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COMPARISON OF PROPHYLACTIC INTRAMUSCULAR EPHEDRINE WITH PRELOADING VERSUS PRELOADING ALONE IN PREVENTION OF HYPOTENSION DURING ELECTIVE CAESARIAN SECTION UNDER SPINAL ANESTHESIA

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ABSTRACT

Background: There is a considerable dispute over the use of different techniques for the prevention of hypotension during caesarean section under spinal anesthesia . There is a hypothesis that crystalloid preloading together with prophylactic intramuscular (IM) ephedrine injection prevents occurrence of hypotension during caesarean section under spinal anesthesia. The best protective dose of (IM) ephedrine in relation to the appropriate time intervals, in order to prevent hypotension during caesarean section was assessed in this study. **Aim:** To compare between the preloading with crystalloid alone and crystalloid preload with ephedrine (IM) in prevention of hypotension during caesarean section under spinal anesthesia. **Patient and Methods:** Eighty healthy pregnant mothers all ASA class I&II were randomly allocated to two groups. Group A (control group) was given crystalloid preloading (0.9% normal saline (15ml/kg)) only within 20 (min) prior to spinal anesthesia. Group B received IM ephedrine 15 mg, 10 and 0 min prior to spinal anesthesia along with crystalloid preloading (0.9% normal saline (15ml/kg)) within 20 (min) prior to spinal anesthesia. **Results:** In the group A, a significant mean arterial blood pressure(MAP) drop was observed at 5 min , 10min, 15min and 20 min time intervals($P<0.01$). Group B steadily maintained the blood pressure at all time intervals without showing any significant changes. **Conclusion:** We conclude that preloading with crystalloid alone and crystalloid with prophylactic (IM) ephedrine 15mg given 10 min and 0 min prior to spinal anesthesia will effectively prevent hypotension during cesarean section under spinal anesthesia.

KEYWORDS: Caesarean section, Bupivacaine, Spinal anesthesia, Hypotension, Ephedrine, Preload.

INTRODUCTION

Hypotension is abnormally low blood pressure, especially in the arteries of the systemic circulation that is low enough that the flow of blood to the organs of the body is inadequate and symptoms and/or signs of low blood flow develop.[1]

Maternal hypotension after spinal anesthesia depends on many factors, including dose of local anesthetic, patient positioning, fluid preloading and co-loading, and the use of prophylactic or therapeutic vasopressors. The principal mechanism by which spinal anesthesia causes maternal hypotension is the blockade of sympathetic efferent neurons. Patients with higher baseline sympathetic activation have been shown to have more marked hypotension after spinal anesthesia. The degree of hypotension was greater at higher levels of spinal anesthesia. More than 50% of the patients with T5 or higher levels of anesthesia had a significant decrease in blood pressure. Excessive vasodilatation, or insufficient constriction of the resistance blood vessels (Mostly arterioles), causes hypotension. This can be due to decreased sympathetic nervous system output or to increased parasympathetic activity occurring as a consequence of injury to the brain or spinal cord or of dysautonomia, an intrinsic abnormality in autonomic system functioning. However in practice, blood pressure is considered too low only if noticeable symptoms are present. For some people who exercise and are in top physical condition, low blood pressure is a sign of good health and fitness. For many people, low blood pressure can cause dizziness and fainting or indicate serious heart,

endocrine or neurological disorders. Severely low blood pressure can deprive the brain and other vital organs of oxygen and nutrients, leading to a life-threatening condition called shock.[4]

Reduced blood volume, hypovolemia , is the most common cause of hypotension. This can result from hemorrhage; insufficient fluid intake, as in starvation; or excessive fluid losses from diarrhea or vomiting. Hypovolemia is often induced by excessive use of diuretics.

The use of vasopressors for the prevention of hypotension during LSCS is well established. Phenylephrine and ephedrine are the most widely used vasopressors in current practice.The epinephrine also can be used.

