ORIGINAL ARTICLE

PRELOADING BEFORE SPINAL ANAESTHESIA FOR CAESARIAN SECTION. A COMPARISON BETWEEN COLLOID AND CRYSTALLOID PRELOAD

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ABSTRACT

Objective: To compare the preloading effect of 500 ml hydroxyethyl starch (HES) 6% with 1000 ml of Ringer's lactate to prevent hypotension in spinal anaesthesia for elective cesarean section.

Design: Randomized clinical trial

Place and duration of study: PAF hospital Islamabad, from November 2005 to March 2006.

Patients and methods: The trial was conducted in two groups of healthy women, scheduled to have elective cesarean section with no fetal compromise. The first group received HES 6% 500 ml (HES group) (n=25) and the second group was infused with 1000 ml Ringer's lactate (RL group) (n=25), in 15 minutes before administering spinal anaesthesia. The incidence of hypotension (systolic B.P < 90 mm Hg or <80% of baseline), and incidence of nausea and / or vomiting were recorded. Neonatal outcome was assessed by apgar scoring at 1, 5 and 10 min.

Results: The incidence of hypotension was lower in HES group than RL group. Hypotension occurred in 9 out of 25 women (36 %) who received HES 6%, while 15 out of 25 women (60 %) of RL group developed hypotension. The incidence of nausea and or vomiting was also lower in HES group (24% vs. 40%). Neonatal outcome was good and similar in both groups.

Conclusion: Preloading pregnant ladies undergoing elective cesarean section, with 500 ml HES 6%, 15 min before induction of spinal anaesthesia decreases the incidence of hypotension more than preloading with 1000 ml Ringer's lactate.

KEYWORDS: Analgesia, Obstetric, Arterial pressure, Subarachnoid block

INTRODUCATION

Maternal hypotension is the commonest serious problem following spinal anaesthesia for Caesarian section, with an incidence of up to 83%.[1] Various techniques have been used to prevent maternal hypotension including intravascular volume expansion using intravenous (IV) fluids 'preloading' immediately before induction of spinal anaesthesia[2], use of left lateral tilt or manual uterine displacement or both[3] and administration of IV fluids and vasopressors, both prophylactically and in response to cardiovascular changes subsequent to neural block.[4]

Volume preloading has been recommended for prevention of spinal induced hypotension in this situation. The type of IV fluid, rate of administration and total volume used remains controversial. Giving up to 2 liters of crystalloid solution may reduce but not eliminate hypotension.[5] Rapid infusion may be tolerated by normal healthy women without complications but there may be problems if practiced routinely. Various colloids have also been used for this purpose. Mathru et al showed that when albumen was used to preload parturients, there was 30% less hypotension as compared to crystalloids, and the clinical and bio-

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chemical status of the neonate improved in the colloid treated group.[6]

When Hydroxyethyl starch 6% was compared with crystalloid preload the incidence of hypotension, although less in colloid group, was not significantly different.[7] Ueyama et al studied crystalloids compared with two different volumes of hydroxyethyl starch 6% for preloading. Hypotension was significantly reduced after large volumes of the colloid. The cardiac output increased and infused solution remained in the circulation for a longer period of time.[8]

French et al also demonstrated a reduction in the incidence of hypotension in the colloid group. There was no main difference in the neonatal outcome.[9] In contrast to these studies which all found colloid preload of benefit, Karinen et al failed to find any reduction in incidence of hypotension when colloid was used.[10]

PATIENTS AND METHODS

Fifty women scheduled for elective Caesarean section were enrolled for the study after permission from the hospital ethics committee and written informed consent was obtained from every participant. Patients were examined in pre-anaesthesia clinic one day before the surgery. Women were at term with singleton pregnancies without fetal compromise. They were in ASA class I and II. Patients with pregnancy induced hypertension, chronic hypertension, cardio-vascular or cerebrovascular disease, breech presentation, diabetes mellitus, obesity (weight > 115 kg), known fetal abnormality or having any contraindication to spinal anaesthesia were excluded from the study.

Study was conducted in such a way that every alternate patient received the same treatment. On arrival in the operating room, patients were placed in supine position with 15° left lateral tilt. Baseline arterial blood pressure and heart rate were taken as the mean of three consecutive readings at three minutes interval during which the systolic pressure did not vary by more than 10% from its average value.

Patients were divided into two groups. Over a period of 15 minutes, group one 'HES group' (n=25) received 500ml HES 6%, while the second group (n=25) was given 1000ml of Ringer's lactate (RL group).

