THE EFFECT OF THYMECTOMY ON THE CHOLESTEROL METABOLISM IN WHITE ALBINO RATS

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The influence of the thymus upon various functions of the organism is rather poorly investigated. Studies are mainly directed to the immunological reactions in the organism (5,9). Regardless of the fact that involution of the thymus occurs with aging, the evidence for the interrelationship existant between the thymus function and age alterations in the organs and in the arterial wall in particular is very limited.

According to Comsa (3), thymectomy in infantile guinea pigs results in exhaustion and early mortality — 20 to 40 days after thymectomy. In the animals surviving the critical period, a decrease is found of blood cholesterol reaching 40 per cent. The cholesterol level in the adrenals is likewise reduced. According to Flesch (6), thymectomy in the rats accounts for cachexia and death following a transitory stage of weight gain. Einhorn and Rowntree (4) state that thymectomy should be repeatedly carried out in more than one generation with a view to obtaining substantial sequel. A number of authors (2, 10, 11, 12) refer to normal development of rats following thymectomy.

Proceeding from the latter data, we set ourselves the task to follow up the influence of thymectomy upon the cholesterol level in the serum, aorta and tissues of white albino rats and thus, make an attempt to establish an eventual dependency between the involution of the thymus and age alterations in the organs.

Method

The experiments were carried out on a series of 25 test animals, distributed into two groups. One of the latter, consisting of 15 small rats (7 male and 8 female) underwent thymectomy 20 days after birth. The second group, comprising 10 small rats of the same age (5 male and 5 female) was used for controls. All experimental animals were equally conditioned insofar regimen is concerned, fed on general diet, beginning with 30 gr every 24 hours, accordingly increased with growth. One hundred days after thymectomy (or at the age of 4 months) one gram lard was added to the general dietary intake for each rat, with a view to increasing the quantity of saturated fatty acids in the food, as with aging and especially in instances of atherosclerosis of the intima of the aorta, cholesterol esthers with saturated fatty acids are deposited (8). The alimentary regimen thus outlined was maintained for 3 months up to the day of their sacrification, i. e. seven months after thymectomy.

The determination of the serum cholesterol was carried out after the slightly modified Bloor method (1), namely: the dried residue after vaporization of the alcohol-ether mixture was dissolved in 5 ml, instead of 10 ml chloroform, with the purpose to obtaining a higher cholesterol concentration in the sample for colorimetry. No special measures were taken in advance for eliminating the effect of bilirubin, as according to literature data (7), the rats exhibit negative reaction for bilirubin in the serum.

The determination of cholesterol in the tissues was likewise performed according to the Bloor method (1), following cleansing of the organs from adipose and connective tissue, and for the aorta, after thorough wash up of blood. Determination was effected through homogenization of 0.1—0.3 gr fresh tissue with quartz sand and ether — absolute alcohol mixture in proportion 1 : 1. The same mixture was utilized for the extraction of cholesterol. Vaporization of the dissolvent was carried out until dried in water bath, and thereupon the dry remnant was diluted in 5 ml chloroform and was further treated for determination of the total cholesterol according to Bloor. Certain difficulties were encountered in the homogenization of the aorta. To this end, the latter was cut on a freezing microtome in sections measuring 30 μ thickness.

Results and Discussion

Table 1

The Level of Total Cholesterol in mg % in the Serum and Tissues of Thymectomized and Non-Thymectomized White Albino Rats

Groups	Serum	Aorta	Liver	Kidneys	Spleen
Non-thymectomized	115.39	841	493.5	597.5	510
Thymectomized	66	830	442	570	457