PATIENT AND METHODS

This prospective, randomized, double-blinded, clinical study was conducted at medical city complex, Baghdad teaching hospital, department of anesthesia and intensive care medicine, from October 2012 to January 2013. After approval of the study by the Board Committee and department of gynecology, eighty patients in the criterion of the American Society of Anesthesiologists' Physical Status I and II With full term uncomplicated single gestation scheduled for caesarean section delivery under spinal anesthesia were enrolled in the study.

Selection of subjects were made after excluding patients who were having maternal complications such as

- Pregnancy Induced Hypertension.
- Pre-existing hypertension.
- Obesity resulting in impalpable lumbar spine.
- Unstable cardiovascular or renal disease and diabetes mellitus.
- Mothers who were diagnosed to be having fetal anomalies.
- Who were having contraindications for spinal anesthesia.

An Informed verbal consent of each patient was obtained prior to the procedure. All patients were premedicated with intravenous metoclopramide (10 mg) and ranitidine (50 mg) injections intravenously. In all selected patients, baseline blood pressure and the pulse rate was recorded initially before intervention. For the assessment of blood pressure, eight blood pressure measurements were taken at (5, 10, 15, 20, 25, 30, 35 and40 min) time intervals using an automated non-invasive Blood Pressure Monitoring apparatus. The first measurement was discarded and the mean of the consecutive measurement were taken as the baseline blood pressure value. The baseline heart rate was taken from the electrocardiogram (ECG) and pulse oximetry. The patients were double blind randomly allocated into two groups.

Group A (the control group) was given only crystalloid preloading(0.9% normal saline (15ml/kg)) within (20 min) prior to spinal anesthesia and received 1ml of normal saline 0.9% (IM).

Groups B received (IM) ephedrine (15 mg) in (1 ml), 10 and 0 min prior to spinal anesthesia along with crystalloid preloading (0.9% normal saline (15ml/kg)) within (20 min) prior to spinal anesthesia.

All subjects in both test groups were preloaded with a calculated amount of 0.9% normal saline (15ml/kg) over (20 min). Spinal anesthesia was conducting in sitting position, Under full aseptic technique and after a skin infiltration with 2% plain lidocaine, a 25-gauge Quincke needle was inserted into the L3-L4 inter-vertebral space with the patient in the sitting position. After confirming a free flow of cerebrospinal fluid (CSF), 0.5% hyperbaric bupivacaine (2.5 ml) (12.5mg) was injected intrathecally. Once the procedure was over, the patients were placed in the left tilted position until the surgery began. Oxygen 4-5 L/min. was given using a clear facemask. One minute after the spinal injection, the onset of spinal anesthesia was confirmed by asking the patient to subjectively verify numbness of the legs. Surgery was started when the sensory level of the block reached T4. Patients belonging to the test groups received (IM) ephedrine injections. Maternal blood pressure and heart rate were measured at (5, 10, 15 20, 25, 30, 35 and 40 min) time intervals after the subarachnoid block by an independent observer who was blind to the procedure. The fetal outcome was assessed by the APGAR score at first and fifth minutes after the delivery. The incidence of maternal adverse effects to ephedrine manifesting as nausea, vomiting, sweating and palpitations were also recorded in each patient by the same independent observer.

If maternal hypotension occurred, it was promptly corrected by rapid administration of (IV) fluid and by (5mg) ephedrine (IV) bolus every 5-10 min until mean blood pressure returned back to the accepted value.

RESULT

By Applying the independent sample T-student test using the SPSS v20/IBM.

We conclude that the use of Ephedrine is significant in the prevention of hypotension following spinal anesthesia. And as shown below throughout the tables and charts:

The results were not significant for Age, weight and height.(table 1,2,3).

The heart rate was recorded in both groups at 5, 10, 15, 20, 25, 30, 35 and 40 (min) time intervals. The heart rate was best maintained by the control group (Group A) throughout the surgery without showing any significant changes. Whereas the test groups showed a significant increase in heart rates at all time intervals. (table 4).

The systolic blood pressure was best maintained in group B which received prophylactic ephedrine (IM) than the group A that received therapeutic ephedrine (IV).(table 5).

There is decline in diastolic blood pressure at 10, 20 and 35 min time interval in group (A). Whereas the decline in diastolic blood pressure in group (B) was only at 20 min time interval.(table 6).

