

A STUDY OF ELECTROLYTE CONTENTS IN MATERNAL AND NEONATAL BLOOD IN NORMAL AND TOXAEMIC PREGNANCY

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Summary

1. Significant decrease in the serum sodium in all trimesters of normal pregnancy before delivery and after 6th day of delivery is noted in contrast to non-pregnant control group.

2. Non-significant decrease in the serum potassium and magnesium in all trimester.

3. Significant increase in the serum and potassium is noted in cases of pre-eclamptic toxæmia. These return to normal in the post-partum period.

4. Significant decrease in the serum calcium in cases of toxæmia is observed. It comes to its normal level during the post-partum period.

5. Significant increase in serum sodium and potassium in foetal blood of

pre-eclamptic toxæmic babies in contrast to babies of normal pregnant mothers has been observed.

6. In conclusion, estimation of serum, sodium, potassium, calcium and magnesium can be of value in the diagnosis of pre-eclamptic toxæmia of pregnancy before the clinical features of this syndrome develop.

Introduction

Pregnancy is an altered physiological condition and in it we find the growth and development of foetus, and this growth, if it be normal must be associated with the maintainance of normal stability of the internal environment which is composed of water and electrolytes.

Growth of the foetus requires a suitable environment and this is maintained by the establishment of normal internal environment of the mother. Estimation of electrolytes in the serum provides a very useful index for the study of certain physiological and pathological processes during pregnancy. Therefore, the study of few electrolytes namely sodium, potassium, calcium and magnesium in the serum was undertaken to compare the levels in normal pregnancy and pre-eclamptic

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toxaemia of pregnancy and to assess, if it bears any relation to the severity of the disease. A comparison in the levels of serum sodium, potassium, calcium and magnesium is also undertaken in the cord blood and on the sixth day of neonatal life of normal pregnant mothers and of mothers of pre-eclamptic toxaemia of pregnancy.

Material and Methods

Present study consists of estimation of serum sodium, potassium, calcium and magnesium in 10 normal healthy non-pregnant women, 60 normal pregnant women, (10, 20 and 30 in I, II and III trimester respectively) and 20 cases of pre-eclamptic toxaemia of pregnancy (mild to severe degree).

Five cc of blood was collected for the study from ante-cubital vein from the mothers. Blood from the umbilical cord was collected soon after the delivery and on 6th day of neonatal period from the femoral vein.

Estimation of serum sodium and potassium have been done by flame photometer technique. Serum magnesium was measured by modified technique of Neill and Neely (1964). Serum calcium was estimated by clark collip method (1925).

Results and Discussion

We have observed a significant fall in the mean serum, sodium levels in all the trimesters of normal pregnancy and sixth day after normal delivery as compared to the normal subjects. Tampan *et al* (1956) and Newmen (1957) also reported such results. These alterations in serum sodium might be apparently physiologic and are particularly impressive when considered with blood volume changes occurring during pregnancy (Newmen, 1957).

The mean serum sodium content in the P.E.T. of pregnancy of all degrees was

significantly higher than in the normal pregnancy ($p=0.001$) (Table 1). On the sixth day after delivery there was fall in serum sodium in normal as well as P.E.T. women. There is also higher level of serum sodium on sixth day after delivery. Roy Chowdhary (1971) has shown that mean serum sodium falls on 6th day after delivery in mild and severe degree of pre-eclampsia. Sita Devi and Nagma (1967) have observed that there is no significant variation in the serum sodium in patients with pre-eclamptic toxaemia.

The mean potassium shows a progressive fall from the first trimester till early puerperium in the normal pregnant women as compared to the control group. Our findings are in accordance with Newman (1957) and Roy Chowdhary (1971). In pre-eclamptic toxaemia the mean serum potassium level is more in mild and severe degrees before and after 6 days of delivery than that in normal pregnant women. This may be the mechanism that electrolyte balance maintained.

The mean serum sodium and potassium levels are more in the cord blood and on the 6th day after birth in the neonates born of pre-eclamptic toxaemic mothers than the neonates of normal pregnant mothers. Sita Devi and Nagma (1967) found no alteration in the serum sodium level in the cord blood. Strangers *et al* (1954) and Thalme (1967) have also reported normal values in serum sodium level from cord blood. Roy Chowdhary (1971) has similar observations and has explained that the reported findings of increased serum sodium content of foetal blood of toxaemic mothers may inhibit the anterior pituitary according to Selye (1943) 'push pull doctrine' endocrine function by liberating the factors necessary for the growth of such babies.

TABLE I
 Mean \pm S.E., Range and P Value of Serum, Sodium, Potassium, Calcium and Magnesium at
 Different Periods of Gestation and Sixth Day of Puerperium

