Original Article

Hypotension in Patients Undergoing Spinal Anaesthesia Pak Armed Forces Med J 2012; 62 (4): 544-8

COMPARISON OF COLLOID (POLYGELINE) OVER CRYSTALLOID (LACTATED RINGER) PRELOADING IN PREVENTING HYPOTENSION IN PATIENTS UNDERGOING CAESAREAN-SECTION UNDER SPINAL ANAESTHESIA

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ABSTRACT

Objective: To assess efficacy of colloid (Polygeline) over crystalloid (Lactated Ringer) preloading in preventing hypotension in patients undergoing caesarean-section under spinal anaesthesia.

Study design: Randomized control trial.

Settings: The study was conducted in department of Anesthesiology and Intensive care Combined Military Hospital Peshawar over a period of 6 months from 01 March 2007 to 31 August 2007.

Material and Methods: One hundred patients fulfilling the inclusion criteria were selected for study and divided into two groups of 50 each. Group A was given 500 ml Polygeline as preloading solution while group B received 1 liter of Ringer's Lactate as preloading solution just before administration of spinal anaesthesia. Heart rate and systolic blood pressure were recorded at 01 min, 05 mins, 10 mins, 15 mins, 20 mins, 30 mins and 45 mins after the performance of spinal block. Dose of ephedrine given to treat hypotension after the block was also recorded.

Results: There was significant difference in terms of heart rate and systolic arterial pressure 1 and 5 minutes after block between both the groups. There was also significant difference in terms of dose of ephedrine between both the groups.

Conclusion: Polygeline is more effective than Ringer's Lactate as preloading fluid in preventing hypotension for caesarean section under spinal anaesthesia.

Keywords: Caesarean section, Colloid, Crystalloid, Hypotension, Spinal anaesthesia.

INTRODUCTION

Maternal hypotension is the commonest serious problem following spinal anaesthesia for caesarean section with an incidence of upto 83%. Most frequent preventive and therapeutic measures to decrease its incidence and severity include uterine shift to the left, preload and vasopressors[1].

Preload may be achieved in several ways with different fluid volumes and infusion rates; before, during or after regional anesthesia or even with different solutions[2]. Intravenous prehydration is the most popular non-pharmacological method. Early studies had impressive results and prehydration became established as an accepted standard of care. However, more recent controlled studies have questioned the efficacy of prehydration and have shown that even large volumes of crystalloid have minimal effect on the incidence of hypotension[3]. Although it is possible that crystalloid prehydration may reduce the severity of hypotension or vasopressor requirement, it cannot be relied upon alone to prevent hypotension. The poor efficacy of crystalloid prehydration probably reflects rapid redistribution and limited augmentation of circulating volume. In comparison, colloid solutions are more effective than crystalloid[4]. This probably reflects greater augmentation of circulating volume and cardiac output that can be achieved with colloid solutions compared with crystalloids. However, colloids are more expensive and have potential risks of fluid overload and allergic reaction due to which they have limited general acceptance into routine practice. Colloids would be more effective due to their higher colloid osmotic effect and for remaining for a longer time in the intravascular space[5].

Attention should be paid to two other aspects of care - the use of vasopressors and positioning. Aggressive treatment of hypotension with ephedrine has been shown to reduce the incidence of hypotension and nausea.

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Ephedrine remains the vasopressor of choice for obstetric use. Phenylephrine may be safely used as a second line drug if ephedrine is ineffective or in the presence of marked maternal tachycardia[6].

Aorto-caval compression is present to some degree in all women during caesarean section. The 15° left lateral tilt advocated by Crawford is insufficient to relieve aorto-caval compression in many women. Hypotension which is resistant to treatment often responds to turning to a full lateral position. Carrie has proposed the maintenance of the lateral position until the moment of skin preparation and Stoneham et al have published research suggesting that hemodynamic stability is greater with Carrie's technique[7,8].

PATIENTS AND METHODS

These randomized control trails were conducted in Department of Anaesthesiology CMH Peshawar over 6 months from 1 March 2007 to 31 August 2007. One hundred surgical patients were randomly divided in two groups of 50 each with group A received Polygeline and group B received Ringer's Lactate.