There is decline in mean arterial blood pressure at 10 min time interval in group (A).Where as it maintained in group (B) at all time intervals.

Table 1: Age distribution in the study.

Group	Mean of age (Years)	Standard deviation	p-Value
A	26.4543	2.331	0.789
B	25.338	1.784	

Table 2: weight distribution in the study.

Group	Mean of weight (kg)	Standard deviation	p-Value
A	79.115	4.677	0.635
B	74.785	6.738	

Table 3: Height distribution in the study.

Group	Mean of height (cm)	Standard deviation	p-Value
A	159.897	14.588	0.493
B	161.941	12.987	

Table 4: Comparison between the group (A) and (B) Pulse Rate at different time interval.

Time	Group	Mean	STD Deviation	P-Value
5 min	A	94.71	17.204	0.368
	B	97.78	17.299	
10 min	A	92.43	21.326	0.882
	B	98.89	22.518	
15 min	A	96.30	19.022	0.499
	B	99.56	20.407	
20 min	A	97.13	13.748	0.037
	B	101.91	20.035	
25 min	A	96.95	14.787	0.053
	B	102.05	21.248	
30 min	A	99.52	17.776	0.652
	B	98.71	16.763	
35 min	A	100.21	15.842	0.858
	B	101.59	14.997	
40 min	A	98.17	16.686	0.646
	B	103.17	14.370	

Table 5: Comparison between the group (A) and (B) Systolic Blood Pressure at different time interval.

Time	Group	Mean	STD Deviation	P-Value
5 min	A	97.86	20.021	0.386
	B	107.26	24.033	
10 min	A	89.00	20.389	0.639
	B	101.54	18.951	
15 min	A	96.43	26.778	0.973
	B	105.26	21.190	
20 min	A	97.17	17.649	0.916
	B	109.73	14.107	
25 min	A	100.43	19.296	0.548
	B	111.42	15.183	
30 min	A	104.52	15.488	0.505
	B	113.61	12.347	
35 min	A	102.60	13.992	0.556
	B	113.49	10.678	
40 min	A	107.21	10.561	0.219
	B	114.03	11.375	

Table 6: Comparison between the group (A) and (B) Diastolic Blood Pressure at different time interval.

Time	Group	Mean	STD Deviation	P-Value
5 min	A	97.86	20.021	0.386
	B	107.26	24.033	
10 min	A	89.00	20.389	0.639
	B	101.54	18.951	
15 min	A	96.43	26.778	0.973
	B	105.26	21.190	
20 min	A	97.17	17.649	0.916
	B	109.73	14.107	
25 min	A	100.43	19.296	0.548
	B	111.42	15.183	
30 min	A	104.52	15.488	0.505
	B	113.61	12.347	
35 min	A	102.60	13.992	0.556
	B	113.49	10.678	
40 min	A	107.21	10.561	0.219
	B	114.03	11.375	

Table 7: Comparison between the group (A) and (B) Mean Blood Pressure at different time interval.

Time	Group	Mean BP	STD Deviation	p-value
5 min	A	68.431	11.231	0.786
	B	75.016	14,872	
10 min	A	59.505	19.673	0.004
	B	73.525	14.539	
15 min	A	63.762	13.683	0.836
	B	76.719	14.221	
20 min	A	63.060	13.362	0.842
	B	75.978	14.689	
25 min	A	66.615	12.371	0.163
	B	76.436	14.921	
30 min	A	70.532	15.325	0.003
	B	80.836	16.547	
35 min	A	67.801	10.209	0.006
	B	82.267	17.652	
40 min	A	72.294	15.119	0.548
	B	82.956	18.031	

