

TOTAL AND DIFFERENTIAL SERUM PROTEINS LEVELS IN NORMAL AND INTRAUTERINE GROWTH RETARDED NEONATES AND THEIR MOTHERS

By

NEELAM BHARDWAJ, A. CHAKRAVARTY AND GAURI BAZAZ MALIK

SUMMARY

Serum proteins in the fetus are derived from two sources, one is passive yet selective transfer of proteins across the placenta and the other is synthesis of proteins by the fetal liver.

A study of total and differential serum protein levels at birth was done in intrauterine growth retarded neonates and their mother and the results were compared with the normal weight neonates and their mothers.

Total serum proteins, albumin, alpha one globulin, alpha two globulin and beta globulin levels were not different significantly in the intrauterine growth retarded neonates and normal weight neonates while serum gammaglobulins were lower in intrauterine growth retarded neonates as compared to the normal weight babies ($p < 0.001$). Total serum proteins, were significantly lower in test and control neonates when compared to their maternal levels ($p < 0.001$). Serum albumin was lower ($p < 0.05$) and total serum globulin and its fractions alpha one, alpha two and beta globulins were also significantly lower ($p < 0.001$) in test and control neonates, on comparing with their maternal levels. Serum gammaglobulins were lower in intrauterine growth retarded neonates as compared to their mothers ($p < 0.001$) while these were similar in the normal weight neonates and their mothers.

Albumin globulin ratio was higher in the neonates than their mothers, this was because of higher albumin and lower globulin fraction in them.

Introduction

Serum proteins are transferred from the mother to the fetus across the placental barrier by passive yet selective transfer. This selectivity is influenced by the

lower molecular weight and the chemical characterization of the protein molecule. To some extent proteins are also synthesised by the fetal liver. Gammaglobulins are higher in full term normal weight neonates as compared to their mothers, although alpha and beta globulins are lower. In intrauterine growth retardation, placental insufficiency leads to im-

From: Lady Hardinge Medical College and Associated Hospitals, New Delhi.

Accepted for publication on 24-2-87.

paired transport of gammaglobulins from the mother to the fetus resulting in lower gammaglobulins in such neonates.

Material and Methods

Total serum proteins were studied in full term neonates i.e. neonates born after thirty seven weeks of intrauterine life. The study also included the mothers of these neonates.

The neonatal maternal pairs were divided into two groups.

- I. Test Pairs: This included neonates with birth weight less than 2.5 Kg and their corresponding mothers.
- II. Control Pairs: This included neonates with birth weight more than 2.5 Kg and their corresponding mothers.

All mothers with any obvious cause of intrauterine growth retardation were excluded.

Cord blood collected after delivery of the fetus from the placental end of the served cord. Maternal venous blood was collected from the antecubital vein during delivery.

The following tests were carried out:

1. Total serum proteins were estimated by Biuret-method.
2. Fractionation of serum proteins were carried out in a horizontal paper strip electrophoresis appara-

tus, with a power supply unit for constant voltage and constant DC current. Whateman's No. 1 filter paper strips measuring 4 cm x 36 cm were used.

Observations

Total serum proteins were observed to be significantly lower in test and control neonates as compared to their maternal levels ($p < 0.001$).

Mean levels of serum albumin were statistically significantly higher in the test and control neonates as compared to their maternal levels ($p < 0.05$).

85.34% of test neonates had serum albumin levels higher than their maternal levels while 8% neonates had levels lower and 6.66% had levels equal to their mothers. In 80% of control neonates serum albumin was higher, in 10% it was equal and in 10% it was lower than their corresponding mothers.

Total serum globulins and its fractions alpha one, alpha two, beta globulins were significantly lower in the test and control neonates as compared to their mothers ($p < 0.001$).

