

STUDY OF SERUM MAGNESIUM LEVEL IN SEVERE
PRE-ECLAMPSIA AND ECLAMPSIA

Thesis
Submitted For The Partial Fulfillment
Of Master Degree In Obstetrics & Gynecology

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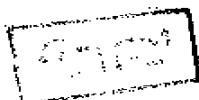
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ACKNOWLEDGEMENT

After thanking God , I have the pleasure to express my great indebtedness and inherited gratitude to Professor Dr. Hamdi El Kabarity , Professor of Obstetrics and Gynecology , Ain-Shams University and Head of Unit "2" for suggesting the subject of this thesis and his generous help , valuable criticisms and continuous kind supervision.

I wish to express my deep thanks and utmost appreciation to Assistant Professor Dr. Saied Tohamy , Assistant Professor of Obstetrics and Gynecology , Ain-Shams University.

Thanks are also sincerely extended to Assistant Professor Dr. Magda Nagaty , Assistant Professor of Biochemistry , Ain-Shams University, for her generous cooperation.

Lastly , I would like to thank every patient and every one who participated in this work by a mean or another.



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INTRODUCTION



INTRODUCTION

Preeclampsia-eclampsia, as one of the major complications of pregnancy, is one of the commonest causes of maternal and fetal mortality & morbidity. Despite decades of intensive research & the discovery of much of the underlying pathology, the exact etiology is still unknown. Accumulation of evidences have pointed out a potential relationship between "magnesium deficiency" during pregnancy & the occurrence of such complication;

Seelig 1980, has observed common characteristics of pregnancy induced hypertension in magnesium deficient animals.

Koberlin 1982, reported the frequent association of hypomagnesemia with pregnancy toxemia.

Charbon 1962, reported that placentas of preeclamptic & eclamptic women contained less magnesium & more calcium than normal placentas.

Conradt et al. 1984, in a retroverted study showed that the frequency of preeclampsia-eclampsia is reduced by magnesium supplementation.

Moreover, Boston et al. 1989, reported an increasing levels of MAP with decreasing levels of plasma magnesium in PIH group of patients, not reported in normal ones.

In conclusion, the question of whether magnesium depletion plays a role in "preeclampsia-eclampsia syndrome" remains unresolved.

AIM OF THE WORK

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Study of " Serum Magnesium Level " in severe preeclamptic and eclamptic patients pointing out the possible role of " Magnesium Deficiency " in the pathogenesis of such condition .

REVIEW OF LITERATURE

MAGNESIUM

Magnesium is an essential body electrolyte. It is the fourth most important cation in the body, and the second most abundant intracellular cation.

Biological Evolution Of Magnesium And Calcium

In a recent monograph, Aikawa (1981) traces in a scholarly manner the origin of life on earth from the formation of the crust composed of iron-magnesium silicate and the primeval ocean rich in magnesium, to the formation of chlorophyll with magnesium in the center of the molecule, giving rise to photosynthesis and finally to the development of the animal cell containing adenosine triphosphate (ATP) with its "obligatory need for magnesium".

A cursory look into the biologic evolution of magnesium and calcium through the development of life on earth indeed indicates that the two bivalent elements were incorporated into living cells for specific purposes, and perhaps as a check and balance on each other. Whereas magnesium was needed for energy transformation and cell metabolism, calcium appeared to be essential for structural stability & motility of the organism through its neuromuscular activity. Biological evolution would tend to favor the incorporation of calcium into primitive beings, when movement through space, because a necessity for survival. Even at this late stage of life on earth, magnesium continued to exert its role not only in catalyzing the manufacture of bone (alkaline phosphatase) and muscle protein (ribosomal protein synthetase), but also in regulating and

modulating tension development in striated muscle responding to ionized calcium. As life on earth became more demanding, the myocardium (through its rhythmic contraction and interaction between troponin, myosine, calcium and magnesium), was called upon to circulate blood throughout the organism (Iseri and French 1984).

FUNCTIONS OF MAGNESIUM IN THE HUMAN BODY:

1. It is a cofactor in many enzyme systems; (alkaline phosphatase, enolases, leucine, aminopeptidase).
2. It is involved in phosphate transfer.
3. It is involved in muscle contractility & nerve excitability.
4. It is also an important cofactor in thermoregulation.
5. It is believed to be essential for the structural stabilization of nucleic acids.

Its activity is often competitive with that of calcium & in a sense, magnesium may be considered nature's physiologic calcium blocker (Iseri & French).

Sources Of Magnesium :

Magnesium is plentiful in both animal and plant sources. Good sources which should be included in the pre-natal diet are : whole-grain ,cereals , flour ,soyabeans, dried beans ,peas, nuts, peanuts, butter, chocolate, hard-cheeses, lean beef, most green vegetables (in which magnesium is organically combined in the prophyrin complex), corn, most seafoods and bananas (Ashe et al 1979). While highly purified food such as sugar, starch, soft drinks and distilled alcohol have very little magnesium. Cow's milk contains magnesium in reasonable amounts but

its high phosphate and calcium content adversely affects the absorption of magnesium(Cantin,Seelig, 1976).