DISCUSSION

The prevention and treatment of maternal hypotension associated with spinal anesthesia for Lower Segment Caesarian Section still remains as a challenge to all Anesthetists.[18] Though the ideal prophylactic sympathomimetic drug has not yet been identified, ephedrine is still in use, mostly in Asian countries due to its cost effectiveness. Phenylephrine is preferred over ephedrine in the prevention of hypotension after spinal anesthesia due to its fewer side effects on mothers and minimal fetal adverse effects. However, (IV) ephedrine is commonly used in many centers to prevent hypotension in LSCS following subarachnoid block . Intramuscular prophylactic vasopressors have been advocated for preventing hypotension associated with spinal anesthesia for LSCS.[19] Though many studies have been performed in order to identify a suitable prophylactic dose of (IM) ephedrine, a proper dosage regime is yet to be finalized. Here, we administered 15 mg ephedrine (IM) at various time intervals and identified a suitable regime that has more effective and less unwarranted effects. Reactive hypertension is one of the unwarranted effects frequently identified after administration of prophylactic (IM) ephedrine, especially with doses exceeding 40 mg.

It has been demonstrated that a si”gle ’ose of ((IV) ephedrine (5mg) decreased the occurrence of the severity of hypotension in preloaded pregnant mothers who underwent LSCS under subarachnoid block.

Another similar study using prophylactic (IV) ephedrine identified that the least effective dose of ephedrine that could reduce the incidence of hypotension was (30 mg).[20]

However, this dose did not completely eliminate hypotension and on the other hand caused reactive hypertension in addition to nausea, vomiting.[21]

Several studies have been undertaken using (I.M) ephedrine and A. A. Webb et al, concluded that a large dose (37.5mg) of (I.M) ephedrine prevented hypotension without causing reactive hypertension or tachycardia.

However (IM) ephedrine provided more sustained cardiovascular support than (IV) ephedrine.[21] In the present study we demonstrated that the (15mg) ephedrine (IM) given (10min.&0 min). prior to the subarachnoid block (Group B) prevented hypotension without causing any fluctuation in the blood pressure. However, there was a significant increase in heart rate at (5min) and 10min time intervals in this group. Moreover the mean arterial blood pressure was not adequately maintained in the control group which received fluid preloading alone (group A). Here marked hypotension was observed at the onset of surgery and continued until the end. Heart rate difference of the control group and the test group were also calculated during the procedure. The incidence of maternal adverse effects to ephedrine manifesting as nausea, vomiting, sweating and palpitations were also recorded. Neonatal APGAR scores at (1min and 5min) were also recorded which was found to be in the normal range in both groups. This study supports the statement given by Jackson R., Reid J.A., Thor burn J.[22] that,

volume preloading is not essential to prevent spinal induced hypotension at caesarean section as preloaded patients also developed hypotension and that the incidence was less in the ephedrine groups, proving that preload alone is not effective and a combination of preload and a prophylactic vasopressor may often become necessary for the prevention of hypotension. The appropriate route and dose of ephedrine that should be used to prevent spinal associated hypotension during cesarean section still remains controversial.

Simon et al showed that a single bolus of IV ephedrine with doses of either 15 or 20 mg decreased significantly the incidence of maternal hypotension associated with spinal anesthesia for cesarean section.[23]

Kee et al reported that the lowest effective dose of ephedrine to reduce the incidence of hypotension was 30 mg.[24] However, Kee et al reported that 45% of the patients developed reactive hypertension.[24]

Some authors recommend intravenous bolus injection, some intravenous continuous infusion and some recommend intramuscular route.[25,26]

Webb and Shipton assessed the safety and efficacy of 37.5 mg ephedrine IM in preventing hypotension associated with spinal anesthesia for Caesarean section.[26] They concluded that 37.5 mg ephedrine (IM) prior to spinal anesthesia was not associated with reactive hypertension or tachycardia and that (IM) ephedrine provides more sustained cardiovascular support than intravenous ephedrine.[26]

In other studies Desalu and Kushimo compared standard infusion of ephedrine 30 mg IV, with traditional prehydration in preventing spinal hypotension. They concluded that prophylactic ephedrine given by standard infusion set was more effective than crystalloid prehydration in the prevention of hypotension during spinal anesthesia for elective caesarean section.[27]

Previous studies have revealed that the best way of administering ephedrine is by infusion pump and that this be started during spinal anesthesia and maintained at least at 2 mg/min.[28]

In a study performed by Lee et al all available studies on IV prophylactic ephedrine administration was systematically reviewed in order to determine the dose response characteristics of prophylactic IV ephedrine for the prevention of hypotension during spinal anesthesia for cesarean delivery.[29]