97.80% of test neonates had serum globulins lower than their corresponding mothers while 2.3% had levels equal to them while all control neonates had levels

TABLE I

Total Serum Proteins and its Fractions (Gm%) in Intrauterine Growth Retarded Neonate (N) and Mothers (M)

	Total Protein		Albumin		Globulin		Alb. Globulin	
	M	N	M	N	M	N	M	N
Mean	7.13	6.54	3.88	4.09	3.34	2.25	1:0.87	1:0.63
SD	0.69	0.67	0.20	0.35	0.29	0.24	1:1.08	1:0.91
Range	5.63-8.03	5.22-8.20	3.07-4.74	3.20-5.10	2.63-4.03	2.00-3.40	to	to
P	<0.001		<0.05		<0.001			

TABLE II

*Serum Globulins and the Fractions (GM%)
in
Intrauterine Growth Retarded Neonates (N) and Their Mothers (M)*

	Alpha ₁ glob.		Alpha ₂ Glob.		Beta glob.		Gamma glob.	
	M	N	M	N	M	N	M	N
Mean	0.41	0.20	0.56	0.40	1.13	0.53	1.74	1.49
SD	0.06	0.09	0.09	0.09	0.12	0.21	0.24	0.20
Range	0.15-0.57	0.01-0.30	0.32-0.76	0.08-0.76	0.90-1.50	0.40-1.26	1.03-2.23	0.90-2.01
P	<0.001		<0.001		<0.001		<0.001	

TABLE III

*Total Serum Proteins and its Fractions (GM%) in Normal Weight Neonates (N)
Their Mothers (M)*

	Total Proteins		Albumin		Globulin		Alb. Globulin Ratio	
	M	N	M	N	M	N	M	N
Mean	7.55	6.77	4.03	4.33	3.36	2.65	1:0.83	1:0.56
SD	0.67	0.58	0.27	0.30	0.23	0.34	1:1.02	1:0.93
Range	5.61-8.89	5.30-8.23	3.37-4.71	8.69-4.82	2.90-3.91	1.84-3.41		
P	<0.001		<0.05		<0.001			

TABLE IV
Serum Globulins and its Fractions (GM%) in Normal Weight NNeonates (N)
and Their Mothers (M)

	Alpha ₁ glob.		Alpha ₂ glob.		Beta glob.		Gama glob.	
	M	N	M	N	M	N	M	N
Mean	0.39	0.18	0.50	0.38	1.05	0.76	1.82	1.85
SD	0.09	0.06	0.08	0.07	0.09	0.23	0.20	0.23
Range	0.19-0.52	0.04-0.30	0.34-0.69	0.15-0.52	0.87-1.26	0.30-1.36		
P	<0.001		<0.001		<0.001			

of total serum globulins lower than their mothers.

Albumin-globulin ratio was observed to be higher in the neonates as compared to their mothers. This was because of higher serum albumin and lower serum globulin levels in them.

Serum gammaglobulin levels were significantly lower in the test neonates ($p < 0.001$) while these were similar in the control neonates when compared to their maternal levels. Gammaglobulins formed greater part of total globulins in all the neonates leading to higher gamma-globulin: globulin ratio when compared to the ratio in their mothers.

The serum levels of total proteins and their fractions were similar in the mothers of the two groups.

Discussion

The total serum proteins have been reported earlier by Raghvan *et al* (1976), Haridas *et al* (1983) to be lower in the test and control neonates when compared to their corresponding mothers, as has also been observed in the present study. Moore *et al* (1949) reported normal levels of serum proteins in the neonates born to mothers with marked deficiency of proteins. It was therefore suggested that the proteins present in the fetal blood were contributed both by the mother and the fetus itself or there was some selective transfer from the maternal pool to the fetal pool keeping the levels constant. Similarly Haridas *et al* (1983) reported insignificant difference in serum albumin levels in the cord serum of normal weight and intrauterine growth retarded neonates while Burgstrand *et al* (1972) and Raghvan *et al* (1976) reported significantly low levels, of serum albumin in the cord blood of neonates with birth weight