The patients with age between 18 to 40 years, non-labouring planned elective caesarean section and those fulfilling American Society of Anaesthesiology (ASA) class I and II were included while the patients who were obesity (weight > 90 kg), Haemoglobin concentration less than 10 gm% or any other bleeding disorder, diabetics, pregnancy-induced hypertension, chronic hypertension, heart disease, known fetal abnormalities, total or partial spinal anesthesia failure, multiple gestation and kyphoscoliosis were not included in the study.

One hundered patients fulfiling the inclusion criteria were included in the study.

These patients were randomly divided into two groups by using random number table. Patients in group A received Polygenline and patients in group B received Ringer's Lactate. Each group consisted of 50 patients.

After obtaining informed written consent, thorough and detailed history of present and past medical illness, past history of anaesthetic exposure with concomitant history of drugs taken in preoperative period was also recorded. General and systemic examinations of all the patients were done. Routine investigation including coagulation profile was done. Laboratory data was provided by pathology laboratory of CMH Peshawar. Inj. Ranitidine 50 mg and Inj. Metoclopramide 10 mg were given IV slowly preoperatively 1 hour before surgery. In the operating room, ECG and heart rate were monitored by a cardioscope. Blood pressure was monitored non-invasively. Pulse oximetry was done using a finger probe.

Intravenous line was established with an 18 G cannula and preloading solution of 500 ml Polygeline or 1 litre ringer's Lactate was infused accordingly, 15-20 minutes before performing the block. Both groups then received an additional litre of Ringer's lactate solution. All patients were given spinal anesthesia at the lumbar 2–3 or lumbar 3–4 interspaces, with the patient in the sitting position, and with the side-port of the needle pointing cephalad. All subjects received 2 ml 0.75% bupivacaine hyperbaric solution delivered through a 25-gauge Quincke needle. Immediately after injection, the patients were positioned supine with left uterine displacement. Heart rate (HR) and systolic arterial pressure (SAP) were recorded at 01 min, 05 mins, 10 mins, 15 mins, 20 mins, 30 mins and 45 mins after the performance of spinal block. Level of sensory block was recorded by pinprick method. Hypotension was treated with IV boluses of 5 mg ephedrine and additional rapid infusion of Ringer's Lactate. Ephedrine treatment was repeated every 2 min if hypotension persisted or recurred. Total dose of Ephedrine (if) required by the patient was also recorded. Complications like nausea, vomiting, bradycardia, respiratory depression, skin reaction were managed symptomatically.

After recovering from spinal anaesthesia, which included complete regression of sensory analgesia of the perineum, full return of motor function of the lower extremity and

spontaneous urination, the patients were shifted to the ward.

All the data entered into the Statistical Package for Social Sciences (SPSS) version 10.0 and analyzed. Mean and Standard Deviation (SD) was calculated for age, weight, systolic blood pressure, heart rate and dose of ephedrine. Frequency (%) was calculated for ASA status and level of sensory block. For quantitative data student's t-test and for qualitative data Chi-square test was applied. *p* value <0.05 was considered statistically significant.

RESULTS

Average age in group A was found to be 28.32 ± 5.9 years while in group B it was 29.12 ±6.0 years (*p*=0.765). The mean weights in group A and B were 55.22 ± 9.8kg and 56.26 ± 9.6 kg respectively (*p*=0.546). In group 'A' there were 42 (84%) ASA-I and 8 (16%) ASA-II patients. In group 'B' there was 39 (78%) ASA-I and 11 (22%) ASA-II patients (*p*=0.411).

Level of sensory block in both groups was comparable. In group A T4 level achieved in 35 (70%) patients and T6 level achieved in 15 (30%) patients while in group B T4 level achieved n 38 patients and T6 achieved in 12 (24%) patients. (*p*=0.345).

Mean ± SD of SAP in group A before performing block, 1, 5 , 10 , 15, 20, 30 and 45 minutes after performing block was 110.10 ± 6.06, 94.06 ± 10.45, 96.70 ± 18.31, 97.64 ± 8.16, 95.66±6.28, 95.44 ± 12.16, 96.04 ± 9.18 and 93.82±9.18 respectively (Fig.1).

