Original Article

Effect of magnesium sulphate on quality of subarachnoid block in terms of onset and duration of motor and sensory block, APGAR score of the neonate and haemodynamic status of the patient

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Abstract

Background *In obstetrics, pregnancy induced hypertension is still a burning question and complicates a large number of pregnancies in developing countries. Chance of hypotension is more in patients getting magnesium sulfate with subarachnoid block but it may be managed with adequate preloading and by pressor agent ephedrine.*

Objectives *This study was designed to observe the effect of magnesium sulphate on quality of subarachnoid block in terms of onset and duration of motor and sensory block, APGAR score of the neonates and haemodynamic status of the patients.*

Methods *Sixty parturients undergoing caesarian sections under subarachnoid block were enrolled for the study. They were divided into two groups. Group-A include normal parturient undergoing caesarian section and group-B include pre-celamptic parturient treated with magnesium sulphate within 1 to 2 hours before block. After recording of base line haemodynamic status (BP, HR, SPO_2) all patients received subarachnoid block with 2 ml (10 mg) hyperbaric bupivacaine at L_{3-4} level. Onset of sensory block was assessed by using pinprick, onset of motor block was assessed by onset time of weakness of lower limb and onset time of complete paralysis of lower limb after SAB. Duration of motor block was assessed by modified bromage scale. Height of the block was assessed by using pin prick at the intercostals space in the mid axillary line after 5 minute of SAB. Neonatal assessment was done by using apgar score in 1 and 5 minutes after delivary of baby. Blood pressure was recorded normally at 2 min interval until 15 minutes then every 5 minutes interval till the surgical procedure is completed.*

Results *Duration of motor block in group B is significantly higher 276 ± 44.92 min compared with group A which was 197.96 ± 24.25 min (P = 0.000). Duration of sensory block in group B also significantly higher with 308.76 ± 61.43 min compared with group A which was 264 ± 30.57 min, and (P = 0.001). Changes in systolic blood pressure in group B patient is more and highly significant (P < .05), for upto 60 min. But changes in diastolic blood pressure in-group B was only highly significant with group A for upto 9 minutes. APGAR score was significantly low both in 1 minute and 5 minutes, in group B patients which was 5.80 ± .61 at 1 minute and 7.73 ± .827 at 5 minutes and in group A which was 6.60 ± .85 at 1 minute and 8.30 ± .595 (mean ± SD) at 5 minutes. Onset of sensory block and onset of motor block revealed on significant difference between groups.*

Conclusions *Chance of hypotension is more in patients getting magnesium sulfate but it may be managed with adequate preloading and by pressor agent ephedrine.. APGAR score of baby of magnesium sulfate getting patient is low but it is acceptable.*

Keywords Subarachnoid block, caesarian section, magnesium sulfate and PIH.

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Introduction

Magnesium is one of the important and second most common intracellular cation after potassium. Magnesium plays an important role in nearly every physiological system by calcium antagonism. Magnesium is involved in several processes including hormone receptor binding, gating of calcium channels, transmembrane ion flux & regulating adenylate cyclase-muscle contraction, neuronal activity, control of vasomotor tone, cardiac excitability and neurotransmitter release.

Magnesium is used as an anticonvulsant by its depressant effect at synapses[1]. It may decrease catecholamine release[19] and antagonize bronchospasm. In cardiology magnesium decreases frequency of both atrial & ventricular arrhythmia and causes vasodilatation[6].

In obstetrics eclampsia & pre eclampsia is still now a burning question and complicates a large number of pregnancies in developing countries. This two remains a major cause of maternal & foetal mortality, primarily by causing cerebral haemorrhage & heart failure. Mortality directly correlates with the severity of hypertension. So anesthetic management should be directed towards avoidance of exacerbation of maternal hypertension. In this group of patient airway management and intubation may be difficult due to distortion of upper airway anatomy by oedema[7] and chance of life threatening gastric acid aspiration and exaggerated intubation reflex is more[18]. Moreover general anaesthesia may decrease placental blood flow[21]and may increase the risk of maternal stroke and heart failure in severely eclamptic & pre eclamptic patient.

