

SEROMUCOPROTEINS IN NORMAL PREGNANCY AND PREGNANCY ASSOCIATED WITH COMPLICATIONS

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Introduction

One of the hypothesis for the success of the foetus as a homograft on the mother and the absence of its immune rejection has been given by Apffel and Peters (1969), who suggested the existence of 'Symbodies' which in contrast to the antibodies, bring about and maintain tolerance to an antigenic stimulus. The nature of these humoural substances was most likely to be glycoproteins. Since seromuroid proteins are known to respond more to immune stress than any other fraction of glycoprotein (Winzler, 1960) they have been chosen for examination. We have studied seromucoproteins in various trimesters of normal pregnancy, labour and complications associated with pregnancy e.g. anaemia, twins, hydramnios, Rh incompatibility, syphilis and vesicular mole.

Material and Methods

We studied 40 normal healthy adult females chosen from among the medical students and the relatives of patients and in these care was taken to exclude pregnancy. These cases served as controls. The study group comprised of 50 normal pregnant women and 58 cases of pregnancy associated with complications. The serum

mucoprotein level was determined along with the total protein level in each case in maternal sera, cord sera and amniotic fluid at various stages of gestation, labour and puerperium.

Total protein was estimated by Biuret method (Wooton, 1969). The seromuroid fraction was separated by the method described by Weimer and Mohsin (1953). Samples of maternal blood, cord blood as well as amniotic fluid were taken and analysed statistically.

Observations

The total protein content was estimated in 40 controls and the mean was found to be 6.9 ± 0.82 gm/dl with a range of 5.2 ± 7.41 gm/dl.

Table I shows mean total protein levels

TABLE I

| Type of case | No. of estimations | Mean total protein in gm/dl \pm S.D. |
|-----------------------|--------------------|--|
| Severe anaemia | 24 | 4.56 ± 0.26 |
| Twins with hydramnios | 12 | 5.52 ± 0.39 |
| Vesicular mole | 6 | 6.8 ± 1.12 |
| Rh incompatibility | 8 | 5.8 ± 0.82 |
| Syphilis | 8 | 7.8 ± 0.96 |

of maternal sera in pregnancy associated with complications.

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Total protein levels were lower than normal in cases of severe anaemia and higher in cases of syphilis. No appreciable difference was observed in case of twins, hydramnios, vesicular mole and Rh incompatibility.

Range of seromucoprotein for normal subjects was 37.5-67.5 mg/dl with a mean of 50.31 ± 15.4 mg/dl. A significant rise in SMP level was observed in the second and third trimesters as compared to the first trimester. However, on comparison with control group, the variations in the three trimesters were found to be statistically insignificant.

No significant change was found in mean SMP levels of maternal or cord sera with change in mode of delivery, viz cases of emergency L.S.C.S., elective L.S.C.S. and vaginal delivery. No significant variations of mean SMP levels of maternal and cord sera were found according to the duration of labour. No change in puerperal levels of SMP was found with the mode of delivery. SMP levels of 7th day

of puerperium were approximately twice as high as that of the time of delivery.

Table II shows total protein levels in maternal sera, cord sera and amniotic fluid in normal pregnancies and those associated with complications.

Although there is no appreciable difference in total protein levels of maternal and cord sera in either of the two groups, the content in amniotic fluid is considerably less in both the groups.

Table III shows mean mucoprotein levels in maternal sera, cord sera and amniotic fluid in pregnancies associated with various complications.

Significantly higher SMP levels were observed in cases of severe anaemia. Rh incompatibility, syphilis and vesicular mole, whereas SMP levels in twins with hydramnios were close to the range for normal pregnancy subjects.

