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Hemodynamic changes following spinal anaesthesia in patients undergoing transurethral resection of prostrate (TURP): A comparison between preloading with crystalloids and no preloading

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Citation

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Abstract

The practice of routinely prehydrating patients with crystalloids (up to 1.0 L/ 70kg) for the prevention of spinal anaesthesia induced hypotension has been challenged recently, after reports of failure to demonstrate its efficacy in young parturient. We compared the hemodynamic changes (heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure) following spinal anaesthesia between prehydration with crystalloid and no prehydration in elderly patients undergoing transurethral resection of prostrate. Eighty ASA grade I or II patients aged 55-75 years, scheduled for elective TURP and TURB T were randomized to receive 7ml/kg of crystalloid preload (group I n=40), over 10-15 mts prior to spinal anesthesia and no preload (group II n=40).Thirty four patients underwent TURP and six patients underwent TURB T from each group. Hypotension was defined as a 30% decrease from the systolic blood pressure or systolic < 90 mmHg and was treated with ephedrine 5 mg boluses.

There was statistically a non significant difference(p>0.50),between the heart rate, systolic, diastolic and mean arterial pressure between group I and group II at baseline,5mts,10mts,15mts and at 20mts respectively during the study period. Vasopressor support was used in two patients(5%) in group I and one patient (2.5%) in group II,respectively. The difference between the two groups in terms of vasopressor support was non significant(p>0.591).We conclude that there appears to be no role of preemptive hydration before spinal anaesthesia, especially in elderly patients undergoing elective surgeries and if hypotension occurs should be treated with boluses of vasopressor.

INTRODUCTION

Spinal anaesthesia is frequently used for patients undergoing transurethral resection of prostrate and bladder tumor. The advantages claimed with spinal anaesthesia for such surgery include reduced blood loss, better operating conditions, minimal effects on arterial O_2 and CO_2 tensions of the patient, preference by surgical and nursing staff and a generally comfortable recovery. [1,2]

Systemic hypotension is the most common complication of spinal anaesthesia, with an incidence of 25-82% in the elderly. [3] Despite no prospective outcome data, it seems reasonable to be concerned that the elderly may be at increased risk of long term complications from hypotension occurring during spinal anesthesia because of reduced physiological reserve and atherosclerosis. [4] Strategies for treating spinal anaesthesia related hypotension include prehydration which increases circulating blood volume and cardiac output or pharmacological reversal, for the reduction in systemic vascular resistance using vasopressor agents. [5]

Several studies have shown that although volume prehydration may reduce incidence of spinal anaesthesia induced hypotension but doesn't reliably prevent it. [6] Rapid, large infusions of fluid may be hazardous in patients with cardiac dysfunction, who may go into cardiac failure and pulmonary edema especially in elderly age group. [7] Most of the studies on preloading before spinal anaesthesia have been conducted on young healthy females undergoing caesarean section. The present study was conducted on elderly population keeping in view their co morbid states.

MATERIAL AND METHODS

After institutional ethics committee approval and written informed consent, 80 male patients of ASA grade I-II, aged 55-75 years, scheduled for elective transurethral resection or prostrate (TURP) and transurethral resection of bladder tumor(TURB -T) were studied. Patients with a history of hypertension, congestive heart failure, any active medication for cardiovascular disease or any other absolute or relative contraindication to spinal anaesthesia were excluded from the study. Patients were randomly allocated to 2 groups of 40 patients each. Group I, patients received 7 ml/kg of crystalloid preload (Ringers lactate) over 10-15 minutes before spinal anaesthesia and Group II, patients received no preloading. 34 patients underwent TURP and 6 patients underwent TURB-T from each of the groups. No premedication was given to any patient. On arrival in operation theatre, an 18 gauge I.V cannula was secured in a peripheral vein, and an infusion of Ringers lactate 5ml/kg/hr was given to all patients during the procedure. Patients were connected to Datex monitor for ECG and NIBP monitoring and O_2 saturation monitored by a pulse oximeter. Baseline heart rate, systolic, diastolic and mean blood pressure was recorded with the patient in a semi-recumbent position.