Spinal anaesthesia causes blockade of motor, sensory and sympathetic nervous system by blocking sodium channels in peripheral nerves. At the motor end plate magnesium inhibits neurotransmiter release in peripheral nerves by competitive calcium antagonist for membrane channels on the pre-synaptic terminal[20].Direct neuromascular block has also been suggested as a mechanism of action of magnesium in pre-eclampsia and eclampsia. So motor block due to spinal anaesthesia may be potentiated by magnesium sulphate. Marked Hoemodynamic changes (i.e. ¯B.P) occur after spinal anaesthesia. On the other hand , magnesium sulphate acts by calcium antagonism via calcium channels[16] and it decreases systemic vascular resistance[9] and reverses increase calcium ion mediated vasospasm[17].Magnesium inhibits catecholamine release[19] and basal myogenic and hormone induced smooth muscle contraction and also has direct vasodilator effect. So chance of hypotension is more in magnesium sulphate treated patient getting spinal anaesthesia. Spinal anaesthesia is often discouraged in patients with preeclampsia and eclampsia because of the risk of severe hypotension[10],leading to maternal, foetal and neonatal morbidity. The first study to call this into question was by Wallace et al[2].In a prospective randomized trial of anaesthesia in parturients with severe preeclampsia ,they compared general anaesthesia with epidural and CSE anaesthesia for caesarean section. The need for ephedrine due to hypotension was similar between the spinal and epidural groups. A retrospective study by Hood et al[3] and a prospective study by Sharwood smith et al[4] agreed with this findings.

Kerinen J.et al have studied the neonates born from pre-eclamptic patient under spinal anaesthesia. They did not find any major effect on clinical condition of the neonates assessed by apgar score and umbilical artery pH values[12].

Comparing general and regional anaesthesia, general anaesthesia is neither contraindicated nor regional anaesthesia indicated exclusively in women with severe pre-eclampsia . Some investigator has also concluded that the use of spinal anaesthesia in cases of severe pre-eclampsia should be reconsidered[5]. When caesarean section is indicated in preeclamptic and eclamptic parturient, a large number of patients remain under magnesium sulphate therapy because it is superior to diazepam or phenytoin in controlling seizure[1]. But there is lack of studies on effect of magnesium sulphate therapy on quality of spinal anaesthesia. This study reveals outcome of spinal anaesthesia in patient getting magnesium sulphate therapy by assessing the effect of magnesium sulphate therapy on quality of spinal anaesthesia.

Methods

This randomized prospective study was carried out in the department of Anaesthesiology, Dhaka medical college hospital. With approval from the hospital ethical committee and written informed

consent, a total of 60 parturients undergoing caesarean section with sub arachnoid block were included in the study. Patients aged between 20-30 years, body weight 50-70 kg , ASA class I and II scheduled for caesarean section. Any one who had relative contraindication for regional anaesthesia were dropped from the study. Patients were divided into two groups: Group A, normotensive parturient undergoing C/S and Group B, parturient getting magnesium sulfate undergoing C/S. Volume preloading done with Hartman's solution 15 ml/kg over 20 to 30 minutes in all patients before giving SAB. Normal fluid balance was however maintained at a rate 4-5ml/kg-hr.

Spinal injections were made with a 25 G Quincke Babcock spinal needle with the patient in lateral position through L 2-3 or L3-4 inter space. In both group of patients 2 ml of 0.5% hyperbaric bupivacaine (10 mg) was injected. Following the end of injection skin patch was applied quickly and patients were immediately placed to supine position.