Obviously, the data obtained demonstrate that a decrease of the total cholesterol quantity in the serum occurs in the 7-month-old animals, subjected to thymectomy on the 20th day after birth. The cholesterol in the serum of the control animals is 115.29 mg %, whereas in those undergoing thymectomy, it is reduced to 66 mg %. The difference in these values is substantial and statistically significant ($P_t > 0.999$). The level of cholesterol is reduced with 42.61%, in conformity with the values reported by Comsa (3). A reduced cholesterol content was also observed in the organs investigated. The quantity of total cholesterol in the wall of the aorta was 841 mg % in the animals not subjected to thymectomy, whereas in those undergoing thymectomy — 830 mg %. In the latter case, a slight difference is concerned, not providing for statistical reliability of the results obtained, but yet, after analysis and comparison to results obtained during the investigation of the liver, kidneys and spleen, it is indicative of a pronounced tendency to a decreas of the total cholesterol in the tissues under the effect of thymectomy. The only exception is detected in the data received from investigations on the spleen, where the differences are substantial even

after statistical elaboration ($0.95 > P_t > 0.90$). The results from the comparative investigations in female and male individuals (Table 2) are likewise of particular interest.

Table 2

Total Cholesterol Level in mg %

Non-thymectomized	Serum	Aorta	Liver	Kidneys	Spleen
Female	105.67	757	551	642	523
Male	125.12	925	436	553	498

In the group not subjected to thymectomy, the male individuals display higher values of total cholesterol in the serum and aorta. As far as the wall of the aorta is concerned, the differences pointed out are significant and with statistical reliability ($0.99 < pt < 0.999$). In the rest of the organs the concentration of cholesterol is higher in the female individuals.

Table 3

Total Cholesterol Level in mg %

Thymectomized	Serum	Aorta	Liver	Kidneys	Spleen
Female	74.27	775	409	637	457
Male	57.60	885	475	503	427

A higher level of cholesterol is established in the serum of thymectomized female animals as compared to males, but the difference is not essential and falls within the limits of admissible error. Substantially higher levels of cholesterol are established in the wall of the aorta and in the liver of male individuals with statistical reliability ($pt > 0.999$ for the aorta and $pt = 0.90$ for the liver). The cholesterol quantity in the kidneys and spleen is higher in the females, with statistical reliability ($pt > 0.999$ for the kidneys and $Pt = 0.90$ for the spleen). These facts could be related to inferences, known from literature reports, according to which disturbances in the cholesterol metabolism and arteriosclerosis are more frequently encountered in male individuals.

The fact proved in the present study — that thymectomy accounts for a reduction of the cholesterol content in the serum and tissues investigated, could be related either to the delayed synthesis of cholesterol, or to the increased disintegration of cholesterol in the organism deprived of thymus. The solution of the question thus posed implies further and more thorough experimentation.

Inferences

1. Thymectomy, carried out in early age, leads to a decrease of the quantity of total cholesterol in the serum, in the wall of the aorta, liver, kidneys and spleen of adult animals.

2. The quantity of cholesterol in the serum and in the wall of the aorta in male animals not subjected to thymectomy, and in the aortal wall and liver of thymectomized male animals is greater than in female individuals.

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ВЛИЯНИЕ ТИМЭКТОМИИ НА ОБМЕН ХОЛЕСТЕРИНА У БЕЛЫХ КРЫС

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РЕЗЮМЕ

Прослежено влияние тимэктомии на уровень холестерина в сыворотке крови, в аорте и в тканях у белых крыс, с целью установить существует ли зависимость между инволюцией вилочковой железы и возрастовыми изменениями в органах. Подопытные животные были тимэктомированы на 20-ый день после рождения и оставлены при одинаковом режиме с группой контрольных животных того-же возраста. До 4-месячного возраста они получали общую пищу, а после этого — и по 1 г смальца в день. Забиты они были в возрасте 7 месяцев.

Определение количества холестерина в сыворотке крови и в тканях проводилось по методу Bloor'a, с небольшой модификацией.

Установлено, что тимэктомия вызывает снижение уровня холестерина в сыворотке крови и в исследованных тканях — аорте, печени, почках и селезенке. У мужских индивидов, количество холестерина выше, чем у женских, как у тимэктомированных, так и у не тимэктомированных животных.

Вопрос, является ли понижение уровня общего холестерина после тимэктомии результатом замедленного синтеза холестерина или же повышенного его распада в организме при отсутствии вилочковой железы, может быть разрешен новыми и более углубленными экспериментами.