The study solution regimen was commenced by a staff member other than the anaesthetist in charge in group I. Patients were placed then placed in sitting position and under all aseptic precautions, a lumbar puncture was performed with a 25 G Quincke spinal needle in L_3-L_4 intervertebral space. All patients received 3 ml of 0.5 % hyperbaric bupivicaine intrathecally, after free aspiration of CSF. After withdrawal of spinal needle, an antiseptic seal was applied at site of lumbar puncture and patient placed in supine position with head up tilt not exceeding 20° .Hemodynamic variables like heart rate, systolic, diastolic, and mean blood pressure were recorded at 5 minute intervals up to 20 minutes after commencement of spinal anaesthesia. Hypotension was defined as a fall in baseline systolic blood pressure by 30 % or < 90 mmHg which is in concordance with most of studies in the literature. If hypotension occurred it was promptly treated by intravenous ephedrine in 5 mg boluses to raise systolic blood pressure up to 80% of the baseline. The total amount of ephedrine used was recorded.

The data obtained was analyzed using standard statistical methods including students' t- test and chi-square test.

RESULTS

Mean age in group I and II was 61.50±7.00 yrs and 60.43±6.68 yrs respectively which was statistically non significant (Table 1 and Dia 1).31 patients (77.50%) in group I and 32 patients (82.50%) in group II belonged to ASA status I, whereas 9 patients(22.50%) in group I and 7 patients (17.50%) in group II belonged to ASA status II respectively.

Heart rate(mean±SD) at baseline in group I was 77.03±12.85 beats /mt versus 72.70±9.50 in group II, at 5 mts 74.68±13.38 beats/mt versus 72.72±9.28 beats/mt, at 10 mts 73.73±14.97 beats/mt versus 71.15±9.71 beats/mt, at 15 mts 72.62±14.48 beats/mt versus 70.52±11.36 beats/mt and at 20 mts 72.10±13.50 beats/mt versus 70.00±10.91 in group I and group II, respectively. Statistically a non significant difference in heart rate persisted at baseline,5,10,15 and 20 mts between the two groups(Table 2 and Dia 2).

In group I, systolic BP(mean ±SD) was 132.05±7.45 mmHg versus 130.32±6.68 mmHg in group II at baseline, at 5 mts 128.35±7.88mmHg versus 127.98±7.90 mmHg, at 10 mts 124.30±8.64 mmHg versus 123.73±8.36 mmHg ,at 15 mts 121.23±11.85 mmHg versus 119.83±8.19 mmHg and at 20 mts 121.73±9.46 mmHg versus 121.30±7.68 mmHg in group I and group II, respectively. The difference between the two groups was statistically non significant(Table 3 and Dia 3).

In group I, diastolic BP(mean ±SD) at baseline was 80.60±7.26 mmHg versus 82.90±6.57 mmHg in group II,at 5 mts 77.63±7.37 mmHg versus 80.13±6.60 mmHg,at 10 mts 75.80±7.43 mmHg versus 76.93±6.24 mmHg,at 15 mts 73.38±7.63 mmHg versus 75.55±6.06 mmHg and at 20 mts 73.68±7.46 mmHg versus 75.23±6.33 mmHg in group I and group II respectively. There was a statistically non significant difference between the two groups at various time intervals (Table 4).

Mean arterial BP(mean±SD)in group I was 97.17+6.17 mmHg versus 98.90+5.74 mmHg in group II at baseline, at 5 mts 94.00+6.28 mmHg versus 95.50+6.05 mmHg,at 10 mts 91.88+6.95 mmHg versus 92.28+6.15 mmHg,at 15 mts 89.05+8.03 mmHg versus 90.27+7.00 mmHg and at 20 mts 89.75+7.11 mmHg versus 90.47+5.60 mmHg in group I and group II respectively. When the two groups were compared the difference was statistically non significant(Diagram 4).

Vasopressor support (ephedrine) was used in 2 patients (5%) in group I and 1 patient(2.5%) in group II,respectively.The relationship between the two groups was statistically nonsignificant (p>0.591).

Figure 1

Table 1: Distribution of Age(Years) in Group I and Group II

GROUP	AGE (YRS) MEAN ± SD	t -Value	P- Value	Significance
I	61.50 ± 7.00	0.64	0.559	NS
II	60.43 ± 6.88	0.64	0.529	NS

Figure 2

Diagram 1 : Bar Diagram Showing Age (years)in Groups I and II

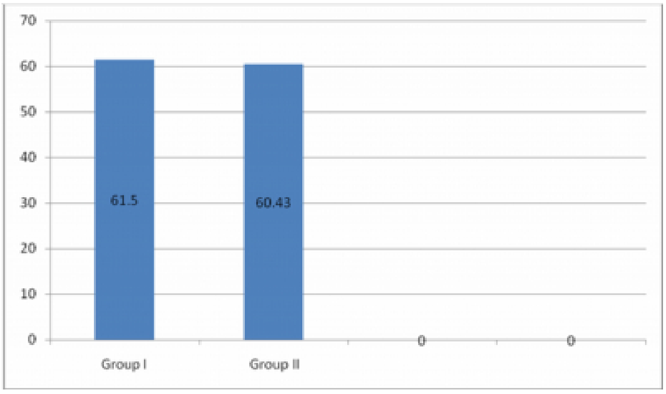


Figure 3

Table 2: Comparison of Heart Rate (beats/mt) in Group I and Group II at Various time intervals