Discussion

Serum Mucoprotein Estimations: The mean SMP level for the control cases in

TABLE II

| Specimen | No. of estimation | Total protein in gm/dl \pm standard deviation | |
|----------------|-------------------|---|---|
| | | Normal pregnancy | Pregnancy associated with complications |
| Maternal sera | 90 | 5.65 ± 0.05 | 7.48 ± 1.02 |
| Cord sera | 90 | 4.92 ± 0.08 | 5.02 ± 0.05 |
| Amniotic fluid | 90 | 0.75 ± 0.02 | 0.55 ± 0.01 |

TABLE III

| Type of case | No. of cases | Mean S.M.P. in maternal sera in mg/dl \pm S.D. | Mean S.M.P. in cord sera in mg/dl \pm S.D. | Mean S.M.P. in amniotic fluid in mg/dl. \pm S.D. |
|-----------------------|--------------|--|--|--|
| Normal pregnancy | 50 | 59.1 ± 2.97 | 20.26 ± 2.06 | 197.35 ± 7.48 |
| Twins with hydramnios | 12 | 80.0 ± 1.64 | 18.8 ± 2.24 | 128.2 ± 16.6 |
| Severe anaemia | 24 | 105.58 ± 10.8 | 19.2 ± 3.21 | 198.8 ± 10.6 |
| Rh incompatibility | 8 | 116.25 ± 6.7 | 19.6 ± 2.28 | 186.2 ± 10.06 |
| Syphilis | 8 | 151.6 ± 15.4 | 21.8 ± 3.2 | 208.9 ± 10.75 |
| Vesicular mole | 6 | 87.0 ± 4.4 | — | — |

this series varied from 37.5-67.5 mg/dl with a mean of 50.31 ± 15.45 mg/dl. This figure is comparable to the values reported by Greenspan (1954) of 52.7 mg/dl for adult females. Zlotnick *et al* (1959) have reported higher values (74.2 mg/dl ± 10.44).

Variations in SMP Levels According to Period of Gestation: A mean SMP level of 53.9 ± 0.89 mg/dl in first trimester, a mean of 54.4 ± 1.06 mg/dl in second trimester and a mean of 59.1 ± 2.97 mg/dl in third trimester of pregnancy. Apparently it can be seen that although there is no significant rise of SMP in the second trimester as compared to the first there is considerable and significant increase in the third trimester in the level of SMP.

Thus the SMP level is almost constant in the first 28-30 weeks of pregnancy but a slight increase is seen towards the last ten weeks. During pregnancy plasma volume usually expands by a volume of 40-50% by the 32nd week (Hyttén and Deitch, 1971) and there is little further change prior to delivery. It therefore follows that the nearly constant value of SMP in the first 28 weeks represents a steady increase in the total amount in circulation. These findings are in agreement with the results published by Good *et al* (1971). They reported the value of SMP in first trimester as 83.7 ± 16.4 mg/dl, in second trimester 88.2 ± 12.3 mg/dl, and in third trimester 96.7 ± 14.2 mg/dl. These findings are in support of the immunological aspects of gestation and the view that the mother lays down an immunological barrier between herself and the foetus is also supported.

Plasma Glycoproteins may be raised in response to non-specific stress (Boas *et al* 1955), resolution of inflamed or injured tissue (Catchpole, 1950) and tissue proli-

feration (Sheltar *et al* 1959). All these aspects may apply to pregnancy also. The possible immune role of glycoprotein is however, even more relevant in pregnancy but the immunoprotective role of the fibrinoid layer of Nitabugh is still a controversial one.

Glycoproteins are synthesized in the liver with an affinity for proliferating cells (Apffal and Peters, 1969). The hormonal stimulus of pregnancy may therefore enhance their production by the maternal liver. These are then deposited as an immunological barrier on the surface of the actively growing trophoblast. This view can also explain the present findings. In the third trimester there is a steady rise in hormone production, while there is reduction in the activity of the trophoblast. Both these factors can contribute to rise of serum glycoprotein.

