



## RBC MAGNESIUM & PLASMA MAGNESIUM IN PRECLAMPSIA & NORMAL PREGNANCY

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### ABSTRACT

Preeclampsia is pregnancy specific, multisystem disorder of unknown etiology occurring in 6.8% of all the pregnancies. Together with other hypertensive disorders of pregnancy, it is the 3<sup>rd</sup> most common cause of maternal mortality. Due to significant role of Magnesium in physiological regulation of blood pressure. For early diagnosis of preeclampsia, this study is conducted to measure the Mg levels in preeclampsia and normal pregnant women of same gestational age. Mg in both plasma and erythrocytes were estimated in 30 normal pregnant women and 100 preeclampsia pts between 24-34 wks of gestation. The data is analyzed with Prism statistics. In this study there is a significant decrease in RBC Mg and Plasma Mg in preeclampsia pts compared to normal pregnant women ( $p < 0.05$ ). In preeclampsia pts Plasma Mg is 1.44mg/dl, RBC Mg is 5.215mg/dl with the cut off value being 1.763mg/dl for Plasma Mg and 6.36mg/dl RBC Mg. The sensitivity of RBC Mg is 99% and specificity is 96.6% with diagnostic efficiency of 98% with regards to preeclampsia. RBC Mg is a more useful screening test to predict Pregnancy induced Hypertension in pregnant women.

**KEYWORDS : PREECLAMPSIA, PLASMA MAGNESIUM , RBC MAGNESIUM**



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## INTRODUCTION

Preeclampsia is pregnancy specific, multisystem disorder that is characterized by the development of Hypertension (130/90) & proteinuria after 20 wks of gestation and can be present as late as 4-6 wks of post partum. Preeclampsia is associated with increased risks of placental abruption, acute renal failure, cerebrovascular disorders and maternal deaths. It accounts for more than 40% of premature deliveries and associated complications of maturity. Consequently early diagnosis of preeclampsia and close observation are imperative. Magnesium is the 4<sup>th</sup> most common cation in the body and second most common intracellular cation<sup>1</sup> necessary for 300 enzymes system. Decreased intracellular Mg would result in partial membrane depolarization and decreases repolarization in association with cellular calcium accumulation and potential calcium dependent cell actions<sup>2,3</sup>.

The great decrease of Mg in the brain in cases of preeclampsia is suggested to be contributing factor to be the pathophysiology of preeclampsia<sup>3</sup>. There is a significant role of Mg in physiological regulation of BP, hence for the early diagnosis of preeclampsia this study is done to compare the Mg levels in RBC and Plasma of preeclampsia patients and normal pregnant women of same gestational age. It is simple and ideal screening test to predict preeclampsia.

## MATERIALS AND METHODS

Study is conducted in two groups includes Group-1 includes 30 (n=30) healthy pregnant women aged between 20-30yrs (Controls), who were non diabetic, nonhypertensive with no renal disease. Group-2 comprises 100 (n=100) pregnant women with in the age group of 20-30 yrs with preeclampsia having BP>140/90mm of Hg and odema being present (Cases). In these pts BP was normal during first 20 wks of gestation. No h/o of previous HTN and renal disease. All women in both the groups were in same gestational age (24-34 wks).

### Methods

3ml of venous blood was collected in clean, sterile bottle and 2ml blood in a heparinised bottle for plasma Mg. Plasma Mg, RBC Mg were estimated by Titan Yellow method<sup>4</sup>.

## RESULTS

Mean value of controls Plasma Mg is 2.33mg/dl & mean value of RBC Mg is 7.975mg/dl. Mean Plasma Mg in preeclampsia cases is 1.44mg/dl & RBC Mg is 5.215mg/dl. There is a significant decrease in plasma Mg in preeclampsia cases when compared to controls (P<0.05). There is a significant decrease in RBC Mg in preeclampsia cases when compare to controls. (P<0.05) (Table-1) (Figure-1 & 2).

**Table 1**

Groups	Plasma Mg	RBC Mg	P Value
Group-1	2.33 mg/dL	7.97 mg/dL	0.05
Group-2	1.44 mg/dL	5.215 mg/dL	0.05

Mean of Analyzed parameters in control and cases

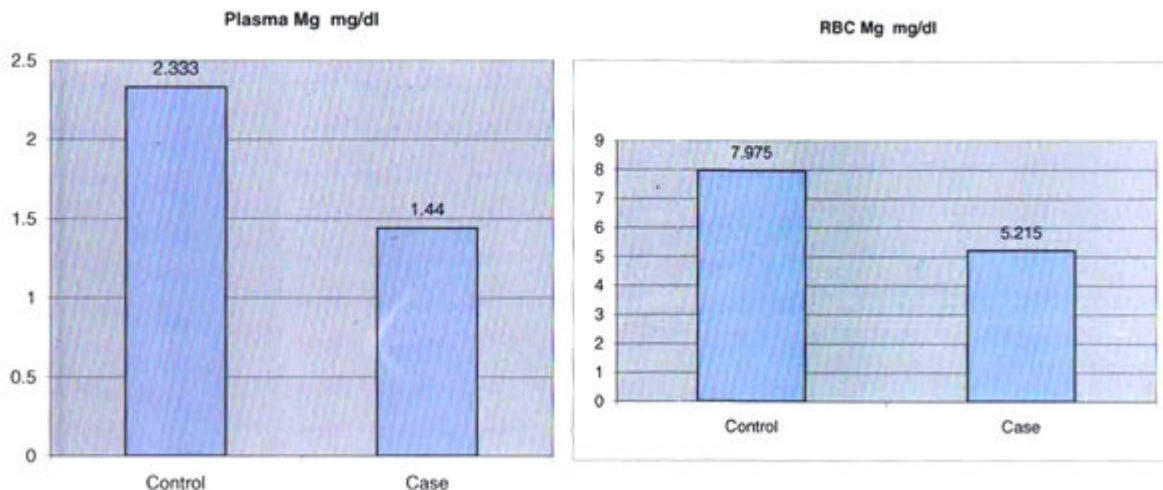


Figure 1

The cut off value is calculated by taking the mean of control and subtracting 2 SD from this for both plasma and RBC Mg (Mean-2 SD). The cut off value of plasmaMg is taken as 1.763 with sensitivity of 85%,specificity of 90%

and diagnostic efficiency of 86%.RBC Mg the cut off value is 6.36mg/dl with sensitivity 99% & Specificity of 96.6% & ostic efficiency 98% (Table-2).

Table 2

Parameter	Cut off Value	Sensitivity	Specificity	Diagnostic efficiency
Plasma Mg	1.763 mg/dL	85%	90%	86%
RBC Mg	6.361 mg/dL	99%	96.6%	98%

In order to assess the utility of various parameters in identifying the abnormality in preeclampsia, the reference various calculated by using mean ± 2 SD values of controls. The upper / lower values of the

reference range are used to calculate the sensitivity, specificity and diagnostic efficiency. Sensitivity, specificity and diagnostic efficiency are calculated by the following formulas

$$\text{Sensitivity} = \frac{TP}{TP + FN} \times 100$$

$$\text{Specificity} = \frac{TN}{FP + TN} \times 100$$

**Diagnostic efficiency**

It is defined as proportion of all currently classified as having (or) not having severe disease.

$$\text{Diagnostic efficiency} = \frac{\text{True positive} + \text{True negative}}{\text{Total no of patients evaluated}}$$

The best cutoff value is calculated by plotting the ROC (Receiver operative curve)curves, based on statistical GraffPad Prism. The best cutoff value for plasmaMg is 1.625mg/dl with sensitivity of 80%,specificity 100%,diagnostic efficiency 86%.RBC Mg the best cutoff value is 6.37mg/dl with 98%,sensitivity

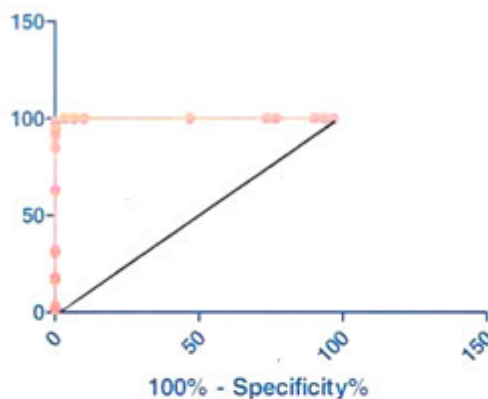
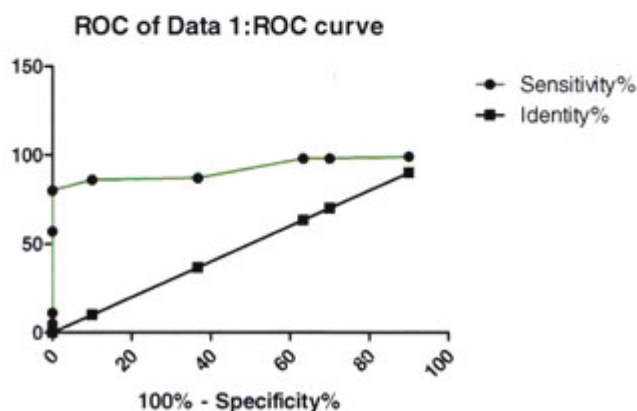
of100%,Diagnostic efficiency of 99% (Table-3).To assess the discriminatory capacity of different cutoff values of both the parameters in the study group the area under cover and confidence interval is 95% CI are calculated using ROC curves (Table-4) (Figure-3).

**Table 3**

Parameter	Best Cut off Value	Sensitivity	Specificity	Diagnostic efficiency
Plasma Mg	1.625 mg/dL	80%	100%	86%
RBC Mg	6.375 mg/dL	98%	100%	99%

**Table 4**

Parameter	AUC	95% CI
Plasma Mg	0.9222	0.8778-0.9666
RBC Mg	0.9997	0.9985-1.001

**ROC OF RBC MAGNESIUM****ROC OF PLASMA MAGNESIUM**

## DISCUSSION

Preeclampsia is pregnancy specific syndrome of reduced organ perfusion, secondary to vasospasm and endothelial activation associated with odema, BP-140/90mm of Hg after 20 wks of gestation and most frequently near term<sup>5</sup>. In addition half of the fetus delivered from preeclampsia pts exhibit growth retardation<sup>6</sup>. Magnesium acts as Calcium antagonist via calcium channels, regulation of energy transfer, membrane stabilization, Mg

has depressant effect at synapses and has been used as anticonvulsant. The mechanism of action of synapses is related to competition between Calcium & Mg in the stimulus secretion process in transmitter release. The most well described of these is presynaptic inhibition of Acetylcholine release at the neuromuscular junction. Its action as an anticonvulsant is secondary to Mg antagonist at Methyl D aspartate (NMPA) receptors. Stimulation of which is known to lead to

excitability of post synaptic potential (EPSP) causing seizures. Mg has been successfully used as an anticonvulsant in Eclampsia<sup>6</sup>. Experimentally, magnesium has been shown to block the NMDA subtype of glutamate channel through which calcium enters the cell and causes neuronal damage during cerebral ischaemia<sup>1</sup>. Ischemia leads to lowering of the transmembrane potential, allowing calcium influx across the membrane and from the endoplasmic reticulum and mitochondria. This leads to further calcium influx as membrane phospholipids are hydrolysed by activated enzyme. Magnesium blocks calcium at intracellular sites in addition to the outer lipid membrane. Pathological finding from brains of patients with eclampsia reveal evidence of cerebral vasospasm, the finding has been backed by cerebral angiography and CT findings and agree with finding in the systemic vasculature<sup>7</sup>. The present study revealed there is a significant decrease in RBC Mg in study group compared to controls and has high sensitivity (98%), high specificity (100%)

with diagnostic efficiency (99%). In accordance with previous study A Study by Zohreh Tavana revealed that the serum magnesium decreased with progress in pregnancy<sup>8</sup>. In this study plasma Mg is lowered in preeclampsia cases compared to normal pregnant women with sensitivity 85%, specificity 90% and diagnostic efficiency 86%. A study by Seydoux J revealed that magnesium levels were decreased in serum and intracellular during normal pregnancy and in preeclampsia cases<sup>9</sup>.

## CONCLUSION

In the present study the level of RBC magnesium (intracellular) should be considered as a predicting factor of preeclampsia during the first evaluation of pregnancy. And it is useful to the pregnant women if the RBC magnesium is estimated during her regular checkups along with other parameters.

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