Heart Rate	Groups I (mean±SD)	II (mean±SD)	t-value	p-value	Remarks
At baseline	77.03±12.85	72.70±9.50	1.842	0.072	NS
At 5 mts	74.68±13.38	72.72±9.28	1.000	0.323	NS
At 10 mts	73.73±14.97	71.15±9.71	1.110	0.272	NS
At 15 mts	72.62±14.48	70.52±11.36	0.790	0.435	NS
At 20 mts	72.10±13.50	70.00±10.91	0.831	0.411	NS

Figure 4

Diagram 2: Bar Diagram presenting changes in Heart rate(beats/mt) in Group I and Group II at various time intervals (study period)

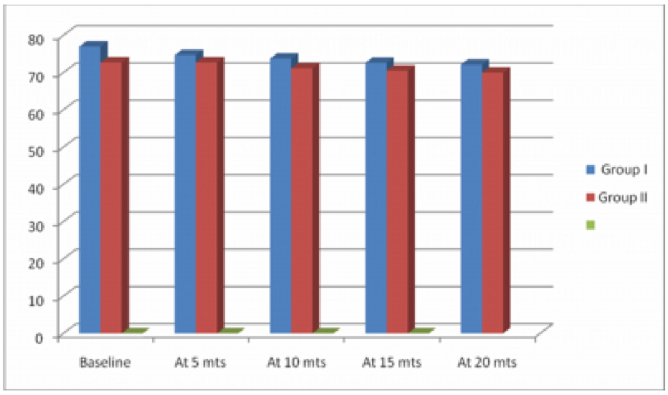


Figure 5

Table 3: Comparison of Systolic Blood Pressure (mmHg) in Group I and Group II at various time intervals

Systolic BP (mm Hg)	GROUPS (Mean ± SD) I	II	t-value	p-value	Remarks
At Baseline	132.05±7.45	130.32±6.68	1.401	0.125	NS
At 5 mts	128.35±7.88	127.98±7.90	0.383	0.703	NS
At 10 mts	124.30±8.64	123.73±8.36	0.302	0.764	NS
At 15 mts	121.23±11.85	119.83±8.19	0.627	0.534	NS
At 20 mts	121.73±9.46	121.30±7.68	0.182	0.857	NS

Figure 6

Diagram 3: Bar Diagram showing changes in systolic BP (mmHg) at various time intervals in Group I and Group II

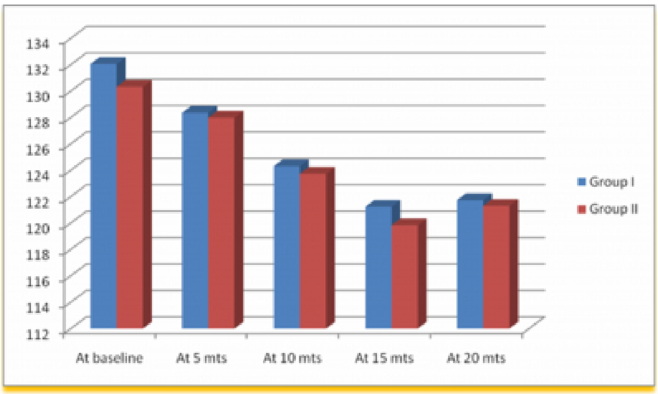


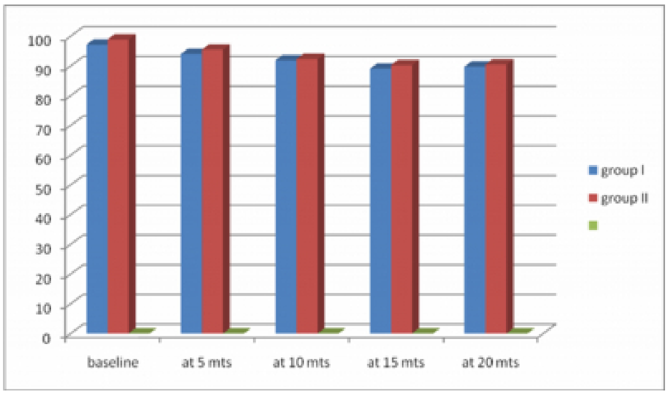
Figure 7

Table 4: Comparison of Diastolic BP(mmHg) at various time intervals in Group I and Group II

