

EFFECT OF PREGNANCY AND THYROIDECTOMY ON THE RAT SPLEEN

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Summary: Pregnancy caused a significant increase ($P < 0.001$) in the ascorbic acid and cholesterol concentrations in the spleen as compared to the controls, indicating a rise in its metabolic functions. When thyroid gland was removed either from the non-pregnant animals or at different stages of gestation from pregnant animals, there were significant ($P < 0.001$) fall in the levels of these biochemical parameters as compared to the corresponding intact groups. These findings indicated that splenic functions undergo certain changes during pregnancy and the thyroid hormones significantly influence them.

Key words: spleen pregnancy thyroidectomy cholesterol ascorbic acid

INTRODUCTION

Spleen, thymus and other lymph glands are associated with the immunogenic mechanisms of the body (1). Thymus has been shown recently to be involved in the regulation of structure and function of the lymphoid tissue (2). It has also been advanced that the thymus is the target organ of the adenohypophysis (3) and is associated with sexual physiology. Sterilizing effect of thymectomy has been shown to be completely prevented by injections of spleen cell suspensions (4) indicating that the spleen is equally involved in the reproductive functions of animals. But no work has been done to see if the splenic functions are concerned in any way with the reproductive phenomena. Further there are reports on the immuno-suppressive effects of the uterine proteins of pregnancy (5,6,7). These proteins are said to be inhibitory on the lymphoid tissue but no information is in the literature about their effects on the spleen. Further, influence of thyroid gland on the splenic metabolism has not been studied. Hence the present work was undertaken to probe into the effects of pregnancy and thyroidectomy on the splenic ascorbic acid and cholesterol levels which are some indices of metabolic activities.

MATERIALS AND METHODS

Fifty adult female rats each of approximately same age and weight were housed in clean cages with food and water *ad lib*. The estrus rats detected from vaginal smear were

allowed to mate with proven males. Presence of spermatozoa next morning in the vaginal smear was noted as the day *one* of pregnancy. The animals were thyroidectomized at different stages of pregnancy and all were allowed to continue full term. Thyroidectomy was performed surgically (8). The spleen was collected on ice from individual animals immediately after parturition and tissue concentrations of ascorbic acid (9) and cholesterol (10) were estimated after homogenization with ice-cold physiological saline.

RESULTS AND DISCUSSION

As shown in Table I, the thyroidectomized animals had significantly lower levels of ascorbic acid ($P < 0.001$) and cholesterol ($P < 0.001$) while those in intact pregnant animals were significantly higher than the controls. But the spleens of pregnant rats thyroidectomized at different stages of pregnancy had invariably both ascorbic acid and cholesterol levels significantly lower than those of intact pregnant ones (gr. 3). There was no significant difference in the concentrations of these important biochemical parameters of the spleen between the groups made hypothyroid for different lengths of time during gestation.

TABLE I : Ascorbic acid and cholesterol contents of spleen of rats made hypothyroid during pregnancy.

Sl. No.	Treatment	No. of animals	Ascorbic acid mg/100 gm tissue (wet)	Cholesterol mg/100 gm tissue (wet)
1.	Control	6	24.15 ± 3.32	378.66 ± 11.32
2.	Non-pregnant Thyroidectomized (Thx)	6	12.82 ± 1.12	201.04 ± 12.57
3.	Pregnant (intact)	8	39.03 ± 4.21	873.55 ± 44.56
4.	Pregnant Thx on 3rd day of Pregnancy	6	25.20 ± 2.54	681.85 ± 49.02
5.	Pregnant Thx on 6th day of Pregnancy	8	24.21 ± 3.71	491.43 ± 62.96
6.	Pregnant Thx on 8th day of Pregnancy	6	18.28 ± 3.46	522.80 ± 96.28
7.	Pregnant Thx on 10th day of Pregnancy	6	19.95 ± 3.45	220.24 ± 22.13
8.	Pregnant Thx on 13th day of Pregnancy	4	22.35 ± 1.67	304.73 ± 24.07

Each figure is mean ± standard error

Student's 't' test has been used for test of significance

Groups	1 vs 2	$P < .001$	for cholesterol groups :	1 vs 2	$P < .001$
	1 vs 3	$P < .01$		1 vs 3	$P < .001$
	2 vs 3	$P > .001$		2 vs 3	$P < .001$
	3 vs other	$P < .05$		3 vs others	$P < .001$

Study on the tissue levels of ascorbic acid and cholesterol is of paramount importance since the former is concerned with tyrosine metabolism, mechanism of electron transfer, redox systems and activation of fibroblasts (12) and its concentration bears a positive correlation with the metabolic activities; whereas the latter forms the intrinsic component of the lipid bilayers of the cell membrane regulating the permeability of water (13) polar (12) and non polar (14) ions. Spleen has both immunologic and non-immunologic functions which are possibly very important in maintenance of pregnancy: firstly, for increased antibody production that gets transferred to the foetus and secondly causing increased release of Fe^{++} for erythropoiesis both in mother and foetus. It has been found that the ascorbic acid in the spleen and thymus plays an important role in the protein synthesis by controlling tyrosine metabolism which is to be in the antibody molecule to serve as an active site for antigen-antibody complex (15). Thyroid hormone is stimulatory to the lymphoid tissue function while progesterone, cortisone and uterine proteins are inhibitory (11). The findings of this study reveal that some aspects of cellular metabolism in the spleen might have been increased during gestation as indicated from the significant elevation in tissue concentrations of ascorbic acid and cholesterol in intact pregnant animals as compared to controls even if the lymphopoietic function might be suppressed to some extent. This increase in metabolic functions may be possibly due to the increased thyroid activity caused by the stimulation of estrogens (16) during this time. It may be possible also that higher levels of splenic metabolism is beneficial for the mother during pregnancy stress while depressed lymphoid function is helpful to the foetus, for it is considered then as an allograft (7). Further it is observed from the present investigation that thyroidectomy caused a significant fall in these splenic parameters in both non-pregnant and pregnant animals, indicating a depression in its metabolism due to the absence of stimulatory effects of the thyroid hormone which is concerned with ascorbic acid and cholesterol synthesis. But thyroidectomy at different stages of pregnancy failed to show any significant difference amongst the hypothyroid groups because, perhaps, the stages of foetal growth have little relationship with splenic functions. The parallelism of splenic ascorbic acid and cholesterol levels with thyroid activity, noted in this study, clearly indicated that the thyroid hormones regulate the cellular activities of spleen, and the derangement in splenic function in hypothyroid pregnant animals may be partly responsible for the failure in maintaining normal pregnancy. However, its role as a regulator of reproductive processes, like thymus, whose absence it can replace (4), is yet to be established.

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