Immediately after preloading, patients were put in sitting position and spinal anaesthesia was induced at L2-L3 or L3-L4 interspaces, with Quinke-Babcock spinal needle 25 or 26 gauge using 1.6 ml Bupivacaine 0.75%. Patients were then placed supine with left lateral tilt and Ringer's lactate infusion was started. Oxygen was given by facemask at rate of 4-5 liters/min. Monitors were attached. Blood pressure was measured at 2 minute intervals, beginning one minute after spinal injection with an automated blood pressure device for 15 minutes and every 3 minute thereafter. Hypotension was defined as systolic blood pressure (SBP) <80% of baseline or <90 mm Hg. The maximum height of block, assessed by pinprick was monitored in all patients. Spinal injection to delivery time, uterine incision to delivery time and incidence of hypotension were recorded in both groups. Hypotension was treated with additional rapid infusion of Ringer's lactate and persistent hypotension was treated with Dopamine infusion (1-10 ug/kg/min) titrated to get SBP 90-100% of baseline.

The incidence and timing of nausea and/or vomiting were monitored. Nausea and vomiting not associated with hypotension was treated with metoclopramide 10 mg IV. Neonatal outcome was assessed using Apgar score at 1, 5 and 10-minute intervals.

RESULTS

The groups were comparable in maternal age, weight and gestational age. All spinal blocks extended to T6 and above. There ware no difference in the level of sensory block or in the spinal injection to delivery or uterine incision to delivery times (Table 1).

Table 1: Maternal characteristics and operative details (mean)

Parameters	Group HES n=25	Group RL n=25
Age (in years)	25.5	24.7
Weight (in Kg)	59.8	57.3
Sensory blocks < T6	0	0
Spinal injection to delivery time (min)	15.8	15.9
Uterine incision to delivery time (min)	167.2	171.8

Both groups had similar pre-induction systolic blood pressure. However the incidence of hypotension after spinal injection was higher in the Ringer's lactate (RL) group than in the Hydroxyethyl starch (HES) group (60% vs. 36%).The incidence of nausea and/or vomiting was also lower in HES group (24% vs. 40%) (Table 2).

Table 2: Hypotensive episodes and their management

Group	HES Group n=25	RL Group n=25
Incidence of hypotension	9 (36%)	15 (60%)
Hypotension corrected by additional rapid infusion of Ringer's Lactate	7 (28%)	13 (52%)
Persistent hypotension requiring Dopamine infusion	2 (8%)	2 (8%)
Nausea and vomiting	6 (24%)	10 (40%)
Nausea and vomiting eliminated by correcting hypotension	4 (16%)	7 (28%)
Nausea vomiting requiring treatment with an anti-emetic	2 (8%)	3 (12%)

DISCUSSION

The present study shows, that patients undergoing elective cesarean section under spinal anaesthesia when preloaded with 500ml of hyperoncotic colloid Hydroxyethyl starch 6% showed a lower incidence and severity of hypotension than patients who were preloaded with 1000ml of Ringer's lactate.

The use of crystalloid preloading does not always prevent hypotension after spinal anaesthesia for cesarean section. 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 colloid solution [11].Thus colloid solutions are a more logical choice for preloading patients undergoing surgery under spinal anaesthesia since these remain in circulation for a longer period of time, due to their physical properties. Baraka et al have shown that preloading with degraded gelatin solution (Haemaccel®) is more effective than saline in attenuating spinal induced hypotension in patients undergoing TURP.

The relatively small volume of 500ml HES 6% can be administered in relatively less time (10-15 min) allowing rapid and effective preloading prior to spinal block in cesarean section which is an advantage in urgent situations. Hydroxyethyl starch 6% has an average molecular weight of 200,000 Daltons and an osmolality of 310mosmol/L. With each ml infused, 0.4 ml is drawn from extra vascular space to the intravascular space, thus it produces a volume expansion of 140 %.The maximal volume expansion is reached within 10 min and persists for about 60 minutes.

In contrast Ringer's lactate is distributed throughout the extra cellular compartment and expansion of plasma volume is only 300ml after infusion of 1000ml. Therefore 3000ml of Ringer's lactate is needed to achieve the same plasma volume expansion, as achieved by 500ml of HES 6%.

Also the incidence of nausea and vomiting is less in patients preloaded with HES 6%. Nausea and vomiting in patients undergoing Caesarean section under spinal anaesthesia has a complex and multifactorial etiology and can be influenced by factors such as hormonal changes, weight, age, pain, hypotension and uterine exteriorization. In our study, most of the episodes of nausea and/or vomiting coincided with the onset of maternal hypotension, and were eliminated by treating the

hypotension. Thus the occurrence of nausea and /or vomiting in such cases is secondary to hypotension and its associated brain stem hypoxemia, which should always be anticipated and treated before administering anti-emetic therapy.

However, preloading with colloids has potential disadvantages including cost (colloids are seven to ten times more costly than crystalloids), risks of hemodilution, fluid overload and significant anaphylactic reactions.[12]

CONCLUSION

In conclusion, preloading with 500ml of HES 6%, infused during the 15 minutes preceding the administration of spinal anaesthesia for elective cesarean section results in a lower incidence of hypotension than preloading with 1000 ml of Ringer's lactate.

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