Mean ± SD of SAP in group B before performing block, 1, 5 , 10 , 15, 20, 30 and 45 minutes after performing block was 108.72 ± 6.04, 84.30 ± 19.72, 86.28 ± 14.10, 98.22 ± 9.19, 97.62 ± 7.85, 97.36 ± 11.64, 95.22 ± 8.80 and 95.22 ± 8.80 respectively (Fig.1).

The differences between two groups 1 and 5 minutes after block was found to be statistically significant with *p*=0.031 and 0.011 respectively.

Mean ± SD of HR in group A before

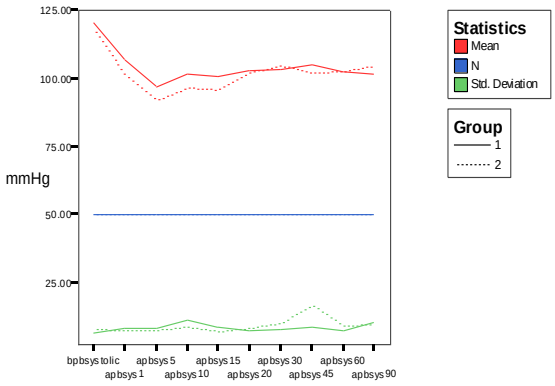

Fig. 1: Comparison of systolic arterial pressure before and after performing block.

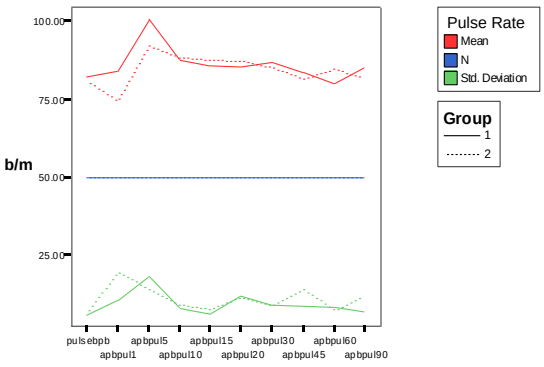

Fig. 2: Comparison of heart rate before and after performing bloc.

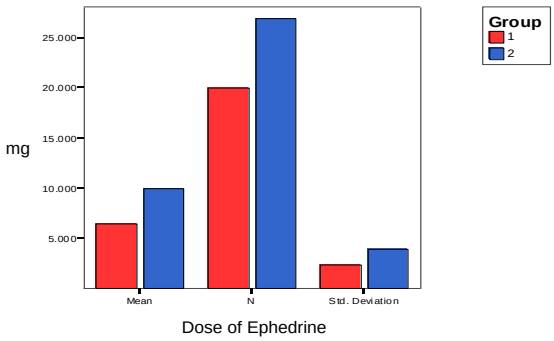

Fig. 3: Comparison of dose of ephedrine.

performing block and 1,5,10, 15, 20, 30, and 45 minutes after performing block was 82.10 ± 6.06, 90.70 ± 18.31, 87.64 ± 8.16, 85.66 ± 6.28, 85.44 ± 12.16, 86.94 ± 9.18 and 83.82 ± 8.95 respectively (Fig 2).

Mean ± SD of HR in group B before performing block and 1,5,10, 15, 20, 30, and 45 minutes after performing block was 80.72 ±

6.24, 100.30 ± 19.72, 98.28 ± 14.10, 88.22 ± 9.19, 87.62 ± 7.85, 87.36 ± 11.64, 85.22 ± 8.80 and 81.62 ± 13.97 respectively (Fig 2).

The differences between two groups 1 and 5 minutes after block was found to be statistically significant with p=0.033 and 0.014 respectively.

DISCUSSION

Maternal hypotension is a common complication of spinal anesthesia for caesarean section with an incidence approaching 82% to 100%. Untreated, severe hypotension can pose serious problems to both mother (unconsciousness, pulmonary aspiration, apnea or even cardiac arrest) and baby (impaired placental perfusion leading to hypoxia, fetal acidosis and neurological injury)[9].

