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Intraoperative Importance of Low Dose Intradural Spinal Anaesthesia of Pre-Eclamptic Patients on Treatment with Magnisium Sulphate Therapy in Emergency Caesarean Section

KEYWORDS: Intradural (subarachnoid) spinal anaesthesia, magnesium sulphate therapy, seizures, complications

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ABSTRACT *Objective: Pre-eclamptic patients have chances of seizures, congestive heart failure, renal failure, pulmonary oedema, HELLP syndrome, and encephalopathy. Termination of pregnancy is the only treatment for reduce maternal mortality. In pre-eclampsia the patient is hypovolumic due to intense vasoconstriction and in spinal anaesthesia chances of vasodilatation due to sympathetic cut down. In emergency cesarian section if conducted in intradural spinal anaesthesia with low dose bupivacaine and fantanyl provides less hyper dynamic changes, quick effects of anaesthesia in less time consuming procedure. Prophylactic magnesium sulfate therapy provides protection against seizures with many other benefits of magnesium which is discussed in this study.*

Results: it is observed that blood pressure and heart rate changed less likely from base line value in low dose spinal intradural (subarachnoid) anaesthesia in pre-eclamptic patients on magnesium sulphate therapy and same has been checked and justified by applying t-test.

Conclusion: Magnesium sulphate therapy protects patients against seizures intraoperatively as well as postoperatively. Protect against complications like hypertension , intracranial haemorrhage, cardiac arrhythmia also give cellular protection during ischaemia, reduce reperfusion injury by inhibiting calcium overload, reduce ischaemic damage and traumatic brain injury, act as a adjuvant in standard bronchodilator therapy. [10]

With prophylactic magnesium sulphate therapy in pre-eclamptic patients undergoing surgery in Spinal anaesthesia (intradural) mean blood pressure and heart rate remains settled with proper fluid preload. Heavy Bupivacaine 0.5% with fentanyl were used as anaesthetics

. Postoperative morbidity and mortality are also less in intradural spinal anaesthesia in this study.

Introduction:

Eclampsia accounted for 43.35% of total maternal deaths, with case fatality of 4.960%. The commonest mode of death in eclampsia is pulmonary oedema. Death due to eclampsia commonly occurs in younger age group of 19–24 years and in primi gravid. Eclampsia related deaths were mostly seen in illiterate and unbooked cases. Maternal deaths were also very common in lower socio economic status.[1]

A large, population-based study compared 26,651 pregnant women with hypertensive disorders to 213,397 pregnant women without hypertensive disorders to determine risk of end-stage renal disease. Results showed that the incidence of chronic kidney disease was almost 11-fold higher in the hypertensive group. This group also exhibited a 14-fold increased risk for end-stage renal disease. The risk was much greater for women with pre-eclampsia or eclampsia. This study highlights the importance of adequate follow-up of BP after pregnancy.[2]

Material and methods

Retrospective analysis of perioperative convulsions in severe pre eclampsia was conducted from 2012 to 2015 after approval by hospital ethical committee and informed consent from all the participants is obtained, at government medical college Kota. Thirty patients posted for caesarean section studied under regional subarachnoid block, who were on prophylacticaly given magnesium sulphate therapy.

It was planned that thirty patients systolic blood pressure 138-172 m.m.Hg. and diastolic blood pressure 90-121 m.m.Hg. with mild protinuria, no evidence of veginal bleeding, no fetal distress underwent caesarean deliveries. Age of the patients were between 19-35 yrs, body weight 48-72 kg, height 4.1-5.4 feet, all patients completed 36 wks of gestation.

All routine investigations and pre-anaesthetic checkups were done before taken in operation theatre. Monitoring such as blood pressure, ECG, pulse oxemeter used intraoperatively.

These thirty were preloaded by magnesium sulphate 12 gm, 4 gm intravenously and 8 gm intramuscularly. These patients receive intradural spinal anaesthesia of heavy bupivacaine 0.5 % [10 mg- 2 ml] + fentanyl [25 µg – 0.5 ml]. For intraoperative hypotension injection ephedrine was used as rescue.

RESULTS:

Morbidity and mortality measured by variation in heart rate, blood pressure, complications and admission in ICU, APGAR score of new borns.

The study included patients who showed 20% or more variation in blood pressure and heart rate. Only one patient had intraoperative and three patients had post operative hypotension while none of patient had hypertension.[table 2] According to heart rate 77% had bradycardia which were controlled by glycopyrrolate 0.2 mg intravenously, none patient had tachycardia. [table 2]

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Only five patients were admitted in ICU, one patient had pulmonary oedema, one had aspiration pneumonitis and three patients had post operative hypotension , all patients discharged uneventfully on seventh day of admission.

Out of thirty newborns only nine remains in APGAR score between 3-6 at one minute which progress to more than 8 at 5 minutes except one.

Stastically all results were tested by student t-test.[table 3]

Condition	Spinal Anaesthesia		
MBP in mmHg→ Pts in %→	<95	>125	>135
Pre-op	0	17	0
induction	0	13	0
intraop			
5mins	0	0	0
10 min	0	7	0
15 min	0	10	0
Post op	3	13	0

Table 1 : percentage of hypertension and hypotension during intraoperative in spinal anaesthesia

Heart Rate						
		Spinal Anaesthesia				
Pts in%→	HR in per/ min→	<85	<95	>115	>125	>135
Pre op		7	40	4	10	0
Induction in SA		7	26	10	0	3
5 min		10	50	10	10	0
10 min		30	30	0	14	0
15 min		11	47	10	10	10
Post op in SA		17	50	0	0	0

Table 2: percentage of tachycardia and bradycardia during intraoperative in SA (20 % fall or raise from base line)

All the above cited Statistical analysis was carried out using "EXCEL statistical formula & Online SPSS tool".

Spinal Anaesthesia						
	MBP in mmHg	t value	p value	HR in per/ min	t value	p value
PRE	116(+/-)7.7			100(+/-)14		
INDUC-TION	114(+/-)6.6	1.0802	0.2845	101(+/-)13	0.2867	0.7754
INTRA						
5 min	113(+/-)4.5	1.8424	0.0705	99(+/-)15	0.2669	0.7905
10 mins	114(+/-)6.9	1.0595	0.2938	98(+/-)17	0.4974	0.6208
15 mins	114(+/-)8	0.9866	0.328	95(+/-)5.3	1.743	0.0865
POST OP	112(+/-)8.1	1.9604	0.0548	92(+/-)6.3	2.8542	0.006
	T test value from chart two tailed at 95% confidence level	2.0				

Table 3: This table showing calculation of t-value and p-value among variation in mean BP and heart rate.

DISCUSSION:

Hypertension is defined as a systolic blood pressure (SBP) of 140 mm Hg or more, or a diastolic blood pressure (DBP) of 90 mm Hg or more, or taking antihypertensive medication.[3, 4]

Definition of pre eclampsia: The pre eclampsia is a hypertensive disorder of pregnancy usually after 20 weeks gestation or in the early postpartum period and return to normal within three months postpartum.

In addition one or more of the following must be present: 1. Proteinuria≥300 mg/24h or a spot urine protein/creatinine ratio ≥30 mg/mmol. 2. Renal insufficiency evidenced by oliguria or serum/plasma creatinine ≥0.09 mmol/L. 3. Liver disease with elevated serum transaminases and/or severe epigastric and/or right upper quadrant pain. 4. Neurologic manifestations such as severe headaches, hyperreflexia, clonus, visual disturbances, or eclamptic convulsions. 5. Hematologic disturbances such as thrombocytopenia disseminated intravascular coagulation, or haemolysis. 6. Fetal growth retardation.

It is worth noting that, although common, proteinuria is not mandatory to the diagnosis of pre-eclampsia. Additionally, oedema is no longer included in the diagnosis of pre-eclampsia as it is too nonspecific a finding to be of value.[5]

Magnesium sulphate[6]:

Magnesium is the fourth most common cation in the body and the second most common intracellular cation after potassium[7,8]. Magnesium deficiency is common and is frequently multifactorial[9]. It has been demonstrated in 7 – 11 % of hospitalised patients and is found to co-exist in up to 40 % of patients with other electrolytes abnormalities, particularly hypokalemia or hypophosphatemia and to lesser extent, hyponatremia and hypocalcaemia[10].

Many uses including anticonvulsive in pre eclamptic toxaemia are hypomagnesaemic convulsions, life threatening cardiac arrhythmias, dementia, restless leg syndrome, chronic fatigue syndrome. The use of magnesium in immunology has been studied in allergic rhinitis and asthma it has been suggested that intracellular calcium concentration increase in response to IgE stimulation leading to histamine release. This can be antagonised by magnesium[11].

Action of magnesium sulphate in eclampsia: - The precise site of action of magnesium sulphate in eclampsia is not known. Experimentally magnesium has been shown to block the NMDA subtype of glutamate channel through which calcium enters the cell and cause neuronal damage during ischemia. [12,13] Ischaemia leads to lowering of the transmambrane potential allowing calcium ion influx across the membrane and from the endoplasmic reticulum and mitochondria. This leads to further calcium influx as membrane phospholipids are hydrolysed by activated en-

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zymes. Magnesium blocks calcium at intracellular sites in addition to outer lipid membrane. This could make it superior to convential ca antagonists that act only on the outer membrane. Magnesium has been shown to protect hippocampel cell culture from anoxia [14] and glutamate, [15] and has also been shown to prolong the ischaemia time before irreversible cell damage in the rabbit spinal cord. [16] It also relieves cerebral vasospasm, calcium and magnesium acts as antagonists of each other on blood vessel tone regulation. Increase in calcium ion concentration cause vasospasm which is reversed by magnesium and worsened by lowering magnesium ion concentration. [17]

Anaesthetists will be particularly concerned by the hemodynamic effects of magnesium sulphate when given in the presence of regional local anaesthetic block. Studies in gravid ewes showed a significant decrease in mean arterial pressure in ewes receiving an infusion of magnesium sulphate compared with control given an infusion of saline. [18,19]

Treatment regimens used in our study is standard Pitchard regimens proved to produce a beneficial effect without risks of side effects. [20]

Monitoring of serum magnesium has been used to assess therapeutic concentrations and adverse effects. Target serum concentrations have been suggested to range from 2-4 mmol/litre, [21] with side effects such as loss of reflexes and respiratory depression occurring at concentrations of more than 5-7 mmol/litre, respectively. However, serum monitoring was not undertaken in the eclampsia trial collaborative groups study, but data on similar regimens suggest that serum of magnesium would have been less than 2 mmol/litre. [22] The result of this study suggests that serum monitoring may be of little benefit and that therapeutic serum concentration may be well below previously accepted values. Monitoring of patellar reflexes and ventilatory frequency may be of equal benefit to monitoring serum concentrations, as loss of the patellar reflexes occur well before respiratory depression and arrest. [20] As magnesium is cleared by kidneys, extra caution is needed in renal failure. In the eclampsia trial collaborative groups study, the magnesium dose was halved in urine output decreased to less than 100 ml /h and there were no other signs of toxicity. Although no untoward events were reported in the study from this strategy, in the presence of renal failure, monitoring of serum concentrations might be of benefit.

In cardiology magnesium studied extensively particularly myocardial infarction, arrhythmias and cardiac surgery. Magnesium administration may provide cellular protection during ischaemia. Magnesium drives calcium into the sarcoplasmic reticulum , reduces mitochondrial calcium overload[23] and competes with calcium for binding to troponin c. magnesium helps to conserve cellular ATP as the mg salts [24] and therefore prevent energy dependent cellular ATP , particularly in the face of adrenergic overstimulation occurring during ischaemic episodes. Other beneficial effect includes improvement of contractile response of stunned myocardium[25] and limitation of infarct size. [26] As a cofactor for sodium-potassium ATPase, magnesium inhibits cellular potassium loss which may also be important in the prevention of arrhythmia. [27] Many of the actions of magnesium have been likened to calcium antagonists. [8] When infused magnesium causes a decrease in peripheral resistance of approximately 25-35% in association with the secondary increase in cardiac index of 25%, with little change in arterial pressure or heart rate.

There are several reasons for preferring intrathecal spinal anaesthesia with magnesium sulphate therapy in pre-eclamptic patients for caesarean sections. Anticonvulsive in pre-eclamptic toxaemia are hypomagnisaemic convulsions, life threatening cardiac arrhythmias, dementia, restless leg syndrome, chronic fatigue syndrome.

The use of magnesium in immunology has been studied in allergic rhinitis and asthma.[11]

It protects hippocampel cell culture from anoxia, relieves cerebral vasospasm, magnesium sulphate has been shown to obtund the hypertensive response to intubation in patients with pre-eclampsia without causing neonatal depression. Conventional strategies for obtunding the hypertensive response to intubation, such as beta block, topical local anaesthesia, opioid and vasodilators appear to be less effective in pre eclampsia conventional strategies for obtunding the hypertensive response to intubation, such as beta block, topical local anaesthesia, opioid and vasodilators appear to be less effective in pre eclampsia. Significant decrease in mean arterial pressure in ewes receiving an infusion of magnesium sulphate compared with control given an infusion of saline.

Magnesium administration may provide cellular protection during cardiac ischaemia. Other beneficial effect includes improvement of contractile response of stunned myocardium 49 and limitation of infarct size.

Although spinal anaesthesia is relative contra indicated in the presence of mild pre-eclampsia, such patients may have altered clotting function and are relatively hypovolaemic but the small doses of local anaesthetics required to perform spinal anaesthesia reduce the risks of systemic toxicity to zero. In this study fantanyl also used further reduced hypodynamic changes.

Spinal anaesthesia is now considered the method of choice for urgent Caesarean section. Preliminary studies indicate that spinal anaesthesia may be safely performed in patients with severe pre-eclampsia, in whom spinal anaesthesia was previously considered controversial.

There is always a chance that a pre-eclamptic patient may suddenly convulsions (fits), but we can avoid it by used magnesium sulphate prophylactically and anticonvulsant drugs (diazepam or thiopentone) must be immediately available intraoperatively.

Hypotension was treated with conventional treatment using ephedrine and IV fluid therapy and hypertension was controlled with labetalol infusion.

Babies born to mothers having spinal anaesthesia may be more alert and less sedated as they have not received any general anaesthetic agents through the placental circulation.

Factors to define the safety of type of anaesthesia: MATERNAL Mortality, MATERNAL Morbidity, Total blood loss, Transfusion requirement, Hypoxemia, Hemodynamic instability, Postoperative pain, Postoperative chronic pain.

CONCLUSION:

Magnesium sulphate therapy protects patients against seizures intraoperatively as well as postoperatively. Protect against complications like hypertension , intracranial haemorrhage, cardiac arrhythmia also give cellular protection

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during ischaemia, reduce reperfusion injury by inhibiting calcium overload, reduce ischaemic damage and traumatic brain injury, act as a adjuvant in standard bronchodilator therapy. [8]

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