less than 2.5 Kg as compared to normal weight neonates. Higher levels of cord serum albumin than maternal levels have also been reported by Raghvan *et al* (1976), Haridas *et al* (1983), but Raghvan *et al* (1976) have reported lower cord serum albumin levels in the growth retarded neonates and Haridas *et al* (1983) have reported similar cord serum in the growth retarded neonates when compared to their maternal levels. Higher cord serum albumin levels led to the question whether the albumin was selectively transferred through the placental barrier or actively synthesised by either the placenta or the fetus in utero. Bardawil *et al* (1958) ruled out the possibility of the placenta itself being the site of synthesis of albumin and globulin by their study of placenta by immuno fluorescence technique. They suggested that proteins are transferred across the placenta syncytium possibly by pinocytosis and then discharged into the placental villous stroma. Gitlin *et al* (1984) showed that fetal liver begins to synthesise albumin by four weeks of gestational age. Serum globulins and its alpha and beta fractions were similar in the neonates of the two groups but these levels were significantly lower in the cord serum of both the groups when compared to the maternal levels as have also been reported by Raghvan *et al* (1976) and Haridas *et al* (1983), while Moore *et al* (1949) have reported higher globulin levels in the cord serum as compared to their maternal levels. Lower levels of cord serum globulins is due to lower levels of alpha and beta globulin fractions. These fractions do not traverse the placental barrier in any appreciable amount because they have large molecular side as compared to albumin (Mendenhall, 1970).

Similar observations were made by

Raghvan *et al* (1976). Lower levels of serum globulins in the neonates of both the groups as compared to their maternal levels resulted in lower levels of total proteins and higher albumin: globulin ratio in these neonates.

Serum gammaglobulin levels were significantly lower in the test neonates as compared to the control group ($p < 0.001$). Test neonates had significantly lower levels of serum gammaglobulins as compared to their mothers ($p < 0.001$) while control neonates had levels similar to maternal levels. Present findings are in agreement with reports published by Raghvan *et al* (1976), although Haridas *et al* (1983) reported higher levels of serum gammaglobulins in control neonates as compared to their mothers.

Dancis *et al* (1961) reported transport of radioactive gammaglobulins in the second half of the pregnancy. Yeung and Hobbs (1968) and Chandra (1970) reported direct correlation between cord serum gammaglobulins and the gestational age. Raghvan *et al* (1976) reported direct correlation between birth weight and serum gammaglobulin levels. The study thus shows the deficiency of gammaglobulins in intrauterine growth retarded neonates.

References

1. Bardwail, W. A., Toy, B. L. and Hertig, A. T.: Am. J. Obstet. Gynec. 75: 708, 1958.
2. Burgstrand, C. G., Borjew, Kartesson, TorUndberg and Hans Ekelund: Acta Paed. Scand. 61: 128-132, 1972.
3. Chandra, R. K., Guha, D. P. and Ghai, O. P.: Ind. J. Paed. 37: 361, 1970.
4. Dancis, J. A.: J. Obstet Gynaec. 82: 167, 1961.
5. Gitlin, D., Kumate, J. and Urvasti, J.: J. Clin. Inv. 43: 1938-51, 1964.

- 6. Haridas, M. and Acharya, P. T.: Ind. Paed. 20: 757, 1983.
- 7. Mendenhall, H. M.: Am. J. Obstet. Gynec. 106: 581, 1970.
- 8. Moore, D. H., Dupan, R. M. and Buxton, E. L.: Am. J. Obstet. and Gynec. 57: 313, 1949.
- 9. Raghvan, Uma, Gauri Bazar Malik, Mary Rays, A. N. Malviya: Ind. Paed. 13: 11, 1976.
- 10. Thom, H., Me, Kay, E. and Gray, D.: Arch. Dis. Child. 42: 259, 1967.
- 11. Yeung, C. Y. and Hobbs, J. R.: Lancet J. 1167-70, 1968.

... lower levels of ... compared to the control group ... lower levels of ... compared to their mothers ...

... of radioactive ... second half of the pregnancy ... of the ...

- 1. ...
- 2. ...
- 3. ...
- 4. ...
- 5. ...

... levels in the ... reported ... lower levels of ... compared to their mothers ...

... (Mendenhall, 1970)