SERUM COPPER AND CERULOPLASMIN LEVELS IN PREGNANCY—INDUCED HYPERTENSION

By

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SUMMARY

Serum copper and ceruloplasmin levels have been studied in normal pregnant women and in patients of pregnancy-induced hypertension (PIH) to evaluate the placental functions. Patients with PIH had significantly higher levels of serum copper and ceruloplasmin as compared to normal pregnant women. Their levels increased with the severity of the disease, being highest in severe PIH. Increasing serum copper and ceruloplasmin levels were found associated with lower birth weight.

Introduction

A battery of tests have been developed to evaluate the placental function. Lately role of serum copper and ceruloplasmin in evaluating the feto-placental unit has been recognised. During pregnancy, serum copper level rises and this rise is ascribed to increased production of hormones particularly oestrogen and progesterone. Correlation of serum copper levels and urinary estriole was established by Russ and Raymunt (1956). Like urinary estriole, serum copper estimation may be used to evaluate the fetal wall being. The latter has the advantage of being a less expensive and easy method.

Copper is present in two forms in blood i.e. 95% is bound to alpha-globulin (ceruloplasmin); rest is free for transport. Ceruloplasmin levels are thus as important as serum copper levels. Serum copper and ceruloplasmin levels increase steadily till third trimester and return to normal during first two months after delivery. These levels have been found to be high in pregnancy-induced hypertension (PIH) as compared to normal pregnant women (Husain *et al*, 1984; Melinkeri and Vasantgadkar, 1985); whereas Friedman *et al* (1969) have reported lower levels in PIH. Since the available literary data is quite variable and even contradictory, the present study was undertaken to determine the levels of serum copper and ceruloplasmin in non-pregnant women, normal pregnant women and patients with PIH.

Material and Methods

The present study, conducted in Medical College Hospital, included 40 women grouped as under:

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	Number
Group A:	
Control group	
Normal nonpregnant women (not using Cu-T or hormonal contraceptives)	10
Group B:	
Normal pregnant women	10
Group C:	
Mild pregnancy induced hypertension	10
Group D:	
Severe pregnancy-induced hypertension	10

All pregnant women included were between 32-40 weeks of gestation. Serum copper and ceruloplasmin were estimated by method described by Raghuramalu *et al* (1983). All results were analysed statistically to assess the significance of change.

Observations and Discussions

Serum copper and ceruloplasmin levels of all the groups are given in Table I. The values of serum copper and ceruloplasmin in non-pregnant women in our study were consistent with the levels reported by Friedman (1969) and Melinkeri and Vasantgadkar (1985).

Mean serum copper levels in normal pregnant women (170.79 ug%) were 54.34% higher than the mean values observed in non-pregnant group (110.66 ug%), the increase being slightly less than that reported by Schenker *et al* (1969). Mean serum ceruloplasmin levels (49.95%) showed a 54.07% rise in normal pregnant group when compared to non-pregnant women (32.42%) which was also statistically significant ($p < 0.001$). These levels were also sightly lower in our study in comparison to other studies (Hussain *et al*, 1984; Melinkeri and Vasantgadkar, 1985). The rise in serum copper and ceruloplasmin levels has been attributed to rise in oestrogen levels in blood during pregnancy (Russ and Raymunt, 1956) Also, it has been found that with the administration of oestrogen or oral contraceptives, there was a rise in serum copper and ceruloplasmin, serving as an indirect evidence that these levels run parallel (Henkin *et al*, 1971).

The mean serum copper levels in patients with mild PIH (211.31 ug%) were 23.73% higher than the ones in normal pregnancy (170.79 ug%), this rise being statistically significant ($p < 0.01$). There was 65.63% rise in mean serum copper levels in patients with severe PIH when

TABLE I

Showing Mean ± SEM and p Value of Serum Copper and Ceruloplasmin Levels and Birth Weights in All the Groups

Group	Serum copper (ug%)	Serum ceruloplasmin (mg%)	Baby weight (Kg)
Control (A)	110.66 ± 4.47	32.42 ± 1.31	N.A.
Normal pregnant (B)	170.79 ± 6.69	49.95 ± 2.07	2.75 ± 0.05
Mild PIH (C)	211.31 ± 8.24	61.73 ± 2.30	2.46 ± 0.13
Severe PIH (D)	282.28 ± 22.19	82.87 ± 6.60	2.17 ± 0.19
Group A Vs B	<0.001	<0.001	N.A.
Group B Vs C	<0.01	<0.01	<0.01
Group B Vs D	<0.001	<0.001	<0.01
Group C Vs D	<0.01	<0.01	<0.01

compared to that of normal pregnant women and here also the rise was statistically highly significant ($p < 0.001$). A 33.87% rise in mean serum copper levels in severe PIH in comparison to mild PIH was found, which was also statistically significant ($p < 0.01$).

Thus significantly higher levels of serum copper were observed in women with PIH as compared to normal pregnant women, levels being highest in severe PIH. Similar rise in serum copper levels has been reported by Schenker *et al* (1969). However Melinkeri and Vasantgadkar (1985) have found a significant increase only in severe PIH, rise in mild PIH being non significant.

There was 34.25% rise in mean serum ceruloplasmin level in patients with mild PIH in comparison to normal pregnant women and this rise was statistically significant ($p < 0.01$). The mean serum ceruloplasmin levels in patients with severe PIH (82.87 mg%) were 65.90% higher than normal pregnant group (49.95 mg%), this rise being statistically highly significant ($p < 0.001$). Fattah *et al* (1976) had also reported significant higher levels in women with mild and severe PIH. But Melinkeri and Vasantgadkar (1985) had reported a significant rise in serum ceruloplasmin in severe PIH only, the rise in mild PIH being not significant. Burrows and Pekala (1971) found no significant change in serum copper and ceruloplasmin levels in patients with PIH.

The rise in serum copper and ceruloplasmin in PIH could be because of subclinical hepatic damage (Grebenikov and Sorokva, 1961). Since the role of ceruloplasmin as an acute phase reactant is well known, the rise in serum ceruloplasmin may be due to reactivity of the body towards growing fetus and associated pathology (Koj, 1974). The decrease in placental functions associated with PIH and the elevated serum copper levels may reflect intrinsic degeneration process at the cellular level as a result of tissue destruction, revealed in the form of infarction or unrecognized cellular degeneration.

The mean birth weight in patients with severe PIH was significantly lower in comparison to normal pregnant women ($p < 0.01$) and in patients with mild PIH ($p < 0.01$). Thus, increasing serum and ceruloplasmin levels were found associated with lower birth weights.

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