spinal anaesthesia by preloading the patients with Haemaccel and ringer`s lactate respectively. They found that the systolic blood pressure decrease was significantly greater in the crystalloid group. The average decrease in systolic blood pressure in the Haemaccel group was 6 mm Hg and in the ringer‟s group it was 16 mmHg

Mortelmans et al,[12] (1995) conducted a study to determine the effects on intravascular volume and coagulation of 2000 ml of the two-isooncotic artificial colloids: 6% hydroxy ethyl starch (HES) and 3% modified gelatin (GEL). Forty-two patients, scheduled for primary total hip replacement were allocated randomly to receive HES or GEL during acute normovolemic haemodilution. Blood samples were taken before and after 500 ml and 1000 ml of acute normovolemic haemodilution; intraoperatively after 20ml/ kg of artificial colloid and at the end of colloid infusion. They quantified the following variables: coagulation variables, blood loss, haemodynamic stability, interstitial extravasation, and the percentage volume effect. The following differences were found (HES vs GEL, $p < 0.05$): 76% vs 56% intravascular volume expansion, 27% vs 29% haematocrit, 35 vs 45g/L total serum protein. This study quantifies a poorer volume effect of GEL and a higher blood loss with hydroxyethyl starch.

Riley et al,[13] (1995) conducted a study to determine whether preoperative administration of 6% hydroxyethyl starch decreases the incidence and severity of hypotension after spinal anaesthesia for elective caesarean section. Forty women who are not in labour belonging to ASA grade I and II having elective caesarean section were randomized to receive either 500 ml of 6% HES plus one litre of ringer lactate (n=20), or two litre of ringer lactate prior to induction of spinal anaesthesia. Hypotension occurred in 45% of patients who received HES Vs 85% of those who received only ringer lactate (p<

0.05) and minimum systolic blood pressure was lower in the ringer lactate group than in the HES group. In addition, the ringer lactate group had a higher maximum heart rate, a shorter mean time to hypotension and required more 5 mg doses of ephedrine for treatment of hypotension than HES group. They concluded that 6% of HES plus ringer lactate is more effective than ringer lactate alone.

Hydroxyethyl starch 6% (130/0.4) is a synthetic colloid solution with a mean molecular weight of 2,00,000. The pH of this hydroxyethyl starch solution is 4-5.5, the osmolarity is 308mOsm/L, and the colloid oncotic pressure (36mm Hg). Its intravascular half-life is 1.4 hours and it has the capacity to expand plasma volume to a volume that is greater than the volume infused. Advantages of hydroxyethyl starch include a lower incidence of anaphylactic reactions as compared to other colloids.

Haemaccel is isooncotic, has a mean half-life of 4-5 hours. It causes allergic reaction probably due to histamine release. A present study confirms that HES is better colloid than Haemaccel in preventing hypotension in patients undergoing surgeries under SAB.

CONCLUSION

We concluded that preloading with colloids reduces the incidence of spinal anaesthesia induced hypotension and 6% HES is safer and effective than Haemaccel in preventing hypotension and achieving haemodynamic goals in patients undergoing surgeries under SAB. Thus among colloids, HES 6% appears to be a promising plasma volume expander.

Conflict of Interest: None

Funding Support: Nil.

REFERENCES

1. Coe AJ, Revanas B. Is crystalloid preloading useful in spinal anaesthesia in the elderly? Anaesthesia 1990; 45: 241–3.
2. Buggy D, Higgins P, Moran C, O'Brien D, O'Donovan F, McCarroll M. Prevention of spinal anaesthesia-induced hypotension in the elderly: comparison between preanaesthetic administration of crystalloids, colloids, and no prehydration. Anesth Analg 1997; 84: 106–10.
3. Casati A, Fanelli G, Berti M, Boccaria P, Agostini M. Cardiac performance during unilateral lumbar spinal block after crystalloid preload. Can J Anaesth1997; 44: 623–8.
4. Arndt JO, Bomer W, Krauth J, Marquardt B. Incidence and time course of cardiovascular side effects during spinal anaesthesia after prophylactic administration of intravenous fluids or vasoconstrictors. Anesth Analg 1998;87: 347–54.
5. Sunder Rao P S, Richard J. An Introduction to Biostatistics, A manual for students in health sciences. New Delhi; Prentice hall of India: 86-160.
6. Vercauteren MP, Hoffmann V, Coppejans HC, Van Steenberge AC, Adriansen HA. HES compared with modified gelatin as volume preload before spinal anaesthesia for caesarean section. British Journal of Anaesthesia1996; 76: 731-733.
7. Prerana P, Sadanand Kulkarni, Smita Lela, Surekha Kamath, Latha Chaudhari, Dewoolkar LV. Randomized, comparative study between polygeline and hydroxyethyl starch (130/0.4) as volume preload before spinal anaesthesia. J Anaesth Clin Pharmacology 2007; 23(30): 269-272.
8. Sharma SK, Gajraj NM, Sidwai JE. Comparison of hypotension during spinal anaesthesia: A comparison of Hetastarch versus lactated Ringer`s solution. Anesth Analg 1997; 84: 111-114.
9. Karinen J, Rasanen J, Alahuhta S, Jouppila R, Jouppila P. The effect of crystalloid and colloid preloading on uteroplacental and haemodynamic state during spinal anaesthesia for caesarean section. British Journal of Anaesthesia1995; 75: 531-535.
10. Baraka AS, Taha SK, Ghabach MB, Sibaii AA, Nader AM. Intravascular administration of polymerized gelatin versus isotonic saline for prevention of spinal induced hypotension. Anesth Analg 1994; 78: 301-305.
11. Shapira S.C et al. A comparison of intravenous loading for epidural with ringer lactate and polygeline. European Journal of Pain 1991; 12:100-103.
12. Mortelmans, Gerry, Verbruggen, Arnout, Jef. Effects of 6% HES and 3% modified gelatin on intravascular volume and coagulation during intraoperative haemodilution. Anesth Analg 1995; 81: 1235-42.
13. Riley ET, Cohen SE, Rubenstein AJ, Flanagan B. Prevention of hypotension after spinal anaesthesia for Cesarean section: Six percent hetastarch versus lactated Ringer's solution. Anesth Analg 1995; 81: 838-842.