Serum electrolytes	Normal control (10)	First trimester (10)	Second trimester (20)	Third trimester (30)	Full term normal preg. (60)	P.E.T. antepartum (20)	Sixth-day puerperium normal preg. (60)	Sixth-day puerperium P.E.T. (18)
Sodium								
mEq/l	145.7 \pm 1.0	142.0 \pm 1.5	142.7 \pm 0.5	142.7 \pm 0.5	143 \pm 0.43	152 \pm 0.61	141.5 \pm 0.37	146.2 \pm 0.13
meant S.E.								
Range	139-152	134-149	133-151	134-151	134-157	140-168	135-151	140-152
p value	—	0.05	1.001	0.05	0.05	0.001	0.001	0.001
Potassium								
mEq/l	4.2 \pm 0.16	4.13 \pm 0.5	4.05 \pm 0.16	4.0 \pm 0.12	3.9 \pm 0.15	5.02 \pm 0.15	3.95 \pm 0.12	5.15 \pm 0.13
Range	3.2-5.0	3.5-4.9	3.1-5.2	3.5-4.5	3.0-4.7	4.2-5.8	3.0-4.9	4.2-6.0
p value	—	0.7	0.7	0.7	0.3	0.001	0.3	0.001
Calcium								
mEq/l	4.8 \pm 0.22	4.9 \pm 0.22	4.83 \pm 0.09	4.69 \pm 0.08	4.63 \pm 0.08	4.0 \pm 0.12	4.8 \pm 0.09	4.7 \pm 0.11
Range	4.4-5.2	4.5-5.3	4.5-5.9	4.5-5.5	4.3-5.0	3.5-4.5	4.2-5.3	4.4-5.2
p value	—	0.7	0.9	0.7	0.7	0.001	0.8	0.8
Magnesium								
mEq/l	1.8 \pm 0.08	1.7 \pm 0.09	1.68 \pm 0.12	1.57 \pm 0.11	1.52 \pm 0.10	1.50 \pm 0.11	1.46 \pm 0.10	1.58 \pm 0.11
Range	1.4-2.2	1.3-2.1	1.3-2.0	1.4-2.2	1.0-1.8	1.2-2.0	1.0-1.8	1.3-2.1
p value	—	0.04	0.6	0.6	0.05	0.05	0.05	0.6

The hyperkalaemia in the cord blood reported by Ovarman *et al* (1951) has suggested the theory of hypoxia and cellular destruction of placenta at the time of birth. Smith (1959) has discussed that possibly hyperpotassiemia is physiological due to heavy demand made by the foetal tissues for the formation and growth of the cells. We have not observed any significant variation in mean serum calcium level before and sixth day after delivery as compared to the normal non-pregnant women. These findings were in accordance with Newman (1957), Shuev (1966) and Chaudhary (1969). Although the insignificant decrease in serum calcium of third trimester and full term normal pregnancy may be due to foetal demand, the mother needs calcium for the formation of placenta and for the growth of maternal tissues.

The mean serum calcium was signifi-

cantly less in all degrees of P.E.T. of pregnancy than the normal pregnant cases before the delivery. On the sixth day of their puerperium the mean serum calcium of toxemia cases was equal to the level of normal pregnant cases. The calcium deficiency can be one of the factors responsible to produce toxemia features. We fully agree with the hypothesis given by Chaudhary (1969) that during pregnancy there is an extra demand of calcium and therefore when the extra demand of calcium is offset it may produce toxemic features in more pregnant women.

There was a fall in the mean serum calcium concentration in the cord blood of neonates of P.E.T. mothers than of the neonates of the normal pregnant women. On the sixth day after birth, there was low serum calcium level of normal pregnant mothers which might be due to

TABLE II

Showing Mean \pm S.E. and Range of Serum Sodium, Potassium, Calcium and Magnesium in Cord Blood and on Sixth-Day after Birth in Neonates of Normal Pregnant and P.E.T. Mothers

Serum electrolytes	Cord blood of neonates of normal pregnant mothers (60)	Cord blood of neonates of pre-eclamptic toxemia mothers (20)	Sixth-day after birth of neonates of normal mothers (50)	Sixth-day after birth of neonates of pre-eclamptic toxemia mothers (18)
Sodium				
mEq/l	142.0 \pm 0.47	151.0 \pm 0.58	141. \pm 0.43	146 \pm 0.38
Range	134-149	138-162	135-148	134-152
Potassium				
mEq/l	5.7 \pm 0.17	6.6 \pm 0.19	5.1 \pm 0.17	5.8 \pm 0.18
Range	4.8-7.0	5.3-8.0	4.0-6.4	5.0-5.7
Calcium				
mEq/l	5.5 \pm 0.12	5.0 \pm 0.10	5.05 \pm 0.12	5.1 \pm 0.12
Range	5.0-6.0	4.5-5.5	4.4-5.5	4.4-5.6
Magnesium				
mEq/l	1.62 \pm 0.08	1.60 \pm 0.09	1.87 \pm 0.09	1.50 \pm 0.08
Range	1.3-1.8	1.3-1.8	1.5-2.3	1.3-1.7

physiological hypoparathyroidism (Smith, 1945).

The low levels of serum magnesium in all trimesters of normal pregnancy and also on the sixth day after delivery in comparison to the control group may be due to hypoalbuminemia and haemodilution (Hall, 1957; Newman, 1957; Degeorge *et al*, 1965; Rusu *et al*, 1966 and Bernard *et al*, 1969).

The mean serum magnesium in the P.E.T. of pregnancy was less than that in normal pregnancy before delivery. On the sixth day of their puerperium the mean serum magnesium was higher than normal puerperal level. The decreased level of serum magnesium may be physiologic gestational hypovolaemia. In cord blood of neonates of P.E.T. mothers, the mean serum magnesium is near about equal to that of the neonates of normal pregnant mothers. On the sixth day after birth in neonates of toxæmic mothers, there was a further decrease in serum magnesium in contrast to the values of neonates of normal pregnant mothers. Similar observations have also been demonstrated by Samli (1954).

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