Preoperative and intraoperative pulse rate was monitored by pulse oxymetry. Blood pressure was recorded normally at 2 min interval over the right arm until 25 minutes than every 5 minutes interval till the surgical procedure was completed. Attempt was made to maintain systolic arterial pressure(SAP) > 90 mm Hg. For this purpose if hypotension occurs (SAP<90 mm Hg) intravenous infusion of crystalloid as necessary and injection ephedrine was given 5 mg intravenously(repeated as necessary). Onset of sensory block was assessed by using pinprick and asking question about tingling, onset of motor block was assessed by onset time of weakness of lower limb and onset time of complete paralysis of lower limb after SAB. Duration of motor block was assessed by modified bromage scale. Height of the block was assessed by using pin prick at the intercostals space in the mid axillary line after 5 minute of SAB. Neonatal assessment will be done by using apgar score in 1 and 5 minutes after delivary.

Severe hypo tension following SAB was defined as a fall of Systemic Arterial Pressure to or below 80 mm Hg and bradycardia as heart rate below 60/ minute.If either severe hypotension (even with usual crystalloid infusion, with or without ephedrine) or bradycardia or both ensued, rescue treatment was to be initiated. An additional intravenous channel(18 G canula) was also to be opened for rapid infusion of colloid(500 ml dextran 40 over 15-20 minutes). Bradycardia was treated with atropine(0.3 mg I/V).

Statistical analysis

The results were compiled and analysed using unpaired t-test, Chi-square ??or ANOVA as appropriate. Results are considered statistically significant if $p<0.05$.

Results

Demographic data was statistically matched (Table I) between the groups. There was significant difference of pulse rate (Fig1) between two groups from 3 min to 23 min. ($P < 0.05$). Systolic blood pressure (Fig2) significantly varied($P< 0.05$) during whole period and diastolic blood pressure(Fig3) ($P< 0.05$) during initial period. Onset of sensory and motor block was (Table2 and Table 3) statistically significant (P=0.009). Duration of sensory(Table4) and motor block (Table5) was also significant APGAR score of the neonates in one and five minutes was highly significant (p=0.004).

Table-I: *Demographic data:*

Group/Variable	Group-A	Group-B
n	30	30
Age in years	24.53±3.38	24.43±4.31
Height in cm	156.21±3.12	155.35±3.26
Weight in kg	58.30±7.27	56.66±7.82

Values are expressed as mean± SD. Values are considered statistically significant if $p<0.05$.