Diastolic BP (mmHg)	GROUPS (Mean ± SD) I	II	t-value	p-value	Remarks
At baseline	80.60±7.26	82.90±6.57	1.743	0.089	NS
At 5 mts	77.63±7.37	80.13±6.60	1.705	0.096	NS
At 10 mts	75.80±7.43	76.93±6.24	0.675	0.503	NS
At 15 mts	73.38±7.63	75.55±6.06	1.307	0.199	NS
At 20 mts	73.68±7.46	75.23±6.33	0.981	0.332	NS

Figure 8

Diagram 4: Comparison of MAP mmHg between the two groups at various time intervals



DISCUSSION

The practice of routinely prehydrating patients by infusing a crystalloid or colloid solution up to 1 liter per 70 kg for prevention of spinal anaesthesia induced hypotension has been challenged recently after several reports of failure to demonstrate its efficacy in young women. [8,9]

Heart rate usually decreases after spinal anaesthesia due to functional denervation to the extent of 10-15 %. In our study there was a nonsignificant decrease in heart rate when the two groups were compared. Malmquist LA and Bengstsson M et al in their study found that heart rate initially increased 6-8% 10 mts after spinal injection but returned to initial value after 20 mts in patients undergoing TURP. [10]

Hypotension after spinal anaesthesia results from functional sympathetic denervation, not only at arterial and arteriolar circulation, but especially at large veins and venules also. There is also peripheral venous pooling of blood, which may reduce cardiac output. [11] Such changes may be harmful in the elderly with incipient cardiac and renal failure, however baroreceptor mediated compensatory cardiovascular responses result, which tend to maintain arterial pressure. In our study there was a statistically non significant (p>0.50) decrease in systolic, diastolic and mean arterial blood pressure between the crystalloid group (group I) and no prehydration group (group II). The fall in mean systolic pressure in group I was 8.3% over 20 mt period and 6.9% in group II, respectively. Similarly fall in diastolic blood pressure in the two groups was 8.7% and 8.5% respectively over 20 mt period. The fall in mean arterial pressure over 20 mt period in the two groups was 8.2% and 8.0%, respectively. Our data showed conflict with the findings of Baraka et al [12] who found that crystalloid prehydration reduced the incidence of hypotension and maintained systolic blood pressure compared to no prehydration in elderly men undergoing TURP. Coe and Revenas [13] compared elderly groups receiving 16ml/kg and 8ml/kg crystalloid prehydration with no prehydration, found incidence of hypotension ranging from 24-32% with no statistical difference between them. Many studies including ours have failed to demonstrate a beneficial effect from prehydration.

Previous studies that demonstrated a beneficial effect of one fluid regimen over another showed a 29-36% difference in proportion of patients developing hypotension. [14] The reported incidence of hypotension varies widely, which is partly explained by the variety of definition of hypotension taken. These range from a 25 to 30% decrease in baseline systolic arterial blood pressure to an absolute systolic arterial pressure of 90 mmHg or a requirement for a bolus of vasopressor.

Also most of the studies have been conducted on healthy females undergoing cesarean section and in them we expect a greater degree of hypotension as the gravid uterus decreases the venous return. In contrast, decrease in systemic vascular resistance appears to be a dominant mechanism for hypotension in the elderly. Intravascular fluids per se don't reverse decreases in systemic vascular resistance, rather they may increase cardiac output. [4,5] A more plausible explanation for the failure of crystalloid administration regimen in the elderly may be that the reduced physiological reserve of the older patients may make them less able to respond to volume with a corresponding increase in cardiac output. [15] Morever, 75% of any crystalloid infused rapidly diffuses into the interstitium where it cannot be effective, as a volume expander. [16] Furthermore, infused fluid stimulates atrial natriuretic peptide (ANP) secretion tending to decrease systemic vascular resistance and initiate diuresis, [17] and if this were true in elderly patients, it may explain the ineffectiveness of fluid administration in preventing hypotension. Also in patients undergoing TURP or bladder tumor resection, there is absorption of irrigation fluid which may offset the need for preloading.

We conclude that there appears to be no role of preemptive hydration before spinal anaesthesia especially for non obstetric elective surgeries in elderly and in case hypotension occurs, it should be treated by boluses of vasopressors.

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