Variation in SMP Levels of Maternal and Cord Sera According to the Mode of Delivery and Duration of Labour: Levels of SMP in maternal and cord sera were determined separately in cases of vaginal delivery, elective L.S.C.S. and emergency L.S.C.S. The difference in these readings was statistically insignificant. Our findings are comparable with the results of Good *et al* (1973). This means that either there was no difference in the degree of clinical stress involved or that the pre-existing pattern of plasma proteins attenuated the stress response. The latter seems the more likely explanation, for previous work has shown that the level of SMP rose from mid pregnancy onwards (Good *et al* 1971).

SMP Levels in Pregnancy Associated with Complications: Twins with Hydramnios: Twelve cases of twins were studied out of which 4 were associated with hydramnios. The maternal SMP level in the third trimester was 80.1 mg/dl

as compared to 59.1 mg/dl in the normal pregnancy group. Cord SMP level did not differ much from the normal, being 18.8 mg/dl as compared to 19.4 mg/dl of the normal cases. Mean mucoprotein content of amniotic fluid was 128.2 mg/dl as compared to 197.35 mg of normal group.

Severe Anaemia: Twenty-four cases were studied with Hb% ranging from 3-6 gm%. Maternal SMP levels were much higher than normal, being 105.58 mg/dl as compared to 59.1 mg/dl of normal cases. This high degree may be due to haematological stress associated with severe anaemia.

Cord SMP level showed no significant variation being 19.2 mg/dl as compared to 19.48 mg/dl of normal group. Mucoprotein level of amniotic fluid was also close to the normal range, being 198.8 mg/dl as compared to 197.35 mg/dl of normal pregnancy cases.

Rh Incompatibility: Maternal SMP was 116.25 mg/dl and was much higher than the normal 59.1 mg/dl. It may be postulated that foetomaternal blood group dissimilarity may provoke an active cell mediated immunity due to a kind of antigenic disparity and cause higher levels of immunoprotective SMP (Das Gupta, 1975). This is also substantiated by the findings of low birth weights and placental weights in these cases. Mean SMP in cord blood was 19.6 mg/dl compared to 19.48 mg/dl of normal pregnancy. Liquor mucoprotein was 186.2 mg/dl as compared to 197.35 mg/dl of normal pregnancy.

Syphilis: Average mean maternal SMP was 151.6 mg/dl which is considerably higher than the normal of 59.1 mg/dl. This rise may be a response to infection (Ferri *et al* 1962). Mean cord SMP was 21.8 mg/dl as compared to 19.48 mg/dl. of normal group.

Liquor mucoprotein was also a little higher, being 208.9 mg/dl as compared to 197.35 mg/dl of normal pregnancy.

Vesicular mole: Maternal SMP was 87.0 mg/dl as compared 59.1 mg/dl of normal pregnancy and therefore appreciable higher (Seibert *et al* 1984). If the theory of Shelter *et al* (1956) is accepted that active proliferation of tissues is responsible for the elevation of glycoprotein the high level of SMP in vesicular mole can be explained on it's basis. But since his theory has not been widely accepted this rise remains to be explained. Since no work on SMP level in complications associated with pregnancy has so far been done in our knowledge, a comparison of these findings was not possible.

Summary and Conclusions

1. In pregnancy the SMP level rose from mid pregnancy onwards.
2. The levels of SMP showed no significant variation with the mode of delivery/duration of labour, thereby proving that there was no attenuation of the response to stress of labour and delivery by the pre-existing patterns of plasma proteins.
3. Cord SMP levels were approximately 1/3rd of the maternal levels and show no variation with the mode of delivery on duration of labour, reflecting either a lack of capacity for SMP synthesis by the foetal liver or protection from stress and infection in the foetal environment.
4. Mean mucoprotein of amniotic fluid of normal pregnancy was 197.35 ± 27.48 mg/dl.
5. In twin pregnancy with hydramnios maternal SMP was higher but cord SMP showed no change and amniotic fluid mucoprotein was 128.2 mg/dl, thus lower than normal.
6. In severe anaemia, Rh incompatibility, syphilis and vesicular mole the

maternal SMP was higher but the cord SMP was in the normal range.

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