In this study we have demonstrated a significantly lower incidence of hypotension in patients who were preloaded with Polygeline (Colloid) 500 ml compared with those who received 1 litre of Ringers lactate (Crystalloid) solution. It could be argued that using 2-3 times the volume of Ringers lactate solution would have been a fairer comparison, but this would have taken a much longer to infuse. We were also concerned that such large volumes might cause excessive haemodilution in an already compromised woman with pregnancy-induced anemia, resulting in reduced oxygen flux to the placenta, in addition the maternal lung is known to be susceptible to pulmonary edema.

This is inconsistent with the findings of others who have compared colloid and crystalloid fluid administration prior to spinal anesthesia. Malthru et al conduted a study and found no hypotension (defined as systolic blood pressure less than 100 mm Hg) when patients received 15 ml/kg of 5% albumin prior to spinal anesthesia for cesarean section. The control group, which received 15 ml/kg of 5% dextrose in LR, had a 29% incidence of hypotension[10].

Rout et al (1993) compared a group of parturient receiving no volume load with a group receiving 20 ml/kg over 20 minutes. Although there was a statistically significant reduction in the incidence of hypotension in the group receiving a volume load (71% vs. 55%), there were no differences in the severity. Again Rout et al (1992) had demonstrated that rapid administration (10 min vs. 20 min) of crystalloid preload before spinal anaesthesia did not decrease the incidence or severity of hypotension and questions the role of crystalloid preload[11]. Riley et al stated that about 75% of intravenous crystalloid solution diffuses into the interstitial space and, hence, about 2.5 to 3 times the volume of crystalloid solution is needed to achieve the same degree of blood volume expansion achieved by iso-oncotic solution. Its efficacy in expanding plasma volume is only transient[12].

In males having spinal anesthesia for transurethral resection of the prostate, Baraka et al. reported an 11% incidence of hypotension after administration of 7 ml/kg of 3% gelatin compared with 52% after the same volume of crystalloid[13].

Sharma et al recently observed that patients given 500 ml of hetastarch had a 21% incidence of hypotension after spinal anesthesia with lidocaine for postpartum tubal ligation compared to a 55% incidence in patients given 1000 ml of LR[14]. The more stable hemodynamic status observed after colloid administration probably relates to their remaining in the intravascular compartment longer than crystalloids. Extravascular redistribution of crystalloids may be so rapid that it may be impossible to infuse them fast enough to maintain intravascular volume and avoid hypotension during spinal anesthesia. Colloid solutions contain large molecules that do not immediately redistribute throughout the extracellular fluid compartment. Therefore, they should not decrease plasma colloid oncotic pressure (COP) as much as crystalloid solutions and intravascular volume should be better maintained.

Hallworth et al conducted a study and found that regimen of Ringer's Lactate plus Gelatin 500 ml solution proved superior to 1000 ml of lactated Ringer's solution and reduced the incidence of hypotension from 45% to 10% in

extradural caesarean section. But it may cause anaphylactoid reaction[15].

Morgan et al found that colloid Dextran is available as Dextran 70 and Dextran 40. Althrough Dextran 70 is a better volume expander than Dextran 40, the later also improves blood flow through the microcirculation, presumably by decreasing blood viscosity. Antiplatelet effects are also described for Dextran. Infusion exceeding 20 ml/kg/day can interfere with blood typing, may prolong bleeding time and have been associated with renal failure. Dextran can also be antigenic and both mild and have severe anaphylactoid and anaphylactic reaction[16].

Bradycardia during spinal anaesthesia results, at least in part, from block of sympathetic cardio accelerator fibers originating from T1-T4. Carpenter et al identified sensory block level as an important parameter for bradycardia following spinal anaesthesia[17]. The median (range) sensory block level in our study was T6 (T4-T8). Patients of our study demonstrated level of block at thoracic four to eight dermatome. But more patients developed bradycardia, needed pharmacological intervention in group B than group A although the level of sensory block of these patients was not significantly different.

CONCLUSION

Preloading with Polygeline solution results in a lower incidence and severity of hypotension as compared to Ringer's lactate solution. The need of vasopressors for treatment of hypotension was lower in Polygeline than Ringer's lactate group.

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