In this dose respond meta-analysis they concluded that prophylactic ephedrine cannot be recommended. They observed that the efficacy of ephedrine was poor at smaller doses (14 mg or less), whereas at larger doses (30 mg or more), the likelihood of causing hypertension is actually more than that of preventing hypotension.[29]

CONCLUSION AND RECOMMENDATION

According to our findings we believe that combination of preloading with prophylactic I.M ephedrine is more effective in preventing hypotension during spinal anesthesia for elective cesarean delivery than preloading alone. Furthermore our study clearly demonstrated that (15 mg) of prophylactic (I.M) ephedrine given (10 min) and (0 min)prior to the subarachnoid block with preloading, reduced hypotension and provided greater hemodynamic stability.

REFERENCES

1. http://www.thefreedictionary.com/hypotension. The Free Dictionary > hypotension. Citing: The American Heritage Science Dictionary Copyright 2005.
2. ^ "BUPA: Low blood pressure".
3. Ngan Kee WD, Khaw KS., Vasopressors in obstetrics: what should we be using?. Curr Opin Anaesthesiol, 2006; 19(3): 238-43.
4. Abdul.H, Shaharbano.s, Khojeste.J,Ephedrine for prevention of hypotension comparison between intravenous, intramuscular and oral administration during spinal anesthesia for elective caesarean section. Professional Med J Dec, 2007; 14(4): 610-615.
5. Vercauteren M. P, Coppejans H.C,Hoffmann V.H,Mertens E,Adriaensen H.A. Prevention of hypotension by a single 5-mg dose of ephedrine during small- dose spinal Anesthesia in Prehydrated Cesarean Delivery Patients. Anesthesia Analgesia, 2000; 90: 324.
6. A Webb. E A Shipton. Re-evaluation of i.m. ephedrine as prophylaxis against hypotension associated with spinal anesthesia for caesarean section. Canadia Journal of Anesthesia, 45: 367-369.
7. Jackson R., Reid J.A., Thorburn J. Volume preloading is not essential to prevent spinal induced hypotension at caesarean section. British Journal of Anesthesia, 1995; (75): 262-265.
8. Simon L, Provenchere S, de Saint Blanquat L, Boulay G, Hamza J. Dose of prophylactic intravenous ephedrine during spinal anesthesia for cesarean section. J Clin Anesth, 2001; 13(5): 366-9.
9. Kee WD, Khaw KS, Lee BB, Lau TK, Gin T: A doseresponse study of prophylactic intravenous ephedrine for the prevention of hypotension during spinal anesthesia for cesarean delivery. Anesth Analg, 2000; 90: 1390 –5.
10. Loughrey JP, Walsh F, Gardiner J. Prophylactic intravenous bolus ephedrine for elective Caesarean. section under spinal anesthesia. Eur J Anesthesiol, 2002; 19(1): 63-8.
11. Webb AA, Shipton EA. Re-evaluation of i.m. ephedrine as prophylaxis against hypotension associated with spinal anesthesia for Caesarean section. Can J Anesth, 1998; 45(4): 367-9.
12. Desalu I, Kushimo OT. Is ephedrine infusion more effective at preventing hypotension than traditional prehydration during spinal anesthesia for caesarean

section in African parturients? Int J Obstet Anesth, 2005; 14(4): 294-9.
13. Mercier FJ, Roger-Christoph S. Spinal anesthesia for Caesarean section: Fluid loading, vasopressors and hypotension. Obstetric Anesthetists' Association meeting, Versailles, France, 2004.
14. Lee A, Ngan Kee WD, Gin T. A dose-response metaanalysisof prophylactic intravenous ephedrine for the prevention of hypotension during spinal anesthesia for elective cesarean delivery. Anesth Analg, 2004; 98(2): 483-90.
15. Azeez, S.A.S., AlMashhadani, M. and Saadoon, A. 'The Effect of height and weight adjusted dose of intrathecal hyperbaric bupivacaine for elective caesarean section', World Journal of Advance Healthcare Research, 2023; 7(11): 123–129.