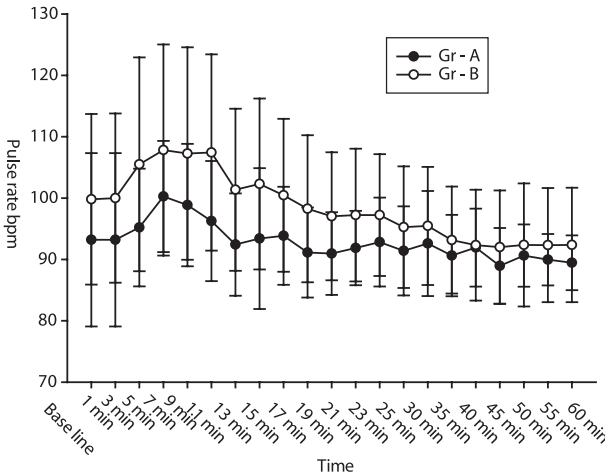

Fig 1 *Changes in pulse rate in different time of two studied groups*

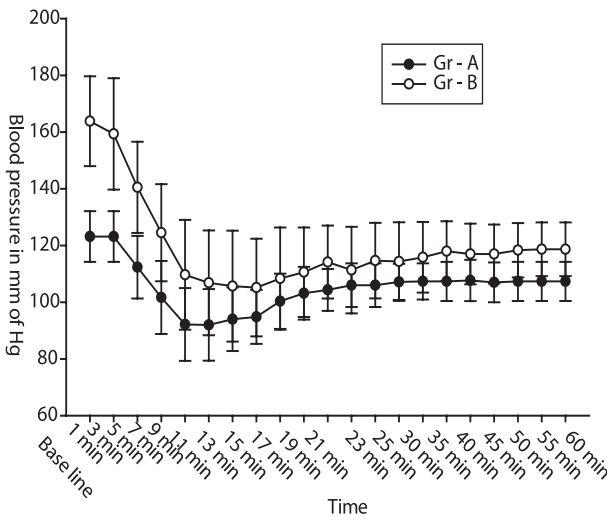

Fig.-2: *Changes of systolic blood pressure in mm of Hg of two studied group*

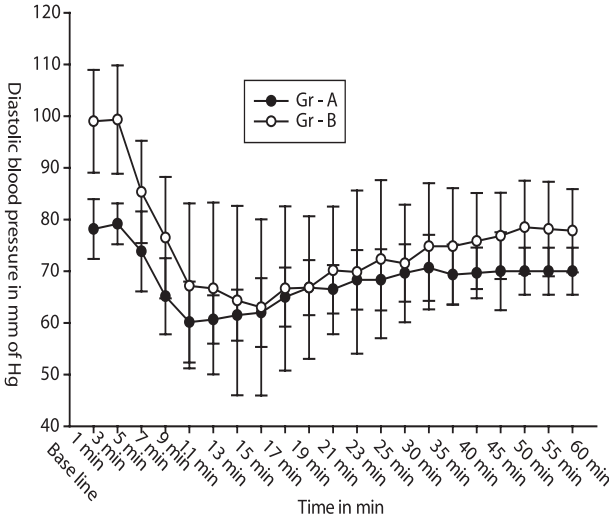

Fig.-3: *Changes of diastolic blood pressure in mm of Hg of two studied group.*

Table II : *Onset of sensory block as indicated by tingling in the leg*

Group / Variable	Group-A	Group-B	p value	Significant level
n=	30	30		
Tingling sensation in the leg in min	1.066±0.25	1.333±0.479	0.009	S

Values are expressed as mean± SD. Between groups analyses were done by student t test (unpaired). Values are expressed as significant if P<0.05 (CI-95%). S- Significant.

Table III : *The onset of motor block as assessed by weakness of lower limb*

Group/Variable	Group-A	Group-B	t	P value	Significant difference
Number of Patient	30	30			
Duration of Motor Block	197.96±24.25	276.26±44.92	-8.40	0.000	S

Values are expressed as mean± SD. Between groups analyses were done by student t test (unpaired). Values are expressed as significant if P<0.05 (CI-95%). S- Significant.

Table IV : *Duration of sensory block*

Group/Variable	Group-A	Group-B	t	P value	Significant Difference
Number of Patient	30	30			
Duration of Sensory Block	264.16±30.57	308.76±61.43	-3.560	0.001	S

Values are expressed as mean± SD. Between groups analyses were done by student t test (unpaired). Values are expressed as significant if P<0.05 (CI-95%). S- Significant.

Table V : *Duration of motor block .*

Group/Variable	Group-A	Group-B	t	P value	Significant difference
Number Of Patient	30	30			
Duration of Motor Block	197.96±24.25	276.26±44.92	-8.40	0.000	S

Values are expressed as mean± SD. Between groups analyses were done by student t test (unpaired). Values are expressed as significant if P<0.05 (CI-95%). S- Significant.

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Table VI *APGAR score in one and five minutes*

Group/Variable	Group-A	Group-B	t	P value	Significant difference
Number Of Patient	30	30			
Weakness of Lower Limb	2.033±0.319	2.400±0.770	-2.408	0.019	S

Values are expressed as mean± SD. Between groups analyses were done by student t test (unpaired). Values are expressed as significant if P<0.05 (CI-95%).

Discussion

Pre eclampsia & eclampsia are the most common direct causes of pregnancy related death mainly due to stroke & heart failure. Mortality directly correlated with severity of hypertension. The mortality rate varies 2 to 5 %[8]. They are often treated with magnesium sulphate and antihypertensives. Because sound clinical research has shown beyond doubt that magnesium is superior to either diazepam or phenytoin for the prevention of recurrent convulsions[1]. magnesium sulphate also decreases systemic vascular resistance[9] and is beneficial for controlling acute hypertension.

Anaesthetic management is very critical in pre-eclamptic & eclamptic patients. Because general anaesthesia has several potential adverse effect like difficulties in airway management & intubation due to distortion of upper airway anatomy by edema, increase chance of aspiration, maternal stroke & heart failure & decreases placental blood flow. On the other hand, spinal anaesthesia is discouraged in pre eclamptic & eclamptic patients because of the risk of severe hypotension [10].

Comparing general & regional anaesthesia, general anaesthesia is neither contra indicated nor regional anaesthesia indicated exclusively in women with severe pre eclampsia. Some investigator has also concluded that the use of spinal anaesthesia in cases of severe pre eclampsia should be reconsidered. [5] The first study to call this in to question was by Wallace et al [2] in a prospective randomized trial of anaesthesia in parturients with severe pre eclampsia. They compared general anaesthesia with epidural &CSE anaesthesia for caesarean section. They found that the need for ephedrine was similar between the spinal & epidural groups and there was no significant difference in maternal or neonatal morbidity among the three groups. A retrospective study by Hood et al[3] and a prospective study by sharwood-smith et al [4] agreed with this findings.

In this study it had been shown that changes in both systolic and diastolic blood pressure were significantly higher (P<0.05) in group B patient than group A. So, pressor agent ephedrine was more used in group B patients. The result was similar to the retrospcetive study be Hood and Boese [11]. Although in majority of the patients in group B systolic blood pressure fall below 100 mmHg

,however in no case this was below 80 mmHg and accordingly,none required rescue treatment. As such the present protocol did not exclude any patient from the study.

Adequate pre loading decreases the chance of hypotension. In this study preloading with crystalloid between group A & group B was not significant (P=. 421) but in group B maternal systolic arterial pressure decreased significantly. This finding is consistent with karinen J et al study[12].

Pressor agent epinephrine should not be used in pre eclamptic patient because pre eclamptic has a markedly increased sensitivity to vasopressors [10,13] and in advertent intravascular injection of epinephrine would further exacerbate maternal hypertension and further decreased placental blood flow[14]. So, the most commonly used vasopressor in obstetric anaesthesia are the predominantly b agonist drugs. Ephedrine is widely used because of its predominantly b and mild a sympathominetic action. Ephedrine increases cardiac out put & therefore flow to the maximally dilated utero placental vessels[15]. Incremental I/V bolus dose of ephedrine counteract hypotension. In this study it had been shown that frequercy of systolic hypotension were more in-group B patients which was managed well by I/V ephedrine.

Karinen J. et. al have studied the neonates born from pre eclamptic patient under spinal anaesthesia. They did not find any major effect on clinical condition of the neonates assessed by Apgar score & umbilical artery p^H values[12]. This study did not match with Karinen J. et. al study. In this study APGAR score is significantly low in group B patient both in 1^{st} min and 5^{th} min than group A patient. In both 1^{st} and 5^{th} min P<0.05. This study matched with the research work of Monika Sharma who found that APGAR was more than 7 in 68.75% of babies and NICU admission and foetal loss were significantly less in study group. She concluded that magnesium sulfate is safe for mother and has no adverse effect on babies.

In this study duration of motor and sensory block in Group B was increased and was statistically highly significant (P< 0.05). Onset time of sensory block – Tingling in the leg was more in-group –B patient and was statistically significant (P< 0.05) but in case of pinprick it was not significant (P = 0.084).

Onset time of motor block – weakness of lower limb was more in-group –B patients and was statistically significant (P = 0.019). On the other hand onset of motor block complete paralysis of lower limb in-group –B patients and was not significant (P < .06).

So study concluded that spinal anaesthesia is safe for pre eclamptic parturient, treated with magnesium sulphate. Although chance of hypotention is more in patients getting magnesium sulfate but it may be managed with adequate preloading and by pressor agent ephedrine.. APGAR score of baby of magnesium sulfate getting patient is low but it is acceptable.

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