Human Requirements:

The average diet contains from 10 to 20 mmol of magnesium daily adequate for normal requirements.

Much of the intake is excreted in the urine and the excess is in the faeces.Excretion in urine is reduced in cases of magnesium deficiency.

THE U.S. NATIONAL RESEARCH COUNCIL (1980) recommended the following daily dietary allowances for magnesium:

1. Infants up to 6 months	.....	50 mg.
2. Infants from 6-12 months	.....	70 mg.
3. Children from 1-2 years	.....	150 mg.
4. Children from 4-6 years	.....	200 mg.
5. Children from 7-10 years	.....	250 mg.
6. Males from 11-14 years	.....	350 mg.
7. Males from 15-18 years	.....	400 mg.
8. Males over 19 years	.....	350 mg.
9. Females over 11 years	.....	300 mg.
10.Females during pregnancy	.....	450 mg.
and lactation		

Magnesium is abundant in green plants,meat and milk.

MAGNESIUM HOMEOSTASIS:

The total body magnesium is about 1000 mmol (2,000m eq; 24 gm). Approximately half of this content is in the bone, the remainder is divided among the other intra-cellular compartments, with only 1% in the extra-cellular space. About 1/3 of plasma magnesium is protein bound (Massry, 1977).

The concentration of magnesium in various tissues and fluids is shown in table(1). Serum magnesium correlates loosely with the total body levels (Opie, Hunt and Finlay, 1964). For this reason a normal serum magnesium level may not exclude a total body magnesium deficiency (McCollister, Flink and Doe, 1960).

Tissues and Fluids	M.EQ/L
Liver	20
Striated muscle	20
Brain	17
Kidney	13
RBCS	6
C.S.F	2.4-3
Serum	1.2-2.5
Gastric juice	1

TABLE(1)
The concentration of magnesium in various tissues and fluids
(Massry, 1977).

Absorption:

Orally ingested magnesium is absorbed from the entire bowel; primarily in the proximal small intestine and to a lesser extent from the colon (Aikawa,1959).The ileum is the main site for absorption. Normally 30% of the ingested magnesium is absorbed.It appears to be absorbed through two separate transport mechanisms.One of these two active transport mechanisms is independant of calcium absorption, while the other is in competition with calcium absorption (Heaton, Hodgkinson and Rose, 1964).The absorption of magnesium is low and is poorly regulated depending upon the concentration in the intestine rather than upon the requirements(Alcock and Macintyre 1962).

Specific factors such as protein intake,administration of growth hormone(Hanna,1961) and large doses of vitamin D and antibiotics have been shown to influence magnesium absorption from the gut,but no single factor has been shown to play a role in the absorption of magnesium similar to that of vitamin D in calcium absorption.

(N.B.) In normal individuals on regular diets,the average daily absorption from the G.I.T. is 0.14mg/Kg/day(Jerry,1976).

Excretion:-

Magnesium excretion depends on filtration and partial reabsorption by the kidney from the 2400 mg magnesium filtered normally through the glomeruli daily;about 2300 mg are reabsorped in the proximal and distal segments of the tubules and in the loop of Henle i.e. urine contains 100mg(9 mEq) per day provided

adequate daily intake.

N.B.

It is the ionic fraction of magnesium in plasma filtered by the glomeruli which appears in the glomerular filtrate while any protein bound magnesium filtered is probably returned to the circulation via lymph except in renal diseases associated with heavy proteinuria (Martin ,Mays ,Rodwell and Granner,1985).

However magnesium output is closely related to magnesium intake i.e. urinary magnesium reflects the absorbed magnesium. When dietary magnesium is decreased, there occurs a profound and immediate fall in urinary magnesium with little changes in plasma level. A high magnesium intake on the other hand, augments the urinary magnesium and there is no indication that the intestinal absorption of magnesium is saturated at high levels of intake (Nordin 1976).

The renal tubular reabsorption seems to be an active transport mechanism similar to the mechanism in bowel. This process reaches a peak (T_{max}) beyond which all magnesium is excreted (Hanna, Harrison and Macintyre 1960). In the dog, Massry and Seelig (1969) have reported a T_m Mg of 140 mg/min/kg and their data have been converted into mg/100 ml. of glomerular filtrate (graph 1). They found that T_m Mg was 5-6 mg/100ml of glomerular filtration. This was the load value at which the reabsorption slope reached its maximum value and corresponds to a plasma magnesium of about 8 mg/100ml. Womersley (1956) stated that the reabsorption was about 80% of the load at a plasma magnesium of 3mg